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Analysis and Design of Pre-Engineered Building Using Software

Navale Revati Vinod[1], Hasnale Priti Ambadas[2], Zende Bhagyashree Satish[3], Sudke Pavan Balasaheb[4], Wakale Niranjan Nitin[5]
[1, 2, 3, 4, 5]*Student Of Civil Engineering Department, Dr. V.V.P. Collage of Engineering A. Nagar*

Abstract: ***Pre-engineered buildings have become quite popular in the last few years. The main advantage are speed of construction and control over quality. However, there is not much information on its economy. There are several parameters like inclination of the gable, spans, bay spacing which control the cost of structure and designed for the common loads DL, LL, EQ, & WL. In this involves comparison of PEB & conventional steel frame. The quality in each case is obtained & finally the structure which regulates the quality of steel is recommended. Cost of steel is increasing day by day & use of steel has increase in the construction industry. Hence to achieve economic sustainability it is necessary to use steel to its optimum quantity. Use pre-engineered building (PEB) & conventional structures, which fulfil our requirements. In present work, PEB & CSB is designed for static & dynamic forces, which includes seismic forces & wind forces.***
Keywords: Pre-engineered building, Conventional steel frame, Quality control, STAAD Pro, Economic sustainability

I. INTRODUCTION

Steel industry is growing rapidly in almost all parts of the world. The use of steel structures is not only economical but also ecofriendly at the time were there is a threat of global warming. Here “economical” word is stated considering time and cost. Time being most important aspect, steel structure (pre-fabricated) is built in very short period & one such example is pre-engineered buildings (PEB). PEB are nothing but steel building in which excess steel avoided by tapering the sections as per the bending moments requirement. The structural performance of these buildings is well understood & for the most part, adequate code provisions are currently in place to insure satisfactory behaviour in high winds. Pre-engineered building have bolted connections & 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 we will discuss the various advantages of PEB.

A. Pre-Engineered Building

Presently, large column free area is the utmost requirement for any type of industry & with advent of computer software’s it is now easily possible. With the improvement in technology, computer software’s have contributed immensely to the enhancement of quality of life through new researches. Pre-engineered building is one of the such a revolution. “pre-engineered building” are fully fabricated in the factory after designing, then transported to the site in completely knocked down condition and all components are assembled & erected with nut-bolts, there by reducing the time of completion.

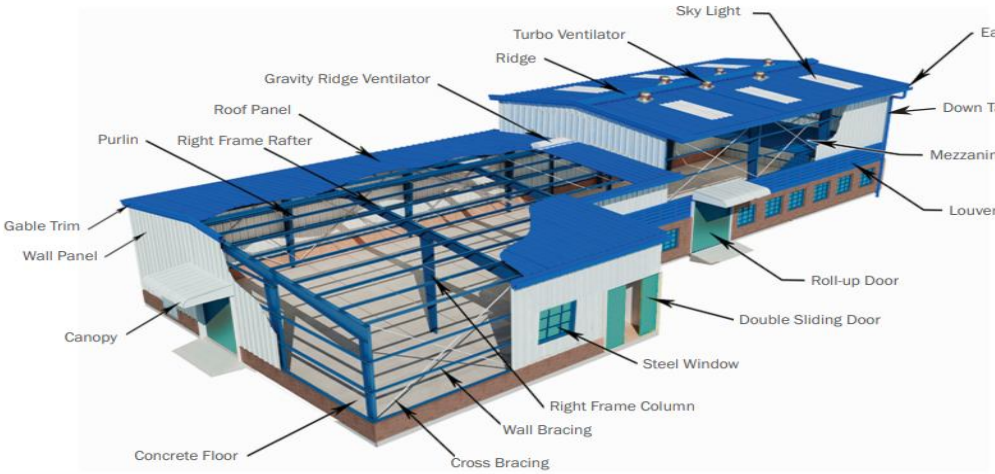
PEB are steel building were in the framing members & other components are fully fabricated in the factory after designing & brought to the site for assembly, mainly by nut-bolts, thereby resulting into a steel structure of high quality and precision. In conventional steel building, we have site welding involved, which is not case in using nut-bolts mechanism. Pre-engineering building is the combination of the tapered bult-up section, hot roll section, and cold-formed section material. The structural engineer designs the primary and secondary members of the PEB. For primary components i.e., column and rafter bult-up tapered section are used instead of hot rolled sections. The girts & purlins which are supporting to sheeting are the secondary members. The section sizes depend on the bending moment diagram.

Components of industrial building:

The elements of industrial buildings are listed below:

1) Purlins
2) Principle rafters
3) Sag rods
4) Roof truss
5) Gantry girders

6) Bracket
7) Column and column base
8) Girt rods
9) Bracings



II. LITRATURE REVIEW

1) Ms. Shalaka Patil Prof. Dr.M.B. Kumthekar

The paper declared that the pre-built steel building framework development has circumstances to the single-story structures, and productive option in contrast to regular structures. Choosing steel to plan a pre-built steel structures building it to pick a material which offers minimum efforts, quality, strength, plan adaptability, versatility & recyclability. Steel is the fundamental material that is utilized in the materials that are utilized for pre-built steel building.

2) Mitali Jayant Gilbile, S.S. Mane

In this paper, an industrial structure (PEB&CSB Frames) is analysed and designed according to the Indian standards. Three models each for PEB and CSB are considered having different widths & parametric study is carried out to access the performance of the model in terms of weight comparison, cost comparison and time comparison. In this study, an industrial structure (factory truss) is analysed and designed according to Indian standards, IS 800-1984, IS 800-2007. The various loads like dead, live wind loads according as per IS codes are considered for the present work for relative study of pre- engineered buildings (PEB).

3) Animesh Patel, Prof. Kapitsa Golghate

In this paper declared that as of late, the presentation of the pre-engineered building idea in the plan of structures has helped in streaming structure. The adaptability of PEB in the spot of conventional steel building structure idea brought about numerous focal points, including economy & simpler manufacture. Prefabricated steel building requires less consumption of time to be constructed. Example, pre-engineered building and conventional steel building.

4) Deepti D. Katkar, Prof. N.P. Phadtare

They observed that pre-engineered building is a suitable construction technique for developing countries. It is combination of precast & prefabricated structures. Pre-engineered buildings are generally low- rise buildings which are ideal for offices, houses, showrooms, shop fronts etc. in recent years, the introduction of pre-engineered building (PEB) concept in the design of structures has helped in optimizing design.

ADVANTAGES

Following are some of the advantages of pre-engineered building structures

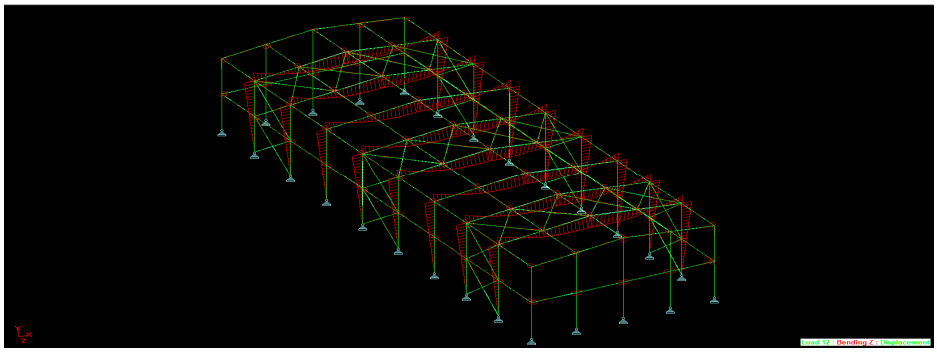
a) Construction time
b) Lower cost
c) Flexibility of Expansion

d) Large Clear
e) Quality control
f) Low maintanance
g) Energy Efficient Roofing
h) Erection

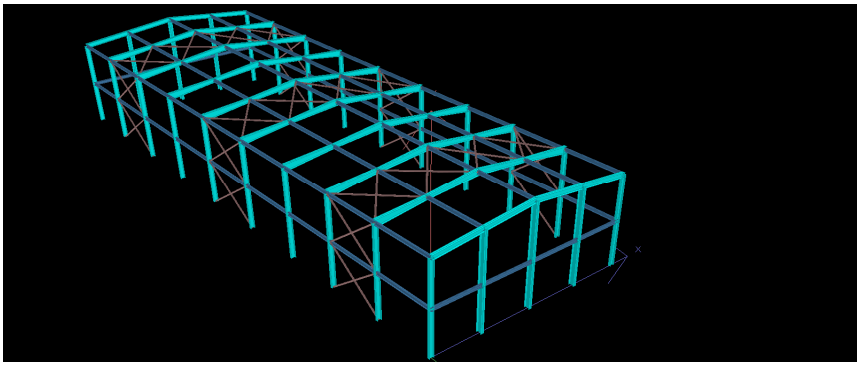
III. METHODOLOGY

The scientific sounding term pre-engineered buildings came into being in the 1960s. The buildings were pre-engineered because, like their ancestors, they relied upon standard engineering designs for a limited number of off-the-shelf configurations. Several factors made this period significant for the history of metal buildings. First, the improving technology was constantly expanding the maximum clear-span capabilities of metal buildings. The first rigid-frame buildings introduced in the late 1940s could span only 40 ft. in a few years, 50, 60, & 70ft buildings become possible. By the late 1950s, rigid frames with 100ft spans were made; ribbed metal panels become available, allowing the buildings to look different from the old tired corrugated appearance. Third, collared panels were introduced by stand-steel corp. In the early 1960s, permitting some design individuality. At about the same time, continuous span cold-formed Z purlins were invented; the first factory-insulated panels were developed by Butler, & the first UL approved metal roof appeared on the market. First and last, but not least, the first computer designed metal buildings also made their debut in the early 1960s. With the advent of computerization, the design possibilities become almost limitless.

1) Bending Moment Diagram From STAAD. Pro



2) 3D View



IV. CONCLUSION

Choosing steel to design a pre-engineered steel structures building is to choose a material which offers low cost, strength, durability, design flexibility, adaptability, and recyclability. Steel is the basic material that are used for pre-engineered steel building. It neglates from regional sources. It also means choosing reliable industrial products which come in the huge range of shapes and colors; it means site installation and less energy consumption. It means choosing to commit the principle of sustainability. Infinitely recyclable, steel is the material that reflects the imperatives of sustainable development. Pre-engineered building construction gives the end users much more economical and better solution for long span structures where large column free areas are needed.

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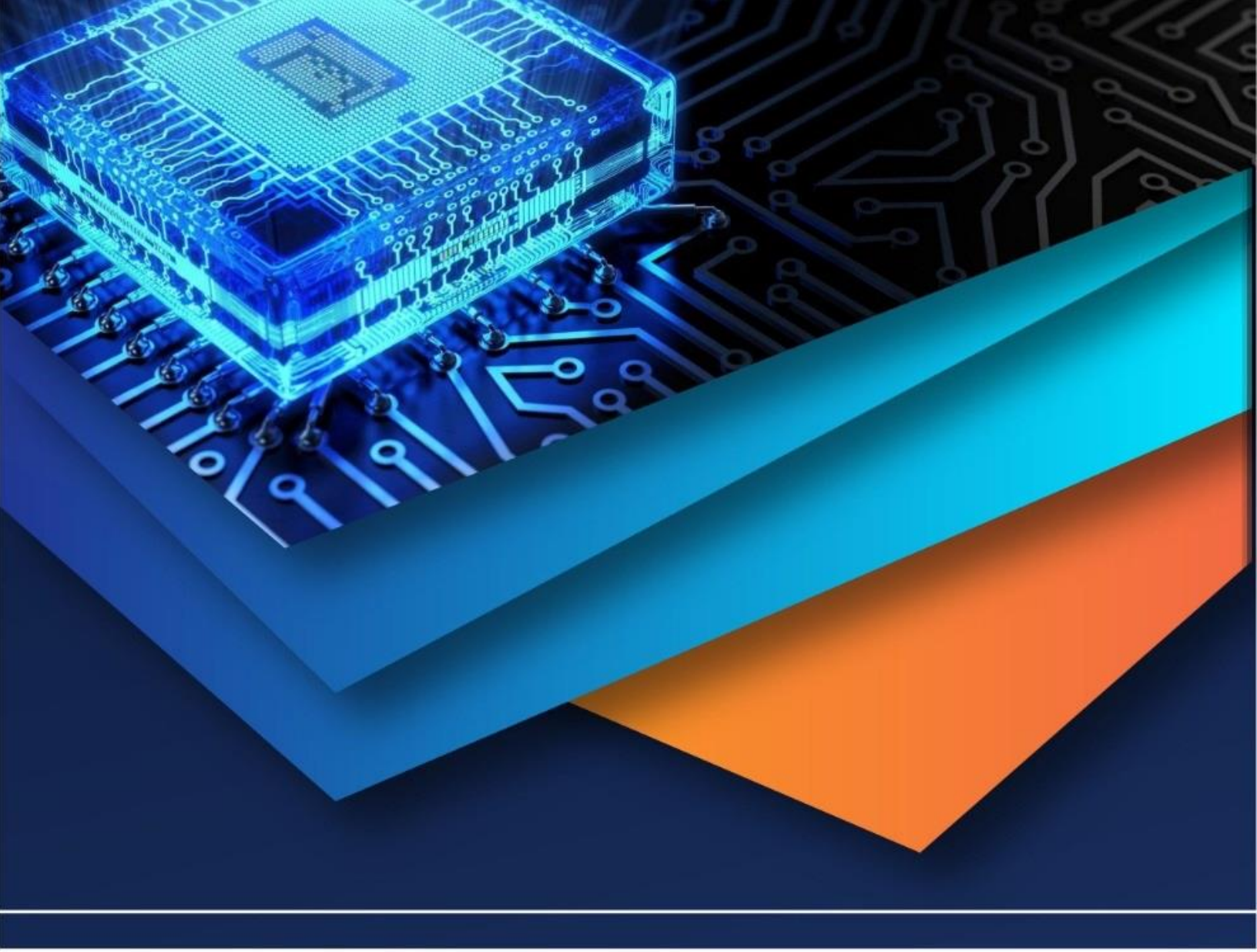

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