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An Investigation into the Factors Influence Soil Properties and CBR Enhancement with Lime and Recron 3S Fiber

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ABSTRACT: When accessible soil is inadequate for intended use, soil stability is needed. Soil stabilization raises the soil's load-bearing capacity and reduces its compressibility. Civil engineers must understand soil permeability. How contaminated soils were in the past affects their hydrological stability. Soil stability reduces the ground's tendency to absorb water and other liquids. Rolling or sliding solid particles leads in a denser packing. Soil stabilization may reduce subgrade compressibility. Poor sub-grade soils may be handled two ways. In the first technique, infill material from a remote region may replace poor soils. Especially if the filler is from another system. Stabilization improves the soil's structure. There are several ways to stabilize. Early examples include cement, lime, asphalt, and other high-quality materials. California's rising population and low load capacity Soil erosion delays traffic compaction, lowering Bearing Ratio. This reduces the project's total cost. Study of this thesis will be done on soil samples from around Haryana to improve CBR using lime and Recrown 3S fibre. This will boost CBR. After a series of tests without Recron-3S fibre or lime, the admixtures increased the quality of both. Investigation results lead to important aims. "Gradation," "Atterberg limits," "optimum moisture content," and "maximum dry density" are determined for these soils. Lime and Recrown 3S fibre admixtures affect characteristics. These admixtures affect soil quality, and the study's conclusions are disputed in this regard. These admixtures' suitability for their intended soils has been determined. This research focuses on Haryana's most frequent soil types, such as Soil (low plastic silts from Bhiwani) and CL soil (low plastic soil from Rohtak). These findings only apply to a given soil and admixture, but they may be applied to any soil and admixture with equal properties. This inquiry will examine the soil's "grading," "Atterberg's limitations," "specific gravity," "OMC," "MDD," and "CBR value." Each admixture is combined with dry soil at 4%, 6%, and 9% by mass.

KEYWORDS: Soil Properties,CBR Enhancement, Lime, Recron 3S Fiber

I. INTRODUCTION

Economic, industrial, social, and cultural progress of a nation are all enhanced by the activities of those involved in the transportation industry. Transportation is critical to a region's economic growth and general development. It's a visual representation of people and things travelling from one location to another. In brief, transportation is required at all phases of production, from raw materials to finished goods, such as food, clothing and industrial items. The ability of a counter to be transported is a sign of its economic and social progress. Land transportation refers to moving people or products by roads, trains, or pipelines.

THE NEED FOR LOW LAND CBR DEVELOPMENT

Subgrade support for larger axle loads has increased as a result of advancements in technology. Consequently, their technical qualities are altered to fulfil the specifications of the design briefs. Whether or whether to take the next step is up to you.

i) Changes to the design ensure that the product meets the required quality requirements.
ii) Better materials are employed in lieu of the existing ones on the site, i.e.
iii) In order to satisfy the criteria of the design standards, a new improved material is created by altering the soil'squalities.

It's hard to impose constraints on design requirements in a situation like this, yet it's uneconomical to replace the whole soil when big amounts are involved. As a result, the only approach to improve these soils' engineering behavior is to stabilize them in a manner that increases their CBR.

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II. MATERIALSUSED

With the use of two kinds of soil stabilizing material, the CBR value of the three sub-grade soils studied in this research is increased. Based on their engineering properties, these sub-grade soils' index characteristics are established in accordance with the appropriate Indian Standard.

MATERIALS USED

SOIL

A mixture of Lime and Recron 3S Fiber was used to increase the CBR value of three different soils from three different locations in Haryana.

LIME

Hydrated Lime is the first stabilizer in the investigation. This study's lime was acquired from a local Bhiwani market. Lime's specific gravity is determined to be 2.1

Table 1: Composition of Lime

S.No.	Constituents	Percentage
1.	CaO	91%
2.	MgO	1.6%
3.	SiO_2	1.3%
4.	Mn_2O_3	1%
5.	$CaCO_3$	2%

RECRON-3S

Geo fiber is readily accessible for purchase. This fiber is made by polymerizing "pure terephthalic acid" using "mono ethylene Glycan" as a catalyst. As a result of the fiber's unique cross-section, it is more suited for anchoring and interaction with soil lime mix. The 125 gramme fiber used in the 12 mm long Recron-3S casing was packed with fiber. Sizes include 6mm, 12mm, and 24mm, however 12 mm is chosen here since it worked well in the previous scenario. The constant cross section ranged from 32u to 55um.

Figure 1: Recron 3S Fiber

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The following are some of the fiber's unique properties:

Table 2:Physical Properties of Recron 3S Fiber

Property	Values
Colour	White
Cut length	12 mm
Denier (D)	1.5
Tensile strength (Mpa)	600
Melting point (°C)	>250
Specific gravity	1.334
Equivalent diameter (µm)	32-55
Water absorbtion (%)	85.22
Acid resistance	Excellent
Alkali resistance	Good

III. EXPERIMENTAL INVESTIGATION

A thorough examination was carried out to determine the properties of the soil found in various places. This soil is characterized by "distance, liquid limit, plastic limit, and plasticity index." This soil and its compounds with various solvents, such as lime and Recron 3S fiber, were subjected to Proctor compaction testing.

These soils and their mixtures with stabilizers were subjected to CBR testing in a damp environment to determine their behavior.

TESTS CONDUCTED IN LABORATORY ON SOIL:

Among the tests carried out in this research were the following: -

1. Classifying soil type based on grain size distribution:
2. Atterberg's Limit Test
   a) In Casagrande's Test
   b) Limitation of the use of plastic
3. Specific Gravity Measurement for determining the density of an object.
4. a typical proctored exam
5. Test for CBR Value Determination Using an Unsoaked CBR Test.

IV. ANALYSIS OF RESULTS AND DISCUSSION

The soils and the two types of admixtures are tested in a series of trials in order to satisfy the goal of the study. They're arranged in the order in which they were collected and evaluated. The purpose of these calculations is to determine the impact of various admixtures on the CBR value.

- Result of a test on dirt.
- The soil and lime mixture tested positive.
- Soil – 12 mm Recron 3S fiber mix test results.

The distance is assessed by a highway engineer using a variety of methods, such as "Atterberg limits, filter analysis, proctor compaction testing, and CBR testing," among others. Mixed and inert soils, such as lime and Recron-3S fiber, were tested. A 4 percent, 6 percent, and 9 percent mixture of dry soil was used.

TEST RESULTS OF PARTICULAR SOILS

Three distinct kinds of soil from three different locations in the state of Haryana are featured in this study. The following table summarizes the various findings.

CLASSIFICATION OF THE SELECTED SOILS

Atterberg's Limits

In the table 3 and 6, the soil and soil mix parameters "liquid limit, plastic limit, and the plasticity index" are listed.

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Table 3: Atterberg's Limits

Index Characteristics	Experimental Values for Soil		
	Bhiwani Soil	Rohtak Soil	Jind Soil
Liquid Limit (%)	26.2	29.7	25.1
Plastic Limit (%)	20.3	22.2	25.1
Plasticity Index (%)	5.9	7.5	Non-Plastic

Table 4: Atterberg's Limit of Bhiwani Soil Mixes

Index Properties	Bhiwani soil						
	Soil Only	Soil+ 4%Lime	Soil+ 6%Lime	Soil+ 9%Lime	Soil + 4% Recron 3S Fiber	Soil + 6% Recron 3S Fiber	Soil + 9% Recron 3S Fiber
Liquid Limit (%)	26.2	24.3	23.15	21.7	24.6	23.2	21.4
Plastic Limit (%)	20.3	19.8	19.0	18.2	20.0	19.3	17.7
Plasticity Index (%)	5.9	4.5	4.15	3.5	4.6	3.9	3.7

Table 5: Atterberg's Limit of Rohita Soil Mixes

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Index Characteristics	Rohtak soil						
	Soil Only	Soil with 4%Lime	Soil with 6%Lime	Soil with 9%Lime	Soil with 4% Recron 3S Fiber	Soil with 6% Recron 3S Fiber	Soil with 9% Recron 3S Fiber
Liquid Limit (%)	29.7	27.65	25.45	22.68	25.52	23.55	22.36
Plastic Limit (%)	22.2	21.61	20..9	19.95	21.10	21.0	19.92
Plasticity Index (%)	7.5	6.04	4.55	2.73	4.42	3.55	2.44

Table 6: Atterberg's Limit of Jind Soil Mixes

Index Characteristics	Jind soil						
	Soil Only	Soil with 4%Lime	Soil with 6%Lime	Soil with 9%Lime	Soil with 4% Recron 3S Fiber	Soil with 6% Recron 3S Fiber	Soil with 9% Recron 3S Fiber
Liquid Limit (%)	-	35.32	32.7	30.1	24.27	22.82	20.6
Plastic Limit (%)	-	-	-	-	-	-	-

V. CONCLUSION AND SCOPE FOR FURTHER RESEARCH

The soil properties of typical Haryana soil samples have been analysed to determine whether lime and Recron 3S fiber may improve the soil's CBR. ML soil from Bhiwani, CL soil from Rohtak, and sand-silty-sand from Jind were all employed in the research (SM soils). Lime and Recron 3S fiber have been added to the soils in different proportions to see how they affect the soil's properties. The test findings lead to the following conclusion:

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CONCLUSION

a) Additional OMC may be obtained by incorporating these compounds into these types of soils, which reduces their high dry density. Increasing the amount of these compounds reduces high density and increases OMC.

b) Studies show that sand makes up 27.2 percent, 18.6 percent, and 52.7 percent of the soil in these three areas. This soil is classified as ML, CL, or SM. ML soil has a plasticity index of 5.9%, CL soil has a plasticity index of 7.5%, and SM soil has a non-plasticity index.

c) The addition these admixtures reduces MDD the most in CL soils, whereas it has the least effect on SM soils.

d) Lime and Recron 3S fibre diminish the soil's liquid limit and plastic index. The amount of PI and LL in the soil decreases as the amount of these admixtures in the soil increases.

e) Adding the same amount of these admixtures to CL, ML, and SM soils results in the greatest rise in OMC.

f) Both lime and Recron 3S fiber exhibit the same MDD behavior.

g) Adding Lime and Recron3S Fiber to soils increases the MDD of soils, which is different from the Omc of soil. The OMC rises as the amount of admixtures in the soil increases.

h) OMC was more variable with li me than with Recron 3S fiber, even though the amounts were the same.

i) Lime had a greater effect on soil MDD than Recron 3S fiber, despite the fact that the amounts were same.

j) The CBR values of all three soils were found to be improved by the addition of these admixtures.

k) CBR soils for CL soils and SM soil soils increase with the addition of Lime and Recron 3S Fiber.

l) Lime has been shown to have a greater effect on soil CBR than Recron3S Fiber in all three soils studied.

m) The findings of the research may be used to determine how much Lime and Recron 3S Fiber should be added to achieve the required CBR value.

n)As a result, both lime and Recron 3S fiber may be used to improve the soil structures commonly seen in Haryana.

SCOPE FOR FURTHER RESEARCH

- A variety of additional substances may be used to carry out the research.
- Proctor compaction and CBR tests are used to conduct the research.. Unconfined Compressive Tests and Tri-axial tests may be added to it.
- Each of the admixtures, lime and Recron3S Fiber, is tested independently in this investigation. A mix of Lime and Recron 3S Fiber may be used for this.
- Lime and Recron3S Fiber may be added in various amounts, such as 15%, 20%, 25%, etc., to perform the experiment.

REFERENCES

1)Arora K.R (2008) , Soil Mechanics and Foundation Engineering , Standard Publishers Distributers, New Delhi, 7th Edition
2) P. Purushothama Raj (2008) “Soil Mechanics and Foundation Engineering’’ published by Dorling Kindersley (India) Pvt. Ltd.
3) O’Flaherty C.A (1998), “ Highways,” Third Edition Volume 2 “Highway Engineering” Edward Arnold , London.
4)IS : 1498-1970, “ Classification and Identification of Soils for general Engineering purposes”
5) Third Edition Vol. 2,”Highway Engineering” Edward Arnold, London.
6) Arman, A.,andMunfakh, G.A. Stabilization of Organic Soils with Lime. Engineering Research Bulletin NO. 103, Division of Engineering Research, Louisiana State University, Baton Rouge, 1970.
7) Chou, L. Lime Stabilization: Ractions, Characteristics, Design and Construction. State of Art Report 5, Transportation Research Board, Washington, DC, 1987.
8) Eades, J.L, and Grim, R.E. Reaction of Hydrated Lime with Pure Clay Minerals in Soil Stabilization. Bulletin 262,

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Highway Reseach Board, Washington, DC,1960.
9) Little, D.N. Handbook for Stabilization of Pavement Subgrades and Base Course with Lime. Kendall/Hunt, lowa 1995.
10) Less, G.,Abdelkader, M.O., and Hamdani, S.K.(1982). Sodium Chloride as an Additive in Lime-Soil Stabilization. Highway Engineer, Vol. 29,NO.12,1982,PP.2-8
11) Thompson, M.R., and Eades, J.L. Evaluation of a Quick Test for Lime Stabilization. Journal of the Soil Mechanics and Foumdation Division, ASCE, Vol. 96. No. SM2,1970

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