STUDY ON STRENGTH OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH ALKALI RESISTANT GLASS FIBRE

AJITH KUMAR[1], CHETHAN L K[2], YOGESH D[3], DHARANESH M P[4]

[1]Asst. professor, Department of Civil Engineering, Channabasaveshwara Institute of Technology, Gubbi, Tumakuru , India.
[2,3,4] Students, Department of Civil of Engineering, Channabasaveshwara Institute of Technology, Gubbi, Tumakuru, India.

Abstract - *In the whole world concrete is mostly used material in mass quantity for a construction. It is expected that in the near future, the Civil Engineering community will have to produce structures in hormony with concept of sustainable development. A number of studies have been carried out to investigate the possibility of utilizing a broad range of materials as partial replacement material for cement in the production of concrete using various different materials. Alkali Resistant Glass Fibers are designed specially for use in concrete.* The project deals with the investigating characteristics of M20 concrete with partial replacement of cement with Glass Fiber. The scope of present investigation deals with the strength properties of concrete, on the effect of partial replacement of cement by Glass Fiber with different percentage (i.e., 1.5%, 3%). The tests are conducted to find out the compressive strength, split tensile strength, at the age of 7days and 28 days.

***Key Words*: Alkali Resistant Glass Fiber, Compressive strength, Split tensile strength, M20 Concrete.**

1.INTRODUCTION

Concrete is most widely used man-made construction material in the world. It is obtained by mixing of two components I.e., aggregate and paste. Usually the paste is mix of Portland cement and water, binds the aggregate (usually sand and gravel or crushed stone) into a rocklike mass known as Concrete. The hardening is because of the chemical reaction of the cement and water, which continue for long period leading too stronger with age. The usefulness elegance and the durability of concrete structures, built during the first half of the last century with ordinary portland cement (OPC) and plain round bars of mild steel. The easy availability of the ingredients (compromising quality) of concrete was used. Strength was emphasized without a thought of the durability of structures. As a consequence of the liberties taken, the durability of concrete was highly affected. After 1970 or thereabout the use of high strength tensile bars with surface deformation started. Significant changes in constituents and properties of concrete were initiated and Engineers started using supplementary cementitious materials and admixtures in concrete, often without adequate considerations.

Concrete is most widely used construction material as several desirable properties like high compressive strength stiffness and durability under usual environment.

At the same time concrete is brittle and weak in tension. These problems can be minimized by usage of glass fibers in concrete. By adding this fibers cracking strength of concrete can be increased.

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2. MATERIALS USED

2.1 Cement

Cement ordinary Portland cement of 53 grade (ultra tech) conforming to IS:12269-1987 was used through out the experiment. The Specific gravity of cement is 3.1, the Fineness modulus of cement is 5.4%, the initial and final setting time of cement are 38 min and 480 min respectively.

2.2 Manufactured-Sand (M-Sand)

Locally available M-Sand passing through 4.75mm IS Sieve having Specific gravity of 2.62 and fineness modulus of 2.4 was used. The M-Sand was dried in sun light before it is used for standard design mix concrete.

2.3 Coarse aggregate

20mm down size natural crushed stone having specific gravity of 2.65 and water absorption of 0.39% was used.

2.4 Water

Locally available portable water is used. Water is important ingredient for strength and durability characteristics of concrete.

2.5 Alkali Resistant Glass Fiber

Alkaline Resistant Glass Fibres of 12mm length fibers are usually round and straight with diameters of 0.014 mm. They could also be bundled together to produce glass fiber bundles with bundle diameters up to 1.3mm. It can be summarized that the utilization of glass fiber in long fiber form has produced composites with high strength. The composites, with glass fiber aspect ratio of 7.05.

Fig:2.5 AR Glass Fibre

3. PROCEDURE:

3.1 Mix Design proportion:

The mix proportion chosen is as follows:

We adopted M20 grade of mix proportion i.e., 1:1.5:3 by partial replacement of cement with increasing percentage of glass fibres. (1.5% & 3%)

3.2 Mix Proportioning:

For compression strength test:

Table 1 Mix proportion for one mould

Identification mark	Cement in kg	M-Sand in kg	Coarse aggregate in kg	AR Glass fibre in gms
B0	1.36	2.35	4.1	-
B1.5	1.23	2.35	4.1	123
B3.0	1.1	2.35	4.1	245

For split tensile strength test:

Table 2 Mix proportion for one cylinder

Identification mark	Cement in kg	M-Sand in kg	Coarse aggregate in kg	AR Glass fibre in gms
B0	8.54	14.78	25.82	-
B1.5	7.77	14.78	25.82	769
B3.0	7.00	14.78	25.82	1530

3.3 Mixing and casting:

- Mixing is done in the normal method i.e.,
- First the cement, sand and coarse aggregate is taken according to their weight and mixed uniformly.
- Then required quantity of water is added to the dry mix and the mixture is mixed until it is homogeneously mixed.
- After the mixing is completed, glass fibers are added to the concrete in the ratio of 1.5 and 3% by replacing cement and the whole mix is mixed properly and this stage over mixing is avoided.
- The moulds are cleaned properly and the inner surface of the mould is properly oiled.Then the concrete is filled inside of the by three layers of 25 blows.
- Once the moulds are filled with concrete mix the excess concrete is removed and the top surface is levelled properly.
- Separate indication for different ratio of glass fibers are given.
- B1.5 for moulds with 1.5% of glass fibres. (6 cubes)
- B 3 for moulds with 3% of glass fibres. (6 cubes)
- B 0 for moulds with 0% of glass fibres. (6 cubes)
- Then the concrete cubes are allowed to set for 24 hours, after 24 hours the concrete cubes are removed

4. Experimental investigation and Results

4.1Compressive strength test:

IS Code 516:1959 was used for method of tests for compressive strength of concrete. When a specimen of material is loaded in such a way that if it extends it is said to be in tension, if the material compressed and shortened it is said to be in compression. . The size of specimens 150mm x 150mm x 150mm. At the time of testing, each specimen must keep in compressive testing machine. The maximum load at which the concrete block break will be noted. From the noted values,
the compressive strength is calculated by using below formula.

Compressive Strength = Load / Area

4.2 Split tensile strength test:

IS Code 5816:1999 was used for method of test split tensile strength of concrete. The size of cylinder is 300 mm (length) x 150mm(diameter). The specimens were tested after 28 days curing . The split tensile strength calculated by using below formula.

Splitting Tensile Strength = $2P/\pi ld$ (Unit = N/mm2 or MPa)

Where: P= Load ,

l= Length of Cylinder ,

d = Diameter of Cylinder

Table 3 Compressive strength test results:

GRADE OF CONCRETE	NO. OF DAYS	COMPRESSIVE STRENGTH N/mm²		
M20		Ordinary Concrete	With 1.5%	With 3.0%
	7	20.66	23.55	25.33
	28	25.66	29.18	29.33

4.3 compressive strength comparison chart:

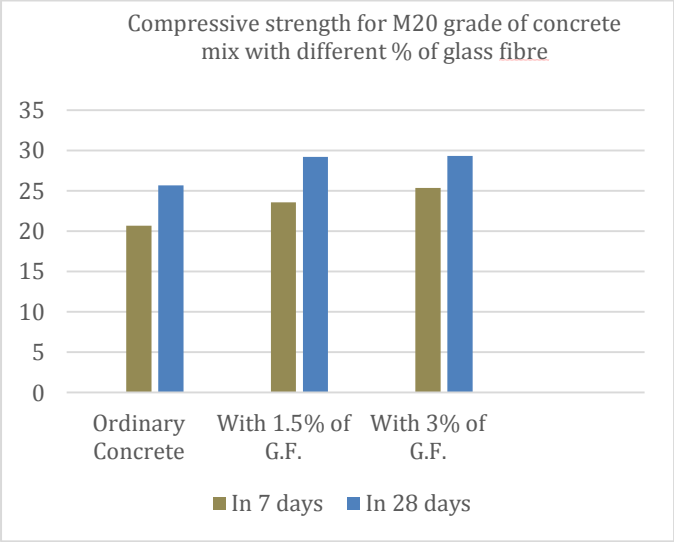
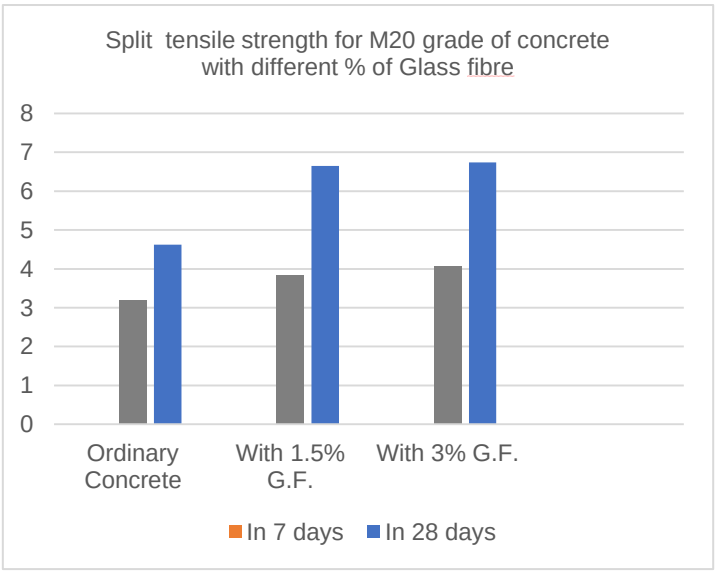


Table 4 Split tensile strength test results:

Grade of concrete	No. of days	Split tensile strength N/mm²		
M20		Ordinary Concrete	With 1.5%	With 3%
	7	3.2	3.82	4.06
	28	4.62	6.55	6.74

4.4 Split tensile strength comparision chart:



5.CONCLUSION

- The percentage increase of compressive strength of various grades of glass fibre concrete mixes compared with 28 days compressive strength is observed from 13 to 19%.
- The percentage increase of split tensile strength of various grades of concrete mixes compared with 28 days is observed from 17 to 21%.
- A reduction in bleeding is observed by addition of glass fibres in the concrete mixes.
- A reduction in bleeding improves the surface integrity of concrete, reduces the probability of cracks

6. REFERENCES

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