The University of Iowa
Department of Civil & Environmental Engineering
Fall Semester, 2002

53:030 Soil Mechanics
Lab Experiment Number 8:
1-Dimensional Compression Test on Dry Sand

A. Objective

In this laboratory experiment, one-dimensional compression of both "loose" and "dense" sand layers is measured. The results of these compression tests are used to estimate the "e vs. log σ_v'" behavior of the sand.

B. Experimental Procedure

1. Prepare two test samples, one loosely packed, and one densely packed as demonstrated by the lab instructor. These samples will be placed in the oedometer apparatus and testing machine shown in Figure 1.
   a. Measure the height of the metal collar. This will be the initial height H_o of the sand layers.
   b. Measure the inside diameter of the collar, and use this value to compute both the cross-sectional area initial volume of the sand sample.
   c. Place the collar on a porous end cap of either sandstone or ceramic, and take the combined mass.
   d. Fill the collar up with sand until top of sand is flush with top of the collar. If preparing a "loose" sample, simply pour the sand into the collar and make it flush. If preparing a "dense" sample, pour the sand into the collar in multiple lifts, using the vibratory compactor to densify each lift. Remove any loose sand on the end cap.
   e. Take the mass of the collar, end cap, and sand.
   f. Based on the dry density of the soil specimen, compute the initial void ratio.
2. Run the experiment on each sample, recording the stress and displacement results on the data sheets provided. The experiment involves a loading/unloading/reloading/unloading sequence as indicated in Tables 1 and 2. To adjust the loading on the soil specimen, consult Table 3.
3. Process the data in both Tables 1 and 2. Each group should process the data and plot the stress-strain behavior of the soils during the lab session to insure that reasonable results have been obtained. If unreasonable or erroneous results have been obtained, the experiment should be repeated.

C. Notes

1. Pay close attention to dial readings. Under confinement sand is very stiff; thus a small error in reading the dial can put a significant "blip" in the graph of the results.
2. Save your test results. Graphs from these tests will be combined and compared with graphs on compressibility of fine-grained soils.

D. Results

1. Plot σ_v' vs. ϵ_v.
2. Plot e vs. σ_v'.
3. Plot e vs. log σ_v'.

Specimen cross-sectional area =	Initial density ρ_d =
Specimen height, H_o =	G_s = 2.66
Specimen volume =	e_{min} = 0.51
Specimen mass =	e_{max} = 0.80
V_s (volume of solids) =	e_o =
H_s (height of solids) =	D_r =

Load Number	σ'_v (kPa)	Raw dial reading	ΔH	Δe $\Delta H/H_s$	e $e_o - \Delta e$	Strain ϵ_v $\Delta H/H_o$
0	0					
1	12.5					
2	25					
3	50					
4	100					
5	200					
6	400					
7	800					
8	400					
9	200					
10	100					
11	200					
12	400					
13	800					
14	1600					
15	800					
16	400					
17	200					
18	100					
19	50					

Table 1: Data collection for confined compression of loose sand.

Specimen cross-sectional area =	Initial density ρ_d =
Specimen height, H_o =	G_s = 2.66
Specimen volume =	e_{min} = 0.51
Specimen mass =	e_{max} = 0.80
V_s (volume of solids) =	e_o =
H_s (height of solids) =	D_r =

Load Number	σ'_v (kPa)	Raw dial reading	ΔH	Δe $\Delta H/H_s$	e $e_o - \Delta e$	Strain ϵ_v $\Delta H/H_o$
0	0					
1	12.5					
2	25					
3	50					
4	100					
5	200					
6	400					
7	800					
8	400					
9	200					
10	100					
11	200					
12	400					
13	800					
14	1600					
15	800					
16	400					
17	200					
18	100					
19	50					

Table 2: Data collection for confined compression of dense sand.

Sample Pressure (kPa)	Sample Pressure (psi)	Sample Load	Dial Pressure Reading (psi)
0	0	0	0 LL or HL
12.5	1.81	8.89	35.48 LL
25	3.63	17.80	51.48 LL
50	7.25	35.60	2.21 HL
100	14.50	71.20	3.57 HL
200	29.01	142.4	6.28 HL
400	58.02	284.9	11.67 HL
800	116.0	569.7	22.40 HL
1600	232.1	1139	44.06 HL
3200	464.1	2278	87.59 HL

Table 3: Loads on sample and corresponding dial pressure readings.

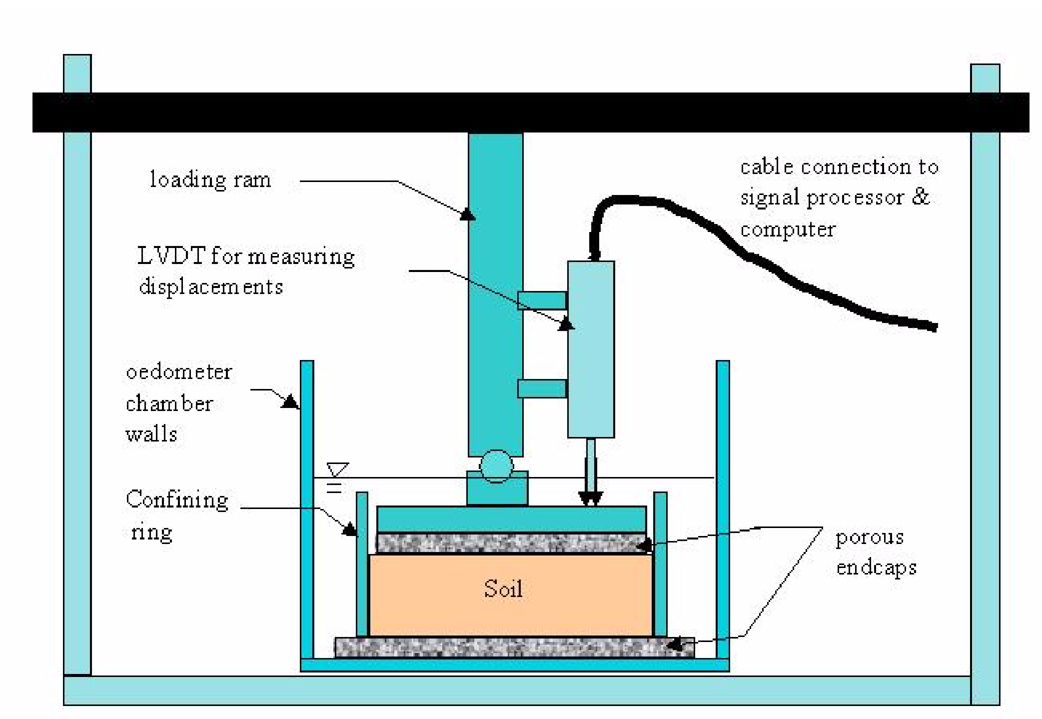

Figure 1. Schematic of soil specimen loaded into oedometer for measurement of σ'_v versus ΔH.