Short test (Geoenv_eng: 2018.6.12)

Two uniform saturated soils with different heights and cross sectional areas are accommodated in a cylinder at which bottom a flexible hose with large diameter is connected. At first, the elevation of outlet of the hose (B) is the same as the top end of the cylinder (C) and all portion in the cylinder and hose are filled with water as shown in Fig.1(a). Known conditions of the soils (for Soil I: height, cross sectional area (A_I), specific gravity (Gs_I) and saturated density (ρ_{satI}); for Soil II: height, cross sectional area(A_{II}), hydraulic conductivity (K_{II}) and specific gravity (Gs_{II}) and void ratio (e_{II})) are given in the figure. Assuming that the volume change of soils due to the change of hydraulic conditions is negligible and the earth gravity g=10m/s^2, answer the following question.

(1) Explain the definition of void ratio (e), saturated density (ρ_{sat}) porosity (n) and hydraulic conductivity (K). *You may define the necessary parameters.*

(2) Obtain the porosity of Soil I (n_I) and effective unit weight of Soil II (γ'_{II}) .

(3) Obtain the vertical total and effective stresses at bottom of Soil I (D) and II (E). *Assume that the inner wall of the hollow cylinder is smooth and the stress varies one dimensionally in the vertical direction in each soil.*

By lowering the outlet of the hose to the elevation of 0m, steady state seepage test is conducted as shown in Fig.1(b) and the discharge rate of Q=0.2m^3/hr is observed.

(4) Obtain Darcy's velocities in Soils I and II (v_I and v_{II}) and the hydraulic conductivity of Soil I (K_I). *Assume one dimensional vertical flow in the two soils.*

(5) Draw the variation of pore pressure and vertical effective stress in the soils in the steady state flow condition.

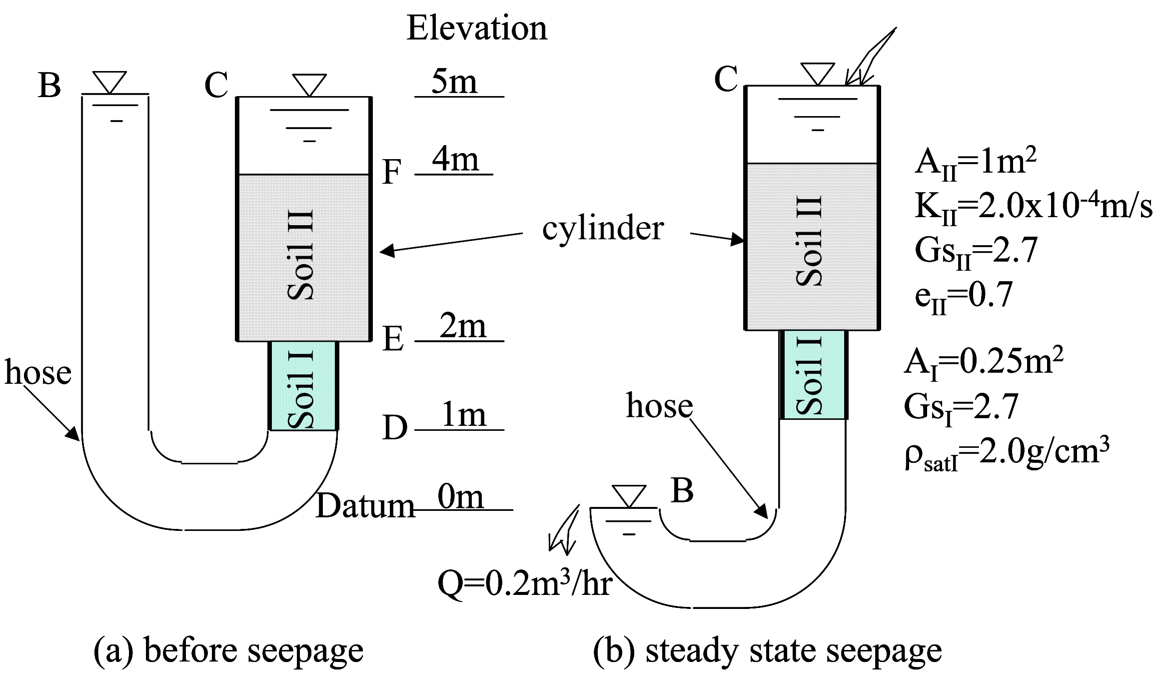

Fig.1