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EXPERIMENTAL STUDY ON STABILIZATION OF BLACK COTTON SOIL USING RICE HUSK ASH

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Abstract *India has a total road network of about 4.7million kilometers. 53 percent of the total road network is paved. The budgeted amount spent over roads is Rs.14, 90,925 Croce. The durability and serviceability of pavements depend mainly on strength of sub grade, which can be enhanced by ground improvement techniques. The field of ground improvement by the use of waste rice husk ash for this purpose. India is one of the world's largest producers of rice. This paper therefore takes the review of the effect of rice husk ash on the properties of soil related to pavement such as Optimum Moisture Content (OMC), Maximum Dry Density (MDD) and California Bearing Ratio (CBR).*

In India the soil mostly present is Clay, in which the construction of sub grade is problematic. In recent times the demands for sub grade materials have increased due to increased constructional activities in the road sector and due to paucity of available nearby lands to allow excavate fill materials for making sub grade. In this situation, a means to overcome this problem is to utilize the different alternative generated waste materials, which cause not only environmental hazards and also the depositional problems. Keeping this in view stabilization of weak soil in situ may be done with suitable admixtures to save the construction cost considerably.

The present investigation has therefore been carried out with agricultural waste materials like Rice Husk Ash (RHA) which was mixed with soil to study improvement of weak sub grade in terms of compaction and strength characteristics. Silica produced from rice husk ashes have investigated successfully as a pozzolanic material in soil stabilization. Due to various construction development projects undertaken all over the world there is a substantial increase in the production of waste materials rice husk. Which create disposal problems. Rice husk waste is produced in large quantity in rice husk mills and is disposed in open land.

Keywords- *Black cotton soil, Rice husk ash, OMC, MDD*

1. INTRODUCTION

A developing country like India which has a large geographical area and population, demands vast infrastructure i.e., network of roads and buildings. Everywhere land is being utilized for various structures from ordinary house to sky scrapers, bridges to airports and from rural roads to expressways. Almost all the civil engineering structures are located on various soil strata. Soil can be defined as a material consisting of rock particles, sand, silt, and clay. It is formed by the gradual disintegration or decomposition of rocks due to natural processes that includes disintegration of rock due to stresses arising from expansion or contraction with temperature changes. Weathering and decomposition from chemical

changes that occur when water, oxygen and carbon dioxide gradually combine with minerals within the rock formation, thus it is breaking down to sand, silt and clay. Transportation of soil materials by wind, water and ice forms different soil formations such as those found in river deltas, sand dunes and glacial deposits. Temperature, rainfall and drainage play important roles in the formation of soils as in the different climatic regions. Under different drainage regimes, different soils will be formed from the same original rock formation. In India, soils are classified into six groups namely alluvial soil, marine soil, laterite and lateritic deposits, expansive soils, sand dunes and boulder deposits. On an average 1 lakh sq.km area is covered by lateritic soil deposits, 3 lakhs sq.km area is covered by black cotton soil, and 5 lakhs sq.km area is covered by sand dunes. Encountering land having soft soil for construction leads to an attention towards adopting ground improvement techniques such as soil stabilization.

1.1 Soil stabilization

"Stabilization is the permanent physical and chemical alteration of soils and aggregates to enhance their engineering properties thus improving the load bearing capacity of a sub-grade or sub-base to support pavements and foundations."

Stabilization in a broad sense incorporates the various methods employed for modifying the properties of a soil to improve its engineering performance. Stabilization is being used for a variety of engineering works, the most common application being in the construction of road and airfield pavements, where the main objective is to increase the strength or stability of soil and to reduce the construction cost by making best use of locally available materials.

1.2 Black cotton soil

Black cotton soil has a huge problem of volume changes as swelling due to excessive amount of water mainly on rainy days and shrinkage due to evaporation mainly on summer days. To reduce these problems in particular seasons or have a permanent solution to such a problem the soil has to stabilize.

Fig 1: Black cotton soil

1.3 Rice husk ash

It is also a by-product of rice from rice milling in the rice production areas. The rice husk ash contains approximately 65- 90% of silica, which is highly chemically reactive. It is also used as a replacement for traditional stabilizers.

Fig 3: Rice husk ash

1.4 Objectives of the study

From this study the following objectives were made

[1]. To study the Atterberg limits for soil by using Rice husk ash in soil.

[2]. To study the OMC and Maximum dry density for different proportions of RHA.

[3]. To study the maximum strength of soil for different proportions of RHA

[4]. To calculate the UCS values for different proportions of RHA.

2. LITERATURE SURVEY

M SANTHOSH,Thovtu Sushma Hindhu, et al.,(2023)

The main objective of this study is to evaluate the feasibility of using Rice Husk Ash as soil stabilization material. A series of laboratory experiment has been conducted on soil blended with Rice Husk Ash in 0%, 2.5%, 5%, 7.5%and 10% by weight of dry soil. The results like liquid limit, plastic limit, compaction, compressive strength values are studied by using various percentages of rice husk ash in black cotton soil.

From this paper the treatment with RHA shows a general decrease in the MDD and increase in OMC with increase in the RHA content. Liquid limit and plastic limit having less values at 5% usage in the soil**.**

Pravin Patel,Dr. H. K. Mahiyar, et al.,(2014)

The objective of this work is to estimate the effect of RHA, Fly ash and Lime on some geotechnical properties of black cotton soil, in order to determine the suitability of RHA, Fly ash and Lime for use as a modifier or stabilizer in the treatment of black cotton soil for roadwork. The aim of this work is to find the optimum percentage of RHA, Fly ash and Lime.

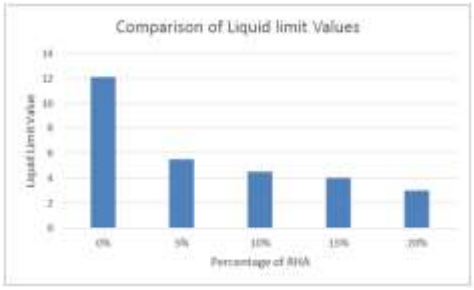
From this paper Liquid limit and plastic limit of Black Cotton soil decrease with increasing % Lime. But Liquid limit and plastic limit of Black Cotton soil increase with increasing % Fly ash and % Rice husk ash. CBR value of Black Cotton soil also increase with increasing varying % Rice husk ash. The optimum percentage of fly ash at 20% for gave the best result for sub grade soil. CBR value of Black Cotton soil also increase with increasing varying % fly ash. The optimum percentage of fly ash at 20% for gave the best result for sub grade soil.

3. METHODOLOGY ADOPTED

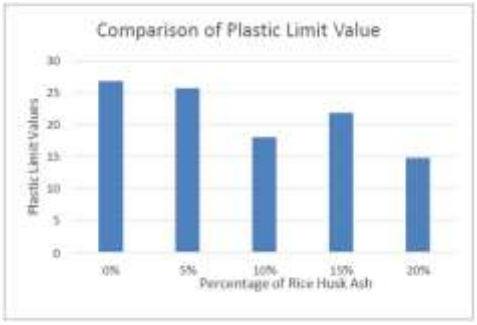
To assess the impact of rice husk ash as a balancing out added substance in far reaching soils, arrangement of tests, where the substance was differed in estimations of 5% to 20% (products of 5). The Indian Standard codes were pursued during the conduction of the accompanying analyses:

1. Standard proctor test – IS : 2720 (Part 7) - 1980
2. Unconfined compressive strength (UCS) test – IS : 2720 (Part 10) - 1991
3. California bearing ratio (CBR) test – IS : 2720 (Part 16) - 1987
4. Liquid & Plastic limit test – IS 2720 (Part 5) - 1985

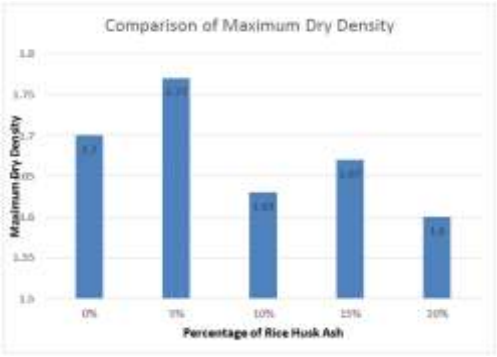
4. EXPERIMENTAL RESULTS



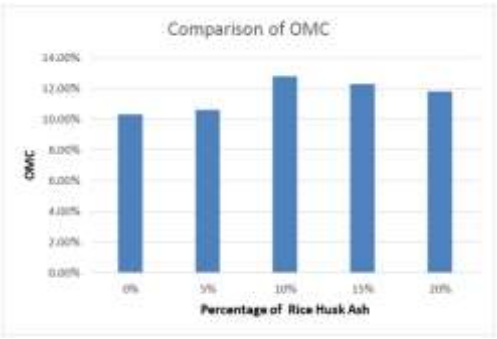
Graph 1: Comparison of liquid limit values



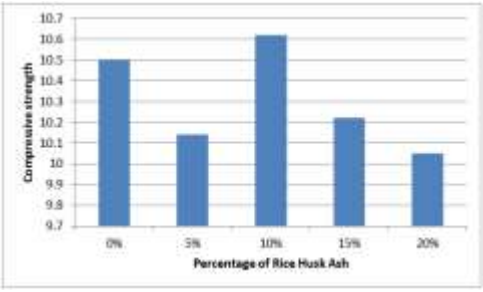
Graph 2: Comparison of plastic limit values



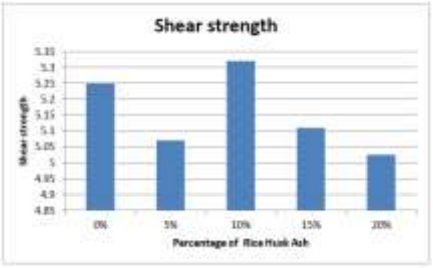
Graph 3: Comparison of maximum dry density values



Graph 4: Comparison of OMC values



Graph 5: Comparison of compressive strength values



Graph 6: Comparison of maximum shear strength

5. CONCLUSIONS

From the above experimental study, the following conclusions were made

1. Rice husk ash is free of cost and available locally, which proves to be economical RHA also decreases swell potential of red soil by replacing some of the volume previously held by expansive clay minerals and by cementing the soil particles together.
2. RHA effectively dries wet soil and lead to an initial rapid strength gain.
3. By using RHA materials, we can decrease the waste materials from the environment
4. From this study it was concluded that the value of liquid limit decreases with increasing the percentage of RHA.
5. The value of plastic limit initially decreasing till the percentage of 10%RHA, then suddenly increases with increase in the percentage of RHA to 15% and then deceases at 20%RHA.
6. The optimal value of maximum dry density was observed at 5% RHA materials. The optimal value of OMC was observed at 10% RHA materials in soil.
7. The value of compressive strength of the soil increases from 0% to 10% RHA materials after 10% it will decrease gradually up to 20%RHA. The optimal value of shear strength was observed at 10% rice husk ash than reaming trials.

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