

Stemwall Cont. Footing Calculator with Shearwall

SWL1

Check continuous footing of wall excluding point loads.

From previous sections and by inspection the loads on the shearwall are given on the following pages.

(plf)	Dead Load	Floor Live	Roof Live
Roof	420	0	463.2
Wall	108	0	0
Floor	55	220	0
Stemwall	150	0	0
Totals	733	220	463.2

ASD Load Cases from ASCE 7-10:

- 2.) D + L = 953 plf
- 3.) D + (Lr or S) = 1196.2 plf
- 4.) D + .75L + .75(Lr or S) = 1245.4 plf (governs)

Bearing Calculations:

Applied Bearing Pressure	Q _{asd} =	1,245 psf	
Eff. Allowable SBP	Q _e =	1,400 psf	
Footing Width Required	W _{req} =	10.7 in	
Footing Width	W _{footing} =	12 in	→ OK

Strength Design Load Cases from ASCE 7-10:

- 1.) 1.4D = 1026.2 plf
- 2.) 1.2D + 1.6L + .5(Lr or S) = 1463.2 plf
- 3.) 1.2D + 1.6(Lr or S) + L = 1840.72 plf (governs)

Beam Shear Calculations (One Way Shear):

Ult. Applied Bearing Pressure	Q _u =	1,841 psf	
Applied Beam Shear	V _u =	115 lbs	
Allowable Beam Shear	V _c =	2,218 lbs (ACI 11-3)	
Footing Depth Required	D _{req} =	0.3 in	
Footing Depth	D _{footing} =	6.0 in	→ OK

Bending Calculations:

	a =	0.26 in	
Cantilever length	L _{cant} =	3.0 in	
Factored Bending Moment	M _u =	690 in-lb	
Moment Strength	M _n =	14,997 in-lb	

Transverse Reinforcement Calculations:

Mu/φbd ²	R _n =	12.6 psi	
Steel Ratio	ρ =	0.0002	
Steel Req. based on Moment	A _{s(1)} =	0.006 in ²	
Steel Req. based on Shrink	A _{s(2)} =	0.130 in ² (ACI 7.12)	
Controlling Reinf. Steel	A _{s(req)} =	0.130 in ²	
Required Spacing with #4 bars =		18.18 in o/c	
Selected Transverse Spacing:	#4 bars @	18 in o/c	
Reinforcement Area Provided	A _s =	0.131 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 =	13.0 in (ACI 12-1)	
Length Available	L _{d-sup} =	0 in	

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

Longitudinal Reinforcement Calculations:

Steel Req. based on Shrink	A _{s(2)} =	0.130 in ² (ACI 7.12)	
Controlling Reinf. Steel	A _{s(req)} =	0.130 in ²	
Required number of #4 bars =		0.66	
Selected Longitudinal Bars:		2 - Cont. #4 bars	
Reinforcement Area Provided	A _s =	0.393 in ²	→ OK

Roof LL or S =	19.3 psf
Roof DL =	17.5 psf
Roof Trib. Width =	24.0 ft
Wall DL =	12 psf
Wall Hgt. =	9 ft
Floor LL =	40.0 psf
Floor DL =	10.0 psf
Floor Trib. Width =	5.5 ft
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. =	6 in
ρ _{soil} =	100 pcf
Stem Width =	6 in
Stem Hgt. =	24 in
Footing Width =	12 in
Footing Depth =	6 in

Eff. Depth to Top Layer of Steel

d =	2.25 in
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Beam Shear Calculations (One Way Shear):

Unreinforced Concrete

V _u =	460 lbs
V _c =	2,103 lbs (ACI 22-9)
D _{req} =	1.3 in
D _{footing} =	6.0 in → OK

Bending Calculations:

Unreinforced Concrete

S =	32.0 in ³
M _u =	690 in-lb
M _n =	5,258 in-lb (ACI 22-2)
D _{req} =	0.8 in
D _{footing} =	6.0 in → OK

(Transverse Reinforcement Unnecessary)

λ =	1.0	(lightweight aggregate factor)
ψ _l =	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)

Overturing Calculations:

ASCE 7-10 Load Case 7: .6D + .6W

Overturing Moment	Mo =	26,250 ft-lb	
Dead Load of Wall	DLwall =	13,194 lbs	
Weight of Footing	Wfoot =	1,388 lbs	
Weight of Soil Overburden	Wsoil =	475 lbs	
Total Dead Load	DL =	15,057 lbs	
Resisting Moment	MR =	139,273 ft-lb	
Overturing Safety Factor	SF =	5.31 > 1.67	→ OK

Shearwall and Stemwall Data

Length of SWL =	18.0 ft
Height of SWL =	9.0 ft
Hgt. of Floor btw. FND and SWL =	12.0 in
Length of Footing =	18.5 ft
Shear (Vasd) =	2,100 lbs
Shear (Vult) =	3,500 lbs
Soil Friction Coef. =	0.25
Aftg =	18.5 ft ²
Sftg =	57.0 ft ³

Horizontal Sliding Calculations:

Friction Sliding Resistance	F =	3,764 lbs	→ OK
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Bearing Calculations with Lateral Load:

Total Dead Load w/o Soil	N =	14,582 lbs	
Eccentricity of Resultant	e =	1.80 ft	(Resultant is inside the kern of the footing)
Kern Limit (L/6)	kern =	3.08 ft	
Max. Bearing Pressure	SBPmax =	1,248 psf	
Min. Bearing Pressure	SBPmin =	328 psf	
SBP Increase per Geotech	Fg =	1.00	(This increase should only be taken based on a geotech soils report)
Eff. Allowable SBP	Qe =	1,475 psf	→ OK

Bearing Calculations with Lateral Load (Strength Design):

Ult. Overturing Moment	Mo =	43,750 ft-lb
Ult. Dead Load w/o Soil	N =	25,627 lbs
Eccentricity of Resultant	e =	1.71 ft
Ult. Bearing Pressure	SBPult =	2,152 psf

Strength Design Load Cases from ASCE 7-10:

4.) 1.2D + 1.0W + L + 0.5(Lr or S) = 1331.2 plf

(Resultant is inside the kern of the footing)

Beam Shear Calculations (One Way Shear):

Applied Beam Shear	Vu =	135 lbs
Allowable Beam Shear	Vc =	2,218 lbs (ACI 11-3)
Footing Depth Required	Dreq =	0.4 in
Footing Depth	Dfooting =	6.0 in → OK

Beam Shear Calculations (One Way Shear):

Unreinforced Concrete

Vu =	538 lbs
Vc =	2,103 lbs (ACI 22-9)
Dreq =	1.5 in
Dfooting =	6.0 in → OK

Bending Calculations:

	a =	0.26 in
Cantilever length	Lcant =	3.0 in
Factored Bending Moment	Mu =	807 in-lb
Moment Strength	Mn =	14,997 in-lb

Bending Calculations:

Unreinforced Concrete

S =	32.0 in ³
Mu =	807 in-lb
Mn =	5,258 in-lb (ACI 22-2)
Dreq =	0.9 in
Dfooting =	6.0 in → OK

Transverse Reinforcement Calculations:

Mu/φbd ²	Rn =	14.8 psi
Steel Ratio	ρ =	0.0002
Steel Req. based on Moment	As(1) =	0.007 in ²
Steel Req. based on Shrink	As(2) =	0.130 in ² (ACI 7.12)
Controlling Reinf. Steel	As(req) =	0.130 in ²
Required Spacing with # bars =		18.18 in o/c
Selected Transverse Spacing:	#4 bars @	18 in o/c
Reinforcement Area Provided	As =	0.131 in ² → OK

(Transverse Reinforcement Unnecessary)

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)

Development Length Calculations:

spacing/cover dimension	c =	3.0 in
Transverse Reinf. Factor	c + K _{tr} /d _b =	6 (use 2.5)
Length Req.	Ld =	13.0 in (ACI 12-1)
Length Available	Ld-sup =	0 in

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

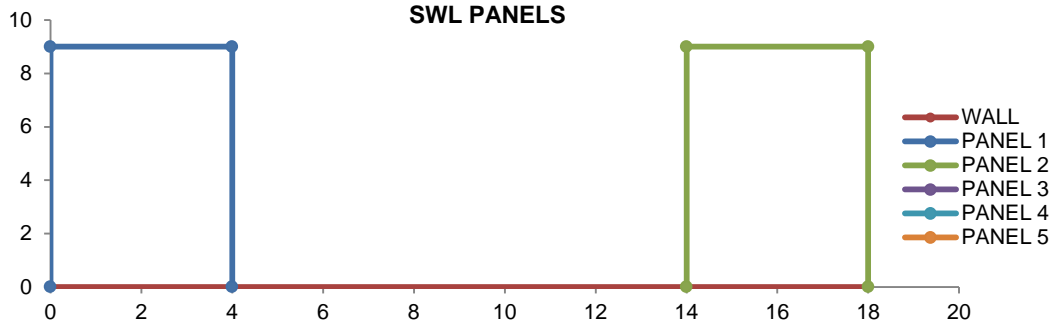
Longitudinal Reinforcement Calculations:

Steel Req. based on Shrink	As(2) =	0.130 in ² (ACI 7.12)
Controlling Reinf. Steel	As(req) =	0.130 in ²
Required number of # bars =		0.66
Selected Longitudinal Bars:		2 - Cont. #4 bars
Reinforcement Area Provided	As =	0.393 in ² → OK

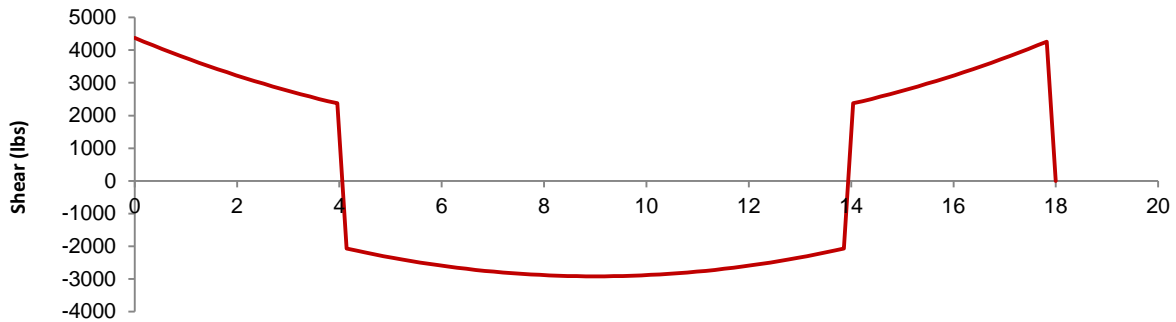
Shear Wall Panels for:		SWL1		[Strength]		[Strength]	
Panel #	a (ft)	b (ft)	Panel Width (ft)	Unit Shear (plf)	Height (ft)	Uplift (lbs)	
1	0	4	4.0	438	10	4,375	
2	14	18	4.0	438	10	4,375	
3			0.0	0	0	0	
4			0.0	0	0	0	
5			0.0	0	0	0	

Stemwall Loads	
Max. Shear =	4,375 lbs
Max. Moment Pos. =	14,463 ft-lbs
Max. Moment Neg. =	-13,973 ft-lbs
Max. Bearing =	3,959 psi
Min. Bearing =	1,366 psi

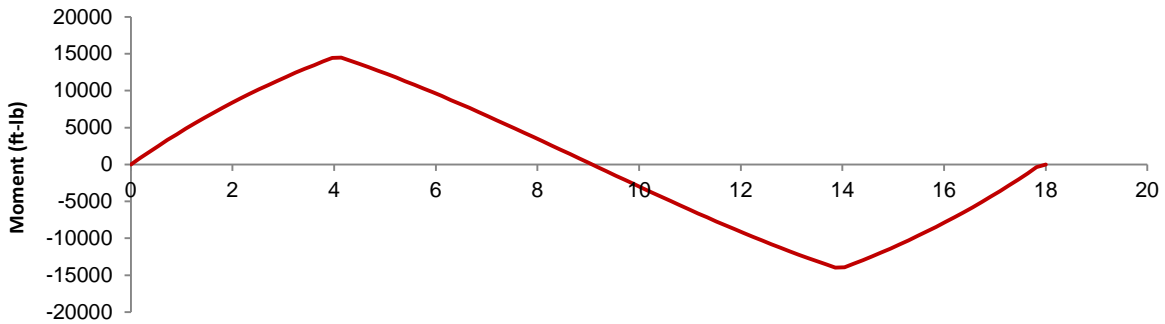
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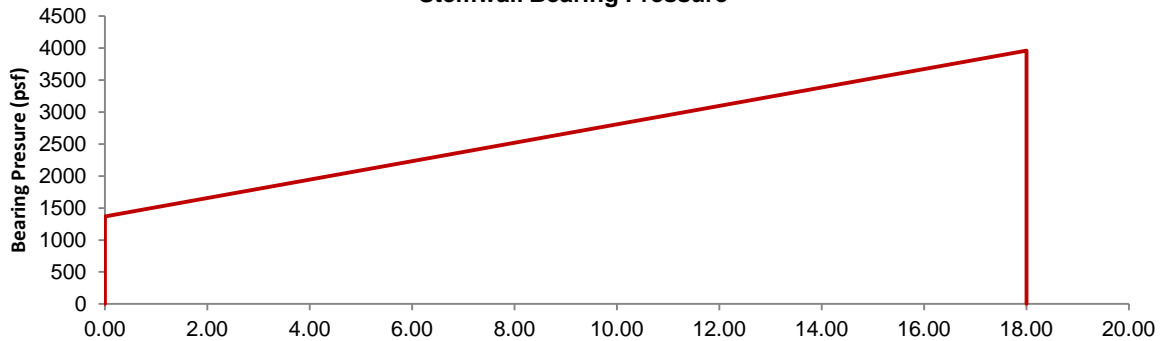
Stemwall Shear Diagram



Stemwall Moment Diagram



Stemwall Bearing Pressure



Stemwall Reinforced Concrete Beam Calculations:

The stemwall under shearwalls is designed with reinforcement top and bottom due to the transient and complex nature of the applied bending moments

Reinforcement Area Provided Top	As =	0.196 in ²	Reinf. Bar Size Top =	4
Reinforcement Area Provided Bottom	As =	0.196 in ²	Number of Top Bars =	1 - Cont. #4
			Reinf. Cover Top =	6 in

Bending Calculations Top:

Conc. Comp. Block	a =	0.77 in	Reinf. Bar Size Bottom =	4
Factored Bending Moment Neg.	Mu =	167,677 in-lb	Number of Bottom Bars =	1 - Cont. #4
Moment Strength	Mn =	184,119 in-lb	Reinf. Cover Bottom =	3 in

Reinforcement Calculations Top:

Mu/φbd ²	Rn =	98.6 psi	Stemwall Width =	6 in
Steel Ratio	ρ =	0.0017	Stemwall Height =	24 in
Steel Req. based on Moment	As(1) =	0.178 in ²	<u>Eff. Depth to Steel</u>	
Controlling Reinf. Steel	As(req) =	0.178 in ²	dtop =	17.75 in
Required number of #4 bars =		0.91	dbot =	20.75 in
Selected Top Longitudinal Bars:		1 - Cont. #4 bars		
Reinforcement Area Provided	As =	0.196 in ² → OK		

Bending Calculations Bottom:

Conc. Comp. Block	a =	0.77 in
Factored Bending Moment Pos.	Mu =	173,557 in-lb
Moment Strength	Mn =	215,928 in-lb

Reinforcement Calculations Bottom:

Mu/φbd ²	Rn =	72.1 psi
Steel Ratio	ρ =	0.0012
Steel Req. based on Moment	As(1) =	0.152 in ²
Controlling Reinf. Steel	As(req) =	0.152 in ²
Required number of #4 bars =		0.77
Selected Bottom Longitudinal Bars:		1 - Cont. #4 bars
Reinforcement Area Provided	As =	0.196 in ² → OK

Reinforcement Calculations Shrinkage and Temp.:

Steel Req. based on Shrink	As(2) =	0.259 in ² (ACI 7.12)
Total Reinforcement Area Provided	As =	0.393 in ² → OK

Beam Shear Calculations (One Way Shear):

Applied Beam Shear	Vu =	4,375 lbs
Allowable Beam Shear	Vc =	8,750 lbs (ACI 11-3) → OK
		(Shear Reinforcement not required)