COMPARATIVE STUDY OF EPS SYSTEM ON CONVENTIONAL
METHOD OF CONSTRUCTION WITH REFERENCE TO
TIME, LABOUR & COST FACTORS

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ABSTRACT

Due to rapid growth of urbanization & migration of the people, the demand for housing sector especially for Economical Weaker Section (EWS), Mid Income Group (MIG) & Low Income Group (LIG) segment of population is growing faster. Recently, traditional material has been used in construction industries and the need is been fulfilled in recent days the environmental related issue are been faced largely, hence there is need of the alternate material which will be strong, durable, energy saving, cost effective, time saving & much more sustainable form of material which can be used along with the traditional material used for construction. To overcome with such problem many advanced construction material & technology is been developed around the world. One such advanced construction material is called as Expanded Poly-Styrene (EPS). This paper focus on EPS, when this system is compared to the conventional method of construction i.e. construction using traditional material like brick as infill material in an RCC structure, it is found to be economical i.e. in terms of material, time & labour Also there is huge time difference when we replaced brick with EPS panel. This type of an advanced material can be thought of viable substitute to achieve a goal of sustainable construction & to promote a green technology.


INTRODUCTION

As a fast growing population i.e. 1.28 billion of India according to census 2011, there are the huge shortage of basic amenities like food, clothing and shelter i.e. nothing but houses. According to the start of 12th financial plan the housing scarcity projected to be 18.78 million, out of which major population is of EWS, LIG & MIG segment of people [3]. In Maharashtra, MHADA is the housing developing authority for such segment of population but in name of affordability the dwelling unit which is provided is unaffordable for nearly 80% of the population of Mumbai. Also the lack of affordable housing solution forces, 57% households live in one room dwellings, 8% households do not have an exclusive dwelling room i.e. one dwelling room is shared by more than one household. [4]. To overcome with such type of the problem there is a need of an advanced material or technology which is fast but cost & resources effective This research paper has highlighted this issue & overcome with an alternative construction material EPS expanded polystyrene when compared with the conventional method.
of construction proven to be more economical in terms of time, cost, labour & resources. EPS system provides great satisfaction among the residents of building and also provides high ranking performance in case of recyclability, reliability, versatility and moisture resistance [5]. This technology also been proven economical in overall life cycle cost of the building, if used on the earlier design stage[6]. When it comes to the load carrying capacity of material, EPS panel possess a high strength [7]. EPS panel also help in improving the thermal conductivity, sound insulation thus making the structure sustainable & economical [8].

MATERIAL DESCRIPTION & METHODOLOGY

Expanded polystyrene is one of the biggest product polymers produced in the world. It is stiff foam with a unique combination of features such as its lightweight, good thermal insulation, strong absorption of shock, high compressive strength and good moisture resistance In building & construction industries EPS is been used on a very large scale to make insulation foam for walls, roofs and floor insulation EPS also has a great application in Infrastructure like roads bridges also making a sound proof room EPS is made from styrene which is a byproduct of crude oil extraction. Thousands of small unit of styrene called monomers are link together to form a large molecules of polystyrene this process is called as polymerization. These processes take place in three stage area pre-expansion, intermediate maturing & final moulding. At initial stage raw materials called beads are introduced in a vessel were it is heated with help of steam at temperature of 1000C. The steam cause pentane to releases and help beads to swell up to 50 times of the original size once the desired volume is archived it is released in the bed dryer were it is kept to become dry. Once it’s dried it is taken to second stage intermediate maturing stage were the cooled expanded beads which has form an vacuum in there interior must be equalized to atmospheric pressure to prevent collision or impulsion of the beads this process is called as aging processes which also help to achieve a greater mechanical elasticity and improve expansion capacity of the beads. at the final stage of this pre expander beads are transferred to a mould where they are compressed to form a block with the help of steam[9]. This block are further cut into desired shape & thick ness and with help of reinforcement assembly machine a galvanised steel truss is been installed at both face of the EPS panel. This panel are then used for wall, floor, staircase & roof. They also possess good load carrying capacity, earthquake resistance, moisture resistance [10].

The main part of the project is to compare the various quantity of the material like sand cement brick, steel, concrete, panels used for the construction using the expanded polystyrene panel and the conventional method for constructing of the building. The cost of the material & labour has been taken for the Mumbai, Maharashtra zone. The time factor has been calculated using the help of MS project while the quantity of the various material has been work out using the Microsoft excel the difference in the cost of some activity is also been work out using rate analysis method. A flow chart indicating the work (Refer Figure 1)
RESULTS & DISCUSSIONS

Various data like drawings, rate of material for brick, sand, cement, reinforcement, labor etc. have been considered for the Mumbai zone. The site is located at Nallasopara near Mumbai, India. This project has been built using only EPS panel i.e. there is no RCC frame structure. For this paper some modification has been done, which has been carried out with the help of RCC consultant. Various drawings provided by RCC consultant have been used for the study. For rate analysis purpose of EPS & brick work, the material quantity for brick work is taken from the book [2]. The differences in the rate are plotted with the help of MS excel in the form of a graph. As seen from Figure 2, there is almost 13% saving in the cost when an EPS panel is used instead of a brick work as an infill material in RCC frame structure.

For analysis of concrete quantity two structures, a residential building & row house of same built up area, both this structure were constructed with two different methods: one with EPS panel technology & the other with conventional method. From Figure 3 & 4 it was observed that when this structure was built using EPS panel as a slab & in replace of brick wall, there was about 19-25% saving in the concrete quantity.
For analysis the steel quantity, two structure of same built-up area i.e. a residential building & a row house both are made from EPS technology & with conventional method is been taken in respect to show the saving achieved in consumption of steel. As from Figure 5 & 6 it is observed that while constructing of these two same structure with different technology there was about 11-12% saving in steel quantity when we use EPS as an infill material i.e. in replacement of brick wall & as a slab panel.
Time analysis is been carried out in form of a work breakdown structure using the help of site experiences graph of various activity against time is been plotted using the excel. For Brick work [1], the output for a single skilled mason & two labour in a day is about 150 sqft for 4” thick wall. For EPS panel from site experiences a single skilled worker & single helper can install about (1.2mtr x 3.05mtrs = 3.66 sqmtr i.e. equal to 39.39 sqft) 600 sqft of panel in a day. From Figure 7 & 8 it is observed that time taken for EPS panel to construct the wall is less than that of the time take to construct same wall using bricks.
The overall construction cost of any project decides the success of that project. From figure 9 & 10 it is seen that the construction which is carried out using EPS technology is about 22-25% less in comparative to the cost of making the same structure with a conventional method i.e. construction with RCC beam, column, slab & brick as an infill material.
Comparative Study of EPS System on Conventional Method of Construction with Reference to Time, Labour & Cost Factors

Time plays an important role in any project. It helps in lowering the overall cost direct or indirect cost also the outcome of the project i.e. profit ratio is also been maximize Using MS project the time duration required to construct a residential building with both the method i.e. using EPS & conventional method we can see from the figure 11 & 12 were the conventional methods takes 125 days to complete the work, EPS system is requires only 111 days to complete the same work i.e. there is a saving of almost 14 days.
CONCLUSIONS

These results were calculated on a residential building G+3 structures & row house with an area of 12402.22 sqft & 1103.14 sqft. As seen from the result the EPS panel system is found to be economical i.e. in terms of material, time & also labour requirement is less compared to the conventional system of construction. Expanded polystyrene can be one of the alternative materials used in achieving the affordability & sustainability in the construction sector. There was about 22 - 25% of saving on overall construction cost when we built a structure using EPS as an infill & slab material. This result depends on the mass housing construction, as the area of construction reduce, the saving will also be reduces. Also there is huge time difference when we replaced brick with EPS panel. From study it is seen that use of such construction method is not made popular since people are not aware about the technology. However proper use of this technology in construction project will lead to achieve long run of life of building & can be used as green building structure.
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