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Experimental Study On The Effect Of Glass Fiber Reinforced Concrete

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ABSTRACT
Concrete is most widely used construction material in the world. Nowadays the world is witnessing the construction of more and more challenging and difficult Engineering structures. So, the concrete need to possess very high strength and sufficient workability. Researchers all over the world are developing high performance concrete by adding various fibers, admixtures in different proportions. Various fibers like glass, carbon, Poly propylene and aramid fibers provide improvement in concrete properties like tensile strength, fatigue characteristic, durability, shrinkage, impact, erosion resistance and serviceability of concrete. Because of such characteristics Fiber Reinforced Concrete has found many applications in civil engineering field. Glass Fiber Reinforced Concrete (GFRC) is a recent introduction in the field of concrete technology. GFRC has advantage of being light weight, high compressive strength and flexural strength. To improve the long term durability an Alkali resistance glass fiber reinforced concrete is also invented. The aim of the work is to study the properties of the effect of glass fibers as reinforcement in the concrete for different proportions from the research work which is already carried out by the researchers. the researchers.rete is most widely used construction material in the world. Nowadays the world is witnessing the construction of more and more challenging and difficult Engineering structures.

1.INTRODUCTION

1.1 General

Concrete is one of the most widely used construction material throughout the world the advantage of it being is it can be mould in to any shape and can be made to take required compressive strength in additional to compressive strength by increasing flexural strength, the load bearing capacity can be increased approximately. The ingredients for making concrete are cement fine aggregate, coarse aggregate and water. Sometimes creative additives are added to it to improve or alter some properties making concrete is an art which one has to be perfectly through otherwise that will end up with bad concrete. Hence as a civil engineer one should be through with the entire factor of concrete from which he can produce a good concrete.

The application of cement concrete is limited due to the characteristics of brittle failure; this can be overcome by the inclusion of a small amount of short and randomly distributed fibers such as steel, glass, synthetic and natural. Such concrete can be practiced where there is a weakness of concrete such as less durability, high shrinkage cracking, etc.

2.LITERATURE REVIEW

kavita Kene, et al conducted experimental study on behavior of steel and glass Fiber Reinforced Concrete Composites. The study conducted on Fiber Reinforced concrete with steel fibers of 0% and 0.5% volume fraction and alkali resistant glass fibers containing 0% and 25% by weight of cement of 12 mm cut length, compared the result.

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G. Jyothi Kumari, et al studied behavior of concrete beams reinforced with glass fiber reinforced polymer flats and observed that beams with silica coated Glass fiber reinforced polymer (GFRP) flats shear reinforcement have shown failure at higher loads. Further they observed that GFRP flats as shear reinforcement exhibit fairly good ductility. The strength of the composites, flats or bars depends upon the fiber orientation and fiber to matrix ratio while higher the fiber content higher the higher the tensile strength.

Dr. P. Srinivasa Rao, et al conducted durability studies on glass fiber reinforced concrete. The alkali resistant glass fibers were used to find out workability, resistance of concrete due to acids, sulphate and rapid chloride permeability test of M30, M40 and M50 grade of glass fiber reinforced concrete and ordinary concrete. The durability of concrete was increased by adding alkali resistant glass fibers in the concrete. The experimental study showed that addition of glass fibers in concrete gives a reduction in bleeding. The addition of glass fibers had shown improvement in the resistance of concrete to the attack of acids.

S. H. Alsayed, et al studied the performance of glass fiber reinforced plastic bars as reinforcing material for concrete structures. The study revealed that the flexural capacity of concrete beams reinforced by GFRP bars can be accurately estimated usingthe ultimate design theory. The study also revealed that as GFRP bars have low modulus of elasticity, deflection criteria may control the design of intermediate and long beams reinforced with FDRP bars.

Yogesh Murthy, et al studied the performance of Glass Fiber Reinforced Concrete. The study revealed that the use of glass fiber in concrete not only improves the properties of concrete and a small cost cutting but also provide easy outlet to dispose the glass as environmental waste from the industry. From the study it could be revealed that the flexural strength of the beam with 1.5% glass fiber shows almost 30% increase in the strength. The reduction in slump observed with the increase in glass fiber content.

3. PROPERTIES OF MATERIALS

3.1 CEMENT

Cement is a binding material used in the preparation of concrete. It bends the coarse aggregates and fine aggregates with the help of water, to a monolithic mater and also it fills the voids in the concrete.

There are two requirements for any cement in the concrete mix design. That is compressive strength development with time attainment of appropriate rheological characteristics, type and production of cement.

3.2 FINE AGGREGATE

The fine aggregate used in the manufacturing of concrete should be free from debris, fungi and chemical attack. It plays a vital role in concrete, so it should durable, angular and sharp edges then only gives a rich mix concrete and workability.

3.3COARSE AGGREGATE

Aggregate are the important constituents in concrete. They give body to the concrete, reduces shrinkage and effect economy. Earlier, aggregates were consider as chemically insert material but now it has has been recognised that some of aggregates are chemically activate and also that certain aggregate exhibit chemical bon at the interface of aggregate and paste. The more aggregates occupying 70-80 % of concrete: their impact on various characteristics and properties of concrete is undoubtedly considerable.

3.4 WATER

Water is an important ingredient of concrete as it actively participate in the chemical reaction with cement. The strength of cement concrete mainly from binding action of the hydration of cement get the requirement of water should be reduced that required chemical reaction of un-hydrated cement as the excess water would end up in only formation undesirable voids or capillaries in the hardened cement past in concrete.

3.5 GLASS FIBER

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The glass fibers used are of Cem-FIL Anti-Crack HD with modulus of elasticity 72 GPa, Filament diameter 14 microns, specific gravity 2.68, length 6 mm and having the aspect ratio of 857.1. The number of fibers per kg is 212 millon fibers.
Glass fibers are useful thermal insulators because of their high ratio of surface area to weight. However, the increased surface area makes them much more susceptible to chemical attack. By trapping air within them, blocks of glass fiber make good thermal insulation.

4. TESTS ON HARDENED CONCRETE

4.1 COMPRESSIVE STRENGTH TEST

The compression test is used to determine the hardness of cubical specimens of concrete.150mmx150mmx150mm size cubical specimens was tested by using compression test machine. Compressive strength should be calculated by dividing maximum load by the cross-sectional area.

Calculation of compressive strength of specimen

The compressive strength was calculated by the following formula.

Compressive strength =,

Where,

P = maximum applied load in N,

A = Cross sectional area in mm.

TABLE 4.1 RESULTS OF COMPRSSIVE STRENGTH TEST FOR CUBICAL SPECIMENS

S.NO	NAME OF THE SPECIMEN	ULTIMATECOMPRESSIVE STRENGTHINN/mm^2
		7 DAYS
1.	0%	13.17
2.	5%	16
3.	10%	18.22

TABLE 4.2 RESULTS OF COMPRSSIVE STRENGTH TEST FOR CUBICAL SPECIMENS

S.NO	NAME OF THE SPECIMEN	ULTIMATECOMPRESSIVE STRENGTHINN/mm^2
		21 DAYS
1.	0%	18.66
2.	5%	20.88
3.	10%	22.44

TABLE 4.3 RESULTS OF COMPRSSIVE STRENGTH TEST FOR CUBICAL SPECIMENS

S.NO	NAME OF THE SPECIMEN	ULTIMATECOMPRESSIVE STRENGTHINN/mm^2
		28 DAYS
1.	0%	23.93
2.	5%	26.07
3.	10%	27.02

4.2 SPLIT TENSILE STRENGTH

TABLE 6.2 RESULTS OF COMPRSSIVE STRENGTH TEST FOR CUBICAL SPECIMENS

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S.NO	NAME OF THE SPECIMEN	SPLIT TENSILE STRENGTH [N/mm^2]
		28 DAYS
1.	0%	3.5
2.	5%	3.86
3.	10%	4.13

6. RESULT AND DISCUSSION

Compressive strength of concrete is tested on cube at different percentage of marble powder content in concrete. The strength of concrete has been tested on cube at 28 days curing. The 28 days test gives the data of final strength of concrete at 28 days curing. Compression testing machine is used for testing the compressive strength test on concrete. At the time of testing the cube is taken out of water and dried and then tested keeping the smooth faces in upper and lower part.

- With the inclusion of marble powder the slump value of concrete gradually increasing from the beginning itself.

- With the inclusion of marble powder the strength of concrete gradually increases up to a certain limit but the gradually decreases.

- At 15% replacement of cement by marble powder there is 12.5% increase in compressive strength for 28 days.

- The compressive strength gradually decreases from 15% of replacement of cement.

7.CONCLUSION

- The Compressive strength of Cubes are increased with addition of waste marble powder up to 20% replace by weight of cement and further any addition of waste marble powder the compressive strength decreases.

- Thus we found out the optimum percentage for replacement of marble powder with cement and it is almost 20% cement for cubes.

- We have put forth a simple step to minimize the costs for construction with usage of marble powder which is freely or cheaply available; more importantly.

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