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Design and Analysis of Pre Engineered Building using Stadd Pro

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Abstract: Pre-Engineered Buildings (PEBs) are the building components that are manufactured at a factory and assembled on site. Usually, PEBs are steel structures and can be an alternative to conventional structural steel buildings. PEB structural components are fabricated at the factory to the exact size, transported to the site, and assembled at the site, usually with bolted connections. The objective of current research is to structurally investigate the Pre Engineered Buildings (PEB) using Staad pro software. The seismic load analysis is to be conducted using IS 875 code.

Key Words: *PEB, steel structure, stability*

1. INTRODUCTION:

Pre Engineered Buildings (PEB) are the buildings which are engineered at a factory and assembled at site. Usually PEBs are steel structures. Built-up sections are fabricated at the factory to exact size, transported to site and assembled at site with bolted connections. This type of Structural Concept is generally used to build Industrial Buildings, Metro Stations, Ware houses etc. The "adoptability of PEB in the place of Conventional Steel Building design concept resulted in many advantages, including economy & easier fabrication" [1].

Figure 1: Pre-engineered building structure

These building structure can be finished internally to serve any functions that are actually help in low rise building design like warehouses, canopies and factories.

2. LITERATURE REVIEW

B. Gireesh [2] have conducted numerical investigation of G+7 building structure using Staad pro analysis software. The type of analysis conducted is seismic and the codal provisions used for the analysis was IS 1893:2002. The base shear and story drift was determined from the analysis. The load conditions involved seismic excitation for city of Hyderabad (corresponding to seismic zone II)

Aman et.al [3] have conducted numerical investigation of commercial G+5 building using Staad pro simulation package. The load combinations included dead load and live load along with seismic excitations. The building details were provided which included beam details, slab details, column details, footing details and staircase details. The research findings have shown that the structure is safe and economical if the deflections are lesser than 20mm.

Mahesh et.al [4] have conducted numerical investigation on structure subjected to wind loading along with sloping effect. The design of wind was based on the "Indian standard code IS 875 part- III" [4]. The study stated that as the height increases the Bending moment, shear force and

joint displacement all show an approx directly proportional relationship with the height. Hence it was concluded that the zone IV was the most critical one as the values of bending moment, shear force and joint displacement was highest in the IV zone and was least in the Zone I.

Anoop et.al [5] have conducted numerical investigation of G+5 building structure using Staad Pro simulation package. The building location was at Kalakode which was at 4Km from Paravoor. The 2D plan was developed in AutoCAD 2014 and different load cases were applied as per IS1893:2002 codal provisions and IS 875 Part 3 codal provisions. The deformation, base reaction and story drift was evaluated for the structure.

D. R. Deshmukh et.al [6] Analysis and design of G+19 Story building using Staad. Pro The design was based on Indian Standards on Staad. Pro and then compared by was then compared by manual calculation. The design loads considered were “dead load, live load, seismic load and wind load and were calculated on the basis of Indian Standards. It was seen that the load was maximum when applied in the x-direction (parallel to shorter span) and the deflection increases as the height of building increases” [6].

3. OBJECTIVE

The objective of current research is to structurally investigate the Pre Engineered Buildings (PEB) using Staad pro software. The seismic load analysis is to be conducted using IS 875 code.

4. METHODOLOGY

The CAD model of structure is developed in Staad pro design modeler. The model is developed by initially generating nodes and attaching lines between nodes. These lines are later assigned with beam cross sections.

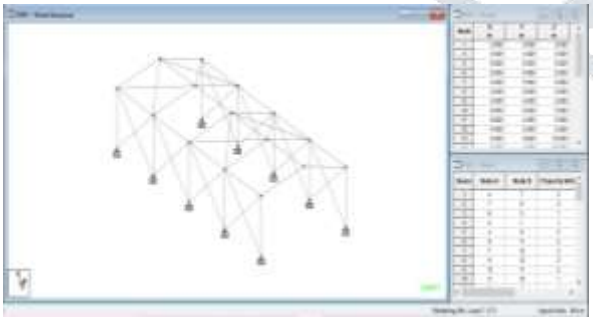

Figure 2: CAD modeling of PEB structure in staad pro

Section Assignment

The sections are defined using taper section as shown in figure 3 below.

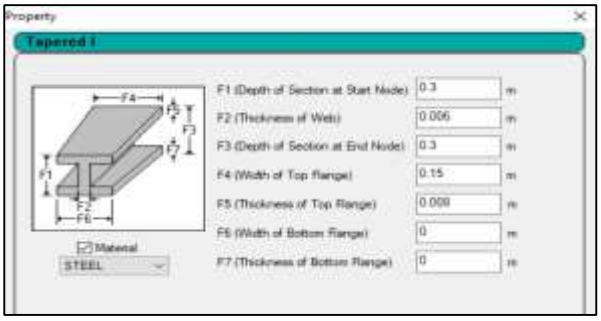

Figure 3: Taper section property definition

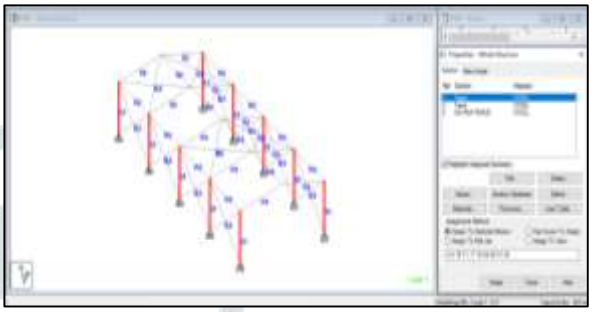

Figure 4: Taper Section assignment for vertical members

The taper sections are assigned for vertical structure as shown in figure 4 above. The top structures are assigned with taper section.

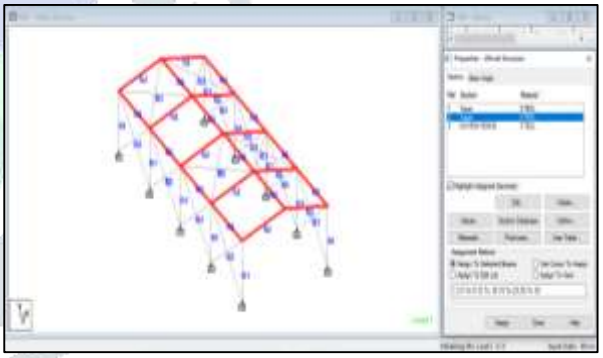

Figure 5: Taper Section assignment for top members

The cross structures are applied with ISA 150*150*20 section as shown in figure 6 below.

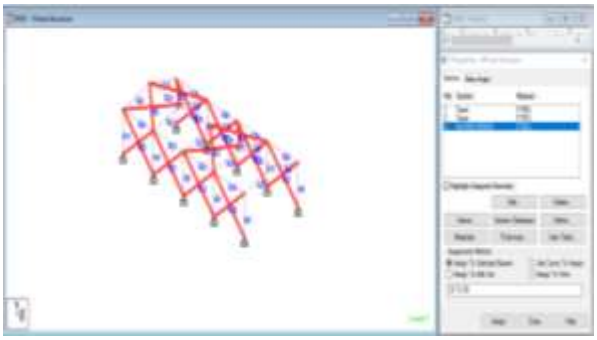

Figure 6: Taper Section assignment for top members

5. RESULTS AND DISCUSSION

From the FEA analysis conducted on pre-engineered building, the failure check is conducted for each member. The failure check is conducted using IS 800-07.

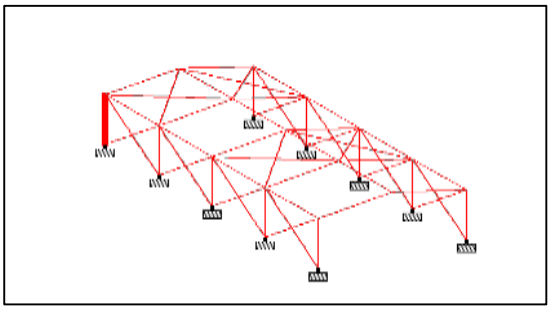

Figure 7: Member selection for failure check

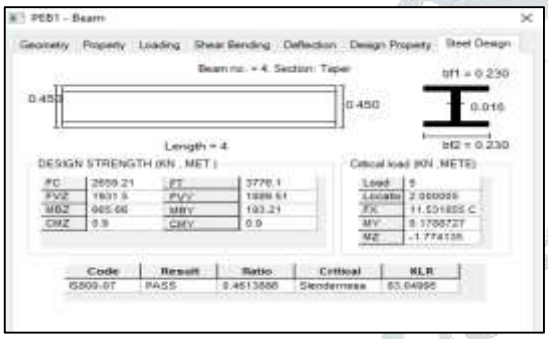

Figure 8: Checking beam for safety

The beam safety analysis is conducted for I shaped beam. Similarly other structural members are also evaluated for different members as shown in figure 9 and figure 10.

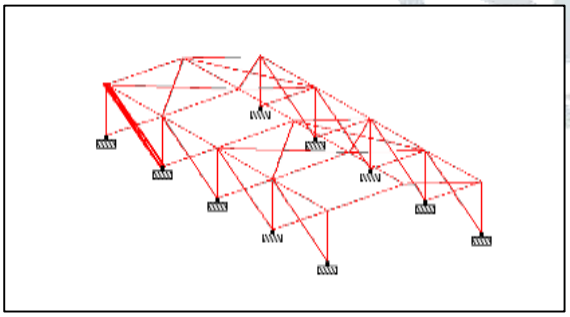

Figure 9: Member selection for failure check

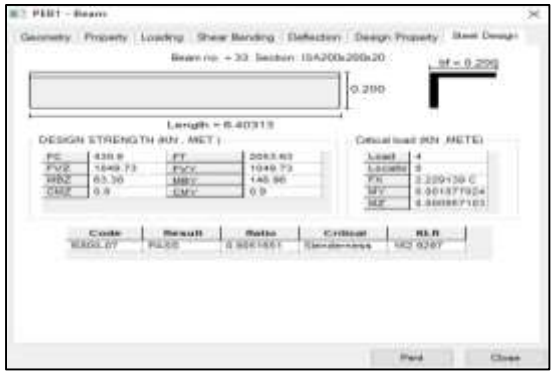

Figure 10: Checking beam for safety

The material takeoff is evaluated for pre-engineered building structure. From the material takeoff the weight of structure is found to be 219.024kN.

Material Takeoff

MEMBER	PROFILE	LENGTH (METE)	WEIGHT (KN)
1	TAP ERED	4.12	4.449
2	TAP ERED	4.12	4.449
3	TAP ERED	4.00	4.317
4	TAP ERED	4.00	4.317
5	TAP ERED	5.00	5.396
6	TAP ERED	5.00	5.396
7	TAP ERED	5.00	5.396
8	TAP ERED	4.12	4.449
9	TAP ERED	4.12	4.449
10	TAP ERED	4.00	4.317
11	TAP ERED	4.00	4.317
12	TAP ERED	5.00	5.396
13	TAP ERED	5.00	5.396
14	TAP ERED	5.00	5.396
15	TAP ERED	4.12	4.449
16	TAP ERED	4.12	4.449
17	TAP ERED	4.00	4.317
18	TAP ERED	4.00	4.317
19	TAP ERED	5.00	5.396
20	TAP ERED	5.00	5.396
21	TAP ERED	5.00	5.396
22	TAP ERED	4.12	4.449
23	TAP ERED	4.12	4.449

24	TAP ERED	4.00	4.317
25	TAP ERED	4.00	4.317
26	TAP ERED	5.00	5.396
27	TAP ERED	5.00	5.396
28	TAP ERED	5.00	5.396
29	TAP ERED	4.12	4.449
30	TAP ERED	4.12	4.449
31	TAP ERED	4.00	4.317
32	TAP ERED	4.00	4.317
33	ST ISA150X150X20	6.40	2.764
34	ST ISA150X150X20	6.40	2.764
35	ST ISA150X150X20	6.40	2.764
36	ST ISA150X150X20	6.40	2.764
37	ST ISA150X150X20	6.40	2.764
38	ST ISA150X150X20	6.40	2.764
39	ST ISA150X150X20	6.40	2.764
40	ST ISA150X150X20	6.40	2.764
41	ST ISA150X150X20	6.40	2.764
42	ST ISA150X150X20	6.40	2.764
43	ST ISA150X150X20	6.40	2.764
44	ST ISA150X150X20	6.40	2.764
45	ST ISA150X150X20	6.40	2.764
46	ST ISA150X150X20	6.40	2.764
47	ST ISA150X150X20	6.40	2.764
48	ST ISA150X150X20	6.40	2.764
49	ST ISA150X150X20	6.48	2.798
50	ST ISA150X150X20	6.48	2.798
51	ST ISA150X150X20	6.48	2.798
52	ST ISA150X150X20	6.48	2.798
53	ST ISA150X150X20	6.48	2.798
54	ST ISA150X150X20	6.48	2.798
55	ST ISA150X150X20	6.48	2.798
56	ST ISA150X150X20	6.48	2.798

TOTAL = 219.024

STEEL TAKE-OFF

PROFILE	LENGTH(METE)	WEIGHT(KN)
Tapered MembNo: 1	141.23	152.410
ST ISA150X150X20	154.30	66.613

TOTAL = 219.024kN

6. CONCLUSION

Pre-engineered steel structures building 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. Infinitely recyclable, steel is the material that reflects the imperatives of sustainable development. The FEM is a viable tool in investigating the structural behavior of pre-engineered building. With the use of staad pro FEM tool, the forces, stresses and moment acting on the beam is determined. The results are summarized below:

1. The effect of wind load, live load, seismic load on pre-engineered structure is analyzed.
2. The deformation and moment developed on each structural member of PEB is determined.
3. All the structural members are tested as per IS 800-07 code and the structure is safe. All the structural members have passed.
4. The steel take off for pre-engineered building is found to be 219.024kN.

REFERENCES

[1] Prasad, B., Kumar, S. and Amaranth, K. (2014) "Optimization of pre-engineered buildings", International Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol. 4, issue 9, pp.174-183.

[2]. B. Gireesh Babu, "Seismic Analysis and Design of G+7 Residential Building Using STAADPRO", International Journal Of Advanced Research, Ideas And Innovations In Technology, Pg. 924-930, Volume3, Issue3, -2017.

[3]. Aman, Manjunath Nalwadgi, Vishal T, Gajendra, "Analysis and design of the multistorey building by using STAAD Pro", International Research Journal of Engineering and Technology (IRJET), Pg. 887-891, Volume: 03 Issue: 06, June-2016.

[4]. Mahesh Ram Patel, R.C. Singh, "Analysis of a Tall Structure using Staad Pro providing different Wind Intensities as per 875 PartIII", International Journal of Engineering Sciences & Research Technology, Pg. 2018-2025, May, 2017.

[5]. Anoop.A Fousiya Hussian, Neeraja.R, Rahul Chandran, Shabina.S, Varsha.S, "Planning Analysis and Design of Multi Storied Building by Staad.Pro.v8i", International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April2016.

[6]. D.R. Deshmukh, A.K. Yadav, S. N Supekar, A. B. Thakur, H. P Sonawane, I. M. Jain, "Analysis and Design of G+19 Storied Building Using Staad-Pro", Pg. 17-19, ISSN: 2248-9622, Vol. 6, Issue 7, (Part-1) July 2016.