國立成功大學

110學年度碩士班招生考試試題

編　號：97

系　所：土木工程學系

科　目：基礎工程

日　期：0202

節　次：第 1 節

備　註：可使用計算機

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※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Caution: Mark the final answer of each question clearly.

1. Answer the following questions concerning pile foundation with supplementary drawings if needed. (30%).

(1) Give an example of drilled piles (categorized by the installation method) and also explain how it can prevent collapse of soil into the borehole. (5%)

(2) Define the friction pile and the point-bearing (end-bearing) pile (10%)

(3) Fig. 1 shows the plan view of a group pile foundation. Given: diameter of piles (D) = 400 mm, center-to-center spacing of piles (d) = 1000 mm, and length of piles = 16 m Piles are embedded in a saturated homogeneous clay (s_u = 50 kN/m^2). Determine the ultimate load-carrying capacity Q_u of the pile group.

(**Hint**: calculate Q_u with the group piles regarded as individual piles and as a block, respectively; then pick the controlling one. Use α method and Table 1 to determine bearing capacity from skin friction. End bearing capacity factor N_c^* = 9 both for single pile and block) (15%).

Fig. 1

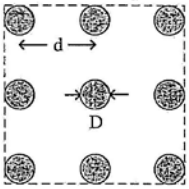


Table 1

$\frac{s_u}{p_a}$	α
≤ 0.1	1.00
0.2	0.92
0.3	0.82
0.4	0.74
0.6	0.62
0.8	0.54
1.0	0.48
1.2	0.42
1.4	0.40
1.6	0.38
1.8	0.36
2.0	0.35
2.4	0.34
2.8	0.34

Note: p_a = atmospheric pressure ≈ 100 kN/m^2

2. For the cantilever retaining wall ($\gamma_{concrete}$ = 24 kN/m^3), let the following data be given.

Wall dimensions:,

H = 9 m, D = 1 m, α = 0°

x_1 = 0.5 m, x_2 = 1 m, x_3 = 1.5 m, x_4 = 3 m, x_5 = 1 m.

Soil properties:

γ_1 = 17.0 kN/m^3, ϕ_1' = 35°, c_1' = 0;

γ_2 = 19.0 kN/m^3, ϕ_2' = 20°, c_2' = 20 kN/m^2.

Angle of friction and adhesion between soil and the base slab: $\delta' = (2/3)\,\phi'$; $c_a' = (2/3)\,c'$

Answer the following questions (35%):

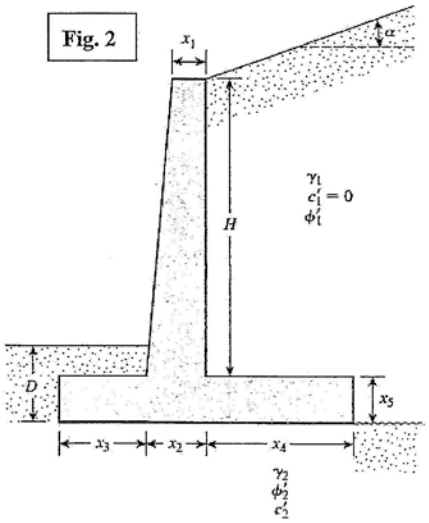
(1) Calculate the Rankine active force per unit length of the wall (with the simplified assumption for design), and the corresponding overturning moment about the toe. (10%)

(2) Calculate the factor of safety against overturning (ignore P_p). (10%)

(3) Calculate the factor of safety against sliding (ignore P_p). (10%)

(4) Is the wall safe? If not, suggest one way to improve. (5%)

Fig. 2



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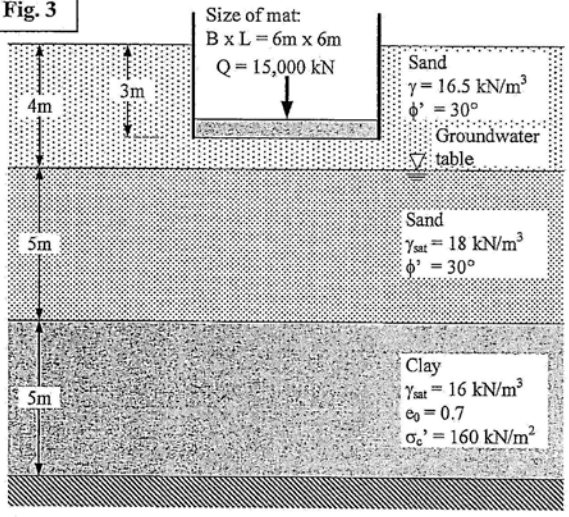
3. Fig. 3 shows an embedded mat foundation under a vertical load. Answer the following questions (35%):
   (1) Determine the average net pressure on soil caused by the mat foundation (5%)
   (2) Use general bearing capacity equation to determine the net ultimate bearing capacity of this foundation; also check if it meets the required factor of safety for long-term loading **based on the answer of (1)** (only considering the contribution of sand layer; **note the influence of the groundwater table!**) (15%)
   (3) Assuming the mat foundation can be regarded as a uniformly loaded flexible rectangular area, estimate the stress increase caused by the mat foundation below its center at the middle of clay layer based on the 2:1 method (5%).
   (4) Given: Cc = 0.48 and Cs = 0.25 Cc. Estimate the consolidation settlement of the clay layer under the center of the mat (using the stress increase at the middle of the clay layer as the average) (10%).

Fig. 3



Bearing capacity factors

ϕ'	N_c	N_q	N_γ
26	22.25	11.85	12.54
27	23.94	13.20	14.47
28	25.80	14.72	16.72
29	27.86	16.44	19.34
30	30.14	18.40	22.40
31	32.67	20.63	25.99
32	35.49	23.18	30.22
33	38.64	26.09	35.19
34	42.16	29.44	41.06
35	46.12	33.30	48.03

Shape factors

$$F_{cs} = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right)$$

$$F_{qs} = 1 + \left(\frac{B}{L}\right)\tan\phi'$$

$$F_{\gamma s} = 1 - 0.4\left(\frac{B}{L}\right)$$

Depth factors $\left(\frac{D_f}{B} \le 1,\ \phi' > 0\right)$

$$F_{cd} = F_{qd} - \frac{1 - F_{qd}}{N_c \tan\phi'}$$

$$F_{qd} = 1 + 2\tan\phi'\,(1 - \sin\phi')^2\left(\frac{D_f}{B}\right)$$

$$F_{\gamma d} = 1$$