Govt. Engineering College, Ajmer

Department of Civil Engineering

Mid – term test – 2 session: 2017 – 18 Time: 1 hr. VI Semester M.M.: 10

Geotechnical Engineering – II

Q: 1. A retaining wall with a stratified backfill and a surcharge load is shown in fig – 1. Draw the active earth pressure diagram detailing the values at the critical points. Also estimate the resultant thrust on the wall and its position. (4)

Q: 2. Using Terzaghi`s theory, determine the ultimate bearing capacity of a strip footing 1.5m wide resting on a saturated clay (c_u = 30kN/m², φ_u = 0° and γ_{sat} = 20kN/m³), at a depth of 2m below ground level. The water table also at a depth of 2m from the ground level. If the water table rises by 1m, calculate the percentage reduction in the ultimate bearing capacity. (3)

Q: 3. What type of information should be gathered from general site exploration? OR

Q: 3. Discuss about different type of soil samplers. (3)

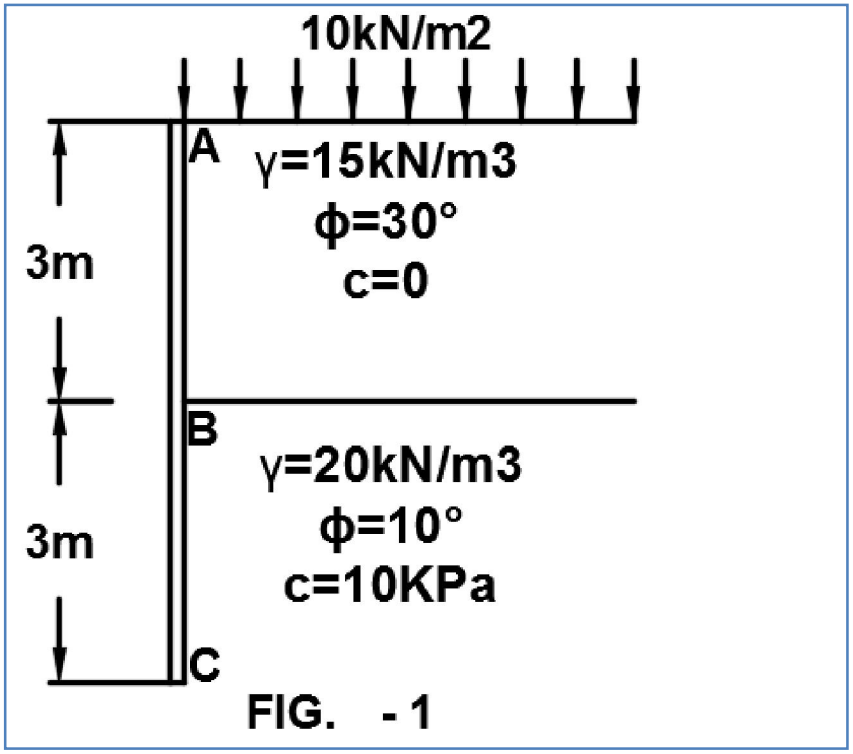

FIG. - 1

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Sol: 1. For the first stratum, $Ka_1 = 0.333$;
For the second stratum, $Ka_2 = 0.704$
(a) p_a – diagram for top soil

$$pa = (Ka1 \times q) + (ka1 \times \gamma 1 \times z1)$$
$$pa = (0.333 \times 10) + (0.333 \times 15 \times 3) = 18.333 kN/m^2$$

(b) p_a – diagram for bottom soil

$$pa = \left(Ka2 \times \left(q + (\gamma 1 \times h1)\right)\right) + (ka2 \times \gamma 2 \times z2) - \left(2 \times c \times \sqrt{ka}\right)$$

or $$pa = \left(0.704\left(10 + (15 \times 3)\right)\right) + (0.704 \times 20 \times z2) - \left(2 \times 10 \times \sqrt{0.704}\right) = 21.939 + 14.08z2$$

At B, z2 = 0; $p_a = 21.939$ kN/m^2
At C, z2 = 3m; $pa = 21.939 + (14.08 \times 3) = 64.179\ kN/m^2$
The composite pa diagram is shown in figure – A.
Now $P1 = 3.333 \times 3 = 10\ kN/m$ **Acting at $z_1 = 4.5$ m above base**
$P2 = (0.5 \times 15 \times 3) = 22.5\ kN/m$ **Acting at $z_2 = 4.0$ m above base**
$P3 = 21.939 \times 3 = 65.817\ kN/m$ **Acting at $z_2 = 1.5$ m above base**
$P4 = 0.5 \times 42.24 \times 3 = 63.36\ kN/m$ **Acting at $z_2 = 1.0$ m above base**
Total Pa = 10+22.5+65.817+63.36 = 161.677 kN/m Ans.
Acting at $z = \frac{(10\times4.5)+(22.5\times4.0)+(65.817\times1.5)+(63.36\times1.0)}{161.677} = 1.837\ m\ above\ base.\quad Ans.$

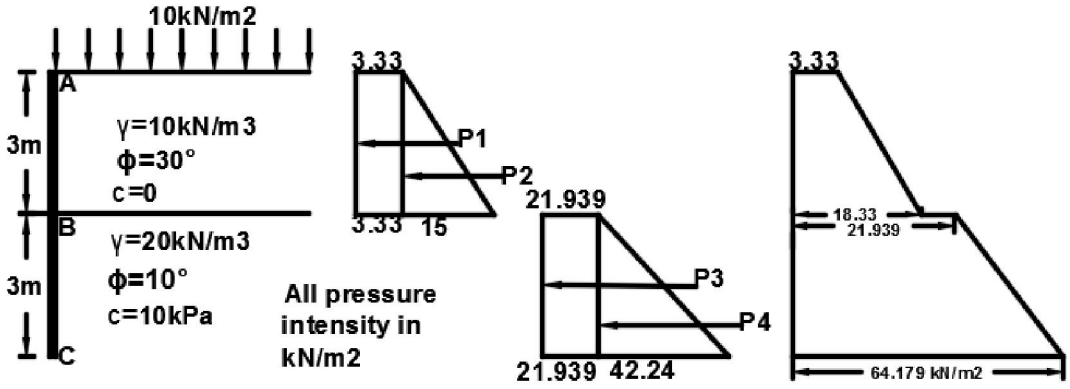

Fig - A

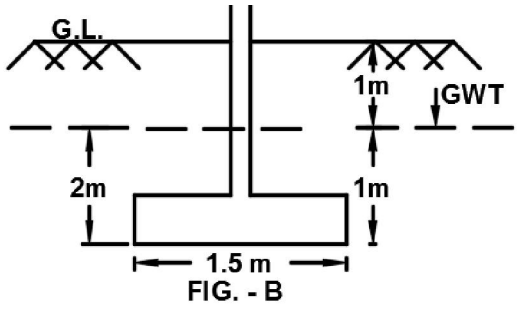

FIG. - B

Sol: 2. For $\emptyset = 0°, Nc = 5.7, Nq = 1.0\ and\ N\gamma = 0$
Also Cu = 30kN/m^2
Hence $q_f = cN_c + \gamma D\ N_q + 0.5B\gamma N_\gamma = (5.7 \times c) + (\gamma \times D)$
(a) Water table at foundation level
$q_f = (5.7 \times c) + (\gamma_{sat} \times D) = (5.7 \times 30) + (20 \times 2) = 211 kN/m^2$
(b) Water Table at 1m above the foundation level: (see fig – B)

$q_f = (5.7 \times 30) + \left((20 \times 1) + (10.19 \times 1)\right) = 201.19\ kN/m^2$

% Reduction = $\frac{211-201.19}{211} \times 100 = 4.75\%\ Ans.$