STEEL AND GLASS FIBER EFFECTON COMPRESSIVE AND FLEXURAL STRENGTH OF CONCRETE

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Abstract - *The time Concrete Mix Design is the method of selecting appropriate materials of concrete and finding out their qualified amounts with an purpose of generate a concrete of the required personality such as strength, durability, and workability in an cost-effective manner. Therefore workability as a material goods of concrete has a vital importance. In hardened concrete, the compressive strength is generally considered to be an beginning of its other properties, depends upon many factors, e.g. quality with quantity of cement, water, aggregates; batching and mixing; placing ,compaction and curing. The aim of this study is to evaluate the mechanical performance of M30 grade concrete containing the M-sand replacement of natural sand including steel fiber and glass fiber replaced in fine aggregate upto 3% to enhance the properties of hardened concrete.*

Key words: glass fiber, steel fiber, Portland pozzaluna cement, compressive strength, flexural strength.

1. INDRODUCTION

Cement concrete use is inadequate due to the physical characteristics of easily damaged; this can be beat by the addition of a smaller quantity of short and distinct at random distributed fibres for example steel, glass, synthetic and natural fibers The shape of the fibres with extreme difference in rounded smooth aggregates is same as normal coarse aggregates. The fibers connect and entangle around the aggregate are considerably increase with workability whereas the combination becomes more consistent and less isolation. throughout the mixing process, the fibers get discrete, spread at random in concrete, and thus improve properties of concrete in all aspects. Therefore, from this study discover the option of using artificial fibers; and intention to do constant study on compressive and flexure strengths for a given grade of concrete, aspect ratio and several extent of fibers. For the reinforcing of concrete, the steel fibers used are defined as short and different length of steel having the aspect ratio of about 20 to 100 with any of several cross sections which square measure suitably little to be random spread in a very unhardened concrete mixture using usual mixing procedures. Steel fiber reinforced concrete has the ability of distinctive tensile strength, flexural strength, shock resistance, fatigue resistance, ductility and crack arrest. They also reduce permeability of concrete and thereby decrease the flow of water. It is, such a construction material is investigate for over 40 years as well as for pavement construction. Glass fiber has been used universal since the early 1970's. FRC kind lead to using it as structural material. Amongst the synthetic fibers, the glass fibers are have the high strength. The glass fibers have high strength with elastic modulus, brittle stress-strain characteristics, elongation at break and less creep at room temperature. Normally, glass fibers are round and straight with the diameter of 0.005 to 0.015mm.Glass fiber is a chemical inorganic fiber having tensile strength behaviour. Mostly glass fibers are available in the form of thread or filament having diameter of around 14microns.In the literature review, it is noticed that addition of fibers improves strength of concrete. Variety of the researches have conducted experiments on concrete combining two fibers and reported that there is an improvement in strength of concrete. The experimental study aims at getting data on the impact of steel, glass fiber and its combination on workability, compressive strength, and flexural strength. The numeral of experiment are carried out on mechanical properties of steel fiber reinforced (SFRC) and glass fiber reinforced concrete (GFRC) are done.

2. MATERIAL USED

Material used in this study are (i) Portland pozzolana cement (ii) glass fiber (iii) steel fiber (iv) coarse aggregate.

The material properties of cement, glass fiber, steel fiber and coarse aggregate are tested according to the codal provisions and are given in the table1, 2 and 3 respectively. The results obtained are there in checked with the normal values.

Table -1 Properties of Cement

S.No	Properties	Results	Nominal Values As Per Is 1489-1991
1	Standard consistency	30%	26%-33%
2	Initial setting time(min)	75	Min30
3	Final setting time(min)	190	Max600
4	Finess retaining on 90mm	308	300

Table -2 properties of fine aggregate

S.No	Test Particulars	Fine Aggregate	Nominal Values As Per IS 383-1970
1	Specific gravity	2.73	2.4-2.9
2	Water absorption	0.23	<0.6

Table-3properties of coarse aggregate

S.No	Test Particulars	Coarse Aggregate	Nominal Values as per IS 2386-1963
1	Specific gravity	2.73	2.5 to 3.0
2	Water absorption	0.23	<0.6

Table -4 properties

s.no	Test particulars	Glass fiber
1	Specific gravity	2.5
2	Bulk density	2.65
3	Moisture content	nil

of glass fiber

Table -5 properties of steel fiber

S.No	Test Particulars	Steel Fiber
1	Specific gravity	2.62
2	Bulk density	2.65
3	Moisture content	nil

3. PREPARATION OF SPECIMENS

(1) M_{30} grade of concrete is used in the test (2) according to IS 456-2000. The specimen be arranged in the following size moulds. (i) cube- 150mm X 150mm X 150mm (ii) cylinder – 150mm diameter and 300mm height (iii) prism – 100mm X 100mm X 500mm (4) specimens be cast with conventional concrete and also with fibers. After 24 hours the moulds are removed and curing is done.

4. CONCRETE TESTING

4.1 Slump Cone Test

The slump cone test is used to appraise the horizontal free flow of in the lack of obstruction. First developed in Japan for use in consideration of underwater concrete. Test method is based on the method for determining the slump. Mould is the shape of a truncated concrete with the internal dimensions 200mm diameter at the base 100mm diameter at the top and a height of 300mm. Base plate is made of a stiff none absorbing material at least 700mm square, marked with circle making central location for the slump cone and a further concentric circle 500mm dia concreter is poured in three layers. Each layer is tampered about 25 times. Immediately the concrete is lifted in an upward direction.

4.2 Compressive Strength Test

The compressive test is used to determine the hardness of the cube and beam specimen of concrete. The strength of a concrete specimen depends upon cement, aggregate, water cement ratio, curing temperature, age, and size of the specimen. Mix design in the major factor controlling the strength of the concrete. After curing the concrete cube specimen

was surface dried for 24 hrs. Then the compressive test were taken using the compression testing machine(CTM) using the formula compressive strength were calculated.

Compressive strength = load at failure/area

Area = 150mm x 150mm

Table-6 compressive strength test

Compressive strength test	7days	14days	28days
Conventional concrete	21.75	34.08	39.84
1% of fiber	26.73	39.12	44.72
2% of fiber	28.23	42.45	43.25
3% of fiber	29.37	44.25	45.58

4.3 Flexural Strength Test

Flexural strength test is done as per IS: 516-1959. Beams are tested for flexure in Universal testing machine of capacity 500 KN as shown in Fig. 4.4 & and the results obtained are reported in Table 4.5 & also shown in graph 4.4. The posture surfaces of the supporting with loading rollers are wiped clean before loading. The beams are placed in the machine in such a manner that the load is applied to the upper most surface along the two lines spaced 13.30 cm apart. The alignment of the specimen is axis with the axis of the loading device. The load is applied at a rate of 180 kg/min without shock on the specimen till it fails and the maximum load (P) applied to the specimen during test is noted.

Where, P = maximum load at failure in N, and

L = length of the beam specimen (400mm)
b = Width of the beam specimen in mm,
d = Depth of beam specimen in mm.

Table -7 flexural strength test

Flexural test	7days	14days	28days
Conventional concrete	3.26	4.08	4.37
1% of fiber	3.61	4.39	4.68
2% of fiber	3.77	4.56	4.90
3% of fiber	3.89	4.92	5.21

5. DISCUSSION

The FRC of all types have shown improvement in terms of first crack, ultimate load and deflection characteristics.

1. By the adding up of steel and glass fibers the surface hardness increase to some extent.

2. From the study, it shows that the compressive strength of fiber with control specimen increases 5.08N/mm for 1% and 6N/mm for 3%.

3. From the results, it shows that the flexural strength of fiber with control specimen increases 0.4N/mm for 1% and 0.92N/mm for 3%.

4. The deflection of FRC beams was greater than the NMC specimens.

5. The cracking behaviour of FRC beam specimens greater strength with those of NMC specimens.

6. Addition of fibers give the better strength compared to that of conventional concrete.

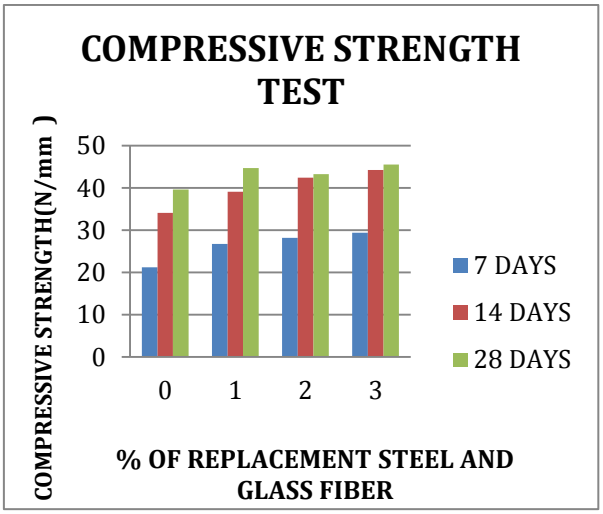

Chart-1: Compressive Strength Test

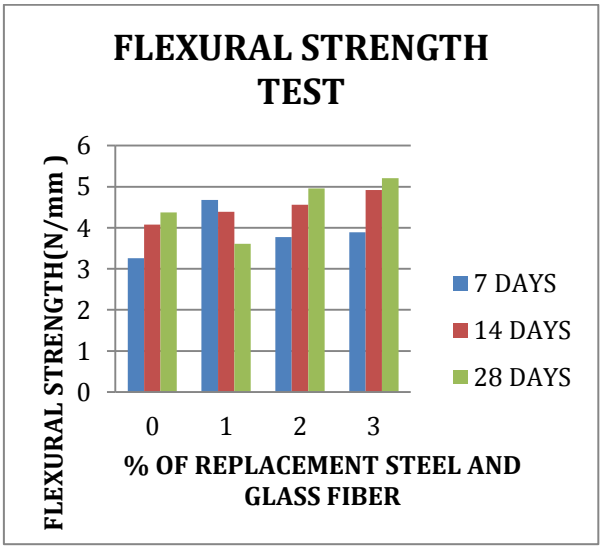

Chart-2: Flexural Strength Test

6. CONCLUSIONS

Better results were obtained from adding 3% of steel and glass fiber concrete where the compressive strength and flexural strength concrete obtained 45.58 N/mm^2 respectively for 28 days curing.

When compared with conventional concrete adding 3% of fiber content increase in compressive strength for 7 days, 14days and 28 days curing.

On comparing the flexural strength results adding 3% of fiber content concrete with the conventional concrete it showed, higher flexural strength than conventional concrete.

Adding 3% of fiber content value higher compressive strength than the conventional concrete during 28 days curing period.

The flexural strength of the concrete having fiber content higher than the conventional concrete after 28 days of curing.

Hence strength of the concrete varies with the variation percentage of fiber content. Hence before using fiber content it's desirable to choose to different percentage of fiber content based on the quality of concrete required

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