國立成功大學 104 學年度碩士班招生考試試題

系所組別：土木工程學系乙組

考試科目：基礎工程

考試日期：0211，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 rational assumptions if needed

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

(1) Define following terms of CPT: (a) cone resistance (q_c) (b) frictional resistance (f_c), and (c) frictional ratio (F_r). (6 pts)

(2) List the stability requirements for conventional retaining walls. (6 pts)

(3) List 3 in situ testing techniques for evaluating undrained shear strength of cohesive soils. (6 pts)

(4) Describe the procedure to determine the Coulomb's passive earth pressure. (6 pts)

(5) Based on elasticity, the lateral strain of an element can be represented as $\varepsilon_h = \frac{\sigma_h'}{E} - \nu(\frac{\sigma_h'}{E} + \frac{\sigma_v'}{E})$ (E= Young's modulus and ν=Poisson's ratio). Derive the relationship between the coefficient of lateral earth pressure at rest (K_0) and Poisson's ratio. (6 pts)

2、Questions related to the bearing capacity of shallow foundations: (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) Derive the factor of safety (FS) for a partially compensated, square foundation subjected to a vertical load Q on saturated clay using Terzaghi's bearing capacity equation. (10 pts).

3、Answer the following questions related to earth retaining structures. (30 pts)

(1) The Coulomb's active earth pressure coefficient can be expressed as:

$$K_a = \frac{\sin^2(\beta+\phi')}{\sin^2\beta\sin(\beta-\delta')\left[1+\sqrt{\frac{\sin(\phi'+\delta')\sin(\phi'-\alpha)}{\sin(\beta-\delta')\sin(\alpha+\beta)}}\right]}$$

where β=inclined wall back angle, α =inclined backfill angle, δ'=wall friction angle. Use the above expression to derive the Rankine active-pressure coefficient with assumptions of Rankin's theory. (10 pts)

(2) Given the height of the retaining wall is 4.5 m and the backfill is a saturated clay with ϕ=0, c=24 kPa and γ_{sat}=18 kN/m^3. Assuming that the water table is below the base of the wall, estimate the Rankine active force per meter of the wall and the location of the resultant force for the following 2 conditions: (a) no tensile crack and (b) tension crack filled with water. (10 pts)

(3) Explain why the lateral earth pressure theory cannot be applied to braced-cut analysis and list the limitations of Peck's apparent pressure envelope for braced-cut design. (10 pts)

國立成功大學 104 學年度碩士班招生考試試題

系所組別：土木工程學系乙組

考試科目：基礎工程

考試日期：0211，節次：1

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

(1) Describe the load transfer mechanism of a single pile subjected to vertical loads. (10 pts)

(2) Fig. 1 shows a drilled shaft with a bell. Here, L_1=10 m, L_2=5 m, D_s=1.0 m, D_b=2.0 m, $c_{u(1)}$=50 kPa, $c_{u(2)}$=100 kPa. Use Meyerhof's method for estimating tip resistance and α-method with $\alpha = 0.21 + 0.25\left(\frac{p_a}{c_u}\right) \le 1.0$ (p_a = 100 kPa) for estimating skin resistance. Determine the working load with FS=3.0. (10 pts)

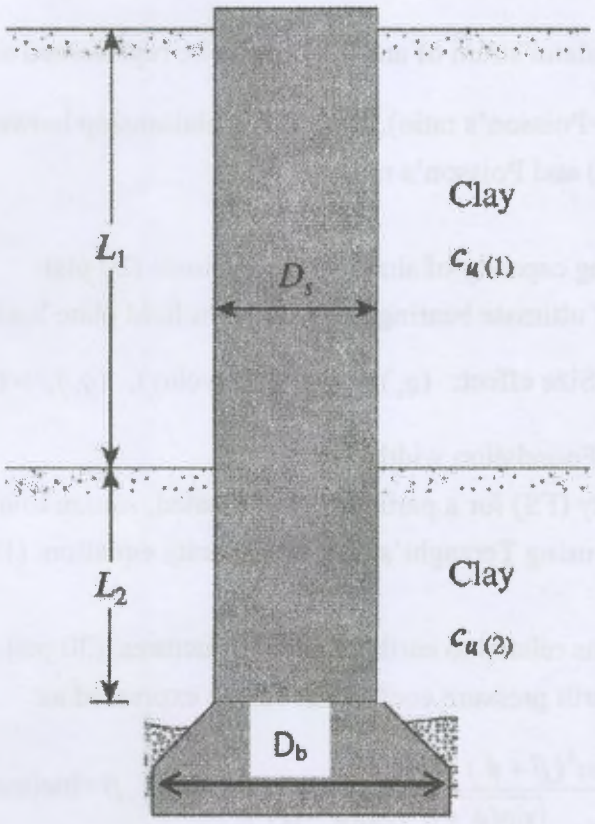

Fig. 1