EXPERIMENTAL STUDY OF CHARACTERISTIC LENGTH SCALES ASSOCIATED WITH LOCALIZED SHEAR IN GRANULAR MATERIAL

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Results will be described of on-going experimental research to quantify particle-scale displacement and strain mechanisms associated with the onset and evolution of localized shear in granular soils. Macroscale sand specimens were tested under plane strain conditions in an apparatus in which the zero strain conditions were enforced by glass walls, through which in-plane displacement processes could be imaged. The soil-apparatus boundary interfaces are mobile and lubricated, minimizing the impact of boundary conditions on material response and shear band formation and propagation. Digital Image Correlation (DIC) was used to track local, in-plane displacements from the digital images, enabling local displacement response measurement to grain-scale (microscale) resolution.

Previous results have revealed repeating patterns of alternating high shear/high rotation/high displacement zones along the length of a shear band, which are strongly indicative of the formation and collapse of grain columns. This talk will discuss the evolution and change of these patterns from shear band formation through steady state deformation. The relationship of these mechanisms to observations of local dilation and compression will also be discussed. The spatial frequency at which the high shear/high rotation/high displacement pattern repeats itself seems to correlate directly with grain diameter and shear band thickness. The results contribute toward further understanding characteristic length scales associated with localized shearing in granular materials.

Keywords: shear band, granular, localization