International Journal of Research
Available at https://edupediapublications.org/journals

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

Stabilization Of Soft Soils Using Industrial Wastes

HARIHARAA.K.P.S.A
PG Student, Department of Civil Engineering, PRIST University,
Thanjavur, Tamil Nadu, India.

ABSTRACT

Soil is a peculiar material. Some materials like fly ash, rice husk ash, pond ash, cement, lime, etc. can be used to stabilize the soil. Soil stabilization is the alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of the soil and control the shrink-swell properties of a soil, thus improving the load bearing capacity of a sub-grade to support pavements and foundations. An investigation concerning stabilization of available fine sand has been performed to improve their strengths with the addition of variable amounts (5%, 10%, 15%, 20%) of cement and lime. Various tests like standard proctor compaction test, direct shear test and California Bearing Ratio (CBR) test were performed on the fine sand. Addition of lime and cement resulted in appreciable increase in the CBR value, Maximum Dry Density (MDD) and Optimum Moisture Content (OMC), whereas in case of fly ash and rice husk ash, the optimum moisture content was increased and the maximum dry density is decreased as their density was less than the density of the soil and.

Keywords: Fine sand, CBR, MDD, OMC, Stabilization.

INTRODUCTION

Transport in the Republic of India is an important part of the nation's economy. Roads are the vital lifelines of the economy making possible trade and commerce. They are the most preferred modes of transportation and considered as one of the most cost effective modes. An efficient and well-established network of roads is considered for promoting trade and commerce in any country and fulfils the needs of a sound transportation system for sustained economic development. To provide mobility and accessibility, all weather roads should connect every nook and corner of the country. To sustain both static and dynamic load, the pavement should be designed and constructed with utmost care. The performance of the pavement depends on the quality of materials used in road construction. Sub-grade is the in-situ material upon which the pavement structure is placed. Although there is a tendency to look at pavement performance in terms of pavement structures and mix design alone, the sub-grade soils can often be the overriding factor in pavement performance. The construction cost of the pavements will be considerably decreased if locally available low cost materials are used for construction of lower layer of pavements such as sub-grade, sub-base, etc. If the stability of local soil is not adequate for supporting the loads, suitable methods to enhance the properties of soil need to be adopted. Soil stabilization is one such method. Stabilizing the sub-grade with an appropriate chemical stabilizer (such as quick lime, Portland cement, fly ash, rice husk ash or composites) increases sub-grade stiffness and reduces expansion tendencies, it performs as a foundation (able to support and distribute loads under saturated conditions).

COMPONENTS OF STABILIZATION

Soil stabilization involves the use of stabilizing agents in weak soils to improve its geotechnical properties such as compressibility, strength, permeability and durability. The components of stabilization technology include soil and stabilizing agents or binders. Image of the soil used for analysis is shown in fig. 1

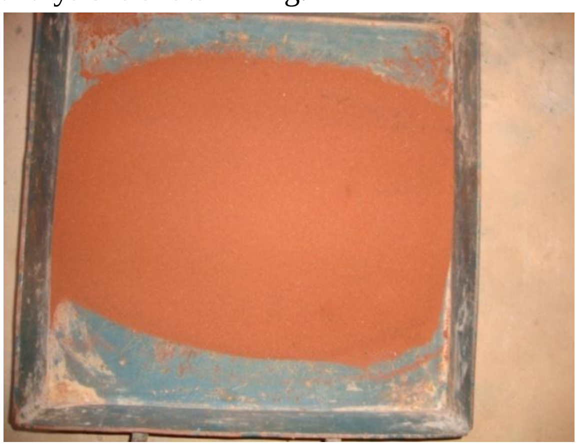

Fig. 1 Photograph of Soil

STABILIZING AGENTS

These are hydraulic or non-hydraulic materials that when in contact with water or in presence of pozzolanic minerals reacts with water to form cementitious composite materials. The commonly used binders are:

- Cement
- Lime
- Fly ash
- Rice husk ash

MATERIALS AND METHODOLOGY

Soil stabilization is the alteration of soils to enhance their physical properties. Stabilization can increase the shear strength of the soil and/or control the shrink-swell properties of the soil, thus improving the load bearing capacity of the sub grade to support pavements and foundations. Stabilization is being used forvariety of engineering works, where the main objective is to increase the strength or stability of soil and to reduce the construction cost by making best use of locally available materials. Soil stabilization is achieved by addition of proper percentages of cement, lime, bitumen, fly ash, rice husk ash or the combination of these materials to the soil. Hence in the present study, a small amount of cement, lime, fly ash, rice husk ash mixed with soil and the effect of soil stabilization on soil properties like optimum moisture content, maximum dry density, California bearing ratio values are observed.

SOIL CLASSIFICATION

The soil was collected from Tisaiyanvilai, Tirunelveli, Tamilnadu, India. Before any construction work the characteristics of soil need to be known and further the weak soil needs to be stabilized. Here disturbed soil sample is collected from the ground surface and tested in laboratory. The image of soil is shown in fig.2.

Fig. 2 Photograph of Soil Sample

Wet sieve analysis of the soil was performed in accordance with IS 2720(part 4) -1985 and were classified in accordance with IS 1498-1970. The particle size distribution curve is shown in fig. 3. By referring IS 1498(1970) table 1(clause 3.2.2), the soil type is identified as "Fine sand"

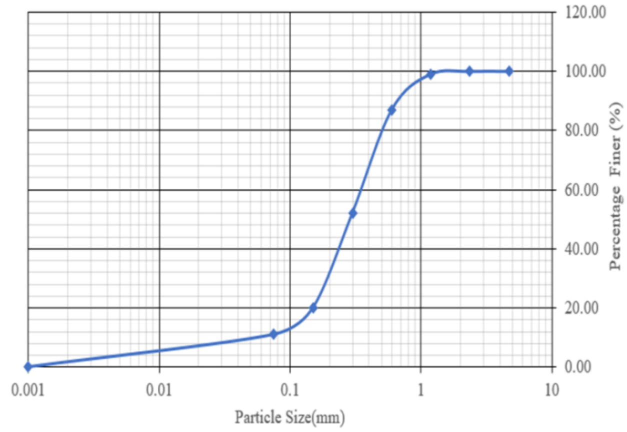

Fig.3 Wet sieve analysis of soil

Density of various materials that are used for investigation from experimental studies is presented in table 1.

Table 1 Density of materials

S.NO	Materials	Density(g/cc)
1	Soil	2.03
2	Cement	3.15
3	Lime	2.4

RESULTS AND DISCUSSION

Maximum dry density, optimum moisture content and CBR value of soil with mineral admixtures are shown in fig. 4 to 13.

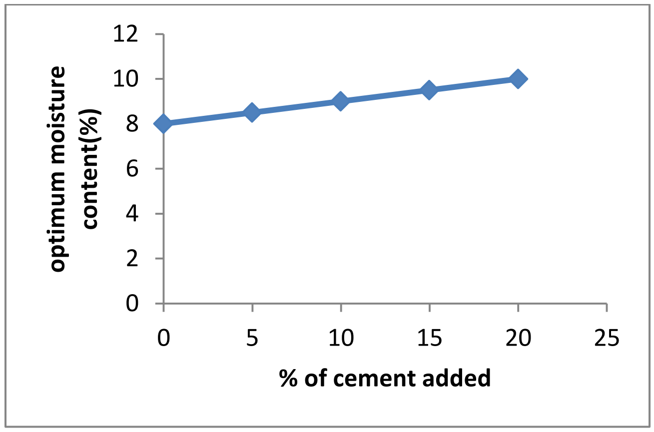

Fig. 4 Variation of OMC with % of cement added

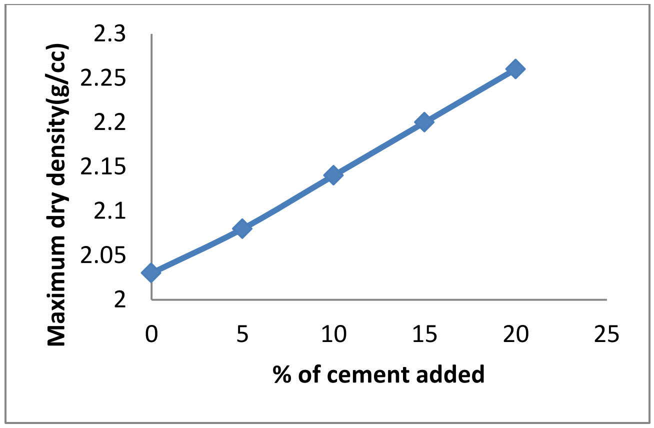

Fig.5 Variation of MDD with % of cement added

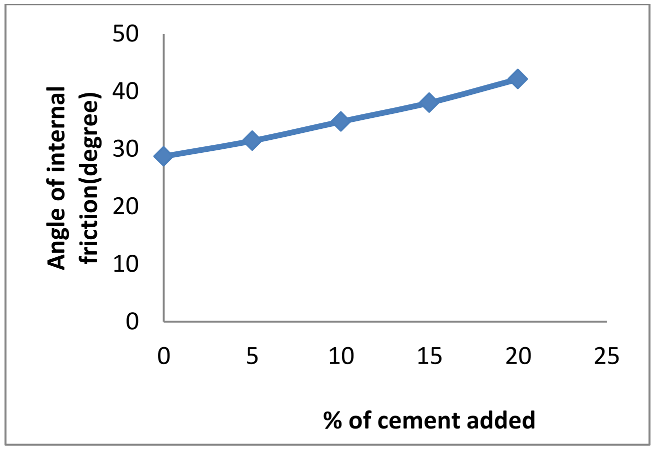

Fig.6 Variation of angle of internal friction with cement content

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 12
April 2018

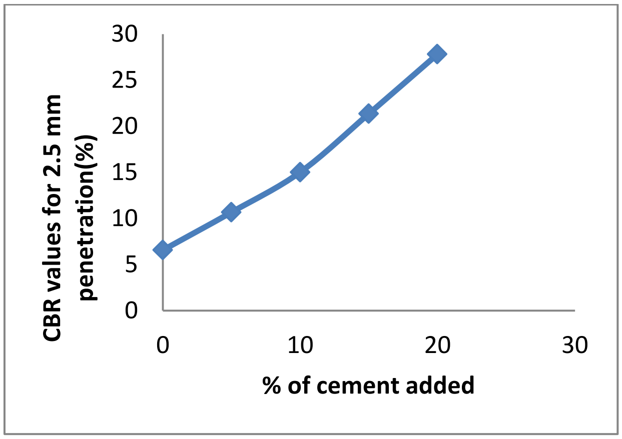

Fig.7 Variation of CBR Values for 2.5mm penetration with % of cement content

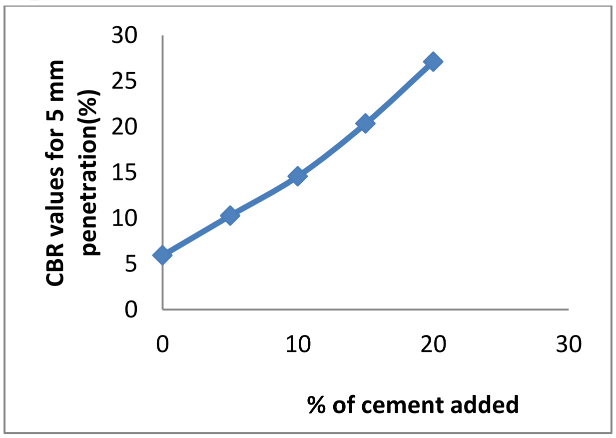

Fig.8 Variation of CBR values for 5mm penetration with % of cement content

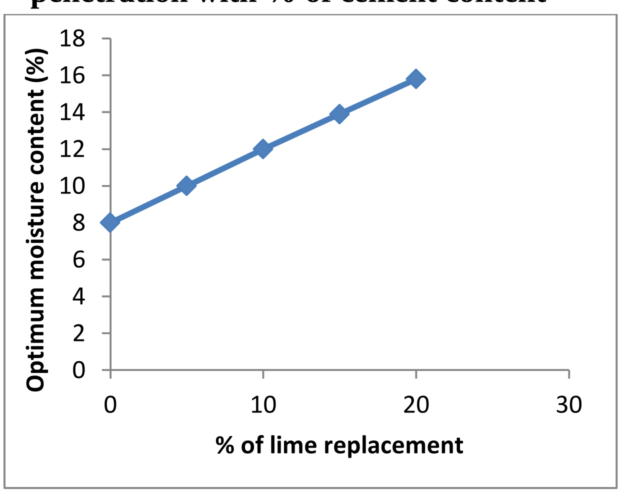

Fig.9 Variation of optimum moisture content with % of lime replacement

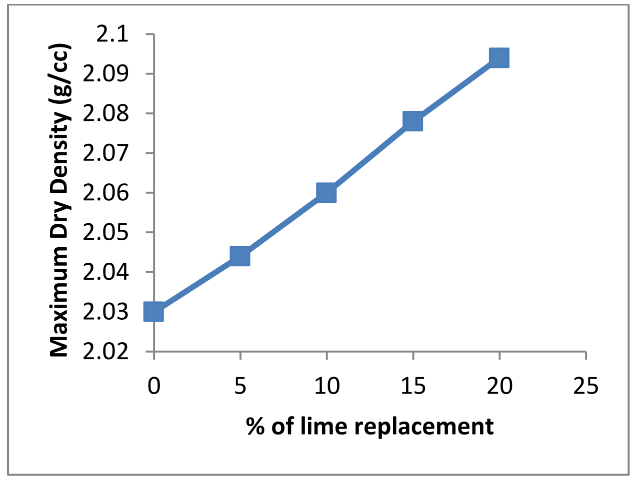

Fig.10 Variation of maximum dry density with % of lime replacement

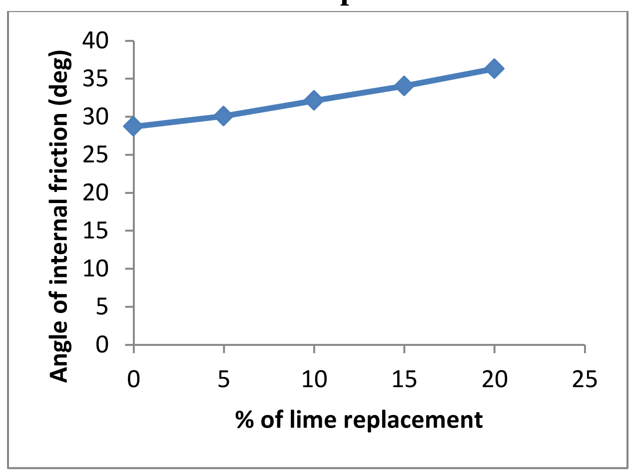

Fig.11 Variation in angle of internal friction with lime content

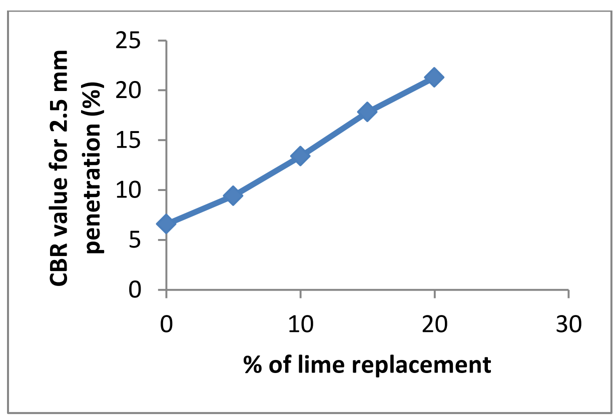

Fig.12 Variation of CBR Values for 2.5mm penetration with % of lime content

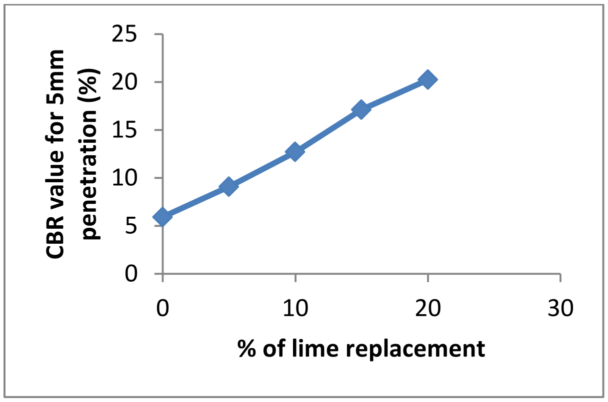

Fig.13 Variation of CBR Values for 5mm penetration with % of lime content

CONCLUSION

The following conclusions are drawn on the basis of test results obtained from experimental results.

- From the particle size distribution curve, the soil is classified as fine soil and can also be called as cohesion less soil.
- From the proctor compaction test, the optimum moisture content for the soil sample is determined as 8% and the density of soil is 2.02g/cc.
- The angle of internal friction between soil particles is found to be 28.7°.
- The density of cement is found to be greater than the other minerals with value of 3.15g/cc.
- Cement shows the higher internal friction values with sand comparing to other minerals used. The angle of internal friction increases from 31.4% to 42.13% for the mineral proportion of 5% to 20%.
- Cement shows the higher CBR values with soil comparing to other minerals used. The CBR value increases from 10.27% to 27.11% for the mineral proportion of 5% to 20%.

REFERENCES

1. **Edil T.B., Acosta H.A. and Benson C.H.** (2006) "Stabilizing Soft Fine-Grained Soils with Fly Ash" Journals of civil engineering ,Vol. 18 , No.2, pp. 283-294.
2. **Emmanuel S.G. and Bind Y. K.** (2014) "Stabilization of Soil by Different Proportions of Fly Ash as Partial Replacement" Journal of Academia and Industrial Research Vol. 2 , No. 9 , pp. 530-533.
3. **Gay G. and Schad H.** (2000) "Influence of cement and lime additives on the compaction properties and shear parameters of fine grained soils" Otto Graf Journal Vol. 11, pp. 19-32.
4. **Gomez J.N. and Anderson D.M.** (2012) "Soil Cement Stabilization - Mix Design, Control and Results during Construction" International Symposium on Ground Improvement.
5. **Jain B.V.K., Akhila B., Mohan K.K. and Karthika K.** (2016) "Laboratory study on soil stabilization by coated lime" International Research Journal of Engineering and Technology, Vol. 03, No. 04, pp. 2452-2454.