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An Experimental Investigation of Steel-Fiber Reinforced Concrete

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ABSTRACT:

In recent past there are many applications of High Performance Concrete spread throughout the world ranging from the making of industrial floors, nuclear power projects to high rise infrastructure buildings and water retaining structures.

The current study includes a number of tests that can be used to measure the characteristics of both fresh and hardened steel fibre concrete. The compressive strength and durability of regular and SFRC on have been compared. In order to better understand the processes occurring inside the steel fibre concrete, some studies were conducted on steel fibres prior to the preparation of the SFRC mix. The institute laboratory provided a safe setting for all the experiments linked to the current investigation. In this paper, the entire experimental programme has been explained.

Keywords :- SFRC, fibers, compressive strength etc.

I. INTRODUCTION

Fibrous material is used in Fibre Reinforced Concrete (FRC), a composite material that increases structural integrity and strength. According to ACI, FRC is defined as concrete that has randomly aligned fibres scattered throughout it. Concrete cracks readily and causes freeze and thaw damage, scaling, discoloration, and steel corrosion because it is an extremely brittle material with a very low tensile strength. Fibres are therefore added to concrete to control cracks and their propagation in order to address these problems. Various synthetic and natural fibres are frequently added to concrete to prevent cracking and the spread of cracks brought on by drying shrinkage and plastic. Researchers in academia and business around the world were first introduced to FRC through the publications of Romualdi and Batson in the early 1960s. There was a lot of excitement and a sense of discovery at the time about FRC's potential to be a very successful composite material based on Portland cement in the future. Since then, researchers have conducted numerous studies on the creation of FRC using a variety of fibres, including glass, sisal, jute, plastic, bamboo, carbon, and polypropylene. The purpose of this article was to discuss the impact of adding different kinds of fibres to concrete.

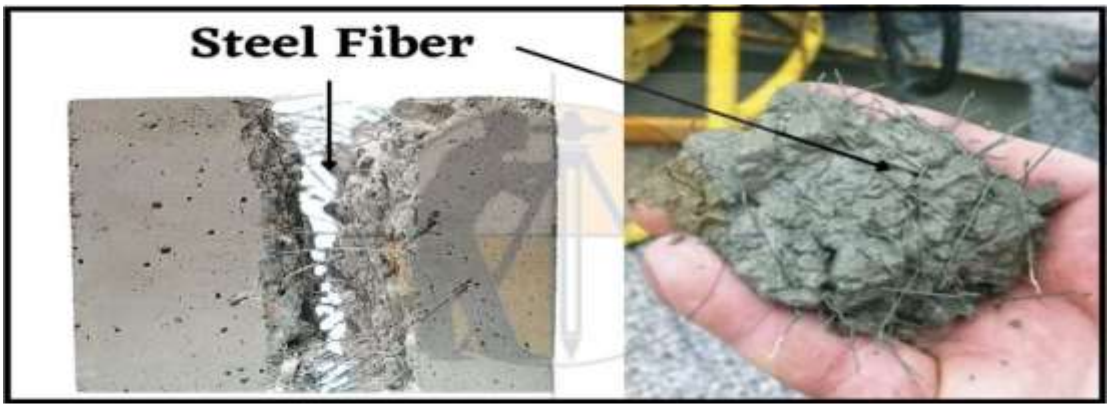

Figure 1 fiber reinforced concrete

II. METHODOLOGY

Since the job is done in discrete steps, a graphical representation of each step's outcome is provided. Cubes, beams, and cylinders are tested, and the strengths after 7, 14, and 28 days are found. A strength-based comparison of various mix amounts is conducted. There is also a comparison of the strengths for 7, 14, and 28 days. Cement underwent a number of tests, and it was found that the cement validates the OPC 43 grade standard results, allowing it to be used for this research.

Table 1 Details of Material Properties

S. No.	PROPERTIES	DETAILS
1	Grade Designation	M25
2	Type of cement	PPC 43grade
3	Min. Cement content	320 kg/m3
4	Max. Water cement ratio	0.45
5	Workability	100mm (slump)
6	Sp. Gravity of coarse aggregate	2.74
7	Sp. Gravity of fine aggregate	2.74

Table 2 Details of Concrete Mix Properties

S. No.	PROPERTIES	DETAILS
1	Cement	80 kg
2	Coarse aggregate	291.075 kg
3	Fine aggregate(sand)	134.15 kg
4	Water	35 liter
5	Admixtures	Not required

Figure 2 Preparation of concrete cubes

III. RESULT AND DISCUSSION

The various data from the water absorption and compressive strength tests were discussed and tabulated. Charts containing the test results were also made available. Table 3 displays the compressive strength results for standard concrete cubes and the 0.5%, 1%, 1.5%, and 2% steel fiber-containing SFRC cubes.

Compressive strength comparison

Three cubes of each batch mix are subjected to a compressive strength test every seven, fourteen, and twenty-eight days. Each of the three batch mixes has nine cubes. Three of these nine cubes are examined for seven, fourteen, and twenty-eight days apiece. For debates, an average of three values from the subhead results tabulation are taken into account.

Table 3 Compressive strength comparison for Conventional Concrete Cubes

S. NO.	Compressive Strength N/mm2		
	7days	14days	28days
1	18.22	24.85	27.50
2	18.32	24.72	27.23
3	18.89	24.87	27.83

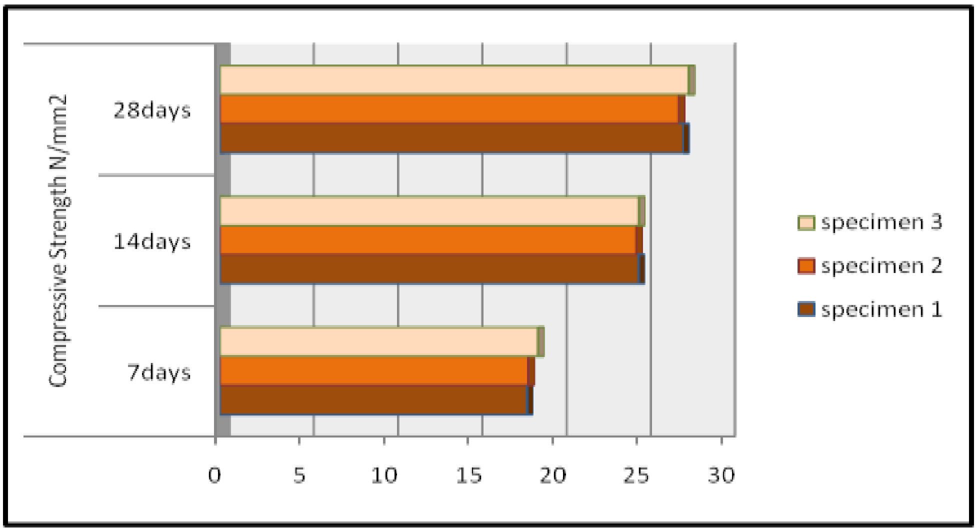

Figure 3 Compressive strength of conventional concrete

Table 4- SFRC cubes with 0.5 % of steel fibers

S. NO.	**Compressive Strength N/mm2**		
	7days	14days	28days
1	21.20	29.13	32.70
2	21.65.	29.64	32.24
3	22.04	29.87	31.98

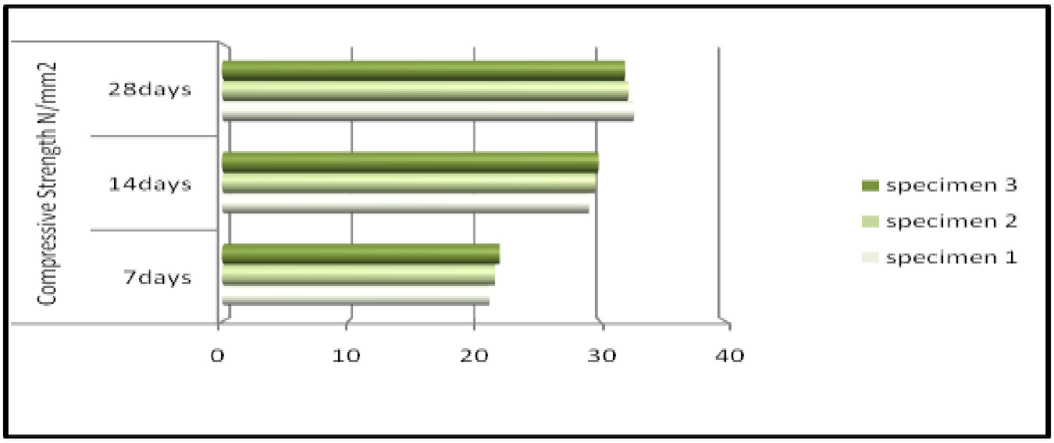

Figure 4 Compressive strength of SFRC cubes with 0.5 % of steel fibers

Table 5: SFRC cubes with 1% of steel fibers

S. NO.	**Compressive Strength N/mm2**		
	7days	14days	28days
1	22.62	31.25	34.45
2	22.88	31.04	34.24
3	22.35	31.87	33.86

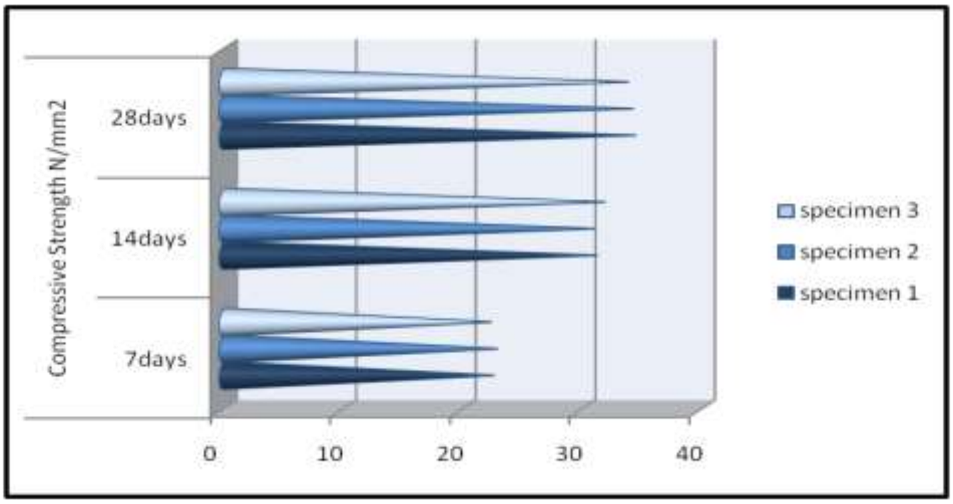

Figure 5 Compressive strength of SFRC cubes with 1% of steel fibers

Table 6: SFRC cubes with 1.5 % of steel fibers

S. NO.	**Compressive Strength N/mm2**		
	7days	14days	28days
1	23.42	33.12	36.88
2	23.99	33.65	36.64
3	23.48	33.82	36.45

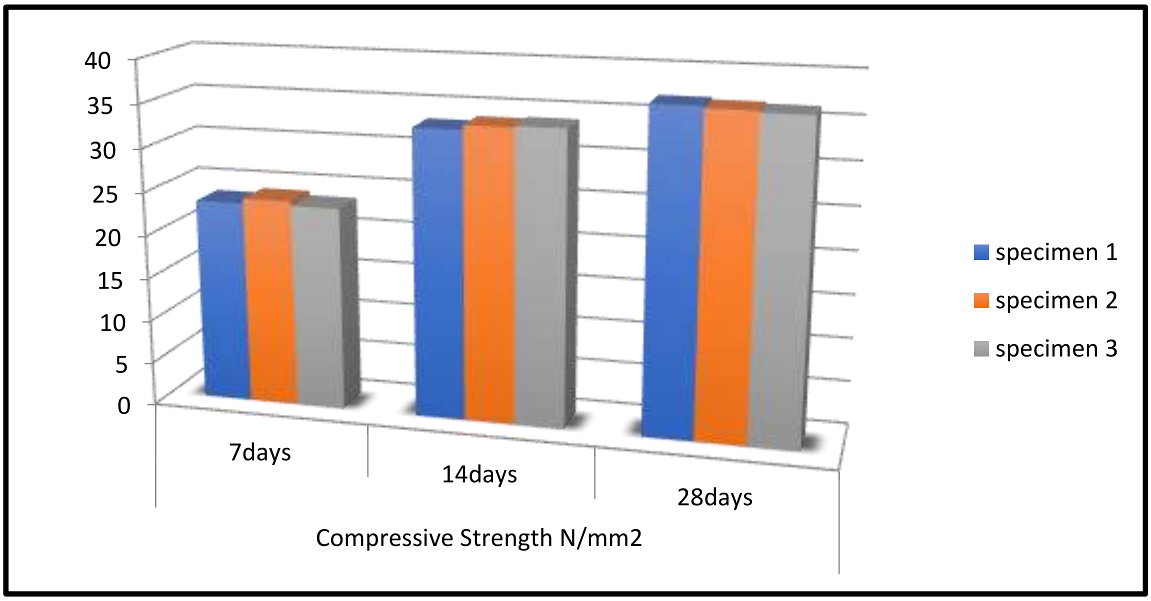

Figure 6 Compressive strength of SFRC cubes with 1.5% of steel fibers

Table 7: SFRC cubes with 2% of steel fibers

S. NO.	**Compressive Strength N/mm2**		
	7days	14days	28days
1	24.62	34.07	37.88
2	24.99	34.85	37.64
3	24.48	34.52	37.45

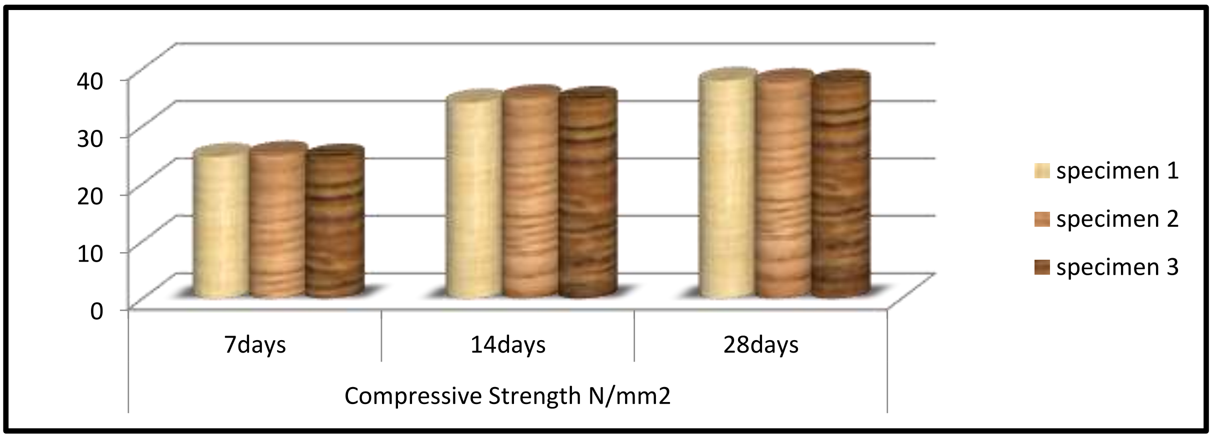

Figure 7 Compressive strength of SFRC cubes with 2 % of steel fibers

Table 8: Comparison of Compressive Strength results

S. NO.	Average Compressive Strength N/mm2				
	Conventional Concrete	SFRC Concrete			
		0.5%	1%	1.5%	2%
1	27.52	32.30	34.18	36.65	37.65

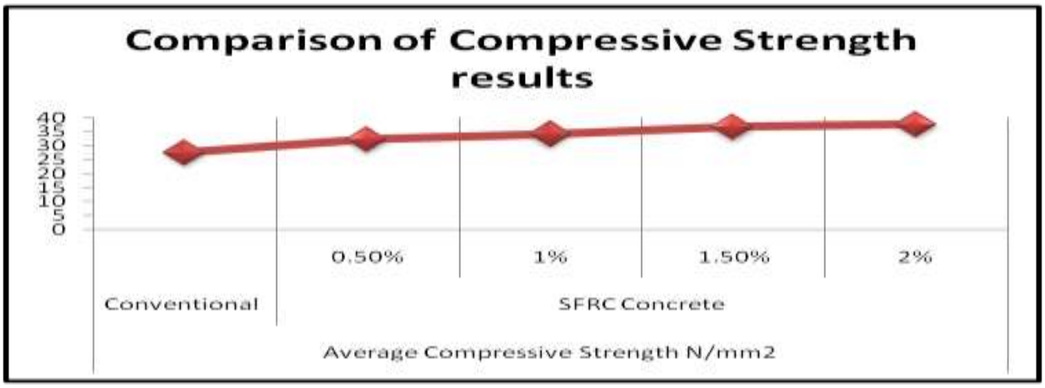

Figure 9: Comparison of Compressive Strength results

IV. CONCLUSION

The Following Conclusions Are Discussed Below, Based On The Experimental Investigations:

- Super plasticizer is used to improve workability because steel fibers reduce it.
- Slump loss results from a deterioration in workability as the volume of steel fibers grows from 0.5% to 1.5%.
- When the volume of steel fibres in concrete is increased from 0.5% to 1%, the concrete's compressive strength increases significantly. This increase is nearly identical to all of the standard concrete grades, which are M20, M25, M30, and M40.
- When it comes to compressive strength, SFRC performs better than traditional concrete. SFRC has 36.7 percent higher strength than regular concrete when compared to the latter. Thus, it will improve the compressive strength at various steel fibre concentrations.

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