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REVIEW STUDY OF LIME AND COIR FIBRE AS SOIL STABILIZING MATERIAL

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Abstract

The roll of soil is very crucial in construction work, since the soil is in direct contact with the structure it act as a medium of load transfer. The stability of any structure depend on the properties of soil. Therefore it is very necessary to improve the properties of soil like low permeability, low compressibility and high shear strength and ultimately the bearing capacity of soil must be enhanced. In this paper improvement of properties of black cotton soil is focused as it is very expansive type of soil. Construction of large structure on black cotton soil can lead to differential settlement of the structure which will cause failure of the structure. Lime is a cementations material which is used to improve the engineering properties of soil. The lime can importantly modify properties of high plastic soil i.e. Black cotton to some extent. The coir fibre used is nothing but a waste product from industry which is biodegradable product and have slow decomposing rate so can be used for long time stabilization. Various applications of stabilization of soil and methods of stabilization have also been discussed below. The effect of lime with soil and coir with soil is studied by using certain tests .the properties of virgin black cotton soil and black cotton soil combined with this material have been compared and it is seen that the combination of this material with soil significantly improvise the properties of soil. It is also seen that the use of these combination maintains the economy of work.

Index Terms: Black cotton soil, lime, coir fibre, Stabilization, etc.

1. INTRODUCTION

Black cotton soils have wide development in geographic area, western a part of Madhya Pradesh, part of Gujarat, and in some components of Madras. In Bombay, giant space is occupied by soils derived from the Deccan lure. Black Cotton soils absorb water heavily, swell, become soft and lose strength. These soils are simply compressible once wet and possesses a bent to heave throughout wet condition. Black Cotton soils shrink in volume and develop cracks throughout summer. they're characterised by extreme hardness and cracks once dry .These properties build them poor foundation soils and earth construction material. the soundness and performance of the pavements are greatly influenced by the sub grade and mound as they function foundations for pavements. For developing an honest and sturdy road network in black cotton soil areas, the character of soils shall be

properly understood. On such soils appropriate construction practices and complicated strategies of style ought to be adopted. Clay soils exhibit typically undesirable engineering properties. Theyhave a tendency to possess low shear strength that reduces any upon wetting or alternative physical disturbances. They can be plastic and compressible, expand once wetted and shrink once dried.

Soil sorts expand and shrink greatly upon wetting and drying, thereby, exhibiting some terribly undesirable options. For these reasons, clays are typically poor materials for foundations. Their properties might have to be improved upon in some cases by soil stabilization. Stabilization is that the method of mixing and combination materials with a soilto improve the properties of the soil. the method could embrace the mixing of soils to achieve a desired gradation or the

blending of commercially offered additives that may alter the gradation and improve the engineering properties of soil, therefore creating it more stable.

2.1 MATERIALS

2.1 Black cotton soil

Black cotton soil is one among major soil deposits of Asian nation. They exhibit high rate of swelling and shrinkage once exposed to changes in wetness content and therefore are found to be most troublesome from engineering consideration. Chemically black soils consist of lime, iron, magnesium, alumina and potash but they lack in nitrogen, phosphorus and organic matter. Because of their capability to carry water, they're appropriate for the cultivation of cotton therefore referred to as black cotton soil.



Fig. 1 Black Cotton Soil

2.2 Lime

Lime is used as excellent soil stabilizing material for highly active soil which undergo through frequent expansion and shrinkage. Lime acts straight off and improves varied property of soil like carrying capability of soil, resistance to shrinkage, during moist condition, reduction in plasticity index, increase in CBR value and subsequent increase within the compression resistance with the rise in time. Lime stabilization generate a long term pozzolanic strength gaining reaction between lime and silica and alumina minerals solubilised at high pH from the clay, forming calcium silicates and calcium aluminates.



Fig. 2 Lime

2.3 Coir fibre

Coconut fiber may be a natural fiber extracted from the husk of coconut.

Coconut coir fibre can be collected from any coir industry as a waste product. The fibres to be collected can be ranged from 10mm to 30mm or can be chopped around the specified size. The fibres should be uniformly chopped so that mixing would be easier. Lengthier fibre can make mixing and moulding difficult.



Fig.3 Coir Fibre

2. METHODS OF STABILIZATION

Followings are the methods of soil stabilization:

2.1 Mechanical stabilization

Mechanical stabilization is achieved by compaction of interlock of soil aggregate particles. The grading of soil aggregate mixture must be such that a dense mass is produced when it is compacted. Uniformly mixing the material and compacting the mixture can accomplished by mechanical stabilization. Soil compaction is the process of increasing the density of soil by packing the particle close together causing the reduction in the volume of air.

2.2 Chemical stabilization

This method deals with improving engineering properties of soil by adding chemical or other such material and it is generally cost effective. This additives react with soil usually clay mineral, with subsequent precipitation of new and insoluble materials, which bind the soil together. Considering the cementing agents, the materials often used are Portland cement, lime, fly ash, sodium silicate, etc.

2.3 Coir Fibre Stabilization

This involves the addition of coconut coir fibre to soil so as to improve its engineering performances. Coir fibre is totally inert and also biodegradable. It has a very slow decomposition process therefore it can increase the strength of various road building elements.

Firstly, the optimum dose of lime was determined then by taking the optimum dose of lime different tests were conducted by the varying the percentage of coconut coir fibre.

3. LITERATURE REVIEW

3.1 Ankit Singh, Md Faizan, Devashish Pandey, Rehanjot Singh(2013) have studied the effect of lime on black cotton soil and have observed:

A reduction in the plasticity index: The soil suddenly switches from being plastic (yielding and sticky) to being crumbly (stiff and grainy).

An improvement in the compaction properties of the soil: The maximum dry density drops, while the optimal water content rises, so that the soil moves into a humidity range that can be easily compacted. This effect is clearly advantageous when used on soils with a high water content.

Improvement of bearing capacity: In most cases, two hours after treatment, the CBR (California Bearing Ratio) of a treated soil is between 4 and 10 times higher than that of an untreated soil.

3.2 SaiHarshita(2018) have used lime to stabilize soil and observed that: Addition of Lime significantly improves the index properties, compaction and strength characteristics of clay Soil. The liquid limit and plastic limit of the soil decreases with the addition of Lime which indicates a desirable change as the soil mixed with Lime mix can gain strength at an early stage than the virgin soil with the change in the water content. The shrinkage limit of the soil increases with the addition of Lime. Addition of Lime brings in an improvement in the compaction parameters of the study soil, by increasing the maximum dry density of the soil with decrease in the corresponding values of optimum moisture content. The unconfined compressive strength of the soil increases upon the addition of Lime. A curing period of 1 day is observed to yield the maximum enhancement in the unconfined compressive strength.

3.3 Devdatt Shukla, ShikhaRajan, A.K. Saxena, A.K. Jha(2015) used coir fibre to improve the properties of soil and observed:

The addition of Coconut coir Fibre into the Expensive soil has changed the compaction parameters. The OMC of the Expensive soil has decreased and the maximum dry density (MDD) increased with the addition of Coconut coir Fibre. The soaked CBR values have also increased significantly with the addition of Coconut coir Fibre content. The addition of 1% Coconut coir Fibre into the Expensive soil, increase the CBR values from 3.9 % to 8.6 %. The industrial waste like Coconut coir Fibre has a potential to modify the engineering behaviour of Expensive soil and to make it suitable in many geotechnical application.

3.4 Pooja Upadhyay, YatendraSingh(2017) observed that:

The cohesion and angle of friction can be significantly improved by using coir fibre.

Coconut coir can be used as reinforcing material as shear strength and unconfined compressive strength parameter of soil increased by using coir fibre.

3.5 S. Muthu Lakshmi, S. Sasikala, V. Padmavathi, S. Priya, V. Saranya concluded that:

With increasing percentage and length of CCF, OMC was found to increase and MDD was found to decrease.

There was nearly 150% growth in the UCS value after reinforcing the soil with CCF.

The CBR value of reinforced soil was observed to be 4 times greater than the unreinforced soil.

3.6 Kavish S. Mehta, Rutvij J. Sonecha, Parth D. Daxini, Parth B. Ratanpara, Kapilani S. Gaikwad

Lime-stabilization of geo-materials by producing cohesive materials in the soil increases the strength and decreases materials plastic properties. Lime-stabilization of geo-materials by producing cohesive materials in the soil increases the strength and decreases materials plastic properties, This is why these materials can be used for projects where high strength and high performance materials are desirable. The clay content of lime-stabilized materials can affect the strength of the materials. The clay-lime compound provides the cemented material in soil. Though addition of lime gives good result and can be used for large projects.

4. CONCLUSION

- I. From the above study it is observed that using lime and coir fibre can improve the properties of black cotton soil to certain extent.
- II. We have observed that it is necessary to find out the quantities of lime and coir fibre at which both can work together to improve the necessary properties of soil.
- III. The quantities of the material should be optimum, so that economical work can be done.
- IV. Lime is a material which reacts with the soil very quickly and give results within 24 hours of mixing.
- V. Coir fibre is a natural, eco-friendly, cheap material having very low decomposing rate can be used to achieve a long term economical stabilization process

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