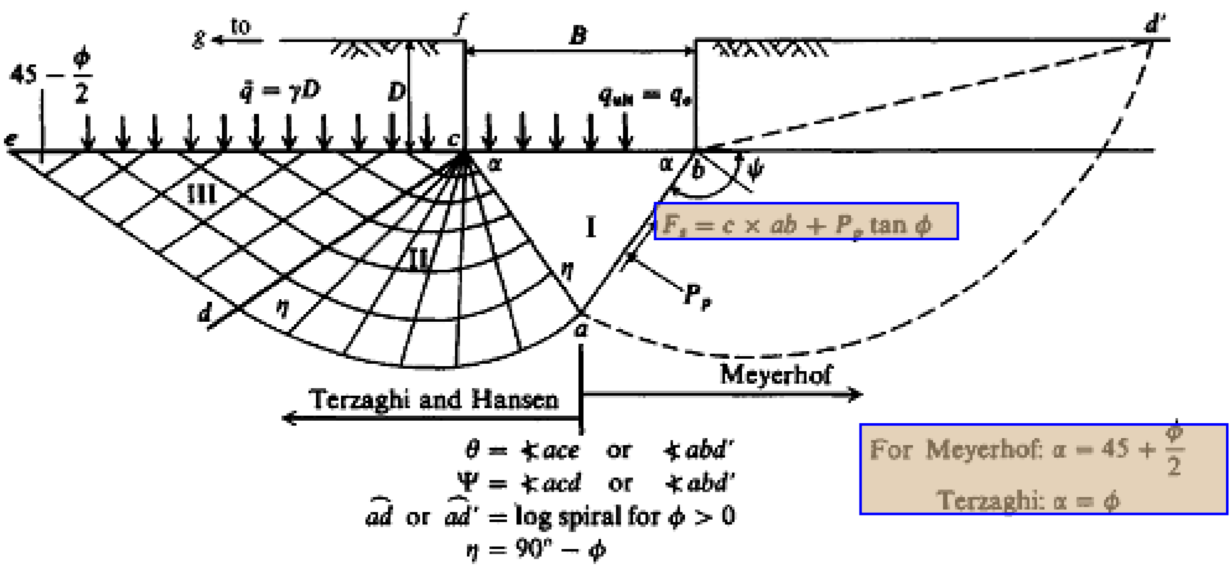
2.1 Meyerhof (1963) Bearing Capacity Equation

A comparison of the Failure Mechanism assumed by Meyerhof and Terzaghi is given below.



Meyerhof bearing capacity equation is given below. It takes into account the reduction caused by moment/eccentricity of load on the footing, and also reduction in bearing capacity due to inclination of load on the footing.

$$q_{ult} = cN_c d_c s_c i_c + \gamma' D N_q d_q s_q i_q + \frac{1}{2}\gamma' B' N_\gamma d_\gamma s_\gamma i_\gamma$$

γ' is effective unit weight of the soil to take into account the water table effect.

B' is the effective width of footing to consider the effect of moment as will be discussed later

2.1.1 Bearing Capacity Factors (Nc, Nq, Nγ)

$$N_q = e^{\pi \tan\phi} \tan^2(45 + \frac{\phi}{2})$$ =e^(pi*tan(fi))*Kp

$$N_c = (N_q - 1) \cot \phi$$

$$N_r = (N_q - 1) \tan(1.4\phi)$$

2.1.2 Shape factor (sc, sq, sγ)

$$sc = 1 + 0.2Kp\frac{B}{L'} \quad \textit{for any } \phi$$

$$sq = s\gamma = 1 + 0.1Kp\frac{B'}{L'} \quad \textit{for } \phi > 10°$$ (For any ϕ)

$$sq = s\gamma = 1 \qquad \textit{for } \phi = 0°$$

2.1.3 Depth factors (dc, dq, dγ)

$$d_c = 1 + 0.2\sqrt{K_p}\frac{D}{B'}$$ (For any ϕ)

$$d_q = d_r = 1 + 0.1\sqrt{K_p}\frac{D}{B'} \quad (\phi > 10^\circ)$$

$$d_q = d_r = 1 \qquad \phi = 0^\circ$$

where

$K_p = \tan^2(45+\phi/2)$

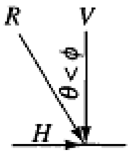
2.1.4 Inclination factors (ic, iq, iγ):

The effect of load inclination is to reduce the bearing capacity of the soil.

Inclined Loads. In addition to the vertical load acting on the footing, it may also be subjected to a lateral load; hence the resultant of the load will be inclined. One possible method as proposed by Merehof is to reduce the allowable bearing capacity based on the inclination of the load. However, this approach has a drawback in that the geotechnical engineer usually does not know the inclination of the various loads when preparing the foundation report. And if the inclinations were known, then numerous allowable bearing capacities would be needed for the various inclinations of the load.

$$i_e = i_q = (1 - \frac{\theta}{90})^2$$

Inclination:



$$i_\gamma = (1 - \frac{\theta}{\phi})^2 \qquad \phi > 0^\circ$$

$$i_\gamma = 0 \qquad \text{For } \phi = 0^\circ$$

Where θ is the angle of the resultant of load on the footing with the vertical

2.1.5 Difference between Terzaghi's and Meyerhof's approach:-

- Difference between "N" factors exists because of assumption of log spiral "ad" and exit wedge "cde".
- Meyerhof's shape factors do not differ greatly than those given by Terzaghi except for addition of "sq".
- Meyerhof approximately accounted for shear along c`d` in his analysis. However observing that shear effect is still being ignored he introduced depth factor.
- For D is approximately equal to B and Meyerhof is approximately equal to Terzaghi, but the difference become pronounced for larger D/B ratio.

2.1.6 Uses of B.C. equations

Terzaghis equation:

- Very cohesive soil when $D/B \leq 1$.
- quick estimate of the q_{ult}.
- Do not use for footings with horizontal forces, for tilted base, for sloping ground.

Uses of Meyerhof Equation

- For any situation.