BEHAVIOUR OF REINFORCED SOIL USING GEOGRID

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Abstract - *The beneficial effects of reinforcing subgrade soils with a single layer of geogrid and their behaviour under loading are investigated. Unconfined compression test was conducted by reinforcing the samples at different depths within the sample height. Proctor compaction test was conducted to determine the optimum moisture content for the soil sample. The effective position for placing geogrid was decided based upon the shear strength value of the different samples. Unconfined compressive strength test was conducted for unreinforced specimen as well as reinforced specimen at the deduced optimum position of the geogrid to study their behavior under repetitive load. The results showed that shear strength increases with reinforcement and attain the highest values when the geogrid is placed at a depth of 1/3 rd from top of the specimen. Further, Geogrids can play an important role in the control of rut formation in the pavement.*

Key Words: Geogrid, Reinforcement, Shear strength, Stress strain curve, Behaviour.

1. INTRODUCTION

Soil is a combination of four basic types such as gravel, sand, clay and silt. It generally has low tensile and shear strength. Its characteristics may depend on the environmental conditions. Reinforcement consists of incorporating certain materials with some desired properties within other materials which lack those properties. Thus soil reinforcement is used to improve the characteristics of soil such as compressibility, density, shear strength and hydraulic conductivity. So, the primary purpose of reinforcing soil is to increase its bearing capacity, to improve its stability, to reduce settlement, lateral deformation, rutting, etc. The reinforced soil behaves as a composite material in which fibers of high tensile strength or embedded in a matrix of soil. The reinforced soil is defined as the soil mass that contains randomly distributed, discreet elements, i.e. geosynthetics.

II. LIERATURE REVIEW

(1) Sayyed Mahdi Hejazi, Mohammed Sheikhzadeh, sayyed Mahdi Abtahi, Ali Zadhoush.

Construction and building materials 30, 100-116, 2012. Soil reinforcement is defined as a technique to improve the engineering characteristics of soil. In this way, using natural fibers to reinforce soil is an old and ancient idea. Consequently, randomly distributed fiber-reinforced soils have recently attracted attention in geotechnical engineering for the second time. The main aim of this paper, therefore, is to review the history, benefits, applications; and possible executive problems of using different types of natural and/or synthetic fibers in soil reinforcement through reference to published scientific data. As well, predictive models used for short fiber soil composite will be discussed. This paper is going to investigate why, how, when; and which fibers have been used in soil reinforcement projects.

[2] Radhey Sharma, Qiming Chen, Murad Abu Farsakh, Sungmin yoon.

Geotextiles and Geomembranes 27 (1), 63-72, 2009. This paper aims at developing analytical solutions for estimating the ultimate bearing capacity of geogrid reinforced soil foundations for both sand and silt clay soils. Failure mechanisms for reinforced soil foundations are proposed based on the literature review and the results of experimental study on model footing tests conducted by authors. New bearing capacity formulas that incorporate the contribution of reinforcements to the increase in bearing capacity are then developed for both reinforced sand and silty clay soil foundations based on the proposed failure mechanisms. The predicted bearing capacity values are compared with the results of laboratory model tests on reinforced sand and silty clay soil. The proposed analytical solutions were also verified by the results of large-scale model tests conducted by the authors for reinforced silty clay and the data reported in the literature. The predicted bearing capacity values from analytical solutions are in good agreement with the test results.

III. OBJECTIVES

- To identify the variation in shear strength of reinforced and unreinforced soil.
- To find the effect of reinforcement on various placement height.
- To determine the stress strain behaviour of Unreinforced and Reinforced soil.

IV. SCOPE

- Geogrids are commonly used to reinforce retaining wall, roadway bases, foundation, etc.,

- Geogrids are mainly used in steep slopes to prevent sliding.
- These are used to increase the effective bearing capacity of an underlying soft subgrade and also used to decrease surface rutting.

V. MATERIALS TO BE USED

- Geogrid.
- PVC pipe.
- Soil.
- Soil extruder.

VI. TESTS CONDUCTED

1. Liquid limit..
2. Plastic limit..
3. Compaction test.
4. Unconfined compression test.

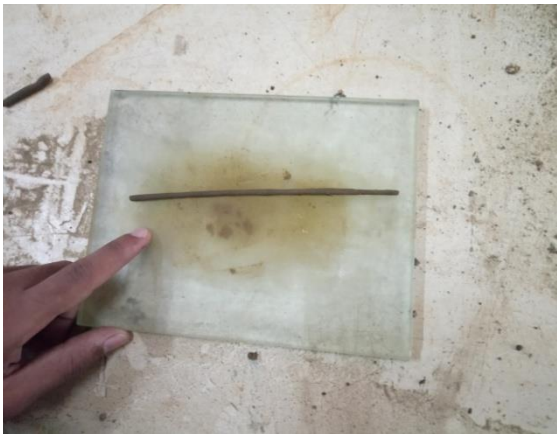
1. LIQUID LIMIT

The liquid limit is the water content at which the soil changes from liquid state to plastic state. At the liquid limit, the clay is practically like a liquid, but possesses a small shearing strength. The shearing strength at that stage is the smallest value that can be measured in the laboratory. The liquid limit of soil depends upon the clay mineral present. The stronger surface charge and the thinner particle, the greater will be the amount of adsorbed water and, therefore, the higher will be the liquid limit. The liquid limit is determined in the laboratory by casagrande's apparatus or by cone penetration method.

CASAGRANDE'S APPARATUS

2. PLASTIC LIMIT

Plastic limit is the water content below which the soil stops behaving as a plastic material. It begins to crumble when rolled into a thread of soil of 3 mm diameter. At this water content the soil loses its plasticity and passes to a semi-solid state. For determination of the plastic limit of the soil, it is air-dried and sieved through a 425 micron IS sieve. About 30 g of soil is taken in an evaporating dish. It is mixed thoroughly with distilled water till it becomes plastic and can be easily moulded with fingers.



PLASTIC LIMIT

3. PROCTOR COMPACTION TEST

To assess the amount of water content required in the field and amount of compaction, compaction test are done on the same soil in the laboratory. The test provides a relationship between the water content and the dry density. The water content at which the maximum dry density is attained is obtained from the relationships provided by the tests.

4. UNCONFINED COMPRESSION TEST

The unconfined compression test is by far the most popular method of soil shear testing because it is one of the fastest and cheapest methods of measuring shear strength. The method is used primarily for saturated, cohesive soils.

VII. PROCEDURE

1. The liquidity and plasticity characteristics of soil are determined.
2. By conducting USCS test, the soil is classified as clay soil.
3. The optimum moisture content is determined by conducting proctor compaction test.
4. After the optimum moisture content of the soil is taken, the behaviour of unreinforced soil is determined using unconfined compression test.
5. Then the behaviour of reinforced soil is determined by placing the geogrid at different levels of the sample based on its shear strength.

6. The shear strength of unreinforced soil sample is 1.03 N/mm^2.
7. The shear strength of reinforced soil sample when the geogrid is placed at the centre of the sample is 1.09 N/mm^2, when the geogrid is placed at one third from the top of the sample is 1.43 N/mm^2 and the geogrid is placed at two third from the top of the sample is 1.06 N/mm^2.

VIII. BEHAVIOUR OF UNREINFORCED SOIL

Shear strength is the strength of the material or component against the type of yield or structural failure when the material or component fails in shear. A shear load is a force that tends to produce a sliding failure on a material along a plane that is parallel to the direction of the force. If the shear strength of the soil is less, then reinforcement is provided for the soil to increase its shear strength.

SHEAR STRENGTH OF UNREINFORCED SOIL

IX. BEHAVIOUR OF REINFORCED SOIL

The shear strength of the unreinforced soil is very less, so geogrid is used as reinforcement material for the soil to increase its shear strength.

Geogrid adds significance strength to the soil cylinder and prevents it from falling. The stability of soil depends on the friction angle of soil. In soil, the friction angle is the maximum shear force between particles of soil as they try to pass each other.

GEOGRID IS PLACED AT CENTRE

The geogrid is placed at one third from the top after the failure occurs when the geogrid is placed at centre.

GEOGRID IS PLACED AT ONE THIRD

The geogrid is placed at two third from the top after the failure occurs when the geogrid is placed at one third.

GEOGRID IS PLACED AT TWO THIRD

REFERENCES

1. The shear strength of unreinforced soil sample is 1.03 N/mm2.
2. The shear strength of reinforced soil sample when the geogrid is placed at the centre is 1.09 N/mm2.
3. The shear strength of reinforced soil sample when the geogrid is placed at one third from the top of the sample is 1.43 N/mm2.
4. The shear strength of reinforced soil sample when the geogrid is placed at two third from the top of the sample is 1.06 N/mm2.

X. CONCLUSION

This project presents the results of shear strength of unreinforced and reinforced soil samples. For reinforced soil sample, the geogrid is placed at centre, one third and two third from the top. Based on the shear strength of different samples the effective placement of reinforcement is chosen. The shear strength of the reinforced sample is high, when the geogrid is placed at one third from the top. Thus the effective placement of geogrid for reinforcement is placed at one third from the top.

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