

Stemwall Cont. Footing Calculator with Shearwall

SWLD

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	52.5	0	57.9
Wall	144	0	0
Floor	6.65	26.6	0
Stemwall	200	0	0
Totals	403.15	26.6	57.9

ASD Load Cases from ASCE 7-10:

- 2.) D + L = 429.75 plf
- 3.) D + (Lr or S) = 461.05 plf
- 4.) D + .75L + .75(Lr or S) = 466.525 plf (governs)

Bearing Calculations:

Applied Bearing Pressure	Q _{asd} =	254 psf	
Eff. Allowable SBP	Q _e =	1,255 psf	
Footing Width Required	W _{req} =	4.5 in	
Footing Width	W _{footing} =	22 in	→ OK

Strength Design Load Cases from ASCE 7-10:

- 1.) 1.4D = 564.41 plf
- 2.) 1.2D + 1.6L + .5(Lr or S) = 555.29 plf
- 3.) 1.2D + 1.6(Lr or S) + L = 603.02 plf (governs)

Beam Shear Calculations (One Way Shear):

Ult. Applied Bearing Pressure	Q _u =	329 psf	
Applied Beam Shear	V _u =	0 lbs	
Allowable Beam Shear	V _c =	7,949 lbs (ACI 11-3)	
Footing Depth Required	D _{req} =	0.0 in	
Footing Depth	D _{footing} =	12.0 in	→ OK

Bending Calculations:

Cantilever length	L _{cant} =	7.0 in	
Factored Bending Moment	M _u =	672 in-lb	
Moment Strength	M _n =	128,588 in-lb	

Transverse Reinforcement Calculations:

Mu/φbd ²	R _n =	1.0 psi	
Steel Ratio	ρ =	0.0000	
Steel Req. based on Moment	A _{s(1)} =	0.002 in ²	
Steel Req. based on Shrink	A _{s(2)} =	0.259 in ² (ACI 7.12)	
Controlling Reinf. Steel	A _{s(req)} =	0.259 in ²	
Required Spacing with #5 bars =		14.20 in o/c	
Selected Transverse Spacing:	#5 bars @	12 in o/c	
Reinforcement Area Provided	A _s =	0.307 in ²	→ OK

Development Length Calculations:

spacing/cover dimension	c =	3.0 in	
Transverse Reinf. Factor	c + K _{tr} /d _b =	4.8 (use 2.5)	
Length Req.	L _d =	13.9 in (ACI 12-1)	
Length Available	L _{d-sup} =	4 in	

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

Longitudinal Reinforcement Calculations:

Steel Req. based on Shrink	A _{s(2)} =	0.475 in ² (ACI 7.12)	
Controlling Reinf. Steel	A _{s(req)} =	0.475 in ²	
Required number of #5 bars =		1.55	
Selected Longitudinal Bars:		2 - Cont. #5 bars	
Reinforcement Area Provided	A _s =	0.614 in ²	→ OK

Roof LL or S =	19.3 psf
Roof DL =	17.5 psf
Roof Trib. Width =	3.0 ft
Wall DL =	12 psf
Wall Hgt. =	12 ft
Floor LL =	40.0 psf
Floor DL =	10.0 psf
Floor Trib. Width =	0.7 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 =	5
Soil Depth Above Ftg. =	18 in
ρ _{soil} =	100 pcf
Stem Width =	8 in
Stem Hgt. =	24 in
Footing Width =	22 in
Footing Depth =	12 in

Eff. Depth to Top Layer of Steel

d = 8.0625 in

Beam Shear Calculations (One Way Shear):

<u>Unreinforced Concrete</u>	
V _u =	192 lbs
V _c =	5,258 lbs (ACI 22-9)
D _{req} =	0.4 in
D _{footing} =	12.0 in → OK

Bending Calculations:

<u>Unreinforced Concrete</u>	
S =	200.0 in ³
M _u =	672 in-lb
M _n =	32,863 in-lb (ACI 22-2)
D _{req} =	0.2 in
D _{footing} =	12.0 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 =	56,625 ft-lb	
Dead Load of Wall	DLwall =	7,458 lbs	
Weight of Footing	Wfoot =	5,225 lbs	
Weight of Soil Overburden	Wsoil =	1,864 lbs	
Total Dead Load	DL =	14,547 lbs	
Resisting Moment	MR =	138,196 ft-lb	
Overturing Safety Factor	SF =	2.44 > 1.67	→ OK

Shearwall and Stemwall Data

Length of SWL =	18.5 ft
Height of SWL =	11.0 ft
Hgt. of Floor btw. FND and SWL =	12.0 in
Length of Footing =	19.0 ft
Shear (Vasd) =	3,775 lbs
Shear (Vult) =	6,292 lbs
Soil Friction Coef. =	0.25
Aftg =	34.8 ft ²
Sftg =	110.3 ft ³

Horizontal Sliding Calculations:

Friction Sliding Resistance	F =	3,637 lbs	→ NG
-----------------------------	-----	-----------	------

Bearing Calculations with Lateral Load:

Total Dead Load w/o Soil	N =	12,683 lbs	
Eccentricity of Resultant	e =	4.46 ft	(Resultant is outside the kern of the footing)
Kern Limit (L/6)	kern =	3.17 ft	
Max. Bearing Pressure	SBPmax =	916 psf	
Min. Bearing Pressure	SBPmin =	0 psf	
SBP Increase per Geotech	Fg =	1.00	(This increase should only be taken based on a geotech soils report)
Eff. Allowable SBP	Qe =	1,405 psf	→ OK

Bearing Calculations with Lateral Load (Strength Design):

Strength Design Load Cases from ASCE 7-10:

Ult. Overturing Moment	Mo =	94,375 ft-lb	4.) 1.2D + 1.0W + L + 0.5(Lr or S) =	539.33 plf
Ult. Dead Load w/o Soil	N =	16,248 lbs		
Eccentricity of Resultant	e =	5.81 ft	(Resultant is outside the kern of the footing)	
Ult. Bearing Pressure	SBPult =	1,601 psf		

Beam Shear Calculations (One Way Shear):

Applied Beam Shear	Vu =	0 lbs	
Allowable Beam Shear	Vc =	7,949 lbs (ACI 11-3)	
Footing Depth Required	Dreq =	0.0 in	
Footing Depth	Dfooting =	12.0 in	→ OK

Beam Shear Calculations (One Way Shear):

<u>Unreinforced Concrete</u>	
Vu =	934 lbs
Vc =	5,258 lbs (ACI 22-9)
Dreq =	2.1 in
Dfooting =	12.0 in → OK

Bending Calculations:

	a =	0.60 in
Cantilever length	Lcant =	7.0 in
Factored Bending Moment	Mu =	3,268 in-lb
Moment Strength	Mn =	128,588 in-lb

Bending Calculations:

<u>Unreinforced Concrete</u>	
S =	200.0 in ³
Mu =	3,268 in-lb
Mn =	32,863 in-lb (ACI 22-2)
Dreq =	1.2 in
Dfooting =	12.0 in → OK

Transverse Reinforcement Calculations:

Mu/φbd ²	Rn =	4.7 psi
Steel Ratio	ρ =	0.0001
Steel Req. based on Moment	As(1) =	0.008 in ²
Steel Req. based on Shrink	As(2) =	0.259 in ² (ACI 7.12)
Controlling Reinf. Steel	As(req) =	0.259 in ²
Required Spacing with # bars =		14.20 in o/c
Selected Transverse Spacing:	#5 bars @	12 in o/c
Reinforcement Area Provided	As =	0.307 in ² → 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)

Development Length Calculations:

spacing/cover dimension	c =	3.0 in
Transverse Reinf. Factor	c + K _{tr} /d _b =	4.8 (use 2.5)
Length Req.	Ld =	13.9 in (ACI 12-1)
Length Available	Ld-sup =	4 in

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

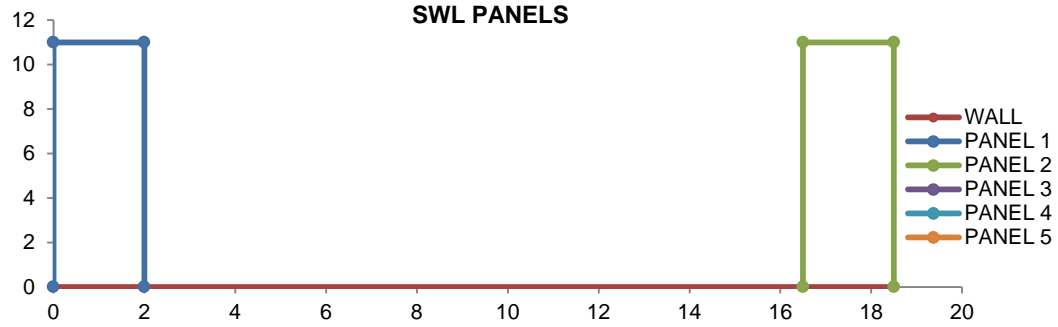
Longitudinal Reinforcement Calculations:

Steel Req. based on Shrink	As(2) =	0.475 in ² (ACI 7.12)
Controlling Reinf. Steel	As(req) =	0.475 in ²
Required number of # bars =		1.55
Selected Longitudinal Bars:		2 - Cont. #5 bars
Reinforcement Area Provided	As =	0.614 in ² → OK

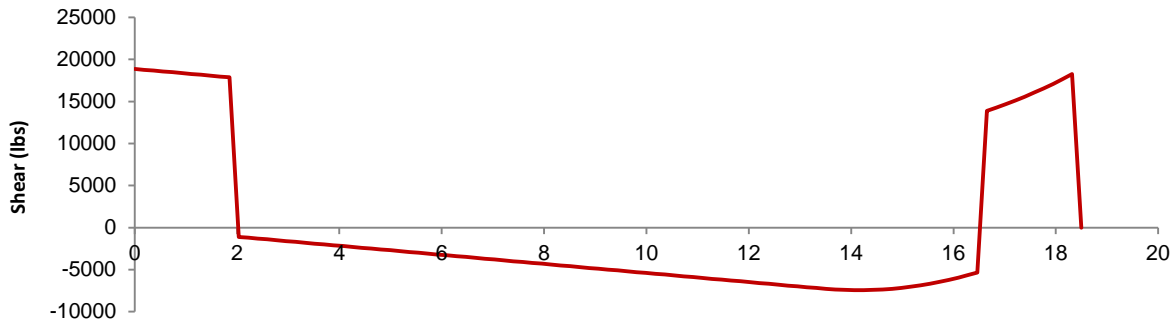
Shear Wall Panels for:		SWLD	[Strength]	[Strength]		
Panel #	a (ft)	b (ft)	Panel Width (ft)	Unit Shear (plf)	Height (ft)	Uplift (lbs)
1	0	2	2.0	1,573	12	18,875
2	16.5	18.5	2.0	1,573	12	18,875
3			0.0	0	0	0
4			0.0	0	0	0
5			0.0	0	0	0

Stemwall Loads	
Max. Shear =	18,875 lbs
Max. Moment Pos. =	38,430 ft-lbs
Max. Moment Neg. =	-35,526 ft-lbs
Max. Bearing =	5,928 psi
Min. Bearing =	0 psi

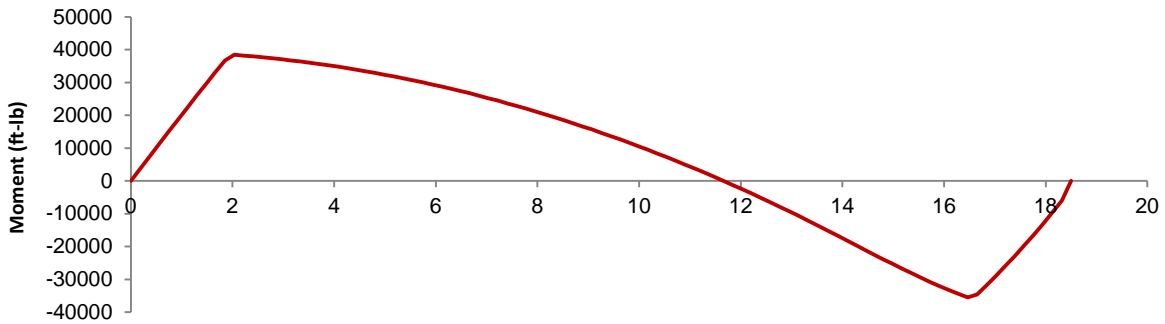
4.0



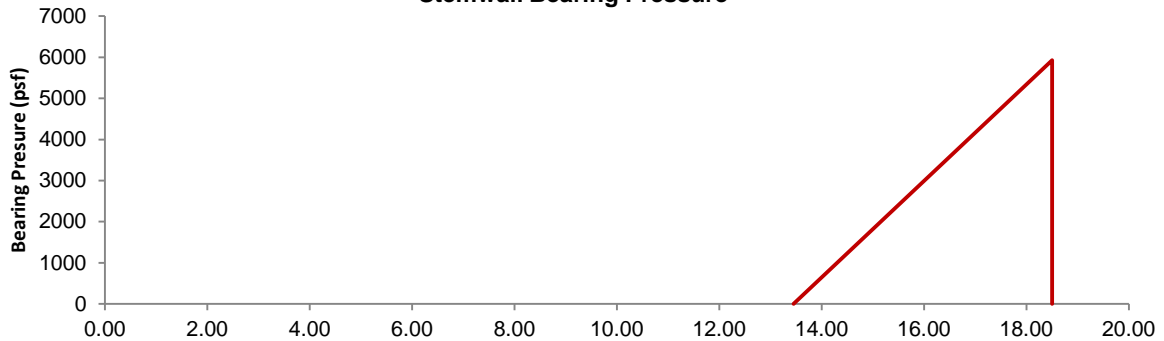
Stemwall Shear Diagram



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 =	0.614 in ²	Reinf. Bar Size Top =	5
Reinforcement Area Provided Bottom	As =	0.393 in ²	Number of Top Bars =	2 - Cont. #5
			Reinf. Cover Top =	6 in

Bending Calculations Top:

Conc. Comp. Block	a =	1.80 in	Reinf. Bar Size Bottom =	4
Factored Bending Moment Neg.	Mu =	426,309 in-lb	Number of Bottom Bars =	2 - Cont. #4
Moment Strength	Mn =	556,159 in-lb	Reinf. Cover Bottom =	3 in

Reinforcement Calculations Top:

Mu/φbd ²	Rn =	189.3 psi	Stemwall Width =	8 in
Steel Ratio	ρ =	0.0033	Stemwall Height =	24 in
Steel Req. based on Moment	As(1) =	0.464 in ²	<u>Eff. Depth to Steel</u>	
Controlling Reinf. Steel	As(req) =	0.464 in ²	dtop =	17.6875 in
Required number of #5 bars =		1.51	dbot =	20.75 in
Selected Top Longitudinal Bars:		2 - Cont. #5 bars		
Reinforcement Area Provided	As =	0.614 in ² → OK		

Bending Calculations Bottom:

Conc. Comp. Block	a =	1.15 in
Factored Bending Moment Pos.	Mu =	461,163 in-lb
Moment Strength	Mn =	427,773 in-lb

Reinforcement Calculations Bottom:

Mu/φbd ²	Rn =	137.5 psi
Steel Ratio	ρ =	0.0024
Steel Req. based on Moment	As(1) =	0.391 in ²
Controlling Reinf. Steel	As(req) =	0.391 in ²
Required number of #4 bars =		1.99
Selected Bottom Longitudinal Bars:		2 - Cont. #4 bars
Reinforcement Area Provided	As =	0.393 in ² → OK

Reinforcement Calculations Shrinkage and Temp.:

Steel Req. based on Shrink	As(2) =	0.346 in ² (ACI 7.12)
Total Reinforcement Area Provided	As =	1.006 in ² → OK

Beam Shear Calculations (One Way Shear):

Applied Beam Shear	Vu =	18,875 lbs
Allowable Beam Shear	Vc =	11,625 lbs (ACI 11-3) → NG

(Shear Reinforcement required at high shear locations)

Use #4 Vertical Bars @ 12" o/c for high shear locations.
--