Laboratory study on soil stabilization by coated lime

Bohra vinay kumar jain[1] B akhila[2] k Krishna mohan[3] k karthika[4]

Department of civil engineering
Vignan's institute of technology and aeronautical engineering
vignans hills deshmukhi(V) nalgonda (Dist)

Abstract. Black Soils (grey color) exhibit medium swelling and shrinking when exposed to changes in moisture content and hence have been found to be most troublesome from engineering considerations. This behavior is attributed to the presence of a mineral illite. The wide spread of the black soil has posed challenges and problems to the construction activities. To encounter with it, innovative and non-traditional research on waste utilization is gaining importance now a days.The main objective of this study is to evaluate the feasibility of using coated lime as soil stabilization material. A series of laboratory experiment has been conducted on 4%, 8% and 12% lime and Rice Husk Ash 5%, 10% and 15% mixed with black soil by weight of dry soil. The experimental results showed a significant increase in CBR..The objective of this study is to evaluate the effect of coated lime and Rice husk ash to improve the performance of black soil. In this paper black soil is treated with lime and rice husk ash. To improve the black soil properties and to increase the CBR of the soil it is tested with combination of additives i.e., coated lime and rice husk ash. By this combination of additives the value of the CBR is increased.

Key Words: CBR, compaction, atterbergs limits, permeability

1. Soil:

Soil is brought from a site near the Vignan's institute of technology and aeronautical engineering vignans hills deshmukhi(V) nalgonda (Dist). This soil is black in color.

Properties of soil used in the study:

Sl. No.	Description of property	Value
1	Gravel content (%)	2.7
2	Sand content (%)	13.17
3	Silt content (%)	5.5
4	Clay content (%)	38
5	Liquid Limit (%)	30
6	Plastic Limit (%)	15
7	Plasticity Index (%)	10
8	Specific Gravity	2.66
9	I.S classification	CI
10	Optimum Moisture Content (%)	13.8
11	Maximum Dry Density (g/cc)	1.65

Table: 1. Properties of soil

2. LAB TESTING: The various tests conducted on the sample are the following:

1. ATTERBERG'S limits
2. Specific gravity
3. Proctor compaction test
4. Permeability
5. CBR test

Firstly the above tests were conducted on plain soil sample to determine its properties.

The tests were conducted in the laboratory on the black soil to study the behaviour of black soil, when it was untreated, treated (with additives) for the modal flexible pavements and also for the foundation soil beds.

1. Properties of the soil:

Sl. No.	Particulars	Test values
1	Specific gravity	2.66
2	Liquid limit %	30
3	Plastic limit %	15
4	Plasticity index %	10
5	Shrinkage limit %	23

Table: 2. Properties of soil

3.STANDARD PROCTOR TEST RESULTS:

Compaction tests were conducted to get the OMC and MDD of soil, Coated Lime, Rice Husk and the different proportions of soil with lime and rice husk ash using standard proctor compaction machine.

Mix proportions	Water content (%)	Dry density (g/cc)
Soil	14	1.65
Soil + 4% Lime	16	1.59
Soil + 8% Lime	16	1.59
Soil+12% Lime	16	1.59
Lime	14	1.25

Table: 3. OMC and MDD values for soil and lime

4.COMPACTION TEST RESULTS FOR RHA:

Rice Husk Ash is added to the soil in different proportions i.e., 5%, 10% and 15%.Soil with rice husk ash OMC and MDD values are given in the below table.

Mix proportions	Water content (%)	Dry density(g/cc)
Soil + 5% RHA	22	1.66
Soil + 10% RHA	22	1.48
Soil + 15% RHA	22	1.34
Rice Husk Ash	24	0.70

Table: 4.OMC and MDD values for soil and RHA

5.COMBINATION OF ADDITIVES:

Rice Husk Ash and coated lime are added to the soil in different proportions i.e.,

Soil with rice husk ash OMC and MDD values are given in the below table.

Mix proportions	Water content (%)	Dry density (g/cc)
Soil+1%lime+ 4%RHA	10	1.61
Soil+2%lime+8%RHA	10	1.57
Siol+3%lime+12%RHA	10	1.51

Table: 5.OMC and MDD values for soil with combination of additives

6.PERMEABILITY TEST RESULTS

Permeability observations for soil, lime and rice husk ash are given below.

s.no	Mix proportions	Total volume of water (Q) in ml	Time period(t) in seconds	Coefficient of permeability (k)
1	Black soil	95	120	$8.73*10^{-3}$
2	Soil + lime	114	120	0.0104
3	lime	66	120	$6.066*10^{-3}$
4	Soil + RHA	204	120	0.0187
5	RHA	86	120	$7.904*10^{-3}$

Table: 6.permeability observations

7.CONCLUSION

- It is found that the O.M.C of the black soil has been increased by addition of 5% , 10% and 15% Rice Husk Ash and it also increased by addition of 4%, 8% and 12% of lime to the soil.
- It is found that the MDD of the soil is increased when lime added to the soil compare to rice husk ash.
- It is also found that in the permeability test the passage of water in soil is more when rice husk ash and lime are added to the soil when compared to the only soil.
- It is observed that the C.B.R. value of the black soil has been increased by addition of lime to the soil compare to addition of rice husk ash to the soil.

- That's why combination of additives are used in this project to check the CBR values of the soil. By this combination of additives CBR values of the soil are increased. By this we can reduce the cost by using less cost of additives.
- Rice husk and lime are easily available and less in cost.
- Variation in CBR values when additives added to the soil are shown in the below table.

s.no	Mix proportions	CBR at 2.5mm	CBR at 5mm
1	Black soil	1.08	1.01
2	Soil + 4% lime	0.71	2.04
3	Soil + 8% lime	0.74	1.26
4	Soil + 12% lime	0.74	1.38
5	Lime	3.28	3.21
6	Soil + 5% RHA	0.14	0.17
7	Soil + 10% RHA	0.32	0.30
8	Soil + 15% RHA	0.21	0.72
9	Rice husk ash	0.95	1.17
10	Soil + 1% lime + 4% RHA	5.80	5.52
11	Soil + 2% lime + 8% RHA	6.22	6.33
12	Soil + 3% lime + 12% RHA	3.48	3.58

Table: 7.comparision of CBR values

The stength of the black soil is increased by 3 times when lime added to the soil.

8.REFERENCES

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