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Experimental Study on Properties of Black Cotton Soil Mixed Stone Dust & Sisal Fiber

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ABSTRACT

- Experimental Studies were conducted to see the effects on strength behavior of Black cotton soil using stone dust & Sisal fiber.
- In this study, the stabilizing effect of sisal Fiber (Natural Fiber) on soil properties. Keeping this in view an experimental study is conducted on locally available i.e. expensive soil mixed with varying percentage of Stone dust and Sisal fiber.
- Soil samples for California bearing ratio (CBR) tests are prepared at its maximum dry density (MDD) corresponding to its optimum moisture content (OMC) in the CBR mould without and with sisal fiber. Tests result indicates that both unsoaked and soaked CBR value of soil increases with the increase.
- Soaked CBR value increases from 3.97 % to 9.75 % and un-soaked CBR value increases from 8.1 % to 40.7 % of soil mixed with stone dust and sisal fiber.
- Due to sisal fiber reinforcement CBR is increased resulting lesser thickness of pavements are used in construction works. Soil becomes ductile in nature.
- This is because of composite effect of sisal fibre (Natural Fibre) changes the brittle behavior of the soil to ductile behavior.

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.

LITERATURE REVIEW

- **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.

Objective

- To study the effect of varying percentage of Stone Dust with sisal fiber on properties of Soil.
- To study the combined effect of varying percentage of optimum quantity of Stone dust and optimum quantity of Sisal Fiber on properties of Soil.
- To study the variation of Liquid Limit, Plastic Limit, Plasticity Index, Dry density, OMC, CBR (Soaked & Un-soaked) of soil.

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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)

Table1. Tests conducted for Prepared Samples

Material	Tests conducted
Raw soil	Grain size Analysis- (mechanical Method), Specific Gravity Consistency Indices (L.L. , P.L. , P.I.) Compaction Test (Light Compaction) CBR Test (Soaked & Un-soaked)
Raw Soil +5 % Stone dust + 0.25% sisal fiber	
Raw Soil + 10 % Stone dust + 0.25%sisal fiber	
Raw Soil + 15 % Stone dust + 0.25%sisal fiber	
Raw Soil + 20 % Stone dust + 0.25%sisal fiber	
Raw Soil + 25 % Stone dust + 0.25%sisal fiber	

RESULT

TABLE2. Compaction Test Results for Expansive Soil treated with varying % of STONE Dust and 0.25% SISAL FIBER

S. No.	Material	MDD (g/cc)	OMC (%)
1	Natural Soil	1.85	13.65
2	Natural soil + 5 % Stone Dust + 0.25% Sisal fiber	1.86	13.40
3	Natural soil +10 % Stone Dust + 0.25% Sisal fiber	1.88	13.00
4	Natural soil +15 % Stone Dust + 0.25% Sisal fiber	1.89	12.90
5	Natural soil +20 % Stone Dust + 0.25% Sisal fiber	1.91	12.80
6	Natural soil + 25 % Stone Dust + 0.25% Sisal fiber	1.95	12.55
7	Natural soil + 30 % Stone Dust + 0.25% Sisal fiber	1.93	12.75

TABLE3. CBR Test Results for Expansive Soil with varying percentages of STONE Dust AND SISAL FIBER

S. No.	Material	CBR (UN-Soaked)	CBR (Soaked)
1	Natural Soil	8.12	3.97
2	Natural soil + 5 % Stone Dust + 0.25% Sisal fiber	10.72	5.18
3	Natural soil +10 % Stone Dust + 0.25% Sisal fiber	12.64	5.88
4	Natural soil +15 % Stone Dust + 0.25% Sisal fiber	17.34	6.67
5	Natural soil +20 % Stone Dust + 0.25% Sisal fiber	30.69	7.21
6	Natural soil + 25 % Stone Dust + 0.25% Sisal fiber	40.20	9.39
7	Natural soil + 30 % Stone Dust + 0.25% Sisal fiber	40.27	9.75

CONCLUSION

- The soaked CBR value of the raw soil is 3.97 % and after mixing of Stone Dust & Sisal Fiber in the soil, there is remarkable change in CBR value. The addition of 30 % Stone Dust & 0.25% Sisal Fiber increased the CBR value from 3.972 % to 9.748 %.

Future Scope of work

Further study can be taken on other soils like silt, loamy & others by using different fibers as reinforcing & treating with other chemicals like lime bitumen & other mixtures & also studying the changed Physico-mechanical & chemical properties of Vertisols

REFERENCES

[1] AmbarishGhosh (2010) "Compaction characteristics and bearing ratio of pond ash stabilized with lime and phosphogypsum." Journal of Materials in Civil Engineering, ASCE, 343-351.

[2] Al-Rawas, A.A., Taha, R., Nelson, J.D., Al-Shab, T.B., and Al-siyabi, H., (2002), "A Comparative Evaluation of Various Additives Used in Stabilization of Expansive Soils", Geotechnical Testing Journal, Vol. 25, No. 2, pp. 199-209

[3] Bell, F.G. 1996. Lime Stabilization of Clay Minerals and Soils, Engineering Geology; 42: 223-237.

[4] Boominathan A, Ratna R.J. (1996) "Lime treated fly ash as embankment material." Proceeding of Indian Geotechnical Conference, Madras, India, 523-526.oceeding of Indian Geotechnical Conference (IGC 96), Madras, 411-414

[5] Consoli, N.C., Prietto, P.D.M. and Ulbrich, L.A (1998) Influence of fiber and cement addition on the behavior of sandy soil. Journal of Geotechnical and Geoenvironmental Engg., ASCE 124(12), 1211-1214.

[6] Fatani, M.N., Bauer, G.E. and Al-Joulani, N., 1991, "Reinforcing Soil With Aligned and Randomly Oriented Metallic Fibers", Geotechnical Testing Journal, Vol. 14, No. 1, pp. 78-87.

[7] Forsyth, R. A. (1978), "Alternative Earth Reinforcements," Proc. ASCE Symposium on Earth Reinforcement, Pittsburgh, 358-370.

[8] Gosavi,M., Patil, K.A., Mittal, S and Saran, S.,(2004), Improvement of properties of black cotton soil subgrade throughsynthet ic reinforcement , Institution of Engineers(I) J, 84, 257- 262.

[9] Gray, D. H. and Brenner, R. P. (1970): The hydrology and stability of cutover slopes, Proc. Interdis- ciplinary Aspects of Watershed Management , ASCE, New York, 295–326.

[10] I.S.2720 (Part iv)-1975, determination of grain size analysis.

[11] I.S. 2720 (Part v)-1970, determination of liquid limit & plastic limit.

[12] I.S. 2720 (Part viii)-1965, determination of maximum dry density and optimum water content

[13] Ingles, O.G., and Metcalf, J.B. (1972), Soil stabilization principles and practice, Butterworth, Sydney, Australia.

[14] J.N. Jha et al (2006) "Effect of Rice Husk Ash on Lime Stabilization." Journal of Institute of Engineers (India), Volume 87, 33-3

[15] Kehew, E.A., (1995), Geology for Engineers and Environmental Scientists, 2nd Ed. Prentice Hall Englewood Cliffs, New Jersey, pp. 295-302