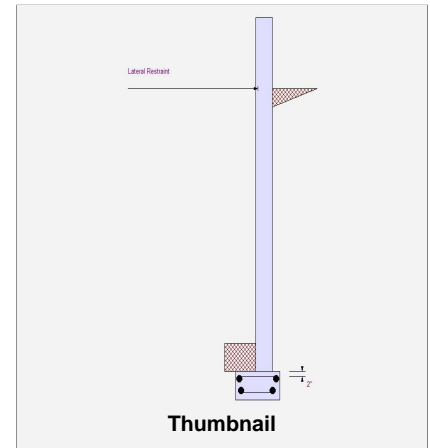


**Criteria**

Retained Height	=	10.00 ft
Wall height above soil	=	2.50 ft
Total Wall Height	=	12.50 ft
Top Support Height	=	10.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in

**Soil Data**

Allow Soil Bearing	=	4,000.0 psf
Equivalent Fluid Pressure Method		
At-rest Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	400.0 psf/ft
Soil Density	=	120.00 pcf
Footing  Soil Frictior	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

**Surcharge Loads**

Surcharge Over Heel	=	0.0 psf
>>>Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
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

**Earth Pressure Seismic Load****Stem Weight Seismic Load****Uniform Lateral Load Applied to Stem**

Lateral Load	=	15.0 #/ft
...Height to Top	=	12.50 ft
...Height to Bottom	=	10.00 ft

Load Type	=	Wind (W)
		(Strength Level)

Wind on Exposed Stem	=	0.0 psf
----------------------	---	---------

$K_H$ Soil Density Multiplier	=	0.200 g
-------------------------------	---	---------

$F_p / W_p$ Weight Multiplier	=	0.000 g
-------------------------------	---	---------

**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

Added seismic per unit area	=	0.0 psf
-----------------------------	---	---------

Added seismic per unit area	=	0.0 psf
-----------------------------	---	---------

**Design Summary**

Total Bearing Load	=	2,070 lbs
...resultant ecc.	=	8.25 in

Soil Pressure @ Toe	=	1,035 psf OK
Soil Pressure @ Heel	=	1,035 psf OK
Allowable	=	4,000 psf
Soil Pressure Less Than Allowable		

ACI Factored @ Toe	=	5,297 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	11.9 psi OK
Footing Shear @ Heel	=	4.7 psi OK
Allowable	=	75.0 psi

Reaction at Top	=	957.8 lbs
Reaction at Bottom	=	2,406.1 lbs

Sliding Stability Ratio	=	0.59 UNSTABL
-------------------------	---	--------------

Sliding Calcs		
Lateral Sliding Force	=	2,406.1 lbs
less 100% Passive Force	=	- 600.0 lbs
less 100% Friction Force	=	- 828.0 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	2,181.2 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	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

**Concrete Stem Construction**

Thickness	=	8.00 in	$F_y$	=	60,000 psi
Wall Weight	=	100.0 psf	$f'_c$	=	3,000 psi
Stem is FREE to rotate at top of footing					

	@ Top Support	Mmax Between Top & Base	@ Base of Wall
<b>Design Height Above Ftg</b>	Stem OK	Stem OK	Stem OK
Rebar Size	10.00 ft	4.26 ft	0.00 ft
Rebar Spacing	# 5	# 5	# 5
Rebar Placed at	14.00 in	14.00 in	14.00 in
Rebar Depth 'd'	Edge	Edge	Edge
	5.50 in	6.00 in	5.50 in

**Design Data**

fb/FB + fa/Fa	=	0.007	0.820	0.000
Mu....Actual	=	46.9 ft-#	5,625.5 ft-#	0.0 ft-#
Mn * Phi....Allowable	=	6,264.0 ft-#	6,861.9 ft-#	6,264.0 ft-#
Shear Force @ this height	=	1,471.4 lbs		2,928.6 lbs
Shear.....Actual	=	22.29 psi		44.37 psi
Shear.....Allowable	=	82.16 psi		82.16 psi

**Other Acceptable Sizes & Spacings:**

Toe: # 7 @ 18.00 in	-or-	Not req'd: $M_u < \phi * 5 * \lambda * \sqrt{f'_c} * S_m$
Heel: # 6 @ 16.00 in	-or-	Not req'd: $M_u < \phi * 5 * \lambda * \sqrt{f'_c} * S_m$
Key: No key defined	-or-	No key defined

This Wall in File: c:\users\hayden\documents\retainpro project files\j18003 - studio 21.rpx

RetainPro (c) 1987-2016, Build 11.16.03.31  
 License : KW-06056406  
**License To : WATSON STRUCTURAL ENGINEERING** **Restrained Retaining Wall** Code: IBC 2015,ACI 318-14,ACI 530-13

**Concrete Stem Rebar Area Details**

Top Support	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.002 in2/ft	
(4/3) * As :	0.0027 in2/ft	Min Stem T&S Reinf Area 1.920 in2
200bd/fy : 200(12)(5.5)/60000 :	0.22 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 :	0.2657 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8941 in2/ft	#6@ 27.50 in #6@ 55.00 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.22 in2/ft	
(4/3) * As :	0.2934 in2/ft	Min Stem T&S Reinf Area 1.103 in2
200bd/fy : 200(12)(6)/60000 :	0.24 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 :	0.24 in2/ft	#4@ 12.50 in #4@ 25.00 in
Provided Area :	0.2657 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.9754 in2/ft	#6@ 27.50 in #6@ 55.00 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0 in2/ft	
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.817 in2
200bd/fy : 200(12)(5.5)/60000 :	0.22 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 :	0.2657 in2/ft	#5@ 19.38 in #5@ 38.75 in
Maximum Area :	0.8941 in2/ft	#6@ 27.50 in #6@ 55.00 in

**Footing Strengths & Dimensions**

Toe Width	=	1.00 ft
Heel Width	=	1.00
Total Footing Width	=	2.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.75 ft
f'c =	2,500 psi	Fy = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	=	2.00 in @ Btm.= 3.00 in

**Footing Design Results**

		<u>Toe</u>	<u>Heel</u>
Factored Pressure	=	5,297	0 psf
Mu' : Upward	=	1,707	0 ft-#
Mu' : Downward	=	162	90 ft-#
Mu: Design	=	1,545	90 ft-#
Actual 1-Way Shear	=	11.86	4.74 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Min footing T&S reinf Area		0.52	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	

This Wall in File: c:\users\hayden\documents\retainpro project files\j18003 - studio 21.rpx

RetainPro (c) 1987-2016, Build 11.16.03.31  
 License : KW-06056406  
 License To : **WATSON STRUCTURAL ENGINEERING**

**Restrained Retaining Wall**

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

**Summary of Forces on Footing : Slab is NOT resisting sliding, stem is PINNED at footing**

**Forces acting on footing for overturning, sliding, & soil pressure**

Overturning Moments...	Lateral lbs	Distance ft	Moment ft-#
Stem Shear @ Top of Footing =	-1,828.6	1.00	-1,828.6
Heel Active Pressure =	-577.5	0.49	-284.2
<b>Sliding Force</b>	<b>= 2,406.1</b>		
Overturning Moment =			-2,112.8

**Footing Overturning Stability Ratio 1,380.00**

Net Moment Used For Soil Pressure Calculations **1,422.8 ft-#**

**Net Mom. at Stem/Ftg Interface = 1,422.8 ft-#**  
**Allow. Mom. @ Stem/Ftg Interface = 3,915.0 ft-#**  
**Allow. Mom. Exceeds Applied Mom.? Yes**  
**Therefore Uniform Soil Pressure = 1,035.0 psf**

Resisting Moments...	Vertical lbs	Lateral lbs	Distance ft	Moment ft-#
Surcharge Over Heel =				
Adjacent Footing Load =				
Axial Dead Load on Stem =				
Soil Over Toe =	120.0		0.50	60.0
Stem Weight =	1,250.0			
Surcharge Over Toe =			1.33	1,666.7
Soil Over Heel =	400.0		1.83	733.3
Footing Weight =	300.0		1.00	300.0
<b>Total Vertical Force</b> =	<b>2,070.0 lbs</b>			
Resisting Moment =				<b>2,760.0</b>

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