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COMPRESSIVE BEHAVIOR OF CONCRETE BLOCK WITH EXPANDED POLYSTYRENE AS A FILLER MATERIAL

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ABSTRACT

Building construction is being the aggressive industry in the world. The construction techniques that are being used by the builders and construction companies are developing the standards for the shelter of the human being. With the look and the facilities they are providing the sufficient strength to the building. Such construction technique is EPS core panel system in trend. This technique provides the benefits more than the conventional technique of the construction. In this paper an attempt is made to point the compressive strength of the concrete block with EPS as a filler material and tested under the compression testing machine by conventional method. The casting of the concrete block with EPS has been done in the conventional way.

Keywords: *EPS Panel, Filler Material, Strength behaviour.*

I. INTRODUCTION

The rapid urbanization and increase in population giving a new challenge to the construction industry to construct new cost effective building satisfying structural stability and fulfilling the requirement of affordable houses and faster delivery of houses. The majority of building in the country are still constructed using traditional building material like clay bricks and reinforced cement concrete which are energy intensive and time consuming. There are number of new alternate faster construction material, technologies and building system are evolving throughout the world fulfilling environmental, quality, speed and cost effectiveness parameters. One such technology is EPS core panel system.

EPS technology is used in many countries in different forms. The system is basically polystyrene corrugated plain sheet of minimum density 15Kg/m^{3}and required thickness and length sandwiched between two sheets of high strength galvanized steel wire mesh interconnected to each other satisfying thermal and sound insulation parameters. The truss formed with galvanized wires provides desired structural strength to the panel[1]. These panels prominently used in building construction because they are light weight, energy efficient, aesthetically attractive and are easy to handle and erect.

II. METHOD & MATERIAL

A. Materials-

1. Cement: In this study, Ordinary Portland cement (OPC) of 43 grade is used for experimental work and the following experiments are carried out-

Fineness of cement (IS: 4031-Part 3, 1988)
Initial setting time test (IS: 4031-Part 5, 1988)
Final Setting time test (IS: 4031-Part 5, 1988)

Table 1. Test Results on Cement

Properties	**Values**
Compression strength	43 MPa

Fineness	5 %
Final setting time	10 hour
Initial setting time	30 minutes
Specific gravity	3.15

2. Fine aggregate : Aggregate smaller than 4.75mm size is called as fine aggregate In this experimental work crushed sand was taken and tested as per the standards of IS: 383-2016 and confirmed to zone II .

Table 2.Test Results on Fine Aggregate

Properties	**Values**
Size	Passing through 4.75mm sieve
Specific gravity	2.6
Water absorption	2.5 %
Grading zone (FM)	Zone II ,
Fineness Modulus	FM 2.8

3. EPS (expanded polystyrene):
The EPS material of size 100 X 100 mm and thickness 100 mm was used .The material includes welded reinforcing meshes of high-strength galvanized wires, diagonal wire and self-extinguishing expanded polystyrene uncoated concrete, manufactured in factory. The diagonal truss wires as well as the wires used in the manufacture of welded wire fabrics were used inconformity with ASTM A82. The density of EPS was 20 Kg/m^3 according to IS 4671: 1984 and having the initial elastic modulus 5.7 MPa.

4. Coarse aggregate (stone chips): The stone chips of size 10 mm to 15 mm is used in concrete work and they are categorized as fine stone chips. In this experimental work for the preparation of concrete stone chips of 8 to 10 mm sizes are used as a coarse aggregate.

5. Water: Water is the most important ingredient in the preparation of concrete. It should not contain any harmful substance which can be harm to the process of heat of hydration and durability of the concrete. The determination of amount of water is important as less amount of water content resulting into high strength of concrete. In this study tap water free from impurities and harmful substances are

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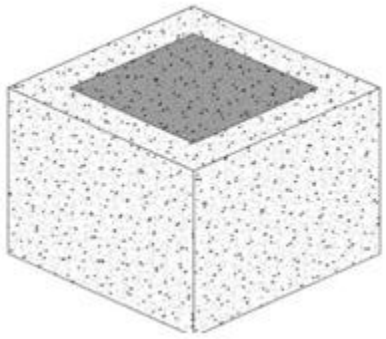

Figure 1. Typical Section of Specimen with EPS

B. Methodology-

The experimental work is carried out in five stages. The first stage includes testing physical properties of materials used in preparation of concrete. The second stage is to prepare the cube using EPS as a filler material. The third stage is to prepare conventional cube without filler material. The fourth stage is to do compression test on compression testing machine (CTM) and the final stage is to compare compression strength of the cube with and without EPS material.

1. Phases of analysis:

Material Collection:

Material required for the preparation of concrete such as cement, fine aggregate and course aggregate and EPS material are obtained from their respective sources. In this study the EPS material having dimensions 100 x 100 mm possessing thickness of 100 mm and50 mm are collected and brought to the laboratory for the experimental program.

Preparation of Cube Specimen:

Cement, fine aggregate and course aggregate of proportion 1:2:3were taken volumetrically and dry mix was done. Water of required amount was taken and mixed thoroughly. The concrete mixing was carried out by conventional and normal method of mixing. All the ingredients of concrete with water were batched volumetrically and desired mix was prepared. The properties of fresh concrete were evaluated and tested for workability that is slump cone test and compaction factor test. The standard cube mould of size 150 x 150 mm was taken and oiled properly on each internal faces. Total eighteen cubes were prepared out of which nine cubes are prepared by keeping two EPS filler material of size 100 x 100 mm with thickness 50 mm sandwiched together by filling a gap of 10 mm with the concrete and filling all sides by providing layer of 20 mm from all sides . Remaining nine cubes were prepared by using EPS as filler material of size 100 x 100 mm with the thickness of 100 mm and kept at the middle of the mould after placing the layer of 25 mm from the bottom and covering the whole material with layer of 25mm from all the faces provided with the compaction done with the tamping rod .Similarly the same number of conventional cubes without EPS filler material was made by conventional method and testing was done. The concrete specimen were demoulded after the duration of 24 hours and kept in the curing tank filled with water until the age of its testing.

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Figure 2. Specimen Preparation

Testing of the specimen:
The compression test was conducted on specimen after the curing age of 7, 14, and 28 days using compression testing machine (CTM) of capacity 200 tons .The 3cubes prepared with the filling of EPS material of thickness 50 mm and 100 mm were taken by curing age of 7, 14 and 28 days respectively. The cubes were kept at the center in compression testing machine and load was applied gradually till the failure of the cubes. The following table gives the compression strength of concrete cubes with the weight of EPS filler material of thickness 50 mm and 100 mm and the conventional concrete cubes without the filler material.

Figure 3. Testing of Specimen

III. RESULT

A. Results

The objective of this study is to determine the compressive strength of concrete with an EPS as a filler material. The laboratory tests were conducted on the cubes with the curing period of 7, 14 and 28 days. This test was conducted based on Reference Standard: IS: 516 - 1959(Reaffirmed 2004) and the results obtained are given below in a tabular form.

Table 3. Compressive Strength of Specimens tested

Specimen Type / Compressive Strength (N/mm^3)	Sandwiched 50mm Thick EPS block	100mm Thick EPS block	Cube without EPS block
After 7 Days	8.52	11.52	11.92
After 14 Days	13.48	17.33	18.62
After 28 Days	14.73	18.86	19.12

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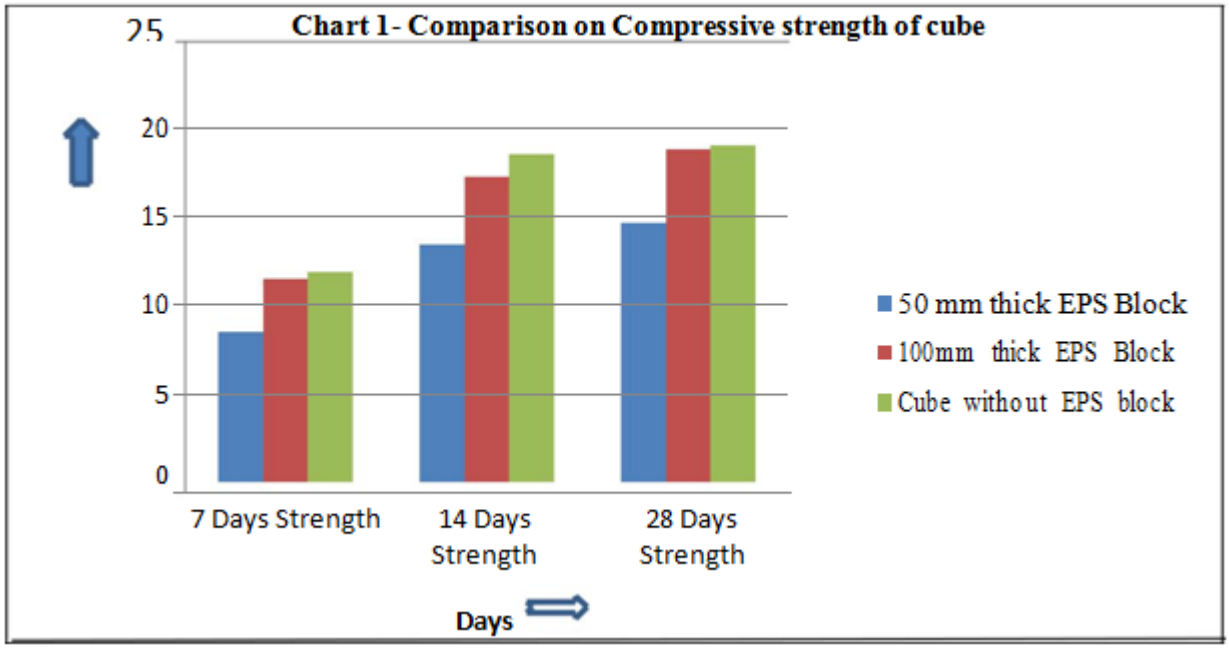
Table 4. Weights of Specimens before testing

Particulars / Specimen Type	Weight of the Specimen
Sandwiched 50 mm thick EPS block	6.9
100 mm thick EPS block	6.9
Cube without EPS block	9

B. Comparision-



C. **Discussion-**

From the above results obtained, it was discussed that if EPS block of 30% by volume is placed as a filler material then the weight of the specimen cube got reduced by 20% to 22% percent. However, there was a slight change in the compressive strength of the cube. Further we noticed that if 10 mm thick concrete layer midst of two 50 mm thick blocks with wire mesh making sandwich pattern gives lesser compressive strength than the alone 100mm thick monolithic EPS block with wire mesh gives the desired strength.

IV. CONCLUSION

Based on the above experimental work done following conclusions are drawn-

- The cubes were filled with the EPS block having 30% by volume of total volume reduces the weight by 20% to 22%. Thus increasing the EPS material beyond the 30% by volume may get reduce the results of compressive strength of the cube.
- While considering the construction of the affordable and lightweight houses the EPS filler material can be considered for the use.

- The compressive strength parameter of the concrete specimen with EPS as a filler material is nearly same as the conventional concrete specimen.

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