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Experimental Study on Behavior of Pervious Concrete in Strength and Permeability by Changing Different Parameters

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***Abstract:** A type of concrete with a high void or porosity that allows water to penetrate through it is called pervious concrete. Pervious concrete behavior was examined using various sizes of aggregate (20mm and 10mm), weight/concentration ratios (0.34 & 0.28), super plasticizers (Aura mix 400 & Conplast SP 430) and different percentages of fiber (i.e. 1% & 2%). Compressive strength, flexural strength, permeability test criteria were used to describe the similarity. The results show that decreasing the w/c ratio from 0.34 to 0.28 results in a moderate increase in strength and super plasticizer (Conplast SP 430) provides good strength. The addition of fiber, at 1% by weight of cement, significantly increased strength. However, porosity was the most important factor in calculating the efficiency of porous concrete, which was affected by the addition of a certain percentage of fiber. The findings of this study provided useful information about the effectiveness of w/c ratio, super plasticizer and fiber in achieving the optimal strength, drain ability balance suitable for various urban uses.*
***Keywords:** Pervious concrete, super plasticizer, polypropylene fiber of 12mm, compressive strength, flexural strength, permeability test*

I. INTRODUCTION

Pervious concrete refers to concrete that allows water to penetrate through it due to its high void or porosity. Because it is an environmentally friendly artifact, the EPA (Environmental Protection Agency) has recognized it as best management practice for storm water management due to the limited amount or absence of fines in pervious concretes extremely good quantity pores that facilitate store storm water inside them and cut back runoff amount in an extremely scientific manner.

Pervious concrete, also known as porous, gap graded or permeable concrete is made up primarily of normal portland cement, course aggregate and water. Fine aggregates are either absent or present in very small quantities, i.e. 10% by weight of the total aggregates. In general, aggregates that pass through a 12.5mm sieve and are retained on a 10mm sieve are used when making porous concrete.

Several studies have shown that previous concrete has the following advantages:

1) Allow for natural recharge of ground water and avoid water evaporation from the soil beneath.
2) Sidewalks, sidewalks, pathways, and large parking lots.
3) Pervious concrete is used as a sub-base for traditional concrete pavements, as well as for pavement edge drains.
4) Private roads and low-water crossings.
5) Vehicle noise is reduced, and there is no plash on the pavement surface, so there is no glisten throughout the night.

A. Objective

1) The primary goal of this paper is I to investigate the performance and behavior of the open structure of pervious concrete in Indian climatic conditions.
2) To compare the strength properties of conventional and pervious concrete.
3) Research into the effects of fine aggregate, w/c ratio, and admixture on the properties of pervious concrete.

B. Scope

1) A porous concrete pavement system can be an effective tool for storm water management.
2) Storm water retention areas may be reduced or eliminated as well.
3) Allowing rainfall to infiltrate can increase ground water level and aquifer recharge.

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C. Materials

1) *Cement:* Ordinary Portland cement of 53 grades was used in the experimental investigation.

The physical properties of cement are as follows:

Specific gravity 3.17
Initial time of setting: 2:07 hrs
Final Setting time: 2:61 hrs.

2) *Aggregate:* Crushed Aggregate (C.A) with a size of 20mm and coarse aggregate with a size of 10mm was used.

C.A carries properties
2.73 specific gravity
1% water absorption

Fine aggregate with a diameter of less than 2.5mm was used.

3) *Super Plasticizer:* In the experiment, two different types of super plasticizer were used namely Auramix 400 and Conplast sp 430. The super plasticizer dosage was 1% of the cement.
4) *Fiber:* To gain strength, polypropylene fiber of size 12 mm was used.

D. Preparation of sample & specimens:

Three different sizes of specimens were prepared for laboratory testing. The restricted compressive strength was measured using a specimen with dimensions of 150*150*150 mm.

The flexural strength, a specimen of size 100*100*500 mm was used, and for split tensile strength and permeability, a specimen of diameter 100mm and length 200 mm was used.

Fig 1: Sample specimens of cubes and cylinder

II. METHODOLOGY

A. Compressive strength testing

Compressive strength tests were performed on a 150*150*150 mm cube after 7 days and 28 days of curing. A standard testing machine with a maximum capacity of 2000 KN was employed at the standard rate of loading specified in IS 516-1959.

C = P/A for compressive strength. N/mm^2

Figure 2: Cubes with fiber and without fiber

B. Flexural Strength Test

Flexural strength tests were performed on beams measuring 100mm*100mm*500mm. The flexural test was performed using two point loading in accordance with IS 516-1959.

The illustration is set in the machine in such a way that the store is associated with the most notable surface as tossed in the shape along two isolated lines.

Flexural strength is calculated as PL/(bd^2) and measured in N/mm^2.

Figure 3: Flexural strength test without fiber

C. Permeability Test

The coefficient of permeability was deduced from Darcy's law, which was preliminary used as a falling head test to obtain its coefficient as per ASTM D2434.

Calculated as

K = $QL\ HAt$ Q = quantity of water collected in cm^3

K = coefficient of permeability (cm/s)

L = length of specimen (cm) T = time (sec)

A = Cross section area of specimen (cm^2)

H = Water head (cm)

Table 1 enlist the details of mixes used in the study with different parameters

TABLE I

Mixes With Different Parameters

Mix Type	W/C Ratio	Mix Ratio	Fiber	Sand	Super Plasticizer
MCP	0.34	1:1:3.55	-	-	Conplast SP430 SRV
MA1	0.34	1:4:55	-	8%	Fosroc Auramix 400
MA2	0.34	1:4.55	-	8%	Fosroc Auramix 400
MA3	0.34	1:4.55	2%	8%	Fosroc Auramix 400
MA4	0.34	1:4.55	4%	8%	Fosroc Auramix 400
MCP1	0.28	1:4.2	1%	12%	Conplast SP430 SRV
MCP2	0.28	1:4.2	2%	12%	Conplast SP430 SRV
MCP3	0.28	1:3.6	1%	12%	Conplast SP430 SRV
MCP4	0.28	1:3.6	2%	12%	Conplast SP430 SRV

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III.RESULT AND DISCUSSION

The mixes were evaluated for strength and permeability. Compressive strength ranges from 3.56 N/mm^2 to 28.5 N/mm^2, while flexural strength ranges from 1.9 N/mm^2 to 3.4 N/mm^2 & coefficient of permeability results range from 0.26 cm/sec to 1.6 cm/sec, respectively. The effects of sand and fiber addition on the w/c; super plasticizer and c/a ratio magnitude relationship were evaluated and discussed below:

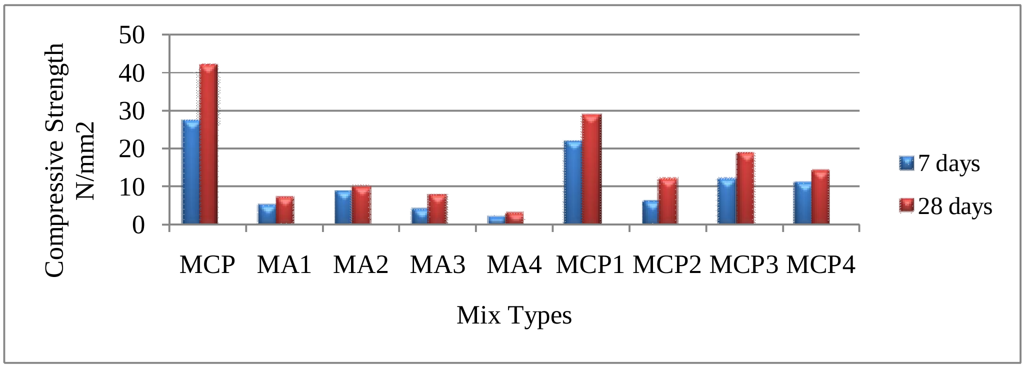

Figure 4: Compressive Strength Graph

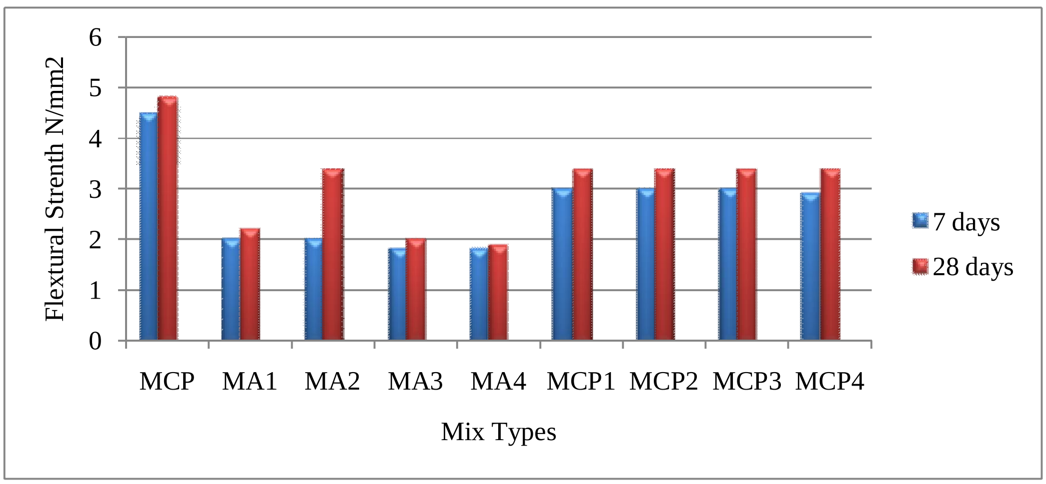

Figure 5: Flexural Strength Graph

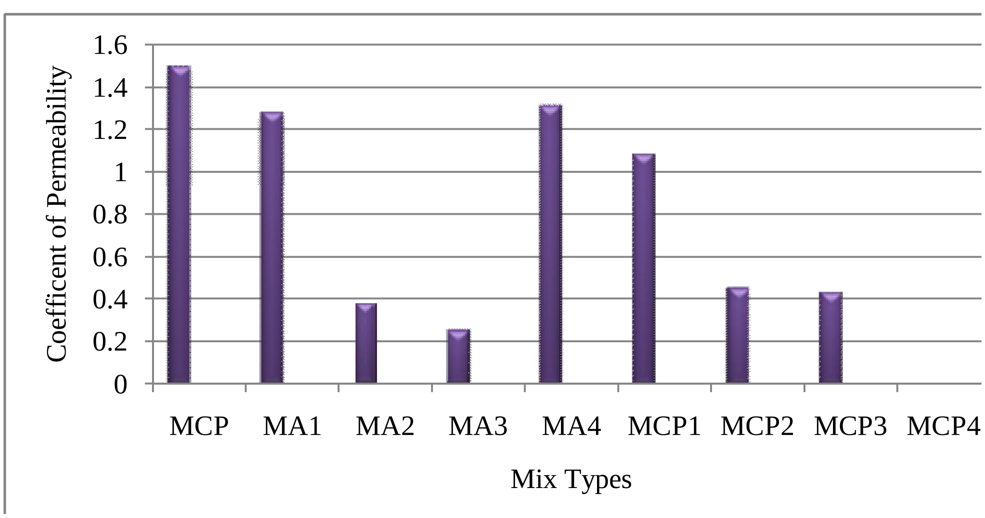

Figure 6: Coefficient of Permeability Graph

A. Effect of sand and fiber
Fiber and sand Influence: After reviewing the results, it was discovered that the amount of fiber in the mixes had a significant influence on strength and permeability. Compressive strength increases with increasing fiber up to 1% by weight of cement, but decreases with increasing fiber. Based on this observation, sample MCP1, which contained 1% fiber, had higher strength and permeability than samples MA2, MA3, MA4, MA6, MA7, and MA8.
Similarly, sand addition was found to be directly proportional to pervious concrete compressive strength but inversely proportional to permeability. Samples MA1 and MA2 containing no sand had low strength but high permeability.

B. Effect of w/c ratio
After analysing all of the graph's results, it was discovered that as the w/c ratio decreased, the strength of previous concrete increased. Specifically, sample MA1 to MA4 with a w/c ratio of 0.34 has less strength than sample MCP1 to MCP4 with a w/c ratio of 0.28. Similarly, the c/a ratio was inversely proportional to strength and directly proportional to pervious concrete permeability. MA1 to MA4 < MCP1& MCP2 < MCP3 & MCP4, whereas MA1 to MA4 > MCP1 & MCP2 > MCP3 & MCP4 for permeability.

IV. CONCLUSION
The following conclusion is drawn based on the information obtained during this study:
1) Fiber content has a strong influence on compressive strength but only a moderate influence on flexural and split tensile strength. i.e., as the percentage of fiber increases, the compressive strength decreases by 50%, and the coefficient of permeability decreases as well.
2) Pervious concrete with fibers is more flexible than pervious concrete without fibers
3) The addition of fiber by weight of cement to pervious concrete increases strength rather than replacing coarse aggregate by weight.
4) Despite having the highest coefficient of permeability, sample M1 cannot be recommended for pavement due to its low compressive strength.
5) The maximum compressive strength of sample MCP3 is 28.50 N/mm^2, but its coefficient of permeability is 0.5 cm/sec. As a result, sample MCP1 with a compressive strength of 28.00 N/mm^2 and a coefficient of permeability of 1.19 cm/sec is suitable for the construction of low traffic volume pavements and parking lots.

REFERENCES
[1] J.J. Kim Yail J.J Kim, Gaddafi A. and Isamu Yoshitake, Permeable Concrete mixed with various admixtures, Materials and Design, 2016, 110-119.
[2] A. Conically, F. Giustozzi, M. Crispino, Experimental study on the effects of fine sand addition on differentially compacted pervious concrete, Construction and Building materials, 2015, 91, 102-110.
[3] Y. Zaetang, A. Wongsa, V. Sata and P. Chindaprasirt, Properties of pervious concrete containing recycled concrete block aggregate and recycled concrete aggregate, Construction and Building Materials, 2016, 111, 15-21.
[4] D. Hanh Nguyen, N. Sebaibi, A modified method for the design of pervious concrete mix, Construction and Building materials,2014, 73, 271-282.
[5] V.L. Narasimha and U. Maguesvari, Characterization of pervious concrete for pavement applications,2nd conference of transportation research group of India, 2013, 198-207.