STANDARDIZATION OF TRUSS PROFILE FOR VARIOUS SPAN AND LOADING CONDITIONS – REVIEW PAPER

M.Indrajit[1], V. Senthil kumar[2]

[1] PG Student, Department of Civil Engineering, Kumaraguru college of Technology, Coimbatore-641049.
[2]Assistant Professor (SRG), Department of Civil Engineering, Kumaraguru college of Technology Coimbatore-641049.

---***---

ABSTRACT - In steel structures it more expensive due to weight and cost of the section. It is mostly preferred for industrial buildings. This paper study about the Standardization of truss profile of various span with various section to obtain the minimization of the steel quantity for various sections like Channel, Angle, and Tubular sections. Here, double Howe truss and Double Fink truss profile of various span of 15m, 20m, and 25m are taken. It is analyzed with Coimbatore wind zone. The Structure is Modeled and analyzed with help of Staad Pro v8i.

Key Words: Channel Section, Angle Section, Tubular Section, Double Howe truss, Double Fink Truss, optimization.

1. INTRODUCTION

A Truss is a structure composed of members (two-force members) joined together at their end points. Joints are modeled by smooth pin connections. Members are either under tension or compression. Joints are usually formed by bolting or welding the members to a common plate, called a gusset plate, or simply passing a large bolt through each member. A plane truss is a rigid truss it won't change its shape when it's subjected to the force applied at the joints. The truss should remain in equilibrium even when it is detached from its supports. The triangular shaped truss is the most stable and basic profile of truss.

2. LITRETATURE REVIEW

F. Braga and P. D.Asdia – According to the arbitrary law is a method for optimizing the plane cable trusses with the load distribution along the cable. It is suitable for the analysis of individual cable by finite element modeling. This optimization is divided by two steps, 1) the structure is optimized by the simplified model connected by two main cables connected by infinite number of ex-tensible wires. 2). the optimal solution obtained for the simplified model serves as the point of departure for the optimization of the real structure, using Powell's method of conjugate directions.

Ezeagu C. A, et.al – In this study, A 1.6m span of web kingpost model trusses were Modeled by using timber and steel, and also fabricated with twelve monochord and double chord trusses with different connection technique in timber and in steel and then eight truss models in timber and steel with four different shapes are - Howe truss system, Hip-stop down truss system, Dual pitch truss system, and Parallel chord truss system. These truss systems were fabricated in timber and steel of 2mm (0.08 inch) thickness and 25mm (0.98 inch) width. Each of the chords (bottom) had a length of 1600mm (63 inches) and height of 200mm (7.9 inches). During the course of the experiment, the trusses systems were loaded and the deflections at the nodes along the bottom chord of the trusses were recorded. It was observed that the maximum deflection occurred at the mid-span for all the trusses tested and of different shapes and configuration. The results show that double chord trusses resist more load than the monochord truss system of both timber and steel. The cost of fabrication of timber is lower than steel trusses. At the end of this study, it was obvious that the type of material, chord model system, configuration of the shape and connection techniques had a direct or indirect effect on the load bearing capacity, deflection of truss systems and cost of the truss fabrication.

Shilpa Chouhan, et.al – The requirement of this study arises where sometimes it is difficult for taking too much time to choose an effective and economical truss shape or truss geometry during the design period. Our study about the steel structures, Industrial trusses make one of the major structural systems, which require for accurate and reasonable design. The configuration and shape of the truss is depends upon the span and different of load. We have tested the considered models using Staad.Pro and ETABS. We have designed steel truss of different spans i.e. 7m, 10m, 12m, 15m and 18m. The steel structure is designed for the efficiency for different configurations. It increases the structural efficiency with different configurations of the truss. Our proposed work shows that more strength beam and strength angle is required if we design the same structure with same material in ETABS as compared to Staad.Pro which demonstrates that it requires less strength. By analyzing the graphs, we could also conclude that as the span of structure increases the strength beam and strength angle condition is increasing considerably in ETABS as compared to Staad.Pro. In this study, main focus is to analyses the steel truss configurations for comparing results of STAAD. Pro & ETABS by considering the strength parameters.

Arvind Bora and Mrs.Sangeeta Dhyani – The main objective of this study is to determine the optimized truss profile and its effect to the design of plane truss by using tubular sections with the aid of STAAD Pro v8i 2007.

Minimum mass is chosen as the objective function. The study is focused to achieve the following objectives: (a) To determine the most effective truss profiles in term of its mass among the 23 candidate fixed geometry of profiles, in the design of trusses using steel tubular section for certain spans and rise to save the time of design by avoiding the efforts of trial and error. (b) To determine whether under which conditions the same optimum profile of truss can be applied considering the different spans, rise and span over rise ratios of trusses. (c) To determine the best possible truss profile to be applied in normal practice.

Yash Patel, et.al – Many of the steel building which are designed and built by conventional approaches. Due to heavy structures it's highly expensive. Hence Tubular section is the best possible alternatives to reduce the weight and better specifications. Dead weight is tending to be decreased for many structural members so it is clear that because of the tube section, it helps in reducing overall economy. Load carrying capacity of all members and for their relative safety measures. The main goal is to make economic and hence tubular section is the more effective for the economic section. This shows that up to 15 to 25% is saved by using tubular sections. Analysis is done for all elements like purlins, roof truss, compression members, tension members are done for Indian Standard by using StaadPro.

Josef Machaceka, Martin Charvat – Concrete trusses and Composite steel are used for floor and bridge structures and analyzed for connections between steel truss and concrete slab for shear. The shear connections on elastic and plastic behavior is studied. On the basis of experimental investigation it is suitable 3D and 2D analyses. It is analysed and influenced of principal parameters are studied in detail. While some plastic redistribution of the longitudinal shear is admissible in some cases for floors of buildings, the elastic distribution is essential for design of bridges. In this paper practical design are presented.

Hazem Madah, Oded Amir – The analysis is done for truss bridge's stability for Linear buckling analysis and nonlinear stability analysis have been done by using ANSYS. Data's for Impact factor and nonlinearity are taken, such that geometric nonlinearity, material nonlinearity and initial geometric defects are been resulted. The structural stability of the Lead Rubber Bearing was studied. The critical buckling load and buckling modes for truss bridge have been resulted. It shows that overall instability appears prior to that of local instability. The critical bucking load of different types is less than linear buckling analysis result after considering nonlinearity, so stability can be reduced by the Lead Rubber Bearing.

Ankush Limbage, kshitija Kadam – In a developing country like India the annual expenditure on construction of industrial building is very high. In almost every industrial building like light engineering industry, warehouse, workshop, and storage sheds the key element is roof truss. To achieve a mass production and economy under a project B-8 Indian government standardized some parameter of

steel truss on board norms. In this paper the comparative study is carried out on the four different spans of A-type truss given in SP-38 (S&T):1987: Hand book for typified designs for structure with steel roof trusses. Thus the comparative study is carried out for a 9m span truss by using IS 875(part 3):1987 and SP38:1987. In height and structure size factor, topography factor and permeability conditions. Therefore the comparative study is carried out with the help of commercial software ANSYS 11.0.

BehroozFarshi, Ali Aliniaziazi, – This paper describes a new approach to optimum weight design of truss structures. The force method is incorporated in an optimization algorithm based on the method of centre points. The optimization method utilizes the largest hyper spheres inscribed within the feasible space. The hyper sphere method is used to solve the compatibility equations. By including the steps in the optimization cycle there is no need to perform separate structural analysis. The viability and efficiency of the proposed method are demonstrated for truss structures subject to multiple loading conditions and constraints on member stresses, nodal displacement and minimum gage. Numerical results are compared with those reported in the literature.

Goraviyala Yogesh, Prof. K. C. Koradiya, – In this paper, different configuration of steel roof trusses, such as Howe type, Fan type, Fink Fan type, and N-type with different span has 9m, 12m, 15m, 18m and 21m, with varying slopes like 12, 14 and 16 degrees with different wind zones, different spacing have been analyze and design as per SP: 38 and IS: 800-2007 by using tubular section. This paper involve the study of comparative study of analysis of truss using tubular and angle sections. The tubular steel section are structurally more efficient than conventional section because its resistance of torsional is very high and high strength to weight ratio.

Ezeagu C. A,Umenwaliri S.N, Aginam C. H and Joseph C.A, – In this study, a 1.6m span, twelve web kingpost model trusses were fabricated using timber and steel, also fabricated were twelve monochord and double chord trusses with different connection technique in timber and in steel and then eight truss models in timber and steel with four different shapes namely: - Howe truss system, Hip-stop down truss system, Dual pitch truss system, and Parallel chord truss system. The results show that double chord trusses resist more load than the monochord truss system of both timber and steel. And also the cost of fabrication timber trusses is cheaper than steel trusses. However all the systems satisfies the deflection requirement both of short and long spans. At the end of this study, it was obvious that the type of material, chord model system, configuration of the shape and connection techniques had a direct or indirect effect on the load bearing capacity, deflection of truss systems and cost of the truss fabrication.

Patil N. S., Jawalkar G.C., – On the basis of study of steel roof truss and aluminum alloy roof truss mainly we conclude that all the members of aluminum alloy roof trusses are light

weight compare to steel roof trusses for different spans and we observed that material consumption is more in aluminum roof trusses. Roof truss made by Aluminum alloy can be used where rainfall areas. It is corrosion less and high durability.

3. CONCLUSION

From the literature studied that the trusses are analyzed for Various spans and various section for truss member and various materials like Aluminum, timber, various configuration have been studied. Here an attempt is made on standardization of truss profile shape and minimization of weight for various span have been analyzed. It will be useful for any type truss with the minimization of the steel quantity.

REFERENCE:

1). Anthony, DK., Elliot, S.J. and Keane, A.K. ''Robustness of optimal design Solutions to reduce vibration transmission in a lightweight 2-D structure'', J. Sound. Vib, 229(3), pp. 505–528 (2000).

2). Dorn, W.S, Gomory, R.E. and Greenberg, H.J. ''Automatic design of optimal Structures'', J. Mec, 3(6), pp. 25–52 (1964).

3). Adeli, H., Kamal, O., 1986. Efficient optimization of space trusses. Computers and Structures 24, 501–511.

4). Allwood, R.J., Chung, Y.S., 1984. Minimum-weight design of trusses by an optimality criteria method. International Journal for Numerical Methods in Engineering 20, 697–713.

5). Arora, J.S., Haug, JR., 1976. Efficient optimal design of structures by generalized steepest descent programming. International Journal for Numerical Methods in Engineering 10, 747–766.

6). Achtziger W. Local stability of trusses in the context of topology optimization. Part I: exact modelling. Struct Optimiz 1999; 17(4):235–46.

7). Amir O. Stress-constrained continuum topology optimization: a new approach based on elasto-plasticity. Struct Multidiscip Optimiz 2016:1–22.

8). Ezeagu. C.A and Nwokoye D.N (2009) "Design in structural Timber" published by Mufti books, Nigeria. 1st edition. ISBN: 978-2692-25-5

9). Joseph C. (2011) "Effect of Shape Configuration on the Deflection of Steel Trusses" An unpublished B.Eng work at the Department of Civil Engineering, Nnamdi Azikiwe University Awka, supervised by Engr. Dr. C.A. Ezeagu

10). Offor N.I. (2011) "Effect of Shape Configuration on the Deflection of Trusses" An unpublished B.Eng work at the Department of Civil Engineering, University of Benin, supervised by Eng. Dr. C.A. Ezeagu.

11). Chen P. L., Chou C. K. and Chen M. S., "Distributed algorithms for k-truss decomposition," 2014 IEEE International Conference on Big Data (Big Data), Washington, DC, 2014, pp. 471-480.

12). Choensiridamrong C., Watjatrakul B. and Prayote A., "A simultaneous topology and sizing optimization for plane trusses," 2014 11th International Joint Conference on Computer Science and Software Engineering (JCSSE), Chon Buri, 2014, pp. 111-116.

13). Dhameliya, H.K., Sharma, J.B. and Tandel, Y., Parametric Studies of Standard 2-D Roof Truss Configuration. INTERNATIONAL JOURNAL OF ENGINEERING TRENDS AND TECHNOLOGY, 1(11), pp.214-218.