

## USE OF AR-GLASS FIBER BY VARYING PERCENTAGE WITH M20 CONCRETE

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**ABSTRACT:** Concrete is one of the most used construction material used in the world today due to its vast properties and applications. After the addition of fibers in the concrete, its properties are further improved. One such fiber used in concrete is glass fiber. Glass fiber when added to concrete also improves its properties. Advantage of glass fiber is its non-corrosiveness and light weight, thus becomes economical. The present paper outlines the use of a glass fiber in concrete mix of M20 to study its performance and properties such as compressive strength, split tensile strength and flexural strength at varying percentages of glass fiber (0.25%, 0.33%, 0.66% and 1%) after 7 days and 28 days respectively. Cem-fill anti crack, high dispersion, alkali resistance glass fiber of diameter 16 micron, having aspect ratio of 875 was employed on percentages, and its properties were studied.

**Keywords:** Cem-fill anti crack glass fiber, Cement, Fine aggregate, Coarse aggregate, Compressive strength, Split tensile strength, Flexural strength.

### I. INTRODUCTION

Concrete is a material which possess low tensile strength, limited ductility and also little resistance to cracking. Despite these disadvantages concrete is used world wide for different construction purposes. Material called fiber is added in concrete mix instead of normally used reinforcing material (usually deformed steel bars or pre-stressing tendons). Fibers possess high tensile strength. These fibers when are added in certain proportions in concrete mix increases its cracking strength and act as a crack arrester. One such type of fiber used in concrete is glass fiber. These fibers improves the properties of concrete such as compressive strength, split tensile strength and flexural strength.

### II. LITERATURE REVIEW

Various literature reviews has been carried out by different investigations regarding the use of glass fiber in concrete. Various papers have been published about the use of glass fiber in concrete till now. With regard to my topic various authors have worked on concrete with glass fiber and they concluded that its ductility gets improved, compressive strength, flexural strength and split tensile strength gets also increased as compared with ordinary plain concrete. Chandramoili et al has observed that compressive strength of various grades of glass fiber concrete mixes gets increased compared with 28 days compressive strength by 20 to 25%. Split tensile strength and flexural strength of various grades of glass fiber concrete gets increased by 15 to 20%. SrinivasaRao et al has studied the effect of AR- glass fiber on durability of the concrete from the aspect of

resistance to acid attacks. He observed that with the addition of glass fiber in concrete, its durability of resistance to acids gets increased. It was also observed that there was no effect of sulphates on concrete. Chloride permeability of glass fiber reinforced concrete shows less permeability of chlorides into concrete when compared with ordinary concrete. Babu investigated that addition of glass fiber in concrete increases its compressive strength upto 1% by volume at higher fiber having aspect ratio of 857.1. Avinash Gornale, et al studied the strength aspect of glass fiber reinforced concrete. The study shows that increase in compressive strength, flexural strength, split tensile strength for M20, M30 and M40 grades of concrete at 3, 7 and 28 days were observed to be 20% to 30%, 25% to 30% and 25% to 30% respectively after the addition of glass fiber as compared to ordinary plain concrete.

### III. EXPERIMENTAL PROGRAM

The different materials used in experimental work are as enlisted below:

**Cement:** The cement used in experimental work has been 43 grade Portland Pozzolona Cement available in local market. The cement used has been tested and resulted were as per IS 1489. The specific gravity was 3.15.

**Coarse Aggregate:** Crushed angular aggregates locally available of size 10mm and 20mm were used as coarse aggregate. The specific gravity was 2.69 and 2.68 respectively.

**Fine Aggregate:** Zone III sand locally available was used as fine aggregate. The specific gravity was 2.67.

**Glass fiber:** Glass fiber used was cem-fill Anti-crack HD with modulus of elasticity 72GPA, Filament of diameter 16 microns, specific gravity 2.68 length 14 mm. The properties of glass Fiber are shown in table 1 and fig no.1 is AR- glass fiber.



Fig no.1: AR-Glass Fiber

Table 1: Properties Of Glass Fiber

Sr. No.	Properties	Description
1.	Type	AR glass fiber
2.	Diameter(micron)	16
3.	Length(mm)	14

4.	Density	2680kg/m <sup>3</sup>
5.	Elastic modulus(GPa)	72
6.	Tensile Strength(Mpa)	1700
7.	Specific Gravity	2.68
8.	No. of fibers(million/kg)	224

Water: Locally available water was used with PH of 7.

Test Specimen: Test specimens of 150×150×150 mm cubes were used.

Concrete Mix:M20 grade of concrete mix has been used for calculating the quantities used in per cubic meters are shown in table 2.The water cement ratio has been fixed.

Table 2:Mix Proportion Of Material

Sr.No.	Material	Quantity per m <sup>3</sup> in kg
1.	Cement 43 grade ppc	325
2.	Fine aggregate	778
3.	Coarse aggregate(10mm)	468
4.	Coarse aggregate(20mm)	703.20
5.	Water	168
6.	Fiber	0-1% by weight of mix
7.	Super plasticizer	5

Mixing Procedure: The cement and sand were mixed dry and after that water /admixture and polymer(if used) were added/Generally a two-speed fiber blender mixer were used. With this mixer used, the fast speed is designed to create smooth creamy slurry. It takes about one-two minutes. The speed of the mixer is then slowed and then chopped glass fiber of length approximately 14mm is added. The fiber is blended into mix for about 1 min to form uniform mix. After mixing is done, Proper compaction is done for about 2 to 4 days during the casting of mix into moulds by using vibrating table.The mix casted in moulds for each % of fiber sufficient no. of cubes are shown in table 3.

Table 3:Number of Cube Specimen Cast Using Different % of Fiber Content

% fiber	0%	0.25%	0.33%	0.66%	1%
No. of cubes	2	2	2	2	2

#### IV. RESULTS AND DISCUSSIONS

##### Compressive Strength

The compressive strength was conducted on the specimens as per Is code 516-1959.The observation from our results shows that the increase in compressive strength is upto 36% in case of adding 0.33% glass fiber content as compared to ordinary plain concrete. Table 4 shows the variation of compressive strength at different fiber content after 7 and 28 days respectively and Fig 2 shows compression testing arrangements. It is evident from the table that compressive strength gets increased on addition of fiber.

Figure no.2: Compression Testing Machine



Table no. 4

Mix Designation	% fiber	Compressive strength after 7days(N/mm <sup>2</sup> )	Compressive strength after 28 days(N/mm <sup>2</sup> )
C 0	0	20.1	30
C 1	0.25	25.82	38.54
C 2	0.33	27.43	40.95
C 3	0.66	20.1	30
C 4	1	19.28	28.79

Split Tensile Strength: The Split tensile test was conducted according to IS code 516-1999.From the experiments conducted on glass fiber concrete, it is clear evident that split tensile strength gets increased with increase in glass fiber content. It is clear that split tensile strength gets increased from 2.09 to 2.78N/mm<sup>2</sup> at 0.25%,from 2.78 to 2.90N/mm<sup>2</sup> at 0.33%,then gets slightly decreased from 2.90 to 2.82N/mm<sup>2</sup> at 0.66 and then again gets further decreased from 2.82 to 2.72N/mm<sup>2</sup> at 1% fiber content. It is evident from the table that split tensile strength of glass fiber is significantly increased than its compressive strength and flexural strength.

Table no.5

Mix Designation	% fiber	Split Tensile Strength after 7 days(N/mm <sup>2</sup> )	Split Tensile Strength after 28 days(N/mm <sup>2</sup> )
C 0	0	2.09	3.14
C 1	0.25	2.78	3.95
C 2	0.33	2.90	4.20
C 3	0.66	2.82	4.14
C 4	1	2.72	4.10

Flexural Strength: The percentage increase in flexural strength of glass fiber concrete is observed to be 130% more as compared to ordinary plain concrete. It is clear shown from the table no.6 that after the addition of glass fiber up to 0.33%,flexural strength gets increased by 150%.Table no.6 shows flexural strength of glass fiber concrete at different percentage of glass fiber after 7 and 28 days respectively.Fig.no.3 shows the flexural strength testing arrangements.



Fig no. 3: Flexural Strength Testing Arrangements

Table no.6

Mix Designation	% fiber	Flexural Strength after 7 days(N/mm <sup>2</sup> )	Flexural Strength after 28days(N/mm <sup>2</sup> )
C 0	0	1.88	3.18
C 1	0.25	3.64	7.10
C 2	0.33	3.90	7.30
C 3	0.66	4.14	7.55
C 4	1	3.56	7.02

## V. CONCLUSION

The Conclusion of the above work done are as enlisted below:

- a. It has been observed that the workability M20 concrete gets decreased after the addition of Glass Fiber. But this problem is over come by using Plasticizers and Super-Plasticizers.
- b. The percentage increase of compressive strength of varioud grades of glass fiber concrete mixes compared with 7 and 28 days compressive strength is observed 36%.
- c. The increase in Compression strength, Flexural Strength, Split Tensile Strength for M20 grade of concrete at 7 and 28 days are observed to be 20-30%, 25-30% and 25-30% respectively. when compared with ordinary plain concrete with 28 days strength.
- d. It has also been observed that there is a gradual increase in compressive and flexural strength as compared to ordinary concrete and there is also sudden increase in split tensile strength of glass fiber reinforced concrete as compared to plain ordinary concrete.
- e. Addition of glass fiber in the concrete acts a crack arrester.
- f. Addition of glass fiber in the concrete improves its ductility.

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