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Assessing Isotropy of Shrinkage in Soils

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Accurate measurements and full knowledge of the soil shrinkage process are very necessary for better understanding the soil behavior and hydraulic properties of soil. The anisotropic nature (heterogeneity) of soil shrinkage that produces soil cracks requires additional quantification. In this project we will introduce a simple, inexpensive, and accurate method to measure the three dimensional shrinkage of undisturbed cylindrical soil cores by digital image correlation method using two digital cameras. We will couple experimental findings and recent theoretical developments to incorporate the three dimensional anisotropic nature of soil shrinkage into the shrinkage curve (ShC) to reach better understanding of soil-water interactions. This project will also explore the effect of the initial soil sample dimensions (diameter and height of the cylindrical sample) on the ShC modeling by using different sample-dimensions for the experimental plan. The "Digital Image correlation" (DIC) will be used to identify the three dimensional shrinkage of cylindrical soil cores by two digital cameras placed in front of the sample. The LVDT (the linear variable differential transformer) will be used in conjunction with the DIC in order to compare the current ShC method to the new one. The images will be analyzed using Adobe photoshop to determine the displacement in the three dimensions from two dimensional image, then the volume can be calculated as a relationship between the height and the diameter of the soil core which will be measured. This gives us more accurate volume calculation, therefore more accurate investigation of the ShC. The DIC method and preliminary data will be presented.