

# Literature Review on Analysis of Pre-Engineering Building With EPS Wall Panels By Using Finite Element Software

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**Abstract-** *The pre-engineered steel building system construction has great advantages to the single storey buildings, practical and efficient alternative to conventional buildings, the System representing one central model within multiple disciplines. Pre-engineered building creates and maintains in real time multidimensional, data rich views through a project support is currently being implemented by Staad pro software packages for design and engineering.*

**Keywords-** pre-engineered building, STAAD pro

## I. INTRODUCTION

Pre-engineering steel building use a combination of built up sections, hot rolled sections and cold formed elements which provide the basic steel frame work with a choice of single skin sheeting with added insulation or insulated sandwiched panels for roofing and wall cladding.

Pre-engineered buildings are factory-built buildings of steel that are shipped to site and bolted together. What distinguishes them from other buildings is that the contractor also designs the building - a practice called *design & build*. This style of construction is ideally suited to industrial buildings and warehouses; it is cheap, very fast to erect, and can also be dismantled and moved to another site - more on that later. These structures are sometimes called 'metal boxes' or 'tin sheds' by laymen - they are essentially rectangular boxes enclosed in a skin of corrugated metal sheeting. Great speed is achieved because while the foundations and floor slab are being constructed, the beams and columns - the structural system - are being fabricated in the factory. Once the foundations and floor are done, the columns are shipped to the site, lifted into place by cranes, and bolted together

Pre-engineered buildings are generally low rise buildings however the maximum eave height can go up to 25 to 30 meters. Low rise buildings are ideal for offices, houses, showrooms, shop fronts etc. The application of pre-engineered buildings concept to low rise buildings is very economical and speedy. Buildings can be constructed in less than half the

normal time especially when complemented with the other engineered sub systems.

## II. LITERATURE REVIEW

### 2.1 GENERAL

To provide detailed review of literature related to pre engineering building. This literature gives study of pre engineering building with eps panel. Also gives us information about analysis of pre engineering building with conventional building in civil engineering works, their advantages and disadvantages.

#### PiyushBhandari.(2016)- Evaluating Properties of Lightweight Sandwich Wall Panels

There is a huge growing requirement of building materials in India due to the existing housing shortage of 46.3 million units, mainly for the low income groups in urban India. Estimated urban housing shortage in 2015 was 56.43 million, while the housing shortage of rural India in 2015 was 62 million units. Thus total estimated housing shortage for Urban & rural India in 2015 was 128.43 million units. To fulfill this basic need of urban habitat; India requires innovative, energy efficient building materials for strong and durable housing in fast track method of construction at affordable cost. All these concerns have lead to develop an energy efficient and economical material. Lightweight pre-fabricated Sandwich wall Panel which provides rapid or faster construction and contributes to environmental protection, can provide a solution to many of the above issues and concerns. The paper describes the overview of sandwich wall panel, method of construction and its properties. Additionally, this sandwich construction deals with the problem of delimitation of face sheets leading to their premature failure. This can be avoided by providing binding cover over the core. The study conducted involved the development of high performance cement based mortar mix to cast Ferro cement cover. The results revealed the potential application of Ferro cement

cover over lightweight insulation core to produce lightweight structural elements which leads towards the industrialization of building system.

#### **Prajwal Paudel, et al. (May 2016)- Study on Pre-fabricated Modular and Steel Structures**

Recent devastating of 7.8 magnitudes in Nepal on 24-04-2015 had destroyed many houses and took many lives. These many losses are due to poor building techniques and heavy building materials. In the developed countries like Japan, China, etc. the earthquakes do not affect the lives and destroy the houses. This is because they use the pre-fabrication building techniques and steel or aluminum frame structures rather than heavy concrete building structures. The prefabricated house is constructed by light steel frame to sandwich panels for the building envelope materials, as a standard module for space series combination of components, the bolt connection, and the new concept of environmental protection economic activities in prefabricated house. The prefabricated components are brought to the site and erected using building block type construction. Work is never delayed by curing time or missing material sand can be completed for 30 to 45 working days. Further study shows that it can also lower the total cost of the project by 12 percent as compare to the traditionally build house using traditional materials such as CHB (Concrete Hollow Blocks).

#### **Rohana Mamat, et al. (2015)- With Steel Fibre Behaviour Of Unreinforced Expanded polystyrene Lightweight Concrete (Eps-Lwc) Wall Panel Enhanced**

This study used steel fibre as reinforcement while enhancing the EPS-LWC strength. In line with architectural demand and ventilation requirement, opening within wall panel was also taken into account. Experimental tests were conducted for reinforced and unreinforced EPS-LWC wall panel. Two samples with size of 1500 mm (height) x 1000 mm (length) x 75 mm (thickness) for each group of wall panel were prepared. Samples in each group had opening size of 600 mm (height) x 400 mm (length) located at 350 mm and 550 mm from upper end respectively. EPS-LWC wall panel had  $f_{cu}$  of 20.87 N/mm<sup>2</sup> and a density of 1900 kg/m<sup>3</sup>. The loading capacity, displacement profiles and crack pattern of each sample was analyzed and discussed. Unreinforced EPS-LWC enhanced with steel fibre resist almost similar loading as reinforced EPS-LWC wall panel. The presence of steel fibre as the only reinforcement creates higher lateral displacement. Wall panel experiences shear failure at the side of opening. The number of micro cracks reduces significantly due to presence of steel fibre.

#### **D.Rakesh. (2016)- Design and Analysis of Conventional and Pre-Engineered Building (R.C.C and Steel)**

Now a day there is a vital change in the steel industry, majorly in the industrial structures the usage of Conventional steel building and Pre-Engineered building is more. Conventional steel building and Pre-Engineered building concept is a new conception of single storey industrial building construction. This methodology is versatile not only due to its quality pre-designing and prefabrication, but also due to its light weight and economical construction. The concept includes the technique of providing the best possible section according to the optimum requirement. In Conventional steel building and Pre-Engineered building concept, the complete designing is done at the factory. The Conventional steel building and Pre-Engineered building calls for very fast construction of buildings and with good aesthetic looks and quality construction. Conventional steel building and Pre-Engineered building can be used extensively for construction of industrial and residential buildings. The buildings can be multi storied (4-6 floors).

#### **Dr Lai Hoke Sai, et al. (23 May 2013)- Design of Precast Concrete Structures for Engineers**

Structural design of precast concrete structures is significantly different from the design of cast-in-situ structures. The difference lies in the structural continuity of individual precast concrete components that are connected by a number of joints. The connections act as links between the components. Hence structural engineers who design precast concrete structures should have a good understanding of the behavior and design principles of connections to ensure stability and safety of the structure. Organised by the BCA Academy, this course will address the structural design issues of precast concrete technology. It also aims to train the practitioners on the practical design of precast concrete structures in an interactive manner. This course will be taught by precast industry specialists who have vast experience in the design of precast concrete structures. The Housing Development Board (HDB) will also share a case-study on the design of a tall precast residential building. The application of building information modeling for precast concrete structures will also be demonstrated.

#### **M S Palanichamy, et al. (30 August 2002)- Prefabrication Techniques For Residential Building**

This paper deals with the prefabrication techniques for residential building using a system of Pre cast units for columns, beams, roof and walls. Precast R.C.C. planks and partially Precast R.C. joists are considered for flooring

Roofing system in this paper and special types of Precast wall panels are recommended. Prefabricated columns with a specific configuration, beams and staircase units are considered in this paper. Special emphasis has been made with respect to the various joints and connections and the details of these are discussed. A comparison of the cost of construction of Pre cast system with that of a conventional construction unit has also been made. Finally, identified that large scale adopting of such a Pre cast systems will eventually result in considerable cost reduction with the added advantages of execution speed.

#### **ApurvRajendraThorat.,et al.(June-2017)- A Study Of Performance Of Pre-Engineered Building Of An Industrial Warehouse For Dynamic Load**

In the present study Pre-engineered Buildings are designed and studied in accordance with Kirby Technical Specification which is based on ASCE-07. Two examples have been taken for the study. Comparison of Pre Engineered Buildings (PEB) with bracings and Pre Engineered Buildings (PEB) without bracings is done in two examples. Later Pre Engineered Buildings (PEB) is analyzed for dynamic loads using El-centro specified ground motion.

#### **Shrunkhal V Bhagatkar.,et al.(March 2015)-A Study On Pre-Engineered Building – A Construction Technique**

Steel industry is growing rapidly in almost all the parts of the world. The use of steel structures is not only economical but also eco friendly at the time when there is a threat of global warming. Time being the most important aspect, steel structures (Pre fabricated) is built in very short period and one such example is Pre Engineered Buildings (PEB). This review from the past experiences presents the results of experimental and analytical studies done on Pre Engineered Building. Results show that these structures are economic, reduces construction cost and time, energy efficient and flexibility of expansion.

#### **D.Rakesh.,et al.(2016)- Design and analysis of conventional and pre-engineering building (R.C.C and steel)**

Now a day there is a vital change in the steel industry, majorly in the industrial structures the usage of Conventional steel building and Pre-Engineered building is more. Conventional steel building and Pre-Engineered building concept is a new conception of single storey industrial building construction. This methodology is versatile not only due to its quality pre-designing and prefabrication, but also due to its light weight and economical construction. The concept includes the technique of providing the best

possible section according to the optimum requirement. In Conventional steel building and Pre-Engineered building concept, the complete designing is done at the factory. The Conventional steel building and Pre-Engineered building calls for very fast construction of buildings and with good aesthetic looks and quality construction. Conventional steel building and Pre-Engineered building can be used extensively for industrial and residential building. The building can be multi-storied (4-6 floors).

#### **AdityaDubey.,et al.(Nov-2016)- Main Frame Design Of Pre- Engineering Building**

Pre-Engineered building (PEB) is a new concept for the construction of single storey industrial building. The concept is versatile not only due to its quality pre-designing and prefabrication but also due to its time efficiency and light weight. The concept of Pre-Engineered Building includes the technique of providing the best possible section according to the optimum requirements. This concept has many advantages over Conventional Steel Structure (CSB). And Pre-Engineered Building is efficient alternative to Conventional Steel Building. In this paper main frame of Pre-Engineered Structure of 12 m, 14m, 16m, 18m, 20m width & 6m Eave height have been analysed and designed by Staadpro to understand behavior of PEB. The design is done by IS 800:2007, "Code of practice for General Construction in Steel Structures" as well as IS 875:1987(Part 1,2&3), "Indian Standard code of practice for loads on buildings and structures". Load case considered in modelling are Dead load, imposed load & Wind load with the various combinations as specified in IS.

#### **TabishIzhar.,et al.(2017)- Comparative Study Between Pre-Engineered RCC Structure And Usual RCC Structure**

The present work involves the comparative study of pre Engineered Buildings (PEB) in RCC and general RCC structure. In this paper ware house structure of 20m width and 24m length & single story have been analyzed and designed by using STAAD Pro.2007 in ordinary RCC and PEB RCC to understand the behavior of Pre Engineered structure. Pre Engineered Buildings fulfils requirement along with reduced time and cost as compared to conventional structures. In the present work, Buildings is designed for wind forces and seismic load both.

#### **J.Jayavelmurugan.,et al.(Jan 2015)- A Study on Pre Engineered Steel Building Structure**

Buildings & houses are one of the oldest construction activities of human beings. The construction technology has advanced since the beginning from primitive construction technology to the present concept of modern house buildings. The present construction methodology for buildings calls for the best aesthetic look, high quality & fast construction, cost effective & innovative touch. Pre Engineered Steel Buildings are manufactured or Produced in the plant itself. The manufacturing of structural members is done on customer requirements. The detailed structural members are designed for their respective location and are numbered, which cannot be altered; because members are manufactured with respect to design features. These components are made in modular or completely knocked condition for transportation. These materials are transported to the customer site and are erected. Pre-engineered buildings can be adapted to suit a wide variety of structural applications; the greatest economy will be realized when utilizing standard details. An efficiently designed pre-engineered building can be lighter than the conventional steel buildings by up to 30%. Lighter weight equates to less steel a potential price saving in structural framework.

#### **JinshaM S., et al.(2015)- Analysis Of Pre-Engineering Building**

In this paper Pre-Engineered Building of 25m width & 6m Eave Height have been analyzed and designed by using STAAD Pro.2007 to understand the behaviour of Pre – Engineered structure & to check in which case it achieve the economy in steel quantity by varying bay spacing as 6m, 8m, 10m, & 12m. Long Span, Column free structures are the most essential in any type of industrial structures and Pre Engineered Buildings fulfils this requirement along with reduced time and cost as compared to conventional structures. In the present work, Pre Engineered Buildings (PEB) is designed for wind forces. Wind analysis has been done manually as per IS 875 PART3-1987.

#### **Pradeepa.S.,et al.(March 2016)- A Study on use of Reinforced Thermocol Panels as an Alternate Building Material**

Thermocol or polystyrene has already found extensive use as filler material in structural members. Various studies have also shown that thermocol panels offer high bending stiffness at low densities due to minimal compressive and flexural strength.

It is because of their ability to withstand external forces, that construction materials are considered in the design of a structural framework. There have been cases where

similar ideas have been tried, one such case being “Thermo 'Cool' Houses” a German technology brought to coastal parts of Surathkal by Captain Karl Neugebauer, the engineer and promoter of Eco-thermo Constructions. The houses are built using thermocol moulds and the strength is obtained by filling the block with concrete. These houses are aimed to be very energy efficient. An investigation was focused on the strength capability of lightweight web sandwich panel (LWSP). This study dealt with the LWS's strength under flexural loading (one point load & three point load) by treating these LWSPs as a floor and also, studying LWSP strength under axial load by treating these LWSPs as a wall. It was found that the material cost for building using the Reinforced Thermocol technology was lesser than the quarried stones for building a wall. Although due to the labour intensive process that masonry work requires, the conventional method was more expensive on labour than the Reinforced Thermocol technology. Hence the technology offers a way of meeting the housing demand at a total lower cost. Thus we aim to prove that by using Reinforced Thermocol as an alternate building material we can achieve an easy, fast and cheap method of construction.

#### **Ahmad Mousa.,et al.(April 2012)- 3-D Panel System: A Sustainable Building Solution for Egypt**

Amounting to approximately 7% of the), the construction industry in Egypt has an undeniable impact on its economy. Although sustainable buildi serve the society as well as the practitioners, it generally suffers from market barriers and resistance due to local construction culture. Therefore, modern construction pillared on sustainability concept and green building perception is - regrettably - still believed to be in its infancy in Egypt.

This study emphasizes the added value of using sustainable construction materials, systems and methods. In doing so, the study proposes the 3-D Enbuil Panel System as a sustainable solution that provides structural and architectural leverage, embraces green building demands, and ensures a contemporary practice in the Egyptian construction market. The system warrants these unique characteristics without compromising economic feasibility.

### **III. CONCLUSION**

We can see in our daily life has used directly or indirectly there is no viable substituent to steel in construction activities. Steel remain and will continue to remain logical and wide choice for construction purpose environmentally also as much of the steel used in recycled.

Steel building offers more design and architectural flexibility for unique or conventional styling. Its strength and large clear spans mean the design is not constrained by the need for intermediate support walls. As per our requirement changes over the years, you can reuse, relocate and modify the structure.

Pre-engineered metal building concept forms an unique position in the construction industry in view of their being ideally suited to the needs of modern engineering industry.

The major advantage of metal building is the high speed of design and construction for building of various categories.

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