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Effective Utilization of Pre Engineering building (PEB) construction for Development of Rapid Healthcare facilitates in Medical Emergency

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Abstract - World is developing at a faster pace in all spheres of technology. The parameters which determine the development have changed a lot in the recent past and will keep changing in future too. Rapid rise in levels of education, high rates of technological innovations and applications, ever faster and cheaper communication that dissolves physical and social barriers both within countries and internationally, greater availability and easier access to information, and the further opening up of global markets are the set of catalytic forces that is accelerating the speed of social change throughout the world.

Pre Engiering building is one of the best application of fast track construction Pre-Engineered Building concept involves the steel building systems which are predesigned and prefabricated .The present construction methodology calls for the best aesthetic look, high quality & fast construction, cost effective & innovative touch. One has to think for alternative construction system like pre-engineered steel buildings. In recent years, the introduction of Pre Engineered Building (PEB) concept in the design of structures has helped in optimizing design. In this report the detail explore of pre engineering as a fast tack construction's application discuss . As the world battles the ongoing COVID-19 pandemic, it has become very clear that societies depend on functioning healthcare facilities. The sufficient availability of hospital beds, healthcare staff, protective gear or ventilators can make all the difference between a situation that is still manageable and a severe crisis. for this infrastructure facilities should be prepare in short time ,For this EPS Pannel and UPVC panels will be use for rapid construction of healthcare facilities

Keyword - Time ,Fast Track Construction, Pre engineering building, Medical Emergency EPS Pannel and UPVC panels

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INTRODUCTION

Steel skyscrapers constitute a relatively little part of the world's overall construction boom. The vast majority of steel construction projects include single-story buildings. Steel factories, car industries, light, utility, and process industries, thermal power stations, warehouses, assembly plants, storage, garages, and small-scale businesses are all common applications for industrial buildings, a subset of low-rise structures. A portal frame is essentially a hot- or cold-rolled rigid connected plane frame that uses purlins and sheeting rails to support the roof and the side cladding.

Portal frames, in their rudimentary form, emerged during the Second World War. Although portal frames have been utilized with spans as wide as 80 meters, the norm is closer to 30 meters. However, when using multi-bay constructions with a span more than 40 meters, the investment is justified. Corrugated galvanized iron (GI) sheets are often used as roofing and wall coverings for factories in India. Cold-formed, ribbed steel or aluminum decking (made by cold drawing flat steel or aluminum strips to make the appropriate section) is now available in light gauges. Asbestos (AC) sheets, which have higher insulating characteristics, are often also given as roof covering.

Painting the top side white might improve their insulating qualities. Due to concerns about the danger of lung cancer, asbestos sheets have been banned in a number of nations. The decking and cladding often employed in Pre-Engineered Buildings include steel and aluminum, both of which will be briefly discussed. The end wall of a metal structure may be extended simply by unbolting its connections, removing it, and replacing it with a new clear spanning frame.

Significance: of this is that the cost of the project may be reduced by 20% by using the PEB approach as opposed to the standard way. PEB erection time is lower than that of traditional methods. In the case of PEB, welding is unnecessary since the material is delivered on-site and assembly entails simply bolting. More steel isn't needed for PEB since it uses tapered sections instead of homogeneous ones as in the traditional approach. As a result, a PEB construction will weigh much less than a comparable steel one. When using the traditional approach, further growth is impossible, but with PEB, it's a breeze.

LITERATURE REVIEW

Roshani Ramkrishna (2017) Teel's many benefits over RCC—including its malleability, reusability, fire resistance, and so on—have led to its meteoric rise in popularity in recent years. A pre-engineered building is a structure whose structural parts were designed and constructed off-site before being sent to the construction site for assembly. This expedites the process while improving quality control. The usefulness of Pre-Engineered building systems for smaller and bigger span structures has not been thoroughly studied, according to a review of the relevant literature. Past research has compared PEBs to traditional steel buildings. A PEB and truss arrangement building configuration check is made for each of the three plan dimensions (15x30m, 40x80m, and 90x180m) for an industrial pitched roof building, and a comprehensive comparative analysis is conducted.

Dipali K. Chhajed, (2020) Steel industry is growing rapidly in almost all the parts of the world. The use of steel structures is not only economical but also ecofriendly at the time when there is a threat of global warming. Long Span, Column free structures are the most essential in any type of industrialstructures, and Pre-Engineered Buildings(PEB)fulfillsthis requirement along with reduced time and cost as compared to conventional structures. The work involvesthe detailed analysis and design of connections in Pre-Engineered Buildings (PEB).

Ryan E.Smith (2019) This article discuss the role of Prefabrication in India. The article discuss on present condition of construction in India with respect to transportation, human rights, schedule, Precision, Climate etc. The article concentrates on transfer of Prefabricated iconology in India & discuss about its effect on government, economy & culture. Fabrication technology has not transfer as easily when compared with other technologies because it is a production technology or knowledge based and not a consumption technology or product based

M. D. Gawade,(2018) A pre-engineered steel building (PEB) has now become one of the most efficient and simplified building type in the steel construction industry. PEB has found a wide application in the Indian civil industry. Use of tapered members for columns and rafters is one of the basic properties of PEB. Use of web-tapered members increases the efficiency of the PEB. Rather there are limitations for design of tapered members by Indian code the use of these members is made in the industry which has its design based on the American design.

OBJECTIVES

1. To study the Current Health care Infrastructure Facilities in Maharashtra
2. To study the concept of Pre Engineering building concept in current scenario.
3. To study and analysis the engineering properties of PEB Members by taking suitable case study (Utilization of UPVC or EPS panel)
4. To analyze the impact on quality and tine and cost of PEB structure in healthcare centre and Conventional Structures by taking suitable cast study (Utilization of UPVC or EPS panel)

METHODOLOGY

Stage 1: To study the Current Health care Infrastructure Facilities in Maharashtra by visiting the related department of Maharashtra Government

Stage 2: By site visit understand concept of Pre Engineering building

Stage 3 : analysis the engineering properties of PEB Members by taking suitable case study(Utilization of UPVC or EPS panel)

Stage 4: Analyze the impact on quality and tine and cost of PEB structure in healthcare centre and Conventional Structures by taking suitable cast study (Utilization of UPVC or EPS panel)

DATA COLLECTION

Health Infrastructure

State governments get funding via NHM to improve their public health systems by doing things like modernizing outdated facilities or building brand new ones.

Infrastructure spending may account for as much as 33 percent of eligible NHM expenditures in high emphasis states, and 25 percent in all other states.

Public health facility placement guidelines based on population size are as follows:

- Sub Centre: 1 per 5,000 people in low-risk locations; 1 per 3,000 people in high-risk

areas such those with large tribal or mountainous populations.

- Primary Health Centre: 1 per 30,000 people in low-risk locations; 1 per 20,000 people in high-risk places like difficult/tribal and steep terrain

- Community Health Centre: 1 for every 120,000 people in no remote areas, and 1 for every 80,000 people in remote, tribal, or mountainous regions.

Selected districts in mountainous and arid regions have also implemented a new standard for placing a SHC based on 'time to care' within 30 minutes of a habitation.

Selected districts in mountainous States and desert regions have also developed Sub-Health Centres focused on 'time to care' within minutes of walking from habitations.

The current state of public health facilities in the country as of 31.3.2020, according to the Rural Health Statistics (RHS) 2020, is as follows:

- 1,57,921 Sub Centres (SCs),
- 30,813 Primary Health Centres (PHCs),
- 5,649 Community Health Centres (CHCs),
- 1193 Sub-divisional Hospitals (SDHs) & 810 Districts Hospitals (DH) in the country

According to the Rural Health Statistics (RHS) 2020, the nation is missing 46140 SCs (24%), 9231 PHCs (29%), and 3002 CHCs (38%).

Including things like cesarean section, newborn care, emergency care of sick children, full range of family planning services, safe abortion services, treatment of STI/RTI, availability of blood storage unit, and referral transport services, First Referral Units (FRU) offers a full spectrum of obstetric care services. From 940 in 2005 to 2996 in 2020 (upto 31.12.2020), the number of FRUs has grown dramatically.

As of 31.12.2020, 10453 PHCs are open as round-the-clock clinics.

The Benefits of Prefabricated Construction after Covid 19 Pandemic

Covid 19 has turned the world upside down, causing irreparable damage in the lives of millions. While construction industry has faced a innumerable problems, from labour shortage to projects getting stalled due to lack of funds, the protocols of safety and social distancing has made working conditions all the more difficult. Post pandemic, wearing of masks, sanitization, etc have become standard practices to prevent community transmission of coronavirus. Work schedules have been split and workforce have been divided into multiple teams to maintain social distancing.

Coming to prefabrication, where components are made off-site in a factory and shipped to construction site for installation. While the world has adopted prefab for cost savings and quick installation benefits, distancing norms and other restrictions at the site gives prefab a further edge over conventional construction.

Contractors are worried about workers contacting covid through community transmission at the jobsite. While reduced manpower means longer construction time. In stark contrast, prefabricated construction allows workers to work in a safe factory environment. Off-site construction is done with machinery and automated systems, that require less manpower. It takes significantly less number of people to do the installation, which is another boon of this construction technology. Social distancing norms are also much easier to follow in a controlled environment within the factory. So the list of benefits are endless, if you think about it.

Further benefits of prefabricated construction include waste reduction measures. Components are pre-engineered so there is very little waste left out, which arises from packaging. There is no congestion of raw materials or other construction waste as is normally seen in brick and mortar construction.

Another notable factor where prefab scores high over traditional construction is safety. There are potential health risks arising from weather conditions at the construction site. Minimizing labours and machinery entails that surface contact points from where infections commonly spread are also reduced. Consequently, health hazards are significantly lower in prefab construction.

Prefabricated construction also enables hindrance-free expansion for people working in healthcare sector. Onsite construction in its all probability pose hindrance to daily activities of a hospital. So building components off-site and then shipping them to the location is beneficial for everyone.

Modular construction can help provide solution to a number of problems in the pandemic and post-pandemic world. Not only does it require lesser number of personnel but also allows project to be complete under safe and controlled working environments.

DATA ANALYSIS

Introduction to EPS core panel system

Housing plays a central role in improving the quality of people's lives in both developing and developed countries. Safe and affordable housing provides personal, social, and economic benefits. Most directly, housing contributes to the health and safety of individual inhabitants. Housing re-anchors the homeless in the community and mobilizes those traumatized by a disaster, impacts especially important in a post-conflict situation. Housing also offers families a platform for economic recovery and is a means of employment generation, requiring intensive unskilled labor and local capital investment.

Housing is one of the basic human needs and is a key component in the sustainable development of the community. Honourable Prime Minister has a dream mission to provide a descent two room *Pakka* houses with electricity, water, toilet facilities to every citizen of India by 2022. To achieve this government has launched Pradhan Mantri Awas Yojana (PMAY) Urban and Pradhan Mantri Awas Yojana (PMAY) Rural for Urban areas and Rural areas respectively. The task is very challenging and requires integrated approach to deal not only with land, finance, and regulatory mechanism but also use of appropriate construction material and technology so as to have faster delivery of houses.

Expanded Polystyrene (EPS) core Panel system

EPS core panel system in many countries under different form and brand name. System is made on factory made composite panel consisting of combination of self-extinguishing polystyrene corrugated plain sheet of minimum density 15kg/m3 and required thickness of 60mm sandwiched between two layers of engineered sheet of high strength galvanised cold steel wire mesh interconnected to each other with high strength steel connector.

The main function of the core is to provide thermal insulation and sound insulation and its thickness and type depends on its thermal resistance and design temperature. The truss form with the galvanised wire gives the desired structural strength to the panel. The EPS panels are manufactured in different types depending upon the application.

EPS panel includes welded reinforcing meshes of high-strength wire, diagonal wire and self-extinguishing expanded polystyrene uncoated concrete, manufactured in the factory and shotcrete is applied to the panel assembled at the construction site, which gives the bearing capacity of the structure.

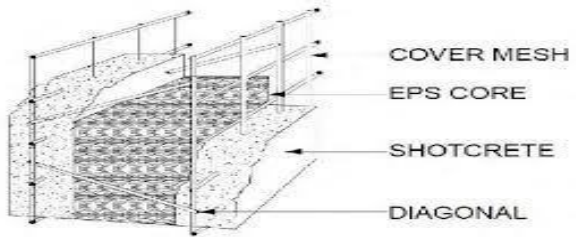

Figure 1: Schematic diagram of Cross section of EPS core wall panel.

(Source- American Journal of engineering and research)

COST COMPARISION BETWEEN EPS CORE PANEL BUILDING AND TYPICAL CONVENTIONAL BUILDING OF G+ 2 STOREYS

The following topics are covered in this section:

I. Building plan with estimate (Bill of quantities) for a standard G+2 structure of 161 square meters in floor space, to be erected utilizing EPS core panel technology.

II. EPS core panel technology pricing and rate breakdown

III. EPS Core panel construction vs RCC construction: a cost analysis

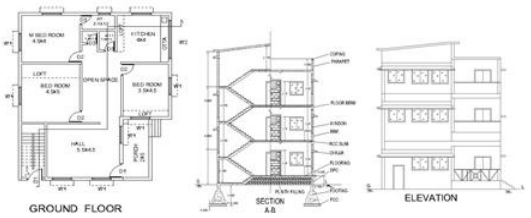

Figure 2: Typical layout of G+2 building with total built up area 161 sq.m

1. The basic materials incorporated in SoR for innovative technology published under authority of director general, New Delhi are considered to be conforming to BIS Standards / CPWD Specifications / Materials of good quality generally available in the market. Based on Delhi Schedule of Rates (DSR) – 2018.
2. For the cost analysis of RRC framed structure building SSR for Maharashtra state published under government of Maharashtra public works department effective from 19.09.2018

3. Cost Comparison of Conventional RCC Structure VS EPS Core Panel System

   Three-story, enclosed building with two bedrooms and one bathroom per level (covered area ≈ 161 sq. m): EPS panel vs. typical brick masonry RCC framed construction cost comparison.

Table 1: Cost comparison of conventional RCC structure vs EPS core panel System

SR. No	Item of Work	Conventional type			EPS Panel type		
		Quantity	Rate as per SSR 2023(in Rs)	Amount (in Rs)	Quantity	Rate as per SOR 2023(in Rs)	Amount (in Rs)
1	Excavation	21.12 cu.m.	225	4752	80.04 cu.m.	225	18009
2	PCC	16.02 cu.m.	5477	87741.54	30.76 cu.m.	5477	168472.5
3	Footing	6.228 cu.m.	7058	43957.22	47.95 cu.m.	6272	300781.3
4	Plinth Filling	91.35 cu.m.	463	42295.05	36.54 cu.m.	463	16918.02
5	Walling Material	113.3 cu.m.	7846	888951.8	672.78 sq.m.	3246.15	2183945
6	RCC Beam	33.09 cu.m.	13069	432453.2	0	0	0
7	RCC Column	15.32 cu.m.	14192	271421.2	0	0	0
8	Roof Slab	61.66 cu.m.	15017	925948.2	415.2 sq.m.	3436.35	1426773
9	Reinforcement	12368 kg	48	593664	0	0	0
10	Internal Plaster	1489.9 sq.m.	787	1172551	0	0	0
11	External Plaster	596.16 sq.m.	835	497793.6	0	0	0
			Total	4961529		Total	4114898
EPS Panel Type Structures Are 17.06% Cheaper Than Conventional Type Structure.							

DISCUSSION

Based on these findings, it was determined that a 30% volume EPS block may be used as a filler to lower the cube's weight by 20%–22%. The compressive strength of the cube, however, was somewhat altered. We also found that the compressive strength of a 100mm thick monolithic EPS block with wire mesh is lower than that of a sandwich structure consisting of a 10mm thick concrete layer between two 50mm thick blocks with wire mesh.

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. It negates from regional sources. Infinitely recyclable, steel is the material that reflects the imperatives of sustainable development Due to the flexibility of the structure in expandability and appearance this prefab houses are the best choice. From the several advantages like reusability, high scrap value, durability, less construction time makes this user friendly. Also, they can be installed in passive weather conditions also. From Case study we can conclude that

1. The EPS core panel system is a cutting-edge, reliable, secure, and cost-effective method of constructing. It may help the Indian government complete its lofty "Housing for all by 2022" goal."
2. Experiments showed that using EPS blocks to fill the cubes reduced their weight by between 20% and 22%. Consequently, the compressive strength of the cube may suffer if the EPS content is increased by more over 30% by volume. EPS filler material may be explored for use in the building of low-cost and lightweight homes. The concrete specimens using EPS as a filler material have virtually the same compressive strength parameter as the standard concrete specimens..
3. The conclusion drawn from cost comparison between EPS core panel building and typical conventional RCC building of G+2 storey is that the EPS Core panel system is 17.06 % cheaper than conventional RCC construction.
4. Due to above all points it can be used as Pre Engineering building (PEB) construction for Development of Rapid Healthcare facilitates in Medical Emergency.

FUTURE SCOPE

The building industry is rapidly modernizing and adopting cutting-edge building techniques. There are a variety of alternative, speedier construction technologies and building systems that have been successfully implemented all over the globe. These systems and technologies meet environmental quality and speed requirements while still being cost-effective and meeting other parameters. India's government has conducted a number of assessments and evaluations of such technologies via the ministry of housing and urban poverty alleviation. These assessments and evaluations have focused on the structural safety, energy efficiency, functional performance, and environmental friendliness of these innovations. One such technology, the EPS-based panel system, has been advocated for use in mass-produced, low-cost homes.

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