Experimental studies on concrete by partial replacement of cement with flyash

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Abstract

Concrete is the most abundant manmade material in the world. Concrete place a vital role in the development of the infrastructure. However the production cement is responsible for approximately 5% of the world's carbon dioxide emissions. High strength concrete is a concrete meeting special combinations of performance and uniformity requirements that can't be always achieved routinely by using conventional constituent and normal mixing.In this paper we had made an attempt to investigate the compressive strength of the M40 grade concrete by incorporating the materials such as Fly ash and Foaming agent in different proportions.The proportions of the different materials used are Flyash (0%, 25%, 50%).The experimental results shows after the casting in testing of 30 samples are: The water absorption values of the concrete is greater for the foam concrete compared with the without foam concrete. The compressive strength values of the concrete is greater for the without concrete compared with the foam concrete. The results are finally conclusion in this project.

Keywords:Acid Attack, Bond Strength, Compressive strength, Flexural strength, Split Tensile strength.

I.INTRODUCTION

Concrete is the most widely used man-made construction material in the world, and is second only to water as the most utilized substance on the plant. It is obtained by mixing cementing material, water and aggregate, and sometimes admixtures, in required proportions. The mixture when placed in forms and allowed to cure, hardens into a rock-like mass known as concrete.Famous concrete structures include the Hoover Dam, the Panama Canal and the Roman pantheon. The earliest large-scale users of concrete technology were the ancient Roman, and concrete was widely used in the Roman Empire. The colosseum in Rome was built largely of concrete, and the concrete dome of the Pantheon is the world's largest unreinforced concrete dome.Today, large concrete structures (for example, dams and multi-storey car parks) are usually made with reinforced concrete.

1.1OBJECTIVE OF STUDY

1. To Achieve M40 N/mm^2

2. To study the strength parameters by reinforcing fly ash, glass fiber, foaming agent in high strength concrete.

2. LITERATURE REVIEW

S. Soleimanzadeh, M. A. OthumanMydin in this study the high temperature flexural strengths of lightweight foamed concrete (L F C) containing flyash (FA) was investigated experimentally and statistically. The variables included were temperature (in the range 20 to 600^{0}C), LFC densities of 600,800,1000,1200,1400 kg/m^3 and additive content. The mix were made by replacing 15% and 30% of cement mass with FA.

A. Sivakumar and P. Gomath The production of concrete requires aggregate as an inert filler to provide bulk volume as well asstiffness to concrete. Crushed aggregates are commonly used in concrete which can be depleting thenatural resources and necessitates an alternative building material. This led to the widespread researchon using a viable waste material as aggregates. Fly ash is one promising material which can be used asboth supplementary cementitiousmaterials as well as to produce light weight aggregate. Artificialmanufactured lightweight aggregates can be produced from industrial by-products such as fly ash,bottom ash, silica fume, blast furnace slag, rice husk, slag or sludge waste or palm oil shell, shale,slate, clay.

XiaoluGuo a, Huisheng Shi a, Warren A. Dick in Geopolymers prepared from a class C fly ash (CFA) and a mixed alkali activator of sodium hydroxide and sodium silicate solution were investigated. A high compressive strength was obtained when the modulus of the activator viz., molar ratio of SiO_2/Na_2O was 1.5, and the proper content of this activator as evaluated by the mass proportion of Na_2O to CFA was 10%. The compressive strength of these samples was 63.4 MPa when they were cured at 75 C for 8 h followed by curing at 23 C for 28 d

3.1 Materials Used In Project Work:

The following are the materials used per 1cu.m of concrete.

3.1.1 M40 Grade Concrete:

Mix design :

- ✓ The mix design adopted in this project work is**1:1.817:3.731**

3.2 Admixtures:

- Super plasticizer brand name = Fosroc
- Modal name = Conplast Sp 430
- Chemical name = Sulphonated

3.5 Calculation

The following are the calculations for special materials used per 1 cu.m of cement.

3.5.1 Fly Ash

ANATOMY OF FLY ASH

3.5.2Foaming Agent

FOAMING AGENT

<u>4.1EXPERIMENTAL WORK</u>

4.1.1 CHARACTERISTIC COMPRESSIVE STRENGTH

Definition : Compressive strength is the capacity of a material or structure to withstand loads tending to reduce size, as opposed to tensile strength, which withstands loads tending to elongate

Procedure :

1. Representative samples of concrete shall be taken and used for casting cubes 15 cm x 15 cm x 15 cm or cylindrical specimens of 15 cm dia x 30 cm long.
2. The concrete shall be filled into the moulds in layers approximately 5 cm deep. It would be distributed evenly and compacted either by vibration or by hand tamping. After the top layer has been compacted, the surface of concrete shall be finished level with the top of the mould using a trowel; and covered with a glass plate to prevent evaporation.
3. Specimen shall be tested immediately on removal from water and while they are still in wet condition.
4. The bearing surface of the testing specimen shall be wiped clean and any loose material removed from the surface. In the case of cubes, the specimen shall be placed in the machine in such a manner that the load cube as cast, that is, not to the top and bottom.
5. Align the axis of the specimen with the steel platen, do not use any packing.
6. The load shall be applied slowly without shock and increased continuously at a rate of approximately 140 kg/sq.cm/min until the resistance of the specimen to the increased load breaks down and no greater load can be sustained. The maximum load applied to the specimen shall then be recorded and any unusual features noted at the time of failure brought out in the report.

TABLE 4.2 - FOR 0% FLYASH , 0% FOAMING AGENT

S.No.	Initial wt. Kg's (W1)	Final wt kg's (W2)	Water – absorption W%= $\frac{W1-W2}{W1} * 100$
1	8.220	8.315	1.2
2	8.445	8.535	1.1
3	8.235	8.335	1.2

∴ Average water absorption for 7 days W% = $\frac{1.2+1.1+1.2}{3}$

= 1.17%

TABLE 4.3 - FOR 25% FLYASH , 0.5% FOAMING AGENT

S.No.	Initial wt. Kg's W1	Final wt kg's W2	Water – absorption W%= $\frac{w_2-w_1}{w_1} \times 100$
1	7.875	7.955	1.02
2	7.820	7.900	1
3	7.960	8.045	1.1

∴ Averagewater absorption for 7 days W% = $\frac{1.02+1.0+1.1}{3}$

= 1.04%

TABLE 4.4 - FOR 50% FLYASH , 0.7%FOAMINGAGENT

S.No.	Initial wt. Kg's W1	Final wt kg's W2	Water – absorption W%= $\frac{w_2-w_1}{w_1} \times 100$
1	7.980	8.030	0.63
2	7.920	7.970	0.63
3	7.985	8.030	0.56

Average water absorption for 7 days W% = $\frac{0.63+0.63+0.63}{3}$

= 0.606%

- **With foam for 7 days**

TABLE 4.5 - FOR 0% FLYASH , 0% FOAMING AGENT

S.No.	Peak load (KN)	Peak stress (KN/m^2)
1	743.7	33.05
2	838.7	32.27
3	658.3	29.25

∴Average compressive strength for 7 days = $\frac{33.05+32.27+29.25}{3}$

= 31.52 KN/m^2

TABLE 4.6 - FOR 25% FLYASH , 0.5% FOAMING AGENT

S.No.	Peak load (KN)	Peak stress (KN/m^2)
1	612.6	27.22
2	576.0	25.60
3	595.5	26.46

∴ Average compressive strength for 7 days = $\frac{27.22+25.60+26.46}{3}$

= 26.42 KN/m^2

TABLE 4.7 - FOR 50% FLYASH ,0.9% , FOAMING AGENT

S.No.	Peak load (KN)	Peak stress (KN/m^2)
1	228	10.13
2	286.6	12.73
3	320.2	14.23

∴ Average compressive strength for 7 days = $\frac{10.13+12.73+14.23}{3}$

= 12.36 N/mm^2

❖ **With Foam For 28 Days**

TABLE 4.8 - FOR 0% FLYASH ,0%, 0% FOAMING AGENT

S.No.	Peak load (KN)	Peak stress (KN/m^2)
1	1086.5	48.29
2	1080.2	48.01
3	1073.9	37.98

$\therefore$ Average compressive strength for 28 days= $\frac{48.29+48.01+37.98}{3}$

$= 44.76\ N/mm^2$

TABLE 4.9 - FOR 25% FLYASH , 0.5% FOAMING AGENT

S.No.	Peak load (KN)	Peak stress (KN/m^2)
1	647.2	28.76
2	826.1	36.71
3	806.0	35.82

$\therefore$ Average compressive strength for 28 days = $\frac{28.76+36.71+35.82}{3}$

$= 33.76\ N/mm^2$

TABLE 4.10 - FOR 50% FLYASH , 0.7% FOAMING AGENT

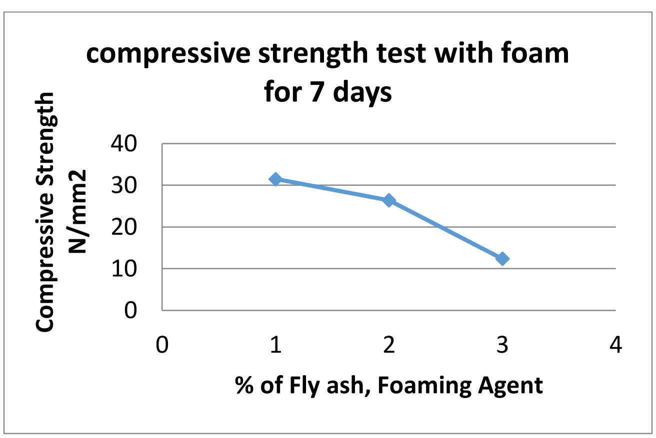
S.No.	Peak load (KN)	Peak stress (KN/m^2)
1	677.1	30.09
2	645.5	28.68
3	645.1	28.67

$\therefore$ Average compressive strength for 28 days= $\frac{30.09+28.68+28.67}{3}$

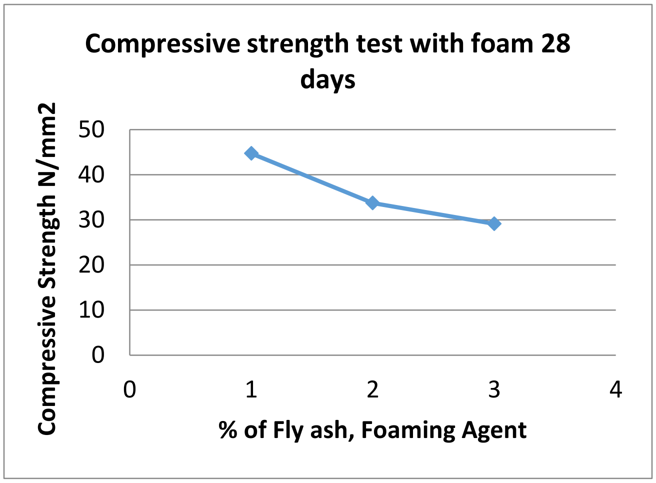
$= 29.14\ N/mm^2$

Discussions:

5.1 Graphs For Characteristic Compressive Strength



Graph 5.2Characteristic Compressive Strength Test with foam For 28 Days



6.CONCLUSIONS :

After the extensive study of "Behavior of a Foam Concrete of a Partial Replacement of Cement with Fly ash. The following conclusions are drawn in this project work.

7. References:

- S.soleimanzadeh,M.A.Othuman Mydin, Influence of high temperatures on flexural strength of Foamed concrete containing Fly Ash and Polypropylene Fiber International Journal Engineering Transactions B: Applications Vol. 26, No.1, (February 2013) 117-126.
- A. Sivakumar and P. Gomathi, Pelletized Fly ash lightweight aggregate concrete: A Promising material. Journal of CIVIL Engineering and construction Technology Vol.3(2), PP 42-48 February 2012. .
- Ashish S. Moon, Dr. Valsson Varghese, S.S. Waghmare, Foam concrete as A Green Building Material. International Journal For research In Emerging science and Technology, Vol.2, Issue-9, Sep-2015
- Xiaolu Guo, Huisheng Shi, Warren A. Dick, compressive strength and microstructural characteristics of class c Fly ash geopolymer, Article in cement and concrete composites. February 2010.