GE - I Solution

31-5-18

QP code: 50653

Q2 a) Data.

$G = 2.67$, $e = 0.63$

$$\gamma_d = \frac{G \cdot \gamma_w}{1+e} = \frac{2.67 \times 9.81}{1+0.63} = 16.06 \text{ kN/m}^3$$

$$I_D = \frac{e_{max} - e}{e_{max} - e_{min}} \times 100 = ~~\frac{1475 - 0.63}{1475 - 1770} \times 100~~$$

$$\gamma_{d\,max} = \frac{1770}{1000} \times 9.81 = 17.36 \text{ kN/m}^3$$

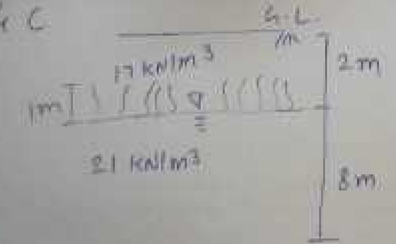
$$\gamma_{d\,min} = \frac{1475}{1000} \times 9.81 = 14.45 \text{ kN/m}^3$$

$$e_{min} = \frac{G \cdot \gamma_w}{\gamma_{d\,max}} - 1 = \frac{2.67 \times 9.81}{17.36} - 1 = 0.508$$

$$e_{max} = \frac{G\ \gamma_w}{\gamma_{d\,min}} - 1 = \frac{2.67 \times 9.81}{14.45} - 1 = 0.81$$

$$I_D = \frac{0.81 - 0.63}{0.81 - 0.508} \times 100 = 59.60\%$$

Q4 c



total stress

$\sigma = Z \cdot \gamma_b$

at $Z = 0$ m $\sigma = 0$

$Z = 1$ m $\sigma = 17 \times 1 = 17$ kN/m²

$Z = 2$ m $\sigma = 17 + 21 \times 1 = 38$

$Z = 10$ m $\sigma = 38 + 21 \times 8 = 206$

$u = \gamma_w \times z$

at $z = 0$ $\quad u = 0$

$z = 1$ $\quad u = -9.81 \times 1 = -9.81$

$z = 2$ $\quad u = -9.81 \times 1 + 9.81 \times 1 = 0$

$z = 10$ $\quad u = 8 \times 9.81 = 78.48$

σ':

$z = 0$ $\quad \sigma' = 0$

$z = 1$ $\quad \sigma' = 17 - (-9.81) = 26.68$

$z = 2$ $\quad \sigma' = 38 - 0 = 38$

$z = 10$ $\quad \sigma' = 206 - 78.48 = 127.52$ kN/m^2

Q3 a] $\quad k = 2.3 \dfrac{aL}{At} \log_{10} \dfrac{h_1}{h_2}$

$h_1 = 50$ cm, $h_2 = 40$ cm, $a =$, $L = 10$ cm, $A =$

$t = 60 \times 1 = 60$ sec

Q5b - i] Liquid limit = 40% Plastic limit = 22%.
ii] Liquid limit = 20%. Plastic limit = 14%.

⇒ ① $W_L = 40\%$, $W_P = 22\%$.
$I_P = 40 - 22 = 18\%$.

Plotting the point for $I_P = 18\%$ & $W_L = 40\%$ on plasticity chart, group symbol for the soil will be CI

② $W_L = 20\%$. $W_P = 14\%$.
$I_P = 20 - 14 = 6\%$.
Soil falls in CL-ML sector.

SE-I, 31.05.18 Q3A, 5C, 6C
(CBSGS)

Q 1. C A_c = Corrected area

$$= \frac{\pi/4 \times 3.8^2}{(1 - 0.02)} = 11.57\ cm^2$$

Unconfined strength (UCS) $= \frac{116}{11.57} = 10.026\ N/cm^2$

Undrained cohesion $c_u = \frac{UCS}{2}$

$$= \frac{10.026}{2} = 5.013\ N/cm^2$$

Q 3 (A) $a = A = \pi/4 \times 5^2$ Here standpipe is used as a permeameter

$L = 10\ cm$, $h_1 = 50\ cm$, $h_2 = 50 - 10 = 40\ cm$

$t = 1\ min = 60\ sec$

$K = ?$

$$K = 2.303 \times \frac{aL}{At} \log_{10}(h_1/h_2)$$

$$= 2.303 \times \left(\frac{a}{A}\right) \times \frac{10}{60} \times \log_{10}(50/40)$$

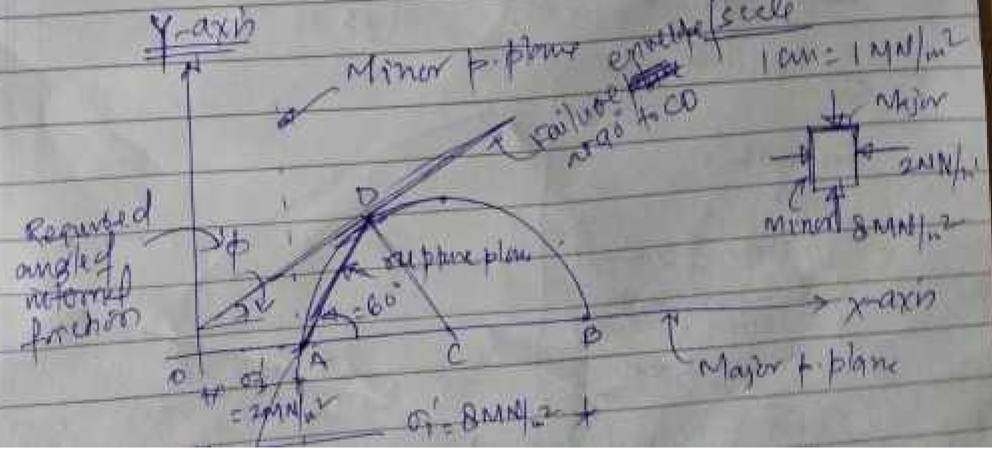
$$= 0.03719\ cm/sec$$

Q. 5 (C) Major effective principal stress = 8 MN/m²

$\sigma_1' = 8\ MN/m^2$

Minor effective principal stress $\sigma_3' = 2\ MN/m^2$

α = angle of rupture plane = 60°



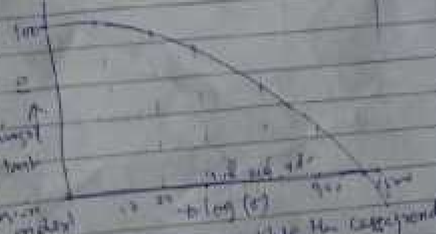
Q5(c)

Steps: 1) Draw the Mohr's Circle diagram AB as usual.
2) Locate the rupture point D on Mohr's Circle by taking θ from x-axis at point A, as pass a line AD (rupture plane / failure plane) at 60° from x-axis.
③ At D, draw a line tangential to Mohr's Circle and at 90° to the radial line CD. this is known as failure envelope,
④ Inclination of failure envelope with horizontal is known as angle of internal friction

Q6(c)

Pressure	Disk. read. (mm)	Final height (mm)	Void ratio $e = (\frac{H}{H_s} - 1) \times 100$ (%)
0	0.000	2.500	100.00
13	0.000	2.500	100
27	0.004	2.496	99.6
54	0.016	2.480	98.4
108	0.044	2.440	85.2
214	0.104	1.956	59.8
480	0.218	1.718	37.4
960	0.340	1.378	30.84
1590	0.470	0.958	23.81

plot the



From this plot:
① Slope of straight line part in that chart is the compression index
② For preconsolidation process, consider the Casagrande's procedure