STUDY ON STRENGTH AND DURABILITY CHARACTERISTICS OF CONCRETE BY USING VARIOUS TYPES OF STEEL FIBERS

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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 different types of steel fibers on strength parameters of concrete for M-40 grade using fibers like straight fiber, crimped fiber and hooked fiber. This study is to study the compressive strength, Split tensile strength and flexural strength of steel fiber reinforced concrete (SFRC) containing fibers of 0.00%, 0.50%, 1%, 1.5%, 2%, and 2.5% by volume of cement.

1. INTRODUCTION

By and by a day's human essential is significantly higher than shield, with the movement of human social requests, structure must be more bound in space occupation, broad and more grounded than some time as of late. Present day structures are made with flawless appearance just as for long life and quality. Move development in basic structure and in building urges organizers and experts to appear and quality. Beside nature's impact like in sort of big enchiladas, flood and seismic quake; structures moreover withstand in ecological condition like tempest, sogginess and tremendous assortment in temperature as demonstrated by climate. In the current work we moreover investigated various roads with respect to steel fibers and various fixings (Steel fiber). Test with different obsession and assorted size of fiber, were organized and pursued for the compressive quality against customary concrete.

Data from the performed investigate were recorded and compressive quality related assessment have been done. Our basic inquiry of the work is to upgrade the Fiber sustained concrete (FRC) is Portland bond concrete reinforced with essentially aimlessly appropriated fibers. In FRC, a colossal number of little strands are dissipated and appropriated indiscriminately in the strong in the midst of mixing, and thusly upgrade strong properties all over. FRC is concrete based composite material that has been made recently. It has been successfully used as a piece of advancement with its radiant flexural-flexibility, insurance from spitting, influence

assurance and incredible permeability and ice security. It is a convincing way to deal with construct solidness, daze insurance and assurance from plastic shrinkage breaking of the mortar. Fiber is a tad of fortifying material having certain traits properties.

Steel fiber reinforced concrete (SFRC)

Steel fiber fortified concrete is a composite material having fibers as the additional fixings, dispersed reliably at sporadic in little rates, for example in the region of 0.3% and 2.5% by volume in plain concrete SFRC things are delivered by adding steel fibers to the components of concrete in the blender and by trading the green concrete into molds. The thing is then compacted and relieved by the standard procedures. Separation or balling is one of the issues experienced in the midst of mixing and compacting SFRC. This should be kept up a key good ways from for uniform appointment of strands. The essentialness required for mixing, passing on, putting and finishing of SFRC is possibly higher. Usage of compartment blender and fiber device to help better mixing and to decrease the plan of fiber balls is essential. Additional fines and confining most outrageous size of sums to 20mm once in a while, bond substance of 350 kg to 550 kg for each cubic meter are ordinarily required.

Objectives of the study

For this study the following objectives were made

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

2. LITERATURE REVIEW

A.M. Shende[1] , A.M. Pande[2] , M. Gulfam Pathan[3] et and all,.(2012)

Basic examination for M-40 review of cement having blend extent 1:1.43:3.04 with water bond proportion 0.35 to ponder the compressive quality, flexural quality, Split rigidity of steel fiber strengthened cement (SFRC) containing filaments of 0%, 1%, 2% and 3% volume portion of snare Stain. Steel strands of 50, 60 and 67 angle proportion were utilized.

It is watched that compressive quality, split elasticity and flexural quality are on higher side for 3% strands when contrasted with that delivered from 0%, 1% and 2% filaments.

Jacek Katzer et and all,. (2006)

This paper depicts the most interesting uses of steel fiber strengthened concretes (SFRC) wherever all through the world. Directly off the bat, the maker shows the progression of steel strands and SFRC. Moreover, the paper covers the contemporary centrality of SFRC in auxiliary structure.

Over 40 years earlier, Romualdi, Baston, and Mandel disseminated the papers (Romualdi and Baston 1963, Romualdi and Mandel 1964) that passed on SFRC to the thought of insightful and current examination analysts around the world. In the accompanying forty years, SFRC has been constantly examined and its advancement was relentlessly made. Today, SFRC is a financially available and plausible improvement material.

3. MATERIALS USED AND MIX DESIGN

Cement

Ordinary Portland cement of 53 grade was used in this experimentation conforming to I.S. – 12269-1987.

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

Fine aggregates

Coarse aggregates

Crushed stone aggregate of 20mm size is brought from nearby quarry. Aggregates of size more than 20mm size are separated by sieving. Tests are carried in order to find out the

- Specific gravity = 2.98
- Fineness modulus = 7.5

Coarse aggregates

Steel fibres

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 fibre of (a)anchor steel fibre(b)hooked end steel fibre(c) reinforced steel fibre(d) recycled steel fibre

Mix Design of M40 grade

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

TEST TO BE CONDUCTED ON THE SPECIMENS:

Compressive strength

- 7 days specimens age
- 14 days specimens age

- 28 days specimens age

Split tensile strength of specimens

- 7 days specimens age
- 14 days specimens age
- 28 days specimens age

Flexural strength of specimens

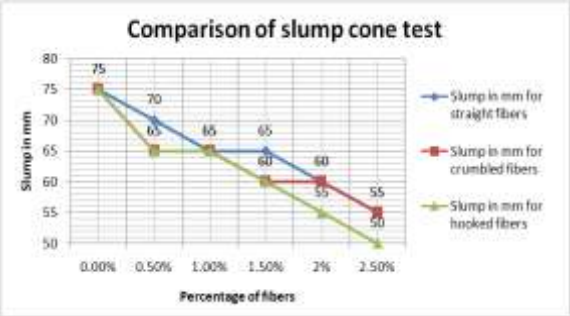
- 7 days specimens age
- 14 days specimens age
- 28 days specimens age

Durability

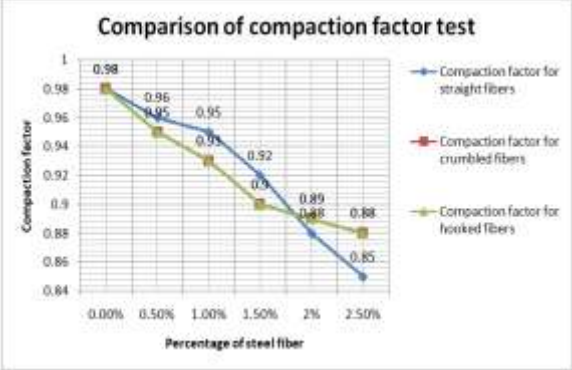
- 90 days specimens age

4. RESULTS AND ANALYSIS

Slump in mm

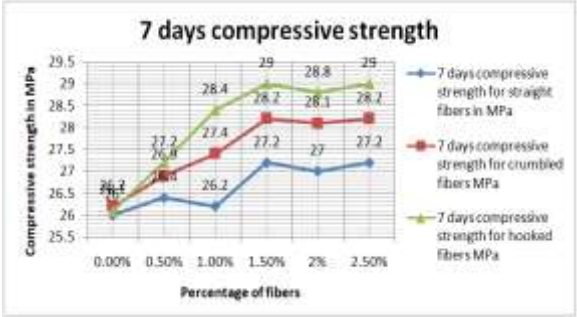


Compaction factor

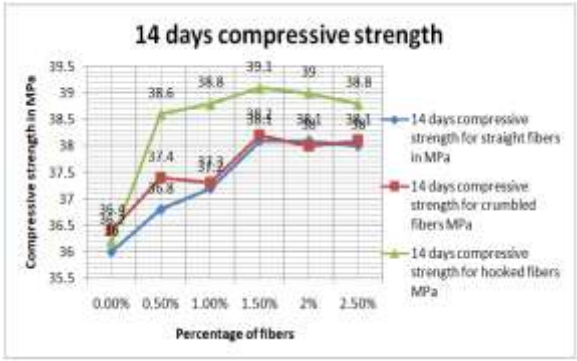


Compressive strength of concrete

7 days



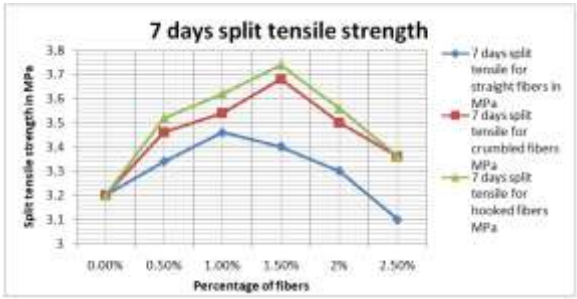
14 days



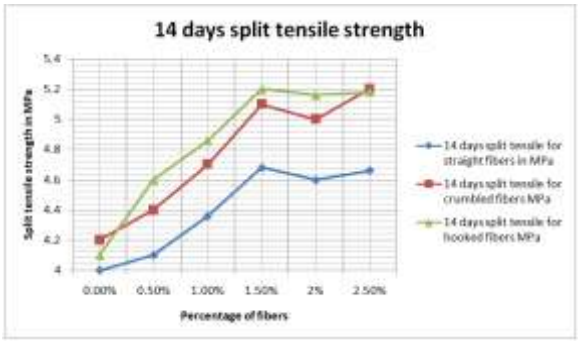
28 days compressive strength

Split tensile strength of concrete

7 days



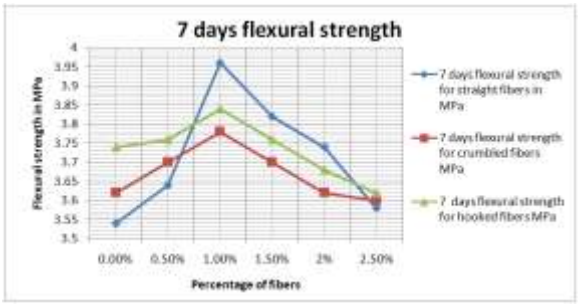
14 days



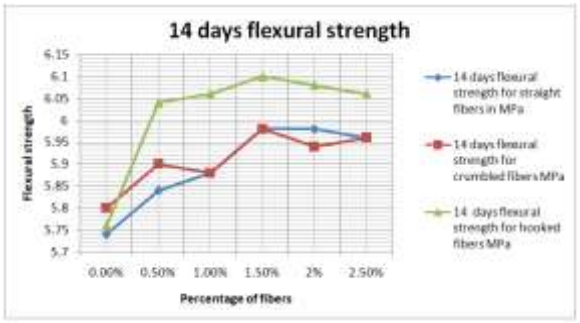
28 days

Flexural strength of concrete

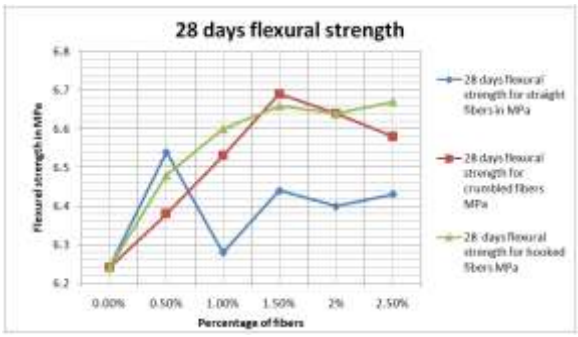
7 days



14 days



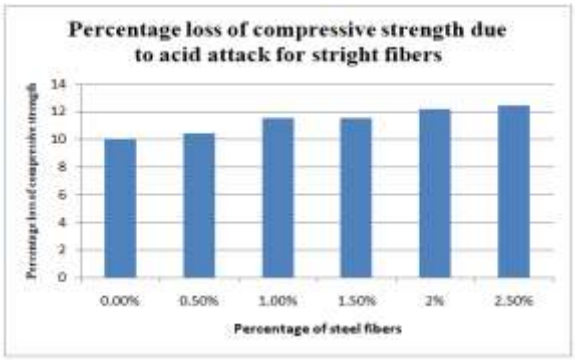
28 days

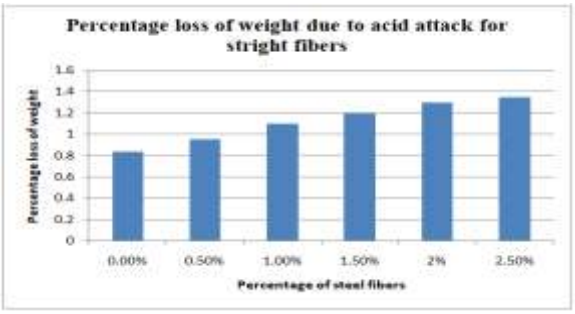


Durability of concrete

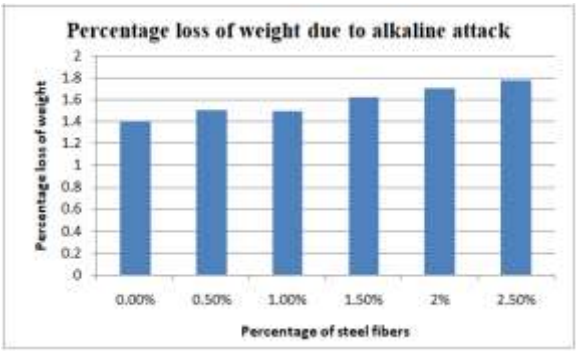
Straight fibers

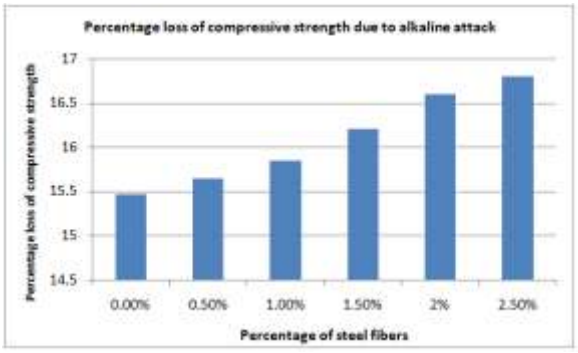
Acid attack

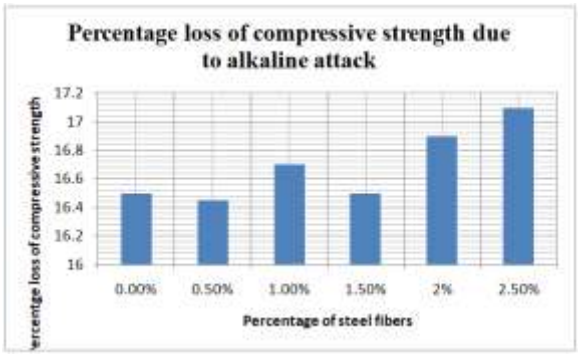




Alkaline attack





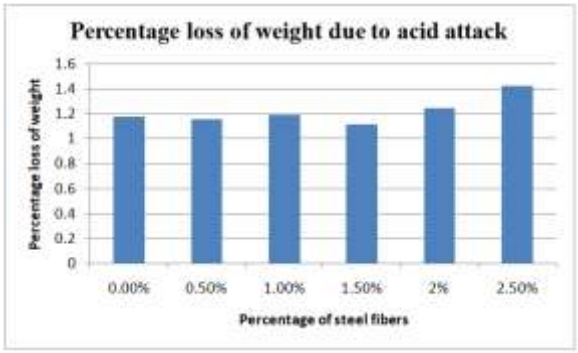


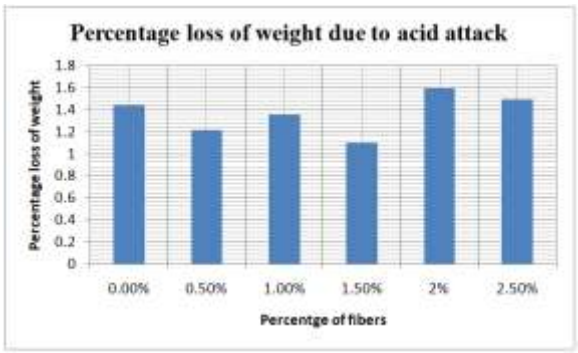
Crumbled fibers

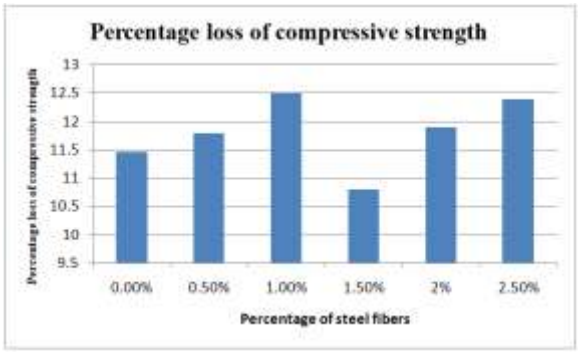
Hooked fibers

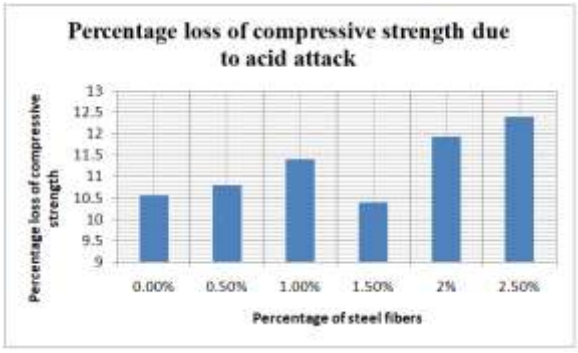
Acid attack

Acid attack



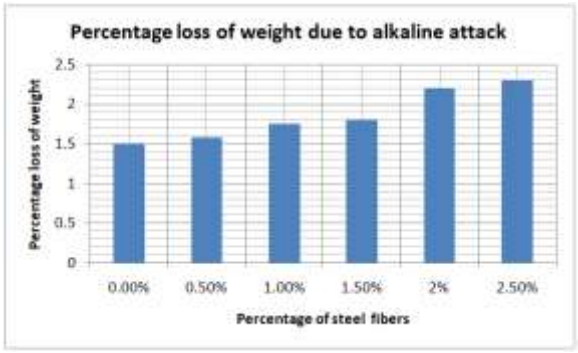


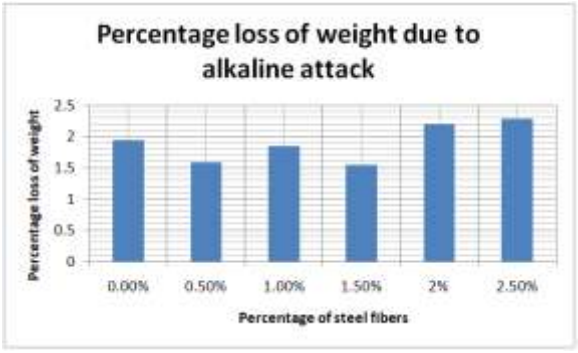


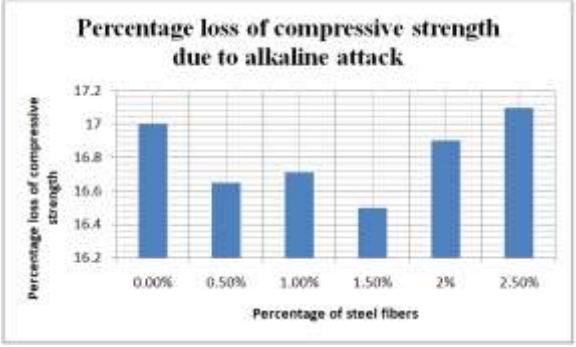


Alkaline attack

Alkaline attack







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 1.5% of steel fibers and is the optimum value for 7days curing,14 days and 28days curing.
5. Split tensile strength for the cylindrical specimens is maximum at 1.5% of steel fibers for 7days curing,14 days and 28days curing.
6. The flexural strength of concrete is also maximum at 1.5% of steel fibers for 7days curing, 14days curing and 28days 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.

So the replacement of1.5 % of steel fibers is generally useful for better strength values in M40 grade of concrete.

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