Increasing Strength of Concrete by Using Glass Fiber

Mr. Mate Akash[1], Miss. Avhad Yogita[2], Miss. Ghuge Sandhya[3], Miss Ingale Vidya[4]
[1, 2, 3, 4] Matoshri Aasarabai Polytechnic, Eklahare

Abstract-*The present day world is witnessing the construction of very challenging and difficult civil engineering structures. Quite often, concrete being the most important and widely used material is called upon to possess very high strength and sufficient workability properties. Efforts are being made in the field of concrete technology to develop such concretes with special characteristics. Researchers all over the world are attempting to develop high performance concretes by using fibers and other admixtures in concrete up to certain proportions. We are use glass fiber like admixture because waste glass fiber are we used directly at the time of dry mixing of concrete. Fibers impart energy absorption, toughness and impact resistance properties to fiber reinforced concrete material and these characteristics in turn improve the fracture and fatigue properties of fiber reinforced concrete research in glass fiber reinforced concrete resulted in the development of an alkali resistance fibers high dispersion that improved long term durability. This system was named alkali resistance glass fiber reinforced concrete. In the present experimental investigation the alkali resistance glass fibers has been used to study the effect on compressive, split tensile and flexural strength on M20, M30, M40 and M50 grades of concrete.*

I. INTRODUCTION

Glass fiber reinforcement concrete are alkali resistant in nature this term is very important to increase compressive strength, flexural strength and as well as split tensile strength. This glass fiber is used of bunch of GF in 10mm, 12mm &16mm diameter. As per study it gets observed 150% tensile strength than without GFRC structure. [01]

Flexural strength of glass fiber reinforcement concrete increases more than 1.5 times at 1.5 & 2.0% mix ratios with respect to control mix.

Compressive strength of GF blended concrete is more than control sample at 1.5% mix ratio. The same is also verified from ultrasonic pulse velocity test control sample.

UPV compressive strength value is lesser than corresponding cube compressive strength values.

Split cylinder strength value are also maximum at 1.5% mix ratio for all testing ages these area18%, 26%, 13%, & 11% more than control sample at 3,7,14,28, & 56 days respectively. [02]

A reduction in bleeding is observation by addition of glass fiber in the glass fiber concrete mixes; intensity of concrete improves its homogeneity and reduces the probability of cracks.

The percentage increase of compressive strength of various grades of glass fiber concrete mixes compressed with 28 days compressive strength is observed from 20 to 25%. [03]

Now a day's waste management is main fact which are create question mark in human mind so we are used waste glass fiber as admixture to increase compressive as well as tensile strength of concrete when we done dry mixing of material at that time we added glass fiber directly to get properly mixed.

II. EXPERIMENTAL PROGRAM

We are conducted following test on material to properly improve experimental properties of concrete.

Test of cement:-

Table.1 properties of cement

Sr. no	Descriptions	Results
01.	Specific Gravity	3.11
02.	Initial setting time	27 Min
03.	Final setting time	545 Min

- **Test on fine aggregates: -**

Sr. no	Descriptions	Results
01.	Specific Gravity	2.8
02.	Fineness modulus	3.31 %
03.	Water absorption	0.33 %
04.	Free surface moisture	3.53 %

Table.2 properties of fine aggregates

- **Tests on coarse aggregates: -**

Sr. no	Descriptions	Results
01.	Specific Gravity	3.72
02.	Fineness modulus	3.26 %
03.	Water absorption	0.13 %
04.	Free surface moisture	0.29 %

Table.3 properties of coarse aggregates

Sr. no.	IS Sieve size	Weight retained in gm	Cumulative Wt. Ret.	Cumulative Wt. Ret. %	% passing
01	4.75	104	5.20	5.20	94.8
02	2.36	60	3	8.20	91.8
03	1.18	172	8.6	16.80	83.2
04	600	516	25.8	42.60	67.4
05	300	656	32.8	75.40	24.6
06	150	488	24.4	99.8	0.2
07	Pan	4	0.2	100	00
	Total			331.6	

Table.4 fineness modulus of fine aggregates

- **Tests on water: -**

Test on water	value
P^H of water	6.91
Temperature of water	28°C

Table.6 properties of water

Table.5 fineness modulus of coarse aggregate

Sr. no.	IS Sieve size (mm)	Weight retained in gm	Cumulative Wt. Ret.	Cumulative Wt. Ret. %	% passing
01	80	0	0	0	0
02	63	0	0	0	0
03	40	0	0	0	100
04	20	1700	34	34	66
05	10	3000	60	94	6
06	4.75	200	4	98	2
07	2	100	2	100	00
	total			326	

- **Test on glass fiber: -**

Test on glass fiber	description
Chemical property	Alkaline
Reaction with cement	No
Water absorption	increases
Diameter &length	Random

Table.7 properties of GF

Fig.01 waste of glass fiber.

III. MIX DESIGN

A total no of 4 mixes were caste using different percentage of glass fiber by weight of cement. The proportion of cement, sand, aggregates waste kept same for all mixed. Various parameter used in the research are given below.

- Concrete mix ratio :- 1:1.92:3.81
- Water cement ratio:- 0.55
- Glass fiber percentage by weight of cement 0%, 0.15%, 0.17% & 0.19%.

- Mix with 0% GF content was declared as control mix.

Casting of test samples:-

A total no of 36 cubes were cast for compressive strength and 36 beams for flexural strength test. Detailed break-up along with dimensions of sample is given in table (08)

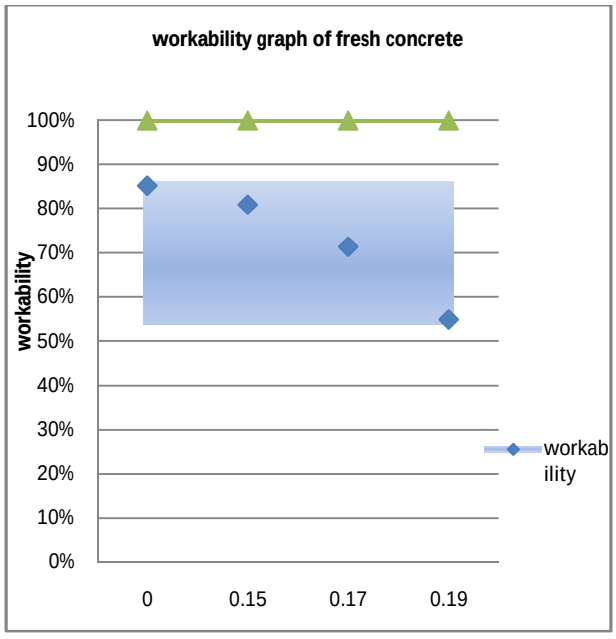
Test	specimen	days			total	For 4 mix
		7	14	28		
Compressive Strength	Cube 150x150x150	3	3	3	12	36
Flexural strength	Beam 500X220X35	3	3	3	12	36

Table.8 casting schedule of specimen.

IV. RESULT AND DESCRIPTION

Workability

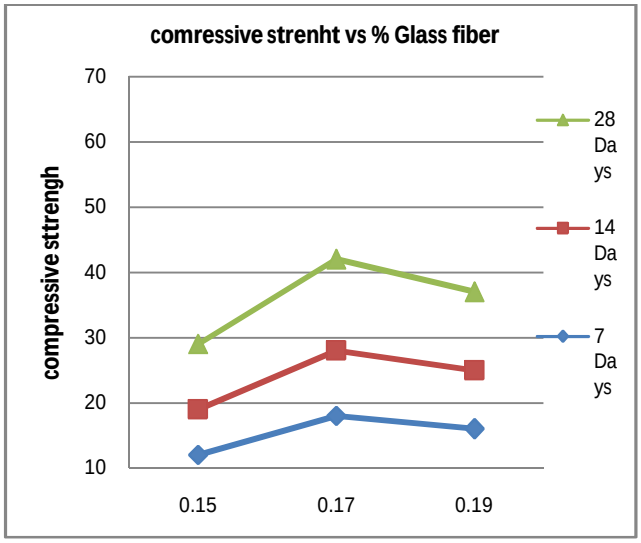
Slump cone test was carried out conforming to workability of this mix is will get increase or decrease by different percentage of glass fiber slump cone results are plotted on following graph.



Slump value versus glass fiber content there is gradually decease in the slump value with addition of glass fiber workability get decrease slightly means GF are absorbed the water thus water reaching admixture are used to get reduce water absorption.

Compressive strength:-

Effect of adding glass fiber in different ratio on compressive strength of concrete was studied by testing cubes of standard dimensions conforming to BS 12390: part 3. Cube was tested at the age of 7 days, 14 days & 28 days. Results are plotted in graph (02) it represents the change in compressive strength value as compared to control specimen. Strength activity index for each mix was also calculated using ATMC 618 (ASTM, 2008 b) and is given in table(09) strength activity index may be defined as ASI= (A/B)X100% where A is the average compressive strength of blended concrete cubes and B is the average compressive strength of control specimen without glass fiber content.



Result shows that there is a marginal increase in 28 days compressive strength for 0.15% addition of GF while compressive strength increases at all ages for 0.17% addition of GF control as compressive strength has only 2.7 to 3.5% net increase compared with control specimen. However, 28 days compressive strength with reference to control mixes. Compressive strength at 0.17% mix ratio of GF content is 0.15%, 0.17% & 0.19% more effective as compare to plain concrete at 7, 14 & 28 days respectively. Result are indicates the maximum increasing strength at 0.17% mix but when we are increases percentage of glass fiber then strength get decreases slightly. So the effective mix is 0.17%.

Sr. no	**% of glass fiber**	**Breaking Load (KN)**		
		7 Days	14 Days	28 Days
01	0.00	412.75	480.20	545.56

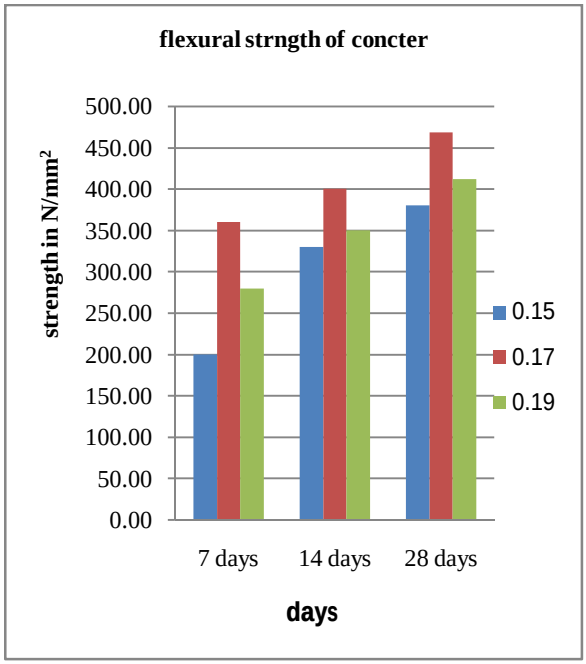
		354.41	478.56	521.85
		420.88	503.50	565.10
02	0.15	471.10	676.00	756.40
		456.91	702.60	722.66
		464.64	692.47	786.56
03	0.17	489.20	786.74	1023.10
		488.56	791.57	952.43
		493.40	796.50	977.18
04	0.19	456.00	565.11	836.46
		470.20	589.94	804.00
		422.46	516.90	784.29

Table.9 result of compressive strength of specimen

Flexural strength:-

The flexural strength are conducted for the tensile strength acting on slab or beams there are three point modulus of rupture test conforming to ASTM C78-02 was performed as well as blending sample at the age of 28 days, to ascertain their flexural strength. Results are shown in graph 3. Strength activity index values, given in Table10 reveal that no mix ratio of GF exhibit flexural strength less than that of concrete sample. Also MOR values for 0.17% mix ratio are 57% more than that for control sample. When glass fiber is increase then strength get loss because extra GF are absorbing the maximum quantity of water and binding material get segregate.

% of GF	0.00%	0.15%	0.17%	0.19%
Flexural strength(main)KN/mm^2	265	380	468	412



Graph.3 flexural strength of specimens

Fig.2 flexural test on specimen

Fig.3 compressive test on specimen.

V. CONCLUSIONS

- Addition of glass fiber in concrete increases compressive strength comparatively plain concrete up to 111.65% at effective mix 0.17%.
- Maximum main compressive strength of glass fiber mixed concrete is 984.24 KN/m^2
- When quantity of glass fiber is increases then workability are slightly decreases because glass fiber is absorbed water and material gets dry.
- When we added glass fiber more than 0.17% then strength of concrete will get decreases so that effective mix is 0.17%
- Reaction of some admixtures is reacted with glass fiber and affected on strength of concrete like ragine are directly separate the binding material.

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