



A Review of Study and Analysis of Pre-Engineered Building Using Staad Pro Software

Jaya Tamrakar¹, Dr. Anil Kumar Saxena²

^{1,2}Department of Civil Engineering, Lakshmi Narain College of Technology Bhopal (M.P.)

ABSTRACT –

The pre-designed building concept includes pre-engineered, pre-engineered steel building systems. The current building approach requires the best architectural appearance, high quality, fast and cost-effective construction and a touch of creativity. One has to consider alternative building systems such as pre-engineered steel buildings. Implementation of Pre-Designed Building (PEB) is a modern concept in which steel structure is used and the design is improved by ensuring economic safety. The main objective of this paper is to understand the concepts of PEB and to reduce the use of cost and time.

Keywords: Pre engineered building, Conventional steel building, Reusable.

1. INTRODUCTION

Although compared to other building technologies, pre-engineered construction is more sustainable and stands out when compared to other technologies. If we choose standard steel structure, the delivery time will be longer and the price will be higher compared to PEB. The materials used in this concept are reusable, recyclable and environmentally friendly. Technological advances have greatly improved over the years, which have greatly contributed to improving living standards through many new products and services. The Pre-Designed Building (PEB) is one such revolution. They use a select stock of time-tested raw materials to meet a wide range of structural and architectural design specifications.

2. LITERATURE REVIEW

Syed Fairouz et al. Al (2012) noted that the pre-engineered steel building system offers significant advantages to single-storey buildings, is a practical and effective alternative to traditional constructions, and the system represents a central paradigm in many disciplines. Pre-designed build creates and maintains real-time support currently implemented by Staad Pro. Choosing steel for a pre-engineered steel structure design is to choose a material that offers low cost, strength, durability, design flexibility, adaptability and recyclability. Steel is the primary material used in materials used in pre-engineered steel construction.

It also means choosing reliable industrial products that come in a great variety of shapes and colors; It means quick installation on site and lower energy consumption. It means choosing to adhere to the principles of sustainability. Steel, infinitely recyclable, is the material that reflects the imperatives of sustainable development. The tall steel building is no longer among the total number of tall steel structures being built worldwide. The large steel structures that have been built are just one-story buildings for industrial purposes.

Sagar Wankhede et.al (2014) presented a review article on comparisons between traditional steel buildings and pre-engineered buildings. The article begins with a discussion of the various elements of industrial construction such as purlin, rafters, main beams, roof trusses, gantry beams, brackets, column and column base, beam rails, buttress. In addition, they are transported by study load and load mix in accordance with IS 875-1987. Next, give an overview of pre-structural engineering concepts, explaining their advantages, their effective use and their structure.

CM Meera (2013) conducted a comparative study of the concept of PEB and CSB. The study is conducted by designing a typical structure for a proposed industrial warehouse building using both the concept and analysis of the designed structures using Staad Pro structural analysis and design software. Industrial warehouse design includes the design of the structural element including main beam or roof truss, column and column base, purlin, rails, tie rails, gantry beam, trusses, etc. Conventional Metal Buildings (CSB) as per design concepts. The article begins with a discussion of the methods adopted in the study. The loads and combination of loads adopted for structural analysis are well defined in the other parts. A section describing the importance of the software used and the software procedure to be followed is included. The last part explains the results obtained from the analysis of the case study program and the conclusions from the literature studies. The article aims to develop a conceptualization of the design of PEB structures and their advantages over CBS structure.

Shrunkhal V. Bhagatkar et. al (2015), a study on pre-construction with a review of several authors of articles on pre-construction. The work is aimed at evaluating from previous progress, if the use of PEB is implemented and in constant increase, its use is not in the entire construction industry.

3. NEED OF PRE-ENGINEERED BUILDINGS

The steel industry is growing rapidly in almost all parts of the world. The use of steel structures at a time when there is a threat of global warming is not only economic, but also environmentally friendly. If we choose the standard steel structures, the duration will be longer, the price will also be higher, and both together, that is, the time and cost, will be cheaper. Therefore, the entire construction is carried out in the factory on pre-engineered structures, and according to the project, the members are prefabricated and then transported to the place where they are installed in less than 6-8 weeks. During the 1960s, standard steel designs for buildings were available in the market and were named as pre-engineered buildings. From day one, the first sections were used as a standard form and structure for pre-engineered buildings. The on-site manufactured steel sections or girders were assembled using nuts and bolts. Various dimensions are manufactured from large to small according to the load and size of the structures required. Later, it was found that with pre-engineered modular buildings, the cost of projects could be reduced by a large difference, and the overall weight of the structure was also up to 30% lighter in the case of prefabricated construction.

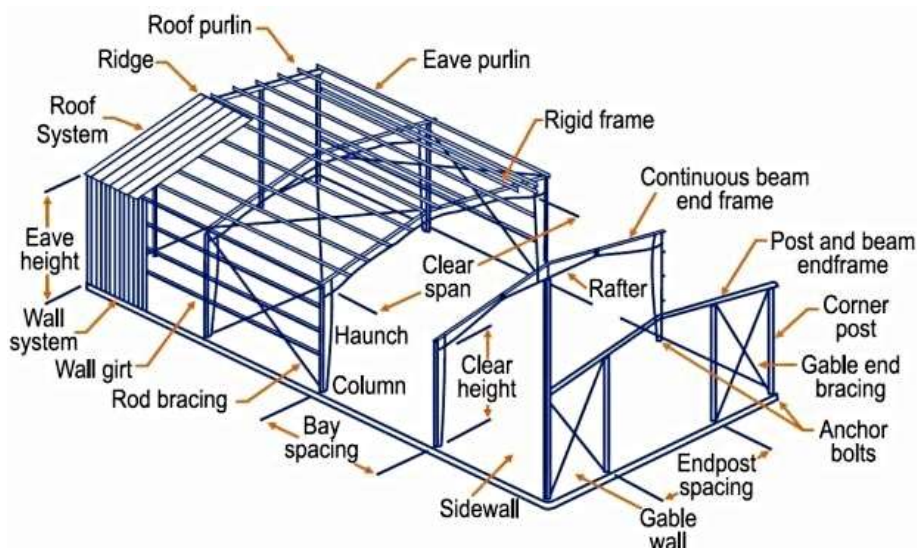


Figure 1 Pre-engineered buildings

4. HISTORY OF PEB

Since then, the use of pre-engineered buildings has spread across Asia and Africa, where the concept of PEB architecture has been widely accepted and praised. The principle of pre-engineered steel buildings is known as the most flexible and economical buildings. In civil construction, the economy and speed of delivery and installation of these buildings are incomparable. No other building system can match a pre-designed building system in terms of speed and cost from excavation to occupation.

5. COMPONENTS OF PEB

5.1. Primary members

The primary members of the PEB are the primary bearing membranes and usually consist of a rigid main skeleton. The vertical members are called columns and the horizontal members are called beams. These members are usually made of hot-rolled plate.

5.2. Secondary members

Cold formed members such as roof purlins, wall beams, eaves trusses, etc., form the secondary members in the PEB process. These are called cold formed members as there are no interventions in processes such as cutting, welding and milling.

6. ANALYSIS USING STAAD PRO V8I

Staad Pro V8i SS5 software was used to analyze and design pre-engineered and conventional building structures in this project. For the first structure, a pre-designed 3D building model of the warehouse building is built and compared with the traditional structure using traditional steel. In the second example, a two-dimensional flat structure with a width of 88 m with conical sections is designed for the PEB, and this structure cannot be built in the traditional way because it is not feasible and also uneconomical for the project. The different distances between the stalls were considered to check the most appropriate.

7. PRE-ENGINEERED BUILDING BY STAAD PRO

Staad pro V8i comes with many tools and modes to take advantage of an easy to use interface. Design and analysis can be done side by side to check that there are no errors in the designs. For PEB design, different dimensions of I-conical sections can be checked for stable and optimized structure and the same is true for conventional steel design, where pre-rolled sections with commercially available dimensions can be accessed for design and analysis purposes. STAAD Pro software can be used to analyze and design pre-engineered buildings. It can analyze the bending moment, axial forces, shear forces, torsion, beam stresses of a steel structure so that the design can be made with conic sections and safety verification. For the present design, the common stiffness matrix method was used to analyze the structure. User pre-designed building members are instructed using the option built into the software. The program offers a range of support options for our requirements. Here in this project, fixed trusses are set. As for the loads, we calculated them manually and assigned them to our chassis using the correct steps.

8. CONCLUSION

In the current situation, funds are gaining importance in all sectors including the construction industry. Sustainability is what the world strives for. In all these aspects, PEB ranks first when compared to other technologies. The most attractive construction economics can be achieved through the efficient use of high-quality steel and building forms composed of advanced materials. The construction cost study of the model showed that PEB structures are as economical as the structural members.

References

1. A.A. Zoned, A. Kulkarni, A. Hutagi, Comparative study of analysis and design of pre-engineered-buildings and conventional frames, IOSR J. Mech. Civ. Eng. 2013 (2013) 2278–1684.
2. A.S. Kumar, et al., Design and Analysis of Pre Engineered Industrial Buildings (PEB), Int. J. Appl. Sci., Eng. Manag. ISSN, 2320–3439.
3. C. Meera, Pre-engineered building design of an industrial warehouse, Int. J. Eng. Sci. Emerg. Technol. 5 (2) (2013) 75–82.
4. D.N. Subramanian, Pre-engineered buildings selection of framing system, roofing and wall materials, Masterbuilder (2008) 48–56.
5. G.S. Kiran, A.K. Rao, R.P. Kumar, Comparison of design procedures for pre engineering buildings (PEB): a case study, Int. J. Civ., Arch., Struct. Constr. Eng. (IICASCE) 8 (4) (2014) 4.
6. J.D. Thakar, P. Patel, Comparative study of pre-engineered steel structure by varying width of structure, Int. J. Adv. Eng. Technol. 4 (3) (2013) 56–62.
7. S. Bhavikatti, Design of Steel Structures (By Limit State Method As Per Is: 800 2007), IK International Pvt Ltd., 2009.
8. S. Wakchaure, N. Dubey, Design and comparative study of pre-engineered building, Int. J. Eng. Dev. Res 4 (2016) 2108–2113.
9. T. Mythili, Analysis and comparative study of conventional steel structure with PEB structure, Int. J. Sci. Res. (IJSR), ISSN (Online) (2015) 2319–7064.
10. V.S. Thorat, A.G. Whatte, IS: 800-General Construction in Steel and its Comparison with International Codes.