International Journal of Scientific Research in Civil Engineering
© 2017 IJSRCE | Volume 2 | Issue 1 | ISSN : 2456-6667

Experimental Investigation on SIFCON with Using Different Type Fibers

M. Vijayakumar*[1], P. Dinesh Kumar[2]

*[1]PG Student M. E Structural Engineering, Kongu Engineering College, Perundurai, Tamilnadu, India

[2]Assistant Professor, Department of Civil Engineering, Kongu Engineering College, Perundurai, Tamilnadu, India

ABSTRACT

Improve the concrete toughness and reduce the amount of defects by adding a some fibers to the concrete for this situation SIFCON type concrete is preferred SIFCON is not having coarse aggregate only have cement and sand or any cementitious material. The main objective of this paper deals with the coarse aggregate not used because of environment safe and saving building materials to future generation. Slurry-infiltrated fibrous concrete (SIFCON) gives the more strength compare to conventional and fiber reinforced concrete (FRC). This type of concrete gives the more ductility, earthquake resistant and tensile strength of concrete has higher strength. SIFCON consist the straight steel fiber, glass fiber, cement, fine aggregate, fly ash and the volume of fiber fraction of steel fiber is only varying to find the strength properties of SIFCON. Abrasion test result gives the lesser wear and tear effect. Aspect ratio of steel fiber is 75 kept in different mixes and it influences the strength of concrete as well as results compared to M30 conventional concrete.

Keywords: SIFCON, Abrasion Test, Straight Steel Fiber, Tensile Strength, Earthquake Resistant, Toughness.

I. INTRODUCTION

The construction of long span bridge, high-rise building, offshore structures, and other mega structures requires materials, with increasingly improved properties, particular strength, stiffness, toughness, ductility, durability. In the cause instances, simultaneous improvement in a combination of properties is needed. Such material often called “High Performance Materials” and “Advanced Materials” and they are different from other conventional materials.

Now a day’s different type concrete is used different type of structures to ensure their strength, resistant to abnormal loads, earthquake loads and cost effect in real life as well as lifetime of structure also considered. This reasons special type concrete is invention by David Lankard, develop the higher strength and high performance material gives the excellent mechanical properties. It have cement mortar or slurry is infiltrated to fiber bed, it is termed as Slurry infiltrated fibrous concrete (SIFCON). The making process of SIFCON is different from FRC and it consist of high fiber volume fraction about 5% to 12 %. Normally FRC 1% to 3 % fiber used. In SIFCON, the matrix is made of flowing cement slurry mortar and fibers are pre- placed in the mould.

The design methods for SIFCON members must take into account their application (or) end, the property

that needs to be enhanced, minimum proportion, strength as well as its constructability and service life.

SIFCON used successfully for refractory applications, pavement overlays, and structures subjected to blast and dynamic loading. Because of its highly ductile behavior and far superior impact resistance, the composite has excellent potential for structural applications in which accidental or abnormal loads such as blasts is encountered during service.

A. Factors affecting SIFCON

There are four variables to consider when evaluating a SIFCON specimen. They are-
Slurry strength, Fiber volume, Fiber alignment, Fiber type.

B. Applications

- Pavement rehabilitation and pre cast concrete products.
- Overlays, bridge decks and protective revetments.
- Seismic and explosive resistant structures.
- Sea protective works.
- Military applications such as anti-missile hangers, underground shelters.
- Repair, rehabilitation and strengthening of structures. Concrete mega structures like offshore and long span structures, solar towers.

II. METHODS AND MATERIAL

The process of making SIFCON is different, because of high steel fiber content. While in SFRC, the steel fibers mixed intimately with wet (or) dry mix of concrete, prior to mix poured into forms. SIFCON made by infiltrating low viscosity cement slurry in to a bed of steel fibers "pre packed" in forms (or) moulds.

A. Materials

- OPC 53 grade cement having specific gravity about 3.15 is used. Natural river sand is used; it passed through 600µ sieve and retain 300µ sieve for making of cement slurry effectively.
- The water has pH value of 6 to 8 used. (Portable).
- High range water reduce admixture like the one Conplast SP- 430 is used. The class F fly ash used in this project, it also passes through 600µ sieve and retain 300µ sieve.
- The stainless straight steel fiber of 0.33mm diameter, 25mm length is used. E type glass fiber used for find out strength of concrete.
- Aspect ratio of steel fiber is 75 kept (L/D).

B. Mix Proportion

The four different mixes are used, the ratio of mix is 1:1:0.5, like as cement, fine aggregate and fly ash. The volume steel fiber fraction changed 5%, 7%, 9%, 11% and glass fiber volume kept 1% constantly 2% superplastizicer and w/c ratio 0.45 for all mixes.
General Mix design is not used and mix ratio of M 30 concrete is 1:1.54:2.62:0.45, such as cement, FA, CA, W/C (water cement ratio). The table 1 gives the mix proportion of SIFCON.

TABLE I
SIFCON MIX PROPORTION

Mix no	Cement	FA	Fly ash	Steel %	Glass %
1	1	1	0.5	5	1
2	1	1	0.5	7	1
3	1	1	0.5	9	1
4	1	1	0.5	11	1

III. RESULTS AND DISCUSSION

150mmX150mmX150mm cube mould, 150mmX300mm cylinder and 400mmX100mmX100mm prism moulds are used to determining the mechanical properties of SIFCON and M30 concrete. The following steps are giving the process of making SIFCON:

- The moulds are free from dust and waste oil applied to mould.
- The steel and glass fibers preplaced in the mould and it is different from normal FRC.
- After cement, fine aggregate, fly ash and water is prepared correct quantity and mixed with superplastizicer.
- The slurry or mortar formed. This slurry is poured through pumps or directly poured into the mould.
- Hand compaction or vibrated for infiltration process and finally SIFCON specimens are casted.

A. Compressive Test

The cube specimens are tested 28 days after casting; compressive load recorded after achieving first crack or failure of cube. Compressive strength = load/area (N/mm^2). The mortar strength of conventional concrete is calculated. The below figure1 shown the compressive strength of SIFCON and M 30 concrete.

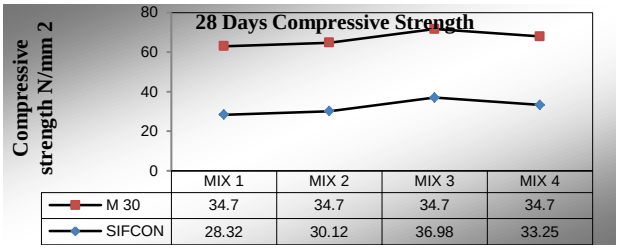

Figure 1. Compressive strength result

B. Split tensile strength test

The tensile strength of specimens finds outed by this test and it shows the higher tensile strength of concrete in compare to M30. Figure 2 gives the tensile strength of SIFCON.

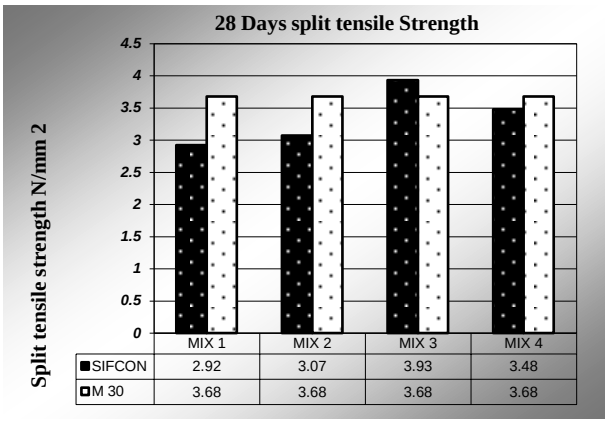

Figure 2. Split tensile strength results of SIFCON

C. Flexural strength test

Flexural strength influences the flexural behaviour of concrete, the results of SIFCON flexural strength is higher than the M30 concrete. Figure 3 shows 28 days flexural strength.

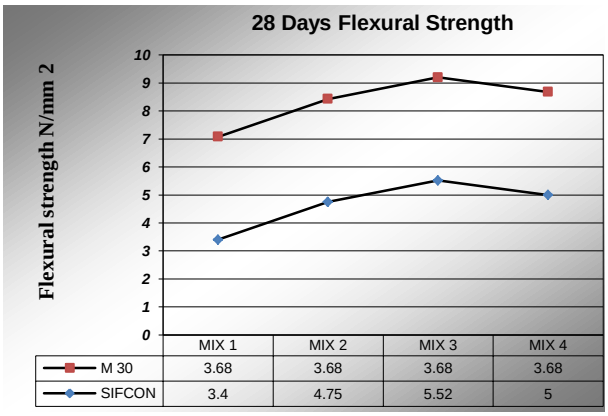

Figure 3. 28 days flexural strength results of SIFCON

D. Abrasion test

The abrasion test was on 100X100X100 mm test specimens and using a standard abrasion-testing machine.

The specimens were first oven dried at 100 degree Celsius for 24 hours and then weighted to an accuracy of 0.001 N (0.1g). Aluminum powder was as the abrasive agent.

The test continued until 110 & 220 revolutions were completed. The surface cleaned, and the specimen weighed.

The loss due to abrasion (abrasion index) calculated as the difference between the initial weight of the

specimen and its weight after a fixed number of revolutions with respect to its initial weight.

TABLE II
ABRASION INDEX VALUE

Specimens	110 revolution	220 revolution
M 30	2.50	7.61
Mix 1	3.11	4.04
Mix 2	2.10	3.80
Mix 3	1.87	2.55
Mix 4	2.18	2.86

IV. CONCLUSION

- Abrasion test gives, clear that SIFCON specimens containing 10 percent fiber content exhibit greater abrasion resistance than other types of specimens. The degree of abrasion, even though high in the initial stages of revolution of the disk (because the outer mortar surface of the specimens wore out faster) is still much lower plain specimens.
- The compressive, split tensile and flexural strength of SIFCON is higher than the conventional concrete.
- The compressive strength of SIFCON increased about 28% in compare to M30 and the optimum mix is the Mix 3 founded.
- Here explained the effect of placing steel fiber in mould and infiltration of slurry influence the results.
- Coarse aggregate is not used, but results are high and economical in compare to M30.
- In using Steel and glass fiber the strength of concrete is increased. Even though some authors used the crimped type steel fiber, it gives better results and bonding between slurry and fibers achieved good manner.
- The flexural strength is achieved 5.52 N/mm^2.

V. REFERENCES

[1] B. Abdollahi, "SIFCON strengthening of concrete cylinders on comparsion with conventional GFRP confinement method", Construction and Building Materials 36, pp .765-778.

[2] Ibrahim and Jannoulakis"The effectiveness of steel fiber reinforcement in composite slabs", International conference on Modern concrete vol 3, isssue 4, pp:243-250.

[3] IS: 2386-1963 (Part 3) "Methods of test for aggregates for concrete", Bureau of Indian Standards, New Delhi, India.

[4] IS: 456-2000 "Indian Standard Code of Practice for Plain and Reinforcement Concrete", Bureau of Indian Standards, New Delhi, India.

[5] S.M Jayashree and R.R Bharatwaj , "Flexural Behaviour of SIFCON Beams", International Journal of Engineering Research & Technology (IJERT), Vol. 2, No. 2, pp. 1-7.

[6] V.S Parameswaran and N.V Ramana, "SIFCON with special admixtures", Indian journal of engineering & Material sciences Vol 12,Oct 2005 pp:427-433.

[7] Ravindra ,"Studies on Slurry-Infiltrated FibrousConcrete SIFCON", Structural Engineering Research Center, CSIR Campus, TRANSPORTATION RESEARCHRE CORD1332.

[8] H. Sudarsana Rao, and N.V Ramana, "Behaviour of SIFCON simply supported two way slab in flexure", Cement and Concrete Research 1028-1036.