International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 10
June 2016

Scrap Steel Fiber Reinforced Concrete: Design & Analysis

Submitted By-
Tarun Kumar(Roll No-17142413)
Civil Engineering Department
HCTM Technical Campus-Kaithal
Affiliated to Kurukshetra University

Guided By-
Dr. Arwind Dewangan
Associate Professor
Civil Engineering Department
HCTM Technical Campus-Kaithal

Email: tarunsingla20071991@gmail.com

ABSTRACT: *This paper describe the use of scrap fibres which comes from the various industries & institutes as steel fibres are much costly and their cost is increased as increasing the percentage of steel fibres in the given concrete mix. so the concept is to design a suitable concrete mix and to analyze the various properties of this particular design mix as all know the function of the fibre based concrete is to arrest cracks, fibre composites possess increased extensibility and tensile strength, both at first crack and at ultimate, particular under flexural loading; and the fibres are able to hold the matrix together even after extensive cracking but by using these scrap fibres I wish to maintain the cost of the mix and obtain the improved values of the different properties related to concrete mix.*

Key Words: Scrap Steel fibres; Design Mix; Compressive strength; splitting tensile strength; Cracking; Workability.

1. INTRODUCTION:

Concrete is most widely used construction material in the world due to its ability to get cast in any form and shape. It also replaces old construction materials such as brick and stone masonry. The strength and durability of concrete can be changed by making appropriate changes in its ingredients like cemetitious material, aggregate and water and by adding some special ingredients. Hence concrete is very well suitable for a wide range of applications. However concrete has some deficiencies as listed below:

1) Low tensile strength

2) Low post cracking capacity

3) Brittleness and low ductility

4) Limited fatigue life

5) Incapable of accommodating large deformations

6) Low impact strength

The introduction of fiber enhances the mechanical properties of concrete by the interaction of fiber and matrix. Various studies have been conducted on Steel Fiber Reinforced Concrete regarding improvement of mechanical properties with introduction of steel fiber but very little work has been done on determining the influence by varying the aspect ratio (length/diameter) of these steel fibers. In the present study the unconventional concrete mixes were reinforced with steel fibers with an aspect ratio of 100, 63, 56 and 43 and the detailed experimental investigation was carried out to determine the extent of improvement that can be achieved in their strength parameters and material behavior. The percentage change in strength with time is determined by varying aspect ratio and volume fraction. Also optimum volume fraction of steel fiber is found out for a particular aspect ratio so as to get maximum strength with minimum fibers, thus saving cost. But in

this paper I just carried out the experimental work without using the aspects ration and just randomly used the scrap fibres into the concrete mix so as to remove the weakness of concrete by inclusion of these scrap fibres as compare to other fibre material & to check the effect of these fibres on different properties of concrete. The fibres help to transfer loads at the internal micro cracks. Such a concrete is called fibre-reinforced concrete (FRC). The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

2. METHODOLOGY:

As with any other type of concrete, the mix proportions for SFRC depend upon the requirements for a particular job, in terms of strength, workability, and so on. Several procedures for proportioning SFRC mixes are available, which emphasize the workability of the resulting mix. So the general methodology used in the research work is:

Figure 1- Scrap Fibres

Figure 2-Scrap Fibres Randomly Used

1) Laboratory investigations
2) Analysis of the test results obtained into the laboratory.
3) Conclusion on results obtained.

3. LABORATORY INVESTIGATION

The work carried out in the laboratory is as follows:

a) Selection of materials, study of their properties i.e. zoning of sand, Water absorption of fine and coarse agregate etc.
b) Mix Design of Concrete using data obtained from above step.
c) Finding workability of designed Concrete mix using slump tests.
d) Casting of cubes and cylinders of Concrete without fibers and with fibres for (1 & 2%).
e) Finding workability of designed Concrete mix with different steel fiber volume fraction ranging from 0, 1 & 2 %.

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 10
June 2016

f) Testing of cubes and cylinders after 7, 14 & 28 days with different fibre fractions.

Figure 3-Mixing of Fibres into Concrete

Figure 4-Curing of Concrete Blocks

4. STATIC PROPERTIES

Workability

Workability is checked with the help of slump cone test. The slump decreased a little from 70 cm to 67 cm for 0 % and 1.0% fiber content respectively and also the slump is decreased from 67 cm to 65 for 1% and 2% scrap fibres.all the values has been depectid into Table 1 and the variation of different fibre ratio w.r.t slump value is shown in figure 5 & Table 1.

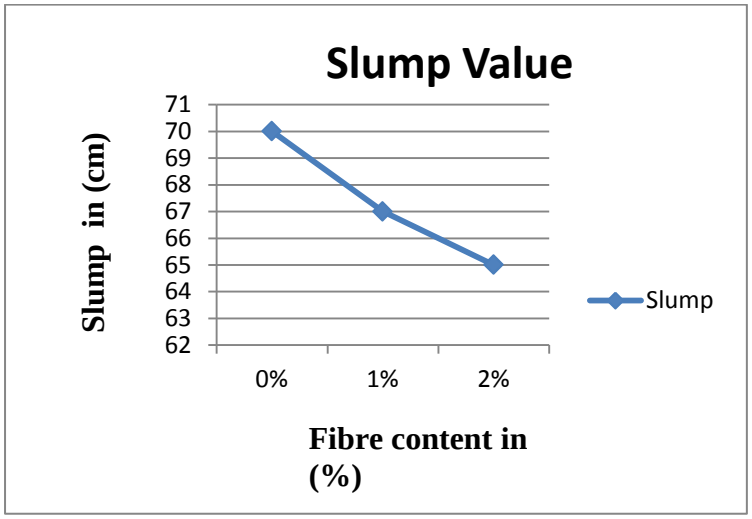

Figure 5-Variation of Slump

Table 1 Variation of Slump w.r.t fibre content

Slump Value(cm)	Fibre Content (%)
70	0
67	1
65	2

Compressive Strength

Fibres do little to enhance the static compressive strength of concrete, with increases in strength ranging from essentially nil to perhaps 15% for cubical blocks and upto 30% for cylindrical blockshowever fibres contributes a little in compressive

strength for 2% fibre but gives good results for 1% scrap steel fibres & all these values are shown in Table 2 & variation is shown in Figure 6 & in figure 7.

Table 2-Variation of Compressive strength for Cubes & Cylinders

Fibre content(%)	Compressive Strength (N/mm^2)					
	Cubes			Cylinders		
	14 days	21 days	28 days	14 days	21 days	28 days
0	29.34	33.29	37.18	18.16	26.10	31.18
1	24.94	30.17	42.87	20.53	26.64	34.42
2	26.26	30.7	36.60	23.73	24.11	30.10
Fibre content(%)	**% Increase in Compressive Strength**					
	Cubes			Cylinders		
	14 days	21 days	28 days	14 days	21 days	28 days
0	0	0	0	0	0	0
1	-15	-9.37	15.30	13.05	2.07	10.40
2	4.63	-21.18	-1.56	30.67	-7.62	-3.46

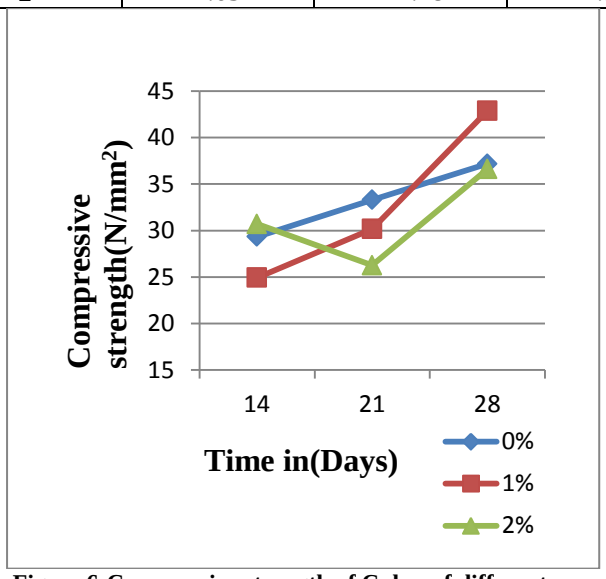

Figure 6-Compressive strength of Cubes of different proportion w.r.t Time

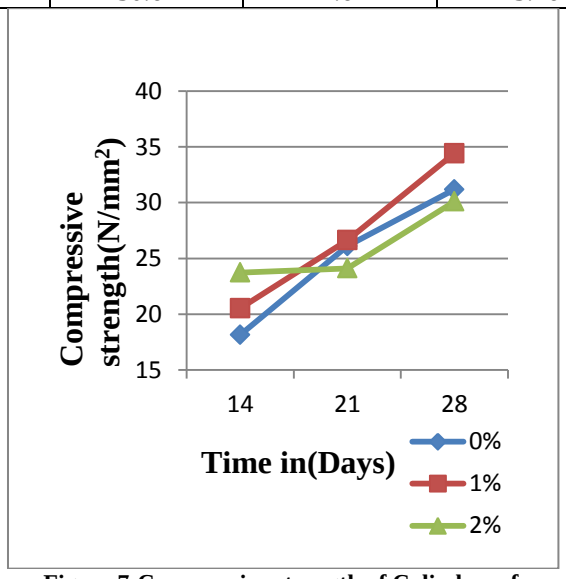

Figure 7-Compressive strength of Cylinders of different proportion w.r.t Time

Figure 8-Cube Under CTM

Figure 9-Cylinder Under CTM

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 10
June 2016

Splitting Tensile Strength

Fibres aligned in the direction of the tensile stress may bring about very large increases in direct tensile strength, as high as 50% for 1% fibres. However, these fibres are randomly distributed, the increase in strength is much smaller, as increasing the fibre content, with many investigations indicating intermediate values, as shown in figure 10 respective values in Table 3.

Table 3-Splitting tensile strength for Different proportion of Fibre Content

Fibre Content(%)	Splitting Tensile Strength (N/mm^2)		
	14 days	21 days	28 days
0	2.11	2.60	2.89
1	3.85	4.10	4.63
2	3.65	3.70	3.90

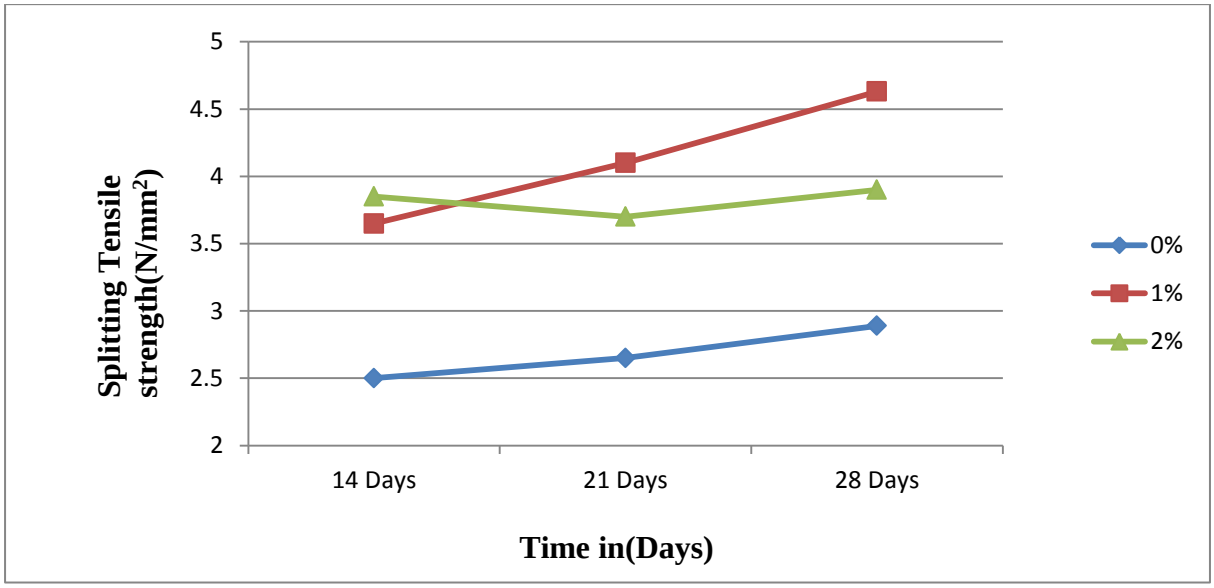

Figure 10-Splitting Tensile strength of Cubes of different proportion w.r.t Time

5. Conclusion

The study on the introduction of scrap steel fibers can be still promising as steel fiber reinforced concrete is used for sustainable and long-lasting concrete structures but Scrap Steel fibers are not widely used as a fiber reinforced concrete all over the world. Lot of research work had been done on steel fiber reinforced concrete and lot of researchers work prominently over it but these types of fibres has been introduced first time and has need further studies to carried out also properties of the these scrap fibres needed to be identified also the chemical effects on these fibres can also be identified to obtain more effective results.

These fibres are cheap and easily available also from conclusion point of view I concluded that they are very much promising from compressive strength point of view and I obtained very effective results for splitting tensile strength. However in future lots of work can be done on this topic and studies can be carried out on these scrap fibres to check the chemical and other properties which affects the strength and other parameters of concrete.

These Scrap fibres also affects workability but can be controlled using suitable amount of plasticizer.

6. REFERENCES:

[1] ACI Committee 544. 1982. State-of-the-Report on Fibre Reinforced Concrete, (ACI 544.1R-82), Concrete International: Design and Construction. 4(5): 9-30, American Concrete Institute, Detroit, Michigan, USA.

[2] ACI Committee 544. 1989. Measurement of Properties of Fibre Reinforced Concrete, (ACI 544.2R-889). American Concrete Institute, Detroit, Michigan, USA.

[3] ACI committee, "State - of - the art report in fibre reinforced concrete'' ACI 554 IR – 82 Detroit Mechigan 1982.

[4] C.D. Johnston, "Steel fiber reinforced mortar and concrete", A review of mechanical properties. In fiber reinforced concrete ACI – SP 44 – Detroit 1974.

[5] C.H. Henager , "Steel fibrous shotcrete". A summary of the State – of – the art concrete Int.: Design and construction 1981.

[6] GAMBHIR, M.L (Fourth Edition). —Concrete Technology.

[7] Ganesh Babu. K and Pavan Kumar. D. 2004. Behavior of Glass Fibre Reinforced Cement Composites. ICFRC International Conference on Fibre Composites, High Performance Concretes and Smart Materials. 8-10 Jan., Chennai.

[8] Griffiths R. 2000. An assessment of the properties and degradation behaviour of glass-fibre-reinforced polyester polymer concrete. Composites Science and Technology. pp. 2747-2753.

[9] IS: 10262-2009. Indian Standards – Concrete Mix Proportioning Guidelines

[10] IS: 1199-1999. Indian Standards - Method of Sampling & Analysis of Concrete.

[11] IS: 1489-1991. Indian Standards - Specifaction for Pozzolana Portland Cement.

[12] IS: 456-2000. Indian Standards – Plain And Reinforced Concrete -. Code Of Practice.

[13] IS: 516-1979. Indian Standards - Method of tests for Concrete.

[14] IS: 5816-1999. Indian Standards – Spliting Tensile Strength of Concrete – Method of Test.

[15] J. Endgington, D.J. Hannant & R.I.T. Williams, "Steel fiber reinforced concrete" Current paper CP 69/74 Building research establishment Garston Watford 1974.

[16] N. Janesan, P. V. Indira and S. Rajendra Prasad, 2010: "Structural behaviour of steel fibre reinforced concrete wall panels in two-way is plane action." Indian concrete journal.

[17] Naaman A.E. 1985. Fibre Reinforcement for Concretes, Concrete International: Design and Construction. 7(3): 21-25.

[18] R.J. Craig, "Structural applications of reinforced steel fibrous concrete". Concrete Int. Design and Construction 1984.

[19] SHETTY, M.S (2012 edition). —Concrete Technology.