Due 27/04, Monday, 17:00

Soil Mechanics Homework-4

1. In an oedometer test on a 2cm thick sample, the following set of data was recorded under constant stress of 800 kPa:

t (min)	1	2	4	8	15	30	60	120	240	480	960	1440
e	0.9221	0.9214	0.9204	0.9193	0.9178	0.9155	0.9123	0.909	0.907	0.906	0.9055	0.905

a) Calculate coefficient of consolidation by Casagrande's method.

b) Calculate coefficient of consolidation by Taylor's method. *(Do not be confused if the answer is different from the answer in part a)*

Void ratios at the end of the other load increments for this test are:

σ (kPa)	0	25	50	100	200	400	800	1600
e	0.946	0.945	0.943	0.941	0.937	0.925	0.905	0.885

c) Find preconsolidation pressure (maximum past effective stress), by Casagrande's method.

d) Calculate compression index , compression ratio , recompression/reload index and reload ratio. Assume the clay was normally consolidated in its natural state before sampling. *(Note that the stress axis is in log-scale, but the numbers written on the axis are actual stress values. So you still need to take their log)*

e) Consider the stress increment from 100 kPa to 200 kPa. Determine the ***pore pressure*** at the center (mid-level) of the specimen when void ratio is 0.939. *Since the setup is open to atmosphere, pore pressure is zero at the end of each stress increment. Hint: find average degree of consolidation first.*

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2. A 6 meter thick clay layer has the following properties: σ_p'=60 kPa , C_c=0.06 , C_r=0.015, e_o=0.8 , γ_{sat}=20 kN/m^3 , c_v=0.24 m^2/month. This clay layer overlies a sand layer. Groundwater level is at the ground surface. A building will be constructed on this soil. A thin layer of crushed stone (uniform gravel with angular particles) is laid on the surface so that the foundation slab is not in direct contact with the clay. The building is large enough to assume one-dimensional consolidation. The construction will take exactly 6 months, during which the load can be assumed to increase linearly with time, starting from 0. When completed, the building will apply 120kPa additional stress to the soil.

a) Plot the variation of over-consolidation ratio with depth, before construction.

b) Calculate the average degree of consolidation for this layer at 1 year after the ***end*** of construction.

c) Calculate the consolidation settlement at 1 year after the ***end*** of construction, relative to the beginning of construction. Divide the clay into two equal sublayers.

d) Calculate effective stress at depths of 0, 1.5, 3, 4.5 and 6 meters at 1 year after the ***end*** of construction. Plot the effective stress distribution with depth, at t.