

ANALYSIS AND EXPERIMENTAL WORK ON COMPRESSIVE STRENGTH OF CONCRETE CUBE USING STEEL CRIMPED FIBER

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CHAPTER-1

INTRODUCTION

1.1 GENERAL

SFC is a composite material made of cements, water, fine and coarse aggregate, and a dispersion of discontinuous, small fibers. These short discrete fibers are uniformly distributed and randomly oriented. They are mixed with concrete before pouring. It is well known that plain concrete is brittle and weak under flexural loads. To eliminate the disadvantages of plain concrete is added fibers into concrete mix. All admixtures meeting ASTM specifications for use in concrete are suitable for use in SFC. Steel fiber concrete (SFC) has gained increased popularity in construction industries in recent years.

Properties of Concrete Improved by Steel Fibers:

- **Fatigue Resistance:** Almost 1 1/2 times increase in fatigue strength.
- **Impact Resistance:** Greater resistance to damage in case of a heavy impact.
- **Permeability:** The material is less porous.
- **Abrasion Resistance:** More effective composition against abrasion and spalling.
- **Shrinkage:** Shrinkage cracks can be eliminated.
- **Corrosion:** Corrosion may affect the material but it will be limited in certain areas.

1.2 OBJECT

The objective of this study is to:

- Investigate the compressive strength of cube.

- Investigate ductility requirement, energy absorption capacity for SFC CUBE under loading using steel fibers of different volume .

1.3 SCOPE OF THE PROJECT

- Use of beam Colum joint connection and improved strength.
- Use of commercial and industrial slab on ground.
- Use of bridge decks overlays and pavements precast concrete applications.
- Use of shortcrete tunuel linings and slope stabilizations.
- Use of mass concrete and composite deck construction.

1.4 STEEL CRIMPED FIBER FEATURES



Fig 1.1 Steel crimped fiber

Crimped steel fiber are low carbon cold drawn steel wire fibers designed to provided concrete with temperature and shrinkage ,crack control, enhancing flexural reinforcement, improved shear strength and increasing the crack resistance of concrete.

Crimped steel fiber complies with ASTM1116, standard specification for fiber reinforcement concrete. The shortcrete and ASTMA820 this steel macro-fiber will also improved impact, s hatter, fatigue and abrasion.

CHAPTER-2

LITERATURE REVIEW

2.1 GENERAL

Bibliographic database available through the science directory and web of science websites were searched for relevant peer-reviewed journal papers and conference proceedings.

Soroshian and Bayasi (1991) Report the results of different types of steel fiber in concrete. The objective of their study was to compare the effects of different steel fiber types on fresh type on fresh-fiber mix workability and hardened material flexural and compressive characteristics of concrete. Steel fibers considered in their crimped round, rectangular collected aspect ratio about 60 and 75. A constant fiber volume of 2% were used. The fresh fibrous concrete was characterized by its slump, inverted slump-cone time and subjective workability.

Sekar (2004) carried out experiment to study the feasibility of using industrial waste fibers in fiber reinforced concrete. He used three types of waste fibers, namely, lathe, wire winding and wire drawing industries. He cast 180 numbers of concrete cylinders with and without fiber and conducted tests on compression, split tension and flexure. he reported that the addition of waste fibers from lathe and wire winding industries in plain concrete increases the strength and waste fibers from wire drawing industries decrease the strength.

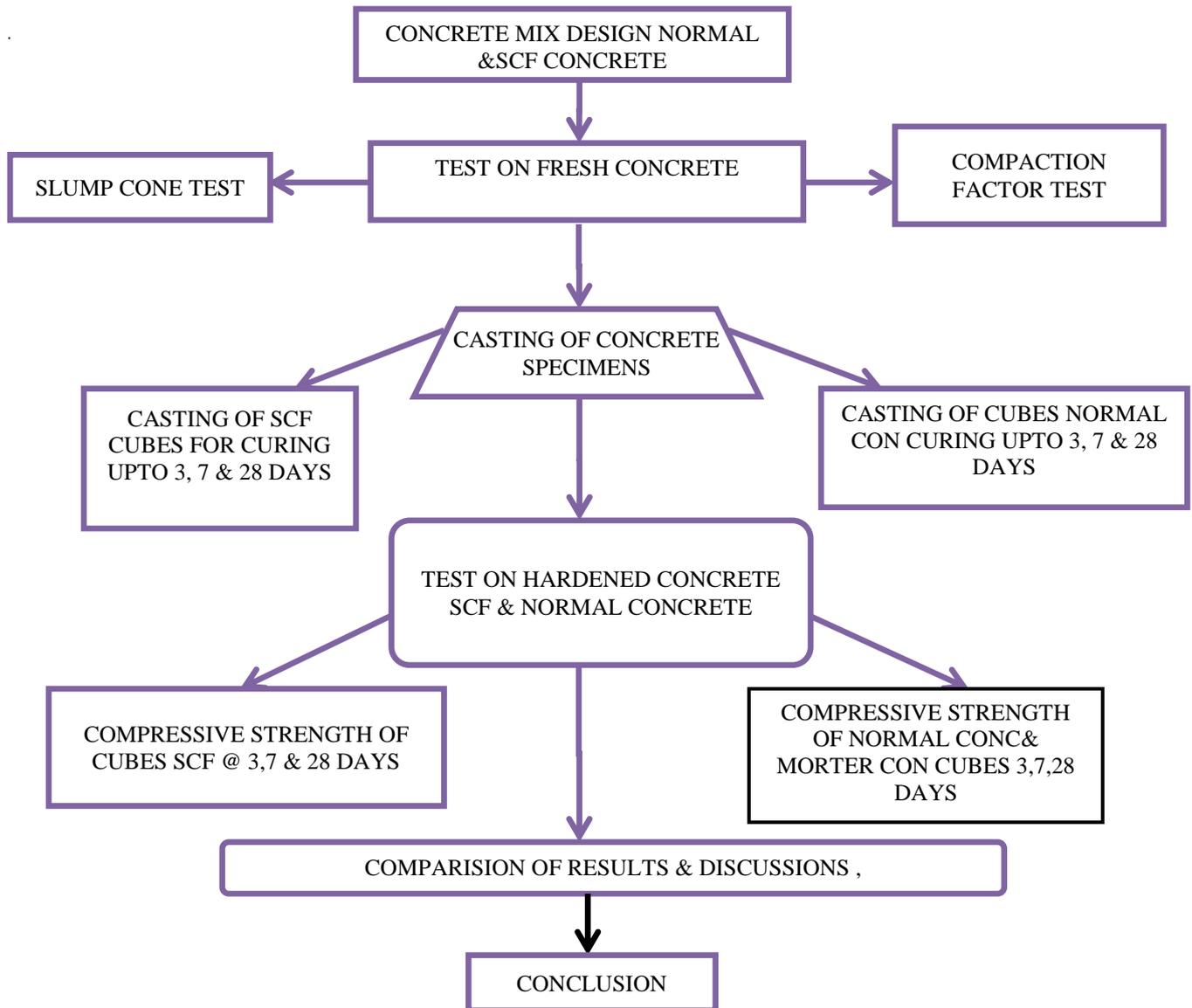
Mirsayah and Banthia (2002) Conducted experiments to study the compression and shear behavior of fiber reinforced concrete using direct shear test. The steel fibers, one with of fiber reinforced concrete using crimped geometry and crescent cross section, were investigated at fiber volume fraction varying between 0 and 1.5%. direct comparison was made with flexural toughness. They reported that for the crimped fiber, The fiber with crimped geometry, shear strength approached a plateau value beyond which on increases in shear strength.

2.5 LITERATURE REVIEW OUT COME

Based on the above literature review, steel crimped fiber is used for the partial replacement of aggregate in the ranges of from 0% to a maximum of 2%.

In usage and the curing days was from 3, 7 and 28 days with various mix

CHAPTER- 3 METHODOLOGY



CHAPTER 4

MIX DESIGN

4.1 DESIGN STIPULATIONS

- | | |
|--|------------------------|
| 1. Characteristic compressive strength | = 20 N/mm ² |
| 2. Maximum size of aggregate | = 20 mm (angular) |
| 3. Degree of workability | = 0.90 |
| 4. Degree of quality control | = Good |

4.2 TEST DATA FOR MATERIALS

1. Specific gravity of cement	= 3.12
2. Specific gravity of coarse aggregates	= 2.97
3. Specific gravity of fine aggregates	= 2.62
4. Water absorption: Fine aggregate	= 0.9%
5. Sieve analysis of fine aggregate	= Conforming to grading Zone III with reference of IS 383-1970

4.3 TARGET MEAN STRENGTH

The target mean compressive (F_{ck}) strength at 28 days is given by

$$F_{ck} = f_{ck} + tS$$

Where

F_{ck} = characteristic compressive strength at 28 days.

t = risk factor (1.65) IS: 456-2000 and IS: 1343-1980

s = Standard deviation as per IS: 456-2000 for M20 grade concrete.

$$F_{ck} = 20 + (1.65 \times 4.6)$$

$$F_{ck} = 27.59 \text{ N/mm}^2$$

4.4 SELECTION OF WATER CEMENT RATIO

The water cement ratio required for the target mean strength of 27.50 N/mm² is 0.50. This is lower than the max value of 0.55 prescribed for mild exposure. (Refer IS: 456-2000)

Adopt water cement ratio is 0.5

4.5 SELECTION OF WATER AND SAND CONTENT

From IS: 383-1970, for 20 mm maximum size aggregate, sand conforming to grading zone II, water content per cubic meter of concrete = 186 kg and sand content as percentage of total aggregate by absolute volume = 35%. For change in value in water-cement ratio, compacting factor, for sand belonging to zone III, following adjustment is required.

Change in condition	Percent adjustment required	
	Water content	Sand in total aggregate
For decrease in water-cement ratio by (0.6-0.5) that is 0.10	0	-2.0
For increase in compacting factor (0.9-0.8) that is 0.10	+3	0
For sand conforming zone III of IS: 383-1970	0	-1.5
Total	+3	-3.5

Table 4.1 Adjustments of Water and Sand Content

Therefore required sand content as percentage of total aggregate by absolute volume

$$=31.5\%$$

$$\text{Required water content} = 186 + [186 * 3/100]$$

$$= 191.6 \text{ L/m}^3$$

4.7 MIX PROPORTION

Water	Cement	Fine Aggregate	Coarse Aggregate
191.6 ml	383 kg	549 kg	1184 kg
0.5	1	1.43	3.09

Table 4.2 Mix Proportions

4.8 THE MIX DESIGN OF CRIMPED STEEL FIBRE

The mix design for special concrete of M20 grade and partially replaced the aggregate and adding of steel crimped fiber 0 to 2%.

S.NO	S.F%	W/C ratio	Cement	S.F	Sand	Agg	Water
1	0	0.5	360	0	584	1224	180.42
2	0.5	0.5	359.0	1.8	584	1224	180.42
3	1.0	0.5	357.1	3.6	584	1224	180.42
4	1.5	0.5	354.6	5.4	584	1224	180.42
5	2.0	0.5	352.6	7.2	584	1224	180.42

Table 4.3 Mix design for special concrete

CHAPTER-5

FRESH CONCRETE TEST & RESULTS

5.1 GENERAL

Workability can be defined as the property of concrete which determines the amount of useful internal work necessary to produce full compaction. A mix must be workable enough to fill the form spaces .

5.2 SLUMP CONE TEST

The slump test is used to find the consistency of the fresh concrete. It measures the consistency or the wetness of concrete. The slump value is indicated in table

	35%	40%	45%	50%
Slump value (mm)	300	295	295	275

Table 5.1 Slump Values

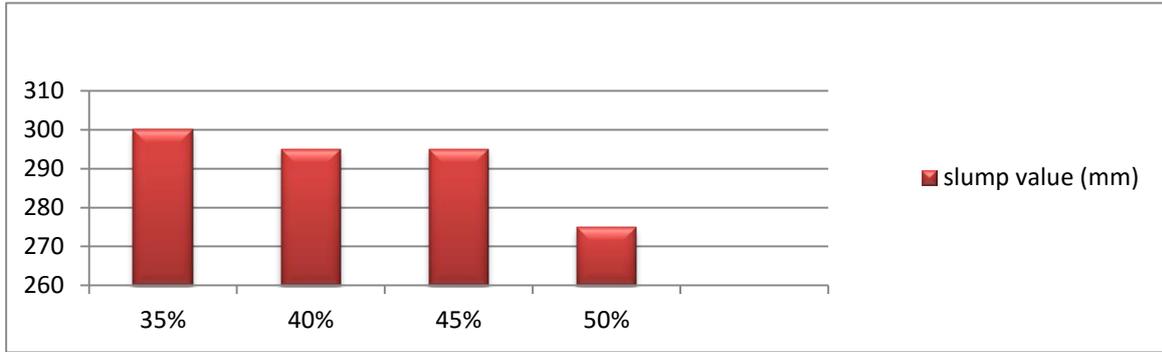


Fig 5.1 Slump value

5.2 COMPACTION FACTOR TEST

It is also used for finding the consistency of the concrete. The compaction factor value is indicated in table

Compaction factor	35%	40%	50%	60%	70%
	0.78	0.84	0.90	0.98	0.99

Table 5.2 Compaction Factor Test

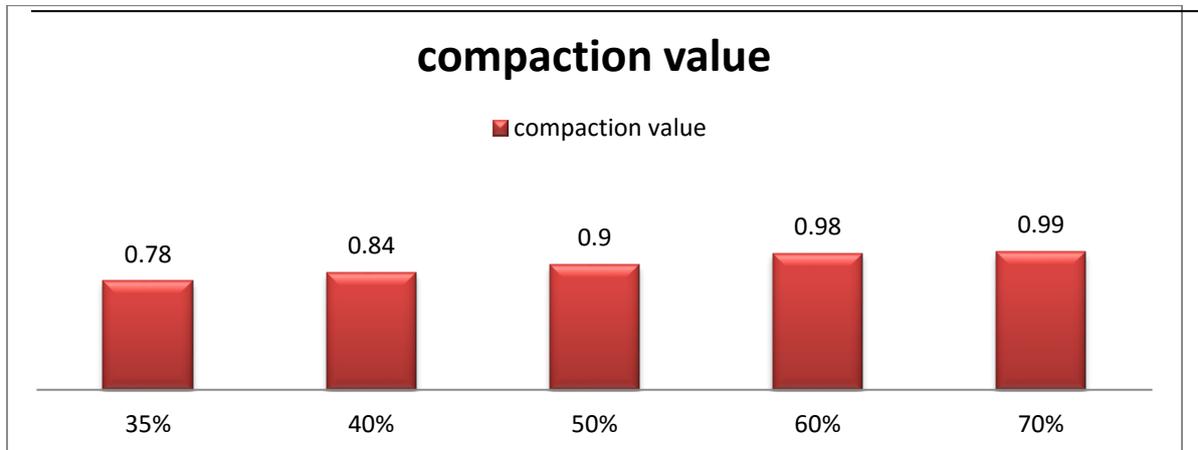


Fig 5.2 Compaction Factor Value

5.3 COMPARISON FOR NORMAL AND SPECIAL CONCRETE CUBES

S.NO	% of SCF	Mortar concrete 3 day's	3 day's (N/mm ²)	7 day's (N/mm ²)	28 day's (N/mm ²)
1	0	6.1	-	8	10
2	0	-	11.5 N/mm ²	14.6	25
3	0.5	-	16.03	20.15	28
4	1.0	-	18.0	21.45	32.55
5	1.5	-	20.0	23.5	38.67
6	2.0	-	22.0	28.73	45.0

Table 5.3 Comparison for Normal and Special Concrete Cubes

CONCLUSION

The experimental values of concrete cube of steel crimped fiber compared with that of the corresponding estimated values of the normal concrete of compression without fiber. The comparison reveals that the strength depends on the presence of fibre and it increases in their strength of concrete.

The compressive strength of SCFC Cubes is compared with normal of experimental results. The mortar concrete result where three days seven days and twenty eight days of 6.1, 8 and 10 N/mm². And normal concrete result for three seven and twenty eight days for higher than the mortar concrete for 11.5, 14.6 and 25 N/mm².

The special concrete for replacement of 0.5, 1.0, 1.5 and 2.0% of SCF Result of three seven and twenty eight days for 22, 28 and 45 N/mm² of the higher of normal and mortar concrete. The result of compared.