

**REVIEW OF COMPARISON BETWEEN CLOSED HOLLOW STEEL  
SECTION AND CONVENTIONAL STEEL SECTION FOR FOOT OVER  
BRIDGE WITH DIFFERENT TRUSS CONFIGURATION**SahilS.Kureshi<sup>1</sup>, HirenG.Desai<sup>2</sup><sup>1</sup>M.Tech. (Structural Engineer), DharmsinhDesai University,<sup>2</sup>M.E. (Structural Engineer), Owner of Sai Consultants,

**Abstract**—generally the foot over bridges are made up of different steel sections and these steel sections are either conventional steel sections or closed hollow section. For instance, angle section, circular hollow steel section (CHS), rectangular hollow section (RHS) and square hollow section (SHS). An exertion has been done here to calculate discrepancy in weight between conventional steel section and closed hollow section with different truss configurations like Pratt truss, Howe truss and Warren truss. Even an attempt has been done here to analyze and design of foot over bridge with multiple truss configuration and all the datas are checked for both steel sections using draft code IS 800:2007, IRC:SP:56-200 and IS 806 for limit state design. Manual calculation is verified by software STAAD PRO V8i. The outcome received by both steel sections is elevated in form of consumption of steel with different heights, spans and configurations.

**Keywords**- Pratt-Truss, Howe-Truss, Warren-Truss, closed hollow steel sections, conventional steel sections

**1. INTRODUCTION**

A steel structure which help the pedestrians to cross the road without interruption of vehicle traffic this structure is known as foot over bridge. Foot over bridge is designed for pedestrians or in some cases cyclist to cross the road. Foot over bridge is becoming very popular in urban area of India as it help to cross the road for pedestrians without worrying about high speed traffic, as well as its very safe option without interrupt vehicles, in rural area of India it is very helpful to cross the rivers. In India generally two types of foot over bridges are mostly used plate girder and truss type. But commonly truss type foot over bridge is used. In case of truss type foot over bridges there are two types: through type and deck type. The commonly used foot over bridges belong to truss-through type. Different truss configurations like Pratt truss, Howe truss, Warren truss, K-truss, Vierendeel truss etc. these trusses and steel sections are designed for D.L., L.L. & W.L. according to Indian Standard Codes. An economy of foot over bridge is mainly depend on appropriate selection of truss configuration and steel section. Two types of steel sections are available: closed hollow steel sections and conventional steel sections. For instance, angle sections, channel sections, rolled steel sections are conventional steel sections. Circular hollow sections, Square hollow sections, Rectangular hollow sections are closed hollow sections. These steel sections are extremely important in reducing weight of the structure if selection is in proper way. Foot over bridges are very easy to maintain and can be erected easily if it is made up by bolting or welding connections. These type of structures have high scrap value, high ductility and can be altered easily in future. Disadvantage of this structure is they require frequent painting and fire proof treatment which raises cost of the structure.

**2. LITERATURE REVIEW****A. 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**

In this case study of Sholapur, Maharashtra. Modified how truss of span 24m, plan area around 800 sq. m, spacing of roof truss is 5m, No. of trusses are 8 is taken for design of industrial building. The sections are used both conventional and tubular sections. This study is focus to prove economy for choosing optimum steel section for given truss configuration. In this study all sections required for the different members of truss is compared between conventional and tubular sections.

Closed hollow steel sections are the optimum replacements compare to the conventional steel sections owing to their better and useful properties. It is fact that because of profile of the hollow steel section, dead weight of the section is likely to be diminished for many structural members which emanates overall economy of the structure.

This study is related to the load carrying capacity of all structural members, economy and their safety measures respectively. Prime purpose of this study is comparison of closed hollow steel section with conventional steel section of

given above requirements. This study proves that tubular sections are economical by saving of 40% to 50% in total cost is achieved.

**B. 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**

Aim of this study was to appraise the economic crux of the closed hollow steel sections (hollow structural sections) with conventional steel sections (open sections). This study was executed to find out the percentage economy received using closed hollow steel sections so as to grasp the importance of cost effectiveness. The method used in order to gain the purpose included the comparison of various truss configuration with different load combinations and loading conditions. The design and analysis part of this study was performed using structural software STAAD PRO V8i. All the results of design and analysis part were verified with the manually calculation. In this study there are two types of trusses Belgian 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 determined for optimum span length for economy point of view for selection from three types of steel sections mentioned above. In this study, Square Hollow Section is economical compared to Rectangular Hollow Section and un economical when compared to open section for more length of span. It is observed that Belgian profile truss is more optimum and economical compare to Random type truss.

**C. SOUVIK CHAKRABORTY, AMIYA K. SAMANTA, “ECONOMIC VIABILITY OF STEEL TUBE SECTION OVER STRUCTURAL STEEL IN DESIGN OF AN AUDITORIUM” – A CASE STUDY**

The author makes an attempt to design a 800 capacity auditorium using both structural steel and steel tube and a detailed comparative study (both member wise and cost wise) has been presented in order to effectively utilize the both in design. Detail planning has been prepared. STAAD Pro V8I is used to analyze the truss whereas the other members are analyzed manually using elastic method of analysis. The design is carried out using limit state method as per the latest Indian Standard code (IS: 800-2007) of practice and an estimation of quantity of steel required is made in order to have an idea about the cost of construction.

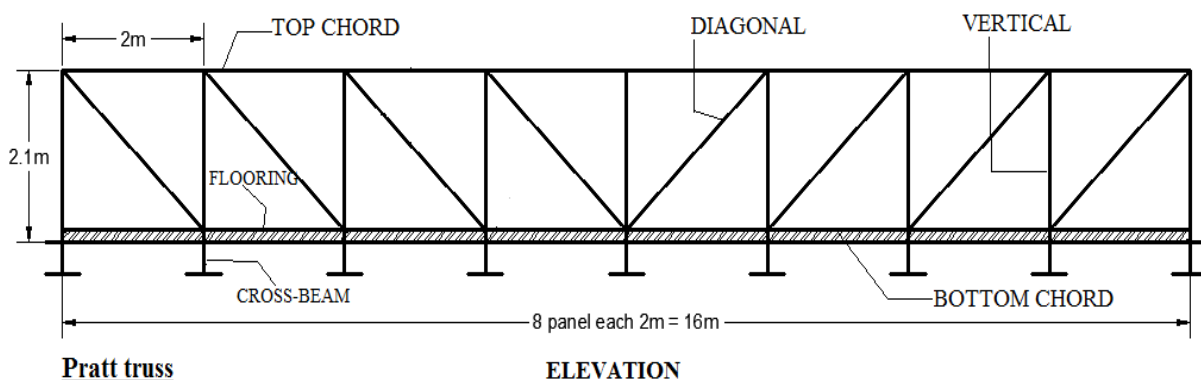
An auditorium of 800 capacity having plan area of 36m x 30m located in Kolkata is considered for design. The plan has been prepared in detail to accommodate the seating capacity. It consists of one central and two side aisles each of width 1.5m. The 15m wide performing stage is provided 1.0m above the aisles. The sideway Centre-to-Centre distance is 0.5m and row distance is 0.75. There are 6nos. column bays with longitudinal spacing equal to 7.2m.

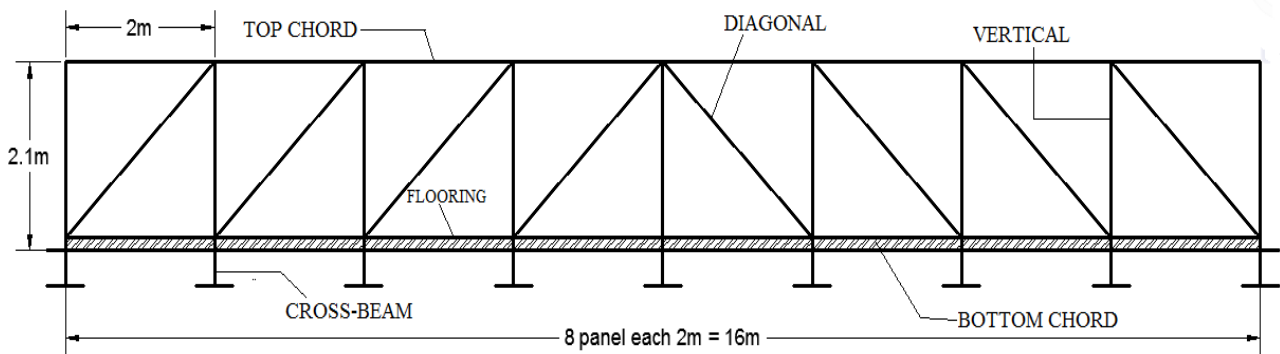
Calculation of consumption of steel and forces on all members of truss are done using STAAD PRO V8I. Tubular sections are proved to be economical around 20% of saving in cost is achieved.

**D. NIKHIL AGRAWAL, ACHAL KR. MITTAL, V. K. GUPTA “COMPARISON OF STEEL QUANTITY FOR GABLE FRAME BASED ON WIND FORCES FROM A FEW INTERNATIONAL WIND CODES”-DECEMBER 2012**

In this study the 25m span of truss is analyzed for different countries codes for wind forces on truss. Codes of different countries are India, Japan, Australia, and New Zealand. But design for different sections of truss is based on Indian code. The forces on members of truss like top chord strut and columns forces are also calculated for different roof angle like 5, 10, 15, 20, 25 degree.

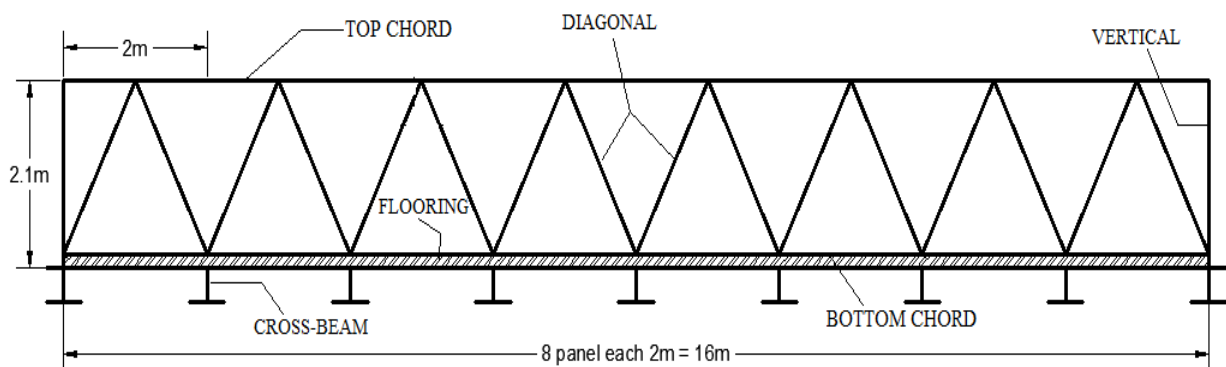
At final the main aim of study is to bring out the variation of total steel percentage used in truss frame with different roof angles and for different wind codes with and without considering openings. For the percentage of steel consumption the code of Japan is proved economical and used efficiently for truss design.





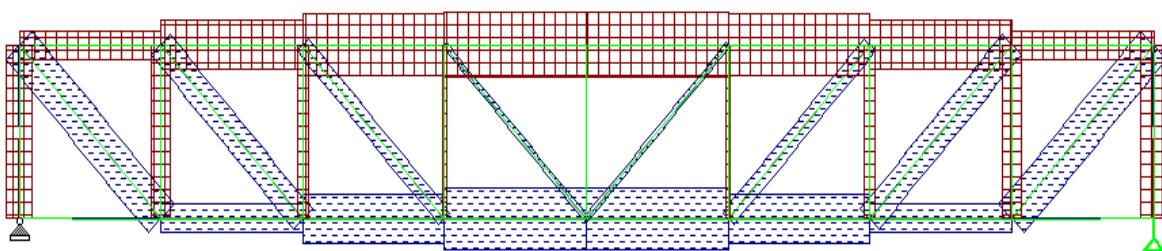
**Howe truss**

**ELEVATION**



**Warren truss**

**ELEVATION**



**Axial behaviour of foot over bridge using STAAD PRO V8I**

Figure 1: Different Truss configurations and axial behavior of foot over bridge

After collation of all outcome received from all analysis of truss configurations, it is concluded that:

**Outcome of weight for 16m, 20m, 24m & 28m span and 2.1m height:**

- CHS 14.615%, RHS 9.47% and SHS 13.75% are economical compared to Angle section for Pratt type configuration.
- CHS 20.71%, RHS 12.57% and SHS 19.41% are economical compared to Angle section for Howe type configuration.
- CHS 18.71%, RHS 12.57% and SHS 17% are economical compared to Angle section for Warren type configuration.

**Outcome of weight for 16m, 20m, 24m & 28m span and 2.5m height:**

- CHS 18.54%, RHS 11.46% and SHS 19.20% are economical compared to Angle section for Pratt type configuration.
- CHS 20.77%, RHS 16.18% and SHS 23.46% are economical compared to Angle section for Howe type configuration.
- CHS 21.91%, RHS 13.83% and SHS 19.81% are economical compared to Angle section for Warren type configuration.
- It was observed that based on overall economy Warren type truss configuration is economical compared to Pratt type and Howe type configuration.
- Steel consumption of closed hollow section is less compared to conventional steel section.

### 3. CONCLUSION

All the above consequences conclude that the consumption of steel for foot over bridge can be diminished by selecting suitable truss configuration and by using closed hollow steel section instead of conventional steel section. Closed hollow steel sections can help for diminish consumption of steel in large quantity for different truss configuration of foot over bridge. It is found that closed hollow steel sections saves about 50% to 60% from total expense of structure with appropriate truss configuration is used. By selecting proper truss configuration and steel section sustainable development can be seen for foot over bridge. STAAD PRO V8i structural software is available in the market and with the help of this software analysis part and manually calculations can be verified.

### 4. REFERENCES

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