

BLAST DAMAGE INVESTIGATIONS OF FOUNDATIONS CONSTRUCTED ON COLLAPSIBLE SOILS

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ABSTRACT

An important factor to consider during blast damage investigations is whether the structure was constructed on collapsible soils. Traditionally, these soils have been considered to be soils such as loess deposits, which occur along the Mississippi River in locations such as Vicksburg, MS. However, recent research into collapsible soils has indicated that a number of soils may also fall into this category. A collapsible soil is any soil that is susceptible to large decreases in bulk volume upon saturation. These deposits generally have a loose structure of bulk-shaped grains, often in the silt to fine sand range. A significant strength factor for this soil is the capillary stresses that develop between the soil particles while in an unsaturated state. The effect of the capillary stresses is to provide a tension force on the soil particles, which increases the soil's strength and stiffness, and is known as soil suction. Since most foundations are placed on soils that are unsaturated, part of the ability of the soil to support the foundation comes from soil suction. However, if the soils become saturated, the soil suction is eliminated and the strength and stiffness of the soil is reduced. This may be accompanied by a volume decrease of the soil if the loose soil structure is metastable resulting in possible foundation settlement. This is especially significant for foundations built on mine spoil or blasted sedimentary rock fills. Under some situations these materials can evolve into collapsible soils if the materials are not adequately compacted or if weathering of the rock materials produces a loose soil structure. In this paper the mechanism of collapsible soil is presented along and a case history of a building constructed on a mine spoil that sustained significant damage due to settlement of the underlying foundation soils. As can be anticipated, damage caused by collapsible soil may be blamed on blast vibrations. However, a clear cause and effect relationship can be established when collapsible soils are involved.