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Pervious Concrete with Varying Percentage of Fine Aggregate

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Abstract:** The beneficial properties of pervious concrete on storm water control, ground water recharging and recharging the local aquifers are well understood. As the use of pervious concrete becomes more prevalent throughout the world, the issue of constructability will become more of a concern. A number of practices exist to place pervious concrete, without any theoretical underpinnings or correlation to laboratory scale studies. This paper describes the current state of practice in Ordinary Portland cement Pervious Concrete (OPCPC) placement and also presents results of OPCPC to determine a field level QC/QA check for fresh OPCPC. Test cubes were placed using a variety of techniques currently employed for field placement of OPCPC. Results show that OPCPC samples with various void ratios having 7, 14 and 28 days compressive strengths and permeability tests. Test values are obtained from the OPCPC have been shown suitable for pervious concrete applications as for the safety and strength. Our study shows that varying of fine aggregates samples with 0%, 12%, and 24% with replacing coarse aggregate. The construction technology of OPCPC is evolving, but the correlation between laboratory and field placement will allow standard QC/QA checks to be developed for producing permeable, strong, durable, and long-lasting pervious concrete.

I. INTRODUCTION

Pervious concrete also called porous concrete, permeable concrete, and no fines concrete and porous pavement. It is a special type of concrete with a high porosity used for concrete flatwork applications that allows water from precipitation and other sources to pass directly through, thereby reducing the runoff from a site and allowing groundwater recharge. Pervious concrete is made using large aggregates with little to no fine aggregates. The concrete paste then coats the aggregates and allows water to pass through the concrete slab. Pervious concrete is traditionally used in parking areas, areas with light traffic, residential streets, pedestrian walkways, and greenhouses. It is an important application for sustainable construction and is one of many low impact ground development techniques used by builders to protect quality. Pervious Concrete with varying percentage of fine aggregates has been extensively used in a number of countries for quite some time as a specialized problem-solving technique for providing pavement in areas where conventional types of construction are less durable due to many operational and environmental constraints. Pervious concrete paver block is solid, unreinforced pre-cast cement concrete paving units used in the surface course of pavement. By improving its compressive strength with varying percentage of fine aggregates it can be used in heavy traffic area also. Interlocking pavers are also manufactured concrete product that is individually placed in a variety of patterns and shapes as per the requirement.

II. NEED FOR STUDY

The Bangalore city has been witnessing a real estate boom with apartment complexes of over a thousand dwelling units. Over the last 10 years, over 2 lakh apartments have come up To take care of water needs of all dwelling units in some huge apartment complexes, 20-25 bore wells are dug up in less than an acre of area. This has an adverse impact on the Groundwater level of the area. In many cases, all bore wells in the neighborhood of a huge Apartment complex have dried up. According to a 2010 study by Karnataka Groundwater Authority members, the city is Recharging only 3,290 hectare metres of groundwater annually even as it exploits three times more than the recharge for various purposes. The study reveals that apart from a steep increase in groundwater exploitation in Bangalore in recent years, there is also a considerable amount of wastage, which can be avoided if water is used and preserved judiciously.

"Bangalore is [spread over] an estimated 800 sq km," says K C Subhash Chandra, hydrologist and groundwater expert member, Karnataka Groundwater Authority. "Of this, the built-up area is 560 sq km, with 240 sq km of open space. Naturally, there is a severe restriction of rain water infiltration into the ground."

According to the study Bangalore receives 830 mm of rainfall annually, which amounts to 66,400 hectare metres of water. "Over 71% of the water is getting wasted in evaporation and transpiration," Chandra says. "If the rainwater that is being wasted as runoff, amounting to 17,040 hectare metres, is saved and used, it can serve 23 lakh people—about 24% of the city's population."

III. SCOPE AND OBJECTIVES

To obtain Mix Design for Pervious Concrete.
To evaluate the pervious concrete specimens in terms of Compressive Strength and Permeability.
To prepare Interlocking Pervious Concrete Blocks using the available mould shapes prevailing in the industries.

IV. METHODOLOGY

In the present dissertation the first stage of the entire work is aimed at obtaining the concrete mix for Pervious Concrete using the naturally available coarser virgin aggregates, Ordinary Portland Cement and suitable admixtures, without the application of fine aggregates or by freezing the limit for its use to a minimum value. The concrete mix specimens prepared using varying percentages of cement and water contents are evaluated in terms of its 28 days compressive strength and Permeability characteristics. The second stage of the dissertation is aimed at preparing Pervious Concrete Blocks or interlocking concrete paver blocks using the available mould shapes prevailing in the industries

FLOW CHART FOR THE PROJECT WORK

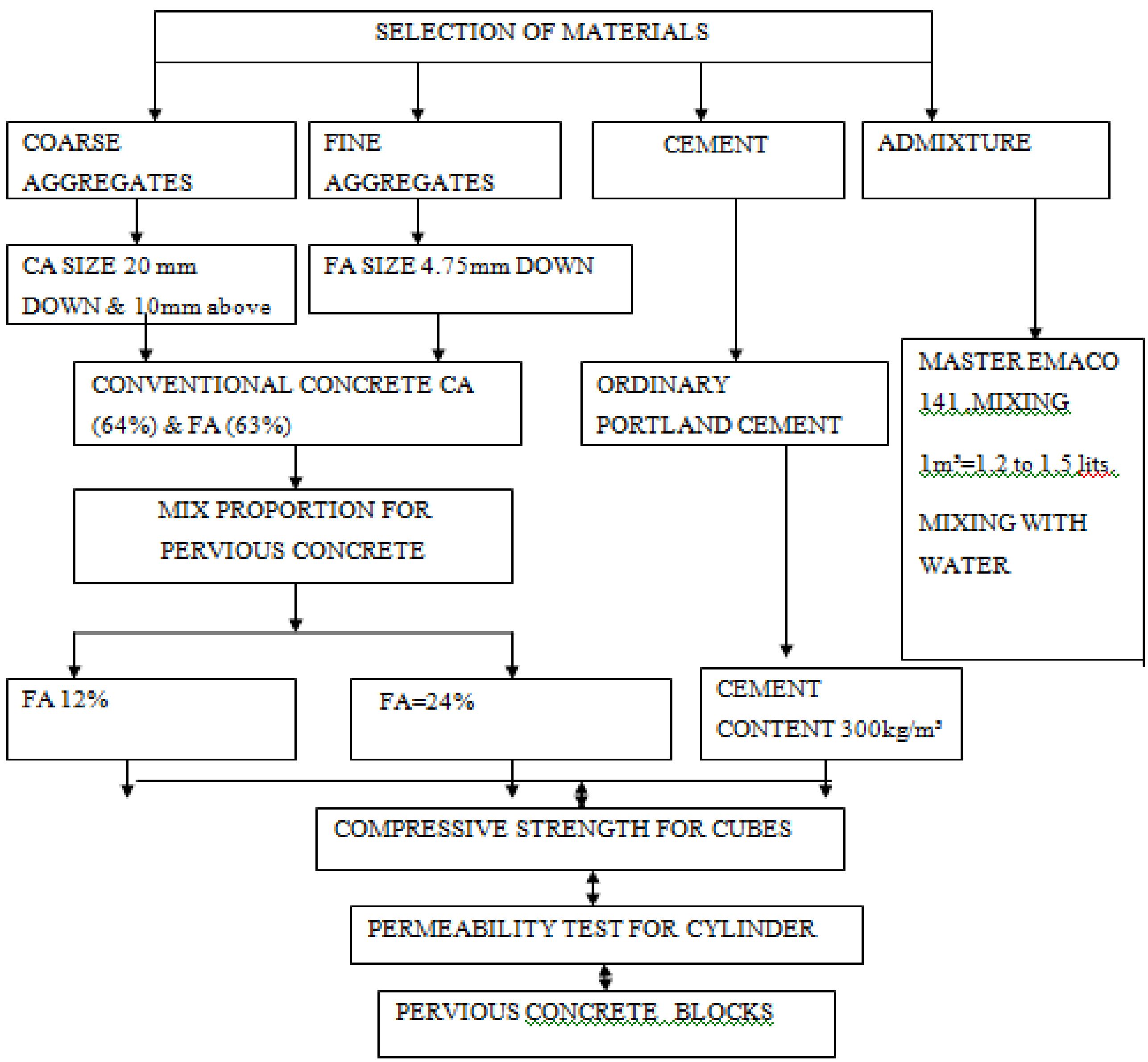

TABLE I MIX SPECIFICATION FOR ONE CUBE

Cement Content	Name of Material	Percentage of sand content		
		0%	12%	24%
300 kg/M^3	Cement in kg	0.82	0.82	0.82
	F.A in kg	0	0.64	1.29
	C.A in kg	5.8	5.27	4.62
	Water in ml	300	300	300

V. PERFORMANCE TESTS

The following chapter discusses the performance tests carried out on the Pervious Concrete block. Two performance tests were conducted which included

A. *Permeability Test*

Permeability is one of the critical properties, as it marks the ability of the pervious Concrete block to properly drain the fluid through the system. The permeability test was conducted using a permeability set up in the laboratory as discussed**.** It should denote that the test method adopted not only suits for the laboratory testing but due to its simplicity, it makes way to test core cut field specimens for Permeability.

The coefficient of permeability or simply permeability is defined as "The average rate of flow that will occur through the total cross-sectional area of specimen under unithydraulic gradient**"**.

1) The Permeability test was conducted on six perviouscy lindrical specimens.
2) (100 mm dia. and 200mm ht.) By adding admixture in order to provide bonding of concrete.
3) Varying in sand percentage of – 0%, 12% and 24%.
4) The test was performed based on the falling head principle of permeability.

B. *Falling Head Permeability Test*

1) The falling head permeability test was performed in a simplest way in the laboratory using a cylindrical measuring jar (refer fig.1)
2) In order to ensure unidirectional flow the sides of the specimen was completely covered with a coating of petroleum jelly and the measuring cylinder was kept attached with specimen with the aid of wax ensuring no leakages.
3) When water is allowed to run down the cylindrical jar, as the water level constantly falls, the water flows down the porous specimen.

Fig.1 Water passing through the pervious concrete specimen during permeablity test

Formulae: Observations are started after steady state of flow has reached. The heads at two successive time intervals *'t1' and 't2'* is recorded as 'h1'and 'h2' respectively.

The coefficient of permeability of the concrete sample in then determined based on Darcy's law.

The coefficient of permeability 'k' is found using the relation as shown below;

$$k = ((a L/ A t) \log e(h 1 /h 2))$$

Where,

k = coefficient of permeability, cm/s;

a = inside cross-sectional area of the cylindrical measuring jar, cm2;

L = average thickness of the test specimen, cm;

A = average cross-sectional area of the test specimen, cm2;

t = elapsed time between *'h1'* and *'h2'*, (t2 ~ t1) s;

h1 = initial head of water in the measuring jar, cm;

h2 = final head of water in the measuring jar, cm;

tc = temperature correction for viscosity of water, (a temperature of 20° C is used as the standard temperature

C. Calculations

1. $K=a*200/(7853.98*7.07)*\log_e(75/25)$

$K=0.053$cm/sec

$K=(3.14*20)/(7853.98*7)*\log_e(75/25)$

$K=0.114$cm/sec

Table II

PERMEABILITY TEST RESULT

TRIAL N0.	CEMENT CONTENT	SAND CONTENT	AVERAGE PERMEABILITY k=cm/s
Mix 1	300kg/m	0%	0.156
Mix 2	300kg/m³	12%	0.099
Mix 3	300kg/m³	24%	0.0578

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D. Compressive Strength Test

Table.III7 days compressive strength test results

Ratio of fine aggregates	Cement in Kg	Water in ml	Fine aggregates in Kg	Coarse aggregates in Kg	7 days compressive strength in N/mm^2
0%	0.82	300	0	5.8	1.5
12%	0.816	300	0.6454	5.27	3.5
24%	0.82	300	1.29	4.62	4.2

Table.IV
28 days compressive strength test results

RATIO OF FINE AGGREGATES	CEMENT IN KG	WATER IN ML	FINE AGGREGATES IN KG	COARSE AGGREGATES IN KG	28 DAYS COMPRESSIVE STRENGTH IN N/MM^2
0%	0.82	300	0	5.8	6.148
12%	0.82	300	0.645	5.27	7.92
24%	0.82	300	1.29	4.62	8.87

VI. CONCLUSION

On conducting permeability test on pervious concrete cylindrical specimens, it was observed that only the specimens that are prepared with zero % fines are found to be pervious having K value = 0.11cm/sec. Conclusion based on compressive strength result based on the compression test conducted on 150*150*150 mm cubes for varied % of cement and fine aggregate content the following observation have been made.

A. Compressive strength is found to increase with increase in sand content that is for higher volume of sand the voids % within the concrete mass is less which helps in increasing the bond strength accordingly the strength varies directly with increasing sand content
B. Another observation that was made is that the compressive strength increases with increasing cement content irrespective of variation in sand content which is universally accepted concept

REFERENCES

[1] "Pervious concrete – an overview"(AUG 2014) Karthik.H.Obla.
[2] "Evaluation of water storage capacity in permeable Block pavement "(4th May 2013) Dae-Geun park, Noe Sandoval, Wuguanglin.
[3] "Low cost interlocking paver block by partially replacement of portlandpozzolana cement (2011) " Dixit N Patel, Jayeshkumar R Pitroda
[4] Recycled plastic used in concrete paver block "(June 2014) Ganesh Tapkire, Satishparihar, PramodPatil, Hemraj R Kumavat.
[5] "Experimental Investigation on Properties Concrete Paver Block"(Aug 2014) G. Navya, J. VenkateswaraRao