Soil stablization using rice husk ash and cement

Richa Bhadouria[1], Dr. Y.P.JOSHI[2]

1. Scholar M.E (Transportation Engineering), Department of Civil Engineering SATI Govt. Engineering College, Vidisha (M.P) 464001.
2. Professor, Department of Civil Engineering, SATI Govt. Engineering College, Vidisha (M.P.) 464001.

---***---

ABSTRACT

Highways are such an intricate part of connectivity in India that there is always a need of highway construction or maintenance of existing highway. Due to lesser availability of fund use of waste material from industries and agricultural fields is much in use. This experimental work briefly describes the use of locally available rice husk ash in soil stabilization along with cement. Rice husk ash helps in improving the desired properties of soil and minimizes the amount of waste to be deposited in environment causing environmental pollution. Rice husk ash is quite easily available and is very low in cost, due to day by day increase in cost of stabilizers like cement, lime and other admixer's use of rice husk ash can result in project completion optimally. The soil sample used is clay which requires to be strengthened due to presence of high plasticity,this soil sample is strengthened by using varying proportion of rice husk ash and cement. Various tests were conducted to analyze the effect of rice husk ash on optimum moisture content, maximum dry density, and California bearing ratio. Results shows increase in optimum moisture content but decrease in maximum dry density, Along with increase in California bearing ratio, from the observations it can be seen that 10% of rice husk ash and 6% of cement results in maximum improvement in desired soil properties. Due to its low cost and effectiveness in increasing the California bearing ratio of soil this method of soil stabilization is strongly recommended.

KEYWORDS :- Soil Stablization, Rice Husk Ash, Modifiers, Stablizers, Low Cost

1. INTRODUCTION

Soil stabilization means improvement of the stability or bearing capacity of soil by the means of controlled compaction, proportioning and or addition of suitable modifiers or stabilizers. Since there is increase in construction there is always a need of material low in cost and environment friendly which can impart desired strength with effectiveness in construction. Past studies have revealed that rice husk can be used effectively in expansive soils that are having high plasticity.

Utilization of farming waste have decreased the environmental hazards, Rice is that primary supply of food for billion peoples across the planet. At the present around 600 metric tons of paddy made annually. Rice husk could be a main agronomic by product acquired from the food crop of paddy. For each four heaps of rice one ton is of rice husk made. Burning of rice husk generates almost 15-20% of its weight as ash. The studies on physical and chemical properties of rice husk ash have revealed that RHA can't be used alone for stabilization of soil attributable to the dearth of building material properties. The high proportion of oxide materials in rice husk ash indicates its potential pozzolanic properties. . Certain varieties of clayey soils expand after they are wetted and shrink once dried. These are referred to as expansive soils.it is difficult to work on these soils. Stabilization uses treatment of soils using manufacturing wastes such as Rice husk ash (RHA), Fly ash and coarse furnace scum, etc. by means of or lacking a binder like lime, salt, cemented is one or all used in the stablization. Some researchers have additionally tried to advance the expansive soil engineering properties by reinforcement method, by auditing fibers.

2. PROPERTIES OF MATERIALS USED

2.1 Properties of the residual soil 2.2 Properties of rice husk ash

Physical properties	Value(%)	Constituent	Composition (%)
Natural water content	26%	SiO_2	75.2%
Liquid limit	31.5%	Al_2O_3	5.2%
Plastic limit	18.95%	Fe_2O_3	1.02%
Plasticity index	17.68%	CaO	1.4%
Linear shrinkage	6.71%	MgO	1.75%
Specific gravity	2.37	Loss on Ignition	15.43%

METHODOLOGY

4. TEST RESULT DISCUSSION

4.1 Water content test:

S.NO	SAMPLE	WW	WS	%WC
I	**NATURAL SOIL**	**38gm**	**200gm**	**19%**

II	SOIL+10%RICE HUSK+6%CEMENT	47gm	200gm	23.5%
III	SOIL+15%RICE HUSK+6%CEMENT	54gm	200gm	27%
IV	SOIL+10%RICE HUSK+8%CEMENT	52gm	200gm	26%
V	SOIL+15%RICE HUSK+8%CEMENT	55.6gm	200gm	27.8%

4.2 Liquid limit determination

Sample	SOIL+10%RHA+6%cement	SOIL+15%RHA+6%cement	SOIL+10%RHA+8%cement	SOIL+15%RHA+8%cement
Mass of empty clean can with lid	22.23gm	22.23gm	22.23gm	22.23gm
Mass of moist soil	28.56gm	29.27gm	28.9gm	30.1gm
Mass of dry soil	27.4gm	28.1gm	27.6gm	29.3gm
Water content	22%	26.1%	25.2%	28%
No of drops	31	29	29	27

4.3 Density: (proctor test)

Determination No.	1 Soil	2 Soil +10%RHA+6%cement	3 Soil +15%RHA+6%cement	4 Soil +10%RHA+8%cement	5 Soil +15%RHA+8%cement
Weight of empty mould + base plate (w_1)kg	4.610	4.610	4.610	4.610	4.610
Weight of compacted soil + base plate (w_2)kg	6.418	6.610	6.642	6.676	6.68
Bulk unit weight of compacted soil γ(gm/cc)	1.808	2.007	2.032	2.066	2.070
Water content (w)	19%	23.5%	27%	26%	27.8%
Dry unit weight $\gamma_d=\gamma/(1+w)$.(gm./cc)	1.519	1.62	1.6	1.64	1.62

Dia. of mould = 100mm

Height of mould=127.3mm

Volume of mould=1000cm^3

Penetration depth (mm)	Unit standard load (kgf/cm^2)	Total standard load (kgf)
2.50	70	1370
5.00	105	2055
7.50	134	2630
10.0	162	3180
12.5	183	3600

1) Natural soil

Value of one division in dial ring = 2.5kg

Penetration	Proving ring reading	test load/Corrected load 3 × Value of One division in (kg)	Standard load load	CBR(%)
0.0				
0.5	**22**			

1	**35**			
1.5	**44**			
2	**50**			
2.5	**55**	**137.5**	**1370**	**10.03%**
3	**57**			
4	**64**			
5	**69**	**172.5**	**2055**	**8.39%**
7.5	**79**			
10				
12.5				

2) Soil + 10%RHA +6% cement

Penetration	Proving ring reading	test load/Corrected load 3 × Value of One division in (kg)	Standard load load	CBR(%)
0.0				
0.5	**22**			
1	**39**			
1.5	**51**			
2	**62**			

2.5	**78**	**195**	**1370**	**14.2**
3	**82**			
4	**95**			
5	**111**	**277.5**	**2055**	**13.5**
7.5	**119**			
10				
12.5				

3)Soil +15%RHA+6%cement

Penetration	Proving ring reading	test load/Corrected load 3 × Value of One division in (kg)	Standard load load	CBR(%)
0.0				
0.5	**22**			
1	**35**			
1.5	**43**			
2	**55**			
2.5	**76**	**190**	**1370**	**13.9**

3	**82**			
4	**96**			
5	**105**	**262.5**	**2055**	**12.8**
7.5	**108**			
10				
12.5				

4)Soil +10%RHA+8%cement

Penetration	Proving ring reading	test load/Corrected load 3 × Value of One division in (kg)	Standard load load	CBR(%)
0.0				
0.5	**31**			
1	**46**			
1.5	**51**			
2	**69**			
2.5	**89**	**222.5**	**1370**	**16.2**
3	**93**			

4	**105**			
5	**126**	**315**	**2055**	**15.3**
7.5	**131**			
10				
12.5				

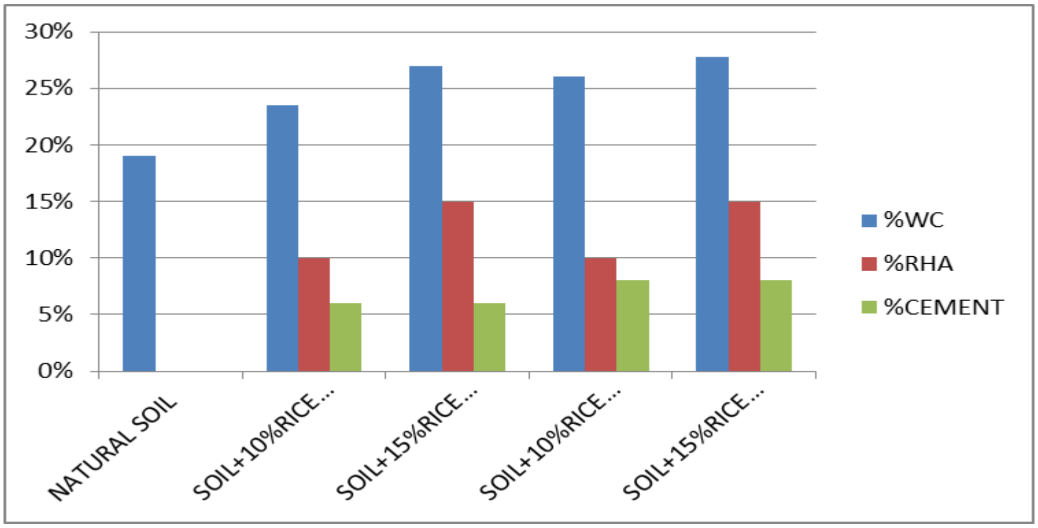
5)Soil + 15%RHA+8%cement

Penetration	Proving ring reading	test load/Corrected load 3 × Value of One division in (kg)	Standard load load	CBR(%)
0.0				
0.5	**36**			
1	**42**			
1.5	**59**			
2	**68**			
2.5	**79**	**197.5**	**1370**	**14.4**
3	**86**			
4	**95**			

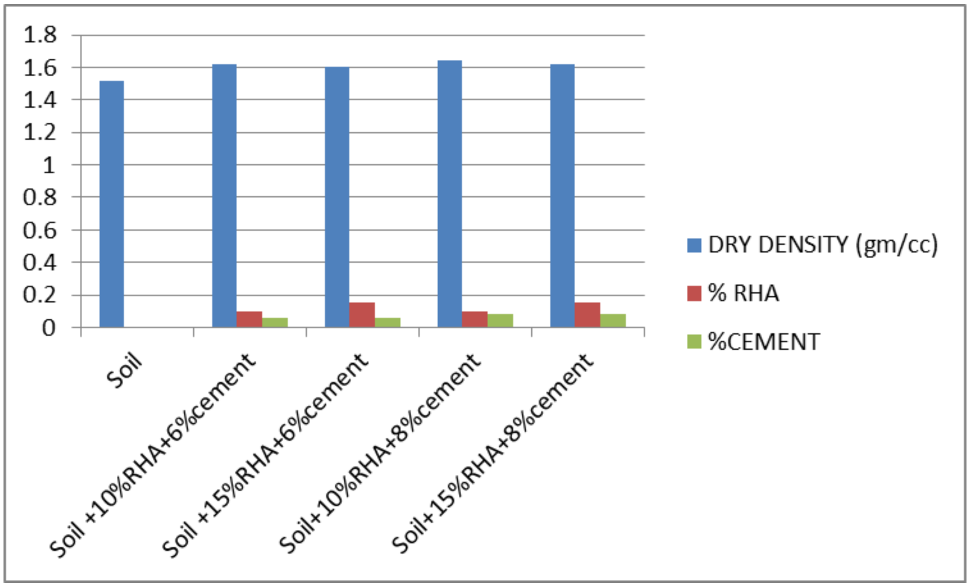
5	100	250	2055	12.16
7.5	116			
10				
12.5				

5 TEST RESULT ANALYSIS:

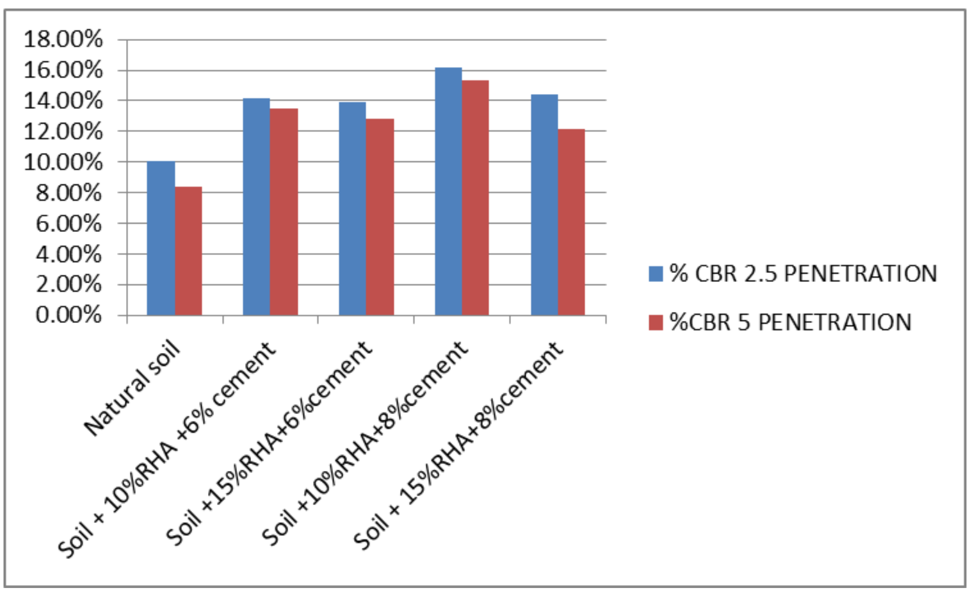
Water content variation



Dry density variation



CBR value variation



6.Conclusion:-

1) The test results showed that there is decrease in maximum dry density of soil but increase in optimum moisture content with increase in rice husk ash content.

2) There was also improvement in the value of unsoaked CBR value of soil in comparison to the natural soil. Soaked CBR also improved.

3) Rice husk ash helped in reducing the plasticity of soil, a considerable reduction was achieved by using the cement stabilized soil.

4) Since cement is more costly than rice husk ash hence it can greatly reduce the overall cost of construction.

5) In general for this particular soil, the properties of soils shows improvement with the use of 6% to 8% of cement along with 10% to 15% of rice husk.

6) Rice husk ash can stabilize the soil either by partial or complete replacement with cement. As it reduces the cost ,it is of great use in rural areas of developing countries like India.

7. FUTURE ASPECT:-

Accumulation of waste material is an important factor to look out for environmentalists. Rice husk ash is one of the products generated as agricultural waste. With great pozzolanic properties it can act as a good building material and can be used in pavement construction also. With day by day increase in cost of cement and the amount of pollution caused by cement factories it is mandatory to look for some sort of substitute and rice husk ash has major properties that make it an attractive alternative in future.

REFRENCES

[1] A.M. Shende, A.M. Pande, M. Gulfam Pathan., "Experimental Study on Steel Fiber Reinforced Concrete for M-40 Grade", International Refereed Journal of Engineering and Science (IRJES) ISSN (Online) 2319-183X, (Print) 2319-1821 Volume 1, Issue 1 September 2012, 43-48

[2] Abdelaziz Meddah, Larbi Belagraa, Miloud Beddar, "Effect of the Fibre Geometry on the Flexural Properties of Reinforced Steel Fibre Refractory Concrete", 7th Scientific-Technical Conference Material Problems in Civil Engineering, Volume 3, 2015, 185 – 192

[3] Ahsana fathima K M , Shibi varghese., "Behavioural study of Steel Fiber and Polypropylene Fiber Reinforced Concrete International Journal of Research in Engineering & Technology, ISSN(E): 2321-8843; ISSN(P): 2347-4599 Vol. 2, Issue 10, Oct 2014, 17-24

[4] Aiswarya Sukumar, Elson John., "Fiber Addition and Its Effect on Concrete Strength" International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163 Volume 1 Issue 8 September 2014, 144-150

[5] Apoorv Singh, Prof. R.D Patel, Khalid Raza., "A Comparative Study on Compressive and Flexural Strength of Concrete Containing Different Admixtures as Partial Replacement of Cement", Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 4, Issue 9(Version 5), September 2014, pp.118-123

[6] Deepa G Nair , K. Sivaraman, and Job Thomas., " 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 2013, 14-19

[7] Dr. Shubha Khatri., "Impact of Admixture and Rice Husk Ash in Concrete Mix Design", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 11, Issue 1 Ver. IV, Feb. 2014, 13-17

[8] Godwin A. Akeke, Maurice E. Ephraim, Akobo, I.Z.S and Joseph O. Ukpata., "Structural Properties of Rice Husk Ash Concrete", International Journal of Engineering and Applied Sciences, ISSN2305-8269, May 2013. Vol. 3,57-62