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EFFECT OF STEEL FIBER ON THE STRENGTH PROPERTIES OF CONCRETE

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ABSTRACT

This paper presents the result of an experimental study investigating the effect of steel fibres on the Mechanical properties. In this project, I am going to carry out test on steel fibre reinforced concrete to check the influence of fibres on flexural Test, split tensile strength test of concrete. The main aim of this experiment is to study the strength properties of steel fibre concrete of M20 grade with 0%, 0.25%, 0.5% and 0.75% by volume of concrete from the exhaustive and extensive experiment to work it was found that with increase in steel fibre content there was a increase in flexural and split tensile strength of concrete. It is now well established that one of that the important properties of steel fiber reinforced concrete is its superior resistance to cracking and crack propagation. As a result of this ability to arrest crack, fiber composite posses increased extensibility and tensile strength ,both at first crack and at ultimate ,particular under flexural loading and the fibers are able to hold the matrix together even after extensive cracking. The net result of all these is to impart to fiber composite pronounced post-cracking ductility which is unheard of material would increase substantially the energy absorption characteristics of the fiber composite and its ability to withstand repeatedly applied ,shock or impact loading . In this paper, the mechanics properties, technologies of steel fiber reinforced concrete are discussed.

KEYWORDS

Fibre Reinforced, Slump, Grade of concrete, Flexural and split Tensile strength of concrete.

1. INTRODUCTION

Fiber reinforced concrete (FRC) is Portland cement concrete reinforced with more or less randomly distributed fibers. The addition of short, discontinuous fiber had played an important role in improvement of many Mechanical properties of concrete. Concrete is characterized by its brittle failure; the nearly complete loss of loading capacity to overcome this characteristic, the inclusion of a small amount of short and randomly distributed fiber can be done. Fiber reinforced concrete is relatively a new construction material developed through extensive research and development work during the last two decades. It has already found a wide range of practical applications and proved to be a reliable construction Material having superior performance characteristic compared to conventional concrete. Incorporation of fibre in concrete has found to improve several properties like tensile strength resistance, ductility steel fiber improves ductility flexural strength and toughness. When the fiber reinforcement is in the form of short discrete fibers , they act effectively as rigid inclusions in the concrete matrix ,physical they have thus the same order of magnitude as aggregate inclusions ,steel fiber reinforced cannot therefore be regarded as a directed replacement of longitudinal reinforced in reinforced and prestressed structural members. However, because of the inherent material properties of fiber concrete, the presence of fibers in the body of the concrete or the provision of a tensile skin of fiber concrete can be expected to improve the resistance of conventionally reinforced structural members to cracking, deflection and other serviceability conditions

2. EXPERIMENTAL PROCEDURE

(i) Material Used

2.1Cement

IS mark 43 grade cement was used in all concrete mixes. The cement used was fresh and without any lumps. The cement used was similar to Type 1 cement (ASTM C 150).

Fig2.1: Cement

2.2 Coarse aggregates

Coarse aggregates having the maximum size of 10 mm and 20 mm were used in this research work. The 10 mm aggregates used were first sieved through 10 mm sieve and then through 4.75 mm sieve and 20 mm aggregates were firstly sieved through 20 mm sieve. They were washed to remove dust and dirt and were dried to surface dry condition.

Fig 3.2: Coarse Aggregates

2.3 Fine aggregates

The sand used for the experimental program was locally procured and confirmed to grading zone III. The fine Aggregate was first sieved through 4.75 mm sieve to remove any particles greater than 4.75 mm and then was washed to remove the dust.

Fig3.3: Fine Aggregates

2.4 Steel Fiber

The typical diameter lies in the range of0.25-0.75 mm hook end steel fibres are being used in this project. Length of these fibres is 30 mm and the aspect ratio of 55. Density of steel fibre is 7900 kg/cum.

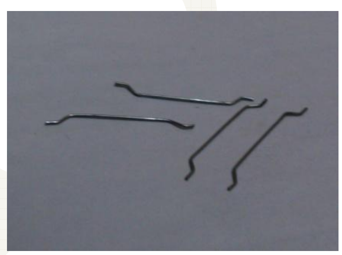

Fig3.4: Hooked End Steel Fibres

3. EXPERIMENTAL METHODOLOGY

3.1 COMPRESSIVE STRENGTH TEST

For compressive strength test, three concrete cubes for each day were coasted and tested in a set itself. The cube specimens were cost for m30 size 150mm x 150mm x 150mm and were prepared and tested according to IS 516-1959.The mould were filled with fibres, vibration was given to the mould using table vibrator is the top surface of the specimens was leveled and finished. After 24 hours the specimens were demoulded and were transferred to curing, these cubes were tested by the help of compression testing machine as per I.S 516-1959. The failure load was noted.

3.2 FLEXURAL STRENGTH TEST

Flexural strength was found according to IS 516-1956 and for the three beam were coasted and tested after 7 and 28 days of water curing. These flexural strength specimens were tested under two point loading over on effective span of 400mm on flexural testing Machine. Load and corresponding defections were noted up to failure.

The flexural strength was calculated as follows

Flexural strength (Mpa) = (PxL)/ (bxd2)

3.3 SPLIT TENSILE STRENGTH

In split tensile strength Test, cylinder specimens of dimension 150mm diameter and 300mm length were cast. The specimens were demoulded after 24 hours of casting and then transferred to curing tank where in they were allowed to cure tested under compression testing machine.

Split Tensile strength was calculated by split tensile strength (Mpa) = $\frac{2p}{DL}$

Where P = failure load
D= Diameter of cylinder
L= Length of Cylinder

4. EXPERIMENTAL RESULTS

Following Graphs give compressive strength of Steel fibre concrete for M20 Grade of Concrete

Table 2.1 Compressive Strength of M20 Grade Concrete cubes.

Fibre content %	7th day	28th day
	Compressive Strength (N/mm2)	Compressive Strength (N/mm2)
0%	14.82	20.60
0.50%	14.40	21.80
0.75%	14.81	24.90
1%	15.80	24.91
1.25%	13.90	24.50

Table 2.2 Split Tensile Strength of M20 Grade Concrete Cylinders

Fibre Content %	7th day	28th day
	Split Tensile Strength (N/mm2)	Split Tensile Strength (N/mm2)
0%	0.89	2.381
0.50%	1.67	2.576
0.75%	1.536	2.631
1%	2.216	2.811
1.25%	1.49	2.416

Table 2.3 Flexural Strength of Steel Fibre Concrete

Designation of Sample Mix	Steel Fibre Content % age	Age (Days)	Flexural Strength, MPa
Co	0%	7	2.361
		28	5.82
1c1	0.50%	7	2.396
		28	6.13
C2	0.75%	7	2.44
		28	6.75
C3	1%	7	2.73
		28	6.33

C4	1.25%	7	2.33
		28	6.46

CONCLUSIONS

The following conclusions could be drawn from the present investigation:

1. There is a decrease in compressive strength of concrete with increase in cement replacement with steel fiber.
2. The mechanical properties of FRC are much improved by the use of hooked fibers than strength fibers, the optimum volume content being 1.5 percent. While fibres addition does not increase the compressive strength, the use of 1.5 percent fiber increase the flexure strength by 67 percent, the splitting tensile strength by 57 percent and impact strength 25times.
3. The splitting tensile strength was increased by 20-22% for concrete cylinder sample with 0.5% fibre content in M20 grade concrete mixes.

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