



“ENHANCE THE STRENGTH OF REINFORCED CONCRETE USING BY STEE FIBER”

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Abstract : The fibers are very small in size & distributed on all over the concrete mix. The accumulation of steel fibers in concrete and create new type of concrete for different purpose. Different type of mix design can be made for this investigation. The fibers taken in this investigation were round shaped fibers and that aspect ratio used, was 75 in this experimental investigation. The entire specimen were casted in lab with the steel fibers. The addition of steel fiber were 0.5, 0.1, 1.5, 2.0 by percent of mix. The tests performed for this experimental program were compressive strength, Flexural Strength, split tensile strength etc.

Keywords: Fibers, Strength, Toughness, Compressive, SFRC

I. INTRODUCTION

Concrete has poor strength in tensile and good strength in compressive. The steel fibers protect the cracks on concrete & increases strength of the concrete in compression, torsion strength, shear and tension, freezing & thawing resistance. The actual input of the fibres to escalation the toughness of concrete under any type containing loading. The fibre are enough tough, enough interconnected to material, moreover credential the FRC to take major stresses to a relatively huge strainability in the post-cracking play.

II. LITERATURE REVIEW

Jindal and Hassan (1984) who startling shear defiance going from SFRC joints became over that one in reference to regular joints. Reinforced fibres among a range epithetical 1in (25-mm), as a consequence a side proportion consisting of one hundred were cast off situated by a number fraction of 2%. It turned into detected that one SFRC marked up the shear as a consequence moment abilities along 19.1% along with 9.97% precisely.

Kaushik et. al. (1987) found that fact a effectiveness proportion going from 1.67 might be actualized amidst strengthful addition consisting of data 0.5% size half of steel fibres plus situation scale consisting of one hundred and the maximum strain in strengthened concrete beams were epithetical startling tell in reference to 0.007 being compared as far as 0.0035 in place of plain reinforced concrete beams used by fibre.

Ezeldin and balaguru [1992] Accompanied tests to gain the entire stress-strain curves containing steel fibre-reinforced concrete upon compressive strengths ranging from 35.3 mPa to 84.2 mPa. Three volume fibres fractions consisting of 30kg/m³, 46 kg/m³ and 61 kg/m³ and the aspect ratios going from 60, 75 and 100 were investigated respectively. It was described that the supplement epithetical hooked-end steel fibres of concrete, amidst or null silica fume, improved marginally the compressive strength.

Shah and Rangan [1971] expected the following generic equivalence for conjecturing the ultimate flexural strength (fibre composite) $f_{cc} = afm(1- vf) b (vf l/df)$ where f_{cc} is the absolute concentration of the fibre combined; g - maximum concentration of the plain matrix (mortar or concrete); a and b are restriction that are calculated empirically. For plain concrete $a = 1$ & $b = 0$. The constant b deficit for the interlink concentration for fibres and volatility of fibre spreading.

III. MATERIALS AND TESTS

I. Cement

Cement is fine, gray powder. It's blended using water and substances like as sand, gravel, and crushed stone to made concrete. The cement plus water structure a paste that binds the other substances collectively as the concrete strengthens. The regular cement contains twice fundamental constituents specifically argillaceous and calcareous. Ordinary Portland cement of grade forty three (ULTRATECH CEMENT) conforming to Indian standard IS: 8112-1989 has been cast off in the current research.

Compound	content
CaO -CALCIUM OXIDE	60-67%
SiO ₂ -SILICON DIOXIDE	17-25%
Al ₂ O ₃ -ALUMINUM OXIDE	3-8%
Fe ₂ O ₃ -IRON OXIDE	0.5-6.0%
MgO-MAGNESIUM OXIDE	0.1-0.4%
ALKALIES	0.1-1.3%
SO ₃	1.0-3.0%

Aggregate

Aggregate are these kinds of the concrete that establish the bulk of the ended product. They contain 60% to 80% of the extent of the concrete; it's have to be so ordered that the total mass of concrete act as a tremendously dense, homogenous, solid combination, using the smaller sizes appearing as an inert packing of the spaces(voids) that exist between the bigger particles.

1. Coarse aggregate, such as gravel, beaten pebble, or blast furnace slag
2. Fine aggregate, such as normal or manufactured slag

Water

It need to be unrestricted from injurious quantity of acids, alkalis or different organic and inorganic impurities. It must be unrestricted from iron, vegetable remember or other different type of ingredients; which are probable to have unfavourable impact of concrete or reinforcement. It will be match for consuming purpose.

II. Steel Fibres

Fibres used in the research had been found from tie metal wires used in binding reinforcement bars. Aspect fraction of the steel fibres used to be 75. These wires have been correct changed to gain a size of 6cm. The diameter of metal fibres used to be 0.8mm and tensile control of 1500N/mm².

Mix Proposal for M20 Grade of Concrete (Is10262:2009)

CEMENT	WATER	FINE AGGREGATE	COARSE AGGREGATE
426	192	727	1078
1	0.45	1.71	2.53

Tests on Concrete

1. Compressive Strength Test

This take a look at was once carried out as per IS516-1959. The cubes of preferred size 150mmx150mmx150mm had been castoff to locate the compressive strength of concrete. Samples had been located on the bearing surfaces of UTM; of capability 300 tones and a uniform rate of loading of 140 Kg/cm was once utilized upto the failure of the cube. The most load was noted and the compressive strength was once determine.

Cube compressive strength= (σ_{cc}) = P/AN/mm²

At the stop of curing time, the above samples had been examined in a compressive trying out computer as per: IS:516-1989

2. Split Tensile Test

This take a look at was once perform as per IS: 5816-1970. The cylinders of preferred measurement 150mm diameter and 300mm depth was once positioned on the UTM, used the diameter horizontal. At the pinnacle a strip of metal used to be positioned to keep away from the crushing of concrete sample at the factors the place the bearing floor of the compression testing machine (CTM) and the cylinder samples meets.

The Split Tensile Strength (Tsp) = $2P/\pi dl$ N/mm²

In order to define the cut up tensile strength of a number concretes check used to be carried out as per IS: 5816-1999.

3. Flexural Strength Test

Test specimens of beam measurement 500mmx100mmx100mm have been prepared for checking out the flexural strength of metal fibre reinforced concrete and substitute of cement with marble dust in different percentages. Loads have been utilized at the one third points at a consistent price of 30kg/minute.

$F_b = PL/BD^2$, when 'a' is larger than 20cm for 15cm specimen

$F_b = 3Pa/BD^2$, when 'a' is much less than 20cm but higher than 17cm for 15cm specimen

III. RESULT ANALYSIS

The goal of this investigation used to be to find out about the behaviour of SFRC. Straight round steel fibres by element fraction of seventy five were castoff. Samples were prepared except fibres and within fibres of 0.5, 1, 1.5 and 2%. Investigations had been carried out for studying the compressive, tensile, flexural strength. Compressive strength and split tensile exams were conducting on dice and cylinder specimens correspondingly.

The five types of samples had been organized and certain like as F-0, F-1, F-2, F-3 and F-4.

F-0: No fibres (PCC).

F-1: 0.5% metal fibres via volume of concrete.

F-2: 1% metal fibres via volume of concrete.

F-3: 1.5% steel fibres via volume of concrete.

F-4:2% steel fibres via volume of concrete.

Seven days Compressive Strength

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.1- 7 Days Compressive Strength Result

Sample	Result-1	Result-2	Result-3	Average Reading	Compressive Strength(N/mm ²)
F-0	315	335	325	325	14.44
F-1	365	360	345	357	15.85
F-2	390	370	365	375	16.66
F-3	347	350	338	345	15.33

Twenty eight days Compressive Strength

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.2- 28 Days Compressive Strength Result

Sample	Result-1	Result-2	Result-3	Average Reading	Compressive Strength(N/mm ²)
F-0	555	560	555	556.6	24.74
F-1	605	610	600	605	26.88
F-2	620	625	630	625	27.77
F-3	535	548	537	540	24.00

Seven Days Tensile Strength

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.3- 7 Days Split Tensile Strength Result

Sample	Result-1	Result-2	Result-3	Average reading	Tensile Strength (N/mm ²)
F-0	80	85	85	85	1.20
F-1	125	127	125	126	1.78
F-2	150	143	142	145	2.05
F-3	137	135	135	136	1.91

Twenty eight Days Tensile Strength

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.4 -28 Days Split Tensile Strength Result

Sample	Result-1	Result-2	Result-3	Average reading	Tensile Strength (N/mm ²)
F-0	160	150	170	160	2.26
F-1	240	240	242	241	3.40
F-2	265	260	255	260	3.68
F-3	220	218	220	220	3.11

Twenty Eight Days Flexural Strength

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.5 -28 Days Flexural Strength Result

Sample	Result-1	Result-2	Result-3	Average reading	Flexural Strength (N/mm ²)
F-0	14	14	16	14.66	4.40
F-1	17	17	18	17.33	5.20
F-2	20.5	21	21.5	21	6.30
F-3	23	23	22.8	22.93	6.88
F-4	19	20	18	19	5.70

7 Days vs. 28 Days Compressive Strength Comparison

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.6 Comparison of 7 and 28 days Compressive Strength

Sample	7 Days Compressive Strength (N/mm ²)	28 Days Compressive Strength (N/mm ²)
F-0	14.44	24.74
F-1	15.85	26.88
F-2	16.66	27.77
F-3	15.33	24.00

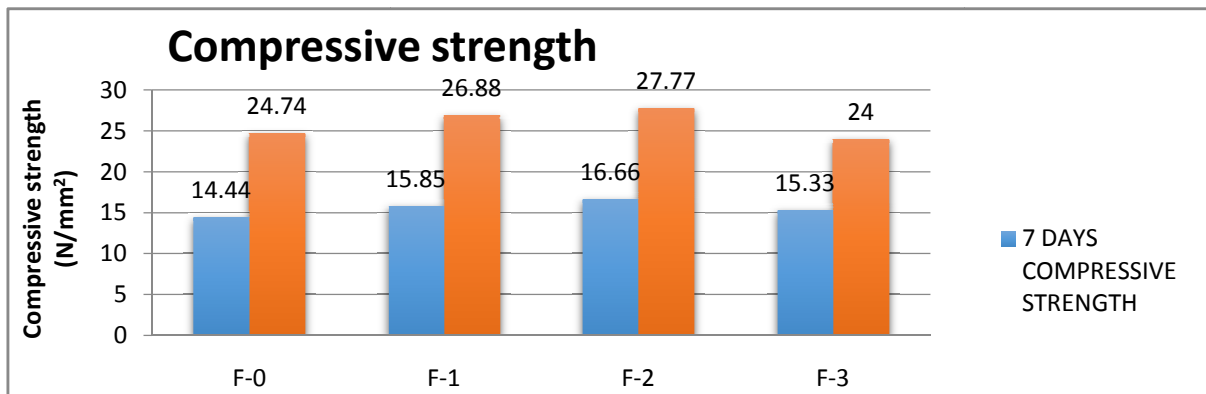


Fig 4.6 Bar chart for 7 days and 28 days of Variation of compressive strength with different percent of SF

7 Days vs. 28 Days Compressive Strength Comparison

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.7 Comparison of 7 and 28 days Compressive Strength

Sample	7 Days Compressive Strength (N/mm ²)	28 Days Compressive Strength (N/mm ²)	Percentage Strength Increment
F-0	14.44	24.74	71.32
F-1	15.85	26.88	69.58
F-2	16.66	27.77	66.68
F-3	15.33	24.00	56.55

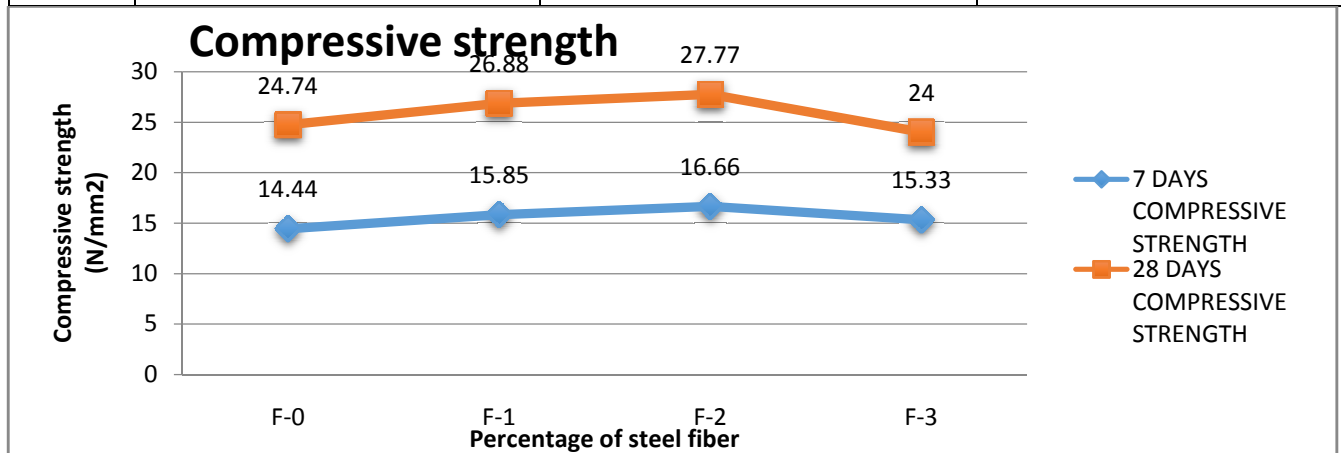


Fig 4.7 Comparison of Strength increment in 7 days and 28 days Compressive Strength with different percent of SF

7 Days vs. 28 Days Tensile Strength Comparison

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.8 Comparison of 7 and 28 days Split tensile Strength

Sample	Tensile Strength 7 Days (N/mm ²)	Tensile Strength 28 Days (N/mm ²)
F-0	1.20	2.26
F-1	1.78	3.40
F-2	2.05	3.678
F-3	1.91	3.11

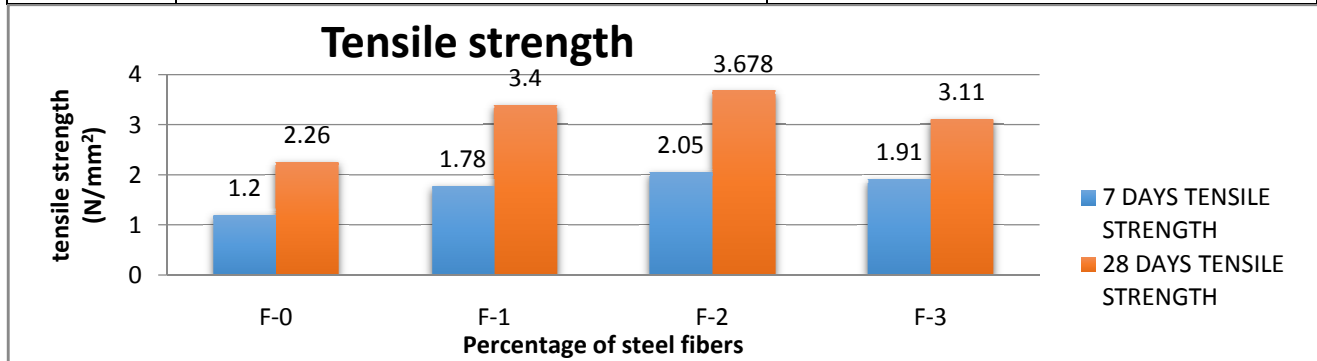


Fig 4.8 Bar Chart of Variation 7 days and 28 days Split tensile Strength with different percent of SF

7 Days vs. 28 Days Tensile Strength Comparison

Proportion Mix: 1:1.71:2.53

Water Cement Proportion = 0.45

Table 4.9 Comparison of 7 and 28 days Split tensile Strength

Sample	7 Days TensileStrength(N/mm ²)	28 Days Tensile Strength (N/mm ²)	Percentage Strength Increment
F-0	1.20	2.26	88.33
F-1	1.78	3.40	91.01
F-2	2.05	3.678	79.41
F-3	1.91	3.11	62.88

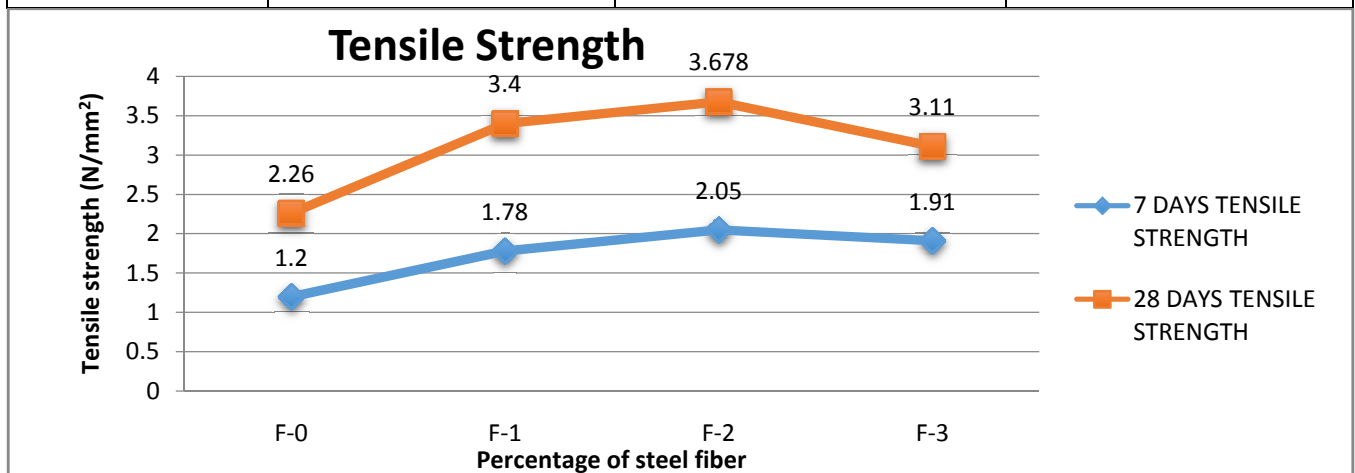


Fig 4.9 Evaluation of 7 days and 28 days Split Tensile Strength with different percent of SF

IV. CONCLUSION

The Strength of the steel fibre two strengthened concrete depends mostly on the amount of fibres brought towards it. The extent of fibres, expand approximately linearly, the compressive Strength, tensile Strength and toughness of the composite. Use of upper share of fibre is prospective to causes aggregation and rigidity of concrete and additionally the workability of concrete is considerably reduced.

The seven & twenty eight days compressive strength of the concrete rises linearly with the rise in quantity of steel introduced towards it, but to a most of 1% steel fibre inclusion. After that the compressive Strength decreases. So the most effective share of steel fibre inclusion is 1% by volume of the concrete mix.

Same behaviour takes place with the tensile Strength of metal fibre bolstered concrete with a top-quality percentage of 1% metal fibre inclusion, most energy is gained.

The flexural strength will increase with increase in metal fibre inclusion but to a maximum of 1.5% by way of volume of concrete mix. After that the flexural strength decreases.

Table 5.1 Different parameters of SF reinforced Variation of concrete

Parameter (28 days-N/mm ²)	PCC	Optimum Percentage of Steel Fibre	Steel Fibre Reinforced Concrete	Percentage Increase in Strength
Compressive Strength	24.74	1%	27.77	12.24%
Tension Strength	2.26	1%	3.68	62.83%
Flexural Strength	4.40	1.5%	6.88	56.36%

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