Flexible Concrete for Structural Applications Using Polypropylene Fiber

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***Abstract*— Concrete is the most used building material in the world. Currently, the planet is witnessing the development of additional, problematic and difficult engineering structures. Therefore, an alarmingly high strength and sufficient workability must be imposed on the concrete. The world is developing high-performance concrete by adding fibers and additives in proportion. Numerous fibers such as glass, carbon and plastic lead to improvements in concrete properties such as tensile strength, durability and usability of concrete. Because of these properties, fiber reinforced concrete has found a variety of applications in engineering. Synthetic fiber concrete is a novelty in the field of concrete technology. PFRC has the advantages of light weight, high compressive strength and flexural strength. In order to increase the long-term durability of FRC, it is additionally invented. The aim of the work is to verify the impact properties of plastic fibers as reinforcement in concrete in different proportions, based on the researcher's analysis work already carried out.**

1. INTRODUCTION

Concrete is the most common building material in the world, they are made in every type and shape. The strength and robustness of concrete can be modified by appropriate changes in its ingredients such as steel fibre, glass fiber, carbon fibre, plastic fibre. They're made higher strength in concrete. various contributions to the current contemporary world by its trendy techniques. many sorts of buildings with completely different technologies are being designed worldwide, however construction mistreatment the concrete continuously the common in world. A polypropylene could be a artificial organic compound compound material. presently polypropylene is that the wide used. for paving and construction applications. plastic fibers act to soak up energy. So, once the amount of fibers increase, the amount of compactive energy needed in achieving a desired consolidation also will increase. plastic fibers are a lot of easier to handle than steel fibers. the sunshine weight and easy handling facilitate to scale back the prices concerned in adding the fibers to concrete mixture.

In this experimental research a try is made to examine the impact of including a polypropylene fiber into the concrete for numerous percentages. With the mechanical residences of M25 grade concrete. A right blend layout is achieved to locate the quantity of cement, sand and mixture for use withinside the experiment

2. OBJECTIVES

- ❖ to see the optimum share combination of FRC.
- ❖ to check the strength of concrete cubes and cylinder & beams containing fibers with normal concrete.
- ❖ To assess & compare the compressive, flexural, tensile strength & role between traditional reinforced concrete & fiber reinforced concrete of grade M25.
- ❖ To analysis & compare the cost between the traditional concrete & fiber reinforced concrete.

3.MATERIALS AND METHODOLOGY

Materials Used on this Project are:

3.1 Cement
3.2 Fine aggregate
3.3 Polypropylene fiber
3.4 Coarse aggregate
3.5 Water

3.1 Cement

In this project work we used ultra-Tech cement of 43 grade ordinary cement used for casting moulds any rough for various concrete mixes. Cement if uniform color shading i.e., dark with lightweight chromatic color and accustomed be free from any rough irregularities. Testing of cement was performed as per IS:8112-2013.

Fig.1. Cement

(1) Grade of Cement: 43 grades (OPC)
(2) Specific Gravity: 3.1Normal
(3) Consistency: 30 %
(4) Initial Setting time: 35 minutes
(5) Final Setting time: 600 minutes

3.2 Fine aggregate

River sand is used in this project as a high-quality mix. River sand to be disposed of internally according to sector II of table IS 3831970.

Fig.2. Fine Aggregates

Properties of Fine Aggregate:

1) Specific Gravity: 2.373
2) Silt content: 4%
3) Bulkiness of sand: 6%
4) Grading of Sand: Zone – II

3.3 Polypropylene:

A polypropylene fiber has been applied for reinforcement of concrete for many years. The polypropylene fiber used inalternative percentages that is 0%, 0.5%, 1%, 1.5%, 2%.

Fig.3. Polypropylene Fiber

3.4 Coarse aggregates:

Coarse Aggregate is a production item made from rock mined from soil deposits. Examples of such soil deposits are river gravel, quarry gravel and previously used concrete.

Fig.4. Coarse Aggregates

3.5 Water

Water plays an important role as it contributes in chemical reaction with cement. Water used for mixing as well as for curing purpose also. It should be clean and free from salts, acids, alkalis and other harmful materials. Portable water can be used for curing of concrete.

Fig.5. Polypropylene Fiber

The Following technique is followed for the present work

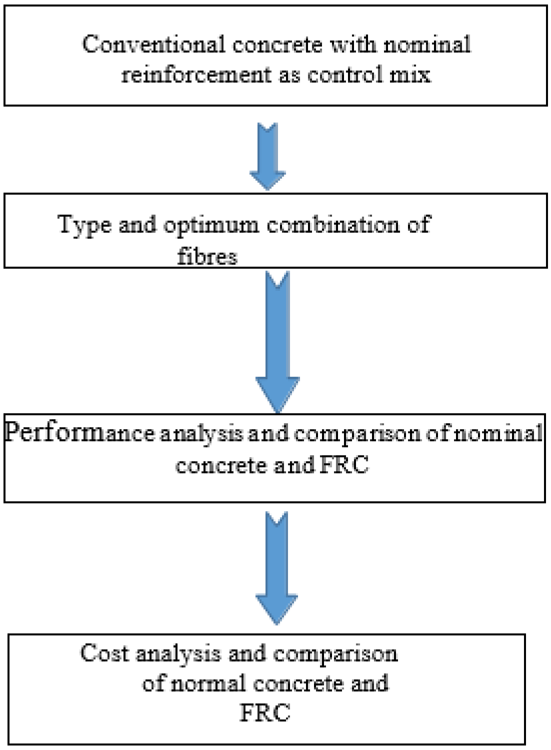

Fig.6. Flowchart

4.EXPERIMENTAL DETAILS:

4.1 Mix Design Mode and it's Means and Methods:

This test is carried out for M25 grades of concrete and it changed into achieved as in keeping with IS 10262-2009. M-25 grade has the combination Ture share of 1:1:2 and we take into consideration 0.45 because the water cement ratio. substances used for the combination Ture share are regionally available. Table.1. Mix Proportion for 1meter cube as per IS 10262-2009

Table.1. Quantity of Materials Used

Materials Used	Quantity of Materials	Mix proportion
Cement	435.45 kg	1
Fine Aggregates	676 kg	1
Coarse aggregates	1067.69 kg	2
Water	191.5 lit	0.45

Fig.7. Casting Specimen

After weighing accurately cement, sand, coarse aggregate, andfibers they are mixed dry until uniform color is obtained. Proper mixing of fibers and cement has been ensured before adding to the mix. fibers have been spread evenly in mix can distributed uniformly throughout the mix. Water was added to mix and proper mixing is ensured with various percentages. Similarly concrete mixture has been prepared for the casting of Cubes, cylinders, and beams. Where the size cube is (150×150×150) mm, for the cylinder is (150×300) mm and (100x100x300) mm for the beams. the specimen's Casting is carried out as per IS coddle provision. The cubes and cylinders are filled with three layers with 25 blows for each layer and for cylinder three layers with 35 blows and then compacted by using vibrators to reduce the segregation and Honeycombing action.

Fig.8. Cube Casting

4.2 Casting of The Specimens:

Before demolding, the specimens were kept at room temperature for 24 hours and after demolding, the specimens were transferred to the curing tank for curing. The sample should be tested on days 7 and 28.

Fig.9. Specimens Curing

4.3 Testing of Specimens:

After curing is complete, test samples are allowed to dry for approximately half an hour for best results. The samples are then tested for 7 and 28 days for compressive strength, split tensile strength and flexural strength with a universal testing machine (UTM).

5. COMPRESSION TEST:

Fig.10. Compression Testing Machine

Table.2. Specimen tested for 7th day curing

SL.No.	Percentage Of Fiber added	Average Compressivestrength (N/ mm^{2})
1	0%	16.8
2	0.5%	18.47
3	1%	23.00
4	1.5%	18.23
5	2%	17.47

Table.3. Specimen tested for 28th day curing

SL.NO.	Percentage Of Fiber added	Average Compressivestrength
1	0%	24.3
2	0.5%	25.47
3	1%	28.25
4	1.5%	25.12
5	2%	23.12

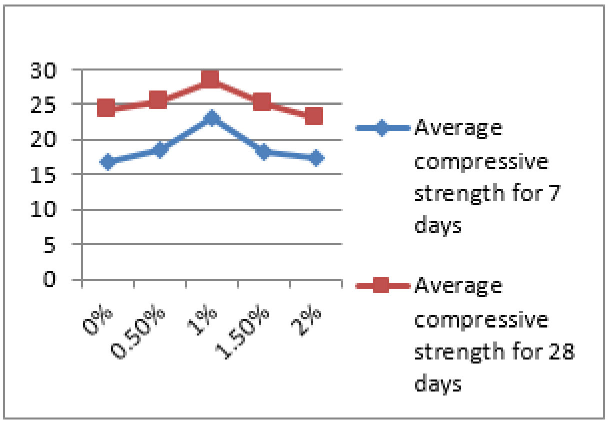

Fig.11. Compressive Strength on 7 & 28 day's

6. FLEXURAL TEST:

Fig.12.Flexural Testing Machine.

Table.4. Specimen tested for 7th day curing

SL.NO.	Percentage Of Fiber added	Average Flexural strength (N/mm^{2})
1	0%	3.00
2	0.5%	3.25
3	1%	3.50
4	1.5%	3.05
5	2%	2.00

Table.5. Specimen tested for 28th day curing.

SL.NO.	Percentage Of Fiber added	Average Flexural strength
1	0%	4.00
2	0.5%	4.02
3	1%	4.10
4	1.5%	3.80
5	2%	3.10

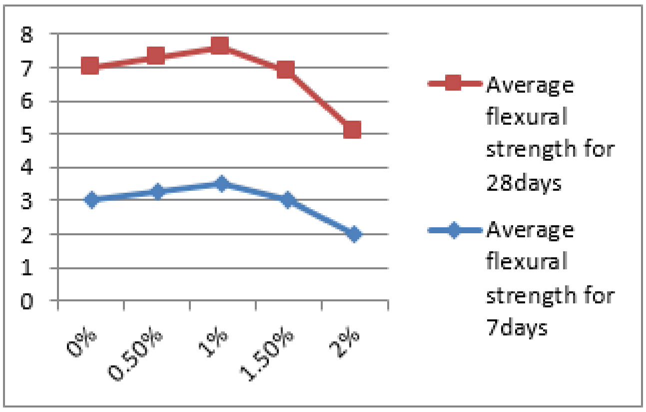

Fig.13. Flexural Strength on 7 & 28 day's

7. SPLIT TENSILE TEST:

Fig.14. Universal Testing Machine.

Table.6. Specimen tested for 7th day curing

SL.NO.	Percentage Of Fiber added	Average Tensile strength
1	0%	2.34
2	0.5%	2.78
3	1%	4.25
4	1.5%	4.78
5	2%	3.88

Table.7. Specimen tested for 28th day curing

SL.NO.	Percentage Of Fiber added	Average Tensile strength
1	0%	4.02
2	0.5%	4.84
3	1%	6.24
4	1.5%	4.98
5	2%	4.06

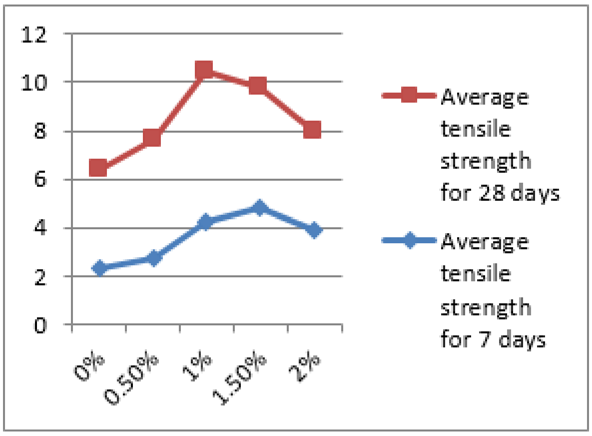

Fig.15. Tensile Strength on 7 & 28 day's

8. CONCLUSION:

- By incorporating polypropylene fibers into the concrete, we conclude that the compressive strength, cracking strength and bending strength are increased.
- Polypropylene fibers mixed with the concrete reduced shrinkage and cracking within the concrete element.
- Compressive strength, tensile shear strength and flexural strength increase with increasing proportion of polypropylene fibers.
- Comparison of the performance of the FRC with the nominal performance of the concrete.
- FRC rate is lower compared to reinforced concrete.

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