HANDOUT

Rock Blasting Technique - I

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Introduction

Lesson 1

Rock Blasting Technique – Mining Engineering Department

Rule of the lesson:

14 x lesson, minimal presence 12 x, the other rules follow the rules of the university rules.

NO	KOMPONEN PENILAIAN	SKOR MAKSIMAL	BOBOT (%)
1	Presence : minimal 12 x	100	10
2	Home work and quiz	100	30
3	Mid term examination	100	30
4	Examination	100	30
Grade	Score		
A	= 75 – 100		
B	= 65 – 74,9		
C	= 50 – 64,9		
D	= 30 – 49,9		
E	< 30		

Litherature

- Ash R.L. ,1990 , *Design of Blasting Round*, in Surface Mining 2nd Ed., by Kennedy (Editor), Colorado, USA, p. 15 – 30.
- Berta Giorgio (1990), *Explosives : An Engineering Tools*, Italesplosivi, Milano, p. 15, 30-35, 71.
- Hemphill G.B.,(1981),*Blasting Operation*, McGraw-Hill Book Company, USA, p.23– 30.
- Jimeno C.L., Jinemo E.L., Carcedo F.J.A, (1995), *Drilling and Blasting of Rock*, AA. Blakema, Balkema/Rotterdam/Brookfield, p. 15-44.
- Koesnaryo. S., (1988), *Bahan Peledak Dan Metode Peledakan*, Fakultas Tambang UPN "Veteran" Yogyakarta, 1988, p. 11-41,
- Koesnaryo. S., (2000), *Teori Peledakan*, Kursus Juru Ledak Klas I, Pusat Pengembangan Tenaga Pertambangan, Bandung, p. 1-11.
- Koesnaryo. S., (2001), *Teknik Peledakan Buku I : Pemboran Untuk Penyediaan Lubang Ledak*, JurTeknik Pertambangan UPN "Veteran" Yogyakarta, p. 4-25, 29-45.
- Koesnaryo. S., (2001), *Teknik Peledakan Buku II : Rancangan Peledakan Batuan*, Jurusan Teknik Pertambangan UPN "Veteran" Yogyakarta, p. 1-8, 12-55.
- *Keputusan Menteri Pertambangan dan Energi Nomor : 555.K/26/M.PE/1995 Tentang Keselamatan Dan Kesehatan kerja Pertambangan Umum*, Direktorat Teknik Pertambangan Umum, Direktorat Jendral Pertambangan Umum, p. 1-8.

Blasting

Objective of rock blasting

Componens of rock blasting operations

History of explosive

Wahy should blast?

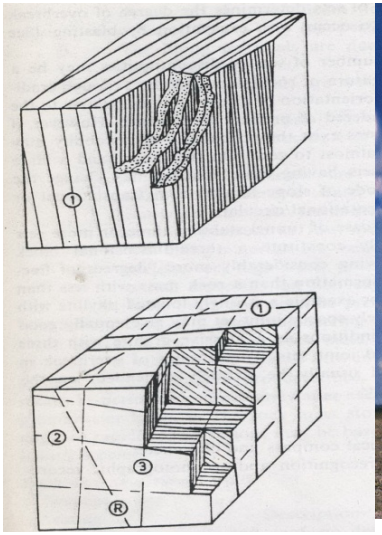
Criteria for blasting succesful

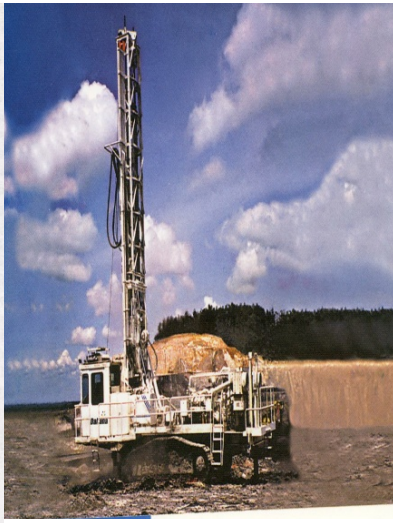
Objective of Rock Blasting

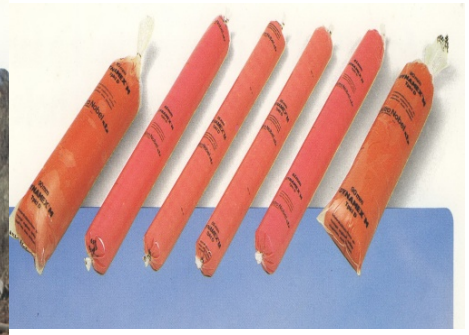
- To break rock into required size and extract the largest possible quantity of valuable resources from the ground at minimum cost.
- Taking into account factors :
  - Technics,
  - economics, and
  - enviroments.

Componens of rock blasting operations

- Regulations
- Rock Mass Characterization
- Drilling Equioments
- Explosive, blasting equipment and blasting accesories (initiating devices)
- Man power
- enviroment

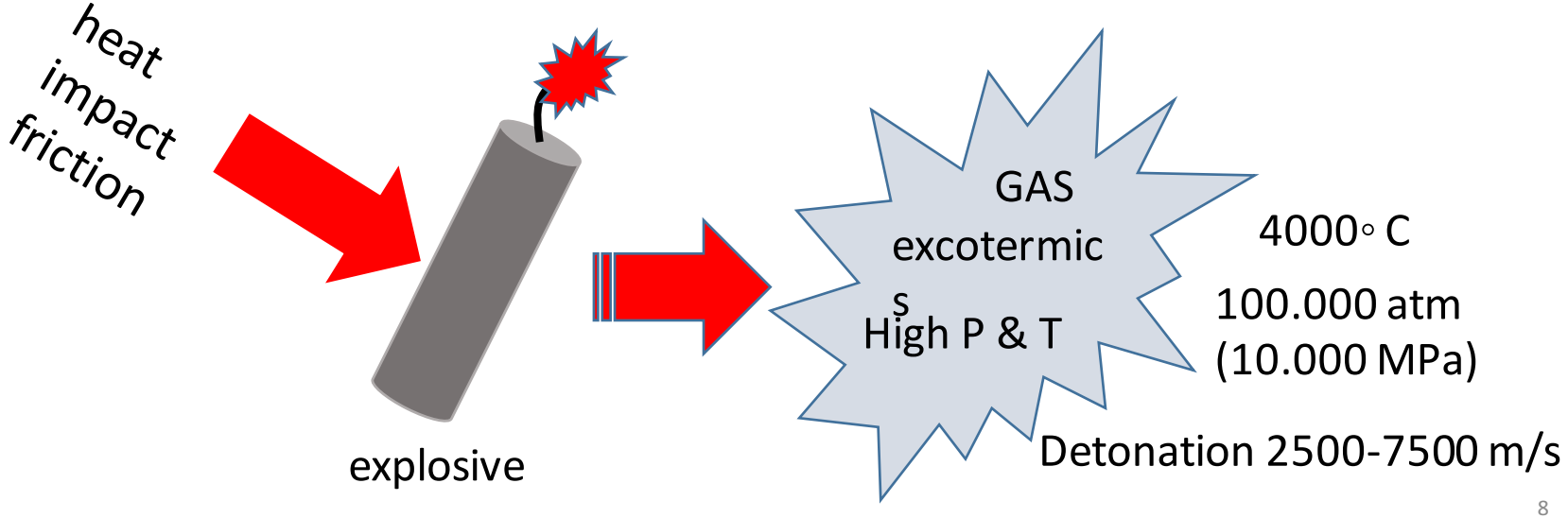






Explosive

- Explosive is a substance or substances in the form of solid, liquid, gas, or mixtures thereof, which when subjected to an action of heat, impact or friction chemically will change into other substances which are largely or entirely gaseous, and the changes taking place within very briefly, accompanied by the effects of heat and very high pressure (Regulation No. 5/1988)



History of explosive

- **BLACK POWDER**
  - 1300an, as ammunision
  - 1627 : the first is used on mining, Hungaria
  - 1917 : approximately 1,3 juta kg black powder for war world I
  - 1930an : the use of black powder lessen
- **DYNAMITE**
  - 1846 : Nitrogliserin (NG) founded
  - 1861 : The first factory made NG by Alfred Nobel, Swedia
  - 1866 : dinamite found (mixed NG and Kieselgurh)
  - 1875 : Gelatine dymanite
  - 1880an : permissible dynamite
  - 1950an : Ammonium Nitrate (AN) substitute NG dynamite
  - 1974 : Dupont market TOVEX watergel

History ... continued

- **AMMONIUM NITRATE (AN) / BLASTING AGENT**
  - 1867 : AN sebagai sensitizer patent
  - 1873 : Alfred Nobel use AN in Gelatine Dynamite
  - 1935 : Du pont market NITROMAN as the first blasting agent
  - 1957 : start market WATERGEL mulai dipasarkan

History …. continued

- INITIATING DEVICE
  - 1831 : safety fuse
  - 1870 : electric blasting cap, and generator type Blasting Machine
  - 1895 : delay electric blasting cap
  - 1913 : detonating cord
  - 1946 : delay EBC with interval milidetik – detik
  - 1950 : delay connector
  - 1960 : low energy detonating cord
  - 1976 : non electric delay cap and non electric delay blasting system : NONEL, HERCUDET.

Why should Blasting?

- Many methods to break the rock mass. Which the method is used depends on whether the rock is easy to dig. Soft rock can be dug with simple equipment (non-mechanical) such as crowbars-shovel, until the mechanical equipment such as backhoes, shovels, draglines. While somewhat medium rock with a bulldozer/ripper.
- **If the ripper is not able to dig, then the rock should be blasted by explosives**
- The method used to determine the rippability is by seismic investigation. From the investigation it will be known seismic velocity of seismic waves when through the rock mass. Based on the seismic velocity is determined index rippability rocks. Church (1977) classifies rippability index based on the value seismic velocity,
- The rock requires drilling and blasting is extreme hard rock with seismic velocity above 2,150 meters per second. Example, granite, basalt, sandstone, limestone, conglomerat, breccia, schist, etc.

Seismic velocity vs excavation method

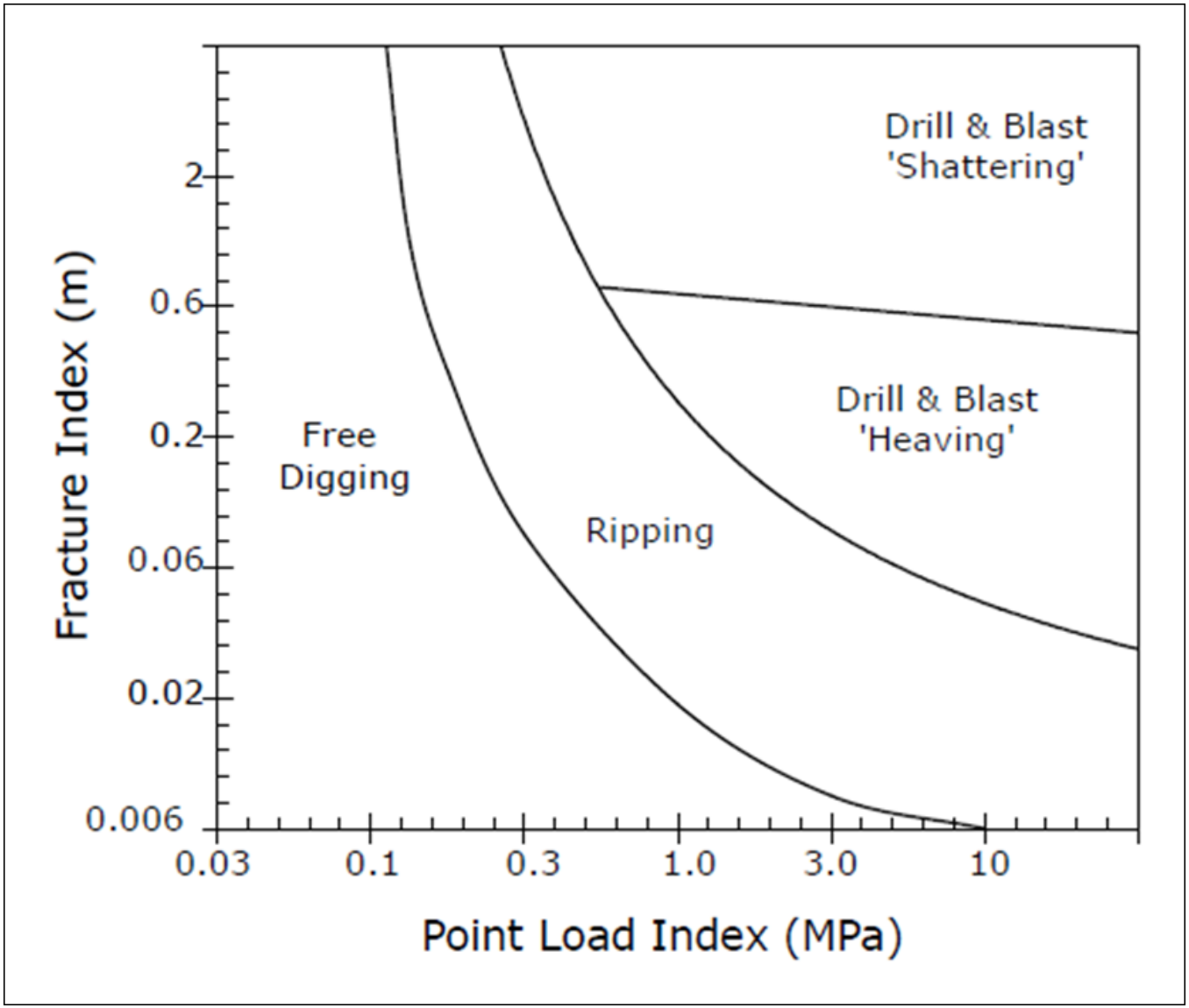
Seismic velocity (mps) ,	Exacavation Method	Description
< 450	No ripping	Soft rock, heavy weatherd
450-1200	Soft ripping	Soft rock, medium weathered, Percistence
1200 -1650	Medium ripping	Medium hard rock, medium weathered, percistence
1650 - 2150	Hard ripping	Hard rock, light weathered, medium percistence
> 2150	Drill & Blasting	Very hard rock, fresh, no percistence and closed aperture

Rock and Rock Mass Properties (rock mechanics)

1. **Unit weight**
2. **strength : Unconfined Compressive Strength (UCS),Unconfined Tensile Strength (UTS)**
   - **Resilience (blastability index), Rock elasticity.**
   - **Drillability index**
3. **Water content**
4. **Structure geology (fissure, joint, bedding plane, folliation)**

Rock Rippability Classification

(Franklin, Broch & Walton, 1971)



Criteria for Blasting Succesfull

- The production target is reached (ton/day or ton/month)
- Efficient use of explosives are expressed in the amount of rock that successfully blasting per kilogram of explosives (powder factor)
- Recovered sized rock fragmentation with little boulder (less than 15% of the broken rock by blasting)..
- Diperoleh dinding batuan yang stabil dan rata (tidak ada *overbreak, overhang*, retakan-retakan, dsb)
- Retrieved wall rocks are stable (no overbreak, overhangs, backbreak.)
- Safe (suitable of Standard Operating Procedure)
- A little impact on the environment (fly rock, ground vibration, noisy, fume, and dust are minimum)