TA3060 Mining Engineering
Exam Surface Mining, November 2014
Surface Mining Section – Time 1.5 hours

This is an open-book exam: material for this course placed on *TUD-black board* can be used in printed form (not in digital form). It is not allowed to use online or digital sources during the exam.

Students are requested to answer the following 4 questions. All questions are of equal value: 25 points. A grade "10: tien" requires 100 points.
To answer some of the questions, some parameters must be:
- taken from the open book material or own experience
- estimated by an educated guess.

Provide quantitative answers instead of prose (give formulas; clarify your answers by providing example calculations). Clarify your answers by providing cross-sections, sketches *etc.*
Answers can be provided in Dutch or in English.

Question 1
a) Which geomechanical parameters of a potential deposit for rock fill do you need to know in advance to determine if excavation with a backhoe can take place directly without prior drilling and blasting?
b) Explain why the inclination of a drillhole in a drill and blasting operation is not per se parallel to the slope of the bench in which is drilled.
c) Explain important factors that you would consider in designing a cast blasting system in a coal mine.
d) Explain why the inclination of a drillhole in a drill and blasting operation is not per se parallel to the slope of the bench in which is drilled.

Question 2
a) Explain as detailed as possible which factors influence the overall equipment effectiveness (or overall system effectiveness) of bucketwheel excavator – bench conveyor – spreader operations (the relationship between the different parameters are presented best by providing formulas).
b) Explain the difference between the system described above and a dozer – feeder breaker (flatback) bench conveyor – spreader system.

Question 3
a) Explain what effect the deterioration of a haul road from status I to II has on the diesel consumption of truck x. Your answer should be numerical not qualitative.

Status I: the haul road is maintained, has a hard smooth surface.
Status II: the haul road is a dirt roadway, rutted and flexing under load with little maintenance.
Truck x has an empty weight m and a gross vehicle weight w.

UNDERFOOTING	ROLLING RESISTANCE, PERCENT*			
	Tires		Track	Track
	Bias	Radial	**	+Tires
A very hard, smooth roadway, concrete, cold asphalt or dirt surface, no penetration or flexing	1.5%*	1.2%	0%	1.0%
A hard, smooth, stabilized surfaced roadway without penetration under load, watered, maintained	2.0%	1.7%	0%	1.2%
A firm, smooth, rolling roadway with dirt or light surfacing, flexing slightly under load or undulating, maintained fairly regularly, watered	3.0%	2.5%	0%	1.8%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 25 mm (1") tire penetration or flexing	4.0%	4.0%	0%	2.4%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 50 mm (2") tire penetration or flexing	5.0%	5.0%	0%	3.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 100 mm (4") tire penetration or flexing	8.0%	8.0%	0%	4.8%
Loose sand or gravel	10.0%	10.0%	2%	7.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 200 mm (8") tire penetration and flexing	14.0%	14.0%	5%	10.0%
Very soft, muddy, rutted roadway, 300 mm (12") tire penetration, no flexing	20.0%	20.0%	8%	15.0%

*Percent of combined machine weight.
**Assumes drag load has been subtracted to give Drawbar Pull for good to moderate conditions. Some resistance added for very soft conditions.

b) Explain how, in a coal mine located in a sea climate, a haul road that is characterised as a dirt roadway, rutted and flexing under load can be improved to a roadway which is hard and has a smooth surface: What is needed in the mine to improve and maintain the road (equipment, materials etc.). Differentiate between the loading area, the main haulroad and the dumping area.

Question 4

a) Describe or draw the different components of a fully mobile crusher/sizing system..
b) How do/should these components differ between a fully mobile crusher/sizer system designed for a hard rock Cu-mine and a lignite mine?
c) Which material properties of the ore and waste need to be known when analysing the use of either a fully mobile crusher – bench conveyor system or a truck haulage system during a feasibility study?
d) Indicate (e.g. in your drawing) where in the fully mobile crushing/sizing system you expect what type of wear (differentiate between a hard rock operation and a lignite mine).