EFFECT OF POLYPROPYLENE FIBER ,COIR AND NON WOVEN GEOTEXTILE ON SUBGRADE SOIL

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***Abstract*—Road should be constructed on strong soil deposits and the behaviour of the road surface depends on the strength of the fill material and the subgrade below it. The performance of a road largely depends on properties of subgrade soil. In order toimprove the performance of road on such soil coir textile has scope as reinforcement. The main objective is to increase stability or strength of soil and to reduce the construction cost. Subgrade soil supports the pavement and also serves as a foundation to carry load. For this an appropriate CBR value is required for subgrade soil in order to ensure adequate strength to support the imposed traffic load regardless of adverse conditions such as high rainfall, flooding. In this project polypropylene fibres of varying percentages added to the total weight of soil and CBR test should be conduct**

INTRODUCTION

Roads are the essential component for the social as well as economic upliftment of a country.. Around 20% of land area of our country is covered with the kind of soils having low shear strength and California Bearing Ratio (CBR) values. The pavement which is constructed over such soils deteriorates significantly under heavy wheel load which leads to substantial enhancement in maintenance and construction costs. To overcome such situations the soil reinforcement techniques have to be resorted to as alternative and removal of soil might lead to heavy monetary liability. On this work, an attempt was made to have a look at the outcomes of non-woven synthetic geotextile at the energy conduct of the soil. The geotextile was placed as multiple layers from the top of mould at exceptional depths in soil subgrade. Geotextiles are Ease of use those fabric used in geotechnical applications, which includes avenue and railway embankments, earth dikes, and coastal protection structures, designed to perform one or more basic capabilities consisting of filtration, drainage, separation of soil layers, reinforcement, or stabilization. It protects from migration of small gravels & sand aggregates.

A geotextiles crafted from artificial or herbal fibers related to soil thin portions. It improves soil characteristics consisting of Friction or motion restraint, aid of masses and modifications in bearing failure aircraft.

It's miles necessary to construct pavements on unfastened soil or expansive soil, for making roads on a massive . However, these unfastened and expansive soils can be modified by using using herbal resources which makes the soil more durable, increases the energy of the soil, makes the process extra environment friendly, and additionally reduces the general value of creation. Among all the natural sources, presently coir fibre is turning into greater popular as a reinforced fabric because of its clean availability, exact wearing resistance, and longer durability. India is the biggest producer of coir which is a flexible natural fibre extracted from the husk of coconut in a considerable quantity. The software of polypropylene fibers can be taken as an answer for several geotechnical engineering troubles because of their availability, low price and durability. Reinforcing flexible pavements the use of distinct forms of geosynthetics is a technique which are extensively used to increase the sturdiness, lessen the upkeep fees and guarantee the high performance in the course of the provider existence.

OBJECTIVE

To determine the engineering properties of soil.Increase the durability and strength of road pavement.To enhance load carrying capacity and improve the performance of unpaved roads.To investigate role of geotextile in road construction and to compare the cost effectiveness. Maintaining the Integrity of the Specifications

MATERIALS

I. SOIL

The laterite soil is formed under conditions of high temperature and heavy rainfall with alternate wet and dry periods ,which leads to leaching of soil.The subgrade should posses sufficient stability under adverse climatic and loading conditions.

TABLE 1.PROPERTIES OF SOIL

Properties	**Values**
Specific Gravity	1.96
Liquid Limit	75.43
Plastic Limit	35.29
Shrinkage Limit	
California Bearing Ratio	8
Maximum Dry Density	
Optimum Moisture Content	

Fig.1 Laterite soil

2. **POLYPROPYLENE FIBER**

Strong-quality chemical resistance to acids and alkalis, strong abrasion resistance, and resistance to vermin and pests are all characteristics of polypropylene fibre. Its minimal moisture absorption enables for quick moisture movement.

TABLE 2. PROPERTIES OF POLYPROPYLENE

Properties	Values
Unit weight (gr/cm$^{3)}$	0.9-0.91
Reaction with water	Hydrophobic
Tensile strength (MPa)	300-400
Elongation at break (%)	100-600
Melting point (^{0}C)	175
Thermal conductivity (W/m/K)	0.12
Length (mm)	6

Fig 2. Polypropylene fiber

*3. **COIR FIBER***

A natural fibre called coir is taken from the coconut's outer husk. One natural fibre that is resistant to harm from saltwater is coir, which is comparatively water resistant. The combined influence of natural fibre transforms the behaviour of soil into ductile behaviour. The coir fibre is obtained from the Government of India's coir board compound in Kalavoor, Alappuzha.

TABLE 3 Properties of Coir Fiber

Properties	Value
Fiber Length	10–30 cm
Fiber diameter	0.15-0.35mm
Tensile strength	300-800 MPa
Moisture content	10-15%
Density	1.2-1.4 g/cm^3
Water absorption	40-50%
pH	5.5-6.8

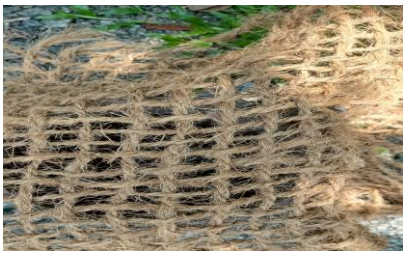

Fig.3 Coir fiber

4. NON WOVEN GEOTEXTILE

Non-woven geotextiles are a subcategory of geotextile.That are made of synthetic fibres that are orientated in sheets or nets and are created mechanically or chemically. Geotextiles that are non-woven exhibit great elongation and permeability. The separation, drainage, and filtration ability is higher than the tensile strength, which is not overly strong.

TABLE 4. PROPERTIES OF NON WOVEN GEOTEXTILE

Properties	Value
Mass (g/mm)	200
Thickness ,t (mm)	1.78
Apparent opening size,AOS(mm)	0.11
Permittivity,(s^{-1})	1.98
Ultimate tensile strength,T_{ult} (kN/m)	9.28 and 7.08

FIG.4 NON WOVEN GEOTEXTILE

METHODOLOGY

DATA COLLECTION

The soil used for the trials was taken from the site of the Vaikom- Kottyam road construction.The job uses soil that was transported from this location.We used non woven geotextile,coir geotextile and polypropylene fiber to enhance the soil's engineering qualities .Indiamart Alappuzha provided the polypropylene fiber for the trial study.Polypropylene fiber measuring 12mm long is used here,which is 100% virgin synthetic fiber.The needed type 1 non woven geotextile 120 GSM thickness was gathered from Indiamart.

EXPERIMENTAL PROCEDURE

1.Specific Gravity - The phase relationships of soils, including the void ratio and the level of saturation, are computed using the specific gravity of soil solid. The density of the soil solids is determined using the specific gravity of the soil solids.

2.Liquid limit-. By dropping 30g of soil sample into a brass cup and watching for the separation to disappear, the liquid limit is determined. From the sample, the soil's water content is determined.

3.Plastic limit-. Plastic limit was established by physically rolling out a little ball of moist plastic soil sample into a thread form after continuously remoulding it.Plasticity of soil sample is determined.

4.Shrinkage limit-Soil samples for shrinkage limit tests is prepared. A soil sample whose moisture content exceeds the liquid limit is placed in a shrink container and cut with a straight edge. The sample is then dried in an oven. Volume changes has been determined.

5.Proctor Compaction Test- Compaction is reducing air voids from the soil mass through densification.Inthe test,soil sample is compacted using rammer falling at a certain distance into soil filled mould.The mould is filled with soil sample as 3 layers .Each layer is subjected about 25 blows of rammer .The maximum dry density and optimum moisture content determined.

5.California Bearing Ratio Test-The laterite soil sample was collected from Vaikom - Kottayam rural road construction site. We sampled and sieved five kilogrammes of the soil sample.The retained soil samples are weighed and baked for at least 24 hours to dry them out. Now, the 12 mm polypropylene and coir fibres have been taken into account. The amounts of coir and polyproplene fibre used in the blend were 0.50, 0.75, and 1 percent, as opposed to the oven-dried laterite soil sample.The process begins with the preparation of four soil samples, each of which is made up of soil mixed in doses of 0.50, 0.725, and 1% respectively. These samples are numbered sample 1, sample 2 and sample 3.Relatively same procedure has been taken into account for non woven geotextiles. Use a 1000 cubic metre volume cylinder. To make the mould easier, a second handle is offered.And the CBR value determined .

Fig 5.California bearing ratio test machine

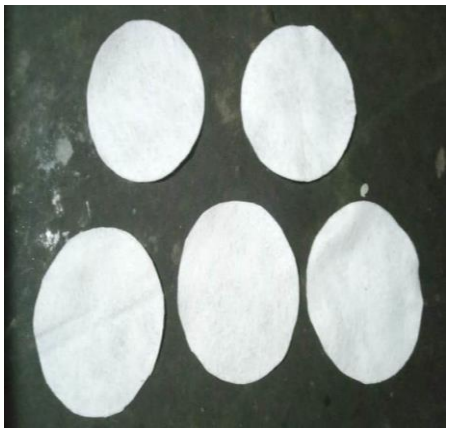

Fig.6 Samples for test procedure

RESULT AND DISCUSSION

The CBR test were carried out and determined the variation in load carrying capacity The different coir percentages were evenly dispersed in equal layers in the mould before being compressed. The appropriate quantity of oven-dried soil was taken and well mixed with water matching to its ideal moisture content in CBR mould, which has a 150 mm diameter and 175 mm height with a detachable perforated base plate.To ascertain differences in cbr value, tests were performed on soil samples containing 0.5%, 0.75%, and 1% polypropylene.

It has been discovered that while 0.25% polypropylene is added to the soil, the CBR value rises from 8.7% to 11.13%. Coir was added to this sample, increasing the CBR value by 6.37%. However, the CBR value increased somewhat after the addition of nonwoven geotextile. The soil's CBR value was raised by adding 0.5%, 0.75%, and 1% polypropylene. However, the CBR value decreased concurrently with the addition of the geotextiles.

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