

# STABILIZATION OF BLACK COTTON SOIL USING TERRAZYME

<sup>1</sup>Jagtap Balaji A., <sup>1</sup>Awale Rohit D., <sup>1</sup>Satpute Shrikrushna M., <sup>1</sup>Giri Krishna H., <sup>2</sup>Mahesh C Swami

<sup>1</sup>U.G. Student, <sup>2</sup>Asst. Professor

Department of Civil Engineering, Trinity Academy of Engg. Pune, Maharashtra, India.

**Abstract :** Black cotton soil poses problem like permeability, low bearing strength, swelling and shrinking etc. when exposed to compressive stress. There are problems involved with construction on black cotton soil, such as settlement of road, settlement of foundations etc. Terrazyme is a natural, non-toxic, non-corrosive liquid enzyme formulation and This terrazyme made from vegetables extracts that improves the engineering qualities of soil and increase stability of soil. For studying the plastic limit of black cotton soil, it is mixed with terrazyme with different dosage i.e. 0.25 ml, 0.50 ml, 0.75ml, 1ml per 100 ml of water. These criteria are also applicable to roads and airfields having a stabilized surface layer. This Study establishes criteria for improving engineering properties of soils used for pavement base courses, sub-base courses, sub-grades by the use of additives which are mixed into the soil to effect the desired improvement.

Keywords- Black cotton soil, plastic limit, Terrazyme, soil stabilization.

## I. INTRODUCTION

The present paper discuss about the change in plastic limit of black cotton soil after adding terrazyme in specific quantities. The long-term performance of any construction project depends on the soundness of the underlying soils. Unstable soils are always a trencher and can create significant problems for pavements or structures. Indeed, the structural strength of stabilized soils can be factored into pavement designs. Stabilizers can be used to treat soils to varying degrees, depending upon the objective. The least amount of treatment is used to dry and temporarily modify soils. Such treatment produces a working platform for construction or temporary roads. A greater degree of treatment supported by testing, design, and proper construction techniques produces permanent structural stabilization of soils. This study prescribes the appropriate type of additive to be used with black cotton soils type, procedure for determining a design treatment level for additive, and recommended construction practice for incorporating the additive into soils. The growth of population has created a need for better and economical vehicular operation which requires good highways having proper geometric design, pavement condition and maintenance. Many areas of India consists of soil with high silt contents low strengths and minimum bearing capacity. The long term of performance of any construction project depends on the soundness of the underlying the soils. soil sample is collected from site location NH211 near paragon dist. osmanabad maharashtra.

## II. MATERIALS

**III. Black cotton soil:** Black cotton soil (BC soil) is a highly clayey soil. The black colour in Black cotton soil (BC soil) is due to the presence of titanium oxide in small concentration. The Black cotton soil (BC soil) has a high percentage of clay, which is predominantly montmorillonite in structure and black or blackish grey in colour. Expansive soils are the soils which expand when the moisture content of the soils is increased. The clay mineral montmorillonite is mainly responsible for expansive characteristics of the soil. The expansive soils are also called swelling soils or black cotton soils. This soil is predominant in most of the areas of maharashtra state.

## IV.

**V. Terrazyme:** Bio-enzyme from Australia is a natural, nontoxic bio-degradable liquid concentrate that mixes easily in water for application with standard water spraying equipment. Bio-Enzyme is a low cost additive with long lasting effects. By altering the physical and chemical characteristics of soil, materials treated with Bio-Enzyme retain higher performance.



Fig 1: Bottle of Terrazyme

## VI. METHODOLOGY

### 3.1 PLASTIC LIMIT TEST

In this study black cotton soil with varying index properties have been tested for stabilization process and strength of the stabilized soil were evaluated after curing period of four days. The tests were carried out to determine the Californian Bearing Ratio (CBR) of the soil specimens with and without stabilization with the enzyme. The test results indicate that bio-enzyme stabilization improves the strength of clayey/silty soil to great extent but some soil exhibits little improvement in strength. Bio-enzyme is suitable for soil stabilization with minimum clay content of 15 percent. In some cases where the soil is very weak, such as highly clayey soil, the effect of stabilization has improved the CBR and compressive strength, which indicate the bearing capacity and the resistance to deformation increases in the stabilized soil.

Adopting the IRC method based on soil CBR, the Pavement design thickness on stabilized soil also reduces 25 to 40 percent. Moreover, in case of scarcity of granular material, only stabilized surface with thin bituminous surfacing also can fulfil the pavement design requirement with more than 10 percent saving in cost component.

## IV. EXPERIMENTAL STUDY

### 4.1 Plastic Limit of soil

20g sample was taken and selected a 1.5 to 2 g specimen the rolled the test specimen between the palm or fingers on the ground glass plate to form a thread of uniform diameter. Continued rolling the thread until it reached a uniform diameter of 3.2mm or 1/8 in. When the thread became a diameter of 1/8 in. reformed it into a ball. Kneaded the soil for a few minutes to reduce its water content slightly. Repeated the above steps until the thread crumbled when it reached a uniform diameter of 1/8 in. When the soil reached the point where it will crumbled, and when the thread is a uniform diameter of 1/8", it is at its plastic limit. water content of the soil was determined using formula.

$$\text{Plastic limit (wp)} = [(M_2 - M_3) / (M_3 - M_1)] * 100$$

Where

- M1 - Mass of the empty container;
- M2 - Mass of the container and wet soil;
- M3 - Mass of the container and dry soil

Table 1: Plastic limit of black cotton soil using 0 ml of stabilizer

Sr.no	Observations	calculations
1	M <sub>1</sub>	21.260
2	M <sub>2</sub>	22.530
3	M <sub>3</sub>	22.300
4	(w <sub>p</sub> )	22.115

Table 2: Plastic limit of black cotton soil using 0.25 ml of terrazyme

S.no	Observations	calculations
01	M <sub>1</sub>	45.660
02	M <sub>2</sub>	47.680
03	M <sub>3</sub>	47.260
04	(w <sub>p</sub> )	26.250

Table 3: Plastic limit of black cotton soil using 0.50 ml of terrazyme

S.no	Observations	calculations
01	$M_1$	42.640
02	$M_2$	53.000
03	$M_3$	52.210
04	$(w_p)$	30.730

Table 4: Plastic limit of black cotton soil using 0.75 ml of terrazyme

S.no	Observations	Calculations
01	$M_1$	49.620
02	$M_2$	52.500
03	$M_3$	51.810
04	$(w_p)$	31.500

Table 5: Plastic limit of black cotton soil using 1 ml of terrazyme

S.no	Observations	Calculations
01	$M_1$	52.930
02	$M_2$	54.890
03	$M_3$	54.480
04	$(w_p)$	26.450

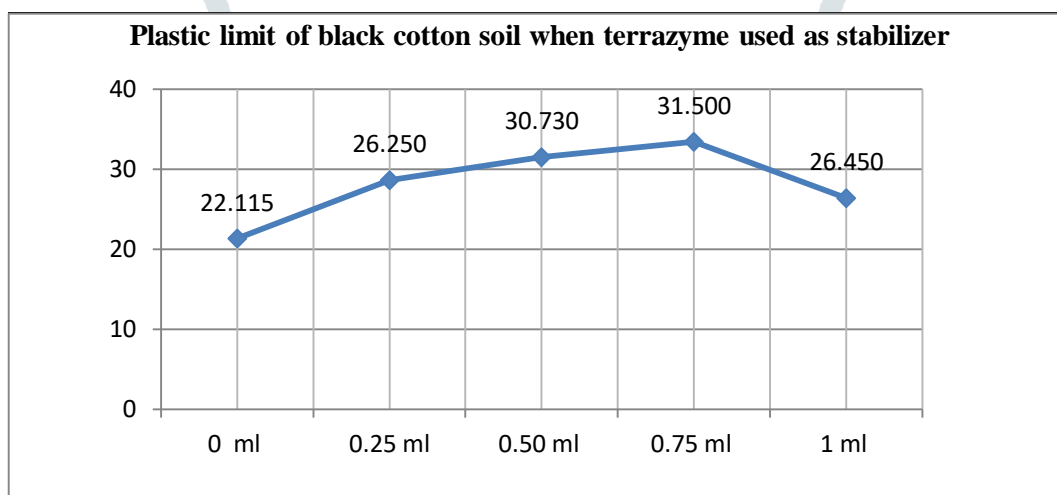


Fig. 2: Plastic limit of black cotton soil using terrazyme as stabilizer

## V. CONCLUSION

As a result of this study the plastic limit of soil is decreased the water tightness, resistance to washout, and other properties are improved. Soil stabilization is widely used in the construction on sagging soils of industrial and civil buildings. Terrazyme stabilization has shown little to very high improvement in physical properties of soils. This little improvement may be due to chemical constituent of the soil, which has low reactivity with Bio-enzyme. Therefore, it is advisable to first examine the effect of Bio-enzyme on soil stabilization in the laboratory before actual field trials.. Pavement design thickness also reduces to 25 to 40 percent. Moreover, in case of scarcity of granular material, only stabilized surface with thin bituminous surfacing can fulfil the pavement design requirement with more than 10 percent saving in cost component.

## REFERENCES

- [1] Amithkadabasheshadri, (2016)“Black cotton soil stabilization by bio enzymes journal-AIJRES (ISSN-2455-6300),vol 1,issue 10,p.p 252-265
- [2] Balakrishna.Y,(2017) “Improving the Properties of Black Cotton Soil Using Terrazyme as an Admixture journal-IJOEAT (ISSN-2395-1303),vol 3,issue 1,p.p 96-105.
- [3] Dr.Vijaykumar Sharma,(2017) “Effect of bio-enzyme (terrazyme) on the properties of sub grade soil of road journal-IJOIRISAE (ISSN-2454-9665) vol 3, issue 3, p.p 231-236.
- [4] I.S.:1498-1970, “Classification and Identification of Soil for General Engineering Purposes”.
- [5] I.S.:2720 (Part 4)-1985, “Specification for Grain Size Analysis”.
- [6] I.S.:2120 (Part5)-1985, “Determination of Liquid & Plastic limit of Soil”.
- [7] I.S.:2720 (Part 3)-1980, “Determination of Specific Gravity of Soil”.
- [8] I.S.:2720 (Part 8)-1983, “Determination of Water Content, Dry Density relation of Soil using Heavy Compaction (Second Revision)”.
- [9] I.S.:2720 (Part 16)-1979, “Laboratory Determination of C.B.R of Soil (First Revision)”.
- [10] I.S.:2720 (Part 10)-1973, “Determination of Unconfined Compressive Strength of Soil”.
- [11] IRC: 37-2001, “Guidelines for the Design of flexible pavements”.
- [12] JoydeepSen ,Jitendra Prasad Singh (2015) Stabilization Of Black Cotton Soil Using Bio-enzyme For a Highway Material journal-IJIRSET(ISSN-2319-8753) vol 4, issue 12, p.p 12453-12459.
- [13] Saurabh B. Gautam,(2016) “Subgrade Soil Stabilization using Terrazyme IJARIE-ISSN(O)-2395-4396 vol 2, issue 3, p.p 2522-2528.
- [14] Venika Saini1, and Priyanka Vaishnava,(2015) “Soil stabilization by using terrazyme journal-IJAET ISSN: 22311963, vol 8,issue 4, p.p 566-573
- [15] Vijay Rajoria1, Suneet Kaur, (2014)“A review on stabilization of soil using bio-enzyme journal-IJRET eISSN: 2319-1163 | pISSN: 2321-7308”.vol 3, issue 1,p.p 75-78
- [16] Vishal Saxena,(2017) “Review paper on soil stabilization by terrazyme journal-IJRET ISSN: 2248-9622, Vol. 7, Issue 4, pp.54-57”.

