Research Journal of Applied Sciences 9 (9): 609-613, 2014
ISSN: 1815-932X

Experimental Study on Anti Crack W70 AR Glass Fibre

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Abstract: The present day world is witnessing the construction of very challenging and difficult Civil Engineering structures. Quite often, concrete being the most important and widely used material is called upon to possess very high strength and sufficient work ability properties. Efforts are being made in the field of concrete technology to develop such concretes with special characteristics. Researchers all over the world are attempting to develop high performance concretes by using fibers and other admixtures in concrete up to certain proportions. In the view of the global sustainable developments, it is imperative that fibers like glass, carbon, polypropylene and aramid fibers provide improvements in tensile strength, fatigue characteristics, durability, shrinkage characteristics, impact, cavitations, erosion resistance and serviceability of concrete. In this present experimental investigation is study the mechanical properties of anti crack W70 AR Glass fibre with the ratio of (0.1-0.8%) by volume of fraction and compares the strength results of 7 and 28 days. Many methods have recommended for mix proportioning of concrete all over the world. Among those methods, ACI Method was selected for the project.

Key words: AR glass fibre, strength properties, concrete, design method, super plasticizer, Slump test, Compaction Factor test

INTRODUCTION

Elloze *et al*. (2010) reported by the property of adding steel fibers to concrete on the mechanical behavior of steel fiber concrete slabs. The compressive force of SFC increased up to 25% compared to plain concrete while the splitting tensile strength tensile tests showed an enhancement of up to 45% of the steel fibre concrete compared to plain cement concrete. The optimum size of the steel fibers suggested resisting on the elastic zone or plastic zone (ductility and deformation) are divert. In the elastic zone, the fibers must be arrest and small while in the plastic zone, the fiber length must be large enough to make certain their proper anchorage in the matrix forms. Rana (2013) discussed some studies of steel fibre reinforced concrete and check their manipulate of fibres on the flexural strength of concrete. From the experimental results experimental work, it was found that with increase in steel fibre content there was a incredible increase in Flexural strength of concrete. Even at 1% steel fibre content increase the flexural strength of concret at 6.46 N/mm^2. Use of carbon fiber laminates for strengthening reinforced concrete beams was studied by Hanafy *et al*. (2012) The tension side bonding of carbon fiber reinforced polymer sheets with U shaped end anchorage very competent for flexural strengthening. Ata and Moustaf (2011) report the experimental investigation of RC beams strengthen by using discrete glass fibre. The results found out that the discrete glass fibres increase ductility. Swami *et al*. (2010) brought the results of studies on AR glass fibre reinforced concrete composites strength and behavior it shows the 1.5% AR glass fibre gives more strength with compressive, split tensile and flexural. The ductility increases from adding AR glass fibre to the concrete. It also helps to improve the control the shrinkage. Barluenga and Herrnandez-Olivares (2007) reported by cracking control of concretes modified with short AR Glass fibres at early age of concrete. The main function of the carbon fibers in concrete is to maintain the linear of the curves of Seebeck voltage difference versus temperature difference irrespective of the concrete. Mineral admixtures reduced Seebeck voltage and the thermal conductivity.

EXPERIEMENTAL INVESTIGATION

In the investigation M20 mix were studied using higher grade ordinary Portland pozzolana cement 53 grade and the glass fiber. Standard concrete cube of 150×150×150 mm size were cast and tested on 7 and 28 days. Addition of AR glass fiber of 0.5, 1.0, 1.5, 2.0 and 2.5% by the volume of content was tried in the control mix and the compressive strength of the adjusted mix proportions was studied.

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Fig. 1: Anti crack W70 AR glass fibre

Standard cylinder of size 150 mm diameter and 300 mm height were cast and tested on 7 and 28 days for 0.5, 1.0, 1.5, 2.0 and 2.5% by the volume of content was tried in the control mix and the split tensile strength of the adjusted mix proportions were studied.

Standard flexure beam of size 150×150×500 mm size were cast and tested on 7 and 28 days for 0.5, 1.0, 1.5, 2.0 and 2.5% by the volume of content was tried in the control mix and the flexural strength of the adjusted mix proportions was studied.

ANTI-CRAK HD W70 AR DISPERSION GLASS FIBRE

Anti-Crak W70 Chopped Strands are obtained by assembling filaments, coating them with a size which enables dispersion in water or other liquids and cutting them to nominal lengths of 6 and 12 mm. Anti-Crak W70 Chopped Strands are designed to disperse into individual filaments on contact with water or other liquids. The best dispersion is obtained in a water solution (Fig. 1).

EXPERIMENTAL PROGRAMME

Cement: It can be defined as material having adhesive and cohesive properties which make it capable of bonding material fragments in to a compact mass. Cement is obtained by burning together in a definite proportion, a mixture of naturally occurring calcareous (containing calcium carbonate or lime) and argillaceous (containing alumina) material to be partial fusion at high temparature about 1450°C.

The ordinary Portland cement was classified in to 3 grades, namely 33 grades, 43 grades, 53 grades depending upon the strength of the cement at 28 days when tested as per IS 4031-1988. If 28 days strength is not <53 N/mm^2, it is called 53 grade of cement. It is proposed to study the properties of high strength concrete of grade M25. Adopting 53 grade of cement for the study.

Fine aggregate: Natural river sand with fraction passing through 4.75 mm sieve and retained on 60 μm sieve is used and will be tested as per IS 2386. The fineness modulus of sand is 3.12 with specific gravity around 2.61.

Coarse aggregate: Coarse aggregate of size 20 mm has been selected for the study. The physical properties will be tested as per IS 2386 (Part 1)-1963. The fineness modulus of sand is 5.94 with specific gravity around 2.72.

Water: Portable tap water available in the laboratory with pH value of 7.0 and conforming to the requirements of IS 456-2000 is used for making concrete and curing the specimen.

CASTING

Before concreting all the moulds were fully tightened. The junctions of vertical and bottom planks were coated with plaster of Paris to avoid any leakage of cement slurry. The inside of the mould was oiled to prevent adhesion of concrete.

Casting of PCC cube, beam and cylinder: The exact quantities of materials for the specimens were weighted and kept ready before the mixing started. The mould was kept ready with the cage placed in position. Mixer was used for mixing the concrete. The concrete immediately after was filled in three layers in the mould and compacted well using the rod. Moulds were finished smoothly after initially setting of concrete.

Casting of GFC cube, beam and cylinder: After mixing the cement, fine aggregate, coarse aggregate, water and the required quantity of fiber sprinkled in the mix and then mixed thoroughly and placed in the mould (Table 1).

Curing: Curing can be described as keeping concrete moist and warm enough so that the hydradition of cement continue, more elaborately, it can be described as the process of maintaining a satisfactory moisture content and a favorable temperature in concrete during the period immediately following placement, so that hydration of cement may continue until the desired properties sre developed to a sufficient degree to meet the requirement of service. Curing is being a place of increasing importance as the demand for high quality concrete is increasing.

Cube, cylinder and flexure were kept in the mould for 1 day. After a period of 24 h, they were marked for later identification. Then, the side planks and bolts were

Table 1: Mix proportions

Density (kg/m^3)			
Water	Cement	Fine aggregate	Coarse aggregate
191.6	383	534.710	1219.66
0.50	1	1.396	3.18

removed. The companion (concrete samples) was removed from the mould platform after 24 h and stored in the water for curing.

TESTING

Testing of companion specimens: The compressive strength (cube), split tensile strength (cylinder) and the flexure strength (beam) are the determined.

Cube compressive strength of glass fibre: 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, the tests were shown in Fig. 2.

Split tensile strength of glass fibre: 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 2, the tests were shown in Fig. 3.

Flexural strength of glass fibre: 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 modulus of rupture values are shown in Table 2, the tests were shown in Fig. 4.

INTERPRETATION OF RESULTS

Anti Crak HD W70 glass fibres is added (0.5-2.5%) to the PCC. Even with the small percentage of adding glass fibres, its compressive strength, split tensile strength and flexural strength are increased when compared to plain cement concrete (Fig. 5-7):

- At 1.5% of glass fibres, GFRC has maximum compressive strength and has increased by 56% with respective plain cement concrete
- Similarly, its split tensile strength is maximum at 1.5% of glass fibres which is 4.2 N/mm^2. Percentage increase is 68% with reference to PCC

Table 2: Comparison of various strengths

Percentage of AR glass fibre	Strength (N/mm^2) Compressive	Split tensile	Flexural
0	26.00	2.5	4.40
0.5	34.50	3.0	5.80
1.0	36.20	3.2	6.30
1.5	40.50	4.2	6.80
2.0	39.68	3.7	6.60
2.5	38.50	3.6	6.48

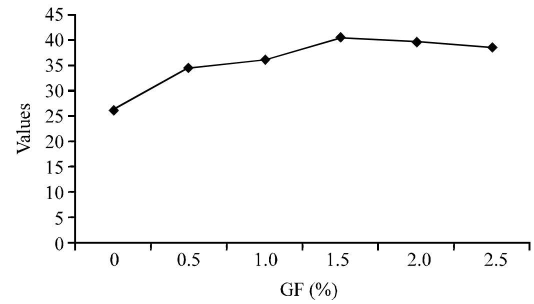

Fig. 2: Compression strength (N/mm^2) testing

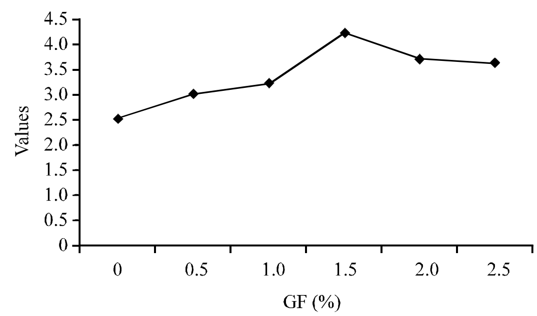

Fig. 3: Split tensile strength (N/mm^2) testing

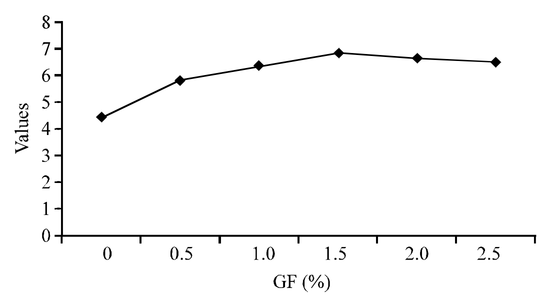

Fig. 4: Flexural strength (N/mm^2) testing

- Flexural strength is also maximum at 1.5% of glass fibres which is 6.3 N/mm^2. Percentage increase is 55 with respect to PCC
- Mixing glass fibres beyond 1.5% does not increase the strength considerably

Hence, it is decided to mix 1.5% of glass fibre with the plain cement concrete and cost analysis is carried out in the study.

Fig. 5: Failure pattern of compression strength of cube

Fig. 6: Failure pattern of split tensile strength of cylinder

Fig. 7: Failure pattern of flexural strength of prism

CONCLUSION

In this research work, ANTI-CRACK HD-W70 glass fibre of 0.5-2.5% is added to the plain cement concrete of grade 20. This glass fibre reinforced cement concrete was tested for compressive strength, split tensile strength and flexural strength for ultimate loading. It was found that the mix has given maximum strength at 1.5% addition of glass fibres. Beyond 1.5% its strengths were declined. The cost of glass fibre when added with a PCC is Rs. 48125 for a 2 bed room flat. The fresh GFRC had good workability and the hardened GFRC had good durability and is ecofriendly and cost effective.

Alkali aggregate reactions are undesirable processes that are observed in numerous civil engineering structures. If the structure is already in service, these reactions cannot be prevented and must eventually be compensated by external reinforcement. In the research, the innovative use of anticrak HDW70 material appears to be an interesting alternative because of their observed advantages as follows:

- Reduction of cracks
- Fibre virtually invisible at surface
- Smooth finishes
- Excellent compatibility with cement matrix
- Excellent workability even at high dosage (No change in slump and compaction factor in all the trails)
- Extends serviceability of concrete

Anti-crak HD fibres when added to PCC as per calculation, they prevent cracking and also improves the performance of concrete. The fibres do not protrude through the surface of concrete mix and requires no additional finishings. In RCC construction the reinforcement inside is can be protected from corrosion and any other chemical reactions. When 2.5 kg anti crack HD W70/m^3 of concrete is added to PCC, the strength increases twice the target mean strength, the compression increases and hence there is increase in tensile strength and hence ductility increases and the cracks are reduced. Hence, with just 10% increase in cost of conventional concrete much durable serviceable high performance and crack free concrete is got.

REFERENCES

Ata, E.S.S. and O. Moustaf, 2011. Experimental analysis of RC beam strengthened with discrete glass fiber. Facta Univ. Series: Architect. Civil Eng., 9: 205-215.

Barluenga, G. and F. Hermandez-Olivares, 2007. Cracking control of concretes modified with short AR-glass fibers at early age. Experimental results on standard concrete and SCC. Cement Concrete Res., 37: 1624-1638.

Elloze, A., M.B. Quezdou and M.A. Karray, 2010. Experimental study of steel fiber concrete slabs part 1: Behaviour under uniformly distributed load. Int. J. Concrete Struct. Mater., 4: 113-118.

Hanafy, M.M., H.M. Mohamed and N.A.B. Yehia, 2012. On the contribution of shear reinforcement in shear strength of shallow wide beams. Life Sci. J., 9: 484-498.

Rana, A., 2013. Some studies of steel fibre reinforced concrete. Int. J. Emerg. Technol. Adv. Eng., 3: 120-127.

Swami, B.L.P., A.K. Asthana and U. Masood, 2010. Studies on Glass Fibre Reinforced Concrete Composites-Strength and Behavior. In: Challenges, Opportunities and Solution in Structural Engineering and Construction, Ghafoori, N. (Ed.). Taylor and Francis Group, London, pp: 601-604.