

Square Footing Calculator**Footing at P1**

Check square pad footing at location of column.

By inspection the dead and live loads acting vertically on this column are:

(lbs)	Dead Load	Floor Live	Roof Live
Roof	709	0	5202
Floor	0	0	0
Totals	709	0	5202

ASD Load Cases from ASCE 7-10:

- 2.) $D + L = 709$ lbs
 3.) $D + (Lr \text{ or } S) = 5911$ lbs (governs)
 4.) $D + .75L + .75(Lr \text{ or } S) = 4610.5$ lbs

Bearing Calculations:

Applied Bearing Pressure	Q _{asd} =	1,086	psf
Eff. Allowable SBP	Q _e =	1,250	psf
Footing Area Required	A _{req} =	4.73	ft ²
Area of Footing	A _{footing} =	5.44	ft ² → OK
Weight to resist Uplift w/ 1.5 F.S.	U.R. =	902	lbs

Strength Design Load Cases from ASCE 7-10:

- 1.) $1.4D = 992.6$ lbs
 2.) $1.2D + 1.6L + .5(Lr \text{ or } S) = 3451.8$ lbs
 3.) $1.2D + 1.6(Lr \text{ or } S) + L = 9174$ lbs (governs)

Beam Shear Calculations (One Way Shear):

Ult. Applied Bearing Pressure	Q _u =	1,685	psf
Applied Beam Shear	V _{u1} =	1,311	lbs
Allowable Beam Shear	V _{c1} =	18,979	lbs (ACI 11-3)
Footing Depth Required	D _{req} =	0.8	in
Footing Depth	D _{footing} =	12.0	in → OK

Punching Shear Calculations (Two Way Shear):

Critical Perimeter	b ₀ =	47.0	in
Column Ratio	β _c =	1.0	
Column Location Factor	α _s =	30	
Punching Shear	V _{u2} =	7,558	lbs
Allowable Punching Shear	V _{c2-a} =	95,571	lbs (ACI 11-31)
Allowable Punching Shear	V _{c2-b} =	115,735	lbs (ACI 11-32)
Allowable Punching Shear	V _{c2-c} =	63,714	lbs (ACI 11-33)
Controlling Punching Shear	V _{c2} =	63,714	lbs
Footing Depth Required	D _{req} =	1.4	in
Footing Depth	D _{footing} =	12.0	in → OK

Reinforcement Calculations:

$M_u / \phi b d^2$	R _n =	14.3	psi
Steel Ratio	ρ =	0.0002	
Steel Req. based on Moment	A _{s(1)} =	0.055	in ²
Steel Req. based on Shrink	A _{s(2)} =	0.605	in ² (ACI 7.12)
Controlling Reinf. Steel	A _{s(req)} =	0.605	in ²
Required number of # bars =		3.08	
Selected Longitudinal Bars:		4 - #4 bars each way	
Reinforcement Area Provided	A _s =	0.79	in ² → OK

Development Length Calculations:

spacing/cover dimension	c =	3.0	in
Transverse Reinf. Factor	$c + K_{tr} / d_b$ =	6	(use 2.5)
Length Req.	L _d =	10.1	in (ACI 12-1)
Length Available	L _{d-sup} =	9.25	in

Note: Plain concrete adequate for bending, therefore development length not required.

Roof LL or S =	5202.0	lbs
Roof DL =	709.0	lbs
Floor LL =	0.0	lbs
Floor DL =	0.0	lbs
Column Width =	3.50	in
Column Breadth =	3.50	in
Column Type =	STEEL	
ρ _{conc} =	150	pcf
Steel Yield Strength =	60,000	psi
Conc. Comp. Strength =	3,000	psi
Soil Bearing Pressure =	1,500	psf
Reinf. Cover =	3	in
Reinf. Bar Size =	4	
Soil Depth Above Ftg.	12	in
ρ _{soil} =	100	pcf
Footing Width =	28	in
Footing Depth =	12	in
Equivalent Footing Dia. =	31.59	in

Eff. Depth to Top Layer of Steel

$$d = 8.250 \text{ in}$$

Baseplate Bearing Calculations:

$\sqrt{A_2/A_1}$ =	8.00	
P _u =	9,174	lbs
P _{allow} =	40,609	lbs (ACI 10.14)
A _{req} =	2.8	in ²
A ₁ =	12.3	in ² → OK

Bending Calculations:

Cantilever length	L _{cant} =	12.25	in
Conc. Comp. Block	a =	0.66	in
Bending Moment	M _u =	24,583	in-lb
Moment Strength	M _n =	335,899	in-lb

Bending Calculations:**Unreinforced Concrete**

S =	466.7	in ³
M _u =	24,583	in-lb
M _n =	76,681	in-lb (ACI 22-2)
D _{req} =	3.8	in
D _{footing} =	12.0	in → OK

λ =	1.0	(lightweight aggregate factor)
ψ _t =	1.0	(reinforcement location factor)
ψ _e =	1.0	(coating factor)
ψ _s =	0.8	(reinforcement size factor)
K _{tr} =	0.0	(transverse reinf. Index)