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EFFECT OF FLY ASH ON THE TENSILE STRENGTH OF SLURRY INFILTRATED FIBER CONCRETE

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ABSTRACT

Slurry-infiltrated fibrous concrete (SIFCON) is a special type of fiber concrete with high fiber content. The matrix usually consists of cement slurry. SIFCON has tremendous potential for application in areas where high strength isdesirable. SIFCON is a fabrication method in which steel fibers are preplaced in the mould, and then cast along with concrete. After placement of fibers, fine-grained cement based slurry is poured into the fibre network. SIFCON utilizes the fibers in the range of 6-20 % by volume fraction as against usual range of 1-3 % for fibre reinforced concrete. The Cylinder specimens of dimensions Dia-150 mm, L-300 mm were cast, to study their behavior in Compression strength. The investigations confirm the superior characteristics of SIFCON as compared with normal FRC. Key conclusions drawn from the investigations are presented.In this paper effect of addition of fly ash on the properties of SIFCON is reported. SIFCON is made from waste steel fibers obtained from MIDC area.In these study fibers having aspect ratios like 80, 90, 100and 110are used with 2%, 4% and 6% fibers. Specimens are cast by adding fly ash at varying percentages like 10%, 15%, 30% and 40% by weight of cementand Tensile strength are evaluated.

Keywords: aspect ratio, fly ash,SIFCON, Tensile strength, waste steel fibers.

I.INTRODUCTION

Concrete is a widely used material in construction engineering all over the world.Concrete, by virtue of its low cost, easy availability, relatively simple Process technology, good compressive strength and durability under widely varying environmental conditions, has become great construction material. Even though concrete possesses many desirable properties, its low tensile strength, low impact strength, cracking behavior hinders its full potential. During the past few decades there has beenconsiderable research carried out throughout the world on the addition of short discontinuous fibers of glass, steel and plastic to cementious materials. These fibers serve as crack arrestors and improve physical properties of matrix materials. This is known as fiber reinforced concrete.

At present steel fibers are considered as structural fibers as they improve strength of the structure largely. Slurry-infiltrated fibrous concrete (SIFCON) is considered as a special type of fiber-reinforced concrete (FRC). In two aspects, fiber content and the method of production of SIFCON is different from normal FRC. The fiber content of FRC generally varies from 1% to 3% by volume, but the fiber content of SIFCON varies between 6% and 20%. Again, the matrix of SIFCON consists of cement paste or flowing cement mortar as opposed to regular concrete used in FRC. These make the production of SIFCON different from FRC. Unlike FRC, for which the fibers are added to the wet or dry concrete mix, SIFCON is prepared by infiltrating cement slurry into a bed of fibers preplaced and packed tightly in the molds.

The addition of steel fibers into concrete mass can considerably increase the strength properties like compressible strength, tensile strength, and flexural strength and impact strength of concrete. The strength properties of FRC can be increased by increasing the percentage of fibers in the concrete. However, as the percentage of fibers increases, there are certain practical problems, which have to be faced. The higher percentage i.e. higher volume content of fibers may cause balling effect in which the fibers cling together to form balls. Thus, uniform distribution of fibers cannot be guaranteed, if percentage of fibers is more. Also longer fibers interfere with the aggregates during compaction thus hindering the proper orientation of fibers. This fact limits the fiber content from 1% to 3% by volume. The limitations of FRC and continuous ongoing demand for high performance material has led to the invention of ‘Slurry infiltrated fiber concrete’ (SIFCON) by Lankard in 1979. The ‘Slurry infiltrated fiber concrete’ is high strength, high performance material containing relatively high volume percentage of fibers as compared to FRC. SIFCON is also sometimes termed as ‘High volume fibrous concrete’.

II.RESEARCH SIGNIFICANCE

SIFCON, which is considered as a high performance concrete, can also be produced by using waste steel fibers and fly ash obtained from the lathe machine shops and foundry. Since these fibers are available locally, they can be easily used in the production of SIFCON. Due to their coiled nature, they may offer more resistance to loads. The study of effect of addition of fly ash on SIFCON produced from such waste coiled fibers may result in an economic building material.

III.EXPERIMENTAL PROGRAMME

The main aim of this experimental programme is to find out effect of addition of fly ash on the strength properties of SIFCON produced from waste coiled steel fibers.

Ordinary Portland cement of 53-grade and artificial sand with a specific gravity 2.65 and fineness modulus of 2.92 was used in the experimentation. To impart additional workability, superplastisizer (1% by weight of cement) was used. The waste steel fibers were procured from local lathe machine shops. The fibers were of chrome steel having density 6.8 gm/cm^3. The percentage of fibers used in the experimentation is 2%, 4% and 6%. The average thickness was 0.5 mm, different aspect ratios were used in the experimentation were 80, 90, 100, and 110. The cement mortar slurry was prepared with 1:1 proportion using w/c ratio 0.45. A superplastisizer

(1% by weight of cement) was added to this slurry, which increased infiltration capacity of the slurry. To study the effect of addition of fly ash on SIFCON, slurry was prepared by adding fly ash at varying percentages like adding fly ash at 10%, 15%, 30% and 40% by weight of cement

The moulds were filled with 2%,4% and 6% fibers and slurry was poured into the moulds. Vibration was given to the moulds using table vibrator. The slurry was poured until no more bubbles are seen. The top surface of the specimen was leveled and finished. After 24 hours the specimens were demoulded and were transferred to curing tank where they were allowed to cure for 28 days.

The effect of addition of fly ash on SIFCON was studied on Tensile strength. After 28 days of curing, the specimens were taken out of the water. Then it is testedfor Tensile strengths.

IV.TEST RESULTS

It shows thatthe Tensile strength for SIFCON with addition of fly ash and2%, 4%, and 6% fibers. The tables also indicate the percentage increase in the strength of SIFCON due to addition of fly ash with reference to normal mix without addition of fly ash.In addition, itshows the variation of Tensile strength of SIFCON with and without addition of fly ash.

V.DISCUSSIONS ON TEST RESULTS

It has been observed that the Tensile strength of SIFCON increases with as the aspect ratio of fibers increases.

It has been observed that the Tensile strength, of SIFCON increases with and without addition of fly ash.

Thus it can be concluded that the SIFCON produced with higher fibers percentage and having Higher an aspect ratio shows the maximum strength.

The increase in Tensile strengths of SIFCON due to addition of fly ash may be credited to pozzolanic activity of fly ash. Further due to its fineness of fly ash, it fills the small pores of the cement paste giving very dense concrete. As a result great increase in strength properties is seen. The values of strength properties of SIFCON increase with an increase in percentage of addition of fly ash.

Table 4.1: Results of Tensile strength on 28 Days of curing with 2% fiber

Different aspect ratios of fibers	Tensile strength (MPa) of SIFCON without	Tensile strength (MPa) of SIFCON with addition of fly ash at varying percentages							
		10% addition	Percentage increase in comp.strength w.r.t ref mix	15% addition	Percentage increase in comp.strength w.r.t ref mix	30% addition	Percentage increase in comp.strength w.r.t ref mix	40% addition	Percentage increase in comp.strength w.r.t ref mix

	addition of fly ash (ref. mix)								
80	2.50	2.61	4.40	2.66	6.40	2.70	8.00	2.60	4.00
90	2.59	2.73	5.41	2.80	8.11	2.85	10.04	2.70	4.25
100	2.72	2.90	6.62	2.94	8.09	3.07	12.87	2.87	5.51
110	2.93	3.18	8.53	3.29	12.29	3.40	16.04	3.15	7.51

Figure 4.1:Variation of Tensile strength on 28 Days of curing with 2% fiber for different aspect ratios

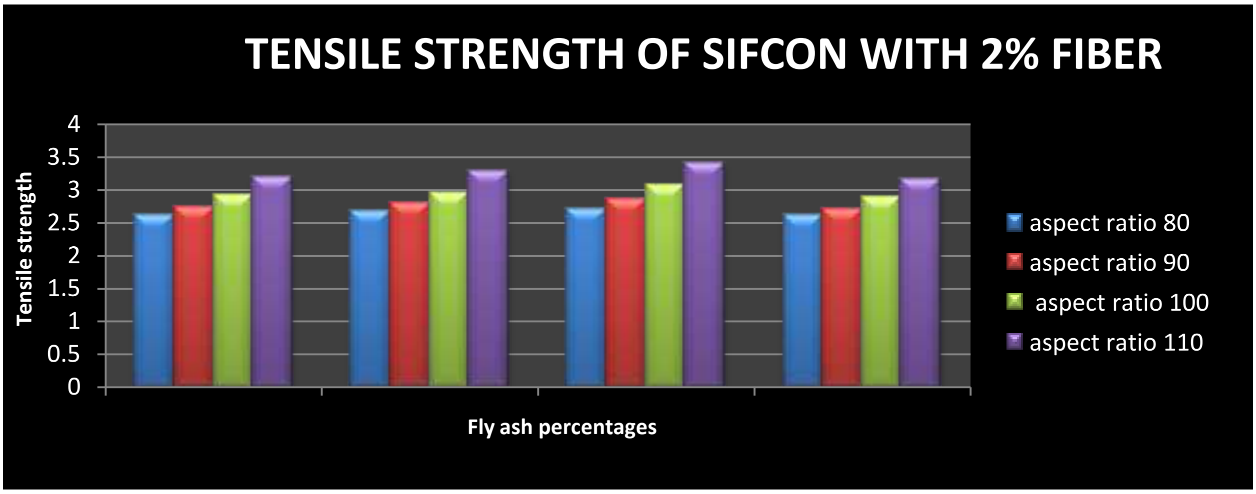

Table 4.2: Results of Tensile strength on 28 Days of curing with 4% fiber

Different aspect ratios of fibers	Tensile strength (MPa) of SIFCO	Tensile strength (MPa) of SIFCON with addition of fly ash at varying percentages							
		10% addition	Percentage increase in comp.strength w.r.t ref mix	15% addition	Percentage increase in comp.strength w.r.t ref mix	30% addition	Percentage increase in comp.strength w.r.t ref mix	40% addition	Percentage increase in comp.strength w.r.t ref mix

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	N without addition of fly ash (ref. mix)								
80	2.63	2.74	4.18	2.82	7.22	2.85	8.37	2.75	4.56
90	2.70	2.83	4.81	2.92	8.14	2.97	10.00	2.86	5.93
100	2.89	3.12	7.96	3.19	10.38	3.22	11.42	3.07	6.23
110	3.02	3.28	8.61	3.37	11.58	3.41	12.91	3.23	6.95

Figure 4.2:Variation of Tensile strength on 28 Days of curing with 4% fiber for different aspect ratios

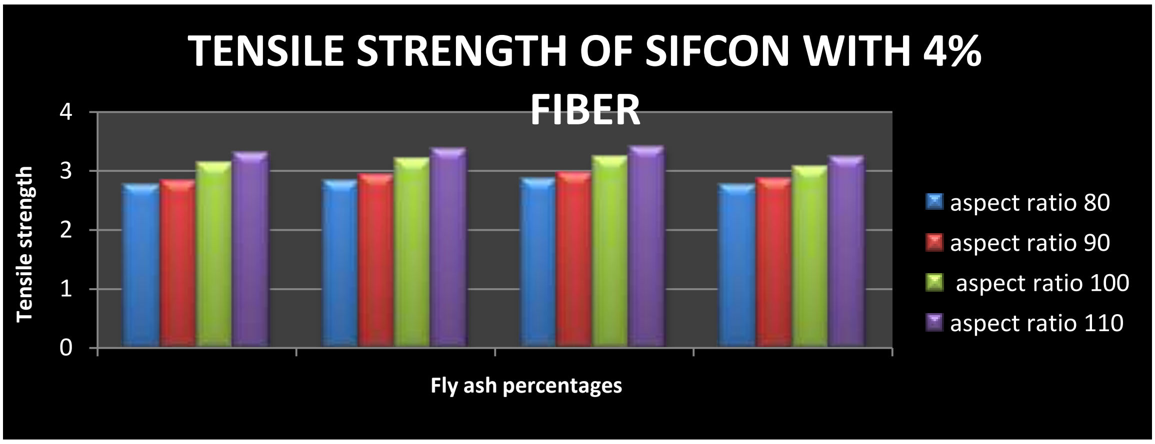

Table 4.3: Results of Tensile strength on 28 Days of curing with 6% fiber with varying percentages of fly ash

Different aspect ratios of fibers	Tensile strength (MPa) of SIFCON without	Tensile strength (MPa) of SIFCON with addition of fly ash at varying percentages							
		10% addition	Percentage increase in comp.strength w.r.t ref mix	15% addition	Percentage increase in comp.strength w.r.t ref mix	30% addition	Percentage increase in comp.strength w.r.t ref mix	40% addition	Percentage increase in comp.strength w.r.t ref mix

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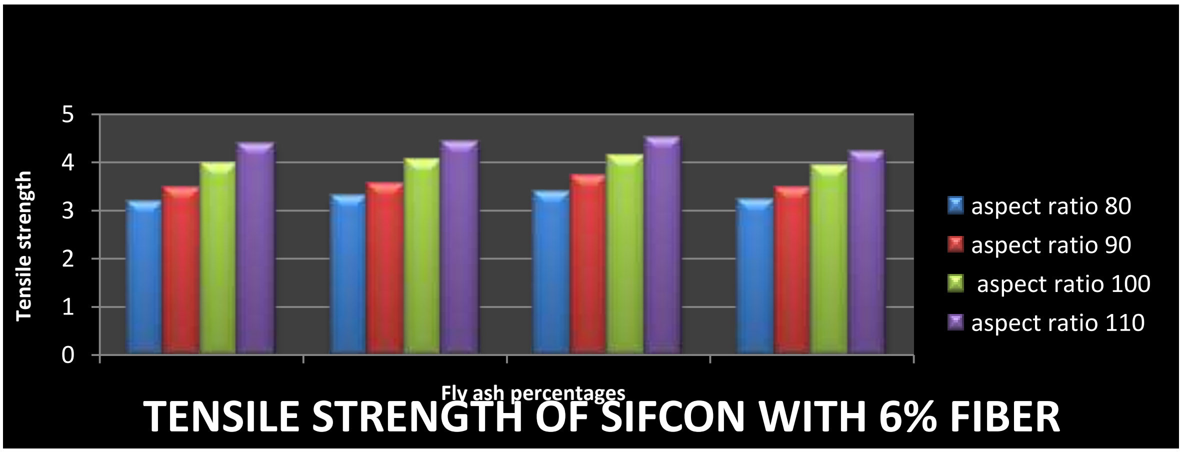
	addition of fly ash (ref. mix)								
80	3.05	3.19	4.59	3.29	7.87	3.39	11.15	3.23	5.90
90	3.28	3.49	6.40	3.56	8.54	3.70	12.80	3.48	6.10
100	3.66	3.98	8.74	4.06	10.93	4.14	13.11	3.91	6.83
110	3.95	4.38	10.89	4.43	12.15	4.53	14.68	4.23	7.09

Figure 4.3:Variation of Tensile strength on 28 Days of curing with 6% fiber for different aspect ratios



V.CONCLUSIONS

The SIFCON produced with higher fibers percentage with Higher an aspect ratio have the maximum strength.
The strength properties of SIFCON also enhanced due to addition of fly ash.
The addition of fly ash and steel fiber with varying percentage may be considered as a high performance concrete which may result in an economic building material.

REFERENCES

[1.] Nanni, A., ‘Properties of aramid fibre reinforced concrete and SIFCON’ , Journal of Materials in Civil Engineering, Feb 1992, Vol. 4, No. 1, pp 1-15.

[2.] Raghuprasad P S, Ravindranatha et al, ‘Experimental investigation on flexural strength of slurry infiltrated fibre concrete (SIFCON)’ Cement and Concrete Research vol 36 (2003) , pp 403-408.

[3.] Abid A. Shah, Y. Ribakov, “Recent trends in steel fibered high-strength concrete”. Materials and Design vol.32 (2011) pp.4122–4151.

[4.] Halit Yazici, Huseyin Yigiter, Serdar Aydin & Bulent Baradan, "Autoclaved SIFCON with high volume Class C fly ash binder phase". Cement and Concrete Research vol. 36 (2006) pp 481– 486

[5.] I. S. 516-1959, 'Methods of tests for strength of concrete', Bureau of Indian standards, New Delhi.

[6.] S. Parameswaran, T.S. Krishnamoorthy, K. Balasubramanian, and Santhi Gangadar, "Studies on Slurry-Infiltrated Fibrous Concrete (SIFCON)". Transportation research record 1382, pp. 57-63.

[7.] Yu-Fei Wu, Jia-Fei Jiang, Kang Liu , "Perforated SIFCON blocks – An extraordinarily ductile material ideal for use in compression yielding structural systems". Construction and Building Materials vol. 24 (2010) pp. 2454–2465.

[8.] Mix Design Manual, Durocrete Engineering services Pvt Ltd.

[9.] IS 10262-2009 Bureau of Indian Standard Concrete mix Proportioning Guide lines.

[10.] 'Use of fly ash in concrete', ACI232.2R-03, reported by ACI committee 232, March 2004, American concrete institute, USA.