



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 9, September 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

Ingeniunity of Soil Reinforcement Methods against Scour Failure

Sathya .M

Soil Mechanics and Foundation Engineering, Solaimalai College of Engineering, Madurai, India

ABSTRACT : The main aim is to study the behavior of various soils such as clay and sands to find new ideas and methods to enhance the overall slope stability around embankments and to strengthen abutments using soil reinforcement methodologies. In this study I will exploit the shear strength, tensile strength, and bearing capacity behavior of various soils to draw to a conclusion on a more versatile, reliable, cost effective method to reduce geotechnical related accidents such as landslides that are results of overloading or poor engineering techniques.

KEYWORDS : slope stability, shear strength, tensile strength, bearing capacity, versatile

I. INTRODUCTION

The concept of soil reinforcement is an ancient technique and is demonstrated abundantly in nature by animals, birds and tree roots. It is an attempt to improve the stability of the soil such as the use of plants and their roots to simply hold the ground together to prevent the top soil from sliding. Constructions using these techniques are known to have existed in the forth and fifth million B.C. (Jones, 1985). This concept has been favorable for many centuries and has been used for improvement of certain desired properties of soil such as bearing capacity (q_u), shear strength (τ) and permeability to name a few. The idea in principle was first developed by Vidal (1969), by inducing an element into soils as a means of increasing its shear resistance to lateral loads. According to Vidal's idea the interaction, in this case the unit weight of soil. The first retaining wall built in France 1968 was based off Vidal's idea. The technology became wide spread through to USA and Europe but wasn't picked upon by Asian countries such as India due to the high cost and availability of the reinforcing materials. More recently, the soil reinforcement techniques is well established and is used in a number of applications such as to control drainage, improve soil bearing capacity and prolonging effects of scour failure

II. LITERATURE REVIEW

This section covers the background knowledge that is necessary to draw any solution to scour failure by looking at the fundamentals of soil mechanics. The complexity of bridge abutment scour necessitates a thorough evaluation of the physical processes involved and their parameterization in scour depth estimation formulas. As river flow approaches a bridge, the streamlines converge due to the physical contraction in width and then diverge once through it. Understanding the soil properties and characteristics prior to construction of bridge abutment could prevent scour failure.

Generally Speaking classifying soil characteristics and its properties in the field of geotechnical engineering has not been adequately appreciated. **Henry R. Reynolds and P. Protopapadakis** mentions that is essential to become familiar with the results of soil tests and to grasp the significance of its properties and behaviours through experience. Soil moisture content, plastic limit and liquid limit are just some of the basic fundamentals towards soil reinforcement. Soil reinforcement believe is a study that will change and change modeling styles

III. METHODOLOGY

Soil Reinforcement Techniques

Soil Reinforcement by fibre materials

Natural fibres are considered to be an ancient cheap technique solution to soil reinforcements.

They are suitable for geotextiles as long as they give good mechanical properties and a reasonably resistance to microbial attacks. Coir and Jutes fibres have been exploited as a reasonable suitable geotextile in many Asian countries

like India for example. (Babu, 2006) explains that materials such as bamboo and timber can also be used as an actual reinforcement in many applications due to their high tensile strength that typically ranges from 600-800kN/m² and gives a compressive strength ranging from 200-300kN/m²

Bamboo and Timber Fibres

Strength and deformation characteristics of several natural materials such as bamboo, timber and fibres are favourable to synthetics. It is a fact with regards to the deformation modulus and creep natural.

Materials such as bamboo /timber are superior to synthetics. Datye(1988) gives a good read on the use of bamboo and timber as a more cost advantage over Indian Coir's. Typical Properties of these materials are as follows.

Table1: Typical properties (Datye, 1988)			
Timber (40mm diameter)		Bamboo dowels	
Weight (gm/m ²)	1430	Allowable tensile Strength	80,000 kPa
Strength at 2% strain (kN/m)	15	Allowable compressive Strength	30,000 kPa

Advantages and disadvantages of Bamboo / Timber

- Bamboo dowels can be efficiently used as reinforcement in preventing down hill movement of slopes.
- Cost advantages are significant

Implementation of Soil Reinforcement

Direct shear test

Apparatus required : Direct shear box apparatus, loading frame, Dial gauge, Proving ring, tamper, balance to weigh, aluminium container, spatula

Test procedure :

1. placing a soil specimen in the direct shear device (shear box apparatus)
2. Applying a predetermined normal stress & providing the necessary condition for wetting and draining the specimen
3. consolidating the specimen under the normal stress,
4. Removing the pins that lock shear box halves holding the test specimen, and shearing the specimen by displacing one shear box half laterally with respect to the other at constant rate of shearing deformation while measuring and shearing force, relative lateral displacement and normal displacement. The Shearing rate must be slow enough to allow nearly complete dissipation of excess pore pressure.

The strength parameters are obtained from a direct shear test are the cohesion (c) and angle of friction. In densely packed granular soils, two distinct values for these parameters exist, namely peak

Table -2 Direct shear test data

Date tested: 21.04.2022

Project name : soil reinforcement

Visual classification: brown uniform sand

Normal stress: 55.3kPa

Tested by : M.SATHYA

Sample no : fibre 9132

Size of shear box: 60 X 60 cm

Density of soil: 1.65 kg/cm³

Horizontal dial reading (.001 in)	Horizontal displacement(in)	load dial reading	horizontal shear force (lb)	shear stress (psi)
0	0	0	0	0
10	0.01	4	5.142	1.064
19	0.019	4.3	5.231	1.082
29	0.029	4.8	5.379	1.113
36	0.036	5	5.439	1.126
44	0.044	7	6.033	1.248
51	0.051	8	6.33	1.31
57	0.057	13.5	7.963	1.648
63	0.063	15	8.409	1.74
70	0.07	17	9.002	1.863
76	0.076	19	9.597	1.986
84	0.084	20	9.893	2.047
91	0.091	22	10.488	2.17
100	0.1	22.5	10.636	2.201
107	0.107	23	10.785	2.232
114	0.114	23.5	10.933	2.262
121	0.121	25	11.379	2.355
129	0.129	25.5	11.527	2.385
137	0.137	26	11.675	2.416
145	0.145	27	11.973	2.478
152	0.152	27.5	12.121	2.508
160	0.16	28	12.27	2.539
179	0.179	25	11.379	2.355

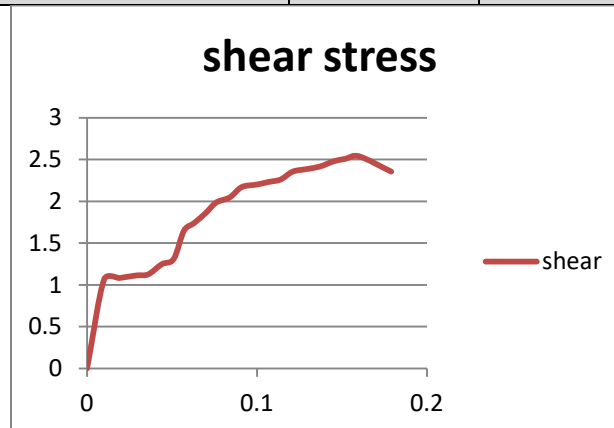


Fig : 1 Relation between horizontal displacement vs shear stress

IV. CONCLUSION

An experiment test was undertaken to investigate the individual effect of randomly placed bamboo fibres on the mechanical behavior of the sand. Compaction and direct shear test were conducted on unreinforced and reinforced sand. The results of the compaction tests indicated that the maximum dry density of reinforced sand decreases with increasing fibres content. An optimum moisture content of 10%, independently of the amount of fibres was noted. The results of the direct shear box test of the randomly oriented fibres increased the failure peak shear strength as well as the corresponding horizontal displacement. The specimens become more dilative with the increasing amount of fibres, the dilation is not inhibited by the presence of fibres. This seems to suggest that the use of mixed materials can improve the static liquefaction behaviour of loose sands. The residual strength is also affected by the fibre content.



REFERENCES

1. Chia-Nan,Liu, Kuo-Hsin Yang, Minh Due Nguyen. (2014) 'Behavior of geo grided reinforced sand and effect of reinforcement anchorage in large-scale plane strain compression', *Geotextiles and Geomembranes*, 42(1), pp.479-493
2. JinchunChai,Suksun Horpibulsuk,Shuilong Shen, John P. Carter. (2014) 'Consolidation analysis of clayey deposits under vacuum pressure with horizontal drains', *Geotextiles and Geomembranes*, 42(1),pp.437-444
3. M.RAbdi, A.R. Zandieh. (2014) 'Experimental and numerical analysis of large scale pull out tests conducted on clays reinforced with geogrids encapsulated with coarse material',*Geotextiles and Geomembranes*, 42(1),pp.494-504
4. R Kerry Rowe, Lauren. E.Ashe, W.Andy Take, RW.I. Brachman.(2014)'Factos affecting the down- slope erosion of bentonite in a GCL' *Geotextile soil Geomembranes*, 42(1),pp.445-456



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details