Investigation on Properties of Black Cotton Soil Using Rice Husk Ash Used For Subgrade Material in Pavement

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Abstract-The growing cost of traditional stabilizing agents and the need for the economical utilization of industrial and agricultural wastes for beneficial engineering purposes has prompted an investigation into the stabilizing potential of Rice Husk Ash in subgrde soil. These Large Quantities of Waste Materials Rice Husk Ash e.g. create negative impact on the environment causing air pollution, water pollution, affecting the local eco- system and hence safe disposal of this waste material is required. Utilizing these waste materials as alternative materials for the construction is no doubt a best solution.

The soil was stabilized with Rice Husk Ash (RHA) stepped concentration of 5%, 10%, 15%, 20%, 25% and 30% by dry weight of the soil individually. All stabilized soil samples were also cured for 96 hours for CBR test in fully saturated condition.

The test results indicate that the addition of RHA enhances the percentage of grain size distribution, but with addition of RHAtill10% the LL, PL,PI and swelling pressure decreases, while these parameters further increases in this limit beyond i.e. 10% to 30% of RHA, these parameters decreases, while enhancement is observed above 20% to 30%, Specific Gravity and Maximum Dry Density (MDD) decrease with addition of RHA, for all percentage values, whereas OMC increases in each material.

Keywords: Natural Soil, Rice Husk Ash, Swelling, OMC, MDD, CBR, Atterberg limits.

I. INTRODUCTION

Soil is basic and important element in Civil Engineering field. Stability of every structure depends on the type and characteristics of foundation which in turn depends on the type of soil. Many problems irrupt if expansive soil, Natural soil is to be used in foundation, because of its shrinkage and swelling properties. There are many methods to make natural soil stable for various constructions. Natural soil is comfortable for road work, compared to other types of soil.

II. LITERATURE REVIEW

Dr Sujatha Evangelin Ramani (2012) provide geogrid reinforcement to improve the strength of subgrade and reduce the thickness of the pavement .The author conducted CBR tests on soil with geogrid introduced at different depths within the sample, in single , double and triple layer and found that the best performance in the single layer occurs when geogrid is placed at 2/3 distance from the base. And found that the CBR value of 3 layer of geogrid is lesser than 2 layer but higher than single layer and hence concluded that geogrid increases the strength of subgrade soil in both soaked and unsoaked condition and proved that geogrid reinforcement provided in a single or multilayer to the subgrade increases the strength of the soil and thus reduces the thickness of the pavement.

Pradeep Singh and K.S. Gill (2012) Reinforced soils are often treated as composite materials in with reinforcement resisting tensile stress and interacting with soil through friction. Although there is lot of information and experience with geo-synthetic reinforcement of sub-grade soils, many pavement failures still occur. These failures may be due to lack of understanding of how these materials influence the engineering properties of sub-grade soils and what is the optimum position of reinforcement. Therefore a compressive laboratory program is required to study strength characteristics of both reinforced and un-reinforced sub-grade soils also to investigate their behaviors under cycle leading. The author in his work describes the beneficial effects of reinforcing the sub-grade layer with a single layer of geo-grid at different positions and thereby determination of optimum position of reinforcement layer. The optimum position was determined based on California Bearing Ratio (CBR value) and unconfined compression tests were conducted to decide the optimum position of geo-grid. Through his experimental work he found that by providing geogrid reinforcement at 0.2H from top give considerable improvement in CBR value and stress strain behavior of subgrade soil.

Mihai Iliescu and Ioan Ratiu (2013) for subsoil with insufficient bearing capacity, stabilization and improvement of subsoil characteristics are necessary. The bearing capacity can be increased by excavation and replacement of the soft material, chemical stabilization by using chalk or by using geosynthetics. Placed between the subgrade and base course, or within the base course, the geosynthetic improves the performance of unpaved roads carrying channelized traffic and unpaved areas subjected to random traffic. They in their paper devised a new design methodology for stabilizing a road subgrade using geogrid reinforcement. In their experiments, they found out that geogrids can improve the performance of the Subgrade soil. They carried out extensive static and dynamic plate bearing tests on different conditions based on the results of trial and the membrane theory of Giroud & Noiray, they developed design graphs for multifunctional geogrids in unpaved and temporary road.

Rakesh Kumar and P.K. Jain (2014), Different ground improvement techniques have been proposed in the literature to work with this soil and are found to be successful to some degree. The construction of granular piles has been proved successful in improving soft marine clays, which are very poor from strength and compressibility criteria. The technique of granular pile may be applied in expansive soil too. The granular piles derive their load carrying capacity from the confinement offered by the surrounding soil. In very soft soils this lateral confinement may not be adequate and the formation of the granular pile itself may be doubtful. Wrapping the granular pile with suitable geogrid is one of the techniques to improve the performance of granular piles. The encasement by geogrid makes the granular piles stiffer and stronger. The behavior and the mechanism of the granular pile and geogrid encased granular piles are not investigated for expansive soil. The author made an attempt to investigate the improvement of load carrying capacity of granular pile with and without geogrid encasement through laboratory model tests conducted on single granular pile installed in expansive clay bed prepared in controlled condition in small testing tanks. The load tests were performed on single granular pile. Tests were performed with different diameter of granular piles with and without geogrid encasement. The results from the load tests indicated a clear improvement in the load carrying capacity of clay, with granular pile and with encased granular pile. The increase in the load carrying capacity also increases as the diameter of the granular pile increases.Thus concluded in their study of ground improvement techniques that the construction of granular piles in expansive soil improves the load carrying capacity of the soil.

Prof Mayura Yeole and Dr. J.R. Patil (2015), carried out a laboratory CBR test on granular soil with or without geotextile which was placed in one or two layer in the mould. The single layer of geotextile was placed at the depth of (25, 50, 100 mm) from the top of the mould, the maximum CBR obtained was at 25mm and when the geotextile was placed in two layers at {(25 &75 mm),(50 &75 mm), (50 &100 mm)} CBR was increased and it was maximum at 25 & 75mm geotextile layer by 38.21% when compared with the CBR of no geotextile.

III. OBJECTIVE

To determine the Geotechnical properties of Natural Soil, RHA individually, for the construction of sub grade soil.

IV. METHEDOLOGY

There are various test performed in laboratory as per IS code standards like :

- Grain Size Distribution
- Liquid Limit
- Plastic Limit
- Plasticity Index
- Specific Gravity
- Optimum Moisture Content (OMC)
- Maximum Dry Density (MDD)
- California Bearing Ratio (CBR)

V. RESULT

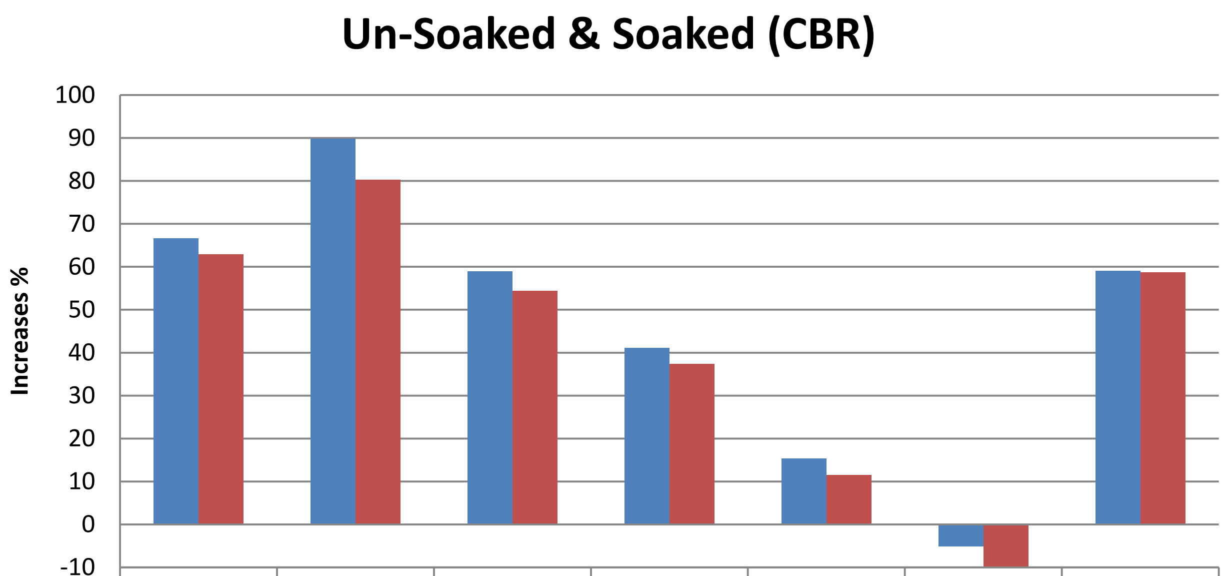
Comparative Effect in CBR value of NR Samples towards Natural Soil

The results of Unsoaked CBR tests on CL Soil treated with different percentage of RHA and from the results it can be seen that with increase in percentage of ash waste, the percentage increment in Unsoaked CBR of soil goes on increasing from 66.62 to 89.8% with respect to natural soil percentage CBR value i.e. 7.04 % when RHA is increased from 0 to 10% (i.e. up to NR-2) is effective beyond also there is a decrease in the percentage increment of CBR of soil from 89.8 to -5.12% when RHA waste is increased from 10% to 30% and further the value for 100% RHA is 58.68% as shown in the Table and figure.

The results of Soaked CBR tests on CL Soil treated with different percentage of RHA and from the results it can be seen that with increase in percentage of ash waste, the percentage increment in Soaked CBR of soil goes on increasing from 62.94 to 80.2% with respect to natural soil percentage CBR value i.e. 4.21 % when RHA is increased from 0 to 10% (i.e. up to NR-2) is effective beyond also there is a decrease in CBR of soil from 80.2 to -9.98% when RHA waste is increased from 10% to 30% and further the value for 100% RHA is 58.68% as shown in the Table .

Table Shows Percentage Increase in CBR of RHA Samples towards Natural Soil

	Un-Soaked (CBR)			Soaked (CBR)		
S.N.	Mix	Value	Percentage Increase	Mix	Value	Percentage Increase
1	N	7.04	--	N	4.21	--
2	NR-1	11.73	66.62	NR-1	6.86	62.94
3	NR-2	13.36	89.8	NR-2	7.58	80.2
4	NR-3	11.19	58.95	NR-3	6.5	54.4
5	NR-4	9.93	41.05	NR-4	5.78	37.3
6	NR-5	8.12	15.34	NR-5	4.69	11.5
7	NR-6	6.68	-5.12	NR-6	3.79	-9.98
8	R	11.19	58.96	R	6.68	58.68



	NR-1	NR-2	NR-3	NR-4	NR-5	NR-6	R
--	66.62	89.8	58.95	41.05	15.34	-5.12	58.96
--	62.94	80.2	54.4	37.3	11.5	-9.98	58.68

Figure shows: Variation of Percentage Increase in CBR with Natural Soil & RHA Combinations

VI. CONCLUSION

The results of percentage increment in Unsoaked CBR & Soaked CBR goes on increasing with respect to Natural Soil when RHA is increased from 0 to 10% and is decreases when RHA Sample is increased.

Future Scope of work

The results of the experimental work undertaken in this dissertation are encouraging and found to have improved the weak soil parameters. However, to validate the result, extensive experimentation is needed which is beyond the scope of this work.

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