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A Comparative and Experimental Study on Self Compacting Concrete Using Flyash with Hybrid Fibre (Steel and Glass Fibre)

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Abstract: ***In the previous couple of years numerous alteration has been done to accomplish quality and solidness property of concrete. Similarly a modified high performance concrete called as self compacting concrete came in to construction. This concrete solved the problem of compacting while casting and also reduce the work force requirement. Expansion of hybrid fibres will likewise treat the quality of concrete and improve tensile strength. PPC 25% flyash based totally used on this examine. The goal of this have a look at to investigate the performance of M25 grade of concrete the use of hybrid fibres (steel fiber (SF) and glass fiber (GF)) alongwith mineral admixture, for example, fly powder. In this investigation 20% replacement of sand by flyash (F) has been done. Four mixes are prepare for this study such as: SCC (without flyash content), SCC with steel fiber (SFRSCC), SCC with glass fiber (GFRSCC) and SCC with hybrid fibers (HFSCC) have set up with same water-bond proportion of 0.40. Fibers have introduced in to SCC by different percentage (0.2%, 0.3%, 0.4%) by weight of cement. Compressive test, split tensile test have been performed in the solidified state. To check the compactability of SCC new properties test were additionally led, for example, slump flow test and T500 test. Expansion of flyash shows increase workability of FRSCC to some extent. Also it is seen that at 0.3% HFRSCC combination performed better than plain SCC and rest of FRSCC mix.***

Keywords: ***Self Compacting Concrete (SCC), Hybrid Fibre Reinforced SCC (HFRSCC), Pozzolana Portland Cement (PPC), T500 (Workability Test)***

I. INTRODUCTION

Self compacting concrete is defined as "radical concrete that is able to flow and consolidate below its own weight, absolutely fill the shape work even inside the presence of dense reinforcement as examine to the conventional concrete. SCC was firstlty developed in Japan by Professor Hazime Okamura. Most prominent weakness of utilizing cementitious material in both SCC and regular concrete is cause to cracking. To control the principal stage splitting at least two strands are added to solid blend upgrade the quality and it is otherwise called Hybrid Fiber. But expansion of fibres influences the usefulness of SCC. So addition of flyash by replacement of 20% sand will increase the slump. Also flyash is a mineral admixture it acts as filler material due to its fineness, it improves the performance of SCC in fresh state at some extent and avoid the use of viscosity modifying agent. Flyash is a waste and can be the one of the best alternative for replacement of sand in order to overcome the depletion of natural source. Addition of steel and glass fibres with flyash improves the compressive and split tensile strength.

II. MATERIAL USED

Pozzolana Portland cement is used in this study. It confirms to IS: 1489-1991 Part-1 (flyash based). Specific gravity of cement is 2.90 and its fineness value is 3%. Locally available sand passed from 4.75 mm sieve before use in the study in order to confirm IS 383-1983. It is used as fine aggregate which comes under (zone 1). Specific gravity of fine aggregate is 2.67 and fineness modulus is 2.57. Coarse aggregate is used of nominal size 20 mm and 10 mm confirming to IS 383-1983. Coarse aggregate of specific gravity is 2.72.

A. Flyash

Class F Flyash used in this study as a filler material to improve workability of SCC. It has a specific gravity 2.32. Properties are considered according to IS 3812-1981. It is collected from , Ambuja cement plant, Bilaspur, India.

Fig. 1 Flyash

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B. Super Plasticizer

Modified (polycarboxylate ether) super plasticizer SikaPlast 4202 NS used in this investigation. It is light brown liquid and complies with IS 9103:1999. Super plasticizer has been mixes 1% by weight of cement. Final dosage of super plasticizer has been given only after 2/3rd of the wet mixing timing to avoid extra water in concrete.

C. Steel and Glass Fibre

Steel and Glass Fibre used in this investigation. Crimped Flat Fibre (CFF-1050) of fibre length 50 mm, fibre diameter 1.0 mm, aspect ratio 50 and tensile strength is 600 N/mm2. AR Glass fibre of filament diameter 13um, Strand Length 12 mm, Tensile Strength 170mpa, ZrO2 content is (17%). Material obtained from B&B ENTERPRISES (Ludhiana) India.

Fig. 2 Steel & Glass Fibre

III. MIX PROPORTIONS

M25 grade of concrete has been designed on the based on EFNARC (European Federation of Procedure and Applicators of Specialist Products of Structure).

Table I Mix Proportions

MATERIALS	QUANTITIES OF MIX FOR SCC			
	SCC	SFRSCC	GFRSCC	HFRSCC
Cement (Kg/m^3)	356	356	356	356
F (Kg/m^3)	-	212.28	212.28	212.28
F.A (Kg/m^3)	1061.39	849.117	849.117	849.117
C.A (Kg/m^3)	833.95	833.95	833.95	833.95
Water (l/m^3)	156.44	156.44	156.44	156.44
S.P (%)	1	1	1	1
SF (%)	-	0.2,0.3,0.4	-	0.2,0.3,0.4
GF (%)	-	-	0.2,0.3,0.4	0.2,0.3,0.4

IV. TEST CONDUCTED ON CONCRETE

A. Fresh Concrete Test

Fig. 3 Slump Flow Test

Workability tests performed according to EFNARC for SCC. Filling ability test slump flow, T500 performed for the four different mix of concrete.

Table II Slump Flow Test Results

Fibre % age	SFRSCC		GFRSCC		HFRSCC	
	Flow speed (mm)	T50 sec	Flow speed (mm)	T50 sec	Flow speed (mm)	T50 sec
0	780	3.6	780	3.6	780	3.6
0.20	760	3.7	770	3.9	750	4.2
0.30	750	3.9	760	4.1	720	4.4
0.40	730	4.0	740	4.2	700	4.7

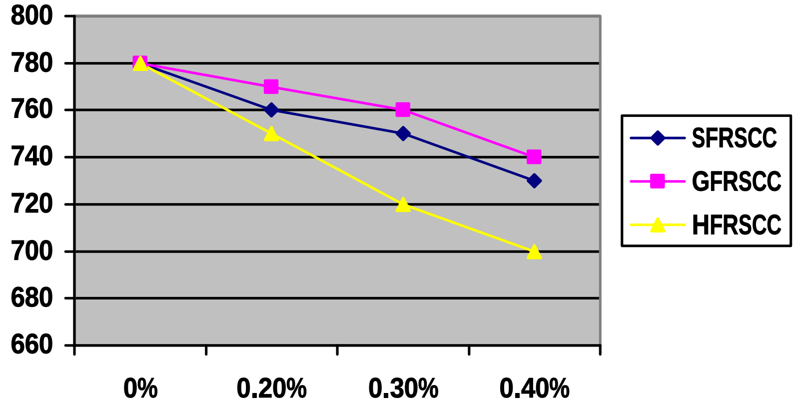

Fig. 4 Slump Flow Graph

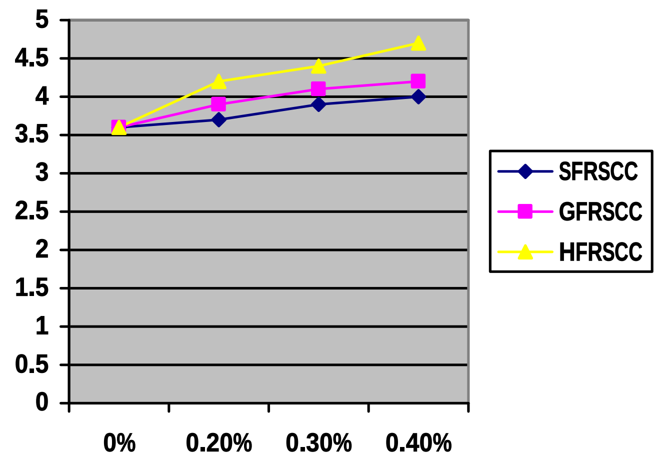

Fig. 5 T50 Graph

B. Compressive Strength Test

After 7 and 28 days compressive strength test has been performed on cube. Standard size of cube 150*150*150 mm utilized in this study according to IS: 516-1959.

TABLE III Compressive Strength Test Results

FIBRE %AGE	COMPRESSIVE STRENGTH (MPa)					
	(SFRSCC)		(GFRSCC)		(HFRSCC)	
	7 days	28 days	7 days	28 days	7 days	28 days
0	17.32	21.03	17.32	21.03	17.32	21.03
0.20	18.07	25.62	17.92	24.88	21.03	30.36
0.30	19.55	30.07	20.96	26.51	22.18	34.36
0.40	21.47	23.99	22.22	24.58	24.73	28.88

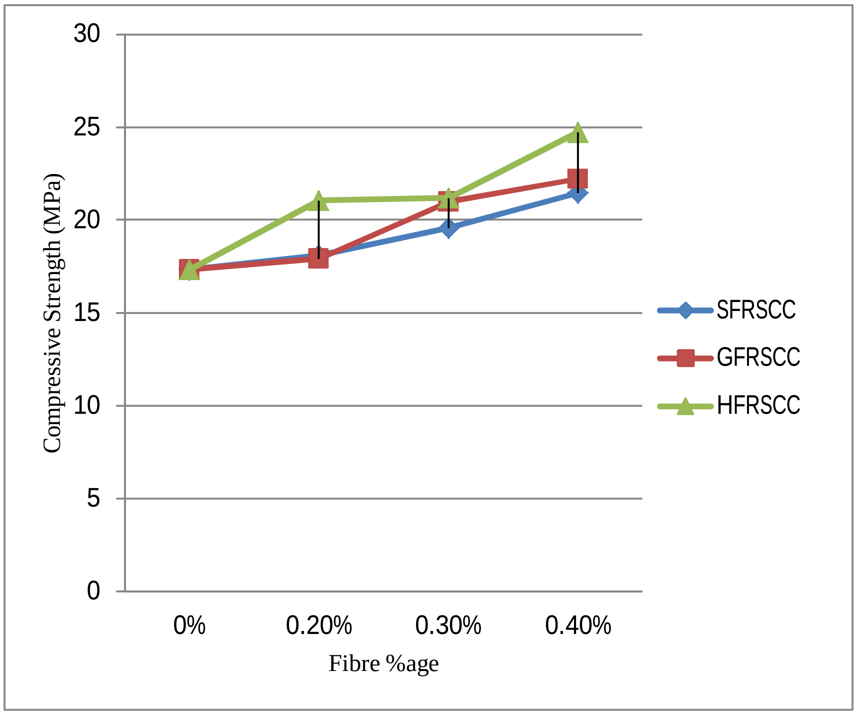

Fig. 6 Compressive Strength for 7 Days

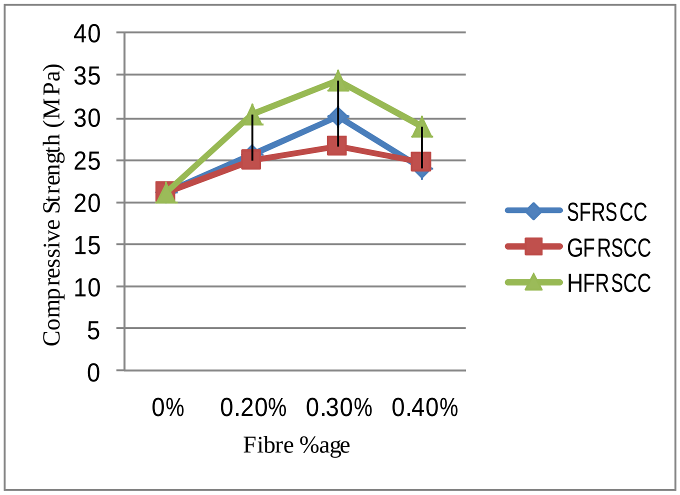

Fig. 7 Compressive Strength for 28 Days

C. Split Tensile Strength Test

After 28 days Split tensile strength test performed on standard cylinder size of 150 mm diameter and 300 mm length as per IS: 516-1959.

Table IV Split Tensile Strength Test

FIBRE %AGE	SPLIT TENSILE STRENGTH (MPa)		
	SFRSCC (28 Days)	GFRSCC (28 Days)	HFRSCC (28 Days)
0	2.75	2.75	2.75
0.20	2.87	2.80	2.99
0.30	3.01	2.89	4.17
0.40	2.68	2.72	2.99

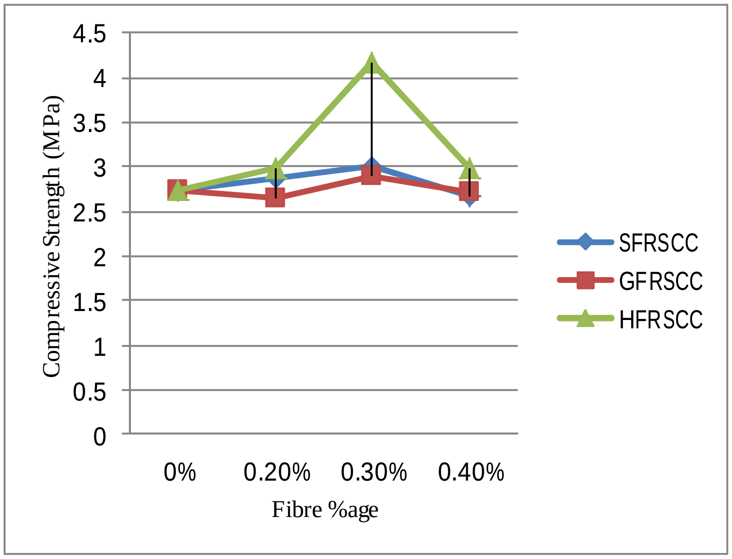

Fig. 8 Split Tensile Strength for 28 Days

V. CONCLUSIONS

It is seen that 28 days compressive and split tensile strength an occurrence of 0.30% (HF) is more than that of plain SCC and same is seen on account of 0.20% and 0.40%. It has additionally been seen that with increment in steel, glass and hybrid fibres the compressive quality and split tensile for 7 days likewise increment. Compressive strength and split tensile strength for SCC-HF 0.30% blends at 28 days is more than that off 0.20% and 0.40% blends. So it is seen that with increase in fibre content compressive and split tensile strength also decrease. Most extreme gain in strength of concrete is found to depend upon the measure of fibre content. Satisfactory workability was maintained with increasing volume fraction of fibres by using flyash. SCC has an excellent slump flow of 780 mm and 3.6 sec. But SFRSCC slump flow little more than GFRSCC and HFRSCC Slump flow is very less for all the mix for different percentage of fibres. The width of cracks is found to be less in SFRSCC, GFRSCC and HFRSCC than in plain SCC. From the test results for 0.3%age of fibres compressive strength, split tensile strength of the mix HFRSCC is found to be 63.38% ,51.63% higher than SCC mix for 28 days. Similarly for percentage of fibres compressive strength, split tensile strength of the mix SFRSCC is found to be higher than GFRSCC.

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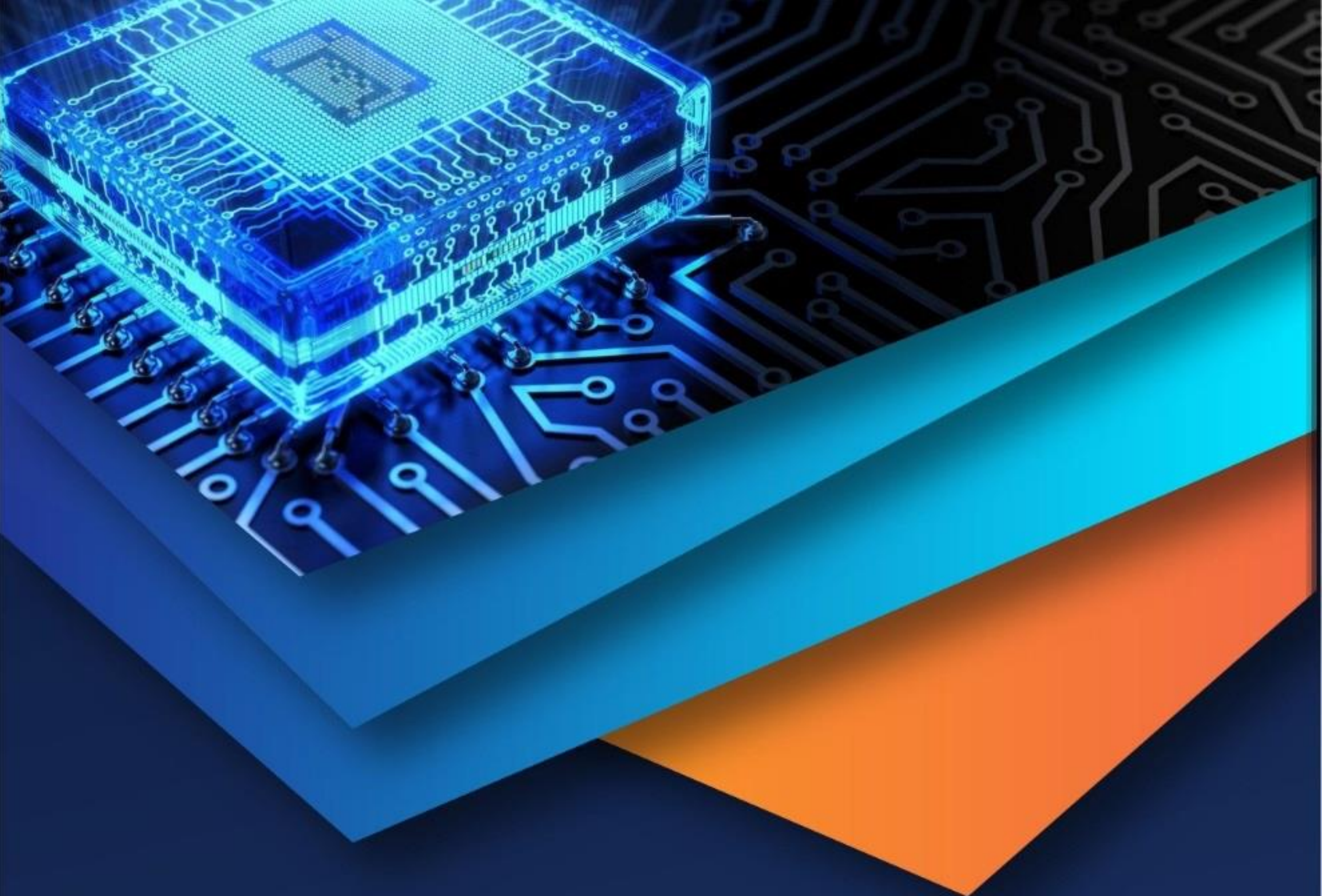

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