

Light Weight Bricks (Partial Replacement of Fine Sand by using EPS Beads)

Kiran Dhobale¹, Arati Sharnagat², Gauri Madavi³, Homendra Katre⁴, Amit Chaure⁵, Aniket Shahane⁶,
 Pranali Bisen⁷, Yogesh Dudhkuwar⁸, Ankush Gharsele⁹, Ingole¹⁰

^{1,2,3,4,5,6,7,8,9}Student, Dept. of Civil Engg., Wainganga College of Engineering and Management, Nagpur, India

¹⁰Assistant Professor, Dept. of Civil Engg., Wainganga College of Engineering and Management, Nagpur, India

Abstract: Now-a-days, the demand of lightweight building material has been increased. In this study expanded polystyrene (EPS) beads are taken consideration to fabrication the light weight bricks. The usage of partial replacement of sand (fine aggregate) using polystyrene beads. The casted bricks specimens (20%, 30% and 40% replacement of fine aggregate) were tested for compressive strength, water absorption, weight analysis and density variation. In this project, the result suggested that, the EPS beads having less water absorption, good compressive strength, fire resistance and reduced weight. Therefore, it is economical than clay bricks.

Keywords: Density, Compressive Strength, Polystyrene Beads, Water Absorption.

1. Introduction

In India, bricks are widely used in building construction as the most common building material. The main objective of these paper is to reduce the weight of brick by replacing sand with EPS beads in different proportion. EPS is a waste material, stable, low density foam and which consist of 90% air and 2% of polystyrene. Then evaluation various physical parameters of EPS bricks such as compressive strength, water absorption, density and weight analysis.

The dead load of the structure, itself are a necessary evil. The smaller the ratio between a structures dead load and the supported live loads. The lighter is the structure. Using our lighter weight bricks problem associate with laying normal brick.

2. Literature review

1. Tarun Jain, Archana Tiwari, June 2017, international journal for research in applied science and engineering technology (IJRASET), volume 5 Issue VI, June 2017. this paper is made to investigate mechanical properties of light weight and compare its function with conventional bricks.

2. Pratichya pradhan, sanjeev mahajan (proceeding of IOE graduate conference, 2016) pp.361-364. This paper is made to investigate the preparation and cost estimation of EPS bricks.

3. Janani. C, Kathiraban. P, G. Dhanalaxmi, international research journal of engineering and technology (IRJET) www.irjet.com volume: 05 issue 05/may-2018. In this paper the

usage of partial replacement of coarse aggregate using polystyrene beads in concrete given prospective solution. To the construction industry.

4. Suhad Mabd, Dhanya Gh, mean Flattem and Dunya Khalif, international journal of engineering research and science and technology ISSN 2319-5991 www.ijerst.com volume 5, no.3, august 2016. In this paper investigate the properties, such as compressive strength and tensile strength of concrete containing expanded polystyrene (EPS).

5. Juan Bosco Hernandez-Zaragoza, Teresa Lopez-Lara, Jaime Horta-angel, et al. (advance in material science and engineering) volume 2013/160162. In this paper manufacturing of cellular concrete bricks by using a lightweight mortar with recycled expanded polystyrene aggregate, instead of sandy material and determining the block properties like absorption, compressive strength and tensile strength.

3. Material and methodology

A. Material

Cement: The Portland Pozzolana cement (PPC) was used, conforming to IS 1489-1991 (part 1). The properties of cement were investigated in lap are shown in table.

Sand: It is locally available river sand use as fine aggregate. Sieve analysis, specific gravity, water absorption test was carried out in laboratory. The sieve analysis of sand confirm that it comes under zone III category.

Table 1
Physical properties

S. No.	Physical properties	Results		
		cement	sand	EPS
1	Initial setting time	120 min	—	—
2	Final setting time	180 min	—	—
3	Specific gravity	3.06	2.65	0.011
4	size	—	—	—
5	Water absorption	—	Below 2.75 mm	—
6	Bulk density	—	0.5	9.5 Kg/m ³
7	Fineness modulus	—	2.65	-
8	Fineness	3 %	—	—

EPS Beads: Expanded polystyrene beads is the best material used for this experimental work has been taken from EPS Thermocol sheet suppliers Nagpur, Maharashtra.

Water: Portable water available in laboratory was used

which having pH of 6.5.

B. Methodology

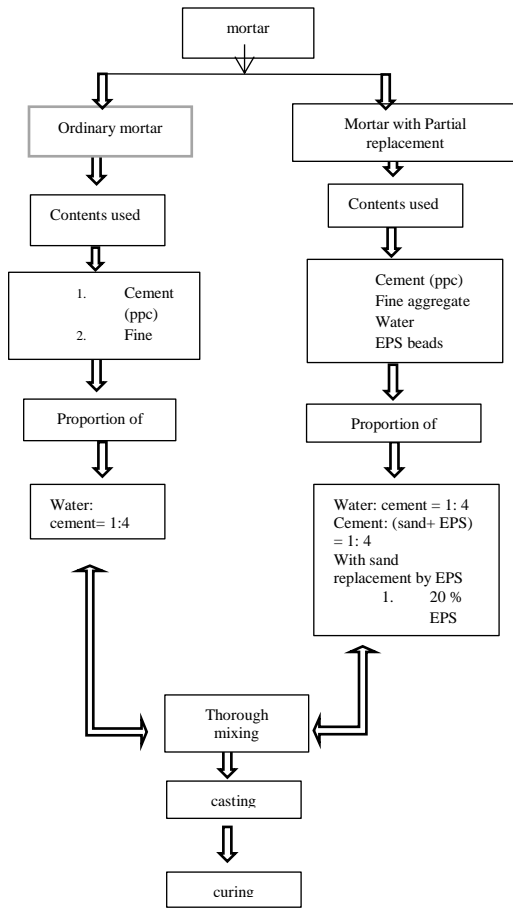


Fig. 1. Methodology

C. Casting and curing

The specimen were casted using wooden mould of size 19×19×9 cm then the mould is filled with mortar mixing and then compacted by hand compaction. The sample is ten remove from the wooden mould after 24 hours of casting. The curing of sample is done by putting the brick in immerge water 7 days and 21 days.

4. Test and results

Weight Analysis: The Bricks are weighed after completely drying. The following table shows the weight of light weight brick compared to the weight of cement brick.

Table 2
Weight analysis

Sample	EPS replacement (%)	Avg. Weight in kg	Reduction in weight (%)
T ₁	0	3.10	0
T ₂	20	2.86	7.74
T ₃	30	2.73	11.93
T ₄	40	2.48	20

Water Absorption Test: In these project water absorption test carried is carried out. First the dry weight of bricks noted then the bricks putting in water for 24 hours. After 24 hours wet bricks reading is noted. Following table shows the results of water absorption test.

Table 3
Weight absorption test

Sample	Dry weight in kg	Wet weight in kg	Water absorption (%)
T ₁	3.1	3.380	9.03
T ₂	2.86	3.025	6.12
T ₃	2.73	2.82	3.29
T ₄	2.48	2.52	1.61

Density Variation: The density variation was carried out on different proportion of EPS used in light weight of brick. Following figure shows the results of variation in densities of different samples.

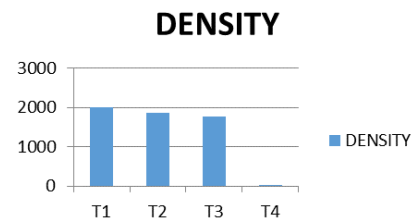


Fig. 2. Density

Compressive strength: The compressive test is carried out in compressive testing machine. In the CTM the brick was placed between the plywood sheet is placed on the bed of compressive strength of bricks testing machine and load is applied at uniformed rate. The results of compressive strength shown in following table.

Table 3
Compressive strength

Sample	Compressive strength in N/mm ²		
	7 Days	14 Days	21 Days
T ₁	6.1	9	11.69
T ₂	5.2	6.14	9.65
T ₃	4	5.3	6.1
T ₄	3.2	4.3	5.28

5. Conclusion

The following conclusion shown from experimental work.

1. EPS brick gives less water absorption than clay brick and other bricks.
2. By using EPS in bricks it comes in light weight than clay brick.
3. EPS is waste material therefore EPS is cheaper material and easily available therefore EPS bricks is more economical than clay brick.
4. EPS also used in concrete for making light weight concrete & it is also used in embankment material.
5. Sample T₂ (9.65 N/mm²) and T₃ (6.1 N/mm²) reach as greater than 2nd class brick.

References

- [1] IS 383:1970 “Specifications for coarse and fine aggregates from natural sources for concrete”, Bureau of Indian Standards, New Delhi.
- [2] IS 456: 2000 – ‘Code of practice for plain and reinforced concrete’, Bureau of Indian Standards, New Delhi.
- [3] ACI 213R, American Concrete Institute “Guide for structural lightweight aggregate concrete”, Farmington Hills, MI.
- [4] Kohling K (1960), “The manufacture of light weight concrete using pre-expanded styropore particles as aggregates”, betorstein – zeitung, Vol. 26, pp. 208.