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ACCESSING SUITABILITY OF PINNED BASE AND FIXED BASE PEB STRUCTURE WITH PILE FOUNDATION BY USING STAAD PRO

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ABSTRACT- *Pre Engineered Buildings (PEB buildings) nowadays are majorly used in industrial areas for its economy and time optimization. In PEB structures, column base provided can be pinned or fixed. It is a general practice in PEB design that when the piles are provided or when the soil strata is weak, PEB column base selected is a pinned base. In such a condition, economy when compared with a fixed base is generally ignored in Indian practice. In this research, Two different industrial PEB sheds are analyzed and designed according to the Indian standard code IS 800-2007 with two different column base conditions; one being the pinned base and another one being the fixed base, both resting on the piles. In this project the economy of structural steel and piles is evaluated for these two column end conditions. The soil under the PEB shed is simulated by the springs of varying stiffness at varying depth. The springs are assigned with the property of soil subgrade reaction obtained from the soil report. Thus bending moment, shear force, and deflection of a pile is found out and the soil can be simulated more accurately.*

KEYWORDS- *PEB shed, pinned base, fixed base, pile, soil simulation, spring subgrade*

1. INTRODUCTION:

India is a developed country and massive house building construction is happening in various parts of the country. Since 32% of Indian population lives in towns and cities; hence constructional activity is more within the urban places. The requirement of housing is extreme but there'll always be a shortage of accommodation availability because the present masonry and conventional construction technology cannot meet the rising demand year by year . Hence theres a need to think for alternative construction system for steel or timber buildings, but timber is anyway unsuitable to tropical countries like India. In structural engineering, pre-engineered building is designed by a manufacturer in factory and is to be fabricated using a pre-determined inventory of raw materials and manufacturing methods that can efficiently compensate a wide range of structural and aesthetic design requirements. Within some geographic industry sectors these buildings are also called Pre-Engineered Metal Buildings. Historically, the primary framing structure of a pre-engineered building is an assembly of I shaped members, often referred as I beam. In PEB, I section beams used are usually formed by welding together 3 steel plates to make of I section. I section beams are then field- assembled and fabricated (e.g. bolted connections) to form the whole frame of the pre- engineered building. Cold formed Zee and C- shaped members 9 could also be used as secondary structural elements to lock and support the external cladding and facias. Roll-formed profiled steel sheet, tensioned fabric, wood, masonry block, precast concrete, glass curtain wall or other materials could also be used for the external cladding of the building. In order to

accurately design a pre-engineered building, engineers consider the clear span between bearing points, roof slope , bay spacing, live loads, wind uplift, dead loads, collateral loads, deflection criteria, internal crane system and maximum practical size and weight of fabricated members. Historically, preengineered building manufacturers have developed pre calculated tables for different structural elements in order to allow designers and engineers to select the most efficient and economic optimal I beams size for their projects. In pre-engineered building concept the entire designing is completed at the factory and the building components are delivered to the location of site in Completely knock down condition or full ready form. These components are then fixed / jointed at the location and raised with the assistance of cranes. The pre-engineered building involves in no time construction of buildings and with aesthetic looks and good quality construction. Pre-engineered Buildings are often used extensively for construction of commercial and residential buildings and industrial sheds. The buildings are often multi storied (4-6 floors). These

buildings are suitable to varied environmental hazards. Pre-engineered buildings are often adapted to suit a good sort of structural applications; the best economy are going to be realized when utilizing standard details. An efficiently designed pre-engineered building are often lighter than the traditional steel buildings by up to 30%. Lighter weight equates to less steel and a possible price savings in structural framework.

2. AIM & OBJECTIVE:

AIM: To access suitability of pinned base/fixed base PEB structure with pile foundation.

OBJECTIVE:

- To access suitability of a PINNED base for PEB shed.
- To access suitability of a FIXED base for PEB shed.
- To design a pre-engineered building frame using IS 800- 2007 LSD
- To design a pile foundation for fixed base that carries a moment along with compressive and uplift force.
- To design a pile foundation for pinned base that carries compressive and tensile force.

3. TECHNICAL PARAMETERS OF PEB:

Pre Engineered Buildings are specially crafted to meet customer's necessities. PEB's are characterized for clear estimations. The created individuals fit to the planned measurements. Estimations are taken precisely for the necessities. The essential boundaries that can characterize a PEB are :

3.1 Width Or Span Of Building:

The inside to focus length from one end divider section to the opposite end divider segment of an edge is viewed as broadness or range of the structure. The width between two sections can be estimated as length. The range length for various structures differs. The plan is done on range length given by client. The fundamental range length begins from 10 to 150 meters or above with moderate sections. Airplane storages, producing businesses, Stadiums gangs significant range width. No adjustments or broadening range be finished.

3.2 Length Of Building:

The length of PEB is the all out length reaching out from one front end to the backside of the structure. The length of PEB can be extendable in future.

3.3 Building Height:

Building stature is the eave tallness which ordinarily is the good ways from the base of the principle outline segment base plate to the top external purpose of the eave swagger. At the point when segments are recessed or raised from completed floor, eave tallness is the good ways from completed floor level to head of eave swagger.

3.4 Roof Slope:

This is the edge of the rooftop as for the level. The most well-known rooftop slants are 1/10 and 1/20 for tropical nations like India. The rooftop incline in snow fall areas can go up to 1/30 to 1/60. Any viable rooftop slant is conceivable according to client's prerequisite.

4. STRUCTURAL CONFIGURATION:

Shed:

Overall dimension of a PEB shade = 35m X 62m
Bay spacing = 7.721m
Height of shade = 8.2 m
Dead load = 0.15 KN/m2
Live load = 0.75 KN/m2
Collateral load = N.A.
Basic wind speed = 44 m/s
Wind terrain category : 2
Wind class: C
Code used : IS-800-2007 LSD

Column base selected: in first trial, a pinned base in second trial, a fixed base

5. LITERATURE REVIEW:

5.1. U. D. Dabhade1, N.A.Hedaoo2, Dr. L. M. Gupta3 and Dr. G. N(2009)

They got to achieved the time saving of 55.3% after used of steel framed composite floor construction instead of using precast framed with precast concrete floor and 14.3% times than that of steel framed with pre concrete slab. After using steel framed composite floor building it saves time which definitely help us for saving in an overall net cost. The direct cost need steel framed with composite floor is 23.10% which is higher than precast concrete floor and only 0.52% higher than steel framed with precast concrete floor. After time saving, the cost need for steel framed with composite floor is 12.99% which is 2.32% is less than steel. The steel framed with precast concrete floor saves 35.83% construction time than precast framed with precast concrete floor.

5.2. S.D. Charkha and Latesh S (June 2014)

Has observed that reduction of steel quantity then PEB is better than CEB . PEB is useful for reduction of steel quantity. So there is reduction in steel quantity then definitely there will be reducing the dead load. if dead load is reduced then it will reduce size of foundation. Using PEB helps to increase the aesthetic view of structure.

5.3. Jatin D. Thaka r, 2 Prof. P.G. Patel

Observed that PEB are steel building on the framing member and other components are fully fabricated in the factory after designing mostly by nut bolts so resulting into steel structure of high quality accurate. It conventional steel construction site welding involved which is not case PEB using nut bolt mechanism for primary framing this kind of structure use for hot rolled tapered section and cold rolled tapered section.

Usually z and c section . in secondary framing wastage of steel get reduced self weight of structure and there will be lighter foundation international codes referred in this design as per the MBMA (metal

building manufacturing association). The tapered section concept was firstly adopted in US by keeping in mind the bending moment diagram. At locations of high bending moment values, greater depth is used while less moment encouraged the use of lesser depths. Further unlike the conventional steel sections, where Moment of inertia (I) remains constant, it is not so in case of P.E.B due to varying depths.

5.4. G. Sai Kiran , A. Kailasa Rao, R . Pradeep Kumar (Aug 2014)

In recent few years its observed that PEB concept in designing helped in improvement designing after adopting of PEB instead of CSB concept proved in many advantage include in their economy and easier fabrication In this study, an industrial structure (Ware House) is analyzed and designed according to the Indian standards, IS 800-1984, IS 800-2007 and also by referring MBMA-96 and AISC-89. In this study, a structure with length 187m,width 40m,with clear height 8m and having R-Slope 1:10,isconsidered to carry out analysis& design for 2D frames (End frame, frame without crane and frame with 3 module cranes). The economy of the structure is discussed in terms of its weight comparison, between Indian codes (IS800-1984, IS800-2007) & American code (MBMA-96), & between Indian codes (IS800-1984, IS800-2007).

5.5. Aijaz Ahmad Zende 1, Prof. A. V. Kulkarni , et.al

They observed PEB structure provide structure clear span their weight is lesser than that of `conventional building and for sustainable development steel is the material that reflect the essential when there are structure life longer span conventional building are not suitable with clear span so therefore PEB are the best way for longer span structure without using interior column. PEB structure are costly as compared to conventional structure in case there are smaller span structure.

5.6. Anbuchezian et al [2013]

- Studied behavior of cold formed sections.
- Cold formed steel purlins are the widely used structural elements in India.
- Practically 'Z' sections are provided, where the span of the roof purlins is sloped and the length of the span is maximum.

5.7. Satpute et al [2012]

- He has done the detailed analysis of lndustrial building with Cold formed concept is carried out.
- A com pa rative study has also been ca rried out between Hot Roll steel lndustrial building and Cold formed lndustrial building and a conclusion has been drawn.
- In lndustrial building the material & cost of the building is minimized in case of cold formed steel while in case of conventional building it was be higher both in two cases.The saving in material and cost is about 25%.

5.8. Kumar et al [2014]

- studied the Pre-Engineered Bulking (PEB) concept in the design of structures which helped in optimizing design.
- The ability of PEB in the place of conventional steel building (CSB) design Concept resulted in many advantages, including economy and easier fabrication.
- The economy of structure is discussed in terms of its weight comparison. Between Indian codes (IS800-1984,IS800-2007).

6. CONCLUSION:

From the literature we can summarize the work in pre-engineered building “as below.

- The construction of steel framed composite floor building saves time, which leads to an overall savings in net cost.
- Pre-engineered building can be adopted to suit a wide variety of structural applications, the greatest economy will be realized when utilizing standard detailks in structural framework.
- To understand the importance of cost effectiveness.
- Minimum weight buildings that are targeted with simple fabrication process and easy erection to have maximum structural efficiency. Minimum weight of structure is proportional to minimum cost and lowers seismic and gravitational forces.
- In industrial the material and cost of the building is minimized in case of cold formed steel while in case of conventional building it was be higher both in two cases. The saving in material and cost is about 25% can be achieved.
- Design of one-story industrial building structure with larger clear spans by using PEB is more economical than truss framing design.
- As per all reviews it is observed that there is a scope of work in Comparing IS800:2007 (LSM) with international standard (LSM/LRFD), so Here an attempt is made to compare the same by designing actual building using IS800 2624.

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