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Flexural Strength and Workability Characteristics of Crimped Steel Fibre Concrete

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***Abstract*: concrete plays important role in design and construction of the nation's infrastructure. Internal micro cracks are essentially present in concrete and its poor tensile strength is due to the increase of such micro cracks, finally leading to fracture of concrete. By adding steel fibres into the concrete, it has been found to improve the tensile strength, cracking resistance, impact, wear and tear, fatigue resistance etc. this investigation mainly focused on flexural strength performance of different percentage of crimped steel fibres of M40 grade concrete.**

***Keywords*: flexural strength, crimped steel fibre**

1. Introduction

Concrete have several desirable properties like high compressive strength, stiffness and durability. Plain concrete possesses very low tensile strength, limited ductility and a low strain at fracture. To overcome this problem, we can provide steel bars at appropriate locations at the time of casting the members to take up the tensile stresses. Normally reinforcement consists of continuous deformed steel bars or pre-stressed tendons. The advantage of reinforcing and pre-stressing technology using steel reinforcement as high tensile steel wires have helped in to fulfill capacity of concrete in tension but the durability and resistance to cracking is not improve. These properties can be improved by the use of fibres in the concrete. Addition of small closely spaced and uniformly distributed CSF into concrete would act as crack arrester and would also significantly improve its dynamic properties. It is also used in concrete to control cracking due to plastic shrinkage and drying shrinkage. They also decrease the permeability of concrete and thus bleeding of water reduces.

2. Methodology

Concrete was prepared by using mix proportion of 1:1.94:3.38 with a W/C ratio of 0.45, which correspond to M40 concrete grade. The different percentage of CSF like 0%, 0.5%, 0.75%, 1.0%, 1.25%, and 1.50% were adopted in investigation. All specimens were cast and tested after 7 and 28 days of curing as per IS specifications and finally results are compared with control specimen. Size of flexural strength specimen 500X100X100mm was used. Two-point loading was adopted.

A. Materials

Cement: ordinary Portland cement of 53 grades available in local market is used in the investigation. All properties of cement are tested by referring IS 12269-1987 specifications for 53 grade ordinary Portland cement.

Fine aggregate: locally available sand passed through 4.75mm IS sieve is used. Specific gravity of 2.60 and fineness modulus of 2.806 are used as fine aggregate, conforming to IS 383:1970.

Coarsed aggregate: the crushed aggregate used were maximum size of aggregate 20mm having specific gravity 2.78, complying with IS 383:1970 is used.

Crimped steel fibre: length of CSF 50mm, diameter 1mm, and aspect ratio 50 were used.

Water: ordinary portable water free from organic content, turbidity and salts was used for mixing and for curing throughout the investigation.

Superplasticizer: to impart the additional desired properties, a

Table 1
Workablity

% of Steel Fibres	Slump value in mm
0%	76mm
0.5%	65mm
0.75%	54mm
1.0%	48mm
1.25%	45mm
1.50%	42mm

Table 2
Flexural Strength Test

% of Steel Fibres	7 Days Strength		28 Days Strength	
	Flexural Strength (MPa)	Average	Flexural Strength (MPa)	Average
0%	4.90	4.96	6.98	6.99
	4.98		6.95	
	5.02		7.04	
0.5%	5.10	5.13	7.33	7.37
	5.12		7.39	
	5.16		7.40	
0.75%	5.60	5.69	8.02	8.06
	5.72		8.05	
	5.74		8.10	
1.0%	5.98	6.00	8.93	8.89
	6.00		8.89	
	6.04		8.85	
1.25%	5.36	5.38	8.27	8.30
	5.42		8.34	
	535		8.31	
1.50%	5.19	5.18	7.77	7.74
	5.13		7.74	
	5.22		7.70	

superplasticizer (conplast SP- 430) was used. The dosage of superplasticizer adopted in the investigation was 1.5% by weight of cement.

3. Results and discussion

Flexural strength increases with increasing percentage of CSF. It can be observed that maximum 28days flexural strength is increased by 27.18% with addition of 1.0% of steel fibre compared to normal M40 concrete.

4. Conclusion

- Workability decreases with increase in percentage of crimped steel fibres.
- Addition of 1% of CSF results in higher flexural strength and use of more than 1% CSF will bring down the flexural strength.

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