**Bowles J.E. (1982)**
Foundation analysis and design. 3rd edition.
Mc-Graw Hill.



## 5-5 IMMEDIATE (ELASTIC) SETTLEMENT COMPUTATION—THEORY

The settlement of a footing on a soil mass immediately after application of load can be computed from an equation from the theory of elasticity [e.g., Timoshenko and Goodier (1951)] as follows:

$$\Delta H = qB \frac{1 - \mu^2}{E_s} I_w \tag{5-10}$$

where $\Delta H$ = settlement
$q$ = intensity of contact pressure in units of $E_s$
$B$ = least lateral dimension of footing in units of $\Delta H$
$I_w$ = influence factor which depends on shape of footing and its rigidity (typical values are given in Table 5-4)
$E_s$, $\mu$ = elastic properties of soil (typical values in Tables 2-6 and 2-7)

The influence factor for use in Eq. (5-10) may be computed from the following equation proposed by Steinbrenner (1934) for the corner of a flexible, rectangular area $B \times L$ on the surface of a semi-infinite, homogeneous, isotropic half-space:

$$I_w = \frac{1}{\pi}\left\{\frac{L}{B}\ln\left[\frac{1+\sqrt{(L/B)^2+1}}{L/B}\right] + \ln\left[\frac{L}{B}+\sqrt{\left(\frac{L}{B}\right)^2+1}\right]\right\} \tag{5-11}$$

According to Schleicher (1926) and others, the influence factor for a rigid footing is about 7 percent smaller than for flexible footings. Those factors, except for the square and circle, shown in Table 5-4 are obtained as 93 percent of the average factor for a flexible footing.

**Table 5-4 Influence factors $I_w$, $I_m$ for various-shaped members and for flexible and rigid footings**

| | Flexible | | | Rigid | |
|---|---|---|---|---|---|
| Shape | Center | Corner | Average | $I_w$ | $I_m$* |
| Circle | 1.00 | 0.64 (edge) | 0.85 | 0.88† | 6.0 |
| Square | 1.12 | 0.56 | 0.95 | 0.82 | 3.7 |
| Rectangle: | | | | | |
| $L/B = 0.2$ | | | | | 2.29 |
| 0.5 | | | | | 3.33 |
| 1.5 | 1.36 | 0.68 | 1.15 | 1.06 | 4.12 |
| 2 | 1.53 | 0.77 | 1.30 | 1.20 | 4.38 |
| 5 | 2.10 | 1.05 | 1.83 | 1.70 | 4.82 |
| 10 | 2.54 | 1.27 | 2.25 | 2.10 | 4.93 |
| 100 | 4.01 | 2.00 | 3.69 | 3.40 | 5.06 |