

# Steel Fiber Reinforced Concrete for M30 Grade

<sup>1</sup>Ravi Kumar GARRE, <sup>2</sup>P. Manthru Naik, <sup>3</sup>K. Gayathri

<sup>1, 2, 3</sup>Assistant Professor

<sup>1, 2, 3</sup>Department of Civil Engineering,

<sup>1, 2, 3</sup>QIS Institute of Technology, Ongole, India

**Abstract :** Critical investigation for M30 grade of concrete having mix proportion 1:1.24:2.83 with water content ratio 0.42 to study the compressive, split tensile strength of steel fiber reinforced concrete (SFRC) containing fibers of 0%, 0.5%, 1.0% and 1.5% to the volume concrete. Steel fibers of 50 aspect ratio were used. A result data obtained has been analyzed and compared with a control specimen (0% fiber). a relationship between aspect ratio Vs compressive strength, aspect ratio Vs split tensile strength represented graphically. Result data clearly shows percentage increase in 28 days compressive strength and split tensile strength for M30 Grade of concrete.

**Index terms -  $f_{ck}$ , cement, steel fiber, compressive strength, tensile strength, flexural strength**

## I. INTRODUCTION

The use of concrete as a structural material is limited to certain extent by deficiencies like brittleness, poor resistant to impact, durability, ductility and fatigue. The brittleness is compensated in structural members by introduction of reinforced or pre-stressing steel in the tensile zone of the concrete; however it does not improve the characteristics of concrete. The main problem of low tensile strength still remains and it is to be improved by different means namely introduction of fibers of different types or of different materials.

## II. OBJECTIVES

- To evaluate the utility of Glass powder as a partial replacement of cement in concrete.
- To study and compare the performance of conventional concrete and Glass powder concrete.
- To understand the effectiveness of glass powder in strength enhancement.

## III. MATERIALS

### a) Cement

Ordinary Portland cement (**Sri Chakra**), 53 Grade is used in the present work. Physical tests conducted on cement are:

- Fineness of cement
- Standard consistency of cement.
- Specific gravity of cement.
- Setting time.
- Compressive strength of cement.

### b) Fine Aggregate

All normal concreting sands are suitable for SCC. In this experimental work the sand having a maximum size of 1.18 mm is used to conduct the tests.

### c) Coarse Aggregate

Maximum size of the coarse aggregate should be restricted to 20mm, to avoid appreciable reduction in strength of the composite. Fibres also in effect, act as aggregate. Although they have a simple geometry, their influence on the properties of fresh concrete is complex. The inter-particle friction between fibres and aggregates controls the orientation and distribution of the fibres and consequently the properties of the composite.

### d) Water

Potable water was used in the experimental work for mixing.

### e) Steel Fibers

- Hooked steel fibres were used in this project with the following properties:-
- Length = 25 mm
- Diameter of steel fibre = 0.50 mm
- Aspect ratio = 50



**IV. DESIGN FOR M30 GRADE CONCRETE MIX AS PER IS: 10262-1982**

**a)Design specification:**

Characteristics compressive strength at 28days (fck) =30Mpa(M30)  
 Maximum size of aggregate =20mm  
 Degree of workability =0.70 C.F  
 Degree of quality control =Good  
 Type of exposure = mild

**b)Test data materials**

Cement used =opc Cement of 53 grade  
 Specific gravity of cement =3.15  
 Specific gravity of coarse aggregate =2.62  
 Specific gravity of fine aggregate =2.60

**1.Target Mean Compressive Strength of concrete:**

Target average compressive strength at 28 days , Fck= fc k +(t\*s) Where  
 Fck =Target Mean Compressive Strength at 28 days in N/mm<sup>2</sup>  
 2fck=Characteristics Compressive Strength at 28 days in N/mm<sup>2</sup>

**Table-1: Values of t (Table 2 of, IS: 10262-1982)**

Accepted proportion of low results T  
 1 in 5 0.84  
 1 in 10 1.28  
 1 in 15 1.50  
 1 in 20 1.65  
 1 in 40 1.86  
 1 in 100 2.33

T= A Statistic, depending on accepted proportion of low results  
 =1.65 for 1 in 20 accepted proportion of low results

**TABLE-2: SUGGESTED VALUES OF STANDARD DEVIATION (Table 2 of, IS: 10262-1982)**

Grade of Concrete  
 Standard Deviation (N/mm<sup>2</sup>)  
 Standard Deviation (N/mm<sup>2</sup>)  
 Standard Deviation (N/mm<sup>2</sup>)

Grade of Concrete	Very Good	Good	Fair
M 10	2.0	2.3	3.3
M 15	2.5	3.5	4.5
M 20	3.6	4.6	5.6
M 25	4.3	5.3	6.3
M 30	5.0	6.0	7.0
M 35	5.3	6.3	7.3
M 40	5.6	6.6	7.6

S = Standard Deviation in N/mm<sup>2</sup>= 6.0

Target average compressive strength at 28days,Fck=30+(1.65×6.0)=39.9Mpa.

**V. RESULTS**

**Compressive strength test results**

**Mix Fiber aspect Fiber weight 7 days 28 days**

**Id. Ratio Fraction (N/mm<sup>2</sup>) (N/mm<sup>2</sup>)**

M0 - 0 20 33  
 M2 50 0.5 22 35

M3 50 1.0 27.5 46.25

M4 50 1.5 28.4 47.6

**% of steel fibre added**

The cube compressive strength results obtained at the age of 7 and 28 days are presented in the above table for 0%, 0.5%, 1.0% and 1.5% volume of fibres. It is observed that as the percentage of fibre content (cold-drawn carbon steel fibres) is increased, the compressive strength also increases. There is a increases in the increase of strength from volume fraction of 1.0% to 1.5% . It indicates that if steel fibres weight increases then the strength also increases.

## VI. CONCLUSIONS

On the basis of experimental studies carried out and the analysis of test results, the following conclusions are drawn:

- The structural integrity of the tested concrete specimens is found to be good under loading.
- The fibrous concrete is found to have maximum ultimate load carrying capacity and is stiffer than the conventional concrete.
- It is observed that the compressive strength and split tensile strength for M30 grade of concrete from different weight Fraction (VF) of fibres increases with increase of percentage of fibre
- Maximum increase in compressive strength obtained at 0.42 w/c ratio with 1.5% of fiber is 28.4 N/mm<sup>2</sup> which is 25% more than the reference mix at the age of 7 days.
- Maximum increase in compressive strength obtained at 0.42 w/c ratio with 1.5% of fiber is 47.6 N/mm<sup>2</sup> which is 30.8% more than the reference mix at the age of 28 days.
- Addition of steel fiber in the concrete effect the workability of concrete. Addition of 0.5%, 1.0% and 1.5% steel fibers reduces the slump value and increases the compaction factor of fresh concrete. This problem of workability and flow property of concrete can be overcome by using suitable admixtures such as Super plasticizers

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