

An Inspective Study on Material Reinforced With Steel-Polypropylene Hybrid Fiber of M30 Grade Material

Atchyutha Reshma Naga Durga

M.TECH in Structural Engineering
Priyadarshini Institute of Technology and
Science

Email id: reshu.kota@gmail.com

K Sangeetha Rao, M.Tech

Assistant professor
Priyadarshini Institute of Technology And
Science

Abstract

Concrete is one of the most widely recognized development material for the most part delivered by utilizing locally accessible ingredients. The present trend in concrete technology is towards increasing the strength and durability of concrete to meet the demands of the modern construction. The main aim of the study is to study the effect of glass fibre and steel fibers in the concrete. FRC has the high tensile strength and fire resistant properties thus reducing the loss of damage during fire accidents. In the present work the strength studies are carried out to compare the glass and steel fiber concrete. The FRC is added 0.5, 1, 2 and 3% are added for M30 grade concrete. Result shows the percentage increase in compressive strength, flexural strength and split tensile strength for 28days.

Keywords: Fiber reinforced concrete, glass fiber, steel fiber and strength studies.

1. Introduction

Concrete is one of the most widely recognized development material for the most part delivered by utilizing locally accessible ingredients. The development of concrete has brought about the essential need for additives both chemical and mineral to improve the

performance of concrete. Hence varieties of admixtures such as fly ash, coconut fibre have been used so far.

Glass fibre has used over 30 years in several construction elements, mainly non constructional ones, like façade panels, piping for sanitation, decorative non recoverable form work and other products. Concrete is one of the most durable building materials. It provides superior fire resistance compared with wooden construction and gains strength over time. Structures made of concrete can have a long service 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 very low coefficient of thermal expansion and shrinks as it matures.

The use of admixtures is mainly to modify the setting and hardening of cement by influencing the rate hydration of cement.

Cite this article as: Atchyutha Reshma Naga Durga & K Sangeetha Rao, "An Inspective Study on Material Reinforced With Steel-Polypropylene Hybrid Fiber Of M30 Grade Material", International Journal & Magazine of Engineering, Technology, Management and Research (IJMETMR), ISSN 2348-4845, Volume 11 Issue 6, June 2024, Page 1-6.

Different types of admixtures are there to reduce the water content by reducing the surface tension of water; other admixtures are used to increase the durability of concrete decrease the thermal cracking. Using of concrete is beneficial because it is Economical, Ambient temperature hardened material, Ability to cast, Energy efficiency, Excellent resistance to water, High temperature resistance, Ability to consume water, Ability to work with reinforcing steel and Less maintenance required.

2. LITERATURE REVIEW

Soulioti et. al, has worked on Effects of Fiber Geometry and Volume Fraction on the Flexural Behavior of Steel-Fiber Reinforced Concrete . The compressive strength, flexural strength were studied and compared with unreinforced concrete. The effect of fiber on workability and air content properties of fresh concrete was also evaluated

Ghosni et. al, has worked on Flexural behaviour of high strength concrete composite incorporating long hooked end steel fibers. In this research long hooked steel fibers have been added to mix and compressive strength, flexural strength of concrete have been found out for 7, 28 and 56 and 14, 28, and 56 days.

Bhawukverma Use of steel fiber reinforced concrete over plane concrete for shotcrete in underground tunnelin. On underground tunnels and his study proved that generally tunnelling requires very strong support and steel fiber reinforced concrete provided much strength when compared to plane concrete.

MohdMuzammilahmed and Mohdmajiduddin Flexural Behavior Ofternary Blended Steel Fiber Reinforced Concrete Beams Using Crimped Fibers has worked on the flexural behavior of beams have improved by adding fibers. The flexural strength of the beam increased nearly by 21.58%. The moment carrying capacity of beams with 0.5% of fiber is 7.16%, 0.75% of fiber is 12.60% and 1.25% is -6.65%. On adding of 1% crimped steel fiber the moment carrying capacity of beam is increased by 21.58%. Specimens with more percentage of fibers shown greater elastic properties.

Raghunath and k.suguna has worked on Flexural behavior of high strength steel fiber reinforced concrete beams by In this study total 4 beams of 3m length and 150mmx250mm in cross section were casted and tested in laboratory. Three different steel fibers volume were taken i.e. 0.5%, 1% and 1.5%. All beams were tested under two point load condition in a loading frame of 750kn capacity.

Avinash.S and Parekar Suresh.R has worked on Steel Fiber Reinforced Concrete Beams under Bending Shear and Torsion without Web Reinforcement. The results for 6 bending, shear and torsion tests on steel fiber reinforced concrete beams without web reinforcement are discussed.

Vikrant s. Valragade and kavita s. Kene has worked on Introduction to steel fiber reinforced concrete on engineering performance of concrete. Steel fiber reinforced concrete is used for long lasting sustainable

concrete structures. All over the world is using steel fiber as fiber reinforced concrete.

Sudheer et. al, has worked on Experimental Investigation on Strength and Durability Properties of Hybrid Fiber Reinforced Concrete. The compressive strength of high fibred reinforced concrete is more when compared to conventional concrete. The increase in compressive strength by addition of 0.5%, 1.0% and 1.5% of fiber is 10.75%, 27.26% and 33.79% respectively. Adding 0.5% of fibers may decrease the tensile strength but 1.5% of fiber gives maximum strength when compared to other proportion.

Shireesha has worked on Experimental studies on steel fiber reinforced concrete. The effects of steel fiber reinforcement in concrete. The design mix of M40 grade was taken and steel fiber of aspect ratio 80 was added. It is observed that the compressive strength increases from 8-21% and 6-12% for 7 and 28 days, Split tensile strength increases from 14-36% and 15-39% for 7 and 28 days. Adding 1.5% of fiber the absorbed energy by specimen was 8 and 10 for 7 days and 28 days.

R.Gowri and M.AngelineMary, this study, the present trend in concrete technology is towards increasing the strength and durability of concrete to meet the demands of the modern construction world at lower cost. These factors can be achieved in concrete by adding natural or synthetic fiber. The strength parameters of concrete such as compressive strength and tensile strength were studied by varying the percentage of fiber from 0.025% to 0.075% of the weight of concrete.

T.Subramani and C.Sumathi the study, Concrete has been used in various structures all over the world since last two decades. Recently a few infrastructure projects have also seen specific application of concrete.

The development of concrete has brought about the essential need for additives both chemical and mineral to improve the performance of concrete. Most of the developments across the work have been supported by continuous improvement of these admixtures.

C. Selin Ravikumar and T.S. Thandavamoorthy, The study there has been a significant increase in the use of fibers in concrete for improving its properties such as tensile strength and ductility. The fiber concrete is also used in retrofitting existing concrete structures. Among many different types of fibers available today, glass fiber is a recent introduction in the field of concrete technology.

Kavita S Kene has studied the Concrete is most widely used construction material in the world. Fiber reinforced concrete (FRC) is a concrete in which small and discontinuous fibers are dispersed uniformly. The fibers used in FRC may be of different materials like steel, G.I., carbon, glass, aramid, asbestos, polypropylene, jute etc.

S. S. Pimplikar conducted an experiment as the Glass-fiber reinforced concrete (GRC) is a material made of a cementitious matrix composed of cement, sand, water and admixtures, in which short length glass fibers are dispersed.

T.Subramani, A.Mumtaj Hence, an attempt has been made in the present investigation to study the behaviour of Glass fibers in Concrete. To attain the set out objectives of the present investigation, sand has been replaced with Glass fibers by 5, 10, and 15 % to produce Concrete.

Eethar Thanon Derwood Investigations were conducted on the development of gypsum plaster used naturally by adding 1% of admixture (Super plasticizer) and reinforcing it with bar chip fibers. Different percentages of bar chip as 0, 0.5, 0.75, 1, 1.25 and 1.5% were used. The compressive and flexural strength of such gypsum plaster are discussed.

A. Meher Prasad and Devdas Menon mentioned Glass fiber reinforced gypsum (GFRG) wall panel is made essentially of gypsum plaster reinforced with glass fibers. The panels are hollow and can be used as load bearing walls.

Deshmukh S.H., Bhusari J. P, Zende A. M Concrete is a tension weak building material, which is often crack ridden connected to plastic and hardened states, drying shrinkage, and the like. Moreover, concrete suffers from low tensile strength, limited ductility and little resistance to cracking.

From the above literature review we have studied that as percentage of steel fibers increase the strength of the concrete increases. So we have concluded to add 0% , 1%, 2% and 3% of steel and Glass fibers in concrete to test for 7days and 28days.

3. MATERIALS

The materials used are cement, coarse aggregate sand as fine aggregate, water and steel fibres

- Cement: Ordinary Portland cement of 53 Grade
- Fine Aggregate (sand): Locally available zone II sand with specific gravity 2.6 confirming with code book IS 393-1970.
- Coarse Aggregate: Crushed stone of 10mm size having specific gravity 2.76 confirming code book IS 393- 1970.
- Water: Potable water for Experiments.
- Steel Fibers: In this Experiment Hook tain steel fibers are used with different aspect ratios 50, 60 and 67 having lengths 35, 30 and 20mm with diameter 0.7, 0.5 and 0.4.
- Glass Fiber: It is the material made from extremely fine fibres of glass. It is a light weight, extremely strong and robust material. There are distinctive sorts of fibre however in these we have taken E-glass fibre to show better resistance and a very good insulation to electricity.

4. RESULTS AND DISCUSSION

In this present work M30 grade of concrete is selected for the proportions of 1:1.96:2.63 and water cement ratio of 0.45 and various studies are conducted to observe the responses. In addition to general ingredients steel and glass fibers are added of percentages 0, 0.5,1,2 and 3.

4.1. Effect of Compressive Strength in FRC

The compressive strength results are tabulated in table.1. The graph is plotted on X- axis the percentage addition of FRC and on Y-axis compressive strength. The graph is a non-linear.

Table 1 Compressive strength of FRC
COMPRESSIVE STRENGTH (N/mm²)

S.NO	% of addition	Steel fiber	Glass fiber
1	0	22.56	22.56
2	0.5	24.06	27.06
3	1	26.00	28.46
4	2	27.66	26.98
5	3	28.15	26.10

4.2. Effect of Flexural Strength in FRC

The Flexural strength results are tabulated in table.2. The graph is plotted on X- axis the percentage addition of FRC and on Y-axis Flexural strength. The graph is a non-linear. Table 2 Flexural strength of FRC

FLEXURAL STRENGTH (N/mm²)

S.NO	% of addition	Steel fiber	Glass fiber
1	0	3.73	3.73
2	0.5	3.9	2.45
3	1	4.4	2.94
4	2	4.75	2.6
5	3	5.20	2.45

4.3. Effect of Split Tensile Strength in FRC

The Split tensile strength results are tabulated in table.3. The graph is plotted on X- axis the percentage addition of FRC and on Y-axis Split tensile strength . The graph is a non-linear.

Table 3 Split tensile strength of FRC
SPLIT TENSILE STRENGTH (N/mm²)

S.NO	% of addition	Steel fiber	Glass fiber
1	0	1.535	1.535
2	0.5	1.59	3.4
3	1	1.65	3.92
4	2	1.96	3.57
5	3	2.17	3.42

5. CONCLUSION

The conclusions are drawn from the test results

- In compressive strength, flexural strength and split tensile strength, the addition of Steel fiber the strength is increasing linearly, but in glass fiber up to 1% it is increasing and from 2% it is decreasing.
- It is concluded that the strength is increasing while increasing the percentage of steel fiber. But in the case of glass fibers, the strength is increasing up to 1%. After 1% the strength is reducing.
- Finally concluded that glass fiber can be add up to the 1%.

REFERENCES

- [1] Alan J. Brookes, “Cladding of Buildings”, Third Edition Published 2002, (pp 82).
- [2] Arnon Bentur and Sidney Mindess, “Fibre Reinforced Cementations Composites”, Second Edition 2007, Chapter 8, (pp278).
- [3] J.G. Ferreira, F.A. Branco 2005, “Structural application of GRC in telecommunication towers”, Construction and Building Materials Journal, Published August 2005.
- [4] Majumdar, A.J. (1974), “The role of the interface in glass fibre reinforced cement”, Building Research Establishment, Published 1974, Current Paper (cp 57- 74).
- [5] M. Levitt 1997 “Concrete materials problems and solutions”, “GRC and Alkali-Glass reaction”, First Edition 1997, (pp 22-24).
- [6] M.W. Fordyce and R.G. Wodehouse, “GRC and buildings”, Published First Edition 1983.

[7] Perumelsamy N. Balaguru and Surendra P. Shah, “Fibre reinforced cement composites”, February 1992, Chapter 13, (pp351).

[8] Dr. P. Perumal and Dr. J. Maheswaran, “Behavioural study on the effect of AR-Glass Fibre reinforced concrete”, NBW & CW October 2006, (pp 174-180).

[9] R .N. Swamy, “Testing and Test Methods of Fibre Cement Composites”, Published 1978, (pp 42-43).

[10] Surendra P. Shah, James I. Daniel, Darmawan Ludirdja, “Toughness of Glass Fiber reinforced concrete panels subjected to accelerated aging”, PCI Journal, September-October 1987, (pp 83-88).

[11] U. M. Ghare, “Manufacture of Glass Fibre Reinforced Concrete Products”, Unit 1, Division of YOGI group-UAE, August 2008.

[12] Bentur, A, and Kovler, K, (1997) “Durability of some glass fibre reinforced cementations composites”, Fifth International Concrete on Structural Failure, Durability Retrofitting, Singapore, November 27-28, pp. 190- 199.

[13] Banthia, N, Yan, C.B, Lee W.Y, (1997) “Restrained shrinkage cracking in fiber reinforced concrete with polyolefin fibres”, Fifth International Concrete on Structural Failure, Durability Retrofitting, Singapore, November 27-28, pp. 456-463.

[14] Chandramouli, K, Srinivasa Rao, P, Pannirselvam, N, Seshadri Sekhar, T, and Sravana, Priyadrashini, T.P, (2010), “ Strength and durability characteristic of glass fibre concrete”, International Journal of Mechanics of Solids, Vol. 5, No.1, pp. 15-26.

[15] Prof. R.M. Sawant, Jabeen Khan, Minal Aher and Akash Bundele, TComprehensive Study of High Strength Fiber Reinforced Concrete under Pull out Strength. International

Journal of Civil Engineering and Technology (IJCIET), 6(1), 2015, pp.14–20.

[16] Chawla, K. and Tekwari, B. (2012), “Glass fibre Reinforced concrete”, Yahoo Group – Civil Engineering Portal, pp. 1-7.