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Experimental Study On Strength Characteristics Of Steel Fiber Reinforced Concrete

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Abstract: ***The concept of utilization of steel fiber in concrete (SFRC) increases the strength of concrete. It has superior resistance to cracking and crack propagation. During the past decade steel fibre-reinforced concrete has progressed from a new relatively untied and unproven material to one which has now achieved recognition in a variety of engineering applications. The addition of fibres in the matrix has many important effects. Most notable among the improved mechanical characteristics of Fiber Reinforced Concrete (FRC) are its superior fracture strength, toughness, impact resistance, flexural strength resistance to fatigue, improving fatigue performance is one of the primary reasons for the extensive use of Steel Fiber Reinforced Concrete (SFRC) in pavements, bridge decks, offshore structures and machine foundation, where the composite is subjected to cyclically varying load during its life time. The steel fiber are able to hold the matrix together even after extensive cracking. Corrugated fibers with aspect ratio of 45 were used in this project. The M30 grade of concrete was used in this project. The main reasons for adding steel fibres to concrete matrix is to improve the post cracking response of the concrete, i.e., to improve its energy absorption capacity and apparent ductility, and to provide crack resistance and crack control. Also, it helps to maintain structural integrity and cohesiveness in the material. Specimens were cast without fibres and with fibres of 0.5% and 1.0%. Tests were conducted for studying the compressive, tensile strength. SFRC has maximum load carrying capacity and strength as compared to plain cement concrete***

Keywords—homomorphic encryption, securedanalysis, medicaldata, ROW's algorithm

I. INTRODUCTION

Concrete is one of the most versatile building materials. It can be cast to fit any structural shape from a cylindrical water storage tank to a rectangular beam or column in a high-rise building. The advantages of using concrete include high compressive strength, good fire resistance,
high water resistance, low maintenance, and long service life. The disadvantages of using concrete include poor tensile strength, low strain of fracture and formwork requirement. The major disadvantage is that concrete develops micro cracks during curing. It is the rapid propagation of these micro cracks under applied stress that is responsible for the low tensile strength of the material. Hence fibres are added to concrete to overcome these disadvantages. The addition of fibres in the matrix has many important effects. Most notable among the improved mechanical characteristics of Fibre Reinforced Concrete (FRC) are its superior fracture strength, toughness, impact resistance, flexural strength resistance to fatigue, improving fatigue performance is one of the primary reasons for the extensive use of Steel Fibre Reinforced Concrete (SFRC) in pavements, bridge decks, offshore structures and machine foundation, where the composite is subjected to cyclically varying load during its life time.

The fact is fibres of almost any description improve the ability of substances to withstand strain.
The main reasons for adding steel fibres to concrete matrix is to improve the post cracking response of the concrete, i.e., to improve its energy absorption capacity and apparent ductility, and to provide crack resistance and crack control. Also, it helps to maintain structural integrity and cohesiveness in the material.

II. MATERIALS USED

2.1 Cement:

Ordinary Portland cement was utilized.

Properties of Cement Test Results

1) Specific gravity - 3.05
2) Normal Consistency - 28%
3) Initial setting time - 30 min
4) Final setting time - 600 min

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2.2 Fine Aggregate:

Fine total free from tidy, clean were utilized. The physical characteristic of fine aggregate are tested in laboratory and the results are obtained in following.

Properties of Sand Test Results

1) Specific gravity - 2.45
2) Water absorption - 0.85%
3) Fineness of Modulus - 4.45

2.3 Coarse Aggregate:

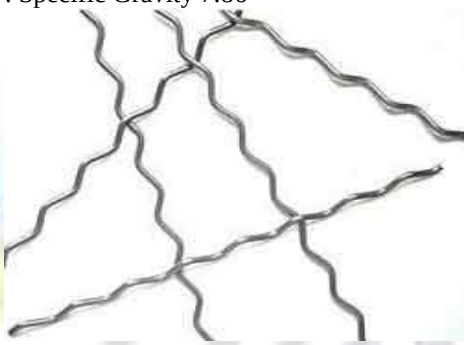
Coarse aggregates below 20mm in size were used. The physical properties of the coarse aggregate as follows.

Properties of Coarse Aggregate Test Results

1) Specific Gravity - 2.85
2) Water absorption - 1.2%
3) Fineness of modulus - 7.1

2.4 Steel Fibre

It is a fibrous material which increases concrete structural integrity. The fibres have an irregular surface and a crimped type. It has a length of 50 mm and a diameter of 1mm resulting in an aspect ratio of about 50. The tensile strength of steel fibre in the range of 1200 N/mm^2. Specific Gravity 7.86



III. MIX PROPORTIONING

Materials Required For M30 Grade of Concrete

Cement = 426 Kg / m3

FA = 472 Kg / m3

CA = 1100 Kg / m3

Water = 191.6 Kg / m3

Steel fibre used - 0.5%, 1% & 1.5%

Mix ratio (M30) : 1 : 1.12 : 2.58

W/C ratio : 0.45

IV.EXPERIMENTAL METHODOLOGY

In this study, some tests were conducted on concrete of strength characteristics of the hardened concrete.

1) Cube for compression strength

2) Split Tensile strength

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4.1 Cubes for Compression Strength:

By using the Standard size of 150×150×150 mm cube specimen were used for compressive strength. The sample was placed on the UTM with a capacity of 100 tones, a uniform rate of 550 kg /cm^2 /min was connected until cube failed.

Compression strength (fck) in MPa

$$= \frac{\text{load(P)}}{\text{Area of cube(A)}}$$

Where,

P= Load failure

A= Area of the Cube (150 x 150= 22500 mm^2)

4.2 Split Tensile Test:

The cylinder with a size of 150 mm (diameter) x 300 mm (height) is cast.

$$\text{Split Tensile} = \frac{2P}{\pi LD}\ N/mm^2$$

Where,

P = Load failure

L = Length of Cylinder.

D = Diameter of Cylinder.

V. RESULTS

5.1 Cubes for compression strength

Fig 5.1 Cube Mould preparation

Fig 5.2 Compression strength test of concrete cube

Table 1: Report of compressive strength values

Specimen	Compressive Strength (N/mm^2)		
	7 days	14 days	28 days
Conventional	24.31	28.12	31.25
SFRC 0.5 %	26.24	28.99	32.22
SFRC 1.0 %	29.72	30.79	34.22
SFRC 1.5 %	30.21	31.54	35.10

5.2 split tensile strength results

Fig 5.3 Cylindrical Mould preparation

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Fig 5.4 Split tensile strength test of concrete cylinder

Table 2: Report of Split tensile strength values

Specimen	Split tensile Strength (N/mm^2)		
	7 days	14 days	28 days
Conventional	4.1	4.24	4.64
SFRC 0.5 %	4.83	4.98	5.3
SFRC 1.0 %	5.85	6.02	6.27
SFRC 1.5 %	5.91	6.09	6.51

VII. CONCLUSION

- Significant improvement on the strength properties of concrete by addition of crimped steel fibres.
- The fibre addition resulted in better matrix strengthening and enhanced compressive & tensile properties of concrete.
- Compressive strength was decreased in the case of 1.5 % steel fibres were used.
- Tensile strength is continuously increased with increasing the percentage of steel fibre.
- The roles of fibres in delaying the crack formation with subsequent increase in strength were realized.

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