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Evaluation of Dry Density for Black Cotton Soil Using Rice Husk Ash

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Abstract: Stabilization is a broad term that refers to the various methods used to improve the engineering performance of a soil and its application in a variety of engineering works. Soil stabilisation is a major concern for civil engineers today, both for road construction and for increasing soil strength or stability, which reduces construction costs. Soil stabilisation is the chemical or physical modification of soil properties to improve the soil's engineering quality. The primary goal of soil stabilisation is to increase the soil's bearing capacity, resistance to weathering processes, and permeability. Due to the rapid growth of urbanization and industrialization, minimizing industrial waste. Because of the rapid growth of urbanization and industrialization, reducing industrial waste has become a major issue in recent years. To encounter this innovative and nontraditional research on waste utilization is becoming increasingly important. Soil improvement using waste materials such as slags, rice husk ash, and silica fume has been recommended from an environmental standpoint in geotechnical engineering. This paper examines the effects of blast furnace slag, fly ash, and micro silica added to black cotton soil to improve soil properties. In addition, this paper provides a review of the use of various solid waste materials for soft soil stabilisation. However, there are numerous methods and techniques available for stabilising these soils. This study describes how waste materials can be used to stabilise soft soil.
Keywords: Black Cotton Soil, Rice husk, Dry Density

I. INTRODUCTION

Soft soils have low shear strength, low CBR, and alternate wetting and drying cycles. Soil strengthening increases bearing capacity, decreases settlement, and helps to reduce soil liquefaction. Since then, significant progress has been made in the construction and design of geotechnical structures such as foundations, embankments, pavements, and retaining walls. The need for soil stabilisation arises from a variety of challenges such as poor bearing capacity, a high rate of settlement after construction, excavation instability, and high construction costs; improve sub-grade strength on clayey soil. J Bala Krishna (2017) presents the efficacy of sodium based alkaline activators and class F fly ash as an additive in improving the engineering characteristics of expansive Black cotton soils. Sodium hydroxide concentrations of 10, 12.5 and 15 molal along with 1 Molar solution of sodium silicate were used as activators. The activator to ash ratios was kept between 1 and 2.5 and ash percentages of 20, 30 and 40 %, relatively to the total solids. The effectiveness of this binder is tested by conducting the Unconfined compressive strength (UCS) at curing periods of 3,7 and 28 days and is compared with that of a common fly ash-based binder, also the most effective mixtures were analysed for mineralogy with XRD. Suitability of alkaline activated fly ash mix as a grouting material is also ascertained by studying the rheological properties of the grout such as, setting time, density and viscosity and is compared with that of common cement grouts. Results shows that the fluidity of the grouts correlate very well with UCS, with an increase in the former resulting in a decrease in the latter. In this work a new idea of stabilizing the expansive soil using alkali activated fly ash was discussed. The chemical sodium hydroxide and sodium silicate were used as a chemical activator for the fly ash. The method of sample preparation, proportion of chemical additive, curing of sample and changes in basic geotechnical properties of expansive soil. Er. Rehana Rasool (2017**)** studied to improve various engineering properties of the soil by using waste material Ground Granulated Blast Furnace Slag (GGBS) as an alternative to lime or cement, so as to make it capable of taking more loads from the foundation structures. This paper includes the evaluation of soil properties like unconfined compressive strength test and California bearing ratio test. The soil sample was collected from Lalru and addition to that, different percentages of GGBS (0%, 6%, 12 %, 18 % and 24%). was added to find the variation in its original strength. Based on these results CBR test was performed with the GGBS percentages (0%, 6%, 12 %, 18 % and 24%). From these results, it was found that optimum GGBS (18%) gives the maximum increment in the CBR value compared with all the other combinations.

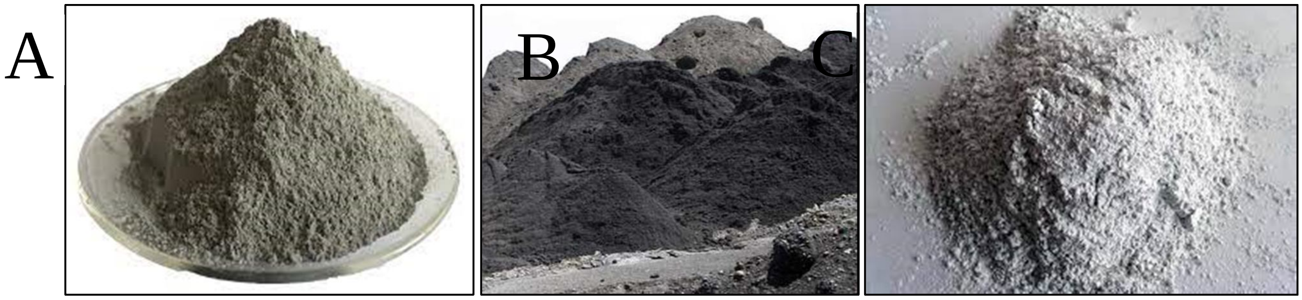

Fig. 1 Material for Soil Stabilisation (a) Silica Fume (b) Fly Ash (c) GGBS

II. MATERIAL & METHODOLOGY

The rice husk ash can be used as a cement replacement in the cement stabilisation methods, or cooperate with lime to enhance the lime stabilisation methods. Being a cement replacement material, rice husk ash can help to reduce considerably the required amount of ordinary Portland cement to archive the same strength in the case of cement only. With a fixed amount of cement, added rice husk ash can improve largely the strength as observed in the work. In cooperation with lime, among different siliceous, rice husk ash gives the most significant result as seen in the work. In this research, 0 % to 15 % of rice husk is been replaced by cement for the better performance in soil stabilisation.

Fig. 2 Rice husk to Rice husk ash

A. Dry Density

Compaction is the process of densification of soil mass by reducing air voids. This process should not be confused with consolidation which is also a process of densification of soil mass but continuously acting static load over a long period. The degree of compaction of a soil is measured in terms of its dry density. The degree of compaction mainly depends upon its moisture content, compaction energy, type of soil. For a given compaction mainly depends upon soil. For a given compaction energy every soil attains the maximum dry density at a particular water content. In the dry side water acts as a lubricant and helps in the closer packing of soil grains. In the wet side, water starts to occupy the space of soil grains and hinders in the closer packing of grains.

Dry density, $\gamma d=\gamma b/(1+w)$ …………..(1)

W= water content = mass of water /mass of soil

γb = Wet density

III. RESULT

The following is the report of dry density done for the case-

Table No. 1 Observation of Unconfined Compression Test

Case Description	Reading 1	Reading 2	Reading 3
Dry density sample without Rice husk ash	0.19	0.17	0.15
Dry density sample with 5 % Rice husk ash	0.15	0.12	0.11
Dry density sample with 15 % Rice husk ash	0.12	0.10	0.09

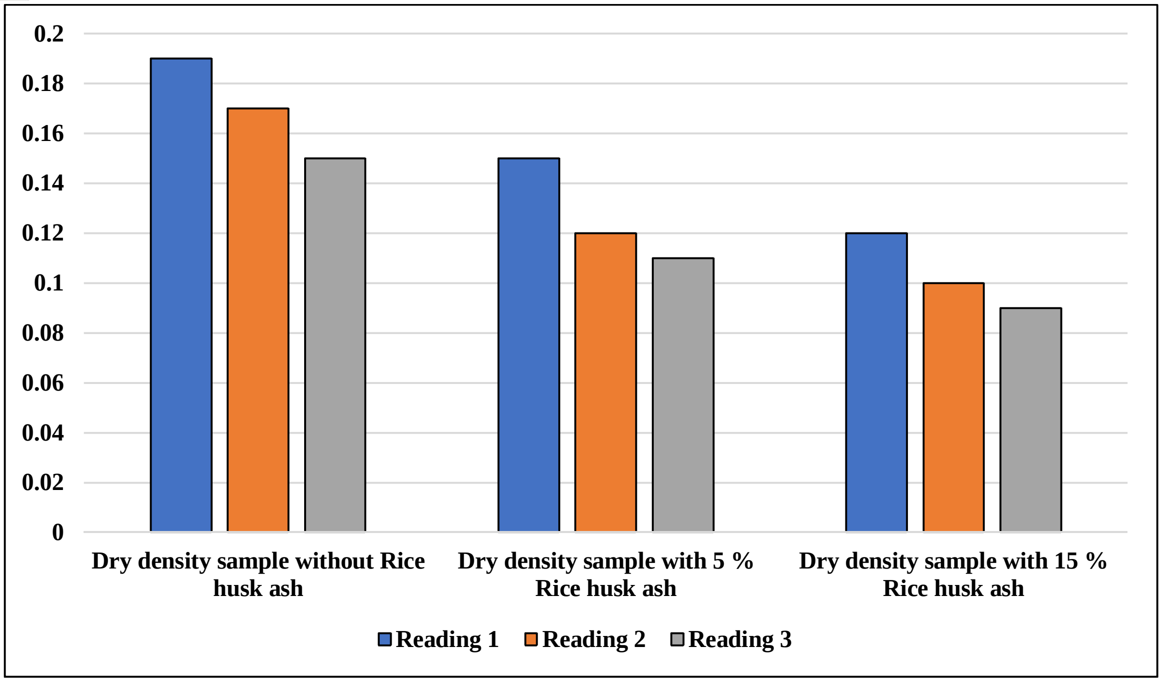

Fig. 3 Comparison of dry density of Case Study

IV. CONCLUSIONS

It has been observed that as the percentage of rice husk ash increase, the density decreases which in turn decreases the strength. This concluded that the properties of soil reveal that rice husk ash is an important material to stabilize the black cotton soil & make suitable for construction purpose up to 5-10 % only.

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