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Research paper

Comparative strength of I section pavement blocks made of PCC mixed with rice husk ash

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Abstract

Originally, pavement solid blocks mold by raw products of brick like clay, fly ash or lime etc. from decades, the solid blocks are commonly casted for getting the keen ambiance for footpath ways. The dismantled solid blocks are reusable in a cost effective way without any pre existing mark.Now-a-days updated technology is giving us a chance to enhance methods in various aspects related to execution of field works like pavements etc.This study determine the comparative strength of I section pavement blocks are casted in 2 ways. They are i) 100% pure PCC which contains cement, fines (FA) and coarse (CA) and ii)PCC mix proportion which is shared a part % of organic additive like rice husk ash added to identify the variation of characteristic strength.The organic supplement is added with PCC in terms of % proportions like 5%, 10% and 15%, to find out the properties of strength for 3,7,14 and 28 days of casted curing blocks. Based on study we noticed that compacting factor test reduces the % with organic additive RHA which improves the strength in a cost effective manner.This paper indicates the organic additive plays a key role to attain high strength of concrete and it indicates clearly the downfall towards self weight to measure the strength with respect to pure PCC.

Keywords: *PCC; Rice Husk Ash; UTM.*

1. Introduction

Generally PCC has low strength compared to RCC (reinforced cement concrete) and it imparts low tensile nature, ductility and poor resistance

I section pavement blocks has been used for pavement works, decoration purpose and in petrol bunk areas. Pavement blocks, familiar to paver blocks are easily available in society in different shapes. The strength is good, but as an engineer we are emphasizing to reduce the initial cost by supplementing with organic additive like rice husk ash, fly ash etc.

Organic additives like RHA, fly ash etc which are polluting the atmosphere, of their adverse effect to the atmosphere can be prevented by using natural additive in an eco-friendly manner which eventually reduces rate of harmful gases in our surroundings.

In this study, a supplement additive called Rice Hush Ash is used. RHA is a waste material which is produced from rice grains. It contains 85% - 90% of amorphous silica. This supplement imparts the properties of strength more than PCC. Ultimately, strength is rich and feasible. Bulk density is ranged in between 86 to 114 kg/cum, attains high ash, porous state with light weight nature.

The objective of this laboratory study is to enhance the compressive strength of concrete using PCC & PCC with natural additive (RHA).

2. Literature review

United States. Davis et al. in 1937.were the first to publish test results concerning the incorporation of RHA in mix Proportion. Until recent years, usage of concrete containing RHA had been limited to mass concrete mixes. As it is helps to expand. More research has been conducted to study the properties of concrete mix with RHA. In recent years Cook Lane has performed much of the pioneering work to expand the applications of concrete containing RHA. Malhotra Cannon.

Ismail and Waliuddin (1996) had worked on effect of rise husk ash on high concrete strength. They studied the effect the rise husk ash (RHA) passing 200 and 325 micron sieves with 10- 30 % supplement of cement on strength of HSC. Based on test results the strength of HSC has been decreased after adding RHA for balancing neutral value of workability. They observed that max to max replacement of cement by RHA was 10 – 20 %.

Based on the previous research, we have chosen this additive for this study to prepare I section pavement blocks to enhance the properties of strength parameters in a cost effective way.

3. Materials

In this study, proportion mixes are taken for two conditions i) purely PCC which contains cement, fines (FA) and coarse (CA) aggregate with moisture content and the other is ii) PCC with organic additive in terms of percentage to do the comparative study of I section pavement solid blocks to determine the properties of concrete materials.

Cement

53 Grade OPC conforming to IS 455: 1989. Laboratory test readings are in Table 1.

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Table 1: Properties of Cement

Property	Value
Fineness (%)	6.05
Specific Gravity	3.15
Soundness (mm)	2
Consistency (%)	29.0
Initial Setting Time (minute)	37
Final Setting Time (minute)	205

Fine Aggregate (FA)

Availability of local sand should be taken which is dry and clean. The sand using sieves passing through IS 4.75 mm sieve [IS: 383:1970] and retained in 600 micron sieve used for study. Laboratory test readings are in Table 2.

Table 2: Properties of FA

Property	Value
Specific Gravity	2.71
FM	3
Zone	III

Coarse Aggregate (CA)

Crushed stone of coarse which is available in local of size 12 to 20mm is used. Laboratory test readings are in Table 3.

Table 3: Properties of CA

Properties	Value
Specific Gravity	2.77
FM	6.96
Bulk density (gm/cm^3)	1.71
Impact strength (%)	21.0

Rice Husk Ash (RHA)

The bulk density ranged in between 86 to 114 kg/cum, attains high content of ash, pervious state with light weight nature.

Water

In site, H_2O must be portable nature used for maintaining moisture nature for blocks and mixing.

MIX PROPORTION

The mix proportion has been taken from IS 456-2000 for M15 grade. Mix details are shown in Table 4. The consumed details of materials are shown in Table 5.

Table 4: Mix Proportion

Particulars	Value
Cement (Kg) per Block	1.6
FA (Kg) per Block	3.2
CA (Kg) per Block	6.4
Water (ml) per Block	580
w/c	0.45
Ratio (C:FA:CA)	1:2:4

Table 5: Quantity of RHA Used

Mix		Percentage of RHA		
% of material		5	10	15
No. of Blocks	3 days	3	3	3
	7 days	3	3	3
	14 days	3	3	3
	28 days	3	3	3

4. Experimental methodology

Compressive Strength Testing Machine

The I section pavement blocks are tested under UTM having a capacity of 200KN as per IS 516-1959. Mould of I section pavement block contains flange size of 200x100x100mm and web size of 60x120x100mm. Laboratory test readings are in Table 6.

Table 6: Compressive Strength Results

No. of days	100 %	Compressive Strength (N/mm^2)
3 days	1:2:4	4.22
7days		4.59
14days		5.06
28 days		19.01
Compressive strength for M15 Grade with additives in %		
Material	%	RHA
3 days	5	8.97
	10	10.64
	15	7.99
7 days	5	13.04
	10	15.26
	15	11.05
14 days	5	14.97
	10	16.87
	15	14.05
28 days	5	19.91
	10	21.12
	15	18.88

5. Results and discussions

The laboratory test readings of UTM for M15 grade mix have been taken in two ways. They are i) 100% PCC and ii) PCC with RHA in terms of percentage casted I section blocks are framed in graphs.

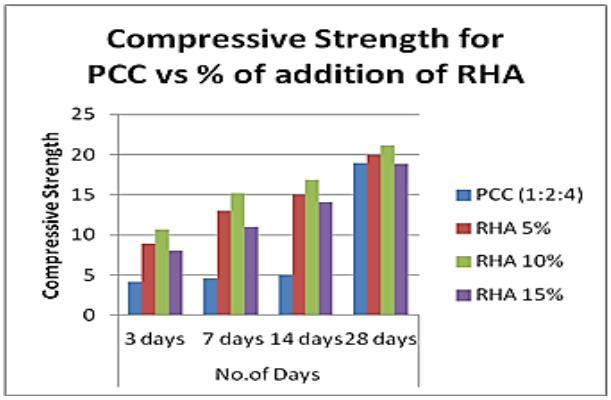

Fig. 1: Compressive Strength.

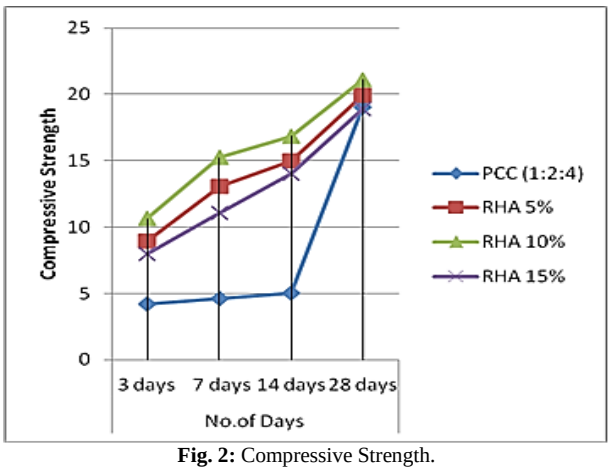

Fig. 2: Compressive Strength.

The Figure one & two explains about strength enhancement for PCC & PCC with RHA supplement in percentages to analyze the properties of strength for 3, 7, 14, 28 days.

6. Conclusion

The charectersic strength of PCC enchanced with a natural additive RHA.

The addition of 10% RHA with PCC has been enhanced the strength of I section block compared to 5% and 15% of RHA with

respect to 100% of PCC respectively. As per the results, noticed that 100% PCC results are balanced with a 15% of RHA supplement.

Orientation of this study improves the strength of PCC with a natural additive of 10% RHA.

By using RHA supplement we achieved higher strength parameters in a cost effective way, also we focused to reduce the hazardous waste produced by power stations to predict the effect of pollution.

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References

[1] Oyetola E. B. and Abdullahi. M., (2006), the Use of Rice Husk Ash in Low - Cost Sandcrete Block Production, Leonardo Electronic Journal of Practices and Technologies; ISSN 1583-1078 Issue 8, January-June.

[2] Muhammad Harunur Rashid, Md. Keramat Ali Molla, and Tarif Uddin Ahmed, (2010), Mortar Incorporating Rice Husk Ash: Strength and Porosity, European Journal of Scientific Research, ISSN 1450-216X Vol.40 No.3.

[3] Musa Alhassan and Alhaji Mohammed Mustapha, (2007), Effect of Rice Husk Ash on Cement Stabilized Laterite, Leonardo Electronic Journal of Practices and Technologies ISSN 1583-1078 Issue 11, July- December.

[4] Guilherme Chagas Cordeiro, Romildo Dias Toledo Filho, Eduardo de Moraes Rego Fairbairn, (2008), Use of ultrafine rice husk ash with high-carbon content as pozzolan in high performance concrete, published online: 12 October.

[5] Ramezanianpour A. A., Mahdi khani. M, Ahmadibeni. Gh. (2009), the Effect of Rice Husk Ash on Mechanical Properties and Durability of Sustainable Concretes, Department of Civil Engineering, Amirkabir University of Technology, March.

[6] Sivakumar. G, (2009), Investigation on the Hydration Properties of the Rice Husk Ash Cement Using Ftir and Sem, Applied Physics Research, Annamalai University, India.

[7] Badorul Hisham Abu Bakar, Ramadhansyah Putrajaya.C and Hamidi Abdulaziz, (2009), Malaysian Rice Husk Ash – Improving the Durability and Corrosion Resistance of Concrete: Pre-review, Asia Pacific Structural Engineering Conference, APSEC.

[8] Habeeb. G. A, Fayyadh. M. M, Rice Husk Ash Concrete: the Effect of RHA Average Particle Size on Mechanical Properties and Drying Shrinkage, (2009), Australian Journal of Basic and Applied Sciences, 3(3): 1616-1622, ISSN 1991-8178. Dr. Jha J. N., Gill K.S. (2006), Effect of Rice Husk Ash on Lime Stabilization, Published in Journal of the Institution of Engineers (India), Volume 87, and November 28.

[9] Hima Hemant, P.JeevaRekha, D.P.Preeti, "A STUDY ON PAVER BLOCKS USING RICE HUSK ASH", proceedings of the International Conference on Science and Engineering (ICSE 2011) organized by INDIA CHAPTER OF ACI, PP 283-292. Mauro M. Tashima, Carlos A. R. Da Silva, Jorge L. Akasaki, Michele Beniti Barbosa, The Possibility of Adding the Rice Husk Ash (RHA) to the Concrete, Civil Engineering Department, FEIS/UNESP, Brazil.

[10] S. D. Nagrale, Dr. Hemant Hajare, Pankaj R. Modak (2012) Utilization of Rice Husk Ash. S. D. Nagrale, Dr. Hemant Hajare, Pankaj R. Modak / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2, Issue 4, July-August 2012, pp.001-005.

[11] Deepa G Nair, K. Sivaraman, and Job Thomas (2013) Mechanical Properties of Rice Husk Ash (RHA) - High strength Concrete. American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume-3 pp-14-19 www.ajer.org.

[12] Dr. A.M. Pande and S.G.Makarande (2013) Effect of Rice Husk Ash on Concrete. Dr. A.M. Pande, S.G.Makarande / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 1, January -February 2013, pp.1718-1723.

[13] Jayanti Rajput, R.K. Yadav and R. Chandak (2013) The Effect Of Rice Husk Ash Used As Supplementary Cementing Material On Strength Of Mortar. Jayanti Rajput, R.K. Yadav, R. Chandak / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 3, May-Jun 2013, pp.133-136.

[14] S. I. Khassaf, A. T. Jasim, F.K. Mahdi (2014) Investigation The Properties Of Concrete Containing Rice Husk Ash To Reduction The Seepage In Canals. INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 3, ISSUE 4, APRIL 2014 ISSN 2277-8616 IJSTR©2014 www.ijstr.org.

[15] Gyanen.Takhelmayum1, Ravi Prasad2, Savitha A.L3 (2014) Experimental Study on the Properties of cement concrete using Rice Husk Ash. ISSN: 2319-5967 ISO 9001:2008 Certified International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 3, Issue 6, November 2014.

[16] Alireza Naji Givi, Suraya Abdul Rashid, Farah Nora A. Aziz, Mohamad Amran Mohd Salleh (2010) Contribution of Rice Husk Ash to the Properties of Mortar and Concrete: A Review. Journal of American Science 2010 6(3), Naji Givi, et al, Rice Husk Ash in Concrete.