Study on Durability Properties of Sifcon

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Abstract— Civil engineering has the main role of to protect buildings from different environmental effects and increase life span or increase the some durability properties. Durability deals with the safe against dynamic loads like earthquake, any sudden abnormal loads and resists the acid and sulphate attack. Abrasion main problem in bridge construction these situation steel fibers are layered in the way of slurry mixing of concrete like as SIFCON. SIFCON is different from normal fiber reinforced concrete (FRC). Slurry infiltrated fibrous concrete (SIFCON) is increased the toughness, tensile strength and decrease the brittle function of concrete.

Key words: Durability, SIFCON, Fiber, Environment, Concrete

I. INTRODUCTION

SIFCON is unique construction material possessing high strength as well as large ductility and far excellent potential for structural applications when accidental (or) abnormal loads are encountered during services SIFCON also exhibit new behavioral phenomenon, that of "Fiber lock" which believed to be responsible for its outstanding stress-strain properties. 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. The matrix fineness must be designed so as to properly infiltrate the fiber network placed in moulds, since otherwise, large pores may form leading to substantial reduction in properties. A controlled quantity of high range water reducing admixtures (super plasticizer) may be used for improving flowing characteristics of SIFCON. All steel fiber types namely straight, hooked and crimped can be used. The fibers are subjected to frictional and mechanical interlock in addition to the bond with the matrix. The matrix plays the role of transferring the forces between fibers by shear, but also acts as bearing to keep fibers interlock.

A. Sifcon:

Slurry-infiltrated fibrous concrete (SIFCON) can be considered as a special type of fiber concrete with high fiber content. The matrix usually consists of cement slurry or flowing mortar. SIFCON has excellent potential for application in where High ductility and resistance to impact are needed. SIFCON is different from normal FRC. The fiber content of FRC generally varies from 1to3 percent by volume, but the Fiber content of SIFCON varies between 5 and 20 percent. The production of SIFCON far different from FRC.

II. MATERIALS

The different materials needed to manufacture the SIFCON like cement, fine aggregate, fly ash, steel fibers, glass fibers and superplasticizers, water. SIFCON, coarse aggregate is not used.

A. C-Flyash:

Fly ash from thermal power plant passing through 300 µ sieve used. It has specific gravity 2.31 with whitish grey to grey with slight black. The fineness of fly ash is 3200cm2/gm.

B. Cement, Fine aggregate:

PPC type cement used specific gravity of 3.15. River sand of size 600 µ pass through and 300 µ retain sieve and fineness of sand high.

C. Water and SuperPlasticizer:

Portable water is used for making mortar. The pH value of water lies between 6 to 8. ConplastSP430 used and it is based on Sulphonated Napthalene Polymers and supplied as a brown liquid.

D. Steel and Glass fiber:

Stainless straight steel fiber of 0.33 mm diameter, 25 mm length with aspect ratio of 75. E type of glass fiber used and it not have any aspect ratio.

III. CASTING AND CURING

150X150X150 mm and 100X100X100 mm cubes are casted to find all durability test and 28 days curing process done. After finishing 28 days water curing, the cubes are immersed in acid and sulphate solution on 90 days curing.

A. Sifcon Making Process:

Mix ratio of 1:1:0.5, water cement ratio 0.45, 2% of superplasticizers are used. The glass fiber volume of fiber fraction kept 1% constantly and steel fiber volume only changed. i.e. 5%,7%,9%,11%.

Making process of SIFCON is different from FRC. Because FRC the fibers are mixed wet or dry concrete mix, in SICON fibers preplaced in moulds after the slurry will poured or infiltrated the bonding properties of fibers are developed by interlock action.

Fig. 1: Mix Process

IV. TESTS CONDUCTED

1) Compression strength test
2) Durability test
3) Acid attack test
4) Sulphate attack test
5) Abrasion test

A. *Compression Strength Test:*

For cube compression tests on concrete, cube of size 150mm were employed. All the cubes were tested in saturated condition after wiping out the surface moisture from the specimen. For each trial mix, cubes were tested at the age of 28 days. The tests were carried out at a uniform stress after the specimen has been centered in the testing machine. Loading was continued till the dial gauge needle just reverse its direction of motion.

Fig. 2: failure load cube

B. *Durability Test*

1) *Acid Attack Test:*

- The acid attack test was carried out on the cubes of size 70.7mmx70.7mmx70.7mm. The cubes were dried in normal room temperature of 27oC ± 2oCafter 28 days of curing;
- the specimens were taken out and allowed to dry for one day and the weight (W1)of cubes was noted. The sulphuric acid solution was prepared by adding 3.0% sulphuric acid of 1N (by volume of water) to 20litres of distilled water.
- The cubes were then immersed in 2.0% sulphuric acid solution for a period of 90days. The observations were then made after 90days from the date of immersion in sulphuric acid solution.

Fig. 3: Acid attacked specimens

2) *Sulphate Attack Test:*

- When concrete is exposed to environment containing aggressive chemicals, it leads to deterioration of concrete which can be assessed in terms of terms of loss weight of concrete. To study the acid resistance of concrete, the cubes of concrete were cured and then immersed in 3 % H2So4 solution up to 28days.
- After 28 days immersion the specimens were taken out and visually observed for the deterioration of concrete due to sulphate attack.The specimens were weighted once again and the weight is compared with the normal concrete.

Fig. 4: Sulphate attacked specimens

3) *Abrasion Test*

- 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 used as the abrasive agent.
- The test was continued until 110 & 220 revolutions were completed. The surface was cleaned, and the specimen was weighed.
- The loss due to abrasion (abrasion index) was 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

V. RESULTS AND DISCUSSION

A. *Compression Strength Test:*

The difference in strength for SICON and M 30 concrete graphed

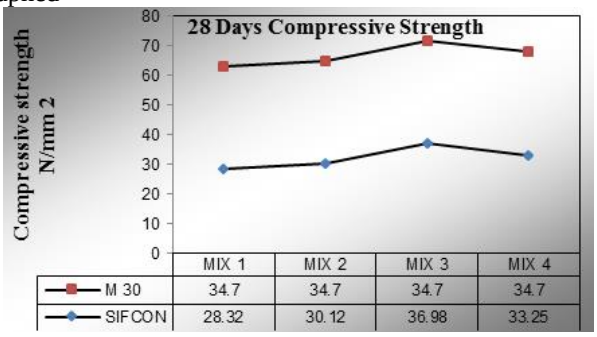

Fig. 5: Compressive test value

B. *Weight Loss in Specimens after Abrasion Test:*

In durability the weight may increase or decrease and it is totally independent of compressive character.

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

Table 1: Abrasion test results.

VI. CONCLUSION

- 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
- Aspect ratio is affect the strength and bonding properties.
- Slurry making process some time gives bad workability, because water content increased highly.
- Ductility of SIFCON is high and resist abnormal loads.

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