國立成功大學 106 學年度碩士班招生考試試題

系　　所：土木工程學系

考試科目：基礎工程

考試日期：0213，節次：1

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

Make reasonable assumptions if necessary.

1、Answer the following questions briefly with texts and/or figures: (30 pts)

(1) Draw the failure plane in Terzaghi's bearing capacity theory. (6 pts)

(2) List factors that affect the in situ SPT-N values. (6 pts)

(3) Define rock quality designation and what it represents in site characterization. (6 pts)

(4) List the limitations of Peck's pressure envelopes. (6 pts)

(5) List methods for estimating pile capacity. (6 pts)

2、Answer the following questions associated with lateral earth pressures. (30 pts)

(1) Describe the required analyses for braced cut design in sand. (6 pts)

(2) Derive the factor of safety against overturning using symbols in Fig. 1 and Table 1. (6 pts)

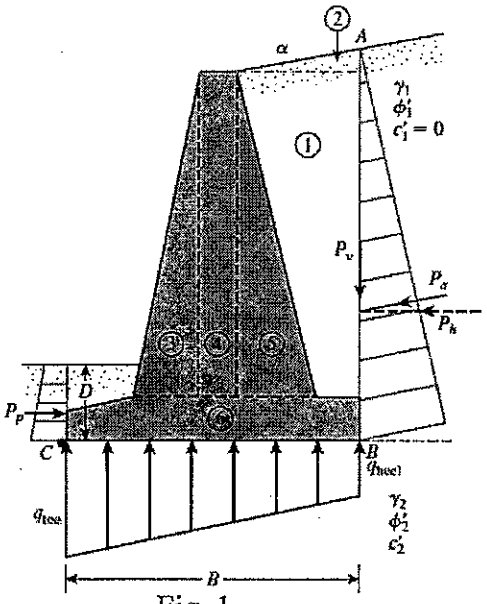

Fig. 1

Table 1.

Section (1)	Area (2)	Weight/unit length of wall (3)	Moment arm measured from C (4)	Moment about C (5)
1	A_1	$W_1 = \gamma_1 \times A_1$	X_1	M_1
2	A_2	$W_2 = \gamma_1 \times A_2$	X_2	M_2
3	A_3	$W_3 = \gamma_c \times A_3$	X_3	M_3
4	A_4	$W_4 = \gamma_c \times A_4$	X_4	M_4
5	A_5	$W_5 = \gamma_c \times A_5$	X_5	M_5
6	A_6	$W_6 = \gamma_c \times A_6$	X_6	M_6
		P_v	B	M_v
		ΣV		ΣM_R

(*Note:* γ_1 = unit weight of backfill
γ_c = unit weight of concrete
X_i = horizontal distance between C and the centroid of the section)

(3) Derive the factor of safety against base sliding using symbols in Fig. 2. (6 pts)

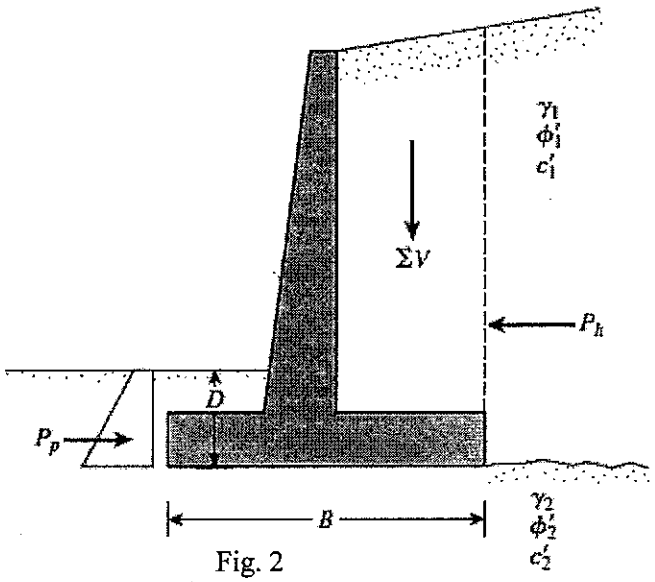

Fig. 2

(4) Given the Coulomb's active earth pressure coefficient:

$$k_a = \frac{\cos^2(\phi'-\theta)}{\cos^2\theta\cos(\delta'+\theta)\left[1+\sqrt{\frac{\sin(\delta'+\phi')\sin(\phi'-\alpha)}{\cos(\delta'+\theta)\cos(\theta-\alpha)}}\right]^2} \qquad (2.1)$$

where α=inclination of backfill from horizontal plane, θ=inclination of retaining wall from vertical plane, δ = friction angle between the wall and the backfill material, and ϕ' = effective friction angle of back fill. Derive the Rankine's active earth pressure coefficient for level backfill from Eq. (2.1). (6 pts)

(5) Compare the free and fixed earth support methods for anchored sheet piles in terms of deflection and moment distribution. (6 pts)

3、Answer the following questions of shallow foundation analysis. (20 pts)

(1) Explain the size effect of ultimate bearing capacity from field plate load test base on Terzaghi's bearing capacity theory. Size effect: $(q_u)_F = (q_u)_P$ (in clay), $(q_u)_F = (q_u)_P \frac{B_F}{B_P}$ (in sand); (F: Foundation, P: Plate, B: Foundation width). (10 pts)

(2) A mat foundation on a saturated clay soil has dimensions of 20 m × 20 m. Given, c_u=25 kN/m^2, γ_{sat}=18.5 kN/m^3.The shape and depth factors associated with cohesion are $F_{cs} = 1+\frac{B}{L}(\frac{N_q}{N_c})$ and $F_{cd} = 1+0.4(\frac{D_f}{B})$, respectively, and where B=width, L=length, D_f=embedded depth. Calculate the depth of the mat (D_f) for a factor of safety of 2 against bearing capacity failure for a given load 40 MN. (10 pts)

4、Answer the following questions related to pile foundations. (20 pts)

(1) State the procedure for estimating ultimate bearing capacity of group piles in saturated clay.(5 pts)

(2) Explain the causes of **negative skin friction** of pile and the effects on piles. (6 pts)

(3) Fig. 3 shows a drilled shaft embedded in two clay layers. Explicitly express the following values with symbols: (a) net ultimate point bearing capacity, (b) ultimate skin resistance, and (c) working load with FS=3.0. (9 pts)

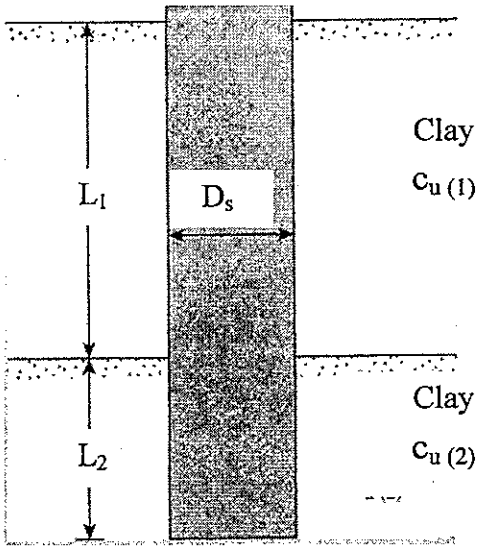

Fig. 3