CIVL 7132 Advanced Soil Mechanics
Spring 2019 - Homework 6

1. A specimen of Sacramento River sand (Figures 12.5-12.9) is hydrostatically consolidated to an effective confining pressure of 600 kPa in a triaxial cell. The void ratio at that point in the test is 0.67. The specimen is then sheared with the drainage valves opened. Will the specimen dilate or contract during the shearing portion of the test? Estimate the volumetric strain when the specimen reaches critical state.

2. Another specimen of the same Sacremento River Sand is hydrostatically consolidated to an effective confining pressure of 1300 kPa in a triaxial cell. The void ratio at that point in the test is 0.55. The specimen is then sheared with the drainage valves closed. Describe the pore pressure change that will be experienced by the specimen during the shearing portion of the test.

3. An unconfined compression test is performed on a dense silt. Previous drained triaxial compression tests on this silt have shown that $\phi' = 32°$. If the unconfined compressive strength is 420 kPa, how much residual confining pressure was generated in the specimen when it was removed from the ground? Assume the specimen is 100% saturated ($B = 1$) and the soil skeleton is perfectly elastic (A = 1/3).

4. A CD triaxial compression test is performed on a sand at an effective confining pressure of 450 kPa. At failure, τ_{max} = 594 kPa. Draw the Mohr circle at failure and determine ϕ'.

5. Now assume that a second specimen of the soil in the previous problem is sheared <u>undrained</u> at the same confining pressure and that Δu_f = 100 kPa. Determine A_f and draw the total stress and effective stress Mohr circles at failure. What is the total stress friction angle of the sand?

6. Now assume that a third specimen of the same sand as in the previous two problems is sheared undrained at a confining pressure of 1000 kPa. Draw the total and effective stress Mohr circles at failure. Assume the same A_f as in the previous problem.

7. The following data were obtained from a CU triaxial compression test on an undisturbed specimen of sandy silt. The consolidation pressure was 850 kPa. (a) Plot the principal stress difference and pore pressure as a function of the axial strain. (b) Plot the total and effective stress paths and mark the points corresponding to the maximum effective principal stress ratio and the maximum effective principal stress difference. (c) Determine ϕ' using both definitions of failure. Is there any difference?

Principal Stress Difference (kPa)	Strain (%)	Induced Pore Pressure (kPa)
0	0	0
226	0.11	81
415	0.25	187
697	0.54	323
968	0.99	400
1470	2.20	360
2060	3.74	219
2820	5.78	−009
3590	8.41	−281
4160	11.18	−530
4430	13.93	−703
4310	16.82	−767
4210	19.71	−789