International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)

Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585

Volume 5, Issue 1, January-2019

EFFECT OF RICE HUSK ASH ON THE PROPERTIES OF EXPANSIVE SOILS

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ABSTRACT : *This studies the variations in the index and engineering properties of clay on usage of rice husk ash as stabilizing agent. A number of laboratory experiments were conducted on clay soils and RHA modified soil mixes. Attempts to study the unpredictable behaviour of the expansive soil and through research on how to bring these problems under control form the backdrop for this project work. Laboratory experiments are conducted to check the engineering properties of a naturally available expansive soil before and after stabilization. Stabilized results of expensive soils are compared to give the conclusion that can find expansive soil problems. The major agricultural product from paddy is rice husk which produces 40kN of rice and 10kN husk every year. The ash which is made by burning of rice husk is used as stabilization agent. The weight of the rice husk ash is very light which can be carried out easily.The disposal of Rice Husks is a big problem and open heap is not acceptable on environmental grounds, and so majority of husk currently going into landfills. Research has been conducted to determine the potential use by burning the husk into ashes. These rice husk ashes have high content of silica if burnt in controlled manner. Hence it can be mixed with expansive soils to improve the properties.*

KEYWORDS : *rice husk ash, expansive soils, Atterberg's limit, specific gravity, free swell index, California bearing ratio, direct shear value for the soil-RHA.*

I.INTRODUCTION

Most of our constructions are failed due to foundation based on the engineering properties of the soil. The main soil which leads to the failure of foundation is the expansive soil, so in this context the engineering properties of the expansive soil are found out. The soil which is used for construction should be stabilized first, one of the stabilization is lime stabilization which is very costly so the rice husk ash is used as a stabilization agent which is a waste product of rice paddy which burnt and used. The stabilization agent (rice husk ash) has a binding property same as pozzoloanic material which makes economical for the construction. In this study the soil is replaced by rice husk ash as percentile of 5, 10, 15 and 20% of the total lime content used for stabilization.

LITERATURE REVIEW

The soil which expands when water is added and shrinks when the soil is dried up completely is known as expansive soil. This continuous change in soil volume can cause the structures built on this soil to move unevenly and crack. The damage is more than twice the damage from floods, hurricanes, tornadoes, and earthquakes combined. Often, damage from expansive soils can be seen within the first few months or years after the structures are built. As water from irrigation or rainfall migrates underneath the foundation, since the soil is expansive the edges of the foundation expands and the edges of the foundations are pushed out this condition is called as edge-lift where cracks form over the edges which is a failure of the foundation. As the ages of the structure increases the moisture further migrates underneath the center of the slab, center-lift can occur, causing additional damage to the structure. This shrinkage can be a result of increasing the settlement of structure after the original construction as the age of the structure increase. To solve this problem, the soil which is used as stabilizer agent is used as a additive material.

I. EXPERIMENTAL INVESTIGATION

Expansive Soil: The expansive soil sample used in this experiment has been collected from the Thotapalli reservoir located at Parvathipuram.

RICE HUSK ASH: Rice Husk Ash collected from brick manufacturing unit situated in Nandigam at Vijayawada.

The following are index and engineering properties which have been investigated on the material used for the investigation on " **effect of rice husk ash on properties of expensive soils**".

3.1 Atterberg's Limits The Consistency of a fine-grained soil is the physical state in which it exists. The Water content at which the soil changes from one state to the other are known as Consistency limits or Atterberg's limits.

These limits are classified into 3 types

1. Liquid limit
2. Plastic limit
3. Plasticity index

3.2 Specific Gravity.

3.3 Free Swell Index

3.4 Standard Proctor's Compaction

3.5 Direct Shear

3.6 Unconfined compressive strength

3.7 California Bearing Ratio Test

IV. RESULT ANALYSIS

Table 1 Standard Load Values

S.No	Penetration(mm)	Standard Load(kg)
1.	2.5	1370
2.	5.0	2055
3.	7.5	2630
4.	10.0	3180
5.	12.5	3600

Table 2 Tests on soil samples

S.No	Properties	Values
1	Liquid Limit	43.5
2	Plastic Limit	27.5
3	Plasticity Index	16
4	Specific Gravity	2.64
5	Free Swell Index	51
6	Maximum Dry Density	5.934g/cc
7	Optimum Moisture Content	20.98%
8	Cohesion intercept ‘c’	0.022
9	Angle of shearing strain	62^0
10	Shear strength	0.167kg/cm^2
11	*Unconfined Compressive Strength*	0.3341kg/cm^2
12	California Bearing RatioC.B.R (2.5 mm penetration) C.B.R(5mm penetration)	 13.49 10.793

Table 3 Observations of liquid limit test for different percentages of RHA

S.No	%RHA	No. of Blows	Water content
1	0	47	35.2
		17	51.3
		9	58.2
2	2.5	48	37.2
		15	48.48
		10	63.04
3	5	44	40
		14	51.1
		10	54.38
4	7.5	50	42.04
		30	44.58
		12	52.56
5	10	42	46.55
		19	66.67
		12	76.1

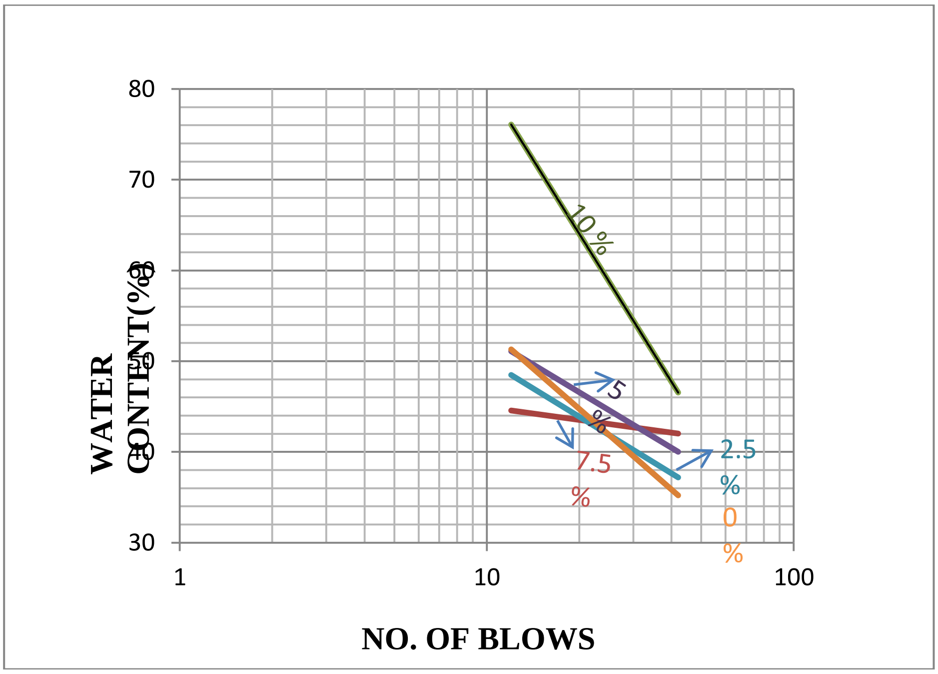

Figure 11 Liquid Limit Value graphs for different % of RHA

Table 4 Variations in Liquid limit for different percentages of RHA

S.No	%RHA	LIQUID LIMIT (%)
1	0	43.5
2	2.5	44
3	5	45.5
4	7.5	47
5	10	60

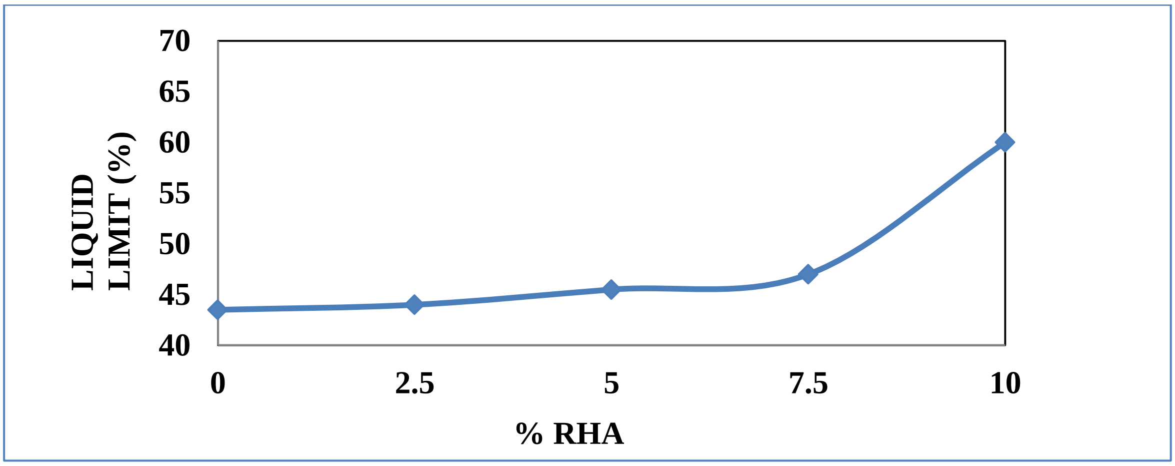

Figure 12 Comparison graph of Liquid limit for different percentages of RHA

Table 5 Variations in Plastic limit for different percentages of RHA

S.No	%RHA	PLASTIC LIMIT
1	0	27.5
2	2.5	31
3	5	33.5

4	7.5	36
5	10	49

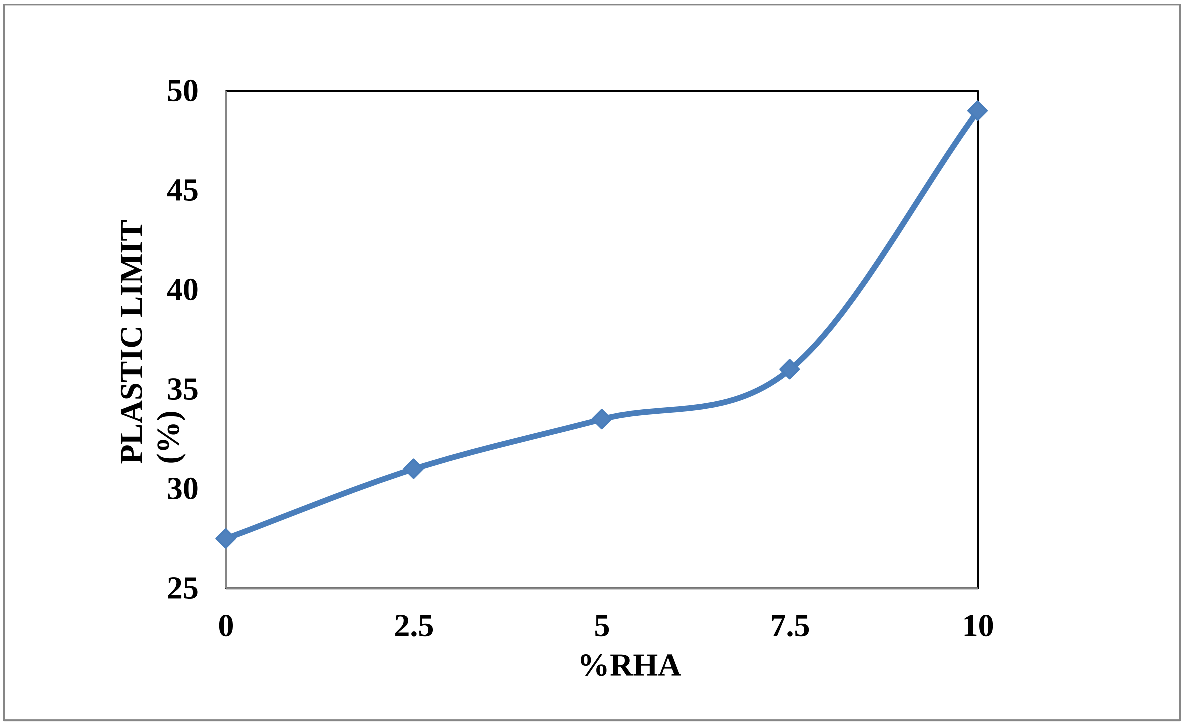

Figure 13 Comparision Graph of Plastic limit

Table 6 Variations in Plasticity index for different percentages of RHA

S.No	%RHA	PLASTICITY INDEX (%)
1	0	16
2	2.5	13
3	5	12
4	7.5	11
5	10	11

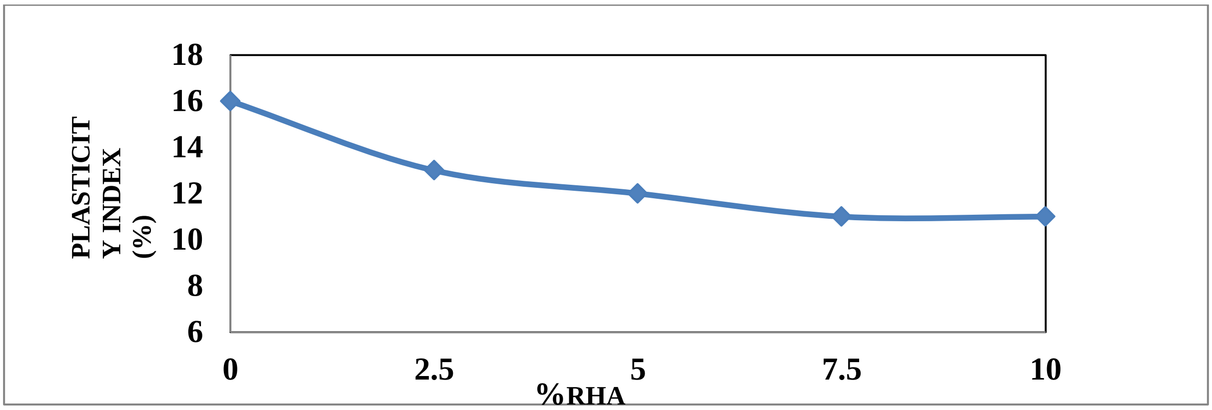

Figure 14 Comparision Graph of Plasticity Index

Table 7Specific Gravity for different percentages of RHA

S.No	%RHA	SPECIFIC GRAVITY
1	0	2.64
2	2.5	2.58
3	5	2.54
4	7.5	2.51
5	10	2.46

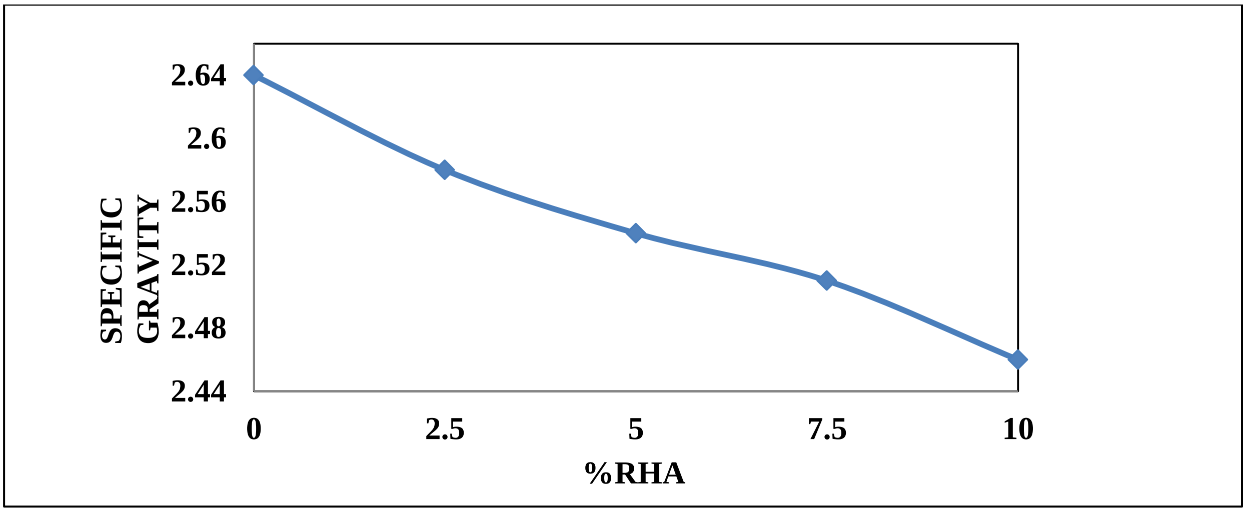

Figure 15 Comparison Graph of Specific Gravity

Table 8Free Swell Index for different percentages of RHA

S.No	%RHA	FREE SWELL INDEX (%)
1	0	51
2	2.5	44
3	5	40
4	7.5	36
5	10	30

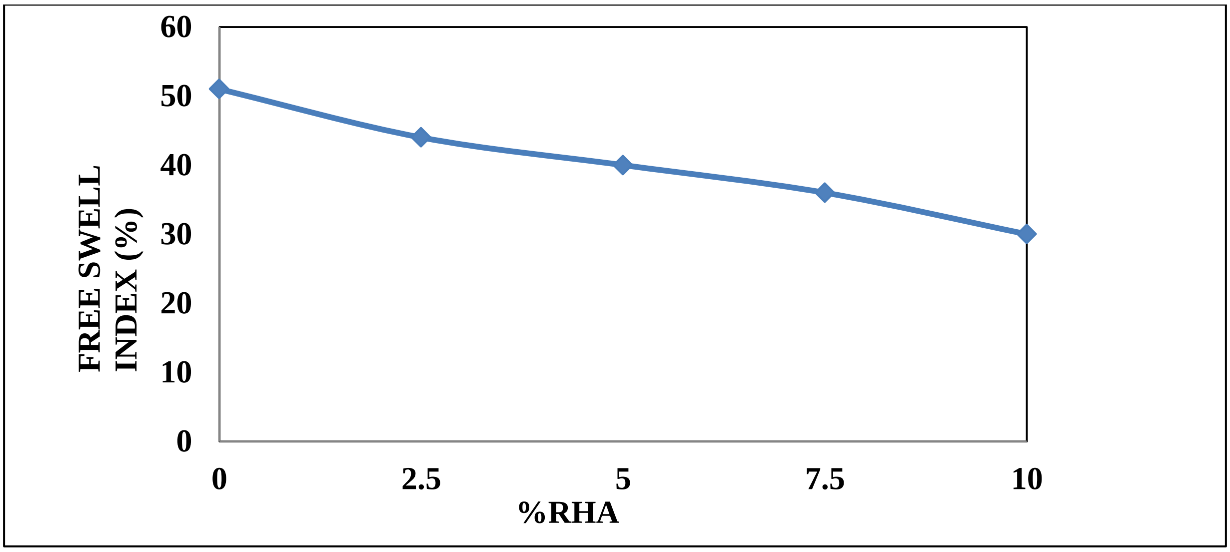

Figure 16 Comparison Graph of Free Swell Index

Table 9 OMC for different percentages of RHA

S.No	%RHA	OPTIMUM MOISTURE CONTENT (%)
1	0	20.98
2	2.5	21.36
3	5	22.29
4	7.5	24.13
5	10	29.2

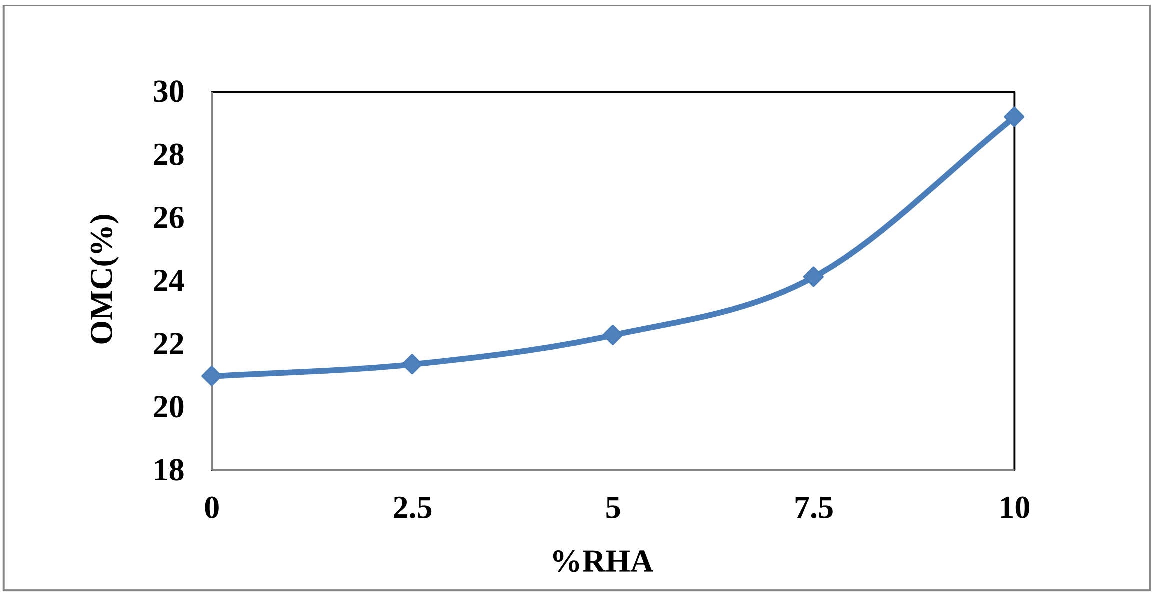

Figure 17 Comparison Graph of OMC

Table 10 MDD for different percentages of RHA

S.No	%RHA	MAXIMUM DRY DENSITY (g/cc)
1	0	5.934
2	2.5	5.738
3	5	5.465
4	7.5	5.2
5	10	4.807

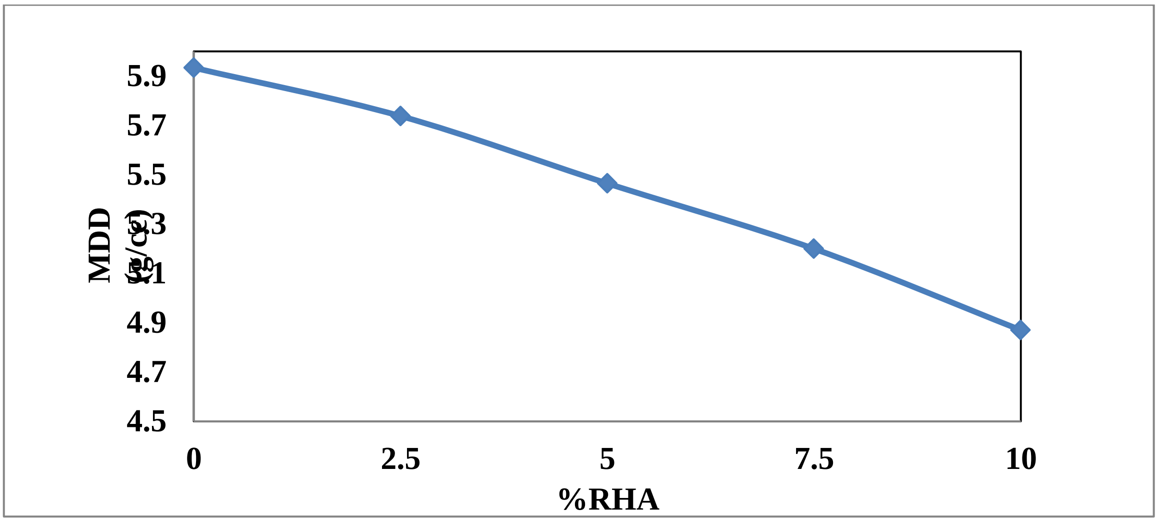

Figure 18 Comparison Graph of MDD

Table 11 Test Results of Direct Shear test for different percentages of RHA

S.No	%RHA	COHESION INTERCEPT (c)	ANGLE OF SHEARING STRAIN(Φ)
1	0	0.022	62^0
2	2.5	0.034	54^0
3	5	0.036	52^0
4	7.5	0.052	50^0
5	10	0.056	45^0

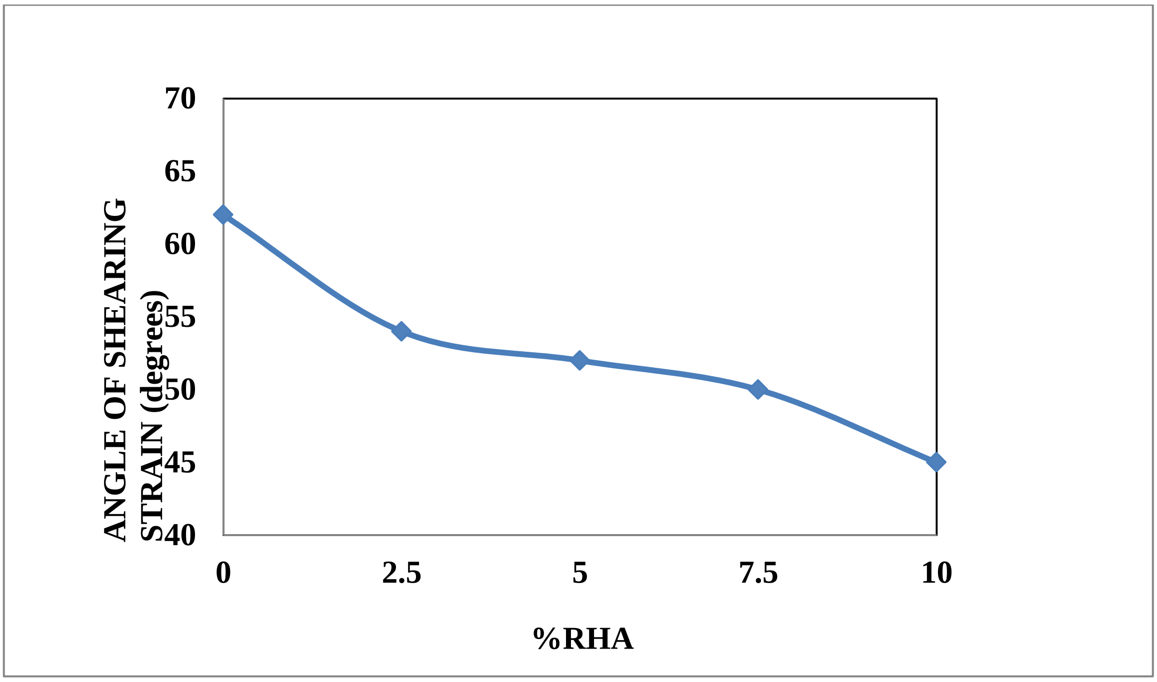

Figure 19 Comparison Graph of Angle of Shearing strain and soil-RHA samples

Table12 Observations of C.B.R for different percentages of RHA

S.No	%RHA	C.B.R for 2.5mm penetration	C.B.R for 5mm penetration
1	0	13.49	10.793
2	2.5	24.29	20.69
3	5	35.03	28.75
4	7.5	41.82	35.09
5	10	49.92	41.39

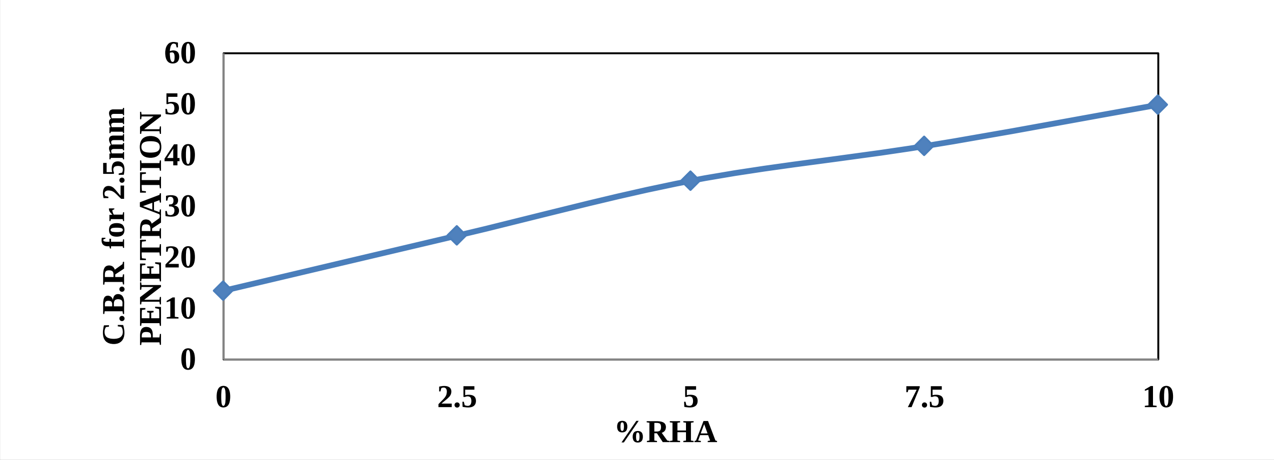

Figure 19 Comparison graph of C.B.R of 2.5mm penetration

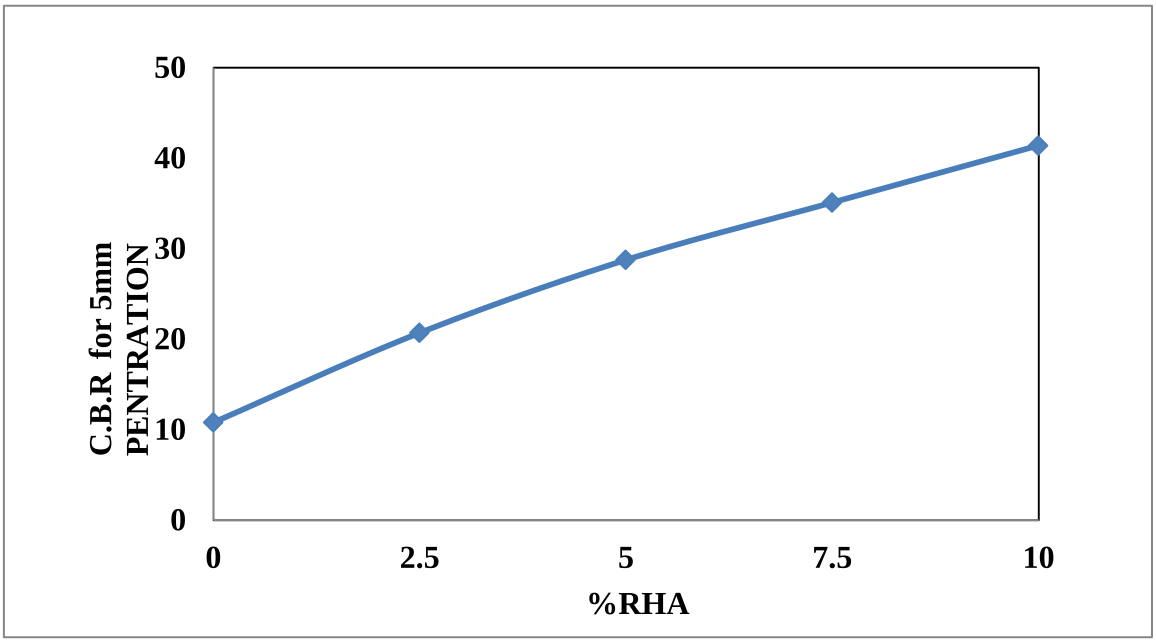

Figure 20 Comparison Graph of C.B.R of 5mm penetration

CONCLUSIONS

The main objective to use Rice Husk Ash (RHA) is to reduce the brunt waste material which can be very effectively done by use it as a soil stabilizer by partial replacement with soil. Rice Husk Ash (RHA) can be used as backfilling with soil as well as making the sub grades of the roads as it is being lighter in weight .The liquid limit and plastic limit increases as the Rice Husk Ash (RHA) content increases. The maximum dry density and optimum moisture content of Rice Husk Ash (RHA) and soil mix decrease and increase respectively as the (RHA) content increases in soil and also CBR values also increases with increase in Rice Husk Ash (RHA). The shear strength increases and also angle of shear strain decreases with respective adding of Rice Husk Ash (RHA).

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