

BEHAVIOUR OF REINFORCED CONCRETE MADE OF GLASS FIBRES

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ABSTRACT

It is evident that the concrete becomes much stronger over time since the strength in compression after 7 days is about 65% of the strength after 28 days. A larger fibre content is associated with a discernible increase in compressive strength. This implies that adding fibres improves the concrete's mechanical qualities. In both the 7-day and 28-day tests, the fibre content of 1.5% yields the greatest compressive strength, suggesting that this is the ideal fibre level for increasing strength. Adding fibres to the sample leads to a significant 16% increase in its compressive strength when compared to the sample without any fibres.

Keywords: Reinforced concrete, fibres, strength, ductility.

INTRODUCTION

For various years reinforced concrete (RC) has been an essential structural material because of its exceptional structural qualities and adaptability. But the search for materials with improved durability and mechanical qualities has prompted researchers to investigate novel composites. One such composite that is gaining popularity is glass fiber-reinforced concrete.

GFRC offers possible gains in strength, ductility, and durability by fusing the advantages of conventional reinforced concrete with the special qualities of glass fibres. Glass fibre integration into concrete matrices offers a way to solve problems with conventional reinforced concrete constructions, like corrosion, shrinkage, and cracking.

The goal of this investigation is to examine the Action of GFRC, specifically focusing on its durability and mechanical presentation. This study goals to shed light on the optimization of GFRC mixtures for structural applications by methodically examining the effects of several parameters, including as fibre content, aspect ratio, and distribution.

Furthermore, a detailed analysis of GFRC's durability features, including its capacity to withstand environmental stresses including moisture intrusion, chemical erosion, and temperature changes, will be conducted. Evaluate GFRC's long-term Action under various exposure scenarios to determine whether it is suitable for resilient and sustainable infrastructure.

Literature review

The significant prized characteristics of concrete are its durability and longevity. They are associated with the cement paste that is hydrated and the internal structure of concrete. These have a direct connection to other concrete properties including strain, stress, and elasticity. Reinforcing concrete

further enhances these strength attributes. Because fibre reinforced concrete is so versatile in its production processes, it may be a useful and reasonably priced building material. Understand the relationship among stress strain and adaptability, which is a feature of concrete as this is the area where the most cement is used. This will provide information on how to prevent the significant from occurring inadvertently.

An investigation was conducted to examine the impact of alkali resistance glass fibre reinforcement on the temperature, bending rigidity, ductility, confined shrinking bursting, and split tolerance of flexible concrete. The researchers used fibres of glass with a total mass portion of 3 percent to carry out the study. The authors proved the efficacy of alkali resistant glass fibres in reducing restricted shrinking cracks in lightweight concrete. A decrease in fracturing widths is another effect of the fibers' stimulation of repeated crack. The fibres considerably enhance the concrete's qualities at 0.25 percent volume fraction. The investigational research by means of non-destructive testing (NDT) techniques showed that UPV (UPV), compressive strength, and stress relaxation Action (SRH) were strongly correlated. While the UPV gives accuracy within $\pm 20\%$, the SRH offers a precision level between ± 15 and $\pm 20\%$. The "UPV technique" is a great instrument for figuring out how homogenous the concrete is. The range of accuracy attained was between 15 and $\pm 20\%$.

The study used locally accessible Portland Pozzolana cement especially grade 33 from the local brand, which adheres to the Indian Standards (B.I.S). The cement was subjected to thorough testing to evaluate its different properties in compliance with the IS: 4031 – 1988 criteria. The results verified that it adhered to the specifications given in IS: 1489-1999 Part-1, therefore assuring that it satisfied the necessary

criteria for utilization in the investigate on the presentation of reinforced concrete composed of glass fibres. For study purpose the fine aggregates are obtained from a local source and comprised of rock dust from zone 2. The material complied with the parameters specified in the IS:2386 and IS:383 standards.

The aggregate consisted of particles with a diameter of 20 mm, in accordance with the IS: 383 requirements.

Water is an essential element of concrete requires careful Deliberation during its production and excellence assessment. The consequence of cement in assisting the hydration process directly influences the development of concrete strength and other desired qualities. In this study, locally available potable water from the concrete laboratory was used for both mixing and curing. It is crucial to guarantee the presence of uncontaminated and appropriate water in order to preserve the quality and effectiveness of the concrete specimens throughout the whole research. The study used an admixture from the brand GREENO LANTER MIX, which consisted of a combination of carefully chosen high molecular weight polycarboxylate ether (PCE) and organic polymer. The company's suggested dose varied between 200ml and 250ml per 50 kg of cement. The primary purpose of this superplasticizer (S.P.) is to augment the fluidity and workability of the concrete mixture.

CONCLUSION AND SCOPE FOR FUTURE STUDY

The results of the investigational study approved out in Part 6 consistently show that increasing fibre content enhances the toughened characteristics of GFRC. It is evident from a thorough examination of many graphs and tables that improvements in the mechanical properties of GFRC are positively correlated with an increase in fibre content.

Glass fibre reinforced concrete (GFRC) has a much higher compressive strength as a result of the fibre content added. After seven days and twenty-eight days, respectively, it was discovered that the 1.5% fibre specimen's compressive strength was 16.18% and 16.23% more than that of the 0% fibre specimen under control.

- Fibre incorporation increases flexural strength and decreases the need for steel reinforcement to achieve the same strength. Because less steel is used, this leads to cost savings.
- As fibre content rises, flexural strength also increases,

peaking at 1.5%. After seven days and twenty-eight days, the flexural strength was found to be 36.27% and 42.89% greater than that of the controlled specimen with 0% fibre content.

- The failure mode is mostly brittle, as the flexural strength test makes clear. A greater proportion of fibres could be required to cause ductile failure.
- By addressing the concrete's inherent weakness under tension, the adding of glass fibre rises the material's stretchable strength.
- The inclusion of fibre greatly raises the split tensile strength of GFRC; after 7 and 28 days respectively increases are 41.22% and 38.15% more than the controlled sample with 0% fibre content; an ideal fibre content is 1.5%.
- According to the investigation's findings, 1.5% fibre content is ideal for better qualities across the board. Rebound Hammer testing and other non-destructive tests show strong connection with destructive compressive strength tests, with an accuracy of within $\pm 25\%$, according to IS: 13311 (Part 2)– 1992.
- Rebound hammer evaluations rise with age, which corresponds to the gradual hardening of concrete.
- According to the findings of the UPV test, increased fibre content is correlated with an increase in pulse velocity, which is related to the concrete quality rating. A significant proportion of the specimens exhibited high quality, with a few even qualifying as exceptional.
- Age-related velocity increases are negligible.
- To properly evaluate the quality of concrete, both non-destructive tests must be used.

REFERENCES

1. Faiz A. Mirza a, Parviz Soroushian, 'Effects of alkali-resistant glass fiber reinforcement on crack and temperature resistance of lightweight concrete'. Cement & Concrete Composites 24 (2002) 223–227.
2. Sanjay Kumar and M M Prasad, 'Flexural Behavior of Short Steel Fiber Reinforced Concrete Beams'. Seventh Intl. RILEM Symposium on Fiber Reinforced Concrete Design and Applications, BEFIB-2008, Chennai, India. 2008. PP. 209-217.
3. Yeol Choia, Robert L. Yuanb, 'Experimental relationship between splitting tensile strength and compressive strength of GFRC and PFRC'. Cement and Concrete Research, 35, (2005), PP. 1587– 1591.

4. Yuwaraj M. Ghugal and Santosh B. Deshmukh, 'Performance of Alkali-resistant Glass Fiber Reinforced Concrete'. Journal of Reinforced Plastics and Composites, vol. 25, No. 6, 2006, PP. 617-630.
5. K.Holschemacher, T. Mueller, Y. Ribakov, 'Effect of steel fibres on mechanical properties of high-strength concrete'. Materials and Design, 31, (2010), PP. 2604–2615.
6. M. J. Roth, C. D. Eamon, T. R. Slawson, T. D. Tonyan, A. Dubey, 'Ultra High Strength Glass Fiber Reinforced Concrete Mechanical Behavior and Numerical Modeling'. ACI Materials Journal, V. 107, No. 2, March-April 2010. PP 185-194
7. Byung Wan Jo, Young Hyun Shen, Young Jim Kim, 'The Evaluation of Elastic Modulus for Steel Fiber Reinforced Concrete'.
8. Jain Akash, Kathuria Ankit 'Combined Use of Non-Destructive Tests for Assessment of Strength of Concrete in Structure'.
9. Hamidian Mohammadreza, Ali Shariati 'Application of Schmidt rebound hammer and UPV techniques for structural health monitoring'
10. Qasrawi Hisham Y Concrete strength by combined non destructive methods Simply and reliably predicted.
11. 11. I.S. 383-1970, 'Specification for coarse and fine aggregate from natural sources for concrete'. BIS
12. I.S. 456-2000, 'Code of practice of plain and reinforced concrete'. BIS.
13. I.S. 516-1959, 'Method of test for strength of concrete', BIS.
14. I.S. 2386 (Part 1) 1963 'Methods of test for Aggregates for Concrete, Part 1 Particle Size and Shape', BIS.
15. I.S. 6461 (Part 7) 1973 'Mixing, laying, compaction, curing and other construction aspects', BIS.
16. I.S. 7246 1974 'Recommendations for use of table vibrators for consolidating concrete', BIS.
17. I.S. 13311(Part 1)-1992 'non-destructive testing of concrete-methods of test Part 1- UPV test'
18. I.S. 13311(Part2)-1992 'non-destructive testing of concrete-methods of test Part 2- Rebound hammer'
19. I.S. 9103-1999, 'Specification for admixtures for concrete'. BIS
20. I.S. 10262-1982, 'Recommend guidelines for concrete mix design'. BIS.
21. I.S. 10262-2009, 'Recommended guidelines for concrete mix design'. BIS.
22. I.S. 12269-1987, 'Specification for 53 grade ordinary Portland cement'. BIS