HIGH EXPLOSIVE DAMAGE IN ROCK AND CONCRETE

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The Defense Threat Reduction Agency (DTRA) has been conducting weapons effects tests on rock and concrete to replicate features of hard targets. Assessment of degree of damage on these materials is very important in quantifying test results and making estimates on subsequent weapon performance. Several methods are being used to assess the pre- and posttest condition of targets and to correlate measurements with reductions in material properties or with enhancement in subsequent weapon performance, such as penetration. Generally the target material is left in a condition that precludes coring and direct property measurements. The assessment methods described in this paper include direct examination, interrogation with diagnostic penetrators and drilling with recorded performance. The drilling method offers fairly economical and non-intrusive access to a large volume of material in rock targets. The drilling data are definitely indirect and may involve different rock properties than those associated with penetrability. Efforts to cross correlate the results of these methods and to correlate with measured material properties, where available, are described. These methods are yielding three dimensional data on the shape of affected target material surrounding coupled high-explosive events and some qualitative data on variations in strength reduction as a function of position and distance from the explosive. Differences in concrete and rock damage are discussed in terms of differences in strength thresholds for the onset of damage. The use of these test data for empirically based models for the prediction of damage is discussed and developed to the extent made possible by current understanding. Positioning of the high explosive with respect to surrounding target geometry and limitations imposed by current target penetrability are considered. Speculations, guided by the test results, are made on the partitioning and absorption of available energy into the permanent deformation and damaging of the target material.