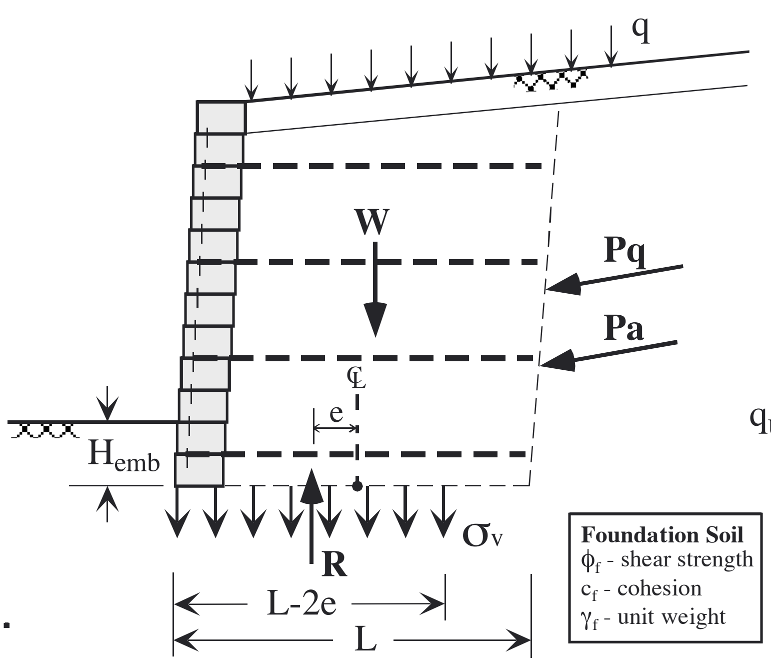
Bearing Capacity

Many soil reports and building codes tend to dictate maximum bearing pressures that may be placed on certain soil types for sake of simplicity with little regard for the specific structure involved and the relevant theory of soil mechanics being applied to the site soil conditions. A typical example of this is the "3,000 psf" maximum bearing pressure requirement unilaterally being applied to all structures, even though the bearing capacity of soils increase with footing width and depth due to increasing confining pressure and stability.

This maximum bearing pressure issue can be a "compliance" or interpretation problem when applied to larger reinforced soil structures which place high earth loads on the foundation due to the height of fill involved. A 20' tall soil structure calculates over 3,000 psf applied bearing pressure yet calculates high bearing capacity safety factors when the site specific geometry and soil conditions are evaluated.



Typical Wall Section

Note: Bearing capacity can be reduced by up to 50% if toe is sloping or below water table.

Bearing Pressure

Vertical Forces, $R = \Sigma W + \Sigma Fv$

Applied Pressure, $\sigma_v = \dfrac{R}{L-2e}$

Bearing Capacity

$$q_{ult} = c_f N_c + H_{emb}\gamma_f N_q + 0.5(L-2e)\gamma_f N_\gamma$$

This term may be omitted if the soil in front of wall is to be ignored.

Factor of Safety

$$FS_{bc} = \frac{q_{ult}}{\sigma_v} > 2.0\text{-}2.5$$

Note: Factor of safety for bearing capacity is typically 3.0 for rigid structures but is reduced to 2.0 (NCMA) or 2.5 (AASHTO) for flexible soil structures.

Bearing Capacity Factors (thru Vesic)

ϕ_f	N_c	N_q	N_γ	ϕ_f	N_c	N_q	N_γ
20°	14.83	6.40	5.39	28°	25.80	14.72	16.72
22°	16.88	7.82	7.13	30°	30.14	18.40	22.40
24°	19.32	9.60	9.44	32°	35.49	23.18	30.22
26°	22.25	11.85	12.54	34°	42.16	29.44	41.06

Vesic/Meyerhof Equations : $N_q = e^{\pi \tan\phi} \tan^2(45 + \phi/2)$, $N_c = (N_q - 1)\cot(\phi)$, $N_\gamma = 2(N_q + 1)\tan(\phi)$