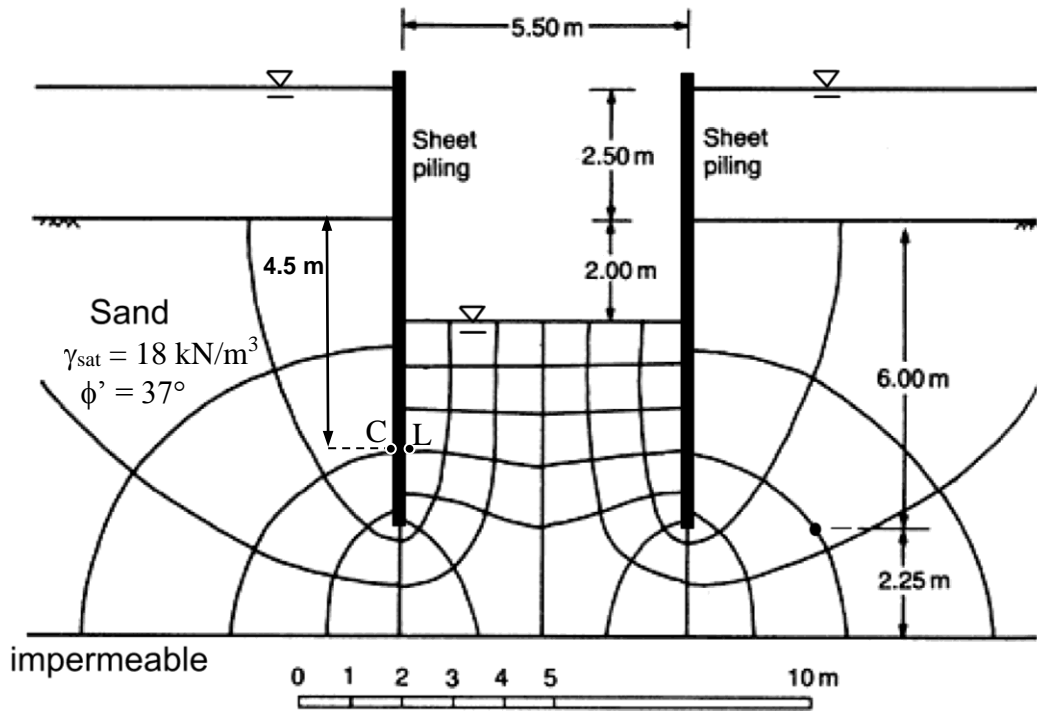


### Soil Mechanics Homework-6

State all assumptions clearly. For all questions, you may take  $\rho_w = 1 \text{ g/cc}$ ,  $g = 10 \text{ m/s}^2$ .

**1.** The figure depicts the canal excavation given in homework 3. (You may consult the solution to that homework, and use the elevations and pore pressures given in that solution.)



**a)** Calculate the maximum horizontal effective stress that might act on the wall at point C.

Assume the soil around the wall fails due to the wall's movement into the excavation for the remainder of this question.

**b)** Draw the strength envelope and effective stress Mohr circles at C and L on the same plot.

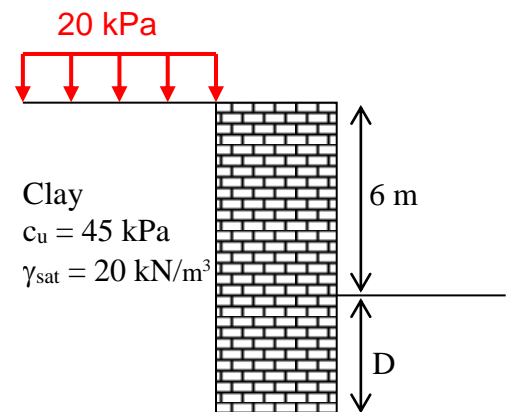
**c)** Plot the horizontal effective stresses along depth, on both sides of one wall.

**d)** Calculate the total active force and total passive force (per unit length into the page).

**2.** For the depicted retaining wall in clay, consider undrained failure of the soil due to the wall translating towards right.

**a)** Calculate the depth of tension crack.

**b)** Determine the minimum depth of embedment (D) that prevents the wall from moving to the right, based on only horizontal force equilibrium (assume unbalanced moments are countered by eccentricity between the weight of the wall and vertical stress on the base, so there is no need to write moment equilibrium). Assume tension crack is filled with water. Ignore shear resistance under the base of the wall.



3. A retaining wall and a trial failure plane behind the wall is shown in the figure below. There is a surcharge of 30 kPa at the ground surface. The effective stress shear strength parameters for the soil are given as :  $c' = 5 \text{ kN/m}^2$   $\phi' = 25^\circ$ . Dry and saturated unit weights of the soil are 18 and  $20 \text{ kN/m}^3$ , respectively. The wall-soil friction ( $\delta$ ) can be assumed to be  $20^\circ$ . The wall-soil adhesion ( $c_w$ ) is the same as  $c'$  of the soil.

Retaining walls are typically designed and constructed with sufficient drainage so that pore water pressure does not develop at the back of the wall. However, we imagine the worst-case scenario, and assume that drainage does not work properly, and there is water pressure behind the wall.

- Show all the forces acting on the soil wedge given below with their proper directions.
- Calculate the magnitude of these forces (show your calculations).
- Find the total soil force (direction and magnitude) that the soil wedge applies on the wall (*Hint: This is the resultant of the unknown force between soil and wall, water force, and the shear on the wall surface*). Solutions with either force polygon or equilibrium equations are acceptable.

