Experimental Study of M30 Grade of Concrete using Glass Fiber

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Abstract— In addition to avail ourselves to the new technologies, we should also extend them for innovations through research and development, which include improving the present technique and to explore better use of our natural resources for civil engineering construction. Concrete is one such basic component in which constant up gradation has always been implemented in order to improve its properties by adding different admixtures and additives. Glass fibres one such material which could be added in concrete to change its properties and strength. Glass fibre is chemically inorganic material obtained from molten glass of a specific Composition. Glass fibre can be added in concrete to change its properties and strength. When M30 grade of concrete is mixed with glass fibre in different proportion we can increase compressive strength and flexure strength of concrete. Test will be carried out at 7 days and 28 days interval to compute difference in compressive strength and flexure strength using universal testing machine.

Keywords: Glass fibre, M30 Grade of Concrete, Mechanical Properties of Concrete

I. INTRODUCTION

Fiber-reinforced concrete (FRC) is concrete containing fibrous material, which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Fibres are usually used in concrete to control cracking due to both plastic shrinkage and drying shrinkage. They also reduce the permeability of concrete and thus reduce bleeding of water. Some types of fibres produce greater impact, abrasion and shatter resistance in concrete. Glass fibres can be incorporated into a matrix either in continuous lengths or in discontinuous (chopped) lengths."

II. OBJECTIVES OF THE STUDY

"To compare the properties of concrete with and without glass fiber and fly ash. To check whether the glass fiber and fly ash can increase the different properties of the concrete. To understand the effect of glass fiber and fly ash on the compressive strength and flexure strength of the concrete."

III. LITERATURE REVIEW

"Gaurav Tuli, et al. Presented "Study of glass fiber reinforced concrete." In June 2016. This paper present experimental investigation conduct on the use of glass fiber with concrete. Anti-crack, High dispersion, alkali resistance glass fiber of diameter 14 micron, having an aspect ratio 857 was employed in percentage varying from 0.33 to 1 by weight in concrete. The properties of concrete like compressive strength, flexure strength, toughness, modulus of elasticity were studied."

"J. D. Chetanya kumar, et al. Presented "Experimental studies on glass fiber concrete." in 2016. Author has study the effect of glass fibre on concrete. Testing of M20 grade of concrete have been done with glass fiber of 0.5%, 1%, 2% and 3% of cement by adding as an admixture. Workability of Concrete, Compressive strength and tensile strength of concrete is tested at 7 days and 28 days and it is observed that it is higher at 1% of replacement."

"Avinash Gornale, et al. Presented "Strength aspect of glass fiber reinforced concrete." in July 2012. In this paper author has done accumulation of information regarding Glass fiber reinforced concrete from internet and some text books. It is observed that like a steel there is no need for a protective concrete cover thickness to prevent rusting. They have done comparative study on effect of glass fiber on workability of concrete, compressive strength of concrete, flexure strength of concrete, split tensile strength of concrete with and with glass fiber for M20 M30 and M40 Grade of concrete at 3 days, 7 days and 28 days."

"Yogesh Iyer Murthy, et al. presented "Performance of glass fiber reinforced concrete" in June 2012, author has studied the compressive strength, flexural strength and workability of concrete containing varying proportions of glass fiber as replacement of fine aggregate. It is 25 micrometer in diameter and 5cm" "long are used for the preparation of standard M30 grade concrete by replacing fine Aggregate by fiber up to 1.5%. The increase in compressive strength is nominal while the flexural strength increased significantly as expected with the increase in percentage of glass fiber. The reduction in slump with the increase in glass fiber content. The flexural strength of beam with 1.5% glass fiber shows almost 30% increase in the strength compared to the beam with 0% glass fiber.

Pshtiwan N. Shakor, et al. presented "Glass fiber reinforced concrete in construction" in March 2011. Author has done trial test for concrete with glass fiber and without glass fiber are conducted to indicate the difference in compressive strength by using cubes of various size. Various practical application of glass fiber reinforced concrete has been studied. They have compared technological and economical parameters with other types of fiber. Increasing weight of glass fiber has an adverse effect on behavior of concrete."

IV. METHODOLOGY

A. Workability:

"Workability is the ease with which concrete mix flows to the concrete corner of the formwork. In more scientific terms, it is the property of concrete which determines the amount of useful internal work necessary to produce full compaction. Slump test gives a measure of workability of the mix in terms of slump observe after the subsidence of a concrete mix. We can get fairly good idea of cohesive ness by gently tapping the platform on which the cone stands.

B. Compressive Strength of Concrete:

Concrete is primarily strong in compression and in" "actual construction, the concrete is used in compression. Concrete which is strong in compression, is also good in other quality. Higher the compression strength better is the durability. Bond strength is importance in R.C.C. compressive strength also indicated extent of control exercised during construction. Resistance to abrasion and volume stability improves with the compressive strength. Test for compressive strength in therefor vary important in quality control of concrete. Cube used is 150 mm width and 150 mm height. Wherever cube are used for compressive strength results the cube strength can be used to calculate with the following formula, Minimum cube strength required = 0.8 compressive strength specified for 150 mm cube.

C. Flexure Strength of Concrete:

Flexure strength is one measure of the tensile strength of concrete. It is a measure of unreinforced concrete beam or slab to resist failure in bending. It is measured by loading 150mm X 150mm X 750mm beam with a span length of at least three times the depth. The flexure strength is expressed as modulus of rupture in MPA and is determined by standard test methods ASTM C 78 and ASTM C 293.Flexure MR is about 10 to 20 percent of compressive strength depending on the type, size and Volume of coarse aggregate used.

Fig. 1: Experimental Setup

V. Results & Discussion

"After casting of cube and beam, it is to be kept for curing for 7 and 28 days. The outcome of this casting for different volumes of glass fibers for different fibers at different water/cement ratio are shown below in tabular and graphical form.

TYPE OF FIBER	VOLUME BY %	COMPRESSIVE STRENGTH (N/MM^2)		FLEXURE STRENGTH (N/MM^2)	
		7 DAYS	28 DAYS	7 DAYS	28 DAYS
E–GLASS	0.076	25.3	50.2	3.9	5.1
	0.152	26.8	48.7	3.4	4.1
	0.227	25.1	42.2	2.8	3.4
O-GLASS	0.076	34.6	47.3	3.3	4.1
	0.152	31.8	46.8	3.3	3.8
	0.227	29.8	39.1	3.1	3.7

Table 1: Strengths of E and O - glass fiber observed at w/c = 0.5 for 7 days and 28 days

Above table show that E-glass fiber has maximum strength at 0.5 w/c ratio. Maximum compressive and flexure strength is achieved when 0.076% of E-glass fiber is added in concrete. It also shows that when excess amount of fiber is added in concrete, it starts losing its strength.

TYPE OF FIBER	VOLUME BY %	COMPRESSIVE STRENGTH (N/MM^2)		FLEXURE STRENGTH (N/MM^2)	
		7 DAYS	28 DAYS	7 DAYS	28 DAYS
E–GLASS	0.076	27.2	51.7	4.1	5.2
	0.152	27.9	49.1	3.8	4.3
	0.227	26.2	43.6	3.0	3.3
O-GLASS	0.076	33.5	47.8	3.7	4.3
	0.152	33.8	46.8	3.5	3.8
	0.227	33.4	40.6	3.8	4.2

Table 2: Strengths of E and O - glass fiber observed at w/c = 0.45 for 7 days and 28 days

The above table shows that strength increases have been seen in compressive and flexure strength when 0.076% of E-glass fiber is added in concrete. Also, increase in compressive strength is seen at 7 day when O-glass fiber is added. But at 28 days O-glass fiber has less strength compare to E-glass fiber.

TYPE OF FIBER	VOLUME BY %	COMPRESSIVE STRENGTH (N/MM^2)		FLEXURE STRENGTH (N/MM^2)	
		7 DAYS	28 DAYS	7 DAYS	28 DAYS
E–GLASS	0.076	29.3	52.2	4.2	5.3
	0.152	25.9	50.8	3.8	4.9
	0.227	24.5	44.2	3.1	3.6
O-GLASS	0.076	32.8	48.3	4.0	4.1
	0.152	34.6	47.1	3.9	4.3
	0.227	31.8	40.3	3.9	4.5

Table 3: Strengths of E and O - glass fiber observed at w/c = 0.4 for 7 days and 28 days

Above Table gives different strengths at different percentage addition of different glass fibers at w/c = 0.4. Good results have been achieved for almost every addition of glass fiber, except increase in addition of O-glass fiber. An increase in compressive and flexure strength have been seen when 0.076% of E- glass fiber is added in concrete.

VI. Conclusion

We conclude that as we increase the content of glass fiber as well as w/c ratio strength will decrease. From the experimental study of M30 grade concrete with E- Glass fiber and o- Glass fiber, we conclude that at w/c = 0.40, 0.076% of addition of E-glass gives maximum compressive and flexure strength.

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