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ESCUELA TÉCNICA SUPERIOR DE INGENIEROS DE MINAS Y ENERGÍA

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BLASTING SOLUTIONS

FRAGMENTATION ANALYSIS

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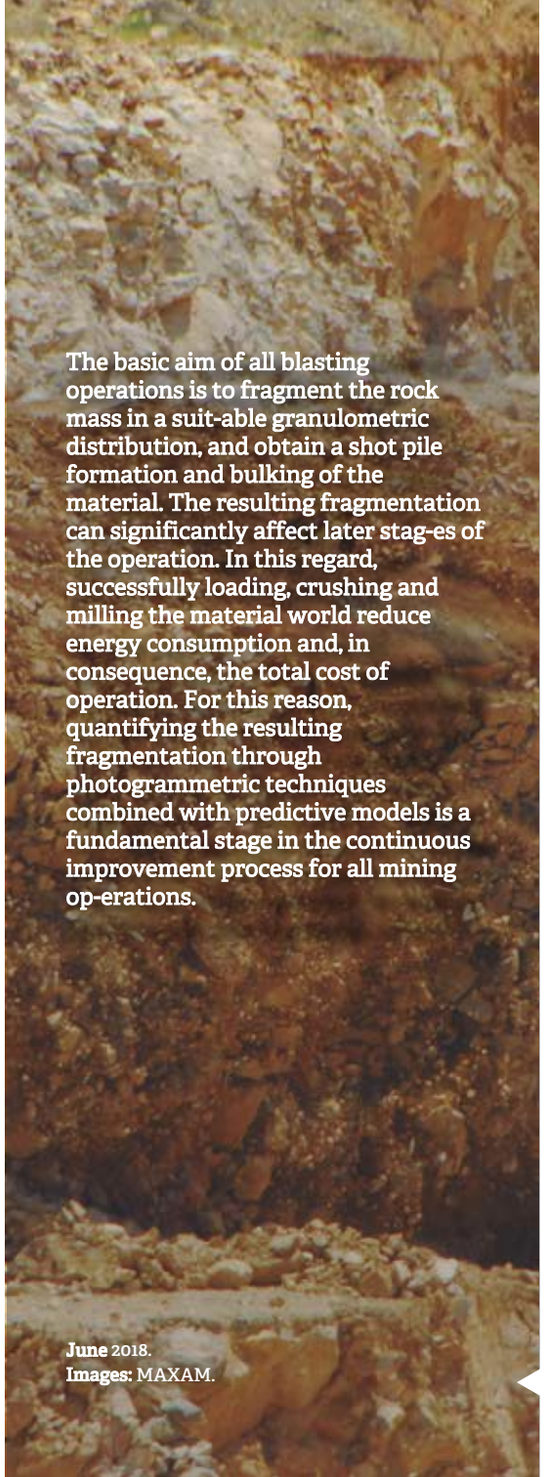


The basic aim of all blasting operations is to fragment the rock mass in a suit-able granulometric distribution, and obtain a shot pile formation and bulking of the material. The resulting fragmentation can significantly affect later stag-es of the operation. In this regard, successfully loading, crushing and milling the material world reduce energy consumption and, in consequence, the total cost of operation. For this reason, quantifying the resulting fragmentation through photogrammetric techniques combined with predictive models is a fundamental stage in the continuous improvement process for all mining op-erations.

June 2018.
Images: MAXAM.

EXPLOSIVE-ROCK INTERACTION

The energy released when detonating the explosive charge generates a powerful shockwave that is transmitted to the surrounding rock mass, and is continued by a violent gaseous expansion. Although some of the energy released in the detonation is lost in ineffective work, most of it is concentrated in two distinct phases: (i) dynamic, dominated by the action of the shockwaves; and (ii) semistatic, dominated by the action of the gaseous expansion in the rock mass.

The high pressures generated by the detonation of the explosive column are transmitted to the rock through shockwaves during the dynamic phase. These propagate radially through the rock mass by means of concentric compression pulses that attenuate as they move away from the load centre. The dynamic state the rock was subjected to recovers it's almost static state once the shockwaves have passed. The static properties of the rock mass begin to manifest themselves more effectively due to the appearance of a semistatic field of voltages corresponding to the pressure of the gases in the walls of the blast hole.

This is how the combination of both phases brings about a very specific granulometric distribution, bulking and shot pile format.

FRAGMENTATION ANALYSIS

Assessment of blasting fragmentation is something that has recently become very effective. The volume of the samples to be screened, according to industrial sampling rules, would imply that this assessment would be physically unfeasible due to the financial, human and time costs involved.

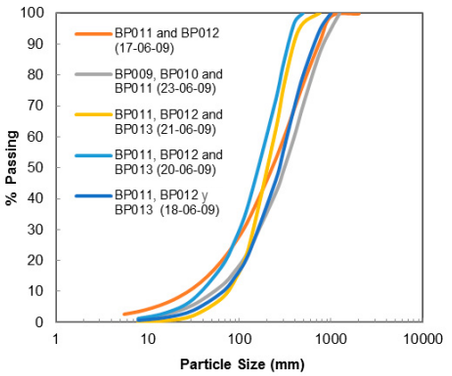
Blasting in an Australian quarry

Fragmentation analysis by photometry

However, new photogrammetric techniques are widespread both in mining and in the ore processing industry, allowing the aforementioned obstacles to be overcome and offering almost immediate results in a convenient, economical manner.

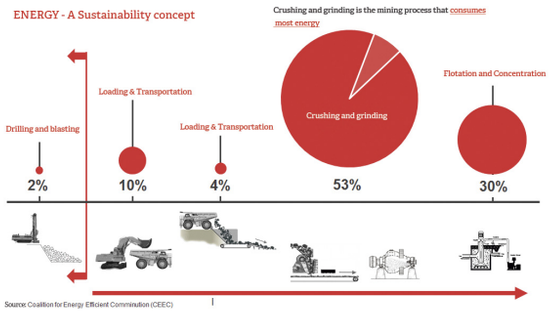
Photometric analysis software can be used to work with images collected using conventional fixed and mobile video cameras, photo cameras or digital files, as well as orthophotos obtained with drones. These use automatic algorithms that identify individual blocks by defining contours. Whenever necessary, the images can be manually reedited in order to improve the digitization of each of the blocks.

The flexibility of the series allows several types of readings in accordance with the requirements of each operation, including the accumulated distribution charts, histograms



Fragmentation curves.

and continuous flows, in order to set out any product quality variations quickly in different time periods.



Estimation of average energy impact in each unit operation.

The need for continuous improvement in all mining operations makes it necessary to apply measuring models that can, in the design phase, predict the impact of fragmentation on the subsequent phases of the production cycle. It is therefore possible to, after comparing the predictions to the actual results, establish the optimal energy configuration in each blast.

Be sure to contact MAXAM if you would like to add value to your mining pro-ject by applying fragmentation optimization services.