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LIGHT WEIGHT CONCRETE USING EXPANDED PLOYSTRENE BEADS AND PLASTIC BEADS

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Abstract: Light weight concrete is a mixture of EPS (expandable polystyrene) beads i.e. light weight aggregate and plastic beads and OPC (Ordinary Portland Cement). EPS beads are sufficient enough to meet the requirement of light weight concrete. The cube containing EPS beads does not show enough compressive strength. Light weight concrete made using EPS beads and plastic beads are effectively used in partition walls, panels and other non-load bearing elements of the buildings as they provide required compressive strength. These elements shows good thermal insulations and durability. Light weight concrete can be made in any size and shape as per the requirement.

Keywords: EPS, OPC, Light Weight Concrete

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INTRODUCTION

With the increase in modern technology and rapid development, the need of substitutes for aggregate in concrete has increased. Day by day new materials are being used as replacement of aggregates in concrete construction. In this paper an attempt has been made to use EPS and plastic beads in concrete in place of coarse aggregates and develop light weight concrete blocks that can be used up in partition walls and other non-load bearing elements. Results have been calculated by taking EPS and plastic beads in varying proportions and various tests have conducted on it after 2 , 7, 14 and 28 days respectively to measure the difference in properties of light weight concrete blocks. Also a report on cost analysis has been carried out for standard size of block (15 cm*15 cm* 15 cm) so as to make the light weight concrete blocks as economical as possible.

II. PROPERTIES OF EPS AND PLASTIC BEADS

EPS:- EPS beads are used in concrete blocks as lightweight aggregate to produce lightweight concrete with density varying from 400 to 2000 kg/m³. A type of commercially available spherical EPS beads that maximum sieve size was 8.0mm. The bulk density was 10-20 kg/m.



Figure: 1 Expanded polystyrene beads

Property	Average value
Density	13 kg/m ³
Compressive strength	0.09Mpa
Flexure strength	0.21Mpa
Water Vapor permeability	1.4 Perm-cm
Water absorption	4% by vol.

PLASTIC BEADS:-

Plastic beads are used as primary product in most of the plastic and fiber industries. They are extremely light in weight but on the other hand they have very high strength. Their melting point is very high and hence they are not affected during the process of oven heating done in making light weight concrete blocks using EPS and plastic beads.



Figure:2 Plastic beads

Property	Average value
Density	0.74 g/cm ³
Compressive strength	50-70Mpa
Melting point	150-170 degree
Decomposition temperature	250 degree

III. INGREDIENTS AND MIX DESIGN

- 1) Fly Ash
- 2) Cement
- 3) Water
- 4) Lime
- 5) Gypsum

- 6) Aluminum
- 7) Plastic Beads
- 8) EPS Beads

IV. METHEDOLOGY

The casting process mainly includes four basic steps namely mixing, moulding, cubing and curing. Fly ash is used as base material in light weight concrete. Other materials that play major role are cement, lime, gypsum and aluminum. Aluminum plays an important role of making concrete porous and light. Firstly cement and fly ash are mixed manually. Then a mixture of water, plastic beads and EPS beads is added to it. Thereafter aluminum is added in very negligible amount. Then proper mixing is carried out. Mixing type used is hand mixing. After proper mixing is done, the mixture is filled in moulds and set aside for drying. After 24 hours, the moulds are opened and the blocks are placed in drying oven for 12 hours at a temperature of 60 degree. Thereafter the temperature is increased up to 80-90 degree and drying is done for 12 hours more so that concrete blocks are completely dried.

Sr no.	Cement (kg)	Fly ash(Kg)	Water (lit.)	EPS beads(kg)	Plastic beads(Kg)	Lime(Kg)	Gypsum(Kg)	Aluminium(Kg)
1.	0.3	1.5	1.000	0.05	0.100	0.160	0.007	0.001
2.	0.5	1.3	0.950	0.05	0.150	0.160	0.010	0.002
3.	0.5	1.2	0.900	0.04	0.180	0.160	0.010	0.002

V. TESTS CARRIED OUT ON CONCRETE

1) WORKABILITY:- This test is the most commonly used test for determining workability of fresh concrete. This test is done to see that the concrete mixture is not too dry because it becomes difficult to handle and place very dry mixture. Workability of concrete can be measured by Vee-bee consistometer test, slump test and compaction factor test also. Vee- bee consistometer and compaction factor test can be done in laboratory and slump test is used to check workability of concrete at construction site.

2) COMPRESSION TEST:- This test is performed to measure the compressive strength of hardened concrete. This is the most important test performed to determine the strength of any concrete blocks. It is performed under universal testing machine (UTM) of capacity 2000KN as per IS code 516:1959. Testing of 3 cubes was carried out at 2, 7 and 28 days after casting and results were noted down.

VI. TEST RESULTS

Sr. no.	Fresh concrete density (Kg/m ³)	Hardened concrete density (Kg/m ³)	Compressive strength at 2nd day N/mm ²	Compressive strength at 7th day N/mm ²	Compressive strength at 28th day N/mm ²
1.	621	598	1.17	1.91	2.51
2.	634	611	1.34	2.08	2.63
3.	648	624	1.81	2.48	3.14

VII. CONCLUSION

- 1) With increase in the amount of EPS in concrete blocks, the cost reduces but also the compressive strength and tensile strength decreases gradually.
- 2) Addition of plastic beads in concrete blocks along with EPS increases the compressive strength but also increases the cost gradually.
- 3) Use of EPS and plastic beads in sensible quantity results in good compressive strength as well as increase in cost is not major.
- 4) It can serve as a way of effective use of EPS disposal as well effective use of plastic beads that are waste products of many industries

VIII. COST ANALYSIS FOR 1 BLOCK

Sr. no.	Material	Rate	Material used 1 cube (Avg)	Final cost for 1 cube in ₹
1.	Cement (53 grade)	5Rs/kg	0.4kg	2
2.	Gypsum	3Rs/kg	0.01 kg	0.03
3.	Aluminium	300 Rs/kg	0.002	0.6
4.	Water	0.10Rs/lit.	1.0 lit	0.100
5.	EPS beads	100Rs/kg	0.05kg	5
6.	Plastic beads	80Rs/Kg	0.10Kg	8
TOTAL				15.73

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