COMPUTATION OF PERMEABILITY BY

FALLING-HEAD PERMEAMETER

We will test in a specimen of soil is placed in a falling-head permeameter apparatus.

Sample:

Given:

$A_{\text{cross-sectional area of specimen}} = 66cm^2$.

Height = 8cm. time = 1hr. and 18mins.

$A_{\text{cross-sectional area of standpipe}} = 0.48cm^2$

$H_1 = 62$ cm. $H_2 = 40$ cm.

Determine the coefficient of permeability of the soil, in cms. per minute.

Calculation Procedure:

Step 1. By using literal values, equate the instantaneous discharge in the specimen to that in the standpipe The velocity at which water flows through a soil is a function of the coefficient of permeability, or hydraulic conductivity, of the soil.

By Darcy's law of laminar flow: $V = K\ i$

Where:

i = hydraulic gradient

K = coefficient of permeability

V = velocity.

In a falling-head permeameter, water is allowed to flow vertically from a standpipe through a soil specimen. Since the water is not replenished, the water level in the standpipe drops as flow continues, and the velocity is therefore variable.

Let:

A = cross-sectional area of soil specimen

a = cross-sectional area of standpipe

L = height of soil specimen

h = head on specimen at given instant.

Q = discharge

H1 and **H2** = head at beginning and end.

t = time interval

Using literal values: Q = A k i

Step 2. Evaluate k Since the head h is dissipated in flow through the soil.

$$i = \frac{h}{L}.$$

By substituting and rearranging:

$$Q = K \frac{h}{L} A$$

$$= -a \frac{dh}{dt}$$

By integrating this equation at left side with limits from 0 to t and the right side with limits of head difference from h_1 to h_2:

$$dt = \frac{aL}{Ak}\left(-\frac{dh}{h}\right)$$

where:

In = denotes the natural logarithm.

Then: $$k = \frac{aL}{At} ln\left(\frac{h1}{h2}\right)$$

Substituting gives: $$k = \frac{0.48\text{cm}^2 \text{x } 8cm.}{66\text{cm}^2\ 78mins.} ln\left(\frac{62cm.}{40cm.}\right)$$

= 0.000326 cm/in.