SUPPLEMENTAL ANALYSIS
FOR:
MEI YOUNG
SITE:
8251 WEST MERCER WAY
MERCER ISLAND, WA 98040

ORIGINAL STAMP
MUST BE RED
TO BE VALID

DATE:	PLAN NUMBER:		PHILLIPS STRUCTURAL ENGINEERING, PLLC	
OCT. 30, 2018	WEN HU RESIDENCE		P.O. BOX 108, MILTON, WA 98354 Phone (253) 344-1666	

FOOTINGS LARGER THAN 9 ft

$A_s = 0.0018 \times b \times h$

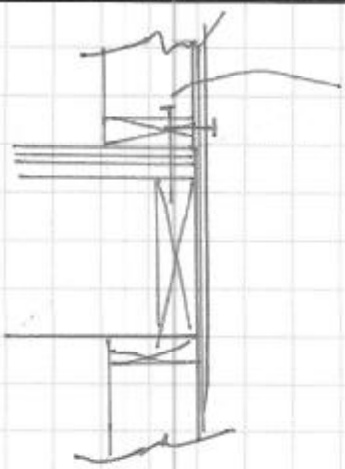
			1500 psf CAP
42" x 42" x 16"	= 1.2 in²	(6) #4 EW	18"
48" x 48" x 18"	= 1.56 in²	(8) #4 EW	24"
60" x 60" x 22"	= 2.4 in²	(8) #5 EW	37"
66" x 66" x 24"	= 2.9 in²	(9) #5 EW	45"

@ 60" FTG $P_{max} = 37^k$ $f_{c,brg} = 37^k / (8\frac{1}{4} \times 7\frac{1}{2}) + (2\frac{3}{4} \times 5\frac{1}{2})$
$= 611 psi = .24 f'_c$ OK

@ 66" FTG $P_{max} = 41^k$ $f_{c,brg} = 41^k /$ SAME AS 60"
$= 677 psi = .27 f'_c$ OK

MAX BRG $\phi(.85 f'_c) = .65(.85) f'_c < .55 f'_c$

OK DUE TO ULT STRENGTH FACTOR < 2.0



12d = 0.148" ϕ x 3¼"
16d = 0.162" ϕ x 3½"

p = 3¼ - ¾" - 1½" = 1" = 6.8ϕ
3½ - ¾" - 1½" = 1¼" = 7.7ϕ

$Z'_{12d} = 118^{\#} \times 1.6 \times \frac{1"}{10(.148)} = 128^{\#}$

$Z'_{16d} = 154^{\#} \times 1.6 \times \frac{1\frac{1}{4}}{10(.162)} = 196^{\#}$

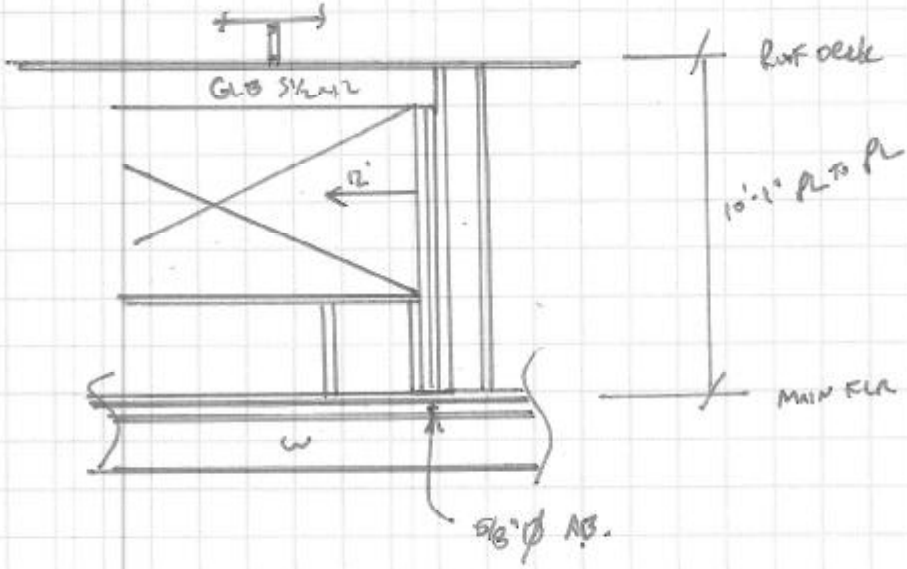
Max Load		w(plf)	12d (5)	16d (5)	
		365	4"	6"	
	SW4	532	2½"	4"	
575PLF	SW3	689	–	3"/3"	(5% O.S. OK)
443PLF	SW2	895	–	2½"	(17% O.S. OK) ✓
	OW4	1065	–	(2) @ 4" o.c. & LTP @ 12" o.c.	✓
	OW3	1370	–	(2) @ 4" o.c. & LTP4 @ 16" o.c.	✓
	OW2	1790	–	(2) @ 4" o.c. & LTP4 @ 12" o.c.	

(2) 16d @ 4" o.c. Cap = 1140#
LTP4 @ 16" o.c. Cap = 625# (12/16) = 469#

1608#

Max Load = 895# ✓

JAMB OVER STL BM.



$P_{WIND\ CALC} = 15PSF$ OR $15 \times \left(\frac{12'}{2} + \frac{1.75'}{2}\right)$

$= 100 PLF$

$M = 1270^{FTH}$

$RXN = 504^{\#}$

$f_b = \frac{15250^{in\#}}{3(7.53)} = 672 psi$ ✓

↳ (1) 5/8" Ø AB $Z_{\perp}' = 470^{\#} \times 1.6$

$= 752^{\#}$ (FOS = 1.5)

CONSIDER TYP WALL UNIF. LOAD

$RXN = 10.08'/2 \times 15PLF = 76 plf$

$\times 32"/12$

$202^{\#}/BOLT$ ✓

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License : KW-06061509
License To : Phillips Structural Engineering

Cantilevered Retaining Wall

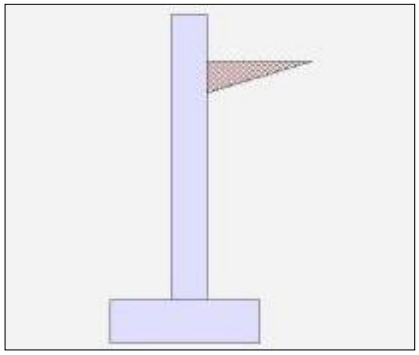
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.72	OK
Sliding	=	1.60	OK
Total Bearing Load	=	2,622 lbs	
...resultant ecc.	=	2.57 in	
Soil Pressure @ Toe	=	1,341 psf	OK
Soil Pressure @ Heel	=	506 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,877 psf	
ACI Factored @ Heel	=	708 psf	
Footing Shear @ Toe	=	9.7 psi	OK
Footing Shear @ Heel	=	8.1 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	612.6 lbs	
less 100% Passive Force	= -	20.0 lbs	
less 100% Friction Force	= -	998.7 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	16.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.285**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	700.0
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	1,166.7
Moment.....Allowable =	4,099.3
Service Level psi =	
Strength Level psi =	9.3
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0437 in2/ft	
(4/3) * As :	0.0583 in2/ft	Min Stem T&S Reinf Area 1.152 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1344 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.15 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.17 ft
Heel Width	=	1.67
Total Footing Width	=	2.84
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,877	708 psf
Mu' : Upward	=	1,175	0 ft-#
Mu' : Downward	=	113	415 ft-#
Mu: Design	=	1,062	415 ft-#
Actual 1-Way Shear	=	9.69	8.12 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.67 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	612.6	1.97	1,208.2	Soil Over Heel	=	551.8	2.34	1,290.4
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	1.50	541.2
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	1.50	1,082.4
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		612.6	**O.T.M.**	1,208.2	Stem Weight(s)	=	600.0	1.50	902.0
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	390.5	1.42	554.5
					Key Weight	=			
					Vert. Component	=			
					Total =		1,902.3 lbs	**R.M.=**	3,288.1

Resisting/Overturning Ratio = 2.72
Vertical Loads used for Soil Pressure = 2,622.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.079	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

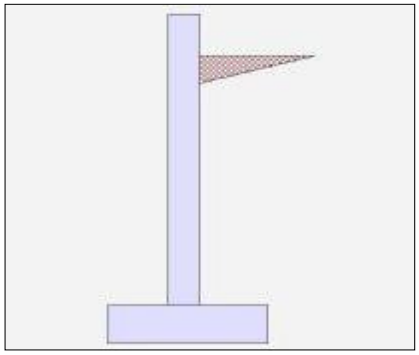
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.76	OK
Sliding	=	1.56	OK
Total Bearing Load	=	3,253 lbs	
...resultant ecc.	=	4.03 in	
Soil Pressure @ Toe	=	1,465 psf	OK
Soil Pressure @ Heel	=	394 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,052 psf	
ACI Factored @ Heel	=	551 psf	
Footing Shear @ Toe	=	13.6 psi	OK
Footing Shear @ Heel	=	1.2 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	837.2 lbs	
less 100% Passive Force	= -	20.0 lbs	
less 100% Friction Force	= -	1,330.1 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	16.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.492**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,008.0
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	2,016.0
Moment.....Allowable =	4,099.3
Service Level psi =	
Strength Level psi =	13.4
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0755 in2/ft	
(4/3) * As :	0.1007 in2/ft	Min Stem T&S Reinf Area 1.344 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1344 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.15 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.33 ft
Heel Width	=	2.17
Total Footing Width	=	3.50
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,052	551 psf
Mu' : Upward	=	1,646	866 ft-#
Mu' : Downward	=	146	1,081 ft-#
Mu: Design	=	1,500	216 ft-#
Actual 1-Way Shear	=	13.59	1.23 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.83 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure =	837.2	2.31	1,930.2	Soil Over Heel =	992.2	2.75	2,726.9
Surcharge over Heel =				Sloped Soil Over Heel =			
Surcharge Over Toe =				Surcharge Over Heel =			
Adjacent Footing Load =				Adjacent Footing Load =			
Added Lateral Load =				Axial Dead Load on Stem =	360.0	1.66	598.8
Load @ Stem Above Soil =				* Axial Live Load on Stem =	720.0	1.66	1,197.6
=				Soil Over Toe =			
				Surcharge Over Toe =			
Total	837.2	**O.T.M.**	1,930.2	Stem Weight(s) =	700.0	1.66	1,164.3
=		=		Earth @ Stem Transitions =			
				Footing Weight =	481.3	1.75	842.2
				Key Weight =			
				Vert. Component =			
				Total =	2,533.5 lbs	**R.M.=**	5,332.2

Resisting/Overturning Ratio = 2.76
Vertical Loads used for Soil Pressure = 3,253.5 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.081	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

This Wall in File: C:\Phillips Structural Engineering\DESIGN\RETAINING WALLS\cantilevered wall ~ dir

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License To : Phillips Structural Engineering

Cantilevered Retaining Wall

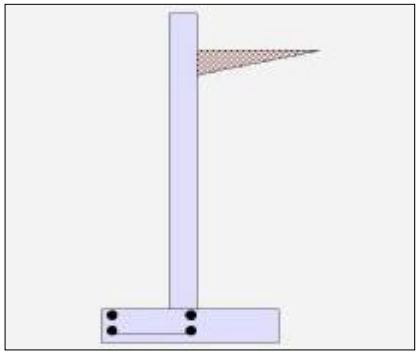
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	3.03	OK
Sliding	=	1.56	OK
Total Bearing Load	=	4,019 lbs	
...resultant ecc.	=	4.20 in	
Soil Pressure @ Toe	=	1,374 psf	OK
Soil Pressure @ Heel	=	478 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,923 psf	
ACI Factored @ Heel	=	670 psf	
Footing Shear @ Toe	=	18.7 psi	OK
Footing Shear @ Heel	=	2.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,096.8 lbs	
less 100% Passive Force	= -	20.0 lbs	
less 100% Friction Force	= -	1,732.1 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	14.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.686**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,372.0
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	3,201.3
Moment.....Allowable =	4,665.4
Service Level psi =	
Strength Level psi =	18.3
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1199 in2/ft	
(4/3) * As :	0.1599 in2/ft	Min Stem T&S Reinf Area 1.536 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1599 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.1714 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.67 ft
Heel Width	=	2.67
Total Footing Width	=	4.34
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,923	670 psf
Mu' : Upward	=	2,458	1,731 ft-#
Mu' : Downward	=	230	2,185 ft-#
Mu: Design	=	2,228	454 ft-#
Actual 1-Way Shear	=	18.66	2.55 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 10.10 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 10.10 in, #5@ 15.66 in, #6@ 22.22 in, #7@ 30.30 in, #8@ 39.90 in, #9@ 5
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.03 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	1,096.8	2.64	2,894.3	Soil Over Heel	=	1,542.6	3.34	5,149.6
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.00	721.2
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.00	1,442.4
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,096.8	**O.T.M.**	2,894.3	Stem Weight(s)	=	800.0	2.00	1,602.7
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	596.8	2.17	1,294.9
					Key Weight	=			
					Vert. Component	=			
					Total =		3,299.3 lbs	**R.M.=**	8,768.4

Resisting/Overturning Ratio = 3.03
Vertical Loads used for Soil Pressure = 4,019.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.070	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

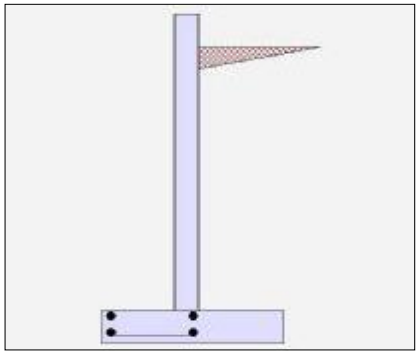
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.98	OK
Sliding	=	1.50	OK
Total Bearing Load	=	4,783 lbs	
...resultant ecc.	=	4.63 in	
Soil Pressure @ Toe	=	1,399 psf	OK
Soil Pressure @ Heel	=	514 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,959 psf	
ACI Factored @ Heel	=	720 psf	
Footing Shear @ Toe	=	20.5 psi	OK
Footing Shear @ Heel	=	4.7 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,417.5 lbs	
less 100% Passive Force	= -	0.0 lbs	
less 100% Friction Force	= -	2,133.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	10.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.742**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,792.0
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	4,778.7
Moment.....Allowable =	6,444.1
Service Level psi =	
Strength Level psi =	23.9
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.179 in2/ft	
(4/3) * As :	0.2387 in2/ft	Min Stem T&S Reinf Area 1.728 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2387 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.24 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.00 ft
Heel Width	=	3.00
Total Footing Width	=	5.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,959	720 psf
Mu' : Upward	=	3,588	2,484 ft-#
Mu' : Downward	=	360	3,365 ft-#
Mu: Design	=	3,228	881 ft-#
Actual 1-Way Shear	=	20.50	4.65 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.30 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	1,417.5	3.00	4,252.5	Soil Over Heel	=	2,053.3	3.83	7,871.1
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.33	840.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.33	1,680.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,417.5	**O.T.M.**	4,252.5	Stem Weight(s)	=	900.0	2.33	2,100.0
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	750.0	2.50	1,875.0
					Key Weight	=			
					Vert. Component	=			
					Total =		4,063.3 lbs	**R.M.=**	12,686.1

Resisting/Overturning Ratio = 2.98
Vertical Loads used for Soil Pressure = 4,783.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.070	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

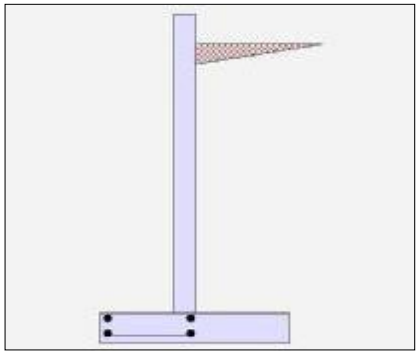
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	3.11	OK
Sliding	=	1.51	OK
Total Bearing Load	=	5,748 lbs	
...resultant ecc.	=	4.91 in	
Soil Pressure @ Toe	=	1,426 psf	OK
Soil Pressure @ Heel	=	573 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,996 psf	
ACI Factored @ Heel	=	802 psf	
Footing Shear @ Toe	=	25.0 psi	OK
Footing Shear @ Heel	=	6.7 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,750.0 lbs	
less 100% Passive Force	= -	0.0 lbs	
less 100% Friction Force	= -	2,639.4 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	11.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.772**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	2,268.0
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	6,804.0
Moment.....Allowable =	8,809.0
Service Level psi =	
Strength Level psi =	30.5
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.19
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.2576 in2/ft	
(4/3) * As :	0.3435 in2/ft	Min Stem T&S Reinf Area 1.920 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2576 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.3382 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.25 ft
Heel Width	=	3.50
Total Footing Width	=	5.75
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,996	802 psf
Mu' : Upward	=	4,659	4,008 ft-#
Mu' : Downward	=	456	5,491 ft-#
Mu: Design	=	4,203	1,483 ft-#
Actual 1-Way Shear	=	25.03	6.74 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 11.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.49 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,750.0	3.33	5,833.3	Soil Over Heel	=	2,805.0	4.33	12,155.0
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.58	930.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.58	1,860.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,750.0	**O.T.M.**	5,833.3	Stem Weight(s)	=	1,000.0	2.58	2,583.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	862.5	2.88	2,479.7
					Key Weight	=			
					Vert. Component	=			
					Total =		5,027.5 lbs	**R.M.=**	18,148.0

Resisting/Overturning Ratio = 3.11
Vertical Loads used for Soil Pressure = 5,747.5 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.069	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

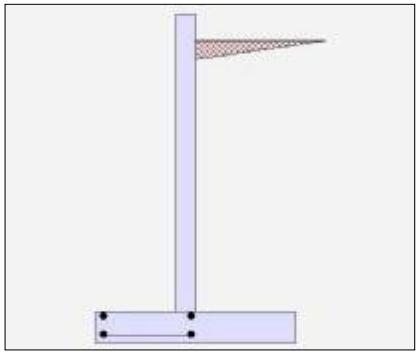
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	10.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	3.28	OK
Sliding	=	1.53	OK
Total Bearing Load	=	7,014 lbs	
...resultant ecc.	=	4.67 in	
Soil Pressure @ Toe	=	1,420 psf	OK
Soil Pressure @ Heel	=	684 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,987 psf	
ACI Factored @ Heel	=	957 psf	
Footing Shear @ Toe	=	23.3 psi	OK
Footing Shear @ Heel	=	7.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,182.2 lbs	
less 100% Passive Force	= -	45.1 lbs	
less 100% Friction Force	= -	3,304.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	10.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.970**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	2,800.0
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	9,333.3
Moment.....Allowable =	9,623.1
Service Level psi =	
Strength Level psi =	37.7
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.19
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.3534 in2/ft	
(4/3) * As :	0.4712 in2/ft	Min Stem T&S Reinf Area 2.112 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.3534 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.372 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.67 ft
Heel Width	=	4.00
Total Footing Width	=	6.67
Footing Thickness	=	14.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,987	957 psf
Mu' : Upward	=	6,594	6,270 ft-#
Mu' : Downward	=	749	8,500 ft-#
Mu: Design	=	5,845	2,230 ft-#
Actual 1-Way Shear	=	23.34	7.62 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 10.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.94 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.81 in, #8@ 31.35 in, #9@ 39
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 2.02 in2
Min footing T&S reinf Area per foot 0.30 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,182.2	3.72	8,122.5	Soil Over Heel	=	3,666.7	5.00	18,345.6
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	3.00	1,081.2
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	3.00	2,162.4
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		2,182.2	**O.T.M.**	8,122.5	Stem Weight(s)	=	1,100.0	3.00	3,303.7
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	1,167.3	3.34	3,892.8
					Key Weight	=			
					Vert. Component	=			
					Total =		6,293.9 lbs	**R.M.=**	26,623.2

Resisting/Overturning Ratio = 3.28
Vertical Loads used for Soil Pressure = 7,013.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.065	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

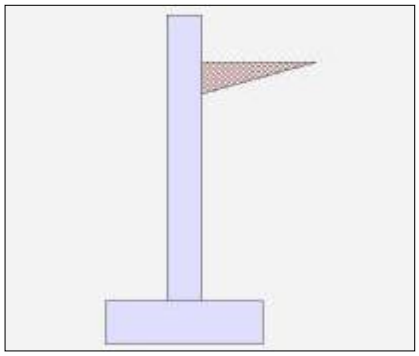
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.60	OK
Sliding	=	1.54	OK
Total Bearing Load	=	2,779 lbs	
...resultant ecc.	=	3.43 in	
Soil Pressure @ Toe	=	1,456 psf	OK
Soil Pressure @ Heel	=	396 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,039 psf	
ACI Factored @ Heel	=	555 psf	
Footing Shear @ Toe	=	10.5 psi	OK
Footing Shear @ Heel	=	0.5 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	687.9 lbs	
less 100% Passive Force	= -	20.0 lbs	
less 100% Friction Force	= -	1,080.9 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	16.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.347**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	801.8
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	1,421.2
Moment.....Allowable =	4,099.3
Service Level psi =	
Strength Level psi =	10.7
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0532 in2/ft	
(4/3) * As :	0.071 in2/ft	Min Stem T&S Reinf Area 1.152 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1344 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.15 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.17 ft
Heel Width	=	1.83
Total Footing Width	=	3.00
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,039	555 psf
Mu' : Upward	=	1,263	505 ft-#
Mu' : Downward	=	113	602 ft-#
Mu: Design	=	1,151	96 ft-#
Actual 1-Way Shear	=	10.53	0.53 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.71 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	612.6	1.97	1,208.2	Soil Over Heel	= 639.8	2.42	1,547.3
Surcharge over Heel	=	75.3	2.96	222.8	Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	= 46.5	2.42	112.5
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	= 360.0	1.50	541.2
Load @ Stem Above Soil	=				* Axial Live Load on Stem	= 720.0	1.50	1,082.4
	=				Soil Over Toe	=		
					Surcharge Over Toe	=		
Total		687.9	**O.T.M.**	1,431.0	Stem Weight(s)	= 600.0	1.50	902.0
	=		=		Earth @ Stem Transitions	=		
					Footing Weight	= 412.5	1.50	618.8
					Key Weight	=		
					Vert. Component	=		
					Total =	2,058.9 lbs	**R.M.=**	3,721.8

Resisting/Overturning Ratio = 2.60
Vertical Loads used for Soil Pressure = 2,778.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.081	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

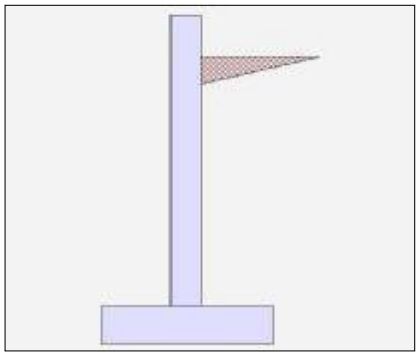
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.77	OK
Sliding	=	1.50	OK
Total Bearing Load	=	3,404 lbs	
...resultant ecc.	=	3.91 in	
Soil Pressure @ Toe	=	1,381 psf	OK
Soil Pressure @ Heel	=	435 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,933 psf	
ACI Factored @ Heel	=	609 psf	
Footing Shear @ Toe	=	15.7 psi	OK
Footing Shear @ Heel	=	2.1 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	925.2 lbs	
less 100% Passive Force	= -	20.0 lbs	
less 100% Friction Force	= -	1,409.1 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	16.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.581**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,130.2
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	2,382.5
Moment.....Allowable =	4,099.3
Service Level psi =	
Strength Level psi =	15.1
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0893 in2/ft		
(4/3) * As :	0.119 in2/ft	Min Stem T&S Reinf Area 1.344 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1344 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.15 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.50 ft
Heel Width	=	2.25
Total Footing Width	=	3.75
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,933	609 psf
Mu' : Upward	=	1,976	997 ft-#
Mu' : Downward	=	186	1,280 ft-#
Mu: Design	=	1,790	283 ft-#
Actual 1-Way Shear	=	15.68	2.06 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.89 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	837.2	2.31	1,930.2	Soil Over Heel	=	1,045.0	2.96	3,091.5
Surcharge over Heel	=	88.0	3.46	304.4	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	63.3	2.96	187.4
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	1.83	660.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	1.83	1,320.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		925.2	**O.T.M.**	2,234.7	Stem Weight(s)	=	700.0	1.83	1,283.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	515.6	1.88	966.8
					Key Weight	=			
					Vert. Component	=			
					Total =		2,684.0 lbs	**R.M.=**	6,188.9

Resisting/Overturning Ratio = 2.77
Vertical Loads used for Soil Pressure = 3,404.0 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.072	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

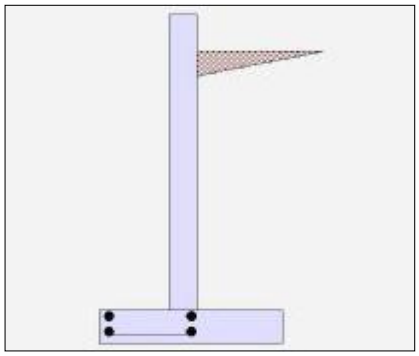
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.93	OK
Sliding	=	1.50	OK
Total Bearing Load	=	4,186 lbs	
...resultant ecc.	=	4.49 in	
Soil Pressure @ Toe	=	1,395 psf	OK
Soil Pressure @ Heel	=	466 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,953 psf	
ACI Factored @ Heel	=	652 psf	
Footing Shear @ Toe	=	20.3 psi	OK
Footing Shear @ Heel	=	4.1 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,197.5 lbs	
less 100% Passive Force	= -	20.0 lbs	
less 100% Friction Force	= -	1,819.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	12.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.684**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,514.5
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	3,700.2
Moment.....Allowable =	5,412.6
Service Level psi =	
Strength Level psi =	20.2
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1386 in2/ft	
(4/3) * As :	0.1848 in2/ft	Min Stem T&S Reinf Area 1.536 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1848 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.75 ft
Heel Width	=	2.75
Total Footing Width	=	4.50
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,953	652 psf
Mu' : Upward	=	2,732	1,851 ft-#
Mu' : Downward	=	253	2,502 ft-#
Mu: Design	=	2,479	651 ft-#
Actual 1-Way Shear	=	20.31	4.08 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 10.10 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 10.10 in, #5@ 15.66 in, #6@ 22.22 in, #7@ 30.30 in, #8@ 39.90 in, #9@ 5
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.07 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,096.8	2.64	2,894.3	Soil Over Heel	=	1,604.2	3.46	5,547.7
Surcharge over Heel	=	100.8	3.96	398.8	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	83.3	3.46	288.2
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.08	750.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.08	1,500.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,197.5	**O.T.M.**	3,293.1	Stem Weight(s)	=	800.0	2.08	1,666.7
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	618.8	2.25	1,392.2
					Key Weight	=			
					Vert. Component	=			
					Total =		3,466.3 lbs	**R.M.=**	9,644.8

Resisting/Overturning Ratio = 2.93
Vertical Loads used for Soil Pressure = 4,186.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.069	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

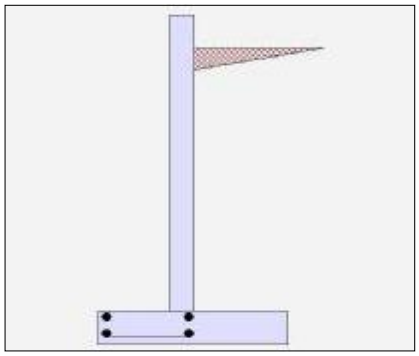
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	3.02	OK
Sliding	=	1.52	OK
Total Bearing Load	=	5,144 lbs	
...resultant ecc.	=	5.08 in	
Soil Pressure @ Toe	=	1,454 psf	OK
Soil Pressure @ Heel	=	506 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,035 psf	
ACI Factored @ Heel	=	708 psf	
Footing Shear @ Toe	=	21.4 psi	OK
Footing Shear @ Heel	=	6.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,532.0 lbs	
less 100% Passive Force	= -	0.0 lbs	
less 100% Friction Force	= -	2,322.7 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	9.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.762**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,954.9
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	5,430.3
Moment.....Allowable =	7,122.4
Service Level psi =	
Strength Level psi =	26.1
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2035 in2/ft		
(4/3) * As :	0.2713 in2/ft	Min Stem T&S Reinf Area 1.728 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.25 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2667 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.00 ft
Heel Width	=	3.25
Total Footing Width	=	5.25
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,035	708 psf
Mu' : Upward	=	3,733	3,090 ft-#
Mu' : Downward	=	360	4,338 ft-#
Mu: Design	=	3,373	1,248 ft-#
Actual 1-Way Shear	=	21.43	6.01 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.36 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	1,417.5	3.00	4,252.5	Soil Over Heel	=	2,273.3	3.96	8,998.6
Surcharge over Heel	=	114.5	4.50	515.5	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	103.3	3.96	409.0
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.33	840.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.33	1,680.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,532.0	**O.T.M.**	4,768.0	Stem Weight(s)	=	900.0	2.33	2,100.0
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	787.5	2.63	2,067.2
					Key Weight	=			
					Vert. Component	=			
					Total =		4,424.2 lbs	**R.M.=**	14,414.8

Resisting/Overturning Ratio = 3.02
Vertical Loads used for Soil Pressure = 5,144.2 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.069	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

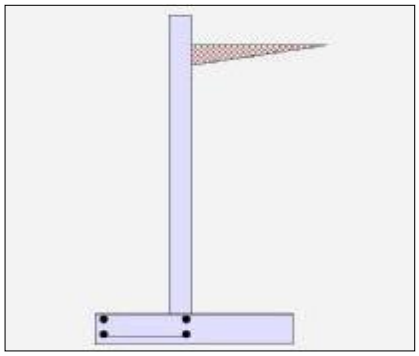
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	3.15	OK
Sliding	=	1.52	OK
Total Bearing Load	=	6,156 lbs	
...resultant ecc.	=	5.27 in	
Soil Pressure @ Toe	=	1,477 psf	OK
Soil Pressure @ Heel	=	575 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,068 psf	
ACI Factored @ Heel	=	805 psf	
Footing Shear @ Toe	=	26.1 psi	OK
Footing Shear @ Heel	=	8.2 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,877.3 lbs	
less 100% Passive Force	= -	0.0 lbs	
less 100% Friction Force	= -	2,853.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	11.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.866**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	2,451.3
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	7,628.7
Moment.....Allowable =	8,809.0
Service Level psi =	
Strength Level psi =	33.0
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.19
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.2889 in2/ft	
(4/3) * As :	0.3852 in2/ft	Min Stem T&S Reinf Area 1.920 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.2889 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.3382 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.25 ft
Heel Width	=	3.75
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,068	805 psf
Mu' : Upward	=	4,834	4,855 ft-#
Mu' : Downward	=	456	6,807 ft-#
Mu: Design	=	4,378	1,952 ft-#
Actual 1-Way Shear	=	26.08	8.18 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 11.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.56 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,750.0	3.33	5,833.3	Soil Over Heel	=	3,052.5	4.46	13,609.1
Surcharge over Heel	=	127.3	5.00	636.4	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	123.3	4.46	549.9
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.58	930.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.58	1,860.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,877.3	**O.T.M.**	6,469.7	Stem Weight(s)	=	1,000.0	2.58	2,583.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=			
					Vert. Component	=			
					Total =		5,435.8 lbs	**R.M.=**	20,372.3

Resisting/Overturning Ratio = 3.15
Vertical Loads used for Soil Pressure = 6,155.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.068	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

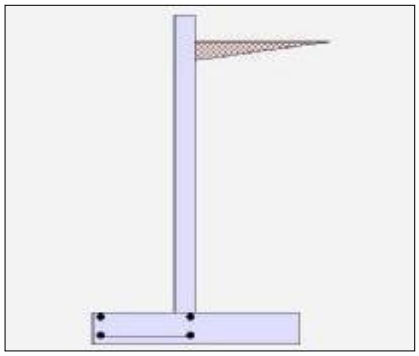
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	10.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	3.29	OK
Sliding	=	1.52	OK
Total Bearing Load	=	7,385 lbs	
...resultant ecc.	=	4.74 in	
Soil Pressure @ Toe	=	1,432 psf	OK
Soil Pressure @ Heel	=	702 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,005 psf	
ACI Factored @ Heel	=	983 psf	
Footing Shear @ Toe	=	24.7 psi	OK
Footing Shear @ Heel	=	8.9 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,324.3 lbs	
less 100% Passive Force	= -	45.1 lbs	
less 100% Friction Force	= -	3,499.0 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	8.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.877**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	3,003.6
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	10,351.5
Moment.....Allowable =	11,799.2
Service Level psi =	
Strength Level psi =	40.5
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.19
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.392 in2/ft		
(4/3) * As :	0.5226 in2/ft	Min Stem T&S Reinf Area 2.112 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.392 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.465 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.75 ft
Heel Width	=	4.17
Total Footing Width	=	6.92
Footing Thickness	=	14.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,005	983 psf
Mu' : Upward	=	7,070	7,090 ft-#
Mu' : Downward	=	794	9,782 ft-#
Mu: Design	=	6,276	2,692 ft-#
Actual 1-Way Shear	=	24.65	8.95 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.94 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.81 in, #8@ 31.35 in, #9@ 39
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 2.09 in2
Min footing T&S reinf Area per foot 0.30 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,182.2	3.72	8,122.5	Soil Over Heel	=	3,853.7	5.17	19,917.0
Surcharge over Heel	=	142.1	5.58	793.5	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	140.1	5.17	724.3
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	3.08	1,110.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	3.08	2,220.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		2,324.3	**O.T.M.**	8,916.0	Stem Weight(s)	=	1,100.0	3.08	3,391.7
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	1,211.0	3.46	4,190.1
					Key Weight	=			
					Vert. Component	=			
					Total =		6,664.8 lbs	**R.M.=**	29,333.0

Resisting/Overturning Ratio = 3.29
Vertical Loads used for Soil Pressure = 7,384.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.063	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

This Wall in File: C:\Phillips Structural Engineering\DESIGN\RETAINING WALLS\cantilevered wall ~ sla

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Cantilevered Retaining Wall

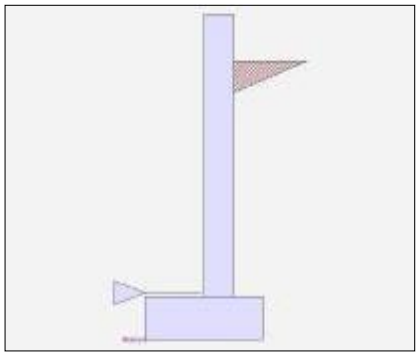
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	40.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	2.09	OK
Slab Resists All Sliding !			
Total Bearing Load	=	2,490 lbs	
...resultant ecc.	=	2.48 in	
Soil Pressure @ Toe	=	1,373 psf	OK
Soil Pressure @ Heel	=	499 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,923 psf	
ACI Factored @ Heel	=	699 psf	
Footing Shear @ Toe	=	12.0 psi	OK
Footing Shear @ Heel	=	0.2 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	687.9 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	16.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.347**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	801.8
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	1,421.2
Moment.....Allowable =	4,099.3
Service Level psi =	
Strength Level psi =	10.7
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0532 in2/ft	
(4/3) * As :	0.071 in2/ft	Min Stem T&S Reinf Area 1.152 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1344 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.15 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.33 ft
Heel Width	=	1.33
Total Footing Width	=	2.66
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,923	699 psf
Mu' : Upward	=	1,520	176 ft-#
Mu' : Downward	=	203	196 ft-#
Mu: Design	=	1,318	20 ft-#
Actual 1-Way Shear	=	12.00	0.25 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.63 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	612.6	1.97	1,208.2	Soil Over Heel	= 364.8	2.33	849.5
Surcharge over Heel	=	75.3	2.96	222.8	Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	= 26.5	2.33	61.8
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	= 360.0	1.66	598.8
Load @ Stem Above Soil	=				* Axial Live Load on Stem	= 720.0	1.66	1,197.6
	=				Soil Over Toe	=		
					Surcharge Over Toe	=		
Total		687.9	**O.T.M.**	1,431.0	Stem Weight(s)	= 600.0	1.66	998.0
	=		=		Earth @ Stem Transitions	=		
					Footing Weight	= 365.8	1.33	486.4
					Key Weight	=		
					Vert. Component	=		
					Total =	1,717.1 lbs	**R.M.=**	2,994.5

Resisting/Overturning Ratio = 2.09
Vertical Loads used for Soil Pressure = 2,490.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.086	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

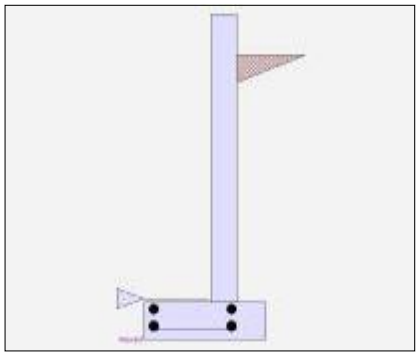
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.96 OK
Slab Resists All Sliding !		
Total Bearing Load	=	2,743 lbs
...resultant ecc.	=	3.11 in
Soil Pressure @ Toe	=	1,290 psf OK
Soil Pressure @ Heel	=	441 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,805 psf
ACI Factored @ Heel	=	618 psf
Footing Shear @ Toe	=	17.9 psi OK
Footing Shear @ Heel	=	1.9 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	925.2 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	16.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.581**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,130.2
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	2,382.5
Moment.....Allowable =	4,099.3
Service Level psi =	
Strength Level psi =	15.1
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0893 in2/ft		
(4/3) * As :	0.119 in2/ft	Min Stem T&S Reinf Area 1.344 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1344 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.15 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.75 ft
Heel Width	=	1.42
Total Footing Width	=	3.17
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,805	618 psf
Mu' : Upward	=	2,430	202 ft-#
Mu' : Downward	=	253	290 ft-#
Mu: Design	=	2,177	88 ft-#
Actual 1-Way Shear	=	17.87	1.94 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 10.10 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 10.10 in, #5@ 15.66 in, #6@ 22.22 in, #7@ 30.30 in, #8@ 39.90 in, #9@ 5
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.75 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	837.2	2.31	1,930.2	Soil Over Heel	=	497.2	2.79	1,388.8
Surcharge over Heel	=	88.0	3.46	304.4	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	30.1	2.79	84.2
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.08	750.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.08	1,500.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		925.2	**O.T.M.**	2,234.7	Stem Weight(s)	=	700.0	2.08	1,458.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	435.9	1.59	690.9
					Key Weight	=			
					Vert. Component	=			
					Total =		2,023.2 lbs	**R.M.=**	4,372.2

Resisting/Overturning Ratio = 1.96
Vertical Loads used for Soil Pressure = 2,743.2 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.079	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

This Wall in File: C:\Phillips Structural Engineering\DESIGN\RETAINING WALLS\cantilevered wall ~ sla

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Cantilevered Retaining Wall

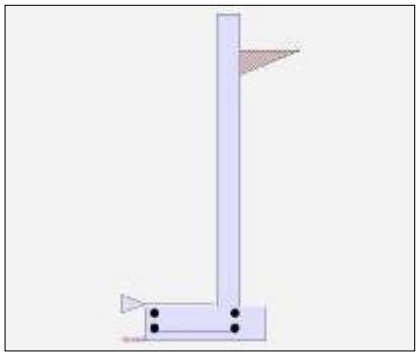
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	40.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.68	OK
Slab Resists All Sliding !			
Total Bearing Load	=	3,055 lbs	
...resultant ecc.	=	4.98 in	
Soil Pressure @ Toe	=	1,493 psf	OK
Soil Pressure @ Heel	=	252 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,091 psf	
ACI Factored @ Heel	=	353 psf	
Footing Shear @ Toe	=	24.3 psi	OK
Footing Shear @ Heel	=	4.5 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,197.5 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	12.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.684**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,514.5
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	3,700.2
Moment.....Allowable =	5,412.6
Service Level psi =	
Strength Level psi =	20.2
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1386 in2/ft	
(4/3) * As :	0.1848 in2/ft	Min Stem T&S Reinf Area 1.536 in2
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.1848 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.08 ft
Heel Width	=	1.42
Total Footing Width	=	3.50
Footing Thickness	=	11.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,091	353 psf
Mu' : Upward	=	3,778	136 ft-#
Mu' : Downward	=	495	327 ft-#
Mu: Design	=	3,283	192 ft-#
Actual 1-Way Shear	=	24.26	4.53 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 10.10 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 10.10 in, #5@ 15.66 in, #6@ 22.22 in, #7@ 30.30 in, #8@ 39.90 in, #9@ 5
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.83 in2
Min footing T&S reinf Area per foot 0.24 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 10.10 in	#4@ 20.20 in
#5@ 15.66 in	#5@ 31.31 in
#6@ 22.22 in	#6@ 44.44 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,096.8	2.64	2,894.3	Soil Over Heel	=	580.1	3.12	1,811.7
Surcharge over Heel	=	100.8	3.96	398.8	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	30.1	3.12	94.1
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	2.41	868.8
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	2.41	1,737.6
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,197.5	**O.T.M.**	3,293.1	Stem Weight(s)	=	800.0	2.41	1,930.7
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	481.3	1.75	842.2
					Key Weight	=			
					Vert. Component	=			
					Total =		2,251.5 lbs	**R.M.=**	5,547.5

Resisting/Overturning Ratio = 1.68
Vertical Loads used for Soil Pressure = 3,054.7 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.095	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

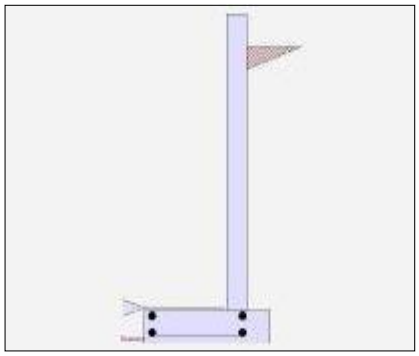
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	40.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.59	OK
Slab Resists All Sliding !			
Total Bearing Load	=	3,390 lbs	
...resultant ecc.	=	6.36 in	
Soil Pressure @ Toe	=	1,476 psf	OK
Soil Pressure @ Heel	=	184 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,066 psf	
ACI Factored @ Heel	=	258 psf	
Footing Shear @ Toe	=	26.7 psi	OK
Footing Shear @ Heel	=	5.8 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,532.0 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	9.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.762**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	1,954.9
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	5,430.3
Moment.....Allowable =	7,122.4
Service Level psi =	
Strength Level psi =	26.1
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.25
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2035 in2/ft		
(4/3) * As :	0.2713 in2/ft	Min Stem T&S Reinf Area 1.728 in2	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.25 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2667 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8467 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	2.67 ft
Heel Width	=	1.42
Total Footing Width	=	4.08
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,066	258 psf
Mu' : Upward	=	5,948	104 ft-#
Mu' : Downward	=	868	366 ft-#
Mu: Design	=	5,080	262 ft-#
Actual 1-Way Shear	=	26.66	5.77 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.06 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	1,417.5	3.00	4,252.5	Soil Over Heel	=	660.3	3.71	2,448.9
Surcharge over Heel	=	114.5	4.50	515.5	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	30.0	3.71	111.3
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	3.00	1,080.1
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	3.00	2,160.2
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,532.0	**O.T.M.**	4,768.0	Stem Weight(s)	=	900.0	3.00	2,700.3
					Earth @ Stem Transitions	=			
	=		=		Footing Weight	=	612.6	2.04	1,250.9
					Key Weight	=			
					Vert. Component	=			
					Total =		2,562.9 lbs	**R.M.=**	7,591.6

Resisting/Overturning Ratio = 1.59
Vertical Loads used for Soil Pressure = 3,389.6 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.090	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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Cantilevered Retaining Wall

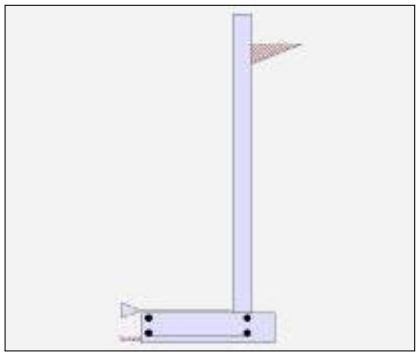
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	40.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.59	OK
Slab Resists All Sliding !			
Total Bearing Load	=	3,781 lbs	
...resultant ecc.	=	7.53 in	
Soil Pressure @ Toe	=	1,427 psf	OK
Soil Pressure @ Heel	=	165 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,998 psf	
ACI Factored @ Heel	=	231 psf	
Footing Shear @ Toe	=	31.9 psi	OK
Footing Shear @ Heel	=	7.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,877.3 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	11.00
Rebar Placed at =	Edge
Design Data	
fb/FB + fa/Fa =	**0.866**
Total Force @ Section	
Service Level lbs =	
Strength Level lbs =	2,451.3
Moment....Actual	
Service Level ft-# =	
Strength Level ft-# =	7,628.7
Moment.....Allowable =	8,809.0
Service Level psi =	
Strength Level psi =	33.0
Shear.....Allowable psi =	75.0
Anet (Masonry) in2 =	
Rebar Depth 'd' in =	6.19
Masonry Data	
f'm psi =	
Fs psi =	
Solid Grouting =	
Modular Ratio 'n' =	
Wall Weight psf =	100.0
Short Term Factor =	
Equiv. Solid Thick. =	
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	2,500.0
Fy psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2889 in2/ft		
(4/3) * As :	0.3852 in2/ft	Min Stem T&S Reinf Area 1.920 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2889 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.3382 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	3.25 ft
Heel Width	=	1.50
Total Footing Width	=	4.75
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,998	231 psf
Mu' : Upward	=	8,423	116 ft-#
Mu' : Downward	=	1,289	497 ft-#
Mu: Design	=	7,134	381 ft-#
Actual 1-Way Shear	=	31.92	7.65 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 11.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.23 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,750.0	3.33	5,833.3	Soil Over Heel	=	825.0	4.33	3,575.0
Surcharge over Heel	=	127.3	5.00	636.4	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	33.3	4.33	144.4
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	3.58	1,290.0
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	3.58	2,580.0
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		1,877.3	**O.T.M.**	6,469.7	Stem Weight(s)	=	1,000.0	3.58	3,583.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	712.5	2.38	1,692.2
					Key Weight	=			
					Vert. Component	=			
					Total =		2,930.8 lbs	**R.M.=**	10,285.0

Resisting/Overturning Ratio = 1.59
Vertical Loads used for Soil Pressure = 3,780.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.083	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

This Wall in File: C:\Phillips Structural Engineering\DESIGN\RETAINING WALLS\cantilevered wall ~ sla

RetainPro (c) 1987-2017, Build 11.17.04.04
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Cantilevered Retaining Wall

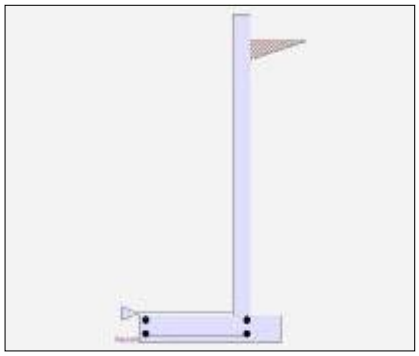
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	10.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.525
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	40.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	40.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	360.0 lbs
Axial Live Load	=	720.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	1.72	OK
Slab Resists All Sliding !			
Total Bearing Load	=	4,481 lbs	
...resultant ecc.	=	8.20 in	
Soil Pressure @ Toe	=	1,422 psf	OK
Soil Pressure @ Heel	=	207 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,991 psf	
ACI Factored @ Heel	=	290 psf	
Footing Shear @ Toe	=	37.4 psi	OK
Footing Shear @ Heel	=	11.2 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,257.5 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.877**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	3,003.6
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	10,351.5
Moment.....Allowable	=	11,799.2
Service Level	psi =	
Strength Level	psi =	40.5
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.19
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	60,000.0

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.392 in2/ft		
(4/3) * As :	0.5226 in2/ft	Min Stem T&S Reinf Area 2.112 in2	
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0014bh : 0.0014(12)(8) :	0.1344 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.392 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.465 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8382 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	3.67 ft
Heel Width	=	1.83
Total Footing Width	=	5.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,991	290 psf
Mu' : Upward	=	10,845	279 ft-#
Mu' : Downward	=	1,641	1,064 ft-#
Mu: Design	=	9,204	784 ft-#
Actual 1-Way Shear	=	37.41	11.18 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.20 in, #5@ 11.16 in, #6@ 15.84 in, #7@ 21.60 in, #8@ 28.44 in, #9@ 36
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 1.43 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,117.5	3.67	7,764.2	Soil Over Heel	=	1,283.0	4.92	6,308.1
Surcharge over Heel	=	140.0	5.50	770.0	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=	46.7	4.92	229.4
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=	360.0	4.00	1,440.1
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=	720.0	4.00	2,880.2
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		2,257.5	**O.T.M.**	8,534.2	Stem Weight(s)	=	1,100.0	4.00	4,400.4
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	825.0	2.75	2,268.8
					Key Weight	=			
					Vert. Component	=			
					Total =		3,614.6 lbs	**R.M.=**	14,646.8

Resisting/Overturning Ratio = 1.72
Vertical Loads used for Soil Pressure = 4,481.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.079	in

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