QUESTION 1

SAFETY MANAGEMENT

1.1 Give reasons why some mines fail in terms of Safety and Health performance. (15)

1.2 Briefly discuss the theory of a Systems Safety Approach (5)

1.3 Name any ten of the 18 OSHAS 18001 elements (10)

(30)

QUESTION 2

OCCUPATIONAL HYGIENE

2.1 Mines have to implement hearing conservation programmes as required by the Mine Health and Safety Act. Discuss three requirements for a successful implementation of a hearing conservation programme. (6)

2.2 Define a homogeneous exposure group and its importance to the implementation of a hearing conservation programme. (4)

2.3 One of the industry milestones by 2013 is to eliminate silicosis. As a Mine Manager of an underground continuous miner operation, describe the measures you would implement towards achieving this target. (10)

(20)

QUESTION 3

ROCK ENGINEERING

"Walk about" methods of monitoring slope stability are applied extensively in open pit mining situations.

3.1 Give important geometrical & geological parameters you would include in your forman's checklist to assist with monitoring for slope stability. (5)

3.2 Explain how each of the parameters you mentioned, would affect slope stability. (5)

3.3 Name 4 common mechanisms of failure in open pit wall and give conditions favourable for their occurrence. (4)

3.4 Give 2 simple methods of monitoring cracks observed on the highwall of the pit. (2)

(16)

QUESTION 4

LOGISTICS (COAL CONVEYING)

4.1 Provide a sketch of a typical gravity take up conveyor system with all the conveyor components shown. On the sketch, show all the safety systems that will be required to operate the conveyor and explain the functions of each safety system. (20)

(20)

QUESTION 5

COAL PROCESSING

5.1 Describe the use of the following equipment in coal processing plants.

5.1.1 Magnetic drum separator (4)

5.1.2 Cyclone (4)

5.2 Discuss the following coal quality parameters:

5.2.1 Calorific Value (2)

5.2.2 % Ash Content (2)

5.2.3 % Total Moisture (2)

(14)

TOTAL [100]

d. Toppling failure

Toppling failure is a special type of planar failure and commonly occurs on highwall hard overburden and interburden. It involves rotation of planes or columns about a fixed base, see figure 9. Normally at shallow depth (as in opencast mine depths) such failure requires an external source of energy to instigate failure. Therefore it is most likely to be induced by blasting and where steep deeping cracks exist striking parallel to the high wall.

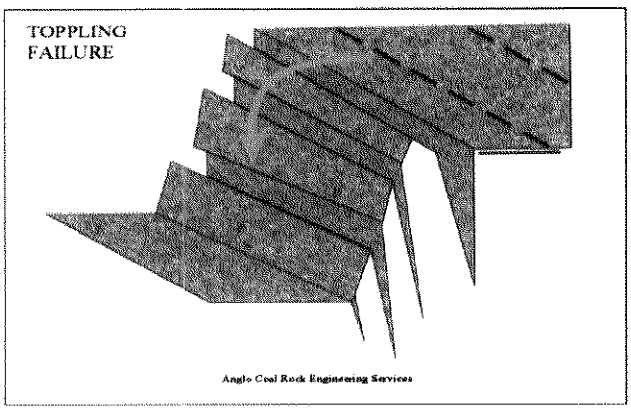

Figure 9. Diagram depicting toppling failure mechanism

A. APPENDIX A: FAILURE MECHANISMS

a. Circular failure

This type of failure can be expected in the soft overburden of the highwall, in the blasted burden, in the extended bench and in the overburden spoil piles on the lowwall. The failure occurs when the rock mass has low cohesion and friction angle values. Failure usually occurs along a line of least resistance, which depends on the depth of the horizon. The scale of failures may be exacerbated by the presence of faults, dykes and water in the area and may be triggered by undercutting the spoils, blasting operations or a build-up of water, See figure 6.

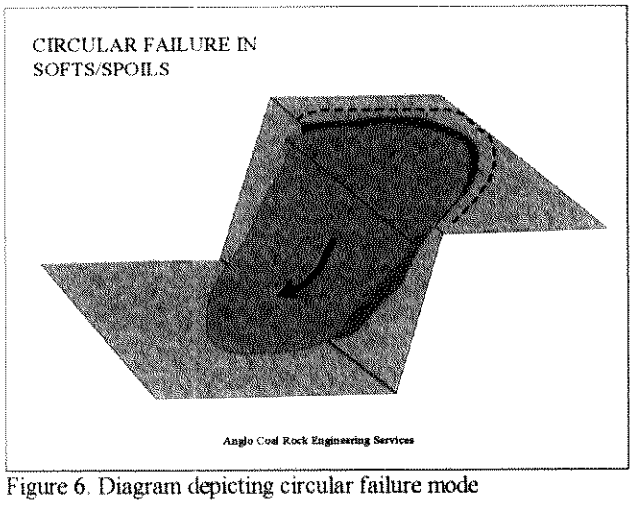

Figure 6. Diagram depicting circular failure mode

b. Wedge failure

Wedge failure usually occurs in the hard overburden and interburden and is structurally related, see figure 7. The possibility of this type of failure occurs when:

- The boundaries of the wedge are joint or slip planes;

- Sliding takes place along the line of intersection of two planar discontinuities;

- The line of intersection daylights in the highwall (slope) face;

- The angle of the intersecting lines exceeds the friction angle of the planar discontinuities;
- The angle of the intersecting lines is less than the slope face angle.

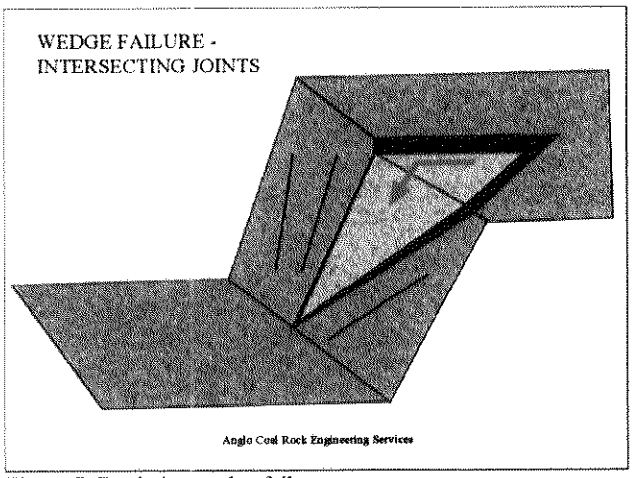

Figure 7. Depicting wedge failure

c. **Planar failure**

This type of failure also involves the hard overburden and interburden of the highwall and occurs when the following geometrical conditions are satisfied:

- The plane on which sliding occurs must strike parallel or near parallel to the highwall face;

- The failure plane may daylight on the highwall face and surface;

- The dip of the failure plane must exceed the angle of friction.

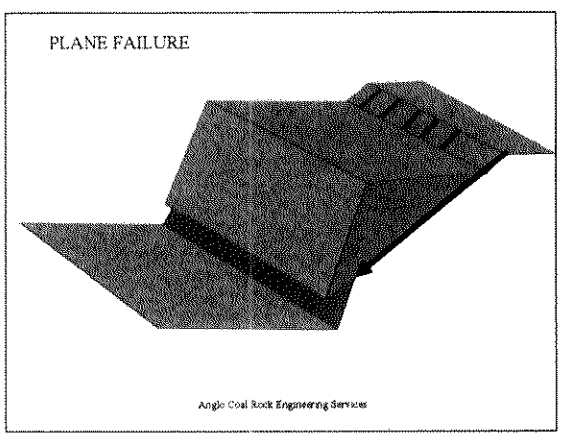

Figure 8. Diagram depicting planar failure

1) "Walk about" methods of monitoring are applied extensively in open pit mining situations.

a. Give important geometrical & geological parameters you would include in your foreman's checklist to assist with monitoring for slope stability.(5)

i. Slope angles.
ii. undercut slopes.
iii. presence of overhangs/loose rock material on high wall.
iv. fresh cracks on high wall.
v. footwall heave.
vi. water accumulations.
vii. presence of geological discontinuities(Joints/fault/dyke)

b. Explain how each of the parameters you mentioned would affect slope stability.(5)

i. Flatter slope angles are more stable than steep. soils/ spoils are stable at their natural angle of repose;
ii. Undercutting increases the effective slope angles
iii. Lose rock material on the highwall pose a risk of rocks falling onto operators and other personnel in pit
iv. Water increases pore water pressure in cracks/joints/slips causing them to open up.
v. Geological discontinuities introduce weakness in rock as compared to intact rock.
vi. Foot wall heave is indicative of high stress and may be a precursor to a slope failure
vii. Cracking on low wall/high wall and on benches is a sign of slope instability

c. Name 5 common mechanisms of failure in open pit walls. And give conditions favourable for their occurrence (10)

i. Planar: Flat dipping day lighting into the face occurring in hard overburden.
ii. wedge;
iii. circular;
iv. toppling; steeply dipping jointing striking parallel to the high wall and

d. Give 2 simple methods of monitoring cracks observed on the highwall of the pit.(2)

i. Tell-Tales
ii. PEGS - PLACE AT A DISTANCE AT 1METRE APART AND MONITOR DISATANCE USING A TAPE MEASURE
iii. WIRE EXTENSOMETERS
iv. ROCK RADAR

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