

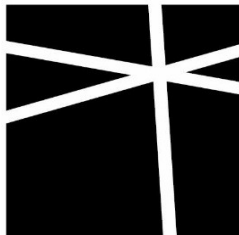
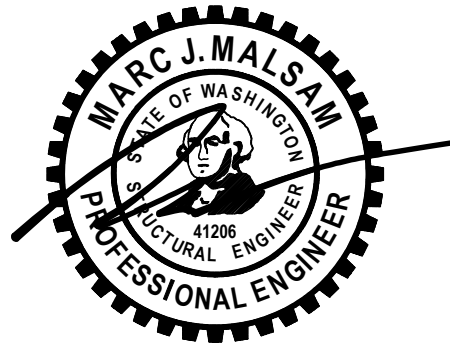
REVISED STRUCTURAL CALCULATIONS FOR:

# 6221 83RD PL SE

MERCER ISLAND, WA

ARCHITECT: JULIAN WEBER ARCH + DESIGN

AUGUST 1, 2023



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STRUCTURAL  
ENGINEERING

# DESIGN CRITERIA IBC 2018

## DEAD LOADS

ROOF		ROOF DECK		FLOOR	
Composition	2.5 psf	Composition	2.5 psf	3/4" Plywood	2.4 psf
3/4" Plywood	2.4 psf	3/4" Plywood	2.4 psf	TJI @ 16" o.c.	2.3 psf
Truss @ 24" o.c.	3.0 psf	Truss @ 24" o.c.	3.0 psf	Flooring	1.0 psf
Insulation	1.0 psf	1 1/2" Rigid	2.3 psf	Gyp Board (5/8")	2.8 psf
Gyp Board (5/8")	2.8 psf	Gyp Board (5/8")	2.8 psf	MEP	1.5 psf
MEP	1.5 psf	MEP	1.5 psf		
Solar Panels	5.0 psf	Palletized Deck	5.0 psf		
<hr/>		<hr/>		<hr/>	
Total	18.2 psf	Total	19.5 psf	Total	10.0 psf
Use	20.0 psf	Use	20.0 psf	Use	15.0 psf

## LIVE LOADS/OCCUPANCY

Risk Category	II	ROOF LIVE	FLOOR LIVE	DECK LIVE
Roof Deck	No	Snow = 25 psf	Occupancy = 40 psf	Occupancy = 60 psf
Common Access	No		Stair/Corridor = 40 psf	

## SEISMIC CRITERIA ASCE 7-16 Ch. 11 & Ch. 12

Imp. Factor =	1.00	Seismic Ht, hn =	45 ft
Site Class =	D(Default)	T, Building =	0.3
R Value =	6.5	Ts =	0.5

Geo. Ground Hazard?	No w/ASCE 11.4.8 Excep's		
S <sub>s</sub> =	1.464	F <sub>a</sub> =	1.200 Table 11.4-1
S <sub>1</sub> =	0.507	F <sub>v</sub> =	NULL Table 11.4-2
S <sub>ms</sub> =	1.757	x 2/3 = S <sub>ds</sub> =	1.171 Eqn. 11.4-3
S <sub>m1</sub> =	NULL	x 2/3 = S <sub>d1</sub> =	NULL Eqn. 11.4-4

C<sub>SULT</sub> = 0.180

C<sub>SALL</sub> = 0.126

T/Ts = 0.672 ≤ 1.5

Okay, Cs Eqn. 12.8-2

## SEISMIC WEIGHT ASCE 7-16 12.7.2

Partitions = 15 psf

\*Roof weight = 1/2 Partition + Roof DL

\*Floor weight = Full Partition + Floor DL

ROOF 26.0 psf      ROOF DECK 27.0 psf

FLOOR 25.0 psf

## SEISMIC DESIGN CATEGORY IBC 1613.2.5

Seismic DC = D

## WIND CRITERIA ASCE 7-16 Ch. 27 Directional Procedure

V =	110 mph	K <sub>d</sub> =	0.85
Exposure =	B	G =	0.85
h =	25 ft	K <sub>zt</sub> =	1.60 *See Kzt Worksheet

Roof Slope = 4 : 12 = 18°

## PRESSURE COEFFICIENTS (Cp)

Windward Wall =	0.8	Windward Roof =	0.2
Leeward Wall =	-0.5	Leeward Roof =	-0.6

## PRESSURE (PSF) q = 0.00256K<sub>z</sub>K<sub>zt</sub>K<sub>d</sub>V<sup>2</sup>

Ht	K <sub>z</sub>	q <sub>z</sub>	0.6xq <sub>z</sub> <sup>1</sup>	q <sub>h</sub>	P <sub>WW</sub>	P <sub>LD</sub>	P <sub>WALL</sub>	P <sub>ROOF</sub>
0-15	0.57	24.0	14.4		9.8	7.1	16.9	
15-20	0.62	26.1	15.7		10.7	7.1	17.7	
20-25	0.66	27.8	16.7	16.7	11.3	7.1	18.4	11.3
25-30	0.70	29.5	17.7		12.0	7.1	19.1	
30-35	0.73	30.8	18.5		12.5	7.1	19.6	
35-40	0.76	32.0	19.2		13.1	7.1	20.2	
40-45	0.79	33.3	20.0		13.6	7.1	20.7	
45-50	0.81	34.1	20.5		13.9	7.1	21.0	

<sup>1</sup> Per IBC 2018 1605.3.1 Basic Load Combinations



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Project

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Date

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Prof. No.

BRR

Design

DC1

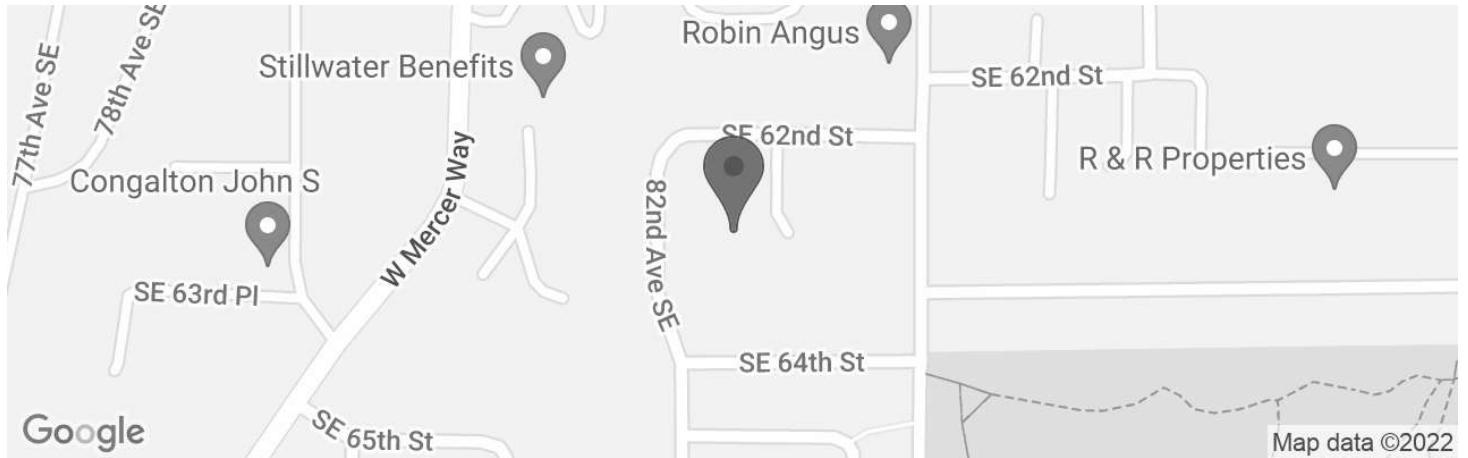
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## 6221 83rd PL SE

6221 83rd PI SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5464898, -122.228772



<b>Date</b>	5/10/2022, 8:50:35 AM
<b>Design Code Reference Document</b>	ASCE7-16
<b>Risk Category</b>	II
<b>Site Class</b>	D - Default (See Section 11.4.3)

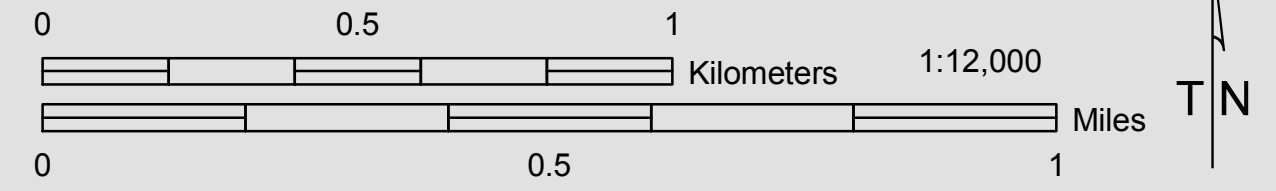
Type	Value	Description
$S_S$	1.464	$MCE_R$ ground motion, (for 0.2 second period)
$S_1$	0.507	$MCE_R$ ground motion, (for 1.0s period)
$S_{MS}$	1.757	Site-modified spectral acceleration value
$S_{M1}$	null -See Section 11.4.8	Site-modified spectral acceleration value
$S_{DS}$	1.171	Numeric seismic design value at 0.2 second SA
$S_{D1}$	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
$F_a$	1.2	Site amplification factor at 0.2 second
$F_v$	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.627	$MCE_G$ peak ground acceleration
$F_{PGA}$	1.2	Site amplification factor at PGA
$PGA_M$	0.752	Site modified peak ground acceleration
$T_L$	6	Long-period transition period in seconds
$S_{sRT}$	1.464	Probabilistic risk-targeted ground motion, (0.2 second)
$S_{sUH}$	1.624	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
$S_{sD}$	4.26	Factored deterministic acceleration value, (0.2 second)
$S_{1RT}$	0.507	Probabilistic risk-targeted ground motion, (1.0 second)
$S_{1UH}$	0.565	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration,
$S_{1D}$	1.642	Factored deterministic acceleration value, (1.0 second)
$PGAd$	1.42	Factored deterministic acceleration value, (Peak Ground Acceleration)
$C_{RS}$	0.902	Mapped value of the risk coefficient at short periods



# Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

by Development Services Group (DSG), City of Mercer Island  
April 2009



## WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS (ICC Section 1609 & ASCE 7-05 Chapter 6)

It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the  $K_{zt}$  factor to be utilized for each specific project. The  $K_{zt}$  factors and wind exposure categories indicated on this map are the minimum values accepted by the City of Mercer Island without requiring the design professional to submit additional calculations and supporting topographic documentation (to verify the values utilized in their wind load determination).

Please note – The  $K_{zt}$  values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

### WIND EXPOSURE CATEGORIES:

Wind Exposure Category		Exposure 'C' (1500 feet from Lake)
		Exposure 'B' (all other areas)

### WIND SPEED-UP (TOPOGRAPHIC EFFECT) - $K_{zt}$ Factor :

$K_{zt}$ Factor		$K_{zt} = 1.0$
		$K_{zt} = 1.3$
		$K_{zt} = 1.6$
		$K_{zt} = 1.9$

### GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer Island. This map shows the minimum wind exposure category and the minimum wind speed-up, " $K_{zt}$ " factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically identified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated "Read Me" document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

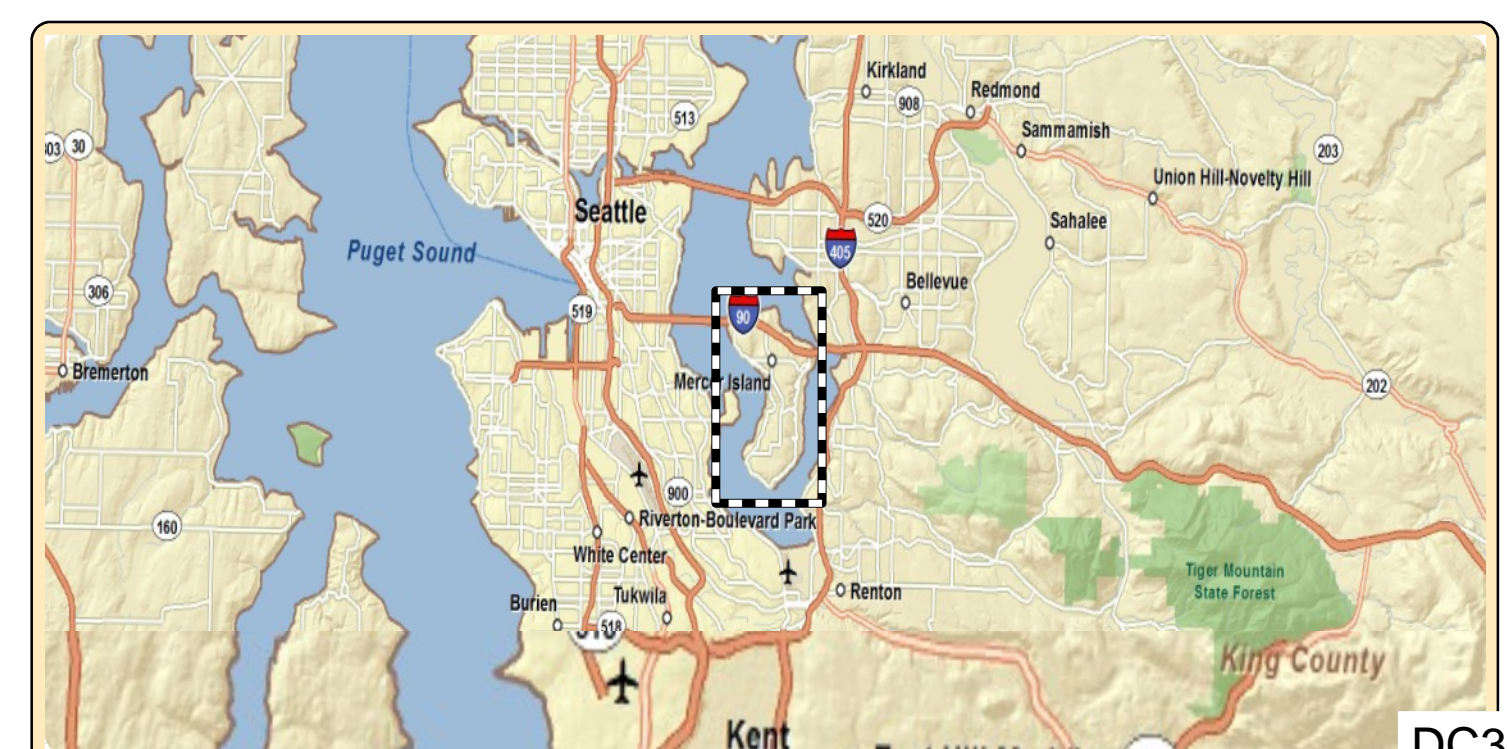
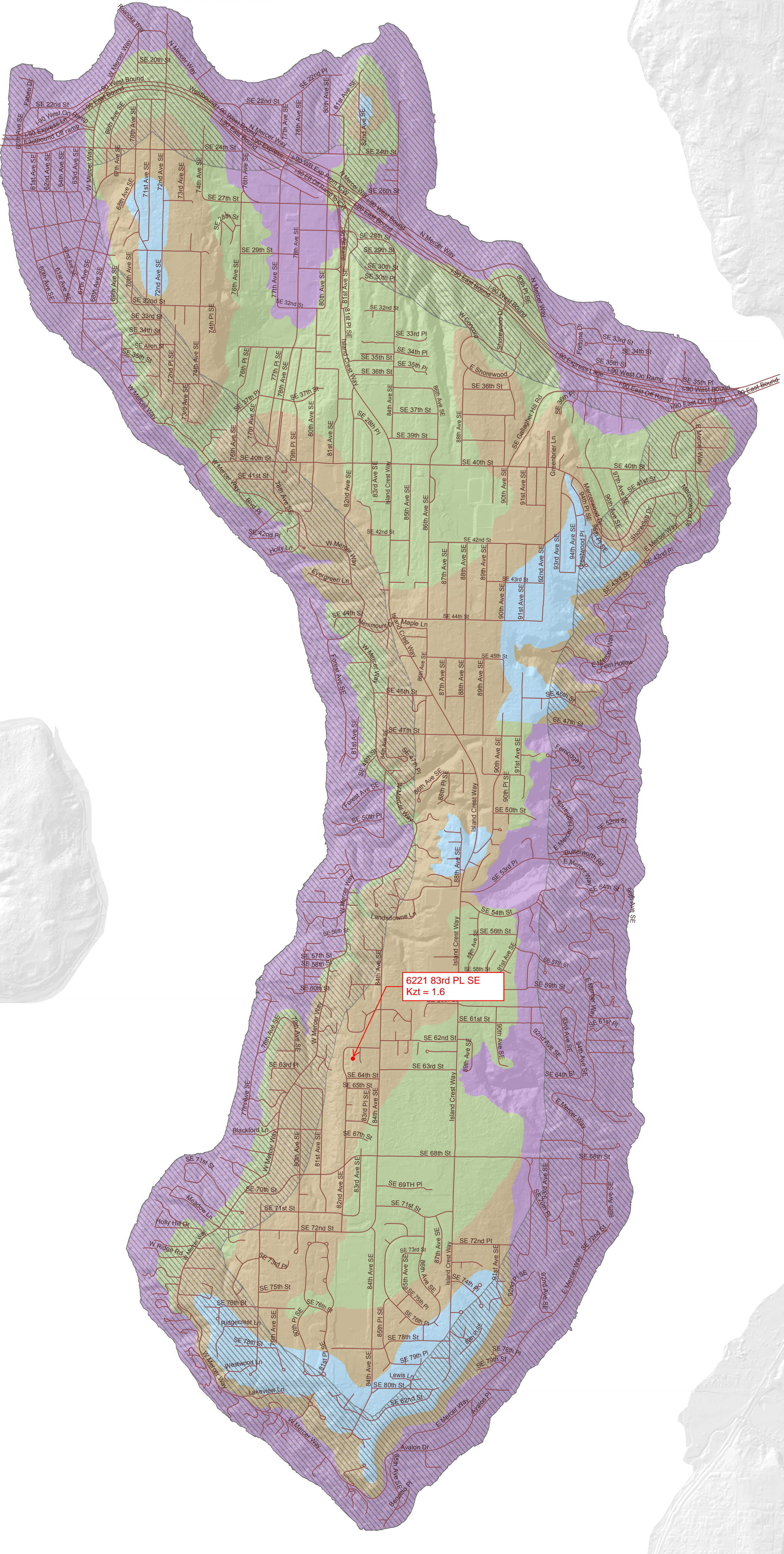
### DEFINITIONS:

**$K_{zt}$  factor:** The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.

**Exposure B:** The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.

**Exposure C:** The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.

**Wind Speed:** Minimum 85 mph 3-second gust per IRC Figure R301.2(4)

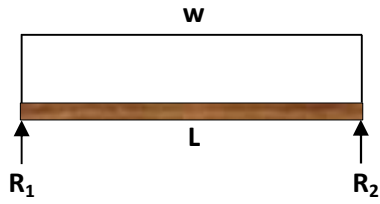




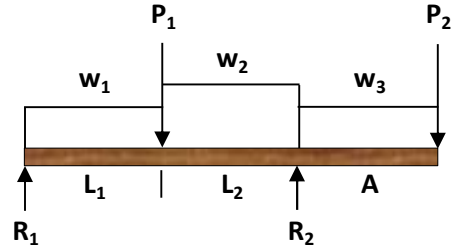
# TYPICAL BEAM CASES

\*ASSUME CASE 1 FOR ALL BEAMS U.N.O.

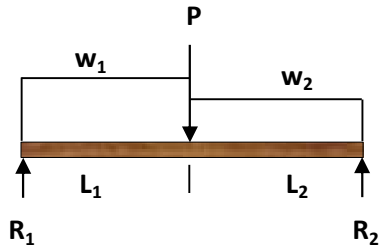
CASE #1: (C1)



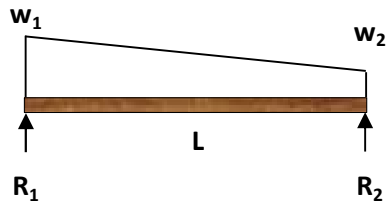
CASE #5: (C5)



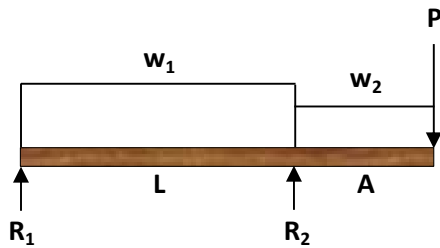
CASE #2: (C2)



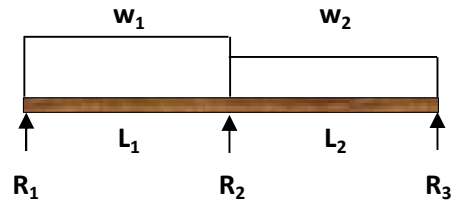
CASE #6: (C6)



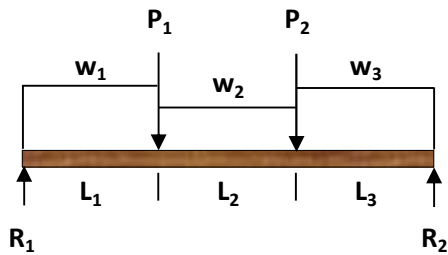
CASE #3: (C3)



CASE #7: (C7)



CASE #4: (C4)



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# LATERAL ANALYSIS

## Seismic:

Level	Area (ft <sup>2</sup> )	Unit Wt (psf)	Weight (kips)	Avg Ht (ft)	Wi-Hi (k-ft)	Distrib. (%)	Shear, V (kips)	Uniform (plf)
Roof	2000	26	52.70	22.5	1185.75	61%	<b>8.73</b>	239 / 157
Level 2	2400	25	61.50	12.5	768.75	39%	<b>5.66</b>	124 / 102

Totals: 114.20 k      1954.50      100%      14.39 k

### Base Shear:

$$\begin{aligned}
 V &= C_s \times W \\
 &= 0.18 \times 114.2\text{k} = 20.56 \text{ kips (Ultimate)} \\
 &= 0.126 \times 114.2\text{k} = 14.39 \text{ kips (Allowable)}
 \end{aligned}$$

## Wind:

### North-South Exposure

Level	Trib (ft)	Wind Load (#/ft)	Length (ft)	Shear, V (kips)
Roof	5.5	2.5' x 18.4 + 3' x 17.7 = 100 plf	36.5	<b>3.65</b> EQ
Level 2	11.25	2' x 17.7 + 9.25' x 16.9 = 192 plf	45.5	<b>8.74</b>

12.39 k

### East-West Exposure

Level	Trib (ft)	Wind Load (#/ft)	Length (ft)	Shear, V (kips)
Roof	5.5	2.5' x 18.4 + 3' x 17.7 = 100 plf	55.5	<b>5.55</b> EQ
Level 2	11.25	2' x 17.7 + 9.25' x 16.9 = 192 plf	55.5	<b>10.66</b>

16.21 k



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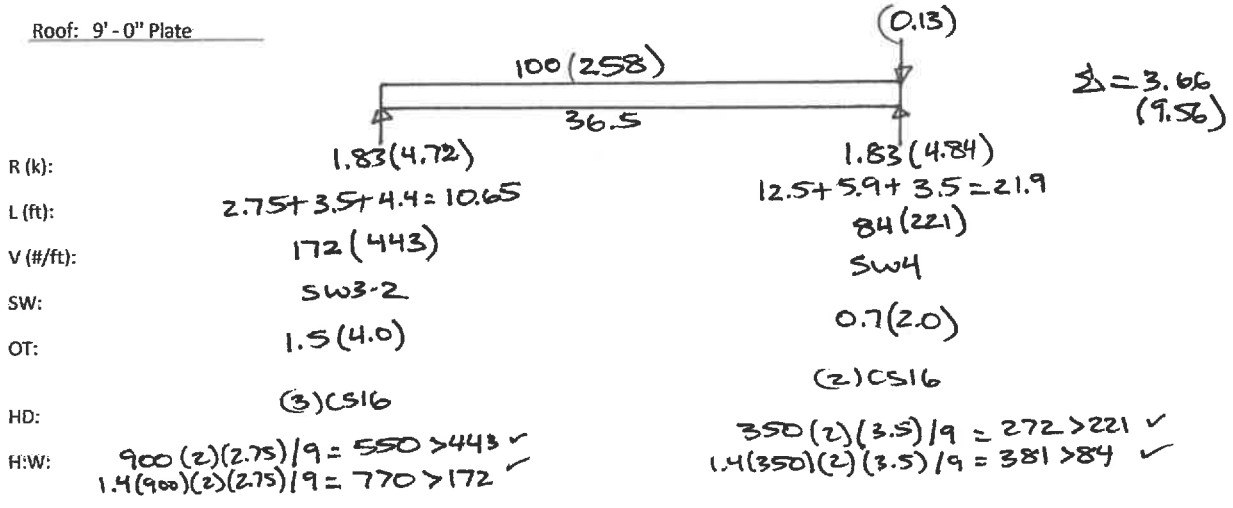
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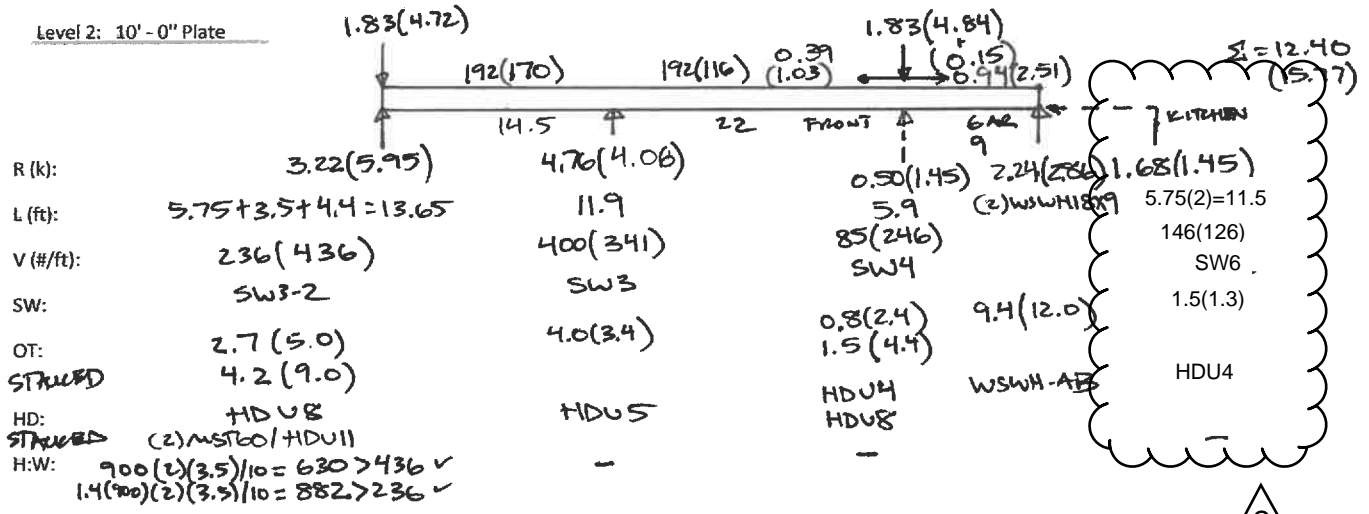
# LATERAL ANALYSIS

NORTH-SOUTH EXPOSURE  
(SEISMIC VALUES IN PARENTHESIS)

Roof: 9' - 0" Plate



Level 2: 10' - 0" Plate



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# LATERAL ANALYSIS

EAST-WEST EXPOSURE  
( SEISMIC VALUES IN PARENTHESIS )

Roof: 9' - 0" Plate

	100 (172)				
	13.5	18.5	23.5		$\Delta = 5.55$ (9.90)
	↑	↑	↑	↓	
R (k):	0.67 (1.16)	1.60 (2.76)	2.10 (3.62)	1.18 (2.02)	
L (ft):	14	9+7.9=16.9	11.9+15.25+9.5=36.65	13.4	
V (#/ft):	48 (83)	95 (163)	57 (99)	88 (151)	
SW:	SW6	SW6	SW6	SW6	
OT:	-	0.9 (1.5)	-	0.8 (1.4)	
HD:	-	CS16	-	CS16	
H:W:	-	-	-	-	

Level 2: 10' - 0" Plate

	0.67 (1.16)	1.60 (2.76)	2.10 (3.62)	1.18 (2.02)	
	↓	0.92 (1.60) ←	0.68 (1.16) →	↓	$\Delta = 16.21$ (15.78)
	↑	13.5	18.5	23.5	
R (k):	4.66 (4.55)	8.11 (7.89)	3.44 (3.34)		
L (ft):	3.9+3.4+5=12.3	21+7+6=34	22.25		
V (#/ft):	379 (370)	239 (232)	155 (150)		
SW:	SW3	SW6	SW6		
OT:	3.8 (3.7)	2.4 (2.3)	1.5 (1.5)		
HD:	HDU5	(2)CS16/HDU4	HDU4		
H:W:	-	-	-		

2



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# VERTICAL ANALYSIS

## ROOF FRAMING

### #300 - CANT BM

C3

$$L = 22$$

$$A = 6$$

$$W_1 = (24/2)(0.02) = 0.24$$

$$W_2 = (24/2)(0.045) = 0.54$$

$$P = 2.2$$

$$R_1 = 1.6$$

$$R_2 = 9.1$$

$$M = -22.9$$

$$D = -0.9$$

$$R = 70$$

$$\Delta C = 0.22 = 24/651$$

GL 5/2 X 18

### #301 - CANT BM

C3

$$L = 9.25$$

$$A = 1.25$$

$$W_1 = W_2 = (18/2)(0.045) = 0.41$$

$$P = 0$$

$$R_1 = 1.9$$

$$R_2 = 2.5$$

$$M = 4.2$$

$$D = 0.3$$

$$R = 31$$

$$\Delta C = -0.003$$

GL 3/2 X 18

BUMP UP TO  
GL 5/2 X 18

### #302 - CANT BM

C3

$$L = 15$$

$$A = 3$$

$$W_1 = W_2 = 0.09$$

$$P = 2.5$$

$$R_1 = 0.15$$

$$R_2 = 4.0$$

$$M = -7.9$$

GL 5/2 X 18

$$D = -0.3$$

$$R = 40$$

$$\Delta C = 0.04 = 24/1927$$

### #303 - INT BM

$$L = 20.5$$

$$W = (41.5/2)(0.045) = 0.93$$

$$P = 9.5$$

$$M = 48.9$$

$$D = 1.5$$

$$R = 103$$

$$\Delta T = 0.48 = 4/509$$

GL 5/2 X 21

C3

$$L = 12$$

$$A = 5$$

$$W_1 = (18/2)(0.02) = 0.18$$

$$W_2 = (18/2)(0.045) = 0.41$$

$$P = 0$$

$$R_1 = 0.7$$

$$R_2 = 3.6$$

$$M = -5.1$$

GL 5/2 X 21

$$D = -0.2$$

$$R = 17$$

$$\Delta C = 0.02 = 24/7609$$

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi  
Units in (Parenthesis) represent Dead Load or 0.6DL ( $\Omega = 2.5$ )



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# VERTICAL ANALYSIS

## SECOND FLOOR FRAMING

Typical Units: L = ft, W = klf, P = kip, R = klp, M = k-ft, V = k, Fb = ksi, Fv = psi  
Units in (Parenthesis) represent Dead Load or 0.6DL (Qo=2.5)

### #200 - INT BM AT GARAGE

$L = 13$   
 $W = (23.25/2)(0.055) = 0.64$   
 $R = 4.2$   
 $M = 13.5$   
 $C = 1.3$   
 $R = 81$   
 $\Delta T = 0.30 = 4524$

GL 5 1/2 X 11 7/8

### #201 - BM AT GARAGE

$C4$   
 $L_1 = 8$   
 $L_2 = 3$   
 $L_3 = 12.25$   
 $W_1 = W_2 = W_3 = 0.07 + (8.5/2)(0.045) + 0.15 + 0.045 = 0.46$

$P_1 = 4.2$   
 $P_2 = [5.0]$

$R_1 = 8.1$   
 $R_2 = 6.8$   
 $M = 50.2$   
 $C = 1.1$   
 $R = 82$   
 $\Delta T = 0.41 = 4680$

GL 5 1/2 X 24

### #202 - BM AT GARAGE DOOR

$L = 20.5$   
 $W = (8.5/2)(0.045) = 0.19$   
 $R = 2.0$   
 $M = 10.0$   
 $F_b = 0.4$   
 $R = 28$   
 $\Delta T = 0.10 = 42365$

GL 3 1/2 X 24

### #203 - E/W BM AT STAIR

$L = 6.5$   
 $W = (9/2)(0.055) = 0.25$   
 $R = 0.8$   
 $M = 1.3$   
 $C = 0.12$   
 $R = 13$   
 $\Delta T = 0.607 = 410732$

GL 5 1/2 X 11 7/8

### #204 - N/S BM AT STAIR

$C2$   
 $L_1 = 8.75$   
 $L_2 = 8.75$   
 $W_1 = 0.07$   
 $W_2 = 0.07 + (7/2)(0.055) = 0.26$   
 $P = 0.8$

$R_1 = 1.4$   
 $R_2 = 2.3$   
 $M = 9.8$   
 $C = 0.9$   
 $R = 46$   
 $\Delta T = 0.36 = 4577$

GL 5 1/2 X 11 7/8

### #205 - BM AT DINING

$L = 13$   
 $W = 0.07 + (8/2)(0.045) + 0.15 + 0.045 = 0.45$

$R = 2.9$   
 $M = 9.5$   
 $C = 0.9$   
 $R = 57$   
 $\Delta T = 0.21 = 4745$

GL 5 1/2 X 11 7/8

### #206 - INT BM

$C4$   
 $L_1 = 1.5$   
 $L_2 = 6.5$   
 $L_3 = 5.75$   
 $W_1 = W_2 = (3/2)(0.055) + 0.15 + (3/2)(0.045) = 1.70$   
 $W_3 = 0.045 + (9/2)(0.055) + 0.15 + (18/2)(0.045) = 0.85$

$P_1 = [3.8]$   
 $P_2 = 4.3 [3.6]$

$R_1 = 12.5 [15.8]$   
 $R_2 = 10.3 [12.1]$   
 $M = 45.7 [55.6]$   
 $S_x : (55.6/50)(12)(1.67) = 22.3 \quad M^3$   
 $TRY \quad W10X26 \quad S_x = 27.9 > 22.3 \quad \checkmark$   
 $\Delta = 0.25 = L/650$

W10X26 <sup>BUMP UP</sup> W10X45



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Project

Mercer Island, WA

5/12/2022  
Date

0329.2022.01.01  
Proj. No.

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BRR

Sheet

V-2



# VERTICAL ANALYSIS

## SECOND FLOOR FRAMING

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi  
 Units in (Parenthesis) represent Dead Load or 0.6DL (Do=2.5)

### #207 - BM OVER KITCHEN

C2  
 L1=13  
 L2=2.75

$$W_1 = (18.5/2)(0.045) = 0.42$$

$$W_2 = (14.5/2)(0.045) + 0.07 + 0.15 + 0.09 = 0.64$$

$$P = 10.3 [15.3]$$

$$R_1 = 5.2 [6.0]$$

$$R_2 = 12.4 [16.5]$$

$$M = 31.7 [42.9]$$

$$B = 0.72 [0.98]$$

$$D = 126 [173]$$

$$\Delta T = 0.12 = L/1619$$

GL 5/2x24

### #208 - BM OVER DECK

C3

L=13.5

A=3.5

$$W_1 = 0.07$$

$$W_2 = 0.09$$

$$P = 0.7$$

$$R_1 = 0.25$$

$$R_2 = 1.7$$

$$M = -3.0$$

$$B = -0.6$$

$$D = 34$$

$$\Delta T = 0.13 = 2L/643$$

PSL 5/4x11 7/8

### #209 - BM UNDER WALL

C2 L1=1 L2=6

$$W_1 = W_2 = (13.5/2)(0.055) + (3/2)(0.045) + 0.15 + (13.5/2)(0.045) = 0.89$$

$$P = 2.7$$

$$R_1 = 5.4$$

$$R_2 = 3.5$$

$$M = 6.9$$

$$B = 0.6$$

$$D = 104$$

$$\Delta T = 0.04 = L/1872$$

GL 5-1/2x11-7/8

### #210 - INT BM

C3

L=16.5

A=3.0

$$W_1 = (13/2)(0.045) + (17.5/2)(0.055) + 0.15 + (24/2)(0.045) = 1.46$$

$$W_2 = 0.29$$

$$P = 0$$

$$R_1 = 0$$

$$R_2 = 1.0$$

$$M = -1.3$$

$$fb = -0.12$$

$$fv = 14$$

$$\delta = 0.03 = L/2352$$

GL 5-1/2x11-7/8

2



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# VERTICAL ANALYSIS

## FIRST FLOOR FRAMING

### #100 - BM ABOVE CLOSET

C2

$L_1 = 6.25$   
 $L_2 = 5.25$

$W_1 = (22/2)(0.055) = 0.61$   
 $W_2 = (15.5/2)(0.055) + 0.04 + 0.15 + 0.045 = 0.66$

$P = 14.1 [6.1]$

$R_1 = 9.9 [10.9]$

$R_2 = 1.62 [12.3]$

$M = 50.2 [55.9]$

$S_x = \frac{90.2}{50}(12)(1.67) = 20.1$

TRY W10X45

$S_x = 49.1 > 20.1$

$\Delta_f = 0.14 = 4/989$

W10X45

### #101 - N/S BM AT BATHRM

C2

$L_1 = 6$   
 $L_2 = 2.75$

$W_1 = W_2 = 0.07$

$P = 9.9 [10.9]$

$R_1 = 3.4 [3.7]$

$R_2 = 7.1 [7.8]$

$M = 19.2 [21.1]$

$S_x = 1.4 [1.5]$

$S_y = 12.7 [13.9]$

$\Delta_f = 0.10 = 4/1002$

PS4 7X11 7/8

### #102 - INT BM

C4

$L_1 = 9.25, L_2 = 3.5, L_3 = 2.5$

$W_1 = W_2 = (13/2)(0.08) + (18/2)(0.055) + 0.15 + (31/2)(0.055) + 0.15 + (31/2)(0.045) = 2.87$

$W_3 = (31/2)(0.055) = 0.85$

$P_1 = 2.6, P_2 = 12.5 [15.8]$

$R_1 = 24.5 [25.1]$

$R_2 = 29.3 [32.0]$

$M = 104.9 [109.6]$

$S_x = (110/50)(12)(1.67) = 44.1$

TRY W10x68

$S_x = 92.2 > 44.1$  ✓

$\Delta_f = 0.39 = L/474$

W10x68

Typical Units: L = ft, W = klf, P = kip, R = kip, M = k-ft, V = k, Fb = ksi, Fv = psi  
 Units in (Parenthesis) represent Dead Load or 0.60L (Lo=2.5)

### #103 - CANT BM

C3

$L = 3$   
 $A = 3$

$W_1 = (13/2)(0.02) + (18/2)(0.015) + 0.15 + (31/2)(0.015) + 0.15 + (31/2)(0.02) = 1.10$

$W_2 = (31/2)(0.05) = 1.24$

$P = 0$

$R_1 = -0.21$

$R_2 = 7.2$

$M = -5.5$

$D = -0.23$

$R = -28$

$\Delta_c = 0.009 = 2L/7836$

GL 5 1/2 X 18 <sup>Bump to</sup>  
W10x68

### #104 - WEST BM

C2

$L_1 = 4$   
 $L_2 = 1$

$W_1 = W_2 = 0.07 + 0.15 + 0.07 + 0.15 + 0.09 = 0.53$

$P = [22.5]$

$R_1 = [5.8]$

$R_2 = [19.3]$

$M = [19.1]$

$D = [0.8]$  ←  $2LS(1.6) = 424 > 285$   
 $R = [281]$

GL 5 1/2 X 18

### #105 - CANT BM

C3

$L = 15$   
 $A = 6.5$

$W_1 = (26/2)(0.02) + 0.15 + (17.5/2)(0.02) = 0.59$

$W_2 = (18/2)(0.05) + 0.15 + (18/2)(0.045) + 0.15 = 1.43$

$P = [4.8]$

$R_1 = 2.4 [0.3]$

$R_2 = 15.7 [22.6]$

$M = -30.2 [-61.4]$

$D = -0.7 [-14]$

$R = 73 [28]$

$\Delta_c = 0.12 = 2L/1352$

GL 5 1/2 X 24

2

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# VERTICAL ANALYSIS

Foundation:

1,500 psf Assumed Soil Bearing

<u>Side</u>	<u>North</u>
Roof	.54
Wall	.15
Level 2	.41
Wall	.15
Level 1	.07
Wall	
Foundation	.50

Totals: 1.82

North:  $1.82 / 1.50 (12) = 14.6''$  Wide Ftg Req'd    Use 18'' Wide Ftg

### Point Loads on the Stem Walls:

Maximum 8.0 kip point load distributed over 4'-0"  
of continuous 18" wide footing = 1.33 psf OK

### PT LOADS

$$P = 6' / 1.5 \text{ ksf} = 4.0 \text{ k} \rightarrow \text{USE } 2' \times 2' \text{ SQ FTG}$$

$$P = 22.6 / 1.5 = 15.0 \text{ k} \rightarrow \text{USE } 4' \times 4' \text{ SQ FTG}$$

$$P = 42 / 1.5 = 28.0 \text{ k} \rightarrow \text{USE } 3' \times 10' \text{ W } \times 10' \text{ L}$$



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0329.2022.01.01  
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### Cantilevered Retaining Wall Design

#### Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method	=	
Heel Active Pressure	=	35.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

#### Surcharge Loads

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

#### Axial Load Applied to Stem

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

#### Design Summary

Wall Stability Ratios	=	2.23 OK
Overturning	=	OK
Slab Resists All Sliding !	=	

Total Bearing Load	=	865 lbs
...resultant ecc.	=	3.77 in

Soil Pressure @ Toe	=	640 psf OK
Soil Pressure @ Heel	=	78 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	768 psf
ACI Factored @ Heel	=	94 psf
Footing Shear @ Toe	=	6.7 psi OK
Footing Shear @ Heel	=	2.9 psi OK
Allowable	=	75.0 psi

Sliding Calcs	Slab Resists All Sliding !	
Lateral Sliding Force	=	394.8 lbs

#### Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of	=	1.00
Wind on Exposed Stem	=	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	=	
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

#### Stem Construction

#### Top Stem

Design Height Above Ftg	ft =	Stem OK 0.00
Wall Material Above "Hit"	=	Concrete
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	18.00
Rebar Placed at	=	Edge
Design Data	=	
fb/FB + fa/Fa	=	0.243
Total Force @ Section	lbs =	448.0
Moment....Actual	ft-# =	597.3
Moment....Allowable	=	2,455.6
Shear....Actual	psi =	8.8
Shear....Allowable	psi =	75.0
Wall Weight	=	75.0
Rebar Depth 'd'	in =	4.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Hook embedment reduced by stress ratio

#### Masonry Data

f <sub>m</sub>	psi =	
F <sub>s</sub>	psi =	
Solid Grouting	=	
Use Half Stresses	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

#### Concrete Data

f <sub>c</sub>	psi =	2,500.0
F <sub>y</sub>	psi =	60,000.0

#### Load Factors

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

### Cantilevered Retaining Wall Design

#### Footing Dimensions & Strengths

Toe Width	=	1.50 ft
Heel Width	=	0.91
Total Footing Width	=	2.41
Footing Thickness	=	9.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f <sub>c</sub>	=	2,500 psi
F <sub>y</sub>	=	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	=	768 94 psf
Mu' : Upward	=	706 11 ft-#
Mu' : Downward	=	206 60 ft-#
Mu: Design	=	501 49 ft-#
Actual 1-Way Shear	=	6.68 2.94 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 < S * Fr	=	
Heel: Not req'd, Mu < S * Fr	=	
Key: No key defined	=	

#### Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	394.8	1.58	625.2		
Surcharge over Heel	=					
Surcharge Over Toe	=					
Adjacent Footing Load	=					
Added Lateral Load	=					
Load @ Stem Above Soil	=					
Total	=	394.8	O.T.M.	625.2		
Resisting/Overturning Ratio	=			2.23		
Vertical Loads used for Soil Pressure	=	865.4 lbs				
Soil Over Heel	=	196.8	2.21	433.9		
Sloped Soil Over Heel	=					
Surcharge Over Heel	=					
Adjacent Footing Load	=					
Axial Dead Load on Stem	=					
* Axial Live Load on Stem	=					
Soil Over Toe	=	60.0	0.75	45.0		
Surcharge Over Toe	=					
Stem Weight(s)	=	337.5	1.75	590.6		
Earth @ Stem Transitions	=					
Footing Weight	=	271.1	1.21	326.7		
Key Weight	=					
Vert. Component	=					
Total =		865.4 lbs	R.M. =	1,396.3		

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

DESIGNER NOTES:



### Cantilevered Retaining Wall Design

#### Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method	=	
Heel Active Pressure	=	35.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

#### Surcharge Loads

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

#### Axial Load Applied to Stem

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

#### Design Summary

<b>Wall Stability Ratios</b>	
Overturning	= 2.27 OK
Slab Resists All Sliding !	
Total Bearing Load = 1,308 lbs	
...resultant ecc. = 4.49 in	
Soil Pressure @ Toe	= 762 psf OK
Soil Pressure @ Heel	= 110 psf OK
Allowable	= 1,500 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe	= 914 psf
ACI Factored @ Heel	= 132 psf
Footing Shear @ Toe	= 8.4 psi OK
Footing Shear @ Heel	= 5.3 psi OK
Allowable	= 75.0 psi
<b>Sliding Calcs</b> Slab Resists All Sliding !	
Lateral Sliding Force	= 595.5 lbs

#### Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of	=	1.00
Wind on Exposed Stem	=	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	=	
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

#### Stem Construction

<b>Top Stem</b>	
Design Height Above Ftg	ft = 0.00 OK
Wall Material Above "Ht"	= Concrete
Thickness	= 6.00
Rebar Size	= # 4
Rebar Spacing	= 18.00
Rebar Placed at	= Edge
<b>Design Data</b>	
fb/FB + fa/Fa	= 0.475
Total Force @ Section	lbs = 700.0
Moment.....Actual	ft-# = 1,166.7
Moment.....Allowable	= 2,455.6
Shear.....Actual	psi = 13.7
Shear.....Allowable	psi = 75.0
Wall Weight	= 75.0
Rebar Depth 'd'	in = 4.25
LAP SPLICE IF ABOVE	in = 18.72
LAP SPLICE IF BELOW	in =
HOOK EMBED INTO FTG	in = 6.00

Hook embedment reduced by stress ratio

#### Masonry Data

f <sub>m</sub>	psi =
F <sub>s</sub>	psi =
Solid Grouting	=
Use Half Stresses	=
Modular Ratio 'n'	=
Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	=
Masonry Design Method	= ASD

#### Concrete Data

f <sub>c</sub>	psi = 2,500.0
F <sub>y</sub>	psi = 60,000.0

#### Load Factors

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

### Cantilevered Retaining Wall Design

#### Footing Dimensions & Strengths

Toe Width	=	1.75 ft
Heel Width	=	1.25
Total Footing Width	=	3.00
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f <sub>c</sub>	=	2,500 psi
F <sub>y</sub>	=	60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00 @ Btm. =	3.00 in

#### Footing Design Results

		<b>Toe</b>	<b>Heel</b>
Factored Pressure	=	914	132 psf
Mu' : Upward	=	1,167	55 ft-#
Mu' : Downward	=	303	245 ft-#
Mu: Design	=	864	189 ft-#
Actual 1-Way Shear	=	8.41	5.34 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	
<b>Other Acceptable Sizes &amp; Spacings</b>			
Toe: Not req'd, Mu < S * Fr			
Heel: Not req'd, Mu < S * Fr			
Key: No key defined			

#### Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	595.5	1.94			
Surcharge over Heel	=			Soil Over Heel	=	450.0
Surcharge Over Toe	=			Sloped Soil Over Heel	=	
Adjacent Footing Load	=			Surcharge Over Heel	=	
Added Lateral Load	=			Adjacent Footing Load	=	
Load @ Stem Above Soil	=			Axial Dead Load on Stem	=	
				* Axial Live Load on Stem	=	
				Soil Over Toe	=	70.0
				Surcharge Over Toe	=	0.88
				Stem Weight(s)	=	61.3
<b>Total</b>	=	<b>595.5</b>	<b>O.T.M. = 1,157.9</b>	Earth @ Stem Transitions	=	412.5
				Footing Weight	=	2.00
<b>Resisting/Overturning Ratio</b>	=		<b>2.27</b>	Key Weight	=	825.0
Vertical Loads used for Soil Pressure	=	1,307.5 lbs		Vert. Component	=	375.0
						1.50
						562.5
				<b>Total =</b>	<b>1,307.5 lbs</b>	<b>R.M. = 2,630.0</b>

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

DESIGNER NOTES:

**Cantilevered Retaining Wall Design**

**Criteria**

Retained Height = 6.00 ft  
 Wall height above soil = 0.50 ft  
 Slope Behind Wall = 0.00 : 1  
 Height of Soil over Toe = 4.00 in  
 Water height over heel = 0.0 ft

**Soil Data**

Allow Soil Bearing = 1,500.0 psf  
 Equivalent Fluid Pressure Method  
 Heel Active Pressure = 35.0 psf/ft  
 Passive Pressure = 150.0 psf/ft  
 Soil Density, Heel = 120.00 pcf  
 Soil Density, Toe = 120.00 pcf  
 Footing|Soil Friction = 0.350  
 Soil height to ignore for passive pressure = 0.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**  
 Overturning = 2.03 OK  
 Slab Resists All Sliding !

Total Bearing Load = 1,555 lbs  
 ...resultant ecc. = 6.25 in

Soil Pressure @ Toe = 841 psf OK  
 Soil Pressure @ Heel = 48 psf OK  
 Allowable = 1,500 psf  
 Soil Pressure Less Than Allowable  
 ACI Factored @ Toe = 1,009 psf  
 ACI Factored @ Heel = 57 psf  
 Footing Shear @ Toe = 12.3 psi OK  
 Footing Shear @ Heel = 7.1 psi OK  
 Allowable = 75.0 psi

**Sliding Calcs** Slab Resists All Sliding !  
 Lateral Sliding Force = 817.2 lbs

**Lateral Load Applied to Stem**

Lateral Load = 0.0 #/ft  
 ...Height to Top = 0.00 ft  
 ...Height to Bottom = 0.00 ft  
 The above lateral load has been increased by a factor of 1.00  
 Wind on Exposed Stem = 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  
 Base Above/Below Soil at Back of Wall = 0.0 ft  
 Poisson's Ratio = 0.300

**Stem Construction**

**Top Stem**  
 Design Height Above Ftg = 0.00 ft  
 Wall Material Above "Ht" = Concrete  
 Thickness = 6.00  
 Rebar Size = # 4  
 Rebar Spacing = 16.00  
 Rebar Placed at = Edge  
**Design Data**  
 fb/FB + fa/Fa = 0.733  
 Total Force @ Section = 1,008.0 lbs  
 Moment...Actual = 2,016.0 ft-#  
 Moment...Allowable = 2,749.3  
 Shear...Actual = 19.8 psi  
 Shear...Allowable = 75.0 psi  
 Wall Weight = 75.0  
 Rebar Depth 'd' = 4.25  
 LAP SPLICE IF ABOVE = 18.72  
 LAP SPLICE IF BELOW =  
 HOOK EMBED INTO FTG in = 6.09

Hook embedment reduced by stress ratio

**Masonry Data**

f'm = psi  
 F\_s = psi  
 Solid Grouting =  
 Use Half Stresses =  
 Modular Ratio 'n' =  
 Short Term Factor =  
 Equiv. Solid Thick. =  
 Masonry Block Type =  
 Masonry Design Method = ASD

**Concrete Data**

f'c = 2,500.0 psi  
 F\_y = 60,000.0 psi

**Load Factors**

Building Code = 1.200  
 Dead Load = 1.600  
 Live Load = 1.600  
 Earth, H = 1.600  
 Wind, W = 1.600  
 Seismic, E = 1.000

**Cantilevered Retaining Wall Design**

**Footing Dimensions & Strengths**

Toe Width = 2.25 ft  
 Heel Width = 1.25  
 Total Footing Width = 3.50  
 Footing Thickness = 10.00 in  
 Key Width = 0.00 in  
 Key Depth = 0.00 in  
 Key Distance from Toe = 0.00 ft  
 f'c = 2,500 psi F\_y = 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	1,009	57 psf
Mu : Upward	2,038	35 ft-#
Mu : Downward	501	285 ft-#
Mu : Design	1,536	250 ft-#
Actual 1-Way Shear	12.32	7.12 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 < S \* Fr  
 Heel: Not req'd, Mu < S \* Fr  
 Key: No key defined

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
Heel Active Pressure	817.2	2.28	1,861.3	Soil Over Heel	540.0	3.13	1,687.5
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			
Load @ Stem Above Soil				* Axial Live Load on Stem			
				Soil Over Toe	90.0	1.13	101.3
				Surcharge Over Toe			
<b>Total</b>	<b>817.2</b>	<b>O.T.M.</b>	<b>1,861.3</b>	Stem Weight(s)	487.5	2.50	1,218.8
				Earth @ Stem Transitions			
<b>Resisting/Overturning Ratio</b>			<b>2.03</b>	Footing Weight	437.5	1.75	765.6
Vertical Loads used for Soil Pressure	1,555.0	lbs		Key Weight			
				Vert. Component			
				<b>Total =</b>	<b>1,555.0</b>	<b>lbs</b>	<b>R.M. = 3,773.1</b>

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

DESIGNER NOTES:



### Cantilevered Retaining Wall Design

#### Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method	=	
Heel Active Pressure	=	35.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in



#### Surcharge Loads

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

#### Axial Load Applied to Stem

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

#### Design Summary

Wall Stability Ratios		
Overturning	=	2.35 OK
Slab Resists All Sliding !		

Total Bearing Load	=	961 lbs
...resultant ecc.	=	3.42 in

Soil Pressure @ Toe	=	715 psf OK
Soil Pressure @ Heel	=	110 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	858 psf
ACI Factored @ Heel	=	132 psf
Footing Shear @ Toe	=	6.4 psi OK
Footing Shear @ Heel	=	2.7 psi OK
Allowable	=	75.0 psi

Sliding Calcs	Slab Resists All Sliding !	
Lateral Sliding Force	=	394.8 lbs

#### Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of	=	1.00
Wind on Exposed Stem	=	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		
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

#### Stem Construction

Design Height Above Ftg	ft =	Stem OK 0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	18.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	0.163
Total Force @ Section	lbs =	448.0
Moment...Actual	ft-# =	597.3
Moment...Allowable	=	3,655.6
Shear...Actual	psi =	6.0
Shear...Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Hook embedment reduced by stress ratio

#### Masonry Data

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Use Half Stresses	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

#### Concrete Data

f'c	psi =	2,500.0
Fy	psi =	60,000.0

#### Load Factors

Building Code		
Dead Load	=	1.200
Live Load	=	1.600
Earth, H	=	1.600
Wind, W	=	1.600
Seismic, E	=	1.000

### Cantilevered Retaining Wall Design

#### Footing Dimensions & Strengths

Toe Width	=	1.25 ft
Heel Width	=	1.08
Total Footing Width	=	2.33
Footing Thickness	=	9.00 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	=	858 132 psf
Mu' : Upward	=	569 15 ft-#
Mu' : Downward	=	143 61 ft-#
Mu: Design	=	426 46 ft-#
Actual 1-Way Shear	=	6.42 2.73 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 < S * Fr		
Heel: Not req'd, Mu < S * Fr		
Key: No key defined		

#### Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	394.8	1.58			625.2
Surcharge over Heel	=					
Surcharge over Toe	=					
Adjacent Footing Load	=					
Added Lateral Load	=					
Load @ Stem Above Soil	=					
Total		394.8	O.T.M.			625.2
Resisting/Overturning Ratio			=			2.35
Vertical Loads used for Soil Pressure	=					960.5 lbs
Soil Over Heel	=	198.4	2.12			421.3
Sloped Soil Over Heel	=					
Surcharge Over Heel	=					
Adjacent Footing Load	=					
Axial Dead Load on Stem	=					
* Axial Live Load on Stem	=					
Soil Over Toe	=	50.0	0.63			31.3
Surcharge Over Toe	=					
Stem Weight(s)	=	450.0	1.58			712.5
Earth @ Stem Transitions	=					
Footing Weight	=	262.1	1.17			305.4
Key Weight	=					
Vert. Component	=					
Total		960.5 lbs	R.M.			1,470.4

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

DESIGNER NOTES:





### Cantilevered Retaining Wall Design

#### Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method	=	
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

#### Surcharge Loads

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

#### Axial Load Applied to Stem

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

#### Design Summary

Wall Stability Ratios	=	
Overturning	=	2.12 OK
Slab Resists All Sliding !	=	

Total Bearing Load	=	1,691 lbs
...resultant ecc.	=	5.64 in

Soil Pressure @ Toe	=	907 psf OK
Soil Pressure @ Heel	=	85 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,088 psf
ACI Factored @ Heel	=	103 psf
Footing Shear @ Toe	=	12.4 psi OK
Footing Shear @ Heel	=	6.6 psi OK
Allowable	=	75.0 psi

Sliding Calc	Slab Resists All Sliding !	
Lateral Sliding Force	=	817.2 lbs

#### Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of	=	1.00
Wind on Exposed Stem	=	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	=	
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

#### Stem Construction

#### Top Stem

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	18.00
Rebar Placed at	=	Edge
Design Data	=	
fb/FB + fa/Fa	=	0.551
Total Force @ Section	lbs =	1,008.0
Moment...Actual	ft-# =	2,016.0
Moment... Allowable	=	3,655.6
Shear...Actual	psi =	13.4
Shear...Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	6.00

Hook embedment reduced by stress ratio

#### Masonry Data

f <sub>m</sub>	psi =	
F <sub>s</sub>	psi =	
Solid Grouting	=	
Use Half Stresses	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

#### Concrete Data

f <sub>c</sub>	psi =	2,500.0
F <sub>y</sub>	psi =	60,000.0

#### Load Factors

Building Code	=	
Dead Load	=	1.200
Live Load	=	1.600
Earth, H	=	1.600
Wind, W	=	1.600
Seismic, E	=	1.000

### Cantilevered Retaining Wall Design

#### Footing Dimensions & Strengths

Toe Width	=	2.00 ft
Heel Width	=	1.41
Total Footing Width	=	3.41
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f <sub>c</sub>	=	2,500 psi
F <sub>y</sub>	=	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	=	1,088	103 psf
Mu' : Upward	=	1,791	48 ft-#
Mu' : Downward	=	396	280 ft-#
Mu: Design	=	1,395	232 ft-#
Actual 1-Way Shear	=	12.40	6.64 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 < S * Fr	=		
Heel: Not req'd, Mu < S * Fr	=		
Key: No key defined	=		

#### Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	817.2	2.28	1,861.3		
Surcharge over Heel	=					
Surcharge Over Toe	=					
Adjacent Footing Load	=					
Added Lateral Load	=					
Load @ Stem Above Soil	=					
	=					
<b>Total</b>	=	<b>817.2</b>	<b>O.T.M.</b>	=	<b>1,861.3</b>	
	=			=		
<b>Resisting/Overturning Ratio</b>	=			=	<b>2.12</b>	
Vertical Loads used for Soil Pressure	=	1,691.5	lbs			
Soil Over Heel	=	535.2	3.04	1,626.1		
Sloped Soil Over Heel	=					
Surcharge Over Heel	=					
Adjacent Footing Load	=					
Axial Dead Load on Stem	=					
* Axial Live Load on Stem	=					
Soil Over Toe	=	80.0	1.00	80.0		
Surcharge Over Toe	=					
Stem Weight(s)	=	650.0	2.33	1,516.7		
Earth @ Stem Transitions	=					
Footing Weight	=	426.3	1.71	726.8		
Key Weight	=					
Vert. Component	=					
<b>Total</b>	=	<b>1,691.5</b>	<b>lbs</b>	<b>R.M.</b>	=	<b>3,949.5</b>

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

DESIGNER NOTES:









### Cantilevered Retaining Wall Design

#### Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method	=	
Heel Active Pressure	=	35.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings  Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

#### Surcharge Loads

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

#### Axial Load Applied to Stem

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

#### Design Summary

Wall Stability Ratios	=	
Overturning	=	1.87 OK
Slab Resists All Sliding !	=	

Total Bearing Load	=	2,937 lbs
...resultant ecc.	=	10.31 in

Soil Pressure @ Toe	=	1,138 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	1,500 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,365 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	20.6 psi OK
Footing Shear @ Heel	=	11.7 psi OK
Allowable	=	75.0 psi

Sliding Calcs	Slab Resists All Sliding !	
Lateral Sliding Force	=	1,750.0 lbs

#### Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of	=	1.00
Wind on Exposed Stem	=	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	=	
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

#### Stem Construction

Design Height Above Ftg	ft =	Stem OK
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge
Design Data	=	
fb/FB + fa/Fa	=	0.838
Total Force @ Section	lbs =	2,268.0
Moment....Actual	ft-# =	6,804.0
Moment....Allowable	=	8,121.3
Shear....Actual	psi =	30.5
Shear....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.19
LAP SPLICE IF ABOVE	in =	23.40
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	8.70

#### Masonry Data

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Use Half Stresses	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

#### Concrete Data

fc	psi =	2,500.0
Fy	psi =	60,000.0

#### Load Factors

Building Code	=	
Dead Load	=	1.200
Live Load	=	1.600
Earth, H	=	1.600
Wind, W	=	1.600
Seismic, E	=	1.000

### Cantilevered Retaining Wall Design

#### Footing Dimensions & Strengths

Toe Width	=	3.50 ft
Heel Width	=	1.66
Total Footing Width	=	5.16
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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	=	1,365	0 psf
Mu' : Upward	=	6,473	43 ft-#
Mu' : Downward	=	1,397	728 ft-#
Mu: Design	=	5,077	685 ft-#
Actual 1-Way Shear	=	20.59	11.71 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 5 @ 12.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

#### Other Acceptable Sizes & Spacings

Toe: #4@ 9.50 in, #5@ 14.50 in, #6@ 20.50 in, #7@ 28.00 in, #8@ 36.75 in, #9@ 46  
 Heel: Not req'd, Mu < S \* Fr  
 Key: No key defined

#### Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	1,750.0	3.33	5,833.3		
Surcharge over Heel	=					
Surcharge Over Toe	=					
Adjacent Footing Load	=					
Added Lateral Load	=					
Load @ Stem Above Soil	=					
Total	=	1,750.0	O.T.M.	5,833.3		
Resisting/Overturning Ratio	=		1.87			
Vertical Loads used for Soil Pressure	=	2,936.8	lbs			
Soil Over Heel	=	1,072.8	4.66	5,002.8		
Sloped Soil Over Heel	=					
Surcharge Over Heel	=					
Adjacent Footing Load	=					
Axial Dead Load on Stem	=					
* Axial Live Load on Stem	=					
Soil Over Toe	=	140.0	1.75	245.0		
Surcharge Over Toe	=					
Stem Weight(s)	=	950.0	3.83	3,641.7		
Earth @ Stem Transitions	=					
Footing Weight	=	774.0	2.58	1,996.9		
Key Weight	=					
Vert. Component	=					
Total =		2,936.8	lbs	R.M. =	10,886.4	

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

DESIGNER NOTES:





### Cantilevered Retaining Wall Design

#### Criteria

Retained Height	=	11.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method	=	
Heel Active Pressure	=	35.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing  Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in

#### Surcharge Loads

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

#### Axial Load Applied to Stem

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

#### Design Summary

<b>Wall Stability Ratios</b>	
Overturning	= 2.00 OK
Slab Resists All Sliding !	
Total Bearing Load	= 4,760 lbs
...resultant ecc.	= 10.93 in
Soil Pressure @ Toe	= 1,401 psf OK
Soil Pressure @ Heel	= 103 psf OK
Allowable	= 1,500 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe	= 1,681 psf
ACI Factored @ Heel	= 123 psf
Footing Shear @ Toe	= 22.4 psi OK
Footing Shear @ Heel	= 15.0 psi OK
Allowable	= 75.0 psi
<b>Sliding Calcs</b>	Slab Resists All Sliding !
Lateral Sliding Force	= 2,626.1 lbs

#### Stem Construction

##### Top Stem

Design Height Above Ftg	ft =	0.00	Stem OK
Wall Material Above "Ht"	=	Concrete	
Thickness	=	10.00	
Rebar Size	=	# 6	
Rebar Spacing	=	12.00	
Rebar Placed at	=	Edge	
<b>Design Data</b>			
fb/FB + fa/Fa	=	0.883	
Total Force @ Section	lbs =	3,388.0	
Moment....Actual	ft-# =	12,422.7	
Moment....Allowable	=	14,069.5	
Shear....Actual	psi =	37.0	
Shear....Allowable	psi =	75.0	
Wall Weight	=	125.0	
Rebar Depth 'd'	in =	7.63	
LAP SPLICE IF ABOVE	in =	28.08	
LAP SPLICE IF BELOW	in =		
HOOK EMBED INTO FTG	in =	11.02	

#### Masonry Data

f <sub>m</sub>	psi =	
F <sub>s</sub>	psi =	
Solid Grouting	=	
Use Half Stresses	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

#### Concrete Data

f <sub>c</sub>	psi =	2,500.0
F <sub>y</sub>	psi =	60,000.0

#### Load Factors

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

### Cantilevered Retaining Wall Design

#### Footing Dimensions & Strengths

Toe Width	=	4.00 ft
Heel Width	=	2.33
Total Footing Width	=	6.33
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f <sub>c</sub>	=	2,500 psi
F <sub>y</sub>	=	60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00 @ Btm =	3.00 in

#### Footing Design Results

		<b>Toe</b>	<b>Heel</b>
Factored Pressure	=	1,681	123 psf
Mu' : Upward	=	10,826	276 ft-#
Mu' : Downward	=	2,184	2,026 ft-#
Mu : Design	=	8,642	1,751 ft-#
Actual 1-Way Shear	=	22.44	14.98 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 6 @ 12.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

#### Other Acceptable Sizes & Spacings

Toe: #4@ 7.50 in, #5@ 11.50 in, #6@ 16.50 in, #7@ 22.25 in, #8@ 29.50 in, #9@ 37  
 Heel: Not req'd, Mu < S \* Fr  
 Key: No key defined

### Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,626.1	4.08			
Surcharge over Heel	=					
Surcharge Over Toe	=					
Adjacent Footing Load	=					
Added Lateral Load	=					
Load @ Stem Above Soil	=					
<b>Total</b>		<b>2,626.1</b>	<b>O.T.M.</b>			<b>10,723.2</b>
<b>Resisting/Overturning Ratio</b>						<b>= 2.00</b>
Vertical Loads used for Soil Pressure	=	4,760.0 lbs				
Soil Over Heel	=	1,975.6	5.58			11,027.1
Sloped Soil Over Heel	=					
Surcharge Over Heel	=					
Adjacent Footing Load	=					
Axial Dead Load on Stem	=					
* Axial Live Load on Stem	=					
Soil Over Toe	=	160.0	2.00			320.0
Surcharge Over Toe	=					
Stem Weight(s)	=	1,437.5	4.42			6,349.0
Earth @ Stem Transitions	=					
Footing Weight	=	1,186.9	3.17			3,756.5
Key Weight	=					
Vert. Component	=					
<b>Total</b>		<b>4,760.0 lbs</b>				<b>21,452.6</b>

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

DESIGNER NOTES:



### Cantilevered Retaining Wall Design

#### Criteria

Retained Height	=	12.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

#### Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method	=	
Heel Active Pressure	=	35.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in



#### Surcharge Loads

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

#### Axial Load Applied to Stem

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

#### Design Summary

<b>Wall Stability Ratios</b>	
Overturning	= 1.88 OK
Slab Resists All Sliding !	
Total Bearing Load = 5,178 lbs	
...resultant ecc.	= 13.18 in
Soil Pressure @ Toe	= 1,489 psf OK
Soil Pressure @ Heel	= 27 psf OK
Allowable	= 1,500 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe	= 1,787 psf
ACI Factored @ Heel	= 32 psf
Footing Shear @ Toe	= 26.8 psi OK
Footing Shear @ Heel	= 17.2 psi OK
Allowable	= 75.0 psi
<b>Sliding Calc</b> Slab Resists All Sliding !	
Lateral Sliding Force	= 3,072.3 lbs

#### Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of	=	1.00
Wind on Exposed Stem	=	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	=	
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

#### Stem Construction

<b>Top Stem</b>	
Design Height Above Ftg	ft = Stem OK
Wall Material Above "Ht"	= Concrete
Thickness	= 10.00
Rebar Size	= # 6
Rebar Spacing	= 9.00
Rebar Placed at	= Edge
<b>Design Data</b>	
ft/FB + fa/Fa	= 0.881
Total Force @ Section	lbs = 4,032.0
Moment.....Actual	ft-# = 16,128.0
Moment.....Allowable	= 18,302.4
Shear.....Actual	psi = 44.1
Shear.....Allowable	psi = 75.0
Wall Weight	= 125.0
Rebar Depth 'd'	in = 7.63
LAP SPLICE IF ABOVE	in = 28.08
LAP SPLICE IF BELOW	in =
HOOK EMBED INTO FTG	in = 10.96

#### Masonry Data

Hook embedment reduced by stress ratio	
f <sub>m</sub>	psi =
F <sub>s</sub>	psi =
Solid Grouting	=
Use Half Stresses	=
Modular Ratio 'n'	=
Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	=
Masonry Design Method	= ASD

#### Concrete Data

f <sub>c</sub>	psi = 2,500.0
F <sub>y</sub>	psi = 60,000.0

#### Load Factors

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

### Cantilevered Retaining Wall Design

#### Footing Dimensions & Strengths

Toe Width	=	4.50 ft
Heel Width	=	2.33
Total Footing Width	=	6.83
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f <sub>c</sub> =	2,500 psi	F <sub>y</sub> = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00	@ Btm = 3.00 in

#### Footing Design Results

		<b>Toe</b>	<b>Heel</b>
Factored Pressure	=	1,787	32 psf
Mu' : Upward	=	14,194	180 ft-#
Mu' : Downward	=	2,764	2,187 ft-#
Mu: Design	=	11,430	2,008 ft-#
Actual 1-Way Shear	=	26.78	17.25 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 6 @ 9.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

#### Other Acceptable Sizes & Spacings

Toe: #4@ 7.50 in, #5@ 11.50 in, #6@ 16.50 in, #7@ 22.25 in, #8@ 29.50 in, #9@ 37  
 Heel: Not req'd, Mu < S \* Fr  
 Key: No key defined

### Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	3,072.3	4.42	13,569.5		
Surcharge over Heel	=					
Surcharge Over Toe	=					
Adjacent Footing Load	=					
Added Lateral Load	=					
Load @ Stem Above Soil	=					
<b>Total</b>	<b>=</b>	<b>3,072.3</b>	<b>O.T.M.</b>	<b>13,569.5</b>		
<b>Resisting/Overturning Ratio</b>	<b>=</b>	<b>1.88</b>				
Vertical Loads used for Soil Pressure	=	5,178.3 lbs				
Soil Over Heel	=	2,155.2	6.08	13,107.2		
Sloped Soil Over Heel	=					
Surcharge Over Heel	=					
Adjacent Footing Load	=					
Axial Dead Load on Stem	=					
* Axial Live Load on Stem	=					
Soil Over Toe	=	180.0	2.25	405.0		
Surcharge Over Toe	=					
Stem Weight(s)	=	1,562.5	4.92	7,682.3		
Earth @ Stem Transitions	=					
Footing Weight	=	1,280.6	3.42	4,373.3		
Key Weight	=					
Vert. Component	=					
<b>Total</b>	<b>=</b>	<b>5,178.3 lbs</b>	<b>R.M.</b>	<b>25,567.8</b>		

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

#### DESIGNER NOTES:

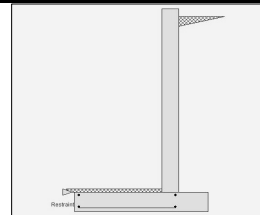


**Criteria**

Retained Height	=	12.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.42 Ratio < 1.5!
Slab Resists All Sliding!	=	

Total Bearing Load	=	6,105 lbs
...resultant ecc.	=	27.59 in

Soil Pressure @ Toe	=	2,393 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	3,350 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	51.4 psi OK
Footing Shear @ Heel	=	21.9 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	4,807.3 lbs
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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

**Lateral Load Applied to Stem**

Lateral Load	=	108.0 #/ft
...Height to Top	=	12.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	12.00
Rebar Size	=	# 6
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.997
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	5,904.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	26,208.0
Moment....Allowable	=	26,273.2

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	51.1
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	9.63

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	150.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

fc	psi =	2,500.0
Fy	psi =	60,000.0

**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

**Bottom**

Stem OK

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.6258 in2/ft	
(4/3) * As :	0.8344 in2/ft	Min Stem T&S Reinf Area 3.600 in2
200bd/fy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.6258 in2/ft	One layer of : Two layers of :
Provided Area :	0.66 in2/ft	#4@ 8.33 in #4@ 16.67 in
Maximum Area :	1.3039 in2/ft	#5@ 12.92 in #5@ 25.83 in
		#6@ 18.33 in #6@ 36.67 in

**Footing Data**

Toe Width	=	5.25 ft
Heel Width	=	2.75
Total Footing Width	=	8.00
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	3,350	0 psf
Mu' : Upward	=	364,019	0 ft-#
Mu' : Downward	=	45,147	2,991 ft-#
Mu: Design	=	26,573	2,991 ft-#
Actual 1-Way Shear	=	51.38	21.91 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 6 @ 8.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 4.54 in, #5@ 7.04 in, #6@ 9.99 in, #7@ 13.63 in, #8@ 17.95 in, #9@ 22.7  
 Heel: phiMn = phi^5 lambda b d^3 / (sqrt(fc) S m)  
 Key: No key defined

Min footing T&S reinf Area	2.59	in2
Min footing T&S reinf Area per foot	0.32	in2 .ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.41 in		#4@ 14.81 in
#5@ 11.48 in		#5@ 22.96 in
#6@ 16.30 in		#6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	3,511.3	4.42	15,508.0	Soil Over HL (ab. water tbl)	2,520.0	7.13	17,955.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		7.13	17,955.0
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	1,296.0	7.25	9,396.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	210.0	2.63	551.3
				Surcharge Over Toe =			
				Stem Weight(s) =	1,875.0	5.75	10,781.3
				Earth @ Stem Transitions =			
				Footing Weight =	1,500.0	4.00	6,000.0
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>4,807.3</b>	<b>O.T.M. =</b>	<b>24,904.0</b>	<b>Total =</b>	<b>6,105.0 lbs</b>	<b>R.M.=</b>	<b>35,287.5</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.42</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			6,105.0 lbs				

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) = 0.104 in

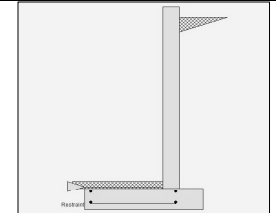
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	8.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**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 =	0.0 psf (Service Level)

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning =	1.91 OK
Slab Resists All Sliding !	

Total Bearing Load =	2,670 lbs
...resultant ecc. =	9.62 in

Soil Pressure @ Toe =	1,077 psf OK
Soil Pressure @ Heel =	11 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,507 psf
ACI Factored @ Heel =	15 psf
Footing Shear @ Toe =	21.9 psi OK
Footing Shear @ Heel =	9.7 psi OK
Allowable =	75.0 psi

<b>Sliding Calcs</b>	
Lateral Sliding Force =	1,620.0 lbs

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

<b>Load Factors</b>	
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**

<b>Design Height Above Ftg</b>	ft = 0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	11.25
Rebar Placed at =	6.25 i

<b>Design Data</b>	
fb/FB + fa/Fa =	0.626

<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 2,048.0

<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 5,461.3
Moment....Allowable =	8,719.4

<b>Shear....Actual</b>	
Service Level	psi =
Strength Level	psi = 27.3
Shear....Allowable =	75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.25

<b>Masonry Data</b>	
fm	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

<b>Concrete Data</b>	
Fc	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) :	0.2046 in2/ft	
(4/3) * As :	0.2728 in2/ft	Min Stem T&S Reinf Area 1.632 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
0.0018bh : 0.0018(12)(8) :	0.1728 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 :	0.3307 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 Data**

Toe Width =	3.25 ft
Heel Width =	1.66
Total Footing Width =	4.91
Footing Thickness =	12.00 in
Key Width =	0.00 in
Key Depth =	0.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure =	1,507	15 psf
Mu' : Upward =	74,669	57 ft-#
Mu' : Downward =	14,450	657 ft-#
Mu: Design =	5,018	600 ft-#
Actual 1-Way Shear =	21.86	9.65 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 5 @ 12.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: No key defined

Min footing T&S reinf Area	1.27	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**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl)	953.6	4.41	4,208.6
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.41	4,208.6
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	130.0	1.63	211.3
				Surcharge Over Toe =			
				Stem Weight(s) =	850.0	3.58	3,045.8
				Earth @ Stem Transitions =			
<b>Total</b> =	<b>1,620.0</b>	<b>O.T.M. =</b>	<b>4,860.0</b>	Footing Weight =	736.5	2.46	1,808.1
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>1.91</b>	<b>Total =</b>	<b>2,670.1 lbs</b>	<b>R.M.=</b>	<b>9,273.7</b>
Vertical Loads used for Soil Pressure =			2,670.1 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)	0.052	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**

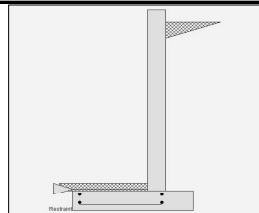
Code: IBC 2015,ACI 318-14,ACI 530-13

**Criteria**

Retained Height = 7.00 ft  
 Wall height above soil = 0.50 ft  
 Slope Behind Wall = 0.00  
 Height of Soil over Toe = 4.00 in  
 Water height over heel = 0.0 ft

**Soil Data**

Allow Soil Bearing = 2,666.0 psf  
 Equivalent Fluid Pressure Method  
 Active Heel Pressure = 40.0 psf/ft  
 Passive Pressure = 150.0 psf/ft  
 Soil Density, Heel = 120.00 pcf  
 Soil Density, Toe = 120.00 pcf  
 Footing|Soil Friction = 0.450  
 Soil height to ignore for passive pressure = 12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning = 1.37 Ratio < 1.5!  
 Slab Resists All Sliding !

Total Bearing Load = 2,255 lbs  
 ...resultant ecc. = 16.56 in

Soil Pressure @ Toe = 1,812 psf OK  
 Soil Pressure @ Heel = 0 psf OK  
 Allowable = 2,666 psf  
 Soil Pressure Less Than Allowable  
 ACI Factored @ Toe = 2,536 psf  
 ACI Factored @ Heel = 0 psf  
 Footing Shear @ Toe = 33.9 psi OK  
 Footing Shear @ Heel = 12.1 psi OK  
 Allowable = 75.0 psi

**Sliding Calcs**

Lateral Sliding Force = 1,668.2 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

**Lateral Load Applied to Stem**

Lateral Load = 63.0 #/ft  
 ...Height to Top = 7.00 ft  
 ...Height to Bottom = 0.00 ft  
 Load Type = Seismic (E)  
 (Service Level)  
 Wind on Exposed Stem = 0.0 psf  
 (Service Level)

**Stem Construction**

Design Height Above Ftg ft = 0.00  
 Wall Material Above "Ht" = Concrete  
 Design Method = LRFD  
 Thickness = 8.00  
 Rebar Size = # 4  
 Rebar Spacing = 8.75  
 Rebar Placed at = Edge

**Design Data**

fb/FB + fa/Fa = 0.711  
**Total Force @ Section**  
 Service Level lbs =  
 Strength Level lbs = 2,009.0  
**Moment...Actual**  
 Service Level ft-# =  
 Strength Level ft-# = 5,202.2  
 Moment....Allowable = 7,314.8

**Shear....Actual**

Service Level psi =  
 Strength Level psi = 26.8  
 Shear....Allowable psi = 75.0  
 Anet (Masonry) in2 =  
 Rebar Depth 'd' in = 6.25

**Masonry Data**

fm 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**

fc psi = 2,500.0  
 Fy psi = 60,000.0

**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

**Bottom**

Stem OK

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**Cantilevered Retaining Wall**

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

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1949 in2/ft	
(4/3) * As :	0.2599 in2/ft	Min Stem T&S Reinf Area 1.440 in2
200bdify : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 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 :	0.2743 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 Data**

Toe Width = 2.75 ft  
 Heel Width = 1.67  
 Total Footing Width = 4.42  
 Footing Thickness = 10.00 in  
 Key Width = 0.00 in  
 Key Depth = 0.00 in  
 Key Distance from Toe = 0.00 ft  
 fc = 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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure =	2,536	0 psf
Mu' : Upward =	72,750	0 ft-#
Mu' : Downward =	8,984	583 ft-#
Mu: Design =	5,314	583 ft-#
Actual 1-Way Shear =	33.90	12.10 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 9.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

**Other Acceptable Sizes & Spacings**

Toe: #4@ 9.42 in, #5@ 14.60 in, #6@ 20.72 in, #7@ 28.26 in, #8@ 37.21 in, #9@ 47  
 Heel: phiMn = phi^5 lambda b d^3 / (sqrt(fc) S m)  
 Key: No key defined

Min footing T&S reinf Area	0.95	in2
Min footing T&S reinf Area per foot	0.22	in2 .ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,227.2	2.61	3,204.4	Soil Over HL (ab. water tbl)	842.8	3.92	3,302.4
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.92	3,302.4
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	441.0	4.33	1,911.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	110.0	1.38	151.3
				Surcharge Over Toe =			
				Stem Weight(s) =	750.0	3.08	2,312.5
				Earth @ Stem Transitions =			
				Footing Weight =	552.5	2.21	1,221.0
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>1,668.2</b>	<b>O.T.M. =</b>	<b>5,115.4</b>	<b>Total =</b>	<b>2,255.3 lbs</b>	<b>R.M.=</b>	<b>6,987.1</b>
<b>Resisting/Overtuning Ratio</b>			<b>= 1.37</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			2,255.3 lbs				

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)	0.085 in

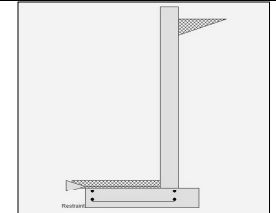
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	7.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**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 =	0.0 psf (Service Level)

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overtuning =	1.86 OK
Slab Resists All Sliding !	

Total Bearing Load =	2,014 lbs
...resultant ecc. =	8.66 in

Soil Pressure @ Toe =	985 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,378 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	22.4 psi OK
Footing Shear @ Heel =	8.3 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	1,227.2 lbs
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Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

<b>Load Factors</b>	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Earth, V	1.000
Wind, W	1.000
Seismic, E	1.000

**Stem Construction**

<b>Design Height Above Ftg</b>	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 =	0.513
<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 1,568.0
<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 3,658.7
Moment....Allowable =	7,122.4

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 20.9
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.25

**Masonry Data**

fm	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**

Fc	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) :	0.1371 in2/ft	
(4/3) * As :	0.1828 in2/ft	Min Stem T&S Reinf Area 1.440 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.1828 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 Data**

Toe Width =	2.75 ft
Heel Width =	1.42
Total Footing Width =	4.17
Footing Thickness =	10.00 in
Key Width =	0.00 in
Key Depth =	0.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure =	1,378	0 psf
Mu' : Upward =	48,532	17 ft-#
Mu' : Downward =	8,984	329 ft-#
Mu: Design =	3,296	311 ft-#
Actual 1-Way Shear =	22.43	8.29 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 9.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: No key defined

Min footing T&S reinf Area	0.90	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,227.2	2.61	3,204.4	Soil Over HL (ab. water tbl)	632.8	3.79	2,400.4
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.79	2,400.4
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	110.0	1.38	151.3
				Surcharge Over Toe =			
				Stem Weight(s) =	750.0	3.08	2,312.5
				Earth @ Stem Transitions =			
<b>Total</b> =	<b>1,227.2</b>	<b>O.T.M. =</b>	<b>3,204.4</b>	Footing Weight =	521.3	2.09	1,086.8
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>1.86</b>	<b>Total</b> =	<b>2,014.1 lbs</b>	<b>R.M.=</b>	<b>5,951.0</b>
Vertical Loads used for Soil Pressure =			2,014.1 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)	0.049	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.

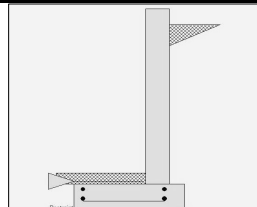


**Criteria**

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.29 Ratio < 1.5!
Slab Resists All Sliding !		

Total Bearing Load	=	1,263 lbs
...resultant ecc.	=	12.82 in

Soil Pressure @ Toe	=	1,786 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,500 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	18.1 psi OK
Footing Shear @ Heel	=	4.4 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	905.6 lbs
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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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Lateral Load Applied to Stem**

Lateral Load	=	45.0 #/ft
...Height to Top	=	5.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (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

**Stem Construction**

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	=	0.307
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	1,075.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	1,979.2
Moment....Allowable	=	6,444.1

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	14.3
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25

**Masonry Data**

fm	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**

Fc	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) :	0.0742 in2/ft	
(4/3) * As :	0.0989 in2/ft	Min Stem T&S Reinf Area 1.056 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.1728 in2/ft	One layer of : Two layers of :
Provided Area :	0.24 in2/ft	#4@ 12.50 in #4@ 25.00 in
Maximum Area :	0.8467 in2/ft	#5@ 19.38 in #5@ 38.75 in
		#6@ 27.50 in #6@ 55.00 in

**Footing Data**

Toe Width	=	2.00 ft
Heel Width	=	1.08
Total Footing Width	=	3.08
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	2,500	0 psf
Mu' : Upward	=	32,432	0 ft-#
Mu' : Downward	=	5,544	87 ft-#
Mu: Design	=	2,241	87 ft-#
Actual 1-Way Shear	=	18.13	4.37 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 10.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings  
 Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.00 in  
 Heel: phiMn = phi^5 lambda da^2 / sqrt(fc) S<sub>m</sub>  
 Key: No key defined

Min footing T&S reinf Area	0.67	in2
Min footing T&S reinf Area per foot	0.22	in2 .ft
If one layer of horizontal bars: If two layers of horizontal bars:		
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	248.0	2.87	712.6
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.87	712.6
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	225.0	3.33	750.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	80.0	1.00	80.0
				Surcharge Over Toe =			
				Stem Weight(s) =	550.0	2.33	1,283.3
				Earth @ Stem Transitions =			
				Footing Weight =	385.0	1.54	592.9
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>905.6</b>	<b>O.T.M. =</b>	<b>2,073.3</b>	<b>Total =</b>	<b>1,263.0 lbs</b>	<b>R.M.=</b>	<b>2,668.8</b>
<b>Resisting/Overtuning Ratio</b>			<b>= 1.29</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			1,263.0 lbs				

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) = 0.089 in

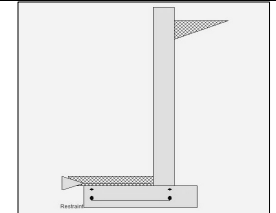
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	6.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**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 =	0.0 psf (Service Level)

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overtuning =	2.06 OK
Slab Resists All Sliding !	

Total Bearing Load =	1,733 lbs
...resultant ecc. =	6.37 in

Soil Pressure @ Toe =	886 psf OK
Soil Pressure @ Heel =	61 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,240 psf
ACI Factored @ Heel =	86 psf
Footing Shear @ Toe =	16.6 psi OK
Footing Shear @ Heel =	6.3 psi OK
Allowable =	75.0 psi

<b>Sliding Calcs</b>	
Lateral Sliding Force =	933.9 lbs

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

<b>Load Factors</b>	
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**

<b>Design Height Above Ftg</b>	ft = 0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	11.00
Rebar Placed at =	Edge

**Design Data**

fb/FB + fa/Fa =	0.391
<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 1,152.0
<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 2,304.0
Moment....Allowable =	5,883.6

**Sliding...Actual**

Service Level	psi =
Strength Level	psi = 15.4
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.25

**Masonry Data**

fm	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**

Fc	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) :	0.0863 in2/ft		
(4/3) * As :	0.1151 in2/ft	Min Stem T&S Reinf Area 1.248 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	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2182 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 Data**

Toe Width	=	2.25 ft
Heel Width	=	1.41
Total Footing Width	=	3.66
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure	= 1,240	86 psf
Mu' : Upward	= 30.479	45 ft-#
Mu' : Downward	= 6.014	280 ft-#
Mu: Design	= 2.039	235 ft-#
Actual 1-Way Shear	= 16.57	6.28 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 4 @ 11.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: No key defined

Min footing T&S reinf Area	0.79	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	535.2	3.29	1,759.9	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.29	1,759.9	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	=			* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	90.0	1.13	101.3
				Surcharge Over Toe	=			
				Stem Weight(s)	=	650.0	2.58	1,679.2
<b>Total</b>	<b>=</b>	<b>933.9</b>	<b>O.T.M. = 2,127.2</b>	Earth @ Stem Transitions	=			
				Footing Weight	=	457.5	1.83	837.2
				Key Weight	=			
				Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			<b>= 2.06</b>	<b>Total =</b>	<b>1,732.7 lbs</b>	<b>R.M.=</b>	<b>4,377.6</b>	
Vertical Loads used for Soil Pressure	=	1,732.7	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)	0.044	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.

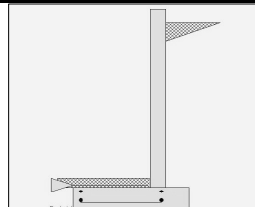


**Criteria**

Retained Height	=	6.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.24 Ratio < 1.5!
Slab Resists All Sliding !		

Total Bearing Load	=	1,596 lbs
...resultant ecc.	=	16.50 in

Soil Pressure @ Toe	=	2,129 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,981 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	23.3 psi OK
Footing Shear @ Heel	=	7.9 psi OK
Allowable	=	75.0 psi

**Sliding Calc**

Lateral Sliding Force	=	1,257.9 lbs
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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

**Lateral Load Applied to Stem**

Lateral Load	=	54.0 #/ft
...Height to Top	=	6.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (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

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	11.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.835
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	1,476.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	3,276.0
Moment....Allowable	=	3,920.0

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	28.9
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.25

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	75.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

Fc	psi =	2,500.0
Fy	psi =	60,000.0

**Bottom**

Stem OK	=	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	11.00
Rebar Placed at	=	Edge

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1852 in2/ft	
(4/3) * As :	0.2469 in2/ft	Min Stem T&S Reinf Area 0.936 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.1852 in2/ft	One layer of : Two layers of :
Provided Area :	0.2182 in2/ft	#4@ 16.67 in #4@ 33.33 in
Maximum Area :	0.5757 in2/ft	#5@ 25.83 in #5@ 51.67 in
		#6@ 36.67 in #6@ 73.33 in

**Footing Data**

Toe Width	=	2.50 ft
Heel Width	=	1.25
Total Footing Width	=	3.75
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	2,981	0 psf
Mu' : Upward	=	53,639	0 ft-#
Mu' : Downward	=	7,425	285 ft-#
Mu: Design	=	3,851	285 ft-#
Actual 1-Way Shear	=	23.28	7.92 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 11.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi^5 lambda b d a^2 / (sqrt(fc) S m)

Key: No key defined

Min footing T&S reinf Area	0.81	in2
Min footing T&S reinf Area per foot	0.22	in2 .ft
If one layer of horizontal bars: If two layers of horizontal bars:		
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	540.0	3.38	1,822.5
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.38	1,822.5
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	324.0	3.83	1,242.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	100.0	1.25	125.0
				Surcharge Over Toe =			
				Stem Weight(s) =	487.5	2.75	1,340.6
				Earth @ Stem Transitions =			
				Footing Weight =	468.8	1.88	878.9
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>1,257.9</b>	<b>O.T.M. =</b>	<b>3,369.2</b>	<b>Total =</b>	<b>1,596.3 lbs</b>	<b>R.M.=</b>	<b>4,167.0</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.24</b>				
Vertical Loads used for Soil Pressure =			1,596.3 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) = 0.103 in

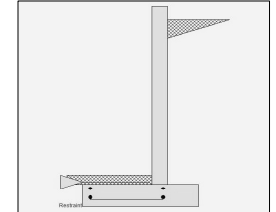
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	6.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning =	2.13 OK
Slab Resists All Sliding !	

Total Bearing Load =	1,766 lbs
...resultant ecc. =	6.11 in

Soil Pressure @ Toe =	855 psf OK
Soil Pressure @ Heel =	87 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,197 psf
ACI Factored @ Heel =	122 psf
Footing Shear @ Toe =	16.2 psi OK
Footing Shear @ Heel =	7.8 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	933.9 lbs
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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
Earth, V	1.000
Wind, W	1.000
Seismic, E	1.000

**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 =	0.0 psf
(Service Level)	

**Stem Construction**

Design Height Above Ftg	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness	= 6.00
Rebar Size	= # 4
Rebar Spacing	= 11.00
Rebar Placed at	= Edge

**Design Data**

fb/FB + fa/Fa	= 0.587
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**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 1,152.0

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 2,304.0
Moment....Allowable	= 3,920.0

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 22.6
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 4.25

**Masonry Data**

fm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Wall Weight	psf = 75.0
Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	= Medium Weight
Masonry Design Method	= ASD

**Concrete Data**

Fc	psi = 2,500.0
Fy	psi = 60,000.0

**Bottom**

Stem OK	
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 =	0.0 ft
at Back of Wall =	
Poisson's Ratio =	0.300

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1302 in2/ft		
(4/3) * As :	0.1737 in2/ft	Min Stem T&S Reinf Area 0.936 in2	
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.17 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2182 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in

**Footing Data**

Toe Width	=	2.25 ft
Heel Width	=	1.50
Total Footing Width	=	3.75
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure	= 1,197	122 psf
Mu' : Upward	= 29,827	109 ft-#
Mu' : Downward	= 6,014	507 ft-#
Mu: Design	= 1,984	398 ft-#
Actual 1-Way Shear	= 16.17	7.80 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 4 @ 11.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: No key defined

Min footing T&S reinf Area	0.81	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	720.0	3.25	2,340.0	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.25	2,340.0	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	=			* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	90.0	1.13	101.3
				Surcharge Over Toe	=			
				Stem Weight(s)	=	487.5	2.50	1,218.8
				Earth @ Stem Transitions	=			
<b>Total</b>	<b>=</b>	<b>933.9</b>	<b>O.T.M. = 2,127.2</b>	Footing Weight	=	468.8	1.88	878.9
				Key Weight	=			
				Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			<b>= 2.13</b>	<b>Total =</b>	<b>1,766.3 lbs</b>	<b>R.M.=</b>	<b>4,538.9</b>	
Vertical Loads used for Soil Pressure	=	1,766.3	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)	0.041	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.



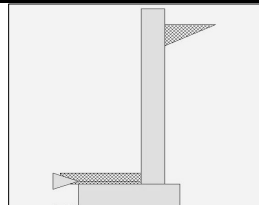
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**Criteria**

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.78 OK
Slab Resists All Sliding !		

Total Bearing Load	=	1,222 lbs
...resultant ecc.	=	6.82 in

Soil Pressure @ Toe	=	962 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,346 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	10.2 psi OK
Footing Shear @ Heel	=	3.7 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	680.6 lbs
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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

**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	=	0.0 psf (Service Level)

**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

**Stem Construction**

**Design Height Above Ftg** ft = 0.00  
 Wall Material Above "Ht" = Concrete  
 Design Method = LRFD  
 Thickness = 8.00  
 Rebar Size = # 4  
 Rebar Spacing = 11.00  
 Rebar Placed at = Edge

**Design Data**  
 fb/FB + fa/Fa = 0.226

**Total Force @ Section**  
 Service Level lbs = 800.0  
 Strength Level lbs = 800.0

**Moment...Actual**  
 Service Level ft-# = 1.333.3  
 Strength Level ft-# = 1,333.3  
 Moment....Allowable = 5,883.6

**Shear....Actual**  
 Service Level psi = 75.0  
 Strength Level psi = 10.7  
 Shear....Allowable psi = 75.0  
 Anet (Masonry) in2 = 6.25  
 Rebar Depth 'd' in = 6.25

**Masonry Data**  
 fm 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**  
 fc psi = 2,500.0  
 Fy psi = 60,000.0

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**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.05 in2/ft	
(4/3) * As :	0.0666 in2/ft	Min Stem T&S Reinf Area 1.056 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.1728 in2/ft	One layer of : Two layers of :
Provided Area :	0.2182 in2/ft	#4@ 12.50 in #4@ 25.00 in
Maximum Area :	0.8467 in2/ft	#5@ 19.38 in #5@ 38.75 in
		#6@ 27.50 in #6@ 55.00 in

**Footing Data**

Toe Width	=	1.75 ft
Heel Width	=	1.08
Total Footing Width	=	2.83
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	1,346	0 psf
Mu' : Upward	=	19,058	0 ft-#
Mu' : Downward	=	3,638	74 ft-#
Mu: Design	=	1,295	74 ft-#
Actual 1-Way Shear	=	10.22	3.70 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: phiMn = phi^5 lambda b d^3 sqrt(fc) S m  
 Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S m  
 Key: No key defined

Min footing T&S reinf Area	0.61	in2
Min footing T&S reinf Area per foot	0.22	in2 .ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	248.0	2.62	650.6
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.62	650.6
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	70.0	0.88	61.3
				Surcharge Over Toe =			
				Stem Weight(s) =	550.0	2.08	1,145.8
				Earth @ Stem Transitions =			
				Footing Weight =	353.8	1.42	500.6
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>680.6</b>	<b>O.T.M. =</b>	<b>1,323.3</b>	<b>Total =</b>	<b>1,221.8 lbs</b>	<b>R.M.=</b>	<b>2,358.2</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.78</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			1,221.8 lbs				

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) = 0.052 in

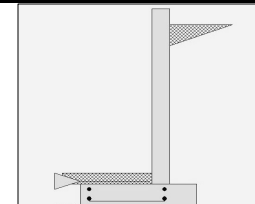
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	5.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	250.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning =	1.43 Ratio < 1.5!
Slab Resists All Sliding!	

Total Bearing Load =	1,349 lbs
...resultant ecc. =	11.59 in

Soil Pressure @ Toe =	1,365 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,910 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	18.5 psi OK
Footing Shear @ Heel =	6.8 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	905.6 lbs
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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
Earth, V	1.000
Wind, W	1.000
Seismic, E	1.000

**Lateral Load Applied to Stem**

Lateral Load =	45.0 #/ft
...Height to Top =	5.00 ft
...Height to Bottom =	0.00 ft
Load Type =	Seismic (E) (Service Level)
Wind on Exposed Stem =	0.0 psf (Service Level)

**Stem Construction**

Design Height Above Ftg	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness	= 6.00
Rebar Size	= # 4
Rebar Spacing	= 11.00
Rebar Placed at	= Edge

**Design Data**

fb/FB + fa/Fa	= 0.483
---------------	---------

**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 1,025.0

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 1,895.8
Moment....Allowable	= 3,920.0

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 20.1
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 4.25

**Masonry Data**

fm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Wall Weight	psf = 75.0
Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	= Medium Weight
Masonry Design Method	= ASD

**Concrete Data**

Fc	psi = 2,500.0
Fy	psi = 60,000.0

**Bottom**

Stem OK

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

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1072 in2/ft		
(4/3) * As :	0.1429 in2/ft	Min Stem T&S Reinf Area 0.792 in2	
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1429 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2182 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in

**Footing Data**

Toe Width =	2.00 ft
Heel Width =	1.25
Total Footing Width =	3.25
Footing Thickness =	10.00 in
Key Width =	0.00 in
Key Depth =	0.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

Factored Pressure =	1,910	0 psf
Mu' : Upward =	30,387	0 ft-#
Mu' : Downward =	4,752	245 ft-#
Mu: Design =	2,136	245 ft-#
Actual 1-Way Shear =	18.54	6.80 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 11.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**  
 Other Acceptable Sizes & Spacings  
 Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5  
 Heel: phiMn = phi\*5\*lambda\*sqrt(fc)\*Sm  
 Key: No key defined

Min footing T&S reinf Area	0.70	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	450.0	2.88	1,293.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.88	1,293.8
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	225.0	3.33	750.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	80.0	1.00	80.0
				Surcharge Over Toe =			
				Stem Weight(s) =	412.5	2.25	928.1
<b>Total</b>	<b>= 905.6</b>	<b>O.T.M. =</b>	<b>2,073.3</b>	Earth @ Stem Transitions =			
				Footing Weight =	406.3	1.63	660.2
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b>			<b>= 1.43</b>	<b>Total =</b>	<b>1,348.8 lbs</b>	<b>R.M.=</b>	<b>2,962.0</b>
Vertical Loads used for Soil Pressure =			1,348.8 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 Def @ Top of Wall (approximate only)	0.064	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.

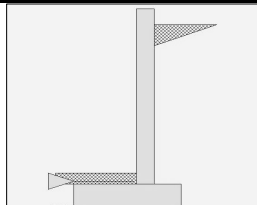
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**Criteria**

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.99 OK
Slab Resists All Sliding !		

Total Bearing Load	=	1,308 lbs
...resultant ecc.	=	6.01 in

Soil Pressure @ Toe	=	872 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,221 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	9.6 psi OK
Footing Shear @ Heel	=	5.6 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	680.6 lbs
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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

**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

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.369
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	800.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	1,333.3
Moment....Allowable	=	3,612.6

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	15.7
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.25

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	75.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

fc	psi =	2,500.0
Fy	psi =	60,000.0

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**Cantilevered Retaining Wall** Code: IBC 2015,ACI 318-14,ACI 530-13

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0754 in2/ft	
(4/3) * As :	0.1005 in2/ft	Min Stem T&S Reinf Area 0.792 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.1296 in2/ft	One layer of : Two layers of :
Provided Area :	0.2 in2/ft	#4@ 16.67 in #4@ 33.33 in
Maximum Area :	0.5757 in2/ft	#5@ 25.83 in #5@ 51.67 in
		#6@ 36.67 in #6@ 73.33 in

**Footing Data**

Toe Width	=	1.75 ft
Heel Width	=	1.25
Total Footing Width	=	3.00
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	1,221	0 psf
Mu' : Upward	=	18,072	28 ft-#
Mu' : Downward	=	3,636	245 ft-#
Mu: Design	=	1,203	216 ft-#
Actual 1-Way Shear	=	9.58	5.61 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: phiMn = phi^5 lambda bda^3 sqrt(fc) S m	
Heel: phiMn = phi^5 lambda bda^3 sqrt(fc) S m	
Key: No key defined	
Min footing T&S reinf Area	0.65 in2
Min footing T&S reinf Area per foot	0.22 in2 .ft
If one layer of horizontal bars: If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in



**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	450.0	2.63	1,181.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.63	1,181.3
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	70.0	0.88	61.3
				Surcharge Over Toe =			
				Stem Weight(s) =	412.5	2.00	825.0
				Earth @ Stem Transitions =			
				Footing Weight =	375.0	1.50	562.5
				Key Weight =			
				Vert. Component =			
				<b>Total =</b>	<b>1,307.5 lbs</b>	<b>R.M.=</b>	<b>2,630.0</b>
<b>Total</b>	<b>680.6</b>	<b>O.T.M. =</b>	<b>1,323.3</b>				
<b>Resisting/Overturning Ratio</b>			<b>= 1.99</b>				
Vertical Loads used for Soil Pressure =			1,307.5 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) = 0.044 in

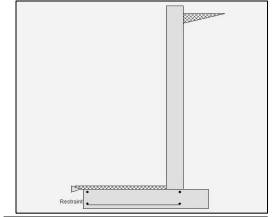
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	12.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing  Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.98 OK
Slab Resists All Sliding !	=	

Total Bearing Load	=	5,641 lbs
...resultant ecc.	=	12.76 in

Soil Pressure @ Toe	=	1,392 psf OK
Soil Pressure @ Heel	=	113 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,949 psf
ACI Factored @ Heel	=	158 psf
Footing Shear @ Toe	=	34.5 psi OK
Footing Shear @ Heel	=	15.5 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	3,511.3 lbs
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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
Earth, V	=	1.000
Wind, W	=	1.000
Seismic, E	=	1.000

**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	=	0.0 psf
(Service Level)	=	

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	12.00
Rebar Size	=	# 6
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge
fb/FB + fa/Fa	=	0.701

**Total Force @ Section**

Service Level	lbs =	
Strength Level	lbs =	4,608.0
Moment...Actual	ft-# =	
Service Level	ft-# =	
Strength Level	ft-# =	18,432.0
Moment....Allowable	=	26,273.2

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	39.9
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	9.63

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	150.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

Fc	psi =	2,500.0
Fy	psi =	60,000.0

**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

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.4401 in2/ft		
(4/3) * As :	0.5868 in2/ft	Min Stem T&S Reinf Area 3.600 in2	
200bdfy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.4401 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.66 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.3039 in2/ft	#6@ 18.33 in	#6@ 36.67 in

**Footing Data**

Toe Width	=	5.00 ft
Heel Width	=	2.50
Total Footing Width	=	7.50
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	Toe	Heel
Mu' : Upward	=	1,949	158 psf
Mu' : Downward	=	232,581	312 ft-#
Mu: Design	=	40,950	2,197 ft-#
Actual 1-Way Shear	=	15,969	1,886 ft-#
Allow 1-Way Shear	=	34.47	15.54 psi
Toe Reinforcing	=	75.00	40.00 psi
Heel Reinforcing	=	# 6 @ 11.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**  
 Other Acceptable Sizes & Spacings  
 Toe: #4@ 5.67 in, #5@ 8.79 in, #6@ 12.47 in, #7@ 17.01 in, #8@ 22.40 in, #9@ 28.  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: No key defined

Min footing T&S reinf Area	2.43	in2
Min footing T&S reinf Area per foot	0.32	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 7.41 in	#4@ 14.81 in	
#5@ 11.48 in	#5@ 22.96 in	
#6@ 16.30 in	#6@ 32.59 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	3,511.3	4.42	15,508.0	Soil Over HL (ab. water tbl)	2,160.0	6.75	14,580.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		6.75	14,580.0
Hydrostatic Force				Watre Table			
Buoyant Force	=			Sloped Soil Over Heel	=		
Surcharge over Heel	=			Surcharge Over Heel	=		
Surcharge Over Toe	=			Adjacent Footing Load	=		
Adjacent Footing Load	=			Axial Dead Load on Stem	=		
Added Lateral Load	=			* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=			Soil Over Toe	=	200.0	500.0
				Surcharge Over Toe	=		
				Stem Weight(s)	=	1,875.0	10,312.5
				Earth @ Stem Transitions	=		
<b>Total</b>	<b>=</b>	<b>3,511.3</b>	<b>O.T.M. = 15,508.0</b>	Footing Weight	=	1,406.3	5,273.4
				Key Weight	=		
				Vert. Component	=		
<b>Resisting/Overturning Ratio</b>			<b>= 1.98</b>	<b>Total =</b>	<b>5,641.3 lbs</b>	<b>R.M.=</b>	<b>30,665.9</b>
Vertical Loads used for Soil Pressure	=	5,641.3	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 Def @ Top of Wall (approximate only)	0.064	in

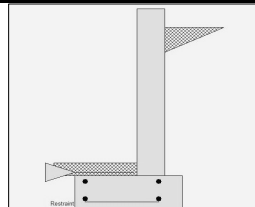
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.45 Ratio < 1.5!
Slab Resists All Sliding !	=	

Total Bearing Load	=	1,095 lbs
...resultant ecc.	=	9.18 in

Soil Pressure @ Toe	=	1,392 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable	=	

ACI Factored @ Toe	=	1,948 psf
ACI Factored @ Heel	=	0 psf

Footings Shear @ Toe	=	9.4 psi OK
Footings Shear @ Heel	=	2.6 psi OK
Allowable	=	75.0 psi

Sliding Calcs	=	
Lateral Sliding Force	=	644.0 lbs

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

**Lateral Load Applied to Stem**

Lateral Load	=	36.0 #/ft
...Height to Top	=	4.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (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

**Stem Construction**

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	=	0.136
<b>Total Force @ Section</b>	=	
Service Level	lbs =	
Strength Level	lbs =	656.0
<b>Moment...Actual</b>	=	
Service Level	ft-# =	
Strength Level	ft-# =	970.7
Moment....Allowable	=	7,122.4

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	8.7
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25

**Masonry Data**

fm	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**

fc	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) :	0.0364 in2/ft	
(4/3) * As :	0.0485 in2/ft	Min Stem T&S Reinf Area 0.864 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.1728 in2/ft	One layer of : Two layers of :
Provided Area :	0.2667 in2/ft	#4@ 12.50 in #4@ 25.00 in
Maximum Area :	0.8467 in2/ft	#5@ 19.38 in #5@ 38.75 in
		#6@ 27.50 in #6@ 55.00 in

**Footing Data**

Toe Width	=	1.50 ft
Heel Width	=	1.08
Total Footing Width	=	2.58
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	1,948	0 psf
Mu' : Upward	=	17,949	0 ft-#
Mu' : Downward	=	3,078	65 ft-#
Mu: Design	=	1,239	65 ft-#
Actual 1-Way Shear	=	9.43	2.60 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 9.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46  
 Heel: phiMn = phi^5 lambda b d^3 / (sqrt(fc) S) m  
 Key: No key defined

Min footing T&S reinf Area	0.67	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**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	500.0	1.67	833.3	Soil Over HL (ab. water tbl)	198.4	2.37	470.9
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.37	470.9
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	144.0	3.00	432.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	60.0	0.75	45.0
				Surcharge Over Toe =			
				Stem Weight(s) =	450.0	1.83	825.0
				Earth @ Stem Transitions =			
				Footing Weight =	387.0	1.29	499.2
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>644.0</b>	<b>O.T.M. =</b>	<b>1,265.3</b>	<b>Total =</b>	<b>1,095.4 lbs</b>	<b>R.M.=</b>	<b>1,840.1</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.45</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			1,095.4 lbs				

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)	0.067 in

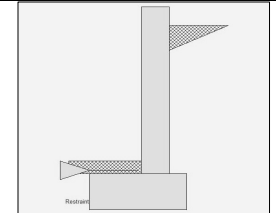
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	4.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**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 =	0.0 psf
(Service Level)	

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning =	1.89 OK
Slab Resists All Sliding !	

Total Bearing Load =	1,048 lbs
...resultant ecc. =	5.52 in

Soil Pressure @ Toe =	991 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,387 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	4.4 psi OK
Footing Shear @ Heel =	2.5 psi OK
Allowable =	75.0 psi

<b>Sliding Calcs</b>	
Lateral Sliding Force =	500.0 lbs

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

<b>Load Factors</b>	
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**

<b>Design Height Above Ftg</b>	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 =	0.095
<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 512.0
<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 682.7
Moment....Allowable =	7,122.4

**Sliding...Actual**

Service Level	psi =
Strength Level	psi = 6.8
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.25

**Masonry Data**

fm	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**

Fc	psi = 2,500.0
Fy	psi = 60,000.0

**Bottom**

Stem OK	
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**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0256 in2/ft	
(4/3) * As :	0.0341 in2/ft	Min Stem T&S Reinf Area 0.864 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.1728 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 Data**

Toe Width =	1.25 ft
Heel Width =	1.08
Total Footing Width =	2.33
Footing Thickness =	12.00 in
Key Width =	0.00 in
Key Depth =	0.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure =	1,387	0 psf
Mu' : Upward =	10,443	1 ft-#
Mu' : Downward =	2,138	65 ft-#
Mu: Design =	692	64 ft-#
Actual 1-Way Shear =	4.36	2.50 psi
Allow 1-Way Shear =	40.00	40.00 psi
Toe Reinforcing =	None Spec'd	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: No key defined

Min footing T&S reinf Area	0.60	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**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	500.0	1.67	833.3	Soil Over HL (ab. water tbl)	198.4	2.12	421.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.12	421.3
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	50.0	0.63	31.3
				Surcharge Over Toe =			
				Stem Weight(s) =	450.0	1.58	712.5
				Earth @ Stem Transitions =			
<b>Total</b>	<b>= 500.0</b>	<b>O.T.M. =</b>	<b>833.3</b>	Footing Weight =	349.5	1.17	407.2
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b>			<b>= 1.89</b>	<b>Total =</b>	<b>1,047.9 lbs</b>	<b>R.M.=</b>	<b>1,572.2</b>
Vertical Loads used for Soil Pressure =			1,047.9 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 Def @ Top of Wall (approximate only)	0.053	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.

**Cantilevered Retaining Wall**

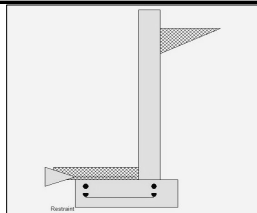
Code: IBC 2015,ACI 318-14,ACI 530-13

**Criteria**

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.27 Ratio < 1.5!
Slab Resists All Sliding!	=	

Total Bearing Load	=	871 lbs
...resultant ecc.	=	10.39 in

Soil Pressure @ Toe	=	1,687 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	2,361 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	15.3 psi OK
Footing Shear @ Heel	=	3.6 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	595.3 lbs
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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

**Lateral Load Applied to Stem**

Lateral Load	=	36.0 #/ft
...Height to Top	=	4.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.268
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	656.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	970.7
Moment....Allowable	=	3,612.6

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	12.9
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.25

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	75.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

fc	psi =	2,500.0
Fy	psi =	60,000.0

**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

**Bottom**

Stem OK

**Cantilevered Retaining Wall**

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

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0549 in2/ft	
(4/3) * As :	0.0732 in2/ft	Min Stem T&S Reinf Area 0.648 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.1296 in2/ft	One layer of : Two layers of :
Provided Area :	0.2 in2/ft	#4@ 16.67 in #4@ 33.33 in
Maximum Area :	0.5757 in2/ft	#5@ 25.83 in #5@ 51.67 in
		#6@ 36.67 in #6@ 73.33 in

**Footing Data**

Toe Width	=	1.50 ft
Heel Width	=	0.92
Total Footing Width	=	2.42
Footing Thickness	=	9.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	2,361	0 psf
Mu' : Upward	=	16,916	0 ft-#
Mu' : Downward	=	2,471	63 ft-#
Mu: Design	=	1,204	63 ft-#
Actual 1-Way Shear	=	15.34	3.56 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 12.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**  
 Other Acceptable Sizes & Spacings  
 Toe: #4@ 12.34 in, #5@ 19.13 in, #6@ 27.16 in, #7@ 37.03 in, #8@ 48.76 in, #9@ 6  
 Heel: phiMn = phi^5 lambda b d^2 / (12 \* sqrt(fc) \* S\_m)  
 Key: No key defined

Min footing T&S reinf Area	0.47	in2
Min footing T&S reinf Area per foot	0.19	in2 .ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 12.35 in		#4@ 24.69 in
#5@ 19.14 in		#5@ 38.27 in
#6@ 27.16 in		#6@ 54.32 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	451.3	1.58	714.5	Soil Over HL (ab. water tbl)	201.6	2.21	445.5
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.21	445.5
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	144.0	2.75	396.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	60.0	0.75	45.0
				Surcharge Over Toe =			
				Stem Weight(s) =	337.5	1.75	590.6
				Earth @ Stem Transitions =			
				Footing Weight =	272.3	1.21	329.4
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>595.3</b>	<b>O.T.M. =</b>	<b>1,110.5</b>	<b>Total =</b>	<b>871.4 lbs</b>	<b>R.M.=</b>	<b>1,410.6</b>
<b>Resisting/Overtuning Ratio</b>			<b>= 1.27</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			871.4 lbs				

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) = 0.087 in

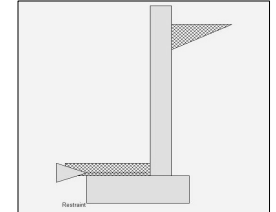
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	4.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning =	1.97 OK
Slab Resists All Sliding !	

Total Bearing Load =	871 lbs
...resultant ecc. =	4.93 in

Soil Pressure @ Toe =	727 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,018 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	7.4 psi OK
Footing Shear @ Heel =	3.2 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	451.3 lbs
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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
Earth, V	1.000
Wind, W	1.000
Seismic, E	1.000

**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 =	0.0 psf
(Service Level)	

**Stem Construction**

Design Height Above Ftg	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness	= 6.00
Rebar Size	= # 4
Rebar Spacing	= 12.00
Rebar Placed at	= Edge

**Design Data**

fb/FB + fa/Fa	= 0.188
---------------	---------

**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 512.0

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 682.7
Moment....Allowable	= 3,612.6

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 10.0
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 4.25

**Masonry Data**

fm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Wall Weight	psf = 75.0
Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	= Medium Weight
Masonry Design Method	= ASD

**Concrete Data**

Fc	psi = 2,500.0
Fy	psi = 60,000.0

**Bottom**

Stem OK

0.00

Concrete

LRFD

6.00

# 4

12.00

Edge

0.188

512.0

682.7

3,612.6

10.0

75.0

4.25

psi =

psi =

psi =

psi =

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**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0386 in2/ft		
(4/3) * As :	0.0515 in2/ft	Min Stem T&S Reinf Area 0.648 in2	
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1296 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in

**Footing Data**

Toe Width	=	1.50 ft
Heel Width	=	0.92
Total Footing Width	=	2.42
Footing Thickness	=	9.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

		<b>Toe</b>	<b>Heel</b>
Factored Pressure	=	1,018	0 psf
Mu' : Upward	=	10,876	4 ft-#
Mu' : Downward	=	2,471	63 ft-#
Mu: Design	=	700	58 ft-#
Actual 1-Way Shear	=	7.41	3.16 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: No key defined

Min footing T&S reinf Area	0.47	in2
Min footing T&S reinf Area per foot	0.19	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 12.35 in		#4@ 24.69 in
#5@ 19.14 in		#5@ 38.27 in
#6@ 27.16 in		#6@ 54.32 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	451.3	1.58	714.5	Soil Over HL (ab. water tbl)	201.6	2.21	445.5	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.21	445.5	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	=			* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	60.0	0.75	45.0
				Surcharge Over Toe	=			
				Stem Weight(s)	=	337.5	1.75	590.6
				Earth @ Stem Transitions	=			
<b>Total</b>	<b>=</b>	<b>451.3</b>	<b>O.T.M. = 714.5</b>	Footing Weight	=	272.3	1.21	329.4
				Key Weight	=			
				Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			<b>= 1.97</b>	<b>Total =</b>	<b>871.4 lbs</b>	<b>R.M.=</b>	<b>1,410.6</b>	
Vertical Loads used for Soil Pressure	=		871.4 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)	0.038	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 2018,ACI 318-14,TMS 402-16

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**Cantilevered Retaining Wall** Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria		Soil Data	
Retained Height =	0.00 ft	Allow Soil Bearing =	0.0 psf
Wall height above soil =	0.00 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall =	0.00	Active Heel Pressure =	0.0 psf/ft
Height of Soil over Toe =	0.00 in		
Water height over heel =	0.0 ft	Passive Pressure =	0.0 psf/ft
		Soil Density, Heel =	0.00 pcf
		Soil Density, Toe =	0.00 pcf
		Footing Soil Friction =	0.000
		Soil height to ignore for passive pressure =	0.00 in

Footing Data		Footing Design Results	
Toe Width =	0.00 ft	Factored Pressure =	Toe Heel
Heel Width =	0.50	Mu' : Upward =	0 0 psf
Total Footing Width =	0.50	Mu' : Downward =	0 0 ft-#
Footing Thickness =	0.00 in	Mu: Design =	0 0 ft-#
Key Width =	0.00 in	Actual 1-Way Shear =	25.94 0.00 psi
Key Depth =	0.00 in	Allow 1-Way Shear =	35.78 35.78 psi
Key Distance from Toe =	0.00 ft	Toe Reinforcing =	None Spec'd
f <sub>c</sub> =	2,000 psi	Heel Reinforcing =	None Spec'd
Footing Concrete Density =	0.00 pcf	Key Reinforcing =	None Spec'd
Min. As % =	0.0000	Footing Torsion, Tu =	0.00 ft-lbs
Cover @ Top =	0.00 @ Btm= 0.00 in	Footing Allow. Torsion, phi Tu =	0.00 ft-lbs

Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel =	0.0 psf	Lateral Load =	0.0 #/ft	Adjacent Footing Load =	0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top =	0.00 ft	Footing Width =	0.00 ft
Surcharge Over Toe =	0.0	...Height to Bottom =	0.00 ft	Eccentricity =	0.00 in
NOT Used for Sliding & Overturning		Load Type =		Wall to Ftg CL Dist =	0.00 ft
		(Service Level)		Footing Type =	Line Load
		Wind on Exposed Stem =	0.0 psf	Base Above/Below Soil at Back of Wall =	0.0 ft
		(Service Level)		Poisson's Ratio =	0.300

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings  
 Toe: phiMn = phi^5 lambda sqrt(fc) Sm  
 Heel: phiMn = phi^5 lambda sqrt(fc) Sm  
 Key: No key defined

Min footing T&S reinf Area = 0.00 in<sup>2</sup>  
 Min footing T&S reinf Area per foot = 0.00 in<sup>2</sup>/ft  
 If one layer of horizontal bars: If two layers of horizontal bars:  
 #4 @ 0.00 in #4 @ 0.00 in  
 #5 @ 0.00 in #5 @ 0.00 in  
 #6 @ 0.00 in #6 @ 0.00 in

Design Summary		Stem Construction		Bottom	
Wall Stability Ratios		Design Height Above Ftg ft =	0.00	Stem OK	
Overturning =	0.00 OK	Wall Material Above "Ht" =	3		
Sliding =	0.00 OK	Design Method =	LRFD		
		Thickness =	0.00		
		Rebar Size =	# 0		
Total Bearing Load =	0 lbs	Rebar Spacing =	0.00		
...resultant ecc. =	3.00 in	Rebar Placed at =	Center		
		Design Data			
Soil Pressure @ Toe =	0 psf OK	fb/FB + fa/Fa =	0.00		
Soil Pressure @ Heel =	0 psf OK	Total Force @ Section			
Allowable =	0 psf	Service Level lbs =			
Soil Pressure Less Than Allowable		Strength Level lbs =			
ACI Factored @ Toe =	0 psf	Moment...Actual			
ACI Factored @ Heel =	0 psf	Service Level ft-# =			
Footing Shear @ Toe =	25.9 psi OK	Strength Level ft-# =			
Footing Shear @ Heel =	0.0 psi OK	Moment.... Allowable =	0.0		
Allowable =	67.1 psi	Shear....Actual			
Sliding Calcs		Service Level psi =			
Lateral Sliding Force =	0.0 lbs	Strength Level psi =			
less 0 % Passive Force =	- 0.0 lbs	Shear.... Allowable psi =	0.0		
less 0 % Friction Force =	- 0.0 lbs	Anet (Masonry) in2 =			
Added Force Req'd =	0.0 lbs OK	Rebar Depth 'd' in =	0.00		
...for 1.5 Stability =	0.0 lbs OK	Masonry Data			
		f <sub>m</sub> psi =	1,500		
		F <sub>s</sub> psi =	32,000		
		Solid Grouting =	No		
		Modular Ratio 'n' =	0.00		
		Wall Weight psf =	0.0		
		Short Term Factor =	1.000		
		Equiv. Solid Thick. in =	0.00		
		Masonry Block Type =	Medium Weight		
		Masonry Design Method =	ASD		
		Concrete Data			
		f <sub>c</sub> psi =	2,500.0		
		F <sub>y</sub> psi =	0.0		

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

Load Factors  
 Building Code IBC 2018,ACI  
 Dead Load 1.400  
 Live Load 1.700  
 Earth, H 1.700  
 Wind, W 1.000  
 Seismic, E 1.700

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)				Soil Over HL (ab. water tbl)		
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		
Hydrostatic Force				Watre Table		
Buoyant Force =				Sloped Soil Over Heel =		
Surcharge over Heel =				Surcharge Over Heel =		
Surcharge Over Toe =				Adjacent Footing Load =		
Adjacent Footing Load =				Axial Dead Load on Stem =		
Added Lateral Load =				* Axial Live Load on Stem =		
Load @ Stem Above Soil =				Soil Over Toe =		
				Surcharge Over Toe =		
				Stem Weight(s) =		
				Earth @ Stem Transitions =		
				Footing Weight =		0.25
				Key Weight =		
				Vert. Component =		
<b>Total</b> =		<b>O.T.M.</b> =		<b>Total</b> =		<b>R.M.</b> =
Resisting/Overturning Ratio						
Vertical Loads used for Soil Pressure =			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 Def @ Top of Wall (approximate only) = 0.038 in

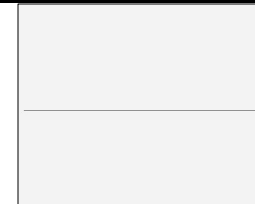
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height = 0.00 ft  
 Wall height above soil = 0.00 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 = 0.0 psf  
 Equivalent Fluid Pressure Method  
 Active Heel Pressure = 0.0 psf/ft  
 Passive Pressure = 0.0 psf/ft  
 Soil Density, Heel = 0.00 pcf  
 Soil Density, Toe = 0.00 pcf  
 Footing|Soil Friction = 0.000  
 Soil height to ignore for passive pressure = 0.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**  
 Overturning = 0.00 OK  
 Sliding = 0.00 OK  
 Total Bearing Load = 0 lbs  
 ...resultant ecc. = 0.00 in  
 Soil Pressure @ Toe = 0 psf OK  
 Soil Pressure @ Heel = 0 psf OK  
 Allowable = 0 psf  
 Soil Pressure Less Than Allowable  
 ACI Factored @ Toe = 0 psf  
 ACI Factored @ Heel = 0 psf  
 Footing Shear @ Toe = 25.9 psi OK  
 Footing Shear @ Heel = 0.0 psi OK  
 Allowable = 67.1 psi  
**Sliding Calc**  
 Lateral Sliding Force = 0.0 lbs  
 less 0 % Passive Force = - 0.0 lbs  
 less 0 % Friction Force = - 0.0 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 2018,ACI  
 Dead Load = 1.400  
 Live Load = 1.700  
 Earth, H = 1.700  
 Wind, W = 1.000  
 Seismic, E = 1.700

**Lateral Load Applied to Stem**

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

**Stem Construction**

Design Height Above Ftg = 0.00 ft  
 Wall Material Above "Ht" = 3  
 Design Method = LRFD  
 Thickness = 0.00  
 Rebar Size = # 0  
 Rebar Spacing = 0.00  
 Rebar Placed at = Center

**Design Data**

fb/FB + fa/Fa = 0.00  
**Total Force @ Section**  
 Service Level lbs =  
 Strength Level lbs =  
**Moment...Actual**  
 Service Level ft-# =  
 Strength Level ft-# =  
 Moment....Allowable = 0.0

**Shear....Actual**

Service Level psi =  
 Strength Level psi =  
 Shear....Allowable psi = 0.0  
 Anet (Masonry) in2 =  
 Rebar Depth 'd' in = 0.00

**Masonry Data**

fm psi = 1,500  
 Fs psi = 0  
 Solid Grouting = No  
 Modular Ratio 'n' = 0.00  
 Wall Weight psf = 0.0  
 Short Term Factor = 1.000  
 Equiv. Solid Thick. in = 0.00  
 Masonry Block Type = Medium Weight  
 Masonry Design Method = ASD

**Concrete Data**

Fc psi = 2,500.0  
 Fy psi = 0.0

**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 = 0.000

**Bottom**

Stem OK

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**Footing Data**

Toe Width = 0.00 ft  
 Heel Width = 0.00  
 Total Footing Width = 0.00  
 Footing Thickness = 0.00 in  
 Key Width = 0.00 in  
 Key Depth = 0.00 in  
 Key Distance from Toe = 0.00 ft  
 f<sub>c</sub> = 2,000 psi F<sub>y</sub> = 60,000 psi  
 Footing Concrete Density = 0.00 pcf  
 Min. As % = 0.0000  
 Cover @ Top 0.00 @ Btm = 0.00 in

**Footing Design Results**

	<b>Toe</b>	<b>Heel</b>	
Factored Pressure	= 0	0	psf
Mu' : Upward	= 0	0	ft-#
Mu' : Downward	= 0	0	ft-#
Mu: Design	= 0	0	ft-#
Actual 1-Way Shear	= 25.94	0.00	psi
Allow 1-Way Shear	= 35.78	35.78	psi
Toe Reinforcing	= None Spec'd		
Heel Reinforcing	= None Spec'd		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00	ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00	ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: phiMn = phi<sup>5</sup>lambda<sup>2</sup>sqrt(f<sub>c</sub>)S<sub>m</sub>  
 Heel: phiMn = phi<sup>5</sup>lambda<sup>2</sup>sqrt(f<sub>c</sub>)S<sub>m</sub>  
 Key: No key defined

Min footing T&S reinf Area	0.00	in <sup>2</sup>
Min footing T&S reinf Area per foot	0.00	in <sup>2</sup> /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 0.00 in		#4@ 0.00 in
#5@ 0.00 in		#5@ 0.00 in
#6@ 0.00 in		#6@ 0.00 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)				Soil Over HL (ab. water tbl)		
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		
Hydrostatic Force				Watre Table		
Buoyant Force =				Sloped Soil Over Heel =		
Surcharge over Heel =				Surcharge Over Heel =		
Surcharge Over Toe =				Adjacent Footing Load =		
Adjacent Footing Load =				Axial Dead Load on Stem =		
Added Lateral Load =				* Axial Live Load on Stem =		
Load @ Stem Above Soil =				Soil Over Toe =		
				Surcharge Over Toe =		
				Stem Weight(s) =		
				Earth @ Stem Transitions =		
<b>Total</b> =		<b>O.T.M.</b> =		Footing Weight =		
				Key Weight =		
<b>Resisting/Overturning Ratio</b> =				Vert. Component =		
Vertical Loads used for Soil Pressure =		lbs		<b>Total</b> =	lbs	<b>R.M.</b> =

\* 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**

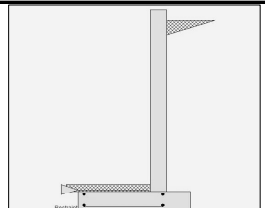
(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci  
 Horizontal Def @ Top of Wall (approximate only) 0.038 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.*

Criteria	
Retained Height	= 8.00 ft
Wall height above soil	= 0.50 ft
Slope Behind Wall	= 0.00
Height of Soil over Toe	= 4.00 in
Water height over heel	= 0.0 ft

Soil Data	
Allow Soil Bearing	= 2,666.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure	= 35.0 psf/ft
Passive Pressure	= 250.0 psf/ft
Soil Density, Heel	= 120.00 pcf
Soil Density, Toe	= 120.00 pcf
Footing Soil Friction	= 0.450
Soil height to ignore for passive pressure	= 12.00 in



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

Lateral Load Applied to Stem	
Lateral Load	= 64.0 #/ft
...Height to Top	= 8.00 ft
...Height to Bottom	= 0.00 ft
Load Type	
(Service Level)	
Wind on Exposed Stem	= 0.0 psf
(Service Level)	

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

Axial Load Applied to Stem	
Axial Dead Load	= 0.0 lbs
Axial Live Load	= 0.0 lbs
Axial Load Eccentricity	= 0.0 in

**Design Summary**

Wall Stability Ratios	
Overturning	= 1.26 Ratio < 1.5!
Slab Resists All Sliding !	
Total Bearing Load	= 2,623 lbs
...resultant ecc.	= 19.73 in
Soil Pressure @ Toe	= 2,548 psf OK
Soil Pressure @ Heel	= 0 psf OK
Allowable	= 2,666 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe	= 3,567 psf
ACI Factored @ Heel	= 0 psf
Footing Shear @ Toe	= 29.8 psi OK
Footing Shear @ Heel	= 12.9 psi OK
Allowable	= 75.0 psi
<b>Sliding Calcs</b>	
Lateral Sliding Force	= 1,929.5 lbs

**Stem Construction**

Design Height Above Ftg	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness	= 8.00
Rebar Size	= # 5
Rebar Spacing	= 12.00
Rebar Placed at	= Edge

Design Data	
fb/FB + fa/Fa	= 0.877
<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 2,416.0
<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 7,125.3
Moment....Allowable	= 8,121.3

Shear....Actual	
Service Level	psi =
Strength Level	psi = 32.5
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.19

Masonry Data	
fm	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	
Fc	psi = 2,500.0
Fy	psi = 60,000.0

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

Load Factors	
Building Code	IBC 2018,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.2698 in2/ft	
(4/3) * As :	0.3597 in2/ft	Min Stem T&S Reinf Area 0.000 in2
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.2698 in2/ft	#4@ 0.00 in #4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in #5@ 0.00 in
Maximum Area :	0.8382 in2/ft	#6@ 0.00 in #6@ 0.00 in

**Footing Data**

Toe Width	= 3.00 ft
Heel Width	= 1.66
Total Footing Width	= 4.66
Footing Thickness	= 12.00 in
Key Width	= 0.00 in
Key Depth	= 0.00 in
Key Distance from Toe	= 0.00 ft
fc =	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	= 3,567	0 psf
Mu' : Upward	= 101,945	0 ft-#
Mu' : Downward	= 14,364	767 ft-#
Mu: Design	= 7,298	767 ft-#
Actual 1-Way Shear	= 29.75	12.86 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 5 @ 12.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 9.07 in, #5@ 14.07 in, #6@ 19.97 in, #7@ 27.23 in, #8@ 35.86 in, #9@ 45

Heel: phiMn = phi^5 lambda^2 / sqrt(fc) S<sub>m</sub>

Key: No key defined

Min footing T&S reinf Area 0.00 in2

Min footing T&S reinf Area per foot 0.00 in2 .ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 0.00 in #4@ 0.00 in

#5@ 0.00 in #5@ 0.00 in

#6@ 0.00 in #6@ 0.00 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl)	953.6	4.16	3,970.2
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.16	3,970.2
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	512.0	5.00	2,560.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	120.0	1.50	180.0
				Surcharge Over Toe =			
				Stem Weight(s) =	850.0	3.33	2,833.3
				Earth @ Stem Transitions =			
				Footing Weight =	699.0	2.33	1,628.7
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>1,929.5</b>	<b>O.T.M. =</b>	<b>6,812.5</b>	<b>Total =</b>	<b>2,622.6 lbs</b>	<b>R.M.=</b>	<b>8,612.2</b>
<b>Resisting/Overturing Ratio</b>			<b>= 1.26</b>				
Vertical Loads used for Soil Pressure =			2,622.6 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)	0.129 in

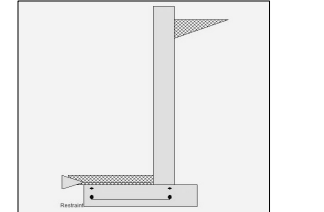
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	6.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,666.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Lateral Load Applied to Stem**

Lateral Load =	54.0 #/ft
...Height to Top =	6.00 ft
...Height to Bottom =	0.10 ft
Load Type =	Seismic (E) (Service Level)
Wind on Exposed Stem =	0.0 psf (Service Level)

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturing =	1.30 Ratio < 1.5!
Slab Resists All Sliding!	

Total Bearing Load =	1,733 lbs
...resultant ecc. =	15.01 in

Soil Pressure @ Toe =	1,993 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,666 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	2,791 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	26.4 psi OK
Footing Shear @ Heel =	7.9 psi OK
Allowable =	75.0 psi

<b>Sliding Calcs</b>	
Lateral Sliding Force =	1,263.3 lbs

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

<b>Load Factors</b>	
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**

<b>Design Height Above Ftg</b>	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness	= 8.00
Rebar Size	= # 4
Rebar Spacing	= 11.00
Rebar Placed at	= Edge

**Design Data**

fb/FB + fa/Fa =	0.556
<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 1,476.0
<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 3,276.0
Moment....Allowable =	5,883.6

**Sliding...Actual**

Service Level	psi =
Strength Level	psi = 19.7
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.25

**Masonry Data**

fm	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**

Fc	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) :	0.1227 in2/ft		
(4/3) * As :	0.1637 in2/ft	Min Stem T&S Reinf Area 1.248 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	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2182 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 Data**

Toe Width =	2.25 ft
Heel Width =	1.41
Total Footing Width =	3.66
Footing Thickness =	10.00 in
Key Width =	0.00 in
Key Depth =	0.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

Factored Pressure =	2,791	0 psf
Mu' : Upward =	48,627	0 ft-#
Mu' : Downward =	6,014	280 ft-#
Mu: Design =	3,551	280 ft-#
Actual 1-Way Shear =	26.40	7.85 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 11.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: No key defined

Min footing T&S reinf Area	0.79	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	535.2	3.29	1,759.9
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.29	1,759.9
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	329.4	3.78	1,246.2	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	90.0	1.13	101.3
				Surcharge Over Toe =			
				Stem Weight(s) =	650.0	2.58	1,679.2
<b>Total</b> =	<b>1,263.3</b>	<b>O.T.M. =</b>	<b>3,373.4</b>	Earth @ Stem Transitions =			
				Footing Weight =	457.5	1.83	837.2
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>1.30</b>	<b>Total =</b>	<b>1,732.7 lbs</b>	<b>R.M.=</b>	<b>4,377.6</b>
Vertical Loads used for Soil Pressure =			1,732.7 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 Def @ Top of Wall (approximate only)	0.098	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.

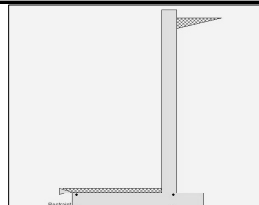


**Criteria**

Retained Height	=	11.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.34 Ratio < 1.5!
Slab Resists All Sliding!	=	

Total Bearing Load	=	4,987 lbs
...resultant ecc.	=	27.81 in

Soil Pressure @ Toe	=	2,468 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	3,455 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	42.1 psi OK
Footing Shear @ Heel	=	17.4 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	4,090.3 lbs
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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

**Lateral Load Applied to Stem**

Lateral Load	=	99.0 #/ft
...Height to Top	=	11.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Service Level)

**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

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	10.00
Rebar Size	=	# 6
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.992
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	4,961.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	20,186.8
Moment....Allowable	=	20,333.2

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	54.2
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	7.63

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	125.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

fc	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) :	0.614 in2/ft	
(4/3) * As :	0.8187 in2/ft	Min Stem T&S Reinf Area 2.760 in2
200bdify : 200(12)(7.625)/60000 :	0.305 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.614 in2/ft	One layer of : Two layers of :
Provided Area :	0.66 in2/ft	#4@ 10.00 in #4@ 20.00 in
Maximum Area :	1.0329 in2/ft	#5@ 15.50 in #5@ 31.00 in
		#6@ 22.00 in #6@ 44.00 in

**Footing Data**

Toe Width	=	5.00 ft
Heel Width	=	2.33
Total Footing Width	=	7.33
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	3,455	0 psf
Mu' : Upward	=	306,045	0 ft-#
Mu' : Downward	=	40,950	2,026 ft-#
Mu: Design	=	22,091	2,026 ft-#
Actual 1-Way Shear	=	42.13	17.36 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 6 @ 8.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 5.21 in, #5@ 8.08 in, #6@ 11.47 in, #7@ 15.65 in, #8@ 20.60 in, #9@ 26. Heel: phiMn = phi^5 lambda da^2 / (sqrt(fc) S\_m) Key: No key defined

Min footing T&S reinf Area	2.37	in2
Min footing T&S reinf Area per foot	0.32	in2 .ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.41 in		#4@ 14.81 in
#5@ 11.48 in		#5@ 22.96 in
#6@ 16.30 in		#6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	3,001.3	4.08	12,255.1	Soil Over HL (ab. water tbl)	1,975.6	6.58	13,002.7
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		6.58	13,002.7
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	1,089.0	6.75	7,350.8	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	200.0	2.50	500.0
				Surcharge Over Toe =			
				Stem Weight(s) =	1,437.5	5.42	7,786.5
				Earth @ Stem Transitions =			
				Footing Weight =	1,374.4	3.67	5,037.1
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>4,090.3</b>	<b>O.T.M. =</b>	<b>19,605.9</b>	<b>Total =</b>	<b>4,987.5 lbs</b>	<b>R.M.=</b>	<b>26,326.3</b>
<b>Resisting/Overturing Ratio</b>			<b>= 1.34</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			4,987.5 lbs				

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)	0.108	in

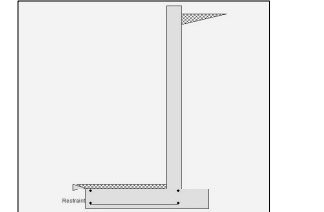
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	11.00	ft
Wall height above soil	=	0.50	ft
Slope Behind Wall	=	0.00	
Height of Soil over Toe	=	4.00	in
Water height over heel	=	0.0	ft

**Soil Data**

Allow Soil Bearing	=	2,000.0	psf
Equivalent Fluid Pressure Method	=		
Active Heel Pressure	=	40.0	psf/ft
Passive Pressure	=	150.0	psf/ft
Soil Density, Heel	=	120.00	pcf
Soil Density, Toe	=	120.00	pcf
Footing  Soil Friction	=	0.450	
Soil height to ignore for passive pressure	=	12.00	in



**Surcharge Loads**

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

**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	

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturing	=	1.95	OK
Slab Resists All Sliding !			

Total Bearing Load	=	4,874	lbs
...resultant ecc.	=	12.40	in

Soil Pressure @ Toe	=	1,362	psf	OK
Soil Pressure @ Heel	=	66	psf	OK
Allowable	=	2,000	psf	
Soil Pressure Less Than Allowable				
ACI Factored @ Toe	=	1,906	psf	
ACI Factored @ Heel	=	92	psf	
Footing Shear @ Toe	=	29.4	psi	OK
Footing Shear @ Heel	=	14.6	psi	OK
Allowable	=	75.0	psi	

**Sliding Calcs**

Lateral Sliding Force	=	3,001.3	lbs
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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
Earth, V	1.000
Wind, W	1.000
Seismic, E	1.000

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	10.00
Rebar Size	=	# 6
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.698
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**Total Force @ Section**

Service Level	lbs =	
Strength Level	lbs =	3,872.0

**Moment...Actual**

Service Level	ft-# =	
Strength Level	ft-# =	14,197.3
Moment....Allowable	=	20,333.2

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	42.3
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	7.63

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	125.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

Fc	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) :	0.4318 in2/ft	
(4/3) * As :	0.5758 in2/ft	Min Stem T&S Reinf Area 2.760 in2
200bd/fy : 200(12)(7.625)/60000 :	0.305 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.4318 in2/ft	#4@ 10.00 in #4@ 20.00 in
Provided Area :	0.66 in2/ft	#5@ 15.50 in #5@ 31.00 in
Maximum Area :	1.0329 in2/ft	#6@ 22.00 in #6@ 44.00 in

**Footing Data**

Toe Width =	4.50 ft
Heel Width =	2.33
Total Footing Width =	6.83
Footing Thickness =	15.00 in
Key Width =	0.00 in
Key Depth =	0.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure =	1,906	92 psf
Mu' : Upward =	183,187	251 ft-#
Mu' : Downward =	33,170	2,026 ft-#
Mu: Design =	12,501	1,775 ft-#
Actual 1-Way Shear =	29.43	14.57 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 6 @ 11.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 7.24 in, #5@ 11.22 in, #6@ 15.93 in, #7@ 21.73 in, #8@ 28.61 in, #9@ 36  
 Heel: phiMn = phi\*5\*lambda\*sqrt(fc)\*Sm  
 Key: No key defined

Min footing T&S reinf Area	2.21	in2
Min footing T&S reinf Area per foot	0.32	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.41 in		#4@ 14.81 in
#5@ 11.48 in		#5@ 22.96 in
#6@ 16.30 in		#6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	3,001.3	4.08	12,255.1	Soil Over HL (ab. water tbl)	1,975.6	6.08
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		6.08
Hydrostatic Force				Watre Table		
Buoyant Force =				Sloped Soil Over Heel =		
Surcharge over Heel =				Surcharge Over Heel =		
Surcharge Over Toe =				Adjacent Footing Load =		
Adjacent Footing Load =				Axial Dead Load on Stem =		
Added Lateral Load =				* Axial Live Load on Stem =		
Load @ Stem Above Soil =				Soil Over Toe =	180.0	2.25
				Surcharge Over Toe =		405.0
				Stem Weight(s) =	1,437.5	4.92
				Earth @ Stem Transitions =		7,067.7
				Footing Weight =	1,280.6	3.42
				Key Weight =		4,373.3
				Vert. Component =		
<b>Total</b>	<b>= 3,001.3</b>	<b>O.T.M. =</b>	<b>12,255.1</b>	<b>Total =</b>	<b>4,873.7 lbs</b>	<b>R.M.= 23,861.0</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.95</b>			
Vertical Loads used for Soil Pressure =			4,873.7 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)	0.064	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**

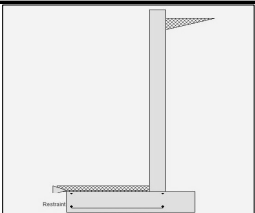
Code: IBC 2015,ACI 318-14,ACI 530-13

**Criteria**

Retained Height	=	10.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Lateral Load Applied to Stem**

Lateral Load	=	90.0 #/ft
...Height to Top	=	10.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem	=	0.0 psf (Service Level)

**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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.39 Ratio < 1.5!
Slab Resists All Sliding !		
Total Bearing Load	=	4,512 lbs
...resultant ecc.	=	23.78 in
Soil Pressure @ Toe	=	2,300 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	3,220 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	37.7 psi OK
Footing Shear @ Heel	=	16.0 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	3,431.3 lbs
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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**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	10.00
Rebar Size	=	# 5
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.948
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	4,100.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	15,166.7
Moment....Allowable	=	15,984.2

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	41.7
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	8.19

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	125.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

fc	psi =	2,500.0
Fy	psi =	60,000.0

**Bottom**

Stem OK		
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	10.00
Rebar Size	=	# 5
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

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**Cantilevered Retaining Wall**

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

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.4283 in2/ft	
(4/3) * As :	0.5711 in2/ft	Min Stem T&S Reinf Area 2.520 in2
200bd/fy : 200(12)(8.1875)/60000 :	0.3275 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.4283 in2/ft	One layer of : Two layers of :
Provided Area :	0.485 in2/ft	#4@ 10.00 in #4@ 20.00 in
Maximum Area :	1.1092 in2/ft	#5@ 15.50 in #5@ 31.00 in
		#6@ 22.00 in #6@ 44.00 in

**Footing Data**

Toe Width	=	4.25 ft
Heel Width	=	2.33
Total Footing Width	=	6.58
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	3,220	0 psf
Mu' : Upward	=	223,025	0 ft-#
Mu' : Downward	=	29,586	1,865 ft-#
Mu: Design	=	16,120	1,865 ft-#
Actual 1-Way Shear	=	37.69	15.97 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 5 @ 8.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 5.61 in, #5@ 8.70 in, #6@ 12.36 in, #7@ 16.85 in, #8@ 22.19 in, #9@ 28. Heel: phiMn = phi^5 lambda b d^3 / (sqrt(fc) S m) Key: No key defined

Min footing T&S reinf Area	2.13	in2
Min footing T&S reinf Area per foot	0.32	in2 .ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.41 in		#4@ 14.81 in
#5@ 11.48 in		#5@ 22.96 in
#6@ 16.30 in		#6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	2,531.3	3.75	9,492.2	Soil Over HL (ab. water tbl)	1,796.0	5.83	10,473.7
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		5.83	10,473.7
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	900.0	6.25	5,625.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	170.0	2.13	361.3
				Surcharge Over Toe =			
				Stem Weight(s) =	1,312.5	4.67	6,125.0
				Earth @ Stem Transitions =			
				Footing Weight =	1,233.8	3.29	4,059.0
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>3,431.3</b>	<b>O.T.M. =</b>	<b>15,117.2</b>	<b>Total =</b>	<b>4,512.3 lbs</b>	<b>R.M.=</b>	<b>21,019.0</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.39</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			4,512.3 lbs				

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)	0.102 in

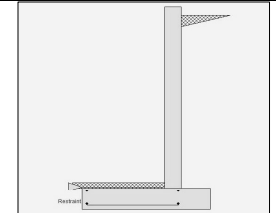
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	10.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing  Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	2.21 OK
Slab Resists All Sliding!		

Total Bearing Load	=	4,512 lbs
...resultant ecc.	=	8.83 in

Soil Pressure @ Toe	=	1,146 psf OK
Soil Pressure @ Heel	=	226 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,604 psf
ACI Factored @ Heel	=	316 psf
Footing Shear @ Toe	=	23.7 psi OK
Footing Shear @ Heel	=	11.5 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	2,531.3 lbs
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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
Earth, V	1.000
Wind, W	1.000
Seismic, E	1.000

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	10.00
Rebar Size	=	# 5
Rebar Spacing	=	10.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.822
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	3,200.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	10,666.7
Moment....Allowable	=	12,971.1

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	32.6
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	8.19

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	125.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

Fc	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) :	0.3012 in2/ft		
(4/3) * As :	0.4017 in2/ft	Min Stem T&S Reinf Area 2.520 in2	
200bd/ft : 200(12)(8.1875)/60000 :	0.3275 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.3275 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.372 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.1092 in2/ft	#6@ 22.00 in	#6@ 44.00 in

**Footing Data**

Toe Width	=	4.25 ft
Heel Width	=	2.33
Total Footing Width	=	6.58
Footing Thickness	=	15.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

		<b>Toe</b>	<b>Heel</b>
Factored Pressure	=	1,604	316 psf
Mu' : Upward	=	143,776	464 ft-#
Mu' : Downward	=	29,586	1,865 ft-#
Mu: Design	=	9,516	1,401 ft-#
Actual 1-Way Shear	=	23.68	11.54 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 5 @ 10.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 7.40 in, #5@ 11.48 in, #6@ 16.29 in, #7@ 22.22 in, #8@ 29.25 in, #9@ 37  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: No key defined

Min footing T&S reinf Area	2.13	in2
Min footing T&S reinf Area per foot	0.32	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.41 in		#4@ 14.81 in
#5@ 11.48 in		#5@ 22.96 in
#6@ 16.30 in		#6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	2,531.3	3.75	9,492.2	Soil Over HL (ab. water tbl)	1,796.0	5.83	10,473.7
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		5.83	10,473.7
Hydrostatic Force				Watre Table			
Buoyant Force	=			Sloped Soil Over Heel	=		
Surcharge over Heel	=			Surcharge Over Heel	=		
Surcharge Over Toe	=			Adjacent Footing Load	=		
Adjacent Footing Load	=			Axial Dead Load on Stem	=		
Added Lateral Load	=			* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=			Soil Over Toe	=	170.0	361.3
				Surcharge Over Toe	=		
				Stem Weight(s)	=	1,312.5	6,125.0
				Earth @ Stem Transitions	=		
<b>Total</b>	<b>=</b>	<b>2,531.3</b>	<b>O.T.M. = 9,492.2</b>	Footing Weight	=	1,233.8	4,059.0
				Key Weight	=		
				Vert. Component	=		
<b>Resisting/Overturning Ratio</b>			<b>= 2.21</b>	<b>Total =</b>	<b>4,512.3 lbs</b>	<b>R.M.=</b>	<b>21,019.0</b>
Vertical Loads used for Soil Pressure	=	4,512.3	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**

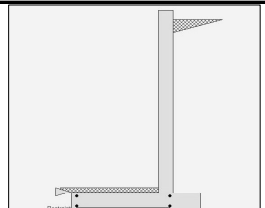
(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.051	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.

Criteria	
Retained Height	= 9.00 ft
Wall height above soil	= 0.50 ft
Slope Behind Wall	= 0.00
Height of Soil over Toe	= 4.00 in
Water height over heel	= 0.0 ft

Soil Data	
Allow Soil Bearing	= 2,666.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure	= 40.0 psf/ft
Passive Pressure	= 150.0 psf/ft
Soil Density, Heel	= 120.00 pcf
Soil Density, Toe	= 120.00 pcf
Footings Soil Friction	= 0.450
Soil height to ignore for passive pressure	= 12.00 in



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

Lateral Load Applied to Stem	
Lateral Load	= 81.0 #/ft
...Height to Top	= 9.00 ft
...Height to Bottom	= 0.00 ft
Load Type	= Wind (W) (Service Level)
Wind on Exposed Stem	= 0.0 psf (Service Level)

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

Axial Load Applied to Stem	
Axial Dead Load	= 0.0 lbs
Axial Live Load	= 0.0 lbs
Axial Load Eccentricity	= 0.0 in

**Design Summary**

Wall Stability Ratios	
Overturning	= 1.33 Ratio < 1.5!
Slab Resists All Sliding !	
Total Bearing Load	= 3,339 lbs
...resultant ecc.	= 22.95 in
Soil Pressure @ Toe	= 2,135 psf OK
Soil Pressure @ Heel	= 0 psf OK
Allowable	= 2,666 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe	= 2,990 psf
ACI Factored @ Heel	= 0 psf
Footing Shear @ Toe	= 38.0 psi OK
Footing Shear @ Heel	= 15.3 psi OK
Allowable	= 75.0 psi
Sliding Calcs	
Lateral Sliding Force	= 2,729.0 lbs

**Stem Construction**

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	= 0.937
Total Force @ Section	
Service Level	lbs =
Strength Level	lbs = 3,321.0
Moment...Actual	
Service Level	ft-# =
Strength Level	ft-# = 11,056.5
Moment....Allowable	= 11,799.2
Shear....Actual	
Service Level	psi =
Strength Level	psi = 44.7
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.19

Masonry Data	
fm	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	
Fc	psi = 2,500.0
Fy	psi = 60,000.0

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

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.4187 in2/ft	
(4/3) * As :	0.5582 in2/ft	Min Stem T&S Reinf Area 1.824 in2
200bdify : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.4187 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 Data**

Toe Width	= 4.00 ft
Heel Width	= 1.91
Total Footing Width	= 5.91
Footing Thickness	= 12.00 in
Key Width	= 0.00 in
Key Depth	= 0.00 in
Key Distance from Toe	= 0.00 ft
fc =	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	= 2,990	0 psf
Mu' : Upward	= 165,915	0 ft-#
Mu' : Downward	= 21,888	1,141 ft-#
Mu: Design	= 12,002	1,141 ft-#
Actual 1-Way Shear	= 37.96	15.29 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 5 @ 8.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 7.05 in, #5@ 10.94 in, #6@ 15.52 in, #7@ 21.17 in, #8@ 27.88 in, #9@ 35

Heel: phiMn = phi^5 lambda b^2 / sqrt(fc) S m

Key: No key defined

Min footing T&S reinf Area	1.53 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**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	2,000.0	3.33	6,666.7	Soil Over HL (ab. water tbl)	1,342.8	5.29	7,101.2
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		5.29	7,101.2
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	729.0	5.50	4,009.5	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	160.0	2.00	320.0
				Surcharge Over Toe =			
				Stem Weight(s) =	950.0	4.33	4,116.7
				Earth @ Stem Transitions =			
				Footing Weight =	886.5	2.96	2,619.6
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>2,729.0</b>	<b>O.T.M. =</b>	<b>10,676.2</b>	<b>Total =</b>	<b>3,339.3 lbs</b>	<b>R.M.=</b>	<b>14,157.4</b>
<b>Resisting/Overturing Ratio</b>			<b>= 1.33</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			3,339.3 lbs				

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

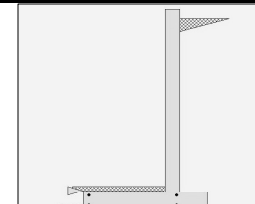
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	9.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	4.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	150.0 psf/ft
Soil Density, Heel =	120.00 pcf
Soil Density, Toe =	120.00 pcf
Footing  Soil Friction =	0.450
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning =	2.00 OK
Slab Resists All Sliding !	

Total Bearing Load =	3,292 lbs
...resultant ecc. =	9.67 in

Soil Pressure @ Toe =	1,079 psf OK
Soil Pressure @ Heel =	85 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,510 psf
ACI Factored @ Heel =	118 psf
Footing Shear @ Toe =	26.6 psi OK
Footing Shear @ Heel =	12.5 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	2,000.0 lbs
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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
Earth, V	1.600
Wind, W	1.000
Seismic, E	1.000

**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 =	0.0 psf
(Service Level)	

**Stem Construction**

<b>Design Height Above Ftg</b>	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 =	0.689
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**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 2,592.0

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 7,776.0
Moment....Allowable	= 11,799.2

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 34.9
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.19

**Masonry Data**

fm	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**

Fc	psi = 2,500.0
Fy	psi = 60,000.0

**Bottom**

Stem OK

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 = 0.0 ft

at Back of Wall = 0.0 ft

Poisson's Ratio = 0.300

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.2944 in2/ft	
(4/3) * As :	0.3926 in2/ft	Min Stem T&S Reinf Area 1.824 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.2944 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 Data**

Toe Width =	3.75 ft
Heel Width =	1.91
Total Footing Width =	5.66
Footing Thickness =	12.00 in
Key Width =	0.00 in
Key Depth =	0.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

Factored Pressure =	Toe	Heel
Mu' : Upward =	1,510	118 psf
Mu' : Downward =	101,481	170 ft-#
Mu: Design =	19,238	1,141 ft-#
Actual 1-Way Shear =	6,854	971 ft-#
Allow 1-Way Shear =	26.60	12.48 psi
Toe Reinforcing =	75.00	40.00 psi
Heel Reinforcing =	# 5 @ 10.00 in	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**  
 Other Acceptable Sizes & Spacings  
 Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: No key defined

Min footing T&S reinf Area	1.47	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**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	2,000.0	3.33	6,666.7	Soil Over HL (ab. water tbl)	1,342.8	5.04	6,765.5
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		5.04	6,765.5
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	150.0	1.88	281.3
				Surcharge Over Toe =			
				Stem Weight(s) =	950.0	4.08	3,879.2
				Earth @ Stem Transitions =			
<b>Total</b> =	<b>2,000.0</b>	<b>O.T.M. =</b>	<b>6,666.7</b>	Footing Weight =	849.0	2.83	2,402.7
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>2.00</b>	<b>Total =</b>	<b>3,291.8 lbs</b>	<b>R.M.=</b>	<b>13,328.6</b>
Vertical Loads used for Soil Pressure =			3,291.8 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)	0.050	in

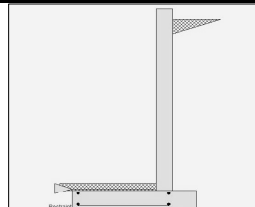
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	8.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footings Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.29 Ratio < 1.5!
Slab Resists All Sliding!	=	

Total Bearing Load	=	2,718 lbs
...resultant ecc.	=	21.21 in

Soil Pressure @ Toe	=	2,231 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	3,123 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	30.6 psi OK
Footing Shear @ Heel	=	11.0 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	2,196.0 lbs
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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

**Lateral Load Applied to Stem**

Lateral Load	=	72.0 #/ft
...Height to Top	=	8.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (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

**Stem Construction**

Design Height Above Ftg	=	0.00 ft
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	=	0.881
<b>Total Force @ Section</b>	=	
Service Level	=	lbs =
Strength Level	=	lbs = 2,624.0
<b>Moment...Actual</b>	=	
Service Level	=	ft-# =
Strength Level	=	ft-# = 7,765.3
Moment....Allowable	=	8,809.0

**Shear....Actual**

Service Level	=	psi =
Strength Level	=	psi = 35.3
Shear....Allowable	=	psi = 75.0
Anet (Masonry)	=	in2 =
Rebar Depth 'd'	=	in = 6.19

**Masonry Data**

fm	=	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**

fc	=	psi = 2,500.0
Fy	=	psi = 60,000.0

**Concrete Stem Rebar Area Details**

Bottom Stem	=	Vertical Reinforcing
As (based on applied moment) :	=	0.294 in2/ft
(4/3) * As :	=	0.392 in2/ft
200bdify : 200(12)(6.1875)/60000 :	=	0.2475 in2/ft
0.0018bh : 0.0018(12)(8) :	=	0.1728 in2/ft
Required Area :	=	0.294 in2/ft
Provided Area :	=	0.3382 in2/ft
Maximum Area :	=	0.8382 in2/ft

**Horizontal Reinforcing**

Min Stem T&S Reinf Area	=	1.632 in2
Min Stem T&S Reinf Area per ft of stem Height	=	0.192 in2/ft
Horizontal Reinforcing Options :	=	
One layer of :	=	Two layers of :
#4@ 12.50 in	=	#4@ 25.00 in
#5@ 19.38 in	=	#5@ 38.75 in
#6@ 27.50 in	=	#6@ 55.00 in

**Footing Data**

Toe Width	=	3.50 ft
Heel Width	=	1.66
Total Footing Width	=	5.16
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
fc =	=	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**

Factored Pressure	=	3,123
Mu' : Upward	=	122,714
Mu' : Downward	=	16,756
Mu: Design	=	8,830
Actual 1-Way Shear	=	30.62
Allow 1-Way Shear	=	75.00
Toe Reinforcing	=	# 5 @ 11.00 in
Heel Reinforcing	=	None Spec'd
Key Reinforcing	=	None Spec'd
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 7.50 in, #5@ 11.63 in, #6@ 16.51 in, #7@ 22.51 in, #8@ 29.64 in, #9@ 37		
Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) / S m		
Key: No key defined		
Min footing T&S reinf Area	=	1.34 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**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl)	953.6	4.66	4,447.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.66	4,447.0
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	576.0	5.00	2,880.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	140.0	1.75	245.0
				Surcharge Over Toe =			
				Stem Weight(s) =	850.0	3.83	3,258.3
				Earth @ Stem Transitions =			
				Footing Weight =	774.0	2.58	1,996.9
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>2,196.0</b>	<b>O.T.M. =</b>	<b>7,740.0</b>	<b>Total =</b>	<b>2,717.6 lbs</b>	<b>R.M.=</b>	<b>9,947.2</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.29</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			2,717.6 lbs				

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)	0.102	in

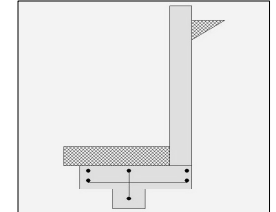
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	5.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	8.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**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 =	0.0 psf
(Service Level)	

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning =	2.16 OK
Sliding =	1.57 OK

Total Bearing Load =	1,281 lbs
...resultant ecc. =	6.12 in

Soil Pressure @ Toe =	710 psf OK
Soil Pressure @ Heel =	39 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	994 psf
ACI Factored @ Heel =	55 psf
Footing Shear @ Toe =	11.1 psi OK
Footing Shear @ Heel =	0.0 psi OK
Allowable =	75.0 psi

<b>Sliding Calcs</b>	
Lateral Sliding Force =	680.6 lbs
less 100% Passive Force = -	554.2 lbs
less 100% Friction Force = -	512.4 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

<b>Load Factors</b>	
Building Code	IBC 2015,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Stem Construction**

<b>Design Height Above Ftg</b>	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness	= 8.00
Rebar Size	= # 4
Rebar Spacing	= 11.00
Rebar Placed at	= Edge

<b>Design Data</b>	
fb/FB + fa/Fa	= 0.240

<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 850.0

<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 1,416.7
Moment....Allowable	= 5,883.6

<b>Shear....Actual</b>	
Service Level	psi =
Strength Level	psi = 11.3
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.25

<b>Masonry Data</b>	
fm	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

<b>Concrete Data</b>	
Fc	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) :	0.0531 in2/ft		
(4/3) * As :	0.0708 in2/ft	Min Stem T&S Reinf Area 1.056 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	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2182 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 Data**

Toe Width	=	2.75 ft
Heel Width	=	0.67
Total Footing Width	=	3.42
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	8.00 in
Key Distance from Toe	=	1.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure	= 994	55 psf
Mu' : Upward	= 33,672	0 ft-#
Mu' : Downward	= 12,599	0 ft-#
Mu: Design	= 17,56	0 ft-#
Actual 1-Way Shear	= 11.07	0.03 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 4 @ 9.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= # 4 @ 9.26 in	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi\*5\*lambda\*sqrt(fc)\*Sm

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	0.74	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	1.8	3.42	6.3	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.42	6.3	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	=			* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	201.7	1.38	277.3
				Surcharge Over Toe	=			
				Stem Weight(s)	=	550.0	3.08	1,695.8
<b>Total</b>	<b>=</b>	<b>680.6</b>	<b>O.T.M. = 1,323.3</b>	Earth @ Stem Transitions	=			
				Footing Weight	=	427.5	1.71	731.0
<b>Resisting/Overturning Ratio</b>	<b>=</b>	<b>2.16</b>		Key Weight	=	100.0	1.50	150.0
Vertical Loads used for Soil Pressure	=	1,281.0 lbs		Vert. Component	=			
				<b>Total =</b>	<b>1,281.0 lbs</b>	<b>R.M.=</b>	<b>2,860.4</b>	

\* 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**

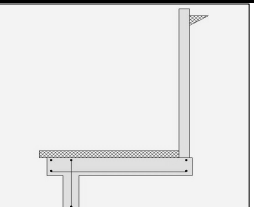
**Horizontal Deflection at Top of Wall due to settlement of soil**

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.032	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.

Criteria		Soil Data	
Retained Height	= 10.00 ft	Allow Soil Bearing	= 2,000.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 6.00 in		
Water height over heel	= 0.0 ft	Passive Pressure	= 300.0 psf/ft
		Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footings Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 0.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 0.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem	= 0.0 psf (Service Level)	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Stem Construction		Bottom	
Axial Dead Load	= 0.0 lbs	Design Height Above Ftg	ft = 0.00	Stem OK	
Axial Live Load	= 0.0 lbs	Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Axial Load Eccentricity	= 0.0 in	Design Method	= LRFD	Design Method	= LRFD
		Thickness	= 8.00	Thickness	= 8.00
		Rebar Size	= # 6	Rebar Size	= # 6
		Rebar Spacing	= 8.00	Rebar Spacing	= 8.00
		Rebar Placed at	= Edge	Rebar Placed at	= Edge

Design Summary		Design Data	
<b>Wall Stability Ratios</b>		fb/FB + fa/Fa	= 0.787
Overturning	= 2.20 OK	<b>Total Force @ Section</b>	
Sliding	= 1.65 OK	Service Level	lbs =
		Strength Level	lbs = 3,400.0
Total Bearing Load	= 3,778 lbs	<b>Moment...Actual</b>	
...resultant ecc.	= 18.42 in	Service Level	ft-# =
		Strength Level	ft-# = 11,333.3
Soil Pressure @ Toe	= 838 psf OK	Moment....Allowable	= 14,393.2
Soil Pressure @ Heel	= 0 psf OK	<b>Shear....Actual</b>	
Allowable	= 2,000 psf	Service Level	psi =
Soil Pressure Less Than Allowable		Strength Level	psi = 50.4
ACI Factored @ Toe	= 1,173 psf	Shear....Allowable	psi = 75.0
ACI Factored @ Heel	= 0 psf	Anet (Masonry)	in2 =
Footing Shear @ Toe	= 18.1 psi OK	Rebar Depth 'd'	in = 5.63
Footing Shear @ Heel	= 1.9 psi OK	<b>Masonry Data</b>	
Allowable	= 75.0 psi	fm	psi =
<b>Sliding Calcs</b>		Fs	psi =
Lateral Sliding Force	= 2,531.3 lbs	Solid Grouting	=
less 100% Passive Force	= - 2,666.7 lbs	Modular Ratio 'n'	=
less 100% Friction Force	= - 1,511.1 lbs	Wall Weight	psf = 100.0
Added Force Req'd	= 0.0 lbs OK	Short Term Factor	=
...for 1.5 Stability	= 0.0 lbs OK	Equiv. Solid Thick.	=
		Masonry Block Type	= Medium Weight
		Masonry Design Method	= ASD

Load Factors		Concrete Data	
Building Code	IBC 2015,ACI	Fc	psi = 2,500.0
Dead Load	1.400	Fy	psi = 60,000.0
Live Load	1.700		
Earth, H	1.700		
Wind, W	1.300		
Seismic, E	1.000		

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

Concrete Stem Rebar Area Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.4746 in2/ft	
(4/3) * As :	0.6328 in2/ft	Min Stem T&S Reinf Area 2.016 in2
200bd/fy : 200(12)(5.625)/60000 :	0.225 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.4746 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.66 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.762 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data		Footing Design Results	
Toe Width	= 8.25 ft	Factored Pressure	= 1,173 0 psf
Heel Width	= 0.83	Mu' : Upward	= 332,890 0 ft-#
Total Footing Width	= 9.08	Mu' : Downward	= 138,643 25 ft-#
Footing Thickness	= 15.00 in	Mu: Design	= 16,187 25 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 18.11 1.92 psi
Key Depth	= 31.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 6 @ 8.00 in
fc = 2,500 psi	Fy = 60,000 psi	Heel Reinforcing	= None Spec'd
Footing Concrete Density = 150.00 pcf		Key Reinforcing	= # 5 @ 12.00 in
Min. As % = 0.0018		Footing Torsion, Tu	= 0.00 ft-lbs
Cover @ Top 2.00 @ Btm = 3.00 in		Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 5.59 in, #5@ 8.67 in, #6@ 12.30 in, #7@ 16.78 in, #8@ 22.10 in, #9@ 27. Heel: phiMn = phi^5 lambda^2 sqrt(fc) S\_m

Key: #4@ 10 in, #5@ 15.5 in, #6@ 18 in, #7@ 18 in, #8@ 18 in

Min footing T&S reinf Area 2.94 in2  
 Min footing T&S reinf Area per foot 0.32 in2 ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 7.41 in #4@ 14.81 in  
 #5@ 11.48 in #5@ 22.96 in  
 #6@ 16.30 in #6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	2,531.3	3.75	9,492.2	Soil Over HL (ab. water tbl)	183.3	9.00	1,650.0
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		9.00	1,650.0
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	453.8	4.13	1,871.7
				Surcharge Over Toe =			
				Stem Weight(s) =	1,050.0	8.58	9,012.5
				Earth @ Stem Transitions =			
				Footing Weight =	1,703.1	4.54	7,735.0
				Key Weight =	387.5	1.50	581.3
				Vert. Component =			
<b>Total</b>	<b>2,531.3</b>	<b>O.T.M. =</b>	<b>9,492.2</b>	<b>Total =</b>	<b>3,777.7 lbs</b>	<b>R.M.=</b>	<b>20,850.5</b>
<b>Resisting/Overturning Ratio</b>			<b>= 2.20</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			3,777.7 lbs				

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) = 0.027 in

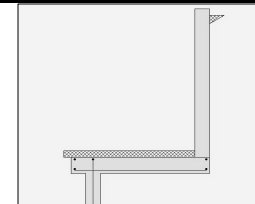
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	11.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	6.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**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 =	0.0 psf
(Service Level)	

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning =	2.17 OK
Sliding =	1.67 OK

Total Bearing Load =	4,424 lbs
...resultant ecc. =	17.96 in

Soil Pressure @ Toe =	906 psf OK
Soil Pressure @ Heel =	26 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,268 psf
ACI Factored @ Heel =	36 psf
Footing Shear @ Toe =	23.1 psi OK
Footing Shear @ Heel =	1.9 psi OK
Allowable =	75.0 psi

<b>Sliding Calcs</b>	
Lateral Sliding Force =	3,001.3 lbs
less 100% Passive Force =	- 3,234.4 lbs
less 100% Friction Force =	- 1,769.5 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

<b>Load Factors</b>	
Building Code =	IBC 2015,ACI
Dead Load =	1.400
Live Load =	1.700
Earth, H =	1.700
Wind, W =	1.300
Seismic, E =	1.000

**Stem Construction**

<b>Design Height Above Ftg</b>	ft = 0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	12.00
Rebar Size =	# 6
Rebar Spacing =	8.00
Rebar Placed at =	Edge

**Design Data**

fb/FB + fa/Fa =	0.574
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**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 4,114.0

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 15,084.7
Moment....Allowable =	26,273.2

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 35.6
Shear....Allowable =	75.0

Anet (Masonry)	in2 = 8.00
Rebar Depth 'd'	in = 9.63

**Masonry Data**

fm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Wall Weight	psf = 150.0

Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	= Medium Weight
Masonry Design Method	= ASD

**Concrete Data**

Fc	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) :	0.3602 in2/ft		
(4/3) * As :	0.4803 in2/ft	Min Stem T&S Reinf Area 3.312 in2	
200bd/fy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.385 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.66 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.3039 in2/ft	#6@ 18.33 in	#6@ 36.67 in

**Footing Data**

Toe Width	=	8.50 ft
Heel Width	=	1.00
Total Footing Width	=	9.50
Footing Thickness	=	15.00 in
Key Width	=	12.00 in
Key Depth	=	36.00 in
Key Distance from Toe	=	1.00 ft
fc =	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**

		<b>Toe</b>	<b>Heel</b>
Factored Pressure	=	1,268	36 psf
Mu' : Upward	=	390,398	0 ft-#
Mu' : Downward	=	147,173	0 ft-#
Mu: Design	=	20,268	0 ft-#
Actual 1-Way Shear	=	23.11	1.92 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 6 @ 8.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	# 5 @ 10.00 in	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 5.21 in, #5@ 8.08 in, #6@ 11.47 in, #7@ 15.65 in, #8@ 20.60 in, #9@ 26.  
 Heel: phiMn = phi^5\*lambda\*bd^3\*sqrt(fc)\*Sm  
 Key: #4@ 7.29 in, #5@ 11.31 in, #6@ 16.05 in, #7@ 18 in, #8@

Min footing T&S reinf Area	3.08	in2
Min footing T&S reinf Area per foot	0.32	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 7.41 in		#4@ 14.81 in
#5@ 11.48 in		#5@ 22.96 in
#6@ 16.30 in		#6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	3,001.3	4.08	12,255.1	Soil Over HL (ab. water tbl)		
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		
Hydrostatic Force				Watre Table		
Buoyant Force	=			Sloped Soil Over Heel	=	
Surcharge over Heel	=			Surcharge Over Heel	=	
Surcharge Over Toe	=			Adjacent Footing Load	=	
Adjacent Footing Load	=			Axial Dead Load on Stem	=	
Added Lateral Load	=			* Axial Live Load on Stem	=	
Load @ Stem Above Soil	=			Soil Over Toe	=	467.5 4.25 1,986.9
				Surcharge Over Toe	=	
				Stem Weight(s)	=	1,725.0 9.00 15,525.0
				Earth @ Stem Transitions	=	
<b>Total</b>	<b>=</b>	<b>3,001.3</b>	<b>O.T.M. = 12,255.1</b>	Footing Weight	=	1,781.3 4.75 8,460.9
				Key Weight	=	450.0 1.50 675.0
				Vert. Component	=	
<b>Resisting/Overturning Ratio</b>			<b>= 2.17</b>	<b>Total =</b>	<b>4,423.8 lbs</b>	<b>R.M.= 26,647.8</b>
Vertical Loads used for Soil Pressure	=	4,423.8	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**

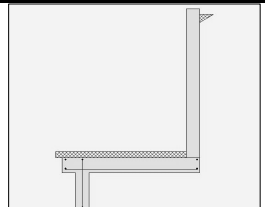
**Horizontal Deflection at Top of Wall due to settlement of soil**

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.030	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.

Criteria		Soil Data	
Retained Height	= 12.00 ft	Allow Soil Bearing	= 2,000.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 6.00 in		
Water height over heel	= 0.0 ft	Passive Pressure	= 300.0 psf/ft
		Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footing Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 0.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 0.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem	= 0.0 psf (Service Level)	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Stem Construction		Bottom	
Axial Dead Load	= 0.0 lbs	Design Height Above Ftg	ft = 0.00	Stem OK	
Axial Live Load	= 0.0 lbs	Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Axial Load Eccentricity	= 0.0 in	Design Method	= LRFD	Thickness	= 12.00
		Rebar Size	= # 6	Rebar Spacing	= 7.00
		Rebar Placed at	= Edge	Rebar Placed at	= Edge

Design Summary		Design Data	
Wall Stability Ratios		fb/FB + fa/Fa	= 0.660
Overturning	= 2.01 OK	Total Force @ Section	
Sliding	= 1.61 OK	Service Level	lbs =
		Strength Level	lbs = 4,896.0
Total Bearing Load	= 4,806 lbs	Moment...Actual	
...resultant ecc.	= 22.23 in	Service Level	ft-# =
		Strength Level	ft-# = 19,584.0
Soil Pressure @ Toe	= 979 psf OK	Moment....Allowable	= 29,648.9
Soil Pressure @ Heel	= 0 psf OK	Shear....Actual	
Allowable	= 2,000 psf	Service Level	psi =
Soil Pressure Less Than Allowable		Strength Level	psi = 42.4
ACI Factored @ Toe	= 1,371 psf	Shear....Allowable	psi = 75.0
ACI Factored @ Heel	= 0 psf	Anet (Masonry)	in2 =
Footing Shear @ Toe	= 26.2 psi OK	Rebar Depth 'd'	in = 9.63
Footing Shear @ Heel	= 1.9 psi OK	Masonry Data	
Allowable	= 75.0 psi	fm	psi =
Sliding Calcs		Fs	psi =
Lateral Sliding Force	= 3,511.3 lbs	Solid Grouting	=
less 100% Passive Force	= - 3,726.0 lbs	Modular Ratio 'n'	=
less 100% Friction Force	= - 1,922.3 lbs	Wall Weight	psf = 150.0
Added Force Req'd	= 0.0 lbs OK	Short Term Factor	=
...for 1.5 Stability	= 0.0 lbs OK	Equiv. Solid Thick.	=
		Masonry Block Type	= Medium Weight
		Masonry Design Method	= ASD

Load Factors		Concrete Data	
Building Code	IBC 2015,ACI	Fc	psi = 2,500.0
Dead Load	1.400	Fy	psi = 60,000.0
Live Load	1.700		
Earth, H	1.700		
Wind, W	1.300		
Seismic, E	1.000		

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

Concrete Stem Rebar Area Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.4676 in2/ft	
(4/3) * As :	0.6235 in2/ft	Min Stem T&S Reinf Area 3.600 in2
200bd/fy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.4676 in2/ft	#4@ 8.33 in #4@ 16.67 in
Provided Area :	0.7543 in2/ft	#5@ 12.92 in #5@ 25.83 in
Maximum Area :	1.3039 in2/ft	#6@ 18.33 in #6@ 36.67 in

Footing Data		Footing Design Results	
Toe Width	= 9.25 ft	Factored Pressure	= 1,371 0 psf
Heel Width	= 1.00	Mu' : Upward	= 482,651 0 ft-#
Total Footing Width	= 10.25	Mu' : Downward	= 174,291 0 ft-#
Footing Thickness	= 15.00 in	Mu: Design	= 25,697 0 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 26.19 1.92 psi
Key Depth	= 40.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 6 @ 7.00 in
fc = 2,500 psi	Fy = 60,000 psi	Heel Reinforcing	= None Spec'd
Footing Concrete Density = 150.00 pcf		Key Reinforcing	= # 5 @ 8.00 in
Min. As % = 0.0018		Footing Torsion, Tu	= 0.00 ft-lbs
Cover @ Top 2.00 @ Btm = 3.00 in		Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 4.69 in, #5@ 7.28 in, #6@ 10.33 in, #7@ 14.09 in, #8@ 18.56 in, #9@ 23.00 in  
 Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S\_m  
 Key: #4@ 5.71 in, #5@ 8.85 in, #6@ 12.56 in, #7@ 17.13 in, #8@ 23.00 in

Min footing T&S reinf Area 3.32 in2  
 Min footing T&S reinf Area per foot 0.32 in2 ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 7.41 in #4@ 14.81 in  
 #5@ 11.48 in #5@ 22.96 in  
 #6@ 16.30 in #6@ 32.59 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	3,511.3	4.42	15,508.0			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force						
Surcharge over Heel						
Surcharge Over Toe						
Adjacent Footing Load						
Added Lateral Load						
Load @ Stem Above Soil						
<b>Total</b>	<b>3,511.3</b>	<b>O.T.M. =</b>	<b>15,508.0</b>			
<b>Resisting/Overturning Ratio</b>			<b>= 2.01</b>			
Vertical Loads used for Soil Pressure			<b>= 4,805.6 lbs</b>			
Soil Over HL (ab. water tbl)						
Soil Over HL (bel. water tbl)						
Watre Table						
Sloped Soil Over Heel						
Surcharge Over Heel						
Adjacent Footing Load						
Axial Dead Load on Stem						
* Axial Live Load on Stem						
Soil Over Toe				508.8	4.63	2,353.0
Surcharge Over Toe						
Stem Weight(s)				1,875.0	9.75	18,281.3
Earth @ Stem Transitions						
Footing Weight				1,921.9	5.13	9,849.6
Key Weight				500.0	1.50	750.0
Vert. Component						
<b>Total</b>				<b>4,805.6 lbs</b>	<b>R.M.=</b>	<b>31,233.8</b>

\* 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)	0.033 in

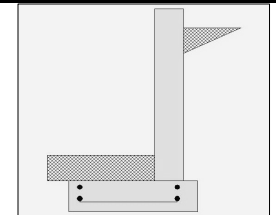
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	8.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing  Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Lateral Load Applied to Stem**

Lateral Load	=	36.0 #/ft
...Height to Top	=	4.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W)
(Service Level)	=	
Wind on Exposed Stem	=	0.0 psf
(Service Level)	=	

**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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.87 OK
Sliding	=	1.35 Ratio < 1.5!

Total Bearing Load	=	1,118 lbs
...resultant ecc.	=	7.12 in

Soil Pressure @ Toe	=	822 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,151 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	10.2 psi OK
Footing Shear @ Heel	=	2.7 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	611.2 lbs
less 100% Passive Force	= -	375.0 lbs
less 100% Friction Force	= -	447.3 lbs
Added Force Req'd	=	0.0 lbs OK
...for 1.5 Stability	=	94.5 lbs NG

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Stem Construction**

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	=	0.203
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	731.2
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	1,099.7
Moment....Allowable	=	5,412.6

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	9.7
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25

**Masonry Data**

fm	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**

Fc	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) :	0.0412 in2/ft		
(4/3) * As :	0.0549 in2/ft	Min Stem T&S Reinf Area 0.864 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	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1728 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 Data**

Toe Width	=	2.00 ft
Heel Width	=	1.00
Total Footing Width	=	3.00
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	6.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure	= 1,151	0 psf
Mu' : Upward	= 20,857	0 ft-#
Mu' : Downward	= 6,664	44 ft-#
Mu: Design	= 1,183	44 ft-#
Actual 1-Way Shear	= 10.15	2.74 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 4 @ 9.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: No key defined

Min footing T&S reinf Area	0.65	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	467.2	1.61	752.7	Soil Over HL (ab. water tbl)	146.7	2.83	415.6
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.83	415.6
Hydrostatic Force				Watre Table			
Buoyant Force	=			Sloped Soil Over Heel	=		
Surcharge over Heel	=			Surcharge Over Heel	=		
Surcharge Over Toe	=			Adjacent Footing Load	=		
Adjacent Footing Load	=			Axial Dead Load on Stem	=		
Added Lateral Load	= 144.0	2.83	408.0	* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=			Soil Over Toe	= 146.7	1.00	146.7
				Surcharge Over Toe	=		
				Stem Weight(s)	= 450.0	2.33	1,050.0
<b>Total</b>	<b>= 611.2</b>	<b>O.T.M. =</b>	<b>1,160.7</b>	Earth @ Stem Transitions	=		
				Footing Weight	= 375.0	1.50	562.5
				Key Weight	=		
				Vert. Component	=		
<b>Resisting/Overturning Ratio</b>			<b>= 1.87</b>	<b>Total =</b>	<b>1,118.3 lbs</b>	<b>R.M.=</b>	<b>2,174.7</b>
Vertical Loads used for Soil Pressure	=	1,118.3	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)	0.034	in

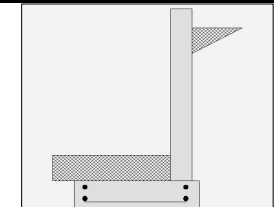
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	8.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.52 OK
Sliding	=	1.35 Ratio < 1.5!

Total Bearing Load	=	940 lbs
...resultant ecc.	=	9.74 in

Soil Pressure @ Toe	=	970 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,357 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	10.1 psi OK
Footing Shear @ Heel	=	1.4 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	611.2 lbs
less 100% Passive Force = -	=	450.0 lbs
less 100% Friction Force = -	=	376.2 lbs
Added Force Req'd	=	0.0 lbs OK
...for 1.5 Stability	=	90.7 lbs NG

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	=	1.400
Live Load	=	1.700
Earth, H	=	1.700
Wind, W	=	1.300
Seismic, E	=	1.000

**Lateral Load Applied to Stem**

Lateral Load	=	36.0 #/ft
...Height to Top	=	4.00 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

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	18.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.447
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**Total Force @ Section**

Service Level	lbs =	
Strength Level	lbs =	731.2

**Moment...Actual**

Service Level	ft-# =	
Strength Level	ft-# =	1,099.7

**Moment....Allowable**

Allowable	=	2,455.6
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**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	14.3

**Shear....Allowable**

Allowable	psi =	75.0
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**Anet (Masonry)**

Rebar Depth 'd'	in =	4.25
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**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	75.0

**Short Term Factor**

Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

fc	psi =	2,500.0
Fy	psi =	60,000.0

**Concrete Stem Rebar Area Details**

Bottom Stem	=	Vertical Reinforcing
As (based on applied moment) :	=	0.0622 in2/ft
(4/3) * As :	=	0.0829 in2/ft
200bd/fy : 200(12)/(4.25)/60000 :	=	0.17 in2/ft
0.0018bh : 0.0018(12)/(6) :	=	0.1296 in2/ft
Required Area :	=	0.1296 in2/ft
Provided Area :	=	0.1333 in2/ft
Maximum Area :	=	0.5757 in2/ft

**Cantilevered Retaining Wall**

Horizontal Reinforcing	=	
Min Stem T&S Reinf Area 0.648 in2	=	
Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	=	
Horizontal Reinforcing Options :	=	
One layer of :	=	Two layers of :
#4@ 16.67 in	=	#4@ 33.33 in
#5@ 25.83 in	=	#5@ 51.67 in
#6@ 36.67 in	=	#6@ 73.33 in

**Footing Data**

Toe Width	=	2.25 ft
Heel Width	=	0.67
Total Footing Width	=	2.92
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	6.00 in
Key Distance from Toe	=	0.00 ft
fc =	=	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**

Factored Pressure	=	1,357	0 psf
Mu' : Upward	=	25,332	0 ft-#
Mu' : Downward	=	8,434	11 ft-#
Mu: Design	=	1,408	11 ft-#
Actual 1-Way Shear	=	10.08	1.37 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing = # 4 @ 9.00 in	=		
Heel Reinforcing = None Spec'd	=		
Key Reinforcing = None Spec'd	=		
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Heel: phiMn = phi^5 lambda ba^2 / sqrt(fc) S m  
 Key: No key defined

Min footing T&S reinf Area	=	0.63	in2
Min footing T&S reinf Area per foot	=	0.22	in2 .ft
If one layer of horizontal bars:	=		
#4@ 11.11 in	=	#4@ 22.22 in	
#5@ 17.22 in	=	#5@ 34.44 in	
#6@ 24.44 in	=	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	467.2	1.61	752.7	Soil Over HL (ab. water tbl)	73.3	2.83	207.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)	2.83	2.83	207.8
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	144.0	2.83	408.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	165.0	1.13	185.6
				Surcharge Over Toe =			
				Stem Weight(s) =	337.5	2.50	843.8
				Earth @ Stem Transitions =			
				Footing Weight =	364.6	1.46	531.7
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>611.2</b>	<b>O.T.M. =</b>	<b>1,160.7</b>	<b>Total =</b>	<b>940.4 lbs</b>	<b>R.M.=</b>	<b>1,768.8</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.52</b>				
Vertical Loads used for Soil Pressure =			940.4 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)	0.042 in

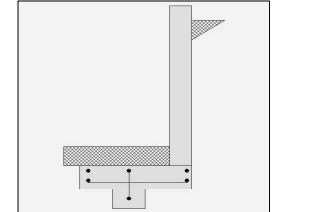
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	5.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	8.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,666.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Lateral Load Applied to Stem**

Lateral Load =	45.0 #/ft
...Height to Top =	5.00 ft
...Height to Bottom =	0.00 ft
Load Type =	Wind (W) (Service Level)
Wind on Exposed Stem =	0.0 psf (Service Level)

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning =	1.38 Ratio < 1.5!
Sliding =	1.18 Ratio < 1.5!

Total Bearing Load =	1,281 lbs
...resultant ecc. =	13.15 in

Soil Pressure @ Toe =	1,390 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,666 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	1,946 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	14.5 psi OK
Footing Shear @ Heel =	0.0 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	905.6 lbs
less 100% Passive Force =	- 554.2 lbs
less 100% Friction Force =	- 512.4 lbs
Added Force Req'd =	0.0 lbs OK
...for 1.5 Stability =	291.8 lbs NG

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Stem Construction**

<b>Design Height Above Ftg</b>	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	11.00
Rebar Placed at =	Edge

**Design Data**

fb/FB + fa/Fa =	0.365
-----------------	-------

**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 1,142.5

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 2,147.9
Moment....Allowable =	5,883.6

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 15.2
Shear....Allowable =	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.25

**Masonry Data**

fm	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**

Fc	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) :	0.0805 in2/ft		
(4/3) * As :	0.1073 in2/ft	Min Stem T&S Reinf Area 1.056 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	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2182 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 Data**

Toe Width =	2.75 ft
Heel Width =	0.67
Total Footing Width =	3.42
Footing Thickness =	10.00 in
Key Width =	12.00 in
Key Depth =	8.00 in
Key Distance from Toe =	1.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure =	1,946	0 psf
Mu' : Upward =	45,959	0 ft-#
Mu' : Downward =	12,599	0 ft-#
Mu: Design =	2,780	0 ft-#
Actual 1-Way Shear =	14.51	0.03 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 9.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	# 4 @ 9.26 in	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.00 in  
 Heel: phiMn = phi\*5\*lambda\*sqrt(fc)\*Sm  
 Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	0.74	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	1.8	3.42	6.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.42	6.3
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	225.0	3.33	750.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	201.7	1.38	277.3
				Surcharge Over Toe =			
				Stem Weight(s) =	550.0	3.08	1,695.8
<b>Total</b> =	<b>905.6</b>	<b>O.T.M. =</b>	<b>2,073.3</b>	Earth @ Stem Transitions =			
				Footing Weight =	427.5	1.71	731.0
				Key Weight =	100.0	1.50	150.0
				Vert. Component =			
<b>Resisting/Overturning Ratio</b>			<b>= 1.38</b>	<b>Total =</b>	<b>1,281.0 lbs</b>	<b>R.M.=</b>	<b>2,860.4</b>
Vertical Loads used for Soil Pressure =			1,281.0 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**

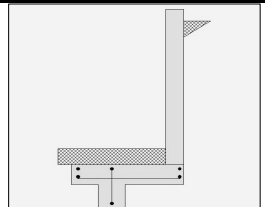
**Horizontal Deflection at Top of Wall due to settlement of soil**

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.062	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.

Criteria		Soil Data	
Retained Height	= 6.00 ft	Allow Soil Bearing	= 2,666.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 8.00 in	Passive Pressure	= 300.0 psf/ft
Water height over heel	= 0.0 ft	Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footings Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 54.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 6.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem (Service Level)	= 0.0 psf	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Design Summary	
Axial Dead Load	= 0.0 lbs	Wall Stability Ratios	
Axial Live Load	= 0.0 lbs	Overturning	= 1.28 Ratio < 1.5!
Axial Load Eccentricity	= 0.0 in	Sliding	= 1.24 Ratio < 1.5!
		Total Bearing Load	= 1,605 lbs
		...resultant ecc.	= 18.07 in

Stem Construction		Bottom	
Design Height Above Ftg	ft = 0.00	Stem OK	
Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Design Method	= LRFD	Design Method	= LRFD
Thickness	= 8.00	Thickness	= 8.00
Rebar Size	= # 4	Rebar Size	= # 4
Rebar Spacing	= 10.00	Rebar Spacing	= 10.00
Rebar Placed at	= Edge	Rebar Placed at	= Edge
Design Data		fb/FB + fa/Fa	= 0.575
Total Force @ Section		Service Level	lbs =
Strength Level	lbs = 1,645.2	Strength Level	psi = 21.9
Moment...Actual		Shear...Allowable	psi = 75.0
Service Level	ft-# = 3,711.6	Anet (Masonry)	in2 =
Strength Level	ft-# = 6,444.1	Rebar Depth 'd'	in = 6.25
Moment....Allowable		Masonry Data	
Shear....Actual		f <sub>m</sub>	psi =
Service Level	psi =	F <sub>s</sub>	psi =
Strength Level	psi =	Solid Grouting	=
Shear....Allowable		Modular Ratio 'n'	=
Anet (Masonry)	in2 =	Wall Weight	psf = 100.0
Rebar Depth 'd'	in = 6.25	Short Term Factor	=
Masonry Data		Equiv. Solid Thick.	=
f <sub>m</sub>	psi =	Masonry Block Type	= Medium Weight
F <sub>s</sub>	psi =	Masonry Design Method	= ASD
Solid Grouting	=	Concrete Data	
Modular Ratio 'n'	=	f <sub>c</sub>	psi = 2,500.0
Wall Weight	psf = 100.0	F <sub>y</sub>	psi = 60,000.0
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type	= Medium Weight		
Masonry Design Method	= ASD		

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

Concrete Stem Rebar Area Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1391 in2/ft	
(4/3) * As :	0.1854 in2/ft	Min Stem T&S Reinf Area 1.248 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.1854 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 Data		Footing Design Results	
Toe Width	= 3.50 ft	Factored Pressure	= 2,585 0 psf
Heel Width	= 0.67	Mu' : Upward	= 78,755 0 ft-#
Total Footing Width	= 4.17	Mu' : Downward	= 20,409 0 ft-#
Footing Thickness	= 10.00 in	Mu: Design	= 4,882 0 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 17.44 0.04 psi
Key Depth	= 14.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 4 @ 8.00 in
f <sub>c</sub> = 2,500 psi	F <sub>y</sub> = 60,000 psi	Heel Reinforcing	= None Spec'd
Footing Concrete Density = 150.00 pcf	Min. As % = 0.0018	Key Reinforcing	= # 4 @ 9.00 in
Cover @ Top 2.00 @ Btm= 3.00 in	Footing Torsion, Tu	= 0.00 ft-lbs	
	Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs	

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 10.29 in, #5@ 15.96 in, #6@ 22.65 in, #7@ 30.89 in, #8@ 40.67 in, #9@ 5

Heel: phiMn = phi^5 lambda da^3 sqrt(fc) S<sub>m</sub>

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area 0.90 in2

Min footing T&S reinf Area per foot 0.22 in2 ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 11.11 in #4@ 22.22 in

#5@ 17.22 in #5@ 34.44 in

#6@ 24.44 in #6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =	324.0	3.83	1,242.0			
Load @ Stem Above Soil =						
<b>Total</b>	<b>1,257.9</b>	<b>O.T.M. =</b>	<b>3,369.2</b>			
<b>Resisting/Overturning Ratio</b>			<b>= 1.28</b>			
Vertical Loads used for Soil Pressure =	1,605.1					
Soil Over HL (ab. water tbl)				2.2	4.17	9.2
Soil Over HL (bel. water tbl)					4.17	9.2
Watre Table						
Sloped Soil Over Heel =						
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =				256.7	1.75	449.2
Surcharge Over Toe =						
Stem Weight(s) =				650.0	3.83	2,491.7
Earth @ Stem Transitions =						
Footing Weight =				521.3	2.09	1,086.8
Key Weight =				175.0	1.50	262.5
Vert. Component =						
<b>Total</b>				<b>1,605.1</b>		<b>R.M.= 4,299.3</b>

\* 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) = 0.080 in

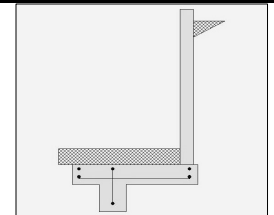
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	6.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	8.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,666.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning =	1.42	Ratio < 1.5!
Sliding =	1.25	Ratio < 1.5!

Total Bearing Load =	1,649 lbs
...resultant ecc. =	17.69 in

Soil Pressure @ Toe =	1,279 psf	OK
Soil Pressure @ Heel =	0 psf	OK
Allowable =	2,666 psf	
Soil Pressure Less Than Allowable		
ACI Factored @ Toe =	1,791 psf	
ACI Factored @ Heel =	0 psf	
Footing Shear @ Toe =	16.3 psi	OK
Footing Shear @ Heel =	1.9 psi	OK
Allowable =	75.0 psi	

**Sliding Calcs**

Lateral Sliding Force =	1,257.9 lbs	
less 100% Passive Force =	- 916.7 lbs	
less 100% Friction Force =	- 659.7 lbs	
Added Force Req'd =	0.0 lbs	OK
...for 1.5 Stability =	310.5 lbs	NG

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Lateral Load Applied to Stem**

Lateral Load =	54.0 #/ft
...Height to Top =	6.00 ft
...Height to Bottom =	0.00 ft
Load Type =	Wind (W)
(Service Level)	
Wind on Exposed Stem =	0.0 psf
(Service Level)	

**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 =	0.0 ft
at Back of Wall =	0.0 ft
Poisson's Ratio =	0.300

**Stem Construction**

Design Height Above Ftg =	0.00
Stem OK	
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	6.00
Rebar Size =	# 4
Rebar Spacing =	9.00
Rebar Placed at =	Edge
fb/FB + fa/Fa =	0.785

**Total Force @ Section**

Service Level	lbs =	
Strength Level	lbs =	1,645.2
<b>Moment...Actual</b>	ft-# =	
Service Level	ft-# =	
Strength Level	ft-# =	3,711.6
Moment....Allowable =		4,722.4

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	32.3
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	9.00
Rebar Depth 'd'	in =	4.25

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	75.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

Fc	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) :	0.2098 in2/ft		
(4/3) * As :	0.2797 in2/ft	Min Stem T&S Reinf Area 0.936 in2	
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.2098 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2667 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	110.0	4.58	504.2
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.58	504.2
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	324.0	3.83	1,242.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	293.3	2.00	586.7
				Surcharge Over Toe =			
				Stem Weight(s) =	487.5	4.25	2,071.9
				Earth @ Stem Transitions =			
				Footing Weight =	583.3	2.33	1,361.1
				Key Weight =	175.0	1.50	262.5
				Vert. Component =			
<b>Total</b>	<b>= 1,257.9</b>	<b>O.T.M. =</b>	<b>3,369.2</b>	<b>Total =</b>	<b>1,649.2 lbs</b>	<b>R.M.=</b>	<b>4,786.3</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.42</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			1,649.2 lbs				

**Footing Data**

Toe Width =	4.00 ft
Heel Width =	0.67
Total Footing Width =	4.67
Footing Thickness =	10.00 in
Key Width =	12.00 in
Key Depth =	14.00 in
Key Distance from Toe =	1.00 ft
fc =	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**

Factored Pressure =	1,791	0 psf
Mu' : Upward =	87,016	0 ft-#
Mu' : Downward =	26,656	15 ft-#
Mu: Design =	5,030	15 ft-#
Actual 1-Way Shear =	16.31	1.91 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 9.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	# 4 @ 9.26 in	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 9.95 in, #5@ 15.42 in, #6@ 21.89 in, #7@ 29.86 in, #8@ 39.31 in, #9@ 49

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	1.01	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

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**

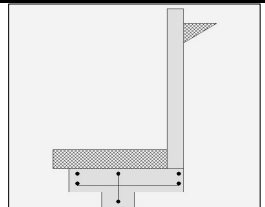
(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.050	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.



Criteria		Soil Data	
Retained Height	= 5.00 ft	Allow Soil Bearing	= 2,666.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 8.00 in		
Water height over heel	= 0.0 ft	Passive Pressure	= 300.0 psf/ft
		Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footings Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 45.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 5.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem (Service Level)	= 0.0 psf	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Design Summary	
Axial Dead Load	= 0.0 lbs	Wall Stability Ratios	
Axial Live Load	= 0.0 lbs	Overturning	= 1.25 Ratio < 1.5!
Axial Load Eccentricity	= 0.0 in	Sliding	= 1.13 Ratio < 1.5!
		Total Bearing Load	= 1,170 lbs
		...resultant ecc.	= 15.74 in

Stem Construction		Bottom	
Design Height Above Ftg	ft = 0.00	Stem OK	
Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Design Method	= LRFD	Design Method	= LRFD
Thickness	= 6.00	Thickness	= 6.00
Rebar Size	= # 4	Rebar Size	= # 4
Rebar Spacing	= 12.00	Rebar Spacing	= 12.00
Rebar Placed at	= Edge	Rebar Placed at	= Edge
Design Data		fb/FB + fa/Fa	= 0.594
Total Force @ Section		Service Level	lbs =
Strength Level	lbs = 1,142.5	Strength Level	lbs = 1,142.5
Moment...Actual		Service Level	ft-# =
Strength Level	ft-# = 2,147.9	Strength Level	ft-# = 2,147.9
Moment....Allowable	= 3,612.6	Moment....Allowable	= 3,612.6
Shear....Actual		Service Level	psi =
Strength Level	psi = 22.4	Strength Level	psi = 22.4
Shear....Allowable	psi = 75.0	Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =	Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 4.25	Rebar Depth 'd'	in = 4.25
Masonry Data		fm	psi =
Fs	psi =	Fs	psi =
Solid Grouting	=	Solid Grouting	=
Modular Ratio 'n'	=	Modular Ratio 'n'	=
Wall Weight	psf = 75.0	Wall Weight	psf = 75.0
Short Term Factor	=	Short Term Factor	=
Equiv. Solid Thick.	=	Equiv. Solid Thick.	=
Masonry Block Type	= Medium Weight	Masonry Block Type	= Medium Weight
Masonry Design Method	= ASD	Masonry Design Method	= ASD
Concrete Data		fc	psi = 2,500.0
fc	psi = 2,500.0	Fy	psi = 60,000.0
Fy	psi = 60,000.0		

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

Concrete Stem Rebar Area Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1214 in2/ft	
(4/3) * As :	0.1619 in2/ft	Min Stem T&S Reinf Area 0.792 in2
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.1619 in2/ft	#4@ 16.67 in #4@ 33.33 in
Provided Area :	0.2 in2/ft	#5@ 25.83 in #5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in #6@ 73.33 in

Footing Data		Footing Design Results	
Toe Width	= 3.00 ft	Factored Pressure	= 2,491 0 psf
Heel Width	= 0.50	Mu' : Upward	= 50,350 0 ft-#
Total Footing Width	= 3.50	Mu' : Downward	= 14,984 0 ft-#
Footing Thickness	= 10.00 in	Mu: Design	= 2,946 0 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 11.56 1.91 psi
Key Depth	= 8.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 4 @ 9.00 in
fc = 2,500 psi	Fy = 60,000 psi	Heel Reinforcing	= None Spec'd
Footing Concrete Density = 150.00 pcf		Key Reinforcing	= # 4 @ 9.26 in
Min. As % = 0.0018		Footing Torsion, Tu	= 0.00 ft-lbs
Cover @ Top 2.00 @ Btm = 3.00 in		Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S m

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area 0.76 in2

Min footing T&S reinf Area per foot 0.22 in2 ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 11.11 in #4@ 22.22 in

#5@ 17.22 in #5@ 34.44 in

#6@ 24.44 in #6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =	225.0	3.33	750.0			
Load @ Stem Above Soil =						
<b>Total</b>	<b>905.6</b>	<b>O.T.M. =</b>	<b>2,073.3</b>			
<b>Resisting/Overturning Ratio</b>			<b>= 1.25</b>			
Vertical Loads used for Soil Pressure =			1,170.0 lbs			
Soil Over HL (ab. water tbl)						
Soil Over HL (bel. water tbl)						
Watre Table						
Sloped Soil Over Heel =						
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =				220.0	1.50	330.0
Surcharge Over Toe =						
Stem Weight(s) =				412.5	3.25	1,340.6
Earth @ Stem Transitions =						
Footing Weight =				437.5	1.75	765.6
Key Weight =				100.0	1.50	150.0
Vert. Component =						
<b>Total</b>				<b>1,170.0 lbs</b>	<b>R.M.=</b>	<b>2,586.3</b>

\* 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) = 0.078 in

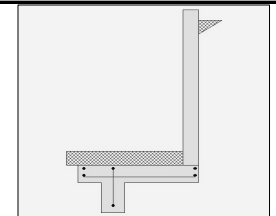
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	7.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	8.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,666.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Lateral Load Applied to Stem**

Lateral Load =	63.0 #/ft
...Height to Top =	7.00 ft
...Height to Bottom =	0.00 ft
Load Type =	Wind (W)
(Service Level)	
Wind on Exposed Stem =	0.0 psf
(Service Level)	

**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 =	0.0 ft
at Back of Wall =	0.0 ft
Poisson's Ratio =	0.300

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning =	1.25 Ratio < 1.5!
Sliding =	1.19 Ratio < 1.5!

Total Bearing Load =	1,954 lbs
...resultant ecc. =	23.20 in

Soil Pressure @ Toe =	1,999 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,666 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	2,798 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	19.9 psi OK
Footing Shear @ Heel =	0.0 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	1,668.2 lbs
less 100% Passive Force =	- 1,200.0 lbs
less 100% Friction Force =	- 781.5 lbs
Added Force Req'd =	0.0 lbs OK
...for 1.5 Stability =	520.8 lbs NG

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 =	1.400
Live Load =	1.700
Earth, H =	1.700
Wind, W =	1.300
Seismic, E =	1.000

**Stem Construction**

Design Height Above Ftg =	0.00
Stem OK	
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	8.00
Rebar Size =	# 4
Rebar Spacing =	8.00
Rebar Placed at =	Edge
fb/FB + fa/Fa =	0.740

**Total Force @ Section**

Service Level =	lbs =
Strength Level =	lbs = 2,239.3

**Moment...Actual**

Service Level =	ft-# =
Strength Level =	ft-# = 5,893.9
Moment....Allowable =	7,959.6

**Shear....Actual**

Service Level =	psi =
Strength Level =	psi = 29.9
Shear....Allowable =	psi = 75.0
Anet (Masonry) =	in2 =
Rebar Depth 'd' =	in = 6.25

**Masonry Data**

fm =	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**

Fc =	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) :	0.2208 in2/ft		
(4/3) * As :	0.2944 in2/ft	Min Stem T&S Reinf Area 1.440 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	
0.0018bh : 0.0018(12)(8) :	0.1728 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 :	0.3 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 Data**

Toe Width =	4.50 ft
Heel Width =	0.67
Total Footing Width =	5.17
Footing Thickness =	10.00 in
Key Width =	12.00 in
Key Depth =	18.00 in
Key Distance from Toe =	1.00 ft
fc =	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**

Factored Pressure =	2,798	0 psf
Mu' : Upward =	126,315	0 ft-#
Mu' : Downward =	33,737	0 ft-#
Mu: Design =	7,715	0 ft-#
Actual 1-Way Shear =	19.86	0.04 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 8.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	# 4 @ 9.00 in	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 8.65 in, #5@ 13.41 in, #6@ 19.03 in, #7@ 25.95 in, #8@ 34.17 in, #9@ 43  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	1.12	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,227.2	2.61	3,204.4	Soil Over HL (ab. water tbl)	2.6	5.17	13.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		5.17	13.3
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =	441.0	4.33	1,911.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	330.0	2.25	742.5
				Surcharge Over Toe =			
				Stem Weight(s) =	750.0	4.83	3,625.0
<b>Total</b> =	<b>1,668.2</b>	<b>O.T.M. =</b>	<b>5,115.4</b>	Earth @ Stem Transitions =			
				Footing Weight =	646.3	2.59	1,670.6
				Key Weight =	225.0	1.50	337.5
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>1.25</b>	<b>Total =</b>	<b>1,953.8 lbs</b>	<b>R.M.=</b>	<b>6,388.8</b>
Vertical Loads used for Soil Pressure =			1,953.8 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)	0.081	in

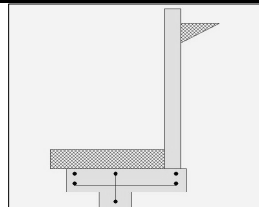
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	8.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footings Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	2.26 OK
Sliding	=	1.57 OK

Total Bearing Load	=	1,283 lbs
...resultant ecc.	=	6.41 in

Soil Pressure @ Toe	=	656 psf OK
Soil Pressure @ Heel	=	44 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	918 psf
ACI Factored @ Heel	=	62 psf
Footing Shear @ Toe	=	10.4 psi OK
Footing Shear @ Heel	=	1.5 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	680.6 lbs
less 100% Passive Force = -	=	554.2 lbs
less 100% Friction Force = -	=	513.0 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	=	1.400
Live Load	=	1.700
Earth, H	=	1.700
Wind, W	=	1.300
Seismic, E	=	1.000

**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	=	0.0 psf (Service Level)

**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

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	16.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.515
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	850.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	1,416.7
Moment....Allowable	=	2,749.3

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	16.7
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.25

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	75.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

Fc	psi =	2,500.0
Fy	psi =	60,000.0

**Concrete Stem Rebar Area Details**

Bottom Stem	=	Vertical Reinforcing
As (based on applied moment)	=	0.0801 in2/ft
(4/3) * As :	=	0.1068 in2/ft
200bd/fy :	=	0.17 in2/ft
0.0018bh : 0.0018(12)(6) :	=	0.1296 in2/ft
Required Area :	=	0.1296 in2/ft
Provided Area :	=	0.15 in2/ft
Maximum Area :	=	0.5757 in2/ft

**Horizontal Reinforcing**

Min Stem T&S Reinf Area	=	0.792 in2
Min Stem T&S Reinf Area per ft of stem Height	=	0.144 in2/ft
Horizontal Reinforcing Options :		
One layer of :		Two layers of :
#4@ 16.67 in		#4@ 33.33 in
#5@ 25.83 in		#5@ 51.67 in
#6@ 36.67 in		#6@ 73.33 in

**Footing Data**

Toe Width	=	3.00 ft
Heel Width	=	0.67
Total Footing Width	=	3.67
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	8.00 in
Key Distance from Toe	=	1.00 ft
fc =	=	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**

Factored Pressure	=	918	62 psf
Mu' : Upward	=	36,951	1 ft-#
Mu' : Downward	=	14,994	13 ft-#
Mu: Design	=	1,830	12 ft-#
Actual 1-Way Shear	=	10.44	1.50 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 11.11 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	# 4 @ 9.26 in	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5
Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S_m
Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	=	0.79	in2
Min footing T&S reinf Area per foot	=	0.22	in2 ft
If one layer of horizontal bars:			
#4@ 11.11 in		#4@ 22.22 in	
#5@ 17.22 in		#5@ 34.44 in	
#6@ 24.44 in		#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	680.6	1.94	1,323.3	Soil Over HL (ab. water tbl)	91.7	3.58	328.5
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.58	328.5
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	220.0	1.50	330.0
				Surcharge Over Toe =			
				Stem Weight(s) =	412.5	3.25	1,340.6
				Earth @ Stem Transitions =			
				Footing Weight =	458.3	1.83	840.3
				Key Weight =	100.0	1.50	150.0
				Vert. Component =			
<b>Total</b>	<b>680.6</b>	<b>O.T.M. =</b>	<b>1,323.3</b>	<b>Total =</b>	<b>1,282.5 lbs</b>	<b>R.M.=</b>	<b>2,989.4</b>
<b>Resisting/Overturning Ratio</b>			<b>= 2.26</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			1,282.5 lbs				

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) = 0.027 in

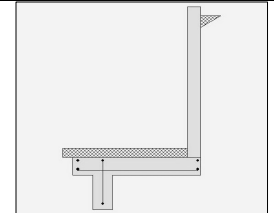
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	8.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	6.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,666.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning =	1.25 Ratio < 1.5!
Sliding =	1.21 Ratio < 1.5!

Total Bearing Load =	2,432 lbs
...resultant ecc. =	29.15 in

Soil Pressure @ Toe =	2,076 psf OK
Soil Pressure @ Heel =	0 psf OK
Allowable =	2,666 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	2,906 psf
ACI Factored @ Heel =	0 psf
Footing Shear @ Toe =	18.4 psi OK
Footing Shear @ Heel =	0.0 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	2,196.0 lbs
less 100% Passive Force = -	1,687.5 lbs
less 100% Friction Force = -	972.9 lbs
Added Force Req'd =	0.0 lbs OK
...for 1.5 Stability =	633.6 lbs NG

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Lateral Load Applied to Stem**

Lateral Load =	72.0 #/ft
...Height to Top =	8.00 ft
...Height to Bottom =	0.00 ft
Load Type =	Wind (W)
(Service Level)	
Wind on Exposed Stem =	0.0 psf
(Service Level)	

**Stem Construction**

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
fb/FB + fa/Fa	= 0.914

**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 2,924.8

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 8,797.9
Moment....Allowable	= 9,623.1

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 39.4
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 6.19

**Masonry Data**

fm	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**

Fc	psi = 2,500.0
Fy	psi = 60,000.0

**Bottom**

Stem OK

Stem OK

Stem OK

Stem OK

Stem OK

Stem OK

Stem OK

Stem OK

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**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3331 in2/ft		
(4/3) * As :	0.4442 in2/ft	Min Stem T&S Reinf Area 1.632 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	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.3331 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 Data**

Toe Width	=	5.75 ft
Heel Width	=	0.67
Total Footing Width	=	6.42
Footing Thickness	=	12.00 in
Key Width	=	12.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	1.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure	= 2,906	0 psf
Mu' : Upward	= 203,027	0 ft-#
Mu' : Downward	= 56,934	0 ft-#
Mu: Design	= 12,174	0 ft-#
Actual 1-Way Shear	= 18.38	0.04 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 5 @ 10.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= # 4 @ 9.00 in	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 7.05 in, #5@ 10.94 in, #6@ 15.52 in, #7@ 21.17 in, #8@ 27.88 in, #9@ 35  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	1.66	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**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl)	2.9	6.42	18.8	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		6.42	18.8	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	=	576.0	5.00	* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	316.3	2.88	909.2
				Surcharge Over Toe	=			
				Stem Weight(s)	=	850.0	6.08	5,170.8
<b>Total</b>	<b>=</b>	<b>2,196.0</b>	<b>O.T.M. = 7,740.0</b>	Earth @ Stem Transitions	=			
				Footing Weight	=	963.0	3.21	3,091.2
				Key Weight	=	300.0	1.50	450.0
				Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			<b>= 1.25</b>	<b>Total =</b>	<b>2,432.2 lbs</b>	<b>R.M.=</b>	<b>9,640.1</b>	
Vertical Loads used for Soil Pressure	=	2,432.2	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**

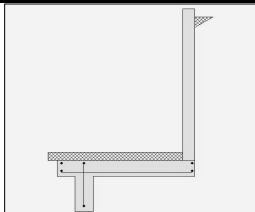
**Horizontal Deflection at Top of Wall due to settlement of soil**

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.076	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.

Criteria		Soil Data	
Retained Height	= 9.00 ft	Allow Soil Bearing	= 2,666.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 6.00 in		
Water height over heel	= 0.0 ft	Passive Pressure	= 300.0 psf/ft
		Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footings Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 81.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 9.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem	= 0.0 psf (Service Level)	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Stem Construction		Bottom	
Axial Dead Load	= 0.0 lbs	Design Height Above Ftg	ft = 0.00	Stem OK	
Axial Live Load	= 0.0 lbs	Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Axial Load Eccentricity	= 0.0 in	Design Method	= LRFD	Design Method	= LRFD
		Thickness	= 8.00	Thickness	= 8.00
		Rebar Size	= # 5	Rebar Size	= # 5
		Rebar Spacing	= 6.00	Rebar Spacing	= 6.00
		Rebar Placed at	= Edge	Rebar Placed at	= Edge

Design Summary		Design Data	
Wall Stability Ratios		fb/FB + fa/Fa	= 0.822
Overturning	= 1.24 Ratio < 1.5!	Total Force @ Section	
Sliding	= 1.13 Ratio < 1.5!	Service Level	lbs =
		Strength Level	lbs = 3,701.7
Total Bearing Load	= 2,826 lbs	Moment...Actual	
...resultant ecc.	= 35.06 in	Service Level	ft-# =
		Strength Level	ft-# = 12,526.7
Soil Pressure @ Toe	= 2,063 psf OK	Moment....Allowable	= 15,222.0
Soil Pressure @ Heel	= 0 psf OK	Shear....Actual	
Allowable	= 2,666 psf	Service Level	psi =
Soil Pressure Less Than Allowable		Strength Level	psi = 49.9
ACI Factored @ Toe	= 2,888 psf	Shear....Allowable	psi = 75.0
ACI Factored @ Heel	= 0 psf	Anet (Masonry)	in2 =
Footing Shear @ Toe	= 20.1 psi OK	Rebar Depth 'd'	in = 6.19
Footing Shear @ Heel	= 0.0 psi OK	Masonry Data	
Allowable	= 75.0 psi	fm	psi =
Sliding Calcs		Fs	psi =
Lateral Sliding Force	= 2,729.0 lbs	Solid Grouting	=
less 100% Passive Force	= - 1,959.4 lbs	Modular Ratio 'n'	=
less 100% Friction Force	= - 1,130.5 lbs	Wall Weight	psf = 100.0
Added Force Req'd	= 0.0 lbs OK	Short Term Factor	=
...for 1.5 Stability	= 1,003.6 lbs NG	Equiv. Solid Thick.	=
		Masonry Block Type	= Medium Weight
		Masonry Design Method	= ASD

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

Concrete Stem Rebar Area Details	
Bottom Stem	Vertical Reinforcing
As (based on applied moment) :	0.4743 in2/ft
(4/3) * As :	0.6324 in2/ft
200bd/fy : 200(12)(6.1875)/60000 :	0.2475 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft
	Horizontal Reinforcing
	Min Stem T&S Reinf Area 1.824 in2
	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
	Horizontal Reinforcing Options :
Required Area :	One layer of : Two layers of :
Provided Area :	#4@ 12.50 in #4@ 25.00 in
Maximum Area :	#5@ 19.38 in #5@ 38.75 in
	#6@ 27.50 in #6@ 55.00 in

Footing Data		Footing Design Results	
Toe Width	= 7.00 ft	Factored Pressure	= 2,888 0 psf
Heel Width	= 0.67	Mu' : Upward	= 289,000 0 ft-#
Total Footing Width	= 7.67	Mu' : Downward	= 84,378 0 ft-#
Footing Thickness	= 12.00 in	Mu: Design	= 17,052 0 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 20.07 0.04 psi
Key Depth	= 27.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 5 @ 8.00 in
fc =	2,500 psi	Heel Reinforcing	= None Spec'd
Footing Concrete Density	= 150.00 pcf	Key Reinforcing	= # 4 @ 9.00 in
Min. As %	= 0.0018	Footing Torsion, Tu	= 0.00 ft-lbs
Cover @ Top	2.00 @ Btm = 3.00 in	Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 5.18 in, #5@ 8.03 in, #6@ 11.39 in, #7@ 15.54 in, #8@ 20.46 in, #9@ 25.00 in  
 Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S m  
 Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in

Min footing T&S reinf Area 1.99 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



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**Cantilevered Retaining Wall**

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

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,000.0	3.33	6,666.7			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force						
Surcharge over Heel						
Surcharge Over Toe						
Adjacent Footing Load						
Added Lateral Load	729.0	5.50	4,009.5			
Load @ Stem Above Soil						
<b>Total</b>	<b>2,729.0</b>	<b>O.T.M. =</b>	<b>10,676.2</b>			
<b>Resisting/Overturning Ratio</b>			<b>= 1.24</b>			
Vertical Loads used for Soil Pressure			<b>2,826.3 lbs</b>			
				<b>Total = 2,826.3 lbs</b>	<b>R.M.=</b>	<b>13,257.9</b>

\* 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) = 0.071 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**

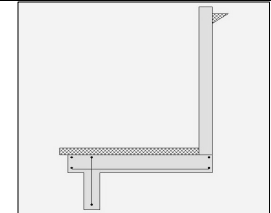
Code: IBC 2015,ACI 318-14,ACI 530-13

**Criteria**

Retained Height	=	10.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing  Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.43 Ratio < 1.5!
Sliding	=	1.26 Ratio < 1.5!

Total Bearing Load	=	3,869 lbs
...resultant ecc.	=	34.45 in

Soil Pressure @ Toe	=	1,544 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	2,162 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	20.4 psi OK
Footing Shear @ Heel	=	0.0 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	3,431.3 lbs
less 100% Passive Force = -		2,776.0 lbs
less 100% Friction Force = -		1,547.8 lbs
Added Force Req'd	=	0.0 lbs OK
...for 1.5 Stability	=	823.1 lbs NG

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Lateral Load Applied to Stem**

Lateral Load	=	90.0 #/ft
...Height to Top	=	10.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W)
(Service Level)	=	
Wind on Exposed Stem	=	0.0 psf
(Service Level)	=	

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	10.00
Rebar Size	=	# 6
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge
fb/FB + fa/Fa	=	0.845

**Total Force @ Section**

Service Level	lbs =	
Strength Level	lbs =	4,570.0

**Moment...Actual**

Service Level	ft-# =	
Strength Level	ft-# =	17,183.3
Moment....Allowable	=	20,333.2

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	49.9
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	8.00
Rebar Depth 'd'	in =	7.63

**Masonry Data**

fm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	125.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

**Concrete Data**

Fc	psi =	2,500.0
Fy	psi =	60,000.0

**Bottom**

Stem OK	=	0.00
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	=	0.0 ft
at Back of Wall	=	
Poisson's Ratio	=	0.300

**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.5226 in2/ft		
(4/3) * As :	0.6968 in2/ft	Min Stem T&S Reinf Area 2.520 in2	
200bd/fy : 200(12)(7.625)/60000 :	0.305 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.5226 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.66 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.0329 in2/ft	#6@ 22.00 in	#6@ 44.00 in

**Footing Data**

Toe Width	=	8.25 ft
Heel Width	=	0.83
Total Footing Width	=	9.08
Footing Thickness	=	15.00 in
Key Width	=	12.00 in
Key Depth	=	32.00 in
Key Distance from Toe	=	1.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure	= 2,162	0 psf
Mu' : Upward	= 427.691	0 ft-#
Mu' : Downward	= 138.643	0 ft-#
Mu: Design	= 24.087	0 ft-#
Actual 1-Way Shear	= 20.44	0.03 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 6 @ 8.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= # 5 @ 12.00 in	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 5.01 in, #5@ 7.77 in, #6@ 11.02 in, #7@ 15.03 in, #8@ 19.80 in, #9@ 25.  
 Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm  
 Key: #4@ 9.64 in, #5@ 14.94 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	2.94	in2
Min footing T&S reinf Area per foot	0.32	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 7.41 in	#4@ 14.81 in	
#5@ 11.48 in	#5@ 22.96 in	
#6@ 16.30 in	#6@ 32.59 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	2,531.3	3.75	9,492.2	Soil Over HL (ab. water tbl)	0.0	9.08	0.0	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		9.08	0.0	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	= 900.0	6.25	5,625.0	* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	453.8	4.13	1,871.7
				Surcharge Over Toe	=			
				Stem Weight(s)	=	1,312.5	8.67	11,375.0
<b>Total</b>	<b>= 3,431.3</b>	<b>O.T.M. =</b>	<b>15,117.2</b>	Earth @ Stem Transitions	=			
				Footing Weight	=	1,703.1	4.54	7,735.0
				Key Weight	=	400.0	1.50	600.0
				Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			<b>= 1.43</b>	<b>Total =</b>	<b>3,869.4 lbs</b>	<b>R.M.=</b>	<b>21,581.7</b>	
Vertical Loads used for Soil Pressure	=	3,869.4 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**

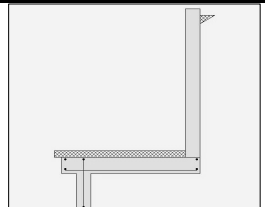
**Horizontal Deflection at Top of Wall due to settlement of soil**

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.050	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.

Criteria		Soil Data	
Retained Height	= 11.00 ft	Allow Soil Bearing	= 2,666.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 6.00 in		
Water height over heel	= 0.0 ft	Passive Pressure	= 300.0 psf/ft
		Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footing Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 99.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 11.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem (Service Level)	= 0.0 psf	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Stem Construction		Bottom	
Axial Dead Load	= 0.0 lbs	Design Height Above Ftg	ft = 0.00	Stem OK	
Axial Live Load	= 0.0 lbs	Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Axial Load Eccentricity	= 0.0 in	Design Method	= LRFD	Design Method	= LRFD
		Thickness	= 12.00	Thickness	= 12.00
		Rebar Size	= # 6	Rebar Size	= # 6
		Rebar Spacing	= 8.00	Rebar Spacing	= 8.00
		Rebar Placed at	= Edge	Rebar Placed at	= Edge

Design Summary		Design Data	
Wall Stability Ratios		fb/FB + fa/Fa	= 0.870
Overturning	= 1.36 Ratio < 1.5!	Total Force @ Section	
Sliding	= 1.22 Ratio < 1.5!	Service Level	lbs =
		Strength Level	lbs = 5,529.7
Total Bearing Load	= 4,424 lbs	Moment...Actual	
...resultant ecc.	= 37.90 in	Service Level	ft-# =
		Strength Level	ft-# = 22,871.0
Soil Pressure @ Toe	= 1,853 psf OK	Moment....Allowable	= 26,273.2
Soil Pressure @ Heel	= 0 psf OK	Shear....Actual	
Allowable	= 2,666 psf	Service Level	psi =
Soil Pressure Less Than Allowable		Strength Level	psi = 47.9
ACI Factored @ Toe	= 2,594 psf	Shear....Allowable	psi = 75.0
ACI Factored @ Heel	= 0 psf	Anet (Masonry)	in2 =
Footing Shear @ Toe	= 25.4 psi OK	Rebar Depth 'd'	in = 9.63
Footing Shear @ Heel	= 0.0 psi OK	Masonry Data	
Allowable	= 75.0 psi	fm	psi =
Sliding Calcs		Fs	psi =
Lateral Sliding Force	= 4,090.3 lbs	Solid Grouting	=
less 100% Passive Force	= - 3,234.4 lbs	Modular Ratio 'n'	=
less 100% Friction Force	= - 1,769.5 lbs	Wall Weight	psf = 150.0
Added Force Req'd	= 0.0 lbs OK	Short Term Factor	=
...for 1.5 Stability	= 1,131.5 lbs NG	Equiv. Solid Thick.	=
		Masonry Block Type	= Medium Weight
		Masonry Design Method	= ASD

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

Concrete Data	
fc	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) :	0.5461 in2/ft	
(4/3) * As :	0.7282 in2/ft	Min Stem T&S Reinf Area 3.312 in2
200bd/fy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.5461 in2/ft	#4@ 8.33 in #4@ 16.67 in
Provided Area :	0.66 in2/ft	#5@ 12.92 in #5@ 25.83 in
Maximum Area :	1.3039 in2/ft	#6@ 18.33 in #6@ 36.67 in

Footing Data		Footing Design Results	
Toe Width	= 8.50 ft	Factored Pressure	= 2,594 0 psf
Heel Width	= 1.00	Mu' : Upward	= 513,407 0 ft-#
Total Footing Width	= 9.50	Mu' : Downward	= 147,173 0 ft-#
Footing Thickness	= 15.00 in	Mu: Design	= 30,519 0 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 25.42 0.03 psi
Key Depth	= 36.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 6 @ 8.00 in
fc =	2,500 psi	Heel Reinforcing	= None Spec'd
Fy =	60,000 psi	Key Reinforcing	= # 5 @ 10.00 in
Footing Concrete Density	= 150.00 pcf	Footing Torsion, Tu	= 0.00 ft-lbs
Min. As %	= 0.0018	Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs
Cover @ Top	2.00 @ Btm.= 3.00 in		

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 3.95 in, #5@ 6.13 in, #6@ 8.70 in, #7@ 11.87 in, #8@ 15.62 in, #9@ 19.7

Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S\_m

Key: #4@ 7.29 in, #5@ 11.31 in, #6@ 16.05 in, #7@ 18 in, #8@

Min footing T&S reinf Area 3.08 in2

Min footing T&S reinf Area per foot 0.32 in2 ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 7.41 in #4@ 14.81 in

#5@ 11.48 in #5@ 22.96 in

#6@ 16.30 in #6@ 32.59 in

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**Cantilevered Retaining Wall**

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

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	3,001.3	4.08	12,255.1			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force						
Surcharge over Heel						
Surcharge Over Toe						
Adjacent Footing Load						
Added Lateral Load	1,089.0	6.75	7,350.8			
Load @ Stem Above Soil						
<b>Total</b>	<b>4,090.3</b>	<b>O.T.M. =</b>	<b>19,605.9</b>			
<b>Resisting/Overturning Ratio</b>			<b>= 1.36</b>			
Vertical Loads used for Soil Pressure			4,423.8 lbs			
				<b>Total =</b>	<b>4,423.8 lbs</b>	<b>R.M.= 26,647.8</b>

Soil Over HL (ab. water tbl)  
 Soil Over HL (bel. water tbl)  
 Watre Table  
 Sloped Soil Over Heel =  
 Surcharge Over Heel =  
 Adjacent Footing Load =  
 Axial Dead Load on Stem =  
 \* Axial Live Load on Stem =  
 Soil Over Toe = 467.5 4.25 1,986.9  
 Surcharge Over Toe =  
 Stem Weight(s) = 1,725.0 9.00 15,525.0  
 Earth @ Stem Transitions =  
 Footing Weight = 1,781.3 4.75 8,460.9  
 Key Weight = 450.0 1.50 675.0  
 Vert. Component =  
 \* 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) 0.062 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**

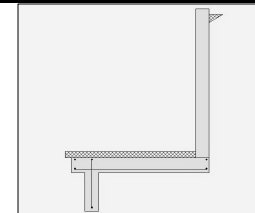
Code: IBC 2015,ACI 318-14,ACI 530-13

**Criteria**

Retained Height = 12.00 ft  
 Wall height above soil = 0.50 ft  
 Slope Behind Wall = 0.00  
 Height of Soil over Toe = 6.00 in  
 Water height over heel = 0.0 ft

**Soil Data**

Allow Soil Bearing = 2,666.0 psf  
 Equivalent Fluid Pressure Method  
 Active Heel Pressure = 40.0 psf/ft  
 Passive Pressure = 300.0 psf/ft  
 Soil Density, Heel = 110.00 pcf  
 Soil Density, Toe = 110.00 pcf  
 Footing||Soil Friction = 0.400  
 Soil height to ignore for passive pressure = 12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning = 1.25 Ratio < 1.5!  
 Sliding = 1.17 Ratio < 1.5!

Total Bearing Load = 4,806 lbs  
 ...resultant ecc. = 45.69 in

Soil Pressure @ Toe = 2,432 psf OK  
 Soil Pressure @ Heel = 0 psf OK  
 Allowable = 2,666 psf  
 Soil Pressure Less Than Allowable  
 ACI Factored @ Toe = 3,405 psf  
 ACI Factored @ Heel = 0 psf  
 Footing Shear @ Toe = 27.4 psi OK  
 Footing Shear @ Heel = 0.0 psi OK  
 Allowable = 75.0 psi

**Sliding Calcs**

Lateral Sliding Force = 4,807.3 lbs  
 less 100% Passive Force = - 3,726.0 lbs  
 less 100% Friction Force = - 1,922.3 lbs  
 Added Force Req'd = 0.0 lbs OK  
 ...for 1.5 Stability = 1,562.6 lbs NG

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 1.400  
 Live Load 1.700  
 Earth, H 1.700  
 Wind, W 1.300  
 Seismic, E 1.000

**Lateral Load Applied to Stem**

Lateral Load = 108.0 #/ft  
 ...Height to Top = 12.00 ft  
 ...Height to Bottom = 0.00 ft  
 Load Type = Wind (W)  
 (Service Level)  
 Wind on Exposed Stem = 0.0 psf  
 (Service Level)

**Stem Construction**

Design Height Above Ftg = 0.00  
 Wall Material Above "Ht" = Concrete  
 Design Method = LRFD  
 Thickness = 12.00  
 Rebar Size = # 7  
 Rebar Spacing = 9.00  
 Rebar Placed at = Edge

**Design Data**

fb/FB + fa/Fa = 0.957

**Total Force @ Section**

Service Level lbs =  
 Strength Level lbs = 6,580.8

**Moment...Actual**

Service Level ft-# =  
 Strength Level ft-# = 29,692.8  
 Moment....Allowable = 31,026.6

**Shear....Actual**

Service Level psi =  
 Strength Level psi = 57.3  
 Shear....Allowable psi = 75.0  
 Anet (Masonry) in2 = 9.00  
 Rebar Depth 'd' in = 9.56

**Masonry Data**

fm psi =  
 Fs psi =  
 Solid Grouting =  
 Modular Ratio 'n' =  
 Wall Weight psf = 150.0  
 Short Term Factor =  
 Equiv. Solid Thick. =  
 Masonry Block Type = Medium Weight  
 Masonry Design Method = ASD

**Concrete Data**

Fc psi = 2,500.0  
 Fy psi = 60,000.0

**Adjacent Footing Load**

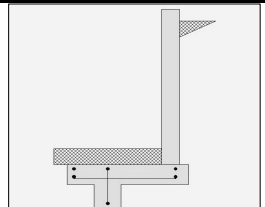
Adjacent Footing Load = 0.0 lbs  
 Footing Width = 0.00 ft  
 Eccentricity = 0.00 in  
 Wall to Ftg CL Dist = 0.00 ft  
 Footing Type Line Load  
 Base Above/Below Soil = 0.0 ft  
 at Back of Wall = 0.0 ft  
 Poisson's Ratio = 0.300

**Bottom**

Stem OK



Criteria		Soil Data	
Retained Height	= 6.00 ft	Allow Soil Bearing	= 2,000.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 8.00 in		
Water height over heel	= 0.0 ft	Passive Pressure	= 300.0 psf/ft
		Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footing Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 0.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 0.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem	= 0.0 psf (Service Level)	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Stem Construction		Bottom	
Axial Dead Load	= 0.0 lbs	Design Height Above Ftg	ft = 0.00	Stem OK	
Axial Live Load	= 0.0 lbs	Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Axial Load Eccentricity	= 0.0 in	Design Method	= LRFD	Design Method	= LRFD
		Thickness	= 8.00	Thickness	= 8.00
		Rebar Size	= # 4	Rebar Size	= # 4
		Rebar Spacing	= 10.00	Rebar Spacing	= 10.00
		Rebar Placed at	= Edge	Rebar Placed at	= Edge

Design Summary		Design Data	
Wall Stability Ratios		fb/FB + fa/Fa	= 0.379
Overturning	= 2.55 OK	Total Force @ Section	
Sliding	= 1.78 OK	Service Level	lbs =
		Strength Level	lbs = 1,224.0
Total Bearing Load	= 1,864 lbs	Moment...Actual	
...resultant ecc.	= 5.79 in	Service Level	ft-# =
		Strength Level	ft-# = 2,448.0
Soil Pressure @ Toe	= 681 psf OK	Moment....Allowable	= 6,444.1
Soil Pressure @ Heel	= 148 psf OK	Shear....Actual	
Allowable	= 2,000 psf	Service Level	psi =
Soil Pressure Less Than Allowable		Strength Level	psi = 16.3
ACI Factored @ Toe	= 953 psf	Shear....Allowable	psi = 75.0
ACI Factored @ Heel	= 207 psf	Anet (Masonry)	in2 =
Footing Shear @ Toe	= 15.5 psi OK	Rebar Depth 'd'	in = 6.25
Footing Shear @ Heel	= 3.0 psi OK	Masonry Data	
Allowable	= 75.0 psi	fm	psi =
Sliding Calcs		Fs	psi =
Lateral Sliding Force	= 933.9 lbs	Solid Grouting	=
less 100% Passive Force	= - 916.7 lbs	Modular Ratio 'n'	=
less 100% Friction Force	= - 745.7 lbs	Wall Weight	psf = 100.0
Added Force Req'd	= 0.0 lbs OK	Short Term Factor	=
...for 1.5 Stability	= 0.0 lbs OK	Equiv. Solid Thick.	=
		Masonry Block Type	= Medium Weight
		Masonry Design Method	= ASD

Load Factors		Concrete Data	
Building Code	IBC 2015,ACI	Fc	psi = 2,500.0
Dead Load	1.400	Fy	psi = 60,000.0
Live Load	1.700		
Earth, H	1.700		
Wind, W	1.300		
Seismic, E	1.000		

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

Concrete Stem Rebar Area Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.0917 in2/ft	
(4/3) * As :	0.1223 in2/ft	Min Stem T&S Reinf Area 1.248 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.1728 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 Data		Footing Design Results	
Toe Width	= 3.50 ft	Factored Pressure	= 953 207 psf
Heel Width	= 1.00	Mu' : Upward	= 55,828 13 ft-#
Total Footing Width	= 4.50	Mu' : Downward	= 20,409 61 ft-#
Footing Thickness	= 10.00 in	Mu: Design	= 2,952 49 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 15.48 3.00 psi
Key Depth	= 14.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 4 @ 11.00 in
fc = 2,500 psi	Fy = 60,000 psi	Heel Reinforcing	= None Spec'd
Footing Concrete Density = 150.00 pcf		Key Reinforcing	= # 4 @ 9.00 in
Min. As % = 0.0018		Footing Torsion, Tu	= 0.00 ft-lbs
Cover @ Top 2.00 @ Btm = 3.00 in		Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.00 in  
 Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S\_m  
 Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in

Min footing T&S reinf Area 0.97 in2  
 Min footing T&S reinf Area per foot 0.22 in2 ft  
 If one layer of horizontal bars: If two layers of horizontal bars:  
 #4@ 11.11 in #4@ 22.22 in  
 #5@ 17.22 in #5@ 34.44 in  
 #6@ 24.44 in #6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	220.0	4.33	953.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.33	953.3
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	256.7	1.75	449.2
				Surcharge Over Toe =			
				Stem Weight(s) =	650.0	3.83	2,491.7
				Earth @ Stem Transitions =			
				Footing Weight =	562.5	2.25	1,265.6
				Key Weight =	175.0	1.50	262.5
				Vert. Component =			
<b>Total</b>	<b>933.9</b>	<b>O.T.M. =</b>	<b>2,127.2</b>	<b>Total =</b>	<b>1,864.2 lbs</b>	<b>R.M.=</b>	<b>5,422.3</b>
<b>Resisting/Overturning Ratio</b>			<b>= 2.55</b>				
Vertical Loads used for Soil Pressure =			1,864.2 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) = 0.027 in

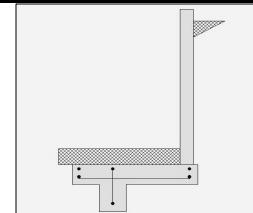
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	6.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	8.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning =	2.25 OK
Sliding =	1.69 OK

Total Bearing Load =	1,649 lbs
...resultant ecc. =	8.65 in

Soil Pressure @ Toe =	681 psf OK
Soil Pressure @ Heel =	26 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	953 psf
ACI Factored @ Heel =	36 psf
Footing Shear @ Toe =	13.9 psi OK
Footing Shear @ Heel =	1.8 psi OK
Allowable =	75.0 psi

**Sliding Calcs**

Lateral Sliding Force =	933.9 lbs
less 100% Passive Force = -	916.7 lbs
less 100% Friction Force = -	659.7 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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**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 =	0.0 psf
(Service Level)	

**Stem Construction**

Design Height Above Ftg	ft = 0.00
Wall Material Above "Ht"	= Concrete
Design Method	= LRFD
Thickness	= 6.00
Rebar Size	= # 4
Rebar Spacing	= 9.00
Rebar Placed at	= Edge

**Design Data**

fb/FB + fa/Fa	= 0.518
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**Total Force @ Section**

Service Level	lbs =
Strength Level	lbs = 1,224.0

**Moment...Actual**

Service Level	ft-# =
Strength Level	ft-# = 2,448.0
Moment....Allowable	= 4,722.4

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 24.0
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 4.25

**Masonry Data**

fm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Wall Weight	psf = 75.0
Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	= Medium Weight
Masonry Design Method	= ASD

**Concrete Data**

Fc	psi = 2,500.0
Fy	psi = 60,000.0

**Bottom**

Stem OK

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 = 0.0 ft

Poisson's Ratio = 0.300



**Concrete Stem Rebar Area Details**

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1384 in2/ft		
(4/3) * As :	0.1845 in2/ft	Min Stem T&S Reinf Area 0.936 in2	
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.17 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.2667 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in

**Footing Data**

Toe Width	=	4.00 ft
Heel Width	=	0.67
Total Footing Width	=	4.67
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	14.00 in
Key Distance from Toe	=	1.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure	= 953	36 psf
Mu' : Upward	= 66,364	1 ft-#
Mu' : Downward	= 26,656	15 ft-#
Mu: Design	= 3,309	15 ft-#
Actual 1-Way Shear	= 13.91	1.82 psi
Allow 1-Way Shear	= 75.00	40.00 psi
Toe Reinforcing	= # 4 @ 11.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= # 4 @ 9.26 in	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi\*5\*lambda\*sqrt(fc)\*Sm

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	1.01	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:	If two layers of horizontal bars:	
#4@ 11.11 in	#4@ 22.22 in	
#5@ 17.22 in	#5@ 34.44 in	
#6@ 24.44 in	#6@ 48.89 in	

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	933.9	2.28	2,127.2	Soil Over HL (ab. water tbl)	110.0	4.58	504.2	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.58	504.2	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	=			* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	293.3	2.00	586.7
				Surcharge Over Toe	=			
				Stem Weight(s)	=	487.5	4.25	2,071.9
<b>Total</b>	<b>=</b>	<b>933.9</b>	<b>O.T.M. = 2,127.2</b>	Earth @ Stem Transitions	=			
				Footing Weight	=	583.3	2.33	1,361.1
				Key Weight	=	175.0	1.50	262.5
				Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			<b>= 2.25</b>	<b>Total =</b>	<b>1,649.2 lbs</b>	<b>R.M.=</b>	<b>4,786.3</b>	
Vertical Loads used for Soil Pressure	=	1,649.2	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 Def @ Top of Wall (approximate only)	0.026	in

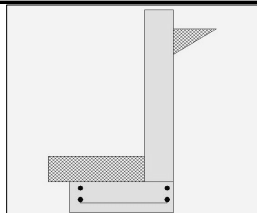
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	8.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footings Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.89 OK
Sliding	=	1.72 OK

Total Bearing Load	=	882 lbs
...resultant ecc.	=	5.45 in

Soil Pressure @ Toe	=	779 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,090 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	7.7 psi OK
Footing Shear @ Heel	=	0.0 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	467.2 lbs
less 100% Passive Force = -	=	450.0 lbs
less 100% Friction Force = -	=	352.9 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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**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

**Stem Construction**

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	=	0.134
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**Total Force @ Section**

Service Level	lbs =	
Strength Level	lbs =	544.0

**Moment...Actual**

Service Level	ft-# =	
Strength Level	ft-# =	725.3
Moment....Allowable	=	5,412.6

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	7.3
Shear....Allowable	psi =	75.0

Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25

**Masonry Data**

fm	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**

Fc	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) :	0.0272 in2/ft	
(4/3) * As :	0.0362 in2/ft	Min Stem T&S Reinf Area 0.864 in2
200bdify : 200(12)(6.25)/60000 :	0.25 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
Required Area :	0.1728 in2/ft	One layer of : Two layers of :
Provided Area :	0.2 in2/ft	#4@ 12.50 in #4@ 25.00 in
Maximum Area :	0.8467 in2/ft	#5@ 19.38 in #5@ 38.75 in
		#6@ 27.50 in #6@ 55.00 in

**Footing Data**

Toe Width	=	1.75 ft
Heel Width	=	0.67
Total Footing Width	=	2.42
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	6.00 in
Key Distance from Toe	=	0.00 ft
fc =	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**

Factored Pressure	=	1,090	0 psf
Mu' : Upward	=	14,873	0 ft-#
Mu' : Downward	=	5,102	0 ft-#
Mu: Design	=	814	0 ft-#
Actual 1-Way Shear	=	7.74	0.03 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 9.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.00 in  
 Heel: phiMn = phi^5 lambda ba^2 / sqrt(fc) S<sub>m</sub>  
 Key: No key defined

Min footing T&S reinf Area	0.52	in2
Min footing T&S reinf Area per foot	0.22	in2 .ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	467.2	1.61	752.7	Soil Over HL (ab. water tbl)	1.5	2.42	3.5
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.42	3.5
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	128.3	0.88	112.3
				Surcharge Over Toe =			
				Stem Weight(s) =	450.0	2.08	937.5
				Earth @ Stem Transitions =			
				Footing Weight =	302.5	1.21	366.0
				Key Weight =			
				Vert. Component =			
<b>Total</b>	<b>467.2</b>	<b>O.T.M. =</b>	<b>752.7</b>	<b>Total =</b>	<b>882.3 lbs</b>	<b>R.M.=</b>	<b>1,419.4</b>
<b>Resisting/Overturning Ratio</b>			<b>= 1.89</b>	* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.			
Vertical Loads used for Soil Pressure =			882.3 lbs				

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)	0.040 in

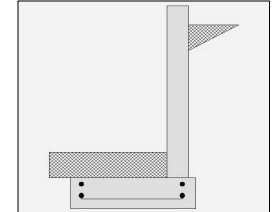
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height =	4.00 ft
Wall height above soil =	0.50 ft
Slope Behind Wall =	0.00
Height of Soil over Toe =	8.00 in
Water height over heel =	0.0 ft

**Soil Data**

Allow Soil Bearing =	2,000.0 psf
Equivalent Fluid Pressure Method	
Active Heel Pressure =	40.0 psf/ft
Passive Pressure =	300.0 psf/ft
Soil Density, Heel =	110.00 pcf
Soil Density, Toe =	110.00 pcf
Footing  Soil Friction =	0.400
Soil height to ignore for passive pressure =	12.00 in



**Surcharge Loads**

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

**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 =	0.0 psf (Service Level)

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning =	2.35 OK
Sliding =	1.77 OK

Total Bearing Load =	940 lbs
...resultant ecc. =	4.53 in

Soil Pressure @ Toe =	573 psf OK
Soil Pressure @ Heel =	72 psf OK
Allowable =	2,000 psf
Soil Pressure Less Than Allowable	
ACI Factored @ Toe =	802 psf
ACI Factored @ Heel =	101 psf
Footing Shear @ Toe =	6.5 psi OK
Footing Shear @ Heel =	1.2 psi OK
Allowable =	75.0 psi

<b>Sliding Calcs</b>	
Lateral Sliding Force =	467.2 lbs
less 100% Passive Force = -	450.0 lbs
less 100% Friction Force = -	376.2 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

<b>Load Factors</b>	
Building Code =	IBC 2015,ACI
Dead Load =	1.400
Live Load =	1.700
Earth, H =	1.700
Wind, W =	1.300
Seismic, E =	1.000

**Stem Construction**

<b>Design Height Above Ftg</b>	ft = 0.00
Wall Material Above "Ht" =	Concrete
Design Method =	LRFD
Thickness =	6.00
Rebar Size =	# 4
Rebar Spacing =	18.00
Rebar Placed at =	Edge

**Design Data**

fb/FB + fa/Fa =	0.295
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<b>Total Force @ Section</b>	
Service Level	lbs =
Strength Level	lbs = 544.0

<b>Moment...Actual</b>	
Service Level	ft-# =
Strength Level	ft-# = 725.3
Moment....Allowable =	2,455.6

**Shear....Actual**

Service Level	psi =
Strength Level	psi = 10.7
Shear....Allowable	psi = 75.0
Anet (Masonry)	in2 =
Rebar Depth 'd'	in = 4.25

**Masonry Data**

fm	psi =
Fs	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Wall Weight	psf = 75.0
Short Term Factor	=
Equiv. Solid Thick.	=
Masonry Block Type	= Medium Weight
Masonry Design Method	= ASD

**Concrete Data**

Fc	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) :	0.041 in2/ft		
(4/3) * As :	0.0547 in2/ft	Min Stem T&S Reinf Area 0.648 in2	
200bd/fy : 200(12)(4.25)/60000 :	0.17 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.1296 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.1333 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.5757 in2/ft	#6@ 36.67 in	#6@ 73.33 in

**Footing Data**

Toe Width =	2.25 ft
Heel Width =	0.67
Total Footing Width =	2.92
Footing Thickness =	10.00 in
Key Width =	0.00 in
Key Depth =	6.00 in
Key Distance from Toe =	0.00 ft
fc =	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**

	<b>Toe</b>	<b>Heel</b>
Factored Pressure =	802	101 psf
Mu' : Upward =	18,888	2 ft-#
Mu' : Downward =	8,434	11 ft-#
Mu: Design =	871	9 ft-#
Actual 1-Way Shear =	6.51	1.16 psi
Allow 1-Way Shear =	75.00	40.00 psi
Toe Reinforcing =	# 4 @ 9.00 in	
Heel Reinforcing =	None Spec'd	
Key Reinforcing =	None Spec'd	
Footing Torsion, Tu =		0.00 ft-lbs
Footing Allow. Torsion, phi Tu =		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi\*5\*lambda\*sqrt(fc)\*Sm

Key: No key defined

Min footing T&S reinf Area	0.63	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	467.2	1.61	752.7	Soil Over HL (ab. water tbl)	73.3	2.83	207.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.83	207.8
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	165.0	1.13	185.6
				Surcharge Over Toe =			
				Stem Weight(s) =	337.5	2.50	843.8
				Earth @ Stem Transitions =			
<b>Total</b> =	<b>467.2</b>	<b>O.T.M. =</b>	<b>752.7</b>	Footing Weight =	364.6	1.46	531.7
				Key Weight =			
				Vert. Component =			
<b>Resisting/Overturning Ratio</b> =			<b>2.35</b>	<b>Total =</b>	<b>940.4 lbs</b>	<b>R.M.=</b>	<b>1,768.8</b>
Vertical Loads used for Soil Pressure =			940.4 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)	0.025	in

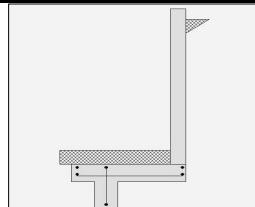
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	7.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	8.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footings Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**Axial Load Applied to Stem**

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

**Design Summary**

**Wall Stability Ratios**

Overturning	=	1.86 OK
Sliding	=	1.60 OK

Total Bearing Load	=	1,904 lbs
...resultant ecc.	=	12.14 in

Soil Pressure @ Toe	=	876 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,227 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	19.2 psi OK
Footing Shear @ Heel	=	0.0 psi OK
Allowable	=	75.0 psi

**Sliding Calcs**

Lateral Sliding Force	=	1,227.2 lbs
less 100% Passive Force = -	=	1,200.0 lbs
less 100% Friction Force = -	=	761.7 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	=	1.400
Live Load	=	1.700
Earth, H	=	1.700
Wind, W	=	1.300
Seismic, E	=	1.000

**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	=	0.0 psf (Service Level)

**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

**Stem Construction**

Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

**Design Data**

fb/FB + fa/Fa	=	0.488
<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	1,666.0
<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	3,887.3
Moment....Allowable	=	7,959.6

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	22.2
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.25

**Masonry Data**

fm	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**

fc	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) :	0.1456 in2/ft	
(4/3) * As :	0.1942 in2/ft	
200bd/fy : 200(12)(6.25)/60000 :	0.25 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	
Required Area :	0.1942 in2/ft	
Provided Area :	0.3 in2/ft	
Maximum Area :	0.8467 in2/ft	

**Horizontal Reinforcing**

Min Stem T&S Reinf Area 1.440 in2
Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft
Horizontal Reinforcing Options :
One layer of : Two layers of :
#4@ 12.50 in #4@ 25.00 in
#5@ 19.38 in #5@ 38.75 in
#6@ 27.50 in #6@ 55.00 in

**Footing Data**

Toe Width	=	4.25 ft
Heel Width	=	0.67
Total Footing Width	=	4.92
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	18.00 in
Key Distance from Toe	=	1.00 ft
fc =	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**

Factored Pressure	=	1,227	0 psf
Mu' : Upward	=	89,622	0 ft-#
Mu' : Downward	=	30,092	0 ft-#
Mu: Design	=	4,961	0 ft-#
Actual 1-Way Shear	=	19.20	0.04 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 4 @ 9.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	# 4 @ 9.00 in	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

**Other Acceptable Sizes & Spacings**

Toe: #4@ 10.09 in, #5@ 15.64 in, #6@ 22.20 in, #7@ 30.27 in, #8@ 39.86 in, #9@ 5
Heel: phiMn = phi^5 lambda b d^3 sqrt(fc) S m
Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	1.06	in2
Min footing T&S reinf Area per foot	0.22	in2 ft
If one layer of horizontal bars:		If two layers of horizontal bars:
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....		
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,227.2	2.61	3,204.4			
HL Act Pres (be water tbl)				2.6	4.92	12.6
Hydrostatic Force				4.92	4.92	12.6
Buoyant Force	=					
Surcharge over Heel	=					
Surcharge Over Toe	=					
Adjacent Footing Load	=					
Added Lateral Load	=					
Load @ Stem Above Soil	=					
<b>Total</b>	<b>= 1,227.2</b>	<b>O.T.M. =</b>	<b>3,204.4</b>			
<b>Resisting/Overturning Ratio</b>			<b>= 1.86</b>			
Vertical Loads used for Soil Pressure	=		1,904.2 lbs			
				<b>Total = 1,904.2 lbs</b>	<b>R.M.=</b>	<b>5,962.8</b>

\* 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)	0.037 in

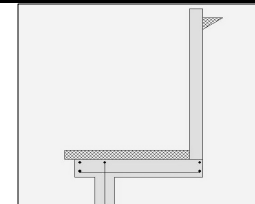
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

**Criteria**

Retained Height	=	8.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

**Soil Data**

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method	=	
Active Heel Pressure	=	40.0 psf/ft
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing  Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



**Surcharge Loads**

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

**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	=	0.0 psf
(Service Level)	=	

**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

**Axial Load Applied to Stem**

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

**Design Summary**

<b>Wall Stability Ratios</b>	
Overturning	= 1.98 OK
Sliding	= 1.64 OK

Total Bearing Load	=	2,432 lbs
...resultant ecc.	=	14.94 in

Soil Pressure @ Toe	=	825 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable	=	
ACI Factored @ Toe	=	1,155 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	17.7 psi OK
Footing Shear @ Heel	=	0.0 psi OK
Allowable	=	75.0 psi

<b>Sliding Calcs</b>		
Lateral Sliding Force	=	1,620.0 lbs
less 100% Passive Force	=	- 1,687.5 lbs
less 100% Friction Force	=	- 972.9 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

<b>Load Factors</b>	
Building Code	IBC 2015,ACI
Dead Load	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

**Stem Construction**

<b>Design Height Above Ftg</b>	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	=	0.602
---------------	---	-------

<b>Total Force @ Section</b>		
Service Level	lbs =	
Strength Level	lbs =	2,176.0

<b>Moment...Actual</b>		
Service Level	ft-# =	
Strength Level	ft-# =	5,802.7
Moment....Allowable	=	9,623.1

**Shear....Actual**

Service Level	psi =	
Strength Level	psi =	29.3
Shear....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	6.19

**Masonry Data**

fm	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**

Fc	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) :	0.2197 in2/ft		
(4/3) * As :	0.293 in2/ft	Min Stem T&S Reinf Area 1.632 in2	
200bd/ft : 200(12)(6.1875)/60000 :	0.2475 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	One layer of : Two layers of :	
Required Area :	0.2475 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 Data**

Toe Width	=	5.75 ft
Heel Width	=	0.67
Total Footing Width	=	6.42
Footing Thickness	=	12.00 in
Key Width	=	12.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	1.00 ft
fc =	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**

Factored Pressure	=	1,155	0 psf
Mu' : Upward	=	154,644	0 ft-#
Mu' : Downward	=	56,934	0 ft-#
Mu: Design	=	8,143	0 ft-#
Actual 1-Way Shear	=	17.68	0.04 psi
Allow 1-Way Shear	=	75.00	40.00 psi
Toe Reinforcing	=	# 5 @ 10.00 in	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	# 4 @ 9.00 in	
Footing Torsion, Tu	=		0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=		0.00 ft-lbs

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 8.13 in, #5@ 12.61 in, #6@ 17.90 in, #7@ 24.41 in, #8@ 32.14 in, #9@ 40

Heel: phiMn = phi^5\*lambda\*sqrt(fc)\*Sm

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area	1.66	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**

Item	.....OVERTURNING.....			.....RESISTING.....				
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#		
HL Act Pres (ab water tbl)	1,620.0	3.00	4,860.0	Soil Over HL (ab. water tbl)	2.9	6.42	18.8	
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		6.42	18.8	
Hydrostatic Force				Watre Table				
Buoyant Force	=			Sloped Soil Over Heel	=			
Surcharge over Heel	=			Surcharge Over Heel	=			
Surcharge Over Toe	=			Adjacent Footing Load	=			
Adjacent Footing Load	=			Axial Dead Load on Stem	=			
Added Lateral Load	=			* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=			Soil Over Toe	=	316.3	2.88	909.2
				Surcharge Over Toe	=			
				Stem Weight(s)	=	850.0	6.08	5,170.8
<b>Total</b>	<b>=</b>	<b>1,620.0</b>	<b>O.T.M. = 4,860.0</b>	Earth @ Stem Transitions	=			
				Footing Weight	=	963.0	3.21	3,091.2
				Key Weight	=	300.0	1.50	450.0
				Vert. Component	=			
<b>Resisting/Overturning Ratio</b>			<b>= 1.98</b>	<b>Total =</b>	<b>2,432.2 lbs</b>	<b>R.M.=</b>	<b>9,640.1</b>	
Vertical Loads used for Soil Pressure	=		2,432.2 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**

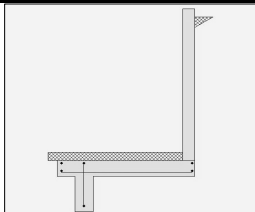
**Horizontal Deflection at Top of Wall due to settlement of soil**

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.030	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.

Criteria		Soil Data	
Retained Height	= 9.00 ft	Allow Soil Bearing	= 2,000.0 psf
Wall height above soil	= 0.50 ft	Equivalent Fluid Pressure Method	
Slope Behind Wall	= 0.00	Active Heel Pressure	= 40.0 psf/ft
Height of Soil over Toe	= 6.00 in	Passive Pressure	= 300.0 psf/ft
Water height over heel	= 0.0 ft	Soil Density, Heel	= 110.00 pcf
		Soil Density, Toe	= 110.00 pcf
		Footings Soil Friction	= 0.400
		Soil height to ignore for passive pressure	= 12.00 in



Surcharge Loads		Lateral Load Applied to Stem		Adjacent Footing Load	
Surcharge Over Heel	= 0.0 psf	Lateral Load	= 0.0 #/ft	Adjacent Footing Load	= 0.0 lbs
NOT Used To Resist Sliding & Overturning		...Height to Top	= 0.00 ft	Footing Width	= 0.00 ft
Surcharge Over Toe	= 0.0	...Height to Bottom	= 0.00 ft	Eccentricity	= 0.00 in
NOT Used for Sliding & Overturning		Load Type	= Wind (W) (Service Level)	Wall to Ftg CL Dist	= 0.00 ft
		Wind on Exposed Stem (Service Level)	= 0.0 psf	Footing Type	= Line Load
				Base Above/Below Soil at Back of Wall	= 0.0 ft
				Poisson's Ratio	= 0.300

Axial Load Applied to Stem		Design Summary	
Axial Dead Load	= 0.0 lbs	Wall Stability Ratios	
Axial Live Load	= 0.0 lbs	Overturning	= 1.99 OK
Axial Load Eccentricity	= 0.0 in	Sliding	= 1.54 OK
		Total Bearing Load	= 2,826 lbs
		...resultant ecc.	= 18.03 in

Stem Construction		Bottom	
Design Height Above Ftg	ft = 0.00	Stem OK	
Wall Material Above "Ht"	= Concrete	Wall Material Above "Ht"	= Concrete
Design Method	= LRFD	Design Method	= LRFD
Thickness	= 8.00	Thickness	= 8.00
Rebar Size	= # 5	Rebar Size	= # 5
Rebar Spacing	= 8.00	Rebar Spacing	= 8.00
Rebar Placed at	= Edge	Rebar Placed at	= Edge
Design Data		fb/FB + fa/Fa	= 0.700
Total Force @ Section		Service Level	lbs = 2,754.0
Moment...Actual		Strength Level	ft-# = 8,262.0
Moment...Allowable		Moment...Allowable	= 11,799.2
Shear...Actual		Service Level	psi = 37.1
Shear...Allowable		Strength Level	psi = 75.0
Anet (Masonry)	in2 = 6.19	Rebar Depth 'd'	in = 6.19

Masonry Data		Concrete Data	
fm	psi =	Fc	psi = 2,500.0
Fs	psi =	Fy	psi = 60,000.0
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		

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	1.400
Live Load	1.700
Earth, H	1.700
Wind, W	1.300
Seismic, E	1.000

Concrete Stem Rebar Area Details		
Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.3128 in2/ft	
(4/3) * As :	0.4171 in2/ft	Min Stem T&S Reinf Area 1.824 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
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :
	=====	One layer of : Two layers of :
Required Area :	0.3128 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 Data		Footing Design Results	
Toe Width	= 7.00 ft	Factored Pressure	= 1,131 0 psf
Heel Width	= 0.67	Mu' : Upward	= 221,640 0 ft-#
Total Footing Width	= 7.67	Mu' : Downward	= 84,378 0 ft-#
Footing Thickness	= 12.00 in	Mu: Design	= 11,439 0 ft-#
Key Width	= 12.00 in	Actual 1-Way Shear	= 19.68 0.04 psi
Key Depth	= 27.00 in	Allow 1-Way Shear	= 75.00 40.00 psi
Key Distance from Toe	= 1.00 ft	Toe Reinforcing	= # 5 @ 8.00 in
fc = 2,500 psi	Fy = 60,000 psi	Heel Reinforcing	= None Spec'd
Footing Concrete Density = 150.00 pcf	Min. As % = 0.0018	Key Reinforcing	= # 4 @ 9.00 in
Cover @ Top 2.00 @ Btm = 3.00 in	Footing Torsion, Tu	= 0.00 ft-lbs	
	Footing Allow. Torsion, phi Tu	= 0.00 ft-lbs	

**If torsion exceeds allowable, provide supplemental design for footing torsion.**

Other Acceptable Sizes & Spacings

Toe: #4@ 7.05 in, #5@ 10.94 in, #6@ 15.52 in, #7@ 21.17 in, #8@ 27.88 in, #9@ 35

Heel: phiMn = phi^5 lambda b^2 sqrt(fc) S\_m

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18

Min footing T&S reinf Area 1.99 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



Project Name/Number : (C02-D30) 200

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**Cantilevered Retaining Wall**

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

**Summary of Overturning & Resisting Forces & Moments**

Item	.....OVERTURNING.....			.....RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	2,000.0	3.33	6,666.7	Soil Over HL (ab. water tbl)	3.3	7.67	25.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		7.67	25.3
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	385.0	3.50	1,347.5
				Surcharge Over Toe =			
				Stem Weight(s) =	950.0	7.33	6,966.7
				Earth @ Stem Transitions =			
<b>Total</b>	<b>= 2,000.0</b>	<b>O.T.M. =</b>	<b>6,666.7</b>	Footing Weight =	1,150.5	3.84	4,412.2
				Key Weight =	337.5	1.50	506.3
				Vert. Component =			
<b>Resisting/Overturning Ratio</b>		<b>= 1.99</b>		<b>Total =</b>	<b>2,826.3 lbs</b>	<b>R.M.=</b>	<b>13,257.9</b>
Vertical Loads used for Soil Pressure =		2,826.3 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) 0.028 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.