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Experimental Study on Strength of Concrete using Glass Fiber

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Abstract. Plain concrete retains veritably low tensile strength, limited rigidity and little resistance to cracking. Cracks are innately present in concrete and their poor tensile strength is due to propagation of similar micro-crack filaments when added at certain chance in the concrete to ameliorate the strain parcels as well as crack resistance, to rigidity as flexure strength and durability. Substantly, the studies and exploration of fiber corroborating concrete has been diverted to sword filaments. In recent times, glass filaments have also become available which are free from erosion problems associated with sword filaments. In this design, examination was conducted using glass fiber with concrete. Anti crack, hyperactive dissipation, alkali resistance glass fiber of periphery 14 microns, having an aspect ratio of 857 were employed in probabilities, varying from 0.33 to 1 chance weight in concrete and the parcels of this fiber corroborated concretelike contraction,flexure strength, durability,and tensile strength was studied.

Introduction

Concrete is a structural material which is rich in diversity and vacuity.RFC is used in areas where a demand for high tensile strength is needed, along with precast concrete periods that can be produced in any form according to demand.Large and heavy structure periods, islands, beans, are completed periods for longer period by the involvement of concrete for now has ever been involvement with numerous other structureaccoutrements in order to enhance theits parcels similar as the GFRC.

Types of Fibres

1. Natural fibre
2. Artificial fibre

Natural fibre

Some of the natural fibres include angora fibre, mortal hair, bagasse, bamboo, coire, jute etc. Bagasse Bagasse is the stringy matter that remains after sugarcane is crushed to produce its juice.It's presently used as a biofuel and in the manufacture of pulp.

Literature References

GRFC is a fibre grounded concrete in which fibres are slightly distributed and incompletely acquainted along with other materials similar as cement, summation, beaches,water, fly ash etc. By adding glass fibre it'll increase the compressive strength,tensile strength, resolve tensile strength of the concrete and it'll also reduce the permeability and cracks of the concrete.

Selin Ravikumar and Thandavamoorthy (2004). The study shows a significant increase in the use of fibres in concrete for improving its properties such as tensile strength and ductility. The

fibre concrete is also used in retrofitting existing concrete structures. Among many different types of fibre available today, glass fibre is a recent introduction into the field of concrete technology.

Subramani, Mumtaj (2006), did, in the present investigation, study the behaviour of glass fibres in concrete. In the present investigation, sand has been replaced with glass fibres by 5, 10 and 15% to produce concrete.

Fig. 1- Sample of Glass fiber

Objectives

- To perform the material test for all the materials worn.
- To determine the strong point of glass FRC using compression, split tensile and flexural test.

Types of Fibre Reinforced Concrete (FRC)

- Steel FRC.
- Natural FRC.
- Polypropylene FRC.
- Carbon FRC.
- Glass FRC.

Applications

- In Africa,sisal fibre corroborated concrete has been used considerably for making roof penstock,corrugated waste.
- Pipes,cilos, gas and water tank Elephant lawn fibre corroborated in mortar and cement is being used in Zambia for low-cost house construction.
- While wood and sisal filaments are being used for making cement compound panel filling, soffits and for sound and fire sequestration.

Need For Study

1. It increases the tensile strength of concrete.
2. It reduces air voids and water voids the essential porosity of strength.
3. The addition of small, nearly spaced and slightly dispersed filaments to concrete would act as a crack arrester.
4. It increases the continuity of concrete.
5. Glass has excellent resistance to creep.

Methodology

In this design, our main ideal is to study the influence of partial relief of cement on glass fibre and to compare it with the compressive strength, flexural strength, complete tensile strength of ordinary M30 concrete.

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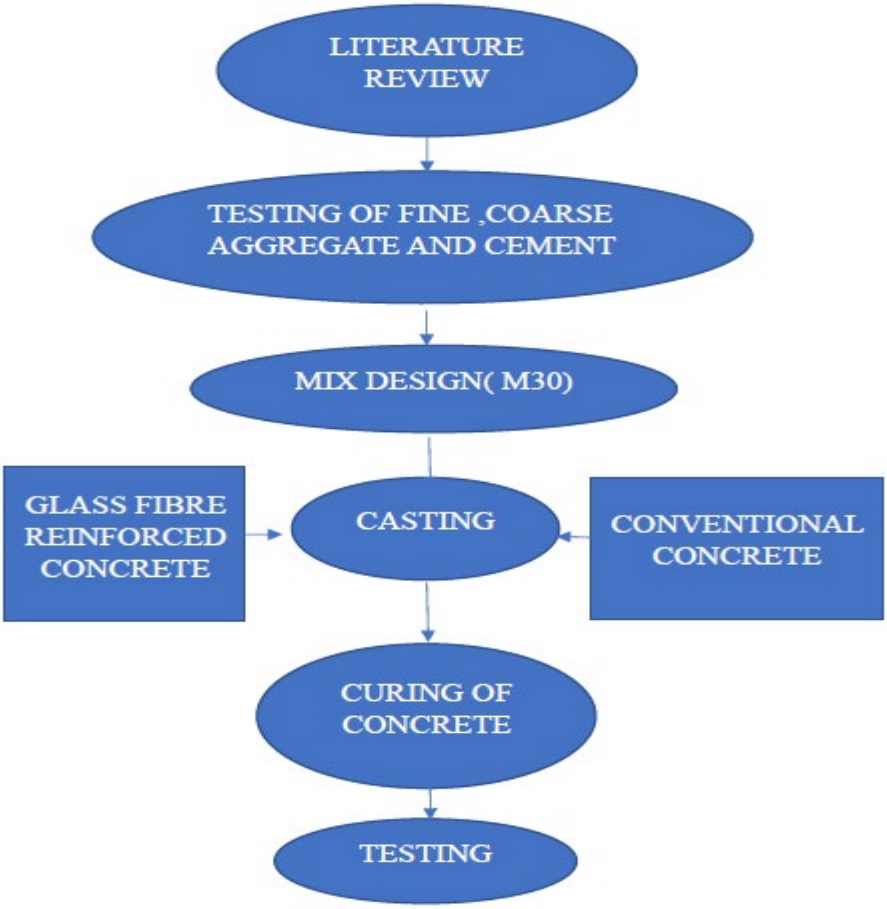

Fig.2 Process flow chart of Glass fibre reinforced concrete

Test on Concrete

a) Compressive Strength Test Cell moulds of 100mm x 100mm x 100mm were used for compressive strength study. Moulds were duly maintained by drawing and slicking before each casting. A wobbling table was used for better contraction and filled in three layers.

Fig 3: Compressive strength on GF Concrete

b) Split Tensile Test Originally, take the wet instance of size 15cm*30cm after 28 days of curing. Also, wipe out water from the face, for instance. After that, insure that they're on the same axial plane.

Fig 4: Split tensile on GF Concrete

c) Flexural Strength Test Flexural strength is the capability of a ray or arbor to repel failure when bending.It's measured by loading-reinforced concrete ray of 500mm x 100mm x 100 mm. Strength value is about 12 to 20 percent of compressive strength.

Fig 5: Flexural strength test

Experimental Investigation

The experimental investigation is divided under 3 headings

I.Compressive strength Test (cube)

Compressive strength for M30 Concrete with various mixed proportions with glass fibre

Table 1: Compressive strength for conventional mixed proportion

Trail	Compressive Load KN	Compressive Strength N/mm^2
1	685	30.30
2	730	32.31
3	705	31.68

II. Split Tensile Test (cylinder)

Split tensile strength for M30 Concrete with various mixed proportions with glass fibre

Table 2: Split tensile strength for conventional mixed proportion

Trail	Tensile Load(KN**)**	Tensile Strength N/mm^2
1	187	2.6
2	206	2.8
3	182	2.5

III. Flexural strength Test (beam)

Flexural strength for M30 concrete with various mixed proportions with glass fiber

Table 3: Flexural Strength for conventional mixed proportion

Trail	Flexure Load KN	Flexure Strength N/mm^2
1	6	2.67
2	8	3.55
3	9	3.8

Conclusion

- GF corroborated concrete is a recent invention in the field of concrete technology. Glass fibre corroborated concrete is a type of concrete which principally corresponds to cementitious matrix composed of cement, beach, coarse total, water, polymerand cocktails in which short-length glass fibres are dispersed. Fibres similar to photography and glass have excellent resistance to creep.

- The addition of small, nearly spaced and slightly dispersed fibres to concrete would act as a crack arrester and would mainly ameliorate its static and dynamic parcels. The mixed design of the M30 grade is adopted. Material testing is done for fine aggregate, coarse aggregate, cement. The mould of the shapes of cube, cylinder and prism is adopted. The concrete mix without any glass fibre is made and casted. Similarly, concrete mix with 0.3% and 0.6% of glass fibre is made and casted in all three moulds.

- After 28 days of curing compression, a split tensile and flexural test is done and their respective values are noted. From the comparison of strength obtained from conventional concrete and glass FRC, it is seen that the use of glass FRC has higher crack resistance and load bearable than conventional concrete.

- For cube, the test results for compression strength are given below: Conventional -31.4 N/mm^2 0.3% Glass Fibre -30.35 N/mm^2 0.6% Glass Fibre -22.4 N/mm^2

- For cylinder cylinders, the test results for split tensile strength are given below: Conventional -2.66 N/mm^2 0.3% Glass Fibre -1.94 N/mm^2 0.6% Glass Fibre -1.96 N/mm^2

- For prism, the test results for flexure strength are given below: Conventional -3.41 N/mm^2 0.3% Glass Fibre -2.8 N/mm^2 0.6% Glass Fibre -2.5 N/mm^2

- From the results obtained, it is observed that the strength obtained for conventional concrete is noted to be higher as the percentage of glass fibre added is less. So it is concluded that for future studies, glass fibre of 3%, 6% and similar percentages has been decided to be used to obtain greater strength from GRC.

References

[1] Chandramouli, Imran (2010), "cladding of buildings", third edition published 2002, pp.82.

[2] Chawala and Tekwari (2012), "Performance of Glass Fibre Reinforced concrete ", International journal of Inovations in engineering and technology (IJIET), volume I Issue 6 pp.264-248.

[3] Gaurav Tuli, Ishan Garg, (2002), 'Why Alkaline resistance Glass Fibre ", IOSR Journal of civil Engineering , volume 13,issue 3

[4] Jyothikumari (2012) "Manufacture of Glass Fibre Reinforced concrete products", Unit 1, Division of YOGI group UAE, August 2008.

[5] Pitrodaet al. (2015), " Effect of Glass Fibre Reinforced in Rigid Pavements", International Journal of scientific Research and education and research and education (IJSAE), Volume 2 Issue 9,,pp.1797-1804.

[6] Ravikumar and Indess, (2013) "Fibre Reinforced Cementitious Composities ", second Edition Thandavamoorthy, "Performance of Glass Fibre Reinforced Self Compacting Concrete", international Journal of Engineering Development and Research (IJEDR)

Volume3 Issue 2, pp.755-760.

[7] Subramani. T , A. Mumtaj (2006), "Fibre Reinforced Cement Composites" , Arnon Bentur and Sidney M, Chapter 8, pp.278

[8] Ahmad, Structural behavior of precast lightweight concrete sandwich panel under eccentric loading: an overview. ,2008

[9] Ahmed Fouad Elragi, (2006) Selected Engineering Properties and application of EPS.

[10] Nahro Radi Husein et al., [2013] An experimental study on using lightweight web sandwich panel as a floor and slab. International journal of Innovative Technology and exploring engineering.2013, (IJITEE)

[11] Poluraju., [2014] Journal of sandwich structures and materials.

[12] TR Greeley - 1997 A Review of Expanded Polystyrene (EPS)Properties, Performance and New Applications.

[13] Karthik Jet al (2014), "Experimental Study on Strength Characterisitics on M20 Concrete with Partial Replacement of Fine Aggregate with Copper Slag" International Journal of Advanced Research.

[14] Binaya Patnaik et al (2014), Strength and Durability Properties of Copper Slag Admixed Concrete" International Journal of Research in Engineering and Technology.

[15] Balamurugan et al (2013) "Use of Quarry Dust to Replacing Sand in Concrete – An Experimental Study" International Journal of Science and Research Publications.