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Experimental Study on Physio-mechanical behavior of Concrete with Chopped Fiberglass Strands

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Abstract- In building construction, use of fiberglass in concrete is gradually increasing after following recent trends. Crack developed on plain concrete is certainly reduced and increased the bending and flexural capacity of concrete. This study investigated chopped fiberglass as an additive ingredient of concrete as certain percentage variation of dimension of beam size and impacts of fiberglass on bending performance of concrete beam. The main aim of the study is to study the effect of glass fiber in the concrete. The addition of glass fibers into concrete dramatically increased the flexural strength of concrete. Fiberglass strands were mixed with ordinary concrete as same ratio as per design mix. In this research, 7, 14 and 28-days test was conducted to determine the mechanical strength of concrete, and each test contains three specimens of various six dosage (0%, 0.12%,0.25%,0.5%, 1% and 2%) by weight of total basic concrete ingredients of fiberglass. Here, 54 Numbers of 100 mm x 100 mm x 500 mm rectangular concrete beam were casted then flexural strength of concrete was evaluated, and 54 Numbers of 150 mm x 150 mm x 150 mm concrete cube were casted then test was conducted to evaluate compressive strength and water absorption of concrete. At the 0.25% of fiberglass content in concrete provides the best result in flexure and compression out of fiberglass content concrete. The experiment aims to demonstrate that use of fiberglass in certain percentage may enhances the flexural strength and compressive strength of concrete and cure respectively than that of ordinary concrete cube and beam. Fiberglass may be one of the alternative construction materials to increase performance of concrete where flexural strength required is more than compressive strength.

Keywords: Compressive Strength; Fiberglass; Flexural Strength; Water-Cement ratio.

I. INTRODUCTION

1.1 Background

Concrete has a relatively low tensile strength but a high compressive strength (CS)[1]. Plain Concrete does not offer sufficient resistance to the tensile/shear stresses imparted by wind, earthquakes, vibrations and other forces and is therefore not viable for most structural applications. In addition, concrete has low tensile strength and low tensile strain limit as a composite material[2]. In reinforced concrete, the tensile strength of steel and the compressive strength of concrete work together to allow the member to sustain these stresses over considerable spans. Concrete became one of the most widely used building materials in the world after reinforced concrete was developed in the 19th century, revolutionizing the construction industry[3].

Reinforcing schemes are generally designed to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and structural failure. The word 'Reinforced' means 'strengthened' or 'supported'. Reinforced Cement Concrete, therefore, is a composite material consisting of concrete and steel reinforcements. Modern reinforced concrete can contain varied reinforcing materials made of steel, polymers or alternate composite material in conjunction with rebar or not. Reinforced concrete may also be permanently stressed (in compression), so to improve the behavior of the final structure under working loads. Furthermore, due to exposure on harmful chemicals that are found in nature e.g. some groundwater, industrial effluents and sea water may cause the deterioration and weaken the concrete structure [4]. One of the most challenging issues that civil engineers need to deal with is repairing and rehabilitating structural elements. Most structures that were built in previous decades, using outdated design criteria, would be considered structurally inadequate according to the current design codes. Consequently, replacing these deficient structural members would require an enormous investment of public funds and time, while the use of strengthening techniques for concrete members has become the most widely accepted method for upgrading their load-carrying capacity and overall stiffness.

Glass fiber is a type of fiber reinforced plastic where the reinforcement fiber is specifically glass fiber. Chopped fibers are generally produced by cutting continuous fiber composites into short lengths ranging from 6 mm to 50 mm[5]. Fiberglass really is made of glass, like windows or the drinking glasses in the kitchen. The glass is heated until it is molten, then it is forced through superfine holes, creating glass filaments that are very thin. Several researchers have already studied the use of fiberglass sheets or plates bonded to concrete members, such as beams or columns. Properties of fiberglass to be used in this research is shown in following table 1.1.

Table 1.1: Properties of chopped fiberglass strands

Glass fiber Strand Parameters	Value
Type of fiberglass	E -glass fiberglass
Length [mm]	9
Diameter [µm]	10
Density [g/cm^3]	2.5
Modulus [GPa]	72
Tensile Strength [MPa]	200 MPa

Glass in the form of fibers has found a wide range of applications in industry since it has become the most versatile material known today. Glass fiber is a chemically inorganic fiber, obtained from molten glass of a specific composition. Glass fiber is made of natural material, so that its products are ecologically pure and not harmful to human health. High bending, pulling and pressure resistance, high temperature resistance, low hydroscopic, resistance against chemical and biological influences, comparatively low density. Glass fiber concrete (GFC) consists basically of a matrix composed of cement, sand, water, and admixtures, in which short length glass fibers are dispersed[6]. Glass fiber products have excellent electronic, heat and sound insulation capacities. Glass fibers are light in weight and when added to prism increases the strength of the concrete when compared to the conventional concrete. GFRP offers several advantages, such as its relatively low cost, easy availability, and high tensile strength[7].They also exhibit improved properties such as strength, flexibility and stiffness(Saranya et al., n.d., 2022). Addition of Glass fiber on concrete (GFRC), enhances tensile strength and overcomes traditional concrete's brittleness[8] [9].

The flexural, shear, and torsional capacity of reinforced concrete beams can be improved through the use of externally bonded GFRP. Due to their flexibility and ease of application and handling, high strength-to-weight ratio, and stiffness, flexible glass fibers are effective for reinforcing reinforced concrete members[10]. Combining various fiber lengths, diameters, moduli, and tensile strengths is one of the several strategies of hybridization of concrete [11].

Different types of fibers can be used in concrete mix. Fibers can enhance the mechanical and structural behavior of RC beams depending on the type, geometry, fiber percentage, orientation and distribution of the fibers[12]. Glass Fiber Reinforced Concrete (GFRC) is composed of concrete, reinforced with glass fibers to produce a thin, lightweight, yet strong material. Though concrete has been used throughout the ages, GFRC is still a relatively new invention[13]. A strengthening system should increase the current structures' ability to withstand internal forces, either actively or passively[10]. Therefore Fiber reinforced composites have superior strength to weight ratio, low alteration of structural geometry, easy and speedy installation & corrosion and fatigue resistance for strengthening applications become the trend[14]. GCSM sheets are highly beneficial and preferred for shear strengthening of RC shallow beams[15]. Glass fibers aid in preventing the formation of micro-cracks in the concrete contact, resulting in a robust composite with higher crack resistance and ductility.

FRPs are widely used and have been shown to be successful in strengthening and rehabilitating structural elements like beams and slabs in flexural and shear to extend the structure's lifespan[16]. The Fiber Reinforced Cementitious Matrix (FRCM) utilizes fiber-reinforced grids, meshes, and fabrics (e.g., basalt, carbon, glass, steel) to improve concrete strength, with composite fiber reinforced polymer (CFRP) offering superior tensile properties[17].

1.2 Statement of the Problem

This study aims to address these gaps by experimentally analyzing the bending performance, strength, and failure behavior of concrete reinforced with fiberglass.

1. Previously, some research was conducted to analysis the behavior of concrete beam wrapped with GFRP sheets is studied.
2. Similarly, other research were conducted to study the behavior of concrete under three different types of glass fiber laminates or bounded by GFRC and analyze the strength and ductility of the beam with limited and very less percentage of fiberglass strands up to maximum 0.06% dosage with SCC only.

Hence, it was found that crushed glass fiber mixed with concrete is not investigated yet. So, this research will give the experimental result which may strengthen the beam on bending and can resist cracking on loading than that of conventional concrete.

1.3 Research Gap

1. The optimum replacement percentages of fiberglass in concrete remain unclear for the best performance on compression as well as flexure.
2. Thus, the study aims to bridge this gap by experimentally investigating the influence on mechanical behavior with adding fiberglass on concrete in terms of compression, flexure and water absorption.

1.4 Research Question

a. How does Physio-Mechanical (Compressive and Flexural strength) behavior of concrete affects with varying percentage of chopped fiberglass strands as an additive ingredient?
b. How does the water absorption behavior of concrete affects with varying percentage of fiberglass compared with ordinary concrete?
c. What is the optimum dosage of chopped fiberglass strands that maximize flexural strength keeping compressive strength in acceptable limit?

1.5 Objectives of the study:

The following are potential objectives of this study.

a. To evaluate the Physio-Mechanical (Compressive and Flexural strength) behavior of concrete with chopped fiberglass strands.
b. To recommend optimum dosage of fiberglass for enhancing bending and compressive strength of concrete.
c. To compare water absorption results of concrete mixtures with and without fiberglass strands.

1.6 Significance of the Study:

From the study chopped fiberglass strands in concrete have the potential to improve flexural strength, durability, and crack resistance and provide a more efficient and cost-effective alternative than ordinary concrete where flexural toughness is prioritized over pure compressive strength such as thin slab, pavement, non-load bearing structure and overlay etc. Decreasing maintenance cost, capable of long-term performance, more lightweight and durable which was the outcome of this research. Not only that, it also helps for sustainability by reducing the requirements of traditional concrete materials from an environment. The results of this work may be of great relevance to current construction due to a focused demand for high-strength, low-maintenance and cost-effective materials.

Uses of Fiberglass in concrete is very effective in construction Industry, with respect to the analysis of flexure and compressive behavior to improve loading capacity. After studying this experiment, dosage of fiberglass optimization and Practical application in construction industry.

1.7 Limitation of the study:

Experimental study is limited due to material compatibility, durability concerns.

Some Limitation of this research are as follows:

1. Long-term Performance: The study focused on short-term performance up to 28 days and the long-term durability of fiberglass in concrete might not be covered.

II. LITERATURE REVIEW

Hammad Tahir, Muhammad Basit Khan and team (2023)[1] carried out an experimental study to determine " Optimization of Mechanical Characteristics of Alkali-Resistant Glass Fiber Concrete towards Sustainable Construction" to evaluate the mechanical properties, durability, embodied carbon, and eco-strength efficiency of concrete containing fiberglass of 8 mix proportions (0%, 0.5%, 0.75%, 1%, 1.25%, 1.5%, 1.75%, 2% GF by weight of cement). The study examines the relationship between Glass fiber (GF) content (independent variable) vs. dependent variables (mechanical properties, durability, embodied carbon, and eco-strength efficiency). The result obtained as a conclusion that 1.25% GF is optimal for enhancing mechanical and durability properties. He concludes the result that Optimal GF content at 1.25% by weight of cement improvements CS +11.76%, STS +17.63%, FS +17.73%, MoE +5.72%, impact energy +62.5% and UPV max at 452 m/s, embodied carbon increases with GF best ESE at 1.25% GF. Addition of glass fiber on concrete improves sustainability but increases embodied carbon.

Ferit Cakir (2021)[5] carried out an experimental study for "Evaluation of mechanical properties of chopped glass/basalt fibers reinforced polymer mortars" to determine the density, flexural strength, compressive strength, failure mode of mortar with chopped glass fibers strands and chopped basalt fibers strands. The study examines the relationship between Type and proportion of chopped fibers (CGFs, CBFs) vs. density, flexural strength, compressive strength, failure mode at 0.5% dosage of CGF and CBF contain. The result obtained as a conclusion that chopped basalt fibers (CBF) containing 0.5% showed highest mechanical properties: flexural strength ~27% higher, compressive strength ~25% higher than plain PC. On increasing the fiber addition more than 0.5%, densities decreased, and failure mode changed from brittle to ductile.

J.D. Chaitanya Kumar, G.V.S. Abhilash and Team (2016)[6] carried out an "Experimental Studies on Glass Fiber Concrete" to investigate the compressive strength, flexural strength and split tensile strength at 7 and 28 days on M_{20} grade concrete with varying percentages of E-glass fiber (0.5%, 1%, 2%, 3% of cement weight). The study examines the relationship between the percentage of E-glass fiber and mechanical properties (compressive, flexural, split tensile strengths) of concrete. The result obtained as a conclusion that Compressive strength max at 1% fiber: 20.76 MPa and 28.46 MPa (7 and 28 days respectively), flexural strength max at 1% fiber: 1.47 MPa and 2.94 MPa (7 and 28 days respectively) and split tensile strength max at 1% fiber: 2.83 MPa and 3.92 MPa at 7 and 28 days respectively. He also concludes that addition of E-glass fibers reduces cracking, improves mechanical strengths, with optimum performance at 1% fiber content. Higher fiber % (>1%) decreases workability and strength.

Biswajit Jena and Asha Patel (2018)[21] carried out an "Study On The Mechanical Properties And Microstructure Of Chopped Fiberglass and Carbon Fiber Reinforced Self Compacting Concrete" to compared the compression, tensile and flexure strength of concrete containing carbon fiber and chopped fiberglass mix concrete with varying fiber volumes (0.1%, 0.15%, 0.2%) by weight. The study examines the relationship between Carbon and glass fiber volume fraction vs. fresh properties (slump flow, T50, L-Box, V-Funnel), compressive strength, split tensile strength, flexural strength, fracture energy, microstructure. The result is obtained as a conclusion that Carbon fibers significantly enhance mechanical properties and fracture energy of SCC more than glass fibers. Optimal dosage is 0.15% for carbon and 0.2% for glass fiber. Scanning Electron Microscope (SEM) showed good fiber-matrix bonding.

III. RESEARCH METHODOLOGY

3.1 Material properties and Tests Program:
In this section, all the properties of materials were tested such as silt content of sand, gradation of sand, Aggregate abrasion value test, Aggregate Impact value test of course aggregate, compressive strength of concrete were conducted.

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3.1.1 Specification of Concrete:

Compressive strength of concrete for beam and cubes was used as per the mix design of M_{25}. From mix design of M_{25} grade of concrete from given requirements cement, sand and aggregate were used in the ratio of 1:1.27:3, respectively. This ratio was obtained from the mix design and is shown in Appendix IV. Water and cement ratio used in mixed design was 0.45. In this experiment, OPC 43 grade of cement and aggregate size was found to be 20 mm down found from sieve analysis.

3.1.2 Properties of Coarse Aggregate

Table 3. 1: Physical Properties of aggregate

Physical properties	Fine aggregate	Coarse Aggregate 20 mm down
Water absorption	1.1	0.72
Specific gravity	2.6	2.7

Table 3. 2: Specific gravity of coarse aggregate.

Weight of flask (W_1)	Weight of flask+ aggregate (W_2)	Weight of flask+ aggregate + water (W_3)	Weight of flask+ water (W_4)	W_2-W_1	W_3-W_4	Specific gravity (W_2-W_1) / [(W_2-W_1)-(W_3-W_4)]
947	1693	2893	2423	746	470	2.7

Table 3.3: Sieve Analysis of coarse aggregate of 20 mm down size

Sieve Size (mm)	Aggregate retained on each sieve (gm)	Cumulative weight retained (gm)	Cumulative % retained	% Passing
40	0	0	0.00	100
20	1002	1002	9.66	90.34
10	6520	7522	72.55	27.45
4.75	2814	10336	99.69	0.31
Pan	32	10368	100.00	0.00
Total	10368			

3.1.3 Properties of Fine Aggregate

The various properties test of fine aggregate (sand) was carried out before starting research work. Fine aggregate used in our research work was purchased and collected from the source and then investigated various properties such as silt content, gradation and organic impurities in laboratory as per specified guideline and codes. The source of fine aggregate is Tinau river, Rupandehi.

Table 3. 4: Silt content test on Fine aggregate

Weight of sample	Weight of sand 200 no. sieve Passing A	Weight of silt clay content B	Percentage of Sand content % = (A-B)/A x 100%	Average silt content %
500	486.5	13.5	97.23	2.77

Table 3. 5: Gradation of Fine aggregate

Sieve Size (mm)	Weight Retained (gm)	Cumulative Weight Retained (gm)	Cumulative Retained (%)	% Passing
10	0	0	0.00	100.00
4.75	28	28	3.28	96.72
2.36	72	100	11.71	88.29
1.180	156	256	29.98	70.02
0.600	162	418	48.95	51.05
0.300	202	620	72.60	27.40
0.150	186	806	94.38	5.62
Pan	48	854	100.00	
Total	854			

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3.2 Mix Design:

Ingredients of concrete i.e. sand, cement and aggregate and as an additive, chopped fiberglass strand were procured from the relevant source and tested for their properties. After procurement and testing of constituent materials following steps were adopted to cast samples of specimens.

3.2.1 Mix Proportion

A Particular mix design method determines a set of mix proportions for producing a concrete that has approximately the required properties of strength and workability.

IS method of concrete design method was used in this experimental study as per IS 10262 (10262: 2019)[22]. Fiberglass is added to the mix design in the respective by 0.12%, 0.25%, 0.5%, 1% and 2% of total ingredients weight respectively for analysis of impact of chopped fiberglass strand in concrete.

Table 3. 6: Details of Mixture in (Kg)

Parameter	Cement (Kg)	Fine Aggregate (Kg)	Coarse Aggregate (Kg)	Fiberglass strands (Chopped) (Kg)
Ordinary Concrete	21.28	27.03	63.85	0
0.5% Fiberglass	21.28	27.03	63.85	0.1345
1 % Fiberglass	21.28	27.03	63.85	0.2804
0.5% Fiberglass	21.28	27.03	63.85	0.5608
1 % Fiberglass	21.28	27.03	63.85	1.1216
2 % Fiberglass	21.28	27.03	63.85	2.2432

In this research work, 45 beams and 45 cubes were casted for test with different proportion addition of fiberglass on concrete and 9 beams and 9 cubes without fiberglass were prepared to study about impact of fiberglass on concrete. Those details are shown in Table 3.7.

Table 3. 7: Concrete Testing

Test	Shape and dimension of the specimens	Time duration (in days)
A. Cube Test:		
Compressive Strength Test	Cube: 150 mm x 150 mm x 150 mm	7,14 and 28
Water absorption Test	Cube: 150 mm x 150 mm x 150 mm	28
B. Beam Test:		
Flexure strength Test	Rectangular: 500 mm x 100 mm x 100 mm	7, 14 and 28

3.3 Collection of Data from Experiment

All the data obtained from laboratory test is kept accordingly and all data are analyzed for obtain results and provide recommendations. Various data illustrate in above table showing properties of all raw materials, mechanical and physical properties of concrete are collected from the laboratory test.

Compressive strength of cube and flexural strength of beam was found out from the respective test of compression test of cube specimen and flexure test of beam specimen. The data obtained from laboratory test was studied, calculated and analyzed the effect of fiberglass in concrete compressive strength and flexural strength.

IV. RESULT AND DISCUSSION

4.1 General:

This section describes the results of the tests carried out to investigate the various physical and mechanical properties of the concrete member with fiberglass in contrast with the design mixes.

4.2 Fresh Concrete Properties:

4.2.1 Compressive Strength Test

The compressive strength of concrete specimens were determined after 7, 14 and 28-days of standard curing. The compressive strength test was conducted on 150 mm cubes. Results of compressive strength of concrete with different percentage levels of fiberglass have been shown in figure 4.1. From chart, it was observed that how compressive strength of concrete

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was influenced with addition of fiberglass as an additive with respect to ordinary concrete. Increase in content of fiberglass in test specimen reduces the weight of of sample and also reduces the compressive strength of concrete. The maximum value of strength was observed with 0.5% of fiberglass content, which is more than ordinary concrete strength. On increasing the quantity of fiberglass, then compressive strength was on decreasing. 7, 14 and 28 days compressive strength test result was shown in figure 4.1. Detail data of Compressive strength result was presented as below.

Table 4.1: Compressive Strength Test Result of Concrete with Fiber.

Test Sample Day Test Parameters	Average 7 days Strength MPa	Average 14 days Strength MPa	Average 28 days Strength MPa
Ordinary Concrete M25	24.58	34.67	38.06
0.12% fiberglass	19.52	28.00	29.12
0.25% fiberglass	20.99	29.48	30.14
0.5% fiberglass	20.52	28.44	29.53
1 % fiberglass	14.00	20.00	21.02
2% fiberglass	9.22	13.33	17.53

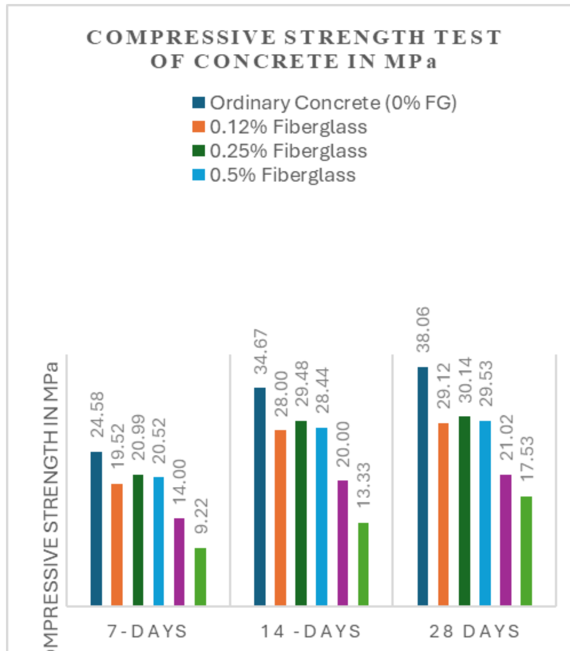

Figure 4. 1: Compressive Strength (N/mm^2) of Test Sample

4.2.2 Flexural Strength Test:

A. Test Arrangements:

The flexural strength test of a beam, also known as the modulus of rupture test, is conducted to determine the bending strength of concrete. In this test, a standard concrete beam specimen—typically of size 100 mm × 100 mm × 500 mm—is placed on two supporting rollers with a specific span (usually 400 mm) and loaded at one-third points or at the center,

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depending on the method (third-point loading or center-point loading). The load was applied gradually through a hydraulic loading machine until the beam fails. The maximum load at failure was recorded, and the flexural strength was calculated using the appropriate formula based on the loading configuration. Calculation is attached in this thesis in APPENDIX II. The test was performed under controlled conditions, and the beam should be properly cured before testing. This test helps in evaluating the tensile strength of concrete beam and is important in pavement and structural applications where bending is critical. Flexural Strength test arrangements was made as shown in figure 4.3.

Figure 4. 2: Arrangement of flexural strength test Machine of beam in Lab

B. Result Obtained:

The flexural strength of concrete specimens were determined after 7, 14 and 28 days of standard curing. The flexural strength test was conducted on 100 mm x 100 mm x 500 mm size beam. Results of flexural strength of concrete beam with different percentage level of fiberglass have been shown in figure 4.3. It can be observed from figure that the flexural strength of concrete with fiberglass as an additives. Increase in content of fiberglass in test specimen reduces the weight of of sample and also reduces the flexural strength of concrete in seven days. The maximum value of strength was observed with 0.25% of fiberglass content, which is more than ordinary concrete strength. On increasing the quantity of fiberglass exceeding 0.25%, the flexural strength was on decreasing. 7-days, 14 days and 28-days flexural strength test results was shown below.

Table 4. 2: Flexural Strength Test Result of concrete.

Test Sample Day / Test Parameters	Average 7 days Strength MPa	Average 14 days Strength MPa	Average 28 days Strength MPa
Ordinary Concrete M25	4.93	5.82	6.17
0.12% fiberglass	5.45	6.57	6.97
0.25% fiberglass	5.82	7.80	8.22
0.5% fiberglass	5.13	6.08	6.80
1 % fiberglass	4.61	5.95	6.57
2% fiberglass	4.08	5.48	6.15

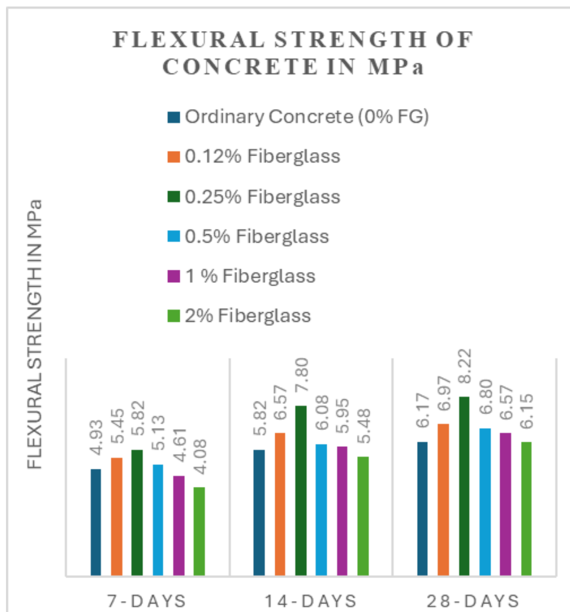

Figure 4. 3: Flexural Strength (N/mm^2) of Test Sample

4.2.3 Water Absorption Test:

Water Absorption test of concrete specimens was determined after 28 days curing 150 mm size concrete cube. Result of water absorption of concrete with normal concrete and various dosage of fiberglass content concrete cube are as shown in figure 4.4. On increasing the fiberglass content in concrete cube, water absorption also increases. From experiments, it is suggested that the concrete containing fiberglass strands in internal parts of buildings which are not exposed to moisture.

$$\% \text{ Water absorption } = \frac{Difference\ in\ weight}{Original\ Weight} \times 100\ \%$$

$$= \frac{7961.8}{7810} \times 100\%$$

$$=1.94\%$$

Table 4. 3: Water absorption test result of concrete

S.No.	Parameter Content in Mix	Oven Dried weight of Sample (Kg) W1	Saturated Weight of Sample after water bath (Kg) W2	Water absorption (%) =[(W2-W1)/W1]x 100
1	Ordinary Concrete	8012	8142	1.62
2	0.12% Fiberglass	7804	7932	1.64
3	0.25% Fiberglass	7810	7961.8	1.94
4	0.5% Fiberglass	7648	7859.4	2.76
5	1% Fiberglass	7610	7906	3.89
6	2 % Fiberglass	7538	7859.6	4.27

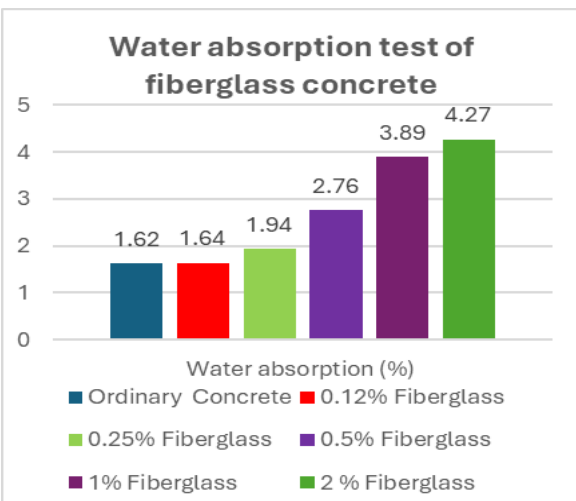

Figure 4. 4 : Water absorption results for various dosages of glass fiber concrete.

The water absorption capacity of chopped fiberglass concrete is in increasing rate on increasing the fiberglass content. Hence, this material is recommended for internal work where water does not affect the structure such as partition, plaster mortar, pavements structure where good flexural behavior is desired than normal concrete.

V. CONCLUSION AND RECOMMENDATIONS

This section summarizes the experimental results of the tested specimens. The performance of the beam with different percentage of fiberglass. In addition, the effect of the fiberglass in concrete beam and cube was experimentally investigated. Based on the limited test results provided in this thesis paper, the following conclusion can be drawn.

1. As per data obtained from 28 days test report, fiberglass contains 0.12%, 0.25%, 0.5% and 1% increased the flexural strength by 13%, 33.2%, 10.2%, and 6.5% respectively than that of ordinary Concrete. At the dosage of 2% fiberglass, the flexure strength decreased by 0.3% than that of ordinary concrete.
2. Compressive strength was reduced by 23.5%, 20.8%, 22.4%, 44.8% and 53.9% than that of ordinary concrete with the addition of 0.12%, 0.25%, 0.5%, 1%, and 2% fiberglass respectively. The result obtained was within the limit of provision in codes up to 0.5% additive of fiberglass.
3. Flexural Strength of Concrete member with chopped fiberglass is influenced by variation of percentage of fiberglass. As per the 7-day, 14 day and 28-days lab report, we can conclude that chopped strands Fiberglass up to 0.25% dosage by total weight of concrete produce the best result. Dosage of fiberglass more than 0.5% of total ingredients weight produces the brittle and is unsuitable in use because of significantly reduces the compressive strength.
4. Water absorption capacity of concrete was increased on increasing the fiber glass content in concrete.
5. As an additive, on increasing the dosage of fiberglass, the workability of the concrete gradually decreased. At 2% fiberglass dosage, the concrete became low workable and making it difficult to cast specimens.

Recommendation for future research:
The present studies may extend in future for the following:

1. Use of chopped fiberglass with superplasticizers
2. Use different length chopped fiberglass with concrete and analyze the impact of chopped fiberglass length on mechanical behavior of concrete.
3. Behavior of chopped fiberglass laying (Sprinkling) in layer during casting.

REFERENCES

[1] H. Tahir *et al.*, "Optimisation of Mechanical Characteristics of Alkali-Resistant Glass Fibre Concrete towards Sustainable Construction," *Sustain.*, vol. 15, no. 14, 2023, doi: 10.3390/su151411147.

[2] C. Jiang, K. Fan, F. Wu, and D. Chen, "Experimental study on the mechanical properties and microstructure of chopped basalt fibre reinforced concrete," *Mater. Des.*, vol. 58, no. June, pp. 187–193, 2014, doi: 10.1016/j.matdes.2014.01.056.

[3] S. Saranya, S. P. Kanniyappan, S. Saranya, A. Faizuneesa, and C. Lavanya, "Experimental Study on the Behaviour of Glass Fiber Laminates in RCC Beams." [Online]. Available: https://www.researchgate.net/publication/358278414

[4] M. V. S. Reddy, Ramana Reddy, K Madan Mohan Reddy, and C M Ravi Kumar, "Durability Aspects," *Int. J. Struct. Civ. Eng. Res.*, vol. 2, no. 1, pp. 40–46, 2013.

[5] F. Cakir, "Evaluation of mechanical properties of chopped glass/basalt fibers reinforced polymer mortars," *Case Stud. Constr. Mater.*, vol. 15, no. July, p. e00612, 2021, doi: 10.1016/j.cscm.2021.e00612.

[6] J. D. Chaitanya, G. V. S. Abhilash, P. K. Khan, G. Manikanta, and V. Taraka, "Experimental Studies on Glass Fiber Concrete American Journal of Engineering Research (AJER)," *Am. J. Eng. Res.*, vol. 5, no. 5, pp. 100–104, 2016, [Online]. Available: www.ajer.org

[7] S. Ramakrishnan, S. Loganayagan, N. Chandramohan, and K. Gowthambalaji, "Comparative Study on the Behavior of Fiber Reinforced Concrete," *Mater. Res. Proc.*, vol. 23, pp. 97–105, 2022, doi: 10.21741/9781644901953-13.

[8] M. J. Islam, M. T. Hossain, and S. Mahmud, "A COMPARISON STUDY ON THE USE OF JUTE FIBER REINFORCED POLYMER TO STRENGTHEN RCC BEAMS IN FLEXURE," *ASEAN Eng. J.*, vol. 14, no. 4, pp. 179–187, Dec. 2024, doi: 10.11113/aej.V14.21577.

[9] G. F. Muhyaddin, "Mechanical and fracture characteristics of ultra-high performance concretes reinforced with hybridization of steel and glass fibers," *Heliyon*, vol. 9, no. 7, p. e17926, 2023, doi: 10.1016/j.heliyon.2023.e17926.

[10] NISHIKANT DASH, "Strengthening of Reinforced Concrete Beams Using Glass Fiber Reinforced Polymer Composites," *Master Technol. Struct. Eng.*, 2009.

[11] V. S. Vairagade and S. A. Dhale, "Hybrid fibre reinforced concrete – A state of the art review," *Hybrid Adv.*, vol. 3, no. January, p. 100035, 2023, doi: 10.1016/j.hybadv.2023.100035.

[12] Y. Z. Murad and H. M. Abdl-jabbar, "The Influence of Basalt and Steel Fibers on the Flexural Behavior of RC Beams," vol. 13, no. 9, pp. 548–551, 2019.

[13] K. R. Kumar and N. Mahendran, "ER ER," vol. 2, no. 4, pp. 1026–1034, 2013.

[14] K. M. Mini, R. J. Alapatt, A. E. David, A. Radhakrishnan, M. M. Cyriac, and R. Ramakrishnan, "Experimental study on strengthening of R.C beam using glass fibre reinforced composite," *Struct. Eng. Mech.*, vol. 50, no. 3, pp. 275–286, 2014, doi: 10.12989/sem.2014.50.3.275.

[15] P. Thansirichaisree, H. Mohamad, M. Zhou, and A. Ejaz, "Behavior of shallow concrete beams strengthened using low-cost GCSM and mechanical anchors," vol. 11, no. September, pp. 858–881, 2024, doi: 10.3934/matersci.2024042.

[16] R. A. Abduljabbar, S. F. Alkhafaji, H. S. Abdulaali, A. Abdulqader, and S. Alqawzai, "Effects of CFRP sheets on the flexural

behavior of high-strength concrete beam," *Open Eng.*, vol. 14, no. 1, Jan. 2024, doi: 10.1515/eng-2024-0048.

[17] S. S. Sagare, K. R, and E. S, "A state of art of review on strengthening of concrete structures using fabric reinforced cementitious matrix," *Res. Eng. Struct. Mater.*, 2024, doi: 10.17515/resm2024.133ma1226rv.

[18] M. K. Askar, L. K. Askar, Y. S. S. Al-Kamaki, and R. Ferhadi, "Effects of chopped CFRP fiber on mechanical properties of concrete," *Heliyon*, vol. 9, no. 3, p. e13832, 2023, doi: 10.1016/j.heliyon.2023.e13832.

[19] D. S.H., "Effect of Glass Fibres on Ordinary Portland cement Concrete," *IOSR J. Eng.*, vol. 02, no. 06, pp. 1308–13012, 2012, doi: 10.9790/3021-026113081312.

[20] F. Polymers, K. Rodsin, A. Ejaz, Q. Hussain, and R. Parichatprecha, "Reinforced Concrete Beams : A Comparison with Carbon / Sisal," 2023.

[21] J. Biswajit and P. Asha, "Study on the mechanical properties and microstructure of chopped carbon fiber reinforced self compacting concrete," *Int. J. Civ. Eng. Technol.*, vol. 7, no. 3, pp. 223–232, 2016, doi: 10.13140/RG.2.2.10336.33287.

[22] I. Standard, "oaQØhV feJ vuqikru ekxZn ' khZ fl¼kar Lic en se d t lib ra ry @ o IR iric ICEN en . go LIB v . i n Lic en se ry @ o IR iric ICEN en . go LIB," no. January, 2019.

[23] B. S. 1881-122, "BSI Standards Publication Testing concrete Part 122 : Method for determination of water absorption," *BSI Stand.*, pp. 1–8, 2011.