STABILIZATION OF BLACK COTTON SOIL BY USING COCONUT COIR FIBER AND LIME

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ABSTRACT

Use of waste material and natural fiber for improving soil property is advantageous because they are cheap, locally available and eco-friendly. The development of any country mainly depends on the transport system, trading etc. One of the major transport systems to connect all the villages and cities are roads. The economic design of pavement results in saving countries economy. The construction of roads in most of the places across the world faces major problems due to work sub grade soil. One such weak sub grade often encountered is black cotton soil. Due to the presence of clay mineral exhibits large swelling and shrinkage under the wet and dry conditions and due to which the vertical movement is experienced in the pavement and there by the failure of pavement takes place. The total load coming on to the pavement should be properly dispersed through the sub grade. As the black cotton soil is having less bearing capacity the strength of the subgrade is improved by using the locally available abundant waste materials like coconut coir. In the present project an attempt is made to find out the improvement of strength in black cotton soil mixed with varying percentage of coconut coir and lime by conducting a series of Unconfined compression strength (U.C.C) and California bearing ratio (C.B.R) tests.

INTRODUCTION

Expansive soils because more damage to structures, particularly light buildings and pavements, than any other natural hazard, including earthquakes and floods. Engineers are continually faced with maintaining and developing pavement infrastructure with limited financial resources. Traditional pavement design and construction practices require high-quality material for fulfilment of construction standards. In many areas of the world, quality material is unavailable or in short supply. Due to these constraints,

engineers are often forced to seek alternative design using substandard materials, commercial construction aids, and innovation design practices.

OBJECTIVE

The objective of the project is to minimize the cost of construction material and also save our environment for our future generation. So we are using the waste material from natural by-products, here we added coir fiber for improve the soil.

The different ratio of coir fiber mix with soil where the properties of soil was compared. CBR and UCC tests improved the soil properties in the mixed soil condition.

NEED FOR STUDY

The life time of pavement depends upon the subgrade soil strength. If subgrade strength is less, it may lead to the propagation of cracks on the pavement surface. The selected paving coir fiber mixed with soil must have the ability to provide reinforcement action and thus increases the subgrade soil strength. Also improves the CBR value.

MATERIALS USED

The waste materials are using for Soil Stabilization. These type of materials are using given below.

Black Cotton Soil

Coconut Coir Fiber

Lime

BLACK COTTON SOIL

Black cotton soil occurs mostly in the central & western parts and covers approximately 20% of the total area of India. Black cotton soil represents a well-known category of problematic from civil engineering point of view. These soils contain fine clay particles. This property induces a great affinity to water. They exhibit large volumetric change on shrinkage and swelling if the moisture content changed. During this process a great extent of cracks are formed.

COCONUT COIR FIBER

Coconut fibre is extracted from the outer shell of a coconut. The common name and plant family of coconut fibre is Coir

Cocosnucifera and Arecaceae (Palm) respectively. Coconut coir Fibre is obtained from the husk of coconut and belongs to the group of hard structural fibres. The fibrous husks are soaked in pits or in nets in a slow moving body of water to swell and soften the fibres.

LIME

Lime is a calcium containing inorganic material in which carbonates, oxides and hydroxides predominate. It is also the name of the natural mineral CaO which occurs as a product of coal seam fires and in altered limestone xenoliths volcanic ejecta. The word lime originates with its earliest use as building motor and has sense of sticking or adhering.

BACKGROUND OF THE PROJECT

Coir or coconut fiber belongs to the group of hard structural fibers. It is an important commercial product obtained from the husk of coconut. The coir fiber is elastic enough to twist without breaking and it holds a curl as though permanently waved. Shorter mattress fibers are separated from the long bristle fibers which are in turn a waste in the coir fiber industry.

STANDARDPROCTOR COMPACTION TEST

The modified proctor compaction test of soil was determined as per "IS 2720: Part 7-1980 Methods of test for soils- Part VII: Determination of water content – Dry density relation Using Light Compaction".

CALIFORNIA BEARING RATIO TEST

In the CBR tests on the soil is done as per "IS 2720: Part 16:1987**.**
Methods of test for soil-part16:Laboratory Determination of CBR". Test were carried out for

OMC condition

Soaked condition

SPECIFIC GRAVITY

The specific gravity of the soil (unstabilized) was determined as per "IS 2720: part -3/sec 1-1980, IS 2720: part 3/sec 2:1980. Methods of test for soil: part determination of specific gravity section 1 fine grained soil".

SIEVE ANALYSIS

The sieve analysis of soil was determined as per "IS 460: Part 1:1985 specification for test sieves".

CONSISTENCY TEST

The liquid and plastic limit of the soil was determined as per "IS 2720: part 5:1985 Methods of the test for the soils-part 5: Determination of liquid and plastic limit".

SHRINKAGE LIMITS

The shrinkage limit of the soil is determined as per "IS 2720: Part 6:1985 Methods of the test for soils: Part 6 determination of shrinkage factor".

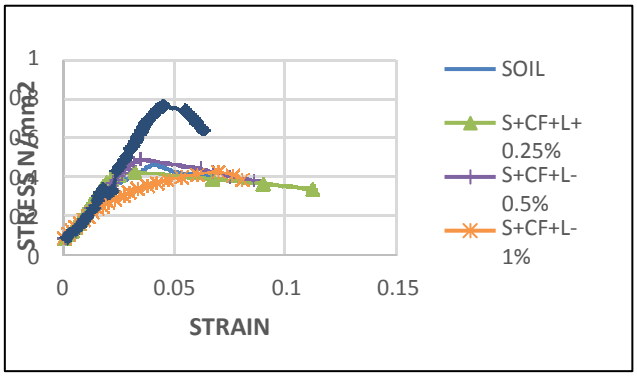
FREE SWELL INDEX

To find the free swell index of the soil as per "IS 2720: Part XL-1977 Methods of test for soils –part XL: Determination of free swell index of soils".

UNCONFINED

COMPRESSIVE STRENGTH TEST

In this, unconfined compression test of the soil was determined as per "IS 2720: part 10-1991 Methods of test for soils: part 10 determination of unconfined compression strength".



ADVANTAGES OF COIR FIBRE

It's a renewable resource and CO2 neutral material.

The fibre is abundant, non-toxic n nature, biodegradable, low density and very cheap.

The fibre has a high degree of retaining water and also rich in Mironutriants.

The fibre instead of going to waste are explored for new user which in turn provide gainful employment to improve the standard living condition of individuals.

COIR FIBRE	UNCONFINED COMPRESSIVE STRENGTH kPa		
	3 days	7 days	28 days
0%	0.159	0.35	0.425
0.25%	0.329	0.403	0.45
0.50%	0.361	0.444	0.490
0.75%	**0.458**	**0.460**	**0.765**
1%	0.298	0.420	0.426

RESULTS

0.75% fiber, 5% lime with soil for 3 days = 0.458 kPa.

0.75% fiber, 5% lime with soil for 7 days = 0.460 kPa.

0.75% fiber, 5% lime with soil for 28 days = 0.765 kPa.

CONCLUSION

The OMC of soil-coir mix increases with increasing the percentage of coir fiber.

CBR and UCC values of soil-coir fiber mix increases with increasing percentage of fiber.

With the addition of 5% lime and 0.75% coconut coir fiber which increasing UCC values.

Maximum improvement in U.C.C and C.B.R values are observed when 0.75% of coir is mixed with the soil.

REFERENCE

Mittal Shelly and Singh R. R. (2014). Improvement of local subgrade soil for road constuction by the use of coconut coir fiber. IJRET: International Journal of Research in Engineering and Technology, Volume: 03 Issue: 05 | May.

IS 2720: Part V: 1985 Methods of test for soils – part V: Determination of Liquid and Plastic Limit.

IS 2720: Part VIII: 1983 Methods of test for soils – part VIII: Determination water content – Dry Density Relation Using Heavy compaction.