

Comparative Performance Evaluation of Fiber Reinforced Concrete & Conventional Concrete

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ABSTRACT: All of us know that the normal concrete possess very low tensile strength, limited ductility and little resistance to cracking. So this focuses towards the experimental investigation of the mechanical properties of glass fiber reinforced concrete with conventional concrete. Fibers while delivered in certain percentage in the concrete improves the property as crack resistance, ductility, as flexural strength and durability. So for enhancing the durability of the structure we are the use of glass fiber. Glass-fiber reinforced concrete (GRFC) is a fabric product of a cementitious matrix composed of cement, sand, water and admixtures, wherein brief duration glass fibers are dispersed. It has been broadly used within the creation enterprise for non-structural factors, like façade panels, piping and channels. GRC gives many advantages, inclusive of being lightweight, heat resistance, appropriate look and strength. For this experimental work we are using glass fibers on the volume fractions of 0.5%, 1% and 2%. After the casting of cubes, beams and cylinder with the above stated quantity fractions we can carry out specific test which include compressive strength, tensile strength and flexural strength respectively. After the completion of this work we compare the results of glass fiber strengthened concrete with that of the normal concrete. From evaluating those two we are able to see that how the addition of the fibers will have an effect on the mechanical properties of conventional concrete and we check that the addition of fibers improves the strength of concrete or not.

KEYWORDS: Glass Fiber, Concrete, Compressive Strength, Flexure Strength, Split Tensile Strength.

I. INTRODUCTION

FRC is a concrete which have fibrous material in concrete that increases the structure integrity. It also includes the short discrete fibers that are randomly oriented and uniformly distributed. FRC is a concrete made primarily of discrete reinforcing fibers, aggregates and hydraulic cements. It is a comparatively new material in construction field. It is a composite fabric consisting of a matrix containing a random distribution of small fibers, both natural or synthetic, having an excessive tensile strength. The cracking power of concrete is multiplied as we add the uniformly dispersed fibers and the fibers performing as crack arresters. All of us know that concrete is always weak in tension so we use the fibers to raise the tensile strength of concrete. It is also found that if we will provide the fibers in small size, uniformly distributed and closely spaced then it will help in decreasing the occurrence of the cracks and will develop its static and dynamic properties.

Paper is organized as follows. Section II describes Literature Review in this Field. Section III describes the Methodology adopted for this work. Section IV describes the Experimental results obtained from the study. Finally, Section V presents conclusion.

II. RELATED WORK

K.I.M.Ibrahim, et al,[1] This paper defined as the experimental investigation of mechanical properties of glass fiber. Glass fiber reinforced concrete is used to make beams, cubes and cylinders containing 0%, 0.1%, 0.3% and 0.5% glass fiber volume fraction. As we compare the plain concrete with the results of glass fibers, this paper confirmed that the percentage increase of glass fiber in concrete gives the positive effects splitting, flexural and compression strength development of specimens at 7 and 28 days. When the 0.1% of glass fiber is added, flexural strength increases about 11.8, split tensile strength increases about 27.1% and compressive strength increases about 7.5% over conventional concrete. When the 0.3% of glass fiber is added, flexural strength increases about 41.2%, split tensile



strength increases about 71.8% and compressive strength increases about 17% over conventional concrete. When the 0.5% of glass fiber is added, flexural strength increases about 58.8%, split tensile strength increases about 94.8% and compressive strength increases about 22.3% over conventional concrete. The strength of concrete increases immensely when we reinforcing with glass fiber.

Mr.Yogesh S.Lanjewar, et al, [2] The main objective of this paper is to check the compressive strength of glass fiber concrete. In this paper we located that on the addition of glass fibers within the concrete it's been determined that the concrete achieved considerably greater strength than that of the conventional concrete. Comparing with everyday concrete strength, the received results resembles that for 7 days, on addition of 1% glass fibers the concrete strength multiplied via 27.08% while on addition of 2% glass fiber 6.34% strength increment is discovered. On the other side when we check the results for 28 days, we get 14.47% increased in concrete strength when we add 1% glass fibers in concrete. While 7.68% increased in concrete strength is observed when 2% glass fibers is added. For 28 days concrete gives more strength when we add glass fibers and coir in normal concrete. After comparing both 7 days and 28 days we get that the 1% glass fiber gives more strength then 2% of glass fibers.

Shrikant M. Harle, et al, [3] The main objective of this study is to check the performance of glass fiber reinforced concrete. we studied Though the initial value is high the general value is greatly decreased because of the good properties of fiber strengthened concrete. The GFRC confirmed almost 20 to 25% increased in split tensile strength, compressive strength and flexural in comparison with 28 days compressive strength of simple concrete. While to improve the durability from the issue of acid attacks on concrete using AR glass fibers had proven true result. So, the GFRC may be used for blast resisting systems, dams, hydraulic systems

III. METHODOLOGY

We are directing this project work for seeing that how the addition of the fibers to the matrix can be useful for the enhancement of the concrete mechanical properties. So in this research work we are going to conduct different test on the materials to be used. After casting of the concrete we will also perform different test on the specimen. As we are going to make M20 grade concrete so for this we have to make mix design. So before making mix design we need to perform different tests on the materials we will be using.

Materials to be used:

Coarse Aggregate,Fine Aggregate,Ordinary Portland Cement (OPC 43),Glass Fibers,Water.

Test On The Material:

Sieve Analysis,Water Absorption Test,Specific Gravity Test.

Cement used	OPC 43grade
Specific gravity of cement	3.10
Specific gravity of coarse aggregates	2.65
Specific gravity of fine aggregates	2.68
Water absorption of coarse aggregates	0.5
Water absorption of fine aggregates	1
Chemical admixture	Nil

Table 1 Test Data of Material



Test On Concrete Before Casting:

Slump Test

Grade designation	M20
Maximum formal sizes of aggregates	20mm
Water cement ratio	0.5
Type of cement	OPC 43 grade
Minimum cement content	300 kg/m ²
Workability	75mm (slump)
Type of aggregates	Angular aggregates
Chemical admixture	Nil

Table 2 Specification Of Material

Test on Concrete After Casting:

Compressive Strength Test, Flexure Strength Test & Split Tensile Strength Test.

Preparation Of Concrete Cubes Steps:

- Mould Details(As Per IS 10086 – 1982) Cube moulds of size 150mm x 150mm x 150mm and cylinder moulds of diameter 75mm and height 150mm were used.
- Batching.
- Proportioning
- Weighing
- Mixing
- Workability
- Placing
- Compaction
- Curing

IV. EXPERIMENTAL RESULTS

Compressive Strength Test Results:

S.NO	M20 + Glass fiber	Compressive strength (N/mm ²)	
		7 days	28 days
1.	0.5%	17.7	27.06
2.	1%	20.76	28.46
3.	2%	19.64	26.98

Table 3 Compressive Strength Test Result

EFFECT OF COMPRESSIVE STRENGTH ON GLASS FIBER CONCRETE:

This figure represents the graph between the Compressive strength vs % of glass fiber. The glass fiber is added at the rate of 0.5%, 1% and 2% . Out of these, the compressive strength is very high at 1% having for 7 days is 20.76N/mm² and for 28 days is 28.46N/mm².

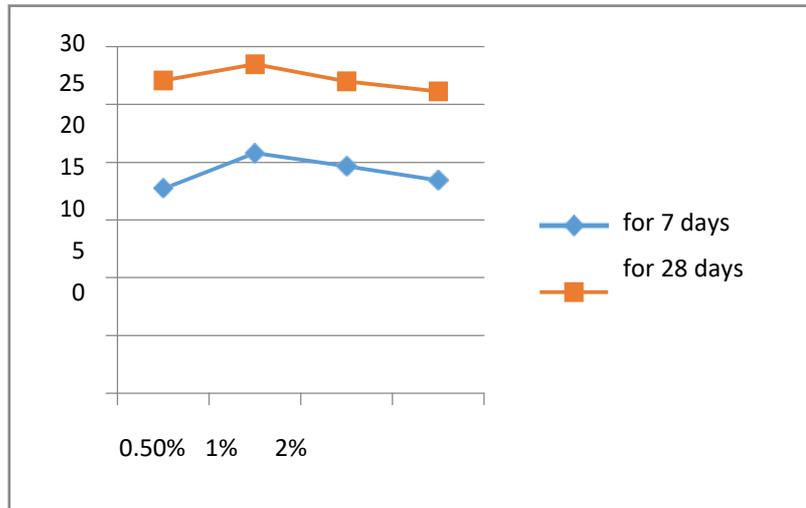


Fig. 1 Effect of Fiber on Compressive Strength of Concrete

Flexure Strength Test Result:

S.NO	M20 + Glass fiber	Flexural strength (N/mm ²)	
		7 days	28 days
1.	0.5%	1.42	2.45
2.	1%	1.47	2.94
3.	2%	1.3	2.6

Table 4 Flexure Strength Test Result

Effect of Flexural strength on Glass Fiber Concrete:

This figure represents the graph between the Compressive strength vs % of glass fiber. The glass fiber is added at the rate of 0.5%, 1% and 2%. Out of these, the tensile strength is very high at 1% having for 7 days is 1.47N /mm² and for 28 days is 2.94N /mm².

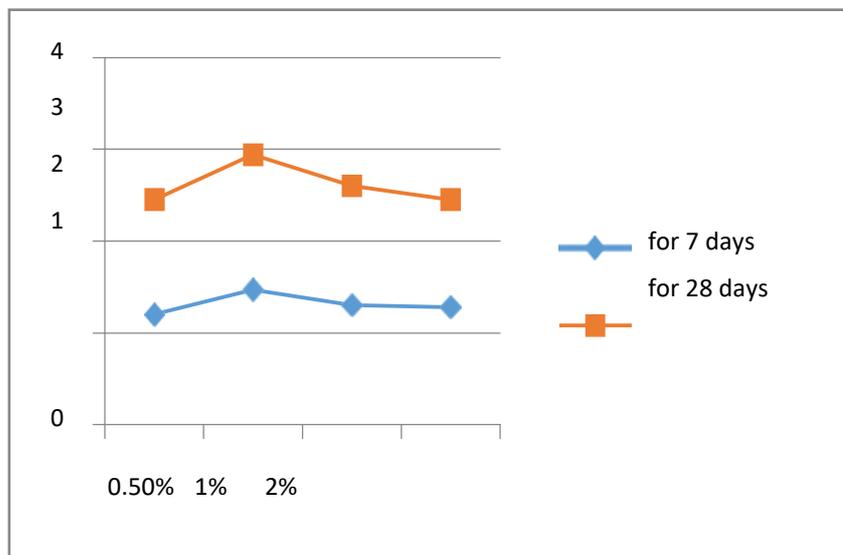


Fig. 2 Effect of Fiber on Flexure Strength of Concrete

Split Tensile Strength Test Results:

S.NO	M20 + Glass fiber	Split tensile strength (N/mm ²)	
		7 days	28 days
1.	0.5%	1.41	3.4
2.	1%	2.83	3.92
3.	2%	2.62	3.57

Table 5 Split Tensile Strength Test result

Effect of Split Tensile strength on Glass Fiber Concrete:

This figure represents the graph between the Split Tensile strength vs % of glass fiber. The glass fiber is added at the rate of 0.5%, 1% and 2%. Out of these, the split tensile strength is very high at 1% having for 7 days is 2.83 N/mm² and for 28 days is 3.92N/mm².

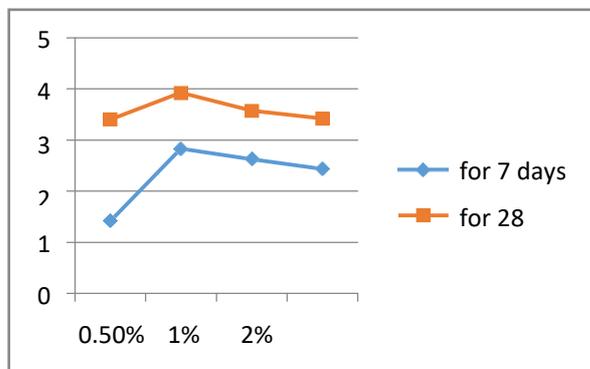


Fig. 3 Effect of Fiber on Split Tensile Strength of Concrete

V. CONCLUSION

The present study concluded that the addition of glass fibers at 0.5%, 1% and 2% of cement reduces the cracks under different loading conditions.

- It has been observed that the workability of concrete increases at 1% with the addition of glass fiber.
- The increase in compressive strength, flexural strength, split tensile strength for M-20 grade of concrete at 7 and 28 days are observed to be more at 1%. We can likewise utilize the waste product of glass as fiber.
- It has been observed that there is a gradual increase in compressive strength compare to the normal concrete. The workability of concrete decreases from 1% due to the addition of fiber.
- The compressive strength is very high at 1% having for 7 days is 20.76N/mm² and for 28 days is 28.46N/mm².
- The tensile strength is very high at 1% having for 7 days is 1.47N/mm² and for 28 days is 2.94N/mm².
- The split tensile strength is very high at 1% having for 7 days is 2.83 N/mm² and for 28 days is 3.9N/mm².

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