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Effect of Aspect Ratio in Slurry Infiltrated Fibre Concrete

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Abstract:
In order to improve the properties of SFRC and hence slurry infiltrated fiber concrete has been introduced as the volume fraction of fiber is limited in conventional steel fiber reinforced concrete. Study shows the use of fibre with different aspect ratio and varying percentage of volume fraction of fiber in slurry concrete. Crimped shaped steel fibre with aspect ratio 40 and 65 are used for compressive strength 1% volume fraction of steel fibre are added with random distribution . Further on basis of compressive strength result the Slurry infiltrated fibre concrete is tested for its flexural behavior with varying percentage of steel fibre 1%, 3%, 5%, 7%, 9%, 11% volume fraction. The result data obtained has been compared for load versus deflection for flexural strength parameters of slurry infiltrated fibre concrete.

Keywords: Slurry infiltrated fiber concrete (SIFCON), flexural strength, compressive strength, steel fiber, aspect ratio

I. INTRODUCTION

Slurry has been key component in construction structure. It smooth thick texture allows it to fill minute holes and pits in a structure creating smooth surface for binding layer of concrete.As slurry has limited shelf life and hence additional material is added to improve its overall strength capacity. The use of alternate fibre element has been introduced in slurry concrete. Many researchs has extensively resreached the effect of fibre volume (Vf) is between 1% and 2% in concrete but in case of slurry infiltrated concrete the range in volume of fibre is 5 to 30% (Lankard 1985). The objective of the study is to used steel fibre with two different aspect ratio 40 and 65 in slurry concrete and to see the behaviour of SIFCON for its compressive strength with 1% volume fraction and on the basis of their compressive strength result they are futher tested for there flexural behaviour for 28 days of curing with varying percentage i.e 1%,3%,5%,7%,9%,11% volume fraction of steel fibre .The result and graph for SIFCON with load versus deflection are plotted based on the results. According to the literature, it can be understood that the optimum percentage of SFs in SFARC beams should be within the range of 1 to 2.5% by concrete volume and depends on the of the fibre (i.e. its aspect ratio) and properties of the fresh concrete such as workability and maximum size aggregates. The addition of less than 1% by volume of SFs is inadequate and amounts beyond 2.5% is also ineffective mostly due to the inadequate compaction and localized distribution of the fibres in the concrete mix leading to a considerable reduction in the compressive strength compared with the same grade of concrete. Johnston has found that the compressive strength of SFRC is increased about with the addition of 1.2% by volume of steel fibres. Research conducted by Johnston showed that the compressive strength of SFRC has been increased from 0 to 15% with the addition of up to 1.5% of steel fibres by volume[1,2,3,4,5]

II. MATERIAL

1. Cement Slurry:

It include cement with OPC 53 grade, silica fume, fly ash, fine sand, super plasticizers and water with specification of OPC as per (IS: 12264-1987)

Sl.No	Test		Result obtained in laboratory	IS:12269 -87
1	Finesse residue on 90 micron		3.00 mm	Not more than 10%
2	Soundness le-chatelaine apparatus		2.00 mm	Not more than 10%
3	Setting time	Initial	104.00 min	Not more than 30 min
		Final	3.9.00 min	Not more than 600 min

2. Aggregate:

- Fine aggregate:- Locally available river sand from shahpur taluka washed with preliminary test conducted in lab

Property	Aggregate type
	Fine aggregate
Fineness modular	2.95
Bulk density	1729 kg/m^3

3. Mixing water:

Portable drinking water was used for the project

4. Super plasticizer:

Belpast SP3 super plasticizer is used with 0.5% by weight of cement in this investigation. It is water reducing agent This is diluted by adding 10% water which is mixed in concrete.

5. Steel fiber:

Steel fiber with crimped shaped are selected.
The physical properties of steel fiber

Properties	Description	Description
Length	0.70mm	0.61 mm
Diameter	28mm	40mm
Aspect ratio (l/d)	50mm	65mm

III. CASTING AND CURING OF MATERIAL

Concrete cube specimen to determine the compressive strength is casted with size (150x150x150) mm and prism specimen of (100x100x500) mm are casted for this study. The specimen is demoulded after 24 hours for 28 days of curing.

IV. METHODLOGY

The specimen are tested for 28 days of curing for their compressive strength using compressive testing machine in total 15 cubes are casted represented as M1, M2 for 28 days of curing. The result of compressive strength test is shown in table1.Based on result of compressive strength flexural strength test is carried out as per IS specification for prism mold of size 100x100x500mm using universal testing machine. The steel fiber with varying percentage of steel (1%, 3%, 5%,7%,9%,11%) randomly distributed in slurry infiltrated fiber concrete are used for aspect ratio 40 and 65. The detail of flexural strength and load deflection of this specimen are shown in table 2 and 3.

V. RESULT AND DISCUSSION

Table.1: Test Result for Compressive Strength

specimen	Type of fiber used with aspect ratio	Compressive strength(N/mm^2)			Avg compressive strength (N/mm^2)
M_1	Not added	25.42	24.33	25.81	25.18
M_2	SF-40	31.47	33.41	30.84	31.90
	SF-65	26.42	28.81	28.84	28.00

Table.2: Average Flexural Strength for Aspect Ratio 40

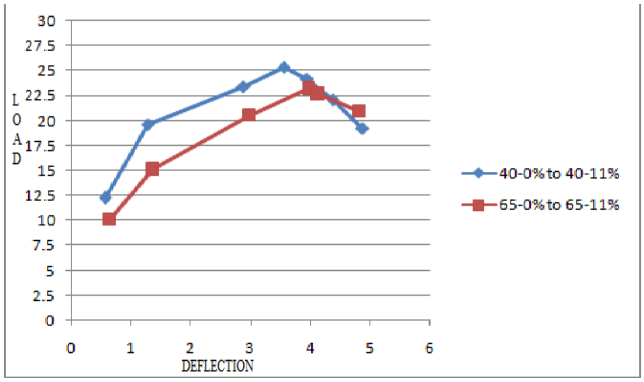
Percentage of fiber	No of sample	Flexural strength N/mm^2	Average flexural strength N/mm^2
40-0%	1	4.31	4.83
	2	4.70	
	3	5.49	
40-1%	1	7.84	7.84
	2	7.23	
	3	8.62	
40-3%	1	8.78	9.43
	2	9.39	
	3	10.12	
40-5%	1	10.37	10.23
	2	9.86	
	3	10.48	
40-7%	1	8.8	9.73
	2	10.4	
	3	10.00	
40-9%	1	7.64	7.84
	2	7.77	
	3	8.13	
40-11%	1	7.06	7.09
	2	7.42	
	3	6.81	

Table.3: Average Flexural Strength for Aspect Ratio 65

Percentage of fiber	No. of sample	Flexural strength N/mm^2	Average flexural strength N/mm^2
65-0%	1	4.09	4.09
	2	3.97	
	3	4.21	
65-1%	1	5.84	6.71
	2	6.07	
	3	6.43	
65-3%	1	7.83	8.24
	2	8.14	
	3	8.91	
65-5%	1	10.42	9.33
	2	8.64	
	3	8.94	
65-7%	1	8.63	9.12
	2	9.42	
	3	9.31	
65-9%	1	7.31	7.38
	2	6.94	
	3	7.81	
65-11%	1	7.34	6.96
	2	6.64	
	3	6.91	

Table.3: Average Flexural Strength for Aspect Ratio 65

% of fiber	Load in (KN)	Flexural strength	Deflection (mm)
40-0%	12.25	4.83	0.57
40-1%	19.62	7.89	1.28
40-3%	23..41	9.43	2.88
40-5%	25.40	10.23	3.56
40-7%	24.21	9.73	3.94
40-9%	22.1	8.84	4.38
40-11%	19.2	7.68	4.87
65-0%	10.1	4.09	0.63
65-1%	15.14	6.71	1.37
65-3%	20.52	8.24	2.98
65-5%	23.21	9.33	3.97
65-7%	22.70	9.12	4.12
65-9%	20.95	8.38	4.81
65-11%	17.4	6.96	5.09



Graph. 1: Load v Deflection

Figure.1. Preparation of Cube and prism Specimen

Figure.2. Testing of Cube Specimen for 28 days of curing

Figure. 3. Failure Pattern and Test Setup for Flexural Loading

VI. CONCLUSION

- From compressive strength result it can be said that Slurry infiltrated fibre concrete gives maximum strength when compared with plain normal slurry concrete
- For aspect ratio there are about 12.25% increases in compressive strength than that of aspect ratio 65.
- For both aspect ration the optimum percentage of steel fibre is 5% after 5% volume fraction of fibre there is decrease in flexural strength of slurry concrete.
- According to the result it can be said lower the aspect ratio higher the strength parameter in Slurry infiltrated fibre concrete.

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