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A Study on Mechanical Properties of Steel Fiber Reinforced Concrete with Magnetite Ore as a Mineral Admixture

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Abstract: ***Concrete is the furthermost eagerly used construction material and has numerous required properties like high compressive strength, stiffness and durable under usual environmental factors. This paper present an experimental study dealing with the behavior of Compressive Strength, Split Tensile strength and Flexural Strength of concrete using steel fiber as a reinforcing material and magnetite ore as a mineral admixture. The concrete cubes, cylinders and unreinforced beams were casted with different percentages of Steel fiber (0.5%, 1.0%, 1.5%, 2%, 2.5%, and 3%) are added by volume of concrete and Magnetite ore (5%, 7.5%, 10%, 12.5%, 15%, and 17.5%) are added by weight of cement. These casted specimens were cured for different period (7, 14, &28 days) as per relevant Indian standard codes. Mechanical properties such as compression split tensile and bending tests were conducted on hardened concrete specimen and results were tabulated. The test results indicate that addition of steel fiber and magnetite ore in concrete, improves the microstructure, as well as mechanical properties of concrete.***
Keywords: Compressive Strength, Split Tensile Strength, Flexural Strength, Steel Fibers, Magnetite Ore, Concrete, Plain Concrete.

I. INTRODUCTION

Concrete is mainly containing natural sand and gravel or crushed- rock aggregate and water, when placed in the skeleton of form and allowed to cure, becomes hard like stone. At the same time it is brittle and weak in tension, limited ductility, little resistance to cracking and internal micro cracks are inherently present in the concrete and it result in poor tensile strength [1]. To overcome this major defect of concrete new advanced technique is developed by addition small, closely spaced and uniformly dispersed fiber to concrete would acts as crack arrester and would substantially improve its static and dynamic properties. This type of concrete is called as fiber reinforced concrete [2]. This paper evaluates the use steel fiber as a reinforcing material and magnetite ore as mineral admixture in concrete. Magnetite ore is a one of mineral and main iron ore, using of magnetite as admixture in concrete increase the density of concrete and make concrete denser and mainly improve thermal characteristics of concrete [3]. Magnetite makes twice the mass in the same volume as standard concrete. Being just as strong and flexible as standard concrete, it can be used in the very same applications and offer substantially improved thermal characteristics and it controls the shrinkage behavior of concrete used in pavements.

II. MATERIALS AND ITS PROPERTIES

A. Cement (OPC)

The cement used in this experimental work is Ultra tech 43 grade ordinary Portland cement confirming to IS: 12269-1987 was used in present study.

TABLE I. PROPERTIES OF CEMENT

Properties	Obtained Value
Specific gravity	3.15
Initial setting time	130 minutes
Final setting time	195 minutes
Consistency	31%

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B. Fine Aggregate

Locally available river sand passed through 4.75mm IS sieved. Natural sand as per IS: 383-1987 was used.

TABLE II. PROPERTIES OF FINE AGREGATE

Properties	Obtained Value
Specific gravity	2.60
Fineness modulus	2.46
Bulk density	1094 to 1162 kg/m3
Water absorption	0.8%
Grading	II

C. Coarse Aggregate

Crushed granite metal aggregate available from local sources conforming to IS: 383-1987.

TABLE III. PROPERTIES OF FINE AGREGATE

Properties	Obtained Value
Specific gravity	2.73
Fineness modulus	7.133
Aggregate Impact value	16%
Aggregate Crushing value	22%
Water absorption	1.2%

D. Water

In the present work drinkable tap water was used for both mixing and curing of concrete.

E. Steel Fiber

Increasing the mechanical bond between the fiber and matrix, round, smooth, indented, machined, crimped, and hook ended fibers are normally produced. Fibers made from mild steel drawn wire conforming to IS: 280-1976 with the diameter of wire 0.5 mm has been used.



Fig. 1.Steel Fiber

TABLE IV. PROPERTIES OF STEEL FIBER

Properties	Obtained values
Length	30 mm
Diameter	0.5 mm
Aspect ratio	60
Density	7850 kg/M^3
Tensile strength	1050 Mpa
Modulus of elasticity	200 Mpa
Specific Gravity	7.8

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F. Magnetite Ore

Magnetite is a mineral and one of the main Iron ores with the chemical formula Fe3O4, It is oxides of Iron. It is attracted to a magnet.



Fig. 2.Magnetite Ore

TABLE V. MAGNETITE ORE

Properties	Obtained values
Specific gravity	5.17-5.18
Specific weight	5.1-5.2
Melting point	c. 1535°C
MOHS hardness	5.5-6.5
20Grain size	<100µm

III. METHODOLOGY

In this paper steel fiber of different proportion i.e. (0.5%, 1.0%, 1.5%, 2% and 2.5%) is used in concrete mixes. Each different replacement of cement by mineral admixtures (i.e.5%, 7.5%, 10%, 12.5%, 15% and 17.5%) of concrete mix is done, with different water cement ratio of 0.3%, 0.4% and 0.45%. Concrete mixed in proportion of 1:1.5:3 (M20 grade) and steel fiber are added as percentage to the volume of concrete and magnetite ore is added to the volume of cement. Mixing is done by hand mixing on water tight platform. Compaction is done to remove air bubbles and give maximum density to concrete.



IV. RESULT AND DISCUSSION

A. Compressive strength



Fig. 3.Compression Test

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It is observed that the cube compressive strength for normal plain cement concrete is about 18.31, 22.75 and 24.53 Mpa for 7days, 14days and 28days respectively.

TABLE VI. COMPRESSIVE STRENGTH (IN MPA) OF CONCRETE FOR DIFFERENT CURING PERIODS

Proportion	Curing Period		
	7 days	14 days	28 days
0 % SF & 0 % MO	18.31	22.75	24.53
0.5 % SF & 5 % MO	22.75	28.88	31.02
1% SF & 7.5% MO	27.91	33.77	35.88
1.5 %SF & 10 % MO	31.68	36.93	40.53

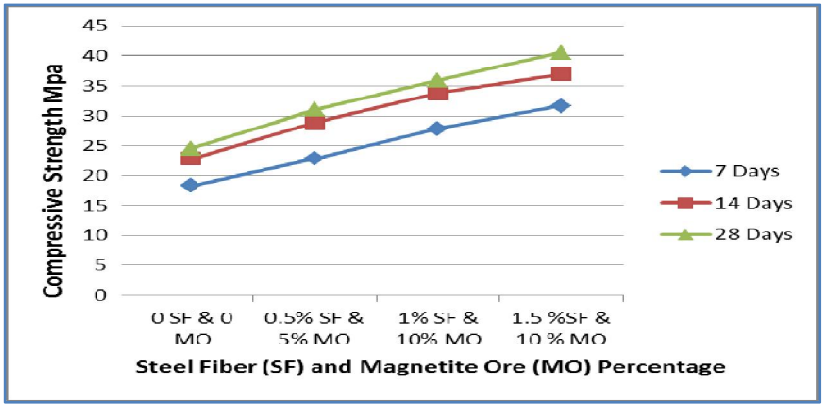


Fig. 4.Graph of compressive strength v/s Steel fiber and Magnatite ore percentage for different curing days

Cube compressive strength of concrete with 0.5% steel fiber of and 5% magnetite ore increased by 25.91% than the normal concrete. By increasing of 1% of steel fiber and 7.5% of Magnetite ore in a concrete there is increase of cube compressive strength to 18.03% over the 0.5% of steel fiber and 5% of magnetite ore. Again by increasing of 1.5% of steel fiber and 10% of magnetite ore in concrete there is increase of cube compressive strength to 11.86% over the 1% of steel fiber and 7.5% of magnetite ore.It is clear that the percentage of compressive strength decreases with increase in the percentage of Steel fibers and Magnetite ore.

B. Split Tensile strength



Fig. 5.Split Tensile Test

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It is observed that the split tensile strength for normal plain cement concrete is about 1.45, 2.10 and 2.24 Mpa for 7days, 14days and 28days respectively.

TABLE VII. SPLIT STRENGTH (IN MPA) OF CONCRETE FOR DIFFERENT CURING PERIODS

Proportion	Curing Period		
	7 days	14 days	28 days
PC 1:1.5:3	1.45	2.10	2.24
0.5 % SF & 5 % MO	2.27	3.24	3.49
1% SF & 7.5% MO	3.18	4.50	4.9
1.5 %SF & 10 % MO	4.17	6.21	6.8

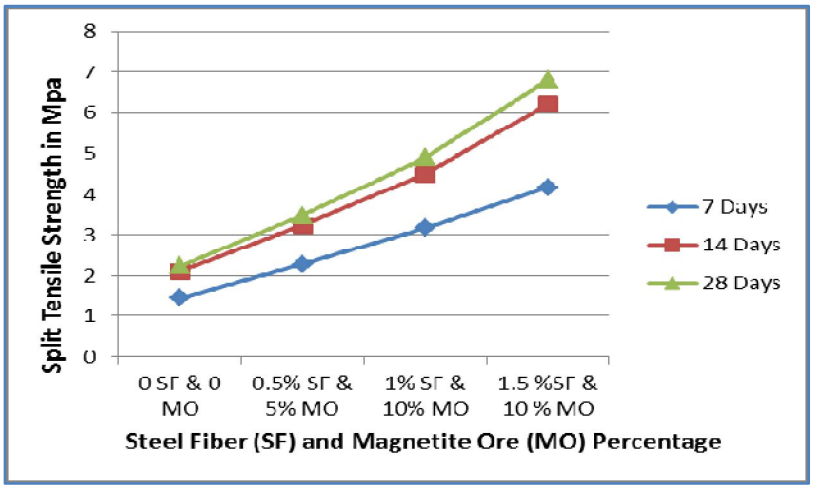


Fig. 6.Graph of Split tensile strength v/s Steel fiber and Magnatite ore percentage for different curing days

Split tensile strength of concrete with 0.5% steel fiber of and 5% magnetite ore increased by 55.54% than the normal concrete. By increasing of 1% of steel fiber and 7.5% of Magnetite ore in a concrete there is increase of cube compressive strength to 39.76% over the 0.5% of steel fiber and 5% of magnetite ore. Again by increasing of 1.5% of steel fiber and 10% of magnetite ore in concrete there is increase of cube compressive strength to 36% over the 1% of steel fiber and 7.5% of magnetite ore. It is clear that the percentage of compressiv strength decreases with increase in the percentageof Steel fibers and Magnetite ore.

C. Flexural Strength



Fig. 7.Flexural Test

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It is observed that the split tensile strength for normal plain cement concrete is about 1.45, 2.10 and 2.24 Mpa for 7days, 14days and 28days respectively.

TABLE VIII. COMPRESSIVE STRENGTH (IN MPA) OF CONCRETE FOR DIFFERENT CURING PERIODS

Proportion	Flexural Strength at 28 days
PC 1:1.5:3	3.25
0.5 % SF & 5 % MO	3.55
1% SF & 7.5% MO	3.95
1.5 %SF & 10 % MO	4.50

Flexural strength of concrete with 0.5% steel fiber of and 5% magnetite ore increased by 9.2% than the normal concrete. By increasing of 1% of steel fiber and 7.5% of Magnetite ore in a concrete there is increase of cube compressive strength to 11.26% over the 0.5% of steel fiber and 5% of magnetite ore. Again by increasing of 1.5% of steel fiber and 10% of magnetite ore in concrete there is increase of cube compressive strength to 13.92% over the 1% of steel fiber and 7.5% of magnetite ore. It is clear that the percentage of flexural strength increase with increase in the percentage of Steel fibers and Magnetite ore.

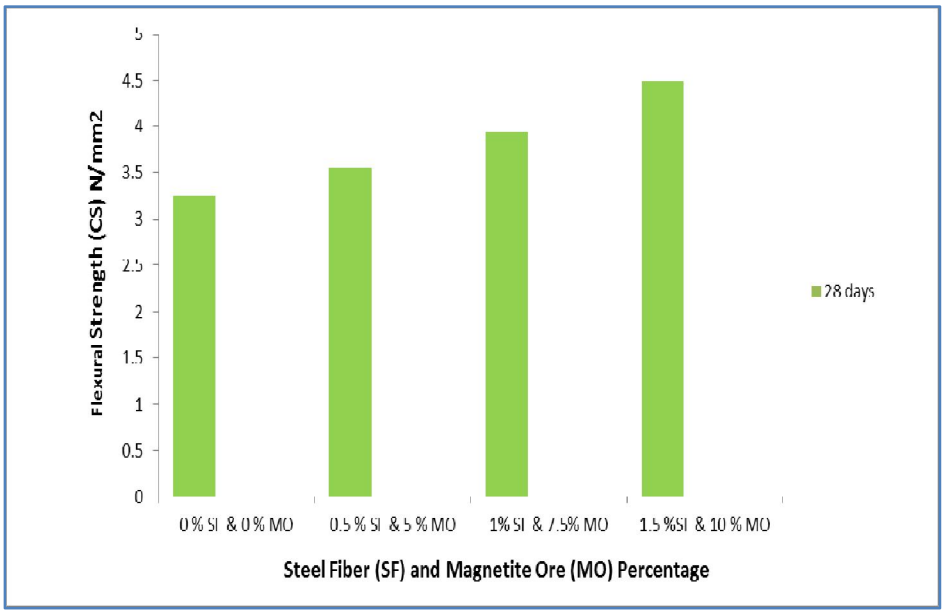
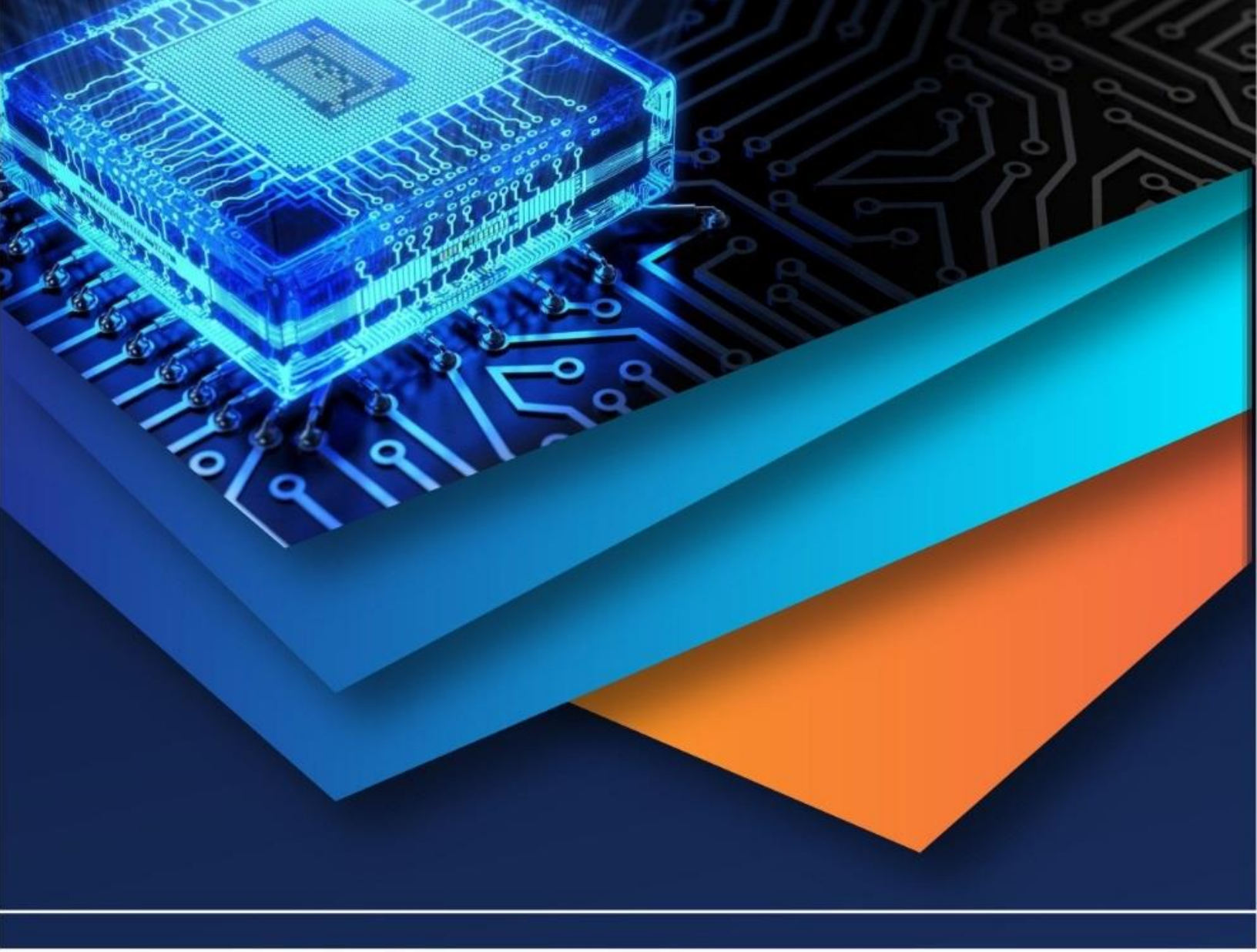


Fig. 8.Graph of Flexural Strength v/s Steel fiber and Magnatite ore percentage for different 28 days

REFERENCES

[1] Ganeshan N et al, (2007) „steel fibre reinforced high performance concrete for seismic resistant structure" Civil Engineering and construction Review, December 2007, pp 54-63
[2] KC Panda & P K Bal (2013), "Properties of self-compacting concrete using recycled coarse aggregate." Procedia Engineering 51 (2013) 159 –164.
[3] A.M. Shende, Comparative Study on Steel Fiber Reinforced cum Control Concrete, University of France, France, 2011.
[4] Ali Ellouze, Experimental study of steel fibre concrete slab Part I: behaviour under u.d.l, International Journal of concrete structure and materials, vol. 4, no. 2, pp 113-118, 2010.
[5] Dr. N. Ganesan& Dr. P.V.Indira, Behaviour of steel fibre reinforced high performance concrete members under flexure, Behaviour of
[6] steel fibre reinforced high performance concrete members under flexure May 2007, Vol. 88, pp 20-23, 2007.
[7] Indian standard recommended guidelines for Concrete Mix Design, IS 10262: 2009. 1st Revision, Bureau of Indian Standards, New Delhi.
[8] Indian standard Code of Practice for Plain and Reinforced Concrete, IS- 456: 2000, 4th Revision, Bureau of Indian Standards, New Delhi.
[9] Indian standard Recommended guidelines for Concrete Mix Design, IS 10262: 1982, 5th Reprint 1998, Bureau of Indian Standards, New Delhi.
[10] P.S. Mangat, Tensile strength of steel fiber reinforced concrete, Department of Construction and Urban Studies Preston Polytechnic,
[11] Preston,England,2003.

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