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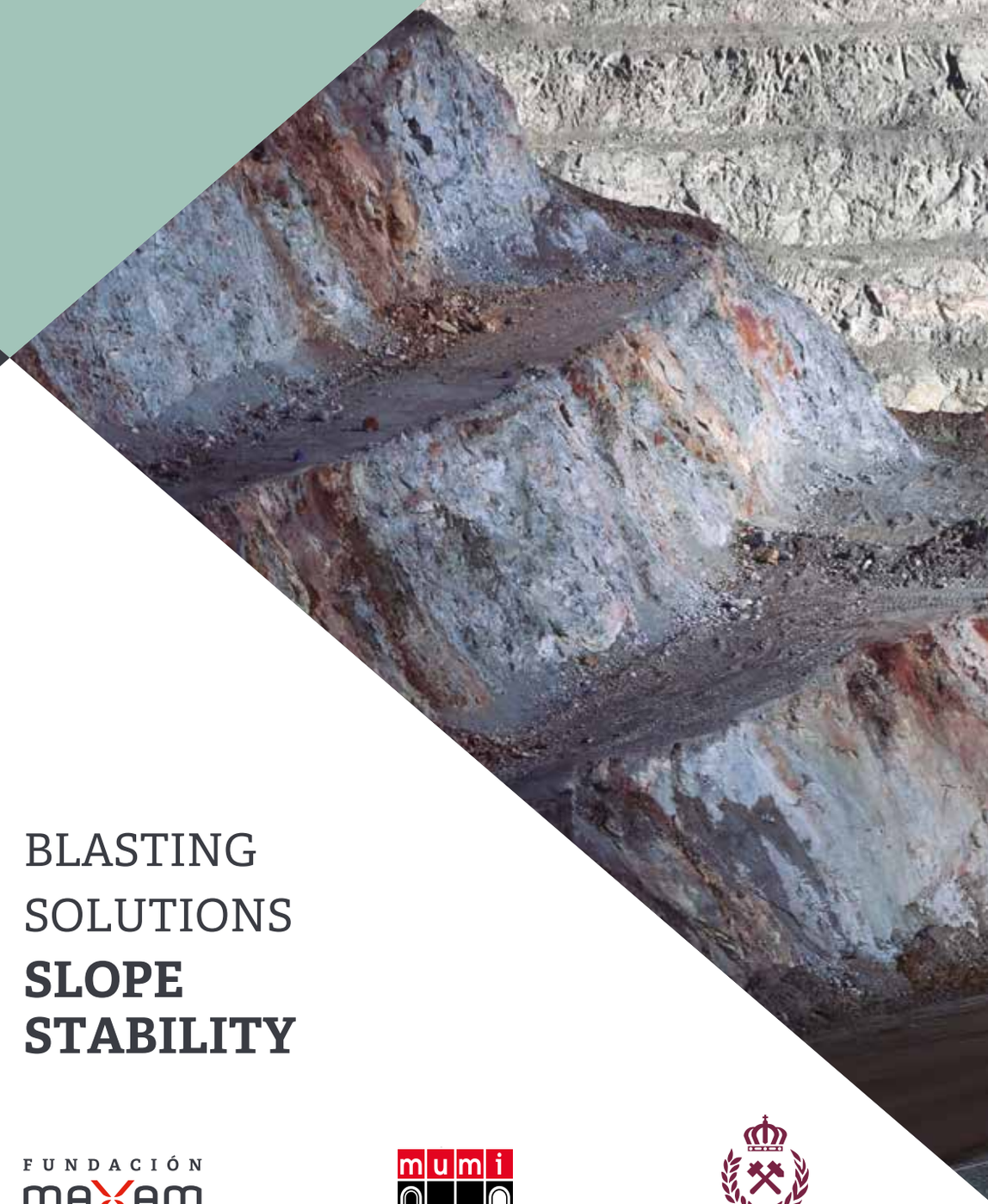

BLASTING SOLUTIONS **SLOPE STABILITY**

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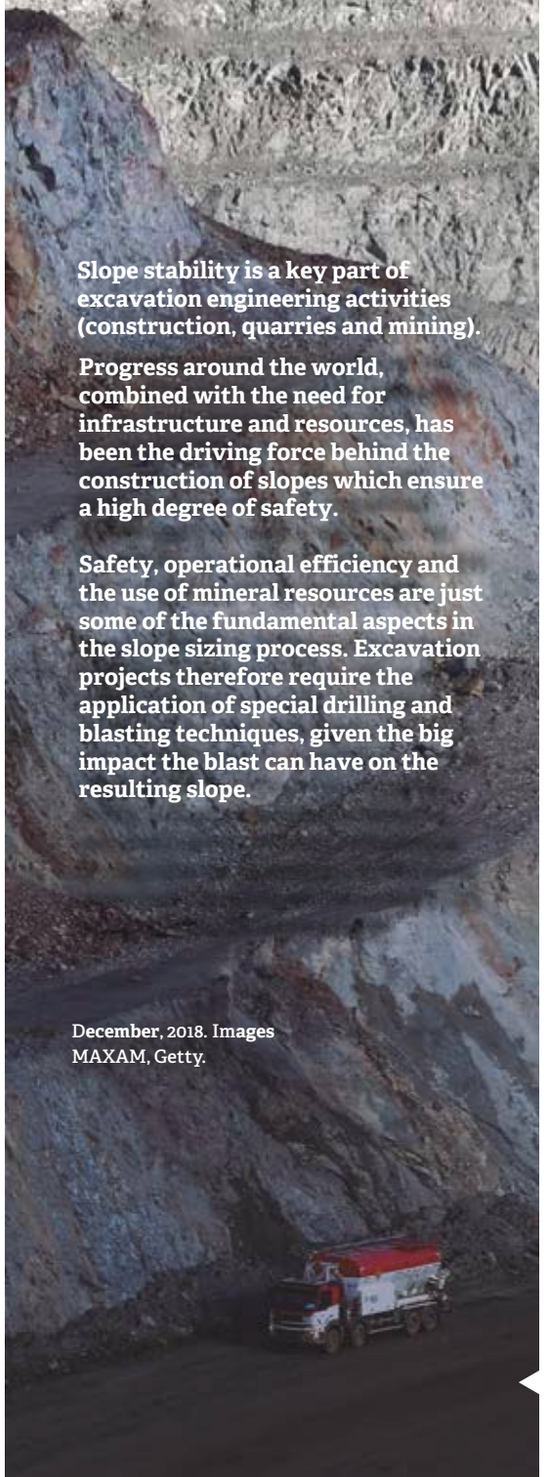


Slope stability is a key part of excavation engineering activities (construction, quarries and mining).

Progress around the world, combined with the need for infrastructure and resources, has been the driving force behind the construction of slopes which ensure a high degree of safety.

Safety, operational efficiency and the use of mineral resources are just some of the fundamental aspects in the slope sizing process. Excavation projects therefore require the application of special drilling and blasting techniques, given the big impact the blast can have on the resulting slope.

December, 2018. Images MAXAM, Getty.

BLASTING AND SLOPE STABILITY

There are two types of slopes: those that require lasting stability, and those in which stability is temporary. This is what determines the excavation method and the stability systems to be applied.

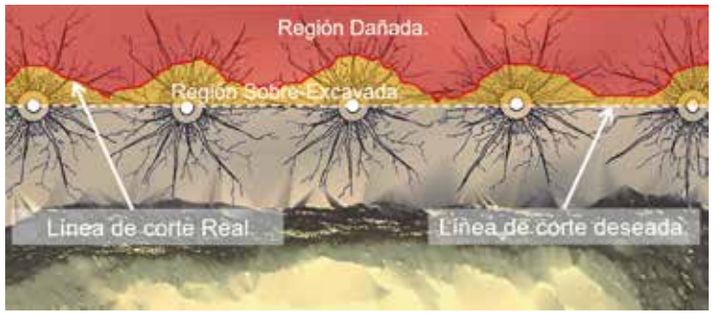
In general, slope stability depends on a confluence of circumstances, most notably:

- The geology of the site.
- The mechanical/elastic properties of the material.
- The stresses it may be subjected to.
- The presence of underground water.
- Slope design and purpose.
- Excavation methods used (mechanical means or blasts).

With regards to methods for excavation by blasting, another two phenomena must be taken into account, in addition to the design of the excavation. Firstly, damage to the near field caused by over-excavation or fracturing of the rock due to the blast. It should also be remembered that slopes located far from the blast which are not in direct contact with the excavated area may suffer stresses as a result of the vibrations generated, possibly leading to destabilisation of the forces acting in the system.

In the case of damage in the near field, the same mechanisms which caused the fragmentation of the rock can often generate over-excavation and damage to the resulting slope. Although the process is quite complex, it involves aspects such as the effect of shock waves and the expansion of detonation gases inside fractures.

Secondly, another important aspect is the induction of stresses due to the vibrations generated by the blasts. In the far field, the seismic waves generated by detonating explosive charges confined in rocks propagate radially from the centre of the charge. Whenever the intensity of these waves is not strong enough to break the material, it instead causes it to deform elastically, thus altering the stresses in the slope. Depending on the amplitude of the vibration, these stresses can lead to instability of forces, possibly causing the slope to collapse.



Idealisation of over-excavation and damaged region after blasting.

DESIGNING THE BLAST

Controlled and contour blasting are normally used when the aim is to ensure the slope integrity. This determines the different design levels to be applied, such as cross-cutting, presplitting or cushion blasting, while also striving to cause the least impact possible in the near field.

When the aim is to avoid instabilities due to induction of stresses, the blast calculation must be estimated in accordance with the intensity of the vibrations in the slope. Once the relationship between distances, loads and stresses has been established, the maximum loads permitted in the blast can be safely determined in order not to induce slope instability close to the detonation.

Be sure to contact MAXAM if you would like to add value to your excavation project through slope control services.