

STRENGTH AND DURABILITY ANALYSIS OF STEEL FIBRE REINFORCED FLY ASH CONCRETE OF M40 GRADE

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Abstract Different types of steel fibers can be used to reinforce concrete. Steel fibers are generally classified depending on their manufacturing method. The addition of steel fibers to concrete necessitate an alteration to the mix design to compensate for the loss of workability due to the extra paste required for coating the surface of the added steel fibers. While many technical and economical advantages are benefited from using SFRC, drawbacks can also be found. They are however not likely to cause major problems. It was thought that steel fibers will have negative implications in concrete practice (i.e. transporting, surfacing, finishing etc), but experience has shown that the influence of steel fibers on these practical aspects is negligible.

This research is based on investigating the effect of crimped steel fibers on strength parameters and durability of concrete for M-40 grade using fibers crimped fiber. This study is to study the compressive strength, Split tensile strength, flexural strength, and durability of steel fiber reinforced concrete (SFRC) containing fibers of 0%, 0.5%, 1%, 1.5%, 2%, and 2.5% by volume of cement.

Key words: Steel fibers, M-40 grade, compressive strength, Split tensile strength, flexural strength, Durability.

1. INTRODUCTION

Steel fiber strengthened cement is a composite material having filaments as the extra fixings, scattered consistently at irregular in little rates, i.e. in the vicinity of 0.3% and 2.5% by volume in plain cement SFRC items are produced by adding steel

filaments to the elements of cement in the blender and by exchanging the green cement into molds. The item is then compacted and cured by the customary strategies. Isolation or balling is one of the issues experienced amid blending and compacting SFRC. This ought to be maintained a strategic distance from for uniform appropriation of strands. The vitality required for blending, passing on, putting and completing of SFRC is marginally higher. Utilization of container blender and fiber gadget to aid better blending and to lessen the arrangement of fiber balls is fundamental. Extra fines and restricting most extreme size of totals to 20mm sometimes, bond substance of 350 kg to 550 kg for every cubic meter are typically required.

Steel filaments are added to cement to enhance the auxiliary properties, especially tractable and flexural quality. The degree of change in the mechanical properties accomplished with SFRC over those of plain cement relies upon a few elements, for example, shape, measure, volume, rate and appropriation of filaments. Plain, straight and round strands were found to grow exceptionally powerless bond and thus low flexural quality. For a given state of strands, flexural quality of SFRC was found to increment with viewpoint (proportion of length to equal width).

Despite the fact that higher proportions of strands gave expanded flexural quality, workability of green SFRC was observed to be antagonistically influenced with expanding viewpoint proportions. Thus perspective proportion is for the most part restricted to an ideal incentive to accomplish great workability

and quality. Dark proposed that perspective proportion of under 60 are best from the purpose of taking care of and blending of strands, however a viewpoint proportion of around 100 is alluring from quality perspective. Schwarz however recommended angle proportion in the vicinity of 50 and 70 is more practicable incentive for prepared blend concrete.

In a large portion of the field applications experimented with to date, the span of the filaments shifts between 0.25 mm and 1.00mm in breadth and from 12mm to 60mm long, and the fiber content went from 0.3 to 2.5 percent by volume. Higher challenges of fiber up to 10% have likewise been tested. Expansion of steel filaments up to 5% by volume expanded the flexural quality to around 2.5 times that of plain concrete.

Innovation for this produce of SFRC light, medium and substantial obligation sewer vents covers has been created in India by Structural Engineering Research Center, Chennai. Field explores different avenues regarding two percent of fiber content showed that SFRC runway chunks could be around one a large portion of the thickness of plain solid sections for a similar wheel stack scope.



Steel fiber reinforced concrete

Today it is steel fiber which is for the most part used to fortify cement and defeat the issue of weakness. This paper portrays the most fascinating utilizations of steel fiber fortified cements (SFRC) everywhere throughout the world. Right off the bat, the creator exhibits the development of steel filaments and SFRC. Also, the paper covers the contemporary significance of SFRC in structural building.

2. LITERATURE SURVEY

Rui D. Neves¹ João C. O. Fernandes de Almeida²

et and all,.(2013) An exploratory examination to research the impact of grid quality, fiber substance and measurement on the compressive conduct of steel fiber fortified cement is introduced. Two sorts of matrix and strands were tried. The influence of grid quality, fiber substance and width on the steel fiber reinforced concrete compressive conduct was examined. Inside the scope of the considered factors in this examination, Young's modulus demonstrates a slight inclination to diminish as fiber content increases.

Jacek Katzer et and all, (2006) Since the start of uses of structural designing materials in view of dirt, lime, and bond, there has been a need to figure out how to diminish their weakness. In antiquated circumstances, the issue was settled by changing fragile earth blocks with the expansion of strands of a natural cause. Furthermore, the paper covers the contemporary significance of SFRC in structural building.

Chandramouli K , Srinivasa Rao P.The present day world is seeing the development of exceptionally difficult and troublesome structural designing structures. Frequently, concrete being the most essential and generally utilized material is called upon to have high quality and adequate workability properties. Endeavors are being made in the field of solid innovation to grow such cements with exceptional attributes.

3. MATERIALS USED IN THE STUDY

Cement

Ordinary Portland cement of 53 grade was used in this experimentation conforming to I.S. – 12269-1987. Ordinary Portland Cement (OPC) is a champion among the most acclaimed constructing materials used the entire path over the globe.



OPC 53 Grade Cement

Fine aggregates

Locally open sand zone II with specific gravity 2.65, water absorption 2% and fineness modulus 2.92, changing in accordance with I.S. – 383-1970. It is the aggregate the lion's share of which passes 4.75 mm IS sifter and contains simply such an extraordinary measure of coarser as is permitted by detail.

Coarse aggregate

Squashed shake stones of 10 mm measure having specific gravity of 2.70, fineness modulus of 2.73, conforming to IS 383-1970 Aggregates are idle granular materials, for instance, sand, shake or pounded stone that are a last outcome in their own right. They are moreover the unrefined materials that are a fundamental settling in concrete.

Steel fibre

Stainless steel wire of 0.5 mm distance across has been utilized as a part of the arrangement of SFRC. The steel fiber of length 40 mm and of perspective proportion 80 has been utilized as a part of this exploratory work. All the steel filaments are tied down, snared, disintegrated fit as a fiddle. The run of the mill distance across lies in the scope of 0.25-0.75 mm snare end steel strands are being utilized as a part of this undertaking. Length of these strands is 30 mm and the angle proportion of 55. Thickness of steel fiber is 7900 kg/cum.



Steel fibers

Mix design of concrete used

Final trial mix for M40 grade concrete is 1:1.63:2.54 at w/c of 0.45

Test to be conducted on concrete

Compressive strength

- 7 days specimens age
- 14 days specimens age
- 28 days specimens age
- 56 days specimens age
- 90 days specimens age

Split tensile strength of specimens

- 28 days specimens age
- 56 days specimens age
- 90 days specimens age

Flexural strength of specimens

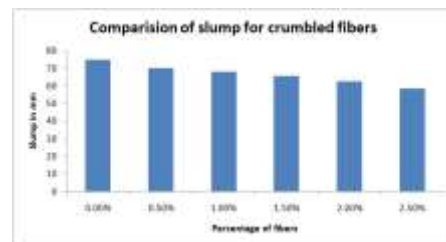
- 28 days specimens age
- 56 days specimens age
- 90 days specimens age

Durability

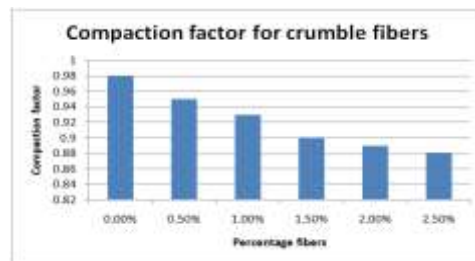
- 90 days specimens age

4. RESULTS AND ANALYSIS

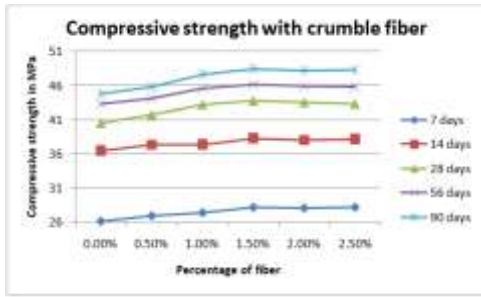
Crumbled fiber slump test results



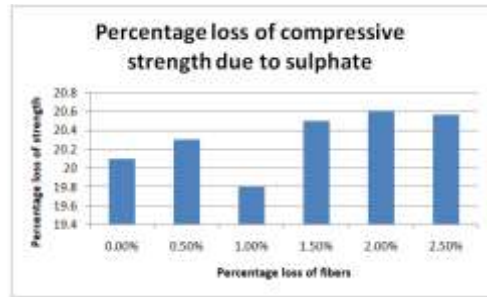
Crumbled fiber compaction factor results



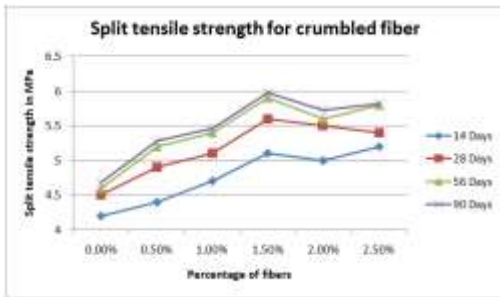
Compressive strength for crumbled fiber



Sulphate attack test for crumbled fiber



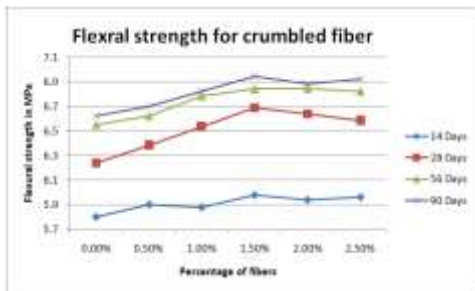
Split tensile strength for crumbled fiber



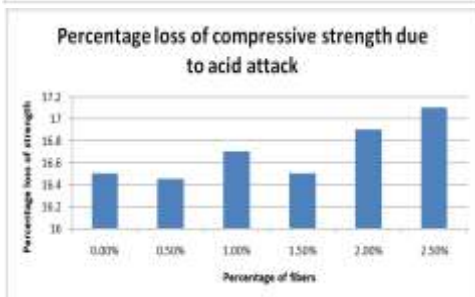
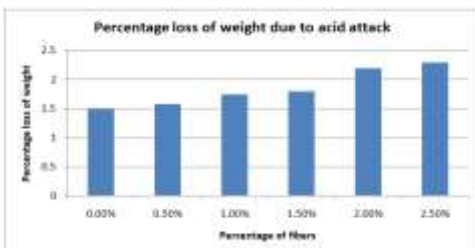
5. CONCLUSIONS

1. The material properties of the cement, fine aggregates and coarse aggregates are within the acceptable limits as per IS code recommendations so we will use the materials for research.
2. Slump cone value for the steel fiber concrete decreases with increasing in the percentage of steel fiber so the concrete was not workable by increasing in the percentage.
3. Compaction factor value of steel fiber reinforced concrete decreases with increase in the percentage of steel fibers and the maximum values of compaction factor was observed at 2% of steel fibers.
4. The compressive strength of concrete is maximum at 3% of steel fibers and is the optimum value for 7days curing, 28days curing, 56days curing, 90days curing.
5. Split tensile strength for the cylindrical specimens is maximum at 3% of steel fibers for 28days curing, 56days curing, 90days curing.
6. The flexural strength of copper slag concrete is also maximum at 3% of steel fibers for 28days curing, 56days curing, 90days curing.
7. The percentage loss of weight and percentage loss of compressive strength due to acid attack is increases with increase in the percentage of steel fibers.
8. The percentage loss of weight and percentage loss of compressive strength due to alkalinity attack is increases with increase in the percentage of steel fibers.
9. The percentage loss of compressive strength due to sulphate attack is decreases with increase in the percentage of steel fibers.

Flexural strength for crumbled fiber



Acid attack test for crumbled fiber



So the replacement of 3 % of steel fibers is generally

useful for better strength values in M30 grade of concrete.

Containing 5 to 20 Percent Steel Fiber". Steel Fiber Concrete USSweden Joint Seminar. Stockholm

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