Design of Pre Engineered Building Using STAAD PRO

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***Abstract*— To design and analyze the casting yard under the concept of Pre-Engineered Building (PEB) involves pre designed and pre-fabricated steel building system. Casting Yard is a confined place where all the concrete structures such as I-girder, beams and other structural members are casted and transported to the site. PEB are fabricated based on the requirements and functional aspects of the building. The use of the optimal least section leads to effective saving of steel and utilization of non-prismatic rigid frames with slender elements. Tapered I section made with built up thin plates are used. Comparing the Pre-Engineered steel Buildings with Conventional Steel Buildings it is time and cost efficient. PEB construction is 30 to 40% faster than masonry construction and conventional steel construction**

***Index Terms*—PEB, Purlin, Rafter, Column, Footing.**

I. INTRODUCTION

In conventional steel building, hot rolled steel sections such as beams and columns are used. The sizes of the members are selected on the basis of internal stresses in the members. Since a hot rolled steel section has a constant depth, many parts of the member in areas of low internal stress are in excess of requirement. In Pre-Engineered Building (PEB), frames are made from an inventory of standard plates stocked by the respective manufacturer. PEB frames are normally tapered and often have flanges and webs of variable thickness along individual members. PEBs use a pre-determined inventory of raw materials that has proven over time to satisfy wide range of structural and aesthetic requirements. This flexibility allows PEBs to fulfil an almost unlimited range of building configurations, custom designs, requirements and applications A PEB building is a building shell comprising of following three distinct product categories.

Built-up I -shaped primary structural framing members (columns and rafters)

C shaped secondary members (roof truss purlin, eave struts and wall girts)

Roll-formed profiles sheeting (roof and wall panels) Concrete in recent years has drawn serious attention of researches and investigators because of the concept of thinking “Environmentally ecofriendly”. It is a substitute for OPC and emit lower CO2.

II. LITERATURE REVIEW

Jaya Tamrakar, Dr. Anil Kumar Saxena (2022) reviews about the concepts of pre-designed building idea incorporates pre-engineered steel building systems. This modern building method prioritizes aesthetics, quality, speed, and cost-effectiveness. Implementation of Pre-Designed Building (PEB) is a current concept in which steel structure is used and the design is providing economic security. Although compared to other building technologies, pre-engineered construction is more sustainable and stands out when compared to other technologies. In the current circumstances, revenue is becoming increasingly important in all industries, including the building business. Sustainability is something that the globe strives for. Using high-quality steel and sophisticated building forms can result in the most cost-effective construction. The building cost analysis of the model revealed that PEB structures are as economical as structural elements.

An Overview of Pre-Engineered Building Systems (2017) T.D. Mythili.(2017) This paper provides an overview of the pre-engineered building idea, in which the structural steels are predesigned and prefabricated. The recent construction period demands for the best aesthetic, high quality, speedy construction, cost-effective, and inventive solution. The use of PEBs in structural design has helped to optimize the design. The use of PEB in place of the Conventional Steel Building (CSB) design idea resulted in numerous

benefits, including cost savings and easier fabrication. This research examines challenges in pre-engineered construction technologies for developing Indian enterprises, as well as key success criteria such as Increased Technical Competence, Standardization and Modularization, closer alignment between manufacturing arm and other supply chain partners, Price Competitiveness, Develop suitable marketing strategies.

Review on Comparative Study of Structural Design of Pre Engineered Building With Design of Conventional Steel Structure (2022) Mr. Rushikesh Patil, Mr. K.S. Patil The application of Pre-Engineered Building (PEB) design has led to more efficient constructions in recent years. The use of PEB instead of Conventional Steel Building (CSB) design concept resulted in numerous benefits when the members were developed. Steel buildings provide better design and architectural versatility, allowing for both different and conventional styles. The design is strong and has huge clear spans, eliminating the need for intermediate support walls. You can reuse, reposition, or adjust the structure to meet your evolving requirements over years. Pre-engineered metal buildings have a distinct advantage in the construction business as they are well-suited to modern engineering requirements. This is the only solution for large industrial enclosures with thermal issues.

Study & Analysis of Pre-Engineered Building [PEB] With Respect to Conventional Steel Building (2018) Mr. Chetan Tagade, Prof.A.D. Shende, Dr.B.S. Ruprai, Mr. Jigar Shah The Prefabricated Building (PEB) is a unique one-story industrial building concept. This technology's lightweight and cost-effective architecture allows for numerous applications. This approach offers advantages over typical steel structures (CSB) for buildings with roof trusses. The industrial building is 60 m long, 15 m wide, and 60 m long, 20 m broad. The roof truss slope is to be 5.71 degrees, and bay spacing is 6m. The eave height is 6 metres. The structures were analyzed using STAAD Pro v8i and design for comparing PEB and typical steel trusses.

The PEB structure model produced by IS 800:2007 has a higher displacement than the CSB structure. Because the structure is lighter than a CSB structure, the support reaction is minimized. PEB produces a 15% lower maximal support reaction than CSB. When compared to a CSB structure, it has lower axial, shear, and bending forces. PEB has a lower maximum axial force compared to CSB. The building weighs less than a CSB building. PEB structures weigh 26% less than CSB ones. Wind resistance is greater than in a CSB structure. Steel is a cost-effective material that provides strength, durability, design flexibility, and adaptability, making it suitable for pre-engineered buildings.

Structural Analysis and Design of Pre-Engineered Buildings for Different Geometrics and Bracings (2022) T. Bharat Bhushan Gupta, Y. Dhana Lakshmi, B. Prudhvi Rani (2022) Pre-engineered buildings provide an example of a rapidly developed steel structure. The paper analyses and designs a 120-meter-long, 35-meter-wide, and 24-meter-tall pre-engineered structure at the eaves using ETABS software. In order to understand its dimensional effect on pre-engineered buildings and the behaviour of pre-engineered structures, I considered various bay spacings in thesis, including 5m, 7.5m, and 10m. The most important requirement for any type of industrial structure is long span, column free structures, which pre-engineered buildings meet and which also require less time and money to construct than traditional structures. The performance under study is compared with the analysis results, including bending moments, shear forces, and the outcomes of all center and gable rafters and center and gable columns.

Review on Implementation of PEB (Pre Engineering Building) Under AWS (2018) Pankaj N. Gadakh, Nikhil B. Bhoj, Rakesh S. Niphade, Amit J. Pund, Joshi Aniket In recent years, pre-engineered buildings have gained a lot of popularity. The primary benefits are quick construction and excellent quality control. On the other hand, hardly much is known about its economy. The cost of the structure is determined by a number of factors, including the bay spacing, spans, and gable inclination. The aforementioned characteristics are changed methodically in the current project, with the gable frame constructed for the common loads of DL, LL, EQ, and WL in each scenario. After determining the amount in each scenario, the structure that controls the least amount of steel is suggested. Pre-engineered steel

building systems are a practical and effective alternative to conventional building construction, offering many advantages over single-story buildings.

Analysis And Design of Pre-Engineering Building (2021) B Uday, A Nagaraju In this case study, analysis and design terminology for the pre-engineered building which can be also fitted with different accessories mezzanine floors, canopies, partition etc., compared with conventional steel buildings. Based on static and dynamic analysis the PEB has been designed and code provisions used are IS 800-2007, IS1893 (Part III), SP16 and IS 875-1987(Part III). This study provides the process of PEB from designing, fabrication and erection of the structure.

Design Concepts of Pre-Engineering Building (2012) Syed Firoz, Sarath Chandra kumar The pre-engineered steel building system construction has great advantages to the single storey buildings, practical and efficient alternative to conventional building. In this study Pre-engineered building creates and maintain a real time multidimensional models such as single slope span and multi slope span designed and analysed using STAAD pro. In this study they provide a guideline and the type of analyses should be considered in static analysis and dynamic analysis

Comparative Study of Pre-Engineered and Conventional Industrial Building (2015) L. Maria Subashini and Shamini Valentina Pre-Engineered Buildings (PEB) meet this condition in addition to taking less time and money than traditional structures. Long span, column-free structures are the most important type of industrial structures. This methodology's versatility stems from its lightweight and cost-effective construction as well as from its excellent pre-designing and prefabrication. The design and comparative analysis of traditional steel frames with concrete columns, steel columns, and pre-engineered buildings (PEB) are presented in this article. STAAD Pro V8i is used in this study to assess and design an industrial building that is 44 meters long and 20 meters wide, with a roofing system made up of pre-engineered steel trusses and ordinary steel trusses.

Comparative Study on Two Storey Car Showroom Using Pre-engineered Building (PEB) Concept Based on British Standards and Euro Code (2019) Balamurali Krishnan R., Ibrahim Shabbir Mohammedali In this research paper, a two-story (G+1) PEB the car showroom is analysed and designed using STAAD Pro according with Euro codes (EC3 EN-1993-1) and British standards (BS 5950-1:2000), including seismic and wind analysis. STAAD Pro was used to develop two models of the vehicle showroom, the British Standard (BS) model and the Euro code (EC) model. The critical dynamic loads for which the stability of the structure against lateral forces will be analysed for wind load and seismic load. The ultimate and serviceability limit state results from the two models' analysis and design remained within the acceptable limits. As a result, the EC model's maximum displacement with time in the X-direction is 8.83 mm while the BS model's is 10.5 mm, the outcomes of the dynamic analysis indicate that the EC model is more resilient to seismic loading than the BS model. The EC model is 7.9% heavier than the BS model, with a total weight of 1214.315 kN compared to 1125.431 kN for the BS model. In addition, the combined weight of all the portal frames for the EC model is 574.725 kN and for the BS model is 457.26 kN, resulting in tapered frame sections that use and cut steel by 25.7%. In light of this, the BS model overcame the Euro code in terms of economy.

Analysis and Design of Pre-Engineered Building Warehouse in Different Seismic Zones (2023) Shubham Dashore, Shraddha Kanojiya Review article on the analysis and design of PEB warehouses in various seismic zones is included in this paper. A wind load analysis study of the current PEB warehouse has also been investigated into. This study uses the Indian standard design codes for steel IS 800-2007 and earthquake IS 1893 part1 to analyze and design an industrial structure (a warehouse) for various seismic zones. Currently, there is a 30 KN/M2 dead load, a 250 KN/M2 live load, a 39 KM/hr wind load, a 250 KN/M2 UDL bearing, and 10 air changes per hour. Utilizing cold formed and tapered I-section sections for columns and rafters, which significantly decreases costs and minimizes steel waste. The smallest weight of a structure reduces seismic and gravitational forces given that it is proportionate to the minimum cost.

Design and analysis of pre-engineered building structure by using staad.pro (2022) Mr. Dharavath Venkatesh, K. Roja, Ms.T. Saritha According to the

study, the objective of this project is to understand the various forces and load effects that need to be considered when constructing an industrial warehouse through the use of a literature review. The dead, live wind load analysis has concluded in accordance with IS 875:1987, and the proposed design for this structure complies with IS 800:2007. (Part 1- Part 2- Part 3). Utilized for warehouse design and analysis is STADD Pro-V8i. Among the materials used to construct pre-engineered steel buildings, steel is the most common since it is a cost-effective resource with excellent strength, durability, adaptability, and recyclability.

An Investigation on Cost, Delay & Labor Problems in PEB Structure (2021) Mr. Shashank B. Petkar & Prof. A. B. Landage According to this paper study, pre-engineered steel construction projects encountered numerous issues as a result of unpredictable, impractical cash flow, inappropriate ways for paying bills, inappropriate project agreement procedures, etc. It is suggested that the contractor's financial stability be improved and that the contractor be subjected to fewer instances of unethical and inappropriate pressure. to improve the project crew's performance and productivity through hiring qualified staff and implementing an appropriate wage pay-outs plan. The project will proceed without incident if the materials are delivered on time and there is a legally enforceable contract between the client and the supplier.

Design and Analysis of a Pre-Engineered Warehouse Building Considering Lateral Load Using ETABS A Review (2019) Anuj Kumar, Afzal Khan, Vikas Patidar An industrial structure (a warehouse) is examined and planned in this study using the Indian standard IS 800-2007. Structural engineers in practice can benefit greatly from the findings of the study that was conducted on Pre-Engineering Buildings with Conventional Steel Buildings. Pre-Engineered Buildings (PEB) satisfy the requirement for long span, column-free structures, which is crucial for any kind of industrial structure.as well as less time and money spent in comparison to traditional constructions. The results indicated that the decrease in dead load will result in a smaller foundation. The mainframes, which spanned between 30 and 50 m, showed an overall reduction in steel weight of 30 to 40%. A higher percentage of reduction in frame weight was observed for larger frame spans (40, 45, and 50 meters) in comparison to smaller frame spans. Due to the building's lighter roofing and lower weight, the seismic pressures have no apparent effect on the frame weights (CSB and PEB).

Effect of Bracing under Different Loading for Conventional and Pre-Engineering Industrial Structure Suraj Tale, K.Vasug Pre engineering building (PEB) is new type of building framing system adopted in the industrial building due to its less in dead weight where these industrial building are designed for lateral loads. To with stand the lateral load bracing are provided in the industrial structure. The aim of this research work is optmize the bracings for both conventional steel building structure (CSB) and Pre Engineering iBuilding (PEB), analyze the behavior of structure under different loads by using Etabs software. The different type of bracings considered are cross bracing, V bracing, inverted V bracing and K bracing among them it is found that pre-engineering building with V bracing comes out to be best suited for both economical and minimum displacement of the structure about 7.1% and 5.68%.

CONCLUSION

Analysis of Pre-Engineered Industrial Building was done by using STAAD Pro connect version for various load combination were analyzed. The results such as maximum bending moment, shear force, axial force was taken to the design of structural elements. Throughout the design of rafters, it was tried to reduce the maximum depth of the member based on bending moment at various section. They also offer flexibility throughout the design phase. The building has a nice architectural viewpoint. PEB offers the least displacement under the load situation according to the investigation. PEB constructions are lighter and more wind-resistant. In the construction industry, among students and others, the understanding of PEB should be enhanced rather of concentrating on RCC.

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