

CONCORDIA UNIVERSITY
CIVI 437/2
Final Examination, Monday December 1992, 9:30-12:30
CLOSED BOOK EXAMINATION
ANSWER ALL QUESTIONS

Question (1)- The dynamic equation of equilibrium in a saturated soil medium is;

$$\partial \sigma'_{ij} / \partial x_j + \partial u / \partial x_i = \partial v_i / \partial t$$

where σ'_{ij} is the conventional effective stress, u is the pore water pressure and v_i is the velocity of movement assumed to be the same for both the solid and the fluid phase. Prove that each term in the above equation is a first order tensor.

Question (2)- Break the bi-harmonic equation;

$$\nabla^4 \phi = 0$$

into its finite difference form (show the results graphically and assume $\Delta x = \Delta y$.)

Question (3)- Describe **very briefly** the principles involved in a geotechnical investigation of rock stratification at great depths by means of bore holes. Write as many equations as you know to illustrate the technique.

Question (4)- Using the Airy stress function

$$\phi = A r \theta \sin \theta$$

or otherwise calculate the normal component of the traction across the diameter marked AA in Fig.(1) which shows a cylindrical sample undergoing a compression test. Given that the diameter and the length of the sample is 10 and 20 cm respectively and that the compressive load P at failure was measured to be 300 kN calculate the tensile strength of the rock.

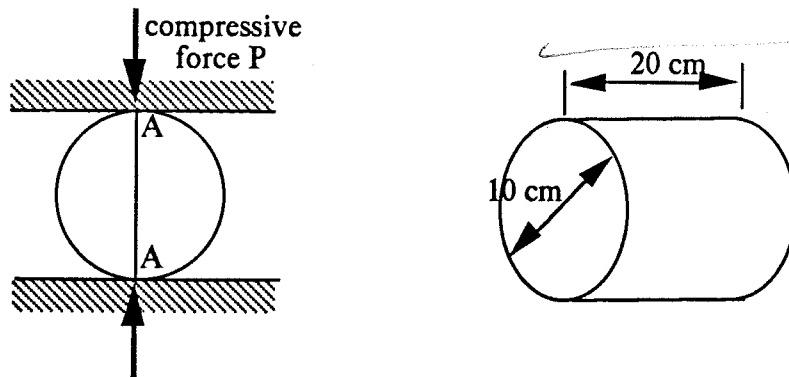


Fig.(1)

Question (5)- Write a short account of your understanding of the liquefaction phenomenon.

Question (6)- The tunnel shown in Fig.(2) is in layered rock. The Young modulus and unit weight of all the three layers are the same. Derive an equation to express the maximum tensile stress induced in the roof of the tunnel.

(2)

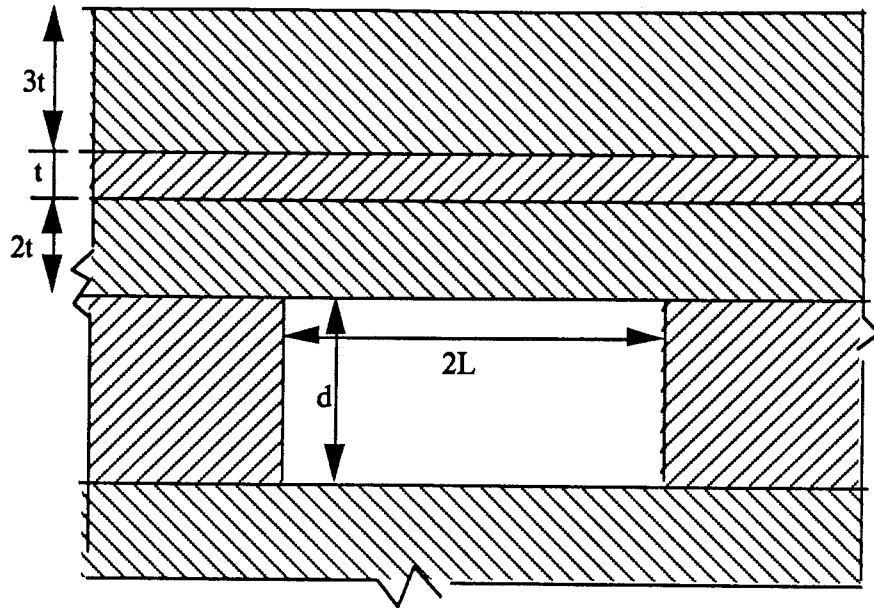


Fig.(2)