



## ANALYTICAL STUDY PEB OVER CSB STRUCTURE USING INTERMEDIATE SUPPORT: A SYSTEMATIC REVIEW ON RECENT STUDIES

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### ABSTRACT

*The advent of Pre-Engineered Building (PEB) design of buildings in recent years has aided in design optimization. The members are designed according to a bending moment diagram, lowering the steel need. Long span, column-free buildings are needed in any sort of industrial construction, and PEB meet this criterion while taking less time and money than traditional structures. This approach is adaptable because of its high-quality pre-designing and pre-fabrication, and low cost of construction. The use of a PEB design concept instead of a conventional steel building (CSB) design concept resulted in several benefits since the members are designed according to a bending moment diagram, lowering the steel need. An industrial structure PEB Frame & CSB Frame is examined and constructed in this research according to Indian standards, IS 800-1984, IS 800-2007. The structure's economy is explored in terms of weight comparisons, between Indian codes (IS800-1984, IS800-2007), and between PEB and CSB building structures.*

**Keywords:** Pre-Engineered Building (PEB), Construction, Steel structures, Convectional buildings.

### 1. INTRODUCTION

#### 1.1 General

Steel is the material of choice for design because it is ductile and flexible. Steel members have high strength per unit weight and the properties of the steel members mostly do not change with time. Also, addition and alteration can be made easily steel structures.

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 are nothing but steel buildings in which excess steel is avoided by tapering the sections as per the bending moment's requirement. One may think about its possibility, but it's a fact many people are not aware about Pre-Engineered Buildings. If we go for regular steel structures, time frame will be more, and also cost will be more, and both together i.e. time and cost, makes it uneconomical. Thus, in pre-engineered buildings, the total design is done in the factory, and as per the design, members are pre-fabricated and then transported to the site where they are erected in a time less than 6 to 8 weeks. The structural performance of these buildings is well understood and, for the most part, adequate code provisions are currently in place to ensure satisfactory behavior in high winds. Steel structures also have much better strength-to-weight ratios than RCC and they also

can be easily dismantled. 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 paper we will discuss the various advantages of pre-engineered buildings and also, with the help of three examples, a comparison will be made between pre-engineered buildings and conventional steel structures.

**1.2 Aim:** The aim of the research is to carry out analytical study of PEB over CSB structure using intermediate support with the help of literature study done by various authors.

### 1.3 Objective

The objectives of the current study can be recognized as follows:

- The main objective of our project is to compare the design of pre-engineered steel structure with conventional steel structure system (industrial building) using IS 800:2007 IS 875 & IS1893.
- To provide stable and safe structure with economic perspective
- Design primary & secondary element of P.E.B & C.S.B and to study the optimized section of structure.
- Compare the weight of normal CSB structures to PEB structures.

**1.4 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.

## 2. LITERATURE REVIEW

**2.1 Vrushali Bahadure et al. "Camparision Between Design And Analysis Of Various Configuration Of Industrial Sheds"(2013)** noted that when comparing the various configurations of the industrial shed, several types of trusses were used, which gave them a suitable shed for the industrial shed and which is more effective in terms of strength and economic point of view. The design of various types of industrial frames using STAAD-Pro 2007 software provided them with a common design and usability. They analyzed three types of industrial shed using STAAD-Pro, from which they obtained the

necessary steel, strength and cost-effectiveness of various sheds, and then compared the corresponding results obtained with the fact that the industrial barn of the saw tooth type is 65% cheaper than the Portal and frame type which means that it is economically good.

**2.2 Firoz Syed et al. (2012) "DESIGN CONCEPT OF PRE ENGINEERED BUILDING"** noted that the construction of a pre-designed steel structure system has great advantages for single-story buildings, a practical and effective alternative to conventional buildings. The system is a central model in several disciplines. The pre-engineered building creates and supports multidimensional and data-rich real-time views with project support, which currently implements Stadd pro software packages for engineering and design.

### 2. 3.M. Meera et al. (2013)

This document is a comparative study of the PEB concept and the CSB concept. The predesigned construction concept is widely used. The article begins with a discussion of the methods adopted in the study. An introduction to the PEB and CSB systems is then described, followed by the details of a case study. Loads and load combinations adopted for structural analysis are clearly defined in additional parts. The paper aims to develop an understanding of the design concepts of PEB structures and their advantages over CSB structures.

### 2.4 Jatin D. Thakar et al. . "Comparative Study Of Pre-Engineered Steel Structure By Varying Width Of Structure" (2013)

The author noted that pre-engineered buildings are more reliable due to the reduction of steel waste and their own weight and, therefore, the ease of foundations. International codes are mentioned in their design in accordance with the standards of MBMA (Association of Manufacturers of Metal Structures), which are more flexible and allow the use of sections made with a minimum thickness of 3.5 mm versus 6 mm as the minimum criterion in the sections. from ordinary steel.

**2.5 Pradeep Kumar Ramancharla et al. (2014)** Studying a pre-designed concept of construction (PEB) in the design of structures helped to optimize the project. In this study, the production structure (warehouse) is analyzed and designed in accordance with Indian standards IS800-1984 and IS800-2007, and also refers to MBMA-96 and AISC-89. It is believed that the structure is 187 m long, 40 m wide, 8 m free height and 1:10 slope. The structure economy is compared in terms of weight of the structure as per the Indian codes (IS800-1984, IS800-2007) and the American code (AISC89).

### 2.6 Chavan et al. (2014)

The purpose is to evaluate the economic importance of hollow structural sections (HSS) as opposed to open sections. This study was conducted to determine the percentage of savings achieved by using hollow structural sections (HSS) to understand the importance of profitability. The technique used to achieve the goal included comparing different profiles for various combinations of material height and cross section for

specific loading and tensile conditions. The analysis and development phase of the project was carried out using Staad pro v8i. The results of the Staad Analysis sample were confirmed by manual analysis.

### 2.7. Aijaz Ahmed Zende “Comparative Study of Analysis and Design of Pre-Engineered Buildings and Conventional Frames” (2013)

The author, has studied comparison and analysis of PEB & CSB staad Pro. In this case study comparison for industrial building is done for bending moments at different sections & the results are compared for economy and time saving in construction. After analysis and design the report is concluded with 37% material saving in case of PEB than that of CSB.

### 2.8 Abhyuday Titiksh et al. (2015)

This paper mainly focuses on the advantages of pre-engineered buildings over conventionally designed buildings. The different fields of comparison mainly constitute its cost effectiveness, time saving, future scope, subtleness and economy of pre-engineered buildings over conventionally engineered buildings and its importance in developing nations like India. This case study for Industrial Shed based on the review & studies which shows experimental and analytical studies carried out in this field. The result shows that these structures are economical, energy efficient and flexible in design.

### 2.9 Milind Bhojkar et al. (2014)

The author has studied that the cost can be minimized by utilizing optimum cross-section of steel. Also they have shown the various application of PEB. They showed that for low rise building, PEB is found to be more economical than CSB. From their studies they concluded that CSB is 26% heavier than PEB and also PEB is 30% economical.

### 2.10 Nitin Vishwakarma et al. (2018)

The author has studied Pre Engineered and Conventional Steel Building concept of Design for Industrial building of 18 m long span located in Palwal near New Delhi, India. A fully stressed design of Pre Engineered Building with members of varying thickness, Conventional Building with Conventional Steel members and Conventional Building with different hollow and compound section are discussed in paper. A total of five cases are studied. It concluded that more than PEB, truss bracing gives the best suited result based on the economical possibility and the structural safety.

### 2.11 Sagar Wankhade et al. (2014)

The author has given importance of using pre-engineered-structure in construction, mainly for single storey building. They also have shown that conventional steel-structure has disadvantages compared to pre-engineered-structure. They have done comparative study of pre-engineered- building with conventional steel-building. From their studies they have found that pre-engineered building can be designed using simple procedures.

### 2.12 Anisha Goswami et al. “Pre-Engineered Building Design of an Industrial Warehouse” (2018)

This paper mainly focuses on the advantages of pre-engineered buildings over conventionally designed buildings. The different fields of comparison mainly constitute its cost effectiveness, time saving, future scope, subtleness and economy of pre-engineered buildings over conventionally engineered buildings and its importance in developing nations like India. This case study for Industrial Shed based on the review & studies which shows experimental and analytical studies carried out in this field. The result shows that these structures are economical, energy efficient and flexible in design.

### 2.13 Rao M.N. and Vishwanath

He noted that PEB reduced the amount of steel used by 36% compared to CSB. The bending and cutting force of PEB is less than CSB, which in turn reduces the material needed for the structure. Lighter taper sections provide better seismic resistance than heavy CSB frames in seismic zones. You can save on PEB costs in many ways, such as saving materials, providing a lighter base, etc. In addition, PEBs are aesthetically pleasing at a lower cost. With PEB, costs can be reduced by up to 30%.

### 2.14 V. Swathi

He noted that the construction of pre-engineered steel structures provides low cost, strength, durability, design flexibility, manufacturability and the possibility of recycling. The paper explains that 2D Plane Frame comparisons are performed for both pre-engineered buildings and conventional types. The flat frame has a width of 38.1 m and a distance between the bays of 6.25 m and a cornice height of 8.2 m. Based on the analytical study.

### 2.15 Subodh S. Patil et al. “Analysis And Design Of Pre-Engineered Building Of An Industrial Warehouse” (2017)

Long Span, Column free structures are the most essential in any type of industrial structures and Pre Engineered Buildings (PEB) fulfills this requirement along with reduced time and cost as compared to conventional structures. The present work involves the comparative study and design of Pre Engineered Buildings (PEB) and Conventional steel frames. Design of the structure is being done in Staad Pro software and the same is then compared with conventional type, in terms of weight which in turn reduces the cost. Three examples have been taken for the study. Comparison of Pre Engineered Buildings (PEB) and Conventional steel frames is done in two examples and in the third example, Pre Engineered Building structure with increased bay space is taken for the study. In the present work, Pre Engineered Buildings (PEB) and Conventional steel frames structure is designed for wind forces. Wind analysis has been done manually as per IS 875 (Part III) – 1987.

### **2.16 Humanaaz Arif Qureshi et al. Comparative analysis of Pre Engineered and Conventional Steel Building (2020)**

In steel structure design the Pre-engineering building (PEB) system is a modern technology that provides economical, eco-friendly and sustainable structures. Whereas before the establishment of the PEB system in steel structure construction conventional steel building (CSB) system is used which is provide time-consuming, costly design. The CSB is costly due to more consumption of steel because of using a uniform cross-section of the hot-rolled section throughout the member length. However, based on the loading effect built-up section used in PEB and only bolted connections are provided at the construction site. PEB consuming less time and provides lightweight design and it is advantageous over CSB when the span is large and column-free space required. The design and manufacturing of structure members are done at plant and later its conveyed to the construction site and the erection process will take place. In this paper, a G+3 industrial warehouse is designed and analyzed as per Indian standard code IS 800-2007 (LSM). The analysis of warehouse building was carryout by using STADD-pro software. In this paper, the comparison is also made between Pre-engineered building (PEB) and Conventional steel building (CSB).

### **2.17 T D Mythili “Analysis and Comparative Study of Conventional Steel Structure with PEB Structure”(2015)**

Cost of steel is increasing day by day and use of steel has become inevitable in the construction industry in general and in industrial building in particular. Hence to achieve economic sustainability it is necessary to use steel to its optimum quantity. 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 predesigning and prefabrication, but also due to its light weight and economical construction. In this paper an attempt has been to present comparative study of conventional and Pre-engineered steel structures which is a truss of span 30m carrying a crane of 10tonne, 15t and 20t. It has shown considerable reduction in the quantity of material.

**2.18 Mitaali Jayant Gilbile et al. (2020)** An industrial structure (PEB & CSB Frames) is analyzed and designed according to the Indian standards. Three models each for PEB and CSB are considered having different widths and a parametric study is carried out to access the performance of the models in terms of weight comparison, cost comparison and time comparison. In this study, an industrial structure (factory truss) is analyzed and designed according to the Indian standards, IS 800-1984, IS 800-2007. The various loads like dead, live, wind, seismic and snow loads according as per IS codes are considered for the present work for relative study of Pre-

Engineered Buildings (PEB) and Conventional Steel Building (CSB). To compare the consequences of the numerous parametric studies to perform the variations in terms of shear force, support reaction, weight correlation and cost evaluation

### **2.19 Anil V. Bandre et al “Optimal Design of Steel Frame using Rolled, Fabricated & PEB Sections for Comparison of Cost and Time” (2019)**

In recent years, the introduction of Pre-Engineered Building (PEB) design of structures has been as an optimised alternative for the design of sheds. The adoption of PEB design concept instead of use of conventional rolled section resulted in many advantages as the members are designed as per bending moment diagram thereby reducing the material requirement. This methodology is versatile not only due to its quality of predesigning and prefabrication, but also due to its light weight and economical construction. This concept has many advantages over the conventional method involving buildings with roof trusses.

### **2.20 Shivangi Agrawal et al. “Wind Evaluation of Pre-Engineering and Conventional Steel Structure-A review” (2021)**

In this study an industrial structure PEB frame and Conventional steel frame is wind analysis and designed according to the Indian standards, IS 800-1984, IS 800-2007 and IS 875(part3):2015. The Conventional steel building and Pre-Engineered building calls for very fast construction of buildings and with good aesthetic looks and quality construction. Conventional steel building and Pre-Engineered building can be used extensively for construction of industrial and residential buildings. The present paperwork was made in interest of studying various research work involved in analysis of PEB and conventional steel structure.

### **2.21 Mahesh Ghumare et al. “Comparative study of industrial steel structure (pre-engineered building) and residential RCC structure” (2021)**

The aim of the present study is to compare of a G+2 story residential RCC structure and industrial steel structure. Both structures are designed for same loading condition. Beam and column sections are made of either RCC, Steel (PEB) sections. STAAD PRO software is used for analysis and design and analysis results are compared. Cost effectiveness based on material cost for Steel structure and RCC structure determined. Study concludes that the industrial steel structures (PEB) are best suited types of constructions in terms of material cost.

### **2.22 Santosh S. Patil et al. “A Study on the Structural Analysis and Design of Pre-Engineered Buildings for Different Geometries” (2018)**

The introduction of Pre Engineered Building (PEB) design of structures has helped in optimizing design. The construction of PEB in the place of Conventional Steel Building design concept resulted in many advantages as the members are designed as per bending moment

diagram and thus reducing the material requirement. This methodology is versatile not only due to its quality pre-designing and prefabrication, but also due to its light weight and economical construction. This concept has many advantages over the conventional concept of steel buildings with roof trusses.

#### 2.24 Muhammad Umair Saleem et al. “Design Solutions for Sustainable Construction of Pre Engineered Steel Buildings” (2018)

Sustainable construction of ecofriendly infrastructure has been the priority of worldwide researchers. The induction of modern technology in the steel manufacturing industry has enabled designers to get the desired control over the steel section shapes and profiles resulting in efficient use of construction material and manufacturing energy required to produce these materials. The current research study is focused on the optimization of steel building costs with the use of pre-engineered building construction technology. Construction of conventional steel buildings (CSB) incorporates the use of hot rolled sections, which have uniform cross-section throughout the length. However, pre-engineered steel buildings (PEB) utilize steel sections, which are tailored and profiled based on the required loading effects. In this research study, the performance of PEB steel frames in terms of optimum use of steel sections and its comparison with the conventional steel building is presented in detail.

#### 2.25 Pradeep V et al.(2014)

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. The present work presents the comparative study and design of conventional steel frames with concrete columns and steel columns and Pre Engineered Buildings (PEB).

#### Vivek Thakre et al.

The author has shown that there are many advantages of pre-engineered- buildings having single storey especially including economy and ease of fabrication. Here they have analyzed and designed an industrial structure according to IS codes 800-1984, IS 800-2007 and by MBMA-96 and AISC-89. Later they have also compared the economy which is in terms of comparison of weight between IS codes and American codes. From their research they have concluded that the design of pre-engineered-structures is done by simple procedures with respect to IS codes.

#### 2.26 Jyoti Aher (2019)

The introduction of Pre Engineered Building (PEB) design of structures has helped in optimizing design. The construction of PEB in the place of Conventional Steel Building design concept resulted in many advantages as

the members are designed as per bending moment diagram and thus reducing the material requirement. This methodology is versatile not only due to its quality pre-designing and prefabrication, but also due to its light weight and economical construction.

#### 2.27 Gourav Jhanji et al. (2018)

Pre-Engineered Steel Buildings uses a combination of built-up sections, hot rolled sections and cold formed elements which provide the basic steel frame work with a choice of single skin sheeting with added insulation or insulated sandwich panels for roofing and wall cladding. The concept is designed to provide a complete building envelope system which is air tight, energy efficient, optimum in weight and cost. These Pre-Engineered Steel Buildings can be fitted with different structural accessories including mezzanine floors, canopies, interior partitions, crane systems etc.

#### 2.28 Nitin K. Dewani et al.(2018)

Pre Engineered Building (PEB) concept in the design of structures has helped in optimizing design. Steel is the basic material that is used in the Materials that are used for Pre-engineered steel building. The latest version of the Code of Practice for general construction in steel IS 800:2007 is based on Limit State Method of design.

#### 2.29 Pratik R. Atwal et al. (2017)

A fully stressed design of Pre Engineered Building with members of varying thickness, Conventional Building with Conventional Steel members and Conventional Building with different hollow and compound section are discussed in paper. A total of five cases are studied. It concluded that more than PEB, truss bracing gives the best suited result based on the economical possibility and the structural safety.

#### 2.30 Rajnandan Verma et al. (2020)

pre-engineered steel building system construction has great advantages to the single storey buildings, practical and efficient alternative to conventional buildings, the System representing one central model within multiple disciplines. Pre-engineered building creates and maintains in real time multidimensional, data rich views through a project support is currently being implemented by Staad pro software packages for design and engineering.

#### 2.31 Darshan Kalantri et.al. “A Comparative study on the Performance of PEB with CSB considering various parameters”(2017)

In recent years, the introduction of PreEngineered Building (PEB) design of structures has helped in optimized design. The adoption of PEB design concept in place of Conventional Steel Building (CSB) design concept resulted in many advantages as the members are designed as per bending moment diagram thereby reducing the material requirement. This methodology is versatile not only due to its quality pre-designing and prefabrication, but also due to its light weight and economical construction. This concept has many advantages over the CSB concept involving buildings with roof trusses.

- 2.32 C. M. Meera, “Pre-Engineered Building Design Of An Industrial Warehouse”(2013)** Pre-Engineered Building (PEB) concept is a new conception of single storey industrial building construction. This methodology is versatile not only due to its quality pre-designing and prefabrication, but also due to its light weight and economical construction. The concept includes the technique of providing the best possible section according to the optimum requirement. This concept has many advantages over the Conventional Steel Building (CSB) concept of buildings with roof truss.
- 2.33 Quazi Syed Shujat et.al., “Comparative Study of Design of Industrial Warehouse Using CSB, PEB and Tubular Sections” (2018)** This Paper provides the comparative study of Conventional steel building (CSB), Pre Engineered Building(PEB) and Tubular Structure. The design is made as per IS 800-2007. Dead load, Live load and wind load calculation is made IS 875 part I, II and III respectively. The concept includes the technique of providing the best possible section according to the optimum requirement. This concept has many advantages over the Conventional Steel Building (CSB) concept of buildings with roof truss. Design and analysis is done with the help of STAAD Pro V8i Software.
- 2.34 Kavya.Rao.M.N et.al. , “Design Optimisation of an Industrial Structure from Steel Frame to Pre-Engineered Building ” (2014)** Over the years, the technological improvements have contributed in enhancing the quality of our daily life to a large extent. Pre-engineered buildings are one such example in this revolution. Though it is known to have its origin in 1960’s it has been in practice widely only during the recent years. The Pre-Engineered Building (PEB) is a new concept of single storey industrial building construction. It includes the technique of providing the best possible section according to the optimum requirement.
- 2.35 Sudhir Singh Bhadoria et.al., “comparative study of pre-engineered building and conventional steel structures”(2017)** Technological advancement over the year has contributed immensely to the enhancement of quality of life through various new products and services. One such revolution in the field of construction industry is the pre-engineered buildings. Pre-Engineered Buildings are custom designed to meet client’s requirements. In Conventional steel structure, there has always been an issue of huge steel consumption and higher cost of the structure.
- 2.36 Md ShahidWasim Chaudhary et.al. , “Comparative Study of Multi-Storey Multi-Span G+4 Building by PEB and CSB Concept” (2019)** 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). Though it is known to have its origin in 1960’s it has been in practice widely only during the recent years. Steel industry is growing rapidly in almost all the parts of the world. Conventional steel buildings and Pre Engineered Buildings can be used extensively for the construction of Industrial , Commercial and Residential Buildings .These buildings can be multistoried (4-6 floors).The adoptability of PEB in the place of Conventional Steel Building (CSB) design concept resulted in many advantages, including economy and easier fabrication. Construction of conventional steel buildings (CSB) incorporates the use of hot rolled sections, which have uniform cross-section throughout the length.
- 2.37 Mitaali Jayant Gilbile et.al., “A Review on Comparative Study on the Structural Analysis and Design of Pre-Engineered Building [PEB] with Conventional Steel Building [CSB]”(2020)** In this paper, an industrial structure (PEB & CSB Frames) is analyzed and designed according to the Indian standards. Three models each for PEB and CSB are considered having different widths and a parametric study is carried out to access the performance of the models in terms of weight comparison, cost comparison and time comparison. In this study, an industrial structure (factory truss) is analyzed and designed according to the Indian standards, IS 800-1984, IS 800-2007. The various loads like dead, live, wind, seismic and snow loads according as per IS codes are considered for the present work for relative study of Pre-Engineered Buildings (PEB) and Conventional Steel Building (CSB). To compare the consequences of the numerous parametric studies to perform the variations in terms of shear force, support reaction, weight correlation and cost evaluation.
- 2.38 Swati Wakchaure et.al., “Design and Comparative Study of Pre-Engineered Building” (2016)** In recent years, the introduction of Pre Engineered Building (PEB) design of structures has helped in optimizing design. The construction of PEB in the place of Conventional Steel Building (CSB) design concept resulted in many advantages as the members are design as per bending moment diagram and thus reducing the steel requirement. In this study, an industrial structure PEB Frame & CSB Frame is analyzed and designed according to the Indian standards, IS 800-1984, IS 800-2007 .In this study, a structure with length 80m, width 60m,with clear height 11.4m and having R-Slope 5.71 Degree for PEB & 18 Degree for CSB is considered to carry out analysis& design for 2D frames . The economy of the structure is discussed in terms of its weight comparison, between Indian codes (IS800-1984, IS800-2007) & in between PEB & CSB building structure. Index terms- Tapered I Section, Pre-Engineered Buildings, Staad Pro, Utilization Ratio, IS code
- 2.39 Balamuralikrishnan R et.al., “Comparative Study on Two Storey Car Showroom Using Pre-engineered Building (PEB) Concept Based on British Standards and Euro Code” (2019)** Majority of steel structures are used for low-rise single storey buildings mainly for industrial purpose. Steel structures are preferred for industrial buildings due to its higher strength to weight ratio as compare to RCC structures and steel structures also gives more free internal space by allowing

long clear span between columns. Pre-engineered building (PEB) is a modern age concept of utilizing structural steel and optimizing the design by ensuring the economical integrity of the structure. The structural members are designed and fabricated in the factory under controlled environment to produce optimum sections by varying the thickness of the sections along the length of the member as per the bending moment requirement. The aim of the research paper is to analyses and design a PEB car showroom of two storey (G+1) using STAAD Pro in accordance to British standards (BS 5950-1:2000) and Euro codes (EC3 EN-1993-1) with wind and seismic analysis. In order to achieve the above aim of the project, two models of the car showroom were created namely British Standard (BS) model and Euro code (EC) model using STAAD Pro.

- 2.40 Anil Benibagde, Et.Al. “Literature Review On Analysis Of Pre Engineering Building (Peb) & Comparative Estimation With Conventional Steel Structure” (2020)** At the present time prebuilt steel building structure advancement has uncommon great conditions to the single story structures, practical and profitable alternative rather than customary structures, the System addressing one central model inside various controls. The flexibility of PEB in the spot of Conventional Steel Building (CSB) plan thought realized various inclinations, including economy and less difficult production. At the present time, mechanical structure (Ware House) is penniless down and arranged by the Indian measures, IS 800-1984, IS 800-2007 and moreover by suggesting MBMA-96 and AISC-89. The economy of the structure is inspected similar to its weight assessment, between Indian codes (IS 800-1984, IS 800-2007) and American code (MBMA-96), and between Indian codes (IS 800-1984, IS 800-2007)
- 2.41 G. S. Patil et.al. , “Why PEB Structures are Needed and Its Benefits” (2021)** Through a variety of new products and services, technological advancements in each industry have contributed to the improvement of quality of life. One of the construction industry's revolutions is the pre-engineering building structure (PEB structure). Traditional steel building structures have long had a problem with excessive steel consumption and greater structure costs (CSB structure). However, the PEB structure concept includes appealing elements that optimise the design, such as members that are developed according to the steel frame's bending moment diagram, resulting in a structure that is efficient in terms of steel consumption and cost.

**2.42 S.SARANYA et.al. , “Comparison of Structural Elements of a Pre-Engineered Building in Two Different Wind Zone Area”(2019)** Steel industry is growing rapidly in almost all the parts of the world. The use of steel structure is not only economical but also eco friendly. The Pre-Engineered steel building system construction has great advantages to the single storey buildings, practical and efficient alternative to conventional buildings. Pre-Engineered Building (PEB)

creates and maintains in real time multi-dimensional data rich views through a project support which is implemented by STAAD.Pro software packages for design and engineering. This paper involves the comparison of dimensions of the structural elements of a PEB built up in two different wind zone area (Hyderabad and Bangalore). Analysis is done as per codal provisions and plan is drafted using AutoCAD.

**2.43 Anil R. Benibagde et.al., “Review Study on Pre Engineering Building” (2020)** Right now prebuilt steel building framework development has extraordinary favourable circumstances to the single story structures, down to earth and productive option in contrast to ordinary structures, the System speaking to one focal model inside different disciplines. The adaptability of PEB in the spot of Conventional Steel Building (CSB) plan idea brought about numerous preferences, including economy and simpler manufacture. Right now, mechanical structure (Ware House) is broke down and planned by the Indian measures, IS 800-1984, IS 800-2007 and furthermore by alluding MBMA-96 and AISC-89. The economy of the structure is examined as far as its weight examination, between Indian codes (IS 800-1984, IS 800-2007) and American code (MBMA-96), and between Indian codes (IS 800-1984, IS 800-2007).

**2.44 Joshi Vaibhav Harish Et.AL, “Parametric Study Of Various Pre-Engineered Buildings”(2016)** The Pre-Engineered Building is having many advantages over Conventional Steel Building. Many authors have studied about benefits of PEB over CSB but there is lack of study about PEB itself. It is fact that there are variations in use of steel quantity with using different type of PEBs like regular, mono slope and curved frame PEB. For this, the analysis has carried out by taking the optimized section for loads and load combinations calculated by excel sheet, considering DL, LL and WL with the Combination according to IS 800: 2007. The analysis has done through the software ANSYS which is based on FEM. Stresses have found for design load and the stress ratio of the support frame has found with quantity of steel and compared with each other for deriving economic type of PEB. One typical frame has also take for deriving which stress is predominant for failure.

**2.45 G. Sai Kiran, “Comparison of Design Procedures for Pre Engineering Buildings (PEB): A Case Study” (2015)** In recent years, the introduction of Pre Engineered Building (PEB) concept in the design of structures has helped in optimizing design. The adoptability of PEB in the place of Conventional Steel Building (CSB) design concept resulted in many advantages, including economy and easier fabrication. In this study, an industrial structure (Ware House) is analyzed and designed according to the Indian standards, IS 800-1984, IS 800- 2007 and also by referring MBMA-96 and AISC-89. In this study, a structure with length 187m,width 40m,with clear height 8m and having R-Slope 1:10,isconsidered to carry out analysis& design for 2D frames (End frame, frame without crane and frame with 3 module cranes). The

economy of the structure is discussed in terms of its weight comparison, between Indian codes (IS800-1984, IS800-2007) & American code (MBMA-96), & between Indian codes (IS800-1984, IS800-2007).

**2.46 Rajnandan Verma Et.Al. , “Comparative Analysis Of Pre-Engineered Steel Building And Conventional Steel Building Using Etab-A Review” (2020)** In these days, the cost and time of construction is in more priority for the client with the large working area for various uses. For the economically and minimum loss of material, pre-engineered building system (PEBs) has many advantages, because it gives more column free space at low cost. Pre-engineered metal buildings are more reliable for various uses like complex industrial facilities, warehouses and distribution centers, stock-house, shopping malls, resort, motor court, office, cabin, service complex, aircraft-hanger, athletics and fun stadium, study places, temples, hospitals, and any types of industrial structures. In the pre-engineered metal building system, the rigid frame consists of slab, walls are connected with primary member (beam and column).

**2.47 Animesh Patel Et.Al, “Analysis And Comparative Study On Conventional Steel Building and Pre Engineered Building Using Staad.Pro”(2021)** Cost of steel is increasing day by day and use of steel has increase in the construction industry. Hence to achieve economic sustainability it is necessary to use steel to its optimum quantity. Long span, Column free structures like complex industrial facilities, warehouses and distribution centers, stock house, shopping malls, resort, motor court, office, cabin, service complex, aircraft-hanger, athletics and fun stadium, study places, temples, hospitals, and any types of industrial structures are the most essential in any type, Hence in steel structures which type of structure is well efficient in less time consuming, cost and strength.

**2.48 Shaik Kalesha,et.al., “An analytical study on pre engineered buildings using staad pro” (2020)** Pre-engineered building concept involves pre-designed and prefabricated steel building systems. The current construction approach calls for the best architectural look, high quality & quick construction, cost-effective & creative touch. One has to think of alternative building systems such as preengineered steel buildings. The implementation of the Pre Engineered Building (PEB) is a modern-day concept in which utilizing the steel structure and optimizing the design by ensuring economical integrity

**2.49 Anil Benibagde, et.al., “Analysis of Pre Engineering Building (PEB) & Comparative Estimation with Conventional Steel Structure”(2020)** Construction has been generally viewed as a feasible development technique as far as its effect on ecological insurance. This undertaking depends on examination of Pre-built modern steel building and customary steel building. Two distribution centers are chosen for this case study situated at Kasargod and Kannur dist, Kerala. In this study an exertion is made to investigate the predesigned steel building and contrast it and ordinary steel structure

for cost and time models. The arranging and planning is finished as indicated by the necessities and the different exercises remembered for the development of the structure.

**2.50 Abhyuday Titiksh et.al., “Comparative Study of Conventional Steel Building and Pre- Engineered Building to be used as an Industrial Shed” (2015)** The paper mainly focuses on the advantages of pre-engineered buildings over conventionally designed buildings. The different fields of comparison mainly constitute its cost effectiveness, time saving, future scope, subtleness and economy of pre-engineered buildings over conventionally engineered buildings and its importance in developing nations like India. It's a case study for Industrial Shed based on the review and various case studies which shows their experimental and analytical studies carried out in this field. The result shows that these structures are economical, energy efficient and flexible in design

### RESEARCH GAP:

Essentially, we have researched the study done by various authors for the topic PEB over CSB structure using intermediate support. There is very less study done on comparison of PEB and CSB structures. To address above concern, in this research analytical study will be carried out on PEB structure and CSB for comparison. The objective of the study is to compare the quantity, cost and time for construction of PEB and CSB.

### 3. CONCLUSION

According to previous research, PEB constructions are more cost effective and result in material savings. The usage of PEB is rising, however the use of PEB is less than projected. According to the studies, PEB structures are simple to construct. Pre Engineered Buildings (PEB) and conventional steel framework structures are meant for dynamic forces such as wind and seismic forces. Lightweight establishment may be obtained for PEB, resulting in simplicity in structure and a reduction in the cost of establishment development. CSB structure will need extensive establishment. The cost of constructing a PEB structure is 30% cheaper than that of constructing a CSB structure. A reduction in the quantity of steel undoubtedly reduces the dead load. Reducing the dead weight reduces the size of the Foundation. The use of PEB improves the aesthetic viewpoint on structure. Pre Engineered Buildings (PEB) and conventional steel framework structures are meant for dynamic forces such as wind and seismic forces. These designs are efficient, resulting in quick construction. These architectures outperform CSB in terms of dependability. As a result, additional study is needed to provide more outputs for design methodologies and material reduction in PEB structures.



#### 4. SCOPE OF THE STUDY:

- The main scope of this project is to provide theoretical & analytical knowledge in the real world by designing a CSB structure and a PEB structure and compare various parameters. To compare both the structures regarding the stability or resistance w.r.t lateral loads. The study gives a scope in terms of design of Main & Secondary Members

like Joist, Beam, Column of steel Building Using IS:800:2007

- This project also focuses on issues like time period of construction, steel consumption and response of the structure to different types of loading and condition.

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