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EXPERIMENTAL INVESTIGATION ON THE STRENGTH CHARACTERISTICS OF PERVIOUS CONCRETE BY ADDING POLYPROPYLENE

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Abstract- Pervious Concrete is a relatively new concept in concrete technology with rapid spread of urbanization the soil cover is gradually reduced and the percolation of rain water into the ground surface is also reduced which in turn leads to decrease in ground water level and also stagnation of water during rainy season. Nowadays impervious concrete is used for the construction of roadways, pavements etc. Due to the impervious nature of the concrete rain water is not able to seep into the ground. Pervious concrete is used as a road material has seen renewed interest due to its ability to allow water to flow through itself to recharge ground water level and reduce surface runoff. This concrete technology creates more efficient land use by eliminating the need for well and other costly strom water management devices by capturing rainwater and allowing it to seep into the ground. But the major problem with the pervious concrete is its strength. As of now pervious concrete are used only in pathways and pavements where the load is minimal. In this paper effort has been taken to increase the strength of pervious concrete by adding polypropylene in the mix. Strength of normal pervious concrete and pervious concrete prepared by adding polypropylene and super plasticizer as admixtures in different proportion were compared. Optimum new mix ratio will be arrived from the different proportion used. Study will be made whether the increased strength of pervious concrete can be used for road construction and check its suitability for various purpose

Keywords - Pervious Concrete, Rain water, Percolation, Polypropylene, Super Plasticizer, Strength Characteristics, Mix Proportion

I. Introduction

Water logging and depleting ground water table are the two major problems faced by the people all over the world. Even though some place have very well planned drainage facilities it becomes sometimes difficult to drain water from road surfaces. In modern times due to increasing population in developing countries like India the exposure of soil surface to the nature is highly reduced because of increased construction activities. Urbanization reduce soil surface exposure on the top earth surface which is often being covered by a layer of tar or concrete for roadway. The ground water level is also reducing due to low rate of infiltration and also the run off water is generally high. Pervious concrete is one of the modern methods which is highly capable of draining water and also has Low strength characteristics. Implementation of pervious concrete roads for Indian condition is very essential for a beneficial town planning with efficient collection system for surface run off water. Pervious concrete is a zero slump, open graded material consisting of hydraulic cement, coarse aggregate, admixtures and water

II. Materials Used

Generally pervious concrete consists of only cement & coarse aggregate. Cement is the only binder material used in this project and hence OPC53 grade cement is used. Coarse aggregate of size 15mm to 25 mm is used in this project to obtain maximum permeability. Apart from cement and aggregate admixtures such as polypropylene fiber are used in this project to increase the compressive strength and abrasion strength of pervious concrete. Polypropylene fibers is added in 2% to 5% weight of cement particles. Polypropylene fibres are used with the concrete and sheets are shreeded into pieces and are mixed with concrete. Barium Di Phenylamine Sulphonate is used as super plasticizer. It is a form of benezene.

TABLE I. Properties of Polypropylene

Density	Kg/m^3	905
Tensile Strength	Mpa	33
Tensile Modulus	Mpa	1.4
Elognation at break	%	150
Hardness	Rockwell R scale	90
Heat Distortion Temp (HDT)	@.45 Mpa/^oC	105
Heat Distortion Temp (HDT)	@1.80Mpa/^oC	65
Volume Resistivity	logUm	19

TABLE II. Properties of Coarse Aggregate

Property	Permissible Value	Actual Value
Specific gravity	2.6 – 2.9	2.8
Sieve analysis	<2	0.0004
Crushing test	<10%	9.4%
Impact Test	<30%	19%

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III. Mix Design

Due to the absence of fine aggregate the general design mix is considered as per IS standarads from 1.5 to 1.10. The mix ratio of 1:6 is considered to be the mix which yields maximum strength i.e 1 part of cement and 6 part of coarse aggregate. Totally two mix design were considered.

- Plain Pervious Concrete
- Pervious cioncrete with polypropylene fiber

Table 3 Mix Ratio

Description	Mix 1	Mix 2
Mix Ratio	1:6	1:6
Water Cement Ratio	1:0.45	1:0.4
Weight of Admixtures	NA	100g

IV. Mixing Methods for admixture

Mixing partial proportions of polypropylene fibers and sheet pieces with cement and coarse aggregate in equal ratios. Then mixing those 2 ingredients with adequate amount of water.

V.Material Testing Result

A. Sieve Analysis

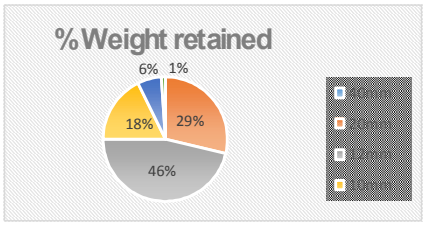

Fig.1.Sieve Analysis

B. Specific Gravity

Specific gravity of coarse aggregate is found to be 2.8 and as per IS2386 (Part 3): 1963, the specific gravity of coarse aggregate should be 2.6% to 2.9%. Water absorption of coarse aggregate = 3.5%. The specific gravity of cement is obtained as 3.5. Fineness of cement = 1%. The percentage of water required for obtaining cement cement paste of standarad consistency = 22.5%

VI. Testing Results

A. Comparative Result for Compression

Comparing the resuts of compression from the 2 types of specimen it is typically found that mix 2 containing polypropylene fiber has relatively high strength compared with that of the conventional one. It is observed that even though there is a failure in the mix1 but the cubes underwent partial failure rather than complete failure

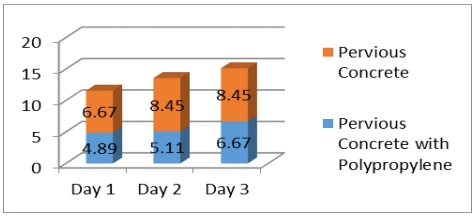

Fig.2.Compression Result

B. Comparative Result for flexure

Comparing the rsults of flexure from the two types of specimen it is found that mix2 containing polypropylene fibre has relatively high strength compared with that of the conventional one. The 2nd mix withstands a high flexural strength than the other 1st mix.

Fig.3. Flexural Result

C. Comparative Result for Split Tensile Test

It is clearly seen that the split tensile strength is high for the first mix due to the bonding between aggregates and cement whereas for mix 2 the split tensile strength is slightly lower than the other one. This might be due to the low bonding between polypropylene fibre and aggregate

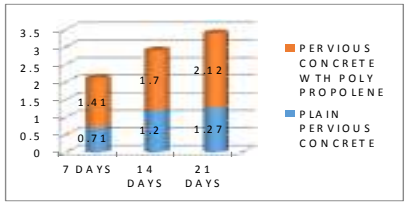

Fig.4 Split Tensile Test

VII. Permeability Analysis

Permeability test is an important test required for determing the permeability or draining capacity of pervious concrete, which is the core idea of the project. From the testing values it is found that the values of permeability are realtively higher for conventional concrete, a little low for pervious concrete with polypropylene fibre

Table 4 Permeability Analysis

Type of Mix	Discharge (m^3/hr)
Pervious Cncrete	12.02

Pervious concrete with poly propylene	15.43

VIII. Conclusion

Pervious concrete or no fineness concrete can be used as a pavement material generally and the usage of admixture with conventional polypropylene fiber increases the strength. The mix attained its maximum strength in 14 days itself. So it can be used for low load bearing roads. It is also an environment friendly material which allows ground water recharge simultaneously.

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