Performance Assessment of Pre-Engineered Building

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***Abstract*— Pre Engineered Buildings name sounds to be heard but in reality many are unaware about it. Time frame will be more for regular frame structures, and more cost i.e. time and cost, makes this un economical .For this purpose total design of pre-engineered buildings is done in factory and according to required design it is elevated in 6 to 8 weeks.**

For Ascertain The Benefits OF PRE-ENGINEERED (PEB) the Analysis and design examples of both conventional and PEB buildings is done and the various parameters like Bending Moment Axial forces Shear force Torsion etc. are ascertained and comparative study is done and the benefits like cost reduction, steel reduction, time and economical are the parameters which make PEB more beneficial than conventional buildings

PEBs are economical than normal conventional buildings because the live load on the structures is less comparative to normal conventional buildings. The required materials quantity is also low. So, the cost of construction is less.

Keywords*— *Pre-Engineered Buildings(PEB),Pre fabricated sections,Advanteges,Forces acting,Analysis in Etab,Displacement values,Design Examples.

I. INTRODUCTION

Pre Engineered Buildings name sounds to be heard but in reality many are unaware about it. Time frame will be more for regular frame structures, and more cost i.e. time and cost, makes this un economical .For this purpose total design of pre-engineered buildings is done in factory and according to required design it is elevated in 6 to 8 weeks. Pre Engineered Buildings structural performance is well understood for most of the part. Dismantling of pre-Engineered buildings can be done and reused as it has bolted connections. This makes possible of shifting and/or expansion as per requirements formatter will need to create these components, incorporating the applicable criteria that follow.

II.NECESSITY OF PRE ENGINEERED BUILDINGS

Following are some of the advantages which can e achieved by using the PEB structures-

1) *Less expenditure*
2) *Flexibility extension*
3) *Big plain distance*
4) *Excellence control*
5) *Short upholding*
6) *Force capable roofing and wall system*
7) *Compact assembly time*
8) *Formation*

III.TECHNICAL PARAMETERS OF PRE ENGINEERED BUILDING

Fig 1: Pre Engineered Building Parameters.

End wall Roof Extension: End wall roof extensions consist of end wall panel, Roof panel, Gable trim, soffit panel, and end wall rafter. The end wall is extended to an extent under end wall panel support.

Sidewall Roof Extension: The sidewall roof extension has the same assembly but the soffit panels are above the Roof Extension Rafter.

Centre Curved Fascia: The centre curved fascia consist Backup panel, soffit panel. It is an assembly of Cap flashing, Fascia panel with valley gutter or eave gutter on the rafter with rigid frame support.

Bottom Curved Fascia: The entire assembly of Centre curved fascia contains for the Bottom curved Fascia a slight change in Connection of wall panel to Frame.

Top and Bottom Curved Fascia: In this the assembly is a combination of Top Curved Fascia which has curvature at top and bottom curved Fascia having bottom Fascia.

Roof Platform: The roof platform has Grating on above and roof panels on the sides

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A. Components

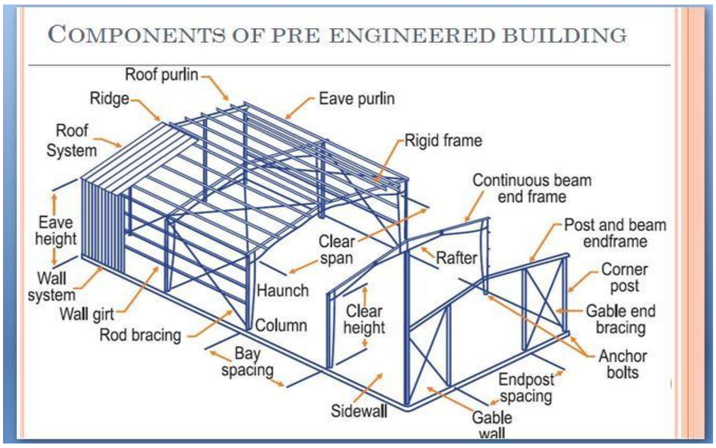

Fig 2: Pre Engineered Buildings Components.

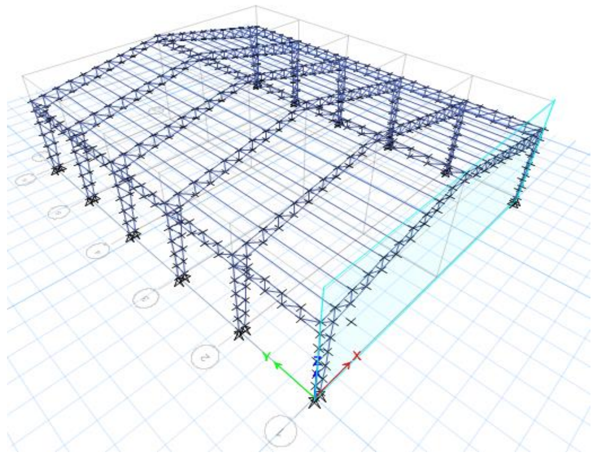

Fig 3: Basic Steel Frame of Industrial Shed

B. Acessories

- Anchor bolts:
- Turbo ventilators
- Sky lights (or) wall lights
- Louvers
- Walking doors
- Aluminum windows
- Roof curbs
- Fasteners

C. Advantages of PEB

b) Construction Time

c) Lower Cost

d) Quality Control

e) Large Clear Spans

f)) Energy Efficient Roofing

h) Low Maintenance Erection Some Common Mistakes

IV. ANALYSIS OF PRE-ENGINEERED BUILDINGS

a. ANALYSIS AND DESIGN OF PEB IN E-TABS

- ETABS software used.
- Example,
- Length 25 m,
- Width 20 m
- Bay spacing 10m

b. Example :

Both conventional type and pre-engineered building.

- Width 20 m
- Bay spacing 10 m
- Eave height 8 m,
- Subjected to earthquake load.
- Design Data-
- Gap- 1.5m c/c
- Roof Purlin- Continuous and sheet
- End wall grits- Continuous
- Sidewall grits- Continuous
- Bay Spacing- 10 m, Clear height- 8m, Roof Slope- 1 in10
- Building Length (L) – 25
- Building Width (W) – 20m.

c. LOAD CALCULATIONS

Calculation of static load:

- Live load as IS 875 (Part-2) – 1987
- LL- on rafter - 0.75 x 10 = 7.5 kN/m
- -On the sloping roof - 0.75 kN/m2

Dead loads Table-2 of IS 875– 1987

- S-W = 0.05 kN/m2
- Combined = 0.10 kN/m2
- gap of purlin = 5 m
- Bay spacing = 10
- Wt of G.I sheeting = 0.05 kN/m2
- Total on frame = 0.10 x 10 = 1 kN/m

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1. CONSIDERING ONLY DEAD LOAD

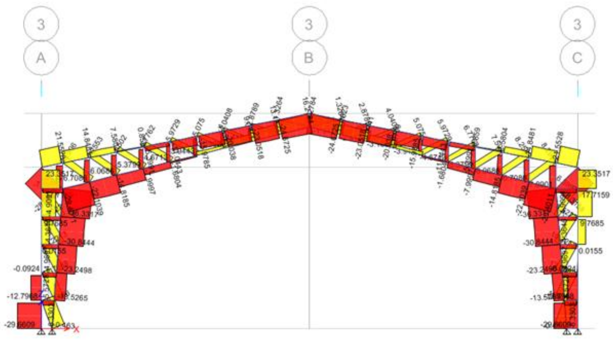

Fig 4: The axial force distribution due to deal laod

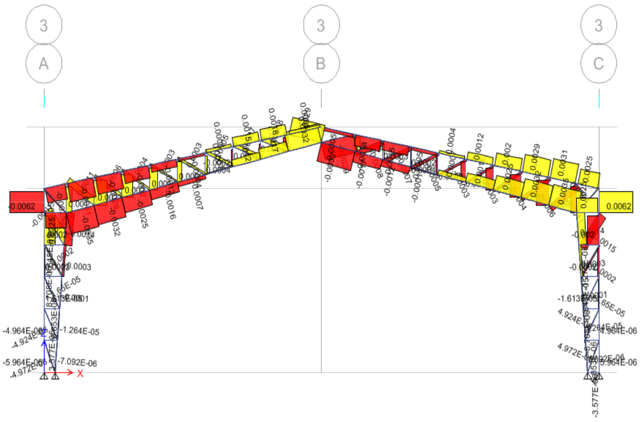

Fig 5: The distribution torsion due to deal laod

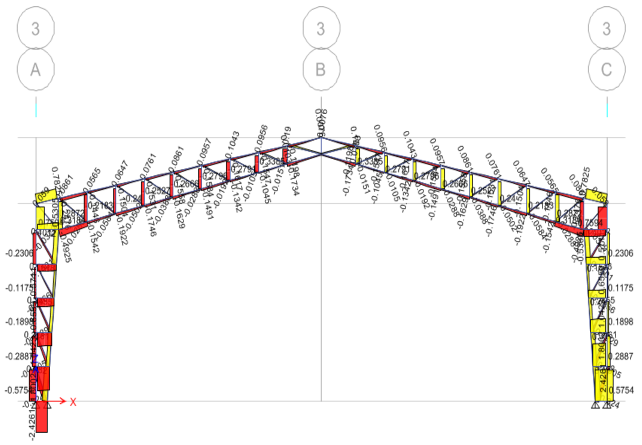

Fig 6: The axial force distribution due to deal laod

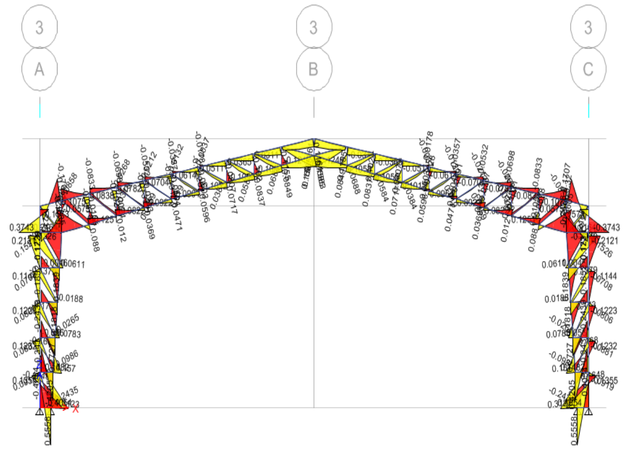

Fig 7: The bending moment distribution due to deal laod

D. Considering 1.0(DL+LL)

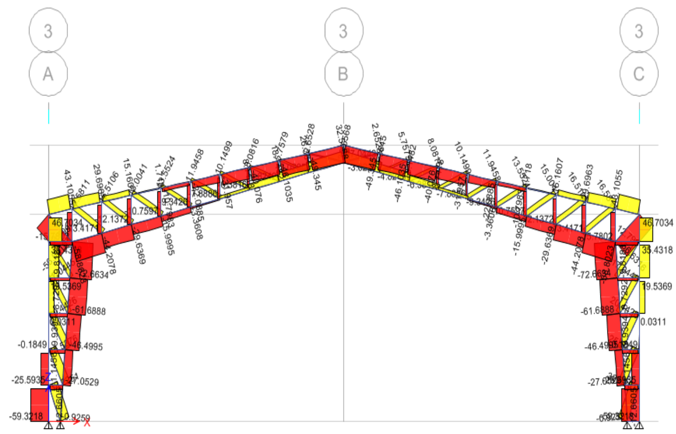

Fig 8: axial force distribution due to 1.0 (DL+ LL**)**

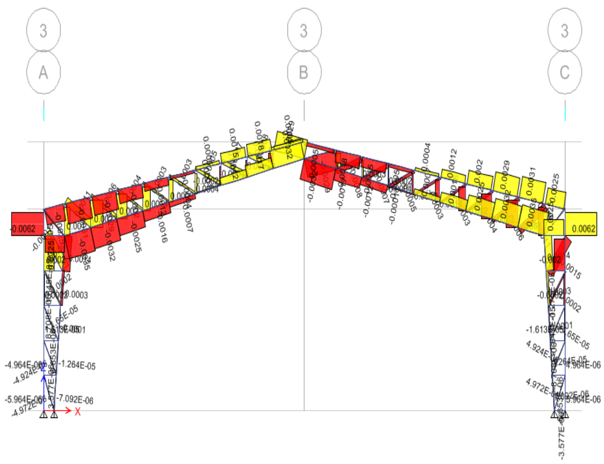

Fig 9: The distribution torsion due to 1.0 (DL+ LL**)**

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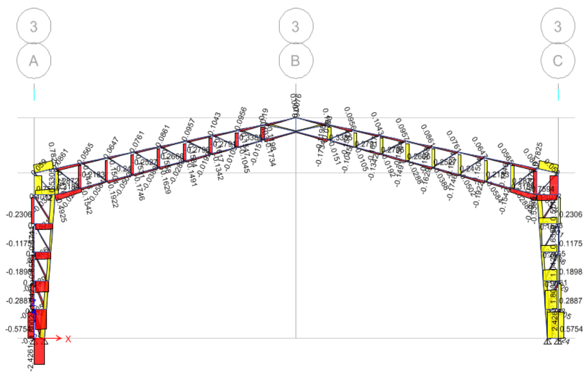

Fig 10: *shear force distribution due to deal laod label,*

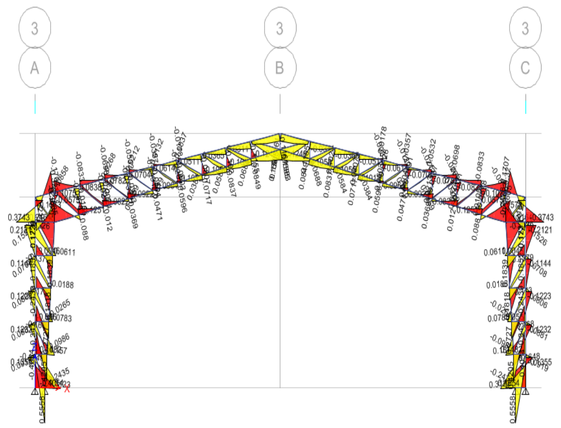

Fig 11: bending moment distribution Considering 1.0 (DEAD LOAD+ LIVE LOAD)

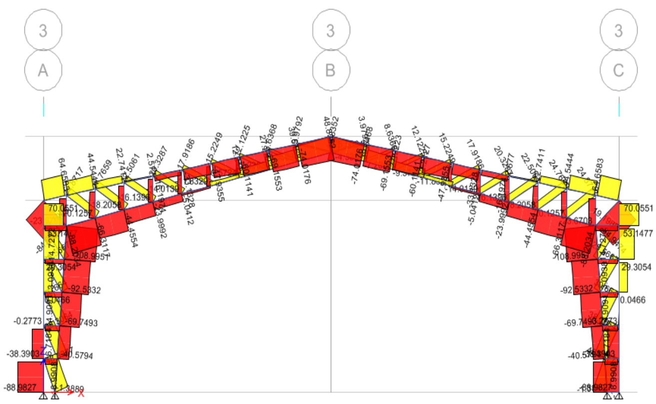

Fig 12: axial force distribution due to 1.5 (DL+ LL)

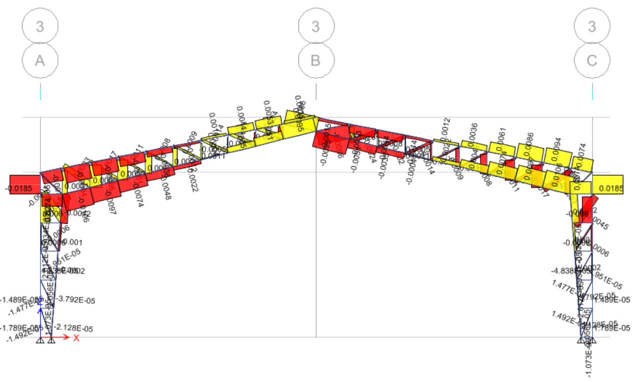

Fig 13: distribution torsion due to 1.5 (dead load+ live load)

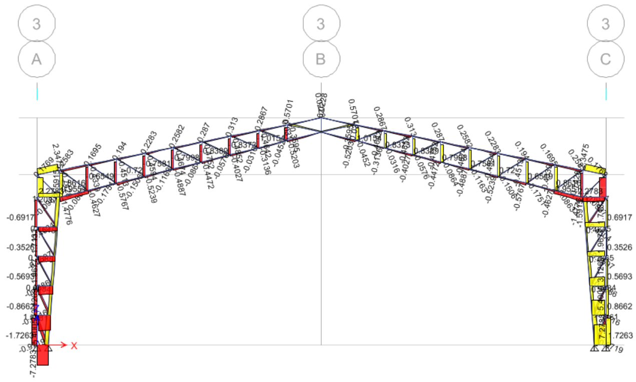

Fig 14: shear force distribution due to deal laod 1.5 (dead load+ live load)

d. Maximum forces And Bending Moments

i. AF : AXIAL FORCE

ii. T: TORSION

iii. SF: SHEAR FORCE

iv. BM: BENDING MOMENT

LOAD COMBINATION	AF	T	SF	BM
DL	-29.60	-0.0062	-2.43	0.558
1.0(DL+LL)	-59.32	-0.0123	-4.85	1.11
1.5(DL+LL)	-88.98	-0.0185	-7.28	1.667
(DL+EQX)	-76.22	-0.0137	-8.52	1.34
(DL+EQY)	-76.22	-0.0137	-8.52	1.34

TABLE.1: Maximum forces And Bending Moments

I. We can say from the analysis that considering different load combinations the Axial forces, torsion, shear force and bending moment values will be differed.

II. Increasing the load the forces and moments also increases.

III. From table.1 we can observe for different load combinations. Generally the live load on PEB is very less compared to normal conventional buildings.

IV. In case of 1.5(DL+LL)the values are higher comparative to (DL+EQX).
V. So, generally live load is less so we can design the structure for normal load without considering factor.
VI. The PEB is designed for (DL+EQX) load combination.

So, we can say that PEBs are Economical than normal conventional buildings.

e. Displacement Values

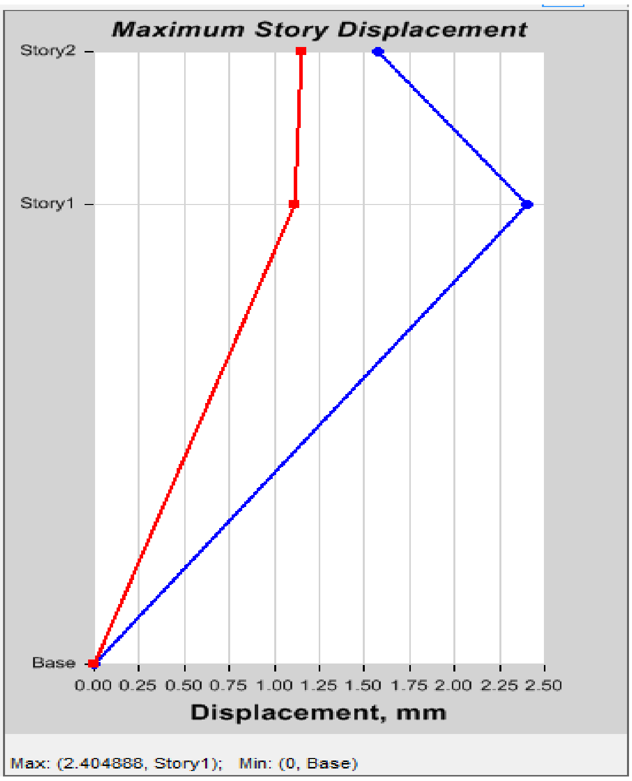

Fig 15: Maximum displacement of the building

CONCLUSION

1. Steel is used directly or indirectly in our basic life. Widely used in construction purpose, environmentally also, more number is recycled.
2. Steel building provides design and architectural enhancing economic styling. No intermediate support is needed as for big clear span. requirements changes daily, reusable, relocate, & change the structure.
3. Pre-engineered Metal building idea is innovative in construction industry progress unique match to parts of present industry.
4. The only solution for huge industrial having thermal and acoustical features.
5. Drastic benefit about this design with more fast and construction in different categories.
6. PEBs are economical than normal conventional buildings because the live load on the structures is less comparative to normal conventional buildings.
7. The required materials quantity is also low. So, the cost of construction is less.

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