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Experimental Investigation on Mechanical Properties of Polypropylene Fibre Reinforced Pervious Concrete

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Abstract: Pervious concrete is also called as porous concrete. It allows runoff or precipitation to penetrate into ground because, it may leads to disaster for environmental effects and conditions and so by using strengthened pervious concrete might be a eco friendly.

Keywords: Porous concrete, permeability, compacting factor, polypropylene fibre, void ratio

I. INTRODUCTION

Pervious concrete is a concrete generally made with cement, aggregate and Water. It is highly porous and permeable. Pervious Concrete is more economical than conventional concrete. To Enhance Sufficient Strength different Proportion of polypropylene fibre is added of about 0.2 percent of volume

II. METHODOLOGY

1) Review of literature
2) Material Selection
3) Material Testing
4) Mix design
5) Specimen casting and curing
6) Strengthening of beam using Polypropylene fibre reinforced concrete
7) Testing of specimen
8) Results and Discussion
9) Conclusion

A. Material Selection

Materials are selected based on IS codes here, Cement, coarse aggregate, Polypropylene fibres are to be used
IS 269:1989 - OPC 53 grade cement
IS 383:1970 - Coarse aggregate 12.5mm size
Water – Normal Portable Water is used

III.POLYPROPYLENE FIBRE

Polypropylene fibre is also known as synthetic fibre, It is the first stereoregular polymer to have reached Industrial Importance .It is used for several purposes such as for carpet, clothing and a thin film for packaging also for a pavement construction. Water penetration is nil in polypropylene fibre so,the binding between cement and coarse aggregate is high.It is easy to access, lowprice and provides excellent chemical resistance

Types of polypropylene fibre
Microfilament fibre-length⟨40mm⟩- 0.35 diameter
Fibrillated fibre – length ⟨30mm⟩- 0.30 diameter

A. Material Test

Material test for cement and coarse aggregate has been tested according to the IS codal provisions. Several test are carried out for coarse aggregate and cement are such as standard consistency of cement,Initial Setting Time of cement,final setting time of cement and for coarse aggregate such as abrasion test, Impact Value test ,Specific gravity of coarse aggregate and fineness modulus etc.The above given test results are mentioned in Table-I

Table I Material Test Results

SR. NO	TEST	RESULT
1	Standard consistency of cement	32%
2	Initial Setting time of Cement	30mins
3	Final setting time of cement	530 mins
4	Specific gravity	2.78
5	Crushing value	22
6	Impact value	15.08
7	FINENESS MODULUS	7.15

B. Mix Design

Based on ACI 522-R Codal provisions
Grade of concrete: M_{20}
Characteristic compressive strength : 20 N/mm^2
Coarse aggregate : 12.5 mm size
Density of concrete : 2400 N/mm^2
Water cement ratio : 0.36
Polypropylene fibre : 0.2% Volume of concrete
Mix Proportion : 1: 4: 0.3

C. Compression Test

Compression cube mould size is of about 150×150×150mm.Theconcrete is to be filled inside the specimen and after 24 hours concrete is to be removed from the mould and the curing process for about 28 days should takes place

Mix	7 Days	14 Days	28 Days
Pervious Concrete	7.8	8.9	10.3
MPC1	8.9	10.2	12.5
MPC2	10.1	12.3	14.7
MPC3	11.23	14.5	18.9

Table II Compression cube test result for about 28 days

D. Split Tensile Strength Test

Tensile cylinder mould size is of about 300×150mm. The concrete is to be poured inside the cylinder mould for about 10cm deep.

Mix	7 Days	14 days	28 days
Pervious Concrete	0.234	0.650	1.00
MPC1	0.534	0.768	1.15
MPC2	0.687	0.890	1.24
MPC3	0.889	0.978	1.36

TABLE III Split Tensile Strength result For about 28 days

E. Flexural Strength Test

Flexural beam mould size is of about 150mm×150mm×700mm.It is a measure of unreinforced concrete beam to resist failure in bending

Mix	7 days	14 days	28 days
Pervious concrete	2.54	3.78	5.88
MPC1	2.76	4.56	6.23
MPC2	3.05	5.34	7.48
MPC2	3.29	6.00	7.63

TABLE IV Flexural test Result Of Beam For about 28 days

F. Permeability Test

Permeability test determines the resistance of concrete against hydrostatic pressure. Permeability of Pervious Concrete core ranges from 0.04 to 4. Two types of permeability test methods are such as constant head method and falling head method used to test permeability of pervious concrete using different Water heads on sample . the results also shows falling head method is lower than constant head method. falling head setup has been made as per code ACI 522-R

Mix	Coefficient of permeability(k) K=VL/Aht
Pervi.Concrete	0.047
MPC1	0.054
MPC2	0.057
MPC3	0.060

Table V Average coefficient of permeability

IV. RESULT AND ANALYSIS

As per IS Codal provision, tests like Compression test, Split tensile test and flexural test are successfully carried out and the strength is also achieved by adding different proportions of polypropylene fibre such as MPC1(25% of monofilament polypropylene fibre and 75% of fibrillated fibre),MPC2(50% of monofilament polypropylene fibre and 50% of fibrillated fibre),MPC3(75% of monofilament propylene fibre and 25% of fibrillated fibre).

The Optimum Percentage has been Observed on MPC1,MPC2,MPC3 at the range falling around 0.2 percentage.

Several Literature Review has been studied and according to that varying proportion of polypropylene fibre is added and the expected strength and result is also achieved. The Crack Pattern Observed in pervious concrete is enough for pure flexural cracks.

Tensile Test with polypropylene fibre 0.2% is achieved more strength than normal pervious concrete. For flexural beam test, by using centre point loading method test was conducted and the strength of about 1.36 N/mm value is obtained. The obtained strength is enough for the durability to pavement and for side walks.

Using varying proportion of polypropylene fibre 0.2% percentage of total volume of concrete.It was observed that coefficient of permeability decreases with increase in percentage of polypropylene fibre. compressive strength is inversely proportional to porosity when compressive Strength increases porosity decreases.

It also shows that by using polypropylene fibre weathering and chemical resistance is also reduced. Normally,as we know that compression strength is weak in tensile strength and the tensile strength is weak in compression but in polypropylene fibre reinforced concrete the failure of the specimen takes more time and it enables more durability.The compacting factor test and void ratio test is also conducted for very low workable concrete

And hence,by using polypropylene fibre to the pervious concrete several advantages and results are obtained.the binding property is very high for the selected material.test results are mentioned in fig 1,fig 2,fig 3 form of graph and charts.the results are properly measured and calculated.

FIG I Compression strength Vs concrete mix

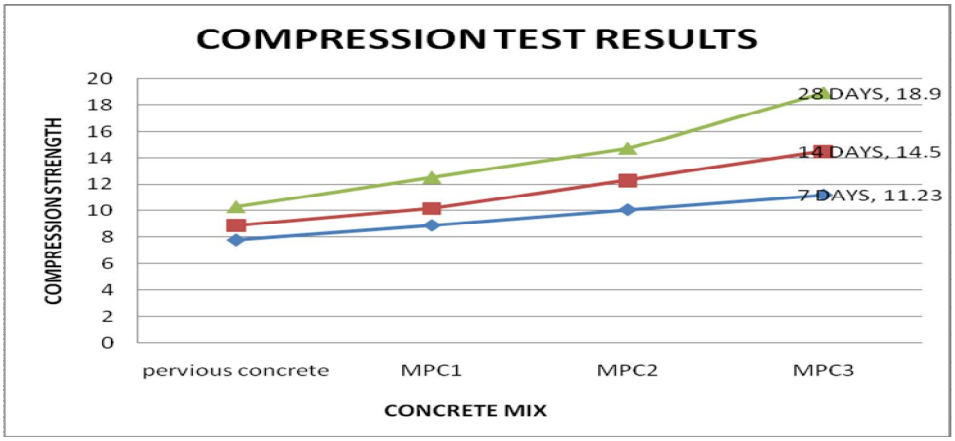


FIG 2 Split Tensile Strength Vs Concrete Mix

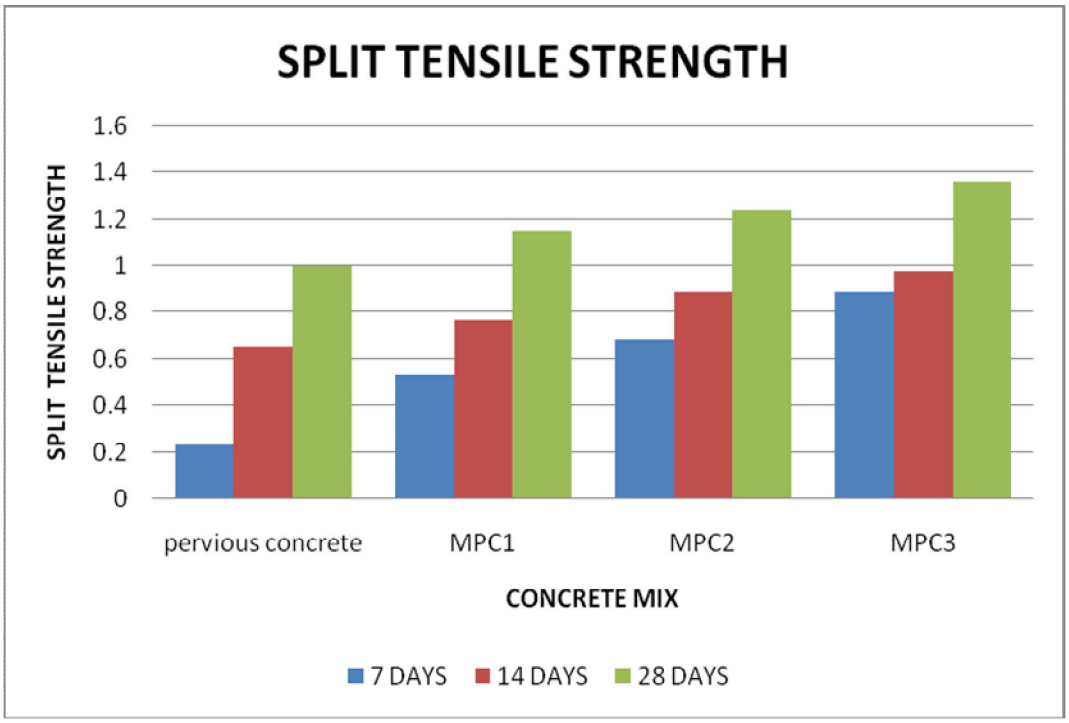
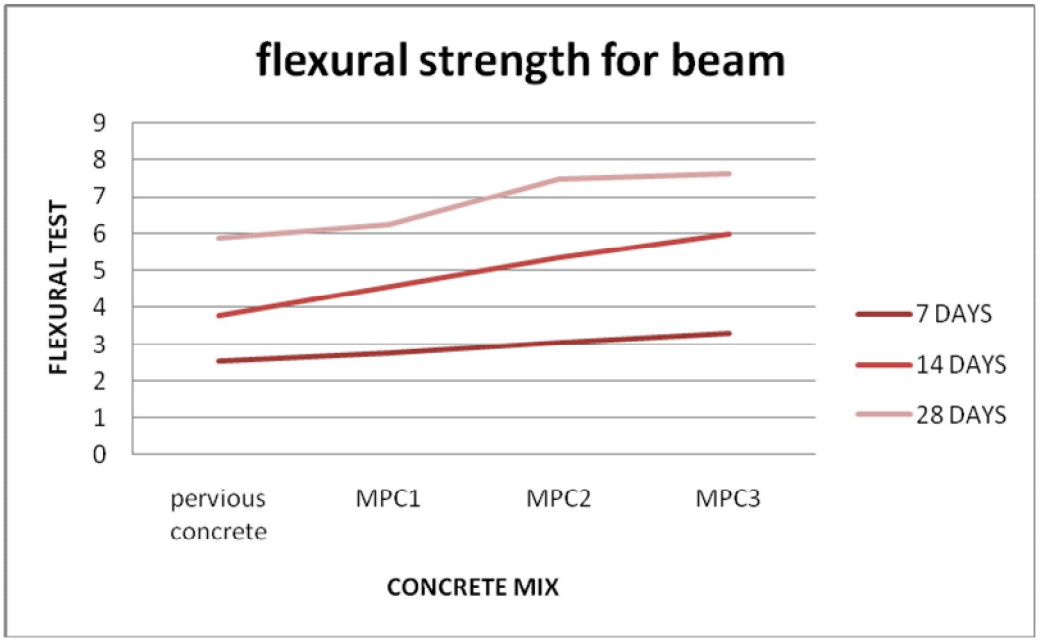


FIG 3 Flexural Beam test Vs Concrete Mix



V. CONCLUSIONS

From thet experimental investigation, it is concluded that compressive strength of mix having 75 percent of monofilament polypropylene fibre and 25 percent of fibrillated fibre gives strength of about 18.9 N/mm^2 which is 41% greater than that of normal pervious concrete. Split tensile strength of mix having 75 percent of monofilament polypropylene fibre and 25 percent of fibrillated fibre gives higher strength of about 1.36 N/mm^2.pervious concrete with 75 percent of monofilament polypropylene fibre and 25 percent of fibrillated fibre achieves strength of about 7.63 N/mm^2.coeffiecient of permeability Reaches of about 0.060 mm/sec.

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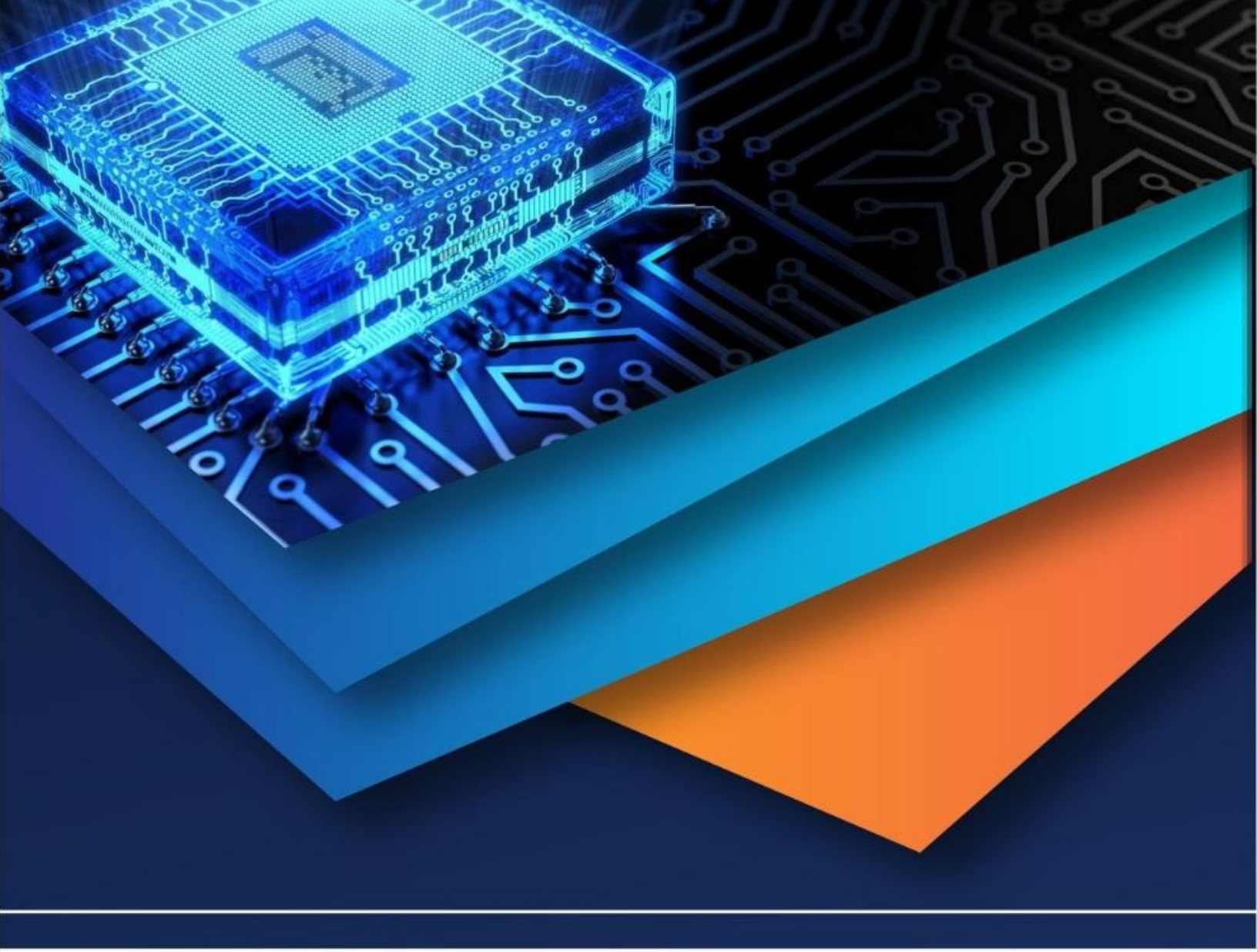

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