

Transfiguring the Strength of Natural Soil using Chemical as an Additive

Bhavinkumar M. Lakani¹ Shivani A. Dimke² Prof. C. B. Mishra³ Mr. Santosh Zunjar⁴

^{1,2}BE Student ³Associate Professor ⁴Proprietor

^{1,2,3,4}Department of Civil Engineering

^{1,2,3}B.V.M Engineering College, Vallabh Vidyanagar, India ⁴Independent Consultant & Technocrats, Vadodara, India

Abstract— In India greatest soil zones are known for bad condition bringing about pavement failures. Development of roads on weaker soil is monetarily the significant issue. Alteration is the only choice for changing the properties of soil to enhance quality and solidness. In this paper, initially the examination of common soil is finished by soil modification with and without utilizing chemical added substance (renolith) by weight of soil test to enhance the physical and designing properties as indicated by Indian Standard by coordinating exploration focus tests for the betterment of road contractors.

Key words: Soil Stabilization, Strength, Renolith, CBR

I. INTRODUCTION

Soil is the essential component of the nature and road development industry knows the significance of it for pavement work.

Soil stabilization can be explained as a means of permanently consolidating soils and base materials while remarkably increasing their strength and load-bearing properties. In addition, soil stabilization will reduce the soils water sensitivity and volume changes during wet/dry cycles in the field. To achieve the desired stability, a stabilizer must be properly incorporated into the soil to render the soils capable of meeting the requirements of the specific engineering project.

The chemical stabilization of the problematic soils is very important for many of the geotechnical engineering applications such as a pavement structure, roadways, building foundation, channel and reservoir linings, irrigation systems, water lines and sewer lines to avoid the damage due to settlement of the soft soil or the swelling action of the expansive soil.

Chemical stabilization consists of bonding of soil particles with cementing agent that is produced by the chemical reaction within the soil. The primary additive is a chemical in the process.

One of the numerous polymer chemical compounds which have gained peak recognition in the recent years is Renolith. Renolith is the liquid polymer additive produced from by blending of locally produced synthetic chemical products. As per the manufacturer the polymer is a non-combustible, non-poisonous, non-toxic, non-corrosive, environmentally safe and eco-friendly. The polymer chemical is a synthetic product with a property of surface activeness which as the capability of changing hydrophilic nature (water absorption) of the fine grained soils to hydrophobic nature (water retention) maintaining the strength criteria. Main advantage of the polymer chemical stabilization is that very small volume of the polymer additive is enough and the cost of ground improvement is less when compared to the other geotechnical processes.

II. OBJECTIVES

To study the transformation of soil index properties of untreated weak local soil and restrict the volume change potential of a highly plastic soil by using dosages as stabilizers of Renolith for road construction to give some structural value or credit in the pavement design process.

III. LITERATURE REVIEW

The scientific view distributed works that relate to the pertinent research examination which is a basic, truthful outline of what has gone some time recently is studied.

Ibrahaim M.A. Moafaq, A.A. Abdulrahman, H.A. (2011) – in his 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.

Raasta [14] directed lab mulls over on properties of soils treated with Proprietary Cementitious Stabilizer. In their study they chose four unique sorts of SC soils and acquired considerable increment in CBR worth (to 20% with 2% stabilizer). The expand and rate of expansion in compressive quality of settled soil tests (following 7 days curing) with expanding stabilizer substance was not significant. Thus it was inferred that low rates around 1-2% of stabilizer is compelling to enhance the properties of such clayey soils.

Nandan A. Patel, Prof.C. B. Mishra, Mr. Vasu V. Pancholi (2015) In their paper titled "Scientifically Surveying the Usage of Terrasil Chemical for Soil Stabilization" wherein the 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.

Lekha B. M. U. Ravi Shankar • Goutham Sarang stated that Soil adjustment is a strategy to enhance the frail soils and making them to meet certain necessities of the particular designing tasks. The sort of soils accessible in Dakshina Kannada area of Karnataka State is laterite and Lithomarge mud. Its Plasticity Index is high because of the vicinity of high rate of sediment and earth content. In the present examination, an endeavor is made to mull over the conduct of laterite with and without including chemicals. A compound named Zycosoil, when added to water and blended with soil changes its designing properties that rely on the kind of the dirt and dose of synthetic. These chemicals are fluid added substances, which follow up on the dirt to decrease the voids between soil particles and minimize adsorbed water in the dirt for most extreme compaction. In the present study, the

adequacy of Zycosoil in balancing out the laterite soils of South Canara locale is examined through research center analyses. Different geotechnical properties are mulled over and relationships between diverse geotechnical properties and change in the dirt properties with distinctive rates of compound increments are determined. The essential properties, for example, list properties, compaction qualities, unconfined compressive quality parameters, California bearing proportion values and weariness conduct were considered.

IV. MATERIALS

Following are the materials which are to be used in this study.

A. SOIL

In this study, the soil under scrutiny is gathered close surat Gujarat where the road is going to pass, surat railway station to kamrej. The soil has an expansive surface zone because of level and lengthened molecule shapes that stick together when wet, avoiding typical waste procedures.

When it is wet it doesn't get to be dry soon. In like way, when completely dry, it is not soon wetted and shrinks causing breaks.

B. RENOLITH

Chemical stabilization consists of bonding of soil particles with cementing agent that is produced by the chemical reaction within the soil. The primary additive is a chemical in the process.

One of the numerous polymer chemical compounds which have gained peak recognition in the recent years is Renolith.

Renolith is the liquid polymer additive produced from by blending of locally produced synthetic chemical products.

It is a non-combustible, non-poisonous, non-toxic, non-corrosive, environmentally safe, eco-friendly, surface active agent and hydrophobic in nature.

Main advantage of the polymer chemical stabilization is that very small volume of the polymer additive is enough and the cost of ground improvement is less when compared to the other geotechnical processes.

V. TEST RESULTS

Various tests were performing for identify the Engineering property of soil as per Indian Standard are as below:

A. Properties of Clayey Soil with and without Additive

B. Liquid Limit

It is a well-known fact that water content has a significant effect on the engineering properties of soils. The results show that liquid limit is on higher trend which usually has a poor technical nature and is a low carrying capacity, towering and difficult compressibility in compaction while soil treated with Renolith shows decreasing values. This can be attributed to coagulation promoted by the chemical reacting with soil to make denser material reducing permeability. Renolith works to bond with the soil's silica and oxygen molecules to make the treated soil water resistant.

Sample	CL Soil	Renolith
Liquid Limit (%)	47.84	35.15
Sample	CL Soil	Renolith

Table 1: Liquid Limit

C. Plastic Limit

It is the moisture content at which the soil passes from the friable to the plastic state. The reaction with the soil is evident and reflection of it in the form of plastic limit is seen.

Sample	CL Soil	Renolith
Plastic Limit (%)	21.99	15.26
Sample	CL Soil	Renolith

Table 2: Plastic Limit

D. Free Swell Index

Swelling is the procedure of passage of water into the pores which causes swelling of the dirt volume. The measure of swelling is the proportion between height changes after immersion of the first original soil specimen is generally displayed as percent. Free swell index bears a unique relationship both with liquid limit and percent swell. There is a marginal decrease in free swell index is seen when Renolith is utilized in dosages with natural soil.

Sample	CL Soil	Renolith
Free Swell Index (%)	50	33
Sample	CL Soil	Renolith

Table 3: Free Swell Index

E. Water Content – Dry Density Relation using Heavy Compaction

Compaction is a procedure by which the air in the pores of the dirt uprooted by mechanical intends to accomplish the thickness necessities. Soil thickness is generally measured in dry unit weight. The dry unit weight extraordinary imply that the quantity of little pores and higher compaction.

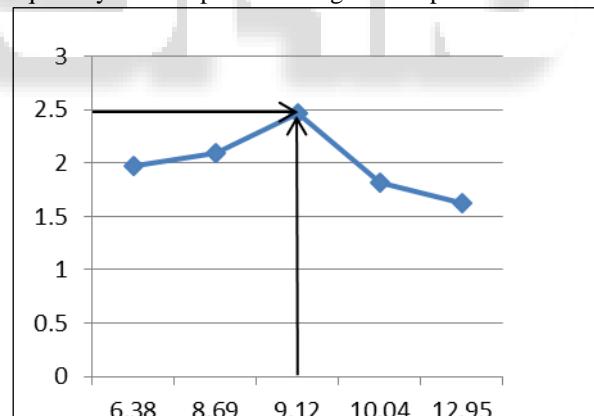


Fig. 1: Dry Density vs. Moisture Content

Natural Soil	
OMC (%)	MDD (gm/cc)
13.63	1.94
Narural Soil + Renolith	
OMC(%)	MDD (gm/cc)
9.12	2.465

Table 4: OMC and MDD

F. CBR Test Result with and without Additive

California Bearing Ratio (CBR) test is led to focus the CBR estimation of the specimens also; to assess the viable of soil test settled Renolith in obliged measurements according to the convention of zydex commercial enterprises, Vadodara. This test did in light of the standard system given in (IS: 2720

Part-16) (Bureau of Indian Standard 1979). CBR characterized as the proportion of the heap supported by the example at 2.5 or 5.0 mm entrance to the heap maintained by standard load at comparing infiltration level. All the whole specimens were tried for CBR taking into account soaked condition. The specimens were readied at most extreme dry thickness and ideal dampness substance of delicate soil. Repetition of tests indicated that CBR value at 5 mm penetration is higher than CBR value at 2.5 mm. Hence for pavement design CBR value at 5 mm penetration needs to be taken for design purpose.

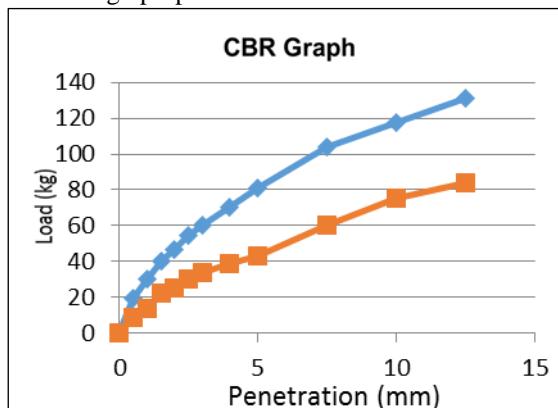


Fig. 2: Load vs. Penetration

CBR Value at St. Penetration 2.5 mm and St. load 1370 Kg		
Sample	CL Soil	Soil + Renolith
Load at 2.5 mm	30	54.39
CBR Value %	2.189	9.378
CBR Value at St. Penetration 5 mm and St. load 2055 Kg		
Sample	CL Soil	Soil + Renolith
Load at 5 mm	43	71.09
CBR Value %	2.092	3.459

Table 5: CBR Value

VI. CONCLUSION

Extent of the work was to propose compound adjustment for upgrading designing properties of natural utilizing by the addition of Renolith (6%) as a part of suitable measurements according to zydex businesses convention. Taking after conclusions are made on the premise of test outcomes:

It has been noticed that liquid limit of confinement abatements and plastic utmost qualities are declining yet the plasticity is diminishing contrasted with untreated soil.

The increment in most extreme dry thickness is an after effect of flocculation and agglomeration of inorganic soil with low versatility soil particles with chemical additives which is because of the consequence of starting covering of soils by chemical to shape larger aggregate, which thusly involve larger spaces.

Looking at CBR estimation of untreated CL soil and same treated with Renolith (6%) shows it ascends from 2.189% to 9.378%. This signifies that the quality of subgrade soil is enhanced consequently expanding the load carrying limit of pavement.

From economy perspective advantage connected with the usage of Renolith (6%) is alluring and backings the supportable improvement in road development.

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