

## **STUDY ON IMPACT OF TERRAZYME STABILISED SOIL ON CALIFORNIA BEARING RATIO**

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*Abstract---The economic status of a country is better evaluated by the prevailing road connectivity and also by steps taken to improve it, thus generating sources of income and employment. With the continuous growth in road users, high quality materials are required to withstand the load on pavements. The non-uniform distribution of soil in subgrade of pavement makes it weaker and needs to be stabilized in order to attain the strength. The current study made use of natural enzymes to stabilize the soil, as it is cost effective and eco-friendly. An unconventional bio-enzyme called terrazyme which is a product of degradation of natural waste is used as a soil stabilizer. Index properties of soil were evaluated to classify the soil and California Bearing Ratio was evaluated for samples with and without terrazyme. The thickness parameter was analyzed using CBR and it was found that the load bearing capacity of soil has improved by 141% at highest dosage of terrazyme.*

**Key words:** Subgrade, Terrazyme, Chemical stabilizer, CBR

### **1. Introduction**

Stabilization provides an alternate method to improve the structural support of the foundation for many of the sub-grade conditions presented. In all cases, the provision for a uniform soil relative to textural classification, moisture, and density in the upper portion of the sub-grade cannot be over-emphasized. This uniformity can be achieved through soil sub-cutting or other stabilization techniques. Stabilization is used to improve soil workability, provide a weather resistant work platform, and reduce swelling of expansive materials.

The growth of vehicular population has created a need for better and economical vehicular operation good highway which requires having proper geometric design, pavement condition. Cost effective roads are very vital for economic growth in any country. Indian Road Network of 45 lakh km is second largest in the world. Majority of the pavements are flexible type. With the rapid socio-economic development in India, there has been tremendous growth in industrialization of the country there is an urgent need to identify new materials to improve the road structure and to expand the road network. Commonly used Materials are fast depleting and this has led to an increase in the cost of construction. Hence, the search for new materials and improved techniques to process the local materials has received an increased impetus. When poor quality soil is available at the construction site, the best option is to modify the properties of the soil so that it meets the pavement design requirements. This has led to the development of soil stabilization techniques. Since the nature and properties of natural soil vary widely, a suitable stabilization technique has been adopted for a particular situation after considering the soil properties. Soil improvement by mechanical or chemical means is widely adopted. In order to stabilize soils for improving strength and durability, a number of chemical additives, both inorganic and organic, have also been used.

Recently Bio Enzymes have emerged as a new chemical for soil stabilization. Bio-Enzymes are chemical, organic, and liquid concentrated substances which are used to improve the stability of soil of sub-base, sub-grade of pavement structures.

Bio-Enzyme is a natural, non-toxic, non-flammable, non-corrosive liquid enzyme formulation fermented from vegetable extracts that improves the engineering properties of soil, facilitates higher soil compaction and increases strength. Enzymes catalyse the reactions between the clay and the organic cat-ions and accelerate the cat-ionic exchange process to reduce absorbed layer thickness. For other types of soil stabilization, chemicals are mixed with soil, which is difficult to mix thoroughly, but Bio-Enzyme is easy to use as it can be mixed with water at optimum moisture content and then it is sprayed over the soil and compacted.

TerraZyme is a natural, non-toxic, formulated using vegetable extracts. Apart from being a concept accepted the world over as a sound and resourceful road building practice, which completely replaces the conventional granular base and the granular sub-base, it emphasizes on strength, performance and higher resistance towards deformation. Organic enzymes come in liquid form. They are perfectly soluble in water, brown in colour and hassmell of molasses. The weight is similar or equal to that of water. The pH level is between 4.3 and 4.6. TerraZyme acts to reduce the voids between soil particles and minimize absorbed water in the soil for maximum compaction. This decreases the swelling capacity of the soil particles and reduces permeability. The application of TerraZyme enhances weather resistance and increases load bearing capacity of soils. These features are particularly evident in fine-grained soils such as clay in which the formulation affects the swelling and shrinking behaviour.

## 2. Study area

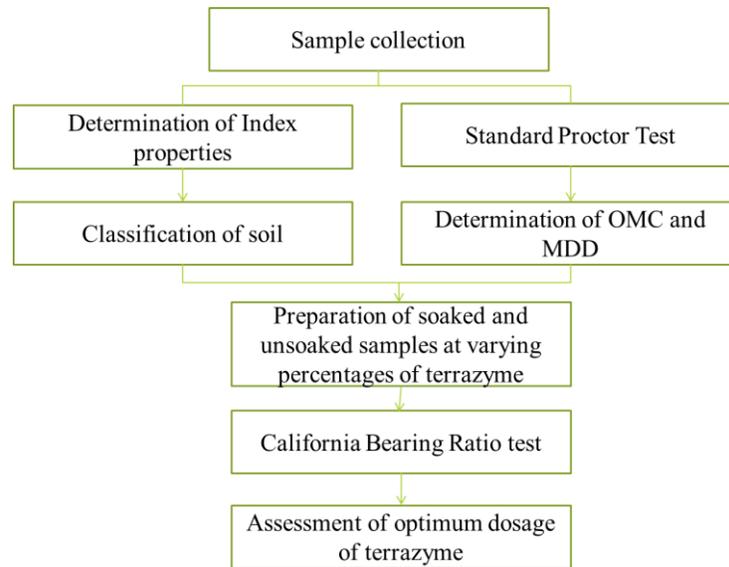
The current study is taken up on soils which are available at working site of Manikonda, Hyderabad. The samples were collected at a longitudinal interval of 100m at a depth of 0.5m.



*Fig 1: Study area*

## 3. Methodology

The methodology for current study is shown in fig 2. The samples collected from the site are thoroughly mixed using a spatula. Firstly specific gravity and sieve analysis of soil is determined. Secondly index properties of soil are to be determined in order to classify the soil. The classification of soil is determined by plasticity index obtained from index properties of soil. As soil is to be compacted in pavements, it is essential to determine optimum moisture content(OMC) and maximum dry density(MDD). The OMC and MDD are determined by standard proctor test. Then the samples are compacted at OMC and load bearing capacity at 2.5mm and 5mm penetration are determined by California Bearing Ratio (CBR) test. CBR is performed on soaked samples of soil treated with terrazyme at various dosages. The dosages adopted in the present study are D1-1 m<sup>3</sup>/50ml, D2-1 m<sup>3</sup>/75ml, D3-1 m<sup>3</sup>/100ml of optimum moisture content.



*Fig 2: Methodology*

#### 4. Results

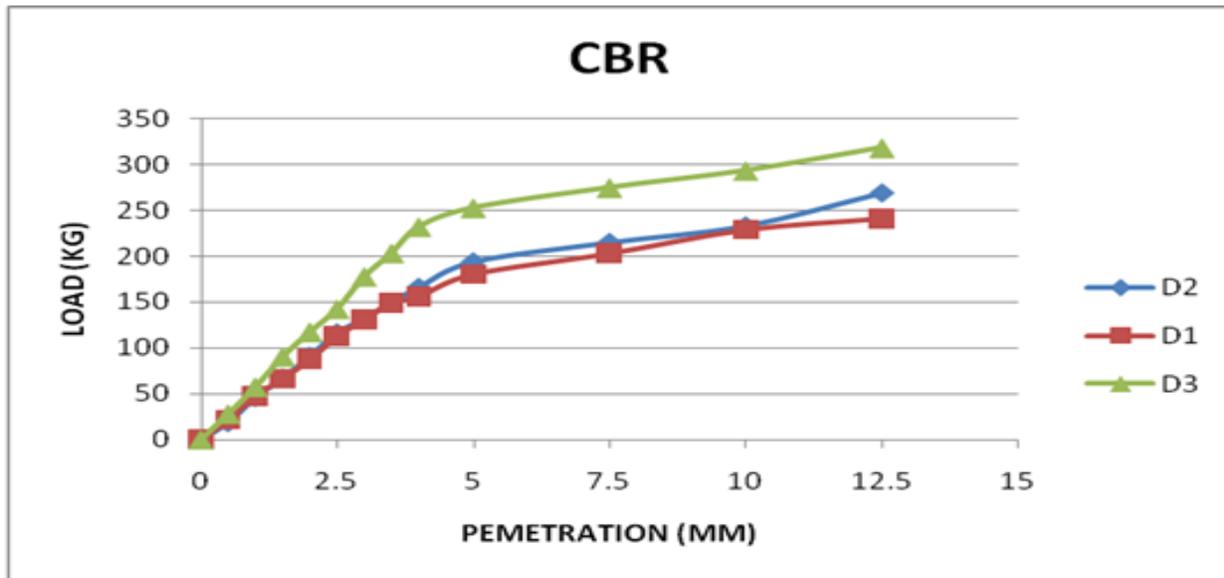
The properties of soil as determined in the methodology explained are as given in table 1. The California Bearing ratio test of soaked samples treated with terrazyme at various dosages show that load bearing capacity does not show an appreciable change for D1 and D2, but an increase is observed for D3. At 2.5mm penetration, an increase of 60% is observed for D3. For the same dosages a 6% increase is observed between D1 and D2, 38% increase is observed between D2 and D3. Conventionally CBR at 2.5mm penetration should be more than 5.0mm penetration, but for the current study the test results when repeated showed that CBR at 5.0mm penetration is more than CBR at 2.5mm penetration. Hence CBR at 5.0mm penetration is considered for thickness design of subgrade. The CBR values for different dosages of terrazyme are given in table 2 and graphical representation of loads at different dosages of terrazyme is shown in fig 3.

Table 1 : Properties of soil

Property	Values	Property	Values
Specific gravity	2.51	Classification	Clayey sand
Gravel(%)	2.9	OMC(%)	9
Sand(%)	79.68	MDD(gm/cc)	2.16
Fines(%)	16.3	CBR of unsoaked sample	7.37%
Liquid limit	30	CBR of soaked sample	4.89%

Table 2: CBR values at different dosages of terrazyme

Dosage	CBR at 2.5mm penetration	CBR at 5.0mm penetration
D1	8.2%	8.7%
D2	8.51%	9.4%
D3	10.4%	12.3%



*Fig 3: Soaked CBR of treated samples*

## 5. Conclusions

From the present study, it can be concluded that bioenzymes are helpful to strengthen the soil. The results show that a small amount of bioenzyme is required to obtain appreciable CBR values. Thus D3 is considered as an optimum dosage for the type of soil taken in study. Hence it can be concluded that the thickness of subgrade can be reduced by improving the strength properties of soil which in-turn is cost effective in nature. Further tests like box shear test and unconfined compression test are required to be performed to assess the dosages of terrazyme effectively.

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