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Experimental Behaviour of Glass Fiber Reinforced Concrete

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Abstract*: *The addition of glass fibers to improve the properties of concrete is very ancient technique. Use of steel reinforcement in concrete increases strength and ductility of the concrete, but requires careful design and erection of steel and and also the labour skill. Alternatively, the use of fibers in discrete form in plain or reinforced concrete may provide a better solution. It is the new-fangled technique developed which is known as fiber reinforced concrete (FRC) few years ago . A Glass Fiber Reinforced Concrete basically consist of a cementitious matrix composed of cement, water, fine sand, coarse aggregate and in which glass fibers of short length are dispersed. It affect in the increase of the compression and impact strength of the material.
Keywords*: *FRC, Compressive strength, glass fiber

I. INTRODUCTION

The great deal of research is currently being carried out concerning about the use of glass fiber as reinforcement in concrete. A fibre is a short length discrete reinforcing material which is produced from various materials like steel, glass, plastic, carbon and natural materials. Due to its less weight it becomes easy and rapid for installation and also load applied on the structure is decreases. Due to such properties of FRC it helps to improve the flexibility in design, and reduces the impact on environment. It enhances the strength characteristics and also ability to sustain seismic loads.

Due to the addition of these uniformly dispersed fibres, the compressive strength of concrete is increased. Addition of fibers to concrete affects its mechanical properties which significantly depend on the type and amount of fiber added to concrete. Many of the current applications of FRC involve the use of fibres ranging around 1% by volume of concrete.1% addition of glass fiber into the concrete shows the better results.

In order to avoid the problems introduced by the corrosion of steel reinforcement in concrete structures, research has demonstrated that one could replace the steel reinforcement in structure by using glass fiber reinforcement. Corrosion of the steel reinforcement in reinforced concrete (RC) structures affects the strength of both the steel and the concrete and reduces the life of the structure. There could be less chances of corrosion due to reduced cross sectional area of steel reinforced bar. In the present experimental investigation, glass fibers has been added to study the Behaviour of the M25 grade of concrete with varying percentage of glass fiber.

II. METHODOLOGY

A. This describes the methodology of this experimental investigation, it includes study of material, testing of materials, mix design, mechanical properties, compressive strength for conventional and glass fiber, and study for both conventional and glass fiber reinforced concrete and the last thing is the results and discussions. Concrete was prepared by using glass fiber which is studied and analyzed.

1) As per IS-456 2000 mix designs for M25 grade of concrete was casted.

2) The glass fiber is used in percentage of 0.33%, 0.67% and 1% of its total weight.

3) The concrete of required grade is prepared and standard cubes of 150x150x150 mm are casted After curing for 24hrs the samples is demoulded and subjected to compressive strength test and split tensile test of 7 & 28 days.

B. Study of Material

It consists of the general study about Cement, fine aggregate , coarse aggregate ,water, glass fiber The constituent materials used in this investigation were procured from local sources. These materials undergone various tests to check with standard parameters. Due to these results we were define what type of materials are used. following material is used.

C. Cement

Ordinary Portland cement of 43 grade conforming to both the requirements of IS: 12269 and ASTM C 642-82 type-I was used. We are conducting different types of tests on cement, those are Consistency test, Initial and Final setting times test,Specific Gravity of cement, Fineness test Compressive strength of cement. Finally concrete of M25 Grade is dsigned.

D. Coarse Aggregate

Aggregate which are crushed blue granite of maximum size 20 mm was used as coarse aggregate.Tests conducted on coarse aggregate are, Specific Gravity and Fineness Modulus of coarse aggregate a Water Absorption Capacity of coarse aggregates.

E. Fine Aggregate

Well graded sand which is passing through 4.75 mm was used as fine aggregate. The sand was air-dried and sieved to remove any unwanted foreign particles before mixing. We are conducting tests on fine aggregate are Water Absorption Capacity, Specific Gravity and Fineness Modulus of fine aggregate.

F. Glass Fiber

The Glass Fiber is with filament diameter of 14 microns, length 0.12cm, tensile strength 2500Mpa, aspect ratio of 858.2, elongation breaks 3.6%, modulus of elasticity 70Gpa, density 2680 kg/m3, colour is white, and in the form of chopped strand are used in this experimental study.

G. Casting and Testing

The quantity of material required are weighed and place over the plat form. Initially the cement and fine aggregate are mixed together in the dry state until they are thoroughly blended. Then the coarse aggregate, glass fibres are added to dry mix of cement and fine aggregate and they are mixed thoroughly until the coarse aggregate and fibres uniformly distributed throughout the batch. Water is added to mixture until the concrete is become of uniform colour .This workable concrete is placed in the cube.After filling of moulds this are placed over the vibrator. And compaction is carried out. Later these moulds are kept for 24 hours. After completion of 24 hours the specimens are taken out from mould and cured for 7 & 28 days. After 7 & 28 days the specimens are taken out form the water and kept for drying. Then this specimens are tested in compression testing machine.The failure load is noted for each cube specimen and strength is determined.

H. Compression Strength Test

Fig. 1 Compression test

1) *Test specimens:* Consisting of 150×150×150 mm cubes for Compressive strength, using different amount glass fiber for the M25 grade concrete mix were cast.

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III. RESULTS

Sr.no	% of glass fiber	Compressive strength(n/mm2) (7days)	average		%of glass fiber	Compressive strength(n/mm2) (28 days)	Average
		19.62				26.20	
1	0%	18.78	19.61		0%	26.83	26.87
		20.43				27.59	
		19.35				27.76	
2	0.33%	21.32	20.81		0.33%	26.92	27.52
		21.77				27.88	
		21.05				28.98	
3	0.66%	22.80	22.26		0.66%	29.25	29.37
		22.95				29.88	
		22.90				30.13	
4	1%	23.40	23.16		1%	32.80	31.58
		23.18				31.81	

Table 1 compressive strength test results

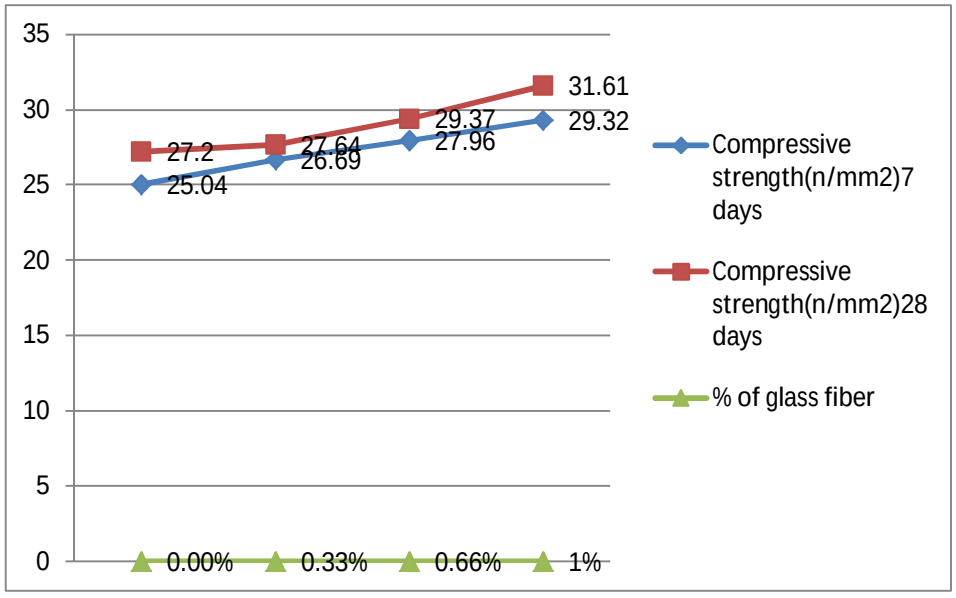

Fig.2 compressive strength vs glass fiber percentage

A. *Compressive Strength*

In this experimental results the compressive strength of concrete was observed to be increasing as the addition of fiber increases. The addition of 0.33% glass fibers by weight of concrete mix, increases the strength by 15 - 18% for this M25 grade concrete . Increase in percentage of fibers increases the strength significantly.

In this result, increasing weight of glass fiber in normal concrete affects the cohesiveness between the ingredients of concrete and this results in degrading of compressive strength. The durability characteristics is gradually increased based on the addition of Glass

Fiber content

IV. CONCLUSION

In this experimental investigation addition of Glass Fibre in plain concrete increases the strength and durability characteristics.
By addition of glass fibres in the concrete mixes a reduction in bleeding is observed.
The addition of glass fibres into the concrete mixture significantly improves the compressive strength. It is observed from the experimental results and its analysis, that the compressive strength of concrete increases with addition of Percentage of glass fibers.
The 1% addition of glass fibers into the concrete shows better result in mechanical properties and durability.
The workability of concrete decreases from 1% due to the addition of fibre.

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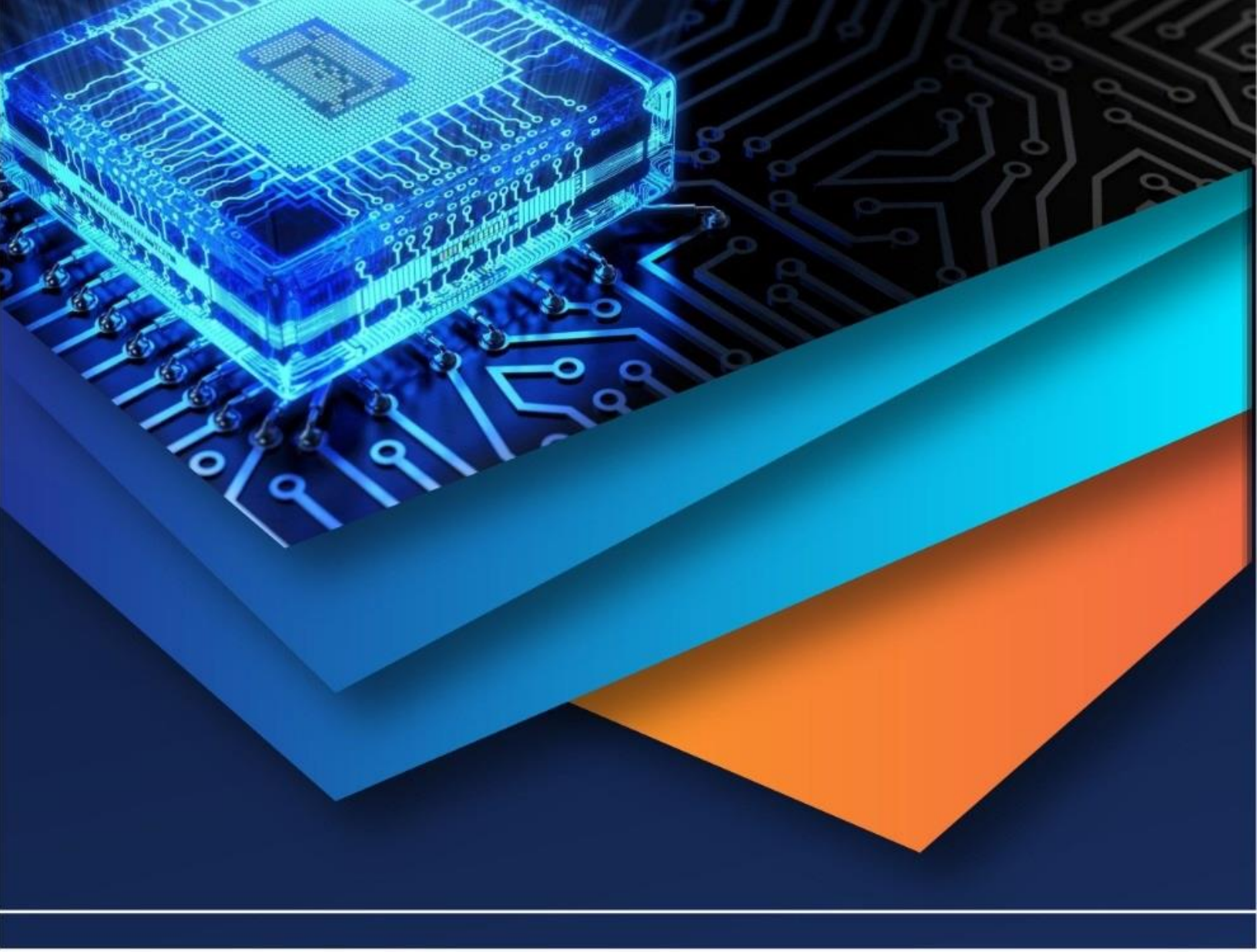

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