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A Review on Cost Effective Design of Air Craft Hangar

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ABSTRACT: In the aircraft industry smallest of airplanes represent thousands of dollars in investment. When you invest in steel aircraft hangar from general steel you're protecting your investment. We have designed this hangar in 3D on STAAD software, for proper simulation of the load distribution uniformly in three co-ordinates system i.e. X, Y and Z. Choosing different shapes of trusses and verify it on software that which truss is fulfill our requirement of strength, safety and economy.

KEYWORDS: Aircraft, hangar, truss, STAAD software.

I. INTRODUCTION

In the aircraft industry even the smallest of airplanes represent in investment totaling thousands of dollar in initial investment and more money in necessary maintenance. When you invest in steel aircraft hangar from general steel you're protecting your investment and providing a suitable service structure using some of the most durable, high quality, and cost effective material available. Basically Hangar is a closed building structure to hold aircraft, spacecraft or tanks in protective storage. Most hangars built of metal but other material such as wood and concrete are also used. Hangar is used for protection from weather, protection from direct sunlight, maintenance, repair, manufacture, assembly and storage of aircraft on airfield. Structure in the civil point of view is very important to be in proper design and detailing so that maximum benefit can be achieved by the people. An aircraft should be properly repaired and maintained after its certain use in transportation hence, the hangar is a place where the aircraft can be taken proper care, proper management and enhancement in the manufacturing parts can be made. If hangars are not provided then the aircraft company can face the problems due to its less maintenance and services. Even less maintenance and repairing may lead to large vital accidents in future; hence hangars should be designed keeping in mind the future point of view. Hangars need special structures to be built. The width of the doors has to be large; this includes the aircraft entrance. The bigger the aircraft to be introduced, the more complex structure is needed. According to the span of the hangar, sizes can be classified span of hangars are constructed from 30m-120m and above. Minimum conventional hangar size shall be 50 feet by 40 feet. Larger hangar sizes may be constructed and are encouraged, but all hangars must first be shown on the Airport Layout Plan and approved by Airport Authority. Conventional hangars must have common design elements. There are many combinations of designing large spans, like conventional truss & RCC column combination, truss & steel columns.

All the basic loads i.e. dead, live, wind, temperature, seismic etc. have been taken into consideration for designing of the frames. The structure has been designed under enclosed as well as open conditions for application of wind loads, the opening and closing size of hangar is the manual analysis of design process carried out for hangar, and its importance in the construction for an airport. The simplest way for controlling this deflection is to increase the geometrical properties/sectional sizes of frame, but it is not advisable as it adds to the tonnage of the whole building, adding not only to the seismic forces but also adding to the cost subsequently.

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II. LITERATURE REVIEW

In this chapter, the literature review is mentioned till date 2015. As members of studies regarding the subject were carried out and papers were published. Here some of the papers published in the same research are described with their Abstracts which show the current development and interest in the Subject.

1. K. N. Kadam and A. J. Limbage

In this paper the design of truss effect of wind forces is predominant to calculate the member forces. In this comparative study between design of truss as per revised provisions of wind load calculation given in IS 875-1987 with the design obtained as per calculation made in SP38 (S&T):1987. The analysis is carried out on the 12M span A- Type truss and the forces are calculated with the help of ANSYS 11.0, IS 875:1987(part 3). Considers terrain class of structure topography factor different permeability condition depending on slope of structure which are not considered in SP38 (S&T):1987. The calculation shows there is considerable variation of member forces as the span of the trusses increases. The percentage of variation of member forces in 24M span truss is nearly double in 12M span truss. The maximum percentage variation of member force is 9.68 for 12M span truss due to the different wind load calculation as per IS 875:1987 and SP38(S&T):1987 and for 24M span the maximum percentage of member forces is 19.60

In this study the author concludes that the percentage of variation of member forces increases with increase in span of truss.

2. Ankush Limbage and Kshitiya Kadam

A detailed comparative study is carried out on span 9m truss by using Indian standard code IS875(part3):1987and SP38:1987. In IS875(part3):1987 the intensity of wind load is calculated considering different conditions of class of structure, terrain, height and structure size factor, topography factor and permeability condition. The comparative study is carried out with the help of commercial software ANSYS 11.0. The result shows that calculated member forces are different from the calculations made in SP (S&T):38-1987 and IS 875:1987 (Part-3). As span increases, there is increase in member forces of tension member but there are slightly decreases in member forces of compression member. Hence it can be concluded that the calculation made in SP-38 cannot be directly applied without considering the class of structure, topology, terrain factor, risk coefficient and permeability mentioned in IS: 875-1987. The maximum available percentage variation of member force is found in second member in each span.

In this paper author is concluded that calculations made in SP38:1987 are have to implement with considering class of structure, topology, terrain factor, risk coefficient and permeability mentioned in IS 875:1987 .

3. Yash Patel, Yashveersinh Chhasatia, Shreepalsinh Gohil, Prof. Tausif Kauswala and Het Parmar

In this paper the conventional steel truss is compared with tubular steel truss for achieving the economy by keeping the economy as the main goal. The comparison between the conventional steel trusses with tubular steel truss is compared in weight in kilogram of all section with the information of current market rates for cost comparison. Saving of 10,729 INR per one roof truss with up to 15 to 25% is achieved in expense by assigning the tubular section instead of conventional steel section. Analysis of the truss is carried out by Dead load, Live load, Wind load with the reference of IS 875 part1, part2, part3 respectively with the assistance of STAAD pro v8i computer software and design is carried out by reference of IS 800 for conventional steel section and for tubular steel section with the assistance of Microsoft EXCEL software.

In this study the author concludes that the tubular steel section has proved to be more economical section than conventional steel section.

4. Goraviyala Yogesh and Prof. K. C. Koradiya

In this paper different types of trusses such as Howe, Fan, Fink fan and N-type with different span has 9m, 12m, 15m, 18m and 21m with varying slopes of 12,14,16 degree with different wind zones, different spacing have been analyzed and designed as per SP:38 and IS:800-2007. In this research author studied different research papers of different

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authors. In this paper author conclude that SP: 38 should be reviewed with IS: 875 also if the tubular sections are used for the large covered and large unsupported length the overall economy will be achieved. They conclude that WSM is more economical than LSM. Hence author concluded for all the research papers from their point of view.

In this research paper author concluded that SP: 38 have to reviewed, the tubular sections are more economical than conventional steel sections and WSM is more economical than LSM.

5. A.Jayaraman, R Geethamani, N Sathyakumar and N Karthiga Shenbagam

In this paper the comparative study on behaviour and economy of roof trusses and purlins by comparing between LSM and WSM. For this study fink type roof trusses, channel section purlins are taken for comparison of limit state and working stress method. Overall two methods were designed and comparison of all the internal forces, economical and hence to evaluate the moments and shear forces at the critical cross-section with same configuration area by keeping all other parameters constant. The theoretical data are calculated using IS 875-1975 (part III), IS 800 – 2007 using limit state method, IS 800- 1984 using working stress method and the section properties of the specimens are obtained using steel table. The specimens are designed under uniformly distributed loading with simply supported condition.

In this study author concludes that the theoretical investigations limit state method design is high bending strength, high load carrying capacity, minimum deflection and minimum local buckling & distortional buckling compare to the working stress method. But working stress method is most economical compare to the limit state method design.

6. Sagar and Pajgade (2014)

In this paper, Industrial Steel Truss Building of 14m x 31.50m, 20m x 50m, 28m x 70m and bay spacing of 5.25m, 6.25m and 7m respectively having column height of 6m is compared with Pre-engineering Buildings of same dimension. Design is based on IS 800-2007 (LSM) Load considered in modeling are Dead load, Live Load, Wind load along with the combinations as specified in IS-875. Results of Industrial steel truss buildings are compared with the same dimensions of Pre-Engineering Building. From the design it is clear that using angle section, pipe section for Truss and channel section for purlins in Steel Truss Building and PEB is found to be economical as compared to Steel Truss Building. It is clear from the result that 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 on higher side.

In this paper author conclude that Pre Engineering Building is more economical than conventional steel truss building.

7. Soni Prabhat et al., (2013)

In this paper, the steel roof truss having 12 m span has been analyzed with design of tubular sections of truss members. The analysis presents comparison for weight of tubular member sections with the help of which, comparative study has been done between design of truss as per revised provisions of wind load calculations given in IS 875 (Part 3):1987 and designs obtained as per calculations made in SP 38(S&T):1987, IS: 875(Part 3)-1987 includes consideration for different conditions of class of structure, topography factor, enlarged provisions of permeability conditions, Terrain, height & structure size factor and various wind zones. These provisions of wind load calculations are different from the considerations used in SP 38(S&T):1987 because of which, there are considerable variations in design of truss. A standard truss is a series of triangles - a stable geometric shape that is difficult to distort under loads. Regardless of its overall size and shape, all the chords and webs of a truss form triangles. These triangles combine to distribute the load across each of the other members, resulting in a light structure that is stronger than the sum of the strength of its individual components.

In this study author concludes that the weight of designed tubular sections obtained by IS-875 are greater than that of SP38:1987.

8. Kalyanshetti and Mirajkar (2012)

In this paper the comparison between conventional steel structure and tubular steel structure is done by taking economy as major objective. This study is done by using conventional steel sections, square tube, rectangular tube and circular tube. For comparison author replace the sections for various members of the truss and the weights required for that member for particular section is calculated. Author considered modified Howe truss for the design. For analysis and

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design purpose author used STAAD.Pro software. After the results of performance it is concluded that tubular sections are economical for the truss. Authors conclude that about 50-60% saving of cost is achieved by using tubular section as replacement of conventional steel structures.

In this study author concludes that the tubular sections are more economical as compare to conventional steel sections.

III.CONCLUSION

1. The percentage of variation of member forces increases with increase in span of truss.
2. The tubular steel section has proved to be more economical section than conventional steel section.
3. Working stress method is most economical compare to the limit state method design.
4. Pre Engineering Building is more economical than conventional steel truss building.
5. Weight of designed tubular sections obtained by IS-875 is greater than that of SP38:1987.
6. Calculations made in SP38:1987 are have to implement with considering class of structure, topology, terrain factor, risk coefficient and permeability mentioned in IS 875:1987 .

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