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Comparison of Glass Fiber Reinforcement Concrete with M20 Concrete and Study of Mechanical Behaviour

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ABSTRACT: -

We all know that normal construction concrete possesses very low compressive strength and low tensile strength. Because of this reason in many cities buildings and towers suddenly collapse. To overcome this defect, we analyzed the properties of concrete. In this research paper, we examine the current state of construction, analyze the strength of concrete and propose a new addition of material to concrete. In practical labs, the foundation of machines is cracked due to the vibration of the motor or machine. So for enhancing the durability and strength of concrete, we use glass fiber. We use glass fiber in variations of 1% and 2% of the total aggregate. From IS standard we added a glass fiber percentage in concrete and checked the compressive strength and split tensile strength. From evaluating and analyzing these two we can see how the addition of fibers will have an effect.

Keywords- Glass Fiber, Concrete, Concrete Reinforcement, Glass Fiber Reinforcement Concrete.

I. INTRODUCTION

In the construction field concrete is one of the most used creation materials. Concrete has various desired properties like high stiffness, high compressive strength, and high durability under usual environmental elements. To overcome this problem, we use reinforcement in concrete. Glass Fiber Reinforcement Concrete is concrete that has fibrous material in concrete that increases the structural integrity as well as increases the stiffness of the concrete. Fiber-reinforced concrete (FRC) reduces the bleeding of water in concrete and thus also reduces the porousness of concrete. All of us know about the benefits of concrete and it is also known to us that concrete fails in tension. So now we will concentrate on the various properties of the glass fibers for this research work and see how they will affect the concrete. In this research we use glass fiber as a reinforcing material (GFRC). Glass fiber concretes are especially used in outward constructing façade panels and as architectural precast concrete. Glass fiber is superb in making shapes at the front of any construction and it's far much less dense than metallic like steel. For enhancing the strength, we use 1% and 2% glass fiber of the total aggregate.

II. FINDING FROM LITERATURE REVIEW

There are some points figured out from the above review:

1) Concrete is one of the most used materials in construction concrete has good strength plain concrete has brittle nature and low tensile strength but we observe from the research paper that glass fiber in concrete increases tensile strength and brittle nature. Adding the glass fiber in the cement to eliminate the cracks on the surface. The performance of the cement concrete with varying the percentage of glass fiber adding like 0.33%, 0.66%, 1%, 1.33%, 1.66%, and 2%.

2) Glass fiber is a lightweight material and high tensile strength therefore many researchers use glass fiber in cement concrete. AR glass fiber has a superior performance to other types and is likely to retain long-term tensile strength and flexibility strength.

3) It was found that glass fibers didn't impact a positive effect on the cement concrete. The split tensile and flexural strength of glass fiber increased with an increase in fiber dosage. When the dosage of glass fibers increases, then the strength of glass fiber-reinforced concrete also increases.

4) Glass fiber reinforced concrete(GFRC) is potentially an ideal composite material. It is manufactured of the thin structural element due to it is superior durability over GFRC containing conventional steel reinforcement. The first part of this paper deals with the stress-strain characteristics of GFRC.

5) Prof. Shital A Patage, Hirawale Bharat, In this study was undertaken to understand the effects of glass fiber on concrete. Glass fiber is available rapidly in the market at a cheaper cost. Glass fiber was used as an admixture to test its effect on concrete. GFRC can be used to increase the strength of concrete improving the life of machine foundation structure. It is a composite constructed from Portland cement, an exceptional combination of water and alkali glass fiber. GFRC is a lightweight and durable material. That may be forged into unlimited shapes.

6) B Vandevyvere, Z Sierens, E, Verstrynge, L Vandewalle, J Li, In this paper experimental study of glass fiber on the mechanical behavior of concrete with recycled concrete aggregate (RCAs). In the test, the four concrete mixtures with course RCAs and glass fiber are manufactured. The investigated properties are the compressive strength, and splitting tensile strength behavior. Based on the test observation, it seems that the use of glass fiber is able to improve the mechanical behavior of RCAs.

7) Ajay Singh Thakur, Tarun Sharma, has studied the glass fiber strength properties, in this study we know that concrete is the most utilized material. It has great compressive strength but it is bad in tensile strength. The alkali resistance glass fiber helps to improve the durability for a long time. The compressive strength and split tensile strength among M20, M30, M40, and M50 with AR glass fiber have been studied.

8) Muhammed ISKENDER, Bekir KARASU has studied glass fiber reinforced concrete. The GFRC is one of the most versatile building materials available to engineers. But in general, the addition of glass fiber results in a higher compressive strength but the amount of fiber causes a reduction in the strength due to reduced workability. Glass fiber has a positive effect on the stress-strain curve of a GFRC and the increased energy absorption of the GFRC. GFRC can increase the life of concrete more than traditional concrete. GFRC is lightweight and is 50-70% lighter than normal concrete. The aim in understanding the mechanical and physical properties of GFRC.

IV. OBJECTIVES OF THE STUDY

In the study, the following objectives are envisaged:

1) The main objective of GFRC is to increase tensile strength in concrete. Normal concrete has low tensile strength than use glass fiber reinforcement and increase tensile strength.

2) Reduce the cracks in the foundation of vibrating mechanical machines.

3) The proposed study is to analyze the characteristics of glass fiber-reinforced concrete.

4) As a new construction material, we can achieve maximum benefits and different properties of glass fiber-reinforced concrete.

V. METHODOLOGY

In glass fiber underpinning concrete, the factors are coarse total, fine total, ordinary Portland cement and glass fiber, etc. In this procedure, we tested the material by taking a sieve analysis test, water immersion test, and specific graveness test. After adding 1% and 2% glass fiber, mixed the materials. Casting the blocks for the compressive test and casting the cylinders for the split tensile test. After moulding the samples, stored in water for 24 hours from the time of addition of water to the other constituents. The temperature of the place of the storehouse was within the range 22^0 to 32^0 Celcius.

1) Compressive Strength Test- Compressive strength of the concrete is the crucial property of concrete. The contraction strength test is done to check whether concreting is done duly or not. We'll perform the test on 150 mm * 150 mm * 150 mm of cell earth. The concrete is poured into the earth and also will be tempered duly similar that there should be no confirmation of air voids. We'll make M20 grade cells and also will be tested by Universal Testing Machine(UTM) after 3, 7, and 28 days.

2) **Compressive Strength = Load / Area**

Fig. Compressive Strength Test

2) Split Tensile Test- Split tensile strength test is an important property of concrete because concrete structures are largely vulnerable to tensile cracking due to colorful kinds of goods applied to the cargo itself. For split tensile strength we've to forge a cylinder and after casting we must perform take a look at the wettish instance after 3 days. We need to perform this test on a contraction testing machine for the specified range. Before putting the cylinder inside the contrivance we want to region plywood strips at the lower plate after which place the instance. So resolve tensile strength is executed at the concrete cylinder to know the tensile strength of concrete.

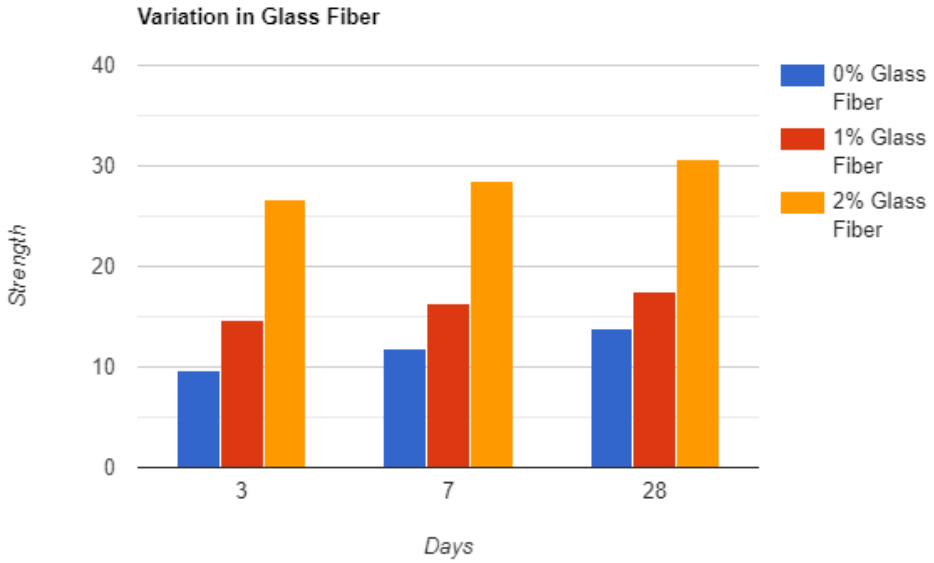
Fig. Split Tensile Test of Cube

In 3 days, glass fiber reinforced concrete strength is increased slightly. In 7 days the strength of concrete is increased more than 3 days. The final strength testing of the block and cylinder is on the 28th day. We take 3 blocks per testing day for better results.

Fig. Split Tensile Test of Cylinder

VI. RESULTS

The main objective of this research is to compare the mechanical properties of conventional concrete with glass fiber-reinforced concrete. We check all the properties of the blocks and cylinders we concluded the result from the respective observations. To increase the load-carrying capacity of the members, we carried out our test by adding various percentages of glass fibers in proportion. In this trial tests for concrete with glass fiber and without glass fiber are conducted to indicate the difference in compressive strength and split tensile strength.



VII. CONCLUSION

In this research, we cleared that we use glass fiber for increasing the strength as well as load capacity. It was found that the addition of 2% of glass fibers can increase the strength as compared to 1% of glass fiber or plain cement concrete. The strength of the blocks is slightly increased day by day but after 28 days the strength of the block is mostly stopped. The strength of glass fiber reinforced concrete is more than the normally used concrete. We used this reinforced concrete for constructing the foundation of mechanical vibration machines as well as for decorative purposes. The durability, as well as flexibility of glass fiber-reinforced concrete, are also increased.

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