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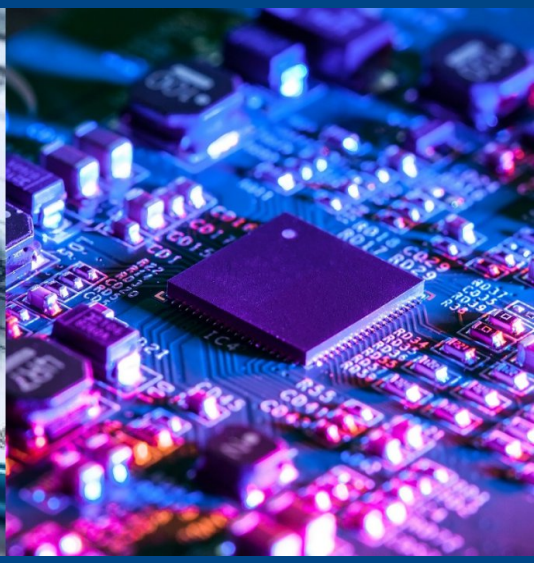

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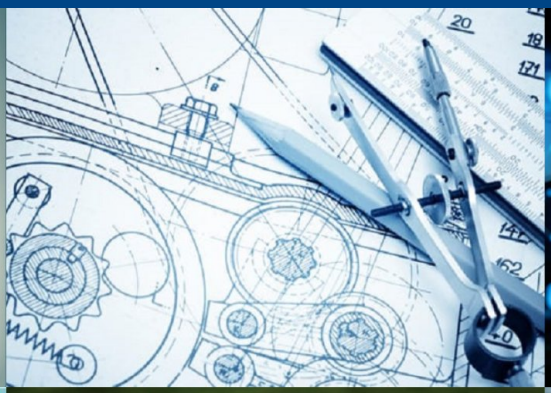

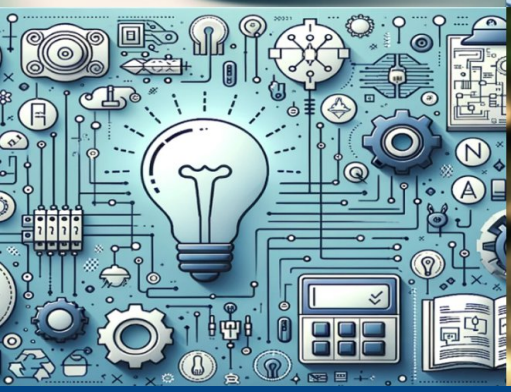

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Design of Pre Engineering Building using ETAB Software

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ABSTRACT: Pre-Engineered Buildings (PEBs) are becoming popular in modern construction because of their cost efficiency and fast construction. This study focuses on the analysis and design of a steel PEB structure using ETABS software. The model is analyzed under different loads such as dead load, live load, wind load, and seismic load according to Indian Standard codes. Parameters like bending moment, shear force, displacement, and axial force are evaluated. The results show that PEB structures use less material, provide better performance, and reduce construction time compared to conventional buildings.

KEYWORDS: Pre-Engineered Buildings (PEB) ,ETABS ,Structural Analysis , Steel Structures , Industrial Buildings , Load Analysis ,Wind Load Seismic Load.

I. INTRODUCTION

Background

In recent years, the construction industry has focused more on reducing cost and construction time while maintaining safety. Traditional construction methods often require more materials and labor. To overcome these issues, Pre-Engineered Buildings (PEBs) are used.

A PEB is a structure whose components are manufactured in a factory and then assembled at the site. This method improves quality control and reduces waste. PEBs are commonly used for warehouses, industries, and large-span buildings.

In India, the use of design codes such as IS 800, IS 875, and IS 1893 ensures safe and reliable construction This study focuses on the design and analysis of a PEB structure using ETABS, considering various loading conditions and evaluating structural performance. The aim is to demonstrate the advantages of PEB systems and highlight their suitability for modern construction needs.

Problem Statement

Conventional steel structures require more time, cost, and material. They are not always optimized for loads like wind and earthquake forces. Hence, there is a need for a better system like PEB which improves efficiency and performance.

Key Research Question:

How effectively can a Pre-Engineered Building (PEB) be modeled and analyzed using ETABS software?
A Pre-Engineered Building (PEB) can be modeled and analyzed very effectively using ETABS due to its advanced structural modeling and analysis capabilities. ETABS allows engineers to create accurate 3D representations of PEB structures, including primary members (columns and rafters), secondary members (purlins and girts), and bracing systems.

The software supports the definition of customized section properties such as tapered and built-up sections, which are essential for PEB design. It also enables the application of various loads—dead, live, wind, and seismic—based on standard design codes, ensuring realistic simulation of structural behavior..ETABS performs detailed analysis to determine key parameters such as bending moments, shear forces, axial forces, and displacements. It also checks whether the structure satisfies safety and serviceability criteria.

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Overall, ETABS provides a highly efficient, accurate, and time-saving platform for analyzing PEB structures, reducing manual errors and enabling optimized structural design.

Objectives of the Study
he primary objectives of this study on **PreEngineered Buildings (PEB)** are:

Structural Analysis:
To evaluate the stress distribution, bending moments, shear forces, and deflections under various load conditions.
Design Optimization:
To optimize the steel sections and bracing systems for material efficiency without compromising safety or serviceability.

Research Objective
To analyze a PEB structure using ETABS
To study behavior under different loads
To compare efficiency with conventional structure

II. LITERATURE REVIEW

Previous studies show that PEB structures are more efficient than conventional steel buildings.
PEBs use portal frame systems which handle loads effectively
They reduce steel usage by about 20–30%
Software like ETABS and STAAD .Pro helps in accurate analysis
Construction time is reduced due to prefabrication
These studies prove that PEB is a better option for modern construction

III. METHODOLOGY

Step 1: Model Creation
Software used: ETABS and STAAD.Pro
Structure: Industrial warehouse
Span: 30 m, Bay spacing: 6 m
Step 2: Material Properties
Steel grade: S355
Sections used:
Columns: IPE 300
Rafters: ISMB 450
Purlins: C-section
Step 3: Load Application
Dead Load: Self-weight + roofing
Live Load: Maintenance load
Wind Load: As per IS 875
Seismic Load: As per IS 1893
Step 4: Analysis
Linear static analysis performed
Results obtained: bending moment, shear force, deflection
Step 5: Optimization
Section sizes adjusted to reduce weight
Deflection limits checked (L/180, L/250)

IV. RESULTS & DISCUSSION

Maximum bending moment occurs at mid-span of rafters
Deflection is within permissible limits
Bracing system improves stability

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PEB reduces steel usage by approximately 25%
Construction time is reduced compared to conventional buildings
The results confirm that PEB is efficient and economical.

Software Accuracy and Reliability
The analysis results obtained from ETABS software are found to be accurate and reliable for PEB design.
The software efficiently handles complex load combinations and provides precise values of bending moment, shear force, and deflection.
This reduces manual calculation errors and improves overall design efficiency.

Structural Stability and Safety
The PEB structure shows good stability under various loading conditions due to the use of bracing systems and proper load distribution.
The structure satisfies safety requirements as per Indian Standard codes, ensuring reliable performance against wind and seismic forces.

Scope of the Study
Analysis of PEB under different loads
Optimization of structural members
Comparison with conventional steel buildings
Study of cost and time savings

V. CONCLUSION

The study shows that Pre-Engineered Buildings are more efficient than traditional structures. They reduce material usage, save time, and provide good structural performance. The use of ETABS software helps in accurate analysis and design. PEBs are suitable for industrial and commercial construction.

VI. FUTURE SCOPE

Use of advanced software integration
Study of seismic performance in detail
Use of eco-friendly materials
Automation in PEB design

VII. ACKNOWLEDGMENT

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