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Experimental Study on Glass Fibre Reinforced Concrete

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ABSTRACT

Glass fibres make it possible to create very thin parts with high tensile strength. Concrete is the most important and used development material and its ingredients get easily. The development has brought the necessary need for both chemicals and minerals to improve the quality of concrete. The admixtures like fly ash, and coconut fibre are used so far. Hence an attempt has been made in the present investigation to study the behaviour of glass fibre in concrete. The present running in concrete technology is towards increasing the strength and durability of concrete to meet the demands of modern construction. The influence of glass fibre in concrete is the primary goal of the investigation. High tensile strength and fire resistance in glass fibre help to minimise damage during fire incidents. The addition of these fibres into concrete can increase the compressive strength and tensile strength of the concrete. In this study,concrete was tested with glass fibre added as 0.5%, 1%, 2%, and 3% of the cement mix.

Keywords:Glass fibre, Admixture, Reinforcement, Compressive Strength, Tensile Strength, Concrete.

1. Introduction

For more than 40 years, the building industry has benefited greatly from the economics, technology, and aesthetics provided by glass fibre reinforced concrete (GFRC), material. One of the most adaptable building materials for architects and engineers is GFRC. It has complex properties due to its special composition compared to conventional concreteThe precision of the manufacturing technique is impacted by several factors, including the water-cement ratio, porosity, composite density, inter-filler content, fibre content, orientation and length, type of cure. These factors also have an impact on the characteristics and behaviour of the GFRC.

The development of these small cracks causes elastic deformation of concrete. The addition of fibre in the plain concrete will control the cracking due to shrinkage and also reduce the bleeding of water. As Civil Engineers, we must be able to analysis and design component parts of Building like Beam, Column, Slab, etc.(Giri et al., 2023)

Fibres aid in enhancing pre-crack tensile strength, fatigue strength, impact strength, and post-peak ductility performance as well as reducing temperature. In order to prevent corrosion in civil constructions, GFRC is employed.Glass fibre is offered in both continuous and cut lengths. One of the most often utilised building materials is concrete.It is usually associated with Portland cement as the main ingredient for making concrete. Ordinary Portland cement (OPC) is traditionally used as the primary binder for the production of concrete. Portland cement production currently exceeds 2.6 billion tons per year worldwide and is growing at 5 percent annually. 5 to 8 % of all man-made atmospheric carbondioxide worldwide comes from the concrete industry. Glass fibres are used to control cracks due to plastic shrinkage. As new fibre types and FRC manufacturing methods are created, new application areas become possible.

Objective

- Study the mixed design feature of GRC.
- Recognize the various applications associated with GRC.
- Explore GRC with preferences through stone, glass, wood, steel, marble and granite.
- Perform laboratory tests that are related to compressive, tensile and flexure by use of glass fibre in the concrete pour.
- Use glass fibre reinforced concrete with Portland cement and minimize the use of Portland cement to the maximum.

2. Literature Survey

1. **Kavita Kene**et.al performed an experimental look at on conduct of metallic and Glass Fibre Reinforced Concrete Composites. The study was conducted on fibre-reinforced concrete with steel fibre of 0% and 0.5% quantity fraction and alkali-resistant glass fibres containing 0% and 25% through the weight of cement of 12 mm reduce the length, in comparison the result.(Kene, 2012)

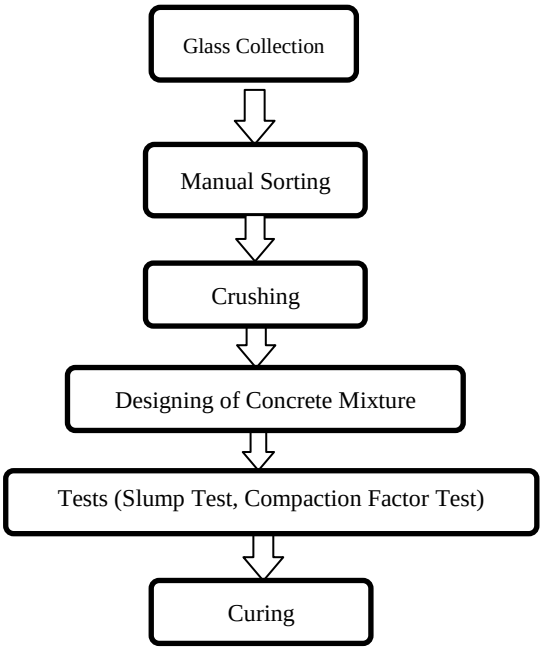
2. **G. Jyothi Kumar e**t al studied the behaviour of concrete beams reinforced with glass fibre-reinforced polymer flats and found that beams with silica-lined Glass fibre-bolstered polymer (GFRP) apartments shear reinforcement show off pretty precise ductility. The energy of the composites, apartments or bars relies upon the fibre orientation and fibre-to-matrix ratio at the same time as better the fibre content material and better tensile strength.(G. Jyothi Kumari, P. Jagannadha Rao, 2013)

3. **Dr. P. Srinivasa Rao**et.al performed sturdiness research on glass fibre-strengthened concrete. Alkali-resistant glass fibres have been used to compare glass fiber-enhanced concrete of grades M30, M40, and M50 to unenhanced concrete in terms of workability and resistance to acids, sulphate, and rapid chloride permeability. The experimental examination confirmed that the addition of glass fibres had proven development withinside the resistance of concrete to the assault of acids.(P. Srinivasa Rao, 2012)

4. **S. H. Alsayed et al.** investigated the general performance of plastic bars reinforced with glass fibre in concrete constructions. The observation discovered that the flexural potential of concrete beams bolstered via way of means of GFRP bars may be correctly expected through the use of the closing layout theory. They take a look at additionally discovered that as GFRP bars have a low modulus of elasticity, deflection standards may also manipulate the layout of intermediate and lengthy beams strengthened with FDRP bars.(S. Alsayed, 2001)

5. **Avinash Gornale**et.al studied the electricity element of glass fibre-strengthened concrete. The observer found that the inclusion of glass fibre increased the compressive energy, flexural energy, and break up tensile energy for M20, M30, and M40 grade concrete at 3, 7 and 28 days by 20% to 30% and 25% to 30%, respectively, in comparison to plain concrete.(Gornale et al., 2012)

3. Methodology



The methodology of the project deals with the series of operations performed for the completion of the project. For ease the project was divided into two Phases as stated:
I- (Material testing): It involves material testing for checking the suitability of the material as a construction material.The entire test was conducted on processed samples to get desired output.
II-(Cube Testing): It involves a series of operations including material sorting, processing, batching, mixing, shuttering, curing and testing under standard conditions. (Bhashakhetre et al., 2017a)

Collection of Material

1 Glass Collection:

The glass waste for recycling was collected around the city from our college campus waste and canteen waste etc. Different types of glass are used.

Fig No. 1: Showing glass bottles for collection

2 Manual Sorting:

Each glass waste type was type separated from other each other and unwanted materials was removed from the waste. like in waste glass bottles, the plastic normally attached to the skin of bottles and the bottle caps were removed.

3 Washing: After being cleaned, the chips were stripped of glue, paper labels, dirt, and several other traces of the substance they originally held.

4Crushing:

The various glass waste sorted was then crushed into smaller pieces.

5 Designing ofConcrete:

Materials

i) Cement

Pozzolana Portland cement is used in the project work, as it is easily available in the local market. Tested for different proportions as per cement used in the project work.

IS: 4031-1988 and determined to be compliant with a number of IS: 1489-1991requirements.

ii) Coarse Aggregate

Crushed annular granite from a local source was used as the coarse aggregate. The specific gravity was 2.7, and the coarse aggregate used in the project work of 60% of 20mm aggregate and 40% of 10mm aggregate.The tests are conducted as per IS codes on Aggregate various tests are conducted such as Specific Gravity test,Water Absorption test, Impact test, Crushing Value Test and Abrasion test.(Bhashakhetre et al., 2017b)

Fig No. 2: Aggregate

iii) Fine Aggregate

local river sand that complies with IS: 383-1970's grading zone 2. Locally available clean and dry river sand will be used. Sand passing IS 4.75mm sieve shall be used for casting all the samples.

Fig No. 3: Fine Aggregate

iv) Glass Fibre

It is a material made of very fine fibres of glass. It is a lightweight, extremely strong and sturdy material. There are distinctive sorts of fibre however in these, we have taken E-glass fibre to show better resistance and very good insulation to electricity.

5 Curing:

Curing is the method of retaining the best temperature and moisture conditions in concrete for a long period for hydration to develop the desired

concrete properties. Concrete's capacity energy and sturdiness might be advanced and most effective if the concrete is well cured.

6 Tests :

Compressive Strength:

Compressive strength tests were performed using a compression testing machine on cube samples of various gradesof concrete. Three samples in step with batch have been examined with the common electricity values suggested in this paper. As the proportion of glass fibre to the volume of concrete rises, the compressive strength of GFRC at 7 days, 14 days, and 28 days shows a rising trend.

The property of any composite material is highly influenced by the characteristics of its component. Thus the properties of the component are tested for various parameters such as Durability, Hardness, Porosity, Water absorption capacity, Impact resistance, gradual load resistance, Gradation and other such parameters. The basic elements of construction and testing of the cubes for specific readings can be obtained only if the results of quality checks are nearby the standard range. (Bhashakhetre et al., 2017)(Tajne , Gayatri; Shende, Shreyas ;Marve, 2022)

4. Conclusion

One of the most adaptable building materials for architects and engineers is GFRC.It has contributed significantly to the economics, technology and aesthetics of the construction industry. In line with this importance, a comprehensive review examining the comprehensive methods of producing GFRCs and the optimization of the developing technology was undertaken by understanding the mechanical and physical properties of GFRC.

i) Though the initial cost is high the overall cost is greatly reduced because of the good properties of fibre-reinforced concrete.

ii) The surface hardness of glass fibre-reinforced concrete is lower than that of steel fibre-reinforced concrete, which is rated as a good layer.

iii) Easily available glass waste.

REFERENCES

Bhashakhetre, C. S., Chalkhure, A. N., Marve, S. R., & Wadhai, N. T. (2017a). Partial Replacement of Course and Fine Aggregate By Plastic Waste and Bed Ash. *International Research Journal of Engineering and Technology(IRJET)*, *4*(6), 914–918. https://irjet.net/archives/V4/i6/IRJET-V4I6171.pdf

Bhashakhetre, C. S., Chalkhure, A. N., Marve, S. R., & Wadhai, N. T. (2017b). Plastic Waste Prevention System Analysis & Application. *International Journal of Innovative Research in Science, Engineering and Technology*, *6*(7), 12625–12631. https://doi.org/10.15680/IJIRSET.2017.0607023

G. Jyothi Kumari, P. Jagannadha Rao, M. V. S. R. (2013). Behaviour of Concrete Beams Reinforced With Glass Fibre Reinforced Polymer Flats. *International Journal of Research in Engineering and Technology*, *02*(09), 202–208. https://doi.org/10.15623/ijret.2013.0209030

Giri, R., Khan, A., Shende, S. R., Khanke, S. A., & Shradhesh, R. (2023). *A Review on Analysis and Design of Multistorey Hospital Building (G + 4) International Journal of Research Publication and Reviews A Review on Analysis and Design of Multistorey Hospital Building*. *March*. https://doi.org/10.55248/gengpi.2023.4.34359

Gornale, A., Ibrahim Quadri, S., Mehmood Quadri, S., Md Akram Ali, S., & Shamsuddin Hussaini, S. (2012). Strength Aspects of Glass Fibre Reinforced Concrete. *International Journal of Scientific & Engineering Research*, *3*(7), 3–7.

Kene, K. S. (2012). Experimental Study on Behavior of Steel and Glass Fiber Reinforced Concrete Composites. *Bonfring International Journal of Industrial Engineering and Management Science*, *2*(4), 125–130. https://doi.org/10.9756/bijiems.1617

Tajne , Gayatri; Shende, Shreyas ;Marve, S. R. (2022). A Review on Manufacturing Process and Techniques of Hume Concrete. *International Journal of Research Publication and Reviews*, *04*(01), 1806–1812. https://doi.org/10.55248/gengpi.2023.4149

Dr. Srinivasa Rao, B Chandra Mouli K. and C Dr. T. Seshadri Sekhar (2012), Durability studies on Glass Fiber Reinforced Concrete, *International Journal of civil engineering science*, vol.1, no-1-2.

S. H Alsayed, B Y.A. Al-Salloum and C T. H. Almusallam (2001), Performance of glass fiber reinforced plastic bars as a reinforcing material for concrete structures, *Journal of Science and Technology.*