JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Compaction and Strength Characteristics of Alkazyme Stabilized Lithomargic Soil

[1]Subhadra G D, [1]Anitha J, [1]Pradeepa S, [1]Tamil Selvi N, [1]Ramya N
[1]Assistant Professor, Department of Civil Engineering, Sir MVIT.

Astract – Today engineers are responsible for specifying or selecting the correct technique, quantity of material required and stabilizing method. Throughout the world the soil vary from place to place and the engineering properties of soil are also equally variable. The success of soil stabilization is determined by soil testing. The soil stabilization method should be verified in laboratory before it is used for construction and preferably before ordering or specifying the materials. Various techniques are used to stabilize the soil. Stabilization of soil with Bio enzymes and waste materials is a newly method to improve the geotechnical properties of the soil. In this present study, the effectiveness of Bio enzymes and waste materials like in stabilizing the soil of South Canara districts are investigated through laboratory experiments. The Lithomargic soil (Shedi soil) is procured from the field is used for the investigation. Bio enzyme (Alkazyme) are used as a soil stabilizer. The pavements of Udupi and Dakshina Kannada districts are found to be damaged due to improper drainage system and heavy rainfall added problems and another major failure of sub base due to improper material usage. The soils available in this region are Lateritic soil and Lithomargic soil. The plasticity index ofthe soil is found to be more due to high presence of silt and clay content in this type of soil.

In this study, the Lithomargic soil sample are collected to investigate the geo technical properties and treated with variable dosage of Bio enzyme. The strength parameters of the stabilized soil have been evaluated for a curing period of 0, 7, 14, 21 and 28 days. The tests were carried out to determine optimum moisture content and maximum dry density, unconfined compressive strength and California bearing ratio.

Index Terms – Lithomargic Soil, Soil Stabilization, Geo technical properties, Bio enzyme.

I. INTRODUCTION

Engineers often faces problems with constructing facilities on or with soils, which do not have adequate potency to sustain the obligatory loads upon them either during construction or during the service time of structure. In India, many areas consist of earth with more silt contents with low down strength and minimum bearing capacity. These negative characteristics performance of soil are generally endorsed to the nature, quantity of fines in the material. Therefore, for better performance of structures which are built on such soils, the characteristics performance need to be improved. This forced the engineers to progress the engineering performances of deprived quality soils. The method of choice, depends mainly on soil type to be enhanced, its characteristics, type and degree of enhancement required in a particular purpose. Recently, Bio enzyme and the has been found as a new substance for soil stabilization. Bio enzyme is a chemical, liquid concentrated and organic material which are used to improve the stability of soil sub grade for pavement construction. For sufficient progress of soil characteristics and pavement operation system stabilization of soil is an efficient method. The main aim of soil stabilization practices to enhance strength and stiffness of soil, workability and constructability of soil and to decrease the Plasticity index. To improve the soil characteristics effectively rather by removing and replacing the material, stabilization methods and other stabilizing agents are considered. Considering the financial considerations and determining factor agents of stabilization are selected.

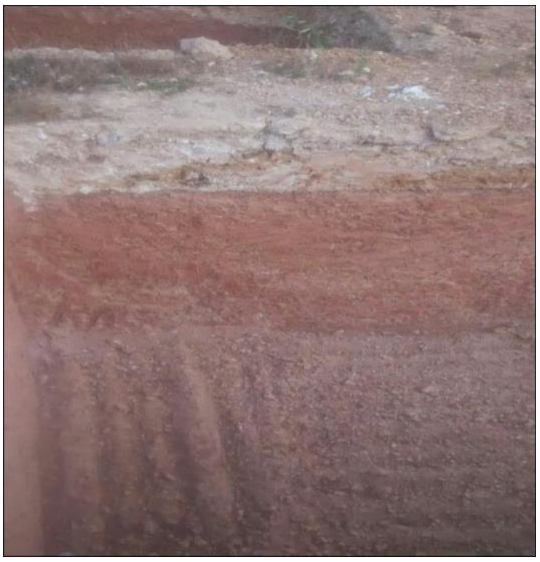

Fig. 1 Lithomargic soil sample

II. RESEARCH OBJECTIVES

The main object of this experimental process is to study the rheological and mechanical behavior of self – compacting concrete using manufactured-sand.

1. To assess the engineering characteristic of the Alkazymestabilized soils.
2. To study and determine the optimum Bio-enzyme content.

III. METHODOLOGY OF THE STUDY

A. Testing Programme for basic Characteristics

Tests are conducted to evaluate the Engineering parameters and geotechnical properties with virgin soil and stabilized soil. The details are tabulated in the Table 1 and Table 2.

Table 1. Testing Programme

Soil	Material Type	Mix Proportions	Curing Period (days)	Test Conducted
Lithomargic Soil	Alkazyme	D1, D2 and D3	0, 7, 14, 21 and 28 days	• Compaction characteristics • Unconfined Compression Strength

Table 2. Testing Programme

SECTION I – IDENTITY	
Identity (As it appears on Label)	Alkazyme
SECTION II – HAZARDOUS INGREDIENT IDENTITY INFORMATION	
Hazardous Components (Chemical Identity, Common)	None
SECTION III- PHYSICAL/CHEMICAL CHARACTERISTICS	
Boiling Point	212^0 F
Specific Gravity	1.05
Melting Point	Liquid
Evaporation Rate	Same as Water
Solubility in Water	Complete
Appearance/Odor	Brown Liquid, Non-Obnoxious

SECTION IV- EXPLOSION AND FIRE HAZARDOUS DATA	
Special Fire Fighting Procedure	None
Unusual Fire/Explosion Hazards	None
SECTION V- REACTIVITY DATA	
Unstable or Stable	Stable
Conditions to Avoid	Temperature above 450 C (1300 F); pH below 3.5, above 9.5
Incompatibility	Caustics Strong Bases
Hazardous Polytenization	Will NOT occur
SECTION VI- HEALTH HAZARD	
Route(s) of Entry	Inhalation: None Skin: None Ingestion: None
Health Hazards (acute or chronic)	None
Carcinogenicity	NTP: NA IAEC: Monographs: NA OSHA Regulated: No
Signs and Symptoms of Exposure	None
SECTION VII – SAFETY MEASURES FOR SAFE HANDLING AND USE	
Steps to be adopted if material is free or Spilled	Wash down with water
Waste Disposal Method	Flush into any sewage system
Procedures To Be Followed in Handling and Storing	Store at temperatures below 45^0 C (130^0 F)
Other Precautions	None
SECTION VIII – CONTROL MEASURE	
Respiratory Protection	Not required
Working/Hygienic Practice	Normal good practices

Table 3. Geotechnical characteristics of Shedi soil

Gain size distribution (%) (IS-2720-PART-4-1985)	
Gravel size fraction	37.85
Sand size fraction	59.7
Silt and clay	2.45
Specific gravity (IS-2720-PART-3-1980)	2.4
Consistency limits (%)	
Liquid limit (IS-2720-PART-5-1985)	55
Plastic limit (IS-2720-PART-5-1985)	20
Plasticity index	35
Compaction test (Std Proctor Test)(IS-2720-PART-7-1980)	
OMC (%)	20.5
MDD kN/m3	1.66
Shear test (UCS test) kN/m^2 (IS-2720-PART-10-1991)	116.28
CBR test (%) (IS-2720-PART-16-1985) 1) Un soaked 2) Soaked	 3.53 2.89

IV. RESULTS AND DISCUSSIONS

A. Compaction Test:

The Light compaction test was conducted to conclude the Optimum moisture content and the maximum dry density and test procedure is according to (IS :2720 (PART-7)- 1980), "Determination of moisture content –Dry density

relationship using Light compaction". Standard Proctor Test equipment consists of ten cm diameter and twelve cm height mould and rammer of weight 2.6 kg. Soil is filled in 3 layers and each layer has given 25 blows from the rammer and height of free drop of rammer is 31 cm. Graph is plotted from the obtained values of the moisture content and the dry density. From crest of the graph the respective maximum dry density and optimum moisture content is determined. The test results are showed in below Table 4 and 5

Table 4. Light compaction test results for various dosages of Alkazyme

Dosage of Alkazyme	Lithomargic soil	
	MDD(g/cc)	OMC(%)
D0	1.60	20%
D1	1.49	14%
D2	2.08	16%
D3	2.03	12%

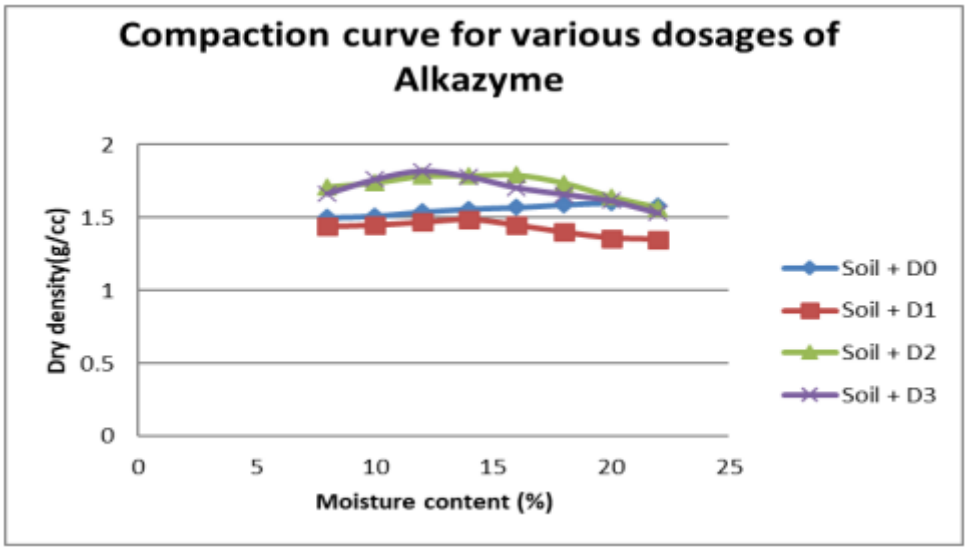

Fig. 2 Compaction curve for various dosage of Alkazyme

B. Unconfined compression strength test results for soil with various dosage of Bio enzyme

Table 5. Unconfined Compression Strength results for various dosages of Alkazyme

Curing period(days)	D1 (MDD=1.49g/cc) (OMC=14%)	D2 (MDD=2.08g/cc) (OMC=16%)	D3 (MDD=2.03g/cc) (OMC=12%)
0	372.65 kN/m^2	364.90 kN/m^2	304.64 kN/m^2
7	265.76 kN/m^2	242.90 kN/m^2	372.64 kN/m^2
14	460.029 kN/m^2	583.45 kN/m^2	277.72 kN/m^2
21	520.24 kN/m^2	802.96 kN/m^2	262.52 kN/m^2
28	352.54 kN/m^2	666.852 kN/m^2	295.18 kN/m^2

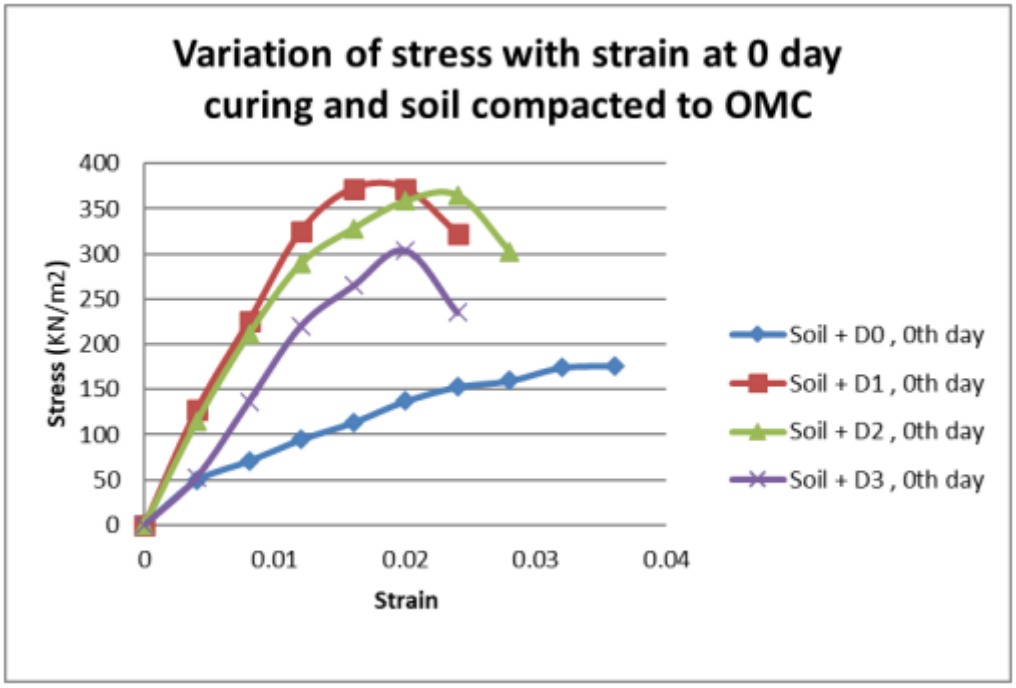

Fig 3. Variation of stress with strain at 0 day curing and soil compacted to OMC

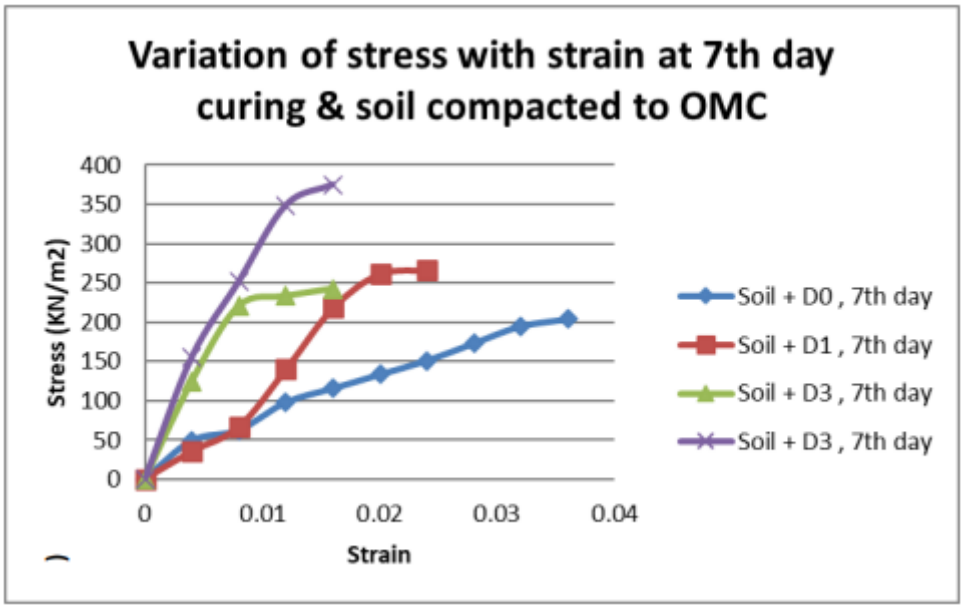

Fig 4. Variation of stress with strain at 7 day curing and soil compacted to OMC

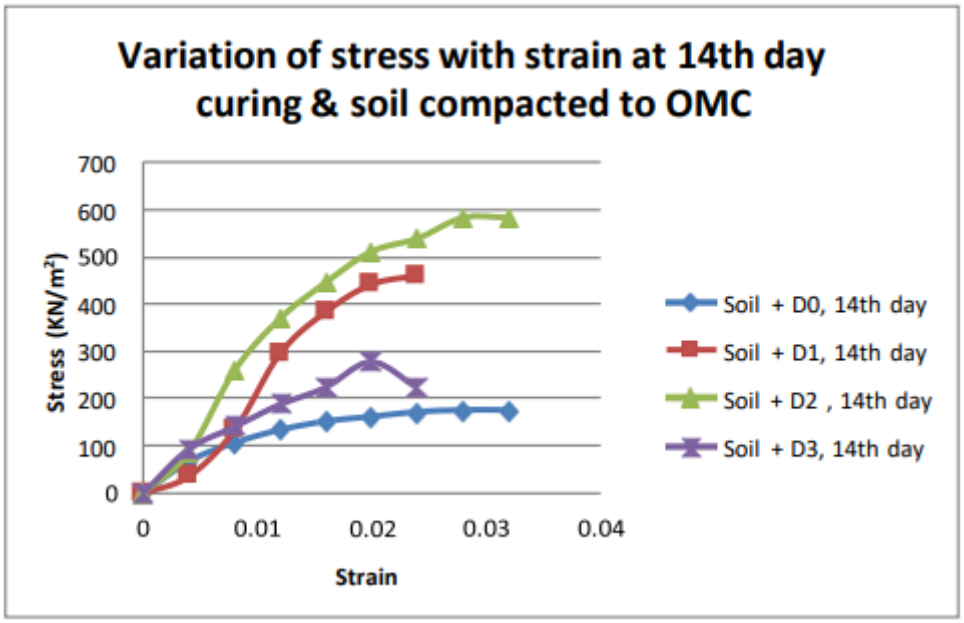

Fig 5. Variation of stress with strain at 14 day curing and soil compacted to OMC

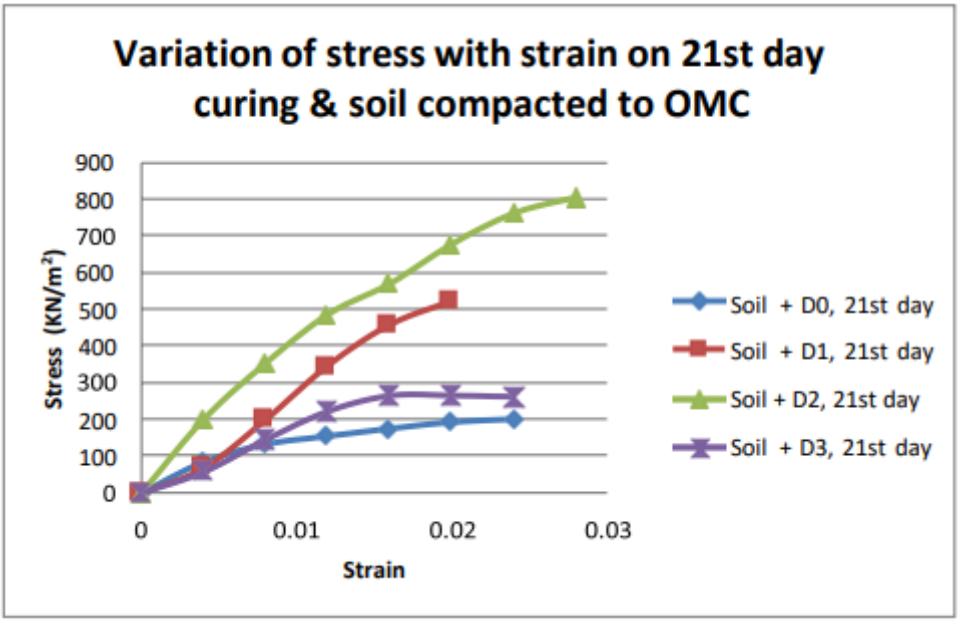

Fig 6. Variation of stress with strain at 21 day curing and soil compacted to OMC

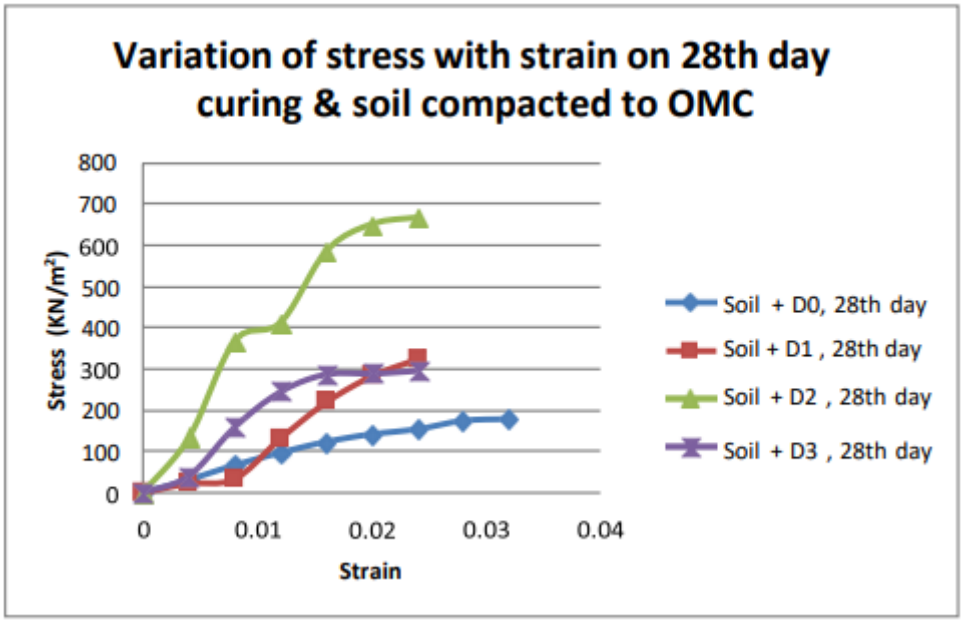

Fig 7. Variation of stress with strain at 28 day curing and soil compacted to OMC

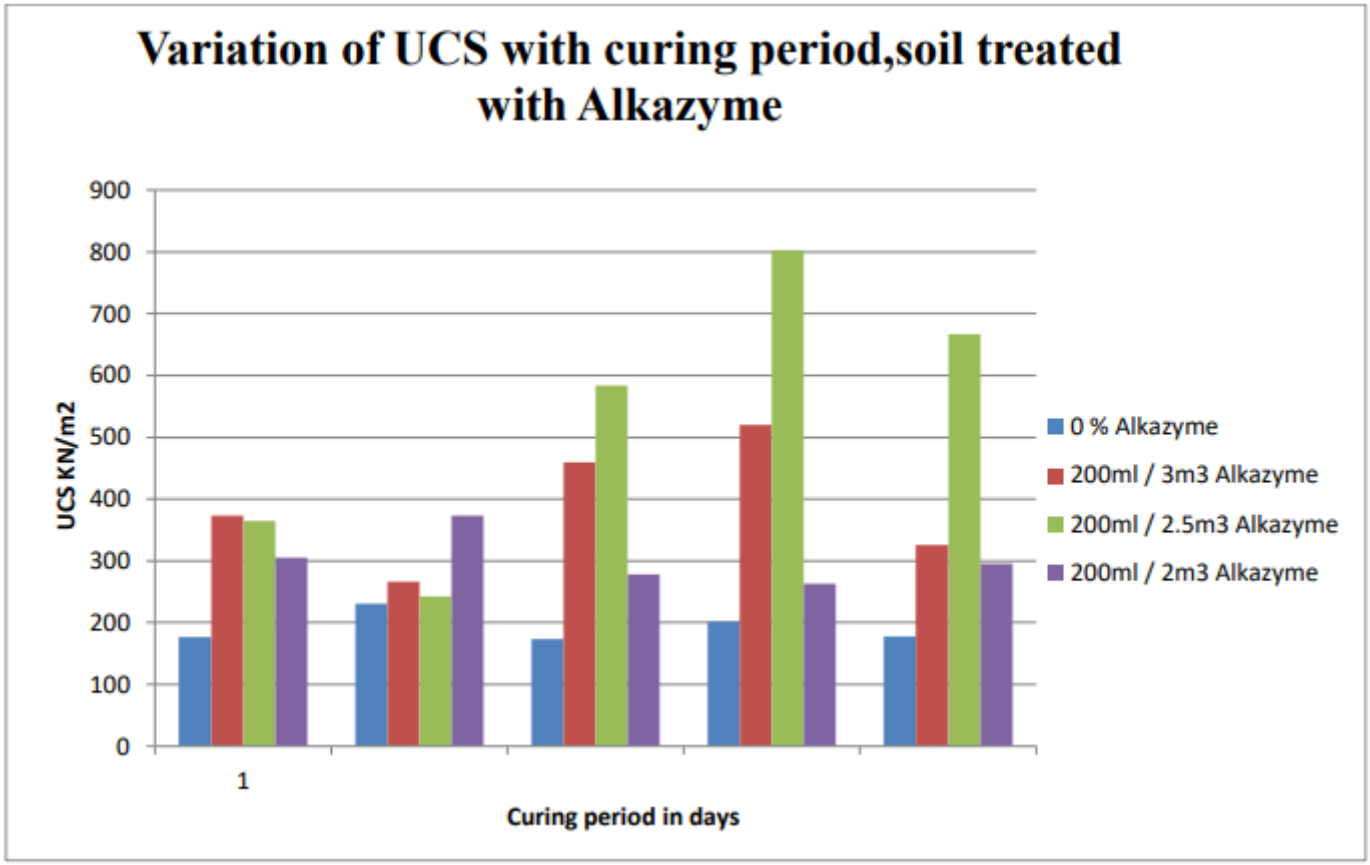

Fig 8. Variation of UCS with curing period, soil treated with Alkazyme

V. CONCLUSIONS

Based on the tests performed in the laboratory and obtained test results the following conclusions can be drawn.

1. It is noticed that the Lithomargic soil contains 37.85% of gravel, 59.7% of sand, 2.45% of silt and clay and this soil is classified as CL. The shedi soil specific gravity found to be 2.4.
2. It is observed from Compaction test that the maximum dry density is 1.6g/cc and OMC is 20%
3. The value of liquid limit is 55 %, plastic limit found to be 20% and the value of plasticity index is 35%. Hence, soil is clay with low plasticity and the soil need to be stabilized to improve its strength to use it as a sub base material.
4. From the obtained value of MDD and the OMC, the highest Unconfined compression strength is 201.3kN/mm³. Therefore, from the above results the Lithomargic soil is found to be problematic and its strength has to be increased to use this soil as a sub base material.
5. The MDD and the OMC of Lithomargic soil after treating with optimal D2 amount of Alkazyme is obtained to be 2.08g/cc and 16%.
6. From the test results obtained from the laboratory experiments, when soil is added with Bio enzyme the compressive strength is found to increase by 176.5kN/m² to 802.96kN/m² which is an increase of 454.93%.

VI. REFERENCES

[1] Andrew, R.T., Fadi , M.S., Nicholos , E.H. and Elahe, M. (2003); "An Evaluation of Strength change on Subgrade soils stabilized with an Enzyme Catalyst solution using CBR and SSG comparisions", Geomatrics, Inc. Columbia, Sc 29210,USA,JULY 2003.

[2] Andromalos, K,B., Hegazy Y.A., Jasperse, B.H.(2000); "Stabilization of Soils by Soils Mixing" Proceedings, International Conference on soft ground technology, ASCE, Noorwijkerhout, Netherlands, pp. 194-205.
[3] Brazetti, R. Murphy, S.R.(2000); "General usage of Bio-Enzyme stabilizers in Road Construction in Brazil",32nd annual meeting on paving Brazil, October 2000.
[4] "Effects of Terrazyme usage on increase of CBR", Technical report by Soil Mechanics Laboratory , National Road Department, Thailand, 1996.
[5] Fine, L ,Remington J,(1972); The corps of Engineers; Constructions in the United States. Airfields for Very Heavy Bombers.
[6] Hitam ,A. and Yusof , A. (1998); "Soil stabilizers for plantation of roads", National seminar on Mechanisation in Oil Palm Plantation, 30 June 1998, Selangor, Malaysia.
[7] IRC: 37-2001 "Guidelines for the design of flexible pavements", The Indian Roads Congress, New Delhi.
[8] ICR: SP: 20 -2002 "Rural roads Manual", The Indian Roads Congress, New Delhi.
[9] IS 2720 (Part III) (1980) " Determination of Specific gravity" Bureau of Indian Standards, Manak Bhavan, New Delhi.
[10] IS 2720 (Part IV) (1975) " Determination of Grain Size" Bureau of Indian Standards, Manak Bhavan, New Delhi.
[11] IS 2720 (Part V) (1985) " Determination of Liquid and Plastic limit" Bureau of Inidan Standards, Manak Bhavan, New Delhi.
[12] IS 2720 (Part VII) (1980) "Determination of Moisture content and Dry density" Bureau of Indian standards , Manak Bhavan, New Delhi.
[13] Roger , B. (2006) ; "Soil stabilizers on universal accessible trails", Technical Report 0023-1202-SDTDC , San Dimas, Ca: U.S. Department of Agriculture, Forest Service ,San Dimas Technology and Development Center,10 p.
[14] Ryan, C.R. and Jasperse, B.H.(1989): "Deep Soil Mixing at the Jackson Lake Dam". ASCE Geotechnical and Construction Divisions. Special Conference, Evanston , II.
[15] Satoni, R.L., Tingle, J.S and Webster, S.L. (2001): " Nontraditional Satbilization of Silty Sand" .U.S .Army Research and Development Center.
[16] Seed, H B Chan, N.C.K, and Monismth , C.L. (1955): "Effects of RepeatedLoading on the Strength and Deformation of Compacted clay". HRB Proceedings no.34, Washington ,D.C. pp. 541-558.
[17] Sharma, A , "Laboratory Study to Use of TerraZyme for Soil Stabilization ", Research Report (unpublished) Central Road Research Institute, New Delhi 2001.