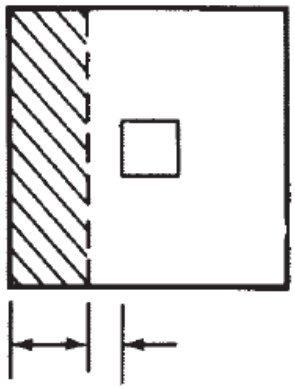
Foundation or Footing Design: Part 3
Courtesy of Dr. Latifee's IMI research group, Text books (Design of concrete structures by McCormac etc.) and others

Continuation of previous example in part 2:

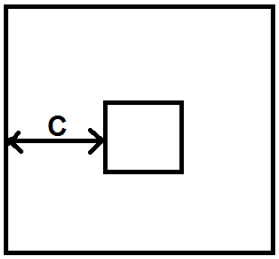
Now, **bearing pressure for strength design** = Factored load/ Area of footing P_u/A_f
Pu = 1.2DL(351)+1.6LL(56.4) = 511.44
Bearing pressure =511.44/90.25 =5.67 ksf, or

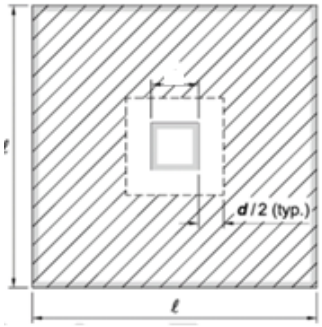
$$\underline{\mathbf{q_u\ net}} = \frac{1.2*351+1.6*56.4}{9.5*9.5} = 511.44/90.25 = 5.67 \text{ ksf}$$

One way shear check:
Considering beam Shear or One way shear :
Beam shear , Vb = qu × Beam strip length × (c-d)
=5.67×9.5×2.167
=116.72 kips
Allowable shear, Va = $2\varphi\sqrt{f'c}$ b d
= (2×.75×√4000× (9.5×12) ×23)/1000
= 248.71 Kips
Since, Va > Vb , therefore, OK.



<C-d><d>
Beam or One way Shear





Two –way or Punching Shear

Considering punching Shear or Two way shear :
Punching shear , Vp = Factored load, or q_u× Footing area – Punched out area× q_u
= 9.5×9.5×5.67 – [(39×39)/144] ×5.67 = 451.55 Kips
Allowable shear, Va = $4\varphi\sqrt{f'c}$ b d
= (4*.75*√4000*(39*4)*23)/1000
= 680.77 Kips
Since, Va > Vp , therefore OK.
The Bending Moment:

Mu =(5.67*9.5*(4.08))^2)/2 = 448.3 k-ft

[Note: Mu = (q_u × b × c^2)/2; considering moment for the whole width of footing]

Reinforcements : $A_s = \frac{Mu}{\emptyset fy\,(d-\frac{a}{2})}$

=448.3*12/[0.9*60*(23-8/2)]; [assumed, a = 8 inches]

= 5.24 in^2 ;

$a= \frac{As\ fy}{.85 f' cb}$

=(5.43*60)/*(.85*4*12)

=7.98 inches; very close to 8 inches assumed, therefore, OK;

A_s required= 5.24 in^2.

Now, Minimum reinforcement for flexure,

A_s (minimum) = 200*b*d/fy

=(200*9.5*12*23)/60000 =8.74 in^2

A_s (minimum) =8.74 in^2; within 9.5 ft footing width, controls.

Since, it is square footing, use 9 #9 bar (Area provided 9 in^2) in each direction.

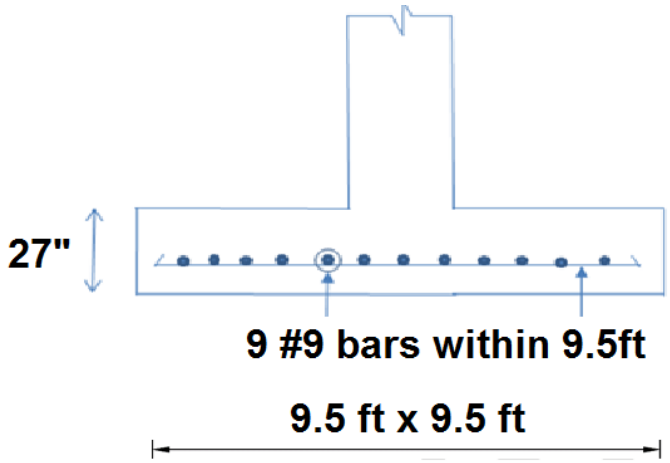


Figure: Detail of reinforcement

Last updated on August 17, 2016