iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VI **Month of publication:** June 2023

DOI: https://doi.org/10.22214/ijraset.2023.54006

Analysis of the Conventional Steel Building and Pre-Engineered Building Structures for Various Bay Lengths

Shubham Upadhyay[1], Prof. Umesh Pendharkar[2]
[1]M.Tech Student- Department of Civil Engineering, Ujjain Engineering College, Ujjain, India
[2]Professor- Department of Civil Engineering, Ujjain Engineering College, Ujjain, India

Abstract: Comparing PEB structures to conventional structures is the main goal of this study. Pre Engineered Buildings (PEB) are constructions that are manufactured and assembled on site. This study assesses both traditional steel structures and pre-engineered structures. Usually, industrial buildings are built using this kind of structural principle. An industrial structure with 5 and 6 m-long bays is under consideration. STAAD PRO software is used for structure analysis. In this study, the maximum reaction, maximum stress analysis, and maximum axial force results for conventional steel structures and pre-engineered structures with bay lengths of 5 and 6 metres are examined and compared. We consequently conclude that PEB is preferable to CSB.
Keywords: PEB, CSB, Reaction, stress, axial force and geometric design etc.

I. INTRODUCTION

A pre-engineered building (PEB) is a structure that has been designed in advance by a manufacturer to be built using a predetermined supply of raw materials and manufacturing processes that may successfully meet a range of structural and visually pleasing design standards. Pre-engineered steel buildings can incorporate mezzanine floors, canopies, fascias, interior partitions and other structural accessories. To make the structure waterproof, special mastic beads, filler strips, and trimmings are employed. Pre-engineered buildings (PEB) have revolutionized the process of creating storage capacity structures. a steel-only structural framework with conventional walls and a normal roof. The fully built structure is moved using cranes from the manufacturer to the installation site. The framework of PEBs is also far lighter than that of conventional steel structures, which lowers the price of steel and increases the affordability of these structures. Due to their quick installation, low cost, high quality, and long lifespan, PEBs are recognised as a breakthrough in the building industry. Pre-engineered structures meet one of the industry's most crucial needs, which is for large, column-free sections.

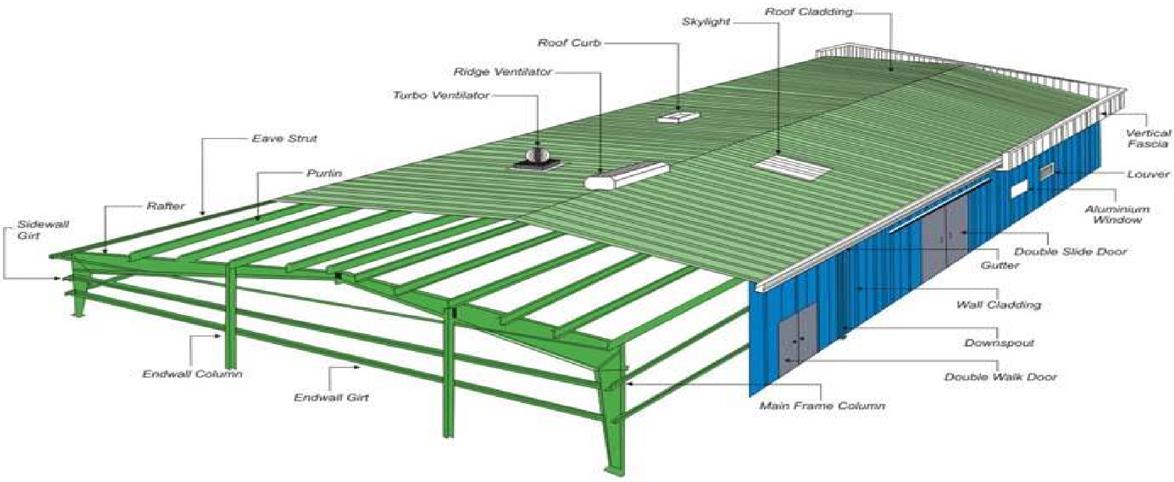


Figure 1 PEB frame

II. CONVENTIONAL STEEL BUILDINGS

Traditional steel structures are conservative and expert. In traditional constructions, structural members are hot rolled and utilised. The materials are created in the factory or made there before being transported to the location. On location, the raw materials are transformed into the desired form and then built. Cut and weld changes can be made while the erection is being performed. The traditional system makes use of truss systems. In typical conventional construction, excavation and foundation building occur first, followed by frame. The effectiveness of each trade determines how quickly each component may be finished before moving on to the next stage. Because each component must be designed from start, design has a significant impact on time, especially if it is complex. Project duration is typically between six and 10 months. Complex designs are best suited for conventional construction. But in contrast to pre-engineered building, conventional construction not only takes longer but also costs more. Even though conventional construction can frequently result in more intricate buildings, this approach has higher labor costs and generates a lot of construction waste. Conventional construction can offer more flexible design possibilities, but it also necessitates comprehensive, continuous upkeep, and because it weighs more than pre-engineered construction, it might eventually damage foundations.

Figure 2 CSB frame

III. TYPE OF PEB FRAMES

PEB frame have many types mainly five types are widely used-

1) CLEAR SPAN
2) MULTI SPAN
3) SINGLE SLOPE
4) MULTI GABLE
5) LEAN TO

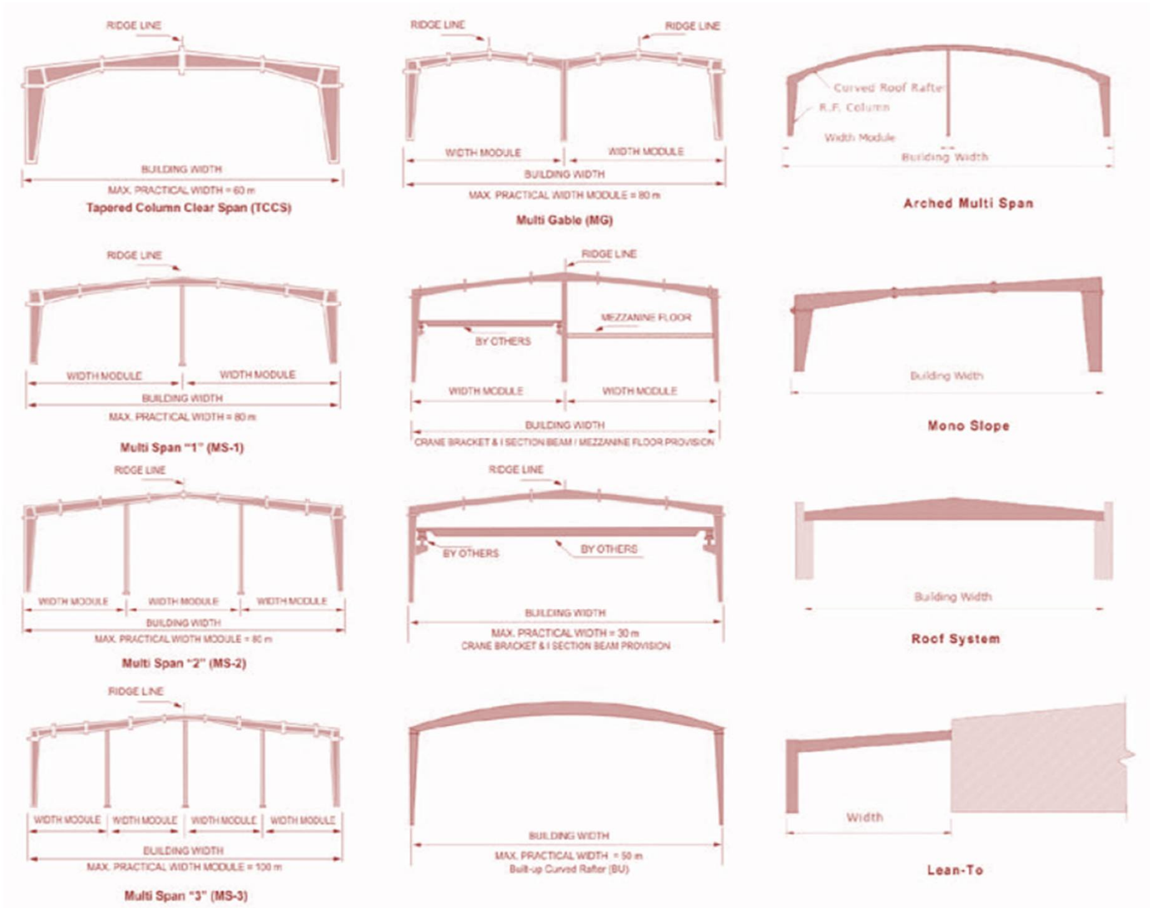


Figure 3 Types of PEB frame

IV. MODELLING

This work takes into account a 480 square metre industrial shed with a three-dimensional RC frame. The current study makes use of a number of codes, including the analysis and construction tool Staad Pro. Next, compare the outcomes of maximum axial force, maximum reaction, and maximum stress analysis.

A. Plan And 3d Views Of Modeling

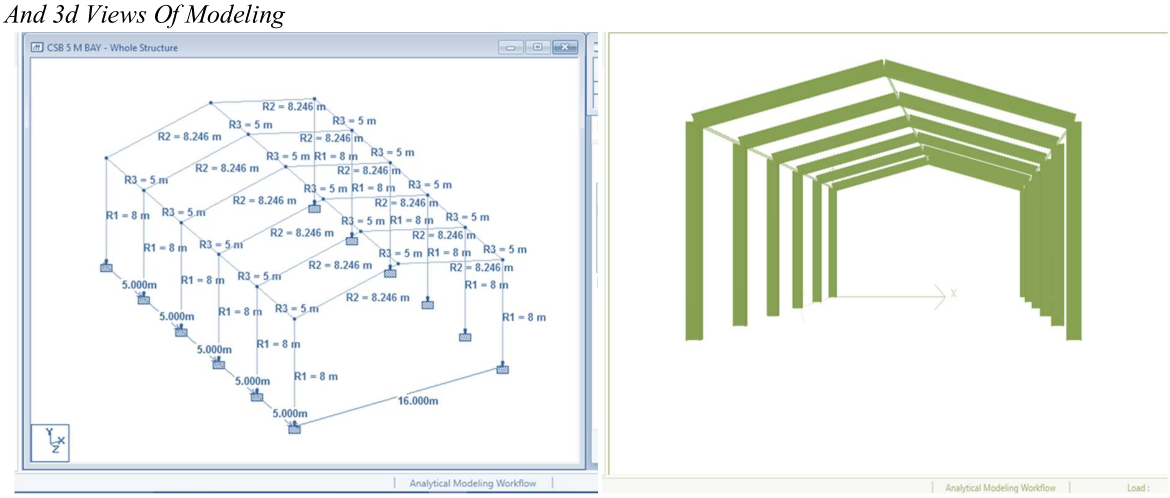


Figure 4 3d view of conventional steel building (5m)

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 VI Jun 2023- Available at www.ijraset.com

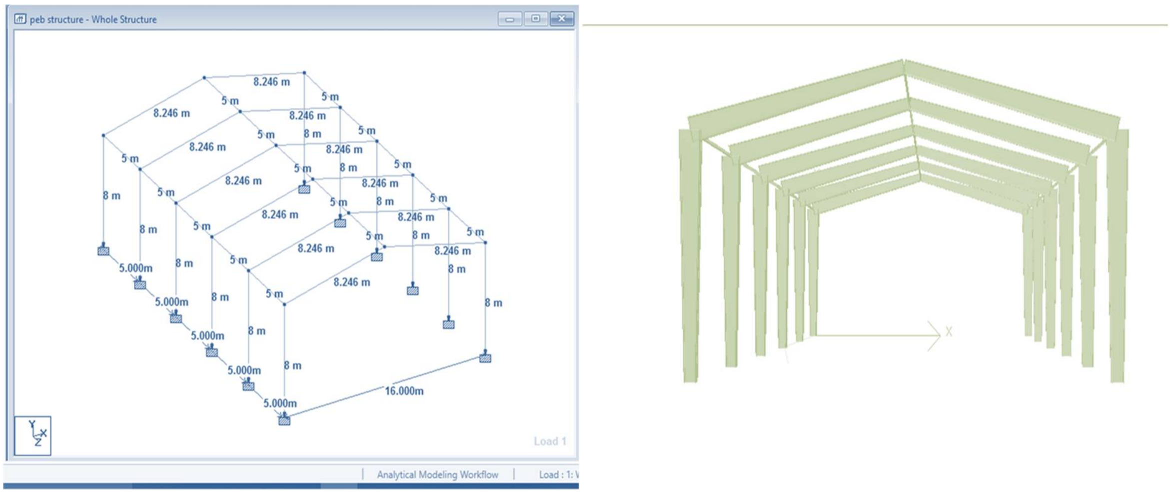


Figure 5 3d view of Pre engineered building (5m)

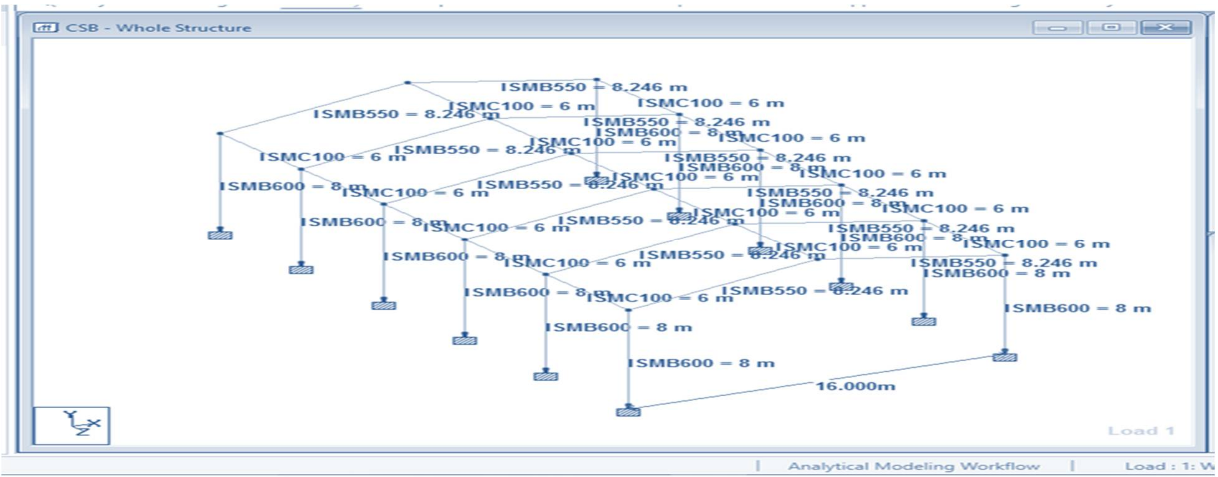


Figure 6 3d view of conventional steel building (6m)

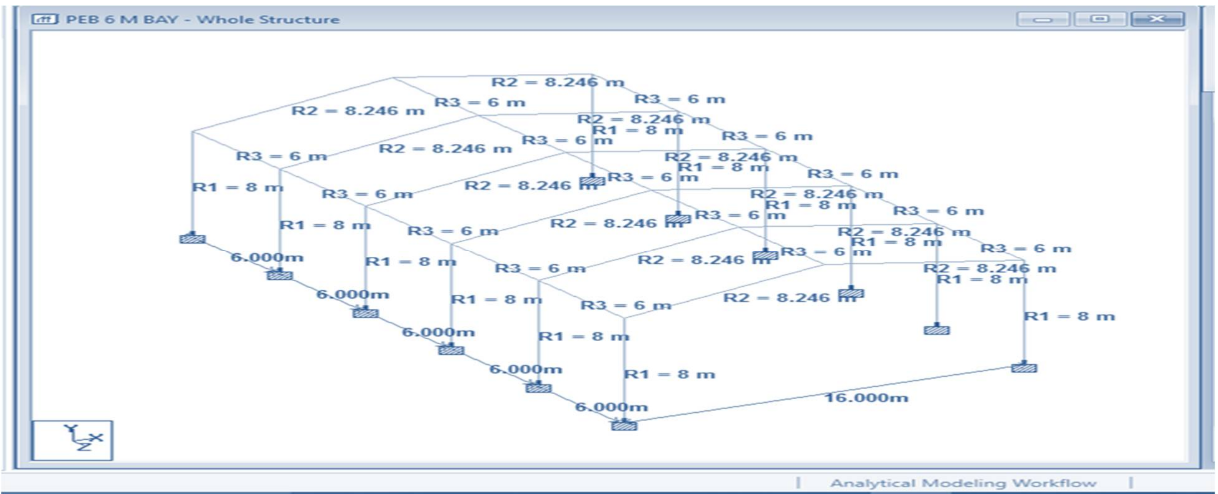


Figure 7 3d view of Pre engineered building (6m)

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 VI Jun 2023- Available at www.ijraset.com

B. Geometrical Modeling

Table1: General Datas Of Building

SPECIFICATION	PEB	CSB
Structure type	Steel	Steel
Plan Area	16x30m	16x30m
Total width	16m	16m
Clear Height	11m	11m
Single Bay length	5m, 6m	5m, 6m
Steel Grade	Fe415	Fe 415
SOFTWARE		STAAAD PRO

V. RESULT AND DISCUSSION

Workload analysis and wind analysis are currently carried out for PES and CSS frames on the Staad Pro programme while preserving the same parameters. The results that were found through analysis are discussed in this chapter. Dead, live, and wind loads are all subject to Indian codes. The analytical results for traditional steel constructions and pre-engineered structures were discussed in this article. Compare their findings for maximum axial force, maximum response, and maximum stress analysis for bay lengths of 5 and 6 metres.

A. Base reaction comparison

A Base reaction comparison results of CSB frame and PEB frame analysis discussed below.

Table 2 Base reaction comparison

Structure Type	Base reaction comparison (KN)	
	5m bay length	6m bay length
CSB	110.31	125.11
PEB	49.44	99.11

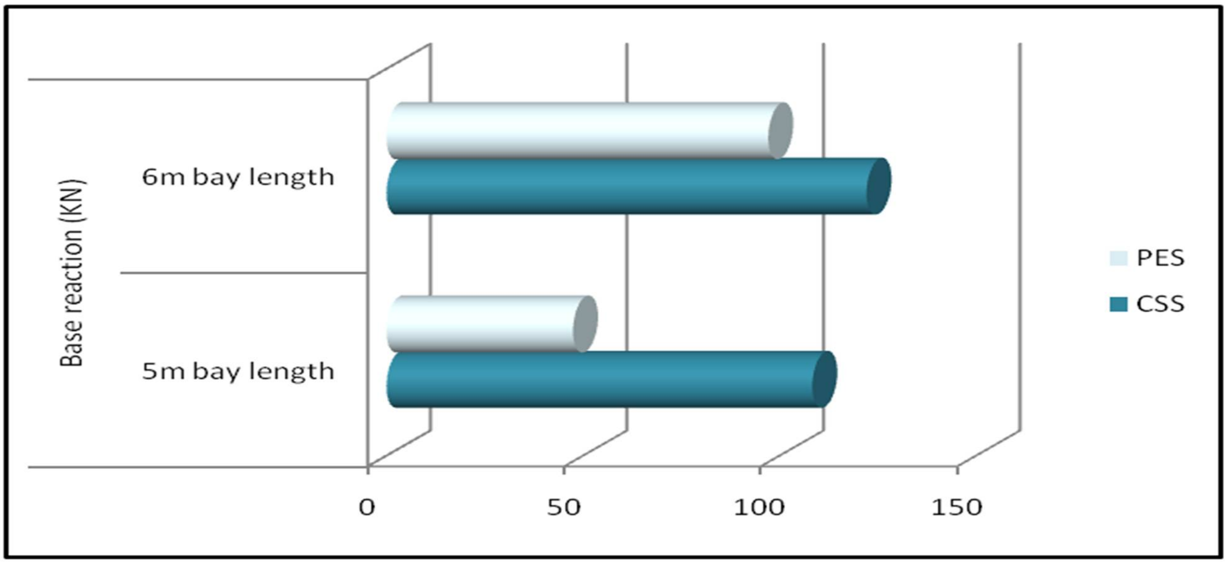


Figure 8 Base reaction comparison

The base reaction value is greater for CSB and lower for PEB in both bay lengths, as can be observed from the aforementioned table and graph.

B. Maximum stress analysis comparison

Maximum stress analysis comparison table is given below.

Table 3 Maximum stress analysis comparison (KN) for 5m

Structure Type	Compressive stress	Tensile stress
CSB	337.21	340.83
PEB	106.03	102.52

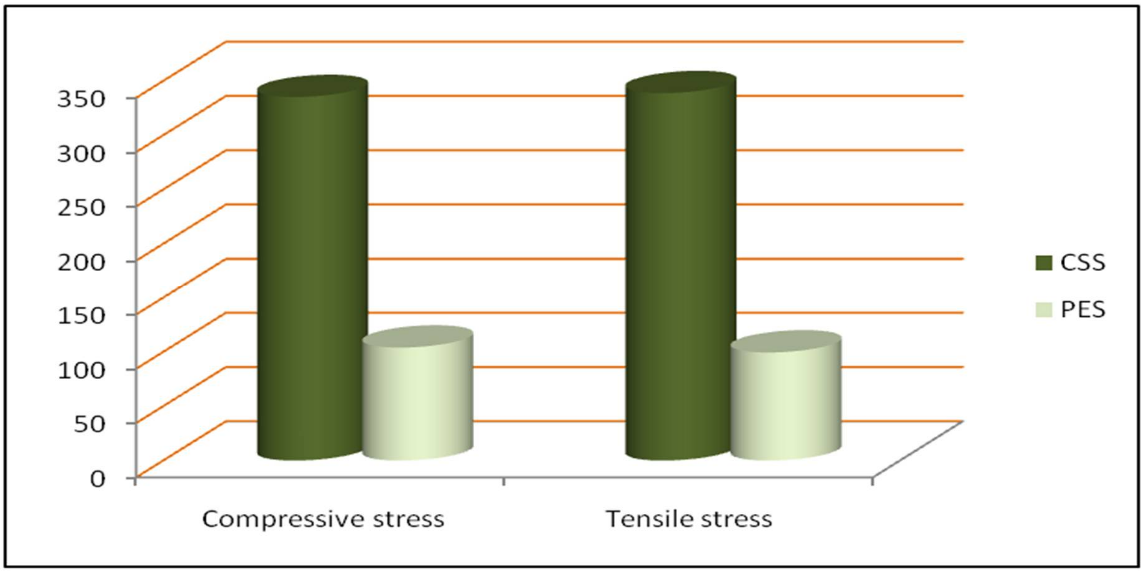


Figure 9 Maximum stress analysis comparison for 5m

Table 4 Maximum stress analysis comparison (KN) for 6m

Structure Type	Compressive stress	Tensile stress
CSB	405.51	410.88
PEB	216.33	210.52

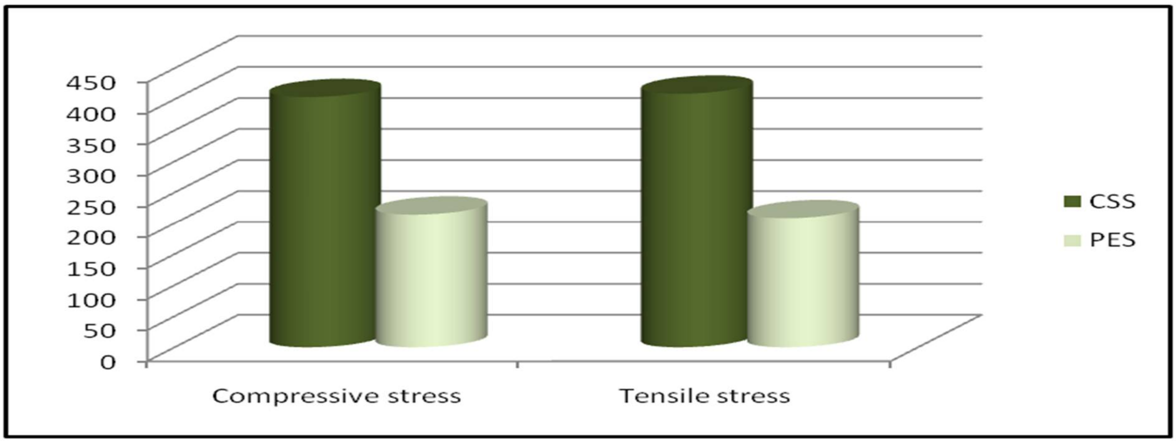


Figure 10 Maximum stress analysis comparison (KN) for 6m

As can be observed from the aforementioned table and graph, the stress value is bigger for CSB frame and lowest for PEB frame in both bay lengths.

C. Maximum axial force comparison

Maximum axial force comparison table is given below.

Table 4 Maximum axial force comparison

Structure Type	Maximum axial force (KN)	
	5m bay length	6m bay length
CSB	180.77	214.20
PEB	49.44	109.80

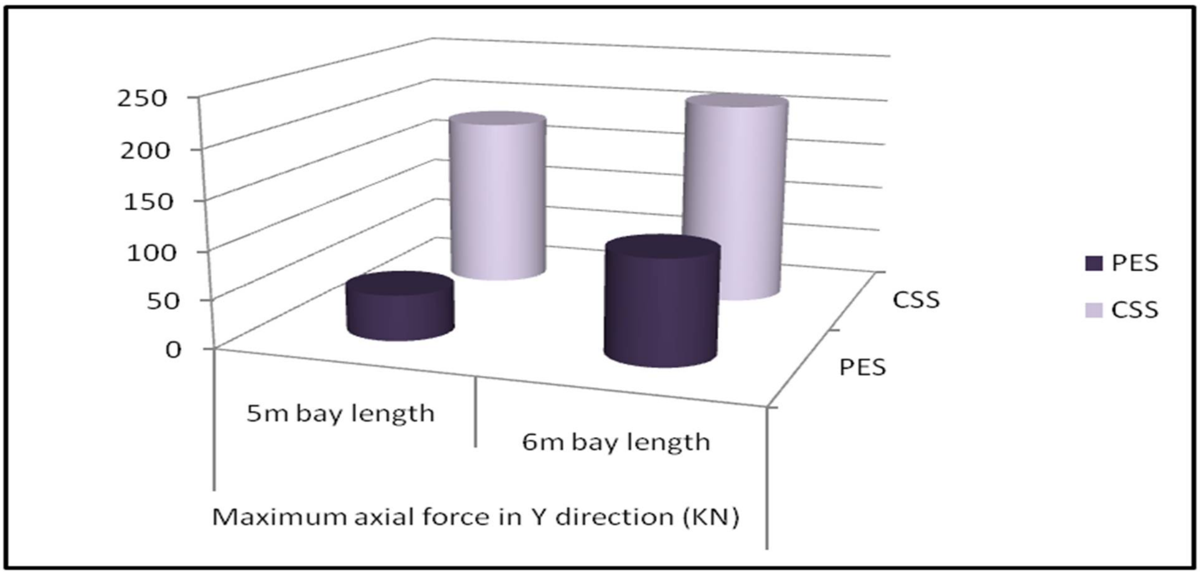


Figure 11 Maximum axial force comparison

According to the aforementioned table and graph, the axial force value is higher for CSB and lower for PEB in both bay lengths.

VI. CONCLUSION

Let's wrap up by discussing the inferences that may be drawn from a comparison of the CSB and PEB frame data. The steel takeoff, the maximum shear force, the maximum moment analysis, and the maximum deflection are among the seven distinct sorts of results presented here. These conclusions come from the work done for the study. These conclusions come from this research project.

A. Conclusion Based on Maximum Reaction

1) For a 5 m bay length, the maximum reaction of CSB is 57.19% higher than PEB.
2) For a 6 m bay length, the maximum reaction of CSB is 21.19% greater than PEB.

.

B. Conclusion Based on Maximum Stress Analysis

1) For a 5 m bay length, the maximum stress analysis of CSB is 69.90% more compressive and 71.6% more tensile than PEB.
2) For a 6 m bay length, the maximum stress analysis of CSB is 51.31% more tensile stress and 47.80% more compressive stress than PEB.

C. Conclusion Based on Maximum Axial Force

1) For a 5 m bay length, the maximum axial force of the CSB is 74.46% more than the PEB.
2) For a 6 m bay length, the maximum axial force of the CSB is 50.24% more than the PEB.

Overall findings indicate that for the same parameter, pre-engineered building are superior to traditional steel building. The pre-engineered buildings are also effective and affordable.

REFERENCES

[1] Jinsha M S and Linda Ann Mathew(2016) " Analysis of Pre –Engineered Buildings " International Journal of Science and Research (IJSR).

[2] K. Prabin Kumar and D.Sunny Praksh (2018)"Planning Analysis and Design of Industrial Building Using STAAD PRO" International Journal of Pure and Applied MathematicsVolume 119 No. 17.

[3] Manoj Kumar v, Syed Suhel Gutti, Nasir shaikh, Vivekananda and Gurupada swamy N M (2019)"A Comparative Study on Pre Engineered Building by using STAAD PRO" International Research Journal of Engineering and Technology (IRJET)Volume: 06 Issue: 06.

[4] Mitaali Jayant Gilbile and S. S. Mane (2020) "A Review on Comparative Study on the Structural Analysis and Design of Pre-Engineered Building [PEB] with Conventional Steel Building [CSB]" International Research Journal of Engineering and Technology (IRJET) Vol. 9 Issue 09.

[5] Bhupesh kumar (2020) "Comparative Study of Warehouse Structure in P.E.B. with C.S.BInternational Journal of Trend in Research and Development, Volume 7(3), ISSN: 2394-9333

[6] Rajnandan Verma and Raghvendra Singh. (2020) "Comparative Analysis Of Pre-Engineered Steel Building And Conventional Steel Building Using Etab-A Review" International Research Journal of Modernization in Engineering Technology and ScienceVolume:02/Issue:02

[7] Animesh patel (2021)"Analysis And Comparative Study On Conventional Steel Building And Pre Engineered Building Using Staad.Pro" International Research Journal of Modernization in Engineering Technology and Science volume 3

[8] Laishram singh (2021) An Analytical Study On Pre Engineered Building By Using Staad ProJetir May 2021, Volume 8, Issue 5

[9] Sudhir paswas (2022) Design & Analysis of Industrial Building Using STAAD.Pro softwareInternational Journal of Research Publication and Reviews.

[10] Jaya tarmarkar (2022) " A Review of Study and Analysis of Pre-Engineered Building Using Staad Pro Software" International Journal of Research Publication and ReviewsVol 3, no 8,

[11] T D Mythili (2015) "Analysis and Comparative Study of Conventional Steel Structure with PEB Structure" International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064

[12] T.D. Mythili (2017) " An Overview Of Pre-Engineered Building Systems" International Journal of Scientific & Engineering Research, Volume 8, Issue 4

[13] M D Gawade and U. P. Waghe (2018) " Study Of Pre-Engineered Building Concept" Journal of Research in Engineering and Applied Sciences JREAS, Vol. 3, Issue 03

[14] Humanaaz Arif Qureshi, Dr. Kuldeep R. Dabhekar, Amol Shahakar, Dr. Isha P. Khedikar (2020) " Comparative analysis of Pre Engineered and Conventional Steel Building" Journal of Emerging Technologies and Innovative Research (JETIR) Volume 7, Issue 5

[15] V Vishnu Sai, P Poluraju and B Venkat Rao (2021) " Structural Performance of Pre Engineered Building: A Comparative Study" International Conference on Advances in Civil Engineering.

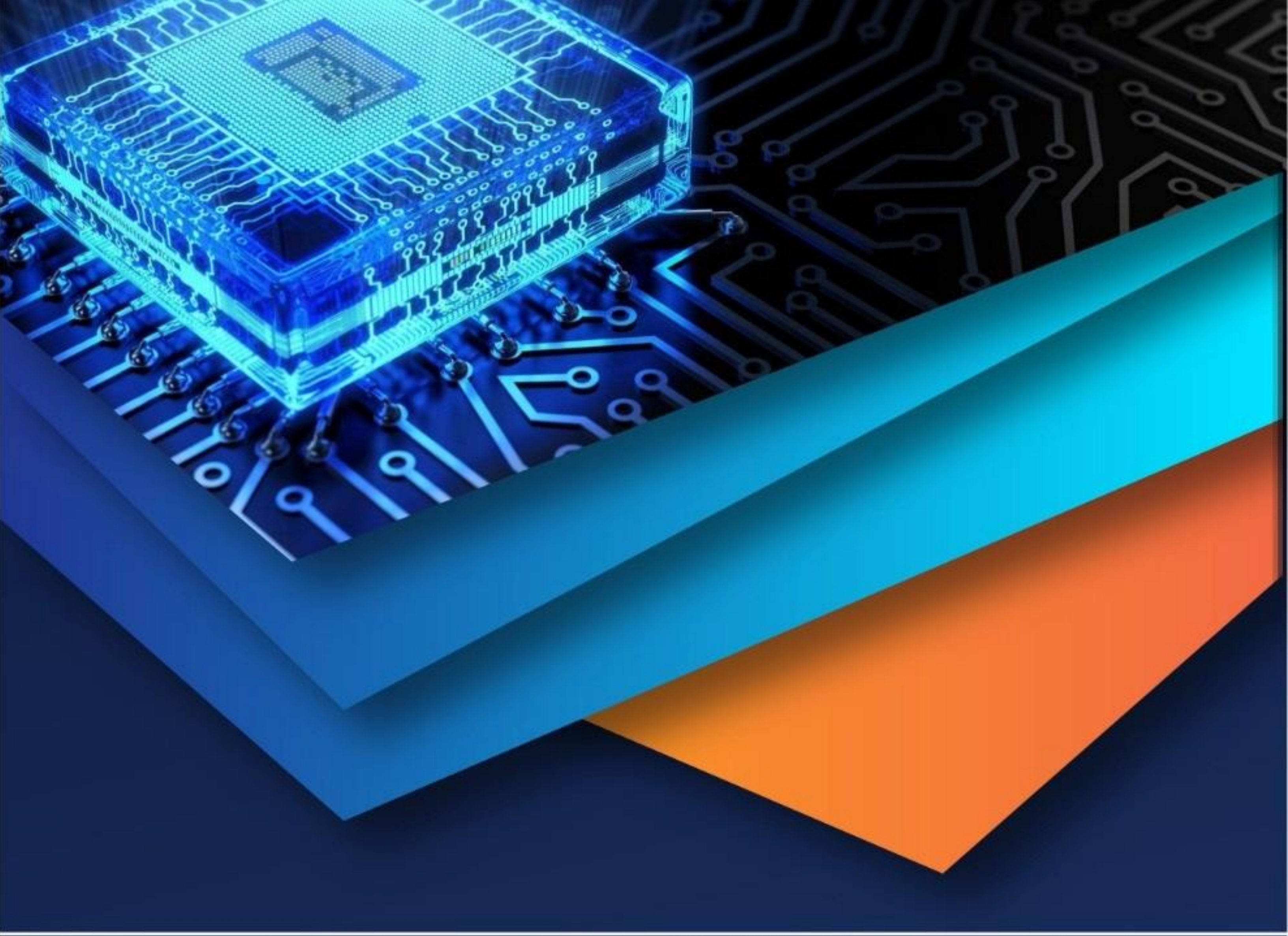
[16] Shubham Shrivastava and Gaurav Shrivastava (2022) " Pre Engineered Structure study: A review" International Research Journal of Engineering and Technology (IRJET) Volume: 09 Issue: 12

[17] IS : 875 part 1. dead load of structure General (Sixth Revision), BIS, New Dehli, India

[18] IS : 875 part 2. live load of structure General BIS, New Dehli, India

[19] IS : 875 2015 part 3. wind load analysis of structure, BIS, New Dehli, India

[20] IS : 800 2007 reinfocement steel – Code of Practice New Dehli, India



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY