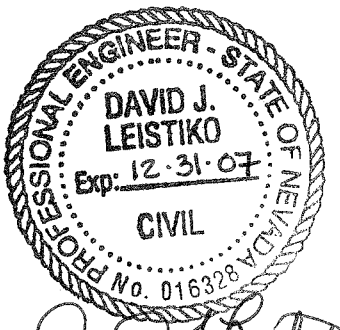
RETAINING WALL DESIGN CALCULATIONS

McLeod Walls

Prepared By:
Kimley-Horn and Associates, Inc.
7878 N. 16th Street
Suite 300
Phoenix, AZ 85020



9/9/05

Kimley-Horn
and Associates, Inc.

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McLeod Walls

Kimley-Horn and Assocaites, Inc.
7878 N. 16th Street
Suite 300
Phoenix, AZ 85020

Title : McLeod 2:1 backfill
Job # : TBD 6.5-ft Dsgnr: IBC 2000 Date: SEP 2,2005
Description....

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Tapered Stem Concrete Retaining Wall Design

Criteria

Retained Height	=	6.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wal	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft
Wind on Stem	=	0.0 psf

Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	65.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure		300.0 psf/ft
Soil Density	=	110.00 pcf
Footing||Soil Friction	=	0.500
Soil height to ignore for passive pressure	=	12.00 in

Footing Strengths & Dimensions

Toe Width	=	1.25 ft
Heel Width	=	4.00
Total Footing Width	=	5.25
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	3.75 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Surcharge Loads

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft

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
Added seismic base force		2,130.5 lbs

<<----- Note! These are horizontal components

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

Design Kh	=	0.050 g
Kae for seismic earth pressure	=	1.052
Ka for static earth pressure	=	0.710
Difference: Kae - Ka	=	0.343

Using Mononobe-Okabe / Seed-Whitman procedure

Stem Weight Seismic Load

F_p / W_p Weight Multiplier = 0.100 g Added seismic base force 0.0 lbs

Design Summary

Total Bearing Load	=	4,667 lbs
...resultant ecc.	=	8.87 in
Soil Pressure @ Toe	=	1,640 psf OK
Soil Pressure @ Heel	=	138 psf OK
Allowable	=	3,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,803 psf
ACI Factored @ Heel	=	152 psf
Footing Shear @ Toe	=	8.3 psi OK
Footing Shear @ Heel	=	10.5 psi OK
Allowable	=	82.2 psi
Sliding Stability Ratio	=	1.50 OK
Sliding Calcs (Vertical Component NOT Used)		
Lateral Sliding Force	=	1,986.3 lbs
less 100% Passive Force	= -	787.5 lbs
less 100% Friction Force	= -	2,197.7 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

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

Tapered Concrete Stem Design Data

Thickness at TOP = 8.00 in Fy = 60,000 psi
Thickness at BOTTOM = 12.00 in f'c = 3,000 psi
Rebar Cover (rebar center to concrete face) 2.00 in

		@ Height #1	@ Height #2	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	3.00 ft	1.00 ft	0.00 ft
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	18.00 in	18.00 in	18.00 in
Rebar Depth 'd'	=	7.65 in	8.88 in	9.50 in
Design Data				
Mu....Actual	=	743.2 ft-#	2,883.8 ft-#	4,752.2 ft-#
Mn * Phi.....Allowable	=	6,929.1 ft-#	8,073.7 ft-#	8,646.0 ft-#
Shear Force @ this height	=	637.0 lbs	1,573.0 lbs	2,173.0 lbs
Vu.....Actual	=	6.94 psi	14.75 psi	19.06 psi
Vn * Phi.....Allowable	=	82.16 psi	82.16 psi	82.16 psi
Rebar Lap Required	=	21.36 in	21.36 in	
Hooked embedment into footing (w/ stress level reduction)	=			6.00 in

Kimley-Horn and Assocaites, Inc.
7878 N. 16th Street
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Title : McLeod 2:1 backfill
Job # : TBD 6.5-ft Dsgnr: IBC 2000 Date: SEP 2,2005
Description....

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www.retainpro.com/support for latest release
Registration # : RP-1146815 2005001

Tapered Stem Concrete Retaining Wall Design

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,803	152 psf
Mu' : Upward	=	1,660	2,427 ft-#
Mu' : Downward	=	403	6,962 ft-#
Mu: Design	=	1,257	4,535 ft-#
Actual 1-Way Shear	=	8.33	10.47 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 5 @ 18.00 in
Heel Reinforcing = # 5 @ 18.00 in
Key Reinforcing = # 6 @ 18.00 in

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr

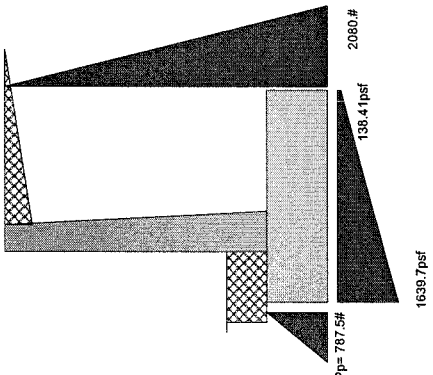
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,080.0	2.67	5,546.7	Soil Over Heel	=	2,145.0	3.75	8,043.8
Toe Active Pressure	=	-93.8	0.83	-78.1	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=		0.00	
Load @ Stem Above Soil	=				Soil Over Toe	=	137.5	0.63	85.9
Seismic Load	=	2,130.5	0.05	107.3	Surcharge Over Toe	=			
					Stem Weight	=	812.5	1.67	1,358.7
Total	=	1,986.3	**O.T.M.** =	5,468.5	Earth above Sloping Sten	=	119.2	2.14	254.9
					Footing Weight	=	1,181.3	2.63	3,100.8
Resisting/Overturning Ratio		=	**2.61**		Key Weight	=		3.75	
Vertical Loads used for Soil Pressure	=	4,667.5 lbs			Vert. Component	=	272.1	5.25	1,428.4
						Total =	4,667.5 lbs	**R.M.=**	14,272.5

Vertical component of active pressure used for soil pressure

DESIGNER NOTES: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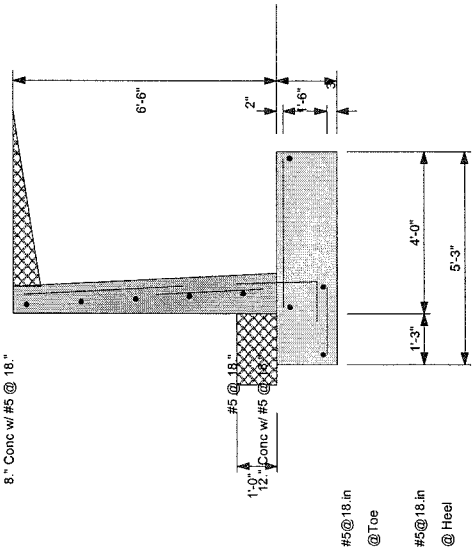
6'-6"
2"
1'-6"
3"
4'-0"
5'-3"
1'-3"
8." Conc w/ #5 @ 18."
#5 @ 18."
1'-0"
12." Conc w/ #5 @ 18."
#5@18.in
@Toe
#5@18.in
@ Heel

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Description....

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Tapered Stem Concrete Retaining Wall Design

Criteria

Retained Height	=	8.33 ft
Wall height above soil	=	0.00 ft
Slope Behind Wal	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft
Wind on Stem	=	0.0 psf

Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	65.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure		300.0 psf/ft
Soil Density	=	110.00 pcf
Footing||Soil Friction	=	0.500
Soil height to ignore for passive pressure	=	12.00 in

Footing Strengths & Dimensions

Toe Width	=	2.50 ft
Heel Width	=	4.00
Total Footing Width	=	6.50
Footing Thickness	=	18.00 in
Key Width	=	12.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	4.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft

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
Added seismic base force		2,130.5 lbs

Earth Pressure Seismic Load

Design Kh	=	0.050 g
Kae for seismic earth pressure	=	1.052
Ka for static earth pressure	=	0.710
Difference: Kae - Ka	=	0.343

<<----- Note! These are horizontal components

Using Mononobe-Okabe / Seed-Whitman procedure

Stem Weight Seismic Load

F_p / W_p Weight Multiplier = 0.100 g Added seismic base force 0.0 lbs

Design Summary

Total Bearing Load	=	6,243 lbs
...resultant ecc.	=	9.14 in
Soil Pressure @ Toe	=	1,636 psf OK
Soil Pressure @ Heel	=	285 psf OK
Allowable	=	3,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,786 psf
ACI Factored @ Heel	=	311 psf
Footing Shear @ Toe	=	15.2 psi OK
Footing Shear @ Heel	=	15.1 psi OK
Allowable	=	82.2 psi
Sliding Stability Ratio	=	1.51 OK
Sliding Calcs (Vertical Component NOT Used)		
Lateral Sliding Force	=	3,048.6 lbs
less 100% Passive Force	= -	1,687.5 lbs
less 100% Friction Force	= -	2,915.9 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

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

Tapered Concrete Stem Design Data

Thickness at TOP = 8.00 in Fy = 60,000 psi
Thickness at BOTTOM = 12.00 in f'c = 3,000 psi
Rebar Cover (rebar center to concrete face) 2.00 in

		@ Height #1	@ Height #2	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	3.00 ft	1.00 ft	0.00 ft
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	18.00 in	18.00 in	9.00 in
Rebar Depth 'd'	=	8.06 in	9.02 in	9.50 in
Design Data				
Mu....Actual	=	2,629.0 ft-#	6,834.8 ft-#	10,021.7 ft-#
Mn * Phi.....Allowable	=	7,306.7 ft-#	8,199.6 ft-#	16,914.0 ft-#
Shear Force @ this height	=	1,478.9 lbs	2,796.2 lbs	3,586.8 lbs
Vu.....Actual	=	15.29 psi	25.83 psi	31.46 psi
Vn * Phi.....Allowable	=	82.16 psi	82.16 psi	82.16 psi
Rebar Lap Required	=	21.36 in	21.36 in	

Hooked embedment into footing (w/ stress level reduction) = 6.00 in

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Title : McLeod 2:1 backfill
Job # : TBD 8.3-ft Dsgnr: IBC 2000 Date: SEP 2,2005
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Tapered Stem Concrete Retaining Wall Design

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,786	311 psf
Mu' : Upward	=	5,632	2,761 ft-#
Mu' : Downward	=	1,429	8,842 ft-#
Mu: Design	=	4,203	6,081 ft-#
Actual 1-Way Shear	=	15.17	15.12 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 5 @ 18.00 in
Heel Reinforcing = # 5 @ 18.00 in
Key Reinforcing = # 5 @ 18.00 in

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr

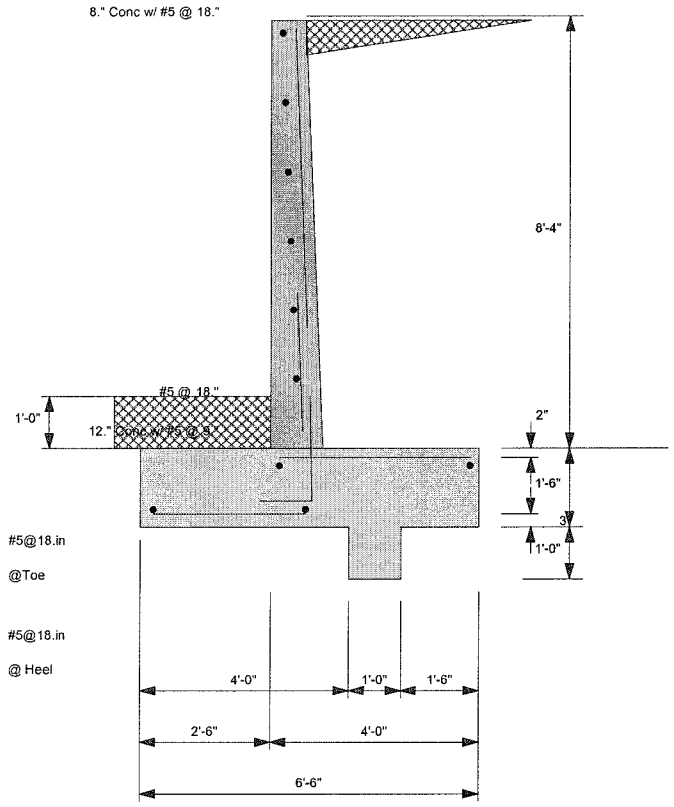
Key:

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	3,142.4	3.28	10,299.6	Soil Over Heel	=	2,749.9	5.00	13,749.5
Toe Active Pressure	=	-93.8	0.83	-78.1	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=		0.00	
Load @ Stem Above Soil	=				Soil Over Toe	=	275.0	1.25	343.8
Seismic Load	=	2,130.5	0.00	0.1	Surcharge Over Toe	=			
					Stem Weight	=	1,041.6	2.92	3,043.9
Total	=	3,048.6	**O.T.M.** =	10,221.5	Earth above Sloping Stem	=	152.8	3.39	517.7
					Footing Weight	=	1,462.5	3.25	4,753.1
Resisting/Overturning Ratio		=	**2.52**		Key Weight	=	150.0	4.50	675.0
Vertical Loads used for Soil Pressure		=	6,242.8 lbs		Vert. Component	=	411.0	6.50	2,671.8
						Total =	6,242.8 lbs	**R.M.=**	25,754.7

Vertical component of active pressure used for soil pressure

DESIGNER NOTES: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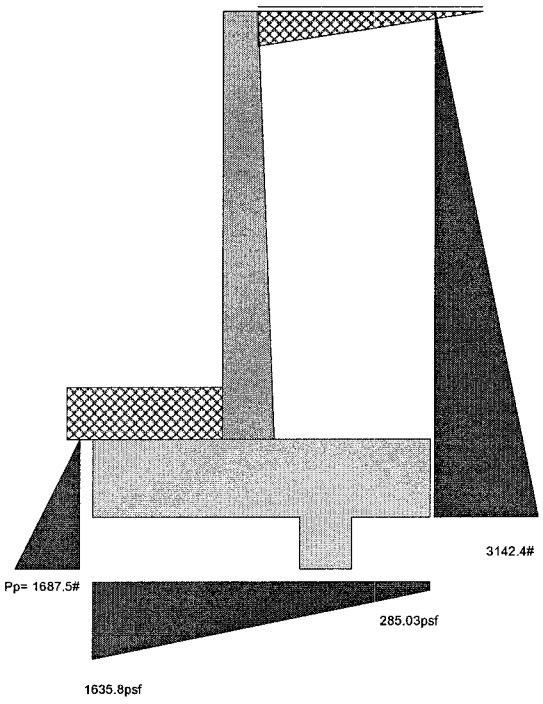
#5 @ 18."
1'-0"
12." Conc w/ #5 @ 8."
2"
1'-6"
3
1'-0"
#5@18.in
@Toe
#5@18.in
@ Heel
4'-0"
1'-0"
1'-6"
2'-6"
4'-0"
6'-6"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Title : McLeod 2:1 backfill
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Description....

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Tapered Stem Concrete Retaining Wall Design

Criteria

Retained Height	=	10.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wal	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft
Wind on Stem	=	0.0 psf

Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	65.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure		300.0 psf/ft
Soil Density	=	110.00 pcf
Footing||Soil Friction	=	0.500
Soil height to ignore for passive pressure	=	12.00 in

Footing Strengths & Dimensions

Toe Width	=	4.00 ft
Heel Width	=	4.00
Total Footing Width	=	8.00
Footing Thickness	=	24.00 in
Key Width	=	18.00 in
Key Depth	=	18.00 in
Key Distance from Toe	=	3.75 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Surcharge Loads

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft

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
Added seismic base force		2,130.5 lbs

<<------ Note! These are horizontal components

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

Design Kh	=	0.050 g
Kae for seismic earth pressure	=	1.052
Ka for static earth pressure	=	0.710
Difference: Kae - Ka	=	0.343

Using Mononobe-Okabe / Seed-Whitman procedure

Stem Weight Seismic Load

F_p / W_p Weight Multiplier = 0.100 g Added seismic base force 0.0 lbs

Design Summary

Total Bearing Load	=	8,523 lbs
...resultant ecc.	=	11.13 in
Soil Pressure @ Toe	=	1,807 psf OK
Soil Pressure @ Heel	=	324 psf OK
Allowable	=	3,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,966 psf
ACI Factored @ Heel	=	353 psf
Footing Shear @ Toe	=	16.7 psi OK
Footing Shear @ Heel	=	15.7 psi OK
Allowable	=	82.2 psi
Sliding Stability Ratio	=	1.51 OK
Sliding Calcs (Vertical Component NOT Used)		
Lateral Sliding Force	=	4,545.0 lbs
less 100% Passive Force	=	2,887.5 lbs
less 100% Friction Force	=	3,955.4 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

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

Tapered Concrete Stem Design Data

Thickness at TOP = 8.00 in Fy = 60,000 psi
Thickness at BOTTOM = 12.00 in f'c = 3,000 psi
Rebar Cover (rebar center to concrete face) 2.00 in

		@ Height #1	@ Height #2	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	3.00 ft	1.00 ft	0.00 ft
Rebar Size	=	# 6	# 6	# 6
Rebar Spacing	=	18.00 in	9.00 in	9.00 in
Rebar Depth 'd'	=	8.30 in	9.10 in	9.50 in
Design Data				
Mu....Actual	=	5,945.3 ft-#	12,636.0 ft-#	17,325.3 ft-#
Mn * Phi.....Allowable	=	10,575.3 ft-#	22,501.0 ft-#	23,557.0 ft-#
Shear Force @ this height	=	2,548.0 lbs	4,212.0 lbs	5,176.0 lbs
Vu.....Actual	=	25.58 psi	38.57 psi	45.40 psi
Vn * Phi.....Allowable	=	82.16 psi	82.16 psi	82.16 psi
Rebar Lap Required	=	25.63 in	25.63 in	

Hooked embedment into footing (w/ stress level reduction) = 8.31 in

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Tapered Stem Concrete Retaining Wall Design

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,966	353 psf
Mu' : Upward	=	14,632	2,835 ft-#
Mu' : Downward	=	4,271	11,362 ft-#
Mu: Design	=	10,361	8,527 ft-#
Actual 1-Way Shear	=	16.69	15.71 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 6 @ 12.00 in
Heel Reinforcing = # 6 @ 18.00 in
Key Reinforcing = # 6 @ 18.00 in

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr

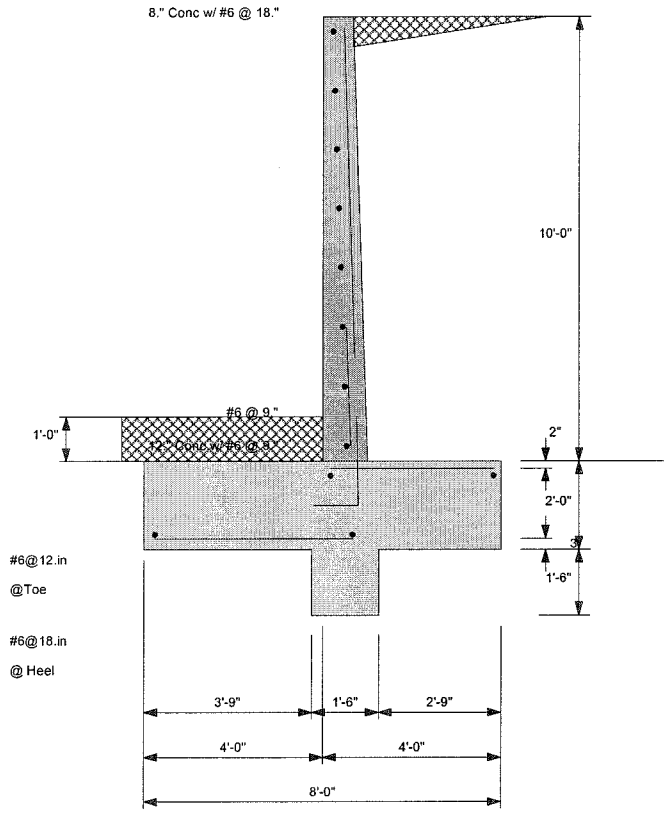
Key: Not Req'd = Mu<S*Fr

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item								
Heel Active Pressure	=	4,680.0	4.00	18,720.0	Soil Over Heel	= 3,300.0	6.50	21,450.0
Toe Active Pressure	=	-135.0	1.00	-135.0	Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	=		
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	=	0.00	
Load @ Stem Above Soil	=				Soil Over Toe	= 440.0	2.00	880.0
Seismic Load	=	2,130.5	0.00	0.0	Surcharge Over Toe	=		
					Stem Weight	= 1,250.0	4.42	5,527.8
Total	=	4,545.0	**O.T.M.** =	18,585.0	Earth above Sloping Sterr	= 183.3	4.89	896.3
					Footing Weight	= 2,400.0	4.00	9,600.0
Resisting/Overturning Ratio		=	**2.41**		Key Weight	= 337.5	4.50	1,518.8
Vertical Loads used for Soil Pressure		=	8,523.0 lbs		Vert. Component	= 612.2	8.00	4,897.5
						Total = 8,523.0 lbs	**R.M.=**	44,770.3

Vertical component of active pressure used for soil pressure

DESIGNER NOTES: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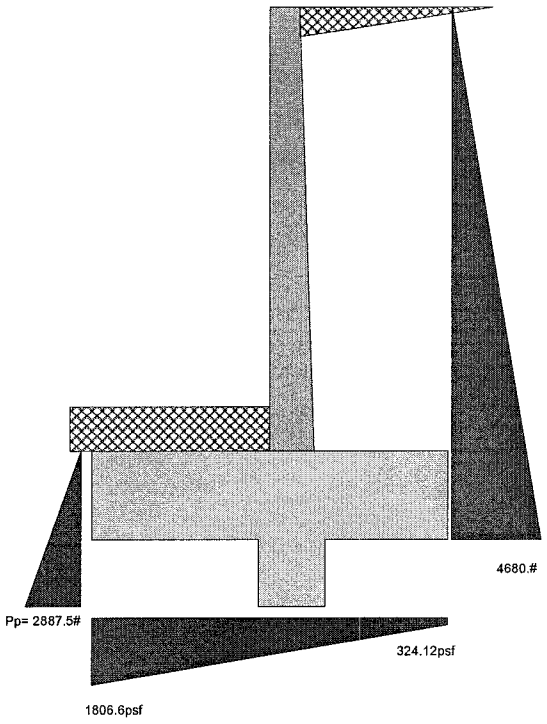
10'-0"
#6 @ 9."
1'-0"
12." Conc w/ #6 @ 9."
2"
2'-0"
3"
1'-6"
#6@12.in
@Toe
#6@18.in
@ Heel
3'-9"
1'-6"
2'-9"
4'-0"
4'-0"
8'-0"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Kimley-Horn and Assocaites, Inc.
7878 N. 16th Street
Suite 300
Phoenix, AZ 85020

Title : McLeod 2:1 backfill
Job # : TBD 11.4ft Dsgnr: DJL Date: SEP 2,2005
Description....

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This Wall in File: K:\Rdwy\Structural\Las Vegas\McLeod\m

Tapered Stem Concrete Retaining Wall Design

Criteria

Retained Height	=	11.33 ft
Wall height above soil	=	0.00 ft
Slope Behind Wal	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft
Wind on Stem	=	0.0 psf

Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	65.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure		300.0 psf/ft
Soil Density	=	110.00 pcf
Footing||Soil Friction	=	0.500
Soil height to ignore for passive pressure	=	0.00 in

Footing Strengths & Dimensions

Toe Width	=	4.00 ft
Heel Width	=	4.00
Total Footing Width	=	8.00
Footing Thickness	=	24.00 in
Key Width	=	18.00 in
Key Depth	=	28.00 in
Key Distance from Toe	=	5.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft

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
Added seismic base force		2,130.5 lbs

<<------ Note! These are horizontal components

Earth Pressure Seismic Load

Design Kh	=	0.050 g
Kae for seismic earth pressure	=	1.052
Ka for static earth pressure	=	0.710
Difference: Kae - Ka	=	0.343

Using Mononobe-Okabe / Seed-Whitman procedure

Stem Weight Seismic Load

F_p / W_p Weight Multiplier = 0.100 g

Added seismic base force 0.0 lbs

Design Summary

Total Bearing Load	=	9,485 lbs
...resultant ecc.	=	15.62 in
Soil Pressure @ Toe	=	2,343 psf OK
Soil Pressure @ Heel	=	28 psf OK
Allowable	=	3,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,526 psf
ACI Factored @ Heel	=	30 psf
Footing Shear @ Toe	=	22.2 psi OK
Footing Shear @ Heel	=	20.5 psi OK
Allowable	=	82.2 psi
Sliding Stability Ratio	=	1.53 OK

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	5,642.5 lbs
less 100% Passive Force	= -	4,266.7 lbs
less 100% Friction Force	= -	4,364.6 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

Load Factors

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

Tapered Concrete Stem Design Data

Thickness at TOP = 8.00 in Fy = 60,000 psi
Thickness at BOTTOM = 12.00 in f'c = 3,000 psi
Rebar Cover (rebar center to concrete face) 2.00 in

		@ Height #1	@ Height #2	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	3.00 ft	1.00 ft	0.00 ft
Rebar Size	=	# 7	# 7	# 7
Rebar Spacing	=	18.00 in	9.00 in	9.00 in
Rebar Depth 'd'	=	8.44 in	9.15 in	9.50 in
Design Data				
Mu....Actual	=	10,029.7 ft-#	19,123.2 ft-#	25,222.0 ft-#
Mn * Phi.....Allowable	=	14,486.1 ft-#	30,097.4 ft-#	31,368.0 ft-#
Shear Force @ this height	=	3,610.8 lbs	5,552.1 lbs	6,654.7 lbs
Vu.....Actual	=	35.65 psi	50.58 psi	58.37 psi
Vn * Phi.....Allowable	=	82.16 psi	82.16 psi	82.16 psi
Rebar Lap Required	=	37.38 in	37.38 in	

Hooked embedment into footing (w/ stress level reduction) = 10.59 in

Kimley-Horn and Assocaites, Inc.
7878 N. 16th Street
Suite 300
Phoenix, AZ 85020

Title : McLeod 2:1 backfill
Job # : TBD 11.4ft Dsgnr: DJL Date: SEP 2,2005
Description....

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Retain Pro 2005 , 7-April-2005, (c) 1989-2005
www.retainpro.com/support for latest release
Registration # : RP-1146815 2005001

Tapered Stem Concrete Retaining Wall Design

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,526	30 psf
Mu' : Upward	=	18,168	1,803 ft-#
Mu' : Downward	=	4,271	12,933 ft-#
Mu: Design	=	13,897	11,130 ft-#
Actual 1-Way Shear	=	22.22	20.47 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 6 @ 12.00 in
Heel Reinforcing = # 6 @ 18.00 in
Key Reinforcing = # 6 @ 18.00 in

Other Acceptable Sizes & Spacings

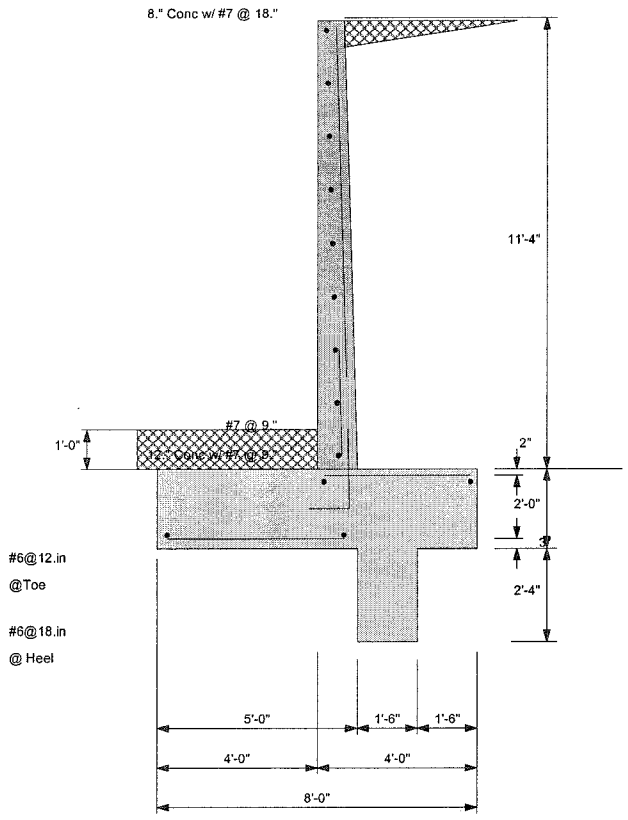
Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr

Key:

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	5,777.5	4.44	25,677.1	Soil Over Heel	= 3,739.9	6.50	24,309.3
Toe Active Pressure	=	-135.0	1.00	-135.0	Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	=		
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	=	0.00	
Load @ Stem Above Soil	=				Soil Over Toe	= 440.0	2.00	880.0
Seismic Load	=	2,130.5	0.00	0.0	Surcharge Over Toe	=		
					Stem Weight	= 1,416.6	4.42	6,264.6
Total	=	5,642.5	**O.T.M.** =	25,542.1	Earth above Sloping Stem	= 207.8	4.89	1,015.8
					Footing Weight	= 2,400.0	4.00	9,600.0
Resisting/Overturning Ratio		=	**2.00**		Key Weight	= 525.0	5.75	3,018.8
Vertical Loads used for Soil Pressure		=	9,485.0 lbs		Vert. Component	= 755.7	8.00	6,046.0
Vertical component of active pressure used for soil pressure						**Total** = 9,485.0 lbs	**R.M.**=	51,134.4

DESIGNER NOTES: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#7 @ 9."
1'-0"
12." Conc w/ #7 @ 9."
2"
2'-0"
3"
2'-4"
#6@12.in
@Toe
#6@18.in
@ Heel
5'-0"
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1'-6"
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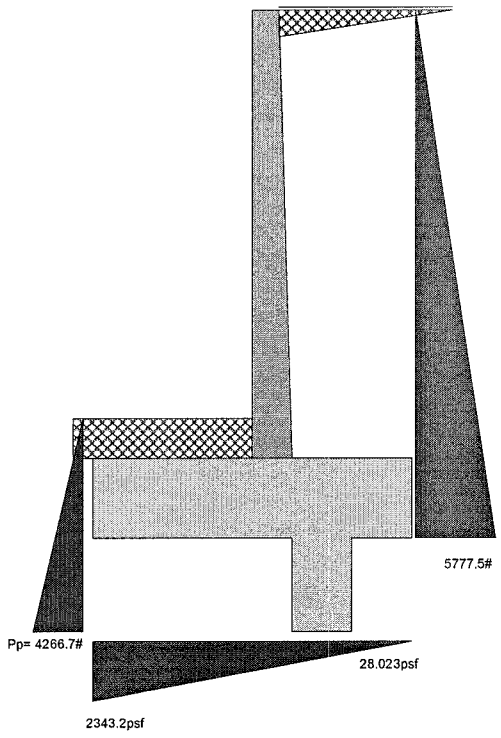
4'-0"
8'-0"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Kimley-Horn and Assocaites, Inc.
7878 N. 16th Street
Suite 300
Phoenix, AZ 85020

Title : McLeod 2:1 backfill
Job # : TBD 12.1-f Dsgnr: IBC 2000 Date: SEP 2,2005
Description....

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Tapered Stem Concrete Retaining Wall Design

Criteria

Retained Height	=	12.08 ft
Wall height above soil	=	0.00 ft
Slope Behind Wal	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft
Wind on Stem	=	0.0 psf

Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	65.0 psf/ft
Toe Active Pressure	=	30.0 psf/ft
Passive Pressure		300.0 psf/ft
Soil Density	=	110.00 pcf
Footing||Soil Friction	=	0.500
Soil height to ignore for passive pressure	=	0.00 in

Footing Strengths & Dimensions

Toe Width	=	4.00 ft
Heel Width	=	4.00
Total Footing Width	=	8.00
Footing Thickness	=	24.00 in
Key Width	=	18.00 in
Key Depth	=	33.00 in
Key Distance from Toe	=	5.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Surcharge Loads

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft

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
Added seismic base force		2,130.5 lbs

<<------ Note! These are horizontal components

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

Design Kh	=	0.050 g
Kae for seismic earth pressure	=	1.052
Ka for static earth pressure	=	0.710
Difference: Kae - Ka	=	0.343

Using Mononobe-Okabe / Seed-Whitman procedure

Stem Weight Seismic Load

F_p / W_p Weight Multiplier = 0.100 g Added seismic base force 0.0 lbs

Design Summary

Total Bearing Load	=	10,021 lbs	
...resultant ecc.	=	18.85 in	
Soil Pressure @ Toe	=	2,751 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	3,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,950 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	26.1 psi	OK
Footing Shear @ Heel	=	23.9 psi	OK
Allowable	=	82.2 psi	
Sliding Stability Ratio	=	1.51	OK

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	6,310.8 lbs	
less 100% Passive Force	= -	4,959.4 lbs	
less 100% Friction Force	= -	4,589.0 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Load Factors

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

Tapered Concrete Stem Design Data

Thickness at TOP = 8.00 in Fy = 60,000 psi
Thickness at BOTTOM = 12.00 in f'c = 3,000 psi
Rebar Cover (rebar center to concrete face) 2.00 in

		@ Height #1	@ Height #2	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	3.00 ft	1.00 ft	0.00 ft
Rebar Size	=	# 7	# 7	# 7
Rebar Spacing	=	18.00 in	9.00 in	9.00 in
Rebar Depth 'd'	=	8.51 in	9.17 in	9.50 in
Design Data				
Mu....Actual	=	12,988.8 ft-#	23,596.9 ft-#	30,569.8 ft-#
Mn * Phi.....Allowable	=	14,604.4 ft-#	30,176.2 ft-#	31,368.0 ft-#
Shear Force @ this height	=	4,290.0 lbs	6,387.3 lbs	7,567.9 lbs
Vu.....Actual	=	42.03 psi	58.05 psi	66.39 psi
Vn * Phi.....Allowable	=	82.16 psi	82.16 psi	82.16 psi
Rebar Lap Required	=	37.38 in	37.38 in	

Hooked embedment into footing (w/ stress level reduction) = 13.04 in

Kimley-Horn and Assocaites, Inc.
7878 N. 16th Street
Suite 300
Phoenix, AZ 85020

Title : McLeod 2:1 backfill
Job # : TBD 12.1-f Dsgnr: IBC 2000 Date: SEP 2,2005
Description....

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Retain Pro 2005, 7-April-2005, (c) 1989-2005
www.retainpro.com/support for latest release
Registration # : RP-1146815 2005001

Tapered Stem Concrete Retaining Wall Design

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,950	0 psf
Mu' : Upward	=	20,727	996 ft-#
Mu' : Downward	=	4,271	13,849 ft-#
Mu: Design	=	16,456	12,853 ft-#
Actual 1-Way Shear	=	26.09	23.86 psi
Allow 1-Way Shear	=	82.16	82.16 psi

Toe Reinforcing = # 6 @ 12.00 in
Heel Reinforcing = # 6 @ 18.00 in
Key Reinforcing = # 6 @ 18.00 in

Other Acceptable Sizes & Spacings

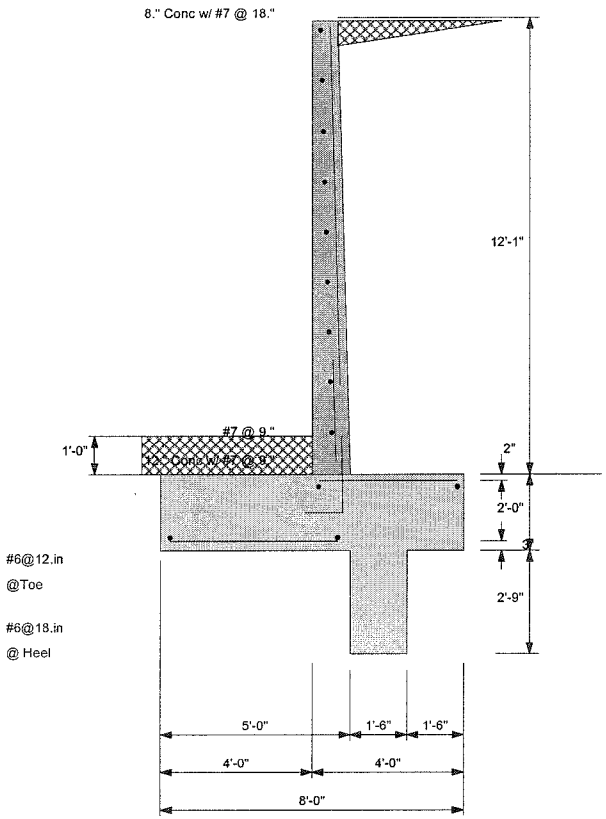
Toe: #4@ 5.50 in, #5@ 8.50 in, #6@ 12.00 in, #7@ 16.50 in, #8@ 21.50 in, #9@ 2
Heel: Not req'd, Mu < S * Fr

Key:

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	6,445.8	4.69	30,258.5	Soil Over Heel	=	3,987.4	6.50	25,918.0
Toe Active Pressure	=	-135.0	1.00	-135.0	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=				Axial Dead Load on Stem	=		0.00	
Load @ Stem Above Soil	=				Soil Over Toe	=	440.0	2.00	880.0
Seismic Load	=	2,130.5	0.00	0.0	Surcharge Over Toe	=			
					Stem Weight	=	1,510.4	4.42	6,679.2
Total	=	6,310.8	**O.T.M.** =	30,123.5	Earth above Sloping Stem	=	221.5	4.89	1,083.0
					Footing Weight	=	2,400.0	4.00	9,600.0
Resisting/Overturning Ratio		=	**1.81**		Key Weight	=	618.8	5.75	3,557.8
Vertical Loads used for Soil Pressure		=	10,021.2 lbs		Vert. Component	=	843.2	8.00	6,745.3
Vertical component of active pressure used for soil pressure						**Total** =	10,021.2 lbs	**R.M.**=	54,463.4

DESIGNER NOTES: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#7 @ 9 "
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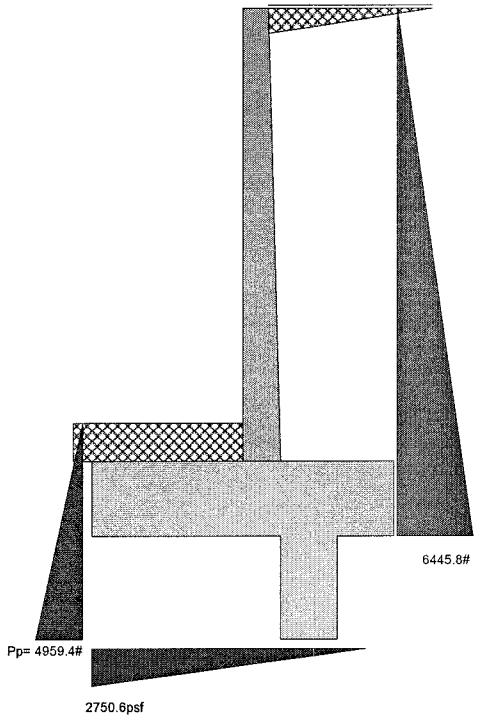
#7 @ 9 "
2"
2'-0"
3"
2'-9"
#6@12.in
@Toe
#6@18.in
@ Heel
5'-0"
1'-6"
1'-6"
4'-0"
4'-0"
8'-0"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