Chapter 17
Settlement of Shallow Foundations

1. The settlement which occurs more or less in a short time after the foundation is subjected to the structural load is called
   (a) elastic settlement.
   (b) primary consolidation settlement.
   (c) secondary consolidation settlement.
   (d) both (b) and (c)

2. A uniformly loaded, perfectly flexible footing resting on a saturated clay will have a
   (a) uniform elastic settlement profile.
   (b) sagging elastic settlement profile.
   (c) triangular elastic settlement profile.
   (d) trapezoidal elastic settlement profile.

3. The contact pressure at the base of a uniformly loaded, perfectly rigid footing resting on a saturated clay will be
   (a) uniform throughout the width of the footing.
   (b) greater at the centre of the footing.
   (c) smaller at the centre of the footing.
   (d) unpredictable.

4. The Poisson’s ratio of saturated clays is
   (a) zero.
   (b) less than 0.5.
   (c) equal to 0.5.
   (d) greater than 0.5.

5. The elastic settlement of a footing is
   (a) directly proportional to the net load per unit area at the base level of the footing.
   (b) directly proportional to the width of the footing.
   (c) inversely proportional to the average Young’s modulus of elasticity of the foundation soil.
   (d) all of the above

6. The ratio of elastic settlement of a rigid footing to that of a flexible footing at its centre is approximately
   (a) 0.
   (b) 0.93.
   (c) 0.99.
   (d) 1.

7. The Young’s modulus of elasticity of the dense sand can be equal to
   (a) 15 MN/m².
   (b) 25 MN/m².
   (c) 50 MN/m².
   (d) 80 MN/m².
8. The Young’s modulus of elasticity of the stiff clay can be equal to
   (a) 10 MN/m².
   (b) 30 MN/m².
   (c) 60 MN/m².
   (d) none of the above

9. The Poisson’s ratio of soils has a range of
   (a) 0 to 0.5.
   (b) 0.2 to 0.5.
   (c) 0 to 1.
   (d) none of the above

10. The semi-empirical strain influence factor proposed by Schmertmann et al. (1978) is used
to calculate the settlement of footings resting on
   (a) clayey soils.
   (b) silty soils.
   (c) granular soils.
   (d) both (b) and (c)

11. The elastic settlement of a footing resting on the granular soil evaluated by using the semi-
empirical strain influence factor proposed by Schmertmann et al. (1978) is
   (a) directly proportional to the strain influence factor.
   (b) inversely proportional to the Young’s modulus of elasticity of soil.
   (c) directly proportional to the difference between the stress at the base level of the
       footing and the surcharge at the base level of footing.
   (d) both (b) and (c)

12. The strain influence factor at the base level of the footing is
   (a) equal to 0.2.
   (b) less than 0.2.
   (c) equal to or less than 0.2.
   (d) greater than 0.2

13. For square foundations, the Young’s modulus of elasticity $E_s$ and the cone penetration
resistance $q_c$ of granular soils have the following relationship:
   (a) $E_s = 0.5q_c$.
   (b) $E_s = 1.5q_c$.
   (c) $E_s = 2.5q_c$.
   (d) $E_s = 3.5q_c$.

14. The net allowable bearing pressure for spread footings resting on granular soils is
   (a) directly proportional to a depth factor equal to or less than 1.33.
   (b) directly proportional to the elastic settlement.
   (c) directly proportional to the field standard penetration resistance.
   (d) all of the above
15. If the average standard penetration resistance of a granular soil deposit is 10, the net allowable bearing pressure of a mat foundation will be approximately
(a) 125 kN/m².
(b) 250 kN/m².
(c) 500 kN/m².
(d) none of the above
Answers, Hints and Discussion

1. (a)

2. (b)
   *Discussion*: (a) is correct for a uniformly loaded, rigid footing resting on the saturated clay.

3. (c)
   *Discussion*: (a) is correct for a uniformly loaded, perfectly flexible footing resting on the saturated clay.

4. (c)

5. (d)
   *Hint*: See Eqs. (17.1) and (17.2).

6. (c)
   *Hint*: See Eq. (17.10).

7. (c)
   *Hint*: See Table 17.6.

8. (c)
   *Hint*: See Table 17.6.

9. (b)
   *Hint*: See Table 17.6.

10. (c)

11. (d)
    *Hint*: See Eq. (17.12).

12. (c)

13. (c)
    *Discussion*: See Eq. (17.17). (d) is correct for rectangular foundations, see Eq. (17.18).

14. (d)
    *Hint*: See Eqs. (17.21) and (17.22).

15. (b)
    *Discussion*: Eq. (17.25): $q_{alt(\text{net})} = (25)(10) \approx 250kN/m^2$. 