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Experimental Study on Light Weight Aereated Block with Partial Replacement of Cement by Fly Ash

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Abstract: **In this paper we are going to study about the light weight concrete which includes rising agent. Mostly light weight concrete is used because of its less density and low thermal conductivity. Light weight concrete can be made by using light weight aggregates. Here in our project we use sand, cement, fly ash, aluminum powder as the major ingredients. Here in this paper we present light weight concrete using various quantities of cement , sand, ,fly ash and appropriate water cement ratio. Here we replace cement by using fly ash and the amount of fly ash is fixed to about 0%, 10%, 20%, 30% ,40%, 50%, 60% of the cement in the mixture. The density of light weight concrete is less than the other normal conventional type of concrete. Finally the specimen prepared was subjected to curing process to gain maximum strength under controlled conditions. The main aim of our project is to study the effect of fly ash on light weight concrete as a partial replacement of cement.**

Keywords: Cement, Sand, Fly Ash, Aluminum Powder, Strength.

I. INTRODUCTION

In this project we deal with light weight aggregate which yields additional qualities such as lowering of dead weight. Here we use sand, fly ash, cement and aluminum powder as the expansion agent, when aluminum powder was added to the mixture it reacts with calcium hydroxide and produces hydrogen gas which gets expels off. Afterwards the mixture was poured into the mould, due to the addition of the aluminum powder the volume of the mixture gets increased.

Afterwards the mould was removed and the cube was subjected to curing process (i.e,) oven curing of temperature about 100°C - 140°C and it was maintained for 10 – 12 hours . Optimum strength was gained only after curing.

II. REVIEW OF LITERATURE

Study of light weight concrete: T.Divya Bhagavan In this paper cement is replaced by using silica fume and Polyvinyl chloride. And expanded clay aggregate have been added to the coarse aggregate.

Effect of Fly ash and Aluminum powder on Concrete : Dr. K. Chandrasekhar Reddy ,S. Dhinesh Kumar In this paper it was concluded that the maximum flexural strength was obtained only when more amount of aluminum powder was used .Hence availability for it was less and it becomes less economic.

Utilization of Eco sand and Fly ash in aerated concrete for a richest ix design: B.Keerthana, Sini Sara Mini, M.Thenmozhi Here the use of conventional sand has been partially replaced by using eco sand and fly ash. And it results in better compressional strength. Floating Concrete by using Light weight Aggregates and air Entraining agent: Mukesh D. Ghadge . Vaibhav D. Kamble . Here pumice stone has been added to the mixture and aluminum powder has been added. It tends to weighs more.

Foam concrete can be used for sustainable construction as a Building material: Mr.Ashish S.Moon ,Dr.Valsson Varghese, Mr. S.S.Waghmare

Here it was concluded that when 1:1 proportions of cement and sand will have less strength and it may yields more strength when certain amount of quarry dust was added to sand. Hence for foam concrete sand has been completely replaced by using quarry sand, sometimes quarry sand may not be suitable due to the mixing of various broken materials.

III. MATERIALS

- CEMENT: Cement is the most import9ant constituent of concrete, it forms the binding medium for the discrete made out of naturally occurring raw materials and sometimes blended or inter-ground with industrial wastes. Cement comes in various types and chemical compositions, “ordinary Portland cement” 53 mega pascal grade of cement is used for concrete. The properties of cement were determined as per the IS 4031: 1968.

- FINE AGGREGATE: River sand was used in preparing the concrete as it was locally available in sand quarry. The specific gravity and water absorption were found to be 2.73 and 2.5% respectively, with sieve analysis data and fineness modulus value of sand confirms to grading zone as per IS: 383-1970.

- FLYASH: In our project we are checking up with grade C fly ash. As grade C fly ash is rich in lime content so additional use of lime to the mixture is not

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necessary. Here in this project fly ash is collected from Coimbatore

- WATER: These types Water used in the manufacture of blocks were normal portable water.
- ALUMINUM POWDER: Here we use finely powdered aluminum powder as the air entraining agent. And we add 0.002 grams of aluminum powder.
- SAND: Sand was used as one of the major fine aggregate. Specific gravity of sand=2.68 (found by specific gravity test).
- MIXING OF MATERIALS: The percentage replacement of OPC by fly ash were 0%,10%,20%,30%,40%,50%,60%,70% and replacement of Cement .And additional admixture of aluminum powder(0.004 kg).
- CONCRETE MIX DESIGN: The mix ratio used to equal proportion of sand and cement in the ratio of 1:1 and 0.004 kg of aluminum powder.

IV. METHODS

The materials required for this project were ordinary portland cement, sand, fly ash, aluminum powder. The cement used here is of 53 grade and it is bought from ACC brand. River sand is used as the fine aggregates which is bought from sand suppliers nearby. Fly ash which is checking up with grade c fly ash. As grade c fly ash is rich in lime content so additional use of lime to the mixture is not necessary. Here in this project fly ash is collected from Coimbatore .fly ash is used as partial replacement for cement .The density of the light weight concrete ranges from 650 kg/m³ to 1850 kg/m³ (As per IS- 2185 part 3,1984) as compared to 1800 kg/m³ to 2400 kg/m³ for conventional brick and concrete respectively.

The mix ratio taken for this light weight aerated block is 1:1 of cement and sand and 0.004 kg of aluminum powder. Fly ash were used to replace 10%, 20%, 30%, 40%, 50%, 60%, 70% of cement by volume. 7 different mixes were taken and 2 cubes were produced with each percentage for 7 days. The compressive strength and split tensile test for each specimen is tested and the results are compared.

V. TESTING RESULTS

Compressive strength :

Compression strength is the capacity of material or structure to withstand against the compressive force which artificially applied by hydraulic pressure in compression testing machine. The cubes of size 75X 75 X 75 mm which casted in 3 numbers for 7days of curing . After curing cubes are placed in CTM one by one between bearing plates and load is applied gradually in kilo Newton.

Compressive strength of cube = 6.4 N/mm².

Table 5.2 -Compression Strength of Cube (Light weight aerated block) Test

S.NO	SPECIMENS	COMPRESSIVE STRENGTH IN(N/mm²)
1	Specimen 1(NF)	3.8
2	Specimen 2(1PF)	4.4
3	Specimen 3(2PF)	4.0
4	Specimen 4(3PF)	4.6
5	Specimen 5(4PF)	5.6
6	Specimen 6(5PF)	6.4
7	Specimen 7(6PF)	4.3

Water absorption test :

Thus the results obtained from the test are tabulated. The percentage of water absorption obtained for the cubes are less than 20% which is within the permissible limits

Formula :

Percentage of water absorption=$(W_2–W_1)/ W_1 \times 100$

W_1 =Weight of the oven dried cube.

W_2 =Weight of the cube after immersed in water for 24 hours.

Water absorption Test:

S.NO	SPECIMENS	PERCENTAGE OF WATER ABSORPTION
1	Specimen 1(NF)	16.83%
2	Specimen 2(1PF)	18.64%
3	Specimen 3(2PF)	19.12%
4	Specimen 4(3PF)	19.11%
5	Specimen 5(4PF)	17.86%
6	Specimen 6(5PF)	19.45%
7	Specimen 7(6PF)	19.81%

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VI. CONCLUSION

From this experimental investigation the following conclusions are drawn:

Hence from the graph we conclude that the compressive strength is high only when the cement is being replaced partially by using fly ash. The water absorption value and the density are within the given permissible limits. And it was found that the weight was very much reduced while adding fly ash instead of cement. Finally it yields light weight when compared other type of conventional concrete blocks. Hence it's more economical and efficient to use these type of ingredients.

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