Wind Evaluation of Pre-Engineering and Conventional Steel Structure-A review

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Abstract **- In recent years, the introduction of Pre-Engineered Building (PEB) design of steel structures has helped in optimizing design concept with reducing the dead load of structure. The construction of PEB in the place of Conventional Steel Building (CSB) design concept resulted in many advantages as the members are design. The design of PEB structure as per bending moment distribution diagram over the whole span of beam and column and thus reducing the steel requirement with the help of using tapered IS- section. 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.**

Index Terms **- Pre-engineering, structure building, wind analysis, construction, residential etc.**

1.INTRODUCTION

The concept of pre-engineering steel structure design approach has become the future direction for Indian standard design codes. In this approach, reduced section according to bending moment analysis procedures become important in determining the patterns and extent of damage to assess the structure response against the load and wind event. software analysis is a simplified procedure which is conducted on single and multi-degree of freedom system to analyse structure frame until collapse mechanism is formed.

This undying quest for height has laid out incredible opportunities for building profession. From early moment frames to today's ultra-efficient mega braced structures, the structural engineering has come a long way. The recent development of structural analysis and design software coupled with advances in finite element method has allowed the creation of many structural and architecturally innovative forms. However, increase reliance on computer analysis is not the solution to the challenges that lie ahead in the profession. The basic understanding of structural behavior while leveraging on computing tools are the elements that will change the way structures are designed and built. the design of structures is controlled by three governing elements strength, stiffness, and serviceability, produced by the action of lateral loading such as earthquake and wind.

Pre-Engineered Steel Buildings use a combination of built-up sections, hot rolled sections and cold formed elements which provide the basic steel framework 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 airtight, energy efficient, optimum in weight and cost and, above all, designed to fit user requirement like a well fitted glove.

2. LITRATURE REVIEW

A brief review of previous studies on the application of PEB (pre-engineering building) on different structural configuration. This literature review also includes previous studies on different application of PEB (Pre engineering building). This literature review on recent contribution related to cost analysis of building structure with both PEB and Conventional Building.

Sudhir Singh Bhadoria is studied about 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. This Paper deals to resolve such issues by replacing conventional steel structure with PEBs. The concept and attracting feature of PEB such as members are designed as per the bending moment diagram of the steel frame, in order to make the structure economical in terms of steel consumption and cost. In this paper, various models of PEB span ranging from 10m to 50m i.e., 10m, 20m, 30m, 40m, 50m are compared with another five models of conventional steel structure of span same as that of PEB. Models of both the system are designed using Staad Pro Software and analyzed under Dead, live, wind and Seismic load to find out which system is economical.

Swati Wakchaure in his research paper 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.

Syed Firoz Et Al., The 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 StaadPro software packages for design and engineering. 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 is used in the Materials that are used for Pre-engineered steel building. It negates from regional sources. It also means choosing reliable industrial products which come in a huge range of shapes and colours; it means rapid site installation and less energy consumption. It means choosing to commit to the principles of sustainability. Infinitely recyclable, steel is the material that reflects the imperatives of sustainable development.

Aijaz Ahmad Zende et al., 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. The present work involves the comparative study of static and dynamic analysis 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, longer span Pre-Engineered Building structure is taken for the study. In the present work, Pre-Engineered Buildings (PEB) and Conventional steel frames structure is designed for dynamic forces, which includes wind forces and seismic forces. Wind analysis has been done manually as per IS 875 (Part III) – 1987 and seismic analysis has been carried out as per IS 1893 (2002). Pre-engineered steel structures building offers low cost, strength.

Subhrakant Mohakul Et Al., In this project work submitted, it is proposed to carry out the design of an industrial steel storage shed, and consideration of forces acting through the other members when one of the members fails, due to the failure of a connecting joint. This topic of work is decided as considering an accident which took place in R.I.N.L. Visakhapatnam, in November 2013, in which a Slag Yard collapsed, during a heavy rain. This Project is a study of the forces acting in the adjacent members when one of the members failed, and calculating the excess stresses and ratios induced in these connected members. Also, the moments and slenderness's produced are found and described. This structure is proposed to design

according to IS: 800 - 2007 and the dead, live and the wind load analysis is done according to IS: 875 - 1987 (Part-I, Part-II, Part-III). A major portion of the analysis is carried out in Bentley Staad.Pro V8i.

Kavita K. Ghogare And Dr. S.K. Deshmukh, the present paper describes the stability analysis of industrial shed subjected to wind load. For present work the equivalent static analysis is carried out for single storey steel building with pitched roof in zone II. It is nothing but the industrial structure. The industrial structures shall be designed and constructed to resist the wind effects in accordance with the requirements and provisions of IS:875 (Part 3):1987. This standard describes the procedure for wind resistant of such structures. The stability analysis of single storey steel building with pitched roof is carried out using Software Computer Aided Design i.e., (STAAD PRO). The main parameters consider in this paper to compare wind performance of buildings are bending moment, shear force, deflection, and axial force. In this paper we only focus on industrial shed i.e., pitched roof truss.

A building has to perform many functions satisfactorily. Amongst these functions are the utility of the building for intended use and the occupancy, structural safety,

G. Durga Rama Naidu et al., Long Span, Column free structures are the most essential in any type of industrial structures and Pre-Engineered Buildings (PEB) fulfils 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.

D V Swathi, Long Span, Column free structures are the most essential in any type of industrial structures and Pre-Engineered Buildings (PEB) fulfils this requirement along with reduced time and cost as compared to conventional structures. The present work involves the analysis and design of Pre-Engineered Buildings (PEB). Examples have been taken for the study. Wind analysis has been done manually as per IS 875 (Part III) – 1987.

To Conclude Pre-Engineered Building Construction gives the end users a much more economical and better solution for long span structures where large column free areas are needed" .

Yash Patel et al., Many of the steel building are made up with orthodox sections of steels which are designed and built by conventional approaches. This directs to weighty or too expensive structures. Tubular steel is the best possible. Analysis of shed's elements was carried out by Staad Pro V8i computer software, with manually applying Indian Standards. Several excel sheets for various structural elements like Purlin, Roof Truss, compression member, Tension member etc. were carried out using Microsoft office excel. Lastly estimation sheet is prepared for each Conventional Roof Truss section as well as Tubular roof truss section.

Overall, 18% saving has been achieved during this project work. From the present study and results we can conclude that, the structural members having larger span length can be designed with tubular sections which will be benefitted in overall economy. For smaller span lengths one would have to design roof truss with minimum sections for both conventional steel sections and tubular steel sections which would affect overall economy due to larger initial cost. Even if cost for tubular sections is more compared to conventional sections, but because of comparatively less dead weight it has proved more economical for the industrial roof truss as well as for other steel structures.

Salem R.S Ghdoura and Vikas Srivastava, Due to limitations on maximum allowable deflection. The high strength properties of structural steel cannot always be utilized to best advantage. As a result, several new methods have been aimed at increasing the stiffness of the steel members without any increase in weight of the steel required. Steel frame is a building technique with a skeleton frame of vertical steel columns and horizontal I-beams, constructed in a rectangular grid to support the floors, roof and walls of a building which are all attached to the frame. The development of this technique made the construction of the skyscraper possible. In this research a steel framed structure is selected and is analysed for different loading and support condition by using STAAD Pro and Robot Software. The deflection patterns at the Centre distance of the members are studied for different loading condition. The principal objective of this project is to analyse and design a steel framed structure by using building design software's.

The design involves load calculations and analysis the whole structure by STAAD Pro and Robot Software.
In connection with the handling of structures it is noticed that steel is the simplest material to model since it is isotropic. Also, it should be noticed that Robot and STAAD Pro originally are developed for steel structures. This might also be the case for the links to the applications. Therefore, it is not surprising that the best results are obtained with the simple steel structure. Iterative optimization is inherent to every design process. This is especially important at the concept design stage, where the engineers explore a number of design options in terms of geometric forms, structural schemes, and individual member sizes before arriving at a working solution. The process continues through the detailed design stage, where more precise member sizes and connection specifications are detailed. In the majority of projects, the iterative design process is manual, and trial-and-error based.
Sagar Wankhade and Dr. P. S. Pajgade, 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. This concept has many advantages over the Conventional Steel Building (CSB) concept of buildings with roof truss. This paper is a comparative study of PEB concept and CSB concept.
This paper effectively conveys that PEB structures can be easily designed by simple design procedures in accordance with country standards. In light of the study, it can be concluded that PEB structures are more advantageous than CSB structures in terms of cost effectiveness, quality control speed in construction and simplicity in erection. The paper also imparts simple and economical ideas on preliminary design concepts of PEBs. The concept depicted is helpful in understanding the design procedure of PEB concept.
Monika Nakum et al., PEB systems are extensively used in industrial and many other constructions worldwide, it is relatively a new concept in India. That concept includes the technique of providing the best possible section according to the optimum requirement & cost effectiveness. In the present work, the study of PEB with CSB has been carried out; the observations made based on this study are very much useful to the practicing structural engineers. In this paper, CSB (Conventional steel building) & PEB (Pre-engineered steel building) were compared after analysed in STAAD-pro & design using IS: 800:2007.
Syed Firoz and S. Kanakambara Rao the steel (I-section) building construction has great advantages to the residential buildings, improving practical and material efficiency, energy efficiency, consumption, impact on natural resources, CO2 emissions due to recycled building material, the system representing the model within multiple disciplines. The steel building creates and maintains in real time multi-dimensional, data rich views through a project support is currently being implemented by Tekla software packages for design, modelling and detailing of the sustainable steel building.

3.CONCLUSIONS

From the above literature review, it is seen that the research is in interest of usage of different types of PEB and steel structure, so I further study The performed wind analysis for the present work clearly shows that there is an important difference in the dead load of the PEB and conventional steel structure with different configuration of span.

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