# THE EFEECTS OF POLYPROPYLENE FIBERS ON THE STRENGTH OF CONCRETE

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***Abstract :*** This paper gives the data acquired from a writing search, site visits, and a research facility investigation of polypropylene filaments in Portland bond concrete (PCC).The writing search yielded data from various lab investigations of the material properties of polypropylene fiber strengthened cement (PFRC). TheLiterature demonstrated that, for the low fiber volumes (0.1 percent) prescribed by producers, there was minimal improvement in sturdiness, weakness, sway obstruction, penetrability, shrinkage, and wear opposition. Most development has been of chunks on-grade and auxiliary pieces.

***IndexTerms*** - Bond (cement) ,Coarse Aggregates , Fine Aggregates, Water, Admixtures, Polypropylene Fiber.

## 1.INTRODUCTION

The fiber scattering into cement is one of the procedure to improve the structure properties of cement. Polypropylene filaments are engineered strands acquired as a side-effect from material industry. These are accessible in various viewpoint proportions and are modest in expense. Polypropylene strands are described by low explicit gravity and minimal effort. Its utilization empowers dependable and compelling usage of characteristic malleable and flexural quality of the material alongside critical decrease of plastic shrinkage splitting and limiting of warm breaking. It gives fortification and secures harm of solid structure and forestalls spalling if there should arise an occurrence of flame. The strands are made either by the pulling wire system with round cross segment or by expelling the plastic film with rectangular cross-segment. They seem either as fibrillated groups, mono fiber. The fibrillated polypropylene strands are shaped by development of a plastic film, which is isolated into strips and after that cut. The fiber packs are cut into indicated lengths and fibrillated. In monofilament strands, the expansion of catches at the closures of the fiber expands the haul out burden.

Splits assume a significant job as they change solid structures into penetrable components and thusly with a high danger of erosion. Breaks not just decrease the nature of cement and make it tastefully unsuitable yet additionally make structures out of administration. On the off chance that these splits don't surpass a specific width, they are neither hurtful to a structure nor to its workableness. Thusly, it is essential to lessen the break width and this can be accomplished by adding polypropylene filaments to concrete. Accordingly expansion of filaments in bond solid framework connects these splits and limits them from further opening. So as to accomplish more diversion in the shaft, extra powers and energies are required to haul out or crack the filaments. This procedure, aside from protecting the trustworthiness of cement, improves the heap conveying limit of auxiliary part past splitting.

Monofilament strands, as per fiber producers, just give control of splitting brought about by shrinkage and warm anxieties happening at early ages. These filaments give no post-break advantage and are utilized distinctly for shrinkage splitting and not to give upgrades to other designing properties. The measure of polypropylene filaments prescribed by most producers for use in clearing blends and most different blends is 0.1 percent by volume of cement (1.5 to 1.6 pounds per cubic yard). Scientists have tried different things with fiber volumes up to 7.0 percent.Fiber volumes more noteworthy than 2.0 percent typically include the utilization of persistent filaments, which are not normally considered for clearing applications because of constructability issues. Fiber volumes up to 0.5 percent can be utilized without significant changes in accordance with the blend extents. As volume levels approach 0.5 percent, air-entraining and water-lessening admixtures are required.

The accompanying outcomes depend on research center work with discrete filaments from 0.1 up to a most extreme volume dimension of 2.0 percent. Most of asphalt development has been finished with volume dimensions of 0.1 percent by weight. Above 2.0 percent by volume, the static quality properties, both compressive and flexural qualities, of the PFRC decline. This lessening is because of a mix of poor usefulness, expanded isolation and dying, and the entanglement of a lot of air . One study26 discovered high fluctuation in exhaustion and static flexural qualities and related this to the irregularities of fiber dissemination in the strain zone because of arbitrarily arranged strands.

## 2. LITERATURE REVIEW

- "Effect of Polypropylene Fibers on Shrinkage and splitting of cements" concentrated on the plastic shrinkage breaking execution of cement joining PP filaments that are exposed to controlled conditions, T.Aly, J.G. Sanjayan, F. Collins.

• "Strength Prediction of Polypropylene Fiber Reinforced Concrete" researches on the investigation of impacts of polypropylene fiber on the compressive and flexural quality of ordinary weight concrete. Rana A. Mtasher, Dr. Abdulnasser M. Abbas, Najaat H. Ne'ma.

• "Effects of Polypropylene strands in cement: Microstructure after flame testing and chloride movement" uncovered that the measure of unstable spalling and the degree of splitting can extensively be decreased by utilization of reasonable measure of polypropylene filaments. J.A. Larbi and R.B. Polder.

• "The impact of polypropylene fiber inside cement as to fire execution in structures" analyzed the impact of different polypropylene fiber expansion to concrte as to touchy spalling when exposed to high temperatures like those accomplished in structure or passage fires. Alan Richardson and Urmil V. Dave.

• "Effects of polupropylene fiber on the quality of fly fiery remains based solid" manages the quality properties of cement xontaining polypropylene fiber and class C fly slag. It was discovered that the compressive, flexural and split rigidity increments bit by bit by expansion of polypropylene filaments. K. Murahari and Rama Mohan Rao.

• The enthusiasm for the utilization of strands for the support of composites has expanded during the most recent quite a long while. A blend of high quality, firmness and warm opposition positively portrays the strands. In this investigation, the consequences of the Strength properties of Polypropylene fiber fortified cement have been exhibited. The compressive quality, part elasticity of solid examples made with various filaments sums differs from 0%, 0.5%,1% 1.5% and 2.0% were contemplated. The examples with included Polypropylene filaments of 1.5 % indicated better outcomes in examination with the others. Kolli.Ramujee (2013)

• This paper introduces a test examine on execution of polypropylene fiber strengthened cement. In this examination manages the impacts of expansion of different extents of polypropylene strands on the properties of High quality cement (M30and M40 blends). A test program was done to investigate its impacts on compressive, malleable, flexural quality under various relieving condition. The principle point of the examination program is to ponder the impact of Polypropylene fiber blend by differing substance, for example, 0% ,0.5%,1%,1.5% and 2% and finding the ideal Polypropylene fiber content. An outstanding increment in the compressive, pliable and flexural quality was watched. Notwithstanding, further examinations were exceedingly prescribed and ought to be completed to see progressively mechanical properties of fiber strengthened cement. Milind V. Mohod (2015)

## 3. OBJECTIVE OF THE WORK

The goal is to think about the impact of polypropylene fiber in cement. To lead a relative report on fiber in concrete and traditional cement.

## 4. METHODOLOGY

The procedure of the work comprise of

**1)** Identifying the determination of material to be chosen.

**2)** Collection of materials.

**3)** Identifying the properties of gathered materials. Different tests were directed on bond, fine total, coarse total.

**4)** Selection of solid evaluation.

**5)** Preparation of blend plan of M30 evaluation concrete.

**6)** Cubes, chamber and bars were casted with control blend utilizing regular total.

**7)** Preparation of test example by including 0.5, 1,1.5and2% of polypropylene strands in cement.

**8)** Workability tests,compressive quality, rigidity, flexural quality and modulus of versatility of cement were directed.

**9)** Optimum level of fiber expansion in cement was resolved.

## 5. TESTS PERFORMED

### 5.1 SIEVE ANALYSIS

Sifter (Sieve Analysis) investigation decides the molecule measure appropriation of the coarse and fine totals. This is finished by sieving the totals as IS:456 2000.

- In this test a lot of IS strainers of sizes: 80mm, 63mm, 50mm, 40mm, 25mm, 20mm, 16mm, 12.5mm, 10mm, 6.3mm are utilized and the totals are gone through it.
- Further the weight going through each strainer is determined as a parentage of the all out weight.
- Fineness modulus is gotten by including total rate and partitioning them by 100.

### 5.2 SPECIFIC GRAVITY TEST

**Fig 1: Specific Gravity Bottle**

- Place bond upto half of the flagon (50g) and weight it (W2).
- Add lamp oil to it upto the half and stire it completely, let the air leave it. Keep blending and add more lamp oil to it sufficient.
- Dry the outside of container and weight it (W3).
- Empty the container and fill it with lamp oil upto the imprint and weight it (W4).

**Figurings:**

$$\text{Sp. Gravity} = \frac{(W2-W1)}{(W2-W1)-(W3-W4)\times 0.79}$$

0.79 = sp gravity of lamp oil

**5.3 FINENESS TEST**

**Fig 2: Sieve With Pan**

• Weigh roughly 10g of concrete to the closest 0.01g and place it on the strainer.

• Agitate the strainer by twirling , planetary and straight development, until not any more fine material goes through it .

• Weigh the buildup and express its mass as a rate R1, of the amount originally put on the Sieve to the closest 0.1 percent.

• Gently brush all the fine material off the base of the sifter.

• Repeat the entire methodology utilizing a new 10g example to acquire R2.

• Then ascertain R as the mean of R1 and R2 as a rate , communicated to the closest 0.1%.

• When the outcomes contrast by over 1% outright , do a third sieving and figure the mean of three qualities.

**5.4 INITIAL SETTING TIME OF CEMENT**

**Test Block Preparation**

• Before beginning setting time test , do the consistency test to acquire the water required to give the glue typical consistency (P).

• Take 400g of concrete and set up a flawless bond glue with 0.85p of water by weight of bond.

• Gauge time is kept between 3-5 minutes. Begin the stopwatch at the moment when the water is added to a concrete. Record this time (t1).

• Fill the Vicatmould, laying on a glass plate, with the concrete glue measured as above.

Fill the form totally and smooth off the outside of the glue making it level with the highest point of the shape. At that point bond square consequently arranged is called test alliance

**5.5 INITIAL SETTING TIME and FINAL SETTING TIME**

**INITIAL SETTING TIME**

• Place the test square kept in the shape and laying on the non-permeable plate , under the bar bearing the needle.

• Lower the needle delicately until it interacts with the outside of test square and snappy discharge , enabling it to enter into the test square.

• In the starting the needle totally penetrates the test square. Rehash this strategy for example rapidly discharging the needle after like clockwork till the needle neglects to puncture the square for about 5mm estimated from the base of the form.

• Note this time (t2).

**FINAL SETTING TIME**

• For deciding the last setting time , supplant the needle of the vicat's mechanical assembly by the needle with an annular connection .

• The concrete is viewed as at long last set when after applying the last setting needle tenderly on the outside of the test hinder; the needle establishes a connection subsequently, while the connection neglects to do as such.

• Record this time as (t3).

**5.6 SLUMP CONE TEST**

Solid Slump test is to decide the functionality or consistency of solid blend arranged at the research facility or the building site during the advancement of the work. Solid ghetto test is completed from clump to group to check the uniform nature of cement during development.

The Slump test is the most basic usefulness test for cement, includes minimal effort and gives middle of the road results . Because of this reality, it has been broadly utilized for usefulness tests since 1992. By and large solid droop worth is utilized to discover the usefulness, which shows water-concrete proportion , however there are different components including properties of materials, blending strategies ,measurements , admixtures and so on . additionally influence the solid droop esteem.

**FACTORS WHICH INFLUENCE THE CONCRETE SLUMP TEST**

• Material properties like science, fineness, molecule measure conveyance, dampness substance and temperature of cementitious materials. Estimate, surface , consolidated evaluating , tidiness and dampness substance of the totals.

• Air substance of cement.

• Concrete bunching, blending and transporting strategies and hardware .

• Temperature of the solid.

• The measure of free water in the solid.

• Time since blending of cement at the season of testing .

• Chemical admixtures measurement, type , mix, association, grouping of expansion and its viability.

**Method**

• Clean the inner surface of the form and apply oil.

• Place the form on a smooth level non-permeable base plate.

• Fill the form with arranged solid blend in four roughly equivalent layers.

• Tamp each layer with 25 strokes of the adjusted end of the packing bar in a uniform way over the cross segment of the form. For the resulting layers, the packing ought to infiltrate into the basic layer.

• Remove the abundance concrete and level the surface with a trowel.

• Clean away the mortar or water spilled out between the shape and the base plate.

• Raise the shape from the solid promptly and gradually vertical way.

• Measure the droop as the distinction between the tallness of the shape and that of stature purpose of the example being tried.

**Table 1 : Test Results**

| PP Fiber Content (%) | Slump values (mm) |
|---|---|
| 0 | 75 |
| 0.3 | 100 |
| 0.6 | 115 |
| 0.9 | 135 |

**Table 2: Final Results**

| Fineness modulus of coarse aggregates | Fineness modulus of fine aggregates | Specific gravity of cement | Standard consistency % | Initial setting time of cement min | Slump mm |
|---|---|---|---|---|---|
| 6.9 | 2.50 | 3.061 | 36.5 | 30 | 75 |

**Table 3 : Compressive Strength Test Observations**

| Compression Strength (MPa) | | | |
|---|---|---|---|
| PP Fiber Content (%) | 7 Days | 14 Days | 28 Days |
| 0 | 20 | 27 | 30 |
| 0.3 | 20.54 | 28.047 | 32.094 |
| 0.6 | 24.98 | 32.48 | 40.968 |
| 0.9 | 22.82 | 29.78 | 35.562 |

## 6. CONCLUSION

The general execution of the Polypropylene fiber cement was not upgraded by either varieties in the sort or length of the polypropylene fiber, nor by any mix of the two properties.The compressive and flexural qualities of Polypropylene fiber cement was not improved by the expansion of polypropylene fibers.The bond between a non-fiber fortified solid base and Polypropylene fiber solid blends was blocked by the expansion of polypropylene strands. This would make fortified overlays at any rate to some degree progressively hard to construct.The sturdiness after improvement of the primary break, durability lists, was upgraded by the expansion of the polypropylene fibers.The exhaustion quality of the PFRC blends and of the non-fiber

strengthened PCC blend demonstrated the PFRC blends were inside the regular furthest reaches of PCC weariness. No improvement of exhaustion quality was seen from the expansion of polypropylene strands to a PCC blend.

## 7. SCOPE OF FUTURE STUDY

Examination on the flexural and shear split example of fiber fortified cement. Relative investigation on mixed kind, small scale and large scale length polypropylene filaments.

## 8. REFERENCES

**[1]** Hannant, D. J., "Fiber Cements and Fiber Concretes," John Wiley and Sons, Ltd., 1978.

**[2]** "Fiber Reinforced Concrete," Portland Cement Association, Publication No.SP039.01T, Skokie, IL, 1991.

**[3]** Hogan, D., "Engineered strands may offer adaptability to solid," Roads and Bridges, March, 1987.

**[4]** "Cutting edge Report on Fiber Reinforced Concrete," ACI 544.1R-82, American Concrete Institute Manual of Concrete Practice, Part 5, Detroit, MI, 1991.

**[5]** Balagruru, P. what's more, Ramakrishnan, V., "Mechanical Properties of Superplasticized Fiber Reinforced Concrete Developed for Bridge Decks and Highway Pavements," American Concrete Institute Publication No. SP-93,1986.

**[6]** Zollo, R. F. what's more, Hays, C. D., "Filaments versus WWF as Non-Structural Slab Reinforcement," Concrete International, Pg. 50-55, November, 1991.

**[7]** Rollings, R. S., "Field Performance of Fiber-Reinforced Concrete Airfield Pavements," DOT/FAA/PM-86/26, Federal Aviation Administration, Washington, DC, 1986.

[8] Mindess, S., Bentur, A., Yan, C., and Vondran, G., "Effect Resistance of Concrete Containing Both Conventional Steel Reinforcement and Fibrillated Polypropylene Fibers," ACI Materials Journal, Title No. 86-M51, Nov-Dec. 1989.

**[9]** Ramakrishnan, V., "Materials and Properties of Fiber Reinforced Concrete," International Symposium on Fiber Reinforced Concrete in Madras, India, Volume I, Pg. 2.3-2.23, 1987.

**[10]** "Guide For Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete," ACI Manual of Concrete Practice - Part 5, ACI 544.3R-84 (Reapproved 1988), Detroit, MI, 1991.

**[11]** IS 516: 1959 Method of test for quality of cement

**[12]** IS 2386 (Part VIII): 1963Methods of Test for Aggregates for Concrete.

**[13]** IS 383:1970, Specification for coarse and fine totals from common hotspots for cement

**[14]** IS 10262:2009 Concrete Mix Proportioning-Guidelines.

**[15]** Aly T, Sanjayan J G and Collins F (2008),"Effect of Polypropylene Fibers on Shrinkage and Cracking of Concretes", RILEM, Materials and Structures, Vol. 41, pp. 1741-1753, DOI 10.1617/s11527-008-9361-2.

**[16]** Rana A. Mtasher, Dr. Abdulnasser M. Abbas, Najaat H. Ne'ma (2011) "Quality Prediction of Polypropylene Fiber Reinforced Concrete", Eng. and Tech. Diary, Vol. 29, No. 2, pp 305-311, 2011.

**[17]** J.A. Larbi and R.B. Polder "Impacts of Polypropylene strands in cement: Microstructure after flame testing and chloride relocation", HERON Vol. 52, No. 4, pp 289-305, 2007.