

Due 27/03, Friday, 17:00  
To be dropped into the homework box inside the laboratory.

### **Soil Mechanics Homework-2**

State all assumptions clearly. For all questions, you may take  $\gamma_w = 10 \text{ kN/m}^3$ .

**1.** A layer of sand extends from ground level to a depth of 6 m and overlies a layer of clay. The ground water table is 2 m below the ground surface. The saturated unit weight of the sand is  $19 \text{ kN/m}^3$  and that of the clay is  $20 \text{ kN/m}^3$ . The dry unit weight of the sand is  $15 \text{ kN/m}^3$ . The capillary zone is 1 m thick.

a) Plot the variation of total vertical stress, pore pressure and vertical effective stress, with depth, down to the depth of 8m.

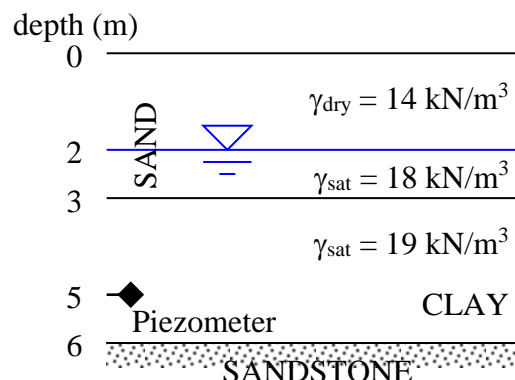
b) Foundation of a very wide (you may ignore variations in the horizontal directions and assume 1-D conditions) building will be placed at the depth of 4 m. For this purpose the groundwater at the site is lowered to the depth of 5m, and the top 4 meters of the soil is excavated, all in a short time. Plot the variation of total vertical stress, pore pressure and vertical effective stress with depth, when the excavation is finished.

c) When completed, the building applies a foundation pressure of 100 kPa. At the end of construction, the dewatering system is also stopped, eventually bringing the groundwater back to its original level. Plot the variation of total vertical stress, pore pressure and vertical effective stress with depth, a long time after the completion of the project.

**2.** A piezometer (pore water pressure monitoring device) is installed to the depth of 5 m, into the illustrated soil profile. It measures 40 kPa.

a) Plot the variation of total vertical stress, pore water pressure, and vertical effective stress with depth.

b) A fill is placed onto the surface. The fill is 2 meters thick and weighs  $17 \text{ kN/m}^3$ . Estimate what the piezometer will measure immediately after the placement of the fill.



c) Another location in the same site will be excavated for a landfill, and any waterflow into the excavation will be pumped out, keeping the groundwater level at the base of the excavation. What is the maximum depth to which we can excavate without having instability at the bottom of excavation. (Hint: the piezometer measurement does not have to remain constant during excavation, but the pore pressure in the sandstone remains constant. Hint2: for the base to remain stable, vertical effective stress has to remain positive.)