Company	Client	Project Name	Project No.	Location
Dartistech	Demo Client	Demo Project	Demo Project No.	Demo Location

Soil Layers

No.	Description	Thickness (m)	γ(kN/m^3)	ϕ(deg)	c(kPa)	Es(kPa)	Consolidation	Cc	Cs	Pc(kPa)	e0
1	Silty Sand	5	18	10	1	10000	No	_	_	_	_
2	Clay	3	18	0	4	15000	Yes	0.3	0.1	50	0.8

Parameters

Gw(m)	Fs	Df(m)
2	3	1

Eccentricity and Inclination

Ecc. (B Direction)(m)	Ecc. (L Direction)(m)	Inclination (deg.)
0	0	0

Qu

Nc	Nγ	Nq	Shape Factor	Depth Factor	Inclination Factor
Prandtl (1921)	Vesic (1973)	Reissner (1924)	DeBeer (1970)	Hansen (1970)	Meyerhof (1963)

Settlement Basic Parameters

Allowable Settlement (mm)	Effective Stratum Depth	Rigidity	a
25.4	10.00	Rigid (Ir = 0.93)	1

Auto calculate c, γ, ϕ	Plane-Strain Correction of Friction Angle	Ignore elastic settlement when consolidation settlement is calculated	Three-dimensional Effect for consolidation settlement	Secondary Consolidation Sc(s)
True	False	False	False	True

Elastic Settlement Method: Schmertmann et al.(1978) (Time(years) = 10.00)

Stress Distribution Method: Boussinesq

B(m)= 4, L(m)= 4, q0(kPa)= 25.63

1_ Shear failure criterion (qall_sh)

Parameters for shear failure calculations are computed:

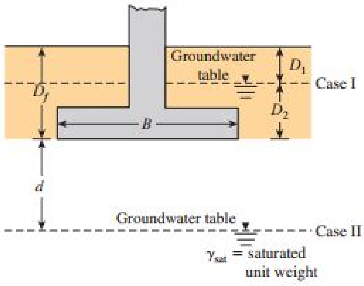
weighted average values based on the relative thicknesses of each stratum in the zone between the bottom of the footing and a depth B below the bottom is calculated:

$\varphi' = \frac{\sum Hi\varphi' i}{\sum Hi} = 10.00(deg.)$

$c = \frac{\sum Hici}{\sum Hi} = 1.00kPa$

$\gamma c = \frac{\sum Hi\gamma i}{\sum Hi} = 18.00kN/m^3$

Modification of Bearing Capacity Equations for Water Table using Das method:



Case II. the water table is located so that 0 <= d <= B, the factor q in the bearing capacity equations takes the form:

q = γ*Df = 18.00 kN/m^2

also γ used in bearing capacity equation is:

(γsat - γw) + d/B * (γ - γsat + γw) = 10.65

$Nq = \tan^2\left(45 + \frac{\varphi'}{2}\right)e^{\pi\tan\varphi'} = 2.47$

$Nc = (Nq - 1)\cot(x) = 8.34$

$N\gamma = 2(Nq + 1)\tan(\varphi') = 1.22$

(Df / B) <= 1 & ϕ > 0:

$F_{cd} = F_{qd} - \frac{1 - F_{qd}}{N_c\tan\varphi'} = 1.10$

$F_{qd} = 1 + 2\tan\varphi'(1 - \sin\varphi')^2\left(\frac{D_f}{B}\right) = 1.06$

$F_{\gamma d} = 1.00$

Inclination (deg.) = 0 : Fci=Fqi=Fγi= 1

$F_{cs} = 1 + \left(\frac{B}{L}\right)\left(\frac{N_q}{N_c}\right) = 1.30$

$F_{qs} = 1 + \left(\frac{B}{L}\right)\tan\varphi' = 1.18$

$F_{\gamma s} = 1 - 0.4\left(\frac{B}{L}\right) = 0.60$

qult_sh = c*Nc*Fcs*Fcd*Fci + q*Nq*Fqs*Fqd*Fqi + 0.5*γ*B*Nγ*Fγs*Fγd*Fγi

qult_sh = 1.00*8.34*1.30*1.10*1.00+18.00*2.47*1.18*1.06*1.00+ 0.5*10.65*4.00*1.22*0.60*1.00*1.00 = (11.91) + (55.48) + (15.65) = 83.04 (kPa)

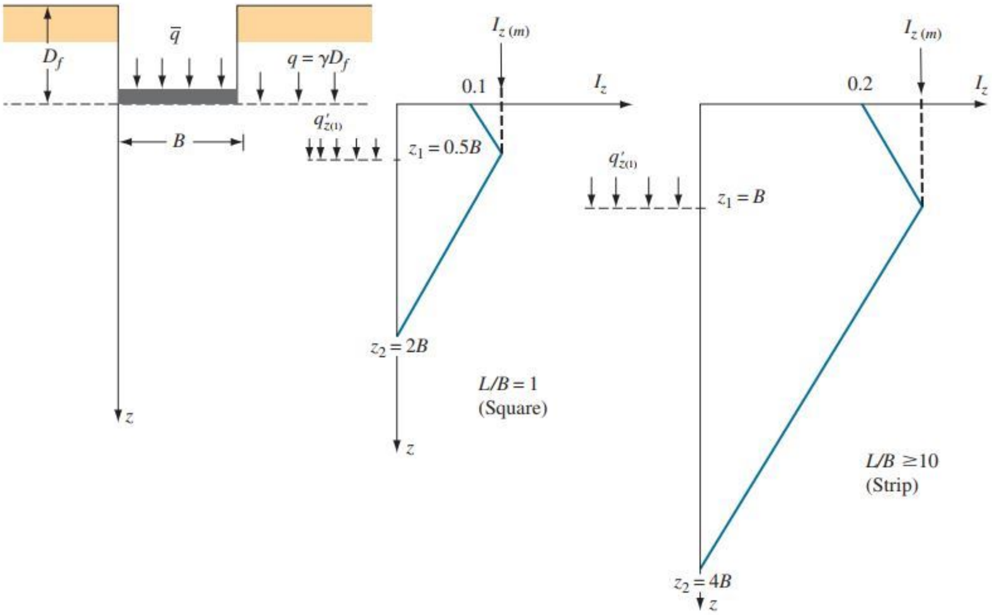
qall_sh = (qult_sh / FS)= (83.04 / 3.00) = 27.68 (kPa)

qll_sh = 27.68 (kPa) >= q0 = 25.63 (kPa)

2_ Settlement criterion (S_total)

$q_0 = \frac{load}{BL} = 25.63 kN/m^2$

Elastic Settlement of Shallow Foundation using strain influence factor proposed by Schmertmann et al. (1978):



using relations suggested by Salgado (2008) for interpolation of Iz at z = 0, z1, and z2 for rectangular foundations:

$z_1 = 0.5B + 0.0555(L - B) \leq B = 2.00m$

$z_2 = 2B + 0.222(L - B) \leq 4B = 8.00m$

at z = 0,

$I_z = 0.1 + 0.0111\left(\frac{L}{B} - 1\right) \leq 0.2 = 0.100$

effective stress at the base of the foundation (q)= 18.00 kN/m^2

effective stress at a depth of z1 before construction of the foundation (qz(1))= 44.20 kN/m^2

$I_{z(m)} = 0.5 + 0.1\sqrt{\frac{q_0 - q}{q'_{z(1)}}} = 0.542$

Layer no.	Δz (m)	Es (kN/m^2)	Iz at middle of layer	(Iz/Es)*Δz (m^3/kN)
1	2	10000	0.320767240561591	6.41534481123182E-05
2	2	10000	0.451278734269318	9.02557468538636E-05
3	4	15000	0.180511493707727	4.81363983220606E-05

$C_1 = 1 - 0.5\left(\frac{q}{q0 - q}\right) = 0.500$

time for creep (t)= 10 years

$C_2 = 1 + 0.2\left(\frac{t}{0.1}\right) = 1.400$

$S_e = C_1 C_2 (q0 - q) \sum \frac{I_z}{E_s} \Delta z = 1.081mm$

primary Consolidation Settlement in clay layer no. 1

at depth (m): 6.50 , stress (kPa) = 72.90

Location	z (m)	I1	I2	I3	I4	q0(I1+I2+I3+I4)
Top	4.00	0.08403	0.08403	0.08403	0.08403	8.61
Middle	5.50	0.05169	0.05169	0.05169	0.05169	5.30
bottom	7.00	0.03430	0.03430	0.03430	0.03430	3.52

$\Delta\sigma_{avg} = \frac{1}{6}(\Delta\sigma_{top} + 4\Delta\sigma_{mid} + \Delta\sigma_{bot}) = 5.55kN/m^2$

preconsolidation pressure = 50.00

Cc	Cs	e0	σ0 (kN/m^2)	Δσav (kN/m^2)	Pc (kN/m^2)
0.3	0.1	0.8	72.9	5.55347965549933	50

σ0 = Pc:

$S_{c(p)} = \frac{C_cH_c}{1 + e_0}\log\frac{\sigma_0 + \Delta\sigma_{av}}{\sigma_0} = 15.94mm$

Secondary Consolidation Settlement in the clay layer:

Ca = 0.02 , t1(years) = 1 , t2(years) = 2

$\Delta e = C_c\log\left(\frac{\sigma_0 + \Delta\sigma}{\sigma_0}\right) = 0.01$

$e_p = e_0 - \Delta e = 0.79$

$C_a^{'} = \frac{C_a}{1 + e_p} = 0.01$

$S_{c(s)} = C_a^{'}H_c\log\left(\frac{t2}{t1}\right) = 10.09mm$

Total consolidation settlement of the layer is 26.03 mm

$S_{total} = I_r(S_e + \alpha(S_{c(p)} + S_{c(s)})) = 25.21mm$

S allowed = 25.40 mm >= S total = 25.21 mm