BURDEN-ROCK STIFFNESS AND ITS EFFECT ON FRAGMENTATION
IN BENCH BLASTING

BY

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ABSTRACT

A correlation is developed between burden-rock stiffness and fragmentation for bench blasting. This reciprocal relationship is introduced as a principle of blast design. Overall stiffness determines the flexural responses of burden-rock to the quasi-static explosion pressure on the walls of a blasthole. Flexure results in displacement, and displacement is required for failure. Therefore, overall burden-rock stiffness controls displacements and the subsequent degree of fragmentation.

Theoretical development proposes that burden-rock stiffness is geometrically defined by the burden, spacing, and bench-height when using analogy to structural members. The structural model is also used to relate stiffness and the internal energy density developed during bending. In recognition of the three-dimensional character of bench blasting a solid finite element model is elastically analyzed by computer methods to confirm this relationship. Finally, an argument is expressed to show that degree of fragmentation is dependent upon the distribution of internal energy density throughout the burden-rock.

Experimental confirmation is provided through comparisons of fragmentation screen analyses from twenty reduced-scale in-situ test blasts in dolomite. Controlled variations of spacing and bench height at constant burden define six conditions of burden-rock stiffness for both delay and simultaneous initiation. Three fragmentation indices
are introduced to develop prediction equations between test blast fragmentation and burden, spacing, and bench height. The prediction equations are all identical in form -- a form that concludes that degree of fragmentation is dependent upon burden-rock stiffness. The influence of the type of initiation on fragmentation is not conclusive.