UNIVERSITY OF SOUTH AUSTRALIA

SCHOOL OF NATURAL AND BUILT ENVIRONMENTS

ANNUAL EXAMINATION
Monday 28 June 2004, 2.00 pm Ridley Centre

ROCK AND SOIL MECHANICS CIVE-3008

ROCK MECHANICS MODULE 2
Paper to be attempted by **Mining Engineering** students only
OPEN BOOK

Time: ONE hour

Answer **BOTH** questions.

Marks will be deducted where units are either missing or incorrect.

QUESTION 1

The benches in an open pit mine are to be excavated in a jointed siltstone rock mass. Inspection of the site indicates that a kinematically feasible two-dimensional single plane sliding mechanism could be formed at the rock face by planes with the following angles of dip:

Slope of rock face βf	70°
Slope of top of rock face βt	0°
Slope of sliding plane βs	50° towards rock face
Slope of tension crack βc	No tension crack

The vertical distance H from the intersection between the sliding plane and the slope face to the slope crest is 8.0 m. The unit weight of the rock is 26 kN/m^3.

Show that the weight of a one metre slice of the potentially unstable block is 395.31 kN, and that the length of the sliding plane is 10.44 m.

5 marks

The sliding plane has the following Barton shear strength parameters: basic friction angle ϕ_b = 34°, JRC = 8 and uniaxial compressive strength of rock material σ_d = 74 MPa. The sliding plane is subjected to an estimated **average** water pressure of 10 kPa

Determine the factor of safety of the block by applying the Barton shear strength model.

15 marks

Please see next page

QUESTION 2

(a) A non-overhanging rock face of strike 225° forms the south-eastern margin of an open pit. The rock mass forming the face is a well-bedded dry siltstone in which the bedding has a dip direction/dip angle 130/60 and an inter-bed friction angle of 35°. Design a slope angle for this face that will provide a factor of safety of 2.0 against failure by flexural toppling.

6 marks

(b) A probabilistic analysis of a failure mechanism for a permanent mine slope indicated a mean factor of safety of 1.75. In the Monte Carlo simulation involving 10,000 simulations, 255 gave a factor of safety of less than 1.0 and 2,411 gave a factor of safety of less than 1.5. Comment briefly on these results and suggest a strategy for operating the mine at this slope angle.

7 marks

(c) A cement grout anchored rock bolt with an anchorage length of 0.65 m in a 35 mm diameter hole failed by slipping at the rock-grout interface at a pull-out load of 230 kN. Calculate the shear strength of the rock-grout interface. These rock bolts, installed in a square grid 1.5 m apart will be used to apply a support pressure of 100 kPa to a rock face. What anchorage length would you recommend in order to achieve this support pressure at a factor of safety of 1.6 against pull-out failure?

7 marks

End of paper