Research Paper Engineering

Achievement of Density and Strength in Light Weight Concrete by Fly Ash as Air Entraining Agent

Tanveer Asif Zerdi	Director, Professor Head of Civil Engg Dept, KCT Engineering college, Gulbarga, Karnataka, India.
Afroz Ahamad	UG Student, Department Of Civil Engineering, V.T.U University, K.C.T. Engineering college, Gulbarga, Karnataka.
Tanviralam Mistry	UG Student, Department Of Civil Engineering, V.T.U University, K.C.T. Engineering college, Gulbarga, Karnataka.
Shoaib Hatif Ahmed	UG Student, Department Of Civil Engineering, V.T.U University, K.C.T. Engineering college, Gulbarga, Karnataka.
Tazeem-ul-haq Zerdi	Student sanint marry, kalburgi, Karnataka, India.

ABSTRACT

Floating concrete is a type of concrete basically its density is less than water and it floats on water. Since this is a unique type of concrete hence authors found that very meager quantum of work is carried out in this regard hence authors have taken up this study under consideration, out of motivation. In this study we have worked on the floating type of concrete by using pumice stone as light weight aggregate, by adding fly ash to the tune of 30% by weight of cement. This leads in reduction of the dead load of the structure and density of the concrete decreases hence consequently bending moment reduces. However this is a non structural concrete. Fly ash is a pozzolanic material and helps in improving the properties such as compressive strength and durability. Concrete is made by using cement, pumice stone and waster also aluminum powder is mixed in it as air entraining agent and some amount of cement is replaced by fly ash. Also herein comparison has been made between plain cement concrete and light weight concrete. As we started preparing the concrete by incorporating sand in different samples density was found more than water, hence in order to achieve the goal we started replacing sand with pumice stone powder, thereafter in the results we obtained the lesser density of concrete than water. The iteration was carried out and within sample 4 values got are optimum for the mix proportion.

KEYWORDS Fly Ash, Ecofriendly, pozzolanic, Durability,pumice stone ,aluminium powder , compressive strength.

I.INTRODUCTION

In this investigation, fly ash was used as a mineral admixture which not only improved the properties of concrete but also resulted in a reduction in the cost of concrete. Fly ash in concrete makes efficient use of the products of hydration of cement, such as, calcium hydroxide PCH), which are otherwise a source of weakness in normal cement concretes and convert them into denser, stronger C-S-H compounds by pozzolanic reaction. The heat generated during hydration initiates the pozzolanic reaction of fly ash. This study deals with study of development of density less than water in floating concrete by using lightweight aggregate (Pumice stone) and Aluminum Powder as an air entraining agent. Floating concrete is made by introducing air or gas into concrete slurry, so that when the mix sets and hardens, uniform cellular structure is formed. Thus it is a mixture of water, cement and finely crushed sand. We mix fine powder of Aluminum to the slurry and it reacts with the calcium hydroxide present in it thus producing hydrogen gas. This hydrogen gas when contained in the slurry mix gives the cellular structure and thus makes the concrete lighter than the conventional concrete. Pumice stone is a lightweight aggregate of low specific gravity. It is a highly porous material with a high water absorption percentage. In this we do not use the conventional aggregate and replace it by the pumice stone. Pumice is the specimen of highly porous rocks having density approximately 500-600 Kg/m3 [(2)]. In addition to which we added fly ash approximately about 30% by weight of cement which provide us the optimum results. Pumice has an average porosity of 60-80% and initially floats on water[(3)].

II.MATERIALS USED

Fly ash is a pozzolanic material here we have used it as 30% by weight of the cement

Stone used: pumice stone (10 to 20mm) Sand used : crushed sand.

Cement used: ordinary Portland cement of 53- grade.

Water: Tap potable water

Mixed Procedure: By hand mixing.

Compaction: Tamping, Rodding.

Curing practice: Curing by submersion.

Cube size: 15cm×15cm×15cm

Testing of cubes: By using CTM, after 3,7,21 & 28 days of curing.

III EXPERIMENTAL PROGRAM

TESTING OF MATERIALS

Sr. no	Description of Test	Results
1	Specific gravity a)Cement b)Fine aggregate	 3.15 2.61

2	Fineness of cement	05%
3	Standard consistency of cement	34%
4	Setting time of cement a)initial setting time b)final setting time	 40 minutes 262 minutes
5	Density of pumice stone	641 kg/m3
6	Specific gravity of fly ash	1.9-2.8

Sample 1: 12 cubes
Cement: 64 kg
Crushed sand: 80kg
Pumice stone (< 20 mm): 5kg
Water: 35.2 kg
Admixture: Aluminum powder 2%
Fly ash as 30% by weight of cement: 19.2 kg

RESULTS OF SAMPLE 1: AFTER 3 DAYS CURING

Sl. No.	Wt. kg	Density kg/m3	Density kg/m3	Load KN	Strength N/mm2	Avg. Comp Strength N/mm2
1	5.35	1585.18	1631.61	265	11.77	12.20
2	5.72	1694.84		287	12.75	
3	5.45	1614.814		272	12	

Sample 2: 12 cubes
Cement: 32kg
Pumice powder: 10 KG
Crushed sand: 48 kg
Pumice stone: (< 20 mm): 20kg
Water: 17.6 kg
Admixture: aluminium powder 2%
Fly ash as 30 % by weight of cement : 9.6kg

RESULTS OF SAMPLE 2: After 7 days of curing

Sp. No.	Wt. (kg)	Density (kg/m3)	Avg Density (kg/m3)	Load (KN)	Strength (N/mm2)	Avg Strength (N/mm2)
1	4.14	1227		167	7.42	
2	4.26	1262	1232.66	197	8.76	8.15
3	4.08	1209		186	8.27	

Sample 3: 12 cubes
Cement: 24 kg
Pumice powder: 10kg
Pumice stone: (10 to 20 mm): 20kg
Water: 13.2 kG
Admixture: Aluminum powder 2%
Fly ash 30% by weight of cement: 4.8kg

RESULTS OF SAMPLE 3: After 21 days of cube testing

Sq. No.	Wt. (kg)	Density (kg/m3)	Density (kg/m3)	Load (KN)	Strength (N/mm2)	Avg. compSt rength(N/mm2)
1	4	895	902.66	65	2.89	3.21
2	2.98	883		68	3.02	
3	3.14	930		84	3.73	

Sample 4: 12 cubes
Cement:24 kg
Pumice powder: 12 kg
Pumice stone: (10 to 20 mm): 24 kg
Water: 13.2 Kg
Admixture: Aluminium powder 2%
Fly ash 30% by weight of cement : 4.8 kg

RESULTS OF SAMPLE 4 : 28 days cube testing

Sp. No.	Wt. (kg)	Density (kg/m3)	Avg. Density (kg/m3)	Load (KN)	Strength (N/mm2)	Avg. Strength (N/mm2)
1	3.84	1137		202	8.97	
2	3.65	1081	1102.66	196	8.71	8.61
3	3.68	1090		184	8.17	

IV. RESULTS AND DISCUSSION

Sample1 gives average compressive strength 12.20 N/mm2, which is good for lightweight concrete. Also it give save rage density 1631.61 kg/m3, but we have to reduce the density of concrete to nearly equals to density of water, so it is to be required that reduce the quantity of crush sand and that's why we reduced the quantity of crushed sand and also replaced it with pumice sand passing through IS sieve of size 4.75 mm. in next sample. Also we used two fractions of Aggregate i.e. M1 (10mm to 20 mm) and M2 (4.75 mm to 10 mm).

Sample 2 gives the improved results having average density 1232.66 kg/m3 and average compressive strength 8.15 N/mm2, but average density of concrete is not nearly equals to the density of water. Also the quantity of cement is high, so we discussed this situation with our guide. He told us that if you reduce the quantity of cement it will help us to reduce the density as well as to achieve economy. Therefore in next sample we reduced the cement quantity and increased the pumice sand.

Sample 3 gives lightweight concrete having average compressive strength 3.21 N/mm2and average density 902.66 kg/m3. Which is less than the density of water hence the concrete cube It was light as desired but its finishing was not good. It happens because of the large sized aggregate. So we have decided to eliminate large size aggregate completely from concrete.

Sample 4 gives lightweight concrete having surface flat & smooth and showing a good finish. Its average density is 1102.66 kg/m3 and average compressive strength 8.61 N/mm2. From the above results it seems that the compressive strength is increased even if the density is nearly same as the previous sample. So this sample is perfect for the mix proportion.

V. CONCLUSION

In this study, the influences of aggregate types and the amount on the compressive strength of concrete were investigated. Using different aggregate proportions (pumice) and five different lightweight concrete mixtures were produced with a satisfied strength. The result of the investigation showed that aggregate size and proportion influenced the unit weight and compressive strength of concrete. Moreover, the result showed that it is possible to produce a Floating and satisfied strength concrete by using pumice as aggregate. It was also seen that, using light

weight aggregate in the concrete mixture can reduce the dead load but decreases the concrete strength. However for the sample 6 it is Reverse, because this proportion gives compressive strength 8.61 N/mm2, which is good for the light weight concrete having density 1102.66 kg/m3. From cost analysis it is proved that the cost of our project is less than that of brick masonry. The study showed that using pumice aggregate as a commixture enable to produce different strength grade lightweight concrete with different unit weight. These concrete does not satisfies the strength requirements for load bearing structural elements. In this study only strength and unit weight were considered, other properties including carbonation and drying shrinkage, thermal conductivity and sound insulation properties can be investigated as a further study.

REFERENCES

1) Dhawal Desai, "Development of Light Weight Concrete", Civil Engineering Portal, 2014.

2) T. Parhizkar, M. Najimi and A.R. Pourkhorshidi, "(Application of pumice aggregate in structural lightweight concrete", Asian journal of civil engineering (building and housing) VOL. 13, NO. 1 (2012) PAGES 43-54.
3) N. Sivalinga Rao, Y.Radha Ratna Kumari, V. Bhaskar Desai, B.L.P. Swami, "Fibre Reinforced Light Weight Aggregate (Natural Pumice Stone) Concrete", International Journal of Scientific & Engineering Research Volume 4, Issue 5, May-2013 ISSN 2229-5518.
4) IS 3812-Specification for fly ash for use as pozzolona and admixture, Part-I (2003), Part-II (2003)
5) IS 1727-Methods of test for pozzolanic materials.(Reconfirmed 2004)
6) IS 456-2000 Specifications for plain and reinforced concrete.
7) Marta Kosior-Kazberuk (2007) Strength Development o concrete with fly ash addition, Journal of Civil Engineering and Management, ISSN1822