

Centrifuge Permeameter for Unsaturated Soils. II: Measurement of the Hydraulic Characteristics of an Unsaturated Clay

John S. McCartney, A.M.ASCE¹; and Jorge G. Zornberg, M.ASCE²

Abstract: This paper presents the hydraulic characteristics of an unsaturated, compacted clay, including its soil-water retention curve (SWRC) and hydraulic conductivity function (K function), determined using a new centrifuge permeameter developed at the University of Texas at Austin. A companion paper describes the apparatus, its instrumentation layout, and data reduction procedures. Three approaches are evaluated in this study to define the SWRC and K function of the compacted clay under both drying and wetting paths, by varying the inflow rate, the g level, or both. For imposed inflow rates ranging from 20 to 0.1 mL/h and g levels ranging from 10 to 100 g, the measured matric suction ranged from 5 to 70 kPa, the average volumetric water content ranged from 23 to 33%, and the hydraulic conductivity ranged from 2×10^{-7} to 8×10^{-11} m/s. The SWRCs and K functions obtained using the three different testing approaches were very consistent, and yielded suitable information for direct determination of the hydraulic characteristics. The approaches differed in the time required to complete a testing stage and in the range of measured hydraulic conductivity values. The g level had a negligible effect on the measured hydraulic characteristics of the compacted clay. The SWRCs and K functions defined using the centrifuge permeameter are consistent with those obtained using pressure chamber and column infiltration tests. The K functions defined using the centrifuge permeameter follow the same shape as those obtained from predictive relationships, although the measured and predicted K functions differ by two orders of magnitude at the lower end of the volumetric water content range.

Full reference:

McCartney, J.S., and Zornberg, J.G. (2010). "Centrifuge Permeameter for Unsaturated Soils II: Measurement of the Hydraulic Characteristics of an Unsaturated Clay." *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, Vol. 136, No. 8, August, pp. 1064-1076.

Link to file*:

[http://dx.doi.org/10.1061/\(ASCE\)GT.1943-5606.0000320](http://dx.doi.org/10.1061/(ASCE)GT.1943-5606.0000320)

*File may be downloaded for a fee from ASCE Library