13 Laboratory Measurement of Hydraulic Conductivity of Saturated Soil

A. KLUTE
University of Illinois
Urbana, Illinois

13–1 INTRODUCTION

The rate of movement of water through soil is of considerable importance in many aspects of agricultural and urban life. The entry of water into soil, the movement of water to plant roots, the flow of water to drains and wells, and the evaporation of water from the surface of soil are but a few of the obvious situations in which the rate of movement plays an important role. An important soil property involved in the behavior of soil water flow systems is the conductivity of the soil to water. Qualitatively, the conductivity is the ability of the soil to transmit water. Measurements of conductivity of saturated soil have long been made. The data are of use in analysis of any saturated-soil water-flow system. These include drainage of soils for agricultural as well as engineering purposes. Drainage of highways, airports, and construction sites, and seepage below dams are among the latter. The data also provide indirect information about the structure and structural stability of soils.

13–2 PRINCIPLES

Water moves through a soil in response to the various forces acting upon it. Among these are the pressure-gradient, gravitational, adsorptive, and osmotic forces. In addition, thermal and electrical gradients may impose forces upon the water in soil and cause its movement under certain circumstances (Hutcheson, 1958). In this discussion we shall deal only with isothermal movement of soil water, and we shall be primarily concerned with liquid-phase movement.

One of the basic physical relationships used to describe the flow of water in soils is a flux equation, Darcy's law, relating the flux of water \( v \) to the driving force:

\[
v = -(k \rho g) \nabla \phi
\]  

[1]