Research Paper

IMPROVING THE MECHANICAL PROPERTIES OF CONVENTIONAL CONCRETE BY USING FIBER

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ABSTRACT

In this research efforts have been put to replace cement with steel fiber for mix design M20. The concrete blocks have been tested for compression, split- tensile test. The values have been compared with that of the conventional values further. In this experimental study considers the effect of steel fibers on the compressive strength and split tensile strength of concrete steel fibers with 2mm diameter and 45mm length is used. The objective of this work is to study Mechanical properties (compressive strength and split tensile strength) of conventional concrete for using fibers of 7 days and 28 days. The concrete mix adopted are M20 with varying percentage of steel ranging from (0%,0.5%,1%,2%,3%,4%,&5%) percentage by weight of cement. The results obtained show that the addition of steel fiber improves the compressive strength and split tensile strength of concrete.

INTRODUCTION

Concrete is the most widely used structural material in the world with an annual production of over seven billion tons. For a variety of reasons, much of this concrete is cracked. The reason for concrete to suffer cracking may be attributed to structural, environmental or economic factors, but most of the cracks are formed due to the inherent weakness of the material to resist tensile forces. Again, concrete shrinks and will again crack, when it is restrained. It is now well established that steel fiber reinforcement offers a solution to the problem of cracking by making concrete tougher and more ductile. It has also been proved by extensive research and field trials carried out over the past three decades, that addition of steel fibers to concrete members at the time of mixing/production imparts improvements to several.

The weak matrix in concrete, when reinforced with steel fiber, uniformly distributed across its entire mass, gets strengthened enormously, thereby rendering the matrix to behave as a composite material with properties significantly different from conventional concrete. Because of the vast improvements achieved by the addition of fibers to concrete, there are several applications where Fibers Reinforced Concrete (FRC) can be intelligently and beneficially used. These fibers have already been used in many large projects involving the construction of industrial floors, pavements, highway-overlays, etc. in India. High percentages of steel fibers are used extensively in pavements and in tunneling. Fibers in the form of mat are also being used in the development of high performance structural composite. Continuous fiber-mat high performance fiber reinforced concrete (HPFRCs) called Slurry Infiltrated Mat Concrete (SIMCON) is used in the production of High performance concrete.

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MATERIAL USED

Cement-

Ordinary Portland cement of 53 grade of ULTRATECH cement is used in this experimental work

Fine Aggregate-

Locally available natural river sand passing through 4.75 mm I.S. Sieve with a fineness modulus of 2.74, and water absorption of 1.5% in saturated surface dry (SSD) condition was used. The specific gravity of the sand is found to be 2.63 and was confining to ZONE-III.

Coarse aggregate-

Crushed granite metal from local sources, passing through 20 mm and retained on 4.75 mm sieve was used as natural coarse aggregate. The fineness modulus of Natural Coarse Aggregate (NCA) is 6.56 and its water absorption is 0.94% in SSD condition. The specific gravity of coarse aggregate is found to be 2.71.

Water-

Potable fresh water available from local sources free from deleterious materials was used for mixing and curing of all the mixes tried in this investigation. W/C ratio is taken as 0.60 for M20.

Steel Fiber-

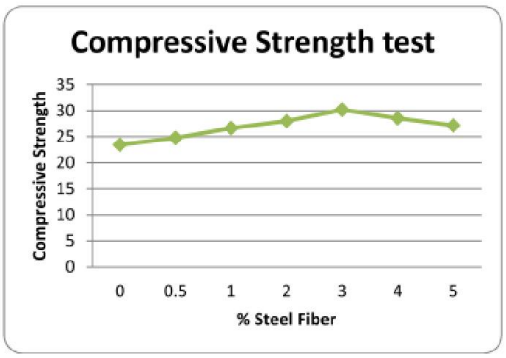
The typical diameter lies in the range of 2 mm steel fibers are being used in this project. Length of these fibers is 45 mm and the aspect ratio of 55. Density of steel fiber is 7900 kg/cum.

RESULT ANALYSIS

Compressive strength Test Results:

Results of Compressive strength for M-20 grade of concrete on cube specimen with 0%, 0.5%,1.0, 2.0,3.0,4.0and 5.0% steel fibers.

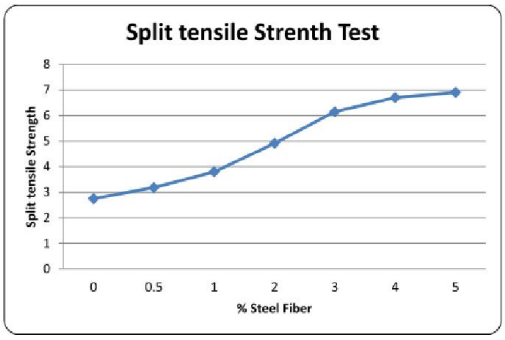
Mix	% Steel Fiber	Compressive Strength	
		7 Days	28 Days
M 20	0	11.11	23.46
	0.5	11.77	24.76
	1	13.33	26.66
	2	18.00	28.00
	3	20.54	30.18
	4	18.58	28.54
	5	17.79	27.17



Split tensile strength test Results:

Results of Split tensile strength for M-20 grade of concrete on cylinder specimen with 0%, 0.5%,1.0%,2.0%,3.0%,4.0% and 5.0% steel fibers.

Mix	% Steel Fiber	Split Tensile Strength	
		7 Days	28 Days
M 20	0	1.06	2.75
	0.5	1.16	3.19
	1	1.48	3.81
	2	2.23	4.91
	3	3.31	6.16
	4	3.1	6.7
	5	2.5	6.9



CONCLUSION

From the results presented in this Experimental Work, using concrete containing different Percentage of Steel Fiber, the main conclusions are:

- The compressive strength and Split Tensile Strength increases rapidly when the Percentage of Steel Fiber increases but at 5% steel Fiber Compressive Strength of Concrete decrease and split tensile strength increase.
- The percentage Steel fiber increase from 0% to 0.5% the compressive strength increase by 5.54% and split tensile strength by 15.27%.
- The percentage Steel fiber increase from 0.5% to 1.0% the compressive strength increase by 6.67% and split tensile strength by 19.49%.
- The percentage Steel fiber increase from 1% to 2% the compressive strength increase by 5.02 % and split tensile strength by 29.02%.
- The percentage Steel fiber increase from 2% to 3% the compressive strength increase by 7.78% and split tensile strength by 25.32%.
- The percentage Steel fiber decrease from 3% to 4% the compressive strength decrease by 5.43% and split tensile strength increase by 0.08%.
- The percentage Steel fiber decrease from 4% to 5% the compressive strength decrease by 4.80% and split tensile strength increase by 0.02%.

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