Faulty of Engineering and Technology

Civil Engineering Department

Soil Lab

ENCE311

Experiment #8 :

" Unconfined Compressive Test "

Instructors :

Dr. Saheem Murshid

Eng. Maha Jarrar

Done by Group A :

Mohammad Al-Swaity	1181136
Wajih Sammour	1180956
Samer Maali	1180360
Thaljea Shaabna	1182216
Mohammad Marbou	1180126
Baseel Abd Elrazaq	1170032

Date of performing the experiment : 6/12/2020

Date of submitting the experiment : 20/12/2020

Contents :

Introduction :

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 recovered from thin-walled sampling tubes. The unconfined compression test is inappropriate for dry sands or crumbly clays because the materials would fall apart without some land of lateral confinement.

To perform an unconfined compression test, the sample is extruded from the sampling tube. A cylindrical sample of soil is trimmed such that the ends are reasonably smooth and the length-to-diameter ratio is on the order of two. The soil sample is placed in a loading frame on a metal plate; by turning a crank, the operator raises the level of the bottom plate. The top of the soil sample is restrained by the top plate, which is attached to a calibrated proving ring. As the bottom plate is raised, an axial load is applied to the sample. The operator turns the crank at a specified rate so that there is constant strain rate. The load is gradually increased to shear the sample, and readings are taken periodically of the force applied to the sample and the resulting deformation. The loading is continued until the soil develops an obvious shearing plane or the deformations become excessive. The measured data are used to determine the strength of the soil specimen and the stress-strain characteristics. Finally, the sample is oven dried to determine its water content. The maximum load per unit area is defined as the unconfined compressive strength, qu.

In the unconfined compression test, we assume that no pore water is lost from the sample during set-up or during the shearing process. A saturated sample will thus remain saturated during the test with no change in the sample volume, water content, or void ratio. More significantly, the sample is held together by an effective confining stress that results from negative pore water pressures (generated by menisci forming between particles on the sample surface). Pore pressures are not measured in an unconfined compression test; consequently, the effective stress is unknown. Hence, the undrained shear strength measured in an unconfined test is expressed in terms of the total

Shear strength of a soil can be given by the Mohr-Coulomb failure criteria as

$$\mathrm{Cu} = \frac{\mathrm{qu}}{2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

q_u: is the peak value of the unconfined compressive stress that applied on the sample on the stress-strain diagram or the max unconfined stress that applied at 20% strain.

Cu: is the undrained-unconsolidated shear strength.

The unconfined strength was determined by applying an axial stress on a cylindrical soil specimen with no confining pressure and then observed the axial strain corresponding to various stress level, the strain that happened in the specimen can be calculated by Equation (2):

$$\in = \frac{\Delta L}{Lo} \dots\dots\dots\dots\dots\dots\dots (2)$$

After the strain determined, the correct area A_c is then calculated by using Equation (3):

$$A_c = \frac{A_0}{(1-\in)} \dots\dots\dots\dots\dots (3)$$

Finally the stress in the sample is also calculated by using Equation (4) which shown below:

$$\sigma = \frac{F}{A_c} \dots\dots\dots..\dots\dots\dots. (4)$$

Where:

$\in$: Strain in the sample, Vertical deformation ΔL: The difference in sample length

Lo: Original length of the sample A_c: Corrected area

A_0: Original area   σ: Stress on the sample

F: Force

Purpose:

to find the stress-strain characteristics of undisturbed, remoulded, and compacted cohesive soil samples .

Materials and Equipment's :

Look at the **" Table 1 "** that show the equipment we used in this experiment :

Equipment	The name of it :	Equipment	The name of it :
 Figure 1	**Calliper**	 Figure 2	**A sample of clay**
 Figure 3	**Metal plate**	 Figure 4	**Balance**
 Figure 5	**Screw**	 Figure 6	**Mold and compaction rod**

Table 1

Procedure :

- A sample of soil was taken.
- The sample was put in a mold in a layer, and after each layer it was compacted.
- The mold was removed, after that, the soil taken a mold shape.
- The length and the diameter of sample was taken using a caliper.
- The steps above was repeated for another sample of soil.
- The strain and the force for each sample was given from the constructor

- **Data and Calculations :**

$$\mathbf{A} = \frac{\pi\, d^2}{4} \quad // \quad \mathbf{q_{un}} = \frac{F}{Af} \quad // \quad \mathbf{C} = \frac{q_{un}}{2}$$

	Sample 1	Sample 2
L_0 (mm)	80.2	80.1
d_0 (mm)	30.9	30.9
F (N)	200	300
Ɛ	0.02	0.03
A_0 (mm^2)	5049.15	5036.57
A_f (mm^2)	5152.19	5192.53
q_{un}	0.039	0.058
C	0.0195	0.029

Results and Conclusion :

Results :

For Sample 1 : C = 0.0195

For Sample 2 : C = 0.029

Conclusion :

This test method covers the determination of the unconfined compressive strength of cohesive soil in the intact, remolded, or reconstituted condition, using strain-controlled application of the axial load, and provides an approximate value of the strength of cohesive soils in terms of total stresses. This test method is applicable only to cohesive materials which will not expel or bleed water (water expelled from the soil due to deformation or compaction) during the loading portion of the test and which will retain intrinsic strength after removal of confining pressures, such as clays or cemented soils.

Sources of errors :

- The amount of water added to the sample is not appropriate
- After adding water and mixing it with the sample, parts of the sample remain not homogeneous with others
- The sample taken was not properly and adequately compaction

References :

- Soil lab manual
- https://www.cyut.edu.tw/~jrlai/CE7334/Unconfined.pdf