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Stabilization of Black Cotton Soil using Rice Husk Ash and Fly Ash

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Abstract :- A black cotton soil is one of the problematic soils that has great tendency for shrinking or swelling due to change of water content. Black Cotton Soils exhibit high swelling and shrinkage when exposed to changes in moisture content and hence have been found to be most troublesome from engineering considerations. The objective of this paper is to upgrade black cotton soil as a construction material using Rice Husk Ash (RHA) and Fly Ash, which are waste materials. Black cotton soil mixed with Rice Husk Ash in 15%, 20%, 25%, and 30% and with Fly Ash in 15%, 20%, 25% and 30% ratio by weight of dry soil. The results obtained show that Maximum Dry Density (MDD) is increased from 1.270 g/cc to 1.486 g/cc and Optimum Moisture Content (OMC) is increased from 12.34% to 14.64% with increase in RHA. MDD is increased from 1.270 g/cc to 1.603 g/cc and OMC is increased from 12.34% to 15.04% with increase in Fly Ash. The Unconfined Compressive Strength (UCS) of soil is increased by 144.92% and 195.72% with increase of RHA and fly ash. The improvement of black cotton soil reveals that Rice Husk Ash and Fly ash is an important material to stabilize the Black Cotton soil and make suitable for construction purpose.

Keywords :- Black cotton soil, Rice Husk Ash, Fly Ash, Soil stabilization, Unconfined Compressive Strength

I. INTRODUCTION

In India Black cotton soil covers about 20% percent area of land. Black cotton soils is one of the problematic soils that has great tendency for Shrinking or swelling due to change of water content. Clays exhibit generally undesirable engineering properties. They tend to have low shear strengths and to lose shear strength further upon wetting or other physical disturbances. They can be plastic and compressible and they expand when wetted and shrink when dried. Some types expand and shrink greatly upon wetting and drying – a very undesirable feature. Cohesive soils can creep over time under constant load, especially when the shear stress is approaching its shear strength, making them prone to sliding. They develop large lateral pressures. They tend to have low resilient modulus values. For these reasons, clays are generally poor materials for foundations. Because of its peculiar cyclic swell shrink behavior, these soils increase in volume when comes in contact with water and decrease in volume when water is evaporates out. Due to this tendency the deformation of soil cannot be predicted. This inadequate natural stability of Black cotton soil needs to be improved to make them suitable for construction, using some sort of stabilization method. Many stabilization techniques are in practice for improving the characteristics of black cotton soil. Stabilizers such as lime, fly ash, rice husk ash, cement, silica fumes etc. are used to enhance properties of black cotton soil. The selection and the amount of stabilizers to be used depend mainly on the mineralogical composition of soil. The objective of this paper is to upgrade Black Cotton Soil as a construction material using RHA and Fly Ash, which are waste materials.

II. MATERIALS

The materials used in the experiments are Black Cotton Soil, Rice Husk Ash and Fly Ash.

1. Black Cotton Soil (BCS)

The Black Cotton Soil used in experimental work was brought form Hudkeshwar, Outer Ring Road, Nagpur. The Properties of Black Cotton Soil are as shown in TABLE 1.

Table-1: Properties of Black Cotton Soil

Sr. No.	Particulars	Test Results
1	Liquid Limit (%)	36.81
2	Plastic Limit (%)	26.11
3	Plasticity Index (%)	10.7
4	Specific Gravity	2.521
5	Maximum Dry Density (g/cc)	1.270
6	Optimum Moisture Content (%)	12.34
7	Unconfined Compressive Strength (kg/sq.cm)	1.87

2. Rice Husk Ash (RHA)

Rice Husk Ash is obtained from the burning of rice husk. The husk is a by-product of the rice milling industry. The RHA used in this study is collected from ellora rice mill, Tumsar, dist. Nagpur.

3. Fly Ash (FA)

Fly Ash is collected from Koradi thermal power station, Nagpur.

III. METHODOLOGY

The laboratory tests were carried out first on the natural soil which include liquid limit, plastic limit, plasticity index, specific gravity, compaction and UCS. Specimens for Unconfined compressive strength (UCS) tests are prepared at the Optimum moisture contents (OMC) and Maximum dry densities (MDD). Further a series of laboratory tests were conducted on BC Soil mixed with Rice Husk Ash in various percentages i.e. 15%, 20%, 25% and 30% and with Fly Ash in 15%, 20%, 25% and 30% by weight of dry soil. For the above different proportions, tests are carried out to observe the changes in the properties of soil i.e. maximum dry density, optimum moisture content, and unconfined compressive strength of soil.

IV. RESULTS AND DISCUSSIONS

1. Compaction characteristics

The variations of MDD and OMC with RHA and with FA contents mixed with soil are shown in Fig. 1 and Fig. 2, respectively. It has been observed that both MDD and OMC are increased with increase in the RHA content. Also MDD and OMC are increased with increase in the FA content.

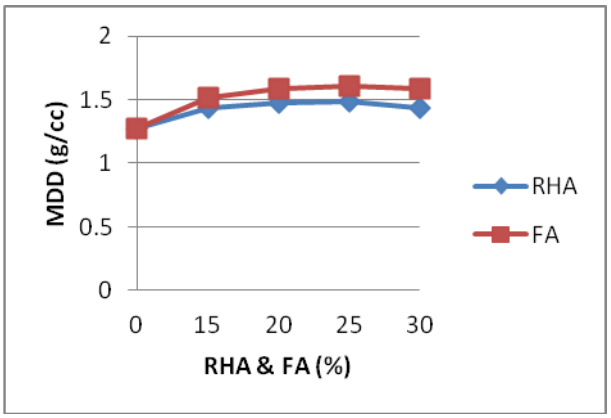

Figure 1 Variation of MDD with increase

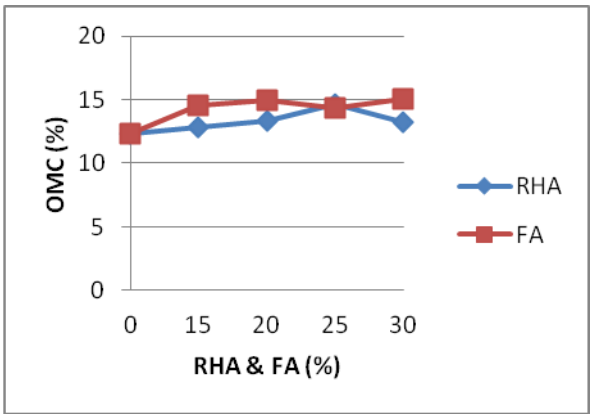

Figure 2 Variation of OMC with increase

in RHA & FA in RHA & FA

2. Unconfined Compressive Strength

Unconfined compressive strength (UCS) is the most common and adaptable method of evaluating the strength of stabilized soil. It is the main test recommended for the determination of the required amount of additive to be used in stabilization of soil. Variation of UCS with increase in RHA and FA content from 15% to 30% were investigated and the results are shown in Fig. 3. It has been observed that strength of the soil is increases with increase in RHA and FA content up to 20% and 25% respectively. The initial increase in the UCS with addition of RHA and FA is attributed to the formation of cementitious compounds between the CaOH present in the soil and the pozzolana present in the RHA and FA. The decrease in the UCS values after addition of 20% RHA and 25% FA may be due to formation of weak bonds between the soil and the cementitious compounds formed

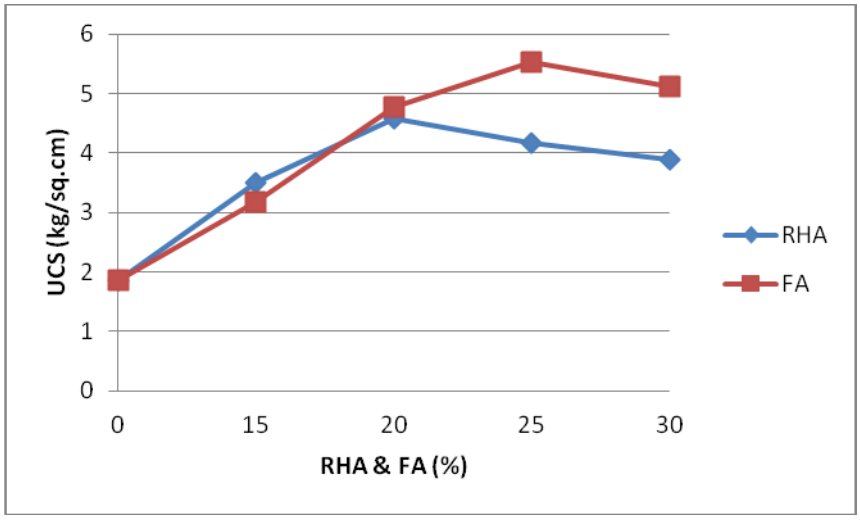

Figure 3 Variation of UCS with increase in RHA & FA

V. CONCLUSION

From the results of investigation carried out the following conclusion can be drawn

- Addition of RHA and FA content results in an increase in MDD.
- With increase in RHA and FA content OMC is also increases.
- Based on UCS test optimum amount of RHA and FA was determined as 20% and 25% respectively.
- The UCS of soil is increased by 144.92% and 195.72% on addition of 20% and 25 % of RHA and FA content respectively compared to raw soil.
- The results shows that FA is better additive as compared to RHA.

REFERENCES

[1] Dilip Shrivastava, AK. Singhai and R.K. Yadav, Effect of Lime and Rice Husk Ash on Index Properties of Black Cotton Soil, *International Journal of Engineering Sciences & Research Technology, 3(4),* 2014, 4030-4033.

[2] Aparna Roy, Soil Stabilization using Rice Husk Ash and Cement, *International Journal of Civil Engineering Research, 5(1),* 2014, 49-54.

[3] K.V. Madurwar, P.P. Dahale and A.N.Burile, Comparative Study of Black Cotton Soil Stabilization with RBI Grade 81 and Sodium Silicate, *International Journal of Innovative Research in Science, Engineering and Technology, 2(2),* 2013, 493-499.

[4] Laxmikant Yadu, Rajesh Kumar Tripathi, Dharamveer Singh, Comparison of Fly Ash and Rice Husk Ash Stabilized Black Cotton Soil, *International Journal of Earth Sciences and Engineering, 4(6),* 2011, 42-45.

[5] Dilip Shrivastava, A K Singhai and R K Yadav, Effect of Lime and Rice Husk Ash on Engineering Properties of Black Cotton Soil, *International Journal of Engineering Research and Sciences & Technology, 3(2),* 2014, 291-296.

[6] B. Suneel Kumar and T.V. Preethi, Behavior of Clayey Soil Stabilized with Rice Husk Ash and Lime, *International Journal of Engineering Trends & Technology, 11(1),* 2014, 44-48.

[7] Anil Kumar Singhai and Sudhanshu Shekhar Singh, laboratory Study on Soil Stabilization using Fly Ash and Rice Husk Ash, *International Journal of Research in Engineering and Technology, 3(11),* 2014, 348-351.

[8] Dr. Robert M. Brooks, Soil Stabilization with Fly Ash and Rice Husk Ash, *International Journal of Research and Reviews in Applied Sciences, 1(3),* 2009, 209-217.

[9] Mohammed Y. Fattah, Falah H. Rahil and Kawther Y. H. Al-Soudany, Improvement of Clayey Soil Characteristics Using Rice Husk Ash, *Journal of Civil Engineering and Urbanism, 3(1),* 2013, 12-18.