EWCE 343

Geotechnical and Foundation Engineering

BC of Soils from SPT:

- SPT is widely used to obtain the bearing capacity of soils directly.

- One of the earliest published relationships was that of **Terzaghi and Peck** (1967).

- **Meyerhof** (1956, 1974) published equations for computing the allowable bearing capacity for a 25-mm settlement.

- Considering the accumulation of field observations and the stated opinions of the authors and others, this **author adjusted the Meyerhof equations** for an approximate 50 percent increase in allowable bearing capacity to obtain the following:

$$q_a = \frac{N}{F_1} k_d \qquad B \leq F_4 \qquad (1)$$

$$q_a = \frac{N}{F_2} \left(\frac{B+F_3}{B}\right)^2 k_d \qquad B > F_4 \qquad (2)$$

Where, q_a = allowable bearing pressure for ΔH_0= 25-mm or 1-in. settlement, kPa.

$$\boldsymbol{k_d}=\mathbf{1}+\mathbf{0.33}\frac{\boldsymbol{D}}{\boldsymbol{B}} \leq \mathbf{1.33} \text{ (Meyerhof)}$$

F factors as follows(SI Unit):

	N_{55}	N'_{70}
F_1	0.05	0.04
F_2	0.08	0.06
F_3	0.3	0.06
F_4	1.2	0.06

In these equations the allowable soil pressure is for an assumed 25-mm settlement. In general the allowable pressure for any settlement ΔH_j is:

$$\boldsymbol{q'_a}=\frac{\boldsymbol{\Delta H_j}}{\boldsymbol{\Delta H_0}}$$

Where, $\boldsymbol{\Delta H_0}$=25mm

$\boldsymbol{\Delta H_j}$=actual settlement that can be tolerated, in millimeters

Example: Find q_a from the diagram from the following data:

N_{70}= 24, Footing depth, D=1.0m footing width, B=3.0m

Solution:

Here, B=3.0 and F_4=1.2

since, B> F_4 use $q_a = \frac{N_{55}}{F_2}\left(\frac{B+F_3}{B}\right)^2 k_d$

F_2=0.08, F_3=0.3

$N_{55} = \frac{70}{55} N_{70} = \frac{70}{55} x24 = 30 > 24$

$\boldsymbol{k_d = 1 + 0.33\frac{D}{B} \leq 1.33}$

$\boldsymbol{k_d = 1 + 0.33\frac{1}{3} = 1.11 < 1.33}$

Substituting value in Following equation:

$$q_a = \frac{N_{55}}{F_2}\left(\frac{B+F_3}{B}\right)^2 k_d$$

$$= \frac{30}{0.08}\left(\frac{3.0+0.3}{3.0}\right)^2 1.11$$

$$= 503.66 \approx 500 \text{ kPa}$$

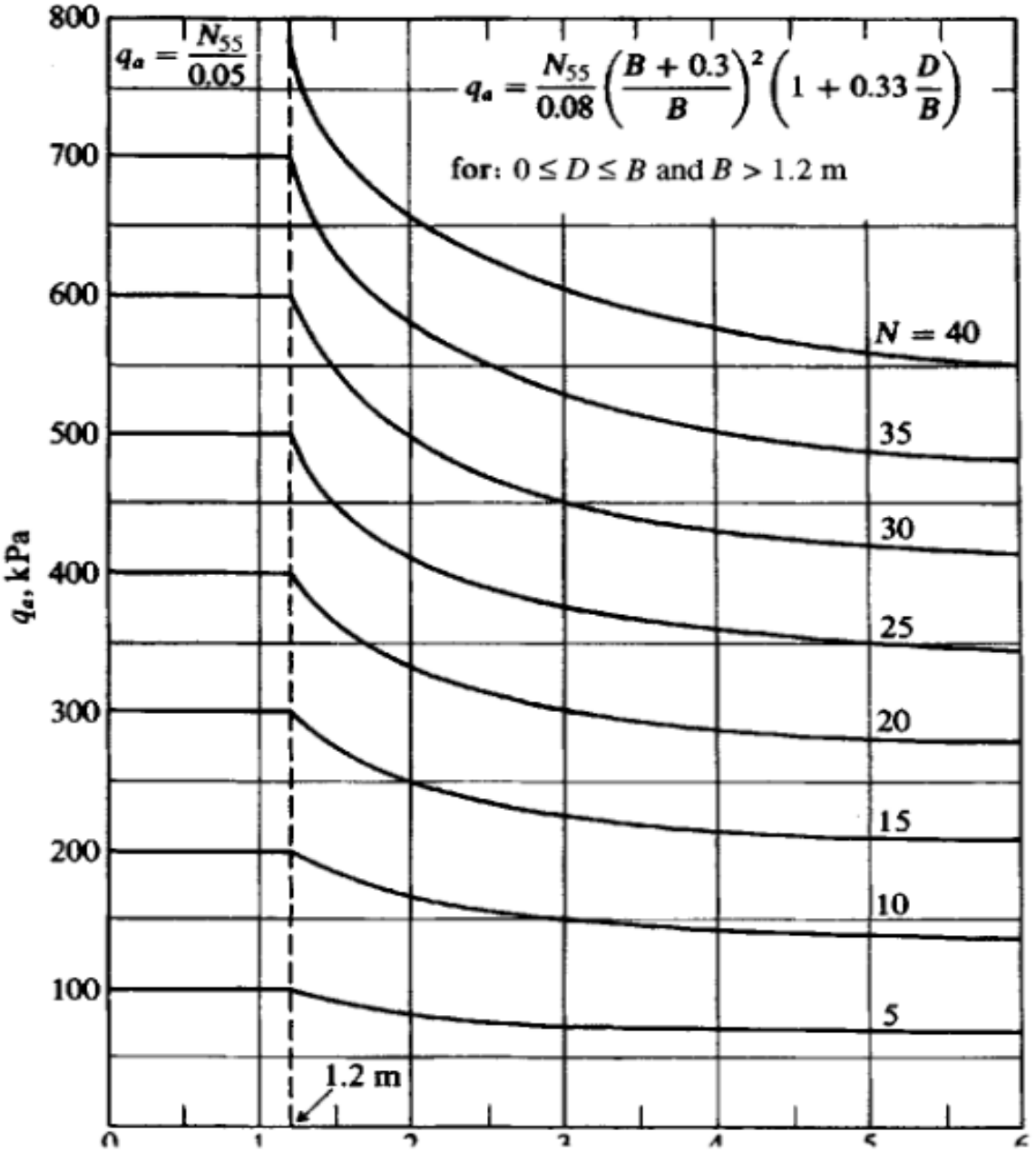


Figure 4-7 Allowable bearing capacity for **surface-loaded** footings with settlement limited to approximately 25 mm. Equation used is shown on figure.

Problem 4-8.

The average N'_{70}Nj0 blow count = 6 in the effective zone for a footing located at D = 1.6 m (blow count average in range from 1- to 4-m depth).

Required. What is the allowable bearing capacity for a 40-mm settlement?

Assume B> $\boldsymbol{F_4}$ where F_4=1.2

Use equation $\boldsymbol{q_a = \frac{N_{55}}{F_2}\left(\frac{B+F_3}{B}\right)^2 k_d}$

with **F2 = 0.08** and F3 = **0.30**

$$\boldsymbol{N_{55} = \frac{70}{55} N_{70} = \frac{70}{55} x6 = 9 > 6}$$

$$\boldsymbol{k_d = 1 + 0.33\frac{D}{B} \leq 1.33}$$

For 25mm settlement

Let B=1.5

$$q_a = \frac{N_{55}}{F_2}\left(\frac{B+F_3}{B}\right)^2 k_d \qquad k_d = 1 + 0.33\frac{1.6}{1.5} = 1.352 > 1.33$$

use k_d=1.33

$$q_a = \frac{9}{0.08}\left(\frac{1.5+0.3}{1.5}\right)^2 x\,1.33 = 215.46 \text{ kpa}$$

For **B=3.0**

$$q_a = \frac{N_{55}}{F_2}\left(\frac{B+F_3}{B}\right)^2 k_d \qquad k_d = 1 + 0.33\frac{1.6}{3.0} = 1.176 < 1.33 \text{ 0k}$$

$$q_a = \frac{N_{55}}{F_2}\left(\frac{B+F_3}{B}\right)^2 k_d$$

$$= \frac{9}{0.08}\left(\frac{3.0+0.3}{3}\right)^2 1.176 = \mathbf{160.083 \text{ kpa}}$$

Suggested $\boldsymbol{q_a}$=200 kPa for 25mm settlement

For 40mm settlement

$$\boldsymbol{q'_a}=\frac{\boldsymbol{\Delta H_j}}{\boldsymbol{\Delta H_0}} \text{ x } \boldsymbol{q_a}= \frac{\boldsymbol{40}}{\boldsymbol{25}}\text{x200=320 kpa}$$

Thanks