International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 03 - Issue 02(S) || PP.49-53

Strength Characteristic of Steel Fibre Reinforced Concrete With M-sand

[1]S Parthiban, [2]Dr. M M Saravan and [3]Dr. M Sivaraja
[1]PG Student, Department of Civil Engineering, Kongu Engineering College, Perundurai, Erode.
[2]Assistant Professor, Department of Civil Engineering, Kongu Engineering College, Perundurai, Erode.
[3]Professor & Principal, N.S.N College of Engineering and Technology, Karur

Abstract: Concrete is one of the essential element in the construction industry. It has been known that concrete is brittle material, good in compression but weak in tension, due to this property, it result in sudden tensile failure without warning. It is essential for concrete, to have some form of tensile reinforcement to overcome its brittle behavior and there by improve its strength and strain capacity. Among the various experimented materials fibers proved to be an effective tensile reinforcement. Fibers are of different materials such as steel, plastic, glass and other natural materials. Among that Steel fibers are found to be superior to other fibers. This paper deals with the strength parameters of steel fiber concrete (compressive, flexural, split tensile) with M-sand.

Keywords: Compressive strength, tensile strength, flexural strength of steel fiber, M-sand.

I. Introduction

Fiber reinforced concrete consist of conventional concrete and short fibers distributed randomly. Fibers are generally described in aspect ratio were they are the reinforcing material in fiber reinforced concrete. The first crack strength and ultimate strength of concrete can be increased by these fibers which act as crack arrestor. The M-sand are used as replacement of natural river sand due to its abundant availability and the scarcity of natural river sand. This chapter tries to bring out the strength characteristics of fiber reinforced concrete with M-sand. The steel fibers were added in 0%, 1%, 1.5%, and 2% in the concrete.

The steel fibres are mostly used because steel has high modulus of elasticity, high elongation, high tensile strength and the bond between steel and the fibre is enormous. The present experimental investigation was carried out to evaluate the influence of steel fibres on physical and mechanical properties of concrete, containing cold drawn carbon steel fibres of hooked end type having aspect ratio of 50 with diameter 0.6mm and length 30mm with varying percentages of 0.5%, 1%, 1.5% and 2.0% volume fraction is added to the concrete.

Cocrete is evaluated for compressive, split tensile and flextural strength at 7, 28 and 90 days, with the additional 1.5% fibre test results show the maximum compressive, split tensile and flextural strength, it become the optimum value.

Split tensile and flextural strength of concrete is done only up to 1.5% volume.

II. Materials Used

The materials used for this experimental investigation are cement, coarse aggregate, fine aggregate, water and steel fiber. The materials used and their properties are listed down below.

2.1 Cement

Cement is one of the important constituents of mortar. It is the binding material in mortar, which is most commonly used for all building elements. Different brands of cement have been found to possess different strength development characteristics due to the variations in the compound composition and fineness. For the experimental work, OPC of 53 grade “JSW” (brand name) is used. The cement samples were tested as per the procedure given in IS: 4031-1996.The tests for cement are shown in table 1.

Table 1 Physical properties of cement

SI. No	Description	Result
1	Specific gravity	3.15
2	Consistency (%)	31
3	Initial setting time (minutes)	35

2.2 Fine Aggregate

Sand is either round or angular grain and is often mixed in various grading of fineness at different zones. For the experimental work, locally available M-sand with 4.75mm maximum size was used as fine aggregate. The tests for fine aggregate are shown in table 2.

Table 2 Physical properties of fine aggregate

SI. No	Description	Result
1	Specific gravity	2.65
2	Water Absorption	1.04%
3	Fineness modulus	2.87
4	Graded Zone	II

2.3 Coarse Aggregate

Coarse aggregates occupy 70 to 80 percent of the volume of concrete. The crushed stone aggregates were collected from the local quarry. The properties of coarse aggregates were evaluated as per the procedure given in IS: 383-1970 and IS: 2386-1963 (part- I, II and III). The tests for fine aggregate are shown in table 3.

Table 3 Physical properties of coarse aggregate

SI .No	Description	Result
1	Specific gravity	2.74
2	Water absorption	0.31%
3	Fineness modulus	2.93

2.4 Crimped Steel Fiber

In this study flat crimped steel fiber conforming to ASTM A820 with aspect ratio of 50 is used for casting specimens. Steel fibers used in conventional concrete is prevention of crack propagation in concrete. For improving the mechanical bond between the fiber and matrix, indented, crimped, machined and hook ended fibers are normally produced. The physical properties of round crimped steel fiber are given in table 4 produced by kem construction and equipment.

2.5 Water

Water is the one of the essential material for concrete process. As per IS 456-2000 pH of water should not be less than 6.The pH of water is 7.2 which is ordinary drinking water used concreting.

Table 4 Physical properties of crimped steel fiber

SI. No	Description	Result
1	Length	50 mm
2	width	1 mm
3	Aspect Ratio	50
4	Tensile strength	1100 MPa
5	Young's modulus	210 GPa
6	Elongation	15%
7	Density	7.85 g/cm^3

III. Experimental Methods

The compressive strength, split tensile strength and flexural strength test were experimentally investigated in this present work. The steel fibers are added in 0.5%, 1%, 1.5% and 2.0% in total volume for experimental investigation which is done for 14 and 21 days.

3.1 Mix Proportion

Table 5 Mix proportion and material quantities

Materials	**Ceme Nt**	**Fine aggre gate**	**Coarse aggregate**	**w/c ratio**
Mix proportion	1	1.67	2.73	0.48
Material quantities (kg/m^3)	412	690.5	1126.6	197.6

The mix proportion for ordinary grade concrete (M20) is designed using IS: 10262 – 2009. The arrived mix proportion and quantities is shown in table 5.

Table 6 Mix identification

Sl. No	**Description**	**Mix identification**
1	Conventional	C.C
2	1%-Steel fiber addition	SFC
3	1.5%-Steel fiber addition	SFC1
4	2%-Steel fiber addition	SFC2

3.2 Compressive Strength

The test was conducted as per IS: 516-1959 codal provision. For compressive tests on concrete, cylinder of diameter-100mm and height-200mm were employed. All the cylinder were tested in saturated condition after wiping out the surface moisture from the specimen. The tests were carried out at a uniform stress after the specimen has been centered in the testing machine.

3.3 Split Tensile Strength

The test was conducted as per IS: 5816-1999 codal provisions. The cylinder of 150mm diameter and 200mm height were used. The test cylinder specimen was prepared in the standard manner. This specimen was laid horizontally in the compression testing machine with the cast forces in contact with plates of the testing machine.

3.4 Flexural Strength

The test was conducted as per IS: 516-1959 codal provisions. The flexural strength represents the highest stress experienced within the material at its moment of rupture. Flexture strength was measured by loading 100mm x 100mm x 500mm concrete prisms in tne test machine.

IV. Test Result And Discussion

The results of compressive strength, flexural strength and split tensile strength of M20 grade concrete of 0%, 1%, 1.5% and 2% addition of steel fiber are reported for 14days and 21days.

4.1 Ḉompressive Strength

The average compressive strength had been evaluated from the peak load obtained by crushing the specimen. The compressive strength is increased by 24.48% for 1.5% steel fiber addition when compared to

conventional mix at 21 days. Result shows that the addition of 1.5% steel fibres increase the compressive strength than addition of 2% steel fiber. The variation of compressive strength at 14days and 21days curing for different concrete composition is given in figure 1.

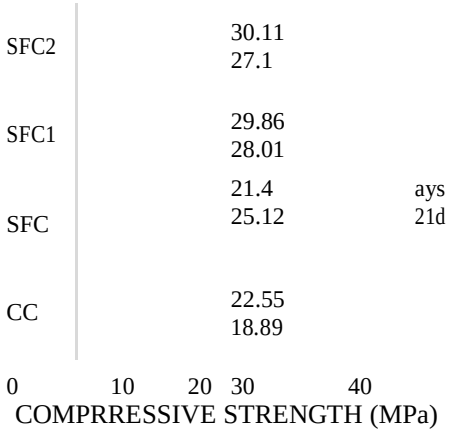

Fig.1 Cylinder compressive strength for 14 and 21days

4.2 Split Tensile Strength

The tests are conducted for the cylinder specimens after 14 and 21 days curing. The split tensile strength of SFRC mixture is increased by49.44% for 1.5% steel fiber addition when compared to conventional mix at 21 days. Result shows that the addition of 1.5% steel fibres increase the split tensile strength than addition of 2% steel fiber is given in figure 2

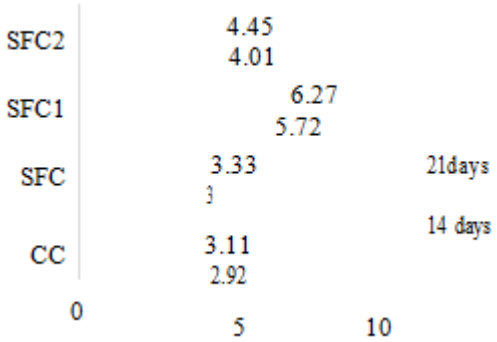

Fig.2 Cylinder split tensile strength for 14 and 21days

4.3 Flexural Strength

The tests are conducted for the prism specimens after 14 and 21 days of curing. The flexural strength of SFRC mixture increased by 65.21% for 1.5% steel fiber addition when compared to conventional mix at 21 days. Result shows that the addition of 1.5% steel fibres increase the flexural strength than addition of 2% steel fiber is given in figure 3

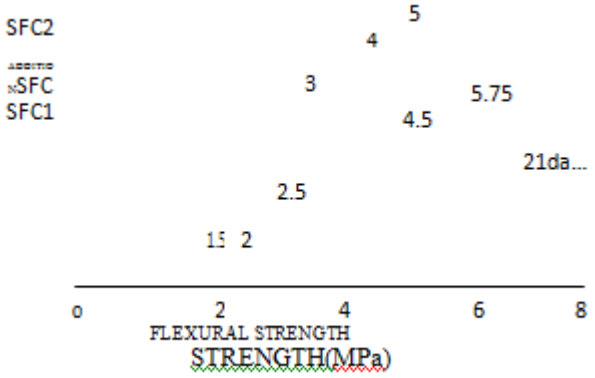

Fig.3 Prism flexural strength for 14 and 21days

V. Conclusion

From the experimental investigation and analysis the following conclusion has been made.

a) By adding steel fiber to concrete the ductility characteristic was found to be increased.
b) The compressive strength of SFRC mixture is 1.48 and 1.32 times higher than nominal concrete mix at 14days and 21days for 1.5% of steel fiber addition than 2%.
c) Similarly, the split tensile strength is 1.95 and 2.01 times higher than nominal concrete mix at 14days and 21days for 1.5% of steel fiber addition than 2%.
d) The flexural strength is 3 and 2.875 times higher than nominal concrete mix at 14days and 21days for 1.5% of steel fiber addition than 2%.

The fiber which act as a crack arrestors, produces less crack width in fibrous concrete when compared with conventional concrete.

VI. References

[1]. Dr. B. Krishna Rao ' A Study on Steel Fiber Reinforced Normal Compacting Concrete' International Journal of Engineering Research and Application Vol. 6, Issue 8, (Part -2) August 2016, pp.41-45
[2]. Ganesan N and Ramana Murthy (1990) 'Strength and Behaviour of Confined Steel Fibre Reinforced Concrete Columns' ACI Materials Journal, Vol.87, No.3, pp.221-227
[3]. IS: 10262-2009, 'Recommended Guidelines for Concrete Mix Design', Bureau of Indian Standards, New Delhi, India.
[4]. IS: 12269-1987, 'Specifications for 53-Grade Portland Cement', Bureau of Indian Standards, New Delhi, India.
[5]. IS:383-1970(reaffirmed1997),'Specifications for Coarse and Fine Aggregate from Natural Source for Concrete', Bureau of Indian Standards, New Delhi, India.
[6]. IS: 456-2000, 'Indian Standard Code of Practice for Plain and Reinforced Concrete', Bureau of Indian Standards, New Delhi, India.
[7]. IS: 516-1959, 'Indian Standard Code of Practice- Methods of Test for Strength of Concrete', Bureau of Indian Standards, New Delhi, India.
[8]. IS: 456-2000, 'Indian Standard Code of Practice for Plain and Reinforced Concrete', Bureau of Indian Standards, New Delhi, India
[9]. Ghosh S, Bhattacharya and Ray S.P (1989) 'Tensile Strength of Steel Fiber Reinforced Concrete' IE (I) Journal-CI, Vol.69 pp.222-227.
[10]. Mekala Prathap Reddy , Dr. K. Chandrasekhar Reddy 'Determination of Mechanical Properties of Steel Fiber Reinforced Concrete with Mineral Admixtures' International Journal of Science and Research Vol 4, (2015) ,pp 224-226