Journal of Civil Engineering and Environmental Technology
p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 5, Issue 8; October-December, 2018, pp. 576-578

http://www.krishisanskriti.org/Publication.html

Soil Stabilization Using Polypropylene Fibre

Atiqur Rahman[1] and Anwesha Gayan[2]

[1,2]M.E. Student, Assam Engineering College
E-mail: [1]atiquraec@gmail.com, [2]anweshagayan77@gmail.com

Abstract—*Soil stabilization is the process of altering some soil properties by different methods, mechanical or chemical in order to produce an improved soil material which has all the desired engineering properties. Soils are generally stabilized to increase their strength and durability or to prevent erosion and dust formation in soils. The main aim is the creation of a soil material or system that will hold under the design use conditions and for the designed life of the engineering project. The main objective of this study is to investigate the use of waste fibre materials in geotechnical applications and to evaluate the effects of waste polypropylene fibres on shear strength of unsaturated soil by carrying out unconfined compression tests on a soil sample. The results obtained are compared for a soil sample and inferences are drawn towards the usability and effectiveness of fibre reinforcement as a replacement for deep foundation or raft foundation, as a cost effective approach. The results from the UCS test for the soil sample are also similar, for reinforcements of 0.10% and 0.20%, the increase in unconfined compressive strength from the initial value are 43.87% & 258.70% respectively. This increment is substantial and applying it for soils similar to soil sample is effective. UCS value increases from 0.0062 kg/cm² to 0.032 kg/cm², a net 416.13% i.e., it increases four times.*

Keywords*: stabilization, polypropylene fibre, fibre reinforcement, unconfined compressive strength.*

1. INTRODUCTION

Stabilization is a process of improving subsoil engineering properties prior to construction. The properties of soil vary a great deal at different places or in certain cases even at one place; the success of soil stabilization depends on soil testing. Various methods are employed to stabilize soil and the method should be verified in the lab with the soil material before applying it on the field. The principles of soil stabilization includes evaluating the soil properties of the area under consideration, deciding the property of soil which needs to be altered to get the design value and choose the effective and economical method for stabilization, designing the stabilized soil mix sample and testing it in the lab for intended stability and durability values.

2. MATERIALS AND METHODOLOGY

The soil sample was collected from Gorchuk, Garoghuli Guwahati, Assam. Short PP (polypropylene) fiber was mixed with soil.

Figure 1: Polypropylene Fibre

Following steps were carried out while mixing the fiber to the soil-

(i) All the soil samples were compacted at their respective maximum dry density (MDD) and optimum moisture content (OMC), corresponding to the standard proctor compaction tests.

(ii) Content of fiber in the soils were determined by the following equation:

$$\rho_f = \frac{W_f}{W}$$

where, ρ_f = ratio of fiber content

W_f = weight of the fiber

W = weight of the air-dried soil

(iii) The different values adopted in the present study for the percentage of fiber reinforcement were 0, 0.10 and 0.20.

(iv) In the preparation of samples, if fiber was not used then, the air-dried soil was mixed with an amount of water that depends on the OMC of the soil.

(v) If fiber reinforcement was used, the adopted content of fibers was first mixed into the air-dried soil in small increments by hand, making sure that all the fibers were mixed thoroughly, so that a fairly homogenous mixture is obtained, and then the required water was added.

3. EXPERIMENTAL TESTS

The specific gravity of the soil sample was found to be 2.42. Liquid limit obtained from graph was 24.5(corresponding to 20mm penetration).

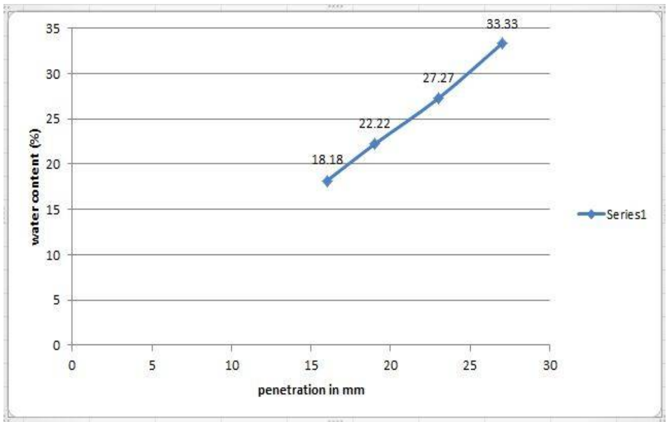

Figure 2: Liquid Limit

From the plastic limit test, the soil sample was classified as CL= clay with low plasticity.

From the sieve analysis,

Uniformity coefficient=.82/.18 = 4.55

Cc =0 .609

Cu = 4.55

was found out.

From the Standard Proctor Compaction Test, the following values were found-

OMC = 10%
MDD=1.74g/cc (from the graph).

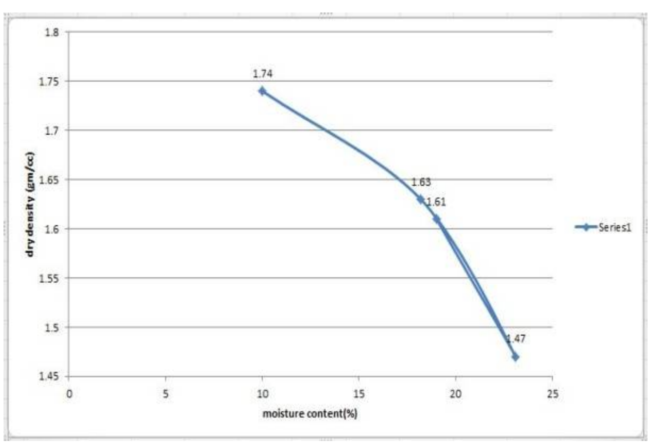

Figure 3: Compaction Curve

Unconfined Compression Strength Test

(i) Unreinforced

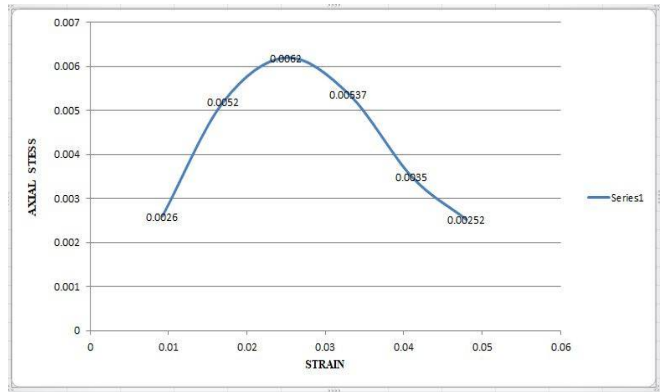

Figure 4: UCS for unreinforced sample

As obtained from graph, UCS = 0.0062 kg/cm².

(ii) Reinforcement = 0.10 %

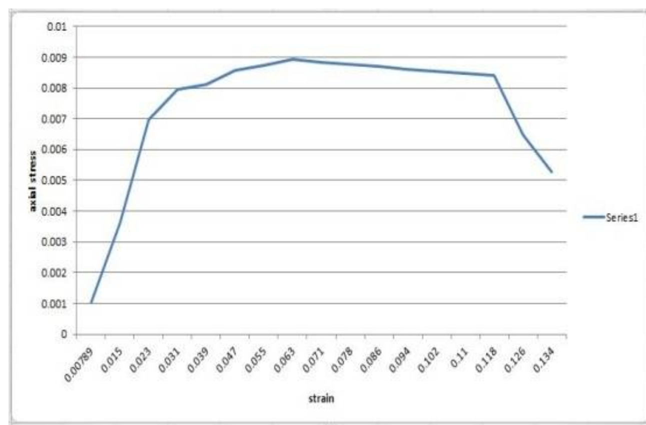

Figure 5: UCS for reinforcement= 0.10%

As obtained from graph, UCS = 0.00892 kg/cm².

(iii) Reinforcement = 0.20%

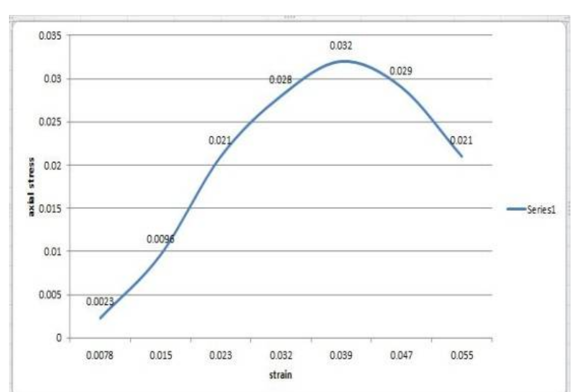

Figure 6: UCS for reinforcement = 0.20%

As obtained from graph, UCS = 0.032 kg/cm².

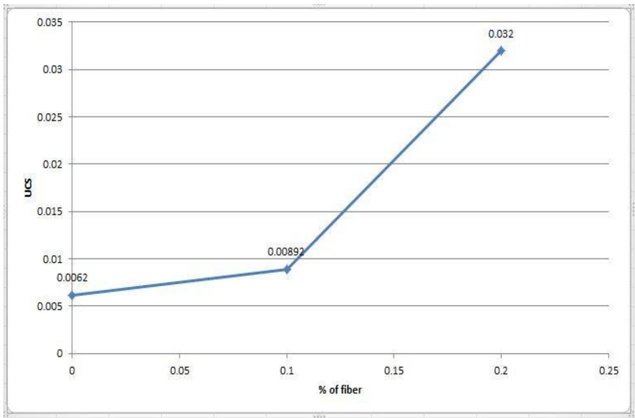

Figure 7: Relationship between UCS and fiber content

Inferences from Unconfined Compression Test

(i) UCS value increases from 0.0062 kg/cm² to 0.032 kg/cm² a net 416.13%.

(ii) The slope of increment graph is continuously increasing with an initially gradual slope.

4. CONCLUSION

The results from the UCS test for the soil sample are also similar, for reinforcements of 0.10% and 0.20%, the increase in unconfined compressive strength from the initial value are 43.87% & 258.70% respectively (illustrated in figure). This increment is substantial and applying it for soils similar to soil sample is effective. Overall it can be concluded that fiber reinforced soil can be considered to be good ground improvement technique specially in engineering projects on weak soils where it can act as a substitute to deep/raft foundations, reducing the cost as well as energy.

REFERENCES

[1] Ayininuola G.M. and Oladotun P.O., "Geotechnical Properties of Coconut Coir Fiber Soil Mixture", *Journal of Civil Engineering Research 2016, 6(4): 79-85.*

[2] Baruah H., Kalita D.M., Mili I. and Islam I., "Comparative Study of Soil Reinforced with Natural Fiber, Synthetic Fiber and Waste Material", *International Journal of Latest Trends in Engineering and Technology (IJLTET),* Vol. 6 Issue 4 March, 2016.

[3] Joe M.A. and Rajesh A.M., "Soil Stabilization Using Industrial Waste and Lime", *International Journal of Scientific Research Engineering and Technology (IJSRET),* ISSN 2278-0882, Volume 4, Issue 7, July 2015.

[4] Kashyap R. and Sen A., "Soil Stabilization Using Waste Fiber Materials", *Department of Civil Engineering, National Institute of Technology, Rourkela,* May 2012.

[5] Nagaraj K., Aroja M., Prashant P. and Rajeshwari S., "Soil Stabilization Using Geosynthetic Material (Bamboo Fibres)", *Department of Civil Engineering, Visveswaraya Technological University, Belgavi,* December 2016-2017.