iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** II **Month of publication:** February 2023

DOI: https://doi.org/10.22214/ijraset.2023.49120

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue II Feb 2023- Available at www.ijraset.com

Comparative Study of Analysis and Design of Pre-Engineered- Buildings Using Staad Pro Software

Mohammed Uvaish Mansoori[1], Rajesh Misra [2]
[1, 2]*Department of Civil Engineering, Lakshmi Narain College of Technology, Bhopal (M.P)*

Abstract: ***The STAAD-PRO offers an even bigger advantage over the manual procedure since it produces results that are more exact and precise. As the members are designed, using PEB construction instead of the Conventional Steel Building (CSB) design idea provides many benefits. With the use of conical IS sections, the PEB structure is designed in accordance with the bending moment distribution diagram along the whole span of the beam and column, therefore lowering the demand for steel.The stiffness matrix method is used to assess the basic framework of PEB systems. The structure's design geometry, load, and desirable load combinations as required by the user-selected building code are produced using acceptable voltage design (AVD) in compliance with the American Institute of Steel Construction or IS 800 specification in various modes. To produce a workable design, the software runs through the maximum number of cycles specified. The maximum displacement beam that results is 0.530. The end girder has a maximum shear force (Fy) and bending force (Mz) of 2.541 KN and 4.381 KN-m, respectively.***

Keywords: Maximum displacement, maximum shear force, Breakdown, PEB, CSB, Bending.

I. INTRODUCTION

Technological improvement throughout the year contributed greatly to the improvement of the quality of life through various new products and services. One of these revolutions was pre- dedicated buildings. Its origins can be traced back to the 1960s, its potential has only been felt in recent years. This was mainly due to the development of technology that helped in the computerization of the project and the project. Although initially only off-the-shelf products in these configurations were available, aided by technological development, special solutions are also made with this technology in very short periods of time. A recent survey by the Metal Building Associations (MBMA) shows that approximately 60% of non-residential low-rise buildings in the United States are prefabricated buildings. These concepts were introduced in the Indian markets in the late 1990s with the opening up of the economy and various multinationals setting up their projects. The market potential of PEBs is 1.2 million tons per year. The current manufacturing capacity for prefabricated steel buildings is0.35 million tons per year. The industry is growing at a compound rate of 25-30%.When it comes to structural design and aesthetic appearance, India is far behind. Indian manufacturers are trying to catch up; It is a very versatile building system and can be finished internally to suit any function and with external fittings for unique and attractive design styles. It is very beneficial over conventional buildings and is really useful in low building design.

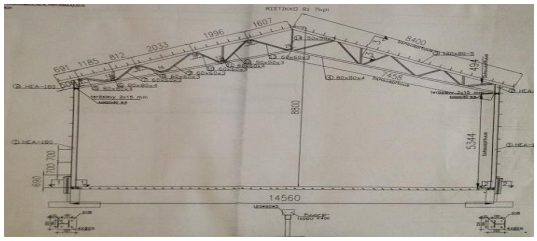


Figure1Technical drawing of truss and column assembly

II. LITERATURE REVIEW

Anop et al. (2016) The aim of the project is to design a multi-storey building of G+ 5 floors, in Kalacode about 4 km from Parafore. STAAD Pro uses a command language-based input format that can be created by an editor called an editor file, the powerful graphical input generator STAAD.Pro, or by CAD-based input generators such as AutoCAD.

Sharma (2016) Bulk grain for food is stored in warehouses, which is crucial. Food Corporation of India (FCI), Central Warehousing Corporation (CWC), and State Warehousing Corporations are primarily the owners of these in India (SFCs).

©IJRASET: All Rights are Reserved

Today, there is a growing problem with how food grains are stored. This article aims to examine the storage capacity offered by Central Warehousing Corporation during a nine-year period, from 2005–2006 to 2013–2014. The yearly reports of CWC have been used to gather and aggregate information about storage capacity availability and utilisation. Along with the Central Warehousing Corporation, the Food Corporation of India and State Warehousing Corporations have also made an effort to analyse the overall storage capacity. According to the study, the storage capacity has not significantly increased in relation to the growth in the purchase of food grains.

Singh et al. (2017) The possibility of post-harvest losses is also decreased by good storage conditions. The quality of the grains during storage is impacted by a number of factors, including ambient moisture, facility temperature, and the length of storage (Singh, Verma, & Srivastav, 2017;Sirohi et al., 2021;Sirohi & Pandey, 2019). The moisture and temperature inside storage bins, in particular, may be directly impacted by the materials used in their construction.

Patil et al. (2017) Pre Engineered Buildings (PEB) fulfil this criteria along with being quicker to construct and less expensive than traditional buildings. Long Span, Column Free Structures are the most important in any form of Industrial Structures. Pre Engineered Buildings (PEB) and Traditional Steel Frames are being compared in the current work. Staad Pro software is used to design the construction, which is then compared to the conventional form in terms of weight. This lowers the cost. For the study, three cases were used. Two examples compare pre-engineered buildings (PEB) with traditional steel frames, while the third example uses a pre-engineered building structure with more bay space for the research. Pre-engineered buildings (PEB) and traditional steel frame structures are constructed for wind forces in the current job. Manual wind analysis has been performed in accordance with IS 875 (Part III)-1987.

Meera (2017) A novel idea for the construction of single-story industrial buildings is the pre-engineered building (PEB) concept. This method's adaptability is a result of its high-quality pre-designing and prefabrication as well as its lightweight and affordable construction. The idea encompasses the method of offering the best segment in accordance with the most pressing need. Compared to the conventional steel building (CSB) concept of structures with roof trusses, this idea has many benefits. The PEB concept and the CSB concept are compared in this essay.

The study is completed by designing an example frame for a hypothetical industrial warehouse structure using both concepts and the structural analysis and design software Staad. Pro.

Thorat and Patil (2017) Pre-engineered buildings are designed and examined in the current study in compliance with Kirby Technical Specification, which is based on ASCE-07. For the study, two examples have been used. There are two instances that contrast pre-engineered buildings (PEB) with bracings versus those without bracings. Later, utilising the ground motion indicated by El-Centro, Pre Engineered Buildings (PEB) are analysed for Dynamic loads.

Daget et al. (2017) the aim of our work is to design the DUPLEX HOUSE as per the Indian standard codes. The design of a building can be done by hand or with the help of software. We chose to do our design with software because manual design takes a lot of time, effort and can contain errors, while using software we can save time and get error-free results. Today there are various software available in the market for analysis and design of 'Civil Engineering Structures' such as ETABS, STAAD Pro and STRUDS etc. along with their analysis and results.

Naga et al. (2017) Structures are designed to resist earthquakes, wind loads and the stable structure in the structure causes loss of people and increases the rigidity of buildings and resists the displacement of the building through proper design and ductile building details and is able to design the appropriate gravi - Building. The work deals with the E-TABS analysis. ETABS is a 3D structural building system analysis software. Therefore, revisions are made depending on the result of the analysis.

Shivaji et al. (2017) the earthquake that occurred in multi-storey buildings shows that if the structures are not well designed and built with sufficient strength, it leads to the total collapse of the structures. To ensure safety against seismic forces of multi-story buildings, there is a need for seismic analysis studies to design earthquake-resistant structures. In the seismic analysis, the response reduction was considered for two cases, both a regular frame and a frame resistant to special moments. The main purpose of this report is to study the seismic analysis of structures for static and dynamic analysis in frames resisting normal moments and frames resisting special moments.

Equivalent static analysis and response spectrum analysis are the methods used in structural seismic analysis. For the seismic analysis we consider the residential building of G + structures 15 floors and located in zone II. The overall structure was analyzed by computer using the STAAD.PRO software. We observed a reduction in the response of frames resisting joint moments and frames resisting special moments with deflection diagrams in static and dynamic analysis. The special moment of the structured portal is good for resisting seismic loads.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

III.ANALYSIS USING STAAD PRO V8I

Staad Pro V8i SS5 software was used to analyze and design pre-engineered building structures and conventional structures in this project. In the second example, an 88m wide 2D flat frame with conical sections is designed for PEB, this structure cannot be built using the conventional method as it is not feasible or economical for the project. Different spacings between bays were considered to verify the adequacy.Staad pro V8i SS5 comes with various tools and modes for us to take advantage of a user- friendly interface. Design and analysis can be done side by side to check for errors in the designs. For PEB design, different dimensions of Conical I-sections can be verified for a stable and optimized structure and the same is for conventional steel design, where pre-rolled sections with commercial dimensions are accessible for design and analysis purposes. STAAD Pro software can be used to analyze and design pre-engineered buildings. It can analyze the bending moment, axial forces, shear force, torsion, beam loads of a steel structure, so that the design can be done with conical sections and checked for safety.

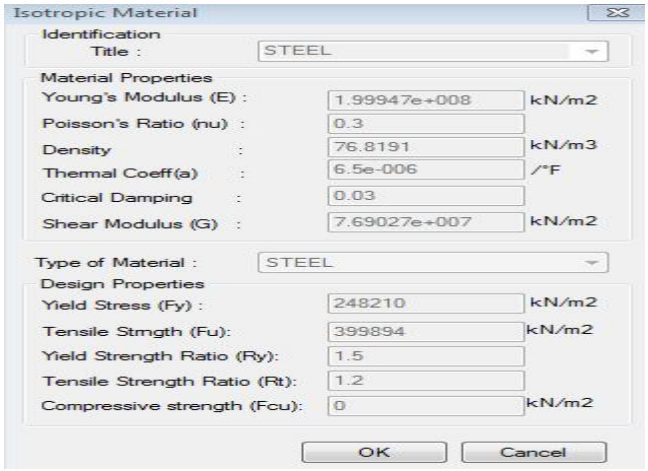


Figure 1 Properties of Steel

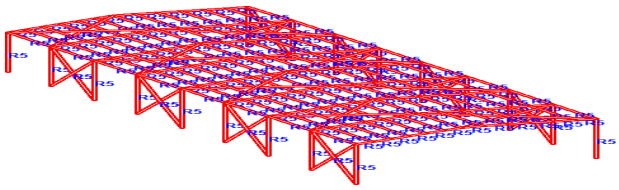


Figure 2 Applied forces on geometry

IV.CONCLUSION

Based on the above study following conclusions can be made

1) Research shows that PEB structures are easy to design. These designs are effective and result in rapid construction.
2) The properties of steel, stainless steel, aluminum and concrete materials are presented in
3) And the total load is applied to the geometry
4) The resulting maximum displacement beam is 0.530

V. ACKNOWLEDGMENT

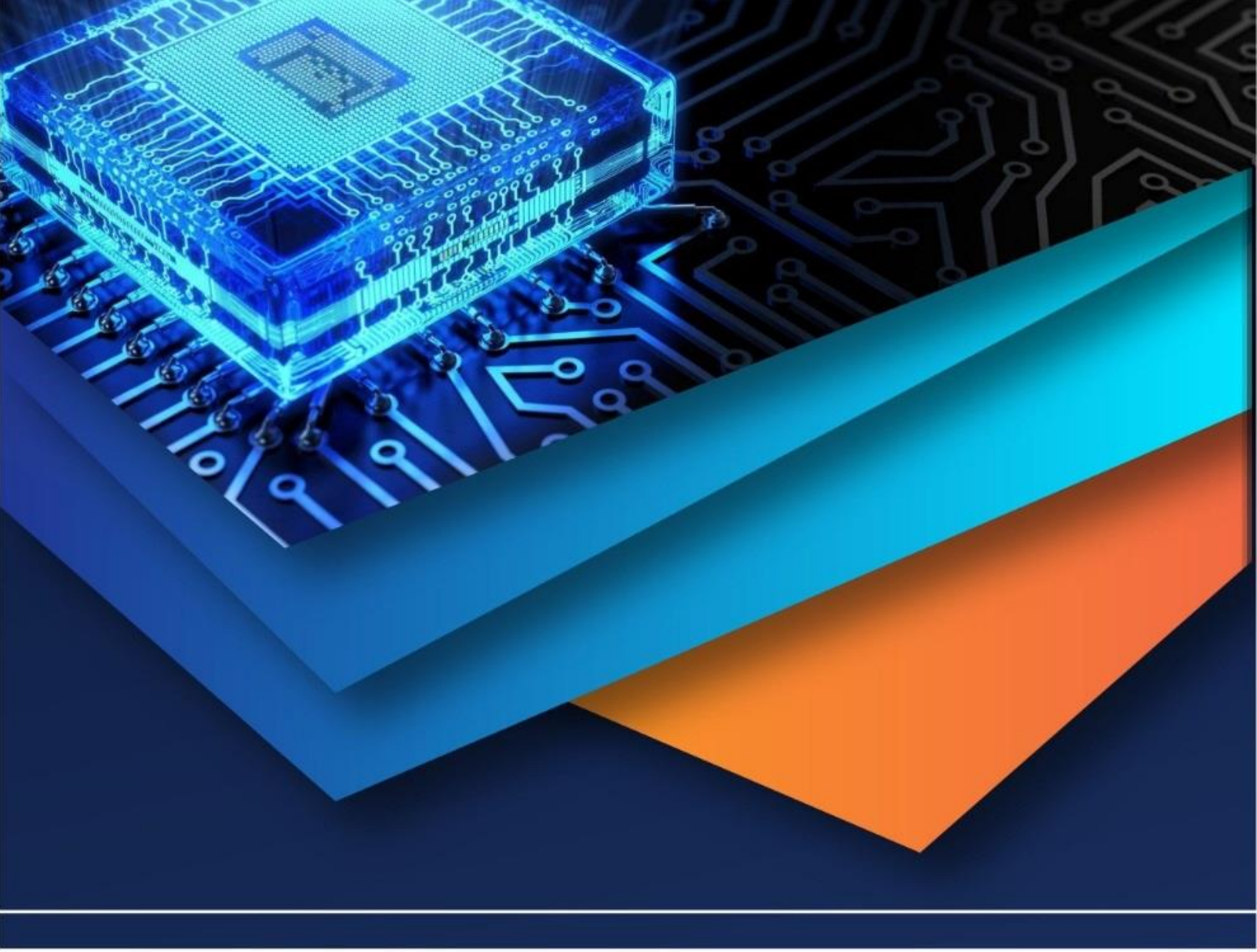
This work was completed with the grants and facilities of Lakshmi Narain College of Technology, Bhopal (M.P.). Authors are thankful to this institute and faculties for extending this cooperation.

REFERENCES

[1] Apurv Rajendra Thorat, Santosh K. Patil (2017)" A STUDY OF PERFORMANCE OF PRE-ENGINEERED BUILDING OF AN INDUSTRIAL WAREHOUSE FOR DYNAMIC LOAD" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
[2] Arote et al. (2022) "ADVANTAGES OF PRE-ENGINEERED BUILDING OVER CONVENTIONAL STEEL BUILDINGS." (2022). International Journal of Scientific Research in Engineering and Management (IJSREM) Volume: 06 Issue: 01 | Jan - 2022 ISSN: 2582-3930.
[3] B. Rouwenhorst et al.(2000)" Warehouse design and control" Framework and literature review,European Journal of Operational Research,Volume 122, Issue 3,2000, Pages 515-533, ISSN 0377-2217,https://doi.org/10.1016/S0377-2217(99)00020-X. https://www.sciencedirect.com/science/article/pii/S037722179900020X).

[4] Bhadoria Sudhir Singh and Yash Pathak Comparative Study Of Pre-Engineered Building And Conventional Steel Structures International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 04 Issue: 09 | Sep - 2017 www.irjet.net p-ISSN: 2395-0072 © 2017, IRJET | Impact Factor value: 5.181 | ISO 9001:2008 Certified Journal | Page 1172
[5] Bhagate et al. Comparative Study of Conventional Steel Building and Pre-Engineered Building S.B. International Journal of Engineering Technology, Management and Applied Sciences www.ijetmas.com April 2017, Volume 5, Issue 4, ISSN 2349-4476
[6] Bhavikatti S., Design of Steel Structures (By Limit State Method As Per Is: 800 2007), IK International Pvt Ltd., 2009.
[7] Bhojkar Milind and Milind Darade 'Comparison of Pre Engineering Building and Steel Building with Cost and Time Effectiveness' IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 10, December 2014.
[8] C. kavita et al. (2021)" Design and Analysis of Pre-engineered Buildings Using Staad Pro" Advances in Materials Research. Springer Proceedings in Materials, vol 5. Springer, Singapore.
[9] C. M. Meera (2017)" PRE-ENGINEERED BUILDING DESIGN OF AN INDUSTRIAL WAREHOUSE " International Journal of Engineering Sciences & Emerging Technologies, June 2013. ISSN: 2231 – 6604.
[10] Dattatray et al.(2022)"Development of decision support system for designing the layout of grain storage warehouse " Journal of Agricultural Engineering?Year : 2021, Volume : 58, Issue : 4?First page : (352) Last page : (368) Print ISSN : 0256-6524. Online ISSN : 0976-2418. ?Article DOI :10.52151/jae2021581.1757.
[11] Goswami et al. (2018) "Pre-engineered building design of an industrial warehouse." International Research Journal of Engineering and Technology (IRJET) 5.6 (2018): 1484-1488.
[12] https://doi.org/10.1007/978-981-15-8319-3_69.
[13] IS 1893(Part 1) –2016 Criteria for Earthquake Resistant Design of Structures
[14] IS: 800 – 2007 Indian Standard General Construction in Steel – Code of Practice
[15] IS: 875 (Part 1) – 1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures (Dead Load)
[16] IS: 875 (Part 2) – 1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures (Imposed Load)

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)