INFLUENCE OF ROCK DISINTEGRATION IN HIGH-LOADING-DENSITY UNDERGROUND EXPLOSIONS ON PEAK OVERPRESSURE

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In 1994 a 37 kg/M3 loading density detonation was initiated in the Linchburg mine tunnel system, Magdalena, N.M. The experimental results and Sharc-Code predictions under the assumption of ideal reflecting boundaries differed considerably. The question arose what caused the disagreement between a well-defined experiment and a validated and established code.

Numerical investigations by Ch. Needham on possible energy dissipating effects: turbulence, water vapor, dust, ground motion and thermal conductivity showed a synergetic effect of max. 10%. But the calculations were a factor of about two too high. The only mechanism that can cause a strong effect is a considerable disintegration of rock material in a high loading density detonation.

The calculations presented apply a granit equation of state model if a given compressive or shear stress is reached. The model also contains a porosity which allows air to mix into rock. Besides rock material can be pushed aside. The additional small volume is quite significant because the gas is under very high pressure. The heating of the rock is also taken into account. The effects due to rock disintegration are a function of loading density and also of the rock properties. Accordingly the computational results with ideal reflecting inactive boundaries differ more and more from those with activated boundaries when the loading density increases. During the reflection phase peak pressures are diminished as function of rock disintegration in comparison to those computed under the assumption of ideal reflection.

The Magdalena experiments were conducted for loading densities of 5, 15 and 37 kg/m'. The computations simulate these experiments applying the granit model in all cases. The comparisons and the influence of rock dis-integration are discussed in detail.