Grand Restaurant By Using Staad Pro

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ABSTRACT- Buildings like condominiums, traditional buildings are built in India which require huge time investment and cost based construction. To solve this big problem and reduce the cost of cement during construction, we came across the construction of PEB structures. The construction of PEB (Pre-Engineered Building) is necessary for the construction of single-story buildings with larger and larger openings.

The main objective of this project is to understand PEB structural analysis and design using STAAD Pro to minimize cost and time consumption. Compared to other construction technologies, PEB is more durable. The restaurant building was modeled as a 3D space frame with the best architectural appearance using AUTOCAD. While designing PEB Structure, we use high quality standard steel construction.

KeyWords: Pre-Engineered buildings, AutoCAD, STAAD Pro.

1. INTRODUCTION

A prefabricated building (PEB) is designed by the PEB manufacturer with a single plan that can be produced using different materials and methods for different structural and aesthetic design needs. This is the opposite of a building that is built to a design specifically for that building. In some industry geographies, prefabricated buildings are also referred to as prefabricated metal buildings (PEMBs) or, as is becoming more common due to the decline in prefabrication for custom computer-aided designs, simply prefabricated metal buildings (EMBs). . I-beams used in prefabricated buildings are usually formed by welding steel sheets together to form an I-profile. The I-beams are then assembled on site (eg bolted together) to form the overall frame of the prefabricated building. Some manufacturers narrow the frame sections (different from the track depth) according to local load effects. Larger plate dimensions are used in areas with higher loads. Other basic frame shapes may include trusses, rolled sections instead of three plate-welded beams, etc. The choice of economic form may depend on factors such as local experience (eg manufacturing, transport, construction) and differences in material and labor costs.

Cold formed Z and C sections can be used as secondary structural members to attach and support the liner. Steel with a rolled profile, wood, tensile fabric, concrete elements, brick blocks, glass curtain walls or other materials can be used for the exterior cladding of the building.

When designing a prefabricated building, engineers consider the free spacing between support points, smoothness, roof pitch, live loads, dead loads, lateral loads, wind suction, deflection criteria, internal crane system and the largest practical size and weight of the. elements to be manufactured.

Pre-Engineered Buildings

Prefab buildings (PEB) use a predetermined stock of raw materials that have proven over time to meet a variety of structural and aesthetic designs. This flexibility allows PEB to respond to an almost unlimited number of building configurations, custom designs, requirements and applications. A prefabricated steel building is a building envelope that uses three different product categories: prefabricated primary structural elements (columns and roof beams) cold-formed Z- and I-shaped secondary structural elements (roofs, eaves supports and wall flanges) roll-formed. profiled sheets (roof and wall panels)

COMPONENTS OF PEB STRUCTURE:

- Main frame or vertical columns
- Splits, straps and supports
- Bolted connections
- Covering, insulation and welding mesh
- Crane system
- Painting and finishing

Modelling of PEB:

The data's required for Modelling of PEB Structure as given below:

Table-1

Specifications	**PEB**
Total length	28.94
Total Width	25.30
Clear Height	5m
Slope of roof	3^{o}
Single bay length	5.53
Column section	ISMC 200
Purlin section	ISA 150X150X10 Angle- ST

AUTOCAD:

Figure:1 Floor plan

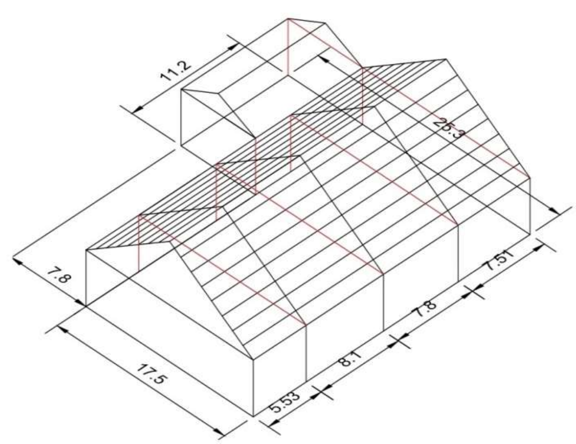


Figure:2 Isometric view

Properties of Soil:

Table-2

PROPERTIES	RESULT
Specific gravity	2.66
Gravel	7.6%
Sand	78.6%
Silt	10.3%
Clay	3.5%
Liquid Limit	40%
Plastic Limit	19%
Plasticity Index	22%
Classification Group	SC(sandy clay)
OMC	13%
MDD	1.62g/cc

PEB Restaurant Structure

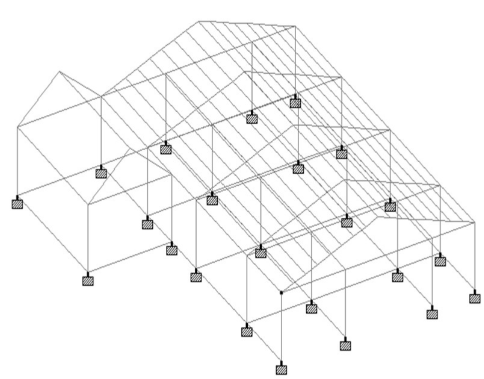


Figure:2 Structure

Loads taken for the analysis of PEB is:

i. DEAD LOAD
ii. LIVE LOAD
iii. WIND LOAD -X
iv. WIND LOAD –Z

<u>Load Calculation by STAAD Pro:</u>

<u>Dead Load</u>

Self-weight load Y-1

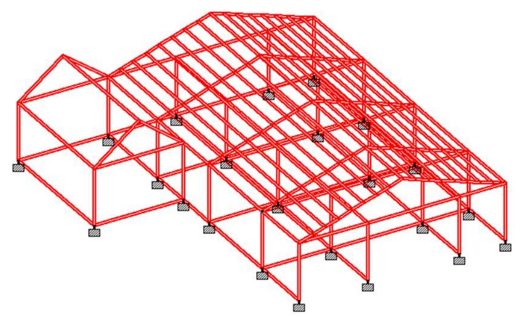


Figure:3 Dead load

<u>Live load</u>

Nodal load FY-5Kn-m

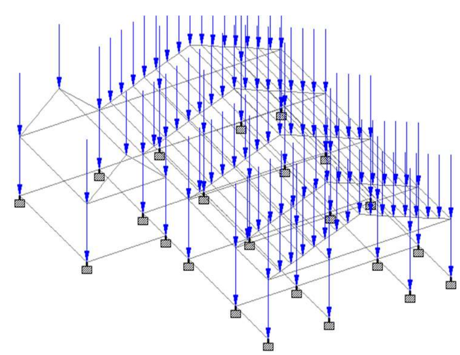


Figure:4 LIVE LOAD

ACTING ON STRUCTURE

Wind load

Intensity =1KN/m2

Exposure=1.00000

Wind load exposure surface direction X-1

Wind load exposure surface direction Z-1

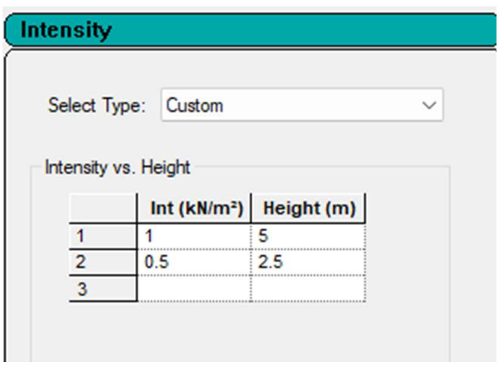


Figure:5 Intensity of Wind load

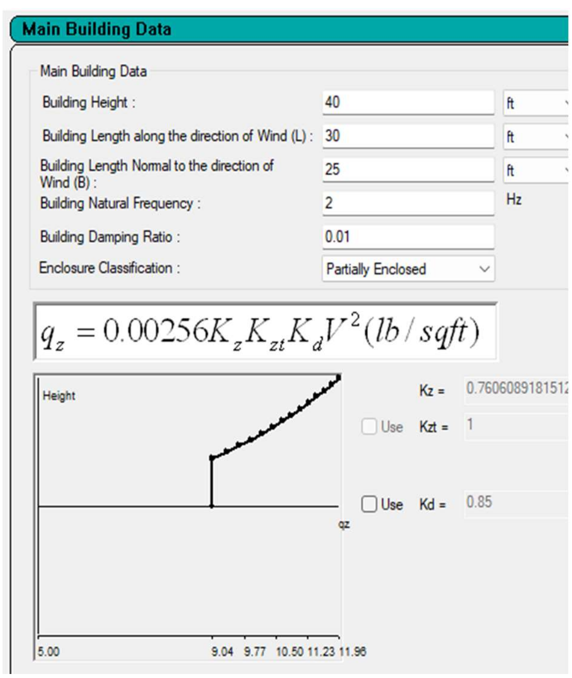


Figure:6 Structure Data

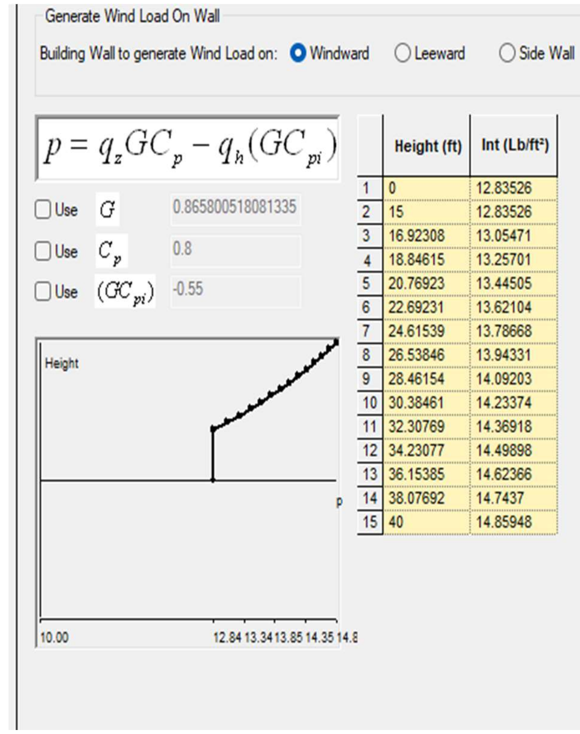


Figure:7 Wind load on the Wall

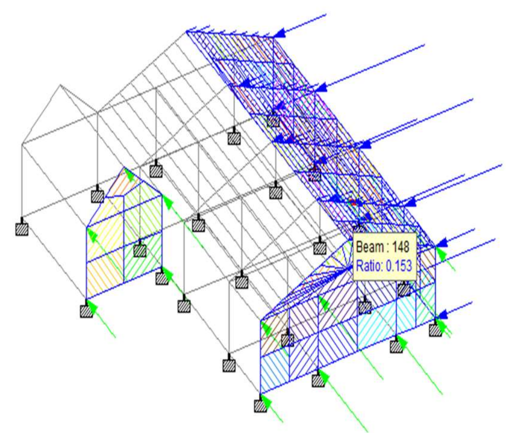


Figure:8 WIND LOAD ACTING ON X DIRECTION

MODELLING OF PEB STRUCTURE

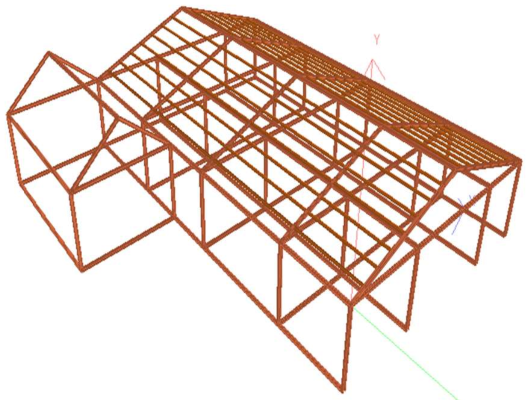
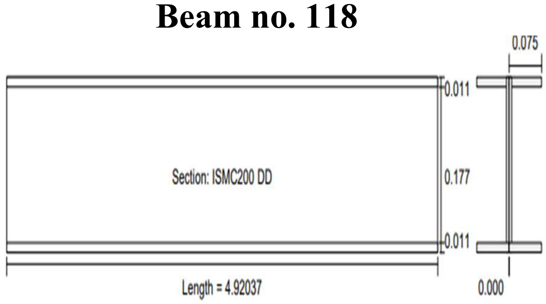


Figure:9 3D RENDERING OF RESTAURANT STRUCTURE

STAAD.Pro Query Steel Design Beam no. 118



DESIGN STRENGTH (KN,MET)

Table-3

FC	338.080	FT	1532.160
FVZ	744.940	FVY	540.190
MBZ	66.400	MBY	50.960
CMZ	0.900	CMY	0.900

Critical load (KN ,METE)

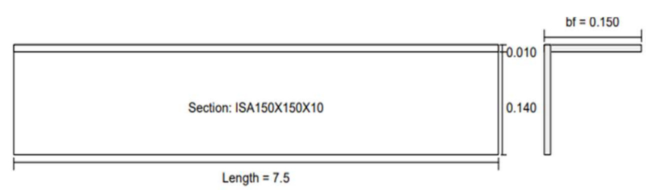
Table-4

Load	3
Location	0.000
FX	0.236 c
MY	-0.207
MZ	2.946

Code	Result	Ratio	Critical	KLR
IS800-07	PASS	0.049	Sec. 9.3.2.2	158.560

STAAD.Pro Query Steel Design

Beam no. 199



DESIGN STRENGTH(KN, MET)

Table-5

FC	60.160	FT	784.900
FVZ	326.730	FVY	326.730
MBZ	0.000	MBY	0.000
CMZ	0.900	CMY	0.900

Critical load (KN ,METE)

Table-6

Load	1
Location	7.500
FX	-0.024 T
My	-0.153
Mz	1.228

Code	Result	Ratio	Critical	KLR
IS800-07	PASS	0.003	Sec. 8.4	127.195

RESULTS:

ESTIMATION:

TABLE-7

PROFILE	LENGTH (METE)	WEIGHT (KN)
D ISMC200	764.12	405.02
ST ISA 150X150X10	334.586	90.851

WEIGHT (KG)	RATE (Rs.)	AMOUNT (Rs)
34117.73	76	25, 92,948
9264.076	74	6, 85,542

Rs. 32,78,490

CONCLUSION:

- The most attractive economy of the PEB structure is cost minimization.
- The amount of steel required for PEB construction is less than CSB constructions.
- Structural analysis and design of PEB using STAAD Pro was done and we got critical pass or fail ratio.
- We design PEB structure of ISMC200 and ISA 150X150X10 structural steel and adopt IS 800-2007 code.
- Load calculation is based on tension and wind load

standard IS 875 PART-II,PART-III.

• We used STAAD Pro to design the PEB structure to make an impression and minimize time.

REFERENCES

- A.S. Kumar, et al., Design and Analysis of Prefabricated Industrial Buildings (PEB), Int. J.Appl. science, eng administer ISSN, 23203439.S. Bhavikatti, Design of Steel Structures (By Limit State Method As Per Is: 800 2007), IK International Pvt Ltd., 2009.
- M.D.P.Zoad, Evaluation of Pre-Engineering Structure Design by IS-800 versus Pre-Engineering Structure Design by AISC, Int. J Eng Resolution Technology (IJERT) 1 (5) (2012) 8th
- Phatangare Roshani Rambhau, Dr.Wakchaure M.R. 'A Review Paper On Alternate Design Of Roofing Sysytem' International Journal Of Engineering Sciences & Research Technology feb,2017.
- Hemant Sharma 'A Comparative Study on Analysis & Design of Pre-Engineered & Conventional Industrial Building' – International Journal for Innovative Research in Science & Technology| Volume 3 Issue 10 | March 2017.
- C. Meera, Pre-engineered building design of an industrial warehouse, Int. J.Eng. Sci. Emerg. Technol. 5 (2) (2013) 75–82.
- G.S. Kiran, A.K. Rao, R.P. Kumar, Comparison of design procedures for preengineering buildings (PEB): a case study, Int. J. Civ., Arch., Struct. Constr. Eng.(IJCASCE) 8 (4) (2014) 4.
- A.A. Zende, A. Kulkarni, A. Hutagi, Comparative study of analysis and design ofpre-

engineered-buildings and conventional frames, IOSR J. Mech. Civ. Eng.2013 (2013) 2278–1684

- A. Mehendale, A. Gupta, D. Desai, Overview of pre-engineered buildings,Imperial J. Interdisciplinary Res. 2 (6) (2016) 1421–1425.
- S. Charkha, L.S. Sanklecha, Economizing steel building using pre-engineeredsteel sections, Int. J. Res. Civ. Eng., Arch. Des. 2 (2) (2014) 01–10.
- M. Shiyekar, Limit state design in structural steel, PHI Learning Pvt. Ltd., 2013.