International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Enhancement of UCS value by adding hairs in soil

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Abstract – *Soil is very important in civil engineering construction. The poor engineering properties of the local soils may present many difficulties for construction and therefore need to improve their engineering properties. Stabilization techniques can be used to improve the properties of the soil. Soil stabilization improves various engineering properties. Ex: Bearing capacity, Compressibility, strength, various other properties of soil. In this study we increased UCS value of soil by adding human hairs in it. Partial replacement of soil is take place by replacing same out of hairs.*

Key Words: Soil, UCS, Hairs, Stabilization

1. INTRODUCTION

For any land-based structure, the foundation is very important and has to be strong to support the entire structure. In order for the foundation to be strong, the soil around it plays a very critical role. So, to work with soils, we need to have proper knowledge about their properties and factors which affect their behaviour. The process of soil stabilization helps to achieve the required properties in a soil needed for the construction work. From the beginning of construction work, the necessity of enhancing soil properties has come to the light. Ancient civilizations of the Chinese, Romans and Incas utilized various methods to improve soil strength etc., some of these methods were so effective that their buildings and roads still exist. In India, the modern era of soil stabilization began in early 1970's, with a general shortage of petroleum and aggregates, it became necessary for the engineers to look at means to improve soil other than replacing the poor soil at the building site. Soil stabilization was used but due to the use of obsolete methods and also due to the absence of proper technique, soil stabilization lost favour. In recent times, with the increase in the demand for infrastructure, raw materials and fuel, soil stabilization has started to take a new shape. With the availability of better research, materials and equipment, it is emerging as a popular and cost-effective method for soil improvement. Here, in this project, soil stabilization has been done with the help of randomly distributed fibres obtained from waste materials. The improvement in the unconfined compressive strength parameters has been stressed upon and comparative studies have been carried out using different types of fibres as well as different types of soils.

1.1 Aim of the study

To study the effect of inclusion of hairs in soil and to optimize the required percentage of fibre at which soil subgrade can give maximum unconfined compressive strength.

2. MATERIAL USED

1. Soil
2. Human Hairs
3. Water

Table -1: Properties of Hair

Property	Remark
Cross-Section	Circular
Diameter	10-100 µm
Length	5-50 mm
Elongation	1.5 times its dry weight
Tensile strength	Equal to Copper wire of similar diameter

3. UCS (UNCONFINED COMPRESSIVE STRENGTH)

Reference: IS 2720-10 (1991): Methods of test for soils, Part 10: Determination of unconfined compressive strength.

APPARATUS

1. Compression Device

The compression device may be any of the following Types:
a) Platform weighing scale equipped with a screw-jack activated yoke;
b) Hydraulic loading device;
c) Screw jack with a proving ring; and
d) Any other loading device. Al1 theses loading devices shall have sufficient capacity and strain control.

2. Proving Ring

The selection of the proving ring shall depend on the following: For relatively weak soil with qu less than 100 KPa (1 kgf/cms) load shall be measurable to 1 KPa. For soils with qu equal to or greater than 100 KPa (1 kgf/cms) load shall be

measurable to the nearest 5 KPa (0.05 kgf/cms). The calibration of the proving ring shall be checked frequently, at least once a year.

3. Deformation Dial Gauge

Axial deformation of the sample shall be measured with a dial gauge having a least count of 0.01 mm and travel to permit not less than 20 percent axial strain.

4. Vernier Calipers

Suitable to measure physical dimensions of the test specimen to the nearest 0-1 mm.

5. Timer

Timing device to indicate the elapsed testing time to the nearest second may be used for establishing the rate of strain.

6. Oven

Thermostatically controlled, with interior of no corroding material capable of maintaining the temperature at 110°C.

7. Weighing Balances

Suitable for weighing soil specimens specially. Specimens of less than 100 g shall be weighed to the nearest 0.01 g whereas specimens of 100 g or larger shall be weighed to the nearest 0.1 g.

- Specimen Size

The specimen for the test shall have a minimum diameter of 38 mm and the largest particle contained within the test specimen shall be smaller than l/8 of the specimen diameter. If after completion of test on undisturbed sample, it is found that larger particles than permitted for the particular specimen size tested are present, it shall be noted in the report of test data under remarks. The height to diameter ratio shall be within 2 to 2.5. Measurements of height and diameter shall be made with veniere calipers or any other suitable measuring device to the nearest 0.1 mm.

- Remolded Specimen

The specimen may be prepared either from a failed undisturbed specimen or from a disturbed soil sample. In the case of failed undisturbed specimen, the material shall be wrapped in a thin rubber membrane and thoroughly worked with the fingers to assure complete remolding. Care shall be taken to avoid entrapped air, to obtain a uniform density, to remold to the same void ratio as that of the undisturbed specimen, and to preserve the natural water content of the soil.

- Compacted Specimen

For the compaction of disturbed material, it shall be done using a mould of circular cross-section. Compacted specimen may be prepared at any predetermined water content and density. After the specimen is formed, the ends shall be trimmed perpendicular to the long axis and removed from the mould. Representative sample cuttings shall be obtained or the entire specimen shall be used for the determination of water content after the test.

Procedure:

1. The initial length, diameter and weight of the specimen shall be measured and the specimen placed on the bottom plate of the loading device. The upper plate shall be adjusted to make contact with the specimen.
2. The deformation dial gauge shall be adjusted to a suitable reading, preferably in multiples of 100. Force shall be applied so as to produce axial strain at a rate of 0.5 to 2 percent per minute causing failure with 5 to 10. The force reading shall be taken at suitable intervals of the deformation dial reading.
3. Force shall be applied so as to produce axial strain at a rate of 0.5 to 2 percent per minute causing failure with 5 to 10. The force reading shall be taken at suitable intervals of the deformation dial reading.

NOTE - Up to 6q/, axial strain force, readings may be taken at an interval of 0.5 mm of the deformation dial reading. After 6% axial strain, the interval may be increased to 1.0 mm and, beyond 12qb axial strain it may be increased even further.

4. The specimen is compressed until failure surfaces have definitely developed, or until the axial strain of 20 percent is reached. Representing the stress-strain plot. The angle between the failure surface and the horizontal may be measured, if possible, and reported 5. The water content of the specimen shall be determined in accordance with IS 2720 (Part 2): 1973 using samples taken from the failure zone of the specimen.

Work:

1. Design of split mold
2. Collection of Human hairs from local salons
3. Perform UCS by on soil with and without adding hairs.
4. Perform UCS by on soil with and with adding hairs.

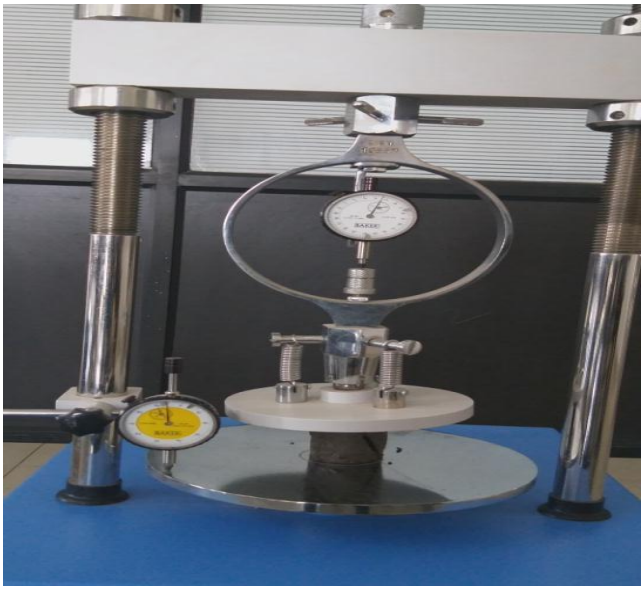

Fig -1: Basic arrangement of UCS Test

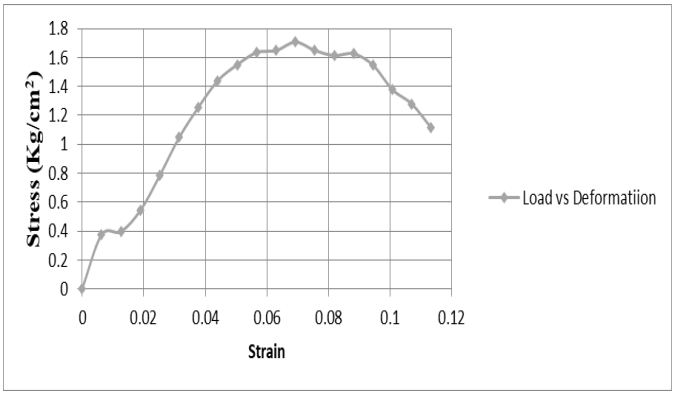

Chart -1: UCS Value for Normal soil sample

Specimen with Human Hair:

We took 0.5%, 1%, 2% of hairs by weight of oven dried soil sample and fixed the limit of water content which is about 20% by weight. We added calculated amount of water in it mix sample properly so that whole hairs get mixed with soil and form uniform mix.

Fig -2: Soil Mixed with Human Hairs

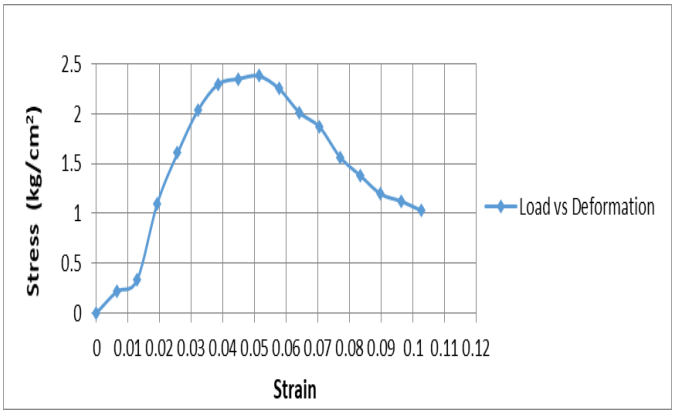

Chart -2: UCS Value chart for 0.5% Hair mixed samples

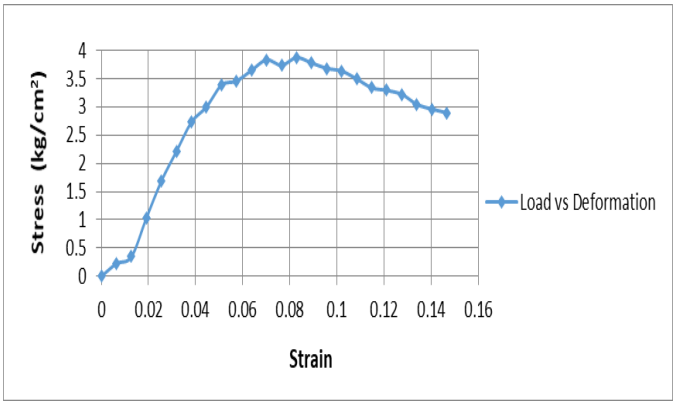

Chart -3: UCS Value chart for 1% Hair mixed samples

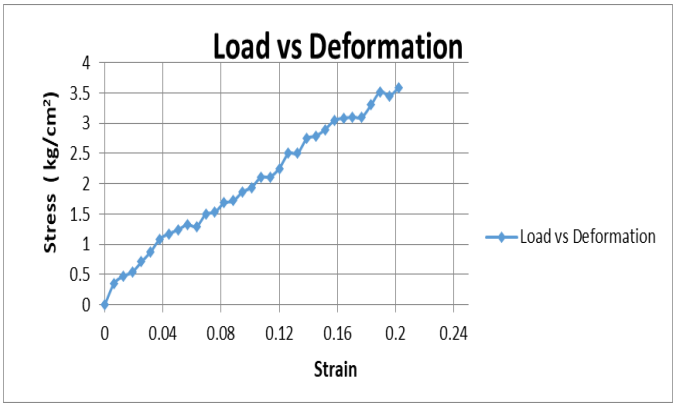

Chart -4: UCS Value chart for 2% Hair mixed samples

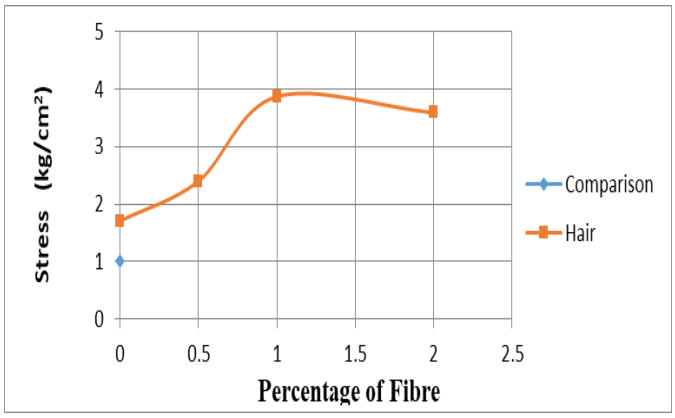

Chart -5: Change in Stress due to inclusion of Hairs fibre with different percentage

4. CONCLUSION

We got 1.7071 kg/cm² as a UCS strength without mixing of hairs in the soil. After Addition of 0.5% hairs in soil we got 2.4011 kg/cm². After addition of 1% hairs in soil we got 3.8711 kg/cm². And after addition of 2% soil we got 3.5889 kg/cm². It is observed that we got maximum UCS value by addition of 1% hairs in soil.

REFERENCES

[1] Phani Kumar. V,CH. Naga Bharath, P. Swathi Priyadarsini (Jan 2015), "Experimental Investigation on California Bearing Ratio (CBR) For Stabilizing Silty Sand with Fly Ash and Waste Polypropylene",ISSN: 2277-3754 ISO 9001:2008 Certified International Journal of Engineering and Innovative Technology (IJEIT) Volume 4, Issue 7, January 2015

[2] V. Mallikarjuna, T. Bindu Mani (May 2016), "Soil Stabilization Using Plastic Waste", IJRET: International Journal of Research in Engineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308.

[3] IS: 1498 (1970), Indian Standard Methods of Test for Soils: Classification and Identification of Soil for General Engineering Purposes (Bureau of Indian Standards. 1970).

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