Mechanical Properties of Fiber Reinforced Concrete by Partial Replacement of Cement by Fly Ash & Natural Sand by M-Sand

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Abstract- In today's development industry the utilization of the solid is expanding step by step at fast rate. The solid is essential and broadly utilized development material as a result of its high auxiliary quality and strength. The usage of fly ash in concrete as halfway substitution of bond is increasing immense significance nowadays, essentially by virtue of the improvement inside the future strength of cement joined with biological preferences. The examination is done for M25 review of cement with substitution of M-Sand 60% constant, and replacement of cement with fly ash (0%, 10%, 20%, 30%, 40%, and 50%) with 1% of galvanized iron fibres constant. during this project the result of concrete on workability, setting time, specific gravity, compressive strength, split tensile strength, flexural strength & acid test for 7 days & 28 days was Explained.

Key Words: **M Sand, Fly Ash, Aggregates, Galvanized Iron Fibres, Compressive Strength, Split Tensile Strength, Flexural Strength, Acid test**

I. INTRODUCTION

In today's construction industry, the speed of use of concrete is gradually increasing. Due to the high structural strength and stability, concrete is the foundation and widely used building materials. In any building activity, several materials require cement, steel, brick, stone, wood and so on. The adaptability, solidness, manageability and economy of solid make it the most generally utilized building material on the planet.

Fly Ash: During construction of the ancient buildings, debris flows from the debris industry carried out construction activities. When the coal from high temperature combustion at high temperatures, will eventually get fine crushed fly ash, fly ash made of coal. Fly fiery remains is a by-result of coal-terminated power plants; the world taking some measures, appropriate use of industrial, agricultural waste and mineral products as a supplementary cement component to improve the strength of concrete, process ability and other properties. Fly ash is a thermal power plant and its fine particles of minerals. Fly ash has the same volcanic ash properties as natural available volcanic ash. Fly ash contains concrete, the structure of concrete with economic and technical benefits, fly ash concrete for the community to bring social benefits, reduce the direct handling of the environment of fly ash, to minimize carbon dioxide emissions into the environment.

Manufactured Sand: The made sand is a pounded fine total produced using a source material & is intended for use in concrete or other particular items. Just raw materials with reasonable quality, solidness and shape properties can be utilized. Generation for the most part includes squashing, screening and conceivable washing. It may be necessary to separate into discrete fractions, recombine and mix.

Fibre Reinforced Concrete: Fiber fortified cement (FRC) is basically part bond; fine total, coarse total, water and fiber blend. Fiber strengthened cement is a moderately new material in fibre reinforced concrete where the fibre length is dispersed as the entire mixture is dispersed. The number of natural fibre and man-made fibre varieties can be obtained in the market, man-made fibers are mainly glass fibre, steel fibre, polyester and organic polymer. When the fibers are present in the concrete mixture, they

will serve as an anti-cracker. Compared with the ordinary concrete mixture, only concrete with cement, fine-aggregate, coarse-aggregate & water, fibre reinforced concrete increases the bending strength and tensile strength.

II. MATERIALS USED

2.1 Cement: Conventional Portland concrete conforming with IS 12262-1987 was utilized. OPC 43 grade of cement obtained from single source properties of which are tried in the lab are given in table.

Table No. 1:-Physical Characteristics of Cement

SL. No.	Properties	Test Results
1)	Specific gravity	3.15
2)	Normal Consistency	32%
3)	Initial setting time	45min
4)	Final setting time	600min

2.2 Fine Aggregate: Fine totals are essentially Sand obtained a land or marine environment. Fine aggregate is usually composed of natural sand or gravel, most of the particles through the 9.5 mm sieve. Fine total free from tidy, clean are utilized. The physical characteristic of fine aggregate are tested in laboratory and the results are obtained in following table.

Table No.2:-Physical Characteristics of Sand

Sl. No.	Properties	Test Results
1)	Specific gravity	2.62
2)	Water absorption	0.85%
3)	Fineness of Modulus	4.45

2.3 M-Sand: Granite Dust Sand is used for construction purposes instead of sand made of crushed hard granite. Granite silt M-sand has a cubic edge of the ground shape, was washed and graded as building materials. Sand (M-Sand) is less than 4.75 mm in size. The granite dust of M sand is obtained from Bellary district. Physical characteristics of M-sand show in table no.3.

Table No.3:-Physical Characteristics of M-Sand

SL. No.	PROPERTIES	TEST RESULTS
1]	Specific gravity	2.71
2]	Water absorption	1.25%
3]	Fineness of modulus	5.2

2.4 Coarse Aggregate: Aggregate is an important part of concrete that can reducing the volume of concrete & reduce shrinkage. Use coarse aggregate below 20mm in size. The physical properties of the coarse total are demonstrated as follows in table No.4.

Table No.4:-Physical Characteristics of Coarse Aggregate

SL. NO.	PROPERTIES	TEST RESULT
1)	Specific Gravity	2.71
2)	Water absorption	1.2%
3)	Fineness of modulus	7.15

2.5 Fly Ash: Fly-ash is a by-result for burning of pummelled coal in electric power era plants. In this study Class C-fly ash are used. The fly ash remains created by the lighter lignite or sub-bituminous coal, notwithstanding the volcanic powder properties. Within the sum of water, the C-type fly fiery debris will hardened & strength gain after time. Class C-type flyash usually most part contains over 20% lime (CaO).

2.5 Galvanized Iron Fibre (GI): In this study galvanized iron fibres are used, length of galvanized iron fibres is 50mm and thickness of 1 mm making aspect ratio of 50mm.

III. MIX PROPORTIONING:

Materials Required For M25 Grade of Concrete

Cement = 337.07Kg / m3

Fly ash = 144.44 Kg/ m3

FA = 619.18 Kg / m3

CA = 1017.79 Kg / m3

Water = 197 Kg / m3

Table No.5: Final Mix Proportion

Cement(C+FA)	F.A (NS+MS)	C.A	W/C
1	**1.28**	**2.11**	**0.41**

IV. EXPERIMENTAL METHODOLOGY

In this study, some tests were conducted on concrete by different methods to understand the freshness and strength characteristics of the hardened concrete.

1) Cube for compression strength
2) Split Tensile strength
3) Flexural strength
4) Acid test for H_2SO_4

4.1 Cubes for Compression Strength:

This test was completed by IS 516-1959. As using the Standard size of 150×150×150mm cube specimen to locate the compressive quality of cement. The sample was placed on the carrier surface of the UTM with a capacity of 100 tones, no eccentricity, and a uniform rate of 550 kg /cm^2 /min was connected until cube failed. Note the maximum load and calculate the compressive strength.

$$\text{Cube compression quality (fck) in MPa} = \frac{\text{load(P)}}{\text{area of cube(A)}}$$

Where,

P= Cube Compression Pressure.

A= Area of the Cube (= 150 x 150= 22500 mm2)

4.2 Split Tensile Test:

The cylinder with a size of 15 cm (diameter) x 30 cm (height) is cast. The test was done by setting the tube shaped specimen evenly between the stacking surfaces of the pressure testing machine and applying a heap along the vertical distance across until

the chamber fizzled. At the point when heap connected together the generatrix, a component on the vertical distance across of the chamber is subjected to a level worry of

$$SPLIT\ TENSILE\ = \frac{2P}{\pi LD} N/mm2$$

Where,

P = The Compression force on cylinder.

L = Length of Cylinder.

D = Diameter of Cylinder.

4.3 Flexural Test

A beam of [100x100x500] mm was tried utilizing a flexure analyzer. Sample was essentially bolstered on two rollers of the machine, separated by 500 mm, and each support had a 50 mm bearing. The load should be applied to the beams of the two rollers placed above the beam at an interval of 200 mm. The heap was connected at a uniform rate so that the extraordinary fiber stretch expanded at 0.7 N/mm 2/min, i.e. the heap rate ought to be 4 KN/min. The load increases until the sample cracked. The most extreme estimation of the recorded load is recorded. Find out the modulus of rupture using following formula.

$$\sigma = \frac{PL}{bd^2} N/mm^2$$

Where,

P = Force applying on sample.

l = Effective length of beam in mm

b = Width of beam in mm

d =depth of beam

4.4 Sulphuric Acid Test:

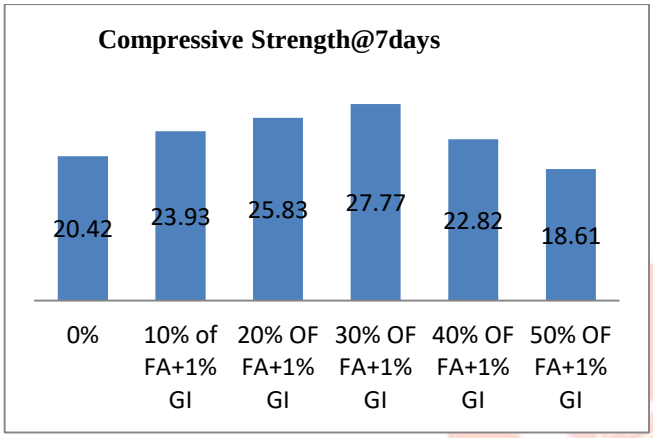
A cube concrete sample of various mix proportion with of 150×150×150mm size, was casted & the specimen was expelled from the curing tank and dried for 24 hours in the wake of curing for 28 days. Take the weight of the concrete cube sample. The acid corrosion test of the concrete cube was carried out by curing the cube in acidic water for 28days. Sulphuric acid (H_2SO_4) having a P_H of around 2 in 5% by weight of water was added in which the cubes was put away. Keep the P_H in 28 days. Following 28 days of submersion, the cubes are expelled from the acidic water. At that point, test the compressive quality of the example. The resistance of the solid to corrosive results is determining by the weight reduction rate of the example & the loss of compression strength of cubes drenched in the acidic water.

V. RESULTS

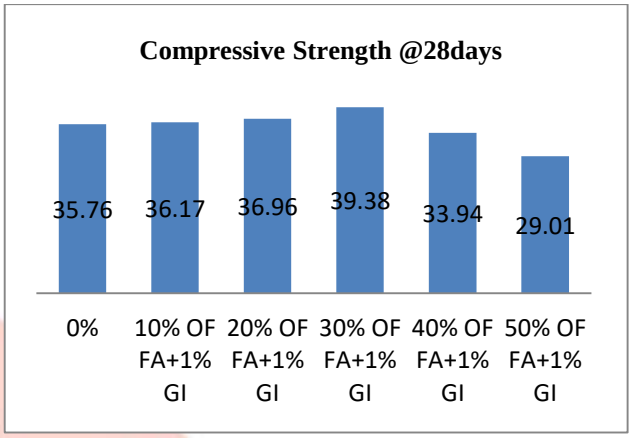
5.1 Cubes for compression strength

Table No.6: compressive Strength Results @ 7 Days and 28 days

Mix designation	Compression strength N/mm^2	
	7 days	28 days
0%	20.42	35.76
10%	23.93	36.17
20%	25.83	36.96
30%	27.77	39.38
40%	22.82	33.94
50%	18.62	29.01



Graph No.1: Average Compressive Strength Results@7days.

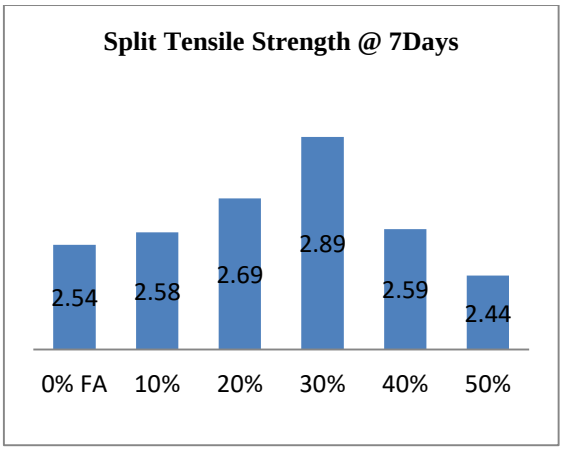


Graph No.2: Average Compressive Strength Results@28days.

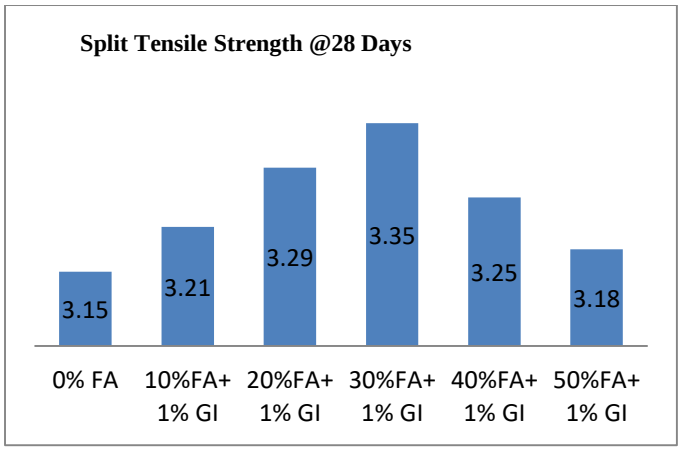
5.2 split tensile strength results

Table No.7: Split Tensile Strength Results @ 7 Days and 28 days

Mix designation	Split tensile strength N/mm^2	
	7 days	28 days
0%	2.54	3.15
10%	2.58	3.21
20%	2.69	3.29
30%	2.89	3.35
40%	2.59	3.25
50%	2.44	3.18



Graph No.3: Average split tensile Strength Results@7days.

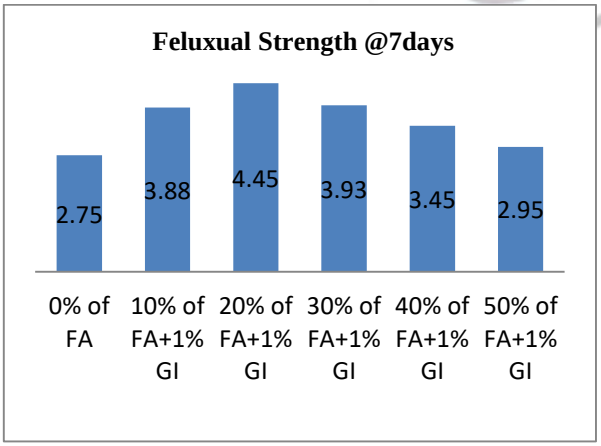


Graph No.4: Average spit tensile Strength Results@28days.

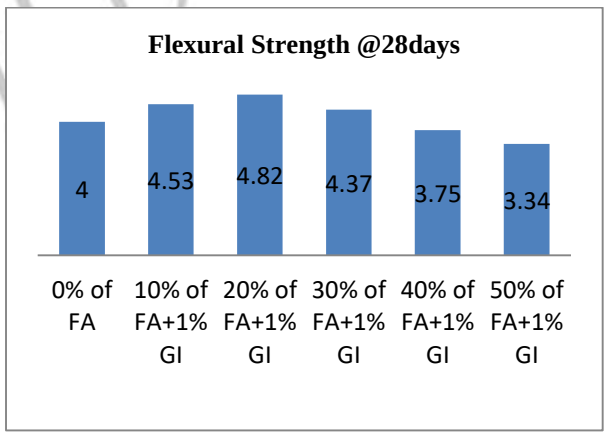
5.3 Flexural strength Results

Table No.8: Flexural Strength Results @ 7 Days and 28 days

Mix designation	Flexural strength N/mm^2	
	7 days	28 days
0%	2.75	4.00
10%	3.88	4.53
20%	4.45	4.82
30%	3.93	4.37
40%	3.45	3.75
50%	2.95	3.34



Graph No.5: Average flexural Strength Results@28days.



Graph No.6: Average flexural Strength Results@28days.

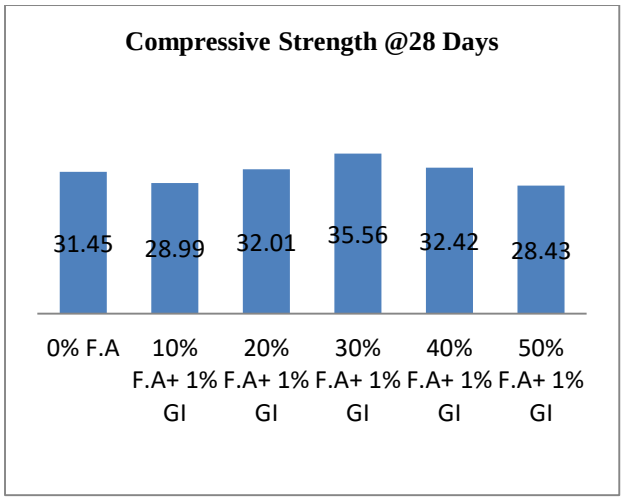
5.4 Acid test results

Table No.: Compressive Strength Results for Cubes Cured In Sulphuric Acid 5%

Mix designation	Split tensile strength N/mm^2

	28 days
0%	31.45
10%	28.99
20%	32.01
30%	35.56

40%	32.42
50%	28.43



Graph No.7: Average Compressive Strength Results@28days.

VI. CONCLUSION

In view of above outcome concerning the compression & split quality of cement, the accompanying conclusions are drawn:

1) Compression strengthen reduces when replacement of cement by flyash. As fly ash percentage increases compression strength & split-tensile strength will be reduces.
2) Producing a 'greener' concrete for construction.
3) The 30% substitution of bond by fly powder with, M-sand (60%) shows optimum compressive strength, split tensile strength for 7 days & 28 days.
4) The 40% substitution of bond by fly powder with M-sand (60%) & added 1% GI fibres, ultimate compressive strength of concrete goes on decreases.
5) Use of M-Sand as fractional substitution of fine total is reasonable substitution to common sand in solid assembling.
6) The 20% substitution of cement by fly ash with M-sand (60%) shows optimum flexural strength for 7 days & 28 days.
7) The compressive strengths of concrete (with 0%, 10%, 20%, 30% 40% & 50%, of cement with FA by weight replacement) cured in 5% concentrations of Sulphuric acid solution for 28day ,that indicate at 30% replacement of fly ash there is in strength increasing and beyond that the strengths decreased, but at 20% replacement FA strength less than to normal concrete.

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