

**AN EXPERIMENTAL STUDY ON POLYPROPYLENE FIBER
REINFORCED CONCRETE WITH M30 & M40 MIX DESIGN.**Syed Zaheer Ahmed¹, Porf S.M. Hashmi² Porf Nadeem Pasha³ Javeed Ahmed⁴¹P.G. Student, Department of Civil Engineering, K.B.N Engineering College, Gulbarga, Karnataka, India²Assistant Professor, Department of Civil Engineering, K.B.N Engineering College, Gulbarga, Karnataka, India³Assistant Professor, Department of Civil Engineering, K.B.N Engineering College, Gulbarga, Karnataka, India⁴U.G. Student, Department of Civil Engineering, K.B.N Engineering College, Gulbarga, Karnataka, India

Abstract—In this experimental study to effort using polypropylene fibre with different mix proportion of fusion ratio to form the fusion reinforced concrete. Polypropylene fibers have transformed properties and these properties will increases the flexural strength, split tensile strength, compressive strength of concrete. By this strength parameter also increases. In this effort has been approved for M30 and M40 grade concrete according to IS 10262:2009 with five various proportions are added with concrete ingredient. The proportion of polypropylene fiber is varying with different fusion fiber amount varies from i.e. 0%0.5%, 1.0 %, 1.5% 2.0%. Polypropylene fiber is added by the weight of cement. These tests were done to analyze the hardened properties of concrete for 7& 28 days curing specimens. Investigation of strength parameter on different tests is evaluated and results are tabulated. From experimental study and results it can be notify that the sample of added polypropylene fiber 1% & 1.5% determined better results.

Keywords- Polypropylene fiber, Compressive strength, Flexural strength, Split Tensile Strength.

I. INTRODUCTION

Now a day's Concrete is largely used material in all the sectors. Concrete require From the small construction to large structures like multi story buildings, irrigation structures, pavements, reservoirs, foundations, dams etc. For construction of all these structure its require huge amount of concrete material. Concrete is exposed to different environmental condition to with stand the environmental effects the properties of concrete have to increases with introducing admixture or fiber to concrete to increases the strength of concrete.

Concrete is made of cement, aggregates, water and with or without admixture and mixing of all these materials gives a composite material is concrete or conventional concrete. Concrete made with this material its quite brittle due to less strength of materials. Conventional concrete have good compressive strength and it is very less or poor strength in tension as well as in flexural strength. So for increasing concrete tension as well as flexural strength it's required to add any innovative materials like fibers, admixture, and waste material having good pozzolanas properties, construction chemical. Portland cement is normally use for making cement mortar and concrete in the world. The above mentioned materials are inherently brittle nature and due to that it has some remarkable disadvantages, during practical application when compared to compressive strength the flexural and tensile strength are very low. by use of fibers in volume fraction weakness in tension can be overcome. Fibres like steel, polypropylene, nylon, polyester, glass, carbon fibers are used to growth of the Compressive/Tensile strength of normal concrete.

Addition of fibers to the concrete mix will give fiber reinforced concrete. To overcome the weakness in tension fibers are added in the mix. Fibers are added in sufficient volume fraction. To increase mechanical parameters of concrete will be better to mix the cement with

fibers that have noble tensile strength. due to fiber addition toughness will be increased. The behaviour of the fiber matrix composite also alters by the use of fibers after it has cracked, thereby toughness will be improved. The use of FRC in structural members such as columns, connections, beams, slabs and pre-stressed concrete structures is being investigated by a number of researchers at current in India and abroad.

II. LITERATURE REVIEW

1. (Mehul J. Patel and MRS. S. M. KULKARNI)their studies deals with the effect on accumulation of various proportion of the polypropylene fiber on the strength properties of the concrete. An investigation study has been advice, on effect of partial replacement of polypropylene fibre to the concrete. the outcome from test are increases the flexural, tensile and shear strength was found.

The aim to study program & get the desirable strength of concrete of grade M40 with simply accessible of material and to investigate the different quantity of the PF in the mix and to find the best principles of polypropylene fibers such as 0.5%, 1%, 1.5% in the conservative concrete. the concrete blocks are tested at different criteria 7days and 28 days for properties of concrete. From result concluded that the PF increases the compressive strength with increases

the % of fly ash. The performance of Polypropylene fibre concrete decreases with increase in Polypropylene fibre content in concrete.

2. (Siddhartha Sen. and R.Nagavinothini) their studies deal with the effect on addition of various proportion of the polypropylene fibers and granite powder on the properties of concrete. An exploration is evaluated to test the compressive strength, tensile strength of concrete. The test are agreed to determine strength for 7 days and 28 days finally the results is compared with normal usual concrete. the main aim to investigate design mix with M25 grade. easily existing component to examine the percentage proportion of the fiber in the mix and to find the best % fibers content such as 0.5%,1%,1.5% and 5%,10%,15% of granite powder in the mix. Results of this investigation advise that Polypropylene fiber and granite powder could be very suitably used in structural concrete. The maximum value of tensile strength and compressive strength is found at 1.5% PPF and 15%GP. This Desirable amount of decrease in micro cracking of concrete. There is an important to increase in the 28 days strength of concrete comparing to 7 days compressive strength, this concluded that the strength of the regular concrete increases with age.

3. (Kolli.Ramujee) their studies deal with uses of PF in the reinforced concrete with combination increases for the period of the previous some years ago. The arrangement of strength, rigidity and whether resistance favourably characteristics of fibre. In this investigation program, the results of the Strength property of PFRC had been vacant.

From the Experimental study it was observed that the concrete mix M25 with fiber. The various % fibers vary from 0% 0.5% 1% 1.5% and 2.0% were added to conventional concrete. Strength of cube better up to 1.5 % fibres satisfied. the following strength is drop at 2.0 % of fibers content. Less slump value with increases in PF content, particularly 1.5% prescribed amount.

III.MATERIALS AND THEIR PROPERTIES

A. Materials:

1) Cement:

Ultratech cement with 53 grade (ordinary Portland cement) confirming to IS 1489-1991 was used for pervious concrete and procured from single source. Test were conducted for material properties of cement and results are tabulated below.

Table 1: specification of Cement

Sl. No	characters	Test results
1	Specific Gravity	3.15
2	Normal Uniformity	28.5%
3	Early setting time	40 min
4	Last setting time	230 min
5	Compressive Strength	
	7 days	23.5 N/mm ²
	28 days	35.8 N/mm ²
6	Fineness of cement	1.2%

2) Fine Aggregate:

Nearby available good quality of sand was used and the same material was used for pervious concrete. The different test was conducted for physical properties of sand. And various test result are given.

Table 2: specification of FA

Sl. No	Properties	Fine aggregate
1.	Specific gravity	2.65
2.	Fineness modulus	3.25
3.	Water absorption	2.83%
4.	Bulk density	
	a)Compacted	1.614
	b)Loose	1.381

3) Coarse Aggregate:

The aggregate are confirming to ASTM D448-C33 was used. The size of aggregate are commonly used as 12.5mm passing and 10mm retain are used.

The different test where conducted for physical properties of course aggregate and test result are given below.

Table 3 : properties of Coarse aggregate

Sl. No	Properties	Coarse Aggregate
1.	Shape of coarse aggregate	Angular
2.	Specific Gravity	2.74
4.	Fineness modulus	7.09
5.	Bulk density	
	a)Compacted condition	1.49
	b)Loose condition	1.34
6.	Crushing strength	25.93%
7.	Water absorption	1.16%

B. Polypropylene fiber.



Polypropylene fiber is collected of non-crystalline (shapeless) and crystalline regions. The fiber differ in size in different fractions such as micrometer to centimetres with respect to dia. The manufacturing of this fiber have to two different types. First rectangular c/s of plastic film or from a circular section a wire is pull procedure is followed .And appearance of this fiber in fibrillated bundle, mono filament. fibers having different cut length available such as 12mm, 24mm, 40mm etc.

In this project study the polypropylene fibers with 12mm cut length is used. These polypropylene fibers are brought from RELIANCE INDUSTRIES PVT LTD, MANGALURU, KARNATATA The properties of polypropylene fibers with their stipulation are mentioned in the table below.

Table 4 : Properties of polypropylene Fiber

Sl. No	specifications	values
1.	Aspect ratio	1800
2.	Tensile strength(MPA)	2.56×10^3
3.	Elastic modulus	8×10^3

IV. EXPERIMENTAL PROGRAMME

The objectives of the present Study are:

- □ To recognize the optimum percentage of addition of fibers to concrete and ruling maximum fusion ratio.
- □ To determine workability by the accumulation of fibres in concrete mix.
- □ To analyze the dissimilar strength properties like: tensile strength, flexural strength, compressive strength of HFRC with different mix proportion of fibers for M30 grade and M40 grade concrete.
- □ To determine collision resistance properties on the HFRC and comparing with the predictable concrete.
- □ To generate polypropylene fiber reinforced concrete mixes of varying strengths and performance.
- □ The aim is to inspect how the proportions of solids and liquids, polypropylene fibres need to be selected in order to produce FRC.
- □ To study the effect of Cement replacement material (CRM) on the properties of polypropylene FRC.
- □ To provide a simple method to assess the direction and division of short polypropylene fibres in polypropylene fiber reinforced concrete mix during flow.
- □ To found a logical Mix Design Methodology for the design of polypropylene fiber reinforcement concrete.
- □ To Study the various types proportion on the properties of PFRC.
- □ weight of coarse aggregate, shape and grading on strength of PF reinforced concrete
- □ To learn the rheological properties of Polypropylene fiber
- □ To revise the consequence cement content on polypropylene fiber reinforced concrete

A). CASTING

1. The mix design shall be cement, fine aggregate & coarse aggregate, polypropylene fiber with M30 and M40 And also PF is adding with 0.5%, 1%, 1.5%, & 2% by weight of cement.
2. Water cement ratio for M30 shall be 0.45 & for M40 shall be 0.40
3. For one proportion three cubes are prepared by using 150mm in length, 150mm in width, 150mm in depth sizes of mould to cast the cubes and to find compressive strength, three cylinders are prepared by using 150mm in diameter, 300mm in length sizes of mould to cast the cylinder and to find split tensile strength, three prism are prepared by using 500mm in length, 100mm in width, 100mm in depth sizes of mould to cast the prism and to find flexural strength

B) CURING

The specimens were remoulded after one day of casting. The specimen were kept under water immersion tank for curing at laboratory temperature $27 \pm 2^\circ \text{C}$ for 7 days and 28 days.

C) TESTING

once curing the specimen for 7 days and 28 days the specimen were removed and dried for 24hrs then specimen are tested.



Fig. 1 : Specimens

V. RESULTS

A. Tests for Compressive Strength: In the present work Compressive strength test can be carried out by using cube size of $150\text{mm} \times 150\text{mm} \times 150\text{mm}$ cubes are casted for M₃₀ grade concrete with different type of hybrid fibers present in concrete.

The cubes are then demolded after 24 hours of casting. After completion of curing period of 28 days cubes shall be removed from water and kept for drying.

After that cubes are tested in compression testing machine with machine having capability of 2000KN the load is applied at the rate of 315kN/min. the load is applied in such a way that two opposite sides are compressed. The load at which specimen fails is noted. For accurate values 3 cubes shall be casted and tested compressive strength can be calculated by following:

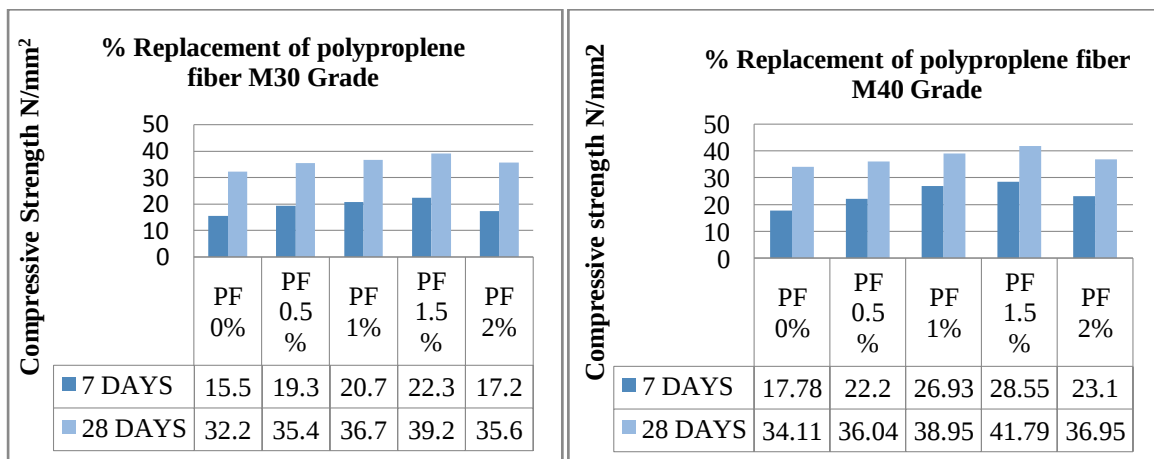
f_c = the ratio of cube failure load in N to its cross section of cube

where f_c = compressive strength of cube

Number of cubes tested for different proportions with conventional concrete and polypropylene fiber in concrete is shown below table.



Fig. 2 : Compression Testing Machine



Graph 1 & 2: Graphical representation for compressive strength for M30 and M40 grade

B. Tests for Split Tensile Strength:

To tensile strength test cylinders specimens can be casted with having dimension of 150mm diameter and 300mm length casted for M₃₀ grade concrete with different type of hybrid fibers present in concrete. The cylinders are then demolded cylinders are kept in water immersion tank about period of 28 days. After completion of curing period of cylinders shall be removed from water and kept for drying after that cylinders should be tested in compression testing machine and taking of 3 average value and tensile strength can be calculated using formula : $\text{tensile strength (N/mm}^2\text{)} = \frac{2P}{\pi dl}$

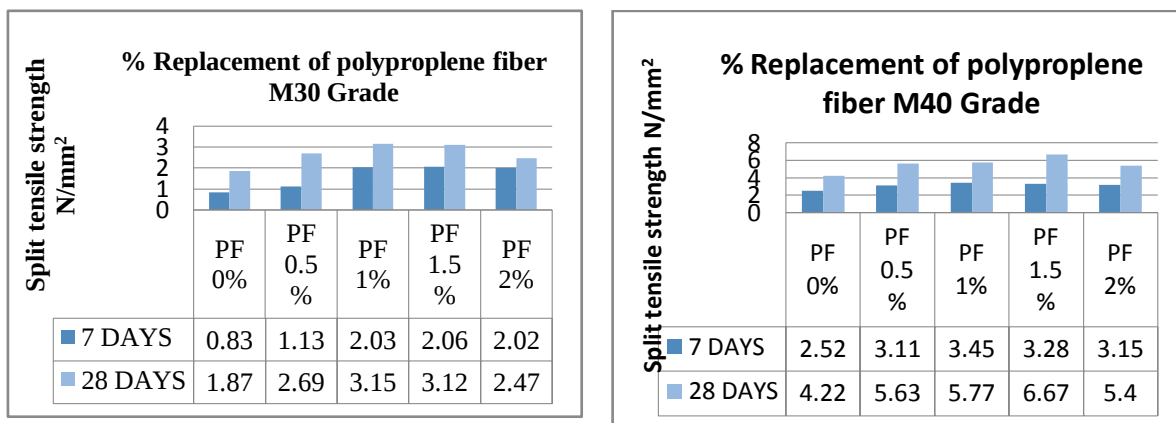
Where, P = cylinder failure

D = Cylinder dia, L = Cylinder length &

h = Cylinder height



Fig. 3 : Split Tensile Testing Machine



Graph 3&4: Graphical representation for split tensile strength for M30 and M40 Grade

C. Tests for Flexural Strength:

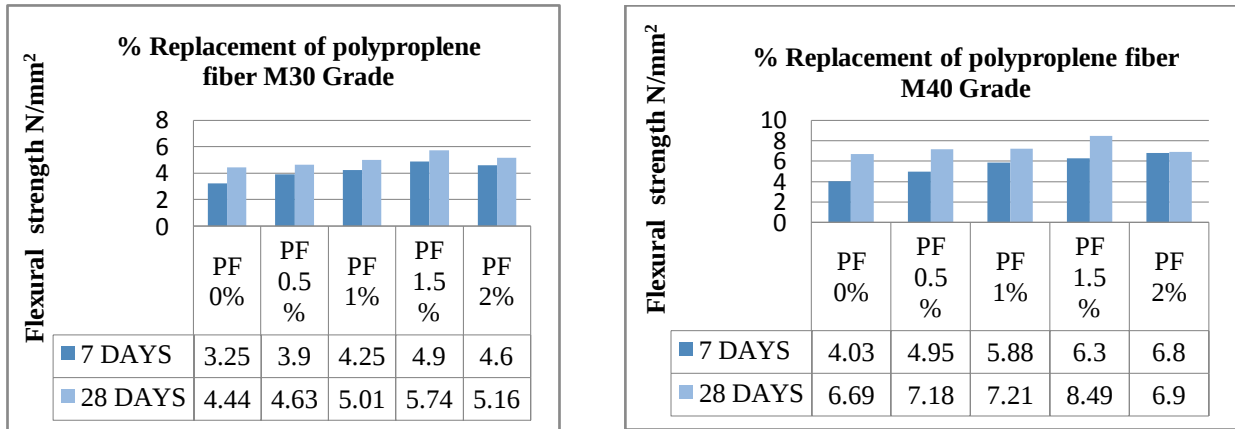
For flexure strength test prisms should be casted with having an dimension of 100mm×100mm×500mm prisms are casted for M₃₀ grade concrete and M₄₀ grade concrete with different type of hybrid fibers present in concrete. The moulds are removed after 24 hours of casting and then prisms are kept in immersion water tank for 28 days. After curing is completed prisms shall be remove from water and keep it for drying. after that prisms should be tested in universal testing machine(UTM) having capacity of 1000KN failure load can be note down and flexural strength can be calculated by:

$$\text{Flexural strength} = PL/bd^2$$

Where, p= failure load l= length of specimen d= depth of specimens b= breadth of specimens



Figure 4: Prism Testing in UTM



Graph 5 &6: Graphical representation for flexural strength for M30 & M40 grade

VI.CONCLUSION

From my experimental investigation I concluded the following points:

1. An Significant effect in addition of polypropylene which increased in % of water absorption
2. Mechanical properties of a concrete improved by use of fibers
3. When PF is used which increases the Shear capacity of concrete
4. If polypropylene is used them reduction in shrinkage cracking.
5. The split tensile strength of concrete is gradually increased by use of ppf content
6. The use of polypropylene fibre decreased the workability to some extent compressive strength increased with use of PPF content 1% to 1.5%

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