

Shear Strength: Mohr Circle and Direct Shear Test

Q1. The stresses acting on a soil element are shown in Figure 1. Draw the Mohr Circle and determine:

- the magnitude of the major and the minor principal stresses and the orientation of the two principal planes.
- the normal stress, σ_α and the shear stress, τ_α on the plane inclined at an angle $\alpha = -20^\circ$ from the horizontal, as shown in Figure 1.
- Describe the steps in the graphical solution for a) and b).

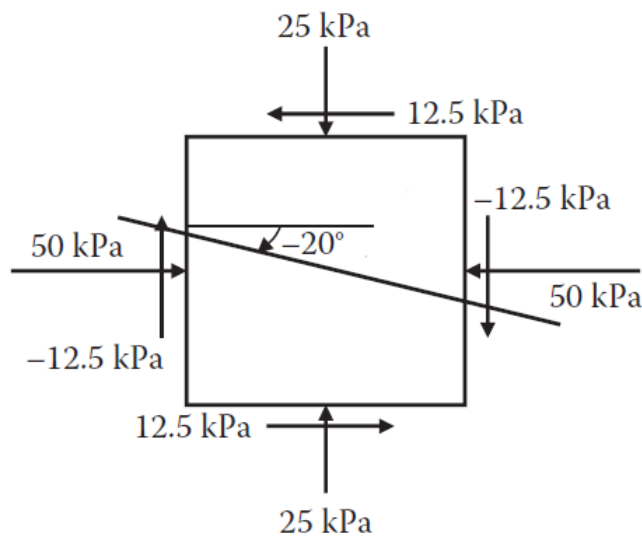


Figure 1

Q2. The major and the minor principal stresses on a soil element, rotated at an angle 30° from the horizontal, are 120 kPa and 50 kPa, respectively. Draw the Mohr Circle and determine the normal stress, σ_α and the shear stress, τ_α on the plane inclined at an angle $\alpha=45^\circ$ from the base of the element, as shown in Figure 2. Describe the steps in the graphical solution.

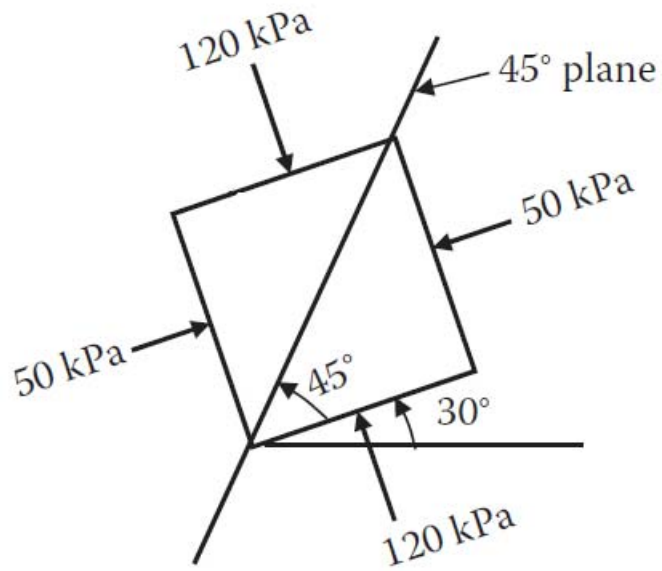


Figure 2

Q3. A direct shear test is performed on a sample of dry sand. At failure, the measured normal force $N = 288$ N and the shear force, $S = 173$ N. The cross sectional area of the sample is 36 cm^2 . Draw the Mohr-Coulomb failure envelope and the Mohr circle at failure. Determine:

- a) The angle of internal friction of the sand.
- b) The major and the minor principal stresses at failure.
- c) The orientation of the failure plane.
- d) The orientation of the major and the minor principal planes at failure.
- e) Describe the steps in the graphical solution for a), b), c) and d).