

DESIGNING BLASTS WITH UNCERTAINTY AND TOLERANCE

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ABSTRACT

When blasts are designed, we normally assume the best case situation. We assume that all burdens and spacings will be properly drilled, holes will be properly loaded, initiators will fire at the nominal time and the explosives will release their full energy. This type of precision can be obtained at a machine shop where precision equipment is available to do machining, however, in the field, no matter how well a blast is designed on paper, it most likely will not be done in the exact manner in the field.

The burdens and spacings are not normally drilled to the exact dimensions. The blastholes may not contain the exact amount of powder as shown on the plan, especially if they are bulk loaded. Initiators may not fire at the exact nominal time. Very often because of the tolerances in the system, the design which will work best in the field would not be one that would seem to produce the proper results on paper.

Another major factor which controls blasting results is the performance of the explosive. We commonly assume that all products will release full energy regardless of the application. This, however, is not true. The efficiency of many products is related to the degree of confinement in the borehole, meaning, that in soft or weaker materials, the explosive will not release the same amount of energy as it would in hard massive granite. Borehole diameter may also control the amount of energy released. Larger borehole diameters may produce a much higher rate of efficiency in the explosive than a smaller borehole diameter.

Electronic instruments are used today to determine both the delivered velocity and explosion pressure in a blasthole. The data obtained with the use of these instruments has given us a better understanding of energy efficiency and how the delivered energy can be properly used to design blasts.

This paper will discuss some case histories of designing blasts with the consideration of uncertainty and tolerance in the design.