ROCK LAND INT	Project:	Awqaf High Rise Buildir g ProJect	Design by:	Date:
	Location:	At Meidan Hawally, Block-29, Plot-22, State of Kuwait.	M.M	9/17/2023
	Client:	Ministry of Awqaf and Islamic Affairs	Checked by:	Project No:
	Subject:	Soil Bearing Capacity	E.T	1

Input Output

Soil Properties

layer 1	Standard Penetration Test	Nspt	8.00	
layer 2	(Sand) Standard Penetration Test	Nspt	15.00	
layer 2	(Clay) UnConfined Comp. Strength	q ucs	0.00	KN/m2
	Soil Type	Sand w. Gravel		
	Cohesion	C	0.00	KN/m2
	Friction Angle	ϕ	30.00	◦
	Friction Angle	ϕ	0.52	Radians
	Bulk Density above Df	Y bulk	15.74	KN/m3
	Saturated Density above Df	Y sat	17.74	KN/m3
	Submerjed Density above Df	Y' sub	7.94	KN/m3
	Bulk Density Below Df	Y bulk	16.75	KN/m3
	Saturated Density Below Df	Y sat	18.75	KN/m3
	Submerjed Density Below Df	Y' sub	8.95	KN/m3
	GWT depth from NGL	Dw	5.00	m

Foundation Properties

Foundation Shape	Strip Footing		
Foundation Width	B	1.25	m
Foundation Length	L	1.50	m
Foundation Depth	Df	1.00	m
Foundation Depth/width	Df/B	0.80	
Foundation Width/Length	B/L	0.83	
GWT depth from Df	Zw	4.00	m

Bearing Factors (N)

	Terzaghi	Meyerhof	Hansen	Visic'
Nc	37.24	30.14	30.14	30.14
Nq	22.50	18.40	18.40	18.40
NY	19.13	15.67	15.07	22.40

Shape Factors (S)

	Terzaghi	Meyerhof	Hansen	Visic'
Sc	1.00	1.29	1.51	1.51
Sq	1.00	1.14	1.42	1.48
SY	1.00	1.14	0.67	0.67

Depth Factors (d)

	Terzaghi	Meyerhof	Hansen	Visic'
dc	1.00	1.21	1.32	1.32
dq	1.00	1.11	1.23	1.23
dY	1.00	1.11	1.00	1.00

Ultimate Soil Bearing Capacity

	Terzaghi	Meyerhof	Hansen	Visic'	Terzaghi&Peck 1967
Strip Footing	KN/m2	KN/m2	KN/m2	KN/m2	KN/m2
Ultimate Gross B/C	554.42	574.06	611.55	684.33	465.00
Ultimate Net B/C	537.67	557.31	594.80	667.58	425.00

Alllowble Soil Bearing Capacity

Factor Of Safety	2.50

	Terzaghi	Meyerhof	Hansen	Visic'	Terzaghi&Peck 1967
Strip Footing	KN/m2	KN/m2	KN/m2	KN/m2	KN/m2
Allowable Gross B/C	222	230	245	274	186
Allowable Net B/C	206	214	229	258	170

Recommended Allowable Gross Bearing Capacity	186.0	KN/m2
Recommended Allowable Net Bearing Capacity	170.0	KN/m2

Soil Immediate Settlement

Soil type	Eq.
Gravelly Sand	1200(N+6)
Sand w. Gravel	1000 N
Silty Sand	600(N+6)
Sandy Silt	300(N+6)
Clayey Sand	300(N+15)
Clay	150 Cu

Soil	Sand w. Gravel		Es	15000.00	KN/m2
Settlement	Si	q*b*(1-v^2)/Es		12.89	mm
Modulus of subgrade Reaction		Ks	q all/Si	13188.52	KN/m3

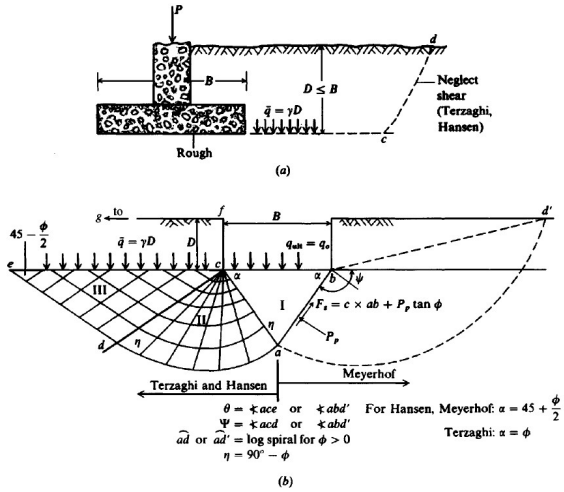

Figure 4-3 (*a*) Shallow foundation with rough base defined. Terzaghi and Hansen equations of Table 4-1 neglect shear along *cd*; (*b*) general footing-soil interaction for bearing-capacity equations for strip footing—left side for Terzaghi (1943), Hansen (1970), and right side Meyerhof (1951).

TABLE 4-1
Bearing-capacity equations by the several authors indicated

Terzaghi (1943). See Table 4-2 for typical values and for $K_{p\gamma}$ values.

$$q_{ult} = cN_c s_c + \bar{q}N_q + 0.5\gamma BN_\gamma s_\gamma$$

$$N_q = \frac{a^2}{a\cos^2(45+\phi/2)}$$

$$a = e^{(0.75\pi-\phi/2)\tan\phi}$$

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

$$N_\gamma = \frac{\tan\phi}{2}\left(\frac{K_{p\gamma}}{\cos^2\phi} - 1\right)$$

For:	strip	round	square
s_c =	1.0	1.3	1.3
s_γ =	1.0	0.6	0.8

Meyerhof (1963).* See Table 4-3 for shape, depth, and inclination factors.

Vertical load: $q_{ult} = cN_c s_c d_c + \bar{q}N_q s_q d_q + 0.5\gamma B' N_\gamma s_\gamma d_\gamma$

Inclined load: $q_{ult} = cN_c d_c i_c + \bar{q}N_q d_q i_q + 0.5\gamma B' N_\gamma d_\gamma i_\gamma$

$$N_q = e^{\pi\tan\phi}\tan^2\left(45 + \frac{\phi}{2}\right)$$

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

$$N_\gamma = (N_q - 1)\tan(1.4\phi)$$

Hansen (1970).* See Table 4-5 for shape, depth, and other factors.

General:† $q_{ult} = cN_c s_c d_c i_c g_c b_c + \bar{q}N_q s_q d_q i_q g_q b_q + 0.5\gamma B' N_\gamma s_\gamma d_\gamma i_\gamma g_\gamma b_\gamma$

when $\phi = 0$

use $q_{ult} = 5.14 s_u(1 + s'_c + d'_c - i'_c - b'_c - g'_c) + \bar{q}$

N_q = same as Meyerhof above

N_c = same as Meyerhof above

$$N_\gamma = 1.5(N_q - 1)\tan\phi$$

Vesić (1973, 1975).* See Table 4-5 for shape, depth, and other factors. Use Hansen's equations above.

N_q = same as Meyerhof above

N_c = same as Meyerhof above

$$N_\gamma = 2(N_q + 1)\tan\phi$$

*These methods require a trial process to obtain design base dimensions since width B and length L are needed to compute shape, depth, and influence factors.

†See Sec. 4-6 when $i_i < 1$.

MAXIMUM ALLOWABLE TOTAL SETTLEMENT

FOOTING TYPE	TOTAL SETTLEMENT (mm)	
	CLAY	SAND
Spread Footings	60	40
Mat Foundations	80	60

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