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Experimental Studies on Fiber Wrapping Concrete in Aggressive Environment

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ABSTRACT

Nowadays in marine zone concrete are affected by tidal waves in the tidal zone and splash zone. Generally, the concrete may be affected by the sulphate, chloride, and Acid and sea water. These effects are reduced by using the fiber wrapped on the concrete. The fiber is to increase the strength and reduce the buckling and porous in concrete in the aggressive zone. Aggressive zone concretes are like chloride, sulphate, and acid and sea water. Glass fiber has the advantages of having higher tensile strength and fire resistant properties, thus reducing the loss of damage during fire accident of concrete structures. In this trial test for concrete with glass fiber wrapping and without glass fiber rapping conducted to show the difference in compressive strength by using cylinder.

Keywords: *Glass Fiber, Pozzolanic, Calcareous, Argillaceous, Compression, Sulphate, Chloride, Acid and Sea Water.*

1. INTRODUCTION

In this modern age, civil engineering constructions have their own structural and durability required every structure. The important properties of fiber wrapped concrete are superior resistance to chemical attack in the concrete. The aggressive environments are liked acid, chloride, sulphate and salt water. Solid salt does not attack concrete but when present in solution they can react with hardened cement paste. In the hardened concrete, sulphates react with the free calcium hydroxide to form gypsum. These effects are reduced by using the glass fiber wrapped in concrete. Glass fibers are also available as thin sheets, called mats. A mat may be made of both long continuous and short fibers. Glass is mainly made of silicon (S with a tetrahedral structure.

Wrapping with Fiber

The cured specimens were prepared for wrapping with FRBS.The surface of the specimens was grounded with an emery sheet to remove loose and dipterous materials from the surface. Then FRP wrapping was done with the epoxy adhesive. The wrapped surfaces were gently pressed with a rubber roller to ensure proper adhesion between the layers and proper distribution of the resin.

Experimental Investigation The test is performed in accordance with IS 516:1959. A standard test cylinder of 300 mm length and 150 mm diameter is placed

Vertically between the loading surfaces of compression testing machine. The compression load is applied vertically and uniformly until the failure of the cylinder.

2. RESEARCH OBJECTIVES

The following are the objective of this study,

- To analyze the percentage of increase in load carrying capacity of GFRP wrapped RC beams under two-pint loading system.
- To study the effect of RC beam and GFRP sheet wrapped RC beams on a deflection, crack pattern.
- To study the effect of GFRP sheet in improving the strength of the reinforced concrete beam.
- To increase the compressive strength of concrete.
- To reduce porous of the concrete
- To reduce the chloride, sulphate, acid and sea water attack
- To reduce effects of the tidal zone in column
- To increase the resistant to chemical attack of the concrete
- To reduce environmental effects
- To reduce erosion of the concrete

•To reduce crack and crack propagation
•Fiber reduces the permeability of concrete and thus reduce bleeding of water.
• Fiber is produced greater impact, abrasion, and shatter-resistance in concrete.

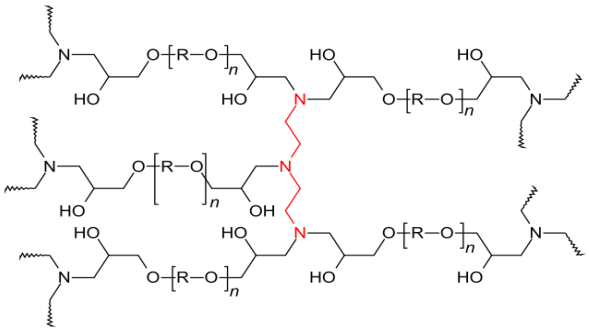
3. MATERIAL PROPERTIES

GLASS FIBER

Glass fibers have been developed mainly in the production of thin sheet components, using glass as reinforcing bars, impregnated and saturated plastics. Glass fibers are produced in the process in which molten glass extracted by the form of filaments, at the bottom of a heated platinum tank.

Epoxy Resine

Epoxy resine refers to a type of reactive prepolymer and polymer containing epoxide groups. These resins react either with themselves in the presence of catalysts, or with many co-reactants like amines, phenols, thiols, etc. Epoxy resine has many industrial applications for variety of purpose. It possesses higher mechanical properties and more thermal and chemical resistance than another type of resine. Epoxy resine also called polyepoxides. Epoxy resine is different from polyester resins with regard to curing agent called hardener rather than a catalyst. It is impact resistant, it has good electrical and insulating properties and a long shelf life.



4. RESEARCH METHODOLOGY

We search different journals and study the different between the conventional concrete and Glass fiber wrapped. Glass fiber gives better result in strength, resistance against all environmental factors than that of conventional concrete. The fiber having good chemical properties, thermal properties, and mechanical properties. The fiber reduces the porous and chemical attack.
Compression test: It is the most recognized test conducted as it is an easy test to perform on hardened cement mortar and also most of the enviable characteristic properties of cement mortar are qualitatively associated to its compressive potency. The compression test is experimented out on cylindrical specimens of the size 150×300 mm. The test is carried out in the following steps: Firstly the mould made up of cast iron, is used to make the specimen of size 150×300 mm. At the time of placing concrete in the moulds it is well compacted with the tamping bar with not less than 35 strokes per layer. After 24 hours the specimens are carefully removed from the moulds and instantly stored in clean fresh water. After 7, 14 and 28 days the specimens are made to test under the load in a compression testing setup.

The results from the compression test are the maximum load that the cube can bear before it ultimately fails. The compressive stress can be computed by dividing the maximum load by the area normal to it. The findings of compression test and the corresponding compressive stress is shown in Table II and Table III.
Let,
P = maximum bear load of the cube prior to the failure
A = area normal to the load = $\pi d^2/4$ mm^2
= 17671.45 mm^2
σ = maximum compressive stress (N/mm^2)
Therefore,
$\sigma = (P/A)$ N/mm^2

5. RESULTS AND DISCUSSIONS

A. PROPERTIES OF GLASS FIBER

Properties	Unidirectional	Bidirectional
Weight of fiber	920g/m^2	750g/m^2
Fiber thickness	0.90mm^2	0.60mm
Nominal thickness per layer	1.5mm	1mm

Primary fiber tensile strength	3400N/mm^2	3400N/mm^2
Tensile modulus	73000N/mm^2	73000N/mm2

Properties of Epoxy Resine

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Glass transion temperature	120-130^{0}c
Tensile strength	85N/mm^2
Tensial modulus	10,500N/mm^2
Elongation at break	0.8%
Flexural strength	112N/mm^2
Compressive strength	190N/mm^2
Flexural modulus	10,000N/mm^2
Water absorption	5-10mg

Thermal properties

Thermal shock	2000cycles
Smoke Emission	Low smoke Emission
Flammability	Class 0 as classified by the current building regulation
Thermal Decomposition	350^{0}c

B. Tests on Cubes

The cylinder moulds size 150mm*300mm as per 10086-1982.Moulds were cleaned thoroughly using a waste cloth and then properly oiled the inner surface. Concrete is filled in to mould and then compacted using a standard tamping rod of 60cm length having a cross-sectional area of 25mm^2 .Cylinder specimens are casted and De-mould after 24 hours from the casting. The specimens were immersed into water for curing up to 7,14,28days.Determine the compressive strength of the concrete for each set of cylinder after7,14,28days.The maximum load at failure was taken and the average compressive strength is calculated using the equation.

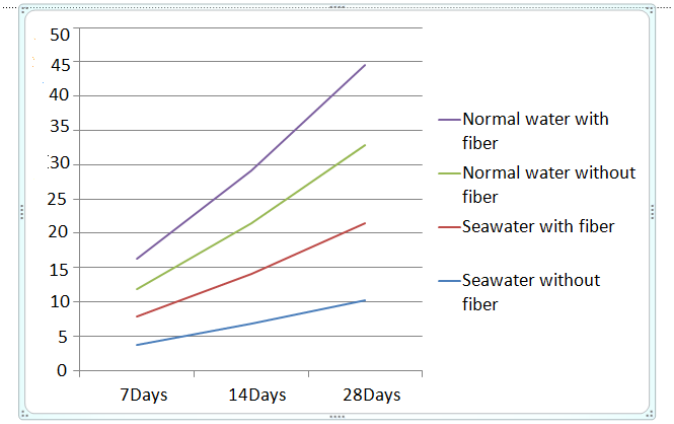
Compressive strength (N/mm^2)=Ultimate load in N

Area of cross section

Table II: Compressive Strength of cement mortar cylinder

DAYS	SEA WATER		NORMAL WATER	
	WITHOUT FIBER	WITH FIBER	WITHOUT FIBER	WITH FIBER
7	19.55	22.066	21.45	24.24
14	29.54	31.21	30.65	35.25
28	43.47	44.59	45.14	47.37

GRAPH:



6. CONCLUSION

Based on the conducted experiment and according to the result obtained, it can be concluded that The glass fiber has to increase the compressive strength, to compare the conventional concrete. Cylinder Specimens wrapped with glass fiber has higher compressive strength than the specimens wrapped with GFRP wrapping. The fibers along the circumference of the specimens have higher compressive strength than the orientation of the fiber along the length of the specimens for both CFRP and GFRP wrapping.

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