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Effect of Marble Dust & Rice Husk Ash to Stabilize Expansive Soil

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Abstract - Soil Stabilization is the alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of a soil and/or control the shrink-swell properties of a soil, thus improving the load bearing capacity of a sub-grade to support pavements and foundations. The Engineering Properties of soil are depended on the many points like minerals, water table, soil water behaviour etc. which vary as per area to area. Due to which we can't get desire properties suitable to our needs of construction. To resolve this problem, we have technique called stabilization which means to stable or to modify or to improve the soil properties in positive manner. So, we can have a construction works which fulfil our needs and objective.
Keywords - environment friendly, marble dust, rice husk ash, expansive soil.

I. INTRODUCTION

Expansive soils can be a significant problem in engineering purposes and stabilization is necessary to relieve their damaging effects. Lime, cement and bitumen are commonly used additives. Recently, different stabilizer materials such as fly ash, rice husk ash, silica fume, ladle furnace slag and geo fibres are used to improve some geotechnical properties. Construction on expansive soil always creates a problem for civil engineers because of its peculiar cyclic swell shrink behaviour. This type of soil swells when it comes in contact with water and shrinks when the water evaporates out. Because of this movement lightly loaded structures such as foundations, pavements, canal beds and linings and residential buildings founded on them can be severely damaged.

The clay mineral montmorillonite is mostly responsible for this type of nature of the soil. There are different methods of altering the nature of this soil to make it fit for construction, stabilization using industrial wastes is one of them.

Rice husks are the shells produced during de-husking operation of paddy, which varies from 20% to 23% by weight of the paddy. The rice husk is considered as a waste material and is being generally disposed of by dumping or burning in the boiler for processing paddy. The burning of rice husk generates about 20% of its weight as ash. Silica is the main constituent of rice husk ash (RHA) and the quality (% of amorphous and unburnt carbon) depends upon the burning process. The RHA is defined as a pozzolanic material due to its high amorphous silica content.

II. LITERATURE REVIEW

"EXPANSIVE SOIL: CAUSES AND TREATMENTS"

The expansive soil problems lead to structural and geotechnical engineering challenges all over the world. Expansive soils are the type of soils which their volume changes considerably depend on their water content. It is worth mentioning that, the expansive soil problems can occur in both humid environments and arid/semi-arid soils. Buildings, roads, pipelines, and other structural members have always been subjected to damages resulted from expansive soils which this damage is even more than twice the damage resulted from floods, hurricanes, earthquakes, and tornadoes. Understanding the behaviour and characteristics of these types of soils can help scientists control the imposed damages to the structure. This paper is a comprehensive study on expansive soils, its nature, shrinkage-swell behaviour, as well as expansive soil causes and treatments.

"STABILISATION OF SOIL WITH MARBLE DUST AND RICE HUSK IN HIGHWAY SUBGRADE"

In today climatic changes, lack of stable ground for development of infrastructures is very common. In fact, of this, construction of buildings on unsuitable ground is unavoidable and making a suitable ground before constructions is real difficult issue for Geotechnical Engineers. To overcome the difficulties experienced with problematic soil in geotechnical applications on one side and safe disposal of solid wastes on the other side, an attempt is made in this investigation to explore the possibilities of utilizing wastes to improve the engineering behaviour of problematic soil. In this, in this present investigation the type of waste namely marble dust and rice husk for stabilization is selected to study the effects of same on the properties of problematic soil.

"IMPROVEMENT OF STRENGTH OF CLAYEY SOIL BY ADDING RICE HUSK ASH AND CEMENT"
Soil stabilization is a process by which natural weak soil is stabilized physically and chemically by adding stabilizers. Normally used primary stabilizers to improve soil properties are cement and lime. But due to increase in cost of stabilizers we cannot use this alone to cover large area. Thus we use industrial waste to reduce certain portion of primary stabilizers. Here rice husk ash, an agro industrial waste is used to improve soil property. This paper presents the experimental results obtained from Thonnakkal clay blended with various percentages (4% to 16%) of rice husk ash (RHA) and cement. Soil-RHA-cement mixtures were compacted using standard compactive efforts at optimum water content. Unconfined compressive strength were tested for 7 day 14 day and 28 day for soil stabilized with rice husk ash alone, and soil stabilized with RHA – 6% cement combination. Volumetric shrinkage strain was noted for soil stabilized with RHA and cement combinations.
"AN EXPERIMENTAL STUDY OF SOIL STABILIZATION USING MARBLE DUST"
The main objective of this study is to investigate the use of waste marble dust in stabilizing soil and to evaluate the effects of marble dust on CBR values of unsaturated soil by carrying out standard proctor tests and CBR tests on different soil samples. The results obtained are compared for the three different percentage of marble dust and inferences are drawn towards the bearing strength of soil with different combination of marble dust. In this study, waste limestone dust and waste dolomitic marble dust, by-products of marble industry, were used for stabilization of clayey soils. The marble dust addition ratios which have been studied were 10%, 15 % and 20% by weight. Marble dust had a noticeable role in the hydration process because of high calcium content. Obtained results showed that marble dust addition to the clay samples will reduce the cost of constructing structures on problematic soils, and finding new utilization areas for waste marble dust will decrease environmental pollution. Utilizing waste marble dust materials in problematic soils will have great contribution to the economy and conservation of resources.
"STABILIZATION OF EXPANSIVE SOIL WITH MARBLE DUST AND ALCCOFINE Sachin Dev, Er. Neeraj Sharma"
Expansive or reactive soil is a soil composed predominantly of clay. Clay undergoes significant volume change in response to changes in the soil moisture content. This volume change is realized by swelling upon wetting, and shrinkage upon drying. Being constructed on expansive soils, buildings are frequently prone to severe movement caused by non-uniform soil moisture changes with consequent cracking and damage related to the distortion. Rainfall and evaporation, garden watering, leaking water pipes, or tree root activity may trigger these moisture changes. In this Study, an attempt has been made to improve the bearing capacity of soil using admixtures/Alternate materials.

III. SCOPE & OBJECTIVE

A. Scope

1) Construction materials are more judged by their ecological characteristics because of the continual depletion of quarry aggregates.
2) In India, huge amount of marble waste is being generated because of lack of technology and also unscientific methods of quarrying marble.
3) Due to generation of marble waste there is a direct exposure of this material with the environment because of which serious environmental problems occur
4) Except few studies where RHA solely has been used to increase the workability or performance of soil.
5) In the present study, the attempt has been made to do the same.
6) Thus, soil stabilization with use of marble dust in presence of RHA would be quite beneficial.

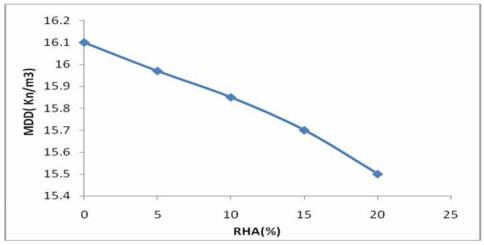
B. Objective

This main objective of this study will be to stabilize the expansive soil by adding marble dust at varying %ages and adding RHA as an additive to attain the following objectives:

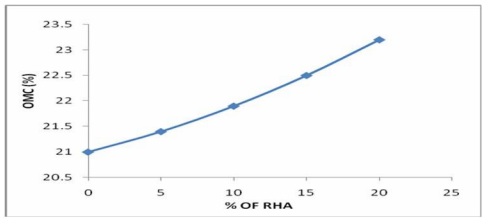
1) To study the effect of Marble dust on Compaction, UCS, Soaked CBR, swelling pressure and durability characteristics of an expansive soil stabilized with optimum percentage of Rice husk ash.
2) To utilize the waste material of marble dust in stabilizing the expansive soil, which otherwise will be very uncomical.
3) To optimize the properties of expansive soil using marble dust and RHA to get the maximum strength.
4) Due to the increasing cost of high quality materials needed for different geotechnical projects, engineers try to improve the physical properties of local soils through different methods and techniques.

IV. RESULTS

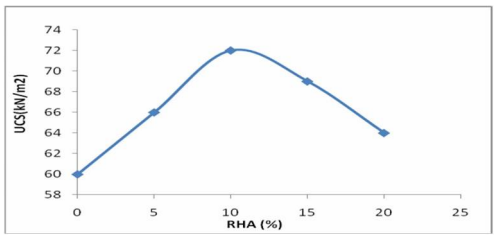
Figure 1 shows the variation of MDD of expansive soil with addition of different percentage of Rice husk ash



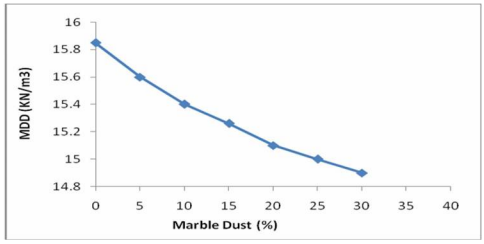
The OMC goes on increasing irrespective of percentage addition of RHA.



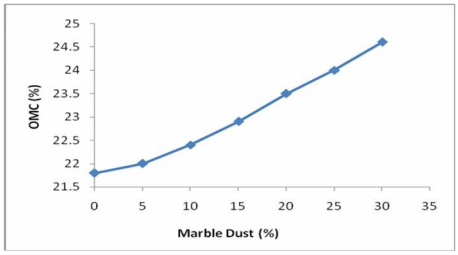
By increasing the percentage of addition of RHA the UCS of soil goes on increasing up to 10% addition of RHA, further addition of RHA, decreases the UCS of the expansive soil.



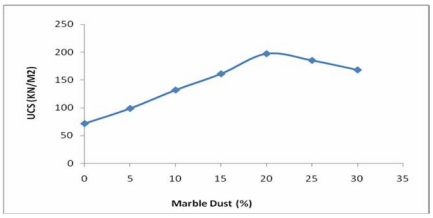
The variation of MDD of the RHA stabilized expansive soil treated with different percentage of Marble dust has been shown in Fig.4 .It is observed that by addition of 10% of RHA, the MDD of soil decreases to 15.85 kN/m ^{3} from 16.1 kN/m ^{3} .



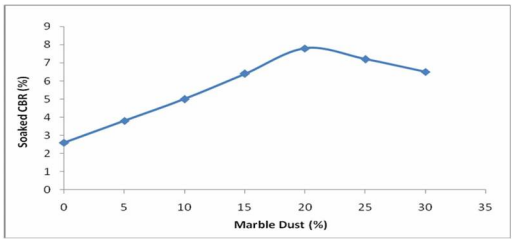
The variation of OMC of the RHA stabilized expansive soil treated with different percentage of Marble dust has been shown in Fig.



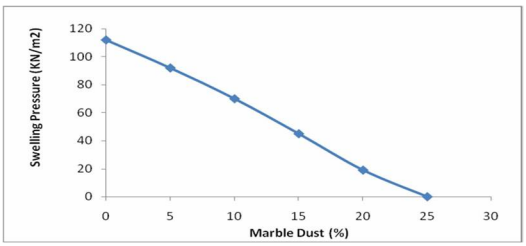
It is observed that by addition of 10% RHA the UCS of soil increases to 72 kN/m ^{2} . After 20% addition of Marble dust,the strength decreases because of the availability of extra Lime to react with the insufficient amorphous silica and Alumina present in soil and RHA , which results in carbonation reaction and strength decreases.



Variation of Soaked CBR of RHA stabilized soil with % of Marble Dust



Variation of Swelling pressure of RHA stabilized soil with % of Marble Dust



V. CONCLUSIONS

The optimum percentage of RHA in stabilization of expansive soil is found out be 10%. The MDD goes on decreasing and OMC goes on increasing irrespective of the percentage of addition of Marble dust to RHA stabilized expansive soil. For best stabilization effect, the optimum proportion of Soil: Rice husk ash: Marble dust was found to be 70: 10: 20. This method of soil stabilization is very effective and economical in the stabilization of expansive soil. It is seen from the test results that the addition of marble dust enhances the strength values of soil. The OMC of soil-marble dust mix increases with increasing the percentage of marble dust. The maximum dry density (MDD) is observed to decrease with increase in the percentage of marble dust. The dry density is decrease when the soil mixed with different percentage of marble dust.

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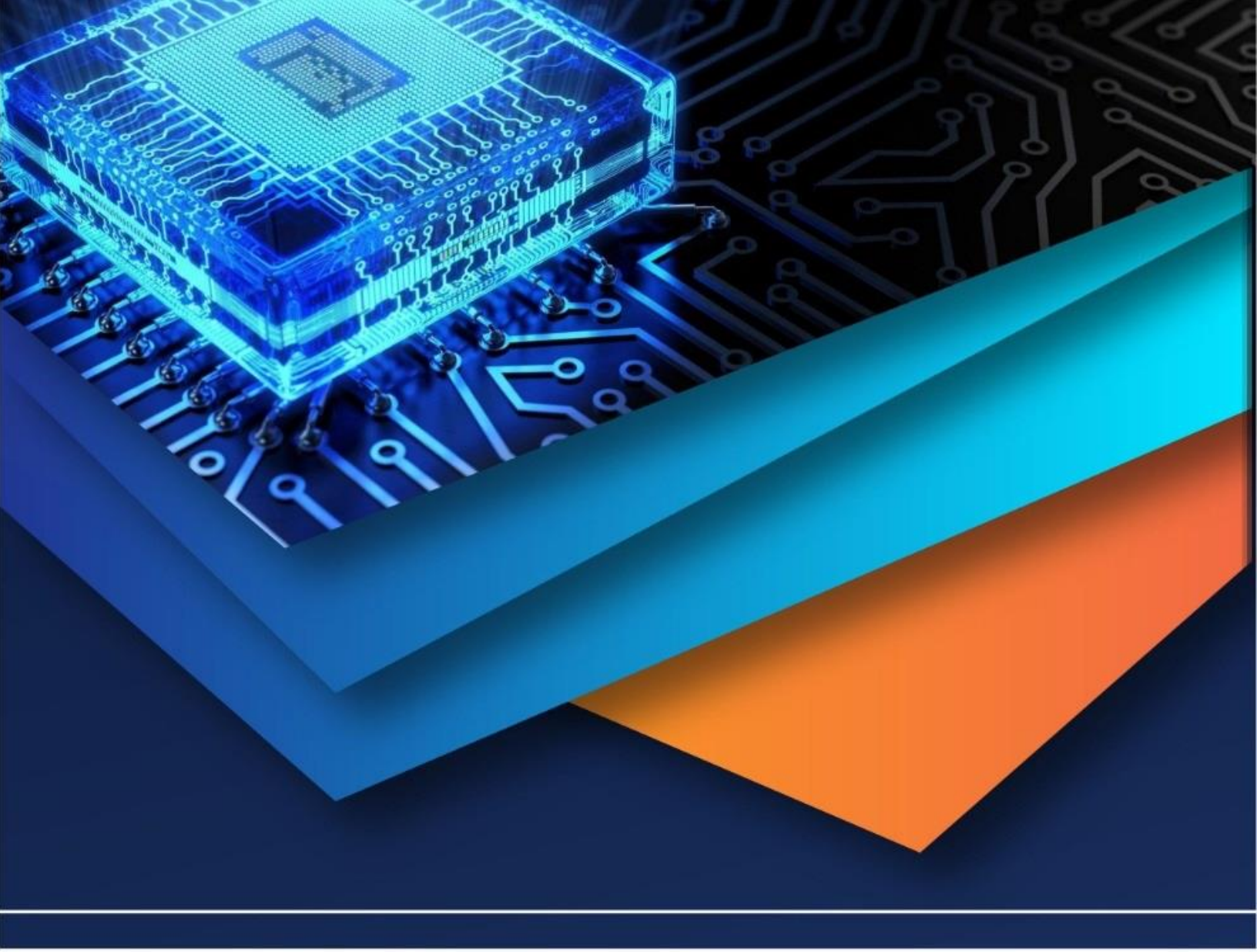

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