CIVL1100 Discovering Civil and Environmental Engineering

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

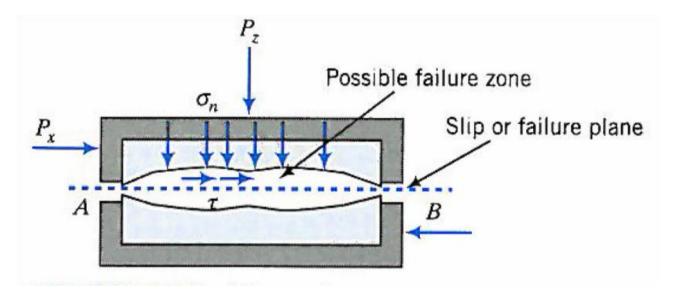
Note 2. Show your homework clearly. When appropriate, illustrate your work with diagrams, and/or figures.

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.

