

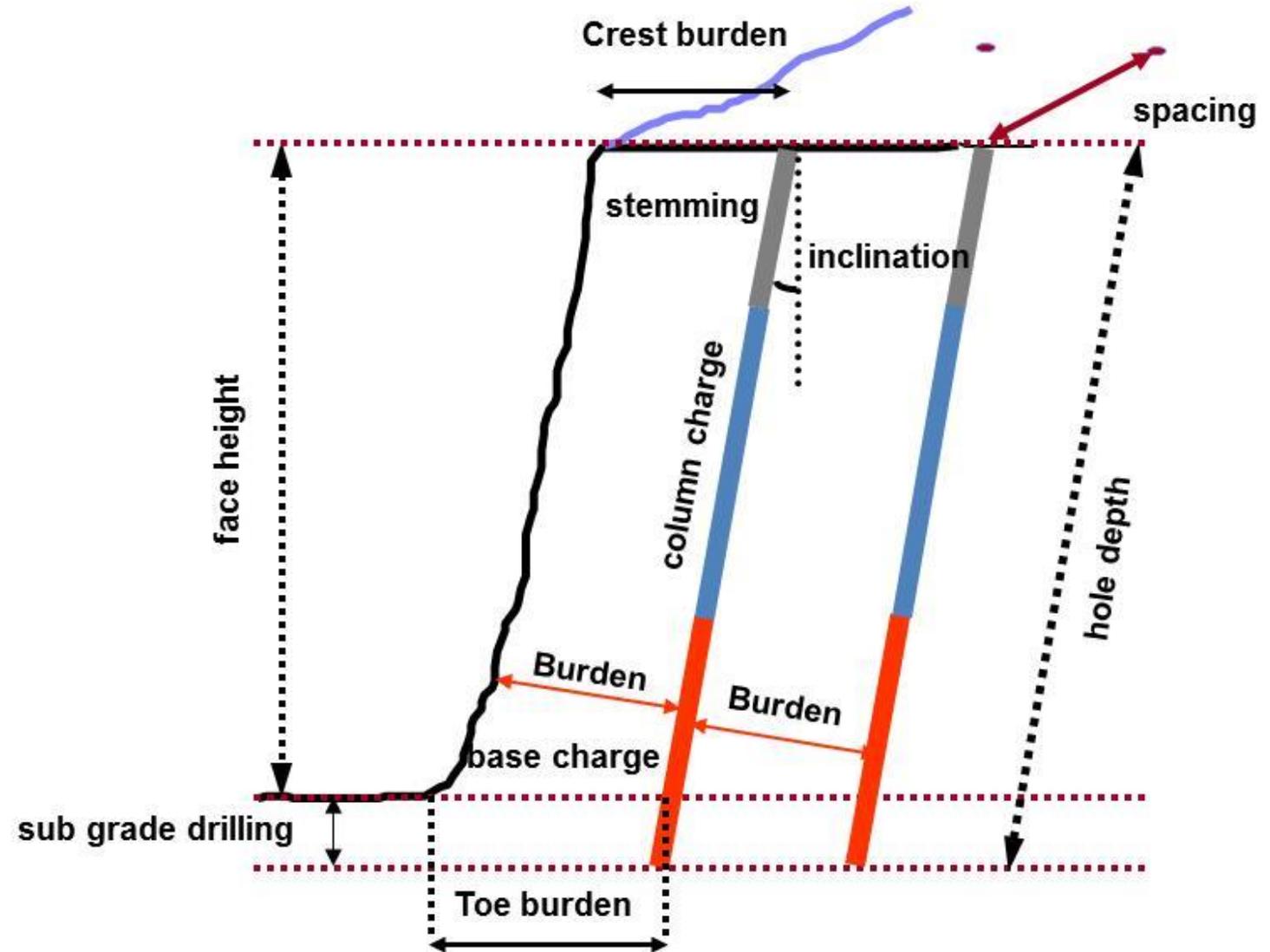


Introduction to blasting & vibration control

EPC-UK

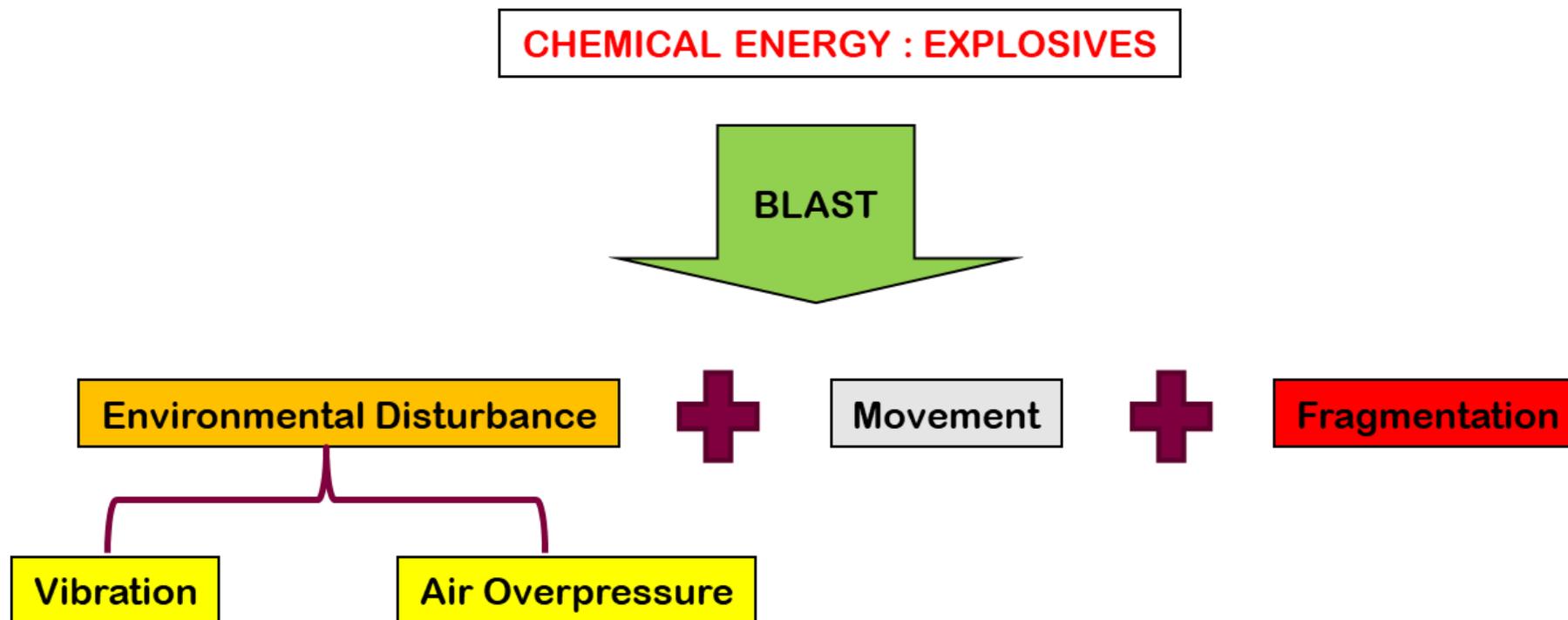
Basics of blasting

- Controlled used of explosives is the most economical primary mineral extraction method
- Aim to break up the rock and place it on the ground to be safely loaded onto dump trucks

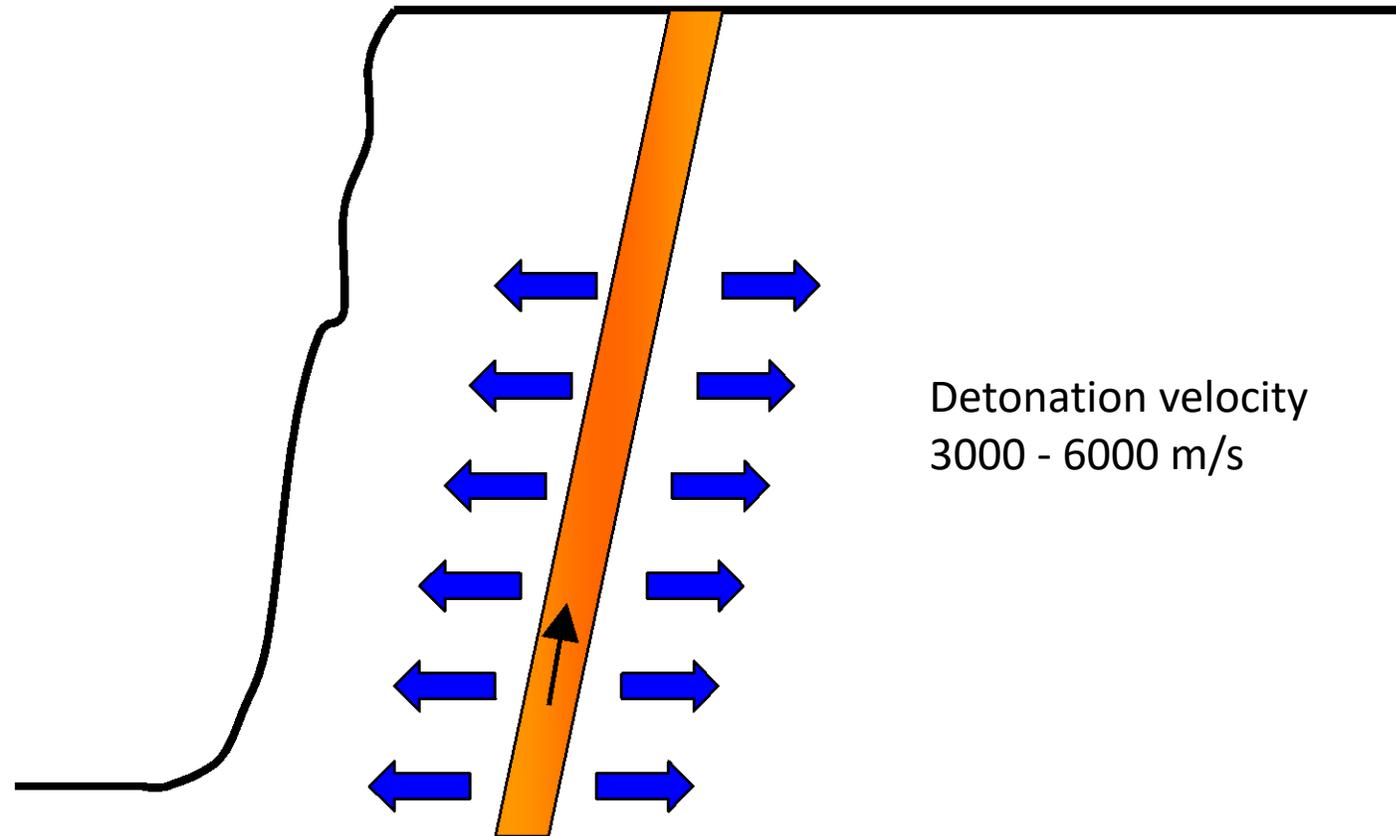


Results of blasting

→ View a blast as an energy balance

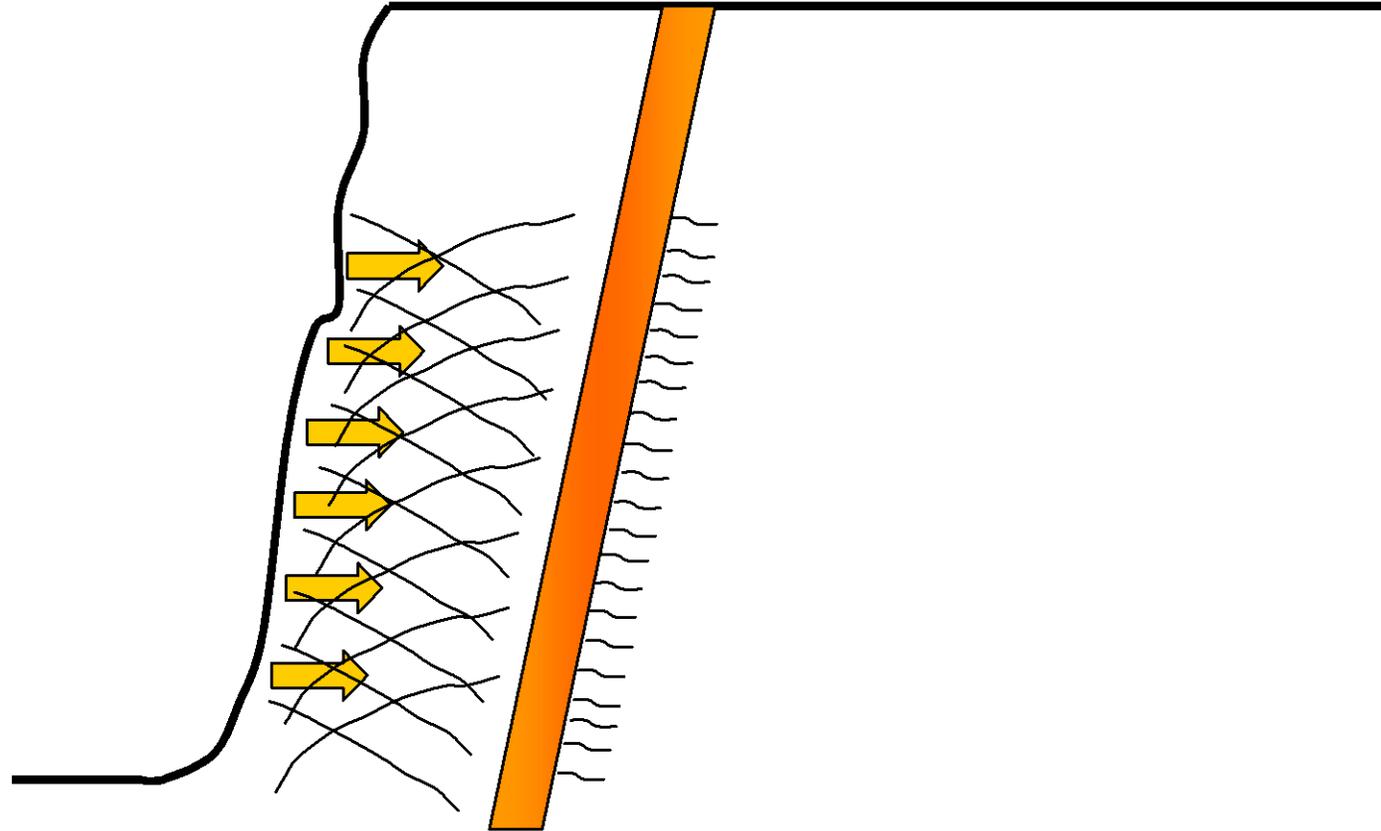


Rock Breakage Mechanism



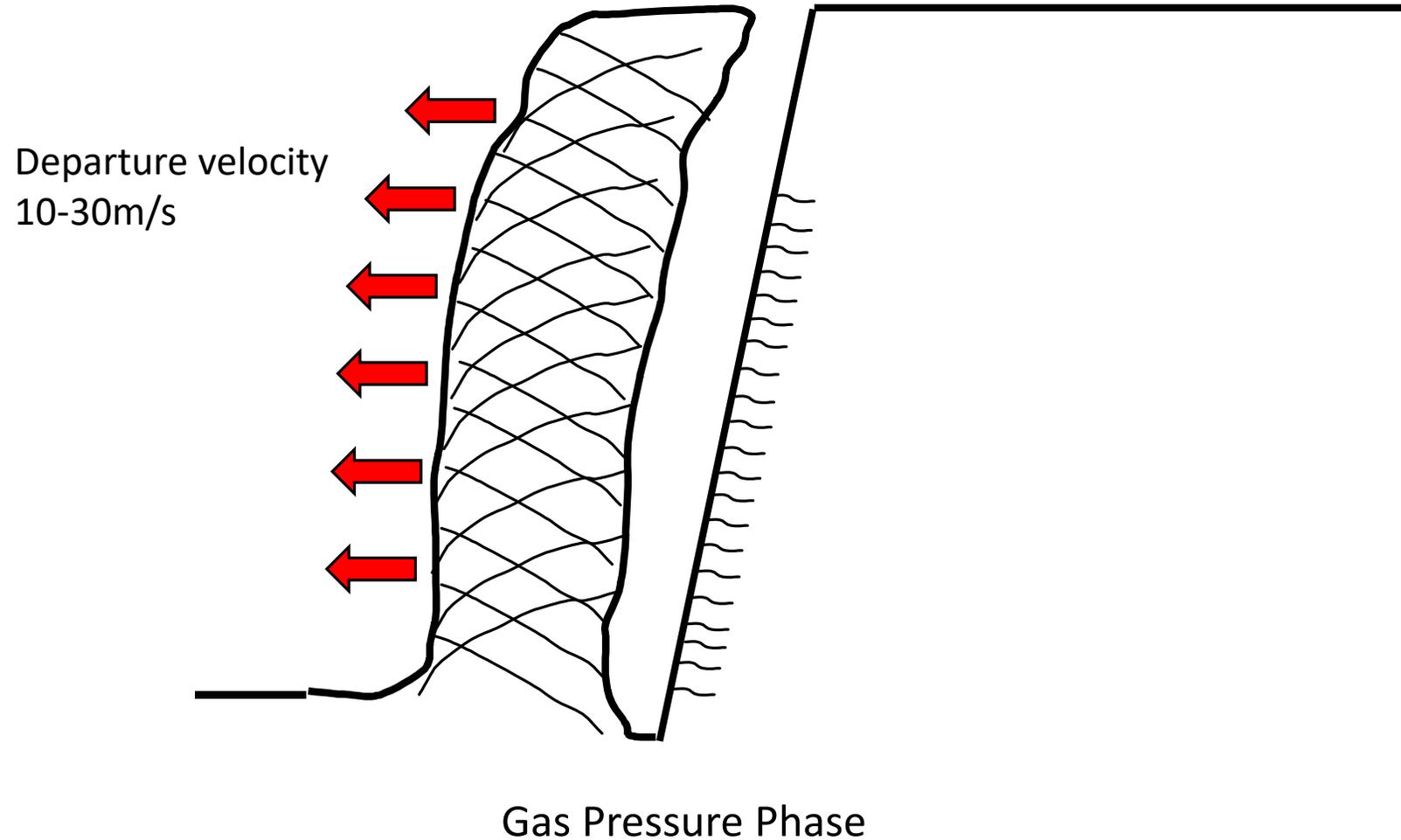
Compression waves travelling at 3000 - 6000 m/s

Rock Breakage Mechanism



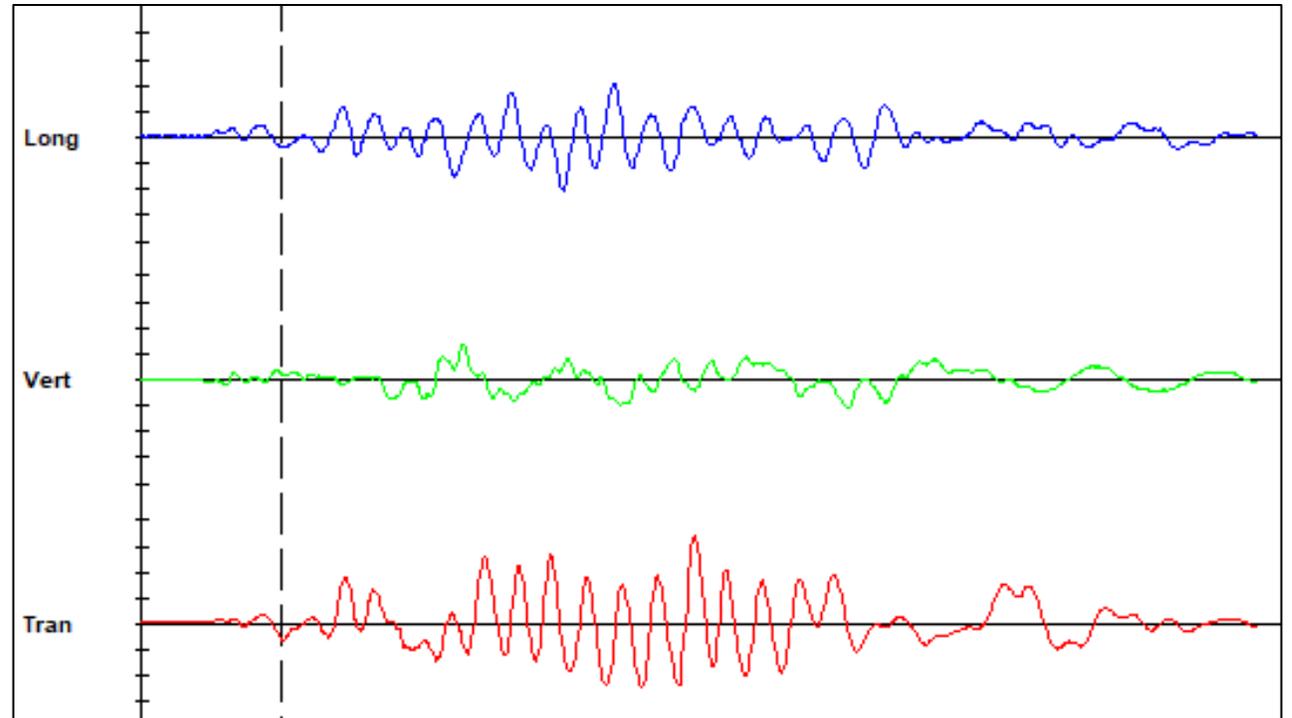
Reflection of shock waves

Rock Breakage Mechanism



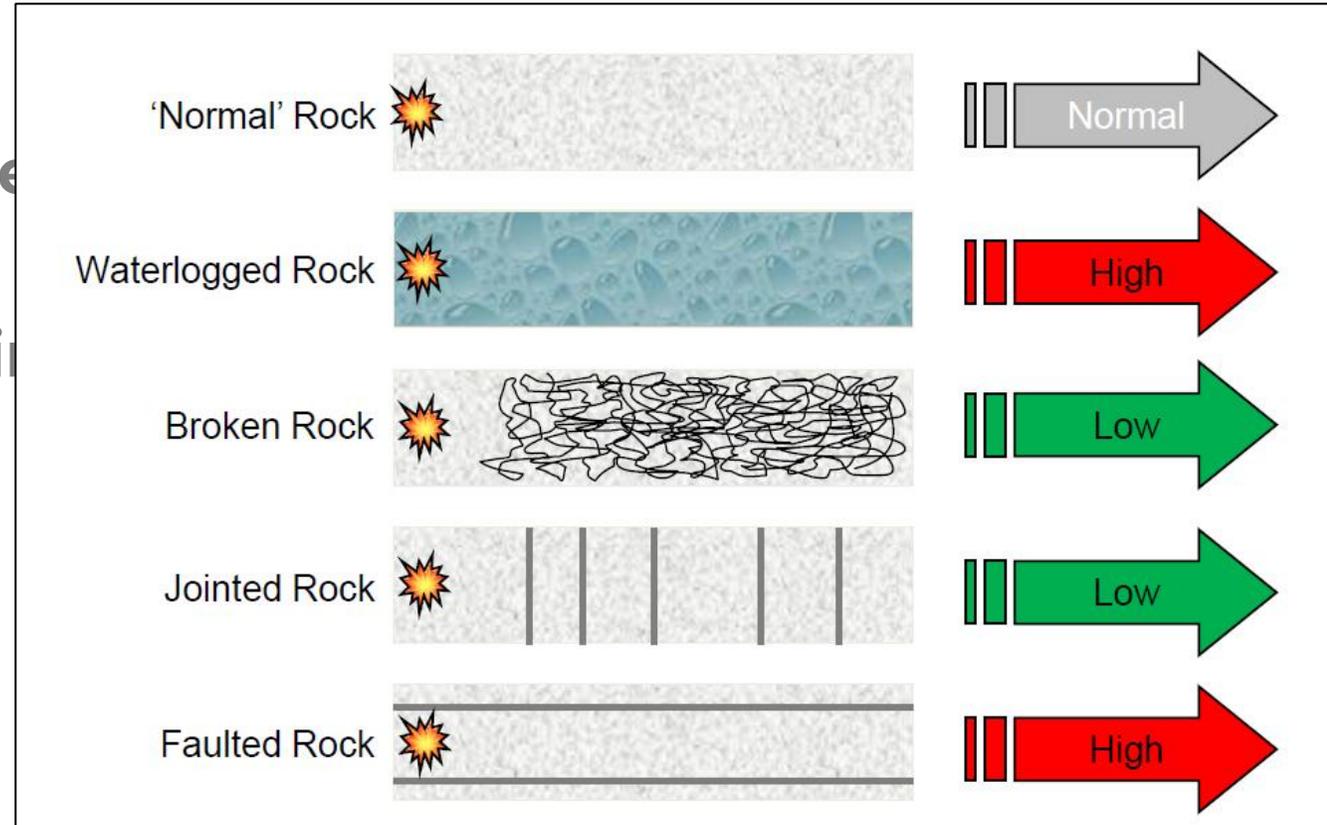
Ground Vibrations

- Vibrations recorded in 3 orthogonal directions.
- Peak value called the peak particle velocity (PPV)
- Measured in mm/s



Factors which influence vibration

- Distance
- Maximum Instantaneous Charge
- Geology
- Drill pattern (burdens and spacings)
- Delay timings



Measures to control vibration

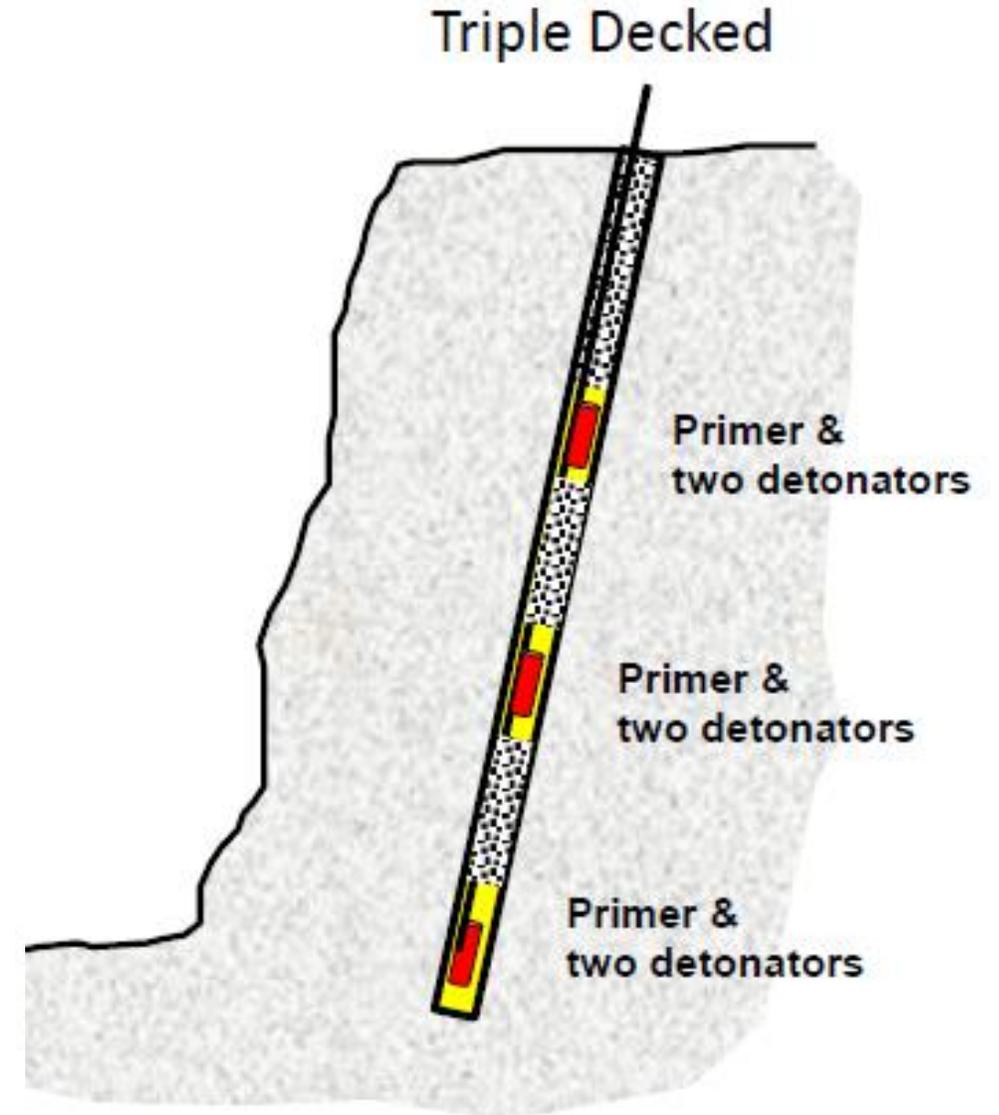
→ Reduce MIC

- Deck the holes
- Reduce bench heights

→ Delay timings

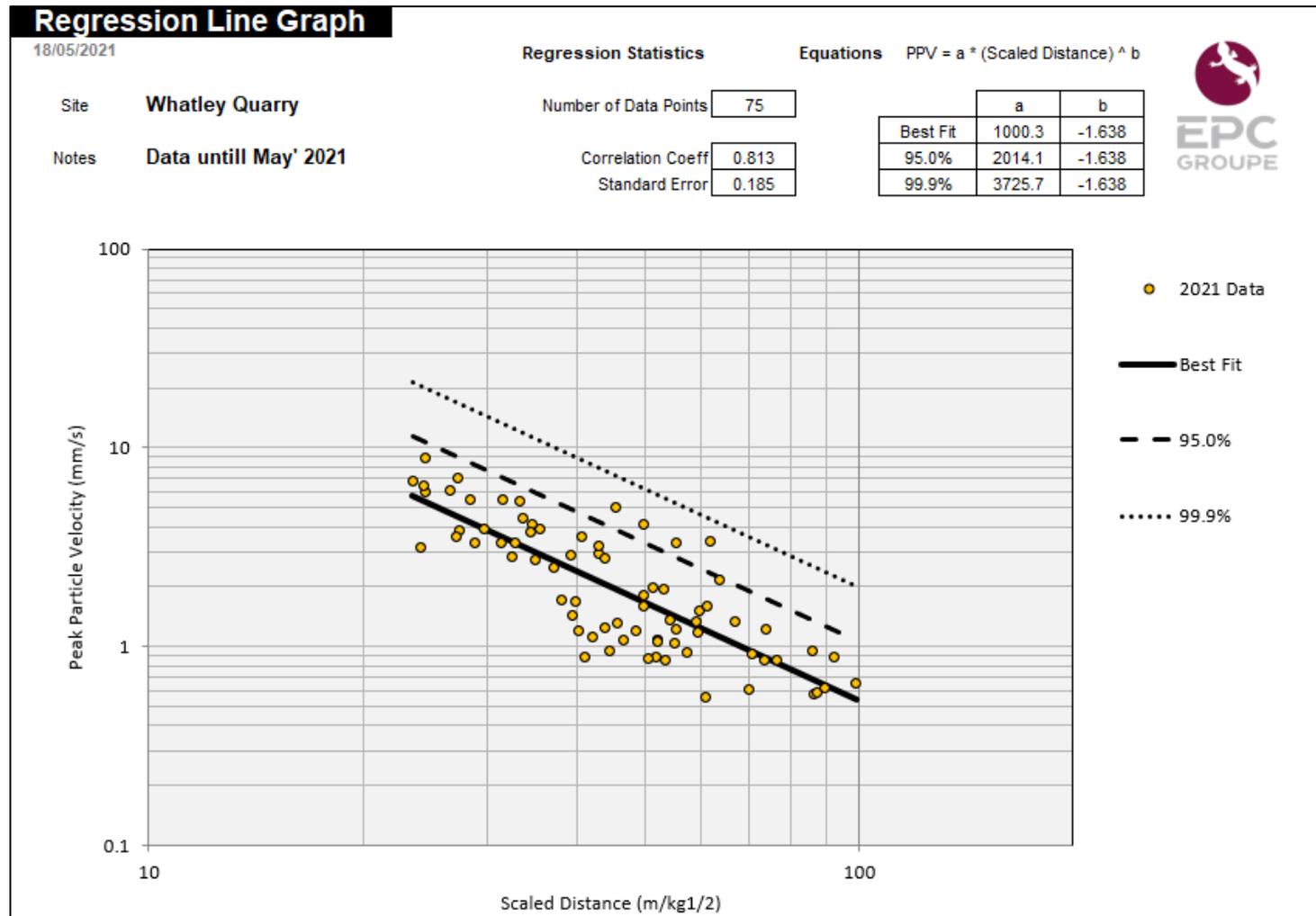
→ Introduce electronic initiation systems

→ Drill pattern



Whatley vibration

- ➔ Monitoring at 5 locations
- ➔ 2x 3rd party remote monitoring units at George Cottage and Old School House in Chantry
- ➔ 3x locations where standalone units are set up at Finger Lodge, Little Claveys & Railford Mill
- ➔ Year to date all blasts have complied with



Context?

➔ **BS7385: Part 2**

➔ **Heat, moisture, settlement, occupational loads, prestressing forces, material creep and chemical changes call cause movements in buildings**

➔ **Cracks normally exist to varying degrees within buildings**

- Natural ageing
- Buildings expand due to temperature fluctuations

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15Hz	15Hz above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings.	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above

The standard states that minor damage is possible at vibration magnitudes which are greater than twice those given in the table

Techniques used

- Electronic detonators
- Drone technology to provide accurate burden measurements and hole placement
- Monitoring 3 locations every blast
- Fixed remote monitoring at 3 locations
- Management of vibration data by engineers
- Model updated and accurate predictions made

Further actions?

- Single hole analysis?
- Deck southern blasts?
- Additional permanent monitoring stations?