



Comparative Study of Resource Management for Pre-Engineered and Conventional Industrial Building

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Abstract:

In this paper 'comparative study of resource management of pre-engineering industrial building and conventional industrial building.' Pre Engineered Buildings (PEB) fulfils this requirement along with reduced time and cost as compared to conventional structures. In this thesis the Pre-engineering Industrial shed the SATIJI steel industry in Buldhana is consulted. The structural designer Mr. Vikram Maldhure has given the design for PEB. It was very useful to me for study of resource management for pre-engineering and conventional industrial building. Design is used to calculate quantity of steel required for Conventional as well as Pre-engineering industrial shed. In this thesis focus on resource management required for both industries by using that basis we can reduce time and we can easily understand how to manage resources.

Keywords: Pre-Engineered-Buildings; conventional steel building. Staad Pro, building cost, comparison, MSP, Resource Management

I. INTRODUCTION

India has the second fastest growing economy in the world and a lot of it is attributed to its construction industry which figures just next to agriculture in its economic contribution to the nation. In its steadfast development, the construction industry has discovered, invented and developed a number of technologies, systems and products, one of them being the concept of Pre-engineered Buildings (PEBs). As opposed to being on-site fabricated, PEBs are delivered as a complete finished product to the site from a single supplier with a basic structural steel framework with attached factory finished cladding and roofing components. The structure is erected on the site by bolting the various building components together as per specifications. Pre-Engineered Buildings (PEB) is the future for India. Most of the Indian business community is just started to realize the benefits of PEB's. Where you have been building with concrete for as long as anyone can remember, it is difficult to change. However India's most progressive companies are seeing the benefits of PEB's. The Pre-engineered Building is the combination of pre-cast and pre-fabricated structures. These are generally ideal for offices, houses, showrooms, shop fronts etc. Long span, Column free structures are the most essential in any type of industrial structures and Pre Engineered Buildings (PEB) fulfil this requirement along with reduced time and cost as compared to conventional structures. This methodology is versatile not only due to its quality pre- designing and prefabrication, but also due to its light weight and economical construction. Where you have been building with concrete for as long as anyone can remember, it is difficult to change. However India's most progressive companies are seeing the benefits of PEB's.

II. NEED OF STUDY

Steel industry is growing rapidly in almost all the parts of the world. The use of steel structures is not only economical but

also eco friendly at the time when there is a threat of global warming. Here, "economical" word is stated considering time and cost. Time being the most important aspect, steel structures (Pre fabricated) is built in very short period and one such example is Pre Engineered Buildings (PEB). Pre Engineered Buildings have bolted connections and hence can also be reused after dismantling. Thus, Pre Engineered buildings can be shifted and/or expanded as per the requirements in future. In this report, a comparison will be made between Pre Engineered buildings and conventional steel structures. One of the great advantages of cold-formed steel (CFS) is the immense flexibility that the material affords in forming cross-sections. This flexibility would seem to readily lend itself to optimization of member cross-section shapes. Cold formed sections also having the great flexibility of cross-sectional profiles and sizes available to structural steel designers. Whereas, the low strength-to- weight ratio of hot rolled steel members leads to increase in overall load on structure as compared with cold-formed steel sections which is having high strength-to-weight ratio. In Industrial building structures, the walls can be formed of steel columns with cladding which may be of profiled or plain sheets, GI sheets, precast concrete, or masonry. The wall must be adequately strong to resist the lateral force due to wind or earthquake.

III. AIM AND OBJECTIVES

In this study comparative study of resource management like labour material and cost of pre-engineering industrial building and conventional industrial building. Pre Engineered Buildings (PEB) fulfils this requirement along with reduced time and cost as compared to conventional structures.

- To study design of pre-engineering industrial building.
- To study design of conventional industrial building,
- To analysis resource management for conventional industrial building,

- To analysis resource management for pre-engineering industrial building,
- To formulate result and conclusion

IV. PROPOSED METHODOLOGY

The present study is included in the design of an Industrial shed structure located at Buldhana. The actual structure is proposed as a Pre-Engineered Building with four spans of 21 meters length and an eave height of 7 meters. In this study, a typical PEB frame of 21 meter span is taken into account and the design is carried out by considering wind load as the critical load for the structure. CSB frame is also designed for the same span considering an economical roof truss configuration. Both the designs are then compared to find out the economical output. The designs are carried out in accordance with the Indian Standards and by the help of the structural analysis and design software Staad.Pro.

V. THEORETICAL ASPECT

In structural engineering, a pre-engineering (PEB) is design by a PEB supplier or PEB manufacturer, to be fabricated using best suited inventory of raw materials available from from all source and manufacturing methods that can efficiently satisfied a wide range of structural and aesthetic design requirement. Each component of the building comes pre-punched, marked, completely constructed to specifications OFF-SITE and shipped to site. This facilitates the minimum ON-SITE work and the erector has to simply assemble the pieces together at site by bolting is called Pre Engineering steel Building.

CONCEPT OF PRE-ENGINEERING BUILDING

The scientific-sounding term pre-engineered buildings came into being in the 1960s. The buildings were pre-engineered because they rely upon standard engineering designs for limited number configurations. These buildings are mostly custom designed metal building to fill the particular needs of customer. Basically, a PEB is a rigid jointed plane frame from hot-rolled or cold – rolled sections, supporting the roofing and side cladding via hot-rolled or cold- formed purlins and sheeting rails. Pre Engineered Buildings offers many advantages such as more effective use of steel than in simple beams, easy extension at any time in the future and ability to Support heavy concentrated loads.

PRE-ENGINEERING BUILDING

Buildings and houses are one of the oldest construction activities of human beings. The construction technology has advanced since the beginning from primitive construction technology to the present concept of modern house building. The present construction methodology for buildings calls for the best aesthetic look, high quality and fast construction, cost effective and innovative touch. Technological improvement over the year has contributed immensely to the enhancement of quality of life through various new products and services.

CONVENTIONAL INDUSTRIAL BUILDING

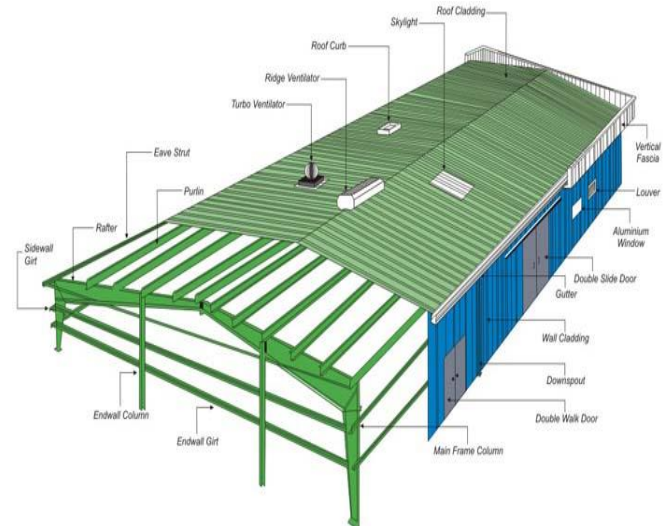
Conventional steel buildings (CSB) are low rise steel structures with roofing systems of truss with roof coverings. Various types of roof trusses can be used for these structures depending upon the pitch of the truss. For large pitch, Fink type truss can be used; for medium pitch, Pratt type truss can be used and for small pitch, Howe type truss can be used. Skylight can be provided for day lighting and for more day

lighting, quadrangular type truss can be used. The selection criterion of roof truss also includes the slope of the roof, fabrication and transportation methods, aesthetics, climatic conditions, etc. Several compound and combination type of economical roof trusses can also be selected depending upon the utility. Standard hot-rolled sections are usually used for the truss elements along with gusset plates.

3.5.2 The component of a PEB may be broadly divided into following four parts, namely

- I) Main Frame
- II) Secondary Frame
- III) Wind Bracing
- IV) Exterior cladding

PEB COMPONENTS



APPLICATION OF PEB

Following are the most applications of Pre Engineered Building are given below;

- Industrial- Factories workshop, Warehouses, Cold stores, Bulk Product storage.
- Commercial - offices, Labour camps, Showroom, Distribution centers, Super market.
- Institutional-School, Exhibitioner hall, Hospitals, Theatres, Auditoriums.
- Recreational - Gymnasium, Swimming pool enclosure.
- Aviation & Military -Aircraft hangers, residential barracks, Administration buildings.
- Agricultural -Green houses, Grain sizes, Poultry building, Grain storage.

ADVANTAGES OF PEB

i) Construction Time :

Buildings are generally constructed in just 6 to 8 weeks after approval of drawings. PEB will thus reduce total construction time of the project by at least 40%. This allows faster occupancy and earlier realization of revenue. This is one of the main advantages of using Pre-engineered building.

ii) Lower Cost :

Because of systems approach, considerable saving is achieved in design, manufacturing and erection cost.

iii) Flexibility of Expansion :

As discussed earlier, these can be easily expanded in length by adding additional bays. Also expansion in width and height is possible by pre designing for future expansion.

iv) Large Clear Spans :

Buildings can be supplied to around 90m clear spans. This is one of the most important advantages of PEB giving column free space.

v) Quality Control :

Buildings are manufactured completely in the factory under controlled conditions, and hence the quality can be assured.

vi) Low Maintenance:

PEB Buildings have high quality paint systems for cladding and steel to suit ambient conditions at the site, which in turn gives long durability and low maintenance coats.

vii) Energy Efficient Roofing:

Buildings are supplied with polyurethane insulated panels or fiber glass blankets insulation to achieve required "U" values (overall heat transfer coefficient).

RESOURCE MANAGEMENT OF INDUSTRIAL SHED

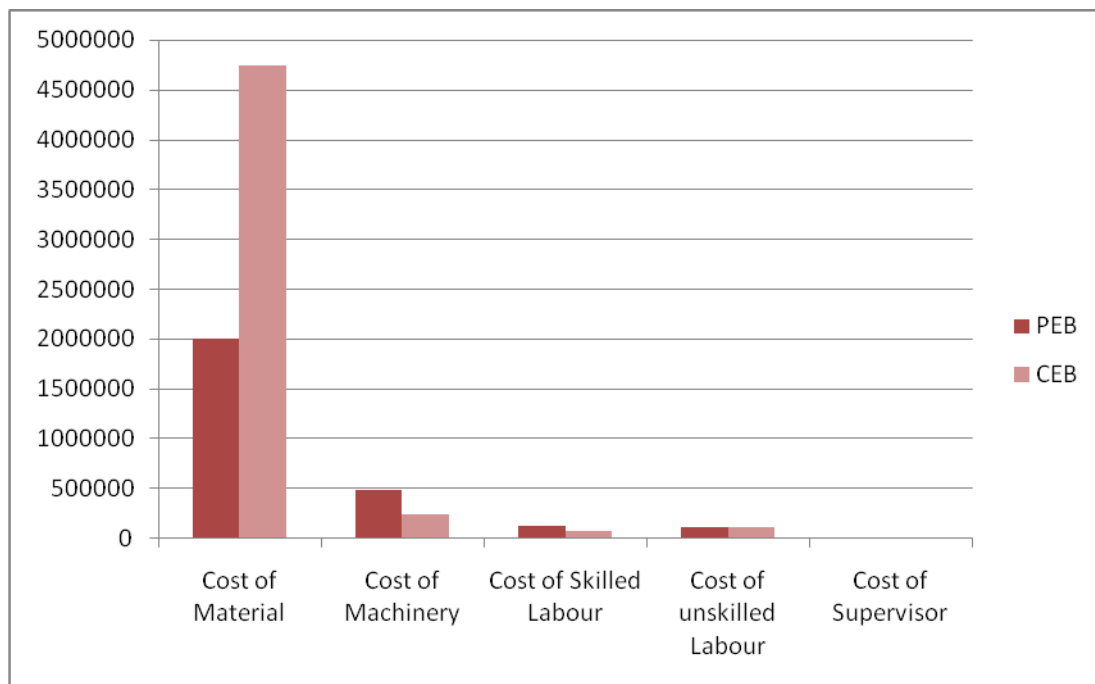
The present work presents the comparative study and design of conventional steel truss with steel columns and Pre Engineered Buildings (PEB). In this work, an industrial building of length 21m and height 7m with roofing system as conventional steel truss and pre-engineered steel truss is analyzed and designed by using STAAD Pro V8i. For the Pre-engineering Industrial shed the SATIJI steel industry in Buldhana is consulted. The structural designer Mr. Vikram Maldhure has given the design for PEB. Design is used for quantity of steel required for Conventional as well as Pre-engineering industrial shed. In this thesis focus on resource management required for both industries by using that basis we can reduce time and we can easily understand how to manage resources.

VI. RESULT AND DISCUSSION

This paper effectively conveys that PEB structures can be easily designed by simple design procedures in accordance with country standards. In light of the study, it can be concluded that PEB structures are more advantageous than CSB structures in terms of cost effectiveness, quality control speed in construction and simplicity in erection. The paper also imparts simple and economical ideas on preliminary design concepts of PEBs. The concept depicted is helpful in understanding the design procedure of PEB concept. In this study attempt are made to Microsoft Project is a Project Management software product, developed and sold by Microsoft. It is designed to assist a project manager in developing a plan, assigning resources to tasks, tracking progress, managing the budget and analyzing workload.

Table.1. Cost Comparison between Conventional Industrial Building and Pre-engineering Industrial Building

Sr. No	Resources	PEB	CEB	% Saving
	Duration	46	70	34.29
1	Cost of Material	2008094	4737901	57.72
2	Cost of Machinery	492600	249700	-97.28
3	Cost of Skilled labour	132600	73050	-35.29
4	Cost of Unskilled labour	121800	121800	0
5	Cost of Supervisor	13000	12600	-3.17



Cost comparison of different resources as shown in graph. The x axis is shows the different material and also resources like cost of material, cost of machinery, cost of skilled labour, cost of unskilled labours. The quantity of steel more used in conventional industrial shed as compare to Pre-engineering industrial shed. That is cost will be reduced in Pre-engineering industrial shed.

VI. CONCLUSION

- PEB structures are more advantageous than CSB structures in terms of cost effectiveness, quality control speed in construction and simplicity in erection. Pre-engineered steel structures building offers low cost, strength, durability, design

flexibility, adaptability and recyclability. PEB building cost is 38.89% lesser than the cost of CSB structure.

- Duration by using PEB the project can be reduced as per the study the duration reducing by 34.29%.
- By the using PEB the cost of the industrial shed can be reduced using PEB cost can be reduced in 38.89%.
- The cost of the material industrial shed can be reducing using PEB as per this study 57.72% saving in the cost of steel material.
- The cost of labour can be reduced by using as per this study overall cost. Saving the overall cost is 35.29%
Cost of skilled labour =35.29%
Cost of unskilled labour =0
- The cost of machinery in industrial shed can be more as comparing the conventional industrial building 97.28% more.
- By comparison weight wise, it is found that the total weight of PEB Frame including cold form Z purlin comes out to be 280460 kg and that of conventional roof truss including channel purlin comes out to be as 440220 kg. Thus it is concluded that Price per square meter is around 30% lower than conventional steel building due to lighter weight. Moreover heavy foundation is required for conventional roof truss due to heavy loads on column. Thus we can say that Pre-Engineered Building Construction gives the end users a much more economical and better solution for long span structures where large column free areas are needed.
- Pre-engineered steel building is very simple and economical with the necessary Architectural, Engineering and Construction.
- This study of comparative study between conventional and pre-engineered building shows their experimental and analytical studies carried out in this field. The results show that the steel structures are far more economical energy efficient and flexible in design than other type of structures for industrial use.

VII. REFERENCES

- [1].Thakre Vivek,Vairagade Laxmikant, "Analysis and Cost Comparative study of Conventional Industrial building with PEB structure" Journal Of Information Knowledge And Research In Civil Engineering Issn 0975 – 6744 , vol issuu year
- [2].Bahadure Vrushali, Prasad R.V.R.K. "Comparison Between Design And Analysis Of Various Configuration Of Industrial Sheds" International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com, Vol. 3, Issue 1, January -February 2013, pp.1565-1568
- [3].Titiksh Abhyuday, Dewangan Abhinav, Khandelwal Ankur, Sharma Akshay "Comparative Study of Conventional Steel Building and Pre- Engineered Building to be used as an Industrial Shed" International Journal of Engineering Research and Applications. www.ijera.com ISSN: 2248-9622, Vol. 5, Issue 11, (Part - 2) November 2015, pp.25-28
- [4].Mansi Solanki B, Kauswala Tausif F "Comparative Study of Design of an Industrial Workshop with Pre-Engineering Building" National Conference on Recent Research in Engineering and Technology ISSN: 2348 - 4470, print-ISSN: 2348-6406
- [5].Pradeep V, Papa Rao G "Comparative Study of Pre Engineered and Conventional Industrial Building" International Journal of Engineering Trends and Technology Volume 9 Number 1 - Mar 2014
- [6].Dineshkumar N., Kathirvel P. "Comparative Study on Prefabrication Construction with Cast In-Situ Construction of Residential Buildings." IJSET International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 4, April 2015 www.ijset.com
- [7].Gone Sai Kiran, Rao Kailash, and Ramancharla Pradeep Kumar "Comparison of Design Procedures for Pre Engineering Buildings (PEB): A Case Study." International Journal of Civil, Architectural, Structural and Construction Engineering.
- [8].Wankhade Sagar D., Pajgade P. S. "Design & Comparison of Various Types of Industrial Buildings." International Refereed Journal of Engineering and Science ISSN (Online) Volume 3, Issue 6 (June 2014), PP.13-29
- [9].Swathi D. V. "Design And Analysis Of Pre-Engineered Steel Frame" International Journal of Research Sciences and Advanced Engineering Volume 2 , Issue 8, PP: 250 – 255, OCT -DEC -2014.
- [10].Firoz Syed, Kumar Sarath Chandra , Rao S.Kanakambara "Design Concept Of Pre Engineered Building" International Journal of Engineering Research and Applications. ISSN: 2248-9622 ,Vol. 2, Issue 2,Mar-Apr 2012, pp.267-272
- [11].Chavan Vaibhav B. "Economic Evaluation of Open and Hollow Structural Sections in Industrial Trusses" International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 2, February 2014
- [12].Meera C. M. "Pre-Engineered Building Design of an Industrial Warehouse." International Journal of Engineering Sciences & Emerging Technologies, June 2013. ISSN: 2231 – 6604 Volume 5, Issue 2, pp: 75-82 ©IJESET
- [13].Villaitramani Krish R. Hirani Dhruv P. "Prefabricated Construction for Mass Housing in Mumbai" International Journal of Innovative Research in Advanced Engineering (IJRAE) ISSN: 2349-2163 Volume 1 Issue 9 (October 2014) www.ijrae.com
- [14].Wankhade Sagar, Pajgade. P. S. "Review Paper on Comparison of Conventional Steel Building & Pre-Engineering Building." International Journal of Research in Advent Technology, Vol.2, No.5, May 2014 E-ISSN: 2321-9637