A study on application of Glass Fibre Reinforced Concrete

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Abstract Glass-fibre ferroconcrete (GFRC) may be a material made from a cementatious matrix composed of cement, sand, water and admixtures, during which short length glass fibres(25-50mm) are dispersed. it's been widely utilized in the development industry for non-structural elements, like façade panels and channels. GRC offers many advantages, like being lightweight, fire resistance, good appearance and strength. during this study trial tests for concrete with optical fiber and without optical fiber are conducted to point the differences in compressive strength and flexural strength by using cubes of varying sizes. Various applications of GFRC shown within the study. Architecture designing, engineering work like façade panel, channels etc

Keywords – Galss Fibre, RCC, GFRC, Construction

1. INTRODUCTION

Glass Fiber ferroconcrete (GFRC) may be a sort of fiber ferroconcrete . optical fiber concretes are mainly utilized in exterior building façade panels and as architectural precast concrete. This material is extremely good in making shapes on the front of any building and it's less dense than steel.

GFRC may be a sort of concrete that uses fine sand, cement, polymer (usually an acrylic polymer), water, and alkali-resistant glass fibers. Many mix designs are freely available on various websites, but all share similarities in ingredient proportions.

Glass fibre reinforced cementitious composites are developed mainly for the assembly of thin sheet components, with a paste or mortar matrix, and 6% fibre content by weight of concrete Other applications are considered, either by making reinforcing bars with continuous glass fibres joined together and impregnated with plastics, or by making similar short, rigid units, impregnated with epoxy, to be dispersed within the concrete during mixing.

2.FINDING FROM LITERATURE REVIEW

There are some points found out from above review:

1. **Majumdar, A.J. (1974)** Glass fibres lose a proportion of their pristine strength when placed during a hydraulic cement environment. AR fibres have a superior performance to other types, and are likely to retain future tensile strengths of about 1000-1200 N/mm2 at ambient temperatures during a cement environment .

2. **Kene, vairagade, sathawane et all (2012)** conducted experimental study on behavior of steel and optical fiber ferroconcrete Composites. The study conducted on Fiber ferroconcrete with steel fibers of 0% and 0.5% volume fraction and alkali resistant glass fibers containing 0% and 25% by weight of cement of 12mm cut length, compared the result

3. **Murthy, sharda, jain et all (2012)** studied performance of optical fiber ferroconcrete . The study revealed that the utilization of optical fiber in concrete only improves the properties of concrete and alittle cut but also provide easy outlet to dispose the glass as environmental waste from the industry. From the study it might be revealed that the flexural strength of the beam with 1.5% optical fiber shows almost 30% increases within the strength he studied aspect of optical fiber ferroconcrete . The study had revealed that the rise in compressive strength, flexural strength, split lastingness for M20 and M40 grade of concrete at 3,7 and 28 days were observed to be 20% to 30% and 25% to 30%

4 **Alan J. Brookes(2002)**Cement, when reinforced with glass fibre, produces precast elements much thinner— typically 10 mm— than would be possible with traditional steel-reinforced precast concrete, where 30mm or more concrete cover to the steel is essential as protection against corrosion. Thinner sections also are made possible by the low water: cement ratio of the fabric , the shortage of coarse aggregate, and its low permeability.

5 **Rao, mouli,s ekhar at all (2012)** conducted durability studies on glass fiber reinforced concrete. The alkali resistant glass fiber were used to find out workability, resistance of concrete due to acid, sulphate and rapid chloride permeability test of M20 M30 and M50 grade of glass fiber reinforced concrete and ordinary concrete. The durability of concrete was increased by adding alkali resistant glass fiber in the concrete

6 **Shah, Daniel, Ludirdja, (1987)** Special methods are suggested to scale back the sensitivity to poor and non uniform water curing. The addition of polymer latex has been reported to be effective in eliminating the adverse effects of lack of water curing. It has been suggested that for AR- GRC, the addition of fifty polymer solids by volume, with none moist curing, may replace the recommended practice of seven days curing in a composite without the polymer .

7 **Balaguru and Shah(1992)** We absorb tests value on GFRC by our study have shown good resistance for fire, since the major use of GFRCs is for architectural building panels. In these buildings, fire resistance becomes a crucial think about design .

8 **Tuli , Garg(2016)** Due to acid resisting property, it can be used for blast resisting structures, dams, hydraulic structures

9 **Tuli , Garg(2016)** GFRC should not be mixed more than one minute in concrete otherwise it will break into tiny pieces and can't be worked with 5.76% higher strength than reference concrete. Similarly, the very best flexural strength was observed in mixes with 1.5% of volume of fibre and located to be 72.5% quite reference concrete .

3.OBJECTIVES OF THE STUDY

the study, the following objectives are envisaged:

(i) The main objective of GFRC is to increase tensile Strength in concrete. Normal concrete has low tensile Strength than use glass fibre reinforcement and increase tensile strength.

(ii) Understand the various applications involving GFRC.

(iii) Applications in involving façade panels ,channels etc.

(iv) Reduce dry shrinkage in concrete

4 METHODOLOGY OF THE STUDY

Mix Design Of mortar Ratio of cement :sand

:: 1:2 Batching Up Of Materials

Concrete mix for 1m^3

For spray up method

Then fibre used 5% of total material by weight

Cement water ratio is a 0.45

material weight

1. Cement -606.48 kg
2. Sand -1617 kg
3. a -glass fibre- 95 kg
4 .Acrylic emlusion polymer- 13.65 lit.
5. water -260 lit.

4.1 casting of GFRC

There are two main production techniques of GFRC, usually preferred as spray–up and pre–mix. In the spray–up process, the mortar is produced separately from the fibres, which are mixed only at the jet of the applicator . The glass fibre strands are cut within the spray gun to the required size, usually being between 25 mm and 50 mm and are about 4–5 % of the total mixture weight. Using matrix without fibres, a skinny coat is made as thin as possible by spraying.

Next layers of matrix with fibres are quickly applied to make sure integrity. After the majority of the GFRC is built–up thereon in layers the mixture is provided to toughen. Covering layer is typically 3–5
mm thick, counting on the sort of surface treatment. Each pass of the spray gun deposits a layer approximately 4–6 mm in thickness, however, has to be carefully an adequate thickness in corners and complex shapes.

. Finally, the structure compacted with a cylindrical roller or a float so on the impregnation of the fibres within the mortar and therefore the removal of the air retained within the mixture. Using a depth gage or a template, thickness of layer is checked within the specification for GFRC being the minimum (figure 1)

In the GFRC production method by pre– mixture and casting, cement matrix is firstly produced and pre–cut glass fibers, between 2–4 % (usually 3.5 %) weight, are then mixed. The length of the pre– cut fiber is usually 8–15 mm, however, longer fibers lead to restrict to the mixture workability. Respectively, the matrix is produced during a high–shear mixer and chopped fiber strands are incorporated during a low–speed mixing regime due to maximum workability. This facilitates their dispersion at the very best practical volume content with a minimum damage to the fibers. Production with pre–mix GFRC may involve several procedures like injection and vibration, pressing, or shotcreting (Figure 2)

figure:-1 spray-up method

figure:- 2 premixed and casting process

Curing

Curing stage is not essentially different from that in normal concrete technology. Moreover, the GFRC product is way more sensitive to the deleterious effects of improper water curing. Higher area and thus the low thickness of the GFRC can cause increased drying and reductions in its strength. thanks to the polymer content, future moist curing is typically unnecessary. Small amounts(5% by weight of total solid) of acrylic polymers within the fresh mixture keep the inside moisture in and stop its loss by evaporation. Sudden and rapid drying–out or large temperature changes must be avoided to make sure that the GFRC reaches adequate strength for the element to be safely faraway from a mould. Generally, GFRC pieces are stripped subsequent day, mostly 16 and 24 hours after casting. Longer curing will always yield better concrete, but the general tendency is strip soon after casting5 Mechanical Properties of GFRC

5.1 Compressive Strength

The compressive strength of concrete has been increased with the addition of fibres , however further addition of fibre indicated a gradual decrease in strength aspects.

5.2 Modulus of Elasticity

In heterogeneous and multiphase materials like concrete, the density and thus the characteristics of the transition zone determine the coefficient of elasticity behaviour of the composite. The experimental test results exhibit that the utilization of fibres has no important influence on the modulus of elasticity of concrete. it had been reported that mostly slightly reduction within the modulus of elasticity of the concrete at a coffee optical fiber content.

5.3 Stress–Strain

Curve Stress-strain behaviour is affected from different parameters just like the effect of fibre lengths, aggregate type and effect of loading rate. because it's given in Figure 3, GFRC features a big impact on the ascending portion of the stress–strain curve and additionally, descending a neighborhood of the stress– strain curve may be a crucial key element under compression loads .

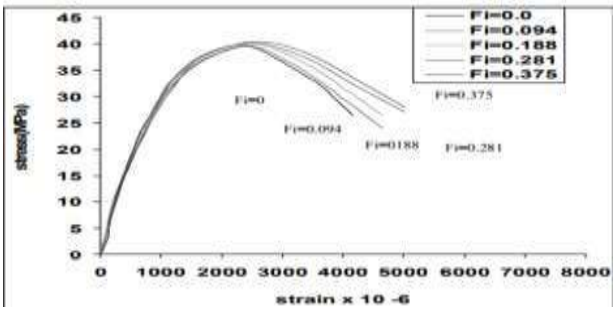

Figure 3. Stress–Strain diagram with differences at fibre ratios

5.4 Flexural Strength

Glass fibres have an effect on the increase in the flexural strength of concrete. Figure 4 presents that an increase in the fibre content (but not much increase) resulted in an increase in the flexural strength of concrete, compared to plain concrete specimen. The fibres resist the propagation of cracks and have a tendency to scale back the sudden failure of structure of concrete then they cause a rise within the load carrying capacity of concrete .

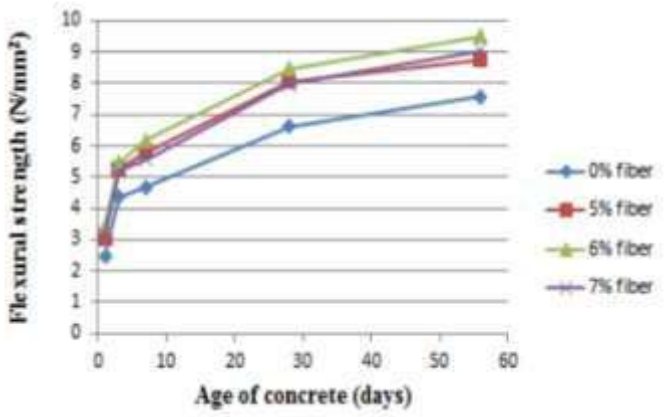

Figure:-4 Variation of flexural strength with the age of concrete

CONCLUSION ➢

The efficient utilisation of a fiber involve improved static and dynamic properties life tensile strength impact strength flexural strength. We already know that concrete is a brittle material and strong in compression and weak in tension. To resolve the problem we use GFRC as a new technology in construction industry. While to improve the durability from the aspect of acid attract on concrete the use of AR glass fiber had shown good result And improve flexural strength . GFRC is a good concrete form a new technology for contruction work in architecture work and designing purpose

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