An Experimental Study on CBR Value of Soil Used for Laying Pavements

[1]Mr. Ch. Naga Bharath, [2]K. Gopichand, [3]K. Naresh, [4]K. Mahipal, [5]N. Naga Siva, [6]K.Bharadwaj
[1]Assistant professor, [2,3,4,5,6]UG Student Gudlavalleru Engineering College, Gudlavalleru, India,
[1]chnagabharath@yahoo.com, [2]gopichandkosuri739@gmail.com, [3]bobbynaresh76@gmail.com,
[4]123kmahi@gmail.com, [5]sivanaraharisetty123@gmail.com, [6]bharadwajkurapati@gmail.com

Abstract **Pavements are like roadways or a drive ways which are covered with concrete or asphalt. Generally, there are 5 types of pavement layers such as surface coarse (25-50mm), Binder coarse (50-100mm), Base coarse (100-300mm), Sub-base (100-380mm), Compacted sub-grade (50-300). We generally use sub-grade as a pavement layer. To find out the strength of the sub-grade layer we conduct California Bearing Ratio Test (CBR Test).**

Keywords —Pavements, concrete, asphalt, surface course, binder course, base course, sub-base course, compacted sub-grade course, CBR Test

I. INTRODUCTION

The very first procedure to be followed before constructing any road over a particular area is to perform soil test so that the engineer can make sure weather the soil is suitable for the construction or not the most commonly used test for finding soil strength is CBR when CBR is performed the strength of soil is known and the necessary improvements are made the improvements can be made by several types of soil stabilization methods few of them are mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization here we used lime stabilization to improve soil strength as lime is available at cheaper cost when compared to other stabilization materials .stabilization using lime is done by using lime as an admixture to soil to improve its strength lime can be used for stabilizing clayey soil as red soil is clayey soil it can be used as stabilizer [1]. there is exchange of cations in the absorbed water layer and a decrease plasticity of the soil occurs. The resulting material is more friable than the original clay and is therefore more suitable as sub grade. Lime is produced by burning of lime stone in kilns. The quality of lime obtained depends upon the parent material and the production process.

Lime stabilization is not effective for sandy soils. However, this soil can be stabilized in combination with clay, fly ash or other pozzolanic materials which serve as hydraulically reactive ingredients. The ratio of fly ash to lime generally varies between 3 to 5. The fly ash used is about 10 to 20% of the soil weight [2].

II. AIM OF THE PROJECT

The Main aim of the project is to observe the change in strength of red soil when it is mixed with an admixture lime with 2% intervals from 0% to 8%. the strength is tested by taking CBR test as standard test for strength measurement.

III. MATERIALS USED

1. RED SOIL:

Red soils are formed due to weathering of igneous rocks. Red soils have Red soils form the second largest soil group in good water holding capacity than black cotton soil. Red colour is mainly due to presence of iron oxides [3].

Properties	Red Soil
Specific gravity	2.69
Characteristics in coarse sand (4.75 – 2mm)	22%
Medium sand (2 – 0.425mm)	34%
Fine sand (0.425 – 0.075mm)	28%
Silt size (0.075 – 0.002mm)	10%
Clay size (<0.002mm)	6%
Liquid limit	38%
Plastic limit	26%
Plasticity index	12%

Table 1 Properties of red soil

2. LIME:

The stabilization using lime is to enhance the the stabilization of soil using lime is to enhance the engineering properties of soil such as shear strength, shrink – swell properties and bearing capacity of soil. The mechanism of using lime as stabilization material involves cation exchange which leads to flocculation and agglomeration of soil particles. The stabilization process can result in higher resistance values, reduction in plasticity, lower

 DOI : 10.35291/2454-9150.2020.0589

permeability, reduction of pavement thickness etc.,

Lime is a calcium-containing inorganic mineral composed primarily of oxides, and hydroxide, usually calcium oxide and/ or calcium hydroxide.

IV. TESTS CONDUCTED

List of the Tests conducted for the study are as follows:

- Liquid Limit
- Plastic Limit
- Free Swell Index
- Sieve Analysis
- Compaction
- California Bearing Ratio Test

V. DISCUSSION ON TEST RESULTS

1. LIQUID LIMIT

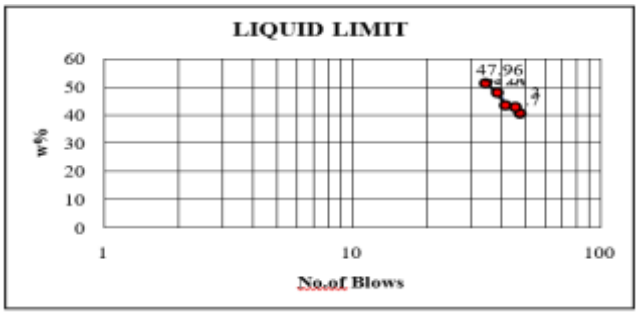

Figure 1 Liquid Limit of soil

2. FREE SWELL INDEX

Free swell index	Degree of expressiveness	Liquid limit	Plastic limit
<20	Low	0-50%	0-35%
20-30	Moderate	40-60%	25-50%
35-30	High	50-75%	35-65%
>50	Very high	>60%	>45%

Table 2 Free Swell Index

3. GRAIN SIEVE ANALYSIS

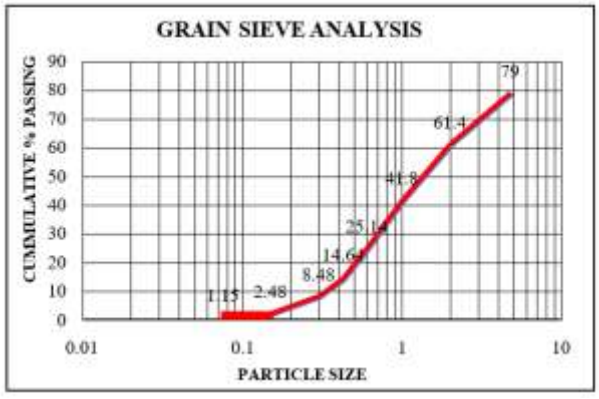

Figure 2 Grain Sieve Analysis

4. COMPACTION TEST

Percentage of Lime (%)	OMC (%)	MDD g/cc
0	10.0	2.15
2	8.22	2.13
4	8.06	2.18
6	6.79	2.19
8	7.16	2.07

Table 3 Compaction Test

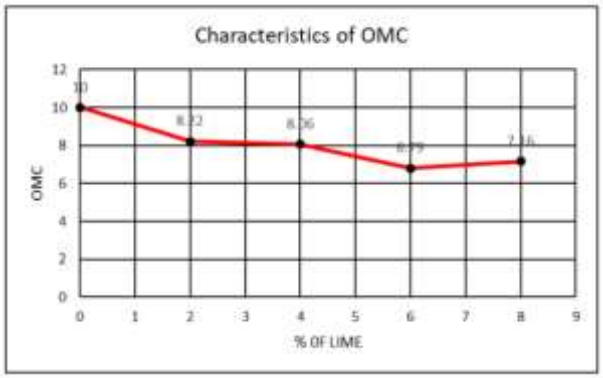

Figure 4 Characteristics of OMC

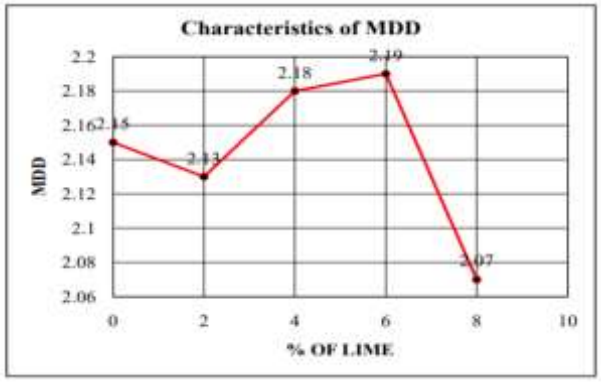

Figure 5 Characteristics of MMD

5. CBR TEST

Percentage of Lime (%)	CBR Value (%)
0	2.12
2	6.70
4	8.11
6	9.17
8	9.87

Table 4 CBR Test

 DOI : 10.35291/2454-9150.2020.0589

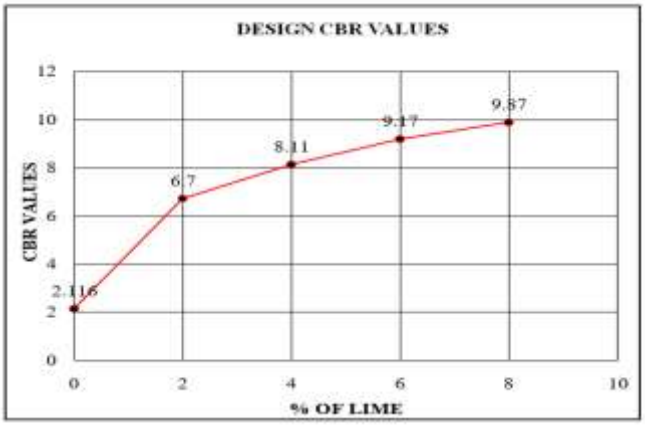

Figure 6 Design values of CBR Test

VI. CONCLUSIONS

1. The OMC values observed for only red soil are 10% and as 2.15gm/cc. The OMC of 2, 4, 6 and 8% of lime added soil when compared to only red soil are decreased by 1.78%, 1.94% ,3.21% and 2.84% respectively.
2. The MDD of 2, 4, 6 and 8% of lime added soil when compared to only red soil are decreased by 2%, increased by 3%,4% and finally decreased by 8% respectively.
3. The CBR values of 2, 4, 6 and 8% of lime added soil when compared to only red soil are increased by 4.58%, 5.99%, 7.58%, 7.75% respectively.
4. On addition of 8% of lime the CBR value is increased by 5 times when compared to the CBR value of only soil.

REFERENCES

[1] Amin Esmaeil Ramaji. "A Review on the Soil Stabilization Using Low-Cost Methods", Journal of Applied Sciences Research 8(4):2193-2196 · April 2012

[2] Ankit Singh Negi, Mohammed Faizaan, Devashish Pandey Siddharth, Rehanjot Singh. "Soil Stabilization Using Lime", International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 2, February 2013

[3] Tarh Reema and Ajanta Kalita. "Strength Characteristics of Red Soils Blended with Fly Ash and Lime". International Journal of Innovative Research in Science, Engineering and Technology an ISO 3297: 2007 Certified Organization Volume 3, Special Issue 4, March 2014

[4] Gayesh Panchal, Avinesh Kumar. "Properties of Sub Grade Soil of Pavement Construction". International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 9, September 2015.

[5] James Alexander.S, Antony Godwin, Alexander. "Study on The Behaviour of Red Soil Cement Concrete". International Journal of Advances in Mechanical and Civil Engineering, ISSN: 2394-2827 Volume-3, Issue-3, Jun.-2016

[6] Pragyan Mishra & P Suresh Chandra Babu. "Improvement of Geotechnical Properties of Red Soil using Waste Plastic". International Journal of Engineering Trends and Technology (IJETT) – Volume 48 Number 7 June 2017.

[7] Prof. P.V.V. Satyanarayana, Sumanjali Parimi, Swathi Priya, Jahara. "A Study on Suitability of Crusher Dust Stabilized Red Earth and Gravel as Subgrade and Sub Base Material". SSRG International Journal of Civil Engineering (SSRG-IJCE) – volume 5 Issue 4 – April 2018.

[8] P.V.V.Satyanarayana,Gopalakrishnan Vaidyanathan, P.S. Naidu. "Engineering Properties of Red Gravel Soils in North Coastal Districts of Andhra Pradesh". IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p- ISSN: 2320-334X, Volume 15, Issue 4 Ver. I (Jul. - Aug. 2018), PP 01-05.

[9] Biao Zeng, Lin-feng Wang, Yun Tian, Tao-rue Zeng and Bing Li."Study on Compaction Characteristics and Construction Contro lof Mixtures of Red Clay and Gravel".Advances in Civil Engineering Volume 2018.

[10] Experimental Investigation on California Bearing Ratio (CBR) For Stabilizing Silty Sand with Fly Ash and Waste Polypropylene -International Journal of Engineering and Innovative Technology (IJEIT) Volume 4, Issue 7, January 2015 by Phani Kumar. V, Ch. Naga Bharath, D. Ganga, P. Swathi Priyadarsini

[11] Experimental investigation on california bearing ratio for mechanically stabilized expansive soil using waste rubber tyre chips - International Journal of Civil Engineering And Technology (IJCIET) - Phani Kumar Vaddi, D. Ganga, P. Swathi Priyadarsini, Ch. Naga Bharath

 DOI : 10.35291/2454-9150.2020.0589