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Rate Effects on Shear Strength in Granular Compaction¹ MICHAEL HOMEL, ERIC HERBOLD, Lawrence Livermore Natl Lab — For shock loaded granular materials, it is difficult to experimentally distinguish between effects of compaction vs. shear strength. This presents a challenge when parameterizing continuum models for use in generalized dynamic loading. Mesoscale simulations reveal that the shear stress behind the shock front in a fully compacted granular material can be well below the shear strength of the solid phase inconsistent with many continuum models for porous strength. The strength of the solid material itself may depend on rate, temperature, pressure, damage, etc., but even without these complications, there are dynamic effects that significantly reduce the apparent shear strength of the granular material in shock loading. Dynamic relaxation occurs from local unloading of material due to impact and release at pore surfaces during compaction. Additionally, there is significant effect of shear heterogeneity, the spatial variability in the alignment of the deviatoric stress tensor immediately behind the compaction front, which produces a non-equilibrium state and subsequent relaxation in the compacted material. Implications on continuum modeling and methods for experimental validation are discussed.

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