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A Laboratory Performance on the Affect of Saw Dust on the Properties of Marine Clay

M.Narendra [1], Dr. B.Satyanarayana [2], Nela Harika Lakshmi [3], Kakarla Manga Devi [4], Ragireddy Mohan Veera Lakshman [5], Kalla Kailash [6]

[1]Assistant Professor Department of civil engineering, Pragati engineering college, Surampalem, Andhra Pradesh, India, 533437

[2] Associate Professor Department of civil engineering, Pragati engineering college, Surampalem, Andhra Pradesh, India, 533437

[3,4,5,6] UG Students, Department of Civil Engineering, Pragati Engineering college ,Surampalem ,Andhra Pradesh, India, 533437

Abstract: ***When it comes to the growth of the Indian economy, the highways of India are the arteries that provide the gasoline. India is a stunning country that has a coastline that stretches for a total of 7516.6 kilometers. The significant bulk of this coastal region is comprised of clay deposits that may be found in the water. When it comes to the construction of roads, it will be more cost-effective to make use of materials and soils that are easily available in the surrounding region. The use of marine clay, which is easily accessible in the region, as a subgrade in coastal locations would not provide the required results due to the poor engineering properties of marine clay. On the other hand, marine clay is readily available in the region. Because doing so would lead to an increase in the total cost of the project, it is not feasible from a financial standpoint to replace the soil during the project. In situations such as these, one of the possible options that may be considered is to stabilize the soil that is currently there. A chemical that is quite easy to get is lime, and sawdust is a waste product that is generated by the wood and timber industry. Lime is a chemical that is widely available. Here is a presentation that presents the findings of an inquiry into the use of the components indicated above for the aim of stabilizing marine clay.***

Keywords: Marine clay, Sawdust, Subgrade in Coastal locations, Timber industry.

I. INTRODUCTIONS

There are many deposits of fine clays on coastal corridor and those soils are suffering from high saturation, low density, low shear strength, sensitivity, and deformation problems and are normally consolidated. Such soils are generally termed as marine clays. In any developing country infrastructure, transportation, and communication facilities play a major role for the development. The properties of marine soil depend significantly on its initial conditions. The properties of saturated marine soil differ significantly from moist soil and dry soil. Marine clay is microcrystalline in nature and clay minerals like chlorite, kaolinite and illite and non clay minerals like quartz and feldspar are present in the soil. In general, the natural water content of the marine clay is always greater than its liquid limit. The marine clays are not suitable as pavement sub grade & foundation soil beds and pose problems due to their inability of strength criteria. More and more construction projects are encountering soft clays and hence there is a need to better quantifying the properties of marine clays. These soils are widely occupied in coastal corridor and not easy to avoid marine clay regions for the construction of pavements and foundations due to the population density. India being peninsular country have a large area coming under coastal region and also it has been the habitat for considerable percentage of

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population. The marine clays are found in the states of west Bengal, Orissa, Andhra Pradesh, Tamilnadu, Kerala, Karnataka, Maharashtra and some parts of Gujarat in India. Hence, for having smooth transportation it needs to improve properties of marine clays. Marine clays are highly compressible in these regions.The development of any country depends on the transportation facilities and the construction projects. For the projects to be successful, the soil used for the foundation beds must be strong which requires in improving the properties of soil.A substantial literature has concluded the severity and extent of damage inflicted by soil deposits of selling nature, to various structures, throughout the world (Ganapathy, 1977; Jones and Jones, 1995; Abduljauwad, 1995; Osama and Ahmed, 2002; Zhan, 2007). The loss caused due to damaged structures proved the need for more reliable investigation, of such soils and necessary methods to eliminate or reduce the effect of soil volume change.Many innovative foundation techniques have been devised as a solution to the problem of expansive soils. The selection of any one of the techniques is to be done after detailed comparison of all techniques for the well suited technique for the particular system. The various additives used for stabilizing expansive soils are lime, calcium chloride, rice husk ash, fly ash, gypsum and others.

- To determine the properties of the marine clay and Saw dust.
- To evaluate the performance of marine clay when stabilized with Saw dust as an admixture and its suitability for the pavement sub grade.
- To evaluate the performance of stabilized marine clay with an optimum of Saw dust on the addition of lime as an additive and it suitability for the pavement sub grade.

II. MATERIALS AND METHODS

The study is carried out on BC soil +Saw Dust and BC soil were varied in the following percentages. Saw Dust in percentages of 10%, 20%, 30% and 40% by Weight of BC soil.

A. Materials

Marine clay: The soil used in this study is BC soil, obtained from NIT Campus, Collected at a depth of 1.5m from ground level. The Index & Engineering properties of BC soil are determined as per IS code of practice and determined.

Saw dust: Locally available Saw Dust was used in the present work. The physical properties are determined.

B. Laboratory studies

Liquid limit test was conducted on BC soil, BCsoil+20% Saw Dust using Casagrande's liquid limit apparatus as per the procedures laid down in IS: 2720 part 4 (1970).

Plastic limit test was conducted on BC soil, BCsoil+20% Saw Dust as per the specifications laid down in IS: 2720 part 4 (1970).

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Shrinkage limit This test is also conducted on to BC soil, BCsoil+20% Saw Dust as per IS: 2720 part 4 (1972).

California bearing ratio Test The California bearing ratio tests are conducted on BC soil, BC soil+ Saw Dust, BC soil+ Saw Dust mixtures as per IS 2720 part 16 (1979). The test was conducted under a constant strain rate of 1.25mm/min. The proving ring reading is noted for 50 divisions, and loading was continued until 3 (or) more readings are decreasing (or) constant. The test was conducted at Optimum moisture content. The samples were tested in soaked condition. The tests were conducted at time interval of curing for 4 days, 7days and 14 days.

The laboratory studies were carried out on the samples of BC soil, BC soil+ Saw Dust.

Table 1 : Physical properties of marine clay

SL.No	Property		Symbol	Value
1	Gravel			0 %
2	Sand			14%
3	Fines	Silt		30%
		Clay		56%
4	Liquid Limit		WL	74.5 %
5	Plastic Limit		WP	26.9 %
6	Plastic Index		Ip	47.6 %
7	Shrinkage limit		ws	10.678 %
8	Soil Classification			CH
9	Specific Gravity		G	2.35
10	Differential Free Swell			80%
11	Optimum Moisture Content		O.M.C.	35%
12	Maximum Dry Density		M.D.D.	1.27 gm / cc
13	Cohesion		C	12 .20 t /m^2
14	Angle of Internal Friction		□	2^0
15	CBR Value (soaked)			0.754 %
16	NMC			86.15%

Table 2: Physical Properties of Saw dust

Sl.no	Properties	Saw dust
1	**Grain size distribution**	
	Gravel(%)	…
	Sand(%) Silt	…
	size(%) Clay	**25**
	size(%)	**70**
		05
2	**Atterberg limits** Liquid	
	limit(%) Plastic limit(%)	**74.5**
	Plasticity index	**26.9**
	Shrinkage limit(%)	**47.6**
		10.678

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3	**Compaction properties** Optimum moisture content(%) Maximum dry density(g/cc)	**20.7** **1.35**
4	**Un-soaked CBR(%)** **Soaked CBR(%)**	**5.5** **3.15**
5	**Specific gravity**	**2.10**
6	**Free swell index**	**80**
7	**Cohesion C (KN/m^2)** **Angle of internal friction**	**8** **31**
8	**Soil classification**	**ML**

III. RESULTS AND DISCUSSIONS

A. *Proctor compaction test results*

Many tests were conducted to get the OMC and MDD of the mix of different proportions of soil and Saw Dust using standard proctor compaction machine.

Table 3: Optimum moisture content and maximum dry density values of marin clays and saw dust

Mix proportion	Water Content (%)	Dry Density (g/cc)
75%soil+25%SD	39.49	1.038
80%soil+20%SD	35.43	1.08
85%soil+15%SD	29.63	1.263
90%soil+10%SD	38.33	1.192
95%soil+5%SD	44.48	1.272

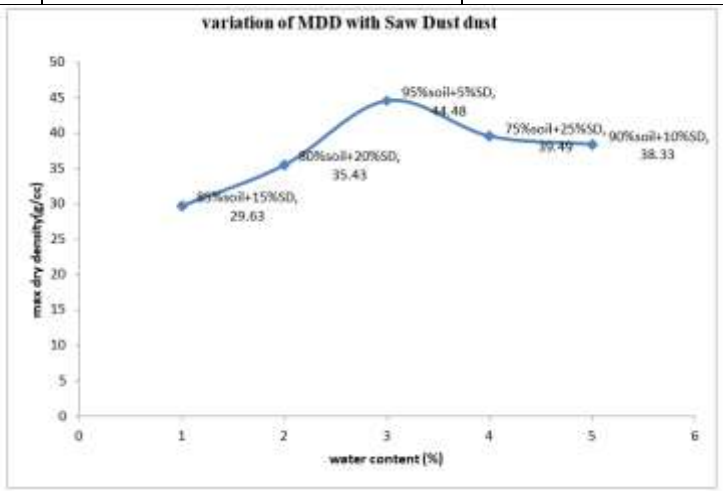

Fig 1: Optimum moisture content and maximum dry density values of marin clays and saw dust

B. *CBR Test results*

The soaked CBR values of various mixes of marine clay and Saw dust using OMC obtained from compaction are determined. The soaked CBR after immersing in water for four days , that is when full saturation is likely to occur, is also determined. Variation of CBR with % variation in Saw Dust is presented.

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Table 4: CBR

Mix proportion	Water Content (%)	Soaked CBR
85%soil+15%SD	29.63	4.03
80%soil+20%SD	35.43	0.672
95%soil+5%SD	44.48	0.896
75%soil+25%SD	39.49	0.896
90%soil+10%SD	38.33	2.24

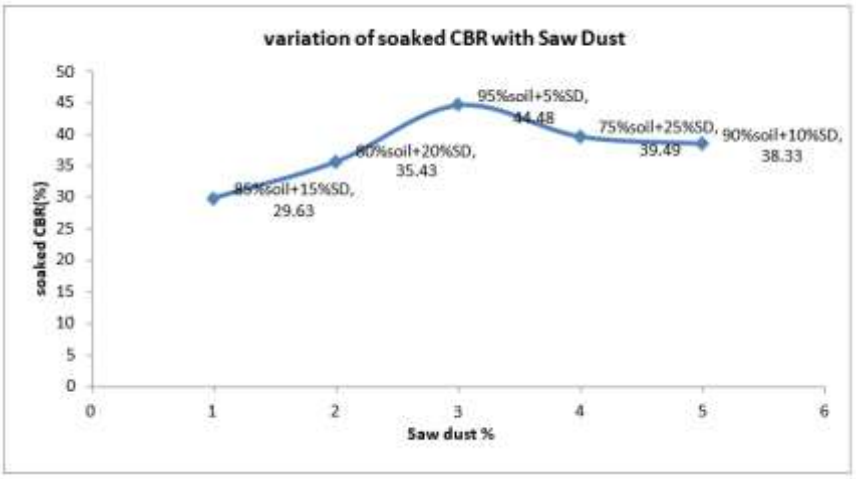

Fig 2: CBR

IV. CONCLUSIONS

- It is noticed that the liquid limit of the marine clay has been decreased by about 11.00% with the addition of 20% saw dust as an optimum. Further it is observed that the liquid limit of marine clay has been decreased by 9% on addition of saw dust.
- It is observed from the results that the Plasticity index of the marine clay has been decreased by about 24.00% on addition of saw dust.
- It is found from the results that the M.D.D of the marine clay has been increased by about by 12.36% on addition of saw dust
- It is observed from the results that the C.B.R. value of the marine clay has been increased by 16.28% on addition of saw dust
- It is observed from the results that the DFS value of the marine clay has been decreased by 58% on addition of saw dust
- The soaked CBR of the soil on stabilizing is found to be 6.48% and is satisfying standard specifications. So finally it is concluded from the above results that the stabilized marine clay is suitable to use as sub grade material for the pavement construction

REFERENCES

1. Ganapathy, 1977; Jones and Jones, 1995; Abduljauwad, 1995; Osama and Ahmed, 2002; Zhan, 2007)
2. Agarwala, V.S and Khanna, J.S (1969), Construction techniques for foundations of buildings on black cotton soils, proceedings of the symposium on characteristics and

construction techniques in black cotton soil, the college of military Engg., Poona, India.
3. Al Quadi, I.L (1994), Laboratory Evaluation of Geosynthetics Reinforced Pavement Sections, TRR-1739, TRB, 1994, pp. 25-31.
4. Al-Omari, R.R and Oraibi, W.K (2000), Cyclic behavior of reinforced expansive clay, Jr. of the Japanese Geotechnical Society of Soils and Foundations, Vol. 40, No. 2; 2000, pp.1-8.
5. Al-Rawas, N.M (2000), Effect of curing and temperature on lime stabilization, Proc. Of Second Australian Conf. on Engineering Materials, Sydney, 1981, pp.611-662.
6. Ambily, A.P and Gandhi, S.R (2004), Experimental and Theoretical Evaluation of Stone Column in Soft Clay, ICGGE, pp 201-206.
7. Anand J.Puppala, Ekarin Wattanasanticharoen and Laureano R.Hoyos (2003), Ranking of Four Chemical and Mechanical Stabilization Methods to Treat Low-Volume Road Subgrades in Texas, Jr.-Transportation Research Record, Vol. 1819B, 2003, pp. 63-71.
8. Anandarajah. A and Chu. J (1997), Laboratory Determination of shear strength parameters for marine clay, Journal of the Institution of Engineers, Singapore, Vol.14, No.3, pp 39-46.
9. Arvind Kumar, Baljit Singh Walia and Asheet Bajaj (2007), Influence of Flyash, Lime and Polyester Fibers on Compaction and Strength Properties of Expansive Soil, J.Mat in Civil Engineering, ASCE, Vol. 19, Issue. 3, 2007, pp. 242-248.
10. Balasubramaniam, A.S., Bergado, D.T., Buensuceso, B.R. and Yang, W.C (1989), Strength and deformation characteristics of lime treated soft clays, Geotechnical Engineering (AIT), 20, 1989, pp. 49-65.
11. Bansal, R.K., Pandey, P.K. and Singh, S.K (1996), Improvement of a Typical Clay for Road Subgrades with Hydrated Lime, Proc. Of National Conf. on Problematic Subsoil Conditions, Terzaghi-96, Kakinada, India, 1996, pp. 193-197.
12. Chandrashekar, B.P., Prasada Raju, G.V.R (1999), Relative Performance of Lime and Calcium Chloride on Properties of Expansive Soil For Pavement Subgrades, Proc. Of IGC-99, Calcutta, 1999, pp 279-282.
13. Heaton, B.S (2001), presented the utilization of waste products from Steel plants in the pavements. Australia Civil Engineering Transaction, IE Aust., Vol. CE35, No.1.
14. I.S: 2720, Part VII, (1980), Determination of Water Content Dry Density Relation Using Light Compaction.
15. I.S: 2720-Part III, Section I, 1980, Determination Specific Gravity.
16. I.S: 2720-Part IV, 1975, Determination of Grain Size Distribution.
17. I.S:2720, Part VI, 1972, Determination of Shrinkage Factors.
18. I.S;2720-Part V, 1970, Determination of Liquid Limit and Plastic Limit.
19. CIRIA Publication (2002); BS EN 15237 (2007); TRL Projects Reports PPR

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