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Analyzing the Performance of Glass Fiber High Strength Concrete (GFHSC) With Fly Ash

[1]Shrinkhala Dewangan and [2]Pooja warke
[1,2]PG Scholar (Structural Engg.), Department of Civil Engineering, G.E.C. Jagdalpur, India

Abstract-- Concrete is widely used in various structure. To improve the performance of development of concrete, essential additive both chemical and mineral material were used. To increase the strength of concrete using Glass Fiber High Strength Concrete (GFHSC) in India, this is produced with locally available material. Fly ash is a mineral material which is obtained from thermal power plant. This paper of experimental research to determine the properties of GFHSC with fly ash contain. Cement is widely used in construction but recently concrete cement is replaced by admixture such as fly ash, silica fume, quarry dust etc and glass fiber is mixed to improve the high strength of concrete and to reduce creep and shrinkage. In paper glass fiber used in different volume with 5%, 10% and 15% replacement of cement by fly ash used in concrete mix of M-20 and M-30 grades. A superplastizier (0.5% by weight of cement) is used in both fly ash and glass fiber to reduced its workability. the ultrapulse velocity and split tensile strength test is performed for 7 and 28 days.

Keyword-- *Fly ash, glass fiber, high strength concrete, superplastizier*.

I. INTRODUCTION

Engineer and material technologies get involved in optimize the strength of concrete, throughout the history of building material concrete is mostly used. Revision of high strength can be done with each sequent development and these corresponding strength increases. about 30 years ago, the strength able was applied to concrete having strength above 40mpa. During 90's use of HSC has taken its due place in India construction scenario. of last concrete varying from 45MPa to 60MPa has been used in high rise building at Mumbai, Delhi and other Metropolitan cites. Similarly HSC was employed in bridge and fly over. HSC produced with the use of glass fiber is known as Glass Fiber High Strength Concrete (GFHSC). In very short time after using high strength concrete in India, it is catching up very fast.

Fly ash is a finely divided inorganic element resulting from the combustion of crushed or powdered coal obtained from thermal power plant and transported through flue gases and collected on electrostatic percipitate. The use of fly ash as concrete admixture not only extend technical advantage to the properties of concrete but also contributes to the environmental pollution control. it reduce the amount of water which produce slump. Basically water demand in mix with fly ash is reduced upto 3% to 10% depending on quantity and class of fly ash used. It also reduce the quantity of sand used in mix which gives workability. In this research paper experiment is represent the study of concrete by replacing cement for fly ash. These usage improve the performance of concrete and comparing its strength with plain cocnrete.

Figure 1: Fly Ash

A. Glass Fiber

Glass fiber is recently introduced in making fiber concrete. it has very high tensile strength about 1020 to 4080 N/mm^2. Glass Fiber is originally used in co-occurance with cement was found to be effected by alkaline condition of cement. since, alkali resistant glass fiber by trade name "CEM-FIL" has been developed and used. Due to use of glass fiber in concrete mix improve the strength and reduce cracks in concrete. Glass Fiber High Strength Concrete (GFHSC) is form the substance of concrete contain glass fiber to produce light weight and strong material. This material is advantageous with low maintained cost, high strength and resistance to crack. it also help the structure with low corrosion resistance, high fire resistance and low thermal expansion

Figure 2: Glass Fiber

II. MATERIAL USED

A. Cement-

Ordinary Portland Cement of 53 grades is used wich is govered by IS 269-1976. The physical properties of Ordinary Portland Cement (OPC):

Physical Properties	**IS 12269-1987**
Fineness (m^2/kg)	225

Initial setting time(minute)	30 min
Final setting time(minute)	600max
Comprssive strength for 3 days(MPa)	25.5 min
Comprssive strength for 7 days(MPa)	36.0 min
Comprssive strength for 28 days(MPa)	51.0 min
Specific Gravity	3.14

B. Aggregate-

This is the most important material in concrete. they give body to the concrete, reduce shrinkage anf effect of economy. The nominal size 20mm crushed cubical aggregate make good concrete. The material should be clean and uniform quality.

Crushed rounded coarse aggregate are loacally availabel material. It is passed throgh 20mm and retained on 4.75 mm sieve. Fine Agrregate is nautral occuring local available material obtaied from indravati river. The aggregate tested according to IS 2386 (Part III): 1963. The result is given in table:

Physical properties	**Coarse Aggregate**	**Fine Aggregate**
Fineness Modulus	2.10	2.86
Specific gravity	2.56	2.65
Water aborption	0.8%	1.5%

C. Glass Fiber-

CEM-FIL type of glass fiber is used in research with modulus of elasticity 70 GPa, specific gravity 2.70 and lenght 12mm

D. Fly ash-

Good fly ash with high fineness and low carbon content. Fly ash is locally available from near electric power plant and its physical and chemical compostion is given in table:

Physical properties	**IS 1727-1967**
Specific gravity	2.14
Wet sieve analysis (% retained on no 325sieve)	50 (dry)
Specific surface (cm^2/g)	2800 to 3200
Chemical Properties	**Percentage**
Silica SiO_2	47-60
Alumina Al_2O_3	21.33
Iron Oxide Fe_2O_3	0.7-6.0
Lime CaO	6-17
Magnesia MgO	1.5-4
Sulphur trioxide SO_3	Trace to 2.5
Loss of ignition	1-2

E. Water-

normal clean water should be free from oil, acid, organic substance and fit for drinking used to cast concrete sample.

F. SuperPlasticizer-

A super plasticizer (SP) based on a modified poly-carboxylate was employed to achieve a better workability of fresh concrete for the different mixes.

III. TESTING OF MIXES

In this experiment mix proportion, 8 batches of concrete were made (4 of M20 grade and 4 of M30 grade) with a Super Plasticizer content. It is designed as per IS 10262:2009 code specification. Mix proportion is given below:

MIX NO.	Grade of concrete	W/C	% GFHSC	% FLY ASH	Cement	Fine aggregate	Coarse aggregate	Water content
M-1	M20	0.50	0	0	350	700	1200	152
M-2			0.03	10				
M-3			0.06	15				
M-4			0.09	20				
M-5	M30	0.40	0	0	380	650	1150	150
M-6			0.03	10				
M-7			0.06	15				
M-8			0.09	20				

Note: Super Plasticizer % = 0.5% by weight of Cement.

IV. PREPARATION

In this experiment 150 cube and 150 cylinder were casted. A total 8 specimen each were puted in cube of 150mm x 150mm x 150mm and cylinder of 150mm x 300mm. All specimen wre perpared in accordance with Indian standard specimen.

V. MIXING, CASTING OF SPECIMEN AND CURING

The materials were weighted and mixed dry in tray and then fiber were spread into the tray during mixing and then water is poured and mixed properly. before casting, mould were cleaned and oiled. pour the mixture into mould which is placed on viberator. After vibaration mould is kept dry for 24hours. then remove the mould and plce the speciment into curing tank for 7 and 28 days.

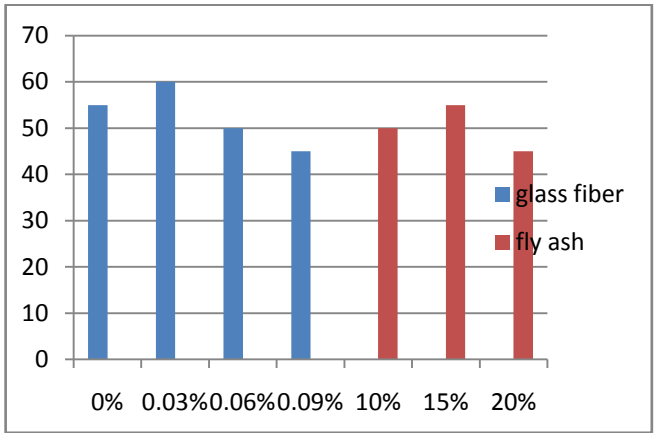
VI. TEST PERFORMED

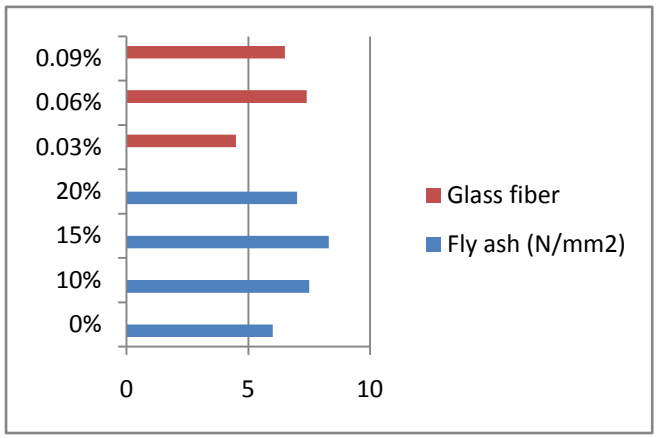
Following test were performed for concrete to check its stability:

1. Slump Test
2. Ultapulse velocity Test
3. Splite Tensile Test

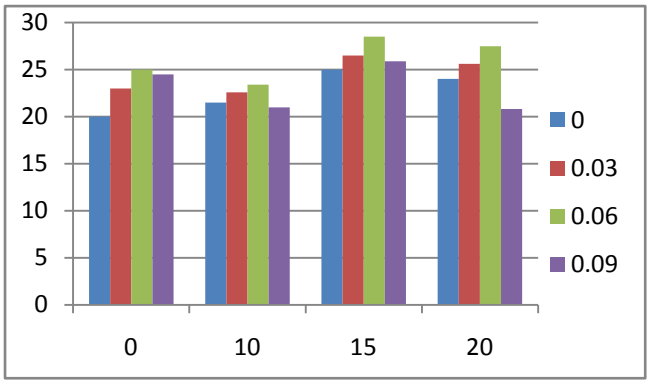
VII. RESULT AND DISCUSSION

A. Slump

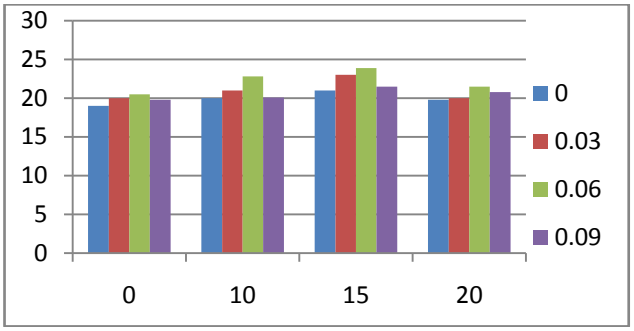




B. Ultrapulse Velocity



C. Split Tensile Strength



CONCULSION

slump test for workabilty of GFHSC mix decrease with increasing its percentage and fly ash content with replacement with cement shows decrease in workabiltiy while increasing its quantity.

Ultrapulse velosity and split tensile strength of GFHSC mix incrrase with increase in percentage of fly ash upto 15% both for 7 days and 28 days.

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