Asian Journal of Advances in Basic and Applied Science
2015: Vol-1: No-1: 33-37
Original Ressearch Article

Experimental study effect of glass fiber mortar on RC beams retrofitted using laminates

Annsingh Shermila G*, Sunilaa George

Department of Civil, Structural Engineering, Anna University, Kotturpuram-600025, Tamil Nadu, India

Abstract

Using advanced materials enclosed with mortar is an innovative study of Structural Engineering as compared to conventional mortar mix. In this thesis GFRC is used. Glass fibers are used as shrinkage resistant, crack resistant and corrosion resistant. And the use of glass fibers on mortar results, the increase in tensile strength and flexural strength. Three percentages (1%, 2% and 3%) of fibers by weight of cement were selected. The specimens of size (70.6x70.6x70.6mm) mould were casted. The specimens were tested at the ages of 7-days and 28-days for compressive strength. The test results showed that, the compressive strength is more in 1% of fiber mix and the strength goes on decreasing. This fiber enclosed mortar is to be used for retrofitting of beams using laminates.

Key words: Cement, GFRC(Glass Fiber Reinforced Cement), Compressive strength, Retrofitting, Laminates.

Corresponding autor

Annsingh Shermila G
Department of Civil, Structural Engineering, Anna University, Kotturpuram-600025, Tamil Nadu, India
shermigilbert@gmail.com

1.0 Introduction

In civil Engineering practice, cement mortar plays an important role. Especially mortar with advanced materials is an innovative study. Cement mortar is a workable paste consisting of cement, sand and water, used to bind building blocks such as stones, bricks, and concrete masonry units together, fill and seal the irregular gaps between them. In this thesis cement mortar is used for retrofitting of RC beams using laminates. Cement mortar infiltrated with glass fibers are used for this purpose. Glass fiber is a material consisting of numerous extremely fine fibers of glass. Glassmakers throughout history have experimented with glass fibers, but mass manufacture of glass fiber was only made possible with the invention of finer machine tooling. Glass fiber when used as a thermal insulating material, is specially manufactured with a bonding agent to trap many small air cells, resulting in the characteristically air-filled low-density "glass wool" family of products. Glass fiber has roughly comparable mechanical properties to other fibers such as polymers and carbon fiber. Although not as strong or as rigid as carbon fiber, it is much cheaper and significantly less brittle when used in composites. Glass fibers are therefore used as a reinforcing agent for many polymer products to form a very strong and relatively lightweight fiber reinforced polymer (FRP) composite material called glass reinforced plastic (GRP), also popularly known as "fiberglass" and is an especially good thermal insulator. The strengthening and enhancement of the performance of deficient structural elements in a structure or a structure as a whole is referred to as retrofitting. Ferrocement is a retrofitting material can be pretty useful, because it can be applied quickly to the surface of the damaged element without the requirement of any special bonding material and also it requires less skilled labour, as compared to other retrofitting material presently existing.

2.0 Materials and methods

2.1 Casting and Curing

In the existing scenario there are a number of laminates like CFRP (Carbon fibre reinforced polymer), GFRP (Glass fibre reinforced polymer), Ferrocement etc. are being used for retrofitting of structures. Here glass fibers are used in mortar. For the proposed work mortar cube of size (70.6x70.6x70.6mm) mould were oiled and to facilitate demoulding. In this paper eight control specimens and eiteen fiber infiltrated cubes were casted. Fibers are added in the proportion of 1%, 2% and 3% by weight of cement. Cubes are mixed in the ratio of 1:2 and the water cement ratio is 0.5. After casting, the specimens were stored in laboratory for 24 hours in a room temperature. Then the specimens were demoulding and submerged in tap water tanks until the time of testing

2.2 Materials and Tests

Physical properties such as consistency, fineness, initial and final setting time, specific gravity, water absorption for cement and sand were tested. The compressive strength is determined using the specimens of mortar cubes. The formula to find out the compressive strength is given by,

$$\text{Compressive strength} = \frac{\text{load}}{\text{area}} \text{N/mm}^2$$

Table 2.1: Details of Mortar Mixes (1:2) by weight

Specimen Designed	Glass fiber (% by weight of cement)
A0	0.0
B1	1.0
C2	2.0
D3	3.0

Figure:2.1 Glass fiber of size 7mm

3.0 Results and discussion

Table 3.1 Physical Properties of Cement Used

Sl. No	Characteristics	Value obtained experimentally	Value specified by Is: 8112-1989
1	Standard consistency	34	-
2	Fineness of cement as retained on 90 micron sieve	0.5	<10%
3	Setting time 1. Initial 2. Final	35 mints 5 hours	>30 mints <10 hours
4	Specific gravity	3.07	-

Table 3.2 Physical Properties of Sand

Sl.No	Characteristics	Value
1.	Specific gravity	2.56
2.	Water Absorption	2.06%
3.	Grading Zone	Zone III

Table 3.3 Sieve Analysis of Sand
Total weight taken = 1000gm

Sl. No	Sieve size (mm)	Mass Retaind (gm.)	Percentage Retained	Cumulative Percentage Retained	Percent Passing
1.	4.75	95.0	9.5	9.5	90.5
2.	2.36	42.5	4.25	13.75	86.25
3.	1.18	110.5	11.05	24.8	75.2

4.	600 µm	128.5	12.85	37.65	62.35
5.	300 µm	308.0	30.8	68.45	31.55
6.	150 µm	281.0	28.1	96.55	3.45
7.	Pan	34.5	3.45		
				Σ = 250.70	Fineness modulus = 2.507

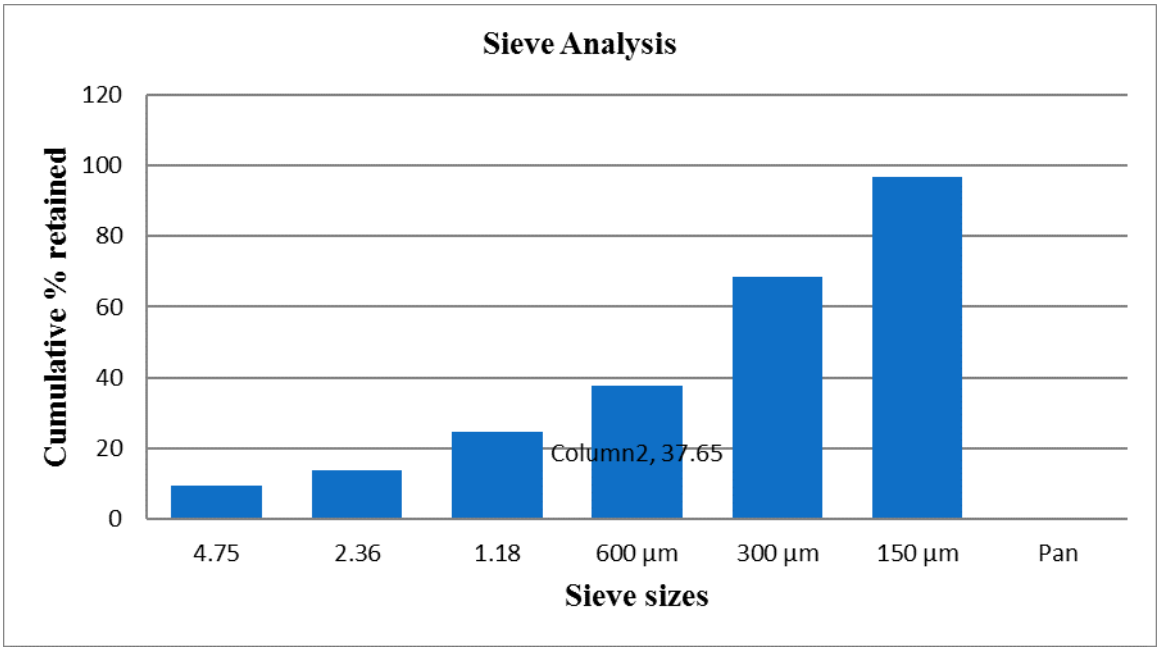

Figure:3.1 Sieve Analysis of Sand

3.4 Compressive Strength of Cube

Specimen Type (mm)	Specimen Designed	Compressive strength (N/mm²)	
		7 - Days	28 – Days
Mortar Cube (70.6 x 70.6 x 70.6)	A0	38.77	53.06
	A0	32.65	51.02
	A0	36.73	52.02
	A0	42.85	53.06
	B1	32.65	36.73
	B1	38.77	40.81
	B1	33.69	46.93
	B1	40.81	51.02
	C2	34.69	34.69
	C2	32.65	40.81
	C2	40.81	53.06
	D3	26.53	36.73
	D3	25.51	32.65
	D3	26.87	40.81

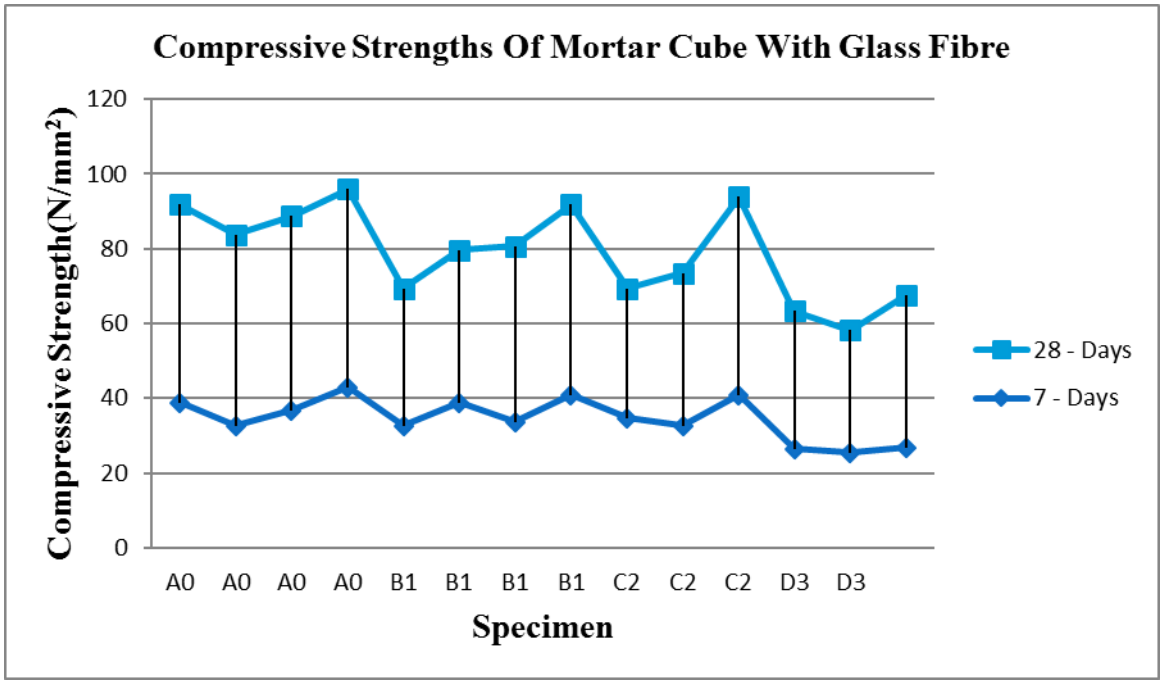

Figure:3.2 Compressive Strength of Morter cube

4.0 Conclusion

The average compressive strength for 28-days is determined as 52.00, 43.87,42.85,36.73N/mm^2. By seeing these values it can be conclude that the compressive strengths are decreasing from 1% to 3%. This can be easily seen by using the graph shown in figure:3.2. So in future research the percentage of glass fiber can be start from 0.5% onwards. Therefore the could be get better.

References

1. Rasha Salah Mahdi,"Experimental Study Effect of Using Glass Fiber on Cement Mortar", Journal of Babylon University/Engineering Sciences/ No.(1)/ Vol.(22): 2014
2. Takagi, J.,"Some Properties of Glass Fiber Reinforced Concrete" Fiber Reinforced Concrete, SP.44-5, 1974. PP.93-111.
3. Hannant, D.J., "Fiber Cement and Fiber Concrete". John Wiley and Sons Co.,1980 ACI Committee 544, "State of the Art report on Fiber Reinforced Concrete". (ACI 544.IR-82), Concrete International Journal, May 1982. PP. 9-30.
4. A.Senthilkumar, L.John Baruch, M. Francis Luther King,D. George Oliver," Experimental Studies On Mechanical Properties Of Glass Fiber Reinforced Ceramic Matrix Composites"