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EXPERIMENTAL STUDY ON GLASS FIBER REINFORCED CONCRETE

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ABSTRACT: Plain concrete possess very low tensile strength, limited ductility and little resistance to cracking. Internal micro cracks are inherently present in concrete and its poor tensile strength is due to propagation of such micro cracks. Fibers when added in certain percentage in the concrete improve the strain properties well as crack resistance, ductility, as flexure strength and toughness. Mainly the studies and research in fiber reinforced concrete has been devoted to steel fibers. in In recent times, glass fibers have also become available, which are free from corrosion problem associated with steel fibers. The present paper outlines the experimental investigation conducts on the use of glass fibers with structural concrete. Cem-fill anti crack, high dispersion, alkali resistance glass fiber of diameter 14 micron, having an aspect ratio 857 was employed in percentages , varying from 0.33 to1 percentage by weight in concrete and the properties of this Fiber Reinforced Concrete (FRC) like compressive strength, flexure strength, toughness, modulus of elasticity were studied.

Keywords: Cement-fill anti crack glass fibers, Reinforcement, Super plasticizer (B233 nepthalene based).

INTRODUCTION

Aims and Scope

Concrete is the most widely used construction material has several desirable properties like high compressive strength, stiffness and durability under usual environmental factors. At the same time concrete is brittle and weak in tension. Plain concrete has two deficiencies, low tensile strength and a low strain at fracture. These shortcomings are generally overcome

by reinforcing concrete. Normally reinforcement consists of continuous deformed steel bars or pre-stressing tendons. The advantage of reinforcing and pre-stressing technology utilizing steel reinforcement as high tensile steel wires have helped in overcoming the incapacity of concrete in tension but the ductility magnitude of compressive strength. Fibre Reinforced Concrete (FRC) is a concrete made primarily of hydraulic cements, aggregates and discrete reinforcing fibres.

FRC is a relatively new material. This is a composite material consisting of a matrix containing a random distribution or dispersion of small fibres, either natural or artificial, having a high tensile strength. Due to the presence of these uniformly dispersed fibres, the cracking strength of concrete is increased and the fibres acting as crack arresters.

Experimental Program

The details of materials used in the present program are as follows.

Cement

Portland pozzolona cement of 43 Grade available in local market has been used in the investigation. The cement used has been tested and found to be conforming to the IS 1489 specifications. The specific gravity was 3.15.

Coarse Aggregate

Crushed angular aggregates from a local source were used as coarse aggregate.

Fine Aggregate

Zone 3rd sand was used as fine aggregate. The specific gravity was determined and was found as 2.74.

Glass Fiber

The glass fibers used are of Cem-FILAnti-Crack HD with modulus of elasticity 72 GPA, Filament diameter 14 microns, specific gravity 2.68, length 12 mm

Water

Locally available portable water is used.

Test Specimens

Test specimens consisting of 100×100×100mm cubes and 100×100×500 mm beams were cast as shown in Figure 1 and tested as per IS: 516 and 1199.

Concrete Mix

The M20 grade is used as design grade for calculating quantities used in per cubic meter are shown in Table 2. The water cement has been fixed.

Mixing Procedure

Pre Mix GRC

The sand and cement are mixed dry and then the water/admixture and polymer (if used) are added. Generally a two-speed slurry/fibre blender mixer is used. With this type of mixer, the fast speed is designed to create smooth creamy slurry. This takes about one-two minutes. The mixer is switched to slow speed and fibre in the form of chopped strand (length approximately 13 mm) is added slowly. The fibre is blended into the mix for approximately 1 min. Once the mix is ready, it is poured into the moulds, which are vibrating using a vibrating table.

Figure 1: Test Specimens 100×100×500mm

1.	Fiber	AR Glass
2.	specific gravity	2.68
3.	elastic modulus(Gpa)	72
4.	tensile strength(Mpa)	1700
5.	diameter(micron)	14
6.	length(mm)	12
7.	number of fibre (million/Kg)	235

Table 2: Mix Proportion of Material

S. No.	Material	Quantity per m3 in kg
1	cement 33 grade ppc	350
2	fine aggregate	873
3	coarse aggregate (20mm)	444
4	coarse aggregate (10mm)	666
5	Water	140
6	Fiber	0-1% by total weight of mix
7	super plasticizer	5

The product is left into the mould to set and is covered with polythene sheet to prevent moisture loss. The product is demoulded the next day.

After demoulding the products are cured under polythene sheets to maintain moist conditions for approximately 2 to 4 days. Alternatively a polymer curing compound can be used as described for the sprayed process.

After mixing in fully pan mixer, the mix was cast in moulds for each % of fiber sufficient no of cubes (Table 3) and flexure beams (Table 4) were cast for testing at the ages of 28 days.

RESULTS AND DISCUSSION

Compressive Strength

The observation from our results shows that the increase in compressive strength is up to 37% in case of adding 0.33% fiber content in comparison of conventional concrete. Figure

3 and Table 5 show the variation in compressive strength by adding fiber.

Flexure Strength

The percentage increase in flexure strength of glass fiber is observed to be 130% when compared with ordinary plain concrete.

The percentage increase in flexure strength

% Fiber Diameter in mm	0 %	0.33 %	0.67 %	1%	Description
10	4	4	4	4	Under reinforced
12	4	4	4	4	Under reinforced
16	4	4	4	4	Over reinforced

% fiber	0%	0.33%	0.67%	1%
Number of cube	8	8	8	8

CONCLUSION:

1. Addition of glass fiber in reinforced concrete increases the toughness by 1157% compare with conventional reinforced concrete. The value of toughness observed maximum 272.4 KNmm when using fiber content 0.67% and 1.25% steel (12 mm reinforcement bar) (Tables 9 and 10)
2. The modulus of elasticity of glass fiber reinforced concrete is increases 4.14% compared with conventional reinforced concrete (Table8)
3. The percentage increase of compressive strength of various grades of glass fiber concrete mixes compared with 28 days compressive strength is observed 37%.
4. The percentage increase of flexure strength of various grades of glass fiber concrete mixes compared with 28 days compressive strength is observed 5.19% (Tables 6 and 7).

REFERENCES

1. http://en.wikepedia.org/wiki/ Fibre_reinforced_concrete
2. Indian standard Code of Practice for Plain and Reinforced Concrete, IS- 456: 2000, 4th Revision, Bureau of Indian Standards, NewDelhi.
3. Indian standard Recommended guidelines for Concrete Mix Design, IS 10262: 1982, 5th Reprint 1998, Bureau of Indian Standards, New Delhi.
4. Mallick P K (2007), "Fiber- Reinforced Composites ", Materials, Manufacturing, and Design.
5. M S Shetty (1987, Concrete Technology Theory and Practices, . Chand & Company, New Delhi
6. Perumalsamy N Balaguru and Sarendra P Shah (1992), ''Fiber reinforced cement composites'', Mc Graw Hill International Editions.
7. Saint Gobain Vetrotex, Cem – Fil. (2002), "WhyAlkaline Resistant Glass Fibers", In Technical data sheet"s, www.cemfil.com
8. Siva Kumar A and Santana Manu (2007), "Mechanical Properties of High Strength Concrete Reinforced with Metallic and Non-Metallic Fibers", *Cement and Concrete Composites,* Vol. 29, pp. 603- 608.