Prince of Songkla University

Faculty of Engineering

Final Examination: Semester II
Date: October 5th, 2007
Subject: 235–402 Geotechniques

Academic Year: 2007
Time: 01.30-04.30 p.m.
Room: Robot

Instructions

1. This is a closed examination, attempts question (4) in total 8 pages.
2. Answer all questions in the given papers and do rear papers allowed
3. Dictionary or electronic-dictionary, calculator without memory program and necessary stationary are allowed
4. Write your name in each page and returned all papers to controllers
5. Total marks are 110 or 25 % of subject.

Question	Full Scores	Assigned Scores
1	35	
2	20	
3	25	
4	30	
Total scores	110	

"ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น และพักการเรียน 1 ภาคการศึกษา สูงสุด ให้ออก"

Name ..... **Surname** ..... **ID** ....

Bonne Chance et bon courage
Danupon Tonnayopas
Instructor
24 September 2007

Name ..... *Surname* ..... *ID* .....

Calculation questions

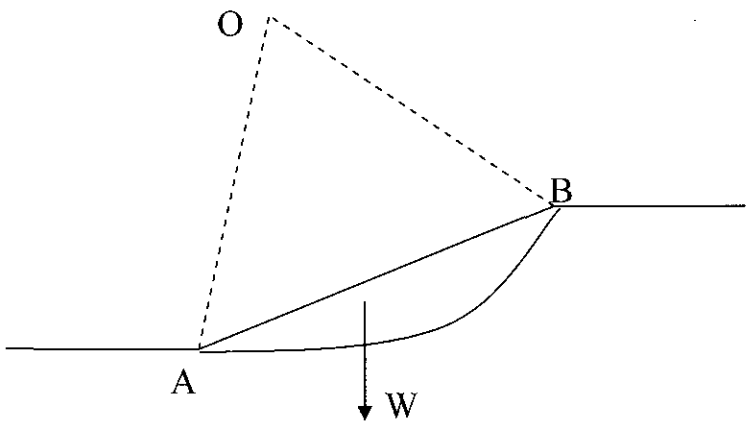
1. A granite quarry has a 30 m high bench with a bench face is inclined at 70° to the ho izontal. An exfoliation joint surface dips at 35° and undercuts the slope. The unit weight of g anite is 0.027 MN/m^3. The cohesive strength along sliding surface of 0.2 MPa and the friction ngle of 45°.

   a) If water-filled tension crack exist behind crest and flow along exfoliation joint surface. Draw schematic bench and find the factor of safety of the slope. (15 points)

   b) If blasting produced acceleration of 0.08 g, how about that factor of safety. (10 poin s)

   c) According to a) calculate stress applied by anchor systems in direction perpendicu lar with failure plane for safety of factor increases to 2. (10 points)

2. An excavation made during open a sand pit was made with the geometry shown below. Soon after open, the slope failed by rotational slump. The soil in the slope is uniform saturated clay with density of 1.75 Mg/m^3. Test drilling showed that the failure surface approximate a circular arc, AB, with a radius of 20 m. The angle formed by radii connecting the ends of the failure surface is 80 degrees. The area of failure circle was found to be 102.3 m^2 and the moment arm about the center of the circle was 4.38 m. Estimate the shear strength of the sand at the time of failure? (20 points)



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3. To determine the thickness of the surface layer in a certain area, the following readings were obtained from refraction seismic records. Find the velocities in the upper and lower beds and determine the depth of underlie layers? (25 points)

Geophone #	Distance, m	Time, msec.
1	1.0	2.5
2	1.5	4.2
3	3.0	7.0
4	5.0	9.0
5	7.0	9.8
6	8.0	10.8
7	10.0	12.7
8	12.0	13.3
9	13.0	13.7
10	15.0	15.0
11	17.0	16.1
12	19.0	17.0
13	20.0	17.4
14	21.0	18.0

4. It is investigated the structural mapping that the following geometrical and structural features have been identified:

Feature	dip°	dip direction °
Overall slope face	50	200
Individual benches	70	200
Sheet joint	35	190
Joint set J_1	80	230
Joint set J_2	80	040

If internal friction angle of rock $\phi = 25°$. Check slope stability both the overall slope and the individual benches by stereo-net method. Determine type of potential slope failures and stability analysis. (30 points)

Available Equations

$$X = \frac{\sin\theta_{24}}{\sin\theta_{45}.\cos\theta_{2na}} \quad ; \qquad Y = \frac{\sin\theta_{13}}{\sin\theta_{35}.\cos\theta_{1nb}} \qquad A = \frac{\cos\psi_a - \cos\psi_b.\cos\theta_{na.nb}}{\sin\psi_5.\sin^2\theta_{na.ab}} \quad ;$$

$$B = \frac{\cos\psi_b - \cos\psi_a.\cos\theta_{na.nb}}{\sin\psi_5.\sin^2\theta_{na.nb}} \qquad \rho = \pi\left(L^2/2l\right)R \quad ; \qquad \rho = 2\pi a.R$$

$$Z_2 = \frac{x_2}{2}\sqrt{\left(\frac{V_3 - V_2}{V_3 + V_2}\right)} + Z_1\left[\frac{V_3\sqrt{V_2^2 - V_1^2} - V_2\sqrt{V_3^2 - V_1^2}}{V_1\sqrt{V_3^2 - V_2^2}}\right]$$

$$F = \frac{c.\mathrm{A} + (\mathrm{W}\cos\psi_p - \mathrm{U} - \mathrm{V}\sin\psi_p)\tan\phi}{\mathrm{W}\sin\psi_p + \mathrm{V}\cos\psi_p}$$

$$\mathrm{A} = \frac{(\mathrm{H} - \mathrm{z})}{\sin\psi_p} \qquad ; \qquad \mathrm{U} = \tfrac{1}{2}\gamma_w z_w.\mathrm{A}$$

$$\mathrm{V} = \tfrac{1}{2}\gamma_w.z_w^2 \qquad : \qquad z = \mathrm{H}.\left(1 - \sqrt{\cot\psi_f.\tan\psi_p}\right)$$

$$b = \mathrm{H}.\left(\sqrt{\cot\psi_f.\cot\psi_p} - \cot\psi_f\right)$$

$$\mathrm{W} = \tfrac{1}{2}\gamma_r.\mathrm{H}^2\left\{\left[1 - \left(\frac{Z}{\mathrm{H}}\right)^2\right]\cot\psi_p - \cot\psi_f\right\}$$

$$\mathrm{W} = \tfrac{1}{2}\gamma.\mathrm{H}^2\left\{\left(1 - \frac{\mathrm{Z}}{\mathrm{H}}\right)^2\cot\psi_p\left(\cot\psi_p.\tan\psi_f - 1\right)\right\}$$

$$F = \frac{c\mathrm{A} + \left(\mathrm{W}\cos\psi_p - \mathrm{U} - \mathrm{V}\sin\psi_p + \mathrm{T}\cos\theta\right)\tan\phi}{\mathrm{W}.\sin\psi_p + \mathrm{V}.\cos\psi_p - \mathrm{T}\sin\theta}$$

$$F = \frac{c\mathrm{A} + \left\{\mathrm{W}(\cos\psi_p - \alpha\sin\psi_p) - \mathrm{U} - \mathrm{V}\sin\psi_p\right\}\tan\phi}{\mathrm{W}\left(\sin\psi_p + \alpha\cos\psi_p\right) + \mathrm{V}\cos\psi_p} \quad ; \qquad \mathrm{U} = \tfrac{1}{4}\gamma_w\frac{\mathrm{H}_w^2}{\sin\psi_p}$$

$$t_i = \frac{2Z_1.\sqrt{V_2^2 - V_1^2}}{V_1V_2} \qquad Z_1 = \frac{x_c}{2}.\sqrt{\left(\frac{V_2 - V_1}{V_2 + V_1}\right)}$$

$$\mathrm{W} = \tfrac{1}{2}\gamma_r.\mathrm{H}^2\left(\cot\psi_p - \cot\psi_f\right)$$

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LAMBERT EQUAL-AREA PROJECTION