A ReviewOnStrength Properties Of Pervious Concrete using A Rice Husk Ash

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Abstract

Pervious concrete(No-fines concrete) is a type of light weight concrete which is made by either Neglecting fine aggregate particle completely or by using small amount of M-sand content in a concrete mix instead of River sand, which allows interlinking void spaces to be formed in the concrete. The main objective of this project was to conduct research on no-fines concrete. High interlinking voids in concrete allow the water to percolate through concrete and then recharge a ground water. The mixture is composed of cement, Coarse aggregate of 95%, Little M-Sand of 5% and Rice husk ash.In this study a/c ratio of 6:1,8:1 &10:1,Water cement ratio of 0.45(Optimum ratio) with different percentage of rice husk ash such as 3%,6% and 9% as a partial replacement of a cement have been used. Properties of No-fines concrete such as compressive strength,flexural strength and split tensile strength were performed.

Keywords - *Rice husk ash, M-sand.*

I.INTRODUCTION

One of the Demerits of conventional concrete is its self-weight and low permeability. It has a density in the range of 2400 to 2600 Kg/m^3. Due to low permeable conventional concrete used in a road,Rain water cannot be easily percolated. No-Fines Concrete(Pervious concrete) is a lightweight concrete is the best option for easily percolation of rain water in a road construction and to be saved a ground water level. It is having a density of range 1600 to 1900 Kg/m^3. Very often only single sized coarse aggregate, of size passing through 20 mm retained on 10mm is used. No-fines concrete is becoming popular because of some of the advantages it possesses over the conventional concrete.

Pervious concrete was produced by adding little M-sand (5%) with different proportion of Rice husk ash was studied in this paper. M-sand is used as replacement of natural river sand due to temporary ban forextraction of natural river sand from river beds. Due to using a little
percentage of M-sand about 5%, light in weight and also to attain sufficient strength with low production cost.

Due to major percentage omission of fines, Surface area of a concrete can be decreased to reduce a cement content used in a No-fines concrete. It consumed less cement content than conventional concrete due to less surface area.

It has better thermal insulating characteristic than normal concrete and thus it is useful for construction of external wall. If it has less dead weight, itcan reduce a overall dead weight of the structure which gives reduction in size of foundation when it used as a masonry unit in building. Numerous pores present in pervious concrete makes it more permeable and a very good acoustic sound absorber.

II.AIM AND OBJECTIVES

The aim of this research work is to study the properties of pervious concrete with different mix proportion by varying Rice husk ash.The main aim behind this research work was to produce a concrete block with few percentage of fine aggregate particle which would result in lower density with sufficient strength thereby reducing cost of production.

- To increase in strength parameters may be due to increase in content of rice husk ash.
- To make low cost and eco-friendly concrete Structure.
- To achieve different properties or behaviourof No-fines concrete.
- To improve strength andperformance.

III.MATERIALS AND METHODOLOGY

A. Materials

Cement: Ordinary Portland cement of 53 grade was used in this study and its properties are given in Table No.1.

Coarse aggregate:

Crushed angular aggregate size between 20mm and 10mm is used and itsproperties are given in Table No.2 .

Fine aggregate:

Manufactured sand is used as a fine aggregate in this project, instead of Natural river sand and its properties are given in Table No.3.

Rice husk ash:

Rice husk ash,is obtained by burning rice husk by proper controlled process.It can control a hydration process.

Water:

Storage tank water available in a sitewas used in mixing and curing process. Water is potable in nature and its PH is not less than 6.

Specific gravity	3.15
Normal consistency	28%
Initial setting time of cement	25 Min.
Final setting time of cement	420 Min.

Table No.1: Properties of OPC 53 Grade cement

Table No.2:Properties of coarse aggregate

Specific gravity	2.74
Water absorption	1.25%
Aggregate crushing value	26.81%
Aggregate impact value	17.55%

Table No.3 : Properties of M-sand(Fine aggregate)

Specific gravity	2.55
Fineness modulus	4.45(Confirming zone III)
Water absorption	6.2%

B.Experimental method

Number of Pervious concrete mixes was prepared by varying aggregate-cement ratio with w/c ratio of 0.45 and Proportion of rice husk ash were 6:1,8:1&10:1and 3%,6%,9% respectively. Coarse aggregate of size between 20mm and 10mm has been carried.

Before mixing, Coarse aggregate is soaked in a water for remove a air from voids present inside it. After wetting, Coarse aggregate, M-sand, cement and rice husk ash are added in rolling drum of machine mixer and mixed for 1.5 minutes. Then water is added to a mixture and mixed for 3 minutes.

After mixing, Pervious concrete is poured into a trolley and the following sizes of cube, Prism and Cylinder can be casted.

The cubeof size 150mm*150mm*150 mm, the prism of 50mm*10mm*10mm and the cylinder of 100mm diameter and 200mm long has been used.FigureNo.1 shows a specimen casting.

Figure:1: Casting of a specimens

IV.RESULTS AND DISCUSSION

Pervious concrete mixes were tested for slump value and its strength characteristics such as cube strength, Cylinder strength and Prism strength. The mix proportions of mixes were selected and its test result of slump values with corresponding density can be mentioned in Table No.4.

The density of a pervious concrete was found be ranging between 1940 to 2100 Kg/m^3, which is lower than that of conventional concrete. It is observed that density of a concrete decreases with increase of a/c ratio and also slump value increased with decrease of a/c ratio.

Table No. 5 shows that the test results of strength characteristics such as Cube strength, Prism strength and Cylinder strength.

Table No.4: Mix proportions, Slump and densityvalues of each mix

Mix proportion		Slump value (mm)	Density (Kg/m^3)
a/c ratio	w/c ratio		
6:1	0.45	165	2100
8:1	0.45	160	2020
10:1	0.45	155	1940

Table No.5:Test results on strength characteristics of Pervious concrete without Rice husk ash

Mix proportion		Cube strength(N/mm^2)		Cylinder strength(N/mm^2)	Prism strength (N/mm^2)
a/c ratio	w/c ratio	7th day	28th day	28th day	28th day
6:1	0.45	3.995	5.952	1.06	1.45
8:1		2.44	3.636	0.97	1.28
10:1		2.1	3.129	0.82	1.09

From above Table No.5 it is clearly seen that cube strength, Prism strength and Cylinder strength of pervious concreteincreases withincrease in w/c ratio. i.e., Water content increases with increase in strength of a concrete and strength is directly proportional to w/c ratio. From the reference of the journals, w/c ratio of 0.45 gives more strength. Hence we taken w/c ratio of 0.45 to all mixes of pervious concrete.

Effect of rice husk ash on strength properties of pervious concrete was later studied. Slump valueand density of pervious concrete mix with 3%,6% and 9% of rice husk ash is represented in Table no.6, whereas Table No.7A, 7B and 7C represents the strength results of 3%,6% and 9% of RHA as a partial replacement of cement respectively.

Figure No.2A shows testing for a cube strengthand 2B shows testing for a Prism strength.

Table No.6:Slump and Density values of pervious concrete with 3%,6% and 9% of RHA

Mix proportion			Slump	Density
a/c ratio	w/c ratio	%of RHA	(mm)	(Kg/m^3)
6:1	0.45	3%	160	2100
8:1			155	2020
10:1			155	1940
6:1	0.45	6%	160	2100
8:1			150	2020
10:1			145	1940
6:1	0.45	9%	155	2100
8:1			150	2020
10:1			150	1940

Table No.7A: Strength results of pervious concrete with 3%of RHA

Mix proportion			Cube strength(N/mm^2)		Cylinder strength(N/mm^2)	Prism strength (N/mm^2)
a/c ratio	w/c ratio	% of RHA	7th day	28th day	28th day	28th day
6:1	0.45	3%	4.22	6.29	1.18	1.52
8:1			2.64	3.93	0.99	1.34
10:1			2.2	3.27	0.90	1.13

Figure No.2A:Testing for a cube strength

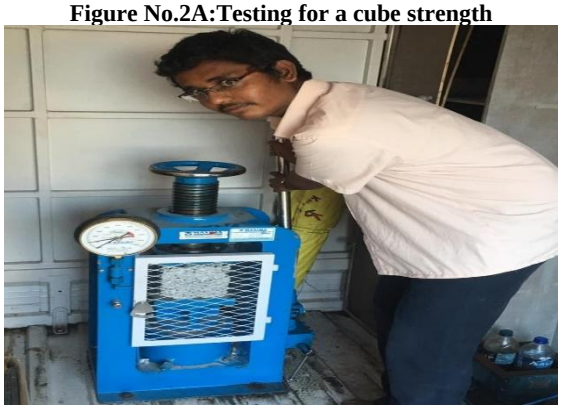


Figure No.2B : Testing for a prism strength

Table No.7B: Strength results of pervious concrete with 6%of RHA

Mix proportion			Cube strength (N/mm^2)		Cylinder strength (N/mm^2)	Prism strength (N/mm^2)
a/c ratio	w/c ratio	% of RHA	7th day	28th day	28th day	28th day
6:1	0.45	6%	4.55	6.78	1.22	1.56
8:1			4.44	6.62	1.01	1.40
10:1			3.8	5.66	0.94	1.18

Table No.7C: Strengthresults of a pervious concrete with 9%of RHA

Mix proportion			Cube strength (N/mm^2)		Cylinder strength (N/mm^2)	Prism strength (N/mm^2)
a/c ratio	w/c ratio	% of RHA	7th day	28th day	28th day	28th day
6:1	0.45	9%	6.33	9.43	1.28	1.63
8:1			5.44	8.11	1.07	1.51
10:1			4.6	6.85	0.98	1.24

Effect of rice husk ash on strength properties of pervious concrete is represented in the below figure 3&4,where comparison of compressive strength of pervious concrete mix with different percentage of RHA at the 7th and 28th days respectively. From the figure3, Strength of this concrete with 3%,6%.9% is increased by 5.67%,13.91%,58.43% than that of mix without RHA with a/c ratio 6:1 and w/c ratio 0.45,whereas also increased for 8:1 a/c ratio.Hence it can be said that addition of RHA in pervious concrete increases the strength properties.

Figure No.3: 7th day cube strength of a pervious concrete

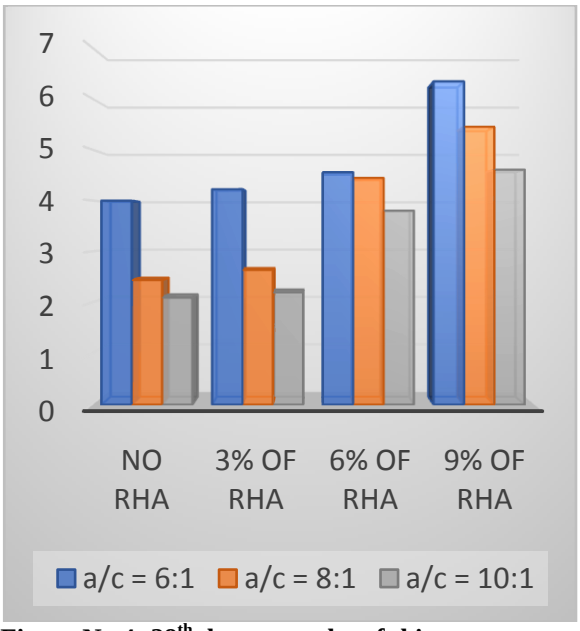
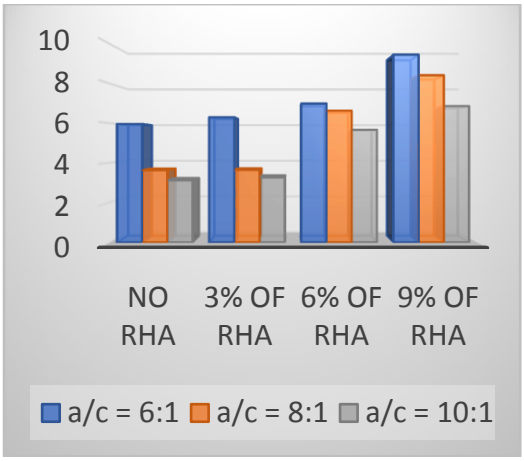


Figure No.4: 28th day strength oaf this concrete



V.CONCLUSIONS

The following conclusions are drawn based on the experimental study on Pervious concrete:

- From this study, for road application aggregate - cement ratio of 6:1 without RHA mix at w/c of 0.45 is recommended whose cube strength at 28th day was found to be 5.952 N/mm^2.
- From this study ,cylinder strength and prism strengthof this concrete was found to be ranging between 0.82 to 1.28 N/mm^2 and 1.09 to 1.63 N/mm^2 respectively. Cube strength, prism strength and cylinder strength to improve its strength by the addition of rice husk ash about 3%,6% and 9%.
- Strength properties of pervious concrete are found to be lower than that of conventional concrete but used for structure and road.
- From this study, cement content reduced due to reduction in surface area of this concrete.
- Lack of natural sand makesthis concrete a best option than other light weight concrete.It is also very cost effective .

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