Stabilization of Expansive Soils by Using BAGGASEASHand RICE HUSK ASH

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ABSTRACT

Soil is a base of structure, which actually support the structure from beneath and distributes the load effectively. If the stability of the soil is not adequate then failure of structure occurs in form of settlement, cracks etc. Expansive soil is more responsible for such situations and this is due to presence of montmorillonite mineral in it, which has ability to undergo large swelling and shrinkage. To overcome this, properties of soil must be improved by artificial means known as 'Soil Stabilization'. In this thesis we are stabilizing the soil by using Natural by products (RICE HUSK AND BAGASSE), with different proportions (0%,2%,4%,6%,8%...etc.,) to find where the maximum strength is attained. The different tests we are going to perform CBR, OMC, and Unconfined compressive strength.

Keywords: Soil Stabilization, Expansive soils, Rice Husk Ash, Bagasse Ash, OMC, CBR, Unconfined compressive strength.

INTRODUCTION

For any land-based structure, the foundation is very important and has to be strong to Support the entire structure. In order for the foundation to be strong, the soil around it plays a very critical role. So, to work with soils, we need to have proper knowledge about their properties and factors which affect their behavior. The process of soil stabilization helps to achieve their required properties in a soil needed for the construction work.

In recent times, with the increase in the demand for infrastructure, raw materials and fuel, soil stabilization has started to take a new shape. With the availability of better research, materials and equipment, it is emerging as a popular and cost effective method for soil improvement.

METHODOLOGY

Collection of materials

Tests conducted on Black cotton soil to determine the Index and Engineering Properties

Partial replacement of Black cotton soil with Bagasse ash and Rice husk ash as intervals of 2%, 4%, 6%,8%,10%,12% to get optimum strength compared to 0%.

Compare the Index, Engineering properties and strength parameter of Black cotton soil, with and without replacement of Bagasse ash and Rice husk ash

Results and Discussions

Conclusion

CHEMICAL OR ADDITIVE METHOD OF SOIL STABILIZATION:

In this procedure, the addition of manufactured products into the soil, which in proper quantities enhances the qualities of the soil. There are two basic types of additives during Chemical Soil Stabilization: Mechanical additives and Chemical additives.

Mechanical Additives, such as Rock dust, Soil cement, mechanically alter the soil by adding a quantity of material that has the engineering characteristics to upgrade the load bearing capacity of the existing soil. Chemical Additives, such as Sludge, Portland cement, Fly ash, Quick lime, Bitumen, etc.

BAGGASE ASH:Bagasse is fibrous residue of sugarcane stalks that remains after extraction of sugar when incinerated gives the ash.Bagasse ash is being accumulated in large volume which is deposed into the environment through dumping yards causing damage to the ecosystem.Bagasse ash is in black colour and it is odour less.

RICE HUSK ASH: Rice husk is extremely prevalent in East and South-East Asia because of the rice production in this area.

The husk of the rice is removed in the farming process before it is sold and consumed.

EXPERIMENTAL INVESTIGATIONS

The experimental works consists of the following steps:

1) Specific gravity of soil
2) Determination of soil index properties (Atterberg's Limits)
    - Liquid limit by Casagrande's apparatus
    - Plastic limit
3) Free swell index
4) Determination of the maximum dry density (MDD) and the corresponding Optimum moisture content (OMC) of the soil by proctor compaction test.
5) California Bearing Ratio

TEST RESULTS:

No. of Trails	Weight of soil (gm)	Wt. of soil	Weight of Admixtures		Liquid Limit
		Black cotton soil	Bagasse ash	Ricehusk ash	
Trail 2%	120	115.2	2.4	2.4	37.2
Trail 4%	120	110.4	4.8	4.8	39.4
Trail 6%	120	105.6	7.2	7.2	34.8
Trail 8%	120	100.8	9.6	9.6	36.1
Trail 10%	120	96	12	12	37.2

No. of Trails	Weight of sample(gm)	Wt. of Soil	Wt. of Admixtures		Plastic Limit
		Black cotton soil	Ricehusk ash	Bagasse ash	
Trail 2%	20	19.2	0.4	0.4	29.3
Trail 4%	20	18.4	0.8	0.8	31.4
Trail 6%	20	17.6	1.2	1.2	22.5
Trail 8%	20	16.8	1.6	1.6	26.1
Trail 10%	20	16	2.0	2.0	27.5

PLASTICITY INDEX:

Plasticity index =Liquid limit- plastic limit

PI= LL-PL

$PI=W_L-W_P$

No. of Trails	Liquid limit	Plastic limit	Plasticity index
Trail 2%	37.2	29.3	7.9
Trail 4%	39.4	31.4	8
Trail 6%	34.8	22.5	12.3
Trail 8%	36.1	26.1	10
Trail 10%	37.2	27.5	9.7

STANDARD PROCTOR TEST:

No. of Trails	Weight of soil(kg)	Black cotton soil	Bagasse ash	Rice husk ash	Maximum Dry Density(g/cc)	OMC (%)
Trail 2%	2500	2400	50	50	1.58	14
Trail 4%	2500	2300	100	100	1.59	13
Trail 6%	2500	2200	150	150	1.73	12
Trail 8%	2500	2100	200	200	1.62	11
Trail 10%	2500	2000	250	250	1.5	18

FREE SWELL INDEX:

$FSI=(V_d–V_k)/V_k$

Where,

V_d = volume of soil in distilled water

V_k = volume of soil in kerosene

FSI = Free swell index.

No. of Trails	Volume of sample in distilled water			Volume of sample in kerosene			FREE SWELL INDEX
	Black cotton soil	Rice husk Ash	Bagasse ash	Black cotton soil	Rice husk Ash	Bagasse ash	
Trail 2%	48	1	1	48	1	1	16
Trail 4%	46	2	2	46	2	2	14
Trail 6%	44	3	3	44	3	3	12
Trail 8%	42	4	4	42	4	4	13
Trail 10%	40	5	5	40	5	5	15

CBR RESULTS MIXING BAGASSE ASH and RICEHUSK ASH (UN-SOAKED)

CBR @2%BA,RHA to BC soil

PENETRATION IN mm	STANDARD LOAD IN Kg/cm²	OBTAINED LOAD IN Kg/cm²	CBR(%)
2.5	1370	87.01	6.351
5.0	2055	114.97	5.595

CBR @4%BA , RHA to BC soil

PENETRATION IN mm	STANDARD LOAD IN Kg/ cm²	OBTAINED LOAD IN Kg/ cm²	CBR(%)
2.5	1370	89.28	6.516
5.0	2055	113.27	5.611

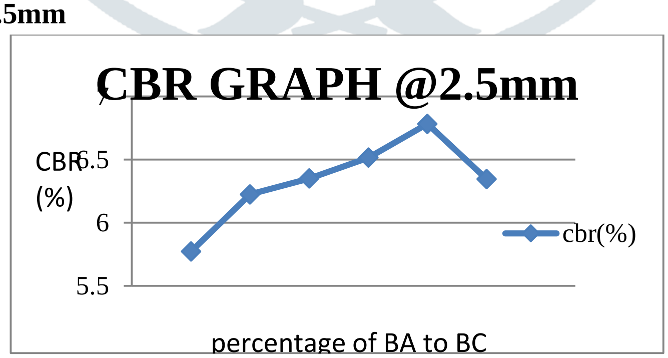
CBR @6%BA,RHAto BC soil

PENETRATION IN mm	STANDARD LOAD IN Kg/ cm²	OBTAINED LOAD IN Kg/ cm²	CBR(%)
2.5	1370	92.94	6.784
5.0	2055	118.46	5.764

CBR @10%BA, RHA to BC soil

PENETRATION IN mm	STANDARD LOAD IN Kg/ cm²	OBTAINED LOAD IN Kg/ cm²	CBR(%)
2.5	1370	86.79	6.347
5.0	2055	109.811	5.344

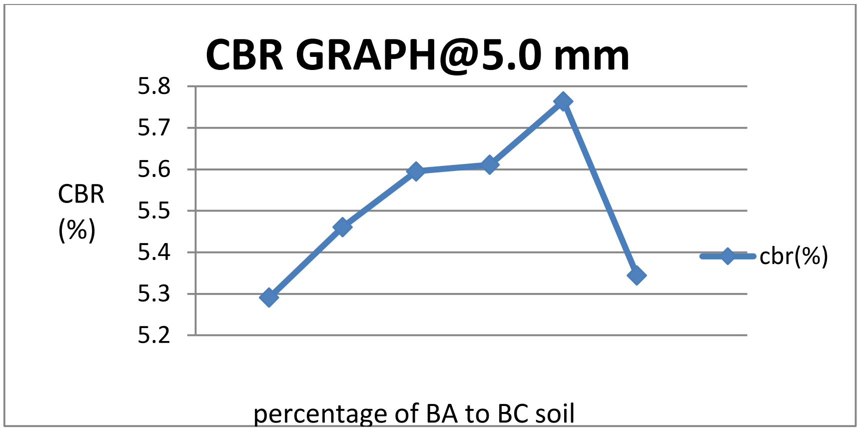
CBR OVERALL GRAPH @2.5mm



CBR graph @2.5mm

CBR OVERALL GRAPH @5.0mm

0% 2% 4% 6% 8%



CBR graph@5.0mm

CONCLUSION:

High expansive black cotton soil can be effectively utilized by as a geotechnical material by addition of 2-6% of Bagasse ash and Rice husk ash each. At this dosage of admixture black cotton soil can be behaves as non plastic and non swelling can reduce the problems of volume change. With increasing percentage of Bagasse ash and Rice husk ask results reduction in liquid limit and plastic limit. A gradual reduction in plasticity index causes significant decreases in swell potential and removal of some water that can be absorbed by clay minerals. By mixing 6% of bagasse ash and rice husk ash to the Black cotton soil, it increases density and decreases OMC. Further addition it decreases density and increases OMC. Compared to other dosage 6% of bagasse ash and rice husk ash is preferable. By mixing 6% of bagasse ash and rice husk ash to the black cotton soil the value of CBR increases it indicates reduction in settlement.

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