Advance Foundation Design:

Unit - 2 (Contd from last lecture)

[Schmmertman & De-Beer Mtd.]

* Immediate Settlement of Cohesionless soil:

As cohesionless soils do not follow Hooke's law, immediate settlements are computed using semi-empirical approach proposed by Schmertmann and Hartman in 1978;

$$S_i = C_1 C_2 (\bar{q} - q) \sum_{z=0}^{2B} \frac{I_z}{E_s} \Delta z \rightarrow \text{Eqn } ①$$

where C_1 = Correction factor for the depth of foundation embedment

$$C_1 = 1 - 0.5 \{ q / (\bar{q} - q) \}$$

C_2 = Correction factor for creep in soils

$$C_2 = 1 + 0.2 \log_{10} (\text{time in years} / 0.1)$$

$\bar{q}$ = pressure at the level of the foundation

q = surcharge = γD_f

E_s = Modulus of Elasticity

I_z = Strain influence factor

The value of the strain-influence factor I_z varies linearly for a square or circular foundation.

The value of I_z at depth $z = 0$, $z = 0.5B$ & $z = 2B$ are respectively equal to 0.1, 0.5 & 0.0.

For rectangular foundation, with L/B ratio equal to or greater than 10.0, the value at depth $z = 0.0$, $z = B$ & $z = 4B$ are respectively 0.2, 0.5 & 0.0.

For immediate value of L/B ratio, i.e between 1 to 10, interpolation can be made.

The value of E_s can be determined from the standard penetration Number (N) using the following equations given by Schmertmann.

$$E_s = 766\ N \text{ (in } kN/m^2\text{)}$$

where N = No. of SPT No.

Procedure:

① → For computation of the immediate settlement, the soil layer is divided into several layers of thickness Δz, upto a depth of $z = 2B$ ⇒ for square footings & $z = 4B$ ⇒ for rectangular footing.

→ The immediate settlement of each layer is computed by eqn ① as given by Schmertmann; taking corresponding values of E_s & I_z.

→ The required immediate settlement is equal to the sum of settlements of all individual small layers

Note: Settlement of foundations on cohesionless soils take place rather quickly after the application of the load. The immediate settlements calculated using Schmertmann & Harman Method would be the final settlement in most cases.

De-Beer Analysis of settlement of foundation in cohesionless soil: (3)

→ Settlement of each layer of foundation is also estimated by De-Beer & Martens Analysis, 1957 for non-cohesive soil, which is estimated as:

$$S = \frac{H}{C} \log_e \frac{\bar{\sigma}_o + \Delta\sigma}{\bar{\sigma}_o}$$

where $C = \frac{1.5 q_c}{\bar{\sigma}_o}$

where q_c = static cone resistance,

$\bar{\sigma}_o$ = mean eff. overburden press.

$\Delta\sigma$ = inc. in pressure at the centre of layer due to net foundation pressure.

H = Thickness of layer.

The total settlement of the entire layer is equal to the sum of settlements of individual layers.

Note: De-Beer Analysis is carried out by the means of Static Cone penetration Method.