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Comparative Study of Polypropylene Fiber Reinforced Concrete with Conventional Concrete Pavement Design

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Abstract*: Transportation always plays a key role in the development of the country. In India, Bituminous pavements are mostly used across the country. Bitumen are obtained by petroleum crude which is used for the making the flexible pavements. As we know, Petroleum crude are gradually diminished on the earth, so there is a need to replace the bitumen pavement by cement concrete pavement. Cement concrete pavement has several advantages like providing smooth ride surface, high compressive strength, etc. But there are several disadvantages that is its low tensile strength, proper need to maintenance and repairing, low durability etc. Polypropylene fiber reinforced concrete pavement has better solution for overcoming the problems related to cement concrete pavement. PPFRC pavements provide better paving road, smart grip to tyres, high flexural strength and high durability. It also provides better solution frequently maintenance and repairing of the cement concrete pavements. The addition of polypropylene fibers makes it proper binding of the concrete ingredients and gets homogeneous fiber concrete. In this experiment we are analysed to get the optimum strength behaviour of polypropylene fiber reinforced concrete by adding the different percentage of polypropylene fiber by volume of concrete.
Keywords*: Polypropylene fiber, Compressive strength, flexural strength, durability.

I. INTRODUCTION

Various researches have been done in the field of fibers for 3 to 4 decades, but at that time it was not popular so much. Concrete is the most widely used as a construction material in the world. Concrete is obtained by mixing cement, fine aggregate, coarse aggregate, and water. As it is well-known that concrete has high compressive strength and it is weak in tension so that steel reinforcement is provided for the improving the tensile strength but it is not satisfactory to control the post cracking behaviour and durability of the life. So there is a need of proper maintenance and repairing of the plain cement concrete pavement. The best solution to increase the flexural strength and counter the post cracking nature is provided by reinforcing by fibers. There are various types of fibers used like steel fibers, glass fibers, synthetic fibers, natural fibers. In this experiment, polypropylene fibers are used for knowing the strength behaviour of the concrete. Polypropylene fibers reinforced concrete pavement is recently advanced researches in cement concrete pavement which removes almost all sorts of problems in cement concrete pavement. Without any types of fibers, there was development of plastic shrinkage, drying shrinkage and other causes like changing the volume of concrete. When the load is applied to fiber reinforced concrete, the strong fibers take the loads so there are a little chances of occur the cracks. In this experiment, the polypropylene fibers are added in various percentages by volume of concrete to know the optimum flexural strength and compressive strength. The strengths are calculated at 0%, 0.50%, 1.00%, 1.50 and 2.00% of polypropylene fibers by volume of concrete.

II. LITERATURE REVIEW

S.Panda, N.H.S.Ray (2014) established an experiment on design procedure and operations of polymer fibre reinforced concrete pavements. They explained a brief comparison of PFRC pavement with conventional concrete pavement. Polymeric fibers are gaining popularity because of its properties like zero risk of corrosion and cost effectiveness. They analysed of various forms of recycled fibers like plastic wastes ,disposed tyres, carpet wastes and wastes from textile industry can also used as a fiber reinforcement. Concrete pavements may be weak in tension and against impact loads, but PPFRC is a suitable material which may be used for cement concrete pavement and it consist the extra strength in flexural fatigue and impact etc. There are two component of PFRC pavement; one is the concrete mix and other is polymer fibers .The polymer fibers increases the compressive strength 12 to

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16% and also the flexural strength 7 to 14% over the normal concrete.

Amit Rai, Dr. Y.P.Joshi (2014) conducted the experimental studies and application of fibers reinforced concrete. They study different types of fibers and their application. The improvement in concrete properties by polypropylene fibers, they analysed that compressive strength which is increased about 16%. The flexural strength of polypropylene fibers is improved about 30%.They studies the different types of fibres and the concrete properties. Fiber addition improves ductility of concrete Slump test were examined to find out the workability and consistency of fresh concrete. The efficiency of all fiber reinforcement is dependent upon achievement of a uniform distribution of the fibers in the concrete, their interaction with the cement matrix, and the ability of the concrete to be successfully cast or sprayed.

N Pannirselvam, V.Nagaradjane, K.Chandramouli (2009) conducted the experimental strength behaviour of fibre reinforced polymer strengthened beam. They found that strengthening of structures using fibre reinforced polymer. The objective of their work is to determine the strength of structural behaviour of reinforced concrete beams. They observed that in the beam the deflection duclity values for beams showed increases over the corresponding the reference beams

Kolli, Ramujee (2013) conducted the experimental studies on the strength properties of polypropylene fibre reinforced concrete. A combination of high strength, stiffness and thermal resistance polypropylene fibers are preferred for the fibre reinforced concrete. In this study, the results of the Strength properties of Polypropylene fiber reinforced concrete have been studied. The compressive strength, splitting tensile strength of concrete samples made with different fibers amounts of percentage varies from 0%, 0.5%, 1% 1.5% and 2.0% were studied. The samples with added Polypropylene fibers of 1.5 % showed better results in comparison with the other fibre percentage.

III. EXPERIMENTAL DETAILS

A. Materials and Mix Design

1) Cement: In this experiment OPC Jaypee 43 grade cements are used which are locally available in Gorakhpur city. The initial and final setting time of cement has been found respectively 35 minutes and 350 minutes in experiment lab. The specific gravity of cement is 3.15. The compressive strength of cement is found 43.60 MPa at the age of 28 days.

2) Fine Aggregate: Fine aggregates are used which is locally available in Gorakhpur. The basic sources of fine aggregates are river sands. The specific gravity of fine aggregates are calculated 2.649 in the experiment. It lies on zone II having fineness modulus 3.02.

3) Coarse Aggregate: Coarse aggregate used in this experiment are crushed angular aggregate. The specific gravity of coarse aggregate is found 2.673. The absorption of water in coarse aggregate are calculated 0.40%. Combined aggregates (20mm and 10mm) are used for mix design of M30 grade of concrete.

4) Water: Fresh water is used in the mixing of concrete. The pH of water is found 8 in pH meter. The pH value of water should not be less than 6.

5) Admixtures: Admixtures are used as a super plasticizer for the reducing the water in the mix design. Super plasticizer can be reduced the water up to 29%. In this experiment, 16% of water is reduced by mixing the super plasticizer. The specific gravity of super plasticizer is found 1.18.

6) Polypropylene Fiber: Polypropylene fibers are used having 12 mm long and 0.45 mm diameter. The polypropylene fibers are manufactured by Reliance Company. There are two types of fibers generally used micro fibers and macro fibers.

7) Mix Design: The mix design has been done by trial and error method. The mix proportions are calculated as per IS code. The ingredients of concrete M30 grade proportion are shown below table1.1. The raw materials are mixed through hand mixing and compacted through the vibrators of casted cubes and beams.

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Ingredients	Quantity(kg/m3)
water	174.75
cement	400
Coarse aggregate (10mm)	437.42
Coarse aggregate (20mm)	657.46
Fine aggregate	780.04
admixture	4

Table1: Mix proportion of ingredients

IV. RESULTS AND DISCUSSIONS

A. Compressive Strength Test

For compressive strength test results, 3 cubes of each percentage of fibers by volume of concrete are casted in standard specimens sizes 150mm*150mm*150mm. Cubes are tested respectively 7 and 28 days of casted each percentage of polypropylene fiber by volume of concrete. In the following figure shows the test specimens during the process of testing in compression testing machine.



Figure1: Cube testing by compression testing machine

B. Compressive Strength Test Result

Compressive strength test results are calculated respectively 7 days and 28 days. The following graph shows the variation of compressive strength at different percentages of fibers by volume of concrete at different age of days.

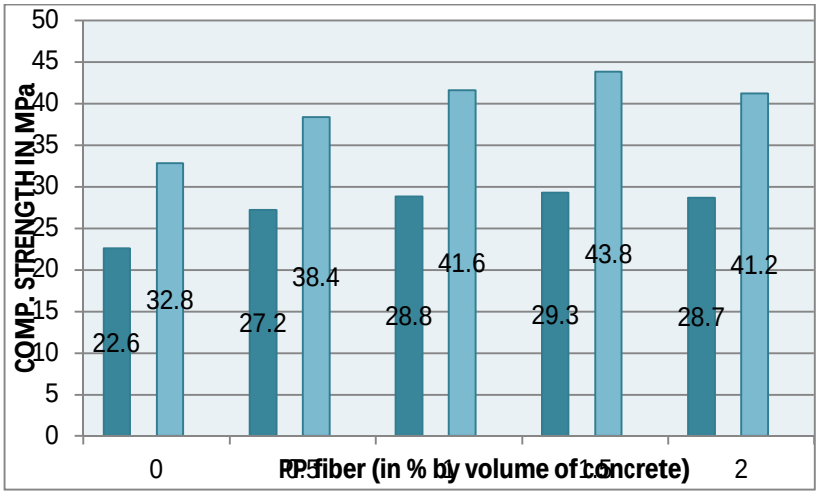


Fig2: Compressive Strength Vs percentage of fiber at different age of days

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In the figure 2, the compressive strength increases 34 % strength at the age of 28 days. The maximum compressive strength is obtained 29.3 and 43.80MPa respectively at the age of 7 and 28 days at 1.50% polypropylene fiber by volume of concrete.

C. Flexural Strength Test

Flexural Strength are tested through the standard size of beam specimen 700mm*150mm*150mm. The flexural beams are casted of each percentage of polypropylene fiber for the testing of 7 and 28 days. In the following figure, flexural beams are tested through the manual flexural testing machine.



Figure3: Beam testing of manual flexural testing machine

D. Flexural Strength Test Result

In the following graph, flexural strength are calculated respectively at the age of 7 and 28 days. The graph is plotted between the flexural strength and different percentage of polypropylene fiber by volume of concrete.

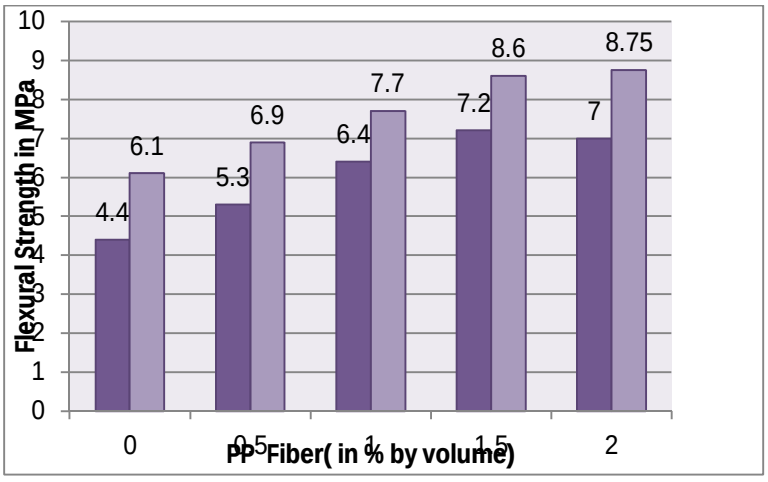


Figure4: flexural strength vs. Different percentage of polypropylene fiber

V. CONCLUSIONS

From the experiment, the following results are concluded:

Compressive Strength increases with adding the percentage of polypropylene fiber. Compressive strength gets maximum at a particular percentages of fibers (here 1.50%) and then decreases with adding the fibers.

Flexural strength increases with increasing the percentage of polypropylene fiber. The maximum flexural strength has obtained at 2.00% of polypropylene fiber by volume of concrete.

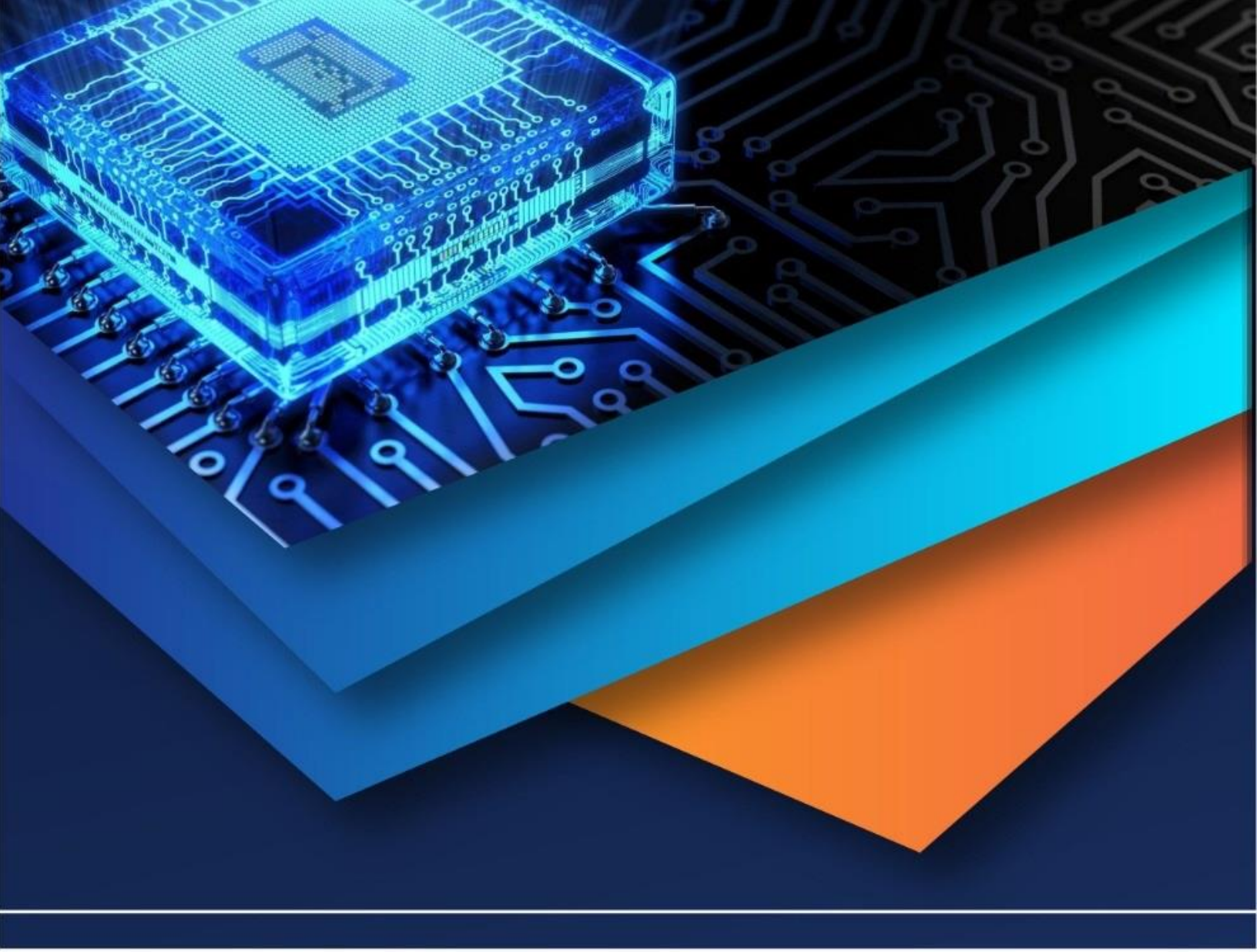
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The slump value decreases with increasing the percentage of polypropylene fiber.

REFERENCES

[1] IS 383:1970 specifications for coarse and fine aggregates from natural sources of concrete.
[2] IS 516:1959 method of tests for test of strength of concrete.
[3] A. M. Neville, Properties of concrete, Longman Singapore publisher's private limited.
[4] Nagarkar P, Tambe S, Pazare D. study of fiber reinforced concrete; 1987.
[5] KENNETH G. BUDHINSKI, MICHEL K. BUDHINSKI," Engineering materials-Properties & selection", 8th edition, Prentice Hall India, pp 194-195
[6] Gopal Krishna, Key role of chemical admixtures for pavement quality concrete", NBM&BW vol 13, pp166-169, July 2007
[7] J.M.L. Reis" Fracture and flexure characterization of natural fibers-reinforced polymer concrete" Construction and Building Materials vol 20 pp 673-678, Nov 2006
[8] Amnon Katz, "Environmental impact of steel and FRP reinforced polymer", Journal for composite for construction vol 8 no.6 pp 48-488. , Nov/Dec 2004.
[9] M S Shetty "Concrete Technology" S Chand Publication 1982 12th Edition, 2007.
[10] en.wikipedia.orhttp://cedb.asce.org/cgi/wwwdisplay.cg(12sep2007).
[11] The code IRC: 44-2008 "for cement concrete mix designs for pavements with fibers"
[12] S.A Kanalli, Ramu Palankar, Bharath Kumar, Praveen Kumar, Prakash S.K.," Comparatively Study of Polymer Fiber Reinforced Concrete With Conventional Concrete Pavement'' IJRET vol 03,issue 01 pp139-143, Jan 2014.

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