Stabilization of Soil using RHA and Waste Cement

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Abstract *— Soil stabilization of expansive soils with various admixtures of the techniques to mitigate the problems possessed by expansive soils. Chemical stabilization of expansive soils involves additives such as cement, lime, bitumen's, calcium chloride, fly ash etc.. soil stabilization is referred to as procedure in which a special soil is proportional or added or removed to a natural soil material to improve one or more of its properties.in our local area expansive soil are more available because of agriculture and sea shore. The strength and durability properties of expansive soils can be improved by replacement of RHA and waste cement. The aim of our study is to improve the properties of expansive soil by using RHA and waste cement as replacement material separately.RHA reduces the environment pollution and also huge amount is available in our country. The replacement level of RHA was taken for this study as 2%,4%,6%,8%,10%,12% and replacement of waste cement was taken as 5%,10%,15%,20%,25%.*

Keywords *— black cotton soil, waste cement, RHA, dry density, moisture content.*

I. INTRODUCTION

Soil can be used as a load bearing material or construction material. When used for these purpose soil possess engineering properties to meet the requirements such as high strength, low settlement etc. In many situations the soil present in the field may be a problematic and such as expansive soil. Expansive soils undergoes volumetric changes due to changes in water content. The swelling characteristics of these soils depends on various factors such as the initial water content and suction .however shrinkage occurs on evaporation of water in dry seasons. This dual problems of swelling and shrinkage cause's damages to many lightly loaded structures.in order to proceed with construction under engineering conditions, some techniques are needed to improve such properties of the soil. Soil stabilization of expansive soil with various additives is one of the techniques to mitigate the problems possessed by expansive soil.

Chemical stabilization of expansive soil involves additives such as cement lime bitumen calcium chloride fly ash etc. Soil stabilization has been used in buildings of roads and craft runways, earth dams and embankments in erosion.

A. Soil stabilization

It is referred to as procedure in which one of the more common method of stabilization can also be achieved by mechanically mixing the natural soil and stabilization agents and then the mixture is blended together so as to obtained a homogeneous mixture. After the soil and the stabilizing agents are blended together they are compacted using an appropriate compaction device. The commonly used stabilizing agents are

- Lime
- Cement
- Bitumen's/asphalt
- Polymers
- Calcium chloride
- Sodium chloride

B. Requirements of soil stabilization

The mode of alteration and the degree of alteration necessarily depend on the character of the soil.in general in the requirement is adequate strength.in the case of cohesion less soil the strength could be improved by providing confinement or by adding cohesive with a cementing or binding agent. In the case of cohesive soil the strength could be increased by making the soil moisture resistant altering the clay electrolyte concentration increasing cohesive with a cementing agent and adding frictional properties. Compressibility can be reduced by consolidation by filling the voids with an appropriate material cementing the grains with a rigid material or by altering the forces. Swelling and shrinking can be controlled by adding cementing agent by altering the double layer thickness and property and by preventing by moisture changes.permiability can be reduced by filling the voids with an impervious material or by creating a dispersed structure of the soil. On the other hand permeability can be increased by removed fines or creating an aggregate grains structure

II. METHODS OF STABILIZATION

Based on their function or the soil they are classified as follows

- Mechanical stabilization (improving the soil gradation or arrangement).
- Cement Stabilization (binding the particles together without their alteration)
- Physic chemical Alteration (changing the clay minerals or the clay water system)
- Voids filling (plugging in voids)

- Aggregate and dispersants (alteration of electrical forces between soil particles)
- Consolidation (expansive of pore water pressure)

A.Properties of RHA

- Water absorption capacity will be more.
- Excellent mechanical properties like internal bond strength, elasticity abrasion resistance.
- Increase surface hardness
- Light weight.

B.Features and benefits

- 100%organic, biodegradable, renewable resources
- High water and nutrition holding capacity
- Expands to hold up to 5 times its weight in water
- Excellent wetting capacity
- Strong air porosity for excellent aeration.

Methodology

The index properties of soil should be calculated. The conducted experiment are

- Specific gravity (IS2720 part III 1980)
- Liquid limit and plastic limit (IS 2720 part V 1970)
- Free swell index (IS 2720 part 40 1977)
- Moisture density relationship using light compaction test (IS 2720 part VII 1980)
- Unconfined compaction test (IS 2720 part X 1973)

Above mentioned tests were to be carried out by replacement of various percentage of RHA and waste cement.

III. RESULTS AND DISCUSSION

Followings are the result of the standard proctor test and ucc test for mixture of this samples for various proportions.

IV. TABLE 1
INDEX PROPERTIES OF SOIL AS FOLLOWS

properties	values
Liquid limit	71%
Flow index	26.57%
Plastic limit	39.5%
Plastic index	31.5%
Toughness index	1.18
Specific gravity of soil	2.47
Differential free swell index	60%(very high expansive soil)
Type of soil-	block cotton soil

From the A line chart it is found that soil is to be highly compressive clay CH type soil.

TABLE 2
INDEX PROPERTIES OF RHA AND WASTE CEMENT

properties	Values for RHA	Values for waste cement
Liquid limit	90%	35%
Plastic limit	Non plastic	42%
Specific gravity of soil	2.16	3.15

A.Comparison of various properties of RHA with clay

TABLE 3
COMPACTION OF CLAY 2%+4%+6%+8%+10%+12% RHA

Proportion	Water content %	Dry density(g/cc)
clay	26	1.42
4%	20	1.39
6%	20	1.44
8%	23	1.36
10%	26	1.55
12%	26	1.35

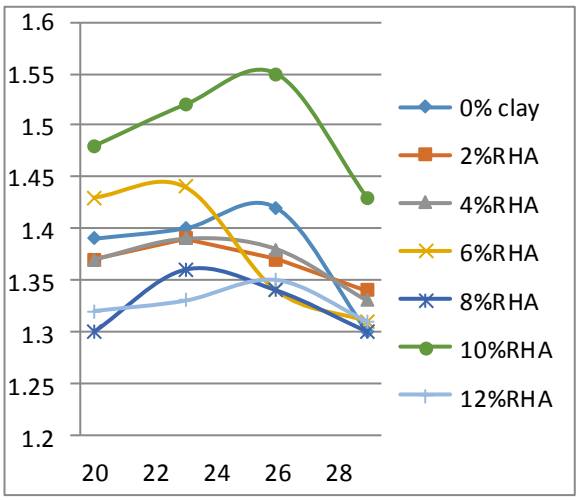

Fig 1: dry density relation for RHA

B. Comparison of various properties of waste cement with clay

TABLE4
COMPACTION OF CLAY 5%+10%+15%+20%+25% REPLACEMENT

Proportion	Water content %	Dry density(g/cc)
clay	26	1.42
4%	20	1.49
6%	23	1.48
8%	23	1.44
10%	23	1.60
12%	26	1.48

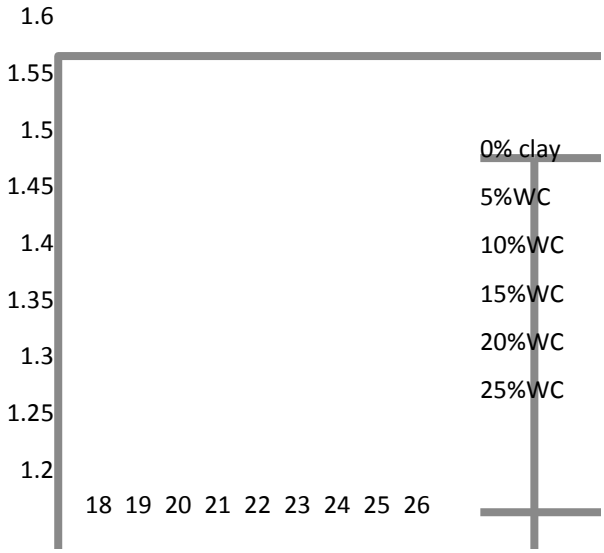

Fig 2: dry density and water content relation for WC

C.Unconfined compressive strength

TABLE 5
UCC OF CLAY +VARIOUS PROPORTION OF RHA

Proportion	Unconfined compressive strength
Clay	0.854
Clay+2% RHA	0.790
Clay+4%RHA	0.700
Clay+6% RHA	0.930
Clay+8% RHA	1.250
Clay+10% RHA	0.950
Clay+12% RHA	0.720

TABLE 6
UCC OF CLAY +VARIOUS PROPORTION OF WC

Proportion	Unconfined compressive strength
Clay	0.854
Clay+5% WC	0.900
Clay+10%WC	0.940
Clay+15% WC	1.086
Clay+20% WC	1.353
Clay+25% WC	1.090

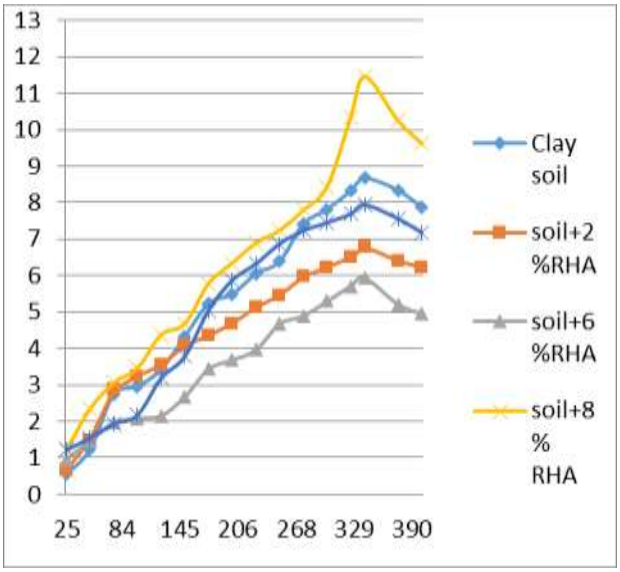

Fig 3: UCC of clay +various properties of RHA

From the fig clay with 20% WC gives maximum unconfined strength

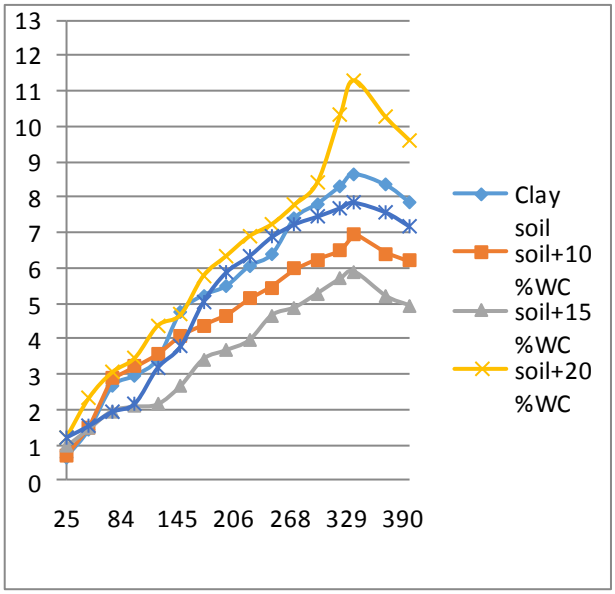

Fig 4: UCC of clay +various proportions of WC

From the fig clay with 20% WC gives maximum unconfined strength.

TABLE 7
TEST RESULT-I

Test	Clay	Rice Husk Ash					
Proportion	0%	2%	4%	6%	8%	10%	12%
Maximum dry density	1.42	1.39	1.39	1.44	1.36	1.55	1.35
UCC Value	0.854	0.79	0.64	0.930	1.25	0.950	0.960

From above table it is observed that the unconfined compressive strength increased from 0.854 for clay to 1.250(clay+8% RHA).so the % increase is 47%.

From this maximum dry density will be obtained at 10% adding of RHA with sample.

TABLE 8
TEST RESULT-II

Test	Clay	Waste cement				
Proportion	0%	5%	10%	15%	20%	25%
Maximum dry density	1.42	1.39	1.39	1.44	1.36	1.55
Unconfined compressive strength	0.854	0.79	0.64	0.930	1.25	0.950

From the above table it is observed that the unconfined compressive strength increased from 0.854 for clay to 1.353(clay +20% WC).So the percentage increase is 63%.

Maximum dry density will be obtained at 25 % adding of RHA with sample.

A.References

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- *Domestic Electrical Supply Monitoring using DSO* by Charu Maggu, Dr.S.K Pahuja [2]

V. CONCLUSION

From the above study the following conclusions are made

- Stress strain behaviour of UCC showed that failure stress and strain increased by 47% and 63% respectively when RHA replacement of 8 % and waste cement of 20%
- The replacement of RHA up to 10% gives a maximum dry density.
- The replacement of waste cement up to 20% recommended for strengthening the expansive soil.
- Waste cement are available huge amount of tones in our country at go downs.
- Rice husk ash and waste cement are place a vital role both in economy and environment.

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