Delft University of Technology

Final Examination – Mining Engineering I (TA3110)

January 19, 2006

Part II - Surface Mining

Open Book Writing

(90 Minutes Duration)

NOTES:

1. This part of exam contains 3 groups of questions. The first group is to test your knowledge of basic concepts of surface mining, and the second and third groups are simple calculations concerning mine design and production. Read the questions carefully before you start answering.

2. All the units appearing in this exam are metric units unless where specially stated. Please be careful at any time when unit conversion is required.

3. Any non-communicating calculator is permitted. This is an Open Book exam.

4. Marks assigned to each question have been stated on the question sheets on a 100% basis, which contributes 50% of the total mark of the overall course, i.e., your final mark of this part of exam will be multiplied by 50% as the contribution to your overall mark of this course.

5. If problem exists as to the interpretation of any question, the candidate should consult the exam supervisor for clearance. Reasonable assumptions acceptable if the supervisor encourages, but any assumptions made should be clearly stated the reason which should be submitted with the answer paper.

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1. General concepts of surface mining

There are 3 questions in this group each might contain a number of sub-questions. Please answer the questions as briefly and clearly as you can.
[40: (1)-15; (2)-10; (3)- 15]

(1) A mineral deposit is anticipated to be exploited using surface mining. As a mining engineer being assigned to do mine design, you are given a whole set (orebody, reserve, geological, environmental and social, etc) of information. Please discuss briefly:

   a) Different surface mining methods and their main differences/ similarities
   b) Base on what key factors, you can choose a most suitable surface mining method
   c) What you might have to accomplish in different design stages so that the design is reliable.

(2) Waste disposal becomes more and more an important concern for a surface mining operation. It has not only been a technical issue, but also an environmental and economical measurement that defines how successful the mine can be operated. As a mine engineer, please
   a) discuss what critical factors you have to consider when you choose a waste dump site; and
   b) describe major methods of dump building.

(3) Please describe briefly (use sketch if it helps) the area strip mine advance process, and
   a) What mining system (in terms of equipment combination) are most often adopted for area stripping
   b) How stripping ratio is calculated

2. Pit geometry [30, 15 each]

(1) Pit limit optimization process presented an ultimate depth of 360 meters for an open pit mine operation. You are the mining engineer assigned to perform detailed mine design based on the optimized pit limit and you are up to the front of placing the production road in pit. Reviewing the dimensions of the selected equipment and related safety rules and legislation, you have determined the following road parameters:

   - Grade: 10%
   - Width: 32m

   Assume the road is placed completely outside the optimized pit limit, how much more waste has to be removed comparing to the optimized pit?

(2) A pit is using shovel and truck system to handle the blasted material on the working benches. The angle of repose is 40^0. Safety control requires the equipment clearance be minimum 1.8 m. The shovel is digging along the bench face and advancing towards only one direction.

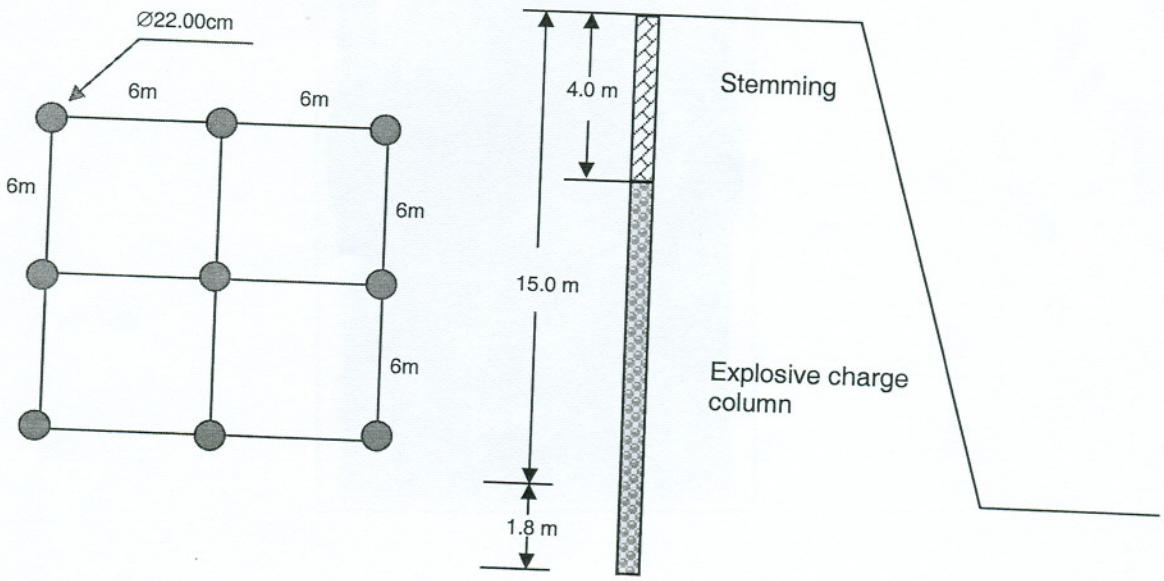
The truck specification is as below:

- Gross Machine Weight: 144.7 ton
- Weight distribution:
  - empty: 47.3% front; 52.7% rear
  - loaded: 34.2% front; 65.8 rear
- Max. Payload: 270 ton/ 153.2 m^3
- Engine power : 2470 hp
- Height: 7.410m
- Overall Length: 13.80 m
- Working Width: 8.19 m
- Tire diameter: 3.5 m
- Turning Circle (Radius): 33.3m

What should be the minimum working bench width if circled maneuver system is used for truck positioning?

3. Production [30]

An iron ore open pit mine is working with 15-meter bench height. The designed capacity of ore production is 75,000 tonnes/day with peak capacity of 80,000 tonne/day. The mine works 3 shift/day,



Traditional drilling-blasting system is used at this mine for rock breakage and the same drilling equipment will be used for both ore and waste production. The blasting is performed with B X S = 6m X 6m pattern and each hole has a 1.8-meter sub-grade drilling (refer to the sketch). Site drilling tests suggest that the selected drills:

- have an average penetration rate of 20 cm/min (or 5 minutes per meter),
- need about 8 minutes for relocation, and
- work for 7.5 hours per 8-hour shift, 3 shifts per day .

(1) How many drills will be needed to meet the ore production requirement?

(2) If they are loaded with ANFO that has density of 0.85 grams per cc. The blastholes are 22 cm in diameter and the collar (stemming) height is 4 meters. Please calculate the powder factor of the blast, and judge if the blast design is reasonable.