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A COMPREHENSIVE STUDY OF PROPERTIES OF POLYPROPYLENE REINFORCED CONCRETE

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Abstract – *The reinforced concrete slab is reinforced with concrete by adding compactly separated beaches to the concrete. Shows numerous stable and advanced engineering structures similar as compressive strength, flexural strength etc filaments are suitable to helps cracks in the ground by the act of cleaning which leads to better resistance to concrete. The combination of two or further different filaments is veritably common these days with the end of perfecting the overall performance of the system. The thing is that the performance of these mongrel systems will overweight the eventuality for each type of fiber.*

Key Words: **Reinforced concrete, flexural strength, compressive strength, Slump test, Polyesterfiber, workability**

1. INTRODUCTION

The dramatic increase in construction activities has led to the widespread use of concrete materials. The performance of conventional concrete is enhanced by the addition of fiber to it. The hardness of the concrete is reduced and its ductility is adequately enhanced by the addition of fiber to it. In the current work of cement concrete, cylinders and concrete prisons for the M25 grade are installed as standard in India. Polypropylene fibers were used individually in various proportions namely 05%, 1%, 1.65%, 1.85%, 2% by weight of cement when preparing concrete mixtures, the same amount of cement was replaced by fiber. Test results show that the use of fiber in concrete, a paid product called Fiber Reinforced Concrete (FRC), improves compressive strength, separating strength and flexural performance compared to conventional concrete. In this experimental study of a concrete cube, beams and cylinders were installed and reinforced with polypropylene fibers containing various percentages of cement weight to study the development of energy structures. The performance of specimens has decreased as the number of fibers increases, which means that at higher percentages fiber mixing is difficult. Some plasticizers need to be added to overcome this difficulty. The concept also outlines the results of experimental tests performed on concrete beams, in size 100mm x 100mm x 500mm. the beams were tested under a two-point bend. The result showed that the flexible properties of the concrete matrix are greatly improved with the addition of polypropylene wires. Of the various types of fibers used in this study, fibers containing 1.65% of concrete have been shown to be effective in developing a flexible response. Types of polypropylene fiber Reinforced Concrete containing these individual strands in various proportions and standard concrete as reference is cast and tested. Based on the mixing method introduced according to the Indian standard, the sizes of various ingredients were obtained to determine the M25 concrete range. Samples were made without merging. The purpose of this concept is to compare the structures of concrete beams in which different percentages of fibers are inserted individually.

1.1.CONTENT

Exploratory research consists of the selection and testing of cement, mixing, the formation of concrete mixtures, preparation and testing of new concrete, and the preparation and testing of solid concrete. The following procedure was followed to conduct a study on polypropylene fiber embedded in concrete. The strength of the sample input fibers was tested and compared with standard models. Graphs were also developed to compare the two.

2. TEST ON FRESH CONCRETE

- Slump test
- Compaction factor test

❖ **TEST ON HARDENED CONCRETE**

- Compressive strength
- Split Tensile Strength
- Flexural Strength

❖ **MATERIALS CHARACTERISTICS**

This research focuses on use of polypropylene fiber in concrete composite. In this flexible polypropylene fiber system and ductile leads to strengthening the stiffness and strength of the post-cracking area (Ramadevi and VenkateshBabu 2012). In this experimental investigation an attempt has been made to study the compressive strength,

split tensile strength and flexural strength of polypropylene concrete. In this study, cement, sand, coarse aggregate, water and fibers were used. Ordinary Portland cement of 53 grade cement as per, bureau of Indian Standard, 12269:1987 was used in this investigation. Locally available coarse aggregate with maximum size of 20mm and 10mm and specific gravity of 2.70 were used. Locally available sand conforming to zone 1 in accordance to Bureau of Indian standard, 383:1970 with specific gravity 2.65, water absorption 2% and fineness modulus 2.8 was used. For the experimentation, portable water was used.

2.1. TEST ON FRESH CONCRETE

2.1.1. SLUMP TEST

Concrete slump test is used to determine the workability or consistency of concrete mix prepared in the laboratory or at the construction site during the progress of work. Concrete tests performed with concrete are performed from batch to batch to test the same quality of concrete during construction. The simplest performance test of concrete, incorporates low cost and provides fast results. Made in accordance with IS: 1199- 1959. The test was conducted by using mould known as slump cone or Abraham's cone. Internal surface of cone was greased and it was placed on hard non-absorbent surface, it was then filled with already prepared concrete in 4 approximately equal layers, tampering each layer to about 25 times using tampering rod, removing extra concrete from top. The mould was then carefully lifted vertically upward, without any disturbance to concrete cone. Concrete subsided. The difference between the top of the mould and that of highest point of the specimen being tested is called slump. Falling concrete has taken many forms, and according to the profile of fallen concrete, falls are called real slump, shear, zero slump or slump slump.

2.1.2. COMPACTION FACTOR TEST

The Compaction factor test is designed in such a way that it can be used not only in the laboratory but, in some cases, in field concrete tests. A compacting factor test was developed at the Road Research Laboratory in the United Kingdom. This test is one of the most accurate tests performed in order to determine the workability of concrete. This test applies to the goal of determining the degree of compression achieved by the normal work done by allowing the concrete to fall to normal length. A compacting factor called a compacting factor is measured by a quantitative measure i.e., a measure of the size actually found in a test of the same concrete. Prepare a concrete mix of particular ratio. With the help of a trolley, fill the newly prepared concrete on top of the device. The concrete should be filled with the hopper edge and weighed with a trowel. Now open the upper hopper trap, so that the concrete falls to the lower hopper. After all the concrete fall from one top hopper to another. Then reopen the hopper trap below. Let the concrete fall into the cylinder. Now take the weight of the cylinder from which the concrete was cut. Let this weight of partially compacted concrete (W1) . Empty the cylinder. Now again, fill the concrete with cylinder in three layers with 25 beats in each layer using a lubricating rod. Fill concrete to the of cylinder and scrape excess concrete above the brim. Now take the weight of cylinder in which concrete we filled. Let this weight be the "weight of fully compacted concrete (W2)".

The concrete composite element can be obtained using a formula,=**(Weight of partially**

Compacted concrete W1)/ (Weight of partially compacted Concrete W2)

2.1.3. COMPRESSIVE STRENGTH TEST RESULT.

The strong pressure of the concrete cube gives an idea of the concrete properties. With this test one can judge whether the display is done correctly or not. The compressive strength of conventional construction varies from 15MPa to 30 MPa and above for commercial and industrial buildings. A pressure test is performed on a cube or cylinder. A cube test two types of 15cm x 15cm x 15cm molds are usually used. Concrete is poured into the mold and spray well so that it is empty. After 24 hours the fungi are removed and tested in water for treatment. These samples were tested with a pressure test machine after three days, 7 days and 28 days of treatment. Loading is applied gradually until the sample fails. Loading templates separated by a template's location enables compression. In this investigation, to calculate the compressive strength of concrete, cube specimens of size 150 x 150 x 150 mm are cast using a M25 concrete range individually with 0.5%, 1%, 1.5%, 1.65%, 1.85% and 2% of polypropylene fiber by weight of cement, respectively. Moulds were vibrated by table vibrator. The upper surface of the specimen was leveled and finished. After 24 hours the specimens were removed from the mould and transferred to curing tank and they were allowed to cure for 3days, 7days, and 28 days of curing, these cubes were tested on digital compression testing machine as per, Bureau of Indian Standards, 516:1959. The failure load was noted. In all category, three cubes were tested and their average value is reported.

2.1.4. SPLIT TENSILE STRENGTH TEST RESULT

Separating the strength of the strength in a concrete cylinder is a way to obtain the strength of the concrete strength. Concrete is very susceptible to friction due to its nature and is not acceptable to resist direct friction. Concrete exposes cracks when exposed to high strength. Therefore, it is necessary to determine the strength of the concrete to obtain a load where the concrete members may crack. Direct concrete strength testing is rarely performed due to the difficulty of inserting specimens and the uncertainty in the

secondry pressure caused by the gripping equipment. Indirect tests of concrete strength strength are used. Accordingly, 3 specimens of cylindrical shape of diameter 150mm and length 300mm were tested under a compression testing Machine of 2000 KN capacity under a compressive load across the diameter along its length till the cylinder splits. The tension grows in the direction at right angles to the action line of the applied load. In order to determine tensile strength of concrete cylinder splitting test is carried out on concrete cylinders. This is an indirect test for measuring tensile strength of concrete.

2.1.5. CYLINDER SPLITTING TEST

The test is performed by placing a sample of the cylinder, horizontally between the loading areas of the pressure gauge and the load applied until the cylinder fails, to the correct width. The loading mode produces a high pressure drop under two areas where the load is applied. But much of the depth associated with the depth is attributed to the performance of the tensile strength horizontally. It is estimated that the compressive pressure applies to both (1/6) th depth and the remaining (5/6) th is under pressure. The horizontal tensile stress is given by the following equation {6}:

Split tensile stress = $2p/\pi DL$

Where,
P= Load at failure
L = Cylinder length (300mm) D = Cylinder width (150mm)

2.1.6. FLEXURAL STRENGTH

Flexural testing tests the strength of concrete strength indirectly. It tests the ability of an unconfirmed concrete pole or slab to withstand bending failure. The result of a flexural test on a concrete shown as a fracture module (MR) in MPa or psi. Furthermore, modulus of rupture is about 10 to 15% of compressive strength of concrete. It is influenced by mixture proportions, size and coarse aggregated volume used by specimen construction. Flexural strength is one of the steps of concrete strength strength. Flexural strength is one of the steps of concrete strength strength. Flexural testing is very critical in specimen preparation, management and treatment process.

Flexural concrete strength tests were performed on the beams. Loads used in beams are loaded with two points where loads are used (1/3) beam points.. The beam is placed in the testing machine in such a way that the load point are 13.3cm apart from each other as well as from each support. The load is increased until the sample fails and this load is considered a failure load. Flexural strength is calculated from the following formula.

Flexural strength = PI/bd^2
Where,
P= Load at failure
I= Length of beam between supports B= breadth of beam (100mm)

D= Depth of beam(100mm)

❖ **COMPARISON OF COMPRESSIVE STRENGTH**

A comparison of the 3, 7- and 28-days cube strength results shows that

➢ At C0.5 in 3 days there is a 7.2% increase in pressure, 6.52% increase in 7 days, a 6.29% increase in 28 days compared to the M25 grade C0.

➢ In C1 in 3 days there was an 8.64% increase in compression strength, an 8.04% increase in 7 days, an 8.02% increase in 28 days compared to the M25 grade C0.

➢For C1.5 at 3 days there is 11.11% increase in compressive strength, 10.70% increase at 7 days, 11.02% increase at 28 days when compared to C0 of M25 grade.

At C1.65 in 3 days there is a 12.86% increase in pressure, 13.29% increase in 7 days, an increase of 12.13% in 28 days compared to the M25 grade C0.

➢ At C1.85 in 3 days there is a 10.39% increase in pressure, 9.56% increase in 7 days, an increase of 11.19% in 28 days compared to the M25 grade C0.

➢ In C2 in 3 days there is a 9.56% increase in stress, an increase of 9.43% in 7 days, an increase of 10.08% in 28 days compared to the M25 grade C0.

❖ **COMPARISON OF SPLIT TENSILE STRENGTH TEST RESULT**

➢A comparison of the of the 7- and 28-days split cylinder strength result show that

At C0.5 in 7 days there is a 6.59% increase in fracture, 19.25% increase in 28 days, compared to C0 grade M25.

➢ In C1 in 7 days there is an 8.12% increase in cracked dividing power, 21.48% increased in 28 days compared to M25 grade C0.

➢ At C1.5 in 7 days there is a 10.65% increase in split power, 24.81% power in 28 days compared to M25 grade C0.

➢ At C1.65 in 7 days there is a 13.19% increase in fracture strength, 25.92% increased by 28 days compared to the M25 grade C0.

➢ For C1.85 in 7 days there is a 9.64% increase in the divided strength, 24.07% increased in 28 days compared to the M25 grade C0.

➢ For C2 in 7 days there is an 8.62% increase in cracked power, 23.33% an increase in 28 days compared to the M25 grade C0.

❖ **COMPARISON OF FLEXURAL STRENGTH**

➢For C0.5 at 7 days there is 7.59% increase in split tensile strength, 6.78% increase at 28 days, when compared to C0 of M25 grade.

For C1 in 7 days there is a 16.15% increase in fracture separation power, 22.36% increased in 28 days compared to M25 grade C0.

➢ For C1.5 at 7 days there is 35.38% increase in split tensile strength, 31.65% increase at 28 days when compared to C0 of M25 grade.

➢ For C1.65 at 7 days there is 54.61% increase in split tensile strength, 47.98% increase at 28 days when compared to C0 of M25 grade.

For C1.85 in 7 days there is a 31.15% increase in fracture strength, 40.70% increased in 28 days compared to C25 grade M25.

➢ In C2 in 7 days there is a 26.15% increase in strong fracture, 33.165% increased in 28 days compared to C0 grade M25.

3. CONCLUSION

In this experimental study the mechanical properties of reinforced fiber concrete were studied and the following results were drawn:

Concrete with 1.65% of fiber is the optimum percentage of fiber, as we go on increasing the percentage of fiber the strength was shown to be decreasing.

- There was not much effect on compressive strength It usually increases by a small percentage to 1.65% of the fiber after which it decreases. There was an increase of 12.86%, 13.29%, 12.13%, compression power for 3, 7 and 28 days respectively.
- There was moderate effect on split tensile strength. There was a balanced effect on the strength of the solid separation. It usually increases by a small percentage to 1.65% of the fiber after which when the percentage of fibers increases the strength of the Split tensile usually decreases. There was an increase of 13.19%, 25.92%, in 7, 28 days strength respectively.
- There was good effect on Flexural strength. It tends to increase with small percentage up to 1.65% of fiber after which when the percentage of fiber of fibers is increased the Flexural strength decrease. There was an increase of 54.61%, 47.98% in 7, 28 days respectively.
- Workability of concrete tends to decrease with increasing percentage of fibers if admixtures are not added.
- 1.25kg of fiber costs 75 Rs/-, thus it becomes economical in use, as cement Is costly some portion of cement is removed with addition of the fiber
- It can be used for slabs, beams and parts of structure where tensile strength is required.

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