國立成功大學

113學年度碩士班招生考試試題

編　號：96

系　所：土木工程學系

科　目：基礎工程

日　期：0201

節　次：第 1 節

備　註：可使用計算機

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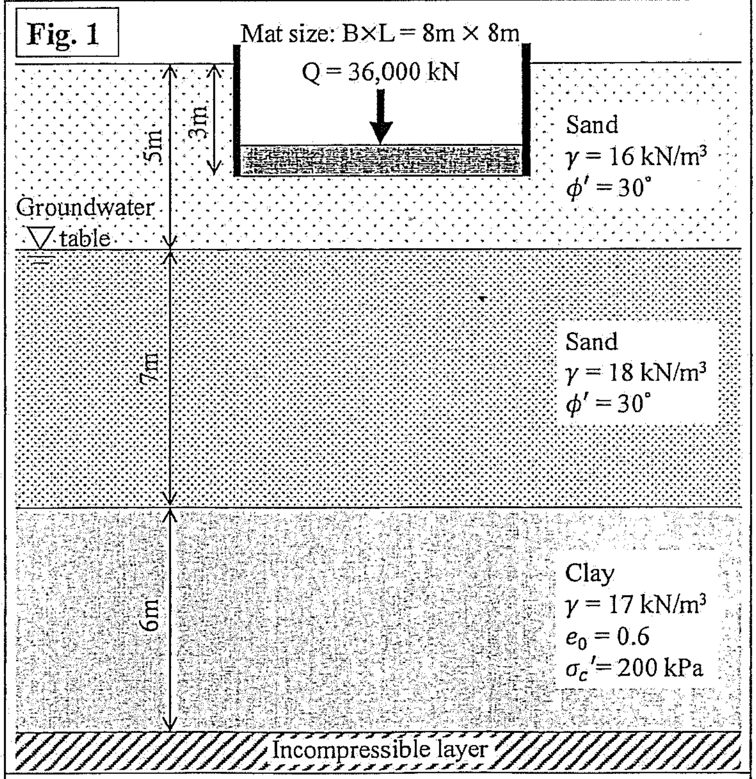
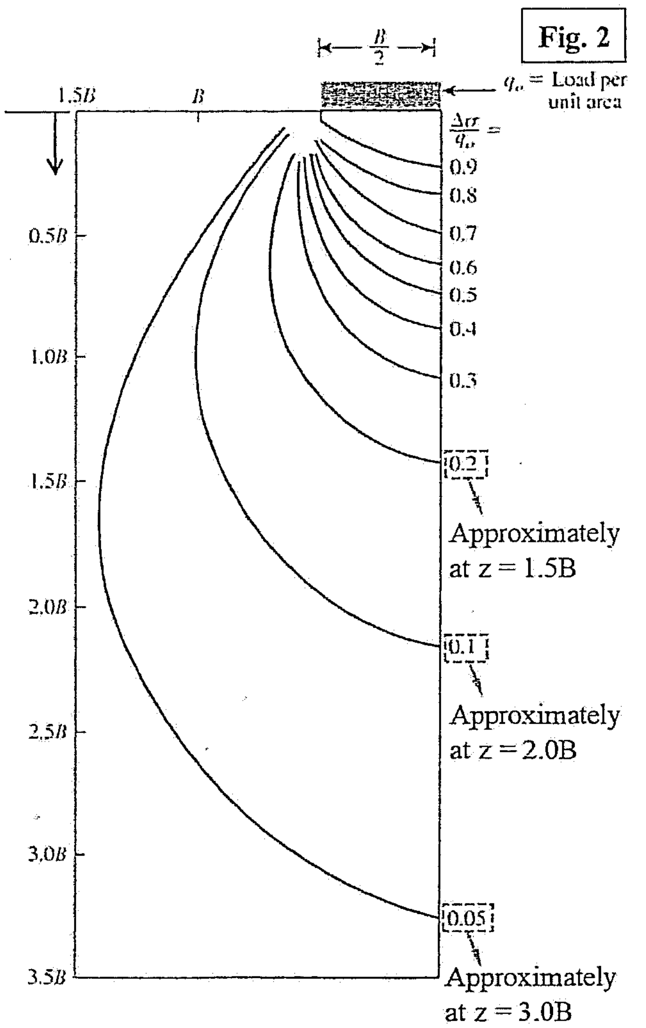
※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Fig. 1 shows a mat foundation. Please answer the following questions (45%)
   (1) Determine the average net pressure on soil caused by the mat foundation (5%).
   (2) Use **Terzaghi's bearing capacity theory** (the factors given in the table below Fig. 1) to determine the net ultimate bearing capacity of this mat (only considering the contribution of sand layer; **NOTE the groundwater table!**) and also calculate the factor of safety **based on the answer of (1)** (15%)
   (3) Assuming the mat can be regarded as a uniformly loaded squared area, suggest a minimum depth of boring based on Fig. 2 (the approximate depths corresponding to $\Delta\sigma/q_0$ values of 0.05, 0.1, and 0.02 noted in Fig. 2 may be used) and also briefly explain the reason (5%).
   (4) Again, regarding the mat as a uniformly loaded squared area, estimate the vertical stress increase caused by the mat foundation below its center at the middle of clay layer based on the Fig. 2 (5%).
   (5) Following (4), estimate the consolidation settlement of the clay layer under the center of the mat (C_c= 0.3 and C_s= 0.1; **using the stress increase at the middle of the clay layer as the average**) (15%).



Bearing capacity factors (for Terzaghi's theory)

ϕ'	N_c	N_q	N_γ
26	27.09	14.21	9.84
27	29.24	15.90	11.60
28	31.61	17.81	13.70
29	34.24	19.98	16.18
30	37.16	22.46	19.13
31	40.41	25.28	22.65
32	44.04	28.52	26.87
33	48.09	32.23	31.94
34	52.64	36.50	38.04



Contours of $\Delta\sigma/q_0$ ($\Delta\sigma$: vertical stress increase) below the center line of a squared loaded area.

2. For the gravity retaining wall ($\gamma_{concrete} = 24$ kN/m^3) as shown in Fig 3, give the following data.

Wall dimensions:

$H = 5$ m, $D = 1$ m, $x_1 = x_4 = x_5 = 0.5$ m, $x_2 = x_3 = x_6 = 1$ m

Soil properties:

$\gamma_1 = 16$ kN/m^3, $\phi_1' = 30°$, $c_1' = 0$;

$\gamma_2 = 17$ kN/m^3, $\phi_2' = 20°$, $c_2' = 30$ kN/m^2.

Answer the following questions (45%).

(1) Calculate the Rankine active force per unit length of the wall (**with the simplified assumption for design**). (10%)

(2) Following (1), Calculate the corresponding overturning moment about the toe. (5%)

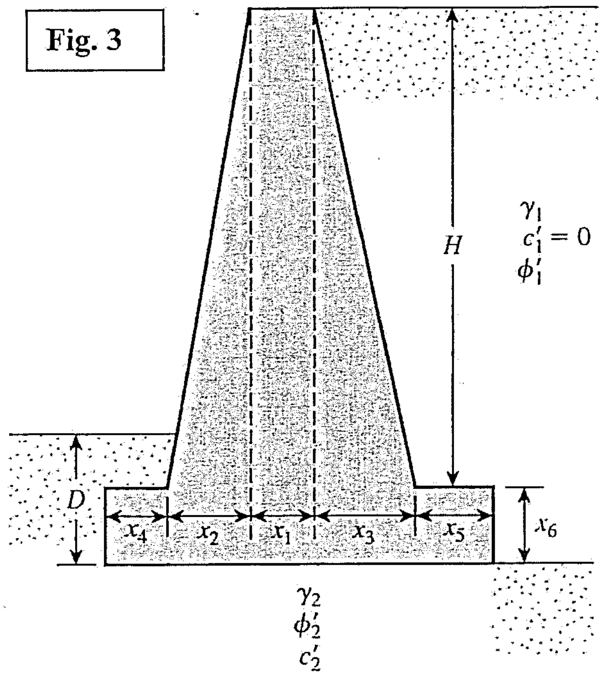
(3) Following (2), Calculate the factor of safety against overturning (**neglect the passive force in front of the wall**). (10%)

(4) Following (1), calculate the factor of safety against sliding (**neglect the passive force in front of the wall**). (10%)

[At the interface of the soil and the base: friction angle $\delta' = (1/2)\phi'$; adhesion $c_a' = (1/2)c'$]

(5) Is the wall safe (considering both overturning and sliding)? If not, give one suggestion for improvement. (10%).

Fig. 3



3. Fig. 4 shows the axial force distribution with depth of a pile, which represents its load transfer mechanism. As its **ultimate load-carrying capacity** Q_u was reached by a vertical compression load test, the axial force distribution curve is **curve (B)**. The diameter and length of the pile are 0.6 m and 20 m, respectively. Answer the following questions (10%).

(1) Determine is the average unit friction resistance (per area) at the depth range of 0~10 m? (5%)

(2) If the factors of safety for the frictional resistance of the pile skin and the load-carrying capacity of the pile point are 2.5 and 4, respectively, determine the allowable load-carrying capacity of this pile. (5%)

Fig. 4