4.4 Differential Settlement of Mats

The American Concrete Institute Committee 436 (1966) has suggested the following method for calculation of the differential settlement of mat foundations. According to this method, the rigidity factor (K_r) can be calculated as

$$K_r = \frac{E'I_b}{E_s B^3} \tag{4.15}$$

where E' = modulus of elasticity of the material used in the structure
E_s = modulus of elasticity of the soil
B = width of foundation
I_b = moment of inertia of the structure per unit length at right angles to B

The term $E'I_b$ can be expressed as

$$E'I_b = E'\left(I_F + \sum I_{b'} + \sum \frac{ah^3}{12}\right) \tag{4.16}$$

where $E'I_F$ = flexural rigidity of the foundation per unit length at right angles to B
$\Sigma E'I_b'$ = flexural rigidity of the framed members
$\Sigma(E'ah^3/12)$ = flexural rigidity of the shear walls
a = shear wall thickness
h = shear wall height

Based on the value of K_r, the ratio (δ) of the differential settlement to the total settlement can be estimated in the following manner:

1. If $K_r > 0.5$, it can be treated as a rigid mat, and $\delta = 0$.
2. If $K_r = 0.5$, then $\delta \approx 0.1$.
3. If $K_r = 0$, $\delta = 0.35$ for square mats ($B/L = 1$), and $\delta = 0.5$ for long foundations ($B/L = 0$).

4.5 Compensated Foundations

The settlement of a mat foundation can be reduced by decreasing the net pressure increase on soil, which can be done by increasing the depth of embedment, D_f. This increase is particularly important for rafts on soft clays, where large consolidation settlements are expected. From Eq. (4.14), the net average applied pressure on soil is (Figure 4.4)

$$q = \frac{Q}{A} - \gamma D_f$$

For no increase of the net soil pressure on soil below a raft foundation, q should be equal to zero. Thus