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STABILIZATION OF SLOPES OF SANDY SOILS BYUSING GEOSYNTHETICS

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ABSTRACT. This paper intended on the interactive performance of geo-synthetics in slope stabilization of non-cohesive soils. Presently, geo-synthetics are performing crucial role in geo-technical uses for reinforcing of soils for slope of stabilization, soil reinforcement for foundations, R E walls for highway and flyover construction etc. Usually, cohesion less soil is ideal for backfills of the embankments as of its exceptional drainage properties, at a low-level hydrostatic pressure built-up on slopes and excessive internal resistance owing to friction and interlocking. To research this property of geo-synthetics, relative density and shear box tests are done on the soil by varying geosynthetics for assessment of the shear parameters of sample. The mosquito reinforcement net as reinforcement on cohesionless soils, improvement in the angle of internal friction of the soil was observed by twenty-two percentage that the shear strength to be improved by 26.5%. So, the soil's lateral load resistance or load transfer capacity improved to prevent the slope failure thereby saves the entire structure.

Keywords: Interaction, Geosynthetics, Reinforcement of soil, Direct Shear Test, Back Fills,

1. INTRODUCTION

In places where the tensile load transfer capacity of the soil is poor, in the era of modern space and land limitations, rapid industrialization and fierce competition in construction speed, soil reinforcement technology is adopted in the arena of geotechnical engineering. Technically, these soil-reinforcement techniques are used to strengthen the cohesion and frictional angle of the soil. Here, the excellent tensile strength characteristics of geosynthetics are used to improve the shear parameters of the soil. can provide different types of improved synthetic flooring materials. They are geotextiles, geomembranes, geogrids, and geo-networks. We adopted mosquito nets as a reinforcing material to study changes in the shear strength parameters of sandy soils (non-cohesive soils), because mosquito nets and geosynthetics have almost the same characteristics, lower cost and Easy to use. get. In soil reinforcement, the interaction between the soil which was good at compressive strength and the reinforcing material which was good at tensile strength of the geosynthetic material. Therefore, the shear box test is used to study the sliding mechanism of the soil on this geosynthetic reinforced material.

2. LITERATURE REVIEW

J. Chetan Anand et al. As the population grows, so does the number of construction activities, prompting this experimental investigation on a black cotton soil to strengthen its properties by adding admixtures such as quarry dust and lime. It was observed that when expansive soil is partially replaced with quarry dust at a rate of 10% and lime at a rate of 6%, the qualities of the soil improve.

Srinivasa Reddy K et al. Now days the construction on problematic soils like expansive soil is challenging task. Bagasse Ash is a fibrous waste product of sugar cane industry. The Different

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI. Published under licence by IOP Publishing Ltd 1 dosage of bagasse the taken soil sample and the properties was evaluated using physical and engineering properties tests namely, Moisture content, specific gravity, consistency limits , compaction, unconfined compressive strength etc.

T.V Sai Krishna et al. - Soil stabilization can be accomplished in a variety of methods. The main objective of soil stabilization to strengthen the geotechnical characteristics of the soil and the carrying capacity of subgrade soil. On the stabilization of soil in flexible pavements, geo grid is the most commonly utilized stabilizer. Geo grids are primarily utilized for soil reinforcement in a variety of building projects.

D.V.K.Sravan et al. In this project, they used admixtures like pond ash & lime to make expansive soil more beneficial. Changes in diverse soil qualities necessitated the use of the same combined quantities of pond ash and lime (10%, 15%, and 20%). As a result, we make unused waste product as useful one which was obtained from the thermal power plant.

D. Srinadh et al. Soil stabilization is a new technique for soil modification that is used in present scenario to fulfill the industry the needs. stabilizing the soil is the term for the approach we apply. As we all know, some soils are unsuitable for construction. After adding the admixtures Soil should be tested by some basic strength determining tests like U.C.C and CBR and also some basic tests like Proctor tests, consistency limits and IS sieve analysis etc. carried out in order to test the improved strength of the soil.

Satya Ravi Teja et al. Contamination of soil occurs due to presence of heavy toxic metal and combination of oil, petroleum, Greece where the automobile repair works done, so that the soil is weak in strength... The main aim is to strengthen the contaminated soil wherever present and these results will help as future reference. The laboratory tests which conducted are Particle Size Distribution, Free Swell Index, Specific gravity, Standard Proctor Test, Atterberg limits, and Unconfined Compressive Strength (UCC).

3. MATERIALS AND METHODS

3.1 Materials

In the present study the cohesion less soil is extracted from near the Krishna River, Guntur, Andhra Pradesh to conduct suitable tests to determine engineering properties of soil with and without interaction with mosquito net as a reinforcement material. Relative density test has been performed to know the degree of compaction or state of compactness of sandy soil

$e_{max} = 0.693$, $e_{min} = 0.513$ and $e_{nat} = 0.598$

Based on the above test results, Relative density of the cohesion less soil obtained was 52.7% and the densest state of the sandy soil is moderately dense. It is the inward atomic fascination which opposes the crack or shear of a material.

IOP Conf. Series: Materials Science and Engineering

1197 (2021) 012081

Table 1. Properties of sand				
S. No.	Property	Obtained Results		
1	Water content (%)	4.25		
2	Specific Gravity	2.475		
3	Plasticity index (%)	Non plastic		
4	Free swell index (%)	0		
5	Relative density (%)	52.7		
6	C Value (kN/m ²)	0		
7	φ Value (degrees)	22		

 Table 2. Grain size analysis

D ₆₀	D ₃₀	D_{10}	Cc	Cu
0.64	0.43	0.26	1.11	2.46

Table 3. Classification of soil







3.2 Mosquito net

Mosquito net was less expensive and easily available material than other geo-synthetics, the mosquito net was chosen as our testing material for this project. It's made of polymeric material and has a high tensile strength.

4. TESTING APPARATUS AND PROCEDURE

4.1 Direct shear apparatus

It is having a setup of shear box which is having dimensions (60mm X 60mm X 25mm) and a lower and upper box.



1197 (2021) 012081

Figure 2. Mosquito net attached to wooden block

4.2 Direct shear test procedure

Before shear shackle to its maximum capacity, water is launched to the soil sample. Soil specimen was arranged in three layers in the upper box using equal blows with gentle tapping on the top. The load is applied vertically on the top using a loading arm that is mounted to the device vertically and functions as the normal stress. Three different normal stresses of 0.7, 1.4, and kg/cm² are used to test the sample. During the shearing process, the vertical load is kept constant. The proving ring measured the applied load, while the dial gauge monitored horizontal displacement.



Figure 3. Shear box with Wooden block arrangement inside.

5. SCOPE OF WORK

In the present study, reinforced and unreinforced sandy soil properties were identified. However, by substituting other soils, such as clayey soils and gravel, this work can be extended. Mosquito net was employed for soil reinforcement in this study, however alternative materials such as polymeric fibres and natural geosynthetic materials like fibre, coir and jute also can be used as reinforcing material.

6. RESULT AND DISCUSSION

The following results has been observed, i.e.

Property	Obtained value				
Specific gravity	2.475				
Relative density (%)	52.7				
Grainsize analysis	Classified as SP				
emax (loose state)	0.693				
emin (dense state)	0.513				
Void ratio (natural)	0.598				
Bulk density and Optimum moisture content	14.8 kN/m ³ 4.4%				
Table 5. Engineering properties of soil					
Property	Obtained value				
Permeability	$5.12*10^{-4}$ cm/s				
Max. Shear strength (without using	net) 0.997 kg/cm^2				
Max shear strength (with using ne	1.261 kg/cm^2				

Table 4. Physical properties of soil

From the above results that the net is placed 2.5cm above the soil's surface. It is clearly understood that improvement in shear parameters. The slope of the graph between normal and shear stress without utilizing mosquito net, was found to be 25.4% in the direct shear test.



Figure 4. Normal vs shear stress plot without placing mosquito net



Figure 5. Normal stress v/s shear stress plot with placing mosquito net

Internal friction of soil evaluated with reinforcing material as mosquito net is 31° , and it is almost increased 22%. Improved shear parameters have a direct impact on the soil's shear strength, which increases significantly. These soil reinforcement techniques can be used to strengthen weak soils in construction projects and other situations when weak soils are the only alternative. Construction activities are based on soil.

We estimated the soil shear stress at 0.7 Kg/cm², 1.4 Kg/cm², and 2.1 Kg/cm², as well as the soil shear strength using the Coulomb–Terzaghi equation:

 $s = c + \sigma$. tan ϕ Shear strength of sample prior to reinforcing: $\rightarrow S1 = \sigma$. tan 25.4



Figure 6. without reinforcement and with reinforcement comparsion

Shear strength of sample prior to reinforcing:

 $\rightarrow S2 = \sigma. \tan 31$ Increase in the shear strength of the sample is obtained by: S2 - S1 $= \frac{S1}{\frac{\sigma.\tan 31 - \sigma. \tan 25.4}{\sigma.\tan 25.4}}$ = 0.265

Utilizing mosquito net as layer at 2.5 cm from the top face increases soil shear strength by roughly 26.5 percent (fig.6). As a result, it is advised that this reinforcement approach be used in various construction activities to increase the soil's carrying capacity.

7. CONCLUSION

In the study of soil geo-synthetic interaction, clearly understood noticed that, there is a considerable variation in sliding friction of sandy soil, which clearly impacts the shear parameters, was detected by conducting direct shear box tests with sandy soil.

From the past studies, soil reinforcement with geo-synthetic interaction is displayed by conduction of direct shear box test with sandy soil, it was observed that a substantial difference in the sliding friction of soil which directly disturbs the shear parameters of the sand. By utilizing the mosquito net, the soil's sliding friction is boosted by 22%, which has a direct impact on the soil's shear strength, which increases by 26.5 percent. As a result, the soil can safely transfer the loads and avoid failure.

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