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# Dynamic Analysis of PEB Over CSB Industrial Structure

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**ABSTRACT:** The concept of Pre-Engineered Building in creation format of structures has helped into optimizing a design of steel structure. Steel industry sector is developing more hastily in almost throughout elements of the world. In a hazard of global warming the usage of steel structures is not only efficient but also sustainable at the time. In Pre-Engineered Buildings (PEB) steel structures (Pre-fabricated) time is being the maximum significant aspect is built in very short duration period. In any type of Industrial structures and Pre-Engineered Buildings (PEB) Maximum Span, Column free suitable structures are the most vital in fulfills this requirement at the aspect of decreased time and price in comparison to conventional structures. In this research, an industrial structure warehouse is analyzed for dynamic forces according to the Indian standards (IS 800-2007) and additionally through referring American Standard (AISC LRFD). The various loads like dead, live, wind, seismic according as per IS codes are considered for the present work for relative study of Pre-Engineered Buildings (PEB) and Conventional Steel Building (CSB).

**KEYWORDS:** Steel Building, Pre-Engineered Buildings, Staadpro.

## I. INTRODUCTION

The most recent improving technology was continuously increasing the maximum clear-span competencies of steel structures. In India the industry has fast development of steel building makes for exciting analyzing and it can have commenced all with the on location fabrication model. With the opening up of the economy during the 1990s but, such things started to change. In the might of the PEB enterprise this became the cause for predominantly “manufacturing plant constructed” structures and to achieve economy growth. In PEB technology steel is one of the world’s most reused material and toward the finish of any steel product’s life, practically 100% of it tends to be reused without losing its engineering properties, preferred and ecological construction methods. The tropical nation like in India to give great protection impact and would be highly suitable for a PEB structures. PEBs is an ideal construction sector for in remote & hilly areas.



Fig 1 Conventional Steel Building



Fig 2 PEB Structure



## II. AIM AND OBJECTIVE

### Aim

The primary aim of this thesis is to perform a comprehensive dynamic analysis of Pre-Engineered Buildings (PEB) in comparison to Conventional Steel Buildings (CSB) for industrial structures.

### Objective

- To study concept of Conventional Steel Building and Pre-Engineered Building structures.
- To do dynamic analysis on PEB and CSB by using Response Spectrum Method For zone III
- To compare the pre-engineered steel structure with conventional steel structure system (industrial building) with and without supported on RCC pedestal by using IS 800:2007 IS 875 & IS1893.
- To provide stable and safe structure with economic and cost effective perspective in Civil Engineering.

## III. PROBLEM STATEMENT

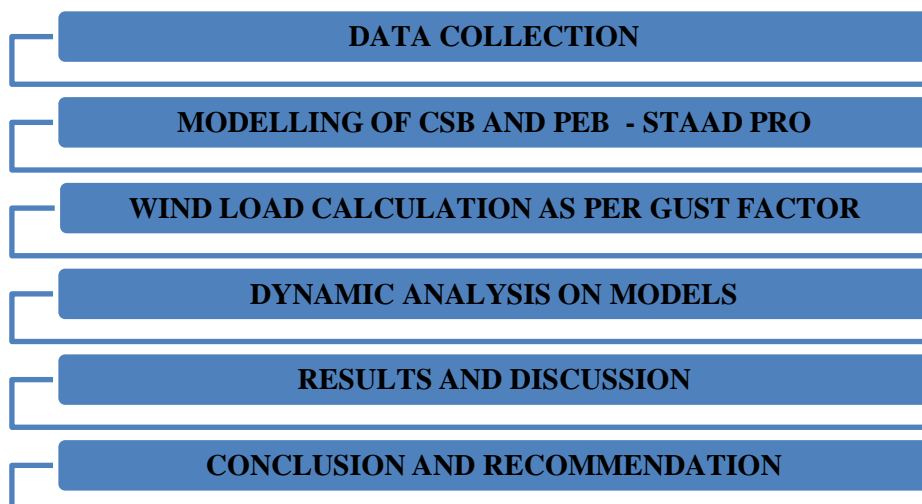
In the field of industrial construction, steel structures are widely adopted due to their strength, durability, and speed of erection. Among these, Pre-Engineered Buildings (PEB) and Conventional Steel Buildings (CSB) represent two major structural systems. While PEBs are gaining popularity due to their optimized design and cost-effectiveness, CSBs remain a traditional and well-established approach. However, limited studies have been conducted to systematically compare the dynamic performance of these two systems under seismic loading conditions. This research aims to address this gap by conducting a dynamic analysis of both PEB and CSB industrial structures, using modern structural analysis tools, to assess their relative performance and guide structural selection based on seismic efficiency, safety, and economic viability.

This study presents a comparative analysis of steel frames designed using the CSB and PEB methodologies. The analysis focuses on structural behavior under various load conditions, material optimization, construction efficiency, and economic feasibility. By evaluating the performance of both systems, the study aims to provide insights into the most suitable approach for different types of steel structures based on functional requirements and project constraints.

### Model Dimensions

- Total Height -10m
- Height of column – 8m
- Width of column – 16m
- Location - Pune.

## IV. METHODOLOGY



### Models in STAAD

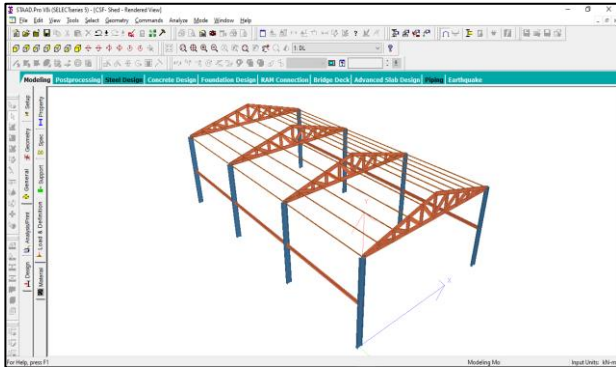


Fig 2 CSB model

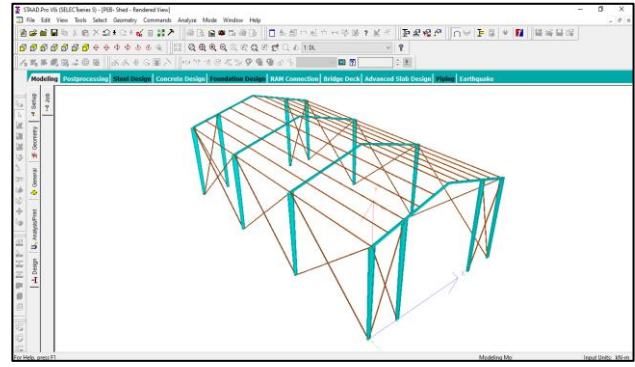


Fig 3 PEB Model

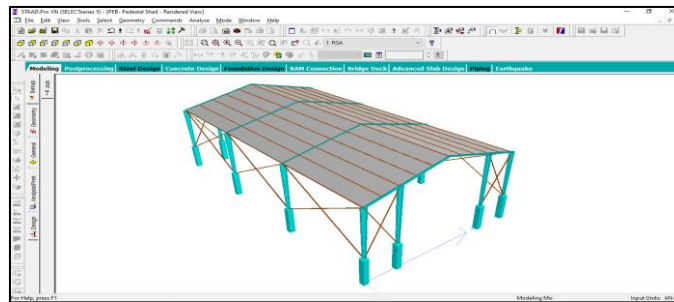


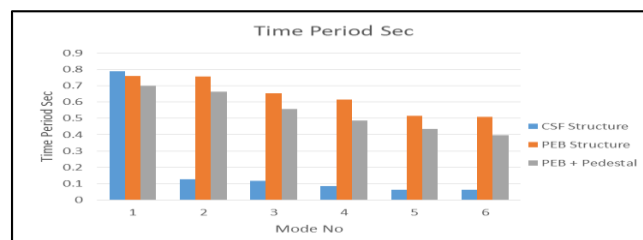
Fig 4 V Bracing Model

## V. RESULTS AND ANALYSIS

### Results For The Response Spectrum Analysis

Table 1 Time Period Sec.

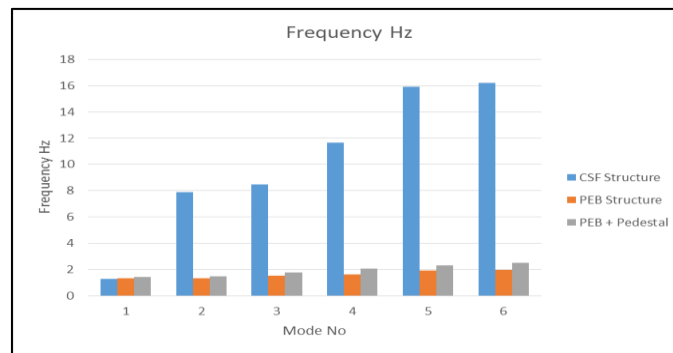
| Time Period Sec |               |               |                |
|-----------------|---------------|---------------|----------------|
| Mode            | CSB Structure | PEB Structure | PEB + Pedestal |
| 1               | 0.788         | 0.76          | 0.698          |
| 2               | 0.127         | 0.755         | 0.663          |
| 3               | 0.118         | 0.654         | 0.556          |
| 4               | 0.086         | 0.615         | 0.486          |
| 5               | 0.063         | 0.515         | 0.434          |
| 6               | 0.062         | 0.51          | 0.396          |



Graph 1 Time Period Sec.

Table 2 Frequency Hz

| Mode | CSB Structure | PEB Structure | PEB + Pedestal |
|------|---------------|---------------|----------------|
| 1    | 1.27          | 1.316         | 1.434          |
| 2    | 7.878         | 1.324         | 1.508          |
| 3    | 8.482         | 1.53          | 1.8            |
| 4    | 11.665        | 1.625         | 2.06           |
| 5    | 15.893        | 1.943         | 2.303          |
| 6    | 16.188        | 1.962         | 2.527          |



Graph 2 Frequency Hz

### Results for Wind Load Analysis – Displacement

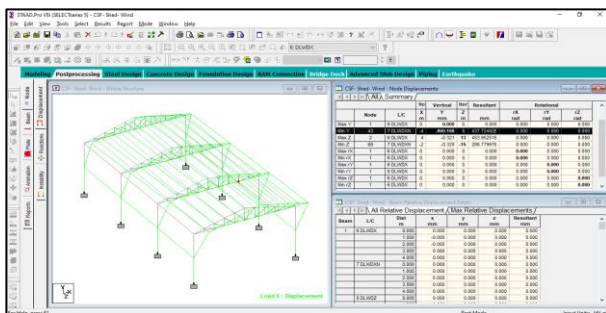


Fig 5 Displacement CSB

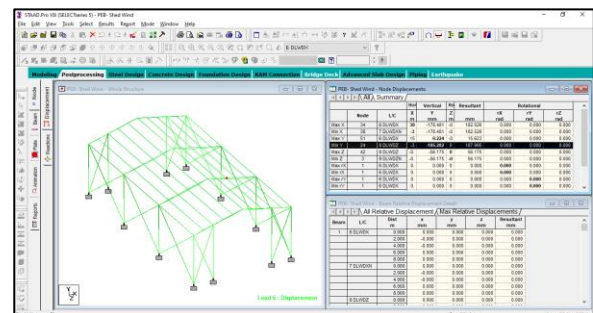


Fig 6 Displacement PEB

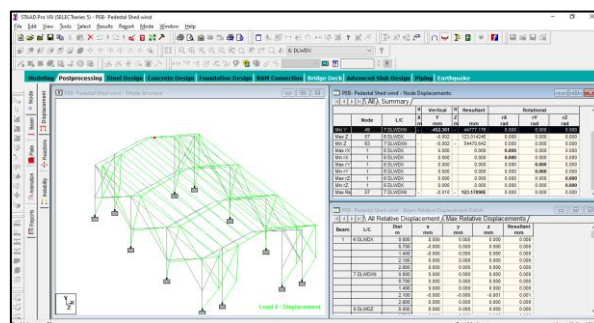
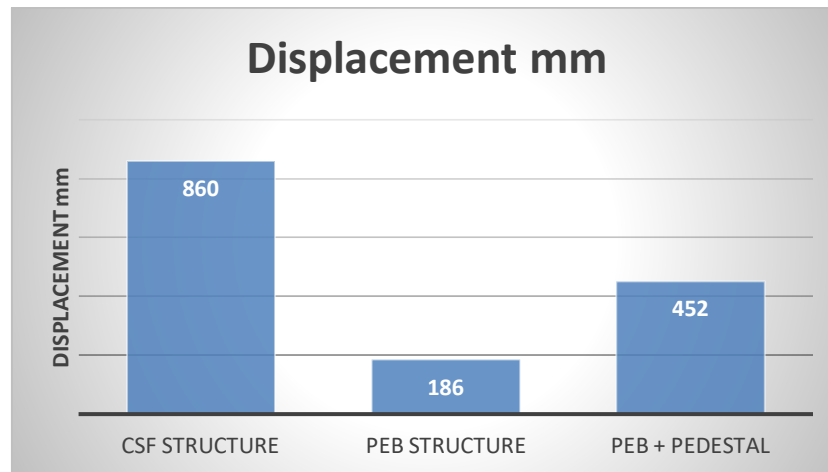


Fig 7 Displacement PEB+ Pedestal

Table 3 Displacement mm

| Displacement mm- Wind Load |               |                |
|----------------------------|---------------|----------------|
| CSB Structure              | PEB Structure | PEB + Pedestal |
| 860                        | 186           | 452            |



Graph 3 Displacement mm

## VI. CONCLUSION

- This study presented a dynamic analysis of Pre-Engineered Buildings (PEB) and PEB structures with pedestals, in comparison to Conventional Steel Buildings (CSB), for industrial applications. Through detailed modeling and response evaluation under dynamic loading conditions, it was observed that PEB systems generally outperform CSB structures in terms of overall structural efficiency, material optimization, and dynamic response characteristics.
- The analysis further highlighted that the incorporation of pedestals in PEB systems significantly improves lateral stability, especially under high lateral force conditions such as wind or seismic loads. This enhancement is attributed to the increased stiffness and better load transfer mechanisms facilitated by the pedestal system.
- In conclusion, PEB structures offer a superior alternative to CSB for industrial buildings due to their lightweight, economical design, and effective dynamic behavior. Additionally, the use of pedestals in PEB is a viable solution in regions susceptible to high lateral forces, providing enhanced structural safety and performance.

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