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EFFECT OF CHOPPED GLASS FIBERS ON THE STRENGTH OF CONCRETE TILES

Ashutosh Kumar[1], Prof. Neeraj Jain[2], Prof. Dr. Sharad Kumar Soni
[1]Research Scholar, [2]Guide, [3]HOD
Department of Structural Engineering
Rabindranath Tagorre University,Bhopla

Abstract: The effect of glass fiber on flexural strength, split-tensile strength and compressive strength was studied on M-20 grade concrete designed in accordance with IS 10262 for different fiber content. The maximum aggregate size used was 20 mm. In order to study the impact on compressive strength, flexural strength, split-tensile strength 6 cubes, 6 prisms and 6 cylinders were casted and tested after account of the practical implementation of GFRC in the form of concrete cement tiles. The tile thickness was 20 mm and the maximum aggregate size used was 8 mm. The water cement ratio was maintained consistently and the admixture content varied from 0.8 to 1.5 percent to maintain a slump between 50 mm and 100 mm. The mixing ratio used was 1:1.78:2.66. The size of the short fibers used was 30 mm and the alkali resistance of the glass fibers. This brief fibers had an impact on wet transverse strength, compressive strength, and water absorption. Six 400mm*400mm*20 mm complete size tiles have been tested and the results have been registered. The water absorption of concrete after 28 days was studied and the average water absorption values of 6 samples obtained. Pulse velocity tests were also performed.

Keywords- Supplementary cementitious materials (SCMs), Glass fiber reinforced concrete (GFRC), Chopped glass fibers, Glass fiber, and Steel fiber reinforced shotcrete (SFRS).

1. INTRODUCTION

We know basic constituents of building material is concrete because it is comparatively cheap and its ingredients are easily available, and concrete available in wide range of civil construction and infrastructure works. Although concrete have some of demerits as weak in tension, brittleness and lower resistance to crack restoration. For there a behavior of Concrete brittleness and possess low tensile strength but as we add fibers, decrease its brittle behavior and the increases tensile strength. With the respect of time a many specimen are in experiments that have been done to increase the concrete properties in initial fresh state or also in hardened state. The desired properties like workability, Increase or decrease in setting time and higher compressive strength are depend also by super plasticizers, admixtures, micro fillers and basic constituents remain the same . For structural concretes Fibers, that have classification according to their material as Alkali resistant Glass fibers (AR), Steel fibers , Synthetic fibers, Carbon, pitch and polyacrylonitrile (PAN) fibres. A cementitous complex product reinforced with distinct glass fibres of variable length and size are known as Glass fibre reinforced concrete (GFRC) . This glass fiber mostly use for is alkaline resistant because alkali decreases the Durability and resistance of GFRC. Basically Glass is made up by silica (SiO_2) ,lime stone ($CaCO_3$) and sodium carbonate (Na_2NO_3).

2. LITERATURE REVIEW

J.G. Ferreria and F.A. Branco (2005) In this paper, the results of a research project were presented in which glass fibers were used in the construction of structural elements, telecommunications towers 30 meters high. The light and strong strength of GRC was associated with carbon and stainless steel reinforcement, resulting in high-strength composites. Concludes, The use of GRC reinforced with carbon fibers or stainless steel bars can be used as building materials, with reduced weight and good strength structures.

The GRC application in telecommunication towers is effective and provides adequate power and disability standards for the facilities. Numerical models developed to determine the strength, disability and flexibility of towers show good correlation with experimental behavior and may be used to design this type of tower.

A.J. Majumdar (1974) In this paper an attempt was made to study the use of glass in concrete, concrete was tested for a period of three years under different environmental conditions and to measure the mechanical properties of these compounds by age. The test results were interpreted according to the micromechanics of the failure of these compounds and an experimental role study was performed to control the behavior of the compound at various stages of its life. It concluded that the interface properties in GRC change over time, in part due to chemical attacks on fiber that weaken the reinforcement but also due to changes in the physical properties of the fiber bundle and porosity and the change in volume in the matrix as it states. and it is hard.

When using alkali-resistant glass fiber, the bending strength indicates an initial increase over the course of months and a slight decrease in strength. The magnitude of the reduction was based on the conditions used in the storage of the material and there are indications that this process was not present when the pfa was added to the mixture. Energy effects were interpreted in terms of quality on the basis of the changes that took place in the junction between the thread and the matrix. These changes were brought about by the interaction of glass fiber with the cement matrix and the continuous flow of the cement itself. These elements, along with many of the matrix fragments, control the mechanical properties of composite materials such as reinforced glass fiber.

M-M. Levitt (1997) examined that when cement, mud or concrete is sprayed or in contact with window glass, embedding occurs. This is because alkali in cement attacks some of the silicates used to make glass. The stock used to make glass fibers has better alkali resistance than window glass because zirconia is used as one of the listed materials.

M.W. Fordyce et. al (1983) examined that the significant difference between GRC dehydrated and non-dewatered density variation has two effects. First, although the fiber content by weight is the same, the high density of the drained board provides a fraction of the higher fiber volume that provides higher strength. Secondly water-repellent board has better strength and reduced porosity which provides better fiber / matrix bond strength.

Perumelsamy N. Balaguru et. al (1992) noted that tests conducted in the GFRC laboratory have shown good resistance to fire, as the main use of GFRCs is on building panels. In these structures, fire resistance becomes an important factor in construction.

Dr. P. Perumal et. al (2006) examined that mixtures with a volume of 1.5% fiber provided a composite composite structure in terms of compressive strength with a power enhancement of 25.39%. The highest increase in the strength of the split strength was observed in the mix with 1.5% of the fiber volume and was found to be more than 5.76% stronger than the reference concrete. Similarly, the highest tensile strength was observed in mixing with 1.5% of fiber volume and was found to be 72.5% above reference concrete.

R .N. Swamy's (1978) study includes not only tests of fiber content and matrix strength, but also details such as fiber distribution, shape, and binding efficiency. Possible production or product defects can also be detected. It also shows that the MOR and LOP in the suspension condition test have a higher effect than the wet round (1- 5) MN / m2 difference.

Surendra P. Shah et. al (1987) has observed that the use of alkali resistant glass fiber as well as E glass fiber in combination and latex fiber when exposed to rapid aging flexibility is reduced. AFTER 52 weeks the rapid aging was just one facet of immortality. The strength level was very low by 1 / 60th.

Benturet. al (1997), has noted that the use of a low percentage of synthetic fibers is most effective in the use of a floor slab. Low fiber content is defined as less than 0.3 percent by volume of concrete mix. The paper is the result of an experimental study of the effect of low percentage of nylon and polypropylene fibers on decay, the duration of the distorted slump cone, air content, compressive and flexible behavior and the impact of concrete resistance. Three percent of the fibers, i.e., 0.15%, 0.22%, and 0.30% by volume of concrete mixture with a single fiber (25 mm) length were used. It is noted that the addition of cables reduces the performance of the concrete and has no significant effect on the compression strength of the concrete. A moderate increase in the flexibility of the order of 10 to 22% with nylon fibers and 8 to 15.5% with polypropylene fibers is observed. Nylon and polypropylene wires also alter the ductility of concrete. Both strands increase the force of impact significantly. The increase in impact strength is 206 kN to 373 kN with nylon fibers.

3. MATERIALS AND METHODOLOGY

3.1 Materials

Concrete is a construction material shaped by the blending of fastener material, coarse aggregate, fine aggregate, water and inorganic or natural admixture. The concrete increase its strength by
solidifying the cover material. Anyway there are different kinds of concrete dependent on various restricting material like Cement concrete and bituminous cement concrete is a sort of concrete blend wherein cement material is utilized as a coupling material. This cement might be standard Portland cement or might be other extraordinary kind of cement like high alumina cement, fast solidifying cement, Portland slag cement contingent on specific prerequisite of the construction.

3.2 Mixing of Concrete

To achieve a standardized blend it is essential to thoroughly mix concrete. Concrete can be manufactured by hand mixing or by machine mixing in two ways. Hand mixing can be carried out on a plane-level surface such as a wooden platform or a paved surface with tight joints to avoid loss of paste. Mixing the new concrete was performed in our investigation machine. The machine drum was first washed and then moistened to avoid any water loss as we only add a calculated quantity and no additional water is added. All dry materials are placed into the drum and then blended into the drum by rotating the drum when a thorough mixture of glass fibers is added as calculated, which a percentage of the complete concrete weight is and then the materials are carefully blended. After adding and mixing water again until a uniform colored blend is acquired. After this whole method, the concrete is dropped onto a flat, smooth plate from where we take it and fill our moulds.

3.3 Compaction

The tiles were set up by setting the concrete in the form and afterward hand packing utilizing a plain wooden square and afterward the shape was kept tight by fingers and vibrated on the vibrator table. Compaction of concrete is one of the significant site tasks that together empower the new concrete to achieve its potential structure strength, thickness and low porousness. Appropriately completed it guarantees that concrete completely encompasses and ensures the reinforcement, ligaments and cast-in supplements. It additionally directly affects accomplishing the predefined surface completion. Compaction is the procedure that ousts captured air from newly put concrete and packs the aggregate particles together in order to expand the thickness of the concrete.

3.4 Curing of Concrete

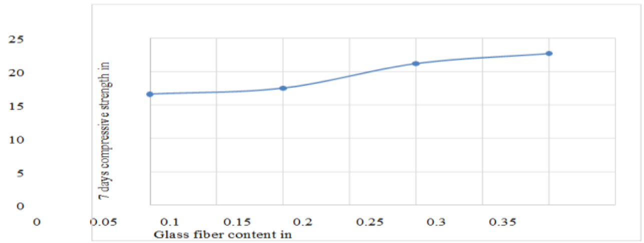
A significant port of cement's physical characteristics depends on the degree of bond hydration and the subsequent hydrated concrete crystalline lattice. Cement hydration only occurs when the capillary pores stay saturated. Curing is required to make the concrete more durable, strong, and impermeable and abrasion and frost resistant. Curing is performed by giving water or pond healing or maintaining them packed under wet gunny bags to avoid surface and indoor moisture loss. Curing begins when the concrete reaches its final set. Curing for at least 14 days is usually suggested to achieve at least 90 percent of the anticipated intensity. For all samples, including the tiles, pond curing technique was used in our situation. Curing of Concrete is a method by which the concrete is protected against loss of moisture required for hydration and kept within the recommended temperature range. Curing will increase the strength and decrease the permeability of hardened concrete. Curing is also helps in mitigating thermal and plastic cracks. Which can severely impact durability of structures. A curing practice involves keeping the concrete damp or moist until the hydration of concrete is complete and strength is attained. Curing of concrete should begin soon after initial setting time of concrete or formwork is removed and must continue for a reasonable period of time as per the specified standards, for the concrete to achieve its desired strength and durability.

4. RESULTS AND DISCUSSION

After doing various experiments on concrete for knowing compressive strength, split tensile strength, flexure strength, wet transverse strength, water absorption test, etc. getting the following results. The 7 days compressive strength has been examined and the values of 3 samples are shown in the tabular form. Table 1 demonstrates the compressive strength information obtained for 7 days. Table 1 provides the 7 day concrete compressive strength with a maximum nominal aggregate size of 20 mm. The compressive strength of 7 days was also plotted Fig 2 by taking a general rise in the compressive strength with the addition of fibers on the average of these three values.

Table: 4.1 Days Compressive Strength of Concrete

S. No	Without fiber	0.1% fiber	0.2% fiber	0.3% fiber
1	16.88	17.78	21.32	22.23
2	16.45	17.34	20.87	22.68
3	16.45	17.34	21.32	23.12



Effect of Glass Fibers on 7 Day Compressive Strength

5. CONCLUSION & RECOMMENDATION

1. The compressive strength of concrete without admixture is not affected by the presence by weight of concrete of short discrete glass fibers with fiber content ranging from 0.1 to 0.3% of fiber content.
2. The split tensile strength of concrete increases with the addition of glass fibers.
3. With increased fiber content, the flexural strength of concrete increases and as such the tension carrying capacity of concrete can increase in flexure.
4. The wet transverse strength of tiles increases and the increase has been found with addition of fibers.
5. The water absorption of the concrete also decreases with increase in fiber content.

FURTHER SCOPE

After the study the effect of inclusion of glass fiber on concrete with other binders like GGBS (Ground-granulated blast-furnace slag), it is felt that there is scope for future study.

1. All the combinations of binders and aggregates can be used to optimize the materials used.
2. Durability studies like permeability, sulphate resistance, acid resistance, impact etc can be made on high volume fly ash concrete to ascertain its use under different extreme conditions.
3. All the concrete mixes made with different replacement levels of metakaolin and alccofine by weight of ordinary Portland cement showed higher compressive strength as compared to concrete mix made with ordinary Portland cement.
4. We have got increase in flexural strength of concrete by replacement of cement by metakaolin and alccofine by 7% and of cement by meta-kaolin and alccofine by 7% and 3% respectively.
5. Utilization of water has been reduced by using curing compound instead of water for curing.

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