

Coal Paper 2: September 2004 Memorandum

Question 1

$$(a) SF_{new} = \frac{288(.85w)^2}{Hh^{.66}C^2}$$

$$SF_{old} = \frac{288(w)^2}{Hh^{.66}C^2}$$

$$\frac{SF_{new}}{SF_{old}} = \frac{288(.85w)^{2.46}}{Hh^{.66}C^2} \frac{Hh^{.66}C^2}{288w^{2.46}}$$

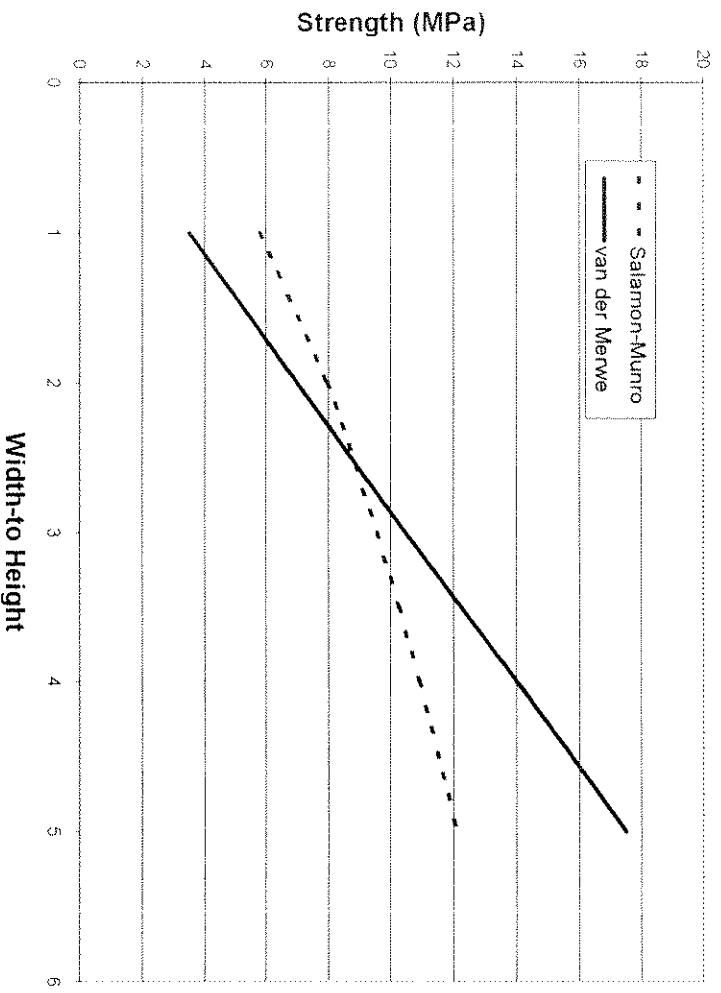
$$SF_{new} = .85^{2.46} SF_{old} = .67 SF_{old}$$

Therefore Safety Factor is reduced by 33%.

(b) The rate is initially high and then decreases rapidly



(c) For constant height, 3 m in this example:



Question 2

$$(a) \sigma = \frac{Fp g(t_w + t_s)L^2}{2t^2} = \frac{1.5 \times 9.83 \times 2480 \times (6 + .5) \times 7.2^2}{2 \times .5^2} = 4161974 Pa = 4.2 MPa$$

Tensile strength = 5 Mpa, can thus support weak layer plus itself.

$$(b) L = \sqrt{\frac{t\sigma}{Fp g}} = \sqrt{\frac{.015 \times 5}{1.5 \times 9.81 \times .00248}} = 1.43 m$$

$$(c) l_a = \frac{r S_b^2 t_w}{\pi d_h r} = \frac{.025 \times 1.43^2 \times 6}{\pi \times .025 \times 1.5} = .26 m$$

$$l_b = l_a + t_w = .6 + .26 = .86 m$$

$$(d) \text{ Resin volume} = l_a \pi (d_h^2 - d^2) / 4 = .26 \pi (.025^2 - .018^2) / 4 = .00006149 m^3 = 61.5 cm^3$$

If capsule diameter = 23 mm, length is:

$$l_c = \text{Volume} / (\pi d_c^2 / 4) = 4 \times 61.5 / (\pi \times 2.3^2 / 4) = 14.8 cm = 15 cm$$

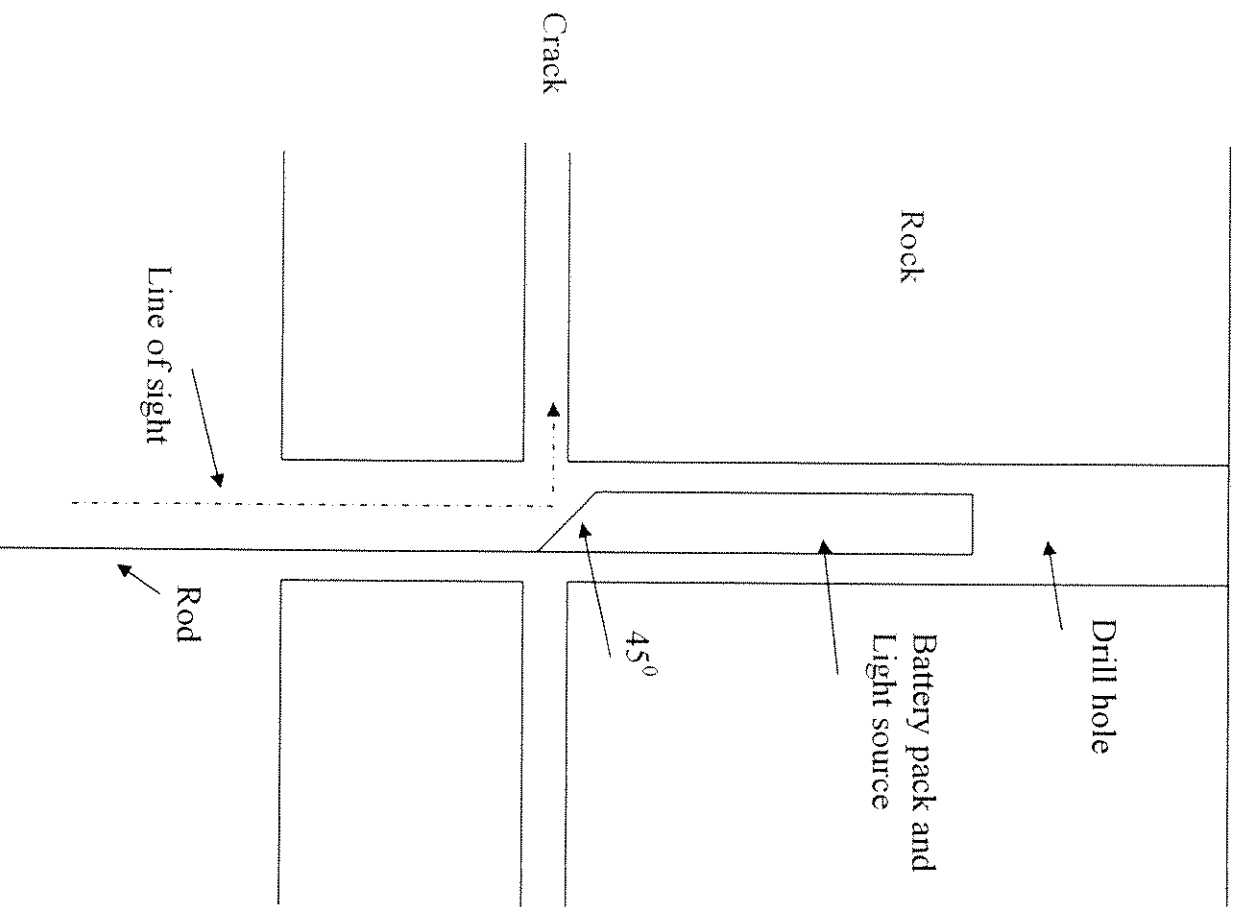
(e) $Weight\ per\ bolt = S^2 x f_w x p_g = 1.43^2 \times 6 \times 9.81 \times 2480 = 29849\ N = .03\ MN$
 $Stress\ in\ bolt = Weight / Area = .03 / (\pi \times 0.018^2 / 4) = 117\ Mpa$

(f) Beam creation steps:

- Calculate thickness of beam to be created
- Assume spacing of bolts
- Calculate required pre-tension
- Check for steel strength
- Assume new spacing if bolt load excessive, iterate
- Calculate anchor length, bolt length
- Calculate resin volume, capsule number and dimensions

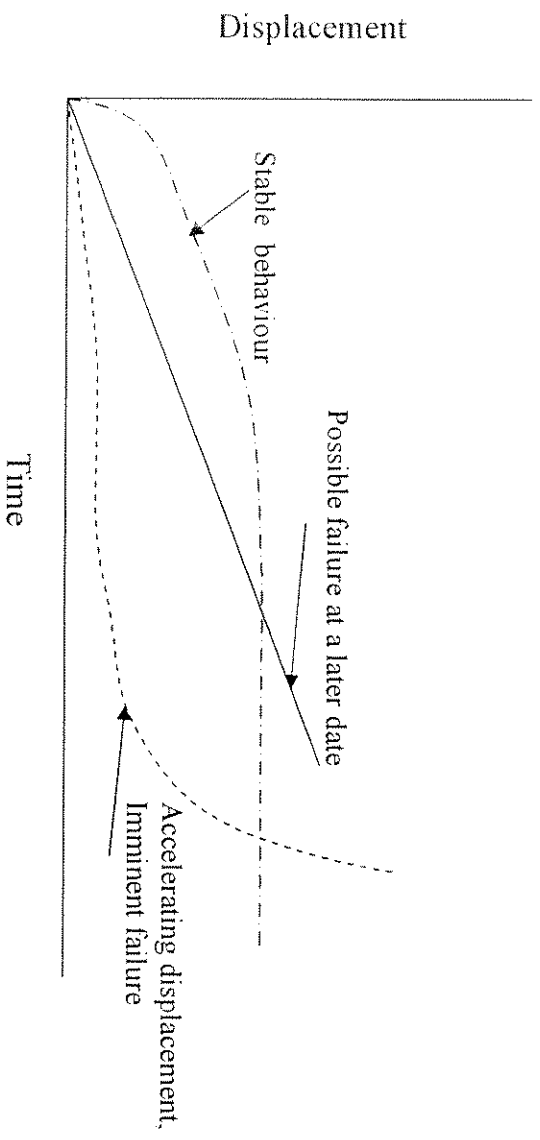
Question 3

(a) Petroscope



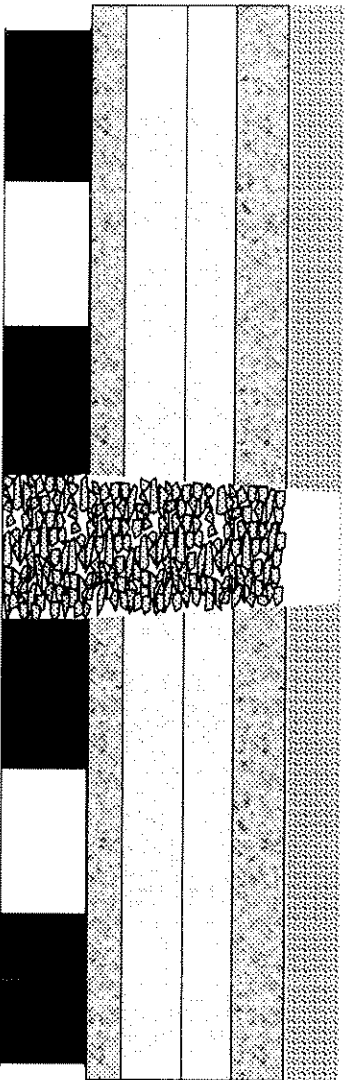
A petroscope is an instrument consisting of a 45 degree mirror mounted on a light source and power pack that is used to push up a drill hole to visually inspect the sides of the hole for cracks, bedding planes, lithological units, etc.

(b) Extensometer results

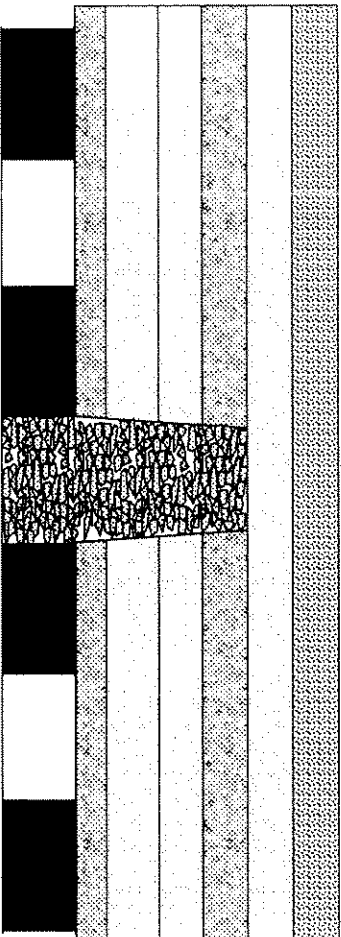


Question 4

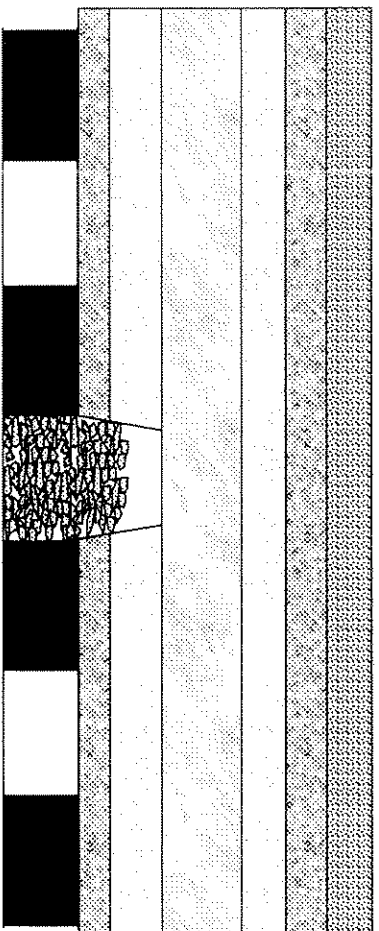
(i) Progressive roof collapse results in sink hole



(ii) Bulking can choke cavity, preventing further progression of collapse and formation of sink hole. Further progression is possible only if broken material is removed, perhaps by water.



(iii) Presence of strong layer can stop or delay process.



Question 5

Question	TRUE	FALSE
a) The Slake Durability Test.....		
i)		x
ii)	x	
iii)		X
iv)		X
b) The Q-rating.....		
i)		x
ii)	X	
iii)		X
iv)		X
c) Fixed head full column....		
i)		X
ii)		x
iii)	x	
iv)		X
d) The Point of Inflexion...		
i)	X	
ii)	X	
iii)		X
iv)		X
e) The stiffness of the loading....		
i)		X
ii)		X
iii)		X
iv)	X	
f) There is a correlation.....		
i)		X
ii)		X
iii)		X
iv)	X	
g) The "Continuous Miner Correction"		
i)		X
ii)		X
iii)	X	
iv)	X	
h) Roof deflection prior to bolt.....		
i)		X
ii)		X
iii)		X
iv)	X	
i) For rectangular pillars.....		
i)	X	
ii)		X
iii)		X
iv)		X

j) Breaker lines		
i)	X	
ii)	X	
iii)	X	
iv)		X