

# Laboratory Investigation of Soil Stabilized using Terrasil

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**Abstract**— Soil stabilization is a technique aimed at increasing or maintaining the stability of a soil mass or otherwise improving its engineering properties. In the present investigation, the behavior of Black Cotton (BC) soil with and without stabilization was studied. A chemical named Terrasil was used as stabilizer. Cement has also been used as a stabilizer. In this study soil with variable dosages were tested for stabilization process and strength of the stabilized soil has been evaluated after curing period. The tests were carried out to determine the consistency limits, CBR value of the soil specimens with and without stabilizers for a curing period.

**Key words:** Terrasil, Soil Stabilized

## I. INTRODUCTION

Transportation by road is the most important facility in moving men and material. It contributes to the economic, industrial, social and cultural development of a region or state of nation. It helps primarily in linking production and consumption centers. As a result, raw and finished goods are utilized in faraway places from their centers of production. By moving people across the country, transportation brings about national integration and an understanding of different cultures. Most suitable for short haul passenger and freight movement in the highway transport. It is most suitable for bulk commodity transportation. The growth of the population has created a need for better and economical vehicular operation which requires good highway having proper geometric design, pavement condition and maintenance. The highways have to be maintained so that comfort, convenience and safety are provided to the traveling public. The damage will be more during rainy season and the main causes are poor strength of sub base, base and low permeability of the above causing unsatisfactory drainage of water in the soil in sub base. Hence it is necessary to have a proper diagnostic study of soil in sub base and to come out with a stabilization method.

### A. Soil Stabilization in Road Construction

Cost effective roads are very vital for economical growth in any country. There is an urgent need to identify new materials, improve road construction techniques 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 to be 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 Bioenzymes have emerged as a new chemical for soil stabilization. Roads are categorized as all-weather roads and fair-weather roads. Roads are classified on the basis of traffic volume, load transported or tonnage, location and function. Based on traffic volume (vehicles per day) roads are subdivided into heavy, medium and light traffic roads. Based on loads (tonnes per day) roads are classified as class I, II etc.

These roads should have proper planning, design, construction and maintenance. None of these can be ignored at any cost. Design is taken as geometric design of road network, road structure and other cross drainage works. Road otherwise roadway or pavement should be stable and non-yielding to allow heavy wheel loads of the traffic to move with least possible rolling resistance. The crest of the road should meet these in varied weather conditions. For this a properly designed and constructed pavement structure is needed to sustain a large number of repeated load applications during the design life.

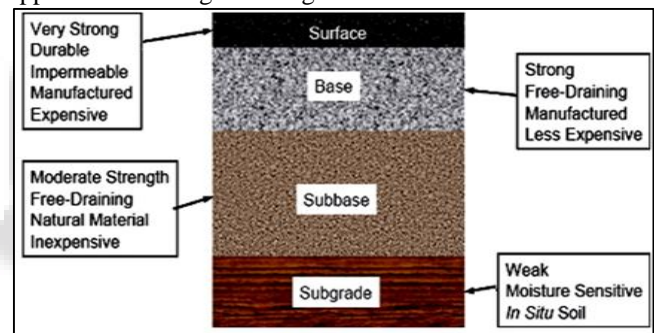


Fig. 1: General Structure of Road

Soil stabilization is the process of improving the engineering properties of the soil and thus making it more stable. It is required when the soil available for construction is not suitable for the intended purpose. In its broadest sense, stabilization includes compaction, preconsolidation, drainage and many other such processes. However, the term stabilization is generally restricted to the strength properties. A cementing material or a chemical is added to a natural soil for the purpose of stabilization.

### B. Present Work

In the present study, Terrasil has been used for stabilization of black cotton soil. Cement has also been used as the stabilizer. Herein soil with variable dosages was tested for stabilization process and strength of the stabilized soil has been evaluated after curing period. The tests were carried out to determine the consistency limits, CBR value of the soil specimens with and without stabilizers for a curing period. The tests performed were as per the guidelines mentioned in the Indian Standards.

### C. Objective

- To improve the California Bearing Ratio.

- To improve onsite materials to create a solid and strong base and sub-base courses.
- Cost Effectiveness.

## II. LITERATURE REVIEW

A number of researchers have worked in developing different methods of soil stabilization, which are practical and economical:

### A. B M Lekha, A Goutham, A U Ravi Shankar, 2013

In their work on " Fatigue and Engineering Properties of Chemically Stabilized Soil for Pavements" expresses that the conduct of Black Cotton (BC) soil with and without adjustment was contemplated. A chemical named Terrasil was utilized as stabilizer and it was utilized for distinctive measurements and cured for 7-28 days. Due to the compound response, the soil mass densifies by minimizing the voids in the middle of particles and it make the soil surface impermeable. The vital geotechnical properties of soil were resolved in the research facility. It is noticed that CBR qualities increment with the increment in rate of stabilizer. Penetrability is observed to be nil for treated soil. It makes the dirt impermeable totally. The XRD and SEM investigation led for the soil examples were not ready to legitimize the change for balanced out so. The study implies that addition in measurements of Terrasil as a stabilizer brought about decrement of consistency cutoff points. So it is clear that the substance makes the soil solid. It is noticed that CBR qualities increment with the increment in rate of stabilizer. The perception record expresses those UCS quality increments with expansion in dose of stabilizer and curing period.

### B. Nandan A Patel, Prof. C.B. Mishra, Vasu V Pancholi, 2015

In their paper titled "Scientifically Surveying the Usage of Terrasil Chemical for Soil Stabilization" emphasized that it is the responsibility of the road authorities to use the local material and correct the soil properties using additives enhancing the strength of soil and make the road durable. The examination was completed to focus first soil engineering properties (with and without stabilizer), standard compaction; four days soaked California Bearing Ratio (CBR), permeability test and cyclic loading test according to codal procurement. A concoction named Terrasil was utilized as stabilizer and it was utilized for altered measurement i.e. 0.041% by dry aggregate weight of soil test according to the convention of Zydex Industries, Vadodara. Test outcome demonstrates that designing properties got modified and CBR on stabilized clayey samples increased considerably, which reflects the lower thickness in correlation with natural characteristic soil properties. Additionally the expense is diminishing which advantages the road builders, engineers, policy makers and pavement designers as well.

### C. Nandan A. Patel and C. B. Mishra, 2014

"Improvement the Strength of Inorganic Clayey Soil using Cement Additive" states that the failures of pavement in from of heave depression cracking and unevenness are caused by the seasonal moisture variation in subgrade soil. The correct stabilization of foundation soils constitutes an

increasingly important issue in the present civil engineering world to alter the properties of soil to meet the desired engineering properties for improving strength and durability. Initially the investigation of soil is carried out to evaluate the physical and engineering properties as per Indian Standard classified as CL (Clay soil having low plasticity) as per Indian Standard (1498 – 1970) by conducting laboratory tests and to evaluate the improvement in properties by the addition of 2 % PPC as stabilizers to be used in pavement design for economy.

### D. Ibrahim M.A. Moafaq, A.A. Abdulrahman, H.A. 2011

In their study on "Long haul Quality and Durability of Clayey Soil stabilized with Lime" goes on that durability characteristics of clayey soil settled with lime were controlled by coordinating tests contains UCS for tests with the perfect lime percent (4%), and subjected to cycles of the WD, dry-wet and FT durability tests and moreover, long haul soaking and slake test.

### E. Greeshma Nizy Eujine, Lamanto T. Somervell, Dr. S. Chandrakaran, Dr. N. Sankar, 2014

UCS tests were conducted on bio-enzyme treated clay sample. The tests were conducted on treated samples on the 0th, 7th, 14th, 28th day of application of the bio-enzyme. On curing it was observed that LL increased by 28% in the first 2 weeks and later decreased. TZ had little effect on the PL of the soil; however it decreased the SL by 30% at the end of four weeks. Addition of Dosage 2 (200 ml/m<sup>3</sup> of TZ), yielded the maximum improvement, enhancing the UCS up to 12 times the untreated strength.

### F. Grytan sarkar, md. rafiqul Islam, Muhammed alamgir, md. Rokonuzzaman, 2012

"Study on the Geotechnical Properties of Cement based Composite Fine-grained Soil". In this study, the expansion of cement was found to enhance the designing properties of accessible soil in settled structures particularly quality, workability, and compaction and compressibility attributes. Thusly, lab tests, for example, compaction, Atterberg limits, unconfined compressive quality, direct shear and union tests for distinctive rates of concrete substance and unique soil tests were performed. These test outcomes demonstrate that the dirt can be made lighter which prompts diminish in dry thickness and increment in dampness content and decreased compressibility because of the expansion of bond with the dirt. Other than that the unconfined compressive quality and shear quality of soil can be improved with the expansion of 7.5% of bond substance.

## III. EXPERIMENTAL PROGRAM

The basic tests including, Atterberg limits (IS:2720, Part-V), Standard Proctor Density Test (IS:2720, Part-VII, VIII), Grain Size distribution (IS:2720, Part-IV), CBR (IS:2720 Part-XVI) are to be performed. All the above mentioned tests are to be performed for VIRGIN SOIL. (Black Cotton Soil).

Initially, Cement is added to the soil and Standard Proctor Test and CBR Test are conducted for the combination of SOIL+CEMENT. The dosages for cement taken are 0.5% and 1%. Later, we add Terrasil. Dosages

taken are 0.02% and 0.04%. CBR test is to be conducted for the combination of SOIL+TERRASIL.

In the last step we take the combination of SOIL+CEMENT+TERRASIL. Dosages taken are

- 1) Soil+0.5% Cement+0.02% Terrasil
- 2) Soil+0.5% Cement+0.04% Terrasil

CBR tests are to be conducted for this combination.

Finally comparison between 4 days and 7 days data are to be made.

#### REFERENCES

- [1] B M Lekha, A Goutham, A U Ravi Shankar, "Fatigue and Engineering Properties of Chemically Stabilized Soil for Pavements", Indian Geotechnical Conference, 2013.
- [2] Nandan A Patel, Prof. C.B. Mishra, Vasu V Pancholi, "Scientifically Surveying the Usage of Terrasil Chemical for Soil Stabilization", ISSSN Vol.3, No.6, June 2015.
- [3] Nandan A. Patel and C. B. Mishra, "Improvement the Strength of Inorganic Clayey Soil using Cement Additive", ISSN 30 Dec 2014, Vol.4, No.6, Dec 2014.
- [4] Ibrahim, M.A., Moafaq, A.A. and Abdulrahman, H.A." Long Term Strength and Durability of Clayey Soil Stabilized With Lime", Eng. and Tech. JI, Vol.29, No.4. 2011.
- [5] Grytan Sarkar, Md. Rafiqul Islam, Muhammed Alamgir, Md. Rokonzaman," Study on the Geotechnical Properties of Cement based Composite Fine-grained Soil International Journal of Advanced Structures and Geotechnical Engineering, ISSN 2319-5347, Vol. 01, No. 02, October 2012"
- [6] IS: 2720 (Part II) – 1973, Determination of Water Content.
- [7] IS: 2720 (Part IV) – 1985, Determination of Grain Size Analysis.
- [8] IS: 2720 (Part V) – 1985, Determination of Liquid and Plastic Limit.
- [9] IS: 2720 (Part VIII) – 1987, Determination of Water Content – Dry Density Relation Using Light Compaction.
- [10] IS: 2720 (Part XVI) – 1997, Laboratory Determination of CBR.