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Experimental Study on Flexural Behavior of Self Compacting Concrete using Steel Fiber

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Abstract: **The aim of the study is to investigate the flexural behavior of self compacting concrete (SCC) beams using steel fiber along with an addition of super plasticizer as a admixture. Conplast SP 430 was used as water reducing admixture and cera hyperplast XR W40 was used as viscosity modifying agent. Corrugated steel fibers of 50mm length were used in this project. Fibers are added 1%, 2%, 3% and 4% in total volume fraction of cement. Steel fibers were added to increase the strength of concrete. Mix designs were done with reference of EFNARC guidelines. Tests on fresh concrete were done to determine its workability. Simply supported beam reinforced with HYSD bars of dimension 150X150X750 mm was tested in laboratory for determining the flexural strength of beam and load deflection data of Self compacting concrete and Fiber self compacting concrete beam was recorded.**

Keywors : - Self Compacting concrete, steel fiber, Flexural strength, Fiber self compacting concrete.

I.INTRODUCTION

Self compacting concrete is a type of concrete which has low yield stress and high deformability. It ensures uniform suspension of solid particles during placement where there is no need for external compaction.

Self compacting concrete has been used in area where compactions seem to be difficult, the area mainly under water construction scc is in usage. In this project scc is used along with steel fiber for increase strength of the concrete. Steel fiber has high elongation property ie., tensile strength, so by the addition of steel fiber in scc we are going to increase the flexural strength of concrete in this project.

II.MATERIALS USED

A. Cement: Ordinary Portland cement, 43 Grade conforming to IS 12269 – 1987.

B. Fine aggregate: available sand conforming to grade zone II.

C. Coarse aggregate: obtain from a local source, had a specific gravity of 2.64 for 20 mm down aggregate, and 2.67 for 10 mm down aggregates.

D. Super plasticizer: CONPLAST SP 430 used commonly.

Table 1: Properties of super plasticizer:

Specification	Value
Specific gravity	1.20 to 1.21 at 300 C
Air entrainment	Approx. 1.5% additional air over control
Chloride content	Nil. to IS:9103-1999

E. Steel fiber: Corrugated steel fiber was used with the length 50 mm.

F. cera hyperplast XR W-40: It helps in production of self compacting concrete

Table 2: Properties of cera hyperplast xrw40

Appearance	Liquid
Colour	Beige
Chemical	Polycarboxylate
Composition	Ether
Active ingredients	40%
Specific gravity	1.11
Ph	7-8
Chloride content	Nil

III. MIX DESIGN

Mix design is the process of selecting suitable ingredients of concrete and determining their relative proportion for producing concrete of certain minimum strength and durability as economically as possible.

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Table 3: mix proportion for SCC

Mixture	Cement	F.A	C.A	VMA	SP
SCC	533	836	771.8 4	0.4%	1.1%
SCC+1% FIBER	533	836	771.8 4	0.4%	1.1%
SCC+2% FIBER	533	836	771.8 4	0.4%	1.1%
SCC+3% FIBER	533	836	771.8 4	0.4%	1.1%
SCC+4% FIBER	533	836	771.8 4	0.4%	1.1%

CA = Coarse aggregate, FA = fine aggregate,
VMA=viscosity modifying agent, SP = Super plasticizer.

IV: EXPERIMENTAL SETUP

A .Dimension of beam

Length = 750mm

Breath =150mm

Depth =150mm

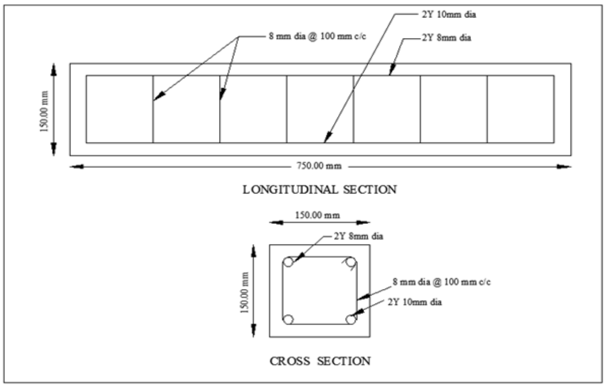
No of specimens =12

B. Beam reinforcement details

- 2Nos of 10 mm dia @ Bottom Raf,

-2Nos of 8 mm dia @ top Raf,

-8mm stirrups @ 100 mm c/c.



C. Tests on fresh concrete

Different test methods have been developed to characterise the properties of SCC. In this paper slump flow and j-ring tests had performed for evaluating workability and blocking resistance.

Table 4: Limitations Specified By EFNARC

Methods	Minimum	Maximum	Units
Slump flow test	650	800	Mm
T50	0	5	Sec
L box	0.8	1	h2/h1
V funnel	0	3	Sec
U box	0	30	h2-h1

Table 5: Fresh Properties of SCC Mixes

Mixture	Slump (mm)	J Ring (mm)
SCC	780	8
SFSCC1%	740	7
SFSCC2%	728	7
SFSCC3%	690	6
SFSCC4%	655	5

D. Tests on hardened concrete

Several tests were carried out on the hardened concrete specimens to determine its strength.

Compression strength test: It was carried out on 150X150X150 mm concrete cube specimens.

Flexural strength test: It was carried out on concrete beams of size 100X100X750 mm.

Tests results on hardened concrete:

Table 7: compressive strength test results

S.No.	Specimen	28 days(Mpa)
1	CM	39.66
2	SCC	42.81
3	SCC+1%F	47.34
4	SCC+2%F	54.85
5	SCC+3%F	61.90
6	SCC+4%F	66.20

Table 8: Flexural strength test results

S.No.	Specimen	28 days(Mpa)
1	CM	7.09
2	SCC	15.62
3	SCC+1%F	18.53
4	SCC+2%F	20.33
5	SCC+3%F	23.05
6	SCC+4%F	24.49

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V. BEHAVIOR IN FLEXURE OF BEAMS

Experimental investigation is carried out on beam to determine its flexural behaviour. The beams are tested using 1000kN capacity UTM under two point load setup to get the flexural behaviour.

Provided Ast = 2 Nos of 10mm dia bars = 157.07mm^2>63.75 mm^2(Min. Ast).

VI RESULTS AND DISCUSSION

The results are obtained by experimentally testing the specimens and it is discussed below,

Table 10: flexural test results of beams for FRSCC

S. No .	Specimen	Initial crack (kN)	Ultimate load (kN)	Ultimate deflection (mm)
1	CM	17.77	37.4	14.87
2	SCC	66.2	80.01	9.95
3	FSCC 0.1	72.67	95.36	8.90
4	FSCC 0.2	79.43	106.1	7.0
5	FSCC 0.3	83.54	120.3	6.5
6	FSCC 0.4	86.37	126.78	5.80

Load versus deflection behaviour of beams are shown below,

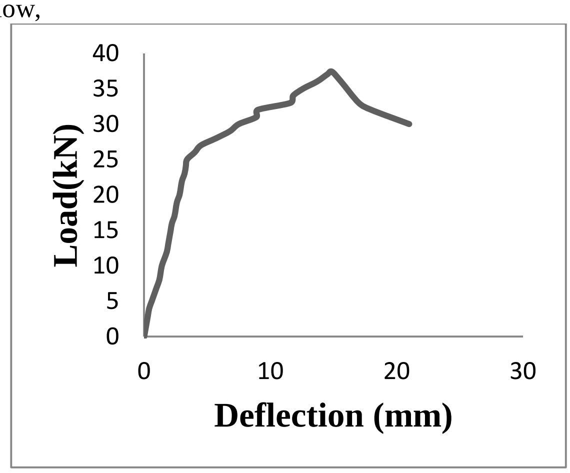

Figure 1 load vs Deflection for occ

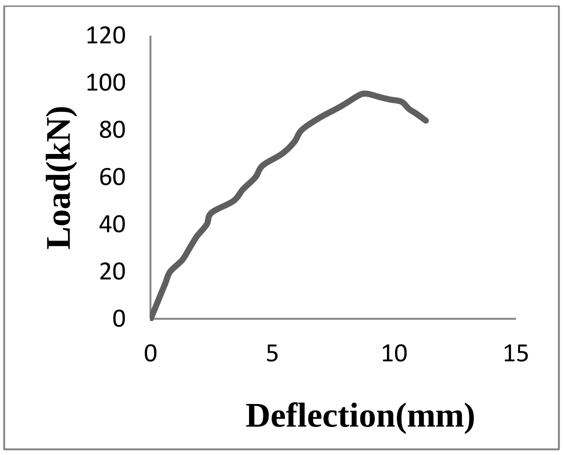

Figure 1 load vs Deflection for scc

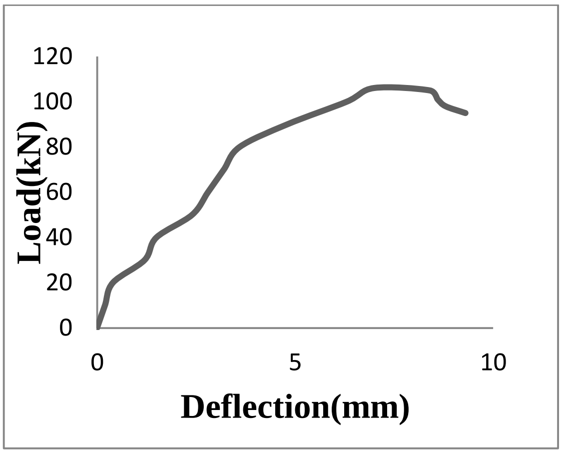

Figure 1 load vs Deflection for scc+1%F

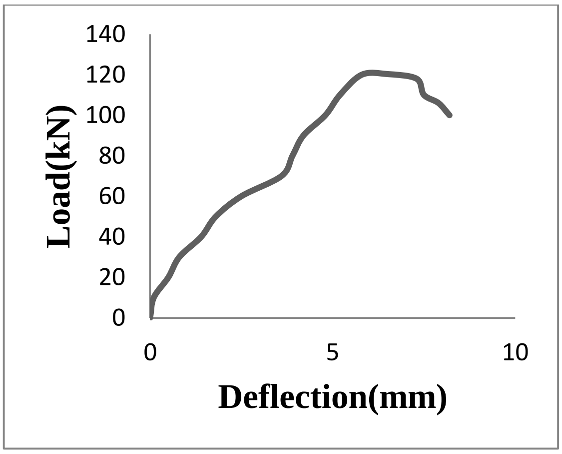

Figure 1 load vs Deflection for scc+2%F

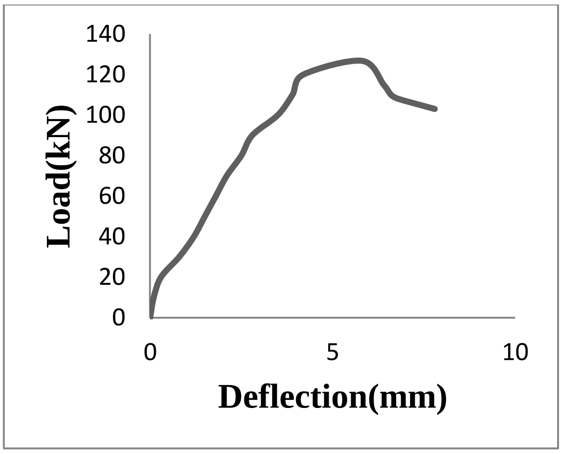

Figure 1 load vs Deflection for scc+3%F

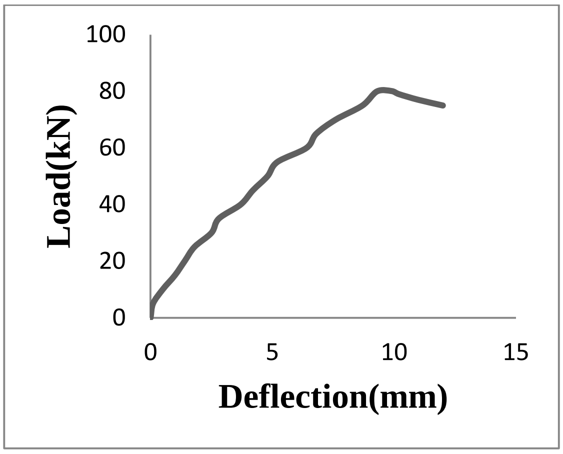

Figure 1 load vs Deflection for scc+4%F

VI CONCLUSION

- Following conclusions are based on the results discussed above,
- From the above experimental investigation it is observed that strength will increase with increase in amount of fiber content.
- The increase in compressive strength is and in flexural strength is of FRSCC over SCC.
- With increasing fiber content, mode of failure is changed from brittle to ductile failure when subjected to compression and bending.

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