

PERFORMANCE OF HOOKED AND CRIMPED STEEL FIBERS IN CONCRETE STRUCTURES

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ABSTRACT

The large quantity of concrete is used by the construction industry all over the world, probably second largest after water. In India, the conventional concrete is produced by using natural sand as fine aggregate that are available from riverbeds. But diminishing sand resources poses the environmental problem and hence government restrictions on sand quarrying resulted in scarcity and significant increase in its cost. This work presents the study of steel fibre reinforced concrete with artificial sand as fine aggregate. M30 concrete where designed as per IS 10262:2009 with ratio 1 : 2.27 : 3.42 and reinforced with Hooked and crimped fibre in the dosage of 2%,4%,6% and 8% were added. The specimens were prepared, cured and tested for compressive strength and split tensile strength. M-sand was used in hooked fibre and river sand was used in crimped fibre. Tensile and compression Strength was found to be better than conventional concrete.

INTRODUCTION

Concrete in general is a widely used material in the world based on the global usage; it is placed at second position after water. Fine aggregate is an essential component of concrete. The most commonly used fine aggregate is natural sand or pit sand. Therefore construction companies of developing countries are in stress to identify alternative material to lesser or eliminate the demand for natural sand.

Plain concrete contains very low tensile strength and resistance and limited ductility to cracking. Internal micro cracks are inherently present in the concrete and its poor tensile strength is due to the generation of such micro cracks, naturally leading to brittle fracture of the concrete. It has been recognized that the addition of small, closely spaced and uniformly scattered fibres to the concrete would act as crack arrester and would gradually improve its Compressive and tensile strength.

To determine the influence of shape effect on Hooked and Crimped Steel fibre in concrete using M sand and river sand as a fine aggregate in concrete.

Even at 1 % steel fibre content flexural strength of 6.46 N/mm^2 was observed against flexural strength 5.36 N/mm^2 at 0% hence increase of 1.2% flexural strength [1].

OBJECTIVE

1. To find out effect of Hooked and Crimped steel fibre and its shape on properties of FRC
2. To find out the compressive strength of fiber and different fine aggregate based concrete
3. To find out the split tensile strength of fiber and different fine aggregate based concrete
4. To find out optimum percentage of Hooked and Crimped steel fibre in concrete.

MATERIALS

CEMENT

The cement used for this work was OPC of 43 grades. The specific gravity of cement was tested as per IS: 8112 and was found to be 3.15.

RIVER SAND

Natural River sand with specific gravity 2.60 and fineness modulus 2.67 was used for this work

M SAND

Manufactured Sand is sand produced from crushing of stones with specific gravity 2.5 was used in this work

COARSE AGGREGATES

The coarse aggregate used is crushed aggregate conforming to code IS 383:1970. The aggregate passing through 20mm sieve and retained in 16mm sieve is used in this work

WATER

Locally available water without hazardous material is used in this work

FIBRES

Hooked and crimped fibers purchased from market were used in this work.

GRADE OF CONCRETE

M30 Grade of concrete with ratio 1: 2.27 : 3.42, fiber Were added for 2%,4%,6%,8% by weight and M-Sand was used in hooked fiber and River sand were used in crimped fiber .

TESTING OF SPECIMENS

Compressive strength of cube was done by casting $150\text{mm} \times 150\text{mm} \times 150\text{mm}$ as per IS 516:1959. Split tensile strength was done as per Indian standard.

Tests was made at recognized ages of the test specimens, the most usual being 7 and 28 days. Compressive strength of Hooked and crimped fiber concrete is done as per IS

Specification and results are tabulated in table 1 and table 2 . Split tensile strength of Hooked and crimped fibre concrete is done by casting cylinder of size 150mm dia and 300mm height and results are shown in table 3 and table 4. Fig 1 to fig 4 shows the variation of strength between conventional concrete and fibre reinforced concrete

Table 1 Compressive strength of Hooked shapefibre after 28days curing

% Of Fibre Added	Compressive strength(N/mm ²)
0%	35.26
2%	37.33
4%	40.1
6%	46.37
8%	41.14

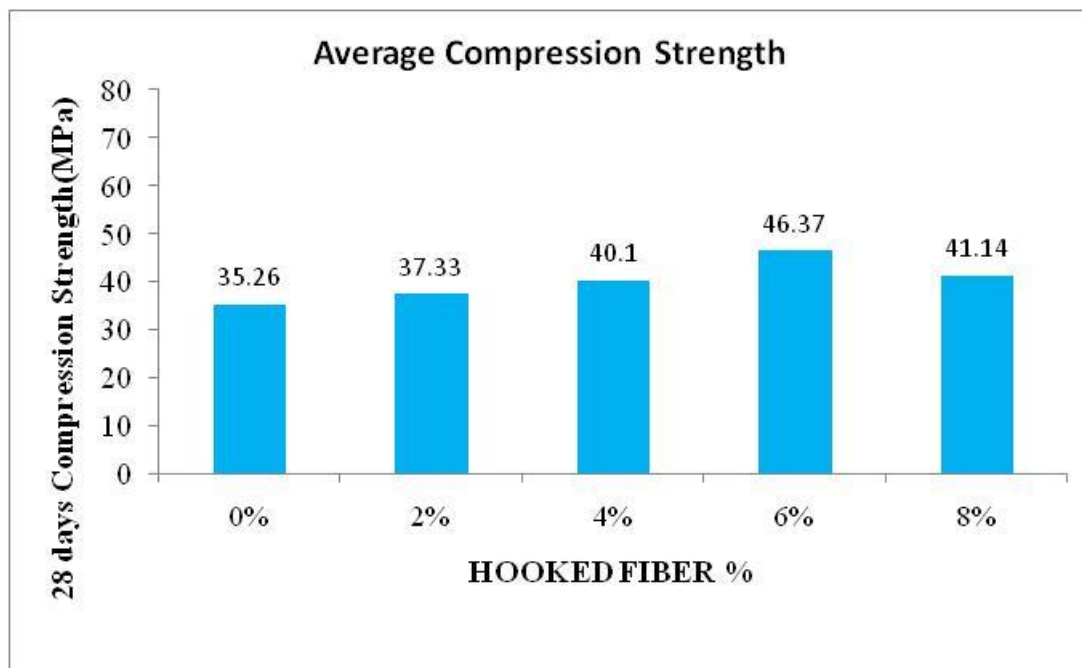


Fig 1 Compressive strength of Hooked fibre after 28days curing

Table 2 Compressive strength of Crimped shape fiber after 28days curing

% Of Fibre Added	Compressive strength(N/mm²)
0%	35.26
2%	36.98
4%	38.42
6%	37.37
8%	38.16

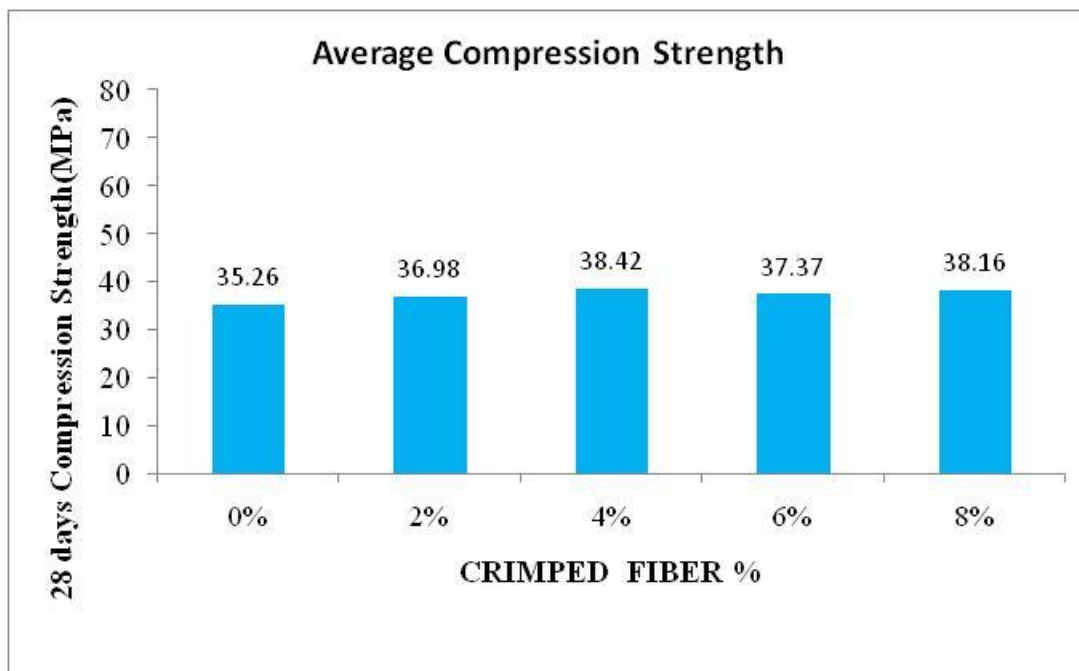
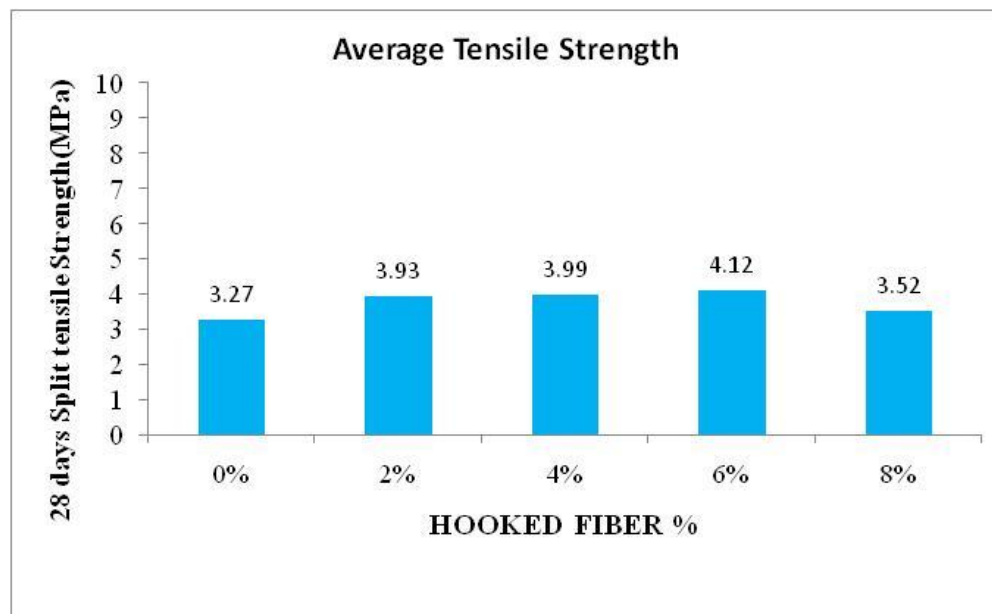
**Fig 2 Compressive strength of Crimped fibre after 28days curing**

Table 3 Split tensile strength of Hooked shape fibre after 28days curing

% Of Fibre Added	Split tensile strength(N/mm ²)
0%	3.27
2%	3.93
4%	3.99
6%	4.12
8%	3.52

**Fig 3 Tensile strength of Hooked fibre after 28days curing****Table 4 Split tensile strength of Crimped shape fibre after 28days curing**

Percentage Of Fibre Added	Split tensile strength(N/mm ²)
0%	3.27
2%	3.59
4%	4.02
6%	3.66
8%	3.27

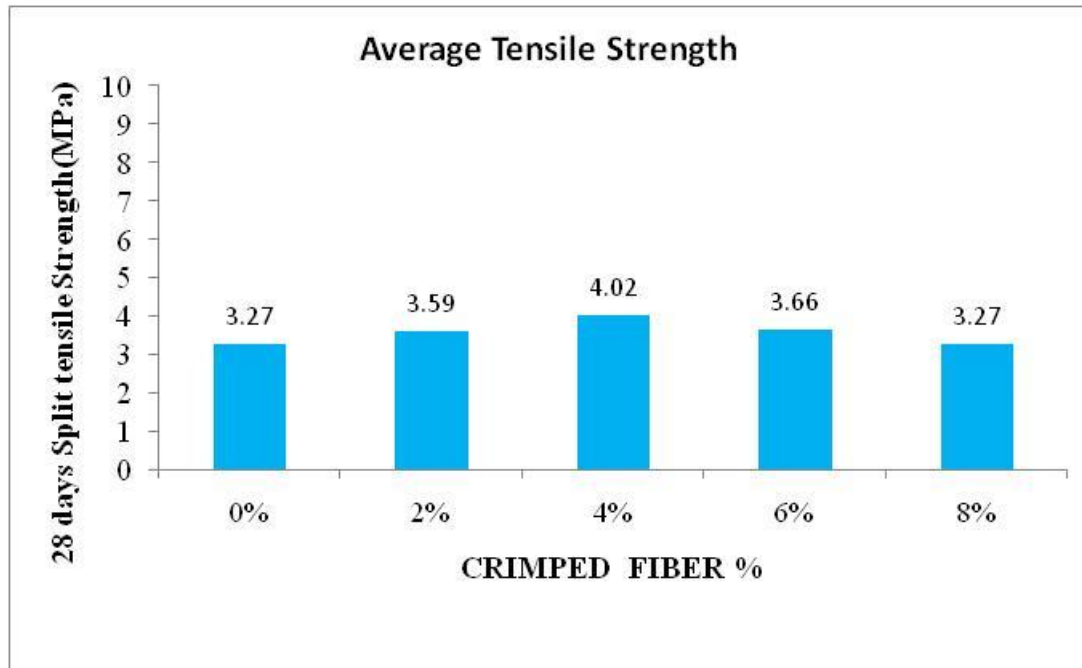


Fig 4 Tensile strength of Crimped fibre after 28days curing

CONCLUSION

Based on the investigation for different concentration of steel fibre and the concrete that is cured for 28 days, the following conclusions can be drawn,

- ❖ The compressive strength and split tensile strength of the concrete increases on the addition of steel fibre than the conventional concrete.
- ❖ On addition of 6% of Hooked shaped fibre the maximum compressive strength of 46.7 N/mm^2 is achieved and addition of 4% increased the compressive strength in crimped fibre thus compression strength is more than conventional concrete.
- ❖ The increase in split tensile strength was found than the conventional concrete.
- ❖ Optimum dosage of Hooked shape steel fibre that can be added in concrete is 4% and 6%.
- ❖ Addition of fibers performs as crack arrestor.
- ❖ The increase in split tensile strength than the conventional concrete at 4% addition of Crimped shaped fibre.
- ❖ Thus the optimum dosage of Crimped shaped fibre is 4% and we concluded that both crimped and hooked fiber can be utilized effectively..

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