Prince of Songkla University
Faculty of Engineering

Final Examination: Semester II
Date: February 16th, 2009
Subject: 235–402 Geotecniques

Academic Year: 2008
Time: 01.30-04.30 p.m.
Room: R200

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 <u>all papers</u> to controllers
5. Total marks are 110 or 35 % of subject.

Part	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
12 Feb 2009

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

1. Cut new slope along a road in the sandstone mountainous. It is found a tension crack on slope face. Determine factor of safety. From measurement data in field and result of laboratory testing shown below; (35 point)

   - Height of cut slope 20 m
   - Dip of cut slope = 65°
   - Dip angle of fault plane failure = 35°
   - Depth of tension crack = 6.8 m
   - Water depth in tension crack = 5.5 m (Z_w)
   - Depth from upper slope to bottom of tension crack = 16.8 m
   - Unite weight of granite 25.5 kilonewton/m^3
   - Cohesion = 45 kilonewton/m^2
   - Peak internal friction angle of rock = 35° and residual internal friction angle of rock = 25°

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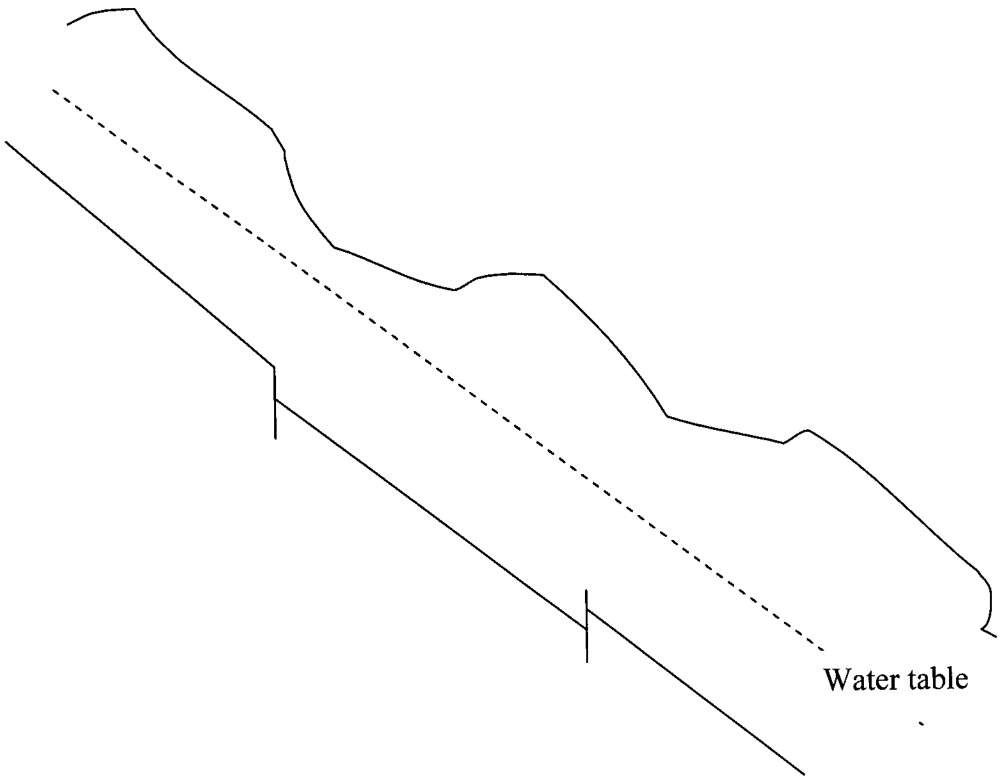
2. An excavation made during open a rubber hill slope was inclined 50 degrees with the geometry shown below. The overburden in the slope is uniform saturated clay 6.2 m in thick with saturated density of 1.75 tonnes/m^3. The internal friction angle of overburden was 20 degrees and cohesion was 13.3 tonnes/m^2. To determined the factor of safety of the hill slope? If density of water is 1.0 tonne/m m^3 (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	1.5	2.5
2	3.0	7.2
3	5.0	9.0
4	7.0	9.8
5	8.0	10.8
6	10.0	12.7
7	12.0	13.3
8	13.0	13.7
9	15.0	15.5
10	17.0	16.1
11	19.0	17.0
12	20.0	17.4
13	21.0	18.9
14	23.0	19.3

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

Feature	dip angle	dip direction
Overall slope face	50	200
Individual benches	70	200
Joint set J_1	80	230
Joint set J_2	80	040
Joint set J_3	70	325

If internal friction angle of rock $\phi = 30°$. 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)

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Available Equations

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

$$Z_2 = \frac{x_2}{2}\sqrt{\left(\frac{V_3 - V_2}{V_3 + V_2}\right)} + Z_1\left[\frac{V_3\sqrt{V_2^2 - V_1^2} - V_2\sqrt{V_3^2 - V_1^2}}{V_1\sqrt{V_3^2 - V_2^2}}\right]; \quad F = \frac{c}{\gamma_{sat} \mathrm{T} \cos^2\beta.\tan\beta} + \frac{\gamma_{sat} - \gamma_w}{\gamma_{sat}}\frac{\tan\phi}{\tan\beta}$$

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

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

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

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

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

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

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

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

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

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

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

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