國立成功大學

112學年度碩士班招生考試試題

編　號：98

系　所：土木工程學系

科　目：基礎工程

日　期：0206

節　次：第 1 節

備　註：可使用計算機

編號： 98

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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。

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

Wall dimensions:,

H = 5 m, D = 0.5 m, $\alpha = 0°$

$x_1 = 0.5$ m, $x_2 = 0.5$ m, $x_3 = 1$ m, $x_4 = 2$ m, $x_5 = 0.5$ m.

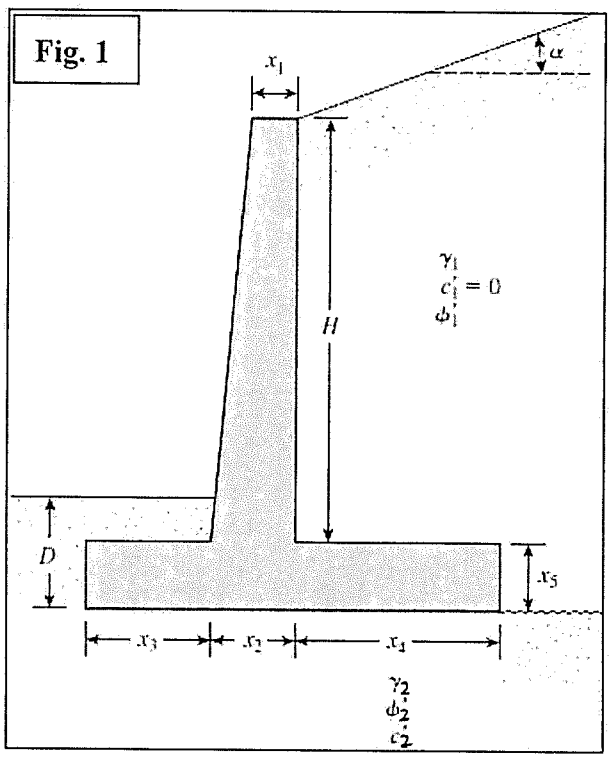
Soil properties:

$\gamma_1 = 17.0$ kN/m^3, $\phi_1' = 30°$, $c_1' = 0$;

$\gamma_2 = 19.5$ kN/m^3, $\phi_2' = 24°$, $c_2' = 15$ kN/m^2.

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

Fig. 1



Answer the following questions (40%):

(1) Calculate the Rankine active force per unit length of the wall (based on the assumption that the Rankine active pressure is acting along a vertical plane through the heel), and the corresponding overturning moment about the toe. (10%)

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

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

(4) Is the wall safe? If not, suggest two ways to improve. (10%)

2. As shown in Fig. 2, the load transfer mechanism of the pile foundation can be demonstrated by its axial force distribution curve with depth. Answer the following questions. (30%).

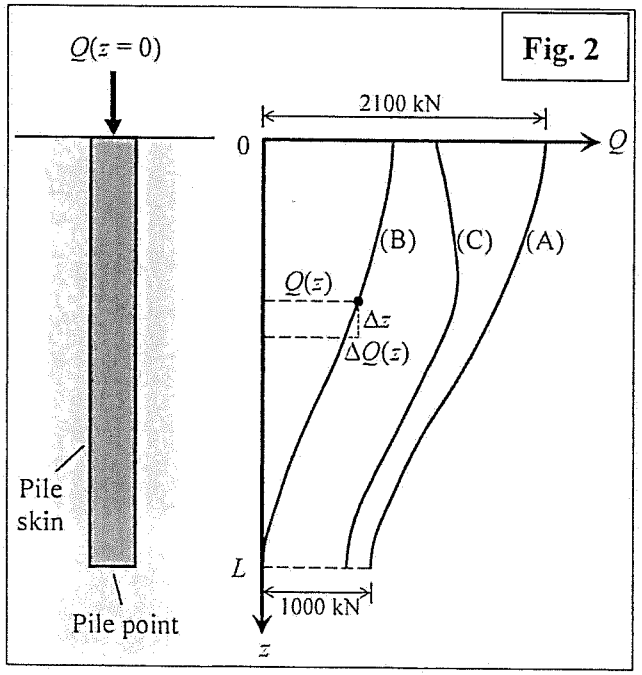
(1) Curve (A) in Fig. 2 shows the condition of the pile at ultimate load. In this condition, how much is the load carried by skin friction? How much is the load carried by pile point (point resistance)? (10%)

(2) Curve (B) in Fig. 2 shows the condition in which $Q(z = L) = 0$. According to this condition, determine which resistance of the pile is mobilized first, skin friction or point resistance? (5%)

(3) Following (2), express the frictional resistance per unit area of the pile skin of at a depth of z in terms of the symbols shown in Fig. 2 (given p = the perimeter of the cross section of the pile). (5%)

(4) What is the phenomenon occurred in the condition shown by Curve (C)? What is its influence on the bearing capacity of the pile? (10%)

Fig. 2



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3. Fig. 3 shows an embedded mat foundation under a vertical load. Answer the following questions **(*note the influence of the groundwater table!)** (30%):
   (1) Determine the net average pressure applied on soil by the mat foundation (5%)
   (2) Use general bearing capacity equation to determine the net ultimate bearing capacity of this foundation (using the factors listed in Tables 1–3); also check if it meets the required factor of safety for long-term loading **based on the answer of (1)**. (15%)
   (3) To determine the required minimum depth of the borings in site investigation, one criterion is to use the depth where the net increase in the vertical stress is equal to 1/10 of the net pressure on soil applied by the foundation. Assuming the mat foundation can be regarded as a uniformly loaded flexible rectangular area, suggest the minimum boring depth (measured from the ground surface) based on aforementioned criterion using the 2:1 method to approximate the stress increase. (10%)

Fig. 3

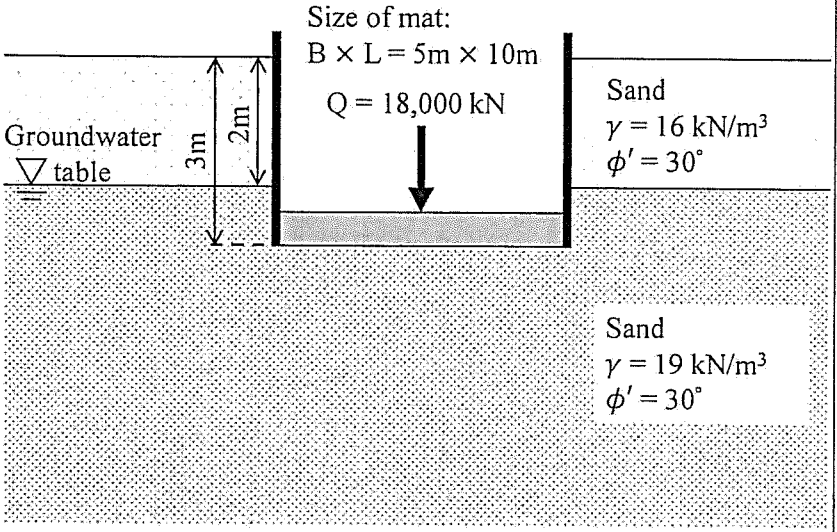

Table 1 Bearing capacity factors

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

Table 2 Shape factors

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

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

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

Table 3 Depth factors $\left(\frac{D_f}{B} \le 1,\ \phi' > 0\right)$

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

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

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