Preparation of Unsaturated Soil Beds for Calibration Chamber Testing
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ABSTRACT

The cone penetrometer test (CPT) and Pre-bored Pressuremeter test (PMT) are becoming popular instruments for subsurface exploration. During in situ tests one encounters both unsaturated and saturated soil but the methods that have been developed to interpret the data are mainly focused on saturated soil. Thus, there is a need to develop a method to interpret these results from the in situ tests for the unsaturated zone. Calibration chamber testing provides an effective and efficient way to study both the cone penetrometer and pressuremeter under controlled conditions. The method used to prepare soil beds for the calibration chamber is critical to obtain reliable results. The method needs to be repeatable and capable of producing homogenous soil fabric in terms of dry unit weight, void size and distribution, and moisture content. Several methods that are currently being used for saturated and dry soil bed preparation have been considered for the current research with some alterations. The currently available methods are pluviation, compaction, and slurry consolidation. Pluviation and compaction have been explored in this study. Bench scale models (1/4 scale) using Minco Silt were used to develop unsaturated soil beds. The first method involved pluviating the soils into a mold in lifts, followed by adding predetermined volumes of water on top of each lift. The second method involved mixing the soil to a predetermined moisture content, then compacting in layers into the mold. Several methods were used to compact the soil-water mixture into the bench scale model, including: impact compaction, static compaction and tamping. In all the tests, sub-specimens were collected to check for homogeneity within the soil beds with regard to variations in moisture content and dry unit weight. Sub-specimens from three soil-beds with different water contents were collected and observed with an Environmental Scanning Electron Microscope (ESEM) as part of microscopic fabric studies on soil-beds prepared. Results showed no variation in pore size distribution for a range of water contents from 8-12%. Among all the soil bed preparation methods investigated, static compaction followed by tamping are the most feasible and promising in producing unsaturated soil beds with acceptable and repeatable homogeneity over a range of moisture contents from 8-12%.