

## Study on stabilizing the black cotton soil with rice husk ash and lime

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### ABSTRACT

Soil is a particular material. Some waste materials such lime, Fly Ash, rice husk ash, may use to make the soil to be steady. Expansion of such materials will expand the physical and additionally concoction properties of the soil. Some anticipating that properties should be enhanced are CBR, shear strength, liquidity index, plasticity, unconfined compressive strength and bearing strength and so forth. Then again, large quantity of waste materials delivered from the distinctive ventures like flyash, ggbs, rice husk ash, paper process slag, and so forth makes a potential negative effect on the natural causing air contamination, water contamination influencing the neighbourhood biological community, and henceforth safe transfer of these waste materials is required. Some of these material can be used for the stabilization of soil. Thus an 133ndeaavour is made to legitimize the utilization of rice husk ash by blending it with lime for stabilization of black cotton soil. This paper features the viability of utilizing rice husk fiery ash (RHA) as a material to improve the lime treatment of soil.

**Keywords:** Black Cotton soil, stabilization, Rice husk ash, CBR Test,

### I. INTRODUCTION

For the most part, lands with Black Cotton soils are fruitful and useful for farming, cultivation, sericulture and aquaculture. Black cotton soils are extensive soils with potential for contracting or swelling under changing moisture condition. The soil are shaped under states of poor waste from essential rocks or limestone under substituting wet or dry climatic conditions. These soil hinder the moisture from the surface in rainy and summer season by methods for dissipation. Inferable from these reasons, the soil have cyclic swell-recoil conduct, low quality, high moisture content, volume change in soil, differential settlement and so forth. These disappointments may bring about longitudinal and transverse breaking of asphalts, surface pain, rutting of surface and profound cutting in foundations. To defeat these conditions in the soil, it ought to be dealt with and balanced out in most ideal way. Rice husk is a result from rice mills. If 1000kg of rice paddy are processed then around 22% of rice husk (220kgs) is gotten and in the wake of consuming this husk we will get around 25% of powder (55kgs). Lime is utilized as a coupling material in little sum in this examination. It gives an practical

method for stabilization being less vulnerable to water content. For the work, lime is utilized as a part of stabilizing agent for stabilization of black cotton soil.

## II. MATERIAL USED

### 2.1 Black cotton soil:

Physical properties of black cotton soil are presented below, it is also known as expansive soil due to its swelling property.

| Sr. No. | Property   | Value                |
|---------|--|----------------------|
| 1       | Specific gravity                                     | 2.49                 |
| 2       | Liquid Limit (%)                                     | 47.95                |
| 3       | Plastic Limit (%)                                    | 23.94                |
| 4       | Plasticity Index (%)                                 | 24.01                |
| 5       | Shrinkage Limit (%)                                  | 16.11                |
| 6       | Free Swell Index (%)                                 | 24                   |
| 7       | IS Classification                                    | CH (High Plasticity) |
| 8       | Grain Size analysis-Percent passing 75 $\mu$ sieve   | 89%                  |
| 9       | Optimum Moisture Content (%)                         | 12                   |
| 10      | Maximum Dry Density (g/cc)                           | 1.01                 |
| 11      | California Bearing Ratio (%)                         | 1.98                 |
| 12      | Insitu Soil Density (g/cc)                           | 1.58                 |
| 13      | Unconfined Compressive Strength (KN/m <sup>2</sup> ) | 71                   |

### 2.2 Rice Husk Ash:

Properties of rice husk are shown below, firstly rice husk is burned to get ash and its colour changed to whitish grey.

| Sr. No. | Property                   | Value |
|---------|----------------------------|-------|
| 1       | Specific Gravity           | 1.95  |
| 2       | Max. Dry Density           | 8.5   |
| 3       | Optimum Moisture Content   | 31.8  |
| 4       | Angle of Internal Friction | 38    |
| 5       | Liquid Limit (%)           | 48.4  |
| 6       | Plastic Limit (%)          | 23.8  |
| 7       | Plasticity Index (%)       | 24.6  |

### **2.3 Lime:**

Lime is used as a binding material and can be used as a stabilizing agent for stabilization of black cotton soil its presence illuminates the presence of water and its effect on properties of soil. Utilization of lime with extended rate in BC Soil was examined for modification reason and the result was surveyed. Lime is a calcium containing inorganic mineral in which carbonates, oxides and hydroxides prevail. It is utilized as a part of vast amount as building and designing material, it is utilized as a binding material.

## **III .TEST INCLUDED**

### **1. Atterberg's limit:**

In this test the soil is sieved through the 425micron IS strainer. Take material which went through the sifter and put in to oven for 2 hours before the test. By test it is observed that the liquid limit for the stabilized soil is reduced about 55% and plastic limit is reduced to 86% by the use of 15% of rice husk and 5% of lime.

### **2. California bearing ratio test :**

Lime content expanded from 0% to 7.5%, it is found that ideal measurements of lime was 5% at which CBR expanded from 0.94 to 5.48% following 28 days curing. RHA was added to lime-soil blend at 5%, 10%, 15% and 20% by weight and it is discovered that Dirt + 5% lime + 15% RHA is the prescribed mix at which CBR following 28 days curing was 23.4%.

### **3. Compaction parameters:**

The test is done to determine the variation in optimum moisture content and maximum dry density in natural soil and RHA mixed soil with 2%of lime. The result obtained is that the increment in rice husk ash leads to decreament in mdd value it reduces to 0.57 from 1.02 (g/cc) at addition of 10% of rice husk and increment in Optimum moisture content is found of almost 20 % at addition of 10 % of rice husk ash.

### **4. Unconfined compressive strength:**

This technique is likewise used to assess the quality of stabilized soils. This test is for the most part prescribed to discover the measure of balancing out material required in soil stabilization. Lime is included at a consistent rate of 2%. On response of lime with silica, it create cementitious material and ties together with the dirt. With the expansion of lime to Soil-RHA blend, UCS value gets expanded to 350 KN/m<sup>2</sup> at !0% content of rice husk ash.

### **5. Differential free swelling test :**

Differential swell index find out by comparision of swelling between two measuring cylinders of containing water & kerosin respectively. It is watched that by expansion of lime and rice husk ash , the differential free swelling index of soil decreases to 4.47% due to the decrease in plasticity of the soil.

#### IV. CONCLUSIONS

- It is evident that the addition of lime and rice husk ash increases the CBR value of the black cotton soil up to 24%.
- Liquid limit is reduced to 55% Plasticity index is reduces to 86% with increament in rice husk ash content to the soil by 10 %
- Differential free swell is also reduces with quantity increament of rice husk ash and lime it reduces to 75% for 20% RHA mix soil sample.
- Specific gravity content is also gets reduced with increament in rice husk ash.
- It is observed that the strength of the soil also gets increased upto 5 times by the additiuon of rice husk into it. It value reaches maximum at 15% of rice husk ash and lime.
- With increament in rice husk ash and lime stabilized black cotton soil the Maximum dry density of soil gets reduced and optimum moisture content gets increased. The mdd value gets down upto 0.57 getting almost decreament of 48% and optimum moisture content increased upto 20%.
- From the above result it can be concluded that rice husk ash might be used as a stabilizing agent.

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