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Comparative Study of 2D Roof Truss Configuration: A Review

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Abstract — *The structural steel pre dominates the construction scenario all over the world, as it is durable and can be molded into desired shape as per requirement. This paper presents a comparative study of roof truss for different configuration and also a comparison is done for different sections such as conventional steel sections, hollow sections and angle sections and pre-engineered sections. The trusses used for the comparison are N- type truss, Howe truss, Warren truss, A –type truss, Portal truss, etc. All the models of the truss were analyzed in Staad pro V8i software. The parameters used for the comparison are the weight of the truss & cost effectiveness. The comparison gives us the suitable configuration from weight and cost point of view.*

Keywords*-truss sections, truss configuration, weight, cost, Staad pro v8i*

I. INTRODUCTION

Trusses are the triangular frame works in which the members are subjected to essentially axial forces due to externally applied load. Steel members subjected to axial forces are generally more efficient than members in flexure since the cross section is nearly uniformly stressed. Trusses, consisting of essentially axially loaded members, thus are very efficient in resisting external loads. They are extensively used, for larger spans. Since truss systems consume relatively less material and more labour to fabricate, compared to other systems, they are particularly suited in the Indian context. Trusses are of two types, plane truss and space truss. Plane truss are the trusses in which the members are oriented in two dimensions and they all lie in the same plane. Also the forces acting on the truss lie in the same plane. While in space truss the members are oriented in three dimensions and the forces may act from any direction. Plane truss are mainly divided into three types: a) Pitched roof truss, b) Parallel chord truss c) Trapezoidal roof truss

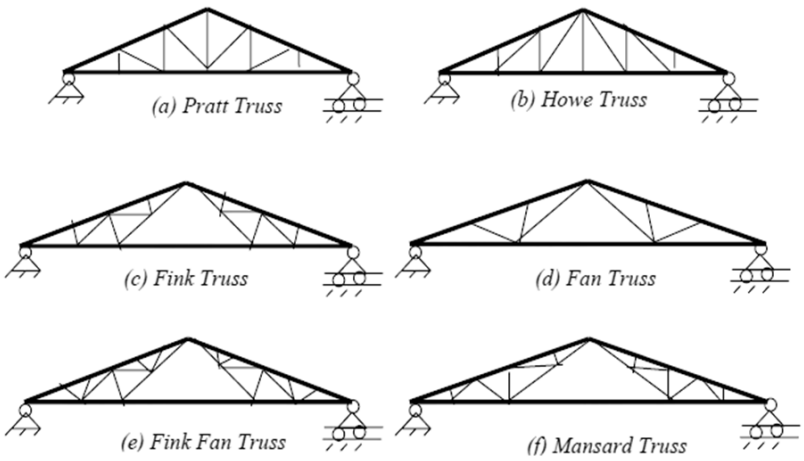

Figure 1 Types of Pitched roof truss

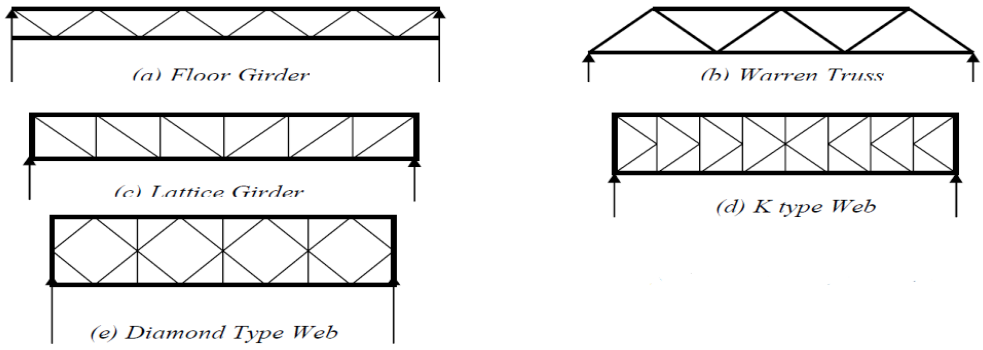

Figure 2 Types of Parallel chord truss

II. LITERATURE REVIEW

Following parameters are selected for comparison:

i. Weight
ii. Cost
iii. Efficiency

2.1 Weight

- **Goraviyala Yogesh et. al.** carried out a comparison between different configurations of the roof truss for different spans of truss and for different slopes using the tubular sections and compared it with that of conventional truss sections and from that he concluded that the tubular sections are light in weight than that of the conventional sections.[4]
- **Upendra Pathak et. al.** carried out a comparison between various configuration of the truss using different sections and he found out that the tubular sections are lighter than the conventional sections formed using the angle sections. Also when the joints are made rigid instead of pinned, the moment is induced between the members which in turn increases the weight of the truss.[1]
- **Dhruv S. Agarwal et. al.** showed that when equal angle section is replaced by the circular section the percentage saving in the steel was about 33.042% and when equal angle section is replaced by the square section the percentage saving in the steel was 26.742% for Fink fan type truss under the same loading condition.[6]
- **Sagar D. Wankhade et. al.** concluded that the Pre- Engineered structures are light in weight in comparison to the truss. Also weight of single truss using angle and pipe both is less compared to PEB but due to weight of channel purlin, weight of steel truss building is higher.[12]
- **Vrushali Bahadure et. al.** concluded that Saw Tooth type industrial shed is lighter in comparison with the Portal frame type industrial shed & A- type frame industrial shed. She also showed that the Pre-engineered truss requires less steel than Howe type and N type truss.[7]

2.2 Cost

- **Goraviyala Yogesh et. al.** in his research work concluded that the truss configuration using the tubular sections are more economical than truss configuration using the conventional sections.[4]
- **Sagar D. Wankhade et. al.** concluded that the Pre- Engineered buildings and truss building with pipe section are more economical than steel truss building with angle section.[12]
- **Vrushali Bahadure et. al.** concluded that the Pre-engineered truss are economical in comparison with Howe type and N type truss. Out of Howe type and N type Truss, Howe type is more economical. She also showed that the Saw Tooth type industrial shed is economical in comparison with the Portal frame type industrial shed & A- type frame industrial shed.[7]
- **Dhruv S. Agarwal et. al.** showed that when equal angle section is replaced by the circular section there is a percentage saving in the steel and hence it is found to be economical than the equal section and when open section is replaced by the square section the square section is found to be more economical than the equal angle section for Fink fan type truss under the same loading condition.[6]
- **Pradeepa S. et. al.** carried out the comparison between Warren, Howe and N truss configuration for 42m span of truss and found that the Warren truss configuration is more economical than other two types of truss. The economy of Howe and N truss configuration is almost the same.[5]

2.3 Efficiency

- **Goraviyala Yogesh et. al.** in his research work concluded that the truss configuration using the tubular sections are more efficient than truss configuration using the conventional sections due to its high resistance towards torsion and high strength to weight ratio.[4]
- **Dhruv S. Agarwal et. al.** showed that the truss made using the hollow sections are more efficient than the truss made using the open sections because hollow sections have properties such as high torsional resistance, smooth surface finish, high strength to weight ratio, free from shape edges.[6]
- **M.G. Kalyanshetti et. al.**, concluded that the connections between the circular sections are more difficult in comparison with the square or rectangular section hence the truss made using the square and rectangular sections are more efficient than the truss made using the circular sections.[3]

III. CONCLUSION

1) From all the above reviews it is concluded the amount of steel consumption in the steel structure can be reduced by proper selection of the truss configuration.
2) The tubular sections are found to be more efficient than the conventional sections because its resistance to torsional is very high and high strength to weight ratio.
3) The type of connection between truss members, support condition and purlin location on truss changes the structural performance of truss, and hence specific analysis is necessary for the rational solution of the truss problems.
4) When the open sections are replaced by hollow sections the saving in the steel is approximately 20 -30%.
5) The cost is directly proportional to the weight of the steel and hence the configuration with the lower weight is more economical

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