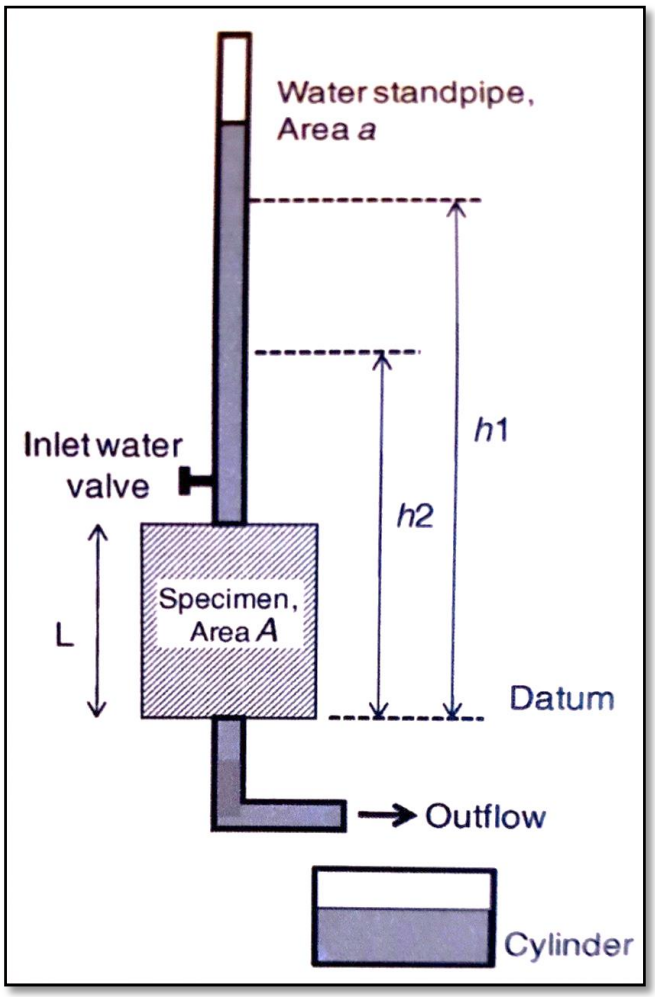
Falling Head Test

Purpose:

The falling head permeability test (variable head test) is a common laboratory testing method performed to determine the permeability of fine grained soils with medium and low permeability such as silts and clays. In this test a relatively short sample is connected to a standpipe which provides both the head of water and measurement of water quantity flowing through the sample.

Apparatus:

1. Permeameter cell or Mold.
2. Standpipe (manometer) panel.
3. Timer.
4. Graduated cylinder.
5. Thermometer.



Specimen preparation:

This testing method can be applied to an undisturbed sample, compacted sample or prepared sample in the laboratory by placing it inside the permeameter cell.

Before placing the soil sample in the permeameter, measure the inside diameter (D) and height (L) of the permeameter cell. Place porous stone or filter paper in the bottom of the cell, then put the soil sample. Add a filter paper on the top of the soil sample and assembly the top part of the permeameter device.

Saturate the soil sample by flowing water through it. It is important that the sample be fully saturated; otherwise, the falling head test will give erroneous results. Then apply a vacuum or remove any entrapped air within the sample.

Test procedure:

1. Determine the standpipe area (a). Note that the diameter of the standpipe depends on the permeability of the tested soil.

2. Locate hl and h2 on the standpipe. Then fill it with distilled water.

3. Allow water to flow down through the sample and observe the water level in the standpipe. As soon as it reaches the level h1,start the timer clock.

4. When the level of water in the standpipe reaches h2, stop the clock and record the time required for the water in the standpipe to drop from h1 to h2.

5. Refill the standpipe and repeat the test two to three times. Use the same h1and h2 values and obtain the corresponding elapsed times. Record the temperature of water (T) for each run.

Calculation:

Calculate coefficient of permeability, k. as follows:

$$k_T = \frac{2.303 a L}{A t} \log_{10} \frac{h1}{h2}$$

$$k_{20} = k_T \frac{\eta_T}{\eta_{20}}$$

Where:

k = coefficient of permeability (hydraulic conductivity) (m/s).

a = the inside area of the standpipe ($a = \frac{\pi}{4} d^2$), d= inside diameter of standpipe).

L = Length of the sample.

A =the inside area of specimen ($A = \frac{\pi}{4} D^2$), D= inside diameter of permeameter).

t = elapsed time of test (s).

h1 = the elevation of water in the standpipe at time t=0.

h2 = the elevation I water in the standpipe at time equal to t.

Usually the average coefficient of permeability of the test sample is expressed in two significant figures, with the form $k_T = 2.3 \times 10^{-4}$ m / s.

Falling Head Test (Data Sheet)

Date tested:

Specimen diameter, D = 10.2 cm.

Specimen height, L = 11.6 cm.

Specimen area, A =81.1 $(cm)^3$.

Water Temp., T = 21 ^oC.

Standpipe area, a = Vol./h = Q/(h1-h2).

Test No.	h1 (cm)	h2 (cm)	Test time (s)	Q out $(cm)^3$	k_T (cm/s)	k_{20} (cm/s)
1	51.1	24.3	54.1	45.8		
2	51.1	24.3	54.2			
3	51.1	24.3	54.3			
average						

Calculate the coefficient of permeability, k_{20} =---------- cm/s.