BLAST SHIELDING & TERRAIN IRREGULARITIES

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ABSTRACT

There are indications that terrain slopes may significantly affect the blast overpressure magnitude and wave shape. Positive or negative slopes may result in increases or decreases in peak over-pressures by a factor of as much as two. The former is attributed to the reflection of the blast wave from the positive slope, whereas the latter is attributable to the diffraction of the blast wave as it moves over the crest of the embankment and down the rear slope.

The qualitative changes in the blast wave shape for a positive slope are the formation of a spike on the front of the pulse at the base of the slope, and the gradual widening of this spike as the blast wave progresses up the slope. The peak pressure ratio (the ratio of the peak pressures on the slope to those which would exist in the absence of the slope) increases as the positive slope angle increases.

On a negative slope, the qualitative changes in blast wave shape are a rounding of the front of the wave at the beginning of the negative slope with a return to the normal shape as the blast wave moves down the slope. The peak pressure ratio in this instance is reduced as the negative slope angle increases. These changes in the blast wave apply to the gross terrain features only, and not to localized terrain features. There is no known procedure for relating local terrain accidents to gross terrain features.

Severe local irregularities or terrain accidents may result in significant shielding from the blast effects. However the effects of isolated terrain features on the blast wave are anticipated to be limited to the immediate vicinity of the terrain feature itself. The total energy of the blast wave is such that recovery from localized perturbations is quite rapid. The precursor effects on the blast wave, when coupled with the effects of terrain features, are unknown, but are believed to be significant.

Three-dimensional, finite element modeling with fluid-structure interaction will be used to investigate terrain effects on the blast wave propagation. This article will focus on terrains with various slopes and localized irregularities. The results of such analytical simulations might be used to explore whether terrain features can be considered as an effective strategy to mitigate blast effects on high value assets.