

# STABILIZATION OF SOIL USING BIO-ENZYME

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## ABSTRACT

*The present study provides an effective technique of ground improvement using bio-enzyme. In this study a bio-enzyme named terrazyme is used for improving the California bearing ratio (CBR) value in road construction. Terrazyme is a natural, non-toxic and liquid enzyme. It is made from fermentation of plants, vegetable extract and fruit extract. Terrazyme can be used as soil stabilizer and also it can improve the CBR value in road construction. The dosage of terrazyme are taken as 500ml/m<sup>3</sup>, 700ml/m<sup>3</sup>, 900ml/m<sup>3</sup> and 1000ml/m<sup>3</sup> in the soil sample and result is analyzed. A significant increase is found in CBR value of the soil sample as the dosage of terrazyme has been increased.*

**Key words:** Ground Improvement, Soil Stabilization, Terrazyme, CBR

**Cite this Article:** Sandeep Panchal, Md. Mohsin Khan and Anurag Sharma, Stabilization of Soil Using Bio-Enzyme. *International Journal of Civil Engineering and Technology*, 8(1), 2017, pp. 234–237.

<http://iaeme.com/Home/issue/IJCIET?Volume=8&Issue=1>

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## 1. INTRODUCTION

Sub-grade soil is an important material in highway construction. In general practice locally available material is used as sub-grade soil. In some cases, the local material does not have sufficient strength to bear the estimated loads. Such soils which do not possess sufficient strength can be stabilized using various additives like lime, cement etc. Soil improvement is a combination of physical and chemical methods for improving the characteristics of soil when it is used as a construction material (Hans et al; 1991).

There are a lot of methods which are used for stabilization of the soil. Grouting of the soil is a very old method. It is used for stabilization of rocks also (Hans et al; 1991). Rock grouting is performed for making the rock structure impervious and filling up its cracks. In soil stabilization, grouting increases the bearing capacity of the soil. Stabilization by grouting is found more suitable for increasing foundation bearing capacity. It proves uneconomical for sub-grade stabilization.

Lime is also used to stabilize the soil. Lime is found in powdered form generally (Neeraj Kumar Sharma et al; 2012). During the mixing process, lime dust is formed which pollutes the environment. Lime stabilization is not eco-friendly and generally avoided in areas of high population.

Pozzolana material like fly ash can also be used as soil stabilizer. The materials like fly ash are not easily available in every area. If fly ash is transported from distant places, transportation cost increases.

An ideal soil stabilizer should be easily available, economical and eco friendly. Terrazyme is a good alternative to the conventional soil stabilizers like fly ash, lime etc. Terrazyme is a bio-enzyme which is used as a soil stabilizer in construction of road infrastructure. It is used to improve the soil properties. It is non-toxic and natural substance. It is formulated from plants, vegetable extract and fruit extract. So it is also ecofriendly. In the present study, effect of addition of terrazyme for improving CBR value of soil is analyzed.

## 2. EXPERIMENTAL SETUP

The whole testing program was done in two phases. In the first phase we conduct the laboratory tests on simple local soil to investigate the geotechnical properties.

In the second phase, the local soil sample was mixed with Terrazyme with different proportions as 500ml in 1m<sup>3</sup>soil, 700ml in 1m<sup>3</sup> soils, 900ml in 1m<sup>3</sup>soil and 1000ml in 1m<sup>3</sup>soil for various tests that are mentioned in Table 1.

**Table 1** Complete description of test to performed

Sr. no.	Laboratory test	Standards	Varying parameter		Resulting parameters
			Dosage of Terrazyme	Curing period	
1	Standard Proctor Test	Is:2720 Part-6 1980	500ml in 1m <sup>3</sup> 700ml in 1m <sup>3</sup> 900ml in 1m <sup>3</sup> 1000ml in 1m <sup>3</sup>	07 days 14 days 28 days	OMC(optimum moisture content)
2	Atterberg's Limit Test	Is:2720 Part-5 1985	500ml in 1m <sup>3</sup> 700ml in 1m <sup>3</sup> 900ml in 1m <sup>3</sup> 1000ml in 1m <sup>3</sup>	07 days 14 days 28days	Liquid limit, Plastic limit, Plasticity index
3	California Bearing Ratio Test	Is:2720 Part-14 1987	500ml in 1m <sup>3</sup> 700ml in 1m <sup>3</sup> 900ml in 1m <sup>3</sup> 1000ml in 1m <sup>3</sup>	07 days 14 days 28 days	C.B.R value

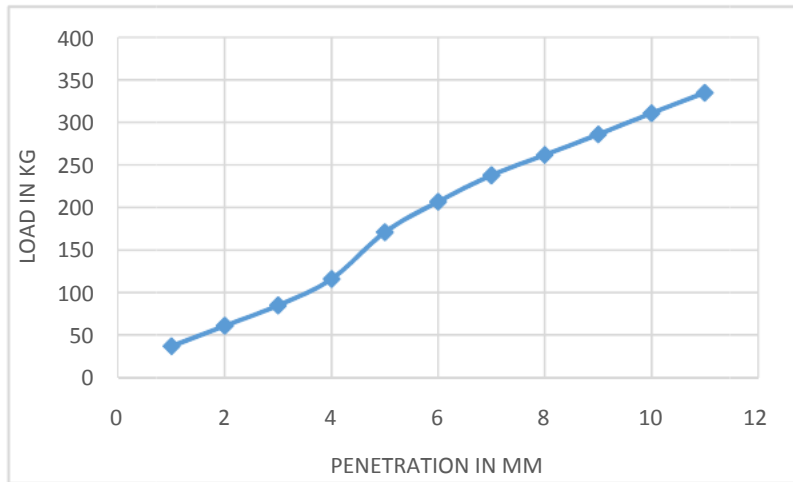
The soil selected in this present study is taken from district Amroha in Uttar Pradesh (U.P.), India. The soil characteristics are tabulated in the Table 2.

**Table 2** General Characteristics of Soil

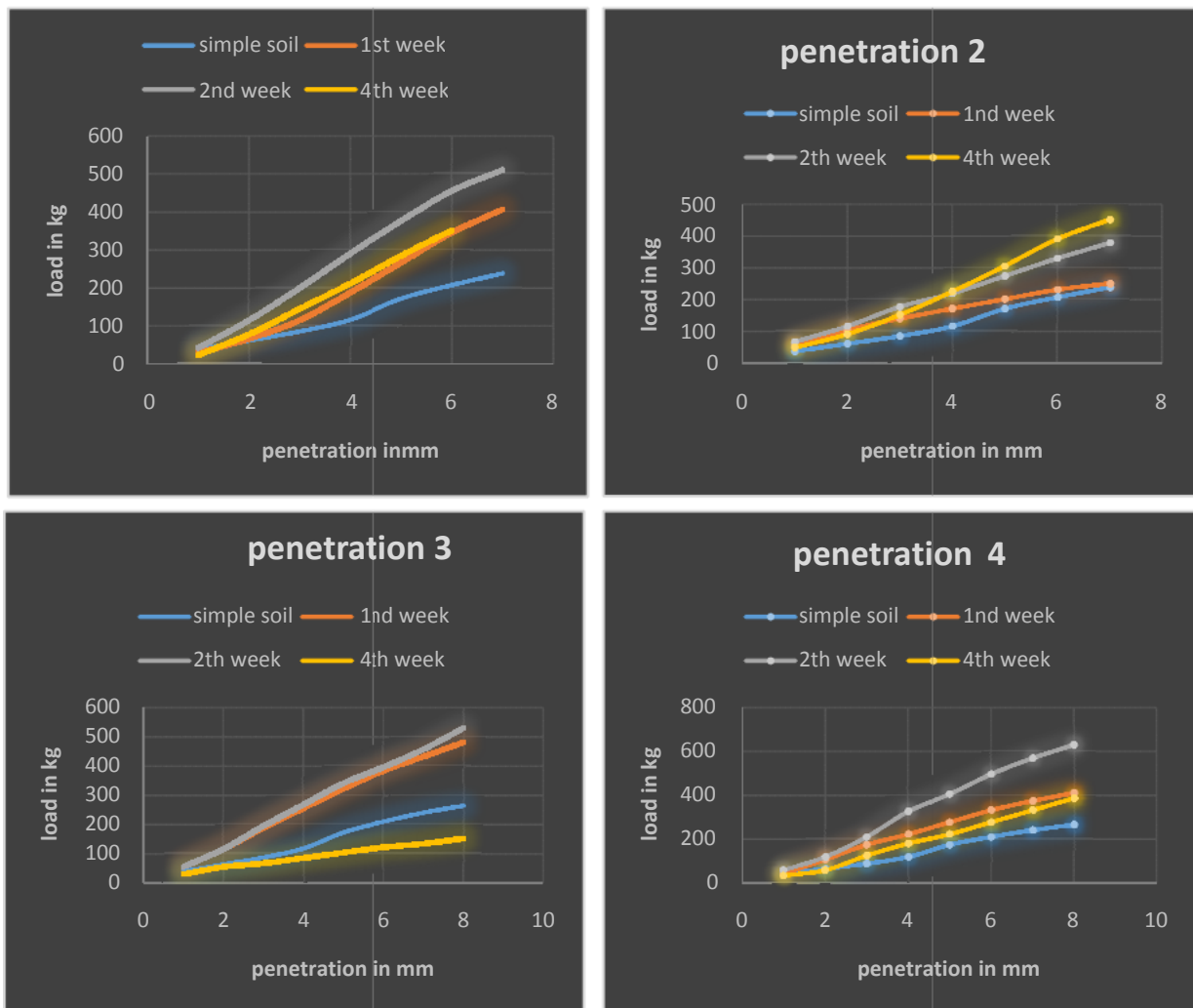
Sr. no.	Properties	Values
1	Specific Gravity	2.5
2	Consistency Limit	
	Liquid limit	23.55
	Plastic limit	15.06
	Plasticity index	08.49
3	Engineering Properties	
	Maximum dry density(gm/cc)	1.742
	O.M.C	14.00
	C.B.R	
	Un-Soaked	8.31%
	Soaked	4.19%

### 3. RESULTS AND DISCUSSION

After addition of varying amount of terrazyme, the effect on the characteristics of soil is analysed and the results are shown in the graphical form. Variation of load w.r.t. penetration in CBR test is shown for normal soil in Figure 1.



**Figure 1** Load Vs Penetration for Normal Soil



**Figure 2** Load Vs Penetration (for addition of 500ml, 700ml, 900ml and 1000ml terrazyme per m<sup>3</sup> of soil sample)

Figure 2 shows the load variation with respect to penetration value in mm. The CBR values calculated from the loading condition and penetration showed significant variation w.r.t. amount of terrazyme mixed. The variation of CBR is noted as follows:

- For first dosage of enzyme CBR value of soil is 12.89% after first week curing, 18.24% after second week curing, and 13.04% after fourth week curing.
- For second dosage of enzyme CBR value of soil is 9.80% after first week curing, 13.43% after second week curing, and 14.80% after fourth week curing.
- For third dosage of enzyme CBR value of soil is 15.71% after first week curing, 16.52% after second week curing, and 5.10% after fourth week curing.
- For first dosage of enzyme CBR value of soil is 13.38% after first week curing, 19.70% after second week curing, and 10.70% after fourth week curing.

#### 4. CONCLUSION

In the present study various geotechnical tests were performed on local soil sample with and without enzyme. After mixing of Terrazyme local soil sample showed proper improvement in consistency limits, dry density and CBR values of local soil sample with mixing a different dosages of Terrazyme with different curing periods. The period of treatment of bio- enzymatic soil played an important role in improvement of strength. The best result of CBR value was observed with the third dosage with two week curing period and percentage increment as compared to local soil sample without Terrazyme is 131.49 %.

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