Role Of Expanded Clay Aggregate As An Light Weight Concrete

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Abstract

The modern era is witnessing construction of terribly difficult and troublesome technology structures. During this study comparison has been created between plain cement concrete and Light-weight concrete having completely different proportion of aggregates and admixtures. In this research Expanded Clay Aggregate 0%, 20%, 40%, 80% and 100% is used with coarse aggregates and combination of Silica fumes 10% and 1.5% 503-SBR Bond of constant replacement with cement and water severally. It helps to extend the quantity of concrete and thus scale back the load.

Key words : Expanded Clay Aggregate, Silica fume, 503 SBR bond, Flexural strength, Density, Compressive strength**.**

1. Introduction

The most mesmerizing invention of the human brain is light weight concrete, utilized in numerous construction functions worldwide. Lightweight concrete maintains its large voids and not forming laitance layers or cement films when placed on the wall. The dry density of light weight concrete is 300kg/m^3 up to 1840 kg/m^3. This research relies on the performance of light weight concrete using Expanded Clay Aggregate. However, adequate water cement ratio relation is significant to supply adequate cohesion between cement and water. Light-weight concrete is sometimes chosen for structural purpose wherever its use can result in a lower overall price of a structure than traditional weight concrete.

This research is to indicate the effect of Expanded Clay Aggregate on the strengthen properties of conventional concrete. The performance of lightweight concrete such as compressive strength tests, flexural strength, density, compressive strength and comparisons has been made with nominal concrete. It's utilized in a variety of construction parts like floors, plate foldings, bridges, precasts, and platforms. Strength wise light weight concrete is 25-30% lighter than the conventional concrete that we use. Light weight concrete may be a style of concrete that contains dilated light weight aggregates that increase the quantity of the mixture whereas giving further qualities like lowering the dead weight. Light weight concrete reduces the loading, accelerates the building construction rate.

2. Research Methodology

The experimental investigation is carried supported volume proportions and also the cement content was taken to be 380 kg/m3. Water/cement magnitude relation (w/c) was taken to be 0.40 from varied mixes. Combine proportion relating 20%, 40%, 80% and 100% replacement of Expanded clay Aggregate is taken into account to hold outexperiment. Combination sizes starting from 16mm-20mm were accustomed prepare the samples of varied combine proportions.

2.1 Compressive Strength

In this investigation, completely different concrete mixture of ECA replacements is taken into account to perform the take a look at by-weight basis with 10% of cement replaced by silica fume and 1.5% 503 SBR BOND . A 150x150 metric linear unit concrete cube was used as take a look at specimens to see the compressive strength of concrete cubes. The constituents of concrete were completely mixed until uniform consistency was achieved. The cubes were properly compacted. All the concrete cubes were de-molded inside 24 hours when casting. The demolded take a look at specimens were properly cured in water offered within the laboratory for 7 and 28days. Compression was conducted on a 2000KN capability on universal testing machine.

2.2 Flexural Strength

In this investigation, completely different concrete mixture of ECA replacements as is taken into account to perform the take a look at by-weight basis with 10% of cement replaced by Silica fume and 1.5% 503 SBR BOND. A 500mm x 100mm x 100mm concrete beam was used as take a look at specimens to see the flexural strength of concrete beams. The ingredients of concrete were completely mixed until uniform consistency was achieved. The beams were properly compacted. All the concrete beams were de-molded inside 24 hours when casting. The demolded take a look at specimens were properly cured in water offered within the laboratory for 7 and 28 days.

3. Material

3.1 Cement

In this gift work, Portland Pozzolana cement confirming to IS 1489.1991 was used. This kind of cement is obtained by grounding the hydraulic cement clinker with fine pozzolanic material and adding a doable quantity of mineral

Properties of Cement

S.No	Property	Value
1	Specific gravity	2.61
2	Standard consistency	34%
3	Initial setting time	50 min

Table no 3.1

3.2 Silica Fume

It's an fine pozzolanic material composed of amorphous oxide, that is very reactive created from the electrical conduction chamber as a by-product of the production of elemental oxide. Silica fume confirming to specifications as per IS 15388:2003 has been used.

Properties of Silica Fume

S.No	Property	Value
1	Specific gravity	2.13
2	Sio2	83% - 90%

Table no 3.2

3.3 Expanded Clay Aggregate

It is a Light weight mixture created by heating clay to around 2190 ^{0}F having a dry density of 300-500kg/m3 , low thermal physical phenomenon, ph nearly 7, it has a high acoustic and fireplace resistance.

Properties of ECA

S.No	Property	Value
1	Specific gravity	0.89
2	Sio2	62 $\pm$ 5%
3	Water absorption	13.32%

Table no 3.3

3.4 Coarse Aggregates

Coarse aggregates of sizes starting from 16mm –20mm were used confirming IS383.1970 the various mixture properties were tested consequently and their worth square measure is shown below

Properties of Coarse Aggregates

S.no	**Property**	**Value**
1	Specific gravity	2.59
2	Water absorption	0.25%

Table no 3.4

3.5 503-SBR BOND

SBR Bond is a latex primarily based, water-proof bonding agent and admixture to be used in areas subject to humidness, moistness and continuous water contact. It improves water resistance of cement mixtures by forming a reinforcing chemical compound that will increase long-run sturdiness and adaptability of the combination on renderings and floor screeds.

Properties of 503-SBR BOND

S.no	**Properties**
1.	Improved adhesion to a large vary of substrates
2.	Excellent resistance to water and water vapour
3.	Resistance to salt permeation
4.	Reduced surface dusting
5.	Improved frost resistance

Table no 3.5

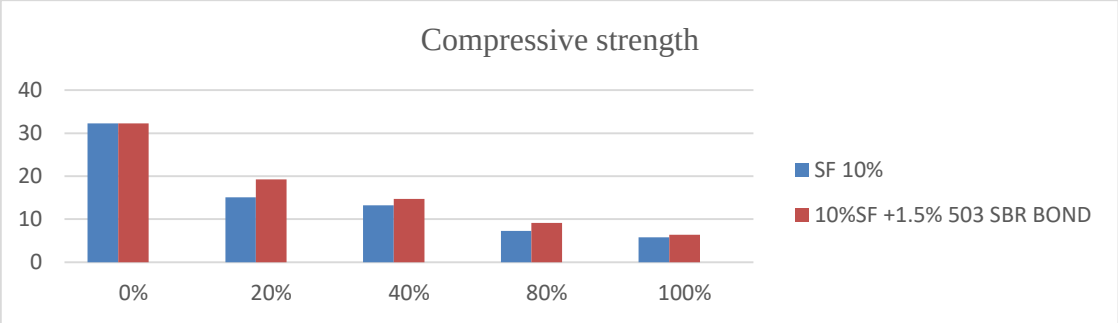
4. Result Analysis

4.1 Compressive Strength

The compressive strength check is run as per IS 516:1959 check on hardened concrete. The load is applied whereas not shock and accumulated endlessly at a rate of roughly 140 kg/sq cm/min until the resistance of the specimen to the increasing load breaks down and no larger load is sustained. The foremost load applied to the specimen shall then be recorded and so the design of the concrete and any uncommon choices inside the sort of failure shall be noted.

S.No	Coarse Aggregate Replacement	Compressive strength For 10% Silica Fume (mpa)	Compressive strength For 10%SF +1.5% 503 SBR BOND
1	0%	32.3	32.3
2	20% ECA	15.1	19.25
3	40% ECA	13.24	14.72
4	80% ECA	7.29	9.14
5	100% ECA	5.78	6.37

Table 4.1 Compressive strength for 28 days for various mix proportions

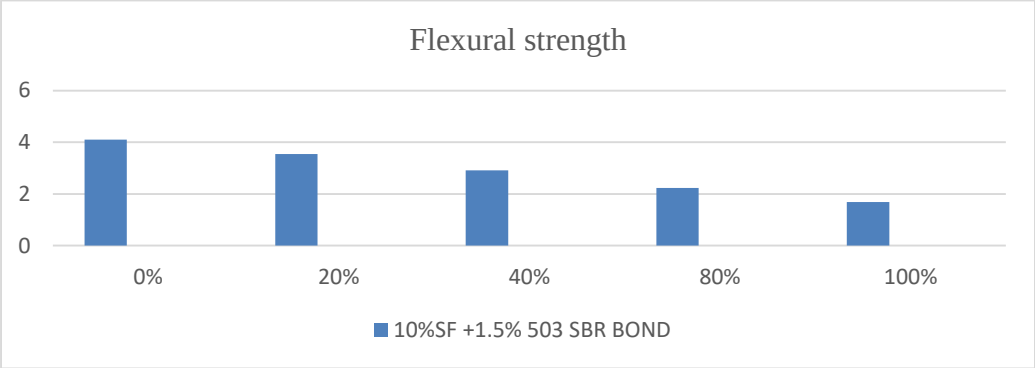


4.2 Flexure Strength

The axis of the specimen is fastidiously aligned with the axis of the loading device. No packing shall be used between the bearing surfaces of the specimen and also the rollers. The load shall be applied while not shock and increasing incessantly at a rate such the intense fiber stress will increase at around 7kg/sq cm/mm that is, at a rate of loading of 400kg/min for the 15cm specimen. The load shall be exaggerated till the specimen fails, and also the most load applied to the specimen throughout the check shall be recorded. The looks of the broken faces of concrete and any uncommon options within the variety of failure shall be noted.

S.No	Coarse Aggregate Replacement %	Percentage of cement replaced	Flexure strength (mpa)
1	0%	0%	4.01
2	20% ECA	10%SF +1.5% 503 SBR BOND	3. 54
3	40% ECA	10%SF +1.5% 503 SBR BOND	2.91
4	80% ECA	10%SF +1.5% 503 SBR BOND	2.23
5	100% ECA	10%SF +1.5% 503 SBR BOND	1.69

Table 4.2 Flexural strength for 28 days for various mix proportions

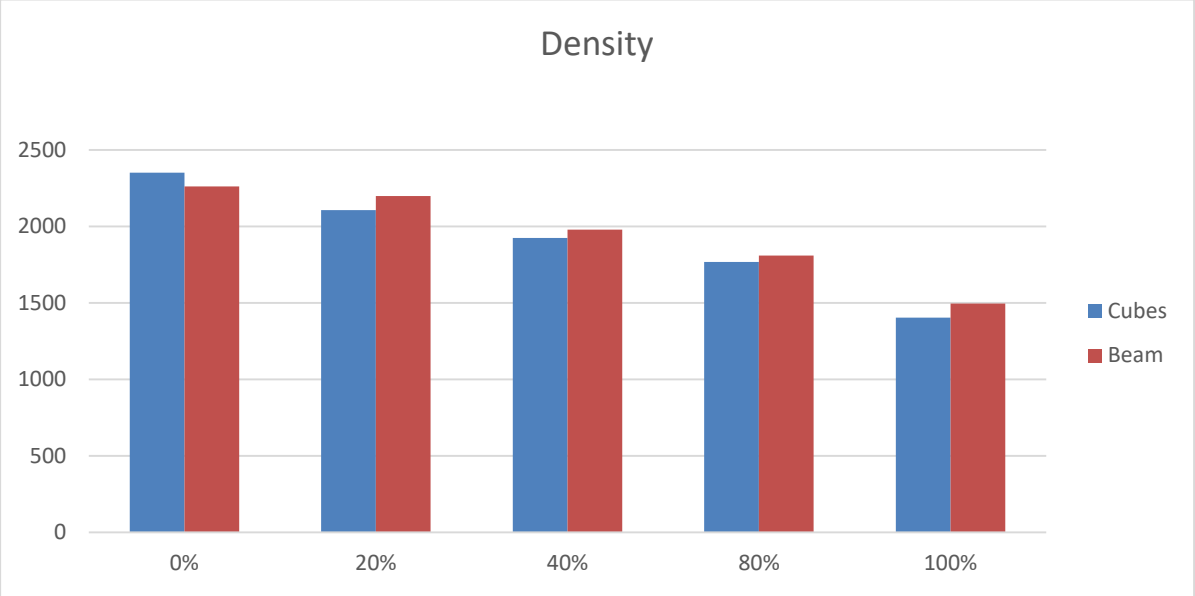


4.3 Density

The density of each recent and hardened concrete is of interest to the parties concerned for varied reasons together with its impact on sturdiness, strength and resistance to permeableness. Hardened concrete density is decided either by straightforward dimensional checks, followed by consideration and calculation or by weight in air/water buoyancy strategies.

S.No	Coarse Aggregate replacement	Density of cubes for 10% SF+1.5% 503 SBR BOND	Density of beams for 10% SF+ 1.5% 503 SBR BOND
1	0%	2350.37	2260.25
2	20% ECA	2107.36	2198.58
3	40% ECA	1923.71	1978.25
4	80% ECA	1768.36	1809.92
5	100% ECA	1402.65	1495.62

Table 4.3 Density 28 days for various mix proportions



5. Conclusion

The initial readings show that Light weight concrete has considerable strength, which may be used as an associate degree alternate material in building construction and different works. For mixture with lower density, low strength aerated concrete area unit being employed. Usage of aerated concrete enhances the rise in voids throughout the sample which could be caused by foam.

The compressive strength of Light weight concrete is below the normal standard concrete. So this light-weight concrete may be utilized in places wherever the external force functioning on the structure is minimum. This light-weight concrete is merely capable to hold its self weight. The workability of Light weight concrete isn't smart once it's compared to the normal standard concrete. This workability may be improved by introducing microscopic air bubbles into this concrete or air entrainment.From the on top of compressive strength results, it's determined that because the share of ECA is increasing the compressive and flexure strength is decreasing since, the density of concrete is reduced by addition of ECA

The partly light-weight concrete may be used as structural concrete on some cases as a result of it's having the compressive strength price that is appropriate for structural. This light-weight concrete has low thermal physical phenomenon and has a capability to soak up sound. So, it may be used for acoustic structures.

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