

EXAMINATION PAPER

SUBJECT: CERTIFICATE IN STRATA CONTROL (COAL) SUBJECT CODE:COMSCC EXAMINATION DATE: 11 OCTOBER 2016 TIME: 14:30 – 17:30	EXAMINER: Mark Henderson MODERATOR: Sandor Petho TOTAL MARKS: [100] PASS MARK: 60%
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NUMBER OF PAGES: 4

SPECIAL REQUIREMENTS:

1. Answer **ALL FIVE** questions
2. References other than those provided are not permitted.
3. Hand-held electronic calculators may be used.
4. Put your examination number on the outside cover of each book used and on any graph paper or other loose sheets handed in.

NB: your name must not appear on any answer book or loose sheets.

5. **Write in ink on the RIGHT HAND SIDE of the paper only (only the right hand pages will be marked).**
6. Show all calculations on which your answers are based.
7. Illustrate your answers by sketches of diagrams wherever possible.
8. In answering these questions, full advantage should be taken wherever necessary of your practical experience as well as of the data given.
9. Answers must be given to an accuracy that is typical of practical conditions.
10. Cell phones are **NOT** allowed in the examination room

CERTIFICATE IN STRATA CONTROL (COAL)

QUESTION 1

- a) Name 4 lead indicators that would suggest that an intersection may be unstable (4)
- b) Explain what *stiffness* is and give an example of when it would be of interest to a Strata Control Officer or Rock Engineer (3)
- c) Explain what cleating is as well as how you would manage it (3)
- d) Describe the steps that you would follow when conducting a Coal Mine Roof Rating (5)
- e) What is tributary area theory and what must hold true for it to be used? (4)
- f) Explain what guttering is, what causes it, and how to control it (6)

[25]

QUESTION 2

Your operation mines at a 7m bord width, and has a point anchored resin bolt system based on the suspension of laminated material of 0.8m thick to overlying sandstone. At present, this is achieved using 20mm 1.8m bolts installed 2m apart between rows with 4 bolts per row, using 26mm diameter holes.

Assume that the weakest interface is between the resin and the rock, with shear strength of 2MPa.

- a) The Manager has asked you whether the bolt length can be reduced to 1.5m. Perform a calculation to determine whether the bolt length can be reduced. Make allowance for reaming (13)
- b) Explain why beam building effectiveness will be severely limited if beam building is to be done using point anchored bolts (3)
- c) Explain why bolts installed to the sides of a road have greater benefit in terms of beam building than those bolts installed at the center of the road (3)

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- d) Calculate how much longer a 23mm resin capsule has to be if allowance must be made for a 50mm gap at the top of the hole (bolt length is shorter than the hole length by 50mm). The hole has a 30mm diameter
(6) [25]

QUESTION 3

- a) You have been asked to evaluate the impact of changing from 16 tonne to 20 tonne shuttle cars from a strata control perspective. You are informed that the larger shuttle cars will require an increase in the road width from 6.8m to 7.2m. Calculate the percentage increase in the tensile stress that the roof beam will be subjected to over the intersection
(12)
- b) The colliery at which you work has a competent sandstone beam as the roof; however, the beam is underlain by a 10cm thick siltstone layer. What bolt spacing would be required to keep this layer from breaking if it has tensile strength of 2MPa and a density of 2500kg/m³?
(13)

[25]

QUESTION 4

Using the pillar strength formula $S=7.2w^{0.46}/h^{0.66}$

Your colliery employs a bord and pillar mining layout at 30m below surface with a mining height of 4m. The minimum w:h ratio applied by Danville is 3, minimum safety factor 1.6, and the road width is 6m. Assume square pillars. Show all calculations.

- a) What size pillars does Danville require
(5)
- b) As part of their surface protection strategy, the Rock Engineer determined that the mining height should be reduced to 2.5m. Following this, you have been requested to re-determine the required pillar size, and then compare the change in extraction percentage of the total volume of coal that would be achieved at a 4m height to that at a 2.5m height
(15)
- c) Using a stress / strain diagram, illustrate differences between a pillar with a width to height of 2 and a pillar with a width to height of 7
(5)

Strata Control Formulae

$$S = 7,2 \frac{w^{0,46}}{h^{0,66}}$$

$$S = 3.5 \left(\frac{w}{h} \right) (MPa)$$

$$L = \frac{25 H C^2}{w^2}$$

$$\eta = \eta_o \left(1 + \frac{2\Delta w_0}{w} \right)^{2,46}$$

$$n = SF \frac{pgt}{Pf}$$

$$Lb = \frac{d_c^2 Lc}{D^2 - d^2}$$

$$\tau = \frac{Pf}{\pi . D . Lb}$$

$$\eta = \frac{\gamma L^4}{23 E t^2}$$

$$\sigma = \frac{\gamma L^2}{2 t}$$

$$FS = 288 \frac{w^{2,46}}{Hh^{0,66} (w + b)^2}$$

$$\sigma_s = 7.2 \frac{R_0^{0.5933}}{V^{0.0667}} \left\{ \frac{0.5933}{\varepsilon} \left[\left(\frac{R}{R_o} \right)^\varepsilon - 1 \right] + 1 \right\}$$

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$$\tau = c + \sigma_n \tan \phi$$

$$V_s = \frac{4 \pi r^3}{3}$$