Soil Properties Influence on Land-Mine Blast Effects

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ABSTRACT:

Land mines and other buried explosives cause significant damage to people, equipment, and vehicles every year. While the effects of explosives in rock have been well documented by the mining industry, the effects of explosives buried in soil are less well documented. A buried land mine has the intended consequence of impulse loading the object directly above the blast area. The soil surrounding the buried explosive has the effect of confining the charge as well as focusing the blast energy upward. Depth of burial for a typical land mine is typically less than 18 inches and the charged shape is flat and typically circular. Additionally, most land mines use high explosives and may use have some booster component, depending on the manufacturer. Understanding the mechanism of soil-blast interaction can lead to predictive models that would aid designers of armored undercarriages and improve vehicle and crew survivability.

In the paper, the results of a preliminary study on land mine blast measurements and observations will be presented. Variables such as land mine burial depth, soil types, soil water content are investigated along with their effects on blast impulse loading at various standoff distances (the height of a measuring location above the ground surface). Initial impulse measurements presented in this paper show that standoff distance is a more important factor than the depth of burial of the charge.

Soil must also be evaluated for its ability to transmit blast loads. Initial tests performed in this study indicate that soils with high percentages of clay transmit higher impulse loads to the standoff plate. The effects of moisture content and compaction (void ratio) are also investigated. The influence of soil strength parameters, cohesion and friction angle, under dynamic loading conditions are still under investigation.

KEY WORDS: land mine, buried explosives, soil properties

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