Assignment 5: Geotechnical Engineering I

Assigned date: 22 Apr 2024
Due date: 29 Apr 2024, 23:59 pm

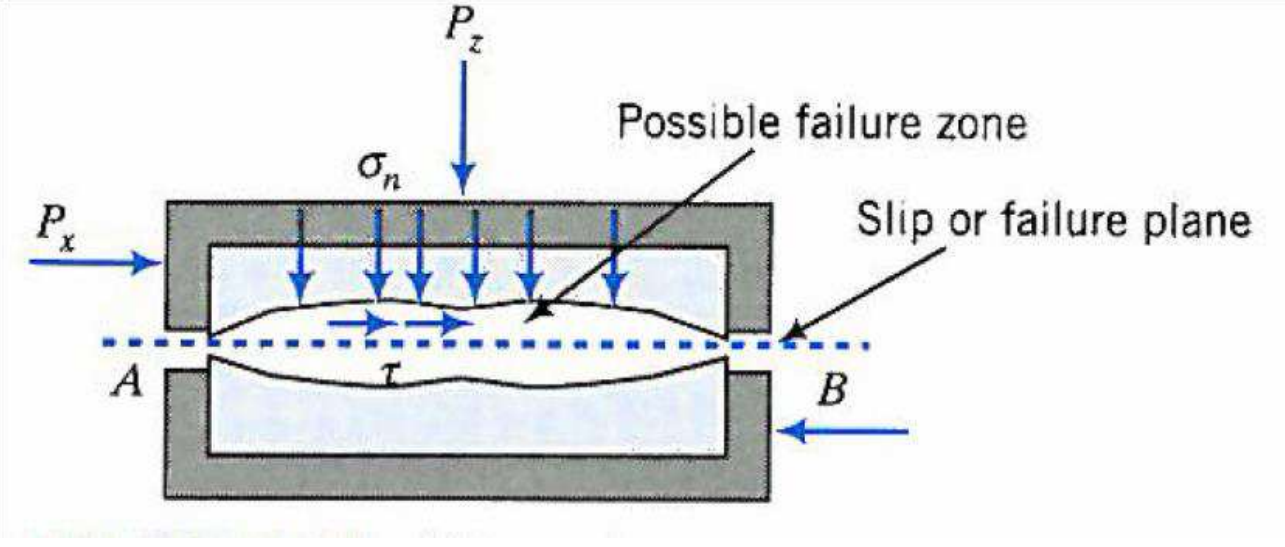
Note 1. Submit your assignment electronically via CANVAS
Note 2. Show your homework clearly. When appropriate, illustrate your work with diagrams, and/or figures.

5.1. Three direct shear tests were conducted on a dry soil. The effective normal stresses (σ_{nf}') and shear stresses (τ_f) at failure in these four tests are as follows (all in kPa): (50, 35); (100, 85); (200, 180); (350, 240).

Assume the soil obeys the Mohr-Coulomb failure criterion:

$$\tau_f = c' + \sigma_{nf}' \tan \phi'$$

(a) Plot the test results in σ_{nf}'- τ_f space;
(b) Hence, determine the effective cohesion, c', and the effective friction angle ϕ' of the soil. *You should use best-fitting method (trend line) with the aid of Microsoft Excel.*
(c) What is the difference between effective stress and total stress? How would water in the soil pore affect the shearing behaviour of the soil?



5.2. Two large diameter bored piles were constructed (D = 2.0 m); one is a straight pile and the other has a bellout with an expanded diameter of 1.5D. Both piles were founded on solid bedrock. Assume an ultimate toe bearing pressure of 15 MPa and neglect the shaft resistance.

(a) Calculate the ultimate bearing capacities of these two piles.
(b) Calculate the allowable capacities of these two piles adopting a factor of safety (FS) = 2.0.