University of California, Berkeley   Prof. Glaser   Dept. of Civil Engineering

CEE 171 INTRODUCTION TO GEOLOGICAL ENGINEERING
FALL SEMESTER, 2003

Midterm Examination, October 29, 2003

Name:

This is an 120 minute closed book examination. Please show all work on the examination paper, and explain assumptions. Use complete sentences so any idiot can understand what you are talking about. Explain your answers in such a way that the same idiot can understand and give you partial credit. Good luck! **THINK! DRAW PICTURES!!**

PROBLEM #	POINTS POSSIBLE	POINTS EARNED
1	20	
2	10	
3	15	
4	30	
5	10	
6	15	

TOTAL

1) **(20 points total)** Describe and explain the following tunneling methods.

a) Shield machine

b) TBM (tunnel boring machine)

c) Cut and cover

d) Drill and blast

2) (10 points) Imagine a 18 ft. diameter tunnel in 12,000 psi limestone. Lab tests and calculation shows that the maximum inward radial displacement is expected to be 8 inches.

   a) What is the radial displacement at the tunnel face?

   b) What is the radial displacement 20 ft. behind (in the excavated portion) the tunnel face?

3) (15 points total) Describe an Observational Design Method that would incorporate how the earth responds to your installing a structure (of your choice) in it. Include a sketch which shows the critical features.

4) (30 points) You need to specify a tunnel boring machine to excavate a 18 ft. diameter tunnel in 12,000 psi limestone. You want to maximize excavation speed therefore you want a penetration rate of 0.6 inches per revolution. The machine will have 12 inch diameter cutters, and the maximum permissible tangential velocity of the cutter head is 400 feet per minute. Use the attached charts to specify the following.
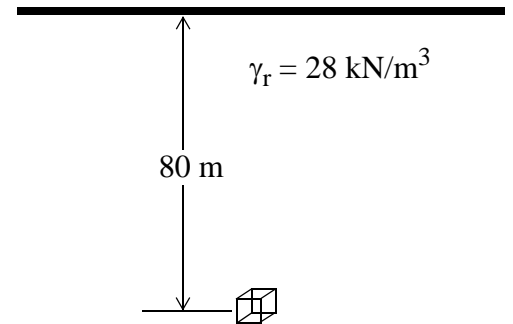
a) Thrust per cutter
b) Cutter spacing
c) Total required thrust
d) Total required torque and rotational horsepower

5) (10 points) Discuss why amorphous (non-crystalline) silicates should be avoided for concrete aggregates?

6) (15 points total) For the following point in the earth-

   a) What is σ_v?

   b) What is $\sigma_{horizontal}$ if $K_o = 0.5$?

$\gamma_r = 28 \ kN/m^3$

80 m

c) If this site is near a compressional fault (thrust fault), is the value of $K_o = 0.33$ Reasonable? Defend your answer.