

CN215: Problem sheet 5 - Lab testing Solutions

Question 1:

- (c) Test 1: $\phi' = 25.3$; Test 2: $\phi' = 20.8$
- (d) $S_u = 182.5$ kPa
- (e) 144.7 kPa, 170.6 kPa

Question 2:

Refer to 04/05 exam and have a go.

Question 3:

Solution The values for the undrained shear box test are plotted on Fig. 4.13, from which it can be seen that:

$$c_u = 60 \text{ kN/m}^2$$

$$\phi_u = 15^\circ$$

It is possible to perform an unconfined compression test in a triaxial testing machine by keeping the cell pressure at zero.

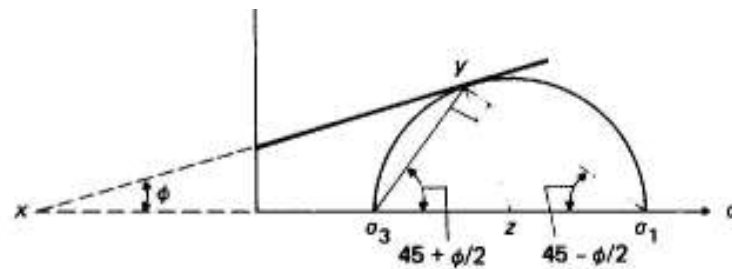


Figure 4.15

unconfined compression test $\sigma_3 = 0$, $\phi = 15^\circ$

$$\sigma_1 = 150 \text{ kN/m}^2$$

$$\therefore c_u = 75 \text{ kN/m}^2$$

undrained triaxial test $\sigma_3 = 275 \text{ kN/m}^2$

$$\sigma_3 = 275 \text{ kN/m}^2$$

$$\therefore \sigma_1 = 610 \text{ kN/m}^2$$

$$\phi_u = 15^\circ$$

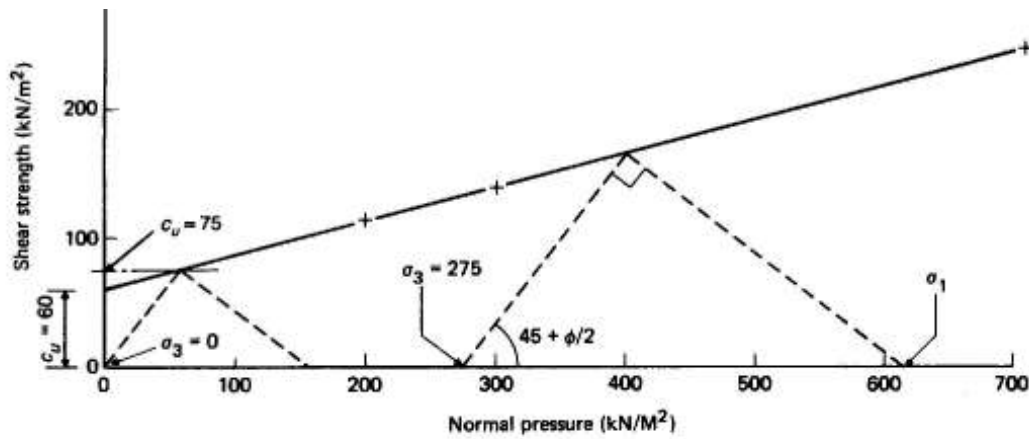


Figure 4.13

Only one result is obtained from this test and, since $\sigma_3 = 0$, the Mohr circle diagram will be as shown on Fig. 4.14 and it is assumed that

$$\tau_f = c_u = \frac{\sigma_1}{2}$$

From the geometry of the Mohr circle of stress (Fig. 4.15), it can be seen that:

$$\begin{aligned} \text{angle } xzy &= 90^\circ - \phi \\ \therefore \text{angle } y\sigma_1x &= 45^\circ - \phi/2 \\ \therefore \text{angle } y\sigma_3\sigma_1 &= 45^\circ + \phi/2 \end{aligned}$$

Thus, if the Mohr-Coulomb failure envelope is known and the cell pressure σ_3 is given, the value of σ_1 can be found by setting out on the shear strength/pressure diagram:

$$\text{angle } y\sigma_3\sigma_1 = 45^\circ - \phi/2$$

and

$$\text{angle } \sigma_3y\sigma_1 = 90^\circ$$

This has been done on Fig. 4.13 and the following results obtained:

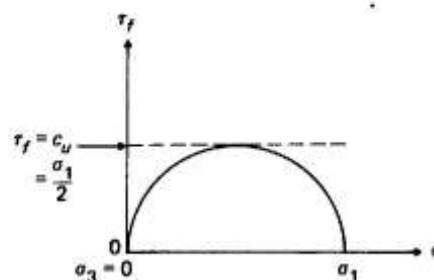


Figure 4.14