Experimental Investigation on Effect of Fiber on properties of Concrete

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Abstract **- Concrete is one of the most widely recognized development materials for the most part delivered by utilizing locally accessible ingredients. The present trend in concrete technology is towards increasing the strength and durability of concrete to meet the demands of the modern construction. Plain concrete possesses very low tensile strength, limited ductility, and little resistance to cracking. Internal micro cracks are inherently present in concrete and its poor tensile strength is due to propagation of such micro cracks. Fibre reinforced concrete has the high tensile strength and fire-resistant properties thus reducing the loss of damage during fire accidents. In the present work the strength studies are carried out to compare the steel and glass fibre concrete. The FRC is added 0%, 1.25%, 1.5%, 1.75% & 2% are added for M30 grade concrete. Result shows the percentage increase in compressive strength for 28days. To obtain the maximum compression strength for addition of steel fibres and glass fibre is found to be greater than the convention.**

The main aim of the study is to study the effect of steel fibre and glass fibre in the concrete. The present paper outlines the experimental investigation conducts on the use of steel fibres and glass fibres with structural concrete.

I.INTRODUCTION

Concrete is a composite material containing cement, water, fine aggregate, and coarse aggregate. Concrete is a hard material which is brittle. These concretes are strong in compression, but very weak in tension. To increase the tensile strength of concrete a technique of interaction of fibres in concrete is being used. These fibres act as a crack arrestor and prevent the propagation of cracks. The main reason for adding fibres concrete is to improve post cracking response of concrete. Glass fibre is a recently introduced fibre in making fibre concrete. It has very high tensile strength of 1020 to 4080 Mpa. Concrete has better resistance in compression, while steel has more resistance in tension. Conventional concrete has limited ductility, low impact and abrasion resistance and little resistance to cracking. A good concrete must possess high strength and low permeability. Addition of fibres improve the post peak ductility performance, pre crack tensile strength, toughness, impact resistance, fatigue performance etc. High strength concrete has been improved in mechanical properties. Concrete is used more than any other manmade material in the world Concrete, has relatively high compressive strength, but much lower tensile strength. Concrete has a very low coefficient of thermal expansion and shrinks as it matures. The use of admixtures is mainly to modify the setting and hardening of cement by influencing the rate hydration of cement. Different types of admixtures are there to reduce the water content by reducing the surface tension of water; other admixtures are used to increase the durability of concrete decrease the thermal cracking.

II. METHODOLOGY

The experimental investigation was carried out in five phases. The first phase is to study of various properties of ingredients of concrete such as cement, sand, aggregate etc. the second phase is to design M-30 mix as per IS code method IS 10262:2009) and add 516-1959 code use for steel fibre Addition of different percentage of steel and glass fibres into the mixture of concrete is scheduled, from which optimum percentage of all type of fibres available for experimental investigation was to be found out. The

third phase addition of fibres (steel & glass fibres) in different proportion such as 0%, 1.25%, 1.5%, 1.75% & 2%. The fourth phase preparation of cubes for compressive strength of concrete for different proportion. The fifth phase to analysis the results based on experimental data. Specimens will be computed by conducting compressive strength tests into the laboratory.

1. A mix design of M-30 grade concrete is adopted. Cubes were casted & cured for a period of 7, 14, 28 days. These cubes were tested for compression strength.
2. A total 90 number of cubes were casted by addition of fibres such as steel and glass fibres in different percentage into the concrete by volume, such as 0%, 1.25%, 1.5%, 1.75% and 2%.
3. By adding different percentage of fibres like steel, glass fibres into the concrete, its optimum percentage quality will be obtained.

III. MATH

CEMENT CONTENT

Cement can be calculated by = cement content / water cement ratio

(Adopted w/c Ratio = 0.45)

Cement Content = 186/0.45 = 413 kg/m^{3s}

= 413 kg/m^3 > 340 kg/m^3 hence ok.

Volume of coarse aggregate and fine aggregate content

From Table 3 of (IS 10262:2009) volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone I) for water-cement ratio of 0.50 =0.60.

Volume of coarse aggregate = 0.60

Fine aggregate = 1-0.60

= 0.4

IV. UNITS

a) Volume of concrete = 1 m^3

b) Volume of cement = [Mass of cement] / {[Specific Gravity of Cement] x 1000}

= 400/ {3.15 x 1000}

= 0.126m^3

c) Volume of water = [Mass of water] / {[Specific Gravity of water] x 1000}

= 186/ {1 x 1000}

= 0.186m^3

d) Volume of all in aggregate = [a - (b + c)] G

V. HELPFUL HINTS

Keywords:

- Water
- Cemet
- Sand
- Glass fier
- Steel fiber
- Coarse and Fine aggregate

EXPERIMETAL ANALYSIS

Table 1. compressive strength of FRC (for 7 days)

COMPRESSIVE STRENGTH (N/ mm ^{2})			
Sr no.	% of addition	Glass fibre	Steel fibre
1.	0%	30.53	32.75
2.	1.25%	38.83	39.71
3.	1.5%	39.13	41.64
4.	1.75%	41.49	43.71
5.	2%	41.50	51.72

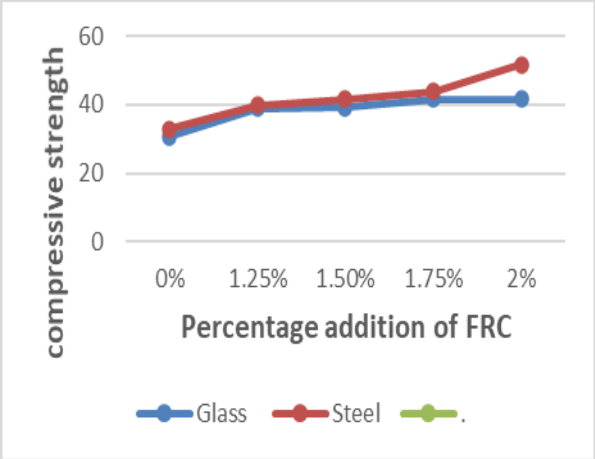
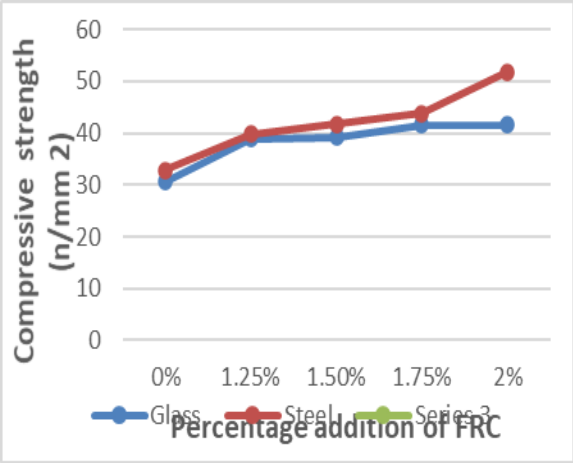


Table 2. Compressive strength of FRC (for 28 Days)

COMPRESSIVE STRENGTH (N/ mm ^{2})			
Sr no.	% of addition	Glass fibre	Steel fibre
1.	0%	33.06	34.68
2.	1.25%	39.86	41.05
3.	1.5%	40.76	42.39
4.	1.75%	42.10	46.38
5.	2%	40.90	50.97



VI. CONCLUSION

Experimental investigation was carried out on the behavior of steel and glass fibre reinforced concrete material using end hooked steel and glass fibre with different volume fractions of the fibres consisting of 0%, 1.25%, 1.5%, 1.75% and 2% as well as plain concrete with no fibres for comparison. Tests included the cube compression test to evaluate the basic material behaviour.

It is concluded that the strength is increasing while increasing the percentage of steel fibre but in the case of glass fibres, the strength is increasing up to 1% after 1% the strength is reducing.

The results showed that the use of fibres enhanced all aspects of material. This was more evident with the increase in the amount in the amount of fibres.

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