011704
C.H.C.

CAMPBELL ENGINEERING
STRUCTURAL ENGINEERS

C.1
1/17

RETAINING WALLS – PRYOR RESIDENCE
5506 E. MORRISON DR.
PARADISE VALLEY, AZ.

CODE: 2012 I. B. C.

SOIL PROPERTIES:

C.1 THRU C.7

CLASS 4 SOIL (TABLE 1806.2)

ALLOWABLE BEARING PRESSURE = 2000 psf
" PASSIVE " = 150 PSF/FT
ACTIVE PRESSURE = 30 "
COEFFICIENT OF FRICTION = 0.25

NOT USED

RETAINING WALLS – H = 6'-0, 3'-0, 1'-0
SEE SHT # C.2 THRU C.7

2-8" ⌀ MAS. PIER ——— 3'-4" ⌀ x 10" FTG

533 #/FT
WC = (60 x 1.33 x 4 + 80 x .67 x 4) x 6 = 3200#
P = 288 psf O.K.

Campbell Engineering, Inc.
6158 N. 9th Ave.
Phoenix, Arizona 85013
PH: (602) 279-6226
FX: (602) 246-9513

Title 6' Site Wall
Job # : 0711605 Dsgnr: CHC
Description....

Date: 30 JAN 2017

C-2

This Wall in File: c:\users\clarence\documents\retainpro 10 project files\pryor.rpx.RPX

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Cantilevered Retaining Wall

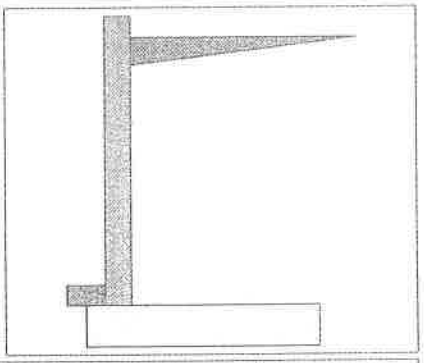
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	6.50 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	=	30.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.250
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
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	=	7.37 OK
Sliding	=	1.56 OK
Total Bearing Load	=	4,902 lbs
...resultant ecc.	=	3.12 in
Soil Pressure @ Toe	=	1,030 psf OK
Soil Pressure @ Heel	=	604 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,442 psf
ACI Factored @ Heel	=	846 psf
Footing Shear @ Toe	=	5.6 psi OK
Footing Shear @ Heel	=	2.0 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	843.8 lbs
less 100% Passive Force	= -	93.8 lbs
less 100% Friction Force	= -	1,225.5 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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Masonry
Design Method	=	ASD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	16.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	0.757
Total Force @ Section		
Service Level	lbs =	633.8
Strength Level	lbs =	
Moment....Actual		
Service Level	ft-# =	1,373.1
Strength Level	ft-# =	
Moment.....Allowable	=	1,812.8
Service Level	psi =	6.9
Strength Level	psi =	
Shear.....Allowable	psi =	45.4
Anet (Masonry)	in2 =	91.50
Rebar Depth 'd'	in =	5.25
Masonry Data		
f'm	psi =	1,500
Fs	psi =	20,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	21.48
Wall Weight	psf =	78.0
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	
Fy	psi =	

Campbell Engineering, Inc.
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Phoenix, Arizona 85013
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Title 6' Site Wall
Job # : 0711605 Dsgnr: CHC
Description....

Date: 30 JAN 2017

C-3

This Wall in File: c:\users\clarence\documents\retainpro 10 project files\pryor.rpx.RPX

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Cantilevered Retaining Wall

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	0.50 ft
Heel Width	=	5.50
Total Footing Width	=	6.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

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

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,442	846 psf
Mu' : Upward	=	178	11,749 ft-#
Mu' : Downward	=	51	12,961 ft-#
Mu: Design	=	127	1,211 ft-#
Actual 1-Way Shear	=	5.63	2.03 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = None Spec'd
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

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

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

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

Summary of Overturning & Resisting Forces & Moments--

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	843.8	2.50	2,109.4	Soil Over Heel	=	3,455.8	3.58	12,383.4
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=			
	=				Soil Over Toe	=		0.25	
					Surcharge Over Toe	=			
Total		843.8	O.T.M.	2,109.4	Stem Weight(s)	=	546.0	0.83	455.0
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=			
					Vert. Component	=			
					Total =		4,901.8 lbs	R.M.=	15,538.4

Resisting/Overturning Ratio = 7.37
Vertical Loads used for Soil Pressure = 4,901.8 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) 0.033 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.

Campbell Engineering, Inc.
6158 N. 9th Ave.
Phoenix, Arizona 85013
PH: (602) 279-6226
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Title 3' Site Wall
Job # : 0711605 Dsgnr: CHC
Description....

Date: 30 JAN 2017

NOT USED C.4

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Cantilevered Retaining Wall

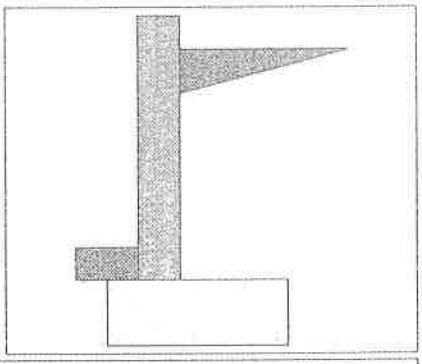
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	3.50 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	=	30.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.250
Soil height to ignore for passive pressure	=	8.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
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	=	4.99	OK
Sliding	=	1.62	OK
Total Bearing Load	=	1,423 lbs	
...resultant ecc.	=	2.17 in	
Soil Pressure @ Toe	=	670 psf	OK
Soil Pressure @ Heel	=	306 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	937 psf	
ACI Factored @ Heel	=	429 psf	
Footing Shear @ Toe	=	3.1 psi	OK
Footing Shear @ Heel	=	0.9 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	303.8 lbs	
less 100% Passive Force	= -	135.4 lbs	
less 100% Friction Force	= -	355.9 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 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Masonry
Design Method	=	ASD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	48.00
Rebar Placed at	=	Center
Design Data		
fb/FB + fa/Fa	=	**0.481**
Total Force @ Section		
Service Level	lbs =	183.8
Strength Level	lbs =	
Moment....Actual		
Service Level	ft-# =	214.4
Strength Level	ft-# =	
Moment.....Allowable	=	446.0
Service Level	psi =	2.0
Strength Level	psi =	
Shear.....Allowable	psi =	44.6
Anet (Masonry)	in2 =	91.50
Rebar Depth 'd'	in =	3.75
Masonry Data		
f'm	psi =	1,500
Fs	psi =	20,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	21.48
Wall Weight	psf =	78.0
Short Term Factor	=	1.000
Equiv. Solid Thick.	in =	7.60
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	
Fy	psi =	

Campbell Engineering, Inc.
6158 N. 9th Ave.
Phoenix, Arizona 85013
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Title 3' Site Wall
Job # : 0711605 Dsgnr: CHC
Description....

Date: 30 JAN 2017

NOT USED 0.5

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Cantilevered Retaining Wall

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	0.50 ft
Heel Width	=	2.42
Total Footing Width	=	2.92
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

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

Footing Design Results

		Toe	Heel
Factored Pressure	=	937	429 psf
Mu' : Upward	=	114	813 ft-#
Mu' : Downward	=	51	1,171 ft-#
Mu: Design	=	62	358 ft-#
Actual 1-Way Shear	=	3.07	0.93 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = None Spec'd
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

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

Min footing T&S reinf Area 0.76 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:
#4@ 9.26 in
#5@ 14.35 in
#6@ 20.37 in

If two layers of horizontal bars:
#4@ 18.52 in
#5@ 28.70 in
#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	303.8	1.50	455.6	Soil Over Heel	= 673.9	2.04	1,375.9
Surcharge over Heel	=				Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	=		
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	=		
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=		
	=				Soil Over Toe	=	0.25	
					Surcharge Over Toe	=		
Total		303.8	**O.T.M.**	455.6	Stem Weight(s)	= 312.0	0.83	260.0
	=		=		Earth @ Stem Transitions	=		
					Footing Weight	= 437.6	1.46	638.2
					Key Weight	=		
					Vert. Component	=		
					Total =	1,423.4 lbs	**R.M.=**	2,274.1

Resisting/Overturning Ratio = 4.99
Vertical Loads used for Soil Pressure = 1,423.4 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) 0.026 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.

Campbell Engineering, Inc.
6158 N. 9th Ave.
Phoenix, Arizona 85013
PH: (602) 279-6226
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Title 1' Site Wall
Job # : 0711605 Dsgnr: CHC
Description....

Date: 30 JAN 2017

C06

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Cantilevered Retaining Wall

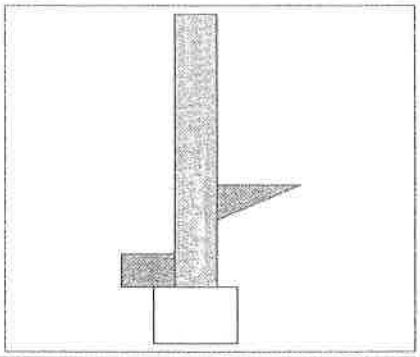
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	1.50 ft
Wall height above soil	=	2.50 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	=	30.0 psf/ft
	=	
Passive Pressure	=	150.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.250
Soil height to ignore for passive pressure	=	8.00 in



Surcharge Loads

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

Lateral Load Applied to Stem

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

Adjacent Footing Load

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

Design Summary

Wall Stability Ratios

Overturning	=	6.03 OK
Sliding	=	2.86 OK
Total Bearing Load	=	534 lbs
...resultant ecc.	=	0.81 in
Soil Pressure @ Toe	=	522 psf OK
Soil Pressure @ Heel	=	278 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	731 psf
ACI Factored @ Heel	=	390 psf
Footing Shear @ Toe	=	1.9 psi OK
Footing Shear @ Heel	=	0.3 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	81.7 lbs
less 100% Passive Force	= -	100.0 lbs
less 100% Friction Force	= -	133.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	0.0 lbs OK

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

Load Factors

Building Code	IBC 2012,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

	Bottom
	Stem OK
Design Height Above Ftg ft =	0.00
Wall Material Above "Ht" =	Masonry
Design Method =	ASD
Thickness =	8.00
Rebar Size =	# 5
Rebar Spacing =	48.00
Rebar Placed at =	Center
Design Data	
fb/FB + fa/Fa =	0.038
Total Force @ Section	
Service Level lbs =	33.8
Strength Level / lbs =	
Moment....Actual	
Service Level ft-# =	16.9
Strength Level ft-# =	
Moment.....Allowable =	446.0
Service Level psi =	0.4
Strength Level psi =	
Shear.....Allowable psi =	44.6
Anet (Masonry) in2 =	91.50
Rebar Depth 'd' in =	3.75
Masonry Data	
f'm psi =	1,500
Fs psi =	20,000
Solid Grouting =	Yes
Modular Ratio 'n' =	21.48
Wall Weight psf =	78.0
Short Term Factor =	1.000
Equiv. Solid Thick. in =	7.60
Masonry Block Type =	Medium Weight
Masonry Design Method =	ASD
Concrete Data	
f'c psi =	
Fy psi =	

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Cantilevered Retaining Wall

Code: IBC 2012,ACI 318-11,ACI 530-11

Footing Dimensions & Strengths

Toe Width	=	0.33 ft
Heel Width	=	1.00
Total Footing Width	=	1.33
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 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	=	731	390 psf
Mu' : Upward	=	39	23 ft-#
Mu' : Downward	=	24	39 ft-#
Mu: Design	=	15	15 ft-#
Actual 1-Way Shear	=	1.92	0.31 psi
Allow 1-Way Shear	=	75.00	75.00 psi

Toe Reinforcing = None Spec'd
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

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

Min footing T&S reinf Area 0.29 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..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	81.7	0.78	63.5	Soil Over Heel	=	55.0	1.17	64.1
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=			
	=				Soil Over Toe	=		0.17	
					Surcharge Over Toe	=			
Total		81.7	**O.T.M.**	63.5	Stem Weight(s)	=	312.0	0.67	207.9
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	166.6	0.67	111.1
Resisting/Overturning Ratio		= **6.03**			Key Weight	=			
Vertical Loads used for Soil Pressure	=	533.6 lbs			Vert. Component	=			
					Total	=	533.6 lbs	**R.M.=**	383.1

* 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.