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RESEARCH ARTICLE OPEN ACCESS

An Experimental Study on Engineering Properties of Different Type of Light Weight Concrete .

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ABSTRACT
Concrete the most versatile material used for construction all over the world. It is well known that concrete is the mixture of cement, aggregates and water. The conventional concrete does not fit for the situations where the heavy weight is not at all required. The concrete with light weight is best suited for these situations .the light weight concrete is really the best alternative construction material where the heavy weight is not required. The present experimental study ,focuses on the production of different type of light weight concrete, they expanded clay aggregate (ECA) ,expanded polystyrene (EPS) and foam concrete (foam agent) , due to the rapid increase of construction activity day by day, the construction materials are being scarce; hence there was a strong need for alternative materials. In this study, manufacturing sand is alternative of river sand. In this research study, the ordinary Portland cement (grade 53) ,is replaced partially replaced by fly ash .In coarse aggregates we use completely light weight aggregates, the test conducted concrete compressive strength test and split tensile strength, which are compared with 3,7,14,28 days.

Keywords: fly ash, Expanded clay aggregate , expanded polystyrene ,form agent, Compressive strength ,split tensile strength

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I. INTRODUCTION

light weight concrete is a human invention which is used several field of construction .light weight concrete has many application which is use in several area like frames an floors ,curtain walls ,shell roofs etc..., the strength of light weight concrete will be around 25% to 35% light when we compared to the normal concrete .there are three different types of concrete which we will use ,they are heavy concrete ,normal weight an light weight concrete .the density of this concrete will be heavy concrete up to 4000kg/m ,normal weight concrete up to 2600 kg/m light weight concrete up to 2000kg/m .In this experiment we use light weight aggregates in the place coarse aggregates ,this light weight aggregate will have density less when we compare to coarse aggregates .they have density that aggregates can easy follow on the water .we use aggregates as expanded clay aggregate, expanded polystyrene and foaming agent.

Expanded clay aggregates which are made into round pellets an they burned or heated in rotary kilns at 1200 degree Celsius .ECA is use mainly in structural backfill against foundations ,retaining wall ,it can reduce earth pressure by 75% with conventional materials. ECA has less thermal conductivity coefficient

Expanded polystyrene is an innovative artifact that lens to the planning and structural integrity of the many buildings projects .Since the 1950s ,EPS has been recognized as main stream insulation material ,however over the past decade new applications has been fastly developed . Now EPS may be one of the powerful design ,element and a good choice for green building design ,providing improved indoor environmental quality and enhancing durability.

Foam concrete is new type concrete which is light weight concrete which containing no large coarse aggregates , only it contains fine aggregate ,cement ,water an foam. It is consider as homogeneous when it is compare to normal concrete, because it does not contain coarse aggregate . manufactures developed foam concrete with various densities which suit at different conditions

II. METHODODLOGY

The experiments were guided on concrete prepared by fully replacement of fine aggregate by manufacturing sand of grade zone II as per IS383 and also fully replacement of coarse aggregate with light weight aggregates like expanded clay aggregate

(ECA) ,Expanded polystyrene (EPS) and foam agent to find there strength at 3,7,14,28 days.

III. MATERIALS USED

CEMENT

Ordinary Portland cement of grade53 conforming to Indian Standards IS 12269-1987 was used throughout the experimental program. In general similar types of cements have quite different rheological and strength characteristics, mainly when used in combination with admixtures and cementing material. Specific gravity of cement is 3.15.

.FLYASH

Fly ash is fine powder which is a byproduct of coal in electric generation power plants. when we use fly ash with replacement of cement it will increase strength an segregation of the concrete and makes is to pump ,specific gravity will range between 2.1 to 3.0

Fine aggregate

Fine aggregate(manufacturing sand) that is produced by crushing stone, gravel, or slag. Used for aggregate material which pass less than 4.75 mm that is processed from crushed rock or gravel and intended for construction use. manufacturing sand is a material of high quality, in conflict to non-refined surplus from coarse aggregate production

Expanded clay aggregate (ECA):

Expanded clay aggregates which are made into round pellets an they burned or heated in rotary kilns at 1200 degree Celsius .this causes the clay to pop up like popcorn an become porous .this pellets are in light in weight an does not compact over time .The shape of the pellet will not be uniform will be irregular depend upon the manufacturing process. They have void ratio 1.628 and 1,894 .

Expanded polystyrene (EPS) :

Expanded polystyrene is produced in a process of adding a blowing agent, usually pentane which causes resin to foam during moulding .This process may be performed as a single step or a two step process .EPS concrete has good vibration energy .The specific gravity is 0.046

Polycarboxylic ether:

polycarboxylic ether is made by adding unsaturated ployether methyl allyl polyoxyethylene ether .there three types of ethers high ,medium and low .we use low polycarboxylic ether. specific gravity is 1.110

FOAMING AGENT :

Master Cell 30:

master cell 30 admixture is a highly concentrate foaming agent is used in light weight concrete .It is a cellular cementations mixture It is suitable for use in combination with various types of foam generating equipment ,which generates by air pressure

IV. MIX DESIGN

Mix design of concrete was prepared by using the guidelines of IS 10262:2019. By several lab trails mix design we have taken standard values.

Mix design for Expanded polystyrene concrete :

Cement	=	250 Kg/m^3
PFA	=	250 Kg/m^3
EPS BEDS	=	11 Kg/m^3
Crushed stone sand	=	400 Kg/m^3
AIR ENTRAINER	=	1 Kg/m^3
ADMLPCE	=	4.5 Kg/m^3
Free water	=	17.5 Kg/m^3
Free w/c	=	0.25
Total water	=	185 Kg/m^3
Total Density	=	1102 Kg/m^3

Mix design for foam concrete :

Cement	=	600 Kg/m^3
PFA	=	500 Kg/m^3
Foaming agent	=	30.0 Kg/m^3
Free water	=	330 Kg/m^3
Free w/c	=	0.30
Total water	=	330 Kg/m^3
Total Density	=	1460 Kg/m^3

Mix design for Expanded clay aggregate concrete:

Cement	=	350 Kg/m^3
PFA	=	250 Kg/m^3
ECA1(2-8)	=	306 Kg/m^3
Crushed stone sand	=	306 Kg/m^3
Chemical admixture	=	5.0 Kg/m^3
Free water	=	200 Kg/m^3
Free w/c	=	0.25
Total water	=	228 Kg/m^3
Total density	=	1445 Kg/m^3

Note : Total water =free water +(Mass aggregate X percentage of water absorption)

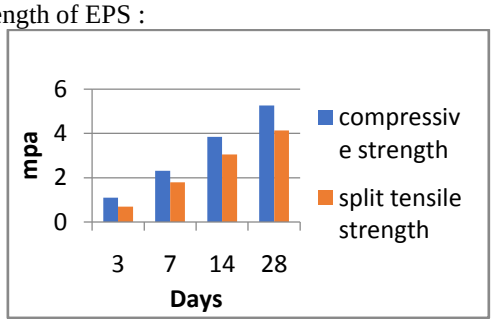
V . RESULTS AND DISCUSSION:

Compressive strength and split tensile srength EPS BEDS :

days	Compressive strength	Split tensile strength
3	1.1 mpa	0.7 mpa

7	2.32 mpa	1.8 mpa
14	3.84 mpa	3.05 mpa
28	5.26 mpa	.13 mpa

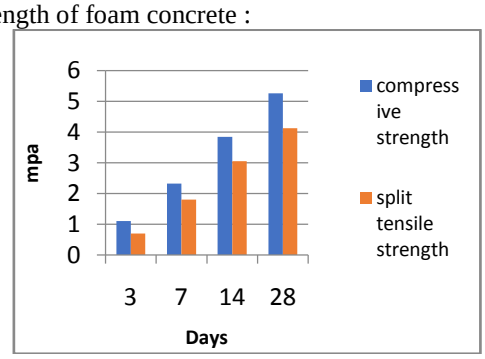
compression between compressive and split tensile strength of EPS :



Compressive strength and split tensile strength of foam concrete :

days	Compressive strength	Split tensile strength
3	0.68 mpa	0.51 mpa
7	1.86 mpa	1.42 mpa
14	3.05 mpa	2.66 mpa
28	5.02 mpa	3.90 mpa

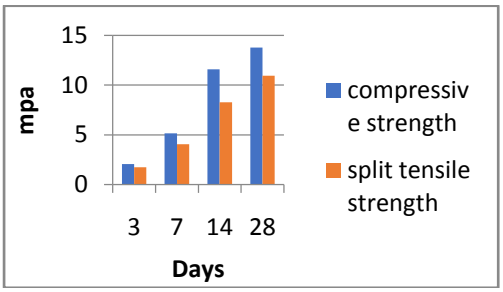
compression between compressive and split tensile strength of foam concrete :



Compressive strength and split tensile strength of ECA :

days	Compressive strength	Split tensile strength
3	2.06 mpa	1.74 mpa
7	5.14 mpa	4.06 mpa
14	11.58 mpa	8.27 mpa
28	13.77 mpa	10.95 mpa

compression between compressive and split tensile strength of ECA :



VI .CONCLUSION

- EPS beds concrete demonstrate at 3 days Compressive strength as **0.70** mpa.
- EPS beds concrete demonstrate at 7 days Compressive strength as 2.32 mpa.
- EPS beds concrete demonstrate at 14 days Compressive strength as 3.84 mpa.
- EPS beds concrete demonstrate at 28 days Compressive strength as 5.26 mpa.
- EPS beds concrete demonstrate at 3 days split tensile strength as 0.7 mpa.
- EPS beds concrete demonstrate at 7 days split tensile strength as 1.8 mpa.
- EPS beds concrete demonstrate at 14 days split tensile strength as 3.05 mpa .
- EPS beds concrete demonstrate at 28 days split tensile strength a 4.13 mpa .
- Extended clay aggregates concrete demonstrate at 3 days Compressive strength as 2.06 mpa.
- Extended clay aggregates concrete demonstrate at 7 days Compressive strength as 5.14 mpa.
- Extended clay aggregates concrete demonstrate at 14 days Compressive strength as 11.58 mpa.
- Extended clay aggregates concrete demonstrate at 28 days Compressive strength as 13.77 mpa.
- ECA concrete demonstrate at 3 days split tensile strength 1.74 mpa.
- ECA concrete demonstrate at 7 days split tensile strength 4.06 mpa
- ECA concrete demonstrate at 14 days split tensile strength 8.27 mpa
- ECA concrete demonstrate at 28 days split tensile strength 10.25 mpa
- Foam concrete demonstrate at 3 days Compressive strength as 0.68 mpa
- Foam concrete demonstrate at 7 days Compressive strength as 1.86 mpa
- Foam concrete demonstrate at 14 days Compressive strength as 3.05 mpa
- Foam concrete demonstrate at 28 days Compressive strength as 5.02 mpa
- Foam concrete demonstrate at 3 days split tensile strength as 0.51 mpa
- Foam concrete demonstrate at 7 days split tensile strength as 1.42 mpa

- Foam concrete demonstrate at 14 days split tensile strength as 2.66 mpa
- Foam concrete demonstrate at 28 days split tensile strength as 3.90 mpa
- When we need high density and high strength we can use extended clay aggregates.
- When we need medium strength and high density we can use form concrete.
- When we need medium strength and low density we can use expanded polystyrene concrete

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[9] Banthia, N. And Trottier,J.performed studies on concrete reinforced with deformed metal fibers and recommended that during light-weight fiber bolstered concrete the addition of fibers produces an boom in compressive electricity

[10] Alaguru, P.; and Ramakrishnan, V performed research on Properties of fiber bolstered concrete and suggested that Properties of lightweight fiber-bolstered concrete resemble that of normal-weight concrete except for air entrainment. Controlling air content material is the primary trouble in lightweight fiber concrete. By incorporating excessive-range water-decreasing admixtures, one could formulate lightweight fibber concrete that is of better workability

[11] Campione G., Cucchiara C., La Mendola L., Papia M suggested that although lightweight concrete is characterized by brittle behaviour it is possible to achieve the ductility required for seismic purposes by using adequate percentages of short fibbers. Also observed that, using fibers only moderate effects in terms of maximum and residual strength were increased.

[12] Campione G., Mindess S., and Zingone suggested that in the case of normal weight or light weight high strength concrete fibers in combination with traditional steel reinforcements reduce the brittleness characterizing these advanced materials. Fibers improve ductility of concrete and avoid congestion of secondary reinforcements required in critical regions of structures designed in seismic zones. Lightweight concrete, which was largely utilized for its non-structural properties (as lagging or soundproofing material), has also been employed more recently to make structural elements, in particular in the field of precast concrete structures

[13] Compione, G., et advised that brittle nature of light-weight mixture can be overcome by means of growing the everyday confinement of transverse reinforcement and/or through including reinforcing fibbers to the concrete matrix. Also they have suggested that the presence of fibbers reduces cloth decay in the subject of the strains exceeding that corresponding to the peak cost power.

[14] P.C.Taylor-presently professor at Wuhan University of Technology has quoted numerous results such as mineral admixtures affect the bodily and mechanical homes of High Strength Structural Light Concrete.Amd moreover concluded that further addition of fly ashes improves the compressive power and splitting tensile energy of HSSLC and moreover Addition of silica fume complements the compressive power approximately 25%

[15] T. Parhizkar et.Al. – Exhibited experiments on the homes of volcanic pumice light-weight aggregates concretes. During the conclusion of the specifically light-weight coarse with herbal pleasant aggregates concrete and lightweight coarse and high-quality aggregates concrete. The observe concludes various outcomes consisting of tensile strength and drying shrinkage show that those lightweight concretes meet the necessities.