



Effect Of Different Positions of Mix Steel Fiber and Mechanical Lathe Scrap on Strength of Concrete

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Abstract—

Concrete is relatively brittle, and its tensile strength is typically only about one tenths of its compressive strength. Regular concrete is therefore normally reinforced with steel reinforcing bars. For many applications, it is becoming increasingly popular to reinforce the concrete with small, randomly distributed fibers. Their main purpose is to increase the energy absorption capacity and toughness of the material, but also increase tensile and flexural strength of concrete. Steel fibers have been used in concrete since the early 1900s. The early fibers were round and smooth and the wire was cut or chopped to the required lengths. The use of straight, smooth fibers has largely disappeared and modern fibers have either rough surfaces, hooked ends or are crimped or undulated through their length. Modern commercially available steel fibers are manufactured from drawn steel wire, from slit sheet steel or by the melt-extraction process which produces fibers that have a crescent-shaped cross section. Steel fibers have been used for a long time in construction of roads and also in floorings, particularly where heavy wear and tear is expected. Steel Fibre Reinforced Concrete (SFRC) is a composite material, which essentially consists of conventional concrete reinforced by random dispersal of short, fine steel fibres of specific geometry. The role of these fibres in the cement based matrix is rather complex.

I. INTRODUCTION

Concrete is the most widely used structural material in the world with an annual production of over seven billion tons. High strength concrete with compressive strength more than 25 MPa is being increasingly used in reinforced and pre-stressed concrete construction of buildings, bridges, and other structures. However, one of the major drawbacks of the high strength concrete is that it is brittle. For a variety of reasons, much of this concrete is cracked. The reason for concrete to suffer cracking may be attributed to structural, environmental or economic factors, but most of the cracks are formed due to the inherent weakness of the material to resist tensile forces. However, an ideal

solution to overcome this serious disadvantage of concrete is to add fibres in concrete to achieve ductility and hence to avoid sudden failures. The incorporation of steel and other fibres in concrete has been found to improve its resistance to cracking, impact and fatigue and modifying its brittle behaviour to obtain appreciable ductility. However, steel fibres are the only fibers that can be used for long- term load bearing application, such as in concrete pavements.

The main effect of steel fibre is on energy absorption capacity (toughness) and prevention of crack propagation in concrete. Fibres significantly reduce the brittleness of concrete and improve its engineering properties, such as tensile, flexural, impact resistance, fatigue, load bearing capacity after cracking and toughness. Steel fibre technology actually transforms a brittle material into a more ductile one. Catastrophic failure of concrete is virtually eliminated because the fibres continue supporting.

II. LITERATURE STUDY

1.1. An appraisal of using steel fiber reinforced cement for pavement-

In this study about SFRC which may be very beneficial for the pavement, the evaluation is as follows. By incorporating steel fibres, the mechanical properties of concrete are changed, resulting in significant load carrying capacity of concrete even after it has cracked. Also, the major incentive for adding steel fibres is to improve the flexural behaviour of a concrete slab. These improved properties result in SFRC being a useful material for concrete pavements, but still SFRC is not a complete solution to the several other problems faced by the concrete pavements.

1.2. liamsanguan, Vissakorn Vannakosit. The research intends Experimental Study on Effects of Steel Fiber Volume on Mechanical Properties of SFRC-

Numerous studies have been done on mechanical characteristics of steel fiber reinforced concrete (SFRC) and structural members reinforced with them. However, more studies on behaviour of concrete reinforced with fibers are needed because many factors affect on mechanical properties of fibers. The aim of this research is investigation on the influence of fibers percentage on compression, splitting and flexural behaviour. Besides, crack pattern and the best amount of fiber were studied. In this study, four different dosage of steel fiber including 0, 0.7, 1.0 and 1.5 % of steel fiber were mixed in concrete.

1.3. Experimental study on strengthens of fiber-

Concrete is one of the most widely used material in construction industry. Nowadays the behaviour the rigid pavement is on the expansion and need more analysis in improvement the properties of concrete. The lack of tensile strength under the severe conditions is one of the orientation or target in this paper. The improvement of the concrete in rigid pavement will be focused on using the fibres. The aim of study is to check the various characteristic of M- 40 concrete mix design by using steel fibers and polypropylene fibers individually as well as in hybrid form with normal mix design by varying the fiber percentages, to check the effects of hybrid fibres on behaviour of pavement quality concrete. Followings are the concluded points from the study.

1.4. Reinforced Concrete for Rigid Pavements-

A. Concrete is one of the most widely used material in construction industry. Nowadays the behaviour the rigid pavement is on the expansion and need more analysis in improvement the properties of concrete. The lack of tensile strength under the severe conditions is one of the orientation or targets in this paper. The improvement of the concrete in rigid pavement will be focused on using the fibres. The aim of study is to check the various characteristic of M- 40 concrete mix design by using steel fibers and polypropylene fibers individually as well as in hybrid form with normal mix design by varying the fiber percentages, to check the effects of hybrid fibres on behaviour of pavement quality concrete. Followings are the concluded.

- B. Reuse of Lathe Waste Steel Scrap in Concrete Pavements- These project works assess on the study of the workability and mechanical strengthen properties of the concrete reinforced with industrialized waste fibers machines parts and dumping of these wastes in the barren soil contaminating l and ground water that builds an unhealthy environment. Now a day's steel scraps as a waste product used by innovative construction industry and also in transportation and highway industry. In addition to get sustainable progress and environmental remuneration, lathe scrap as worn-recycle concrete is likely to be used. When the steel scrap reinforced in concrete it acquires term; fiber reinforced concrete and steel fibers in concrete defined as steel fiber reinforced concrete (SFRC). Different experimental studies are done to identify about fresh and hardened concrete properties of scrap fiber reinforced concrete (SSFRC) and their mechanical properties found to be increase due to the addition of steel scrap in concrete i.e.

III. METHODOLOGY

The aim of this experimental investigation is to study the effect on strength characteristics of concrete with M25 grade concrete in each mix containing different positions of steel fibres in concrete were used.

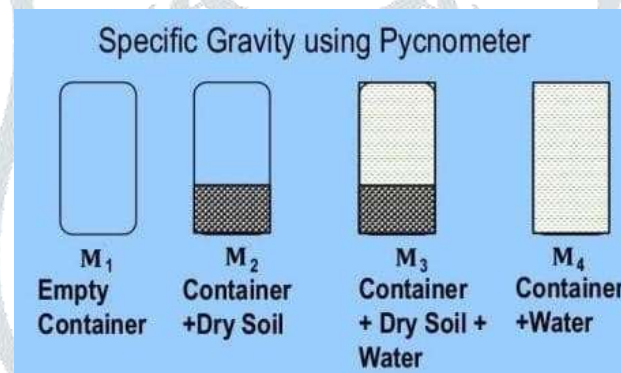


Fig 3.1

A) For Fine Aggregate

B) $M_1 = \text{Weight of Empty Pycnometer} = 641 \text{ gms}$ $M_2 = M_1 + \text{Weight of Sand} = 1141 \text{ gms}$ $M_3 = M_2 + \text{Weight of Water} = 1836 \text{ gms}$ $M_4 = M_1 + \text{Weight of Water} = 1522 \text{ gms}$

Specific Gravity = $G = \frac{(M_2 - M_1)}{(M_2 - M_1) - (M_3 - M_4)}$

$$= \frac{(1141 - 641)}{(1141 - 641) - (1836 - 1522)} = 02.69$$

C) For Coarse Aggregate

D) $M_1 = \text{Weight of Empty Pycnometer} = 641 \text{ gms}$ $M_2 = M_1 + \text{Weight of Sand} = 1019 \text{ gms}$ $M_3 = M_2 + \text{Weight of Water} = 1768 \text{ gms}$ $M_4 = M_1 + \text{Weight of Water} = 1522 \text{ gms}$

$$\begin{aligned}\text{Specific Gravity} = G &= [(M_2 - M_1) / (M_2 - M_1) - (M_3 - M_4)] \\ &= [(1019 - 641) / (1019 - 641) - (1768 - 1522)] \\ &= 02.86\end{aligned}$$

Sl No.	Grade of Concrete	Value of X
(1)	(2)	(3)
i)	M10 M15	5.0
ii)	M20 M25	5.5
iii)	M30 M35 M40 M45 M50 M55 M60	6.5
iv)	M65 and above	8.0

Sl No.	Grade of Concrete	Assumed Standard Deviation N/mm ²
(1)	(2)	(3)
i)	M10 M15	3.5
ii)	M20 M25	4.0
iii)	M30 M35 M40 M45 M50 M55 M60	5.0
iv)	M65 M70 M75 M80	6.0

Figure. 3.2

Concrete Mix Design is a step-by-step design procedure to determine the percentage of various ingredients of concrete for achieving optimum conditions. The objectives of Concrete Mix Design can be stated as given below:

A. Mix Design by IS Method:

Procedure:

Step 1 - Target Strength for Mix Proportioning In order that not more than the specified proportion of test results are likely to fall below the characteristic strength, the concrete mix has to be proportioned for higher target mean compressive strength f''_{ck} . The margin over characteristic strength is given by the following relation:

$$f''_{ck} = f_{ck} + 1.65 S \quad f''_{ck} = f_{ck} + X$$

whichever is higher. Where, f''_{ck} = target mean compressive strength at 28 days, in N/mm²;

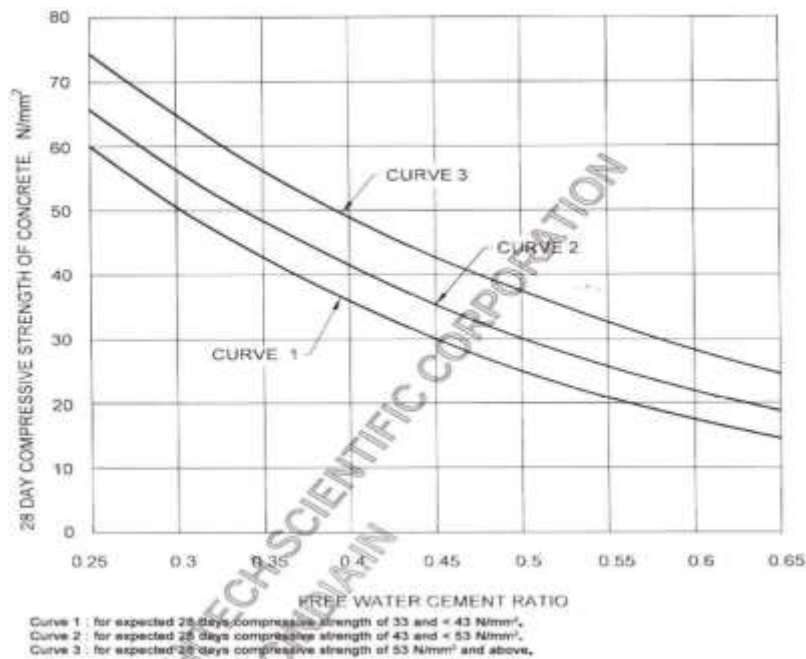
f_{ck} = characteristic compressive strength at 28 days, in

N/mm²; S = standard deviation, in N/mm² (see 4.2.1); and

X = factor based on the grade of concrete, as per Table 1.

i)	10	1.5
ii)	20	1.0
iii)	40	0.8

Figure. 3



Grade Designation : M25

Table 4 Water Content per Cubic Metre of Concrete For Nominal Maximum Size of Aggregate
(Clause 5.3)

Sl No.	Nominal Maximum Size of Aggregate mm	Water Content ¹⁾ kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

¹⁾ Water content corresponding to saturated surface dry aggregate.

Type of Cement : OPC conforming to IS 12269

Max. Nominal Size of Aggregate: 20 mm

Min. Cement Content: 300 kg/m³



Workability : 75 – 100 mm (Slump)

Method of Concrete Placing: Manu

Degree of Site Control: Good

Type of coarse aggregate: Crushed Angular

Exposure condition: Mild



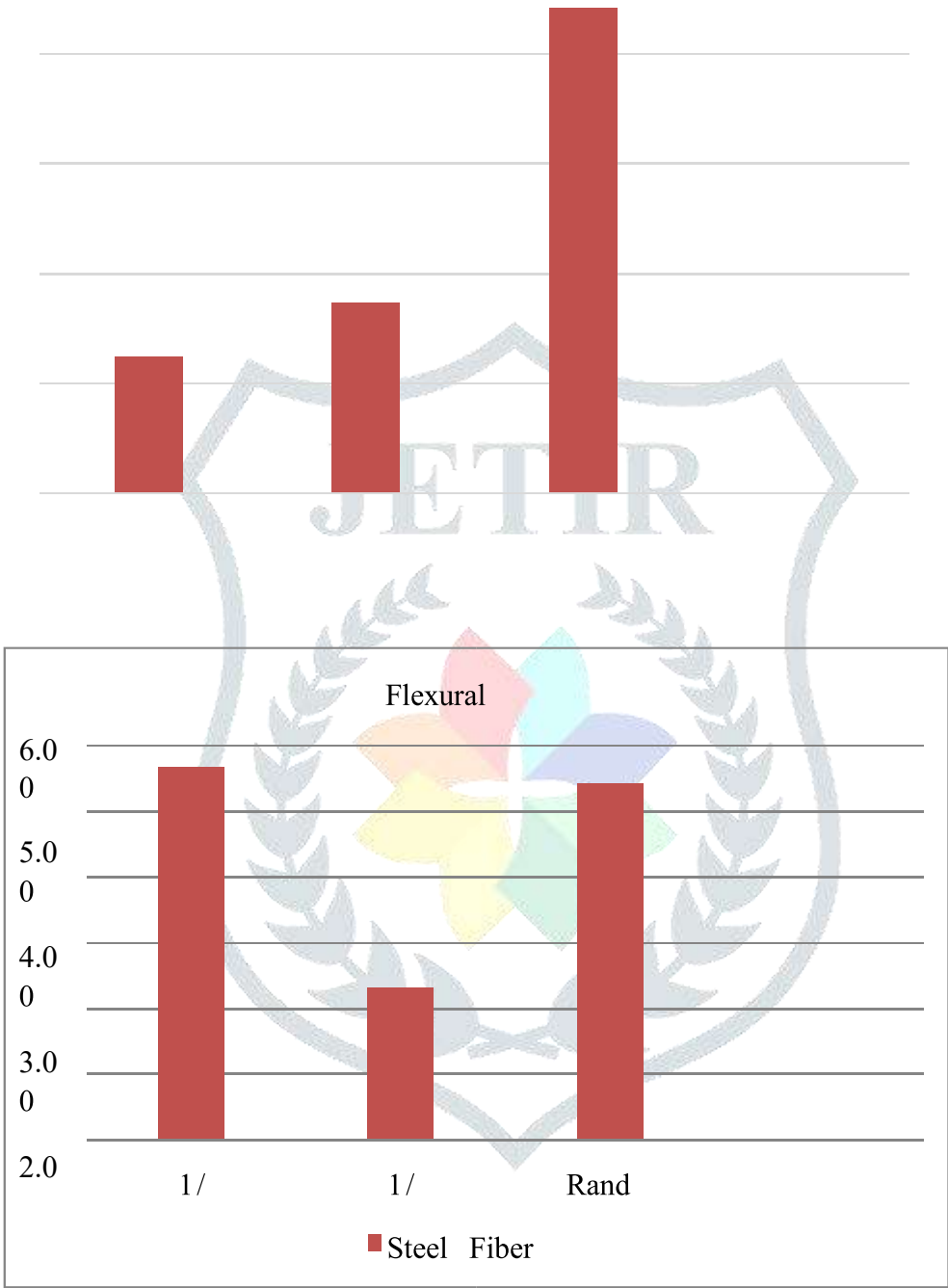
RESULT

POSITION	CUBES			UTM READING (KN)
	CTM READING (KN)	COMPRESSIVE STRENGTH (N/MM2)	AVERAGE	
1/2	325	14.44	12.52	32.25
	260	11.56		31.65
	260	11.56		-
1/3	340	15.11	17.4	13.6
	310	13.77		12.4
	525	23.33		-
RANDOM	900	40	43.11	30.9
	1000	44.44		30.2
	1010	44.88		-



IV. CONCLUSION

CHART 1. TEST RESULTS OF CUBES AFTER 28 DAYS OF CURING



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