

Critical Review on Effect of Glass Wool Fibre In Concrete

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Abstract – Glass fiber has used over many years in many construction elements, mostly non constructional ones, like facade panels, piping for sanitation, decorative non recoverable form work. Concrete is one of the best durable building materials. It provides high fire resistance compared with wooden construction and gains strength over time. Structures made of concrete can have a long life. Concrete is used more than any other manmade material in the world Concrete, has relatively high compressive strength, but much lower tensile strength. Concrete has a too low coefficient of thermal expansion and shrinks when it matures. All concrete structures has fine crack to some extent, due to shrinkage and tension. Glass Wool Fiber concrete (GWFC) consists basically of a matrix composed of cement, sand, water, and admixtures, in which Glass Wool Fibers are dispersed. The effect of the fibers in this composite leads to an increase in the compression and tension strength of the material. Glass Wool Fiber, however, was invented in 1938 by Russell Games Slater of Owens-Corning as a material to be used as insulation. It is marketed under the trade name Fiberglass, which has become a generalized trademark. It is a material made from very fine fibers of glass. Fiberglass is a lightweight, highly strong, and robust material.

Keywords- Glass fiber, compressive strength, flexural strength, alkali resistant

I- INTRODUCTION

Concrete has manifested an integral part of our life's as it can be witnessed anywhere around us. Concrete is a building material which is rich in diversity and availability. Reinforced concrete is used in areas where a demand of high tensile strength is required along with precast concrete which can easily create in any form according to the demand. Large and heavy structures like dams, bridges, tunnels are completed to withstand for

longer time period by the involvement of concrete. Concrete for now has ever been involved with many other building materials in order to enhance its properties such is the Glass Fibre Reinforced Concrete. Fundamentally, GFRC is a fibre based concrete in which fibre are uniformly distributed and partially oriented along with other material such as cement, aggregates, sand, water, fly ash, etc. These fibre reinforce the concrete internally. The length of glass fibre may vary depending upon their requirement for the specific objective. They may be applied either by spraying or by pouring. GFRC is significantly used in building countertops, construction or renovation of exterior facades of building, drainage works, architectural works such as cladding etc.

The usage of glass fiber in concrete is increased in last decade for the purpose of the strengthening of concrete. Various studies have been carried over in last decade in all aspect of the strength. Usually concrete has the good compressive strength and bad in tension. This problem is overcome by using the glass fiber in concrete. The strength condition is based on the proposition of the fiber used in the concrete and the aspect ratio of the fiber. The aspect ratio of the fiber is depended on the diameter and length of the fibre.

Practiced where there is a weakness of concrete such as less durability, high shrinkage cracking, etc. Concrete has some deficiencies such as low tensile strength, low post cracking capacity, and brittleness, highly porous, susceptible to chemical and environmental attack. The above deficiencies of plain concrete are overcome in the new materials which have unique characteristics, which make them highly susceptible to any environment. Fiber Reinforced concrete is one of them and relatively a new composite material in which concrete is reinforced with short discrete (length up to 35 mm), uniformly distributed fibers so that it will improve many Engineering properties such as flexural strength, shear

strength and resistance to fatigue, impact and eliminate temperature and shrinkage cracks. Fibers lengths up to 35 mm are used in spray applications and 25 mm length premix applications. Glass fiber has high tensile strength (2-4 GPa) and elastic modulus (70-80 GPa), brittle stress-strain characteristics (2.5-4.8 % elongation at break) and low creep at room temperature. Glass fibers are usually round and straight with diameters of 0.005 to 0.015 mm. They can be bundled with bundle diameter of 1.3 mm.

Glass Wool Fiber concrete (GWFC) consists basically of a matrix composed of cement, sand, water, and admixtures, in which Glass Wool Fibers are dispersed. The effect of the fibers in this composite leads to an increase in the compression and tension strength of the material. Glass Wool Fiber, however, was invented in 1938 by Russell Games Slater of Owens-Corning as a material to be used as insulation. It is marketed under the trade name Fiberglass, which has become a generalized trademark. It is a material made from very fine fibers of glass. Fiberglass is a lightweight, highly strong, and robust material. Although its strength and weight properties are also enough favorable when compared to metals, and it can be easily formed by using molding processes. Glass is the mature, and most well known, performance fiber. In the study, the following objectives are envisaged:

- i) Study the mix design aspects of the GWFC.
- ii) Understand the various applications involving GWFC
- iii) Compare GWFC with alternatives such as stone, aluminum, wood, glass, steel, marble and granite.
- Iv) Perform laboratory tests that are related to compressive, tensile and flexure by use of Glass wool fiber in the concrete pour.

II-LITERATURE REVIEW

- Gupta et al. (2017) analyzed the effect on compressive and flexural strength of M25 grade of concrete after the addition of alkali resistant glass fibre and observed that the inclusion of the glass fibre into the mixture of concrete replacing the cementitious material did not improve its compressive and flexural strength. However at the age of 28 days, the values of the mix with 2% of glass fibre are comparable to the controlled concrete mix having no glass fibre at all
- An experimentation on the properties of reinforced glass fibre and ground granulated blast furnace slag concrete was carried out by Kumar Shantveerayya and NikkamVikasin (2016) which concluded that the concrete workability increases and decreases in accordance to the inclusion of Ground Granulated Blast Slag and glass fibre. Slump value gets gradually increase up to 45% in 0.33% and 0.67% of glass fibre along with the addition of GGBS and then further decreases. The split tensile strength and compressive strength value of cube exhibit efficacious strength with the addition of GGBS from 0% to 45% in 0.33% of glass fibre and 0% to 30% in 0.67% of glass fibre. However further more addition of GGBS may result in decreasing the value of cubes.
- **Rajendiran . M** and his team investigated that, to increase the compressive strength and tensile strength in concrete we use natural or synthetic fibers. Glass wool is obtained as a by-product from manufacturing of glass in industries. This is considered as a waste and mainly burnt by incineration. Glass wool is mainly used for insulation purpose in refrigerators. Glass wool possess the properties of synthetic fibers thus by adding glass wool to conventional concrete glass wool reinforced concrete is obtained. By this method we can reuse the waste as well as increase the properties of conventional concrete. In this project we have produced glass wool FRC by adding wool of 4%, 5%, and 6% to the weight of cement. The grade of concrete used for investigation is M20.
- **S. H. Alsayed**, et al studied the performance of glass fiber reinforced plastic bars as reinforcing material for concrete structures. The study revealed that the flexural capacity of concrete beams reinforced by GFRP bars can be accurately estimated using Review on the Performance of Glass Fiber Reinforced Concrete 283 the ultimate design theory. The study also revealed that as GFRP bars have low modulus of elasticity, deflection criteria may control the design of intermediate and long beams reinforced with FDRP bars.
- **Yogesh Murthy**, et al studied the performance of Glass Fiber Reinforced Concrete. The study revealed that the use of glass fiber in concrete not only improves the properties of concrete and a small cost cutting but also provide easy outlet to dispose the glass as environmental waste from the industry. From the study it could be revealed that the flexural strength of the beam with 1.5% glass fiber shows almost 30% increase in the strength. The reduction in slump observed with the increase in glass fiber content.
- **Dr. P. Srinivasa Rao**, et al conducted durability studies on glass fiber reinforced concrete. The alkali

resistant glass fibers were used to find out workability, resistance of concrete due to acids, sulphate and rapid chloride permeability test of M30, M40 and M50 grade of glass fiber reinforced concrete and ordinary concrete. The durability of concrete was increased by adding alkali resistant glass fibers in the concrete. The experimental study showed that addition of glass fibers in concrete gives a reduction in bleeding. The addition of glass fibers had shown improvement in the resistance of concrete to the attack of acids.

- **C.SelinRavikumar** (2013), have investigates the strength and fire resistance parameter of the glass fiber concrete. In this work M25 grade of concrete is used. Glass fibre is added with increment of 0.5% (0%, 0.5%, 1%). The concrete is subject for testing at two different ages they are 7 days and 28 days, after the curing the concrete for 28 days in compression test the concrete attains 42.87 Mpa strength when fibre is added for 1% of weight of the cement, in flexural test concrete attains 12.67Mpa and in split tensile test concrete attains 12.67Mpa when compared with the controlled concrete the contemporary concrete attain 72% percentage of more strength the controlled concrete in compression test.
- **T.SaiKiran** have made an experiment on concrete which is added with glass fiber in it. Glass Fibre used in this project is an Alkali Resistance Glass Fibre, which has a specific gravity of 2.68 and in 14 microns diameter. For the experimentation M30 grade of concrete is used in this work with 0.45 W/C Ratio. Glass fiber is added with the concrete in 5%, 6%, 7%, and controlled concrete are also cast. In this work, the author has tested the concrete for compression and flexural test. In this work, the concrete is tested for different ages from 1 to 56 days (1 day, 3 days, 7 days, 28 days, 56 days). After curing for 28 days the concrete.
- **Subramani and Mumtaj** (2015) conducted an experimental investigation Of Partial Replacement of Sand with Glass Fibre which deduces out that the strength of concrete with 10% of glass fibre was higher than compared to that of the conventional mix. The optimum intensity to be sustained for the higher value of strength and durability at 7 days was acquired with sand replacement amount of 10% of glass fibre in variant mixes. The coefficient of permeability of Concrete mix with glass fibre remains negligible and without glass fibre increased significantly. Fibres in the concrete help in depleting the pores, hence creating erratic pore structures

which increase the impermeability of concrete. Cementitious materials fracture energy remarkably increases with the addition of glass fibre.

III- SUMMARY

Thus all works are stated that adding glass fiber in concrete will gain sufficient strength in all aspect of concrete like compression, flexural and tension. In most of the work optimized strength is attained fiber is added 1% weight of the cement to the concrete. And almost 33% of strength is gained than the target compression strength. Then the workability of concrete is increased when the fiber is added to the concrete. In most of the work super plasticizer is not used and in all the work W/C ratio is used between 0.4 to 0.5. and all the base materials are tested according to with the relevant IS Codes.

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