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Study on Structural Behavior of Steel Fiber Reinforced Concrete

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Abstract: Steel fiber concrete is a recently innovated in construction. This steel fiber has an advantage of light weight, so, it reducing the cost of construction, it having economy in construction. The steel reinforcement in concrete is easily corroded then structural deformation to be appear then the replacing materials and rehabilitation techniques. So, researchers all over the world are attempting to develop high-performance concrete using glass fibers and other admixtures in the concrete up to certain extent. Now a day's different types of fibers are used in modern civil construction like glass, carbon, agamid and poly-propylene provide vast improvements in tensile strength of concrete.

Key words: Steel fiber concrete, structural behavior, tensile strength of concrete, construction, improvements, high-performance

INTRODUCTION

The unreinforced concretes having low tensile strength and strain capacity, hence, it is an easily brittle material. The primary objective of this research is to increase the power of concrete by using steel fiber. The power of steel fiber concrete is grater to compare with conventional concrete. Steel fiber is a heat resistant material. Thus it prevents the formation of cracks. Fiber reinforced concrete is a composite material made up off portland cement, aggregate and incorporating discrete discontinuous fibres (Johnston, 2000). About steel fiber concrete slabs on ground is discussed by Waqas *et al.* (2014). Physical properties of steel fiber reinforced cement composites made with fly ash are discussed by Almottiri (2011). The effects of steel fibers on compressive and tensile strength of concrete are discussed by Sorelli *et al.* (2006).

MATERIALS AND METHODS

Depend upon the job requirements like strength, workability and so on, the mix proportions for SFRC be varied. In general, SFRC mixes contain higher cement contents and higher ratios of fine to coarse aggregate than do ordinary concretes and so, the mix design procedures the apply to conventional concrete may not be entirely applicable to SFRC. To reduce the quantity of cement in concrete mix, commonly part of cement may be replaced with fly ash, water reducing admixtures and superlasticizers. For steel fibre reinforced concrete, typical mix designs are given below. Three different concrete mixes were prepared by replacing 1.5, 1.8 and 2% of cement in each mixes with same amount of steel fibers and using these mixes few cubes and beams are made. The tests as discussed by ASTM C1018-89 (1991), Anonymous (1983) are conducted on these cubes and beams in the time intervals of 7, 14 and 28 days, compressive and flexural strengths are found and logged.

Mix design for M-20 concrete:

- Grade of concrete = M-20
- Cement type = O.P.C-53 grade
- Fine aggregate = Zone-2
- Specific gravity cement = 3.15
- Specific gravity fine aggregate = 2.54
- Specific gravity coarse aggregate (20 mm) = 2.71
- Minimum cement content (as per code) = 400 kg/m^3
- Maximum water cement ratio (As per code) = 0.45
- Cement = 400 kg/m^3
- Water = 180 kg/m^3
- Fine aggregate = 582 kg/m^3
- Coarse aggregate 20 mm = 1256 kg/m^3
- Water:cement: FA:CA = 0.45:1:1.45:3.14

RESULTS AND DISCUSSION

The compressive and flexural strength of different specimens found from the tests are shown in Table 1 and 2. The results shows that at 2.0% replacement, the maximum compressive and flexural strength is achieved which is found to be greater than the conventional concrete.

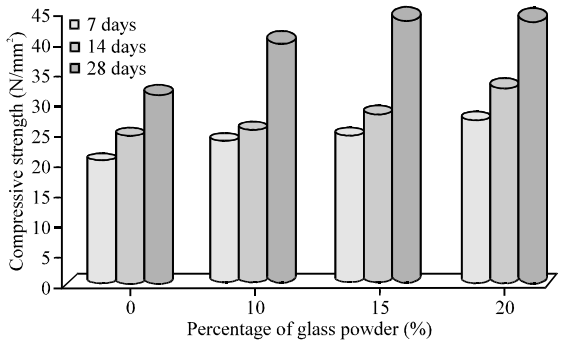

Fig. 1: Compressive strength of cubes

Table 1: Test results of compressive strength of cubes

	Average compressive strength (N/mm^2)			
		Steel fiber concrete (%)		
No. of curing days	0 (%)	1.5	1.8	2.0
7	20.44	23.72	24.86	27.30
14	24.77	25.90	28.32	32.97
28	31.61	40.67	44.47	44.59

Table 2: Test results beam for flexural strength

	Average compressive strength (N/mm^2)			
		Steel fiber concrete (%)		
No. of curing days	0 (%)	1.5	1.8	2.0
7	3.46	2.78	2.85	3.05
14	4.28	3.29	4.32	4.52
28	5.86	5.61	6.53	6.81

CONCLUSION

The following are the conclusions drawn from the test results. All the strengths properties are increasing when increasing the replacement percentage of steel fibers. Compressive strength and flexural strength are high for 2% replacement as compared to that produced from 0, 1.5 and 1.8% replacement.

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