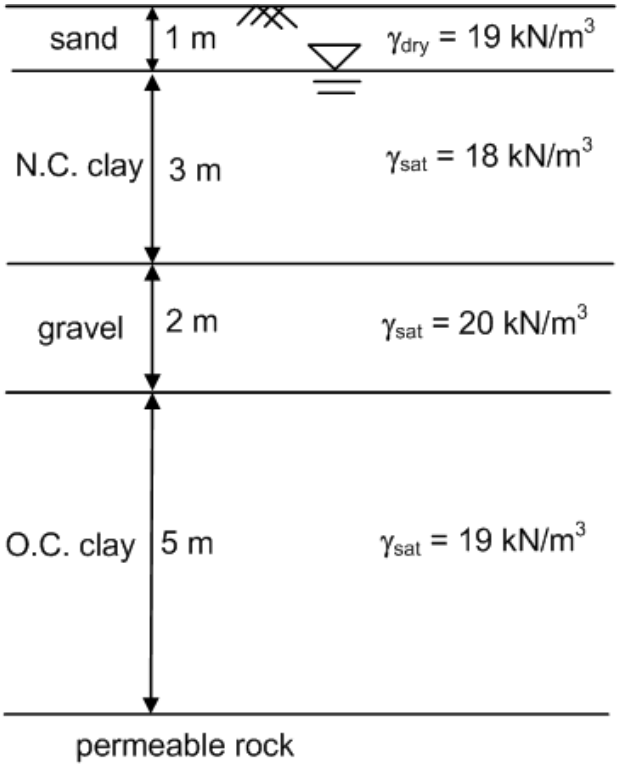
Deadline: April 28 Monday, 17:00

Spring'14 Soil Mechanics Homework 4

Soil profile given below is composed of sand, normally consolidated (N.C) clay, gravel and over consolidated (O.C.) clay. A 4-m-thick fill (γ=17 kN/m^3) will be placed rapidly at the ground surface.



1) Calculate the total and effective vertical stresses and the pore water pressure, only at the mid-depth of each clay layer, before the fill is placed, immediately after the fill is placed, and after the clays have fully consolidated under the vertical stress increment due to the fill.

2) A laboratory oedometer (consolidation) test is carried out on a sample taken from the N.C. clay. Using the lab data given below, plot the void ratio versus effective stress (e - σ') graph and calculate m_v of the N.C. clay layer. You can see from your plot that m_v changes with effective stress. Consider the initial (σ'_o) and final effective stresses (σ'_f) at the mid-depth of N.C. clay layer, and use values (e_o , σ'_o) and (e_f , σ'_f) obtained from your plot to calculate m_v .

σ' (kPa)	e
25	0.966
50	0.920
100	0.847
150	0.796
200	0.759
300	0.698

3) A laboratory oedometer test is carried out on a sample taken from the O.C. clay. Using the lab data given on the right, plot the void ratio versus log effective stress (e - log σ') graph and determine preconsolidation pressure (σ_p'), reloading index (C_r), compression index (C_c) and over-consolidation ratio at the top of the layer (OCR= σ_p'/σ_v').

σ' (kPa)	e
25	0.826
50	0.817
100	0.805
200	0.710
400	0.618

4) Calculate final consolidation settlement of each clay layer due to the stress increase caused by 4-m-high fill.

The placement of the fill was actually not instantaneous, but it took 2 months. Answer the remaining parts accordingly.

5) How much ground surface settlement will be observed at 7 months after the end of placement of the fill. Coefficient of consolidation for the N.C. clay is 1.8 m^2/year and for O.C. clay it is 1.2 m^2/year.

6) How long time is required after the placement of the fill for the N.C. clay layer to settle 50 mm?

7) Calculate the pore pressure at the depth of 10 m from the initial ground surface, 1 year after the placement of the fill.