

DETERMINATION OF MECHANICAL PROPERTIES OF SLURRY INFILTRATED CONCRETE (SIFCON)

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Abstract: The matrix in SIFCON has no coarse aggregates, but a high cementitious content. If percentage of steel fibers in cement matrix could be increased, one could get a material with very high strength properties which can be called as SIFCON. Proportions of cement and sand used SIFCON are 1:1 by weight. Water cement ratio taken 0.4. Percentage of super plasticizers taken 2% by weight of cement. The percentage of fibers by volume used is 4%, 6% and 8%. This study's main objective is to find out the mechanical properties of SIFCON for various types of volume fraction of steel fibers. In this present study two types of steel fibres are used which are of different aspect ratios. The study showed that 8% fibre volume shows great strength than the remaining volume fractions in Compressive Strength, Flexure Strength as well as Split Tensile Strength.

Keywords: SIFCON, Steel fibers

I. INTRODUCTION

Slurry Infiltrated Fibrous Reinforced Concrete (SIFCON) is a relatively new high performance and advanced material and can be considered as a special type of Steel Fiber Reinforced Concrete (SFRC). If percentage of steel fibers in cement matrix could be increased, one could get a material with very high strength properties which can be called as SIFCON. The matrix in SIFCON has no coarse aggregates, but a high cementitious content. However, it may contain fine (or) coarse sand and additives such as fly ash, micro silica and latex emulsions. Proportions of cement and sand generally used for making SIFCON are 1:1, 1:1.5 (or) 1:2 cement slurry alone have some applications. Water cement ratio varies between 0.3 to 0.4. Percentage of super plasticizers varies from 2 to 5% by weight of cement. The percentage of fibers by volume can be anywhere from 4 to 20% even though the current practical ranges from 4 to 12%.

II. LITERATURE REVIEW

H. Sudarshana Rao, K.Gnaneswar and N.V.Ramana studied the "Behaviour of Simply supported steel reinforced SIFCON two way slabs in Punching shear". SIFCON slabs are cast with 8, 10 and 12% fibre volume fraction and for comparison, fibre reinforced concrete (FRC) with 2% fibre volume fraction and reinforced cement concrete (RCC) slabs are cast and tested. The results of the experimentation show that the SIFCON slabs with 12% fibre volume fraction exhibits excellent performance in punching shear among other slabs. The experimental results have been compared with the provisions of ACI and IS codes. A regression model

has been proposed for estimating the punching shear strength of reinforced SIFCON slabs. An Yan, Keru Wu and Xiong Zhang studied "A quantitative study on the surface crack pattern of concrete with high content of steel fiber". The mechanical properties and digital image analysis of slurry-infiltrated fiber reinforced concrete(SIFCON)were investigated experimentally. Fractal dimension is used as a parameter to characterize the crack pattern on the surface of SIFCON. It is found that there exists fractal phenomenon for different fiber contents of SIFCON, fractal dimension can be a parameter to characterize crack pattern on the surface of SIFCON quantitatively, and there exists a good correlation between mechanical properties and fractal dimension. From these papers with the basic idea of what is a sifcon, now in the present work it is decided to test and check the mechanical properties of sifcon.

III. EXPERIMENTAL DETAILS

The details of carried out works are given below:

A. MATERIALS

Cement: Ordinary Portland cement of 53 grade manufactured by Nagarjuna company confirming to IS 12269 was used.

Fine Aggregate: Locally available river sand passing through 4.75mm IS sieve was used.

Fibers: Steel fibers of Dramix 3D of Bekeart corporation are used and 50mm and 35 mm hooked end fibers of 1mm dia and 0.55mm dia respectively.

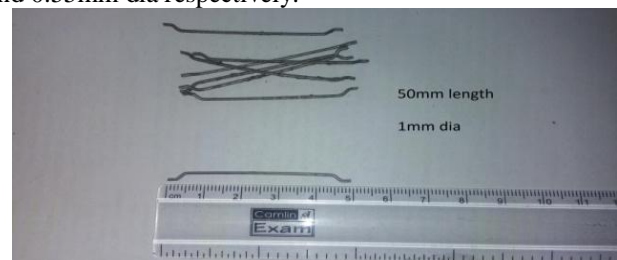


Fig.1 showing 50mm length steel fibers



Fig.2 showing 35m length steel fibers

Water of PH 7.0 is used

SP CONPLAST-430 is used.

B. MIX PROPORTIONS

In this study the mix taken is 1:1 cement and sand ratio and the steel fibers are mixed with different proportions of 4, 6 & 8% volume fractions. Providing a water cement ratio of 0.4 and 2% of Super plasticizer is used. Also firstly two types of different steel fibers taken one is 50mm and the other is 35mm. Both are mixed and tested for the compressive strength.

C. DETAILS OF SPECIMENS

The compressive strength was found out confirming to ASTM C 39/C 39M- 11 with cube dimensions of 100mm X 100mm X 100mm. For split tensile strength cylinder specimens of dimension 100 mm diameter and 200 mm length as per ASTM C 496-96 were cast. Flexural strength was determined confirming to ASTM C348 - 14 with the dimension of prism 100mm X 100mm X 500 mm.

IV. RESULTS AND DISCUSSIONS

A. Compressive Strength

The compressive strength is carried out for different lengths of fibers 35mm and 50mm for various volume fraction of steel fibers such as 4%, 6% and 8% are used.

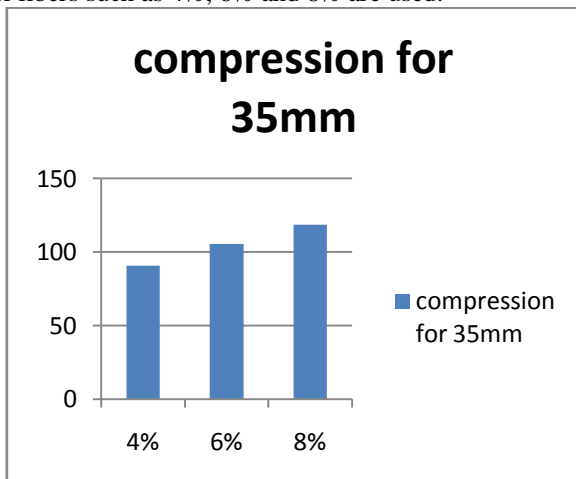


Fig.3 compression test results after 28days for 35mm steel fibers

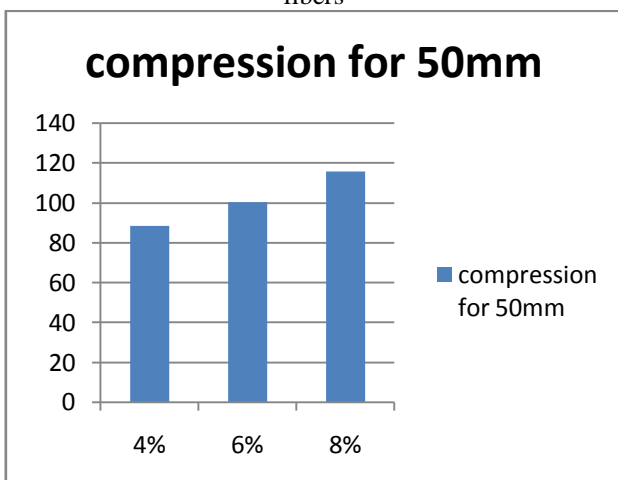


Fig.4 compression test results after 28days for 50 mm steel fibers

From the above results it is clear that for 35mm length fibers the compressive strength is more than that of 50mm length fibers.

B. Split Tensile Strength

Based on the compressive strength results the split tensile strength is carried out for 8% volume fraction of steel fiber of length 35mm and is found to be 1.98N/mm² after 7days and 3.08N/mm² after 28days of curing.

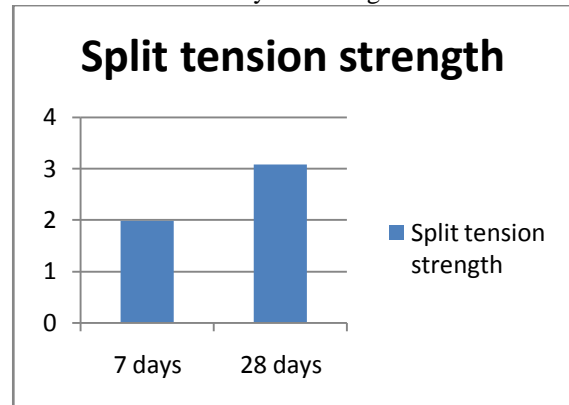


Fig.5. split tension results for small cylinder

C. Flexure Strength

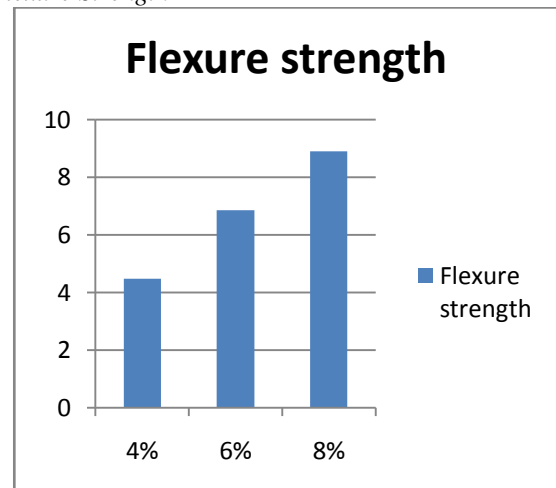


Fig.6 flexure strength results

The flexure strength is carried out for 4%, 6% and 8% Volume fraction for 35mm length and found as 4.47Mpa, 6.84Mpa and 8.90Mpa.

V. CONCLUSIONS

The experimental investigation on mechanical properties of SIFCON was carried out and the following conclusions can be made out:

- The compressive strength is more for smaller length fibers than higher length fibers.
- The more is the volume fraction more is the compressive strength.
- For flexure and split tension tests also if the percentage of steel fibers is more then the strength is also higher.

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