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Concrete Subjected to spiral steel Fibre

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Abstract: ***Concrete is quite popular material in today's era. It has a history of evolution at different stages. In modern time we can see concrete made structures all around rather it is Residential Buildings, flyovers, industrial building, water carrying structures like elevated water tanks etc. It is strong under compression yet weak under tension. To counter the weakness in tension we have to add something which can bear tensile force subjected to concrete ex: steel bars and to resist cracks we have to add fibres which gave some additional benefits along with increasing cracking strength it also improve tensile, flexural, shear, torsional strength and also improves its durability etc.***

Present study is to ascertain the behavior of steel fibre reinforced concrete with varying percentage of fibres. The experiments were conducted on concrete mixes of M20 grades. Spring fibres of length 25mm and diameter of 0.1mm (cross-section) and spring diameter 8mm with aspect ratio of 31.25 was used. Concrete was reinforced with different percentage of above mentioned fibres i.e. 0%, 0.5%, 1%, 1.5% and 2% by weight of cement. A total of 15 cubes of standard size 150mm*150mm*150mm, 15 cylinders of 150mm diameter and 300mm height were cast and 15 beams of 100mm*100mm*500mm were cast and tested under two point loading to find flexural strength. The experimental program involved the evaluation of the compressive strength of concrete cubes under uniaxial compression. The cylinders were tested for their splitting tensile strength and the tensile strength was recorded under uniaxial compression testing machine. Flexural test on plain concrete and SFRC-Standard beam of size 100mm*100mm*500mm Were supported symmetrically over a span of 420 mm and subjected to two points loading till failure of the specimen.

Keywords : M20 Grade Of Concrete, Compressive Strength, Split Tensile Strength, Flexural Strength, Shear Strength, Impact, Aspect Ratio, Uniaxial Compression.

I. INTRODUCTION

As the world population is increasing rapidly that population requires homes so we have to think about the alternatives of concrete or to reduce the cost of construction and increase strength. Even government through PMAY(Prime Minister Awas Yojna) tries to give shelter to poors for that they requires concrete and if we are able to increase the strength of concrete with some waste products then it is economically better than ordinary concrete. So we are using spiral steel fibers to increase the strength.

II. MATERIALS

Cement, aggregates (sand and gravel), water and spiral steel fibers were used for the study. We uses spiral steel fibers in 5 terms in increasing percentage of cement by weight 0% , 0.5% , 1% ,1.5% ,2%.
Some physical properties of aggregates and cement used for study are shown below in Tables.

Table-1: Properties of Aggregates

S. No	Properties	Aggregate
1.	Impact value of aggregate	13.5
2.	Water absorption capacity	0.9
3.	Bulk density of aggregate	0.7
4.	Crushing strength	17.5
5.	Abrasion value	14.0
6.	Specific gravity of aggregate	2.7
7.	Sieve Analysis	40% retained over 4.75 passed by 10mm ISS 60% retained over 10mm and passed by 20mm ISS

Table-2: Properties of Cement (OPC 43)

S.No	Properties	OPC 43 Grade
1.	Specific gravity	3.15
2.	Initial setting time(min)	30
3.	Final setting time(min)	600
4.	Soundness by Le-Chatelier(mm)	10
5.	Fineness(sqm/kg)	225

Table-3: Physical properties of steel fibers

Density (g/cm^3)	7.5
Diameter(mm) cross sectional	0.3
Diameter spring (mm)	8
Length (mm)	25
Aspect ratio spring	3.125

III. MATERIALS AND METHODS:

We did design mix for M20 grade and mix cement , sand , Aggregate according to derived ratio manually by hand mixing.

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For compressive strength we use 15cm*15cm*15cm Cubes. Cylindrical mould of 15cm and 30cm diameter and length respectively were used for tensile strength and beam of 10cm*10cm*50cm is used to calculate its flexural strength. Poured concrete was compacted by mechanical vibrator.

. **Figure-1 : Cubes ,cylinders and beams**

IV. TESTING PROCEDURES

A. Compressive Strength test:

It was carried out on cube specimen of 150 mm X 150 mm X 150 mm and we consider average value of strength at each percentage of fiber used after 28 days using compression testing machine.

B. Split Tensile Test:

It is important in case of concrete because it is weak in tension and that's why we provide reinforcement of steel to bear tension but it doesn't mean that concrete doesn't bear a little of tensile stress. For calculating tensile strength we make cylinders and test them on compression testing machine.

C. Flexural test: For flexural stress we make beams and test it under two point loads and evaluate flexural strength.

(a)

(b)

Figure-2 :(a) Compressive Strength test of Cube Samples (b) Split tensile test of cylindrical specimen

V. RESULTS AND DISCUSSION

A. Compressive strength of cube:

Table: 4 Compressive strength of cube

Sr no.	Percentage(%)	Load(KN)	Stress(N/mm^2)
1	0	461.67	20.51
2	0.5	650	28.88
3	1	755	33.56
4	1.5	613.34	27.26
5	2	400	17.8

B. Split Tensile strength of cylinder:

Table: 4 Split Tensile strength of cylinder

Sr no.	Percentage(%)	Load(KN)	Stress(N/mm^2)
1	0	131.67	1.86
2	0.5	142.34	2
3	1	151.67	2.14
4	1.5	160	2.28
5	2	173.34	2.45

C. Flexural Strength of beam

Table 5: Flexural Strength of beam

Sr no.	Percentage(%)	Load(KN)	Stress(N/mm^2)
1	0	69.3	2.912
2	0.5	74.67	3.136
3	1	77.67	3.262
4	1.5	88.67	3.724
5	2	97	4.074

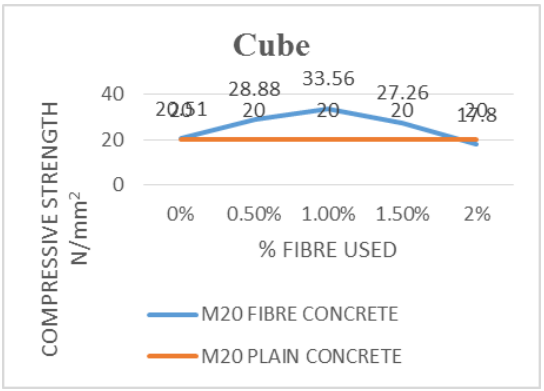

Fig.3 Compressive strength of cube v/s percentage of fibre

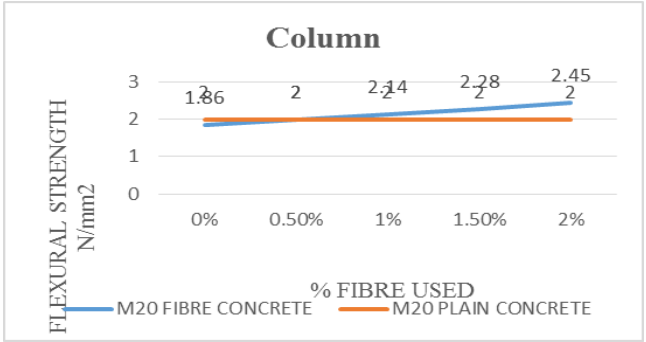

Fig.4 Split Tensile strength of cube v/s percentage of fibre

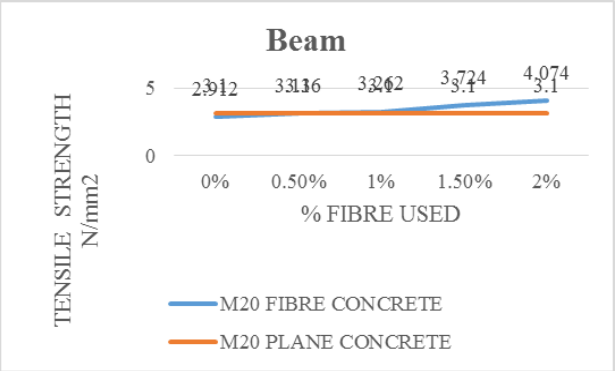

Fig.5 Flexural strength of cube v/s percentage of fibre

VI. CONCLUSION

Based on this Experiment we can said certain things:

- Compressive strength is increases by adding helical shaped fibres and maximum value is at 1% addition of fibres 63.62% increase in strength.
- Split tensile strength also increases on increasing fibre percentage.
- Flexural strength also keeps on increasing while increase in percentage of fibres.

From this we can assure that if we use helical fibre reinforced concrete instead of plane concrete then we can save considerable amount of money and achieve maximum strength.

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