Research Journal of Applied Sciences, Engineering and Technology 7(7): 1448-1449, 2014
DOI:10.19026/rjaset.7.416
ISSN: 2040-7459; e-ISSN: 2040-7467

Submitted: May 29, 2013 Accepted: July 01, 2013 Published: February 20, 2014

**Research Article**

# Experimental Study on the Behavior of Glass Fiber Concrete

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**Abstract:** Our aim to study the behaviour Glass Fibre Concrete with the ratio of (1 to 5%) by volume of fraction and study the mechanical properties of concrete by carrying compressive strength, flexural strength test and splitting tensile strength test. Many methods have recommended for mix proportioning of concrete all over the world. Among those methods, ACI method was selected for our project.

**Keywords:** Floating table test, glass fibers, slump test, strength properties, super plasticizer

## INTRODUCTION

Alkali Resistant Glass Fiber is a recent introduction in making fibrous concrete. Glass fiber which is originally used in conjunction with cement was found to be affected by alkaline condition of cement. Therefore Saint Gobain Vetrotex (2002) alkaline Resistant Fiber has been developed and used. Experiments have been carried out by several authors using fibers of glass, carbon, asbestos, polypropylene etc. Henrik and Victor (2004) have outlined the classification and structural applications of composite materials. Majumdar and Laws (1991) has worked on the development of fiber reinforced cements. Sivakumar and Santhanam (2007) have studied the properties of FRC using high percentage dosages of hybrid fiber like steel, glass and polypropylene.

Commercially available fibers include Aramid, Glass and carbon. Most research activities concentrated on Glass FRP (GFRP) owing to their lower cost Mota *et al*. (2006). In the present experimental study on the behavior of Glass fiber concrete with the ratio of (1 to 5%) by volume of fraction and study the mechanical properties of concrete by carrying compressive strength, flexural strength test and splitting tensile strength test. Many methods have recommended for mix proportioning of concrete all over the world. Among those methods, ACI method was selected for our project.

## RESEARCH METHODOLOGY

**Materials:**

**Cement:** Ordinary Portland cement of 53 grades available in local market is used in the investigation.

Table 1: Mix proportions

| Cement, kg/m$^3$ | Fine aggregate, kg/m$^3$ | Coarse aggregate, kg/m$^3$ | Water, kg/m$^3$ |
|---|---|---|---|
| 458 | 641 | 1016 | 165 |

The specific gravity was 3.02 and the fineness was 3200 cm$^2$/gm.

**Fine aggregate:** All normal concreting sands are suitable for GRC. Either crushed or rounded sands can be used. River sand was used as fine aggregate. The specific gravity was 2.606.

**Coarse aggregate:** All types of aggregates are suitable. The normal maximum size of aggregate is generally 16 to 20 mm. Consistency of grading is vital importance. Crushed angular granite metal from a local source was used as coarse aggregate. The specific gravity was 2.76.

**Water:** Water of good quality was used throughout.

**Admixtures:** Admixtures are materials other than cement, aggregate and water that are added to concrete either before or during its mixing to improve its properties, such as workability, curing temperature range, setting time or color. We are using super plasticizers (high range water reducers), are used to increase workability of concrete and to reduce water content. The super plasticizers namely Sulphonated Naphthalene-Formaldehyde condensates (SNF) was used in our study. From the marsh cone test optimum dosage of super plasticizers to mix was found out (Table 1).

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Fig. 1: Slump cone test

Fig. 2: Flow test

Table 2: Compressive strength test result

| Types of fibers | @ 7 days (N/mm$^2$) | @ 28 days (N/mm$^2$) |
|---|---|---|
| Plain cement concrete | 15.60 | 51.28 |
| 1% of GFRC | 28.44 | 74.57 |
| 2% of GFRC | 21.60 | 62.22 |
| 3% of GFRC | 20.26 | 60.08 |
| 4% of GFRC | 18.22 | 53.60 |
| 5% of GFRC | 17.68 | 51.28 |

Table 3: Split tensile strength test result

| Types of fibers | @ 7 days (N/mm$^2$) | @ 28 days (N/mm$^2$) |
|---|---|---|
| Plain cement concrete | 1.67 | 5.008 |
| 1% of GFRC | 2.63 | 7.920 |
| 2% of GFRC | 1.98 | 6.168 |
| 3% of GFRC | 1.78 | 5.404 |
| 4% of GFRC | 1.56 | 4.690 |
| 5% of GFRC | 1.49 | 4.440 |

Table 4: Flexural strength test result

| Types of fibers | @ 7 days (N/mm$^2$) | @ 28 days (N/mm$^2$) |
|---|---|---|
| Plain cement concrete | 3.26 | 9.18 |
| 1% of GFRC | 5.33 | 10.07 |
| 2% of GFRC | 3.85 | 8.29 |
| 3% of GFRC | 3.55 | 7.70 |
| 4% of GFRC | 3.26 | 6.81 |
| 5% of GFRC | 2.67 | 6.22 |

## RESULTS AND DISCUSSION

**Workability of fresh concrete:**

**Slump cone test:** Slump Test is the most commonly used method of measuring consistency of concrete which can be employed either in laboratory or at site ofwork. It is used conveniently as a control test and gives an indication of uniformity of concrete from batch to batch. Slump value from the experiment is found as 45 to 50 mm. The slump cone test are shown in Fig. 1.

**Floating table test:** This is a laboratory test, which gives an indication of the quality of concrete with respect to consistency, cohesiveness and proneness to segregation. In this test, a standard mass of concrete is subjected jolting. The spread or flow of concrete is measured and the flow is related to workability. By experiment, it is found out as 14%. The floating table test are shown in Fig. 2.

**Strength of harden concrete:**

**Cube compressive strength of glass fiber:** The cube testing was done by placing flat pads both top and bottom in compression testing machine. Ultimate load was noted and compressive strength calculated was present in Table 2.

**Split tensile strength of glass fiber:** The cylinder was placed in universal testing machine such that the load was perpendicular to the axis of the cylinder and the load at which the cylinder split was noted and the tensile strength was calculated and the result are shown in Table 3.

**Flexural strength of glass fiber:** The flexural strength was obtained by applying the load by the equal concentrated load at one third of the beam. The beam was simply supported. Testing was done in UTM and the ultimate load was noted and the moduli of rupture values are shown in Table 4.

## CONCLUSION

Based on the results of this experimental investigation the following conclusions are drawn, a detailed analysis of compressive strength, flexural strength and tensile strength of concrete mixed with glass fibres is done. The results are taken after 28 days of curing. The percentage increase of compressive strength of glass fiber concrete with 28 days compressive strength is 45.41%. The percentage increase of flexural and split tensile strength of glass fiber concrete with 28 days strength is 9.69 and 58.14%, respectively. Based in the above observation it has been formed that the maximum optimum value is obtained from 0 to 1%. The addition of glass fiber in concrete will increased the workability.

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