The University of Iowa
Department of Civil & Environmental Engineering
Fall Semester

53:030 Soil Mechanics
Lab Experiment No. 13:
Compaction of Moist Soil

A. Objective

In this laboratory experiment, compaction will be performed on a moist soil FI-10 at various water contents to measure two moisture density curves associated with two different compaction energies. Each lab group will be given a soil sample having a designated nominal water content. With that sample, each group will compact half of the soil at energy E_1, and the remaining half at energy E_2. After compacting the soil at each energy level, the compacted soil will be removed from the mold, trimmed, and subjected to an unconfined compression test. Data will be shared among all of the lab groups to draw moisture-density curves and strength contours. The assignment of water contents to lab groups are as follows:

Group	water content	Group	water content
1	0.06	8	0.13
2	0.07	9	0.14
3	0.08	10	0.15
4	0.09	11	0.16
5	0.10	12	0.17
6	0.11	13	0.18
7	0.12	14	0.19

B. Experimental Procedure

1. Compaction Testing

a. Each group is given approximately 400 grams of dry soil (M_s) in a plastic bag. Add an amount of distilled water wM_s and thoroughly mix it in to obtain as uniform a water content as possible.

b. Assemble the soil mold, and begin to compact the soil.

   1. For the first level of compactive effort, place the soil in two layers, and apply 20 hammer strokes to each layer. The compactive effort per unit volume of soil for this procedure is roughly equal to that of the Modified Proctor test, or 2670kJm^{-3}.
   2. For the second level of compactive effort, place the soil in five layers, and apply 25 hammer strokes to each layer. The compactive effort per unit volume of soil for this procedure is approximately 8340kJm^{-3}

c. After compacting the soil, use the special apparatus for removing the top and bottom collars. After removing both collars, trim the soil with a spatula so that it is flush with the ends of the mold.

d. With the soil trimmed from the ends, initiate a water content test to find w for the compacted soil. (Table 1)

e. Using the special apparatus once again, push the compacted soil specimen out of the mold. Measure the mass of the moist compacted soil specimen M_c.

f. Wash and dry the mold and collars so that they are clean for the next group, and clean up your work area, disposing of loose soil fragments and putting tools back where they belong.

2. Unconfined Compression Test

a. After taking the mass of the compacted soil specimen, seat the sample on the loading plate of the testing machine.

b. Adjust the height of the loading plate until the loading ram is properly seated on the sample, and adjust the load-dial in the load-ring so that it measures a zero displacement.

c. Turn on the loading machine to perform a strain-controlled unconfined compression test to failure on the compacted soil sample. Record the maximum displacement in the load ring $\Delta_{\max}$. The maximum axial force and deviator stress on the specimen are computed as :

$$F_{\max} = \Delta_{\max}(\text{in.}) * \frac{25.4\text{mm}}{1\text{in.}} * 369.8\frac{\text{N}}{\text{mm}}$$

$$(\sigma_1 - \sigma_3)_{\max} = \frac{F_{\max}}{A_{\text{mold}}.}$$

d. Dispose of soil fragments and specimens in an appropriate bin.

C. Analysis

Due to the lateness in the semester, no writeups are required for this lab. Your data will be collected and processed, however, to show the following:

1. A plot of the moisture-density curves both tests (E_1 = 2670kJm^{-3}) and (E_2 = 8340kJm^{-3});
2. A plot the zero air voids curve; and
3. Contours of unconfined compression strength on the moisture-density curves.

The collective results from all lab groups will be distributed in class on Wednesday, December 8. **So that your data can be processed, please leave your <u>completed</u> Tables 1 and 2 (except for final water content values) with the lab instructor before you leave the lab.**

Test No.	1	2
Can No.		
Mass of can (g)		
Mass of can + moist soil (g)		
Mass of can + dry soil (g)		
Mass of dry soil (g)		
Mass of water (g)		
water content (%)		

Table 1: Water content computations.

A_{mold} = $9.026 * 10^{-4}$m^2

V_{mold} = 64.08cm^3 = $6.408 * 10^{-5}$m^3

G_s = 2.66

Test No.	Compaction Energy	Mass of moist soil M_c	Moist density $\rho = M_c/V_{mold}$	Dry density $\rho_d = \frac{\rho}{1+w}$	Strength $(\sigma_1 - \sigma_3)_{\max}$
1					
2					

Table 2: Density computations.