EXPERIMENTAL STUDY ON THE EFFECT OF STEEL STRIPS ON THE PROPERTIES OF CONCRETE

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Abstract: Concrete, which is made of cement, fine and coarse aggregates is one of the world's most widely used building material. Now-a-days concrete also replaces old construction materials such as brick and stone masonry etc. It's durable, strength and ease of availability have been its main advantages. Concrete is strong in compression. The only drawback in concrete is that it has low tensile strength. Historically, steel has been used as the material of choice for improve tensile strength in concrete. So in order to improve its strength/quality various types of fibers materials such as steel, glass, polypropylene, asbestos, carbon, organic etc. are added. The objective of this investigation was to study the behavior of M20 grade of concrete with 0.5 w/c when steel strips or fibers in various proportions such as 0%, 1%, 2%, 3%, 4%, 5% by weight of cement with Aspect ratio 50 (25mm length and 0.5mm diameter). The samples were prepared and was tested after proper curing at 7th day, 14th day and 28th day. It has been observed that there is significant improvement in mechanical properties of concrete with the addition of steel fiber. The highest strength was gained with the addition of 3% of fiber, a further increase in fiber decreases the strength. Therefore, the optimum dosage of steel fibers was determined to be 3 %.

Keywords: steel fiber reinforced concrete(SFRC), steel fiber, flexural strength, compression strength, split tensile strength

I. INTRODUCTION

Concrete is a composite material composed of aggregate bonded together with a tank to rectangular beam or column in a high-rise building. One of the challenges facing water and cement which hardens over time. A large variety of waste materials are considered feasible and even much valuable additives for concrete. Some of these materials include cellulose, fly ash, silica fume, wood particles etc.In this investigation, steel fibers or strips obtained from the scrapped tyres is considered as the most recent waste materials that have been examined because of its vital use in the construction field. In our day to day life one of the major environmental challenges facing municipalities around the world is the disposal of worn out automobile tyres. To address this global problem, steel strips from beads of the tyres are added in concrete to improve quality and also decrease the disposal load to some extent.

II. LITERATURE REVIEW

N. Shireesha et.al:Concrete mixes were prepared using M40 grade concrete and hooked end glued steel fiber with aspect ratio of 80 were added at a dosage of 0.5%, 1.0%, 1.5% volume fraction of concrete.

P Soroushian, Z Bayasi:The fibers considered in this study were straight-round, crimped round, crimped-rectangular, hooked-single and hooked collated with aspect ratios of about 60, and straight-round and hooked-collated fibers with aspect ratios of about 75.

Rui D. Neves and Joao C. O:These varied the percentage of volume of fiber in the concrete up to 1.5%. His researchers had work on it, the recommended reinforcement of steel fiber in concrete is up to 3% by weight of cement only.

Abhishek Mandloi:Every day about 8 to 10 kg of lathe waste are generated by each lathe industries in the Pondicherry region and dumped in the barren soil there by contaminating the soil and ground water, which creates an environmental issue. Hence by adopting proper management by recycling the lathe scrap with concrete is considered to be one of the best solutions.

Nawy and Neuwerth (1971):tested twenty simply supported rectangular beams reinforced with GFRP and steel reinforcing bars. The tests have revealed that the reinforcing ratio of FRP beams did not affect moment capacity.

III. MATERIAL USED

1) Cement

In the present study ordinary Portland cement of Ultratech brand of 43 grade confirming to IS 4031-1988 was used.

2) Fine aggregate

Fine aggregate are materials passing through as IS sieve of 4.75mm. Natural river sand locally available confirming to IS 383-1987 was used of grading zone II.

3) Coarse Aggregate

In this study, 20mm graded natural coarse aggregate which are irregular angular shape is used. And was passing through 20mm sieve and retaining on 4.75 mm. These aggregates were tested and satisfied as per IS:383.

4) Fibers

In this study the steel fibers or strips was used, which are derived from automobile tyres. The length, diameter & aspect ratio is 25mm,0.5mm&50. respectively

5) Water

The water should be free from dust, impurities and should meet the codal requirements IS 456: 2000 and usually tap water is preferred.

IV. EXPERIMENTAL WORK

Slump test

The consistency and workability of concrete was evaluated using slump test. In case of reference mix, the slump was 86 mm but in case of other mixes with steel fibres in varying proportions, the slump observed was going decreasing. The

variation of slump is shown in table 1

Compressive strength

The test was carried out conforming to IS 516-1959 to obtain compressive strength of concrete at the age of 7, 14 & 28 days. The variation in compressive strength in concrete for different mixes after 7, 14 &28 days are shown in table 2

S NO.	MIX	COMPRESSIVE STRENGTH(MPa)			VARATION OF STRENGTH AFTER		
		7 DAYS	14 DAYS	28 DAYS	7 DAYS	14 DAYS	28 DAYS
1	NORMAL CONCRETE(M1)	12.26	19.75	26.60	-	-	-
2	ADD 1% STEEL FIBRE(M2)	13.99	23.17	29.34	14.11%	17.31%	10.30%
3	ADD 2% STEEL FIBRE(M3)	14.88	25.08	30.49	21.37%	26.98%	14.61%
4	ADD 3% STEEL FIBRE(M4)	15.67	25.49	31.48	27.81%	29.06%	18.34%
5	ADD 4% STEEL FIBRE(M5)	15.30	25.91	31.26	24.79%	31.18%	19.39%
6	ADD 5% STEEL FIBRE(M6)	14.53	24.54	29.22	18.51%	24.25%	09.84%

Split tensile test

It is observed that the maximum tensile strengthafter 28-days occurs for 3% addition of steel fiber in concrete is 4.92MPa.The variation in tensile strength in concrete for different mixes after 7, 14 &28 days are shown in table 3

S NO.	MIX	SPLIT TENSILE STRENGTH(MPa)			VARATION OF STRENGTH AFTER		
		7 DAYS	14 DAYS	28 DAYS	7 DAYS	14 DAYS	28 DAYS
1	NORMAL CONCRETE(M1)	1.07	1.39	2.97	-	-	-
2	ADD 1% STEEL FIBRE(M2)	1.41	1.82	3.79	31.17%	30.93%	27.60%
3	ADD 2% STEEL FIBRE(M3)	1.53	2.01	4.02	42.99%	44.60%	35.25%
4	ADD 3% STEEL FIBRE(M4)	1.97	2.43	4.92	84.11%	74.82%	65.65%
5	ADD 4% STEEL FIBRE(M5)	1.58	2.07	4.06	47.66%	50.01%	36.70%
6	ADD 5% STEEL FIBRE(M6)	1.56	1.97	3.97	45.79%	41.72%	33.60%

V. CONCLUSION AND FUTURE SCOPE

From the results, the following conclusion may be drawn: -

- The fibrous concrete is found to have maximum ultimate load carrying capacity and is stiffer than the conventional concrete.
- With the addition of steel fibers, the slump was decreased. This reduction does not affect the filling ability as required.
- The compressive strength of the mix M2, M3, M4, M5 and M6 increased by 10.30%, 14.61%, 18.34%, 19.39% and 9.84% with respect to mix M1 at 28 days with proper curing.
- The split tensile strength is increased for the mixes M2, M3, M4, M5 and M6 by 27.60%, 35.25%, 65.65%, 36.70% and 33.60% with respect to M1 at 28 days curing.

The strength characteristics of steel fiber reinforced concrete can be further studied by considering the following parameters

- By varying the water cement ratio.
- By varying the grade of concrete.
- By using of other types of fibers in concrete.
- By using admixture like super-plasticizer.
- By varying the cement grade i.e. 33-grade and 53-grade.
- By studying the other parameters like durability properties.
- By using recycled aggregates as replacement of coarse aggregates.
- By introducing new variety of types of fibers form industry.

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