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FINAL EXAMINATION

QUESTION # 1 (25%)

Compute the anticipated total consolidation settlement under the center of the raft foundation (45 m X 30 m) shown in **Figure # 1**. The clay is normally consolidated which has a compression index of 0.36 and an initial void ratio of 1.13. The moist and saturated unit weights of the sand layer are 16.5 kN/m³ and 18.6 kN/m³, respectively. The saturated unit weight of the clay layer is 19.5 kN/m³.

If the coefficient of consolidation of the clay layer is 3.94 m²/year, compute the time required for the clay layer to settle 8 cm?

Use
$$T = \frac{\pi}{4} \left[\frac{U\%}{100} \right]^2$$

QUESTION # 2 (25%)

A direct shear test is run on a medium dense sand with the normal stress ($\sigma_n = 65$ kPa). At failure the normal stress ($\sigma_n = 65$ kPa), and the shear stress = 41 kPa.

Draw the Mohr circle at failure and determine:

- The major and minor principal stresses at failure.
- The orientation of the major principal plane at failure.
- The orientation of the failure plane.
- The orientation of the plane of maximum shear stress at failure.

QUESTION # 3 (25%)

For the retaining wall shown in **Figure # 2**, plot the active pressure distribution on the back of the wall and determine the active thrust, P_a , and its location.

Use Rankine theory.

QUESTION # 4 (25%)

Determine the factor of safety for the slope shown in **Figure # 3** for the given failure surface. For both soils, the unit weight is 17 kN/m³, and the angle of friction is zero. The values of the undrained shear strength, C_u , are 20 kN/m² for soil (1) and 35 kN/m² for soil (2).

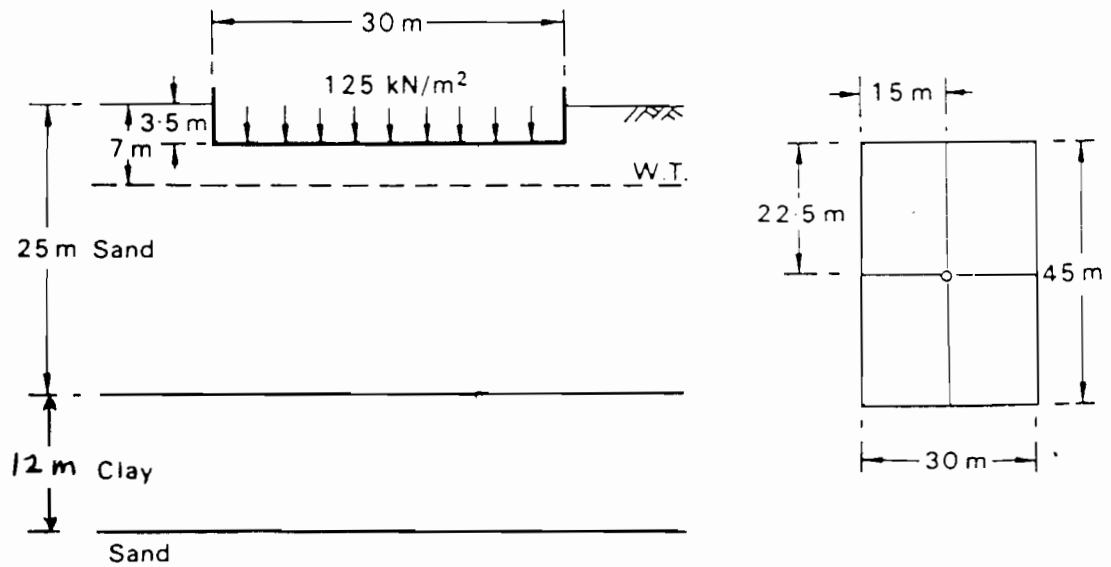


Figure # 1

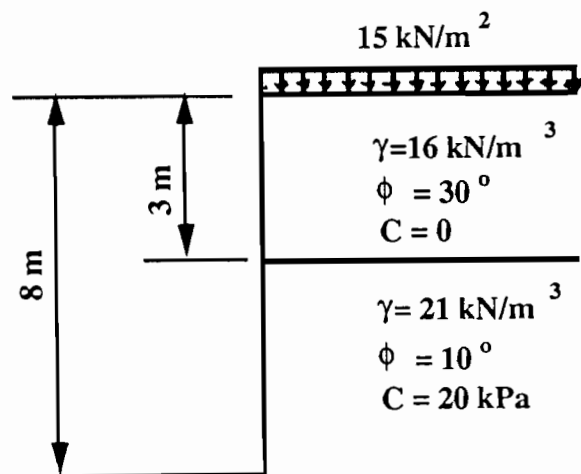


Figure # 2

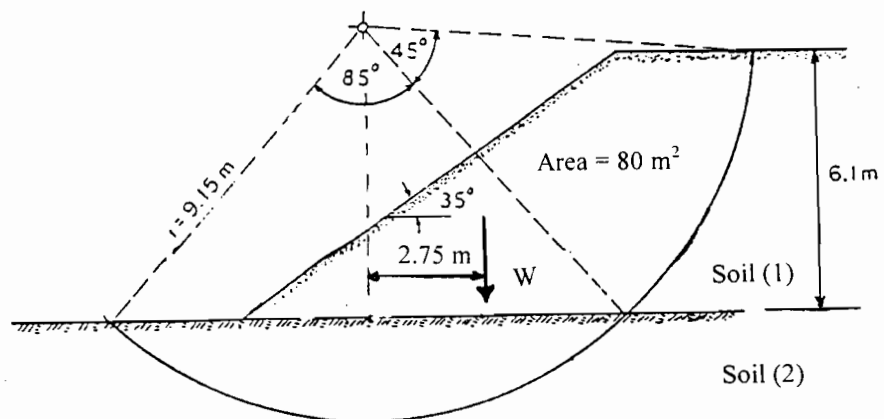


Figure # 3