編號： 103

國立成功大學 109 學年度碩士班招生考試試題

系　　所：土木工程學系

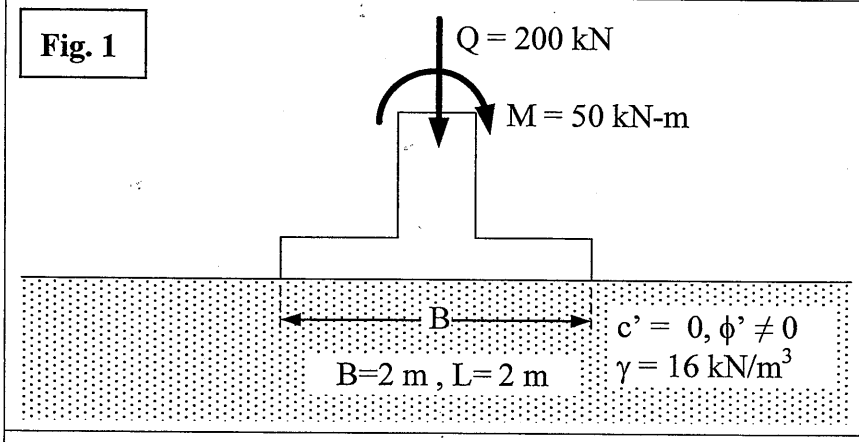
考試科目：基礎工程

考試日期：0210，節次：1

※ 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 surface foundation subjected to a vertical load Q = 200 kN and a moment M = 50 kN-m. Please answer the following questions (30%).
   (1) Soil samples obtained from the site are composed of cohesionless sand ($c' = 0$). A consolidated drained triaxial test was conducted on one of the samples at a confining pressure $\sigma_3' = 150$ kN/m^2. Failure occurred when the deviator stress $(\sigma_1' - \sigma_3') = 300$ kN/m^2. Determine the effective stress angle of friction, ϕ' of the soil, based on the given information. (10%)
   (2) Check if the load eccentricity causes a separation between the foundation and the soil (5%).
   (3) Use general bearing capacity equation and effective area method proposed by Meyerhof to check if the bearing capacity of the foundation meets the required factor of safety for long-term loading (15%).

Fig. 1



Bearing capacity factors

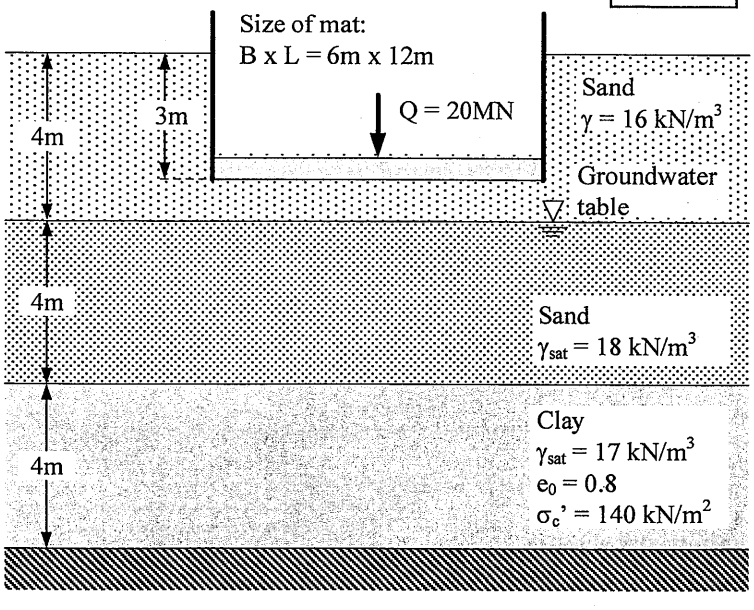
ϕ'	N_c	N_q	N_γ
26	22.25	11.85	12.54
27	23.94	13.20	14.47
28	25.80	14.72	16.72
29	27.86	16.44	19.34
30	30.14	18.40	22.40
31	32.67	20.63	25.99
32	35.49	23.18	30.22
33	38.64	26.09	35.19
34	42.16	29.44	41.06
35	46.12	33.30	48.03

Shape factors

$$F_{cs} = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right) \qquad F_{qs} = 1 + \left(\frac{B}{L}\right)\tan\phi' \qquad F_{\gamma s} = 1 - 0.4\left(\frac{B}{L}\right)$$

2. Fig. 2 shows a mat foundation. Please answer the following questions (30%)
   (1) Determine the average net pressure on soil caused by the mat foundation (5%).
   (2) 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 (10%).
   (3) Given: $C_c = 0.48$ and $C_s = 0.25\ C_c$. 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) (15%).

Fig. 2



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3. For the cantilever retaining wall as in Fig3a($\gamma_{concrete}$ = 24 kN/m^3), give the following data.

Wall dimensions:

H = 8 m, D = 2 m, x_1 = 1 m, x_2 = x_3 = 1.5 m, x_4 = x_5 = x_6 = 1 m

Soil properties:

γ_1 = 16.5 kN/m^3, ϕ_1'= 35°, c_1'= 0;

γ_2 = 18 kN/m^3, ϕ_2'= 24°, c_2' = 18 kN/m^2.

Please answer the following questions (40%).

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

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

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

(4) Following (a), calculate the factor of safety against sliding (neglect P_p). (10%)
[friction angle between the soil and the base $\delta' = (2/3)\phi'$; adhesion between the soil and the base $c_a' = (2/3)c'$]

(5) Refer o Fig 3b., determine the angle of active force P_a to the normal drawn to $\overline{AB}$, θ_1, and the angle of soil reaction R to the normal drawn to $\overline{BC}$, θ_2, based on Coulomb's active earth pressure theory (5%).

Fig. 3a

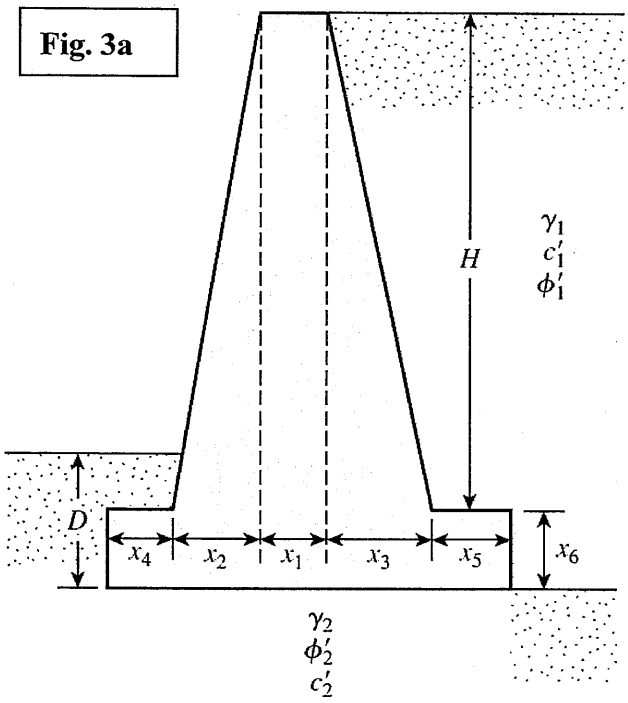

Fig. 3b