|| Volume 7 || Issue 6|| March 2023 || ISSN (Online) 2456-0774

INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH AND ENGINEERING TRENDS

Construction Of Low Cost Housing By Using EPS Panel

Prof. Chetan Bidwaik[1], Ms. Kajal Mankar [2], Ms.Sanjana Bhele[3], Ms.Rutuja Belsare [4], Ms.Rutika Ganorkar[5] , Ms.Sneha Padghan [6], , Ms.Nishigandha Suryawanshi [7]

Asst. Prof. Department of Civil Engineering[1]

U.G. Students, Department of Civil Engineering & Management[2,3,4,5,6,7]

P. R. Pote (Patil) College of Engineering & Management, Amravati, India, Amravati, India

Abstract— **With the increase in demand for construction material, man has improved a lot in construction techniques of structures. In earlier ages structures were constructed with heavy materials and methods which were time consuming, costly and maintenance would be more. But this modern era is following the latest techniques in construction which have lot of advantages so these use of lightweight materials and faster construction has been are started. Therefore one such material is reinforced expanded polystyrene wall panel, which is better replacement to the conventional building material. This lightweight reinforced expanded polystyrene wall panel provides faster construction & contributes to environmental protection. The aim of the study was to determine the cost of EPS model and compare it with conventional method. In experimental analysis, three test were performed compressive, flexural and water absorption. A specimen size 400x250x150 mm was used with density of EPS panel 20 kg/m3. The result of this research proves that the use of EPS for residential building construction is more economical.**

Keywords—Thermocol(EPS), Compressive Strength, Water Absorption , Alternative material,

1. INTRODUCTION

The initial basic needs of human being are food, water, clothing & shelter. In this 21st century housing demand has risen due to rapid population growth & consequent rural to urban migration. As the demand is increases for housing, therefore there is huge rise in demand for conventional building material. Therefore this has resulted in shortage of conventional building material. The human being demand for strong, durable & economical house at minimum time requirement & at affordable cost, but it is difficult by using traditional construction material & methods. Due to the rapid increase of population, the construction industry is facing a new challenge. This challenge is to construct new, cost-effective building systems to satisfy the tremendous demand for low-cost housing. The building systems must be structurally stable, should allow fast and easy erection with unskilled labors and provide good thermal and sound insulation. They must also make use of prefabricated elements produced on an industrial scale and use local materials (thus making it low- cost). Traditional building systems like concrete, steel or prefab only partly comply with these requirements. Due to these inadequacies of the existing traditional building construction systems, there is need for new kind of building construction techniques that will cater to the present needs. To overcome these issues and achieve the economical practices, this research focuses on Reinforced Expanded Polystyrene wall panels as a possible substitute to the conventional building materials & methods. The EPS core Panel system is a modern, efficient, safe, and cost-effective building solution. These panels can be load-bearing as well as non-load-bearing components. In the traditional construction method i.e. R.C.C, brick masonry & rubble masonry construction, self-weight of structure is huge. Thus reduction in self-weight of structure results in the reduction of c/s size of foundation & other structural elements & there by reduced total cost of the project. This panel consists of EPS beads, welded galvanized steel mesh placed at the center of the panel & finishing outer core on both side as cement mortar plaster. The standard EPS panel is 1200 mm wide, 3000 mm long, and has a thickness range of 80-230 mm. These panels can be joined with tongue & groove jointing system, The panel shall be fixed on floor and top using 1mm/1.2mm thick galvanized C channel, Screws shall be fixed in wall and pillar, Reinforcement bars shall be fixed in the beam and panels, The panels shall be grouted and glue filled in the joints. After that putty shall be applied over the joints.

2. LITERATURE REVIEW

Nathan Koekoek (2019) worked on this paper has illustrated sandwich panel technology and Easy panel having a number of advantages over ordinary onsite production. Easy Panel has been designed to enjoy the advantages of sandwich panel technology - strength in combination with low weight - in accordance to the specific demands of property construction. This leads to greater efficiency and speed benefits. Fewer resources are being wasted and projects are finished sooner allowing for a quicker return on investment. Society also enjoys from these efficiencies, by reduced environmental impact as a result of more efficient production and better insulation. Also, Easy panel franchising model of turn-key

delivery enabling the opportunity to quickly enter a local market when demand is being observed reduces potential inefficiencies related to transportation. All these make that negative implication of prefab offsite production could be reduced - or even disappear.

Omid Rezaifar (2019) worked on ., "Nonlinear dynamic behavior of structural frames constructed with EPS wall panels with Vertical Irregular arrangement". The current study investigates the hysteresis behavior for combined systems, RC frame, and pre-cast EPS wall sandwich panels, in non-linear material properties. The seismic behavior of building constructed by EPS wall panels is studied for absorb of energy and dissipation of it with material nonlinearities. The results are compared regular bending RC frames to complete box type shotcrete sandwich panels system and present the differences of hysteresis behavior for each system and any of cases with irregularity in vertical stiffness such as soft story. In this study, material nonlinearity simulated with Drucker-Prager failure criteria.

P. Poluraju, G. Appa Rao [2014] tested the EPS wire mesh panels on a comprehensive review of state of art on the performance of EPS wire mesh panels for structural applications under general loading. Axial compression strength of EPS wall panel depends on compressive strength of concrete and aspect ratio of the wall panel, whereas shear strength of EPS wire mesh panels depends on the number of diagonals (100 or 200 diagonals per square meters)

Piyush Bhandari [2016] In this paper Piyush Bhandari take the different tests on EPS panels. And he investigated that the strength of EPS panel is higher than the other conventional building material. This paper mainly examines the properties of sandwich panels. The use of Thermocol core along with wire mesh layers have helped to enhance property of precast wall panels. He also compared with conventional building method it is less time consuming & also cost effective. It has less water absorption than conventional brick masonry.

Pradeepa. S , Anitha. J, N. Tamil Selvi, Pranav. P, Arpit Jaketia [March 2016] In this paper studied that, Reinforced Thermocol Panel offers high bending stiffness at low densities due to minimal compressive and flexural strength. The cost of the construction using thermocol lesser than conventional or traditional building material. The flexural tests conducted on EPS panels under one point loading and two point loading.

Emad et al. [10] studied the behaviour of fibrous concrete containing polypropylene fibre and mentioned that for 1% fibre dosage the workability decreased. This proves that these fibres tend to increase viscosity of the mix. Greater the number of fibers in the mix more is the contact surface which increases the viscosity and hence lowers the workability.

Soon Poh Yap et al. [11] investigated concrete with PPF (0.1%), steel fibre (0.9%) and the hybrid combination on mechanical and fresh properties of concrete with w/c 0.30. Higher the dosage of PPF i.e >0.25% poorer the dispersion in concrete which effects the workability negatively. On considering PPF only a notable range of 15-30mm decrease in workability is observed. large surface area of fibres requires more paste to interact which makes concrete more viscous thus decreasing the workability.

Okan Karahan et al. [12] work intended to study the durability features of concrete (freeze thaw resistance and drying shrinkage) mass implemented with combination of fly ash and PPF. 15% and 30% of cement was replaced with fly ash (w/c=0.35) and PPF were used in following volume fraction 0.05%,0.1% and 0.2%. The density showed decreasing trend with increase of fibre content which is the point to be noted. Ease of handling the concrete decreased making the mix harsh with the addition of fibers but fly ash showed a positive impact on the workability.

3. METHODOLOGY

3.1 MATERIALS:

3.1.1 Thermocol(Expanded polystyrene System):

EPS is used in the building and construction industry and huge quantities are utilized to make insulation foam for walls, roofs and floor insulation. EPS is light weigh and recyclable construction material. here, EPS were used in the form of beads. size of the beads was uniform. density of as per tested data is 20 kg/m3.

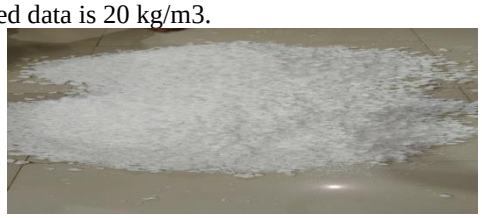

Fig. no. 1 Thermocol (eps)

3.1.2 Cement:

Ordinary Portland Cement (OPC) of was used to the study. The OPC used of grade 53 Grade as per IS: 1489 Part (I):1991

1) Fineness of cement (IS:4031-Part 3, 1988)
2) Standard consistency of cement (IS:4031-Part4-1988)
3) Initial setting time test (IS:4031-Part 5, 1988)
4) Final Setting time test (IS:4031-Part 5, 1988)

Fig. no. 2 Cement

3.1.3 Fine Aggregate:

Locally available river sand passing through 4.75 mm sieve was used as fine aggregate in mortar. The sand used was as per the specifications of IS 1542(1992).
1) Sieve Analysis of fine aggregate (IS 383)
2) Specific Gravity & Water absorption of fine aggregate (IS: 2386 Part III: 1963).

Fig. no. 3 Fine Aggregate

3.1.4 Fibre:

It is polypropylene concrete fibre which was used in panel. The density of Fibre 0.895-0.93 gm/cu.cm

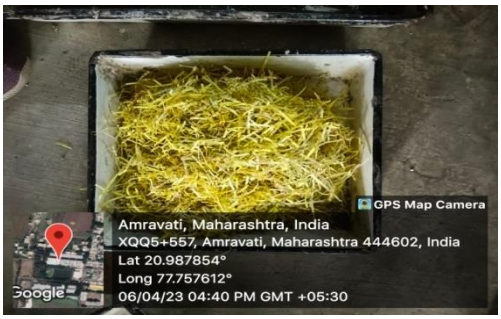

Fig. no. 4 Polypropylene concrete fibre

3.1.5 Recycled crusher Dust:

Crusher Dust has a wide range of uses, The size of Recycled Crusher dust was 6 mm. The density of recycled crusher dust was 1500 Kg / cu.m

Fig. no. 5 Recycled crusher Dust

3.1.6 Galvanized Welded Steel Mesh:

Welded wire mesh, or welded wire fabric, or "weld mesh" is an electric fusion welded prefabricated joined grid consisting of a series of parallel longitudinal wires with accurate spacing welded to cross wires at the required spacing. The steel mesh has average diameter 1.5 mm and center to center distance 15mm.

Fig. no. 6 Galvanized Welded Steel Mesh

3.1.7 Water:

Water is one of the most important constituents without which mortar cannot be produced. In this study tap water was used for the preparation of the mortar.

3.2 MANUFACTURING PROCESS:

1. *Design:*
   In this stage, the mould was design. The size of mould was 400mm x 250mm x 50mm. the shape of mould was rectangular.

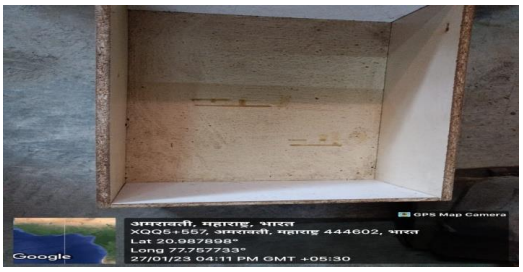

Fig. no. 7 Mould

2. *Mixing:*
   In this stage, mixture were divided into dry mix and wet mix. By using the different proportion amount of cement, sand and thermocol and cement, Recycled crusher dust and fibre were taken and transferred to the weigh batcher which was measured in proper amount / quantity of each materials. After that materials gets mixed together by adding proper amount of water for several minutes.

Fig. no. 8 Dry Mix

|| Volume 7 || Issue 6|| March 2023 || ISSN (Online) 2456-0774

INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH AND ENGINEERING TRENDS

Fig. no. 9 Wet Mix

3. *Moulding:*

In this stage, the mixture is filled at the half of the thickness of mould. After that galvanized steel wire was placed at the middle of the mould and then remaining material was filled at the top of the wire mesh. The mould was kept for settling for 24 to 48 hours.

Fig. no. 10 Placing of Galvanized steel weir mesh

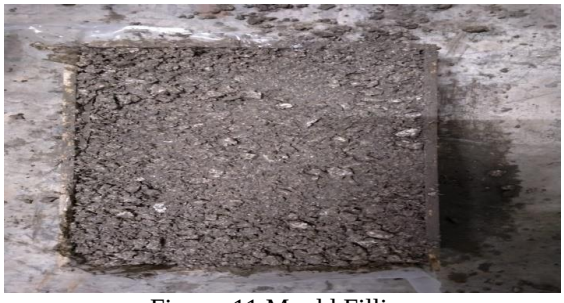

Fig no. 11 Mould Filling

4. *Curing:*

Demoulding the panel and placed it into water for curing process up to 7 days. It maintained moisture and temperature conditions. Proper curing improves strength, durability, water tightness and wear resistance.

Fig. no. 12 Curing Process

4 TESTING ON PANELS

The panels were cured for 7 days and were tested in universal testing machine under axial loading. The load was applied till the panel failure.

1) Compressive Strength Test:

The most important property of a structural material which will be covered with concrete is the compressive strength which is determined by loading as dictated by the standards.

2) Water Absorption Test:

The water absorption test determines the water absorption rate of both inner and outer concrete surface. The water absorption reflects the density of the tile body. Water absorption is also directly related to the suitability for interior or exterior application.

Fig. no. 13 Compresive strength on EPS panel

5 TEST RESULT

1. Compressive Strength Test Result:

Sr. no.	Panels	Result(kN/mm2)	
		M15	M20
1.	Panel with thermocol(EPS)	875	844
2.	Panel with Fibre	810	800
3.	Panel with Recycled crusher aggregate	951	900

Table no. 1 Compressive Strength Test Result

2. Water Absorption Test Result:

Sr. no.	Panels	Result in %

1.	Panel with thermocol(EPS)	3.86
2.	Panel with Fibre	2.75
3.	Panel with Recycled crusher aggregate	3.40

TABLE NO. 2 WATER ABSORPTION TEST RESULT

6 CONCLUSION

- EPS core panel system is a modern, efficient, safe and economic construction system for the construction of buildings. It has got the potential in achieving the Government of India's ambitious project "Housing for all by 2022"
- To determine the suitability of using Reinforced Thermocol technology in construction.
- evaluating the cost of using Reinforced Thermocol as a construction material.
- EPS is well established insulation material that is used for various applications such decorative molding, backfilling, and as a core in panel application for buildings.
- Properties of EPS like compressive test, flexural and water absorption improved with increasing density.
- EPS core Panel is exceptional lightweight and galvanized wire mesh make it strong as compared to conventional bricks and EPS is recyclable material

REFERENCES

1. International Journal of Research in Advent Technology, Vol.4, No.3, March 2016 E-ISSN: 2321-9637A Study on use of Reinforced Thermocol Panels as an Alternate Building Material
2. International Journal of Scientific Research in Engineering and Management (IJSREM) Volume: 06 Issue: 05 | May - 2022 Impact Factor: 7.185 ISSN: 2582-3930 © 2022, IJSREM | www.ijsrem.com DOI: 10.55041/IJSREM13638 | Page 1 Comparative Study of Cost of EPS with Regular Construction Materials
3. IJSRD - International Journal for Scientific Research & Development| Vol. 6, Issue 03, 2018 | ISSN (online): 2321-0613 All rights reserved by www.ijsrd.com 1828 A Study on Application of Reinforced Expanded Polystyrene Wall Panel Technology
4. International Journal of Research Publication and Reviews Journal homepage: www.ijrpr.com ISSN 2582-7421 A REVIEW ON EXPANDED POLYSTYRENE MONOLYTIC PANELS – EPS
5. Manual for Expanded Polystyrene (EPS) Core Panel System and its field Application
6. International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal) Volume:04/Issue:04/April-2022 Impact Factor- 6.752 www.irjmets.com www.irjmets.com @International Research Journal of Modernization in Engineering, Technology and Science [2356] COMPARISON BETWEEN EPS CONSTRUCTION AND BRICK CONSTRUCTION
7. © 2022 IJCRT | Volume 10, Issue 8 August 2022 | ISSN: 2320-2882 IJCRT2208431 International Journal of Creative Research Thoughts (IJCRT) www.ijcrt.org d590 EXPERIMENTAL STUDY ON EPS SANDWICH PANEL & COST ANALYSIS"- LIGHT HOUSE PROJECT
8. International Journal of Research Publication and Reviews, Vol 3, no 5, pp 522-525, May 2022 International Journal of Research Publication and Reviews Journal homepage: www.ijrpr.com ISSN 2582-742
9. International Journal of Civil Engineering Research. ISSN 2278-3652 Volume 5, Number 2 (2014), pp. 145-150 © Research India Publications http://www.ripublication.com/ijcer.htm
10. IJARSCT ISSN (Online) 2581-9429 International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 2, Issue 2, June 2022 Copyright to IJARSCT DOI: 10.48175/IJARSCT-5618 648 www.ijarsct.co.in Impact Factor: 6.252 Construction using EPS Technology
11. Hindawi Advances in Civil Engineering Volume 2021, Article ID 6652077, 13 pages https://doi.org/10.1155/2021/6652077 Review Article Review on the Durability of Polypropylene Fibre-Reinforced Concrete
12. See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/354667588 A Review on Efficiency of Polypropylene Fiber-Reinforced Concrete Chapter · September 2021 DOI: 10.1007/978-981-16-2826-9_50