DOI: https://doi.org/10.29121/ijetmr.v5.i6.2018.252

IJETMR
International Journal of Engineering Technologies and Management Research
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COMPRESSIVE STRENGTH COMPARISON OF CONTROL SPECIMEN WITH GLASS FIBRE REINFORCED CONCRETE AND GEOGRID FIBRE REREINFORCED CONCRETE

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Abstract:

Most widely recognized material in the present world is Concrete due its durability, and strength aspects. Hence by using different additives like Glass fibre and woven biaxial Geogrid the compressive strength test is carried out for M30 and M40 grade of concrete to improve the performance of concrete. The main aim of the present study is to analyze the compressive strength of concrete, when concrete is mixed with glass fiber and Geogrid, to meet the demands of the modern construction. The addition of Glass fibre into concrete increases the compressive strength of concrete than Geogrid concrete. Tests are conducted by using glass fibre and Geogrid. For 1 m3 of concrete 612grams of glass fibre for M30 grade of concrete and for M40 grade of concrete 697 grams of glass fibre for 1m3 of concrete are used. Geogrids are placed at 2 layers (50mm interval each) in a 150*150mm cube in both M30 and M40 grade of concrete.

Keywords: Coarse Aggregates; Fine Aggregates (M- Sand); Glass Fibre; And Ordinary Portland Cement; Woven Biaxial Geogrids,Slump Test; Compressive Strength Test.

Cite This Article: Pankaja B S, Kiran. (2018). "COMPRESSIVE STRENGTH COMPARISON OF CONTROL SPECIMEN WITH GLASS FIBRE REINFORCED CONCRETE AND GEOGRID FIBRE REREINFORCED CONCRETE." *International Journal of Engineering Technologies and Management Research,* 5(6), 120-127.

1. Introduction

In modern days for construction of any structure concrete is used as a main construction material in addition to fine and coarse aggregates, to make the structure more durable and stable.in this study an effort made to study the compressive strength characteristics of concrete along with the Glass fibre and woven biaxial geogrid. Since Glass fibre is an extremely fine fibres of glass, has roughly comparable mechanical properties to other types of fibres such as polymers and carbon polymers and it is less cost than carbon fibre, and these glass fibres have some special characteristics like, they are invisible on finished surfaces, safe and easy to handle. More importantly no need to alter the water-cement ratio while adding glass fibres to the mix. And Geogrids are commonly made of polymer materials, such as polyester, polyvinyl alcohol, polyethylene or polypropylene. They may be woven or knitted from yarns, heat-welded from strips of material, or produced by punching a regular pattern of holes in sheets of material,

ISSN: 2454-1907
DOI: 10.5281/zenodo.1313118

then stretched into a grid. Here an effort is made to compare the compressive strength characteristics of these material when compared with normal concrete.

2. Object of the Study

- Compressive Strength comparison of Glass fibre reinforced concrete (GFRC) with normal and GFC concrete.
- Compressive strength of Geogrid fibre reinforced concrete (GFC) with normal concrete and GFRC can be studied.

3. Materials and Methods

3.1. Materials

Coarse aggregates
Coarse Aggregate in general should consist of natural occurring stones (crushed, uncrushed or broken), riverbed single or pit gravel. It should be hard, strong, dense, durable, and clean. It must be free from veins, adherent coatings and injurious amounts of disintegrated pieces, alkali, vegetable matter and other deleterious substances. River gravels make the best coarse aggregate. Angular and roughly cubical particles in shape are ideal. Flaky pieces shall be avoided. It should confirm to IS 2383(I)

Fine aggregates
In this study M-sand is used as fine aggregates. Manufactured sand (M-Sand) is a substitute of river sand for concrete construction. Manufactured sand is produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of manufactured sand (M-Sand) is less than 4.75mm.

Glass fibre
The most common types of glass fibre used in fiberglass is E-glass, which is 121 ehavio-borosilicate glass with less than 1% w/w alkali oxides, mainly used for glass-reinforced plastics. Other types of glass used are A-glass (**A**lkali-lime glass with little or no boron oxide), E-CR-glass (**E**lectrical/**C**hemical **R**esistance; 121 ehavio-lime silicate with less than 1% w/w alkali oxides, with high acid resistance), C-glass (alkali-lime glass with high boron oxide content, used for glass staple fibers and insulation), D-glass (borosilicate glass, named for its low **D**ielectric constant), R-glass (121 ehavio silicate glass without MgO and CaO with high mechanical requirements as **r**einforcement), and S-glass (121ehavio silicate glass without CaO but with high MgO content with high tensile strength).

Woven biaxial Geogrid
The key feature of all geogrids is that the openings between the adjacent sets of longitudinal and transverse ribs, called “apertures,” are large enough to allow for soil/concrete strike-through from one side of the geogrid to the other.

ISSN: 2454-1907
DOI: 10.5281/zenodo.1313118

3.2. Methods

3.2.1. Specific Gravity and Water Absorption of Coarse Aggregates

As per IS 2386.3.1963

3.2.2. Specific Gravity of Fine Aggregate

As per IS 2386.3.1963

3.2.3. Compressive Strength Test

Compressive strength test was performed according to IS 516: 1959.Cubes of specimen of size 150 mm x 150 mm x 150 mm were prepared for each mix. After 24 hours the specimens were demolded and cured in water for 28 days until testing. For specimens with uneven surfaces, capping was used to minimize the effect of stress concentration. The compressive strength reported is the average of three results obtained from three identical cubes.

Compressive strength (N/mm^2) = Ultimate load (N) / cross sectional area (mm2).

4. Results and Discussions

Table 1: Compressive strength test values at 7and 28days of curing for M30 grade normal concrete with GFRC

Sl no	**Load (kN)**	**Compressive strength at 7days of curing(N/mm^2)**	**Compressive strength at 28days of curing(N/mm^2)**	**Load (kN)**	**Compressive strength at 7days of curing(N/mm^2)**	**Compressive strength at 28days of Of curing(n/mm^2)**
		For normal concrete			With GFRC	
1	490	21.77		550	24.44	
2	500	22.22		530	23.55	
3	485.66	21.58		555	24.66	
Avg=21.85				Avg=24.21		
1	710.65		31.58	750.65		33.36
2	720.52		32.02	780.87		34.70
3	712.25		31.65	768.67		34.16
Avg= 31.75					Avg=34.07	

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Table 2: Compressive strength test values at 7and 28days of curing for M30 grade normal concrete with GFC

Sl no	Load (kN)	Compressive strength at 7days of curing(N/mm^2)	Compressive strength at 28days of curing(N/mm^2)	Load (kN)	Compressive strength at 7days of of curing(N/mm^2)	Compressive strength at 28days of curing(N/mm^2)
		For normal concrete			With GFC	
1	490	21.77		509.79	22.65	
2	500	22.22		500.79	22.25	
3	485.66	21.58		490.62	21.80	
Avg=21.85				Avg=22.73		
1	710.65		31.58	709.45		31.53
2	720.52		32.02	697.53		31.00
3	712.25		31.65	680.96		30.26
Avg= 31.75					Avg=30.93	

Table 3: Compressive strength test values at 7and 28days of curing for M30 grade GFRC with GFC

Sl no	Load (kN)	Compressive strength at 7days of curing(N/mm^2)	Compressive strength at 28days of curing(N/mm^2)	Load (kN)	Compressive strength at 7days of of curing(N/mm^2)	Compressive strength at 28days of curing(N/mm^2)
		With GFRC			With GFC	
1	550	24.44		509.79	22.65	
2	530	23.55		500.79	22.25	
3	555	24.66		490.62	21.80	
Avg=24.21				Avg=22.73		
1	750.65		33.36	709.45		31.53
2	780.87		34.70	697.53		31.00
3	768.67		34.16	680.96		30.26
Avg= 34.07					Avg=30.93	

Table 4: Compressive strength test values at 7and 28days of curing for M40 grade Normal concrete with GFRC

Sl no	Load (kN)	Compressive strength at 7days of of curing(N/mm^2)	Compressive strength at 28days of of curing(N/mm^2)	Load (kN)	Compressive strength at 7days of of curing(N/mm^2)	Compressive strength at 28days of of curing(N/mm^2)
		For normal concrete			With GFRC	
1	625.25	27.78		670.98	29.82	
2	638.62	28.38		675.86	30.03	
3	626.59	27.84		669.58	29.75	

ISSN: 2454-1907
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Avg=28.0				Avg=29.86		
1	910.59		40.47	975.65		43.36
2	909.19		40.40	945.89		42.03
3	899.00		39.95	975.59		43.35
Avg= 40.27					Avg=42.91	

Table 5: Compressive strength test values at 7and 28days of curing for M40 grade normal concrete with GFC

Sl no	**Load (kN)**	**Compressive strength at 7days of curing(N/mm^2)**	**Compressive strength at 28days of curing(N/mm^2)**	**Load (kN)**	**Compressive strength at 7days of of curing(N/mm^2)**	**Compressive strength at 28days of curing(N/mm^2)**
		For normal concrete			With GFC	
1	625.25	27.78		638.59	28.38	
2	638.62	28.38		620.39	27.57	
3	626.59	27.84		615.62	27.36	
Avg=28.0				Avg=27.77		
1	910.59		40.47	940.64		41.80
2	909.19		40.40	935.19		41.56
3	899.00		39.95	900.29		40.01
Avg= 40.27					Avg=41.12	

Table 6: Compressive strength test values at 7and 28days of curing for M40 grade GFRC with GFC

Sl no	**Load (kN)**	**Compressive strength at 7days of of curing(N/mm^2)**	**Compressive strength at 28days of curing(N/mm^2)**	**Load (kN)**	**Compressive strength at 7days of of curing(N/mm^2)**	**Compressive strength at 28days of curing(N/mm^2)**
		With GFRC			With GFC	
1	670.98	29.82		638.59	28.38	
2	975.86	30.03		620.39	27.57	
3	669.58	29.75		615.62	27.36	
Avg=29.86				Avg=27.77		
1	975.65		43.36	940.64		41.80
2	945.89		42.03	935.19		41.56
3	975.59		43.35	900.29		40.01
Avg= 42.91					Avg=41.12	

This figure depicts the increase in compressive strength with the addition of Glass fibre to the control specimen

 ISSN: 2454-1907
DOI: 10.5281/zenodo.1313118

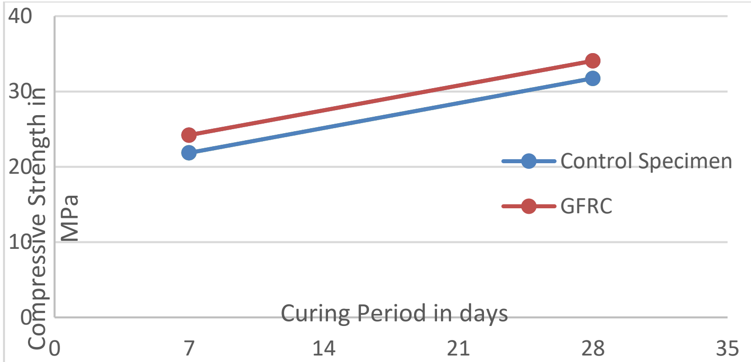


Figure 1: Compressive strength comparison of Control specimen with GFRC at 7and 28days of curing for M30

In this figure with the addition of GFC the control specimen there is no much increase in the compressive strength, as GFC is good in tension.

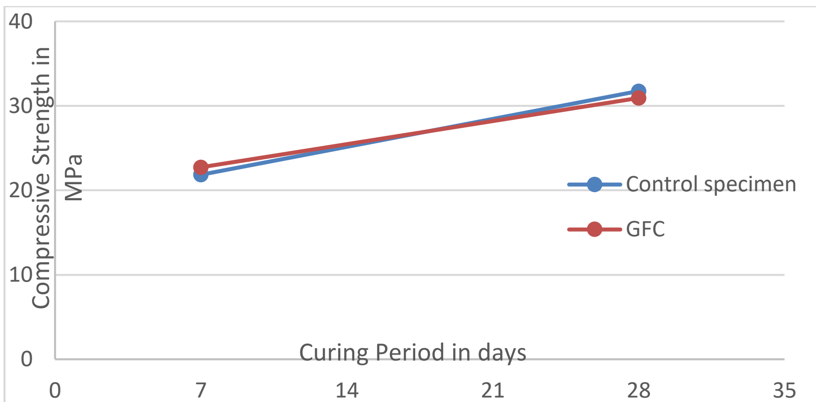


Figure 2: Compressive strength comparison of Control specimen with GFC at 7and 28days of curing for M30

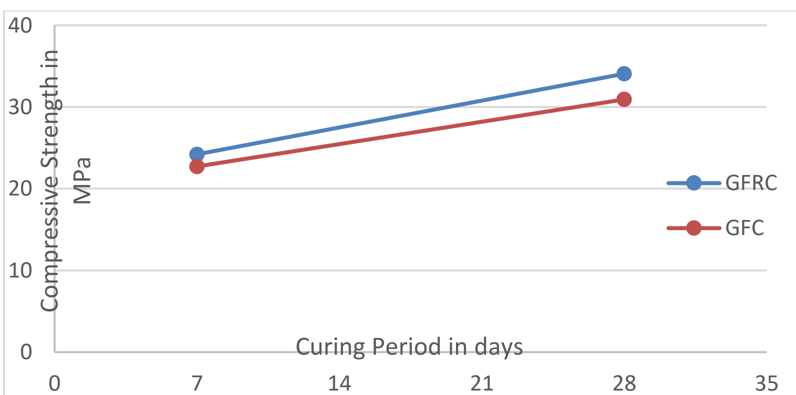


Figure3: Compressive strength comparison of GFRC with GFC at 7and 28days of curing for M30

This figure depicts increase in compressive strength in case of GFRC than in GFC

ISSN: 2454-1907
DOI: 10.5281/zenodo.1313118

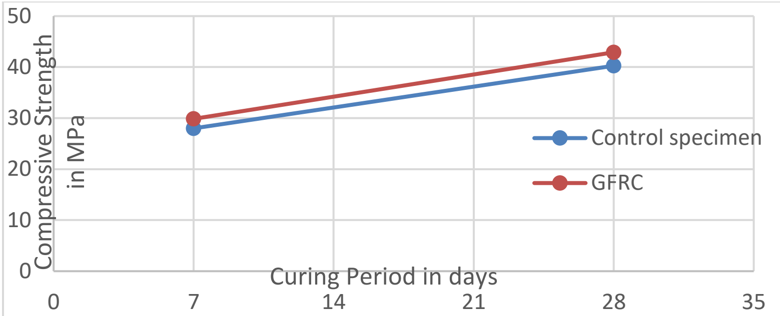


Figure 4: Compressive strength comparison of control specimen with GFRC at 7and 28days of curing for M40

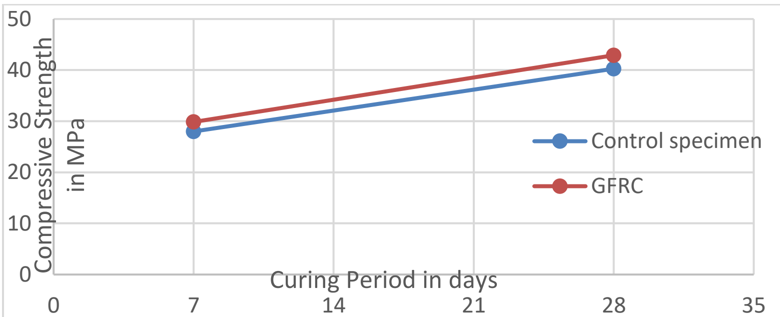


Figure 5: Compressive strength comparison of control specimen with GFC at 7and 28days of curing for M40

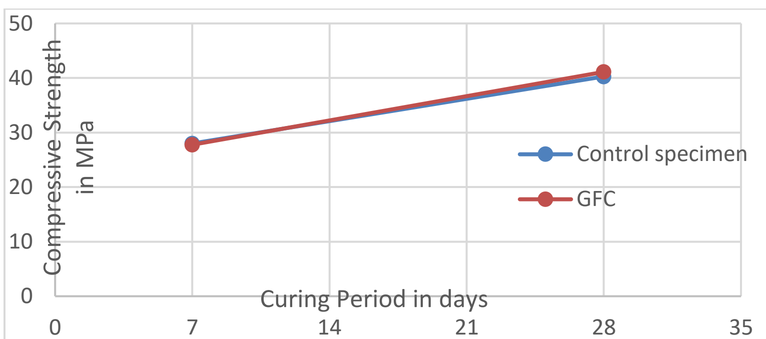
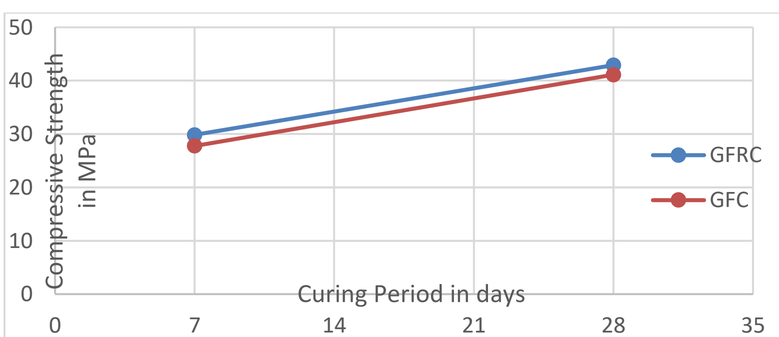


Figure 6: Compressive strength comparison of GFRC with GFC at 7and 28days of curing for M40



 ISSN: 2454-1907
DOI: 10.5281/zenodo.1313118

5. Conclusions

The compressive strength increases with the addition of GFRC to the control specimen. Addition of GFC to the control specimen, only a marginal increase in the compressive strength, as GFC is good in tension.

Compressive strength of concrete increases with the addition of GFRC than GFC.

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