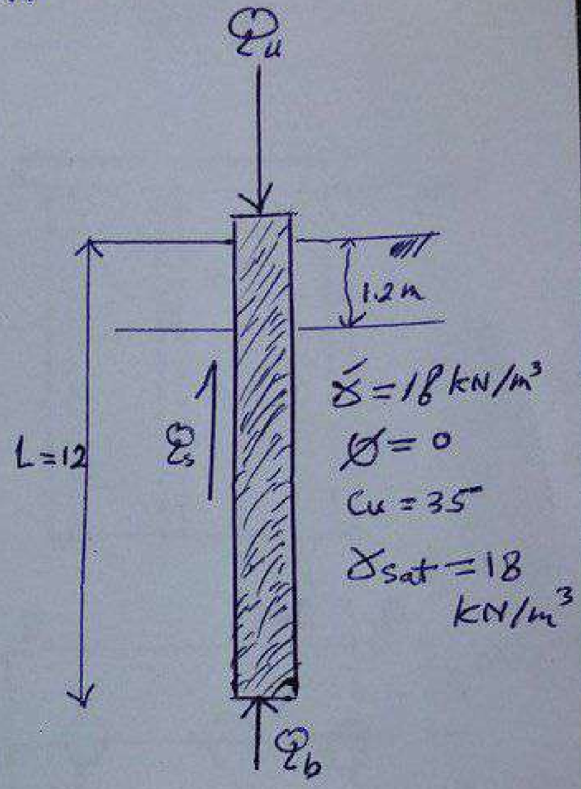
Q1: Determine the max Load can be applied on the pile of (D=0.8m)

$$\frac{C_u}{P_{atm}} = \frac{35}{100} = 0.35 \quad \therefore \alpha = 0.78$$



$$Q_s = P L \alpha C_u$$

$$= \pi(0.8) * 12 * 0.78 * 35$$

$$= 823.3 \text{ kN}$$

$$Q_b = 9\, C_u A_b + q$$

$$= 9 * 35 * \frac{\pi\, 0.8^2}{4} + (2\times16 + 8*10.8)$$

$$= 270 \text{ kN}$$

$$Q_u = 823 + 270$$

$$= 1093 \text{ kN}$$

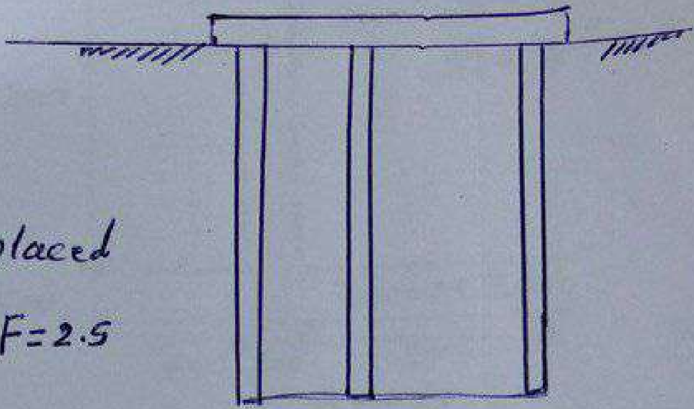
$\frac{C_u}{P_{atm}}$	α
0.1	1.00
0.2	0.92
0.3	0.82
0.4	0.74

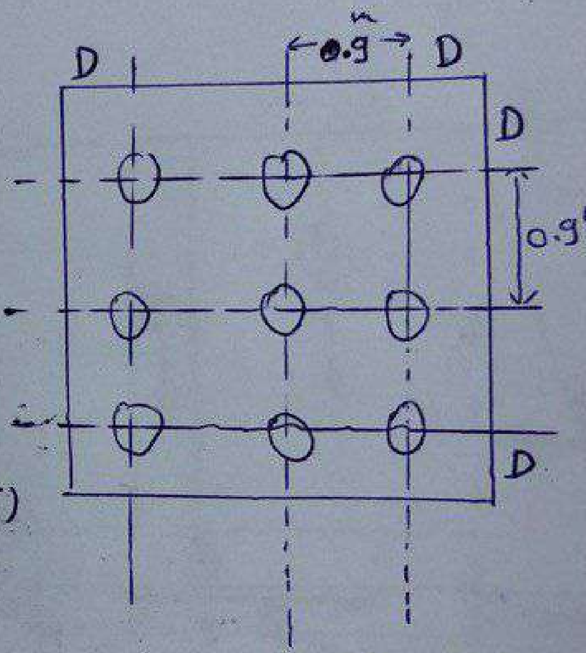
0.35 → (between 0.3 and 0.4) → α

$$\alpha = \frac{0.82 + 0.74}{2}$$

$$= 0.78$$

A group of 9 piles were driven into a soft clay the diameter and length of the piles are 0.35 m and 12 m respectively.
$q_u = 70\ kN/m^2$. The piles were placed 90cm c-c. compute Q_{all} if $F=2.5$ let $N_c = 9$





step1:

$n_1 = n_2 = 3$

$L_g = B_g = 2*0.9 + 2D$

$= 2*0.9 + 2*0.35 = 2.5\ m$

$\sum Q_u = n_1 n_2 [9 C_u A_b + \sum \alpha C_u p \Delta L]$

$= 3*3 [9*35*\frac{0.35^2 \pi}{4} + 0.78*(0.35\pi)\ 35 * 12m]$

$= 3514\ kN$

$C_u = \frac{q_{unc}}{2} = \frac{70}{2} = 35\ kN/m^2$

A_b

$\frac{C_u}{P_{atm}} = \frac{35}{100} = 0.35$

$\rightarrow \alpha = 0.78$

step2:

$\sum Q_u = L_g B_g C_u N_c + \sum 2(L_g + B_g) C_u \Delta L$

$= 2.5*2.5*35*9 + \sum 2(2.5+2.5) 35 * 12$

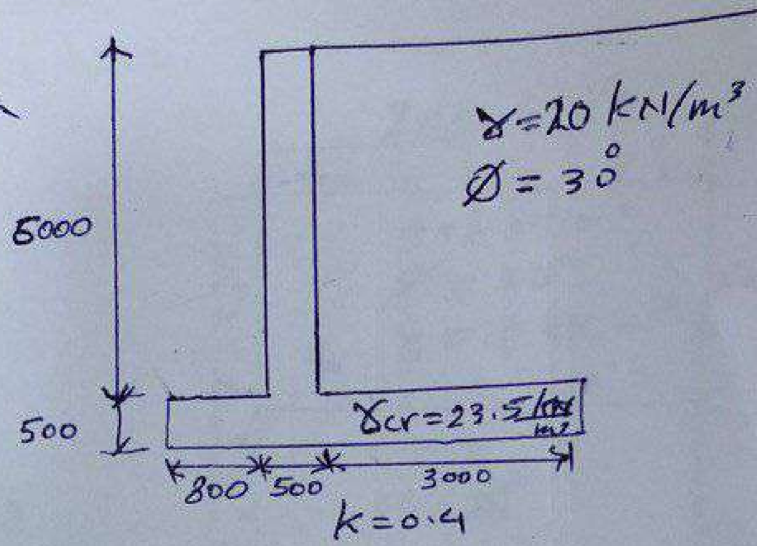
$= 6168$

chose $Q_u = 3514$

$Q_{all} = \frac{Q_u}{F} = \frac{3514}{2.5} = 1405\ kN$

Q:

check Sliding, overturning for the Cantilever wall shown in the figure.



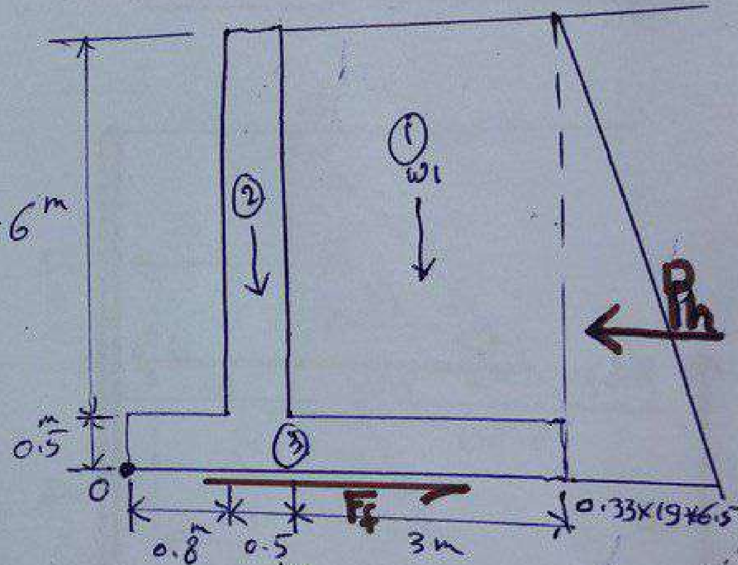
$K_a = \tan^2(45 - \frac{\phi}{2})$

$= \tan^2(45 - \frac{30}{2})$

$= 0.33$

$P_h = k_a \frac{\gamma H^2}{2} = \frac{0.33 * 20 * 6.5^2}{2}$

$= 139$ kN



$F_f = \Sigma V * K$

$= 481 * 0.4$

$= 192.4$

Factor of safety for sliding

$F_s = \frac{F_f}{P_h} = \frac{192.4}{139} = 1.38 < 1.5$

Not good

The retaining wall requirs some proportioning

Factor of safety for overturning

$F_s = \frac{\Sigma M_R}{\Sigma M_o}$

$= \frac{1190}{300} = 3.96 \simeq 4$

> 2.5

good

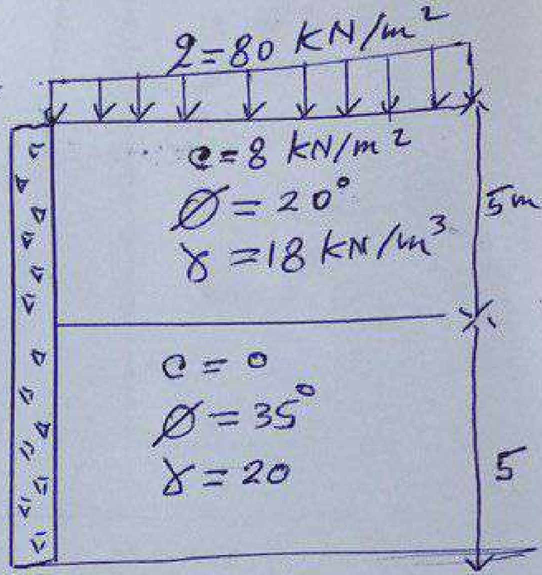
section	Force, kN	d, m	M, kN.m
①	360	2.8	1008
②	70.5	1.05	74
③	50.5	2.15	108.5
Ph	139	2.16	300

$\Sigma V = 481$ kN

$\Sigma M_R = 1190$

$\Sigma M_o = 300$

Q/ Determine the resultant of the Lateral forces acting on the wall and its distance from the wall base.



Layer ①

$k_a = \tan^2(45 - \frac{20}{2}) = 0.49$

at h = 0m

$P_a = (q + \gamma h)k_a - 2c\sqrt{K_a}$

$= (80 + 18*0)\,0.49 - 2*8\sqrt{0.49}$

$= 39.2 - 11.2 = 28$

at h = 5m

$P_a = (80 + 18*5)\,0.49 - 2*8\sqrt{0.49}$

$= 158.8$ kN/m²

Layer ②

at h = 5m

$k_a = \tan^2(45 - \frac{35}{2}) = 0.27$

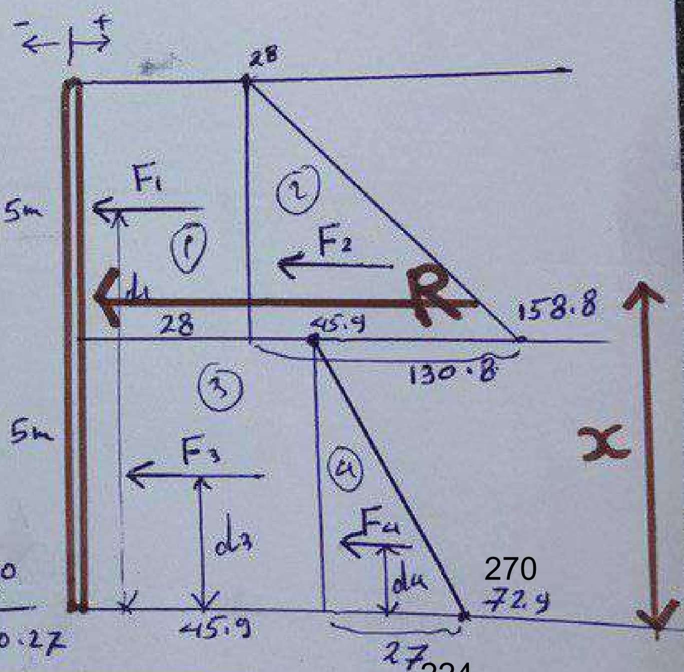
$P_a = (80 + 18*5)\,0.27 - 2*0\sqrt{0.27}$

$= 45.9$ kN/m

at h = 10m

$P_a = (80 + 18*5 + 20*5)\,0.27 - 2*0\sqrt{0.27}$

$= 72.9$ 270KN/m



section	F, kN/m	d, m	M, kN.m/m
①	140	7.5	1050
②	327	6.66	2177.8
③	229.5	2.5	573.75
④	560 67.5	1.66	112.5 929.6KN.m
	R = 764 1256.5 kN		ΣM = 3914 4731

$\Sigma M = R x$

4714 1256.5

$3914 = 764$

$x = 5.12$ m

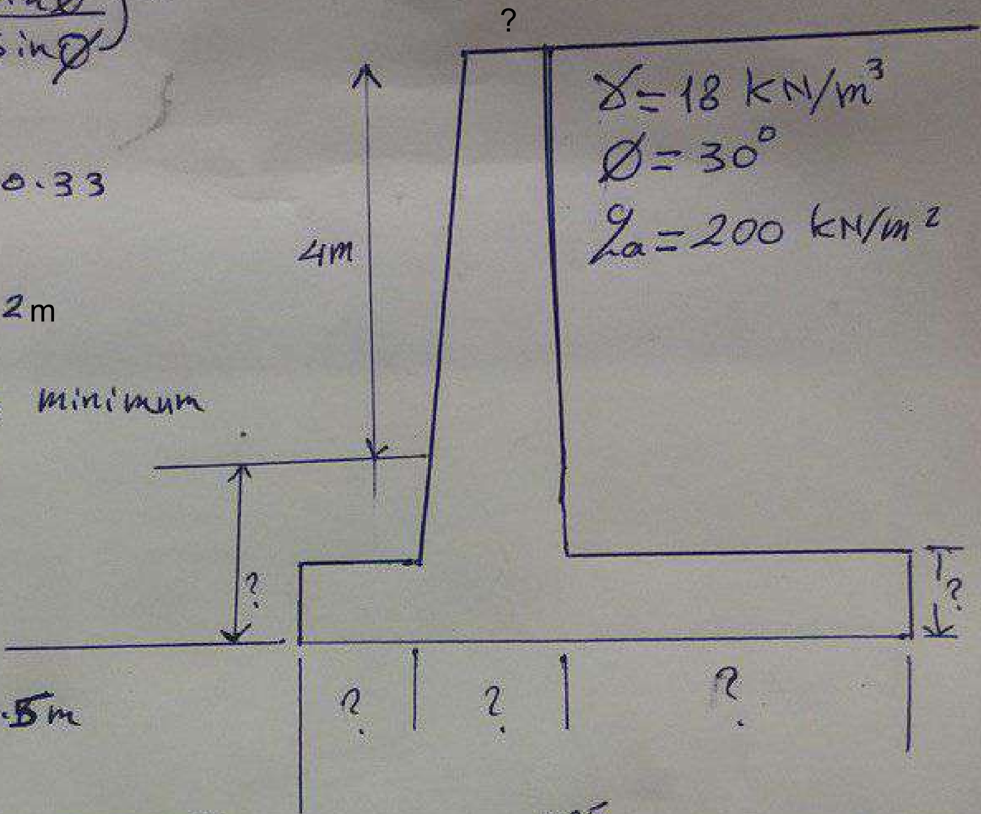
3.7

④

Design the cantilever wall (Dimensions only)
check sliding only.

$T_{base} = \frac{H}{12}$, $B = 0.5H \longrightarrow 0.6H$

$D_{f(min)} = \frac{q_a}{\gamma} \left(\frac{1-\sin\phi}{1+\sin\phi} \right)^2$



$K_a = \tan^2(45 - \frac{\phi}{2})$

$= \tan^2(45 - \frac{30}{2}) = 0.33$

$K_p = 3$

$D_{f\,min} = \frac{200}{18} * (0.33)^2 = 1.2$ m

let $D_f = 2m > 1.2m$ minimum

$\therefore H = 4 + 2 = 6m$

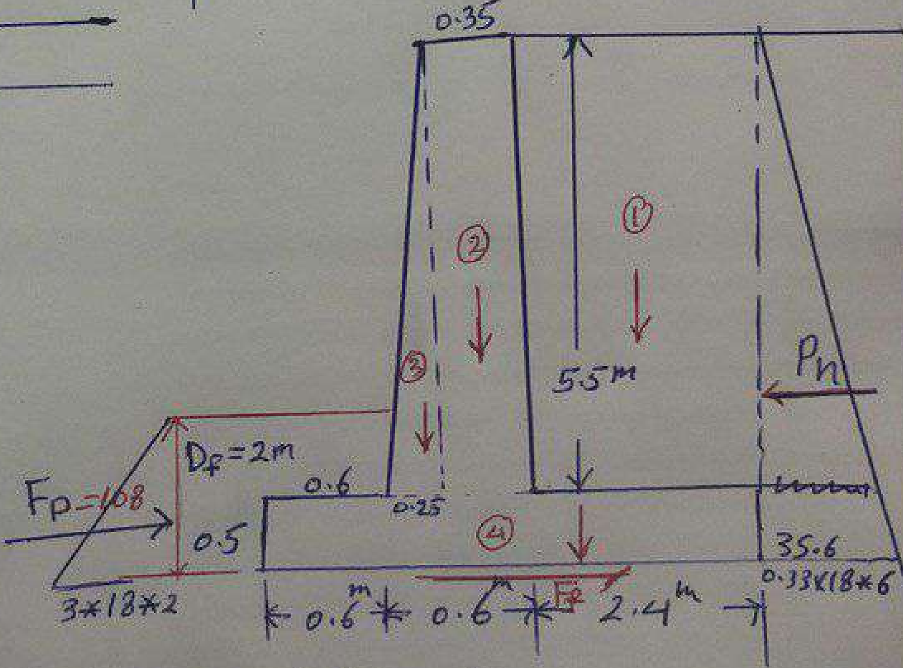
$B = 0.6 * 6 = 3.6$

$Toe = 0.1H = 0.6$

$T_{base} = \frac{H}{12} = \frac{6}{12} = 0.5m$

section	kN/m		
①	237.6		
②	45.2		
③	16.1		
④	42.3		
P_h	106.8		
F_p	108		

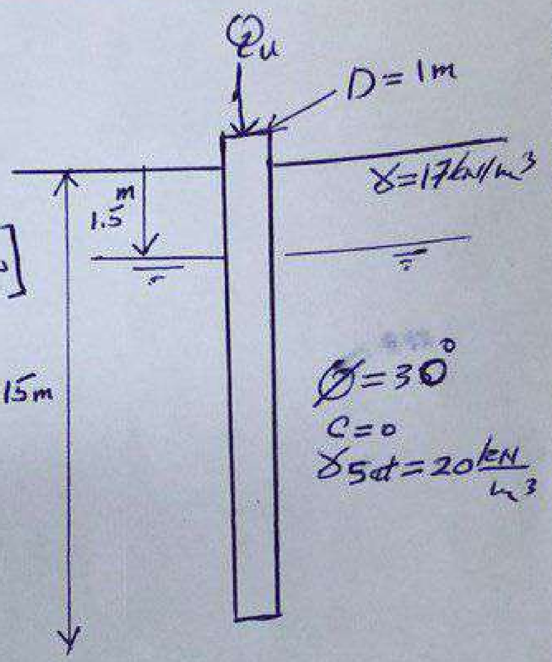
$\Sigma V = 341.2$



$F_s = \frac{\Sigma V * \mu + F_p}{P_h}$

$= \frac{341.2 \times 0.4 + 108}{106.8} = 2.289 > 1.5$ o.k

Q/ Determine the maximum load can be applied on the driven pile in Sand



$\frac{L}{D} = \frac{15}{1} = 15$

For $\varnothing = 30^\circ$ $N_q = 55$ [from graph below]

$Q_b = q N_q A_b$

$= (17 * 1.5 + 10 * 13.5) * 55 * \frac{\pi 1^2}{4}$

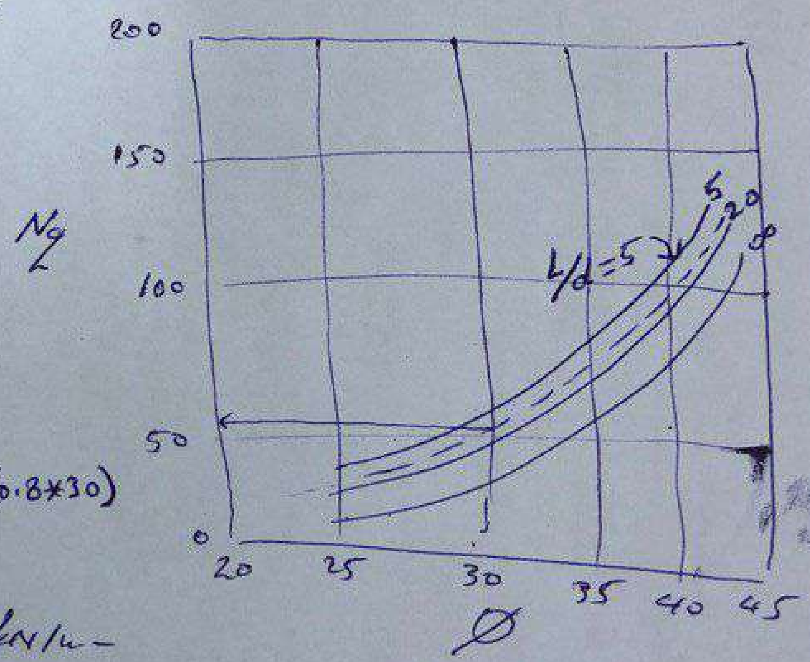
$= 6933$ kN

or

$Q_b = 0.5 \, P_{atm} \, N_q \tan(\varnothing) \, A_b$

$= 0.5 \times 100 * 55 \tan(30) \frac{\pi (1)^2}{4}$

$= 1247$ kN ✓



$Q_s = ?$

$L' = 15D = 15(1) = 15$ m

$f = K \sigma' \tan(0.8 \varnothing)$

$K = \frac{1}{2} \tan^2(45 + \frac{30}{2}) = 1.5$

$f_{15} = 1.5 * (1.5 * 17 + 13.5 * 10) \tan(0.8 * 30)$

$= 107$

$f_{avr} = \frac{0 + 107}{2} = 53.6$ kN/m²

$Q_s = pLf = \pi(1) \times 15 * 53.6$

$= 2525$ kN

$Q_u = 1247 + 2525$

$= 3772$ kN