5.9 DEGREE OR RATE OF SETTLEMENT

It is the ratio of consolidation at time (t) to that of 100% consolidation when the pore water pressure was diminishes. It is calculated as follows:

(1) First, from Oedometer tests, the coefficient of consolidation (C_v) is calculated as:

$$C_v = \frac{k}{m_v . \gamma_w} \quad \text{.....(5.13)}$$

where, m_v = volume.change.coefficient $= \frac{a_v}{1+e_o}$, $a_v = \frac{\Delta e}{\Delta p} =$ compressibility coefficient and k = permeability of soil.

(2) Second, the time factor (T_v) is calculated from:

$$T_v = \frac{C_v . t}{(H_d)^2} \quad \text{.....(5.14)}$$

where, H_d (drainage path) = H *(for one-way drainage)* and
= H/2 *(for two-way drainage).*

(3) Third, with (T_v) value obtained from Eq. (5.14), the degree of consolidation $U\%$ at any time (t) is calculated from **Fig.(5.8)** depending on the distribution of the excess pore water pressure; or one of the following equations:

$$T_v = \frac{\pi}{4}\left(\frac{U\%}{100}\right)^2 \quad \text{for } U \le 60\% \quad \text{.....(5.15a)}$$

$$T_v = 1.781 - 0.933.\log_{10}(100 - U\%) \quad \text{for } U > 60\% \quad \text{.....(5.15b)}$$

(4) From the degree of consolidation $U\%$ at any time (t), the settlement at any time is calculated from the following relation if the total settlement is known:

$$U_t = \frac{S_t}{S_\infty} = \frac{\text{Settlement.at.any.time(t)}}{\text{Total.settlement}} \quad \text{.....(5.16)}$$

where, $S_\infty = S_T = S_i + S_c + S_{sc}$.

Q3: A) For the square footing (2 x 2) m shown in Fig. (4):

1. Calculate the immediate settlement of the footing.
2. Calculate the consolidation settlement of the footing.
3. Estimate the time required for consolidation settlement of the footing to reach (1) cm if the final consolidation settlement was (2) cm.

Note: Use 2:1 method for stress distribution (15 marks)

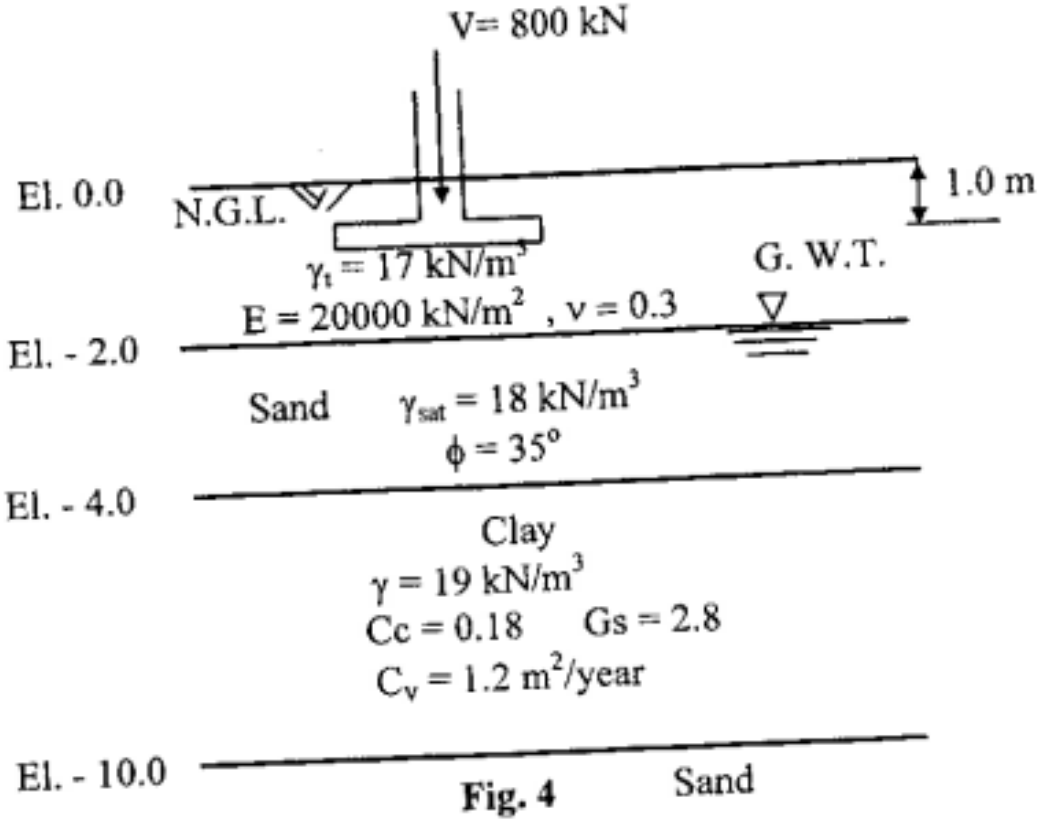

Fig. 4