

MYERS ENGINEERING

Addendum to Structural Calculations



A handwritten signature in blue ink, appearing to read "Mark Myers".

Digitally signed by
Mark Myers, PE
Date: 2023.02.07
18:44:00 -08'00'

MUST BEAR ORIGINAL BLUE INK SIGNATURE OR
DIGITAL PDF SIGNATURE FOR PERMIT SUBMITTAL.

Project: SFR of RKK Construction
3419 72nd Place Southeast
Mercer Island, WA

February 7, 2023

2018 INTERNATIONAL BUILDING CODE
100 MPH BASIC WIND, EXPOSURE B, $K_{zt} = 1.00$
RISK CATEGORY II - SOIL SITE CLASS D
SEISMIC DESIGN CATEGORY D (IBC)

3206 50th Street Court, Suite 210-B
Gig Harbor, WA 98335
Phone: 253-858-3248
Email: myengineer@centurytel.net

UPPER FLOOR JOISTS SHALL BE:
1 1/8" TJI 210 SERIES I-JOISTS @ 16" O.C.
UNLESS NOTED OTHERWISE (U.N.O.)

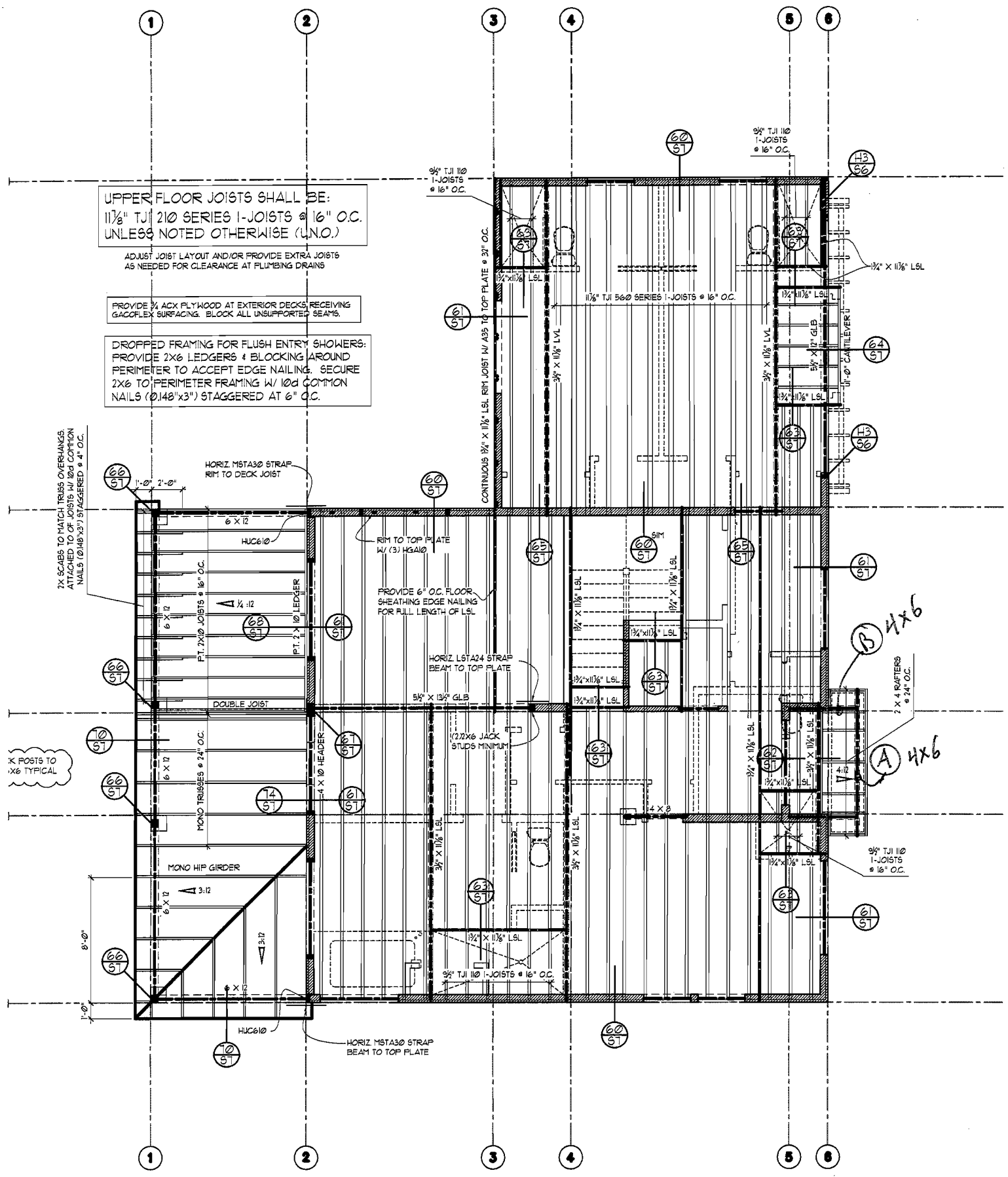
ADJUST JOIST LAYOUT AND/OR PROVIDE EXTRA JOISTS
AS NEEDED FOR CLEARANCE AT PLUMBING DRAINS

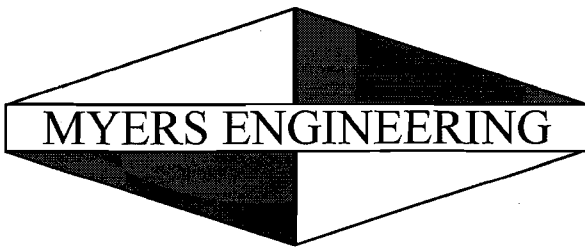
PROVIDE 3/4" ACX FLYWOOD AT EXTERIOR DECKS RECEIVING
GACOFLEX SURFACING. BLOCK ALL UNSUPPORTED SEAMS.

DROPPED FRAMING FOR FLUSH ENTRY SHOWERS:
PROVIDE 2X6 LEDGERS & BLOCKING AROUND
PERIMETER TO ACCEPT EDGE NAILING. SECURE
2X6 TO PERIMETER FRAMING W/ 10d COMMON
NAILS (Ø.148"x3") STAGGERED AT 6" O.C.

2X SCABES TO MATCH TRUSS OVERHANGS.
ATTACHED TO CP JOISTS W/ 12d COMMON
NAILS (Ø.148"x3") STAGGERED @ 4" O.C.

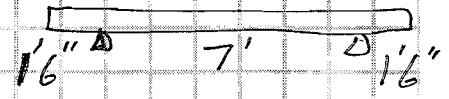
K POSTS TO
X6 TYPICAL





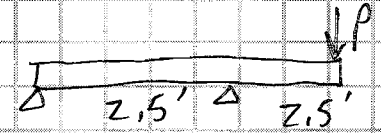
Myers Engineering LLC
 3206 50th St Ct NW, Ste 210-B
 Gig Harbor, WA 98335
 (253) 858-3248
 Fax (253) 858-3249
 myengineer@centurytel.net

(A) $w_D = 10 \text{ psf} \left(\frac{3'}{2}\right) = 15 \text{ plf}$
 $w_S = 25 \text{ psf} \left(\frac{3'}{2}\right) = 37.5 \text{ plf}$



2x6 DF#2
 Minimum

(B) $w_D = \text{self}$
 $P = 75 \text{ \# DL} + 188 \text{ \# SL}$



4x4 DF#2
 Minimum

FOR Fisher/RKR
 JOB 3419 72nd

2

DATE 1-24-23
 BY [Signature]

Multiple Simple Beam

Project File: 3419-72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

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Wood Beam Design : A. Porch Roof beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x6, Sawn, Fully Unbraced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : DouglasFir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
 Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

Applied Loads

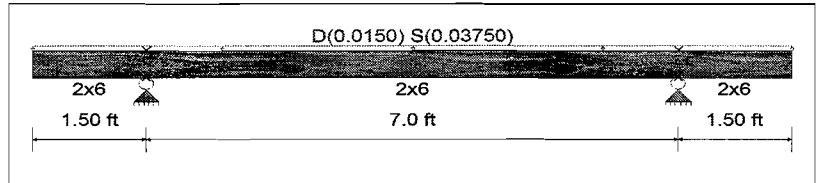
Unif Load: D = 0.0150, S = 0.03750 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.340 : 1**
 fb : Actual : 416.53 psi at 3.500 ft in Span # 2
 Fb : Allowable : 1,224.23 psi
 Load Comb : +D+S

Max fv/FvRatio = **0.142 : 1**
 fv : Actual : 29.40 psi at 6.580 ft in Span # 2
 Fv : Allowable : 207.00 psi
 Load Comb : +D+S

Max Reactions (k) D Lr L S W E H
 Left Support 0.07 0.19
 Right Support 0.08 0.19



Max Deflections

Transient Downward	0.048 in	Total Downward	0.067 in
Ratio	1752	Ratio	1251
	LC: S Only		LC: +D+S
Transient Upward	-0.029 in	Total Upward	-0.041 in
Ratio	1240	Ratio	886
	LC: S Only		LC: +D+S

Wood Beam Design : B. Support Beam for Porch Roof

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **4x4, Sawn, Fully Unbraced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : DouglasFir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
 Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

Applied Loads

Beam self weight calculated and added to loads

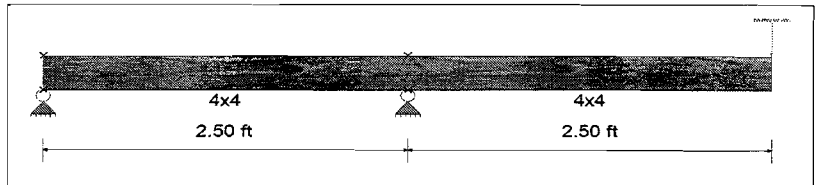
1Point: D = 0.0750, S = 0.1880 k @ 5.0 ft

Design Summary

Max fb/Fb Ratio = **0.720 : 1**
 fb : Actual : 1,118.04 psi at 2.500 ft in Span # 1
 Fb : Allowable : 1,552.50 psi
 Load Comb : +D+S

Max fv/FvRatio = **0.159 : 1**
 fv : Actual : 32.92 psi at 2.500 ft in Span # 1
 Fv : Allowable : 207.00 psi
 Load Comb : +D+S

Max Reactions (k) D Lr L S W E H
 Left Support -0.07 -0.19
 Right Support 0.16 0.38



Max Deflections

Transient Downward	0.169 in	Total Downward	0.238 in
Ratio	354	Ratio	250
	LC: S Only		LC: +D+S
Transient Upward	-0.016 in	Total Upward	-0.023 in
Ratio	1831	Ratio	1299
	LC: S Only		LC: +D+S

Multiple Simple Beam

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Description :

Wood Beam Design : 13. Beam in Crawl East of Grid 3

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : 5.5x10.5, GLB, Fully Unbraced

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : DF/DF

Wood Grade : 24F-V4

Fb - Tension	2,400.0 psi	Fc - Prll	1,650.0 psi	Fv	265.0 psi	Ebend- xx	1,800.0 ksi	Density	31.210 pcf
Fb - Compr	1,850.0 psi	Fc - Perp	650.0 psi	Ft	1,100.0 psi	Eminbend - xx	950.0 ksi		

Applied Loads

Unif Load: D = 0.30, L = 0.80 k/ft, Trib= 1.0 ft

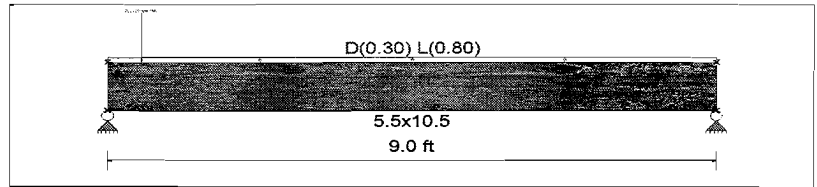
1Point: D = 1.780, L = 4.730 k @ 0.50 ft

Design Summary

Max fb/Fb Ratio = 0.640 : 1
 fb : Actual : 1,522.76 psi at 4.170 ft in Span # 1
 Fb : Allowable : 2,378.95 psi
 Load Comb : +D+L

Max fv/FvRatio = 0.427 : 1
 fv : Actual : 113.11 psi at 8.130 ft in Span # 1
 Fv : Allowable : 265.00 psi
 Load Comb : +D+L

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	3.03		8.07				
Right Support	1.45		3.86				



Max Deflections			
Transient Downward	0.146 in	Total Downward	0.201 in
Ratio	738	Ratio	537
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : 14. Main Floor Deck Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : 6x12, Sawn, Fully Unbraced

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Hem-Fir

Wood Grade : No.1

Fb - Tension	1050 psi	Fc - Prll	750 psi	Fv	140 psi	Ebend- xx	1300 ksi	Density	26.84 pcf
Fb - Compr	1050 psi	Fc - Perp	405 psi	Ft	525 psi	Eminbend - xx	470 ksi		

Applied Loads

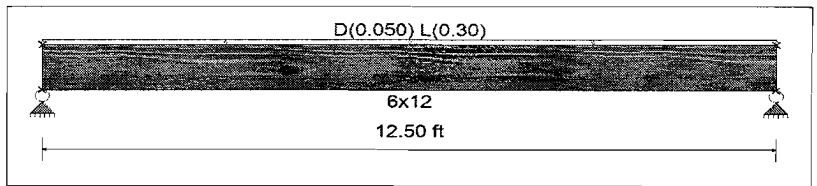
Unif Load: D = 0.050, L = 0.30 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = 0.813 : 1
 fb : Actual : 676.66 psi at 6.250 ft in Span # 1
 Fb : Allowable : 832.28 psi
 Load Comb : +D+L

Max fv/FvRatio = 0.395 : 1
 fv : Actual : 44.27 psi at 11.583 ft in Span # 1
 Fv : Allowable : 112.00 psi
 Load Comb : +D+L

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.31		1.88				
Right Support	0.31		1.88				



Max Deflections			
Transient Downward	0.183 in	Total Downward	0.213 in
Ratio	820	Ratio	703
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

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DESCRIPTION: 8ft Stem

Code Reference:

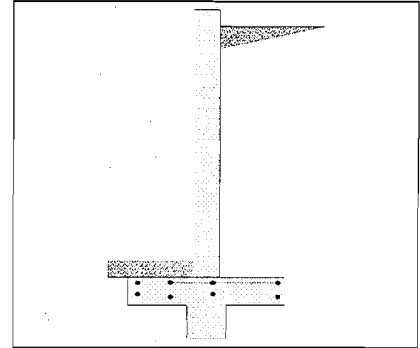
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	7.50 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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing Soil Friction	=	0.350
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	=	200.0 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	=	0.0 psf (Strength 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	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

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DESCRIPTION: 8ft Stem

Design Summary

Wall Stability Ratios			
Overturning	=	2.47	OK
Sliding	=	1.50	OK
Global Stability	=	1.75	
Total Bearing Load	=	3,317 lbs	
...resultant ecc.	=	6.06 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,457 psf	OK
Soil Pressure @ Heel	=	201 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,040 psf	
ACI Factored @ Heel	=	282 psf	
Footing Shear @ Toe	=	22.2 psi	OK
Footing Shear @ Heel	=	11.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,215.3 lbs	
less 100% Passive Force	-	666.7 lbs	
less 100% Friction Force	= -	1,160.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
...for 1.5 Stability	=	0.0 lbs	OK

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

Load Factors

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

Stem Construction

		2nd	Bottom	
Design Height Above Ftg	ft =	Stem OK 2.50	Stem OK 0.00	
Wall Material Above "Ht"	=	Concrete	Concrete	
Design Method	=	SD	SD	SD
Thickness	=	8.00	8.00	
Rebar Size	=	# 4	# 4	
Rebar Spacing	=	12.00	8.00	
Rebar Placed at	=	6 in	6 in	

Design Data

fb/FB + fa/Fa	=	0.224	0.516
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	700.0	1,575.0
Moment....Actual			
Service Level	ft-# =		
Strength Level	ft-# =	1,166.7	3,937.5
Moment....Allowable	ft-# =	5,187.6	7,622.1
Shear.....Actual			
Service Level	psi =		
Strength Level	psi =	9.7	21.9
Shear....Allowable	psi =	75.0	75.0
Anet (Masonry)	in2 =		
Wall Weight	psf =	100.0	100.0
Rebar Depth 'd'	in =	6.00	6.00

Masonry Data

f _m	psi =
F _s	psi =
Solid Grouting	=
Modular Ratio 'n'	=
Equiv. Solid Thick.	=
Masonry Block Type	=
Masonry Design Method	= ASD

Concrete Data

f _c	psi =	2,500.0	2,500.0
F _y	psi =	60,000.0	60,000.0

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC# : KW-06015659, Build:20.22.12.28

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DESCRIPTION: 8ft Stem

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
2nd Stem		
As (based on applied moment) :	0.0456 in2/ft	
(4/3) * As :	0.0608 in2/ft	Min Stem T&S Reinf Area 1.056 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 :
	=====	<u>One layer of :</u> <u>Two layers of :</u>
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 :	0.8128 in2/ft	#6@ 27.50 in #6@ 55.00 in

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
Bottom Stem		
As (based on applied moment) :	0.154 in2/ft	
(4/3) * As :	0.2054 in2/ft	Min Stem T&S Reinf Area 0.480 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 :
	=====	<u>One layer of :</u> <u>Two layers of :</u>
Required Area :	0.2054 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 :	0.8128 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	1.67 ft
Heel Width	=	2.33
Total Footing Width	=	4.00
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	1.50 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

	<u>Toe</u>	<u>Heel</u>
Factored Pressure	= 2,040	282 psf
μ_u : Upward	= 2,494	731 ft-#
μ_u : Downward	= 313	1,771 ft-#
μ_u : Design	= 2,182 OK	1,040 ft-# OK
ϕM_n	= 6,376	7,358 ft-#
Actual 1-Way Shear	= 22.25	11.61 psi
Allow 1-Way Shear	= 75.00	75.00 psi
Toe Reinforcing	= # 4 @ 11.00 in	
Heel Reinforcing	= # 4 @ 11.00 in	
Key Reinforcing	= None Spec'd	
Footing Torsion, T_u	=	0.00 ft-lbs
Footing Allow. Torsion, ϕT_u	=	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@ 55.55 in, #10@ 70.55 in

Heel: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 55.55 in, #10@ 70.55 in

Key: $\phi M_n = \phi'5' \lambda \sqrt{f_c} S_m$

Min footing T&S reinf Area	0.86	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
<u>If one layer of horizontal bars:</u>		<u>If two layers of horizontal bars:</u>
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

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DESCRIPTION: 8ft Stem

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	1,215.3	2.78	3,375.8	Soil Over HL (ab. water tbl)	1,562.5	3.17	4,947.9
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.17	4,947.9
Hydrostatic Force				Water 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 =	200.0	2.00	400.0
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	104.2	0.83	86.8
				Surcharge Over Toe =			
				Stem Weight(s) =	800.0	2.00	1,600.0
				Earth @ Stem Transitions =			
				Footing Weight =	500.0	2.00	1,000.0
				Key Weight =	150.0	2.00	300.0
				Vert. Component =			
Total	= 1,215.3	O.T.M. =	3,375.8	Total =	3,316.7 lbs	R.M. =	8,334.7
Resisting/Overturning Ratio	=	2.47					
Vertical Loads used for Soil Pressure =		3,316.7 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) 0.081 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.

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC# : KW-06015659, Build:20.22.12.28

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DESCRIPTION: 8ft Stem

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd

Stem Design Height: 2.50 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) = 18.72 in
Development length for #4 bar specified in this stem design segment = 14.40 in

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) = 18.72 in
Development length for #4 bar specified in this stem design segment = 14.40 in

Hooked embedment length into footing for #4 bar specified in this stem design segment = 6.00 in
As Provided = 0.3000 in²/ft
As Required = 0.2054 in²/ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

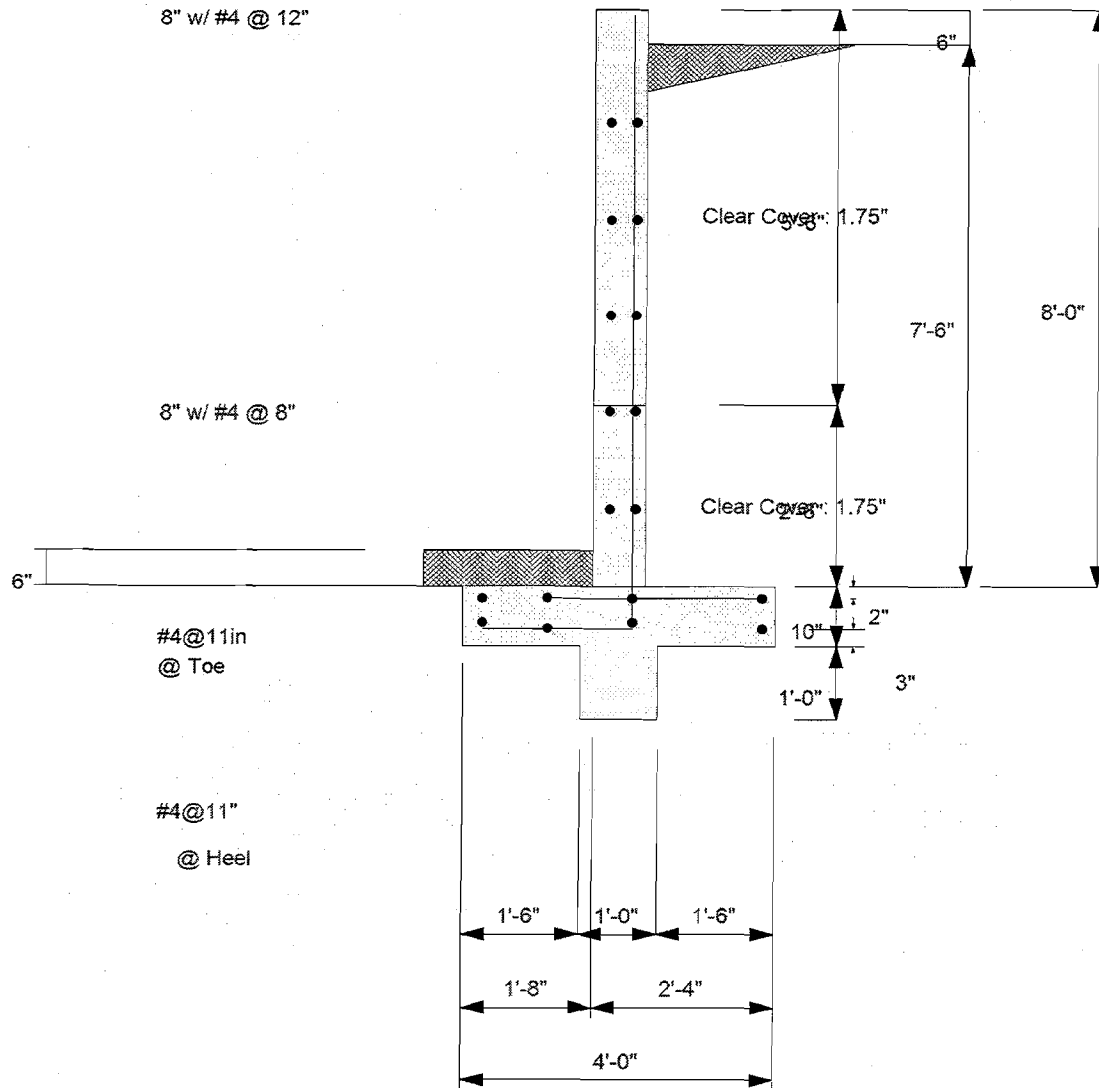
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LIC# : KW-06015659, Build:20.22.12.28

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DESCRIPTION: 8ft Stem



Cantilevered Retaining Wall

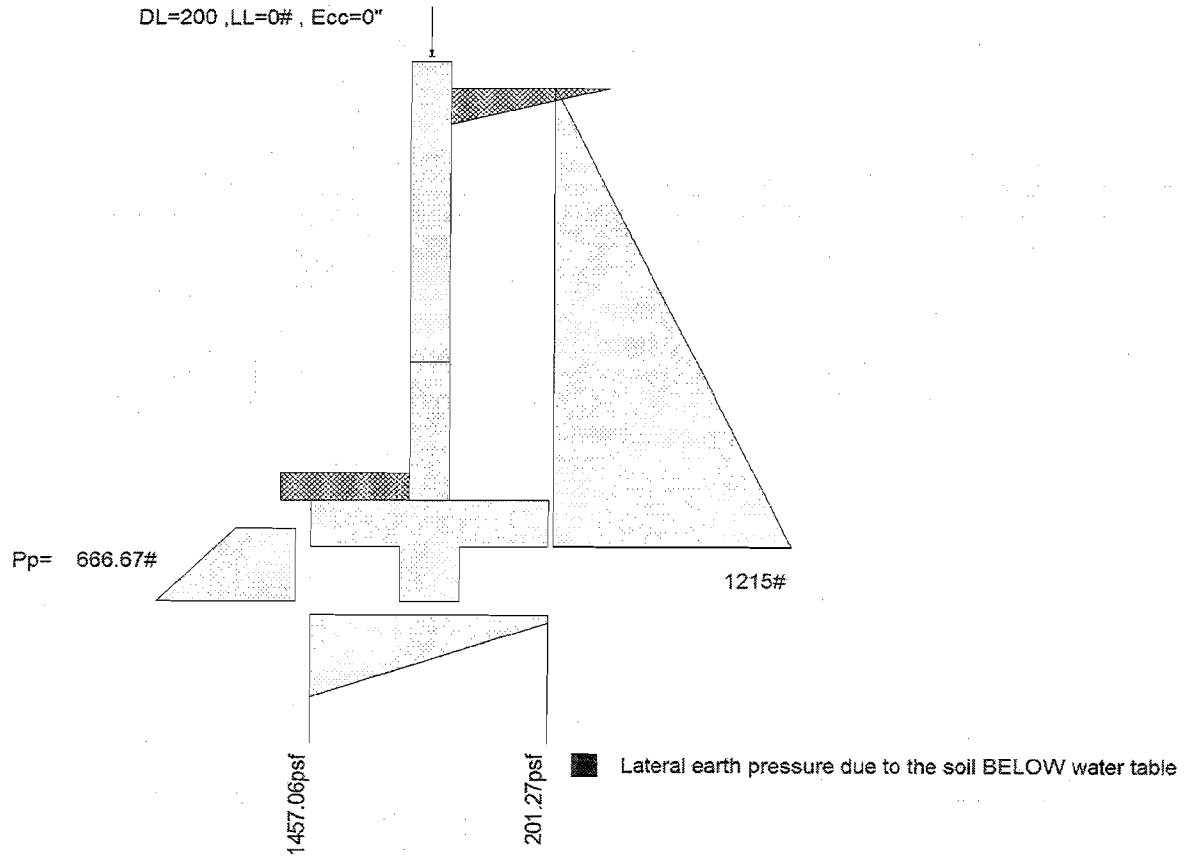
Project File: 3419 72nd PL SE.ec6

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DESCRIPTION: 8ft Stem



Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC# : KW-06015659, Build:20.22.12.28

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DESCRIPTION: 6ft Stem

Code Reference:

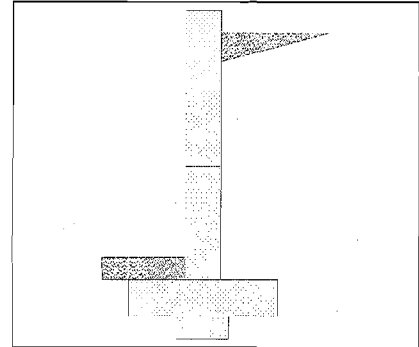
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	5.50 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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footings Soil Friction	=	0.350
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	=	200.0 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	=	0.0 psf (Strength 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	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 6ft Stem

Design Summary		Stem Construction		2nd	Bottom
Wall Stability Ratios		Design Height Above Ftc	ft =	Stem OK 2.50	Stem OK 0.00
Overturning	= 2.35 OK	Wall Material Above "Ht"	=	Concrete	Concrete
Sliding	= 1.52 OK	Design Method	=	SD	SD
Global Stability	= 2.00	Thickness	=	8.00	8.00
		Rebar Size	=	# 4	# 4
		Rebar Spacing	=	12.00	10.00
		Rebar Placed at	=	6 in	6 in
		Design Data			
Total Bearing Load	= 2,041 lbs	fb/FB + fa/Fa	=	0.048	0.251
...resultant ecc.	= 5.24 in	Total Force @ Section			
Eccentricity within middle third		Service Level	lbs =		
Soil Pressure @ Toe	= 1,389 psf OK	Strength Level	lbs =	252.0	847.0
Soil Pressure @ Heel	= 53 psf OK	Moment....Actual			
Allowable	= 1,500 psf	Service Level	ft-# =		
Soil Pressure Less Than Allowable		Strength Level	ft-# =	252.0	1,552.8
ACI Factored @ Toe	= 1,945 psf	Moment....Allowable	ft-# =	5,187.6	6,174.1
ACI Factored @ Heel	= 74 psf	Shear.....Actual			
Footing Shear @ Toe	= 8.5 psi OK	Service Level	psi =		
Footing Shear @ Heel	= 6.1 psi OK	Strength Level	psi =	3.5	11.8
Allowable	= 75.0 psi	Shear....Allowable	psi =	75.0	75.0
Sliding Calcs		Anet (Masonry)	in2 =		
Lateral Sliding Force	= 701.9 lbs	Wall Weight	psf =	100.0	100.0
less 100% Passive Force	= - 354.2 lbs	Rebar Depth 'd'	in =	6.00	6.00
less 100% Friction Force	= - 714.4 lbs	Masonry Data			
Added Force Req'd	= 0.0 lbs OK	f'm	psi =		
....for 1.5 Stability	= 0.0 lbs OK	Fs	psi =		
		Solid Grouting	=		
		Modular Ratio 'n'	=		
		Equiv. Solid Thick.	=		
		Masonry Block Type	=		
		Masonry Design Method	=	ASD	
		Concrete Data			
		f'c	psi =	2,500.0	2,500.0
		Fy	psi =	60,000.0	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				

DESCRIPTION: 6ft Stem

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
2nd Stem		
As (based on applied moment) :	0.0099 in2/ft	
(4/3) * As :	0.0131 in2/ft	Min Stem T&S Reinf Area 0.672 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 :
	=====	<u>One layer of :</u> <u>Two layers of :</u>
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 :	0.8128 in2/ft	#6@ 27.50 in #6@ 55.00 in

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
Bottom Stem		
As (based on applied moment) :	0.0607 in2/ft	
(4/3) * As :	0.081 in2/ft	Min Stem T&S Reinf Area 0.480 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 :
	=====	<u>One layer of :</u> <u>Two layers of :</u>
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 :	0.8128 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	1.08 ft
Heel Width	=	1.75
Total Footing Width	=	2.83
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	6.00 in
Key Distance from Toe	=	0.92 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

		<u>Toe</u>	<u>Heel</u>	
Factored Pressure	=	1,945	74 psf	
Mu' : Upward	=	996	184 ft-#	
Mu' : Downward	=	131	572 ft-#	
Mu: Design	=	864 OK	388 ft-#	OK
phiMn	=	1,600	1,600 ft-#	
Actual 1-Way Shear	=	8.51	6.12 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: $\phi Mn = \phi^5 \lambda \sqrt{fc} Sm$

Heel: $\phi Mn = \phi^5 \lambda \sqrt{fc} Sm$

Key: $\phi Mn = \phi^5 \lambda \sqrt{fc} Sm$

Min footing T&S reinf Area	0.61 in2
Min footing T&S reinf Area per foot	0.22 in2 /ft
<u>If one layer of horizontal bars:</u>	<u>If two layers of horizontal bars:</u>
#4@ 11.11 in	#4@ 22.22 in
#5@ 17.22 in	#5@ 34.44 in
#6@ 24.44 in	#6@ 48.89 in

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 6ft Stem

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	701.9	2.11	1,481.9	Soil Over HL (ab. water tbl)	744.8	2.29	1,704.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.29	1,704.3
Hydrostatic Force				Water 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 =	200.0	1.41	282.7
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	67.5	0.54	36.5
				Surcharge Over Toe =			
				Stem Weight(s) =	600.0	1.41	848.0
				Earth @ Stem Transitions =			
Total	= 701.9	O.T.M. =	1,481.9	Footing Weight =	353.8	1.42	500.6
				Key Weight =	75.0	1.42	106.3
				Vert. Component =			
Resisting/Overturning Ratio		= 2.35		Total =	2,041.0 lbs	R.M. =	3,478.3
Vertical Loads used for Soil Pressure =		2,041.0 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) 0.082 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

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 6ft Stem

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd

Stem Design Height: 2.50 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) = 18.72 in
Development length for #4 bar specified in this stem design segment = 14.40 in

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) = 18.72 in
Development length for #4 bar specified in this stem design segment = 14.40 in

Hooked embedment length into footing for #4 bar specified in this stem design segment = 6.05 in
As Provided = 0.2400 in²/ft
As Required = 0.1728 in²/ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

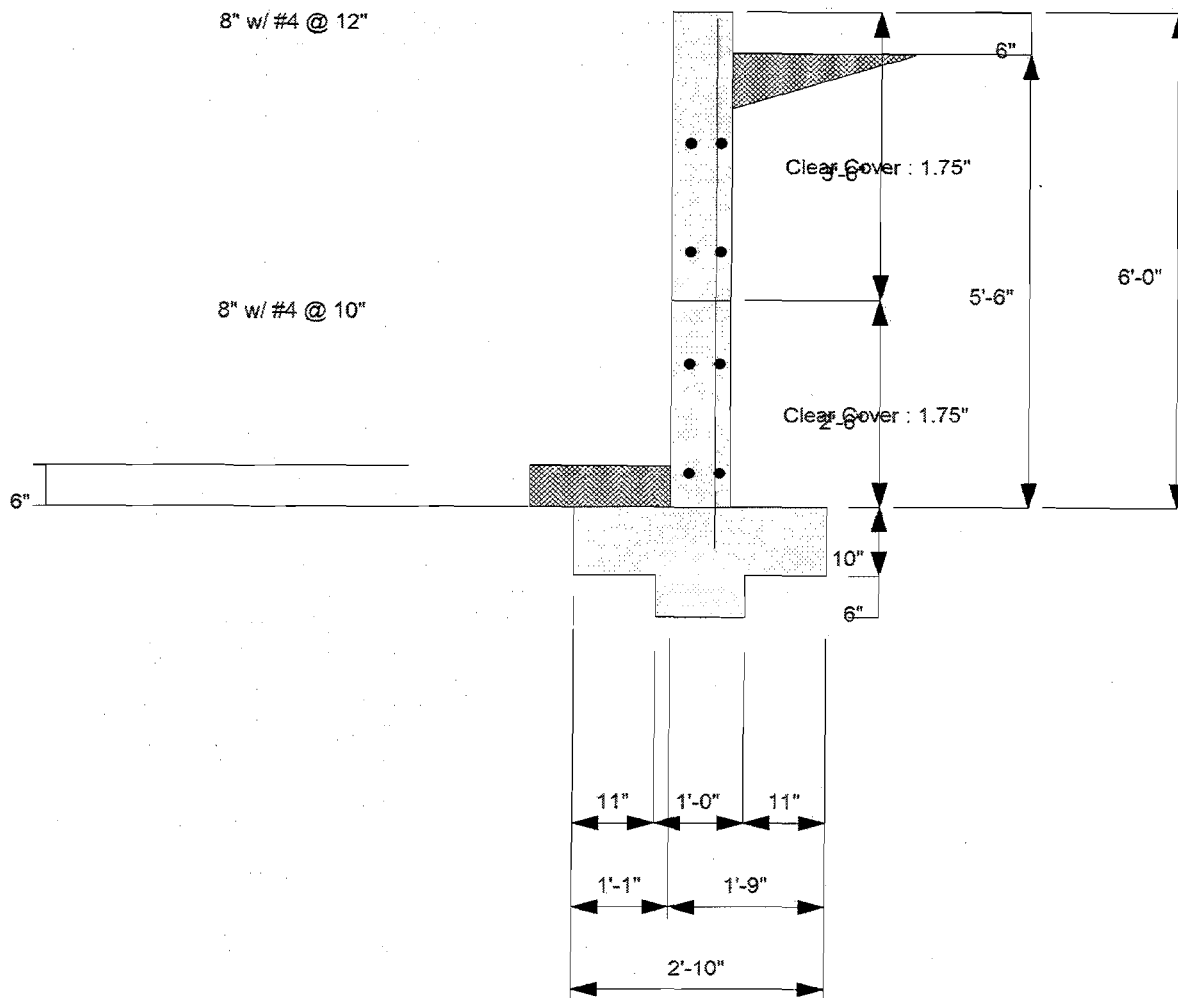
Project File: 3419.72nd PL SE.ec6

LIC# : KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

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DESCRIPTION: 6ft Stem



Cantilevered Retaining Wall

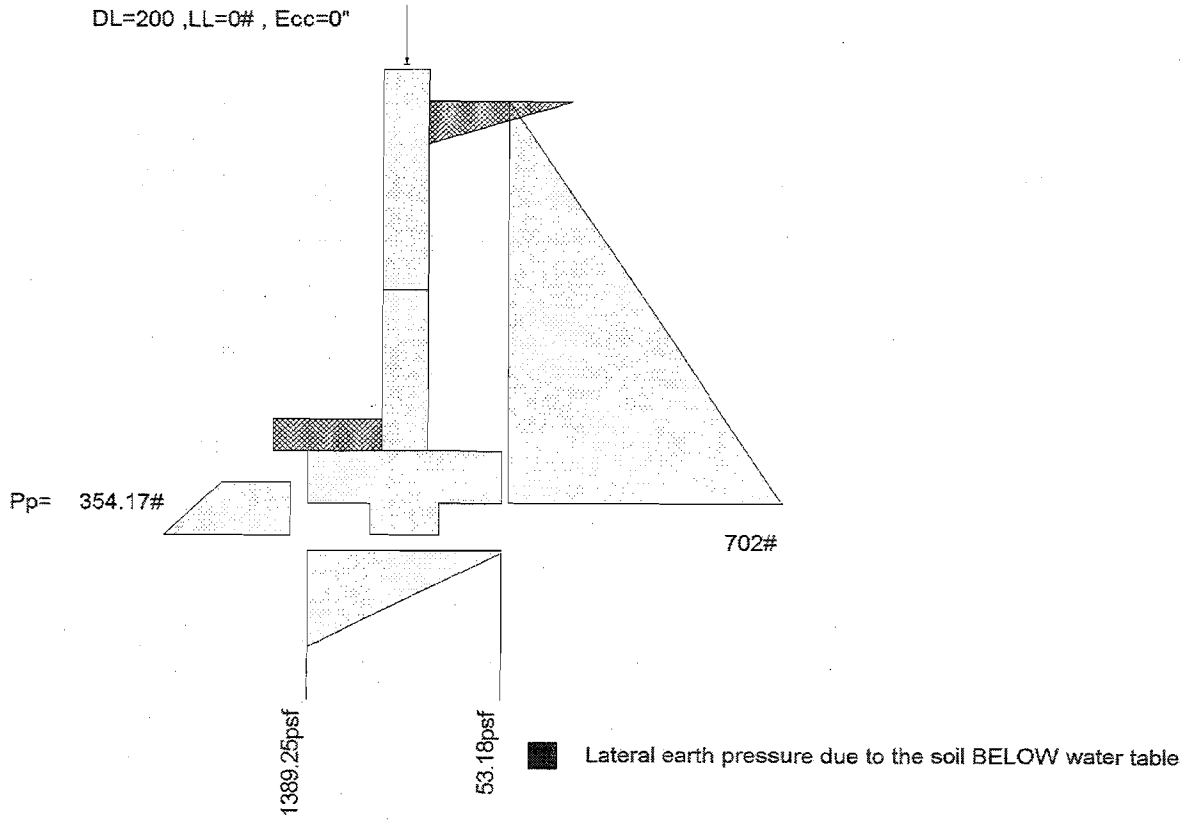
Project File: 3419 72nd PL SE.ec6

LIC# : KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

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DESCRIPTION: 6ft Stem



Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KVV-06015659, Build:20.22.12.28

MYERS ENGINEERING

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DESCRIPTION: 4ft Stem

Code Reference:

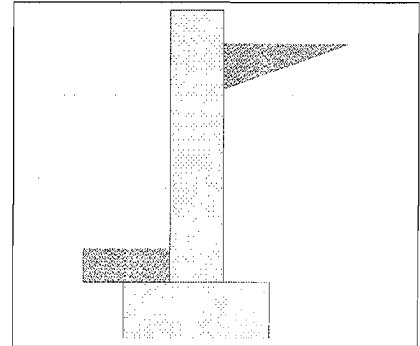
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

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	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing Soil Friction	=	0.350
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		

Axial Load Applied to Stem

Axial Dead Load	=	200.0 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	=	0.0 psf (Strength 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	=	Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC# : KVV-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 4ft Stem

Design Summary		Stem Construction		Bottom	
Wall Stability Ratios		Design Height Above Ft_c	ft =	Stem OK	
Overturning	= 2.45 OK	Wall Material Above "Ht"	=	Concrete	
Sliding	= 1.55 OK	Design Method	=	SD	SD
Global Stability	= 2.62	Thickness	=	8.00	
		Rebar Size	=	# 4	
		Rebar Spacing	=	10.00	
		Rebar Placed at	=	6 in	
Total Bearing Load	= 1,121 lbs	Design Data			
...resultant ecc.	= 3.62 in	fb/FB + fa/Fa	=	0.064	
Eccentricity within middle third		Total Force @ Section			
Soil Pressure @ Toe	= 1,215 psf OK	Service Level	lbs =		
Soil Pressure @ Heel	= 8 psf OK	Strength Level	lbs =	343.0	
Allowable	= 1,500 psf	Moment....Actual			
Soil Pressure Less Than Allowable		Service Level	ft-# =		
ACI Factored @ Toe	= 1,701 psf	Strength Level	ft-# =	400.2	
ACI Factored @ Heel	= 11 psf	Moment....Allowable	=	6,174.1	
Footing Shear @ Toe	= 0.6 psi OK	Shear....Actual			
Footing Shear @ Heel	= 2.4 psi OK	Service Level	psi =		
Allowable	= 75.0 psi	Strength Level	psi =	4.8	
Sliding Calcs		Shear.....Allowable	psi =	75.0	
Lateral Sliding Force	= 328.6 lbs	Anet (Masonry)	in2 =		
less 100% Passive Force	= - 116.7 lbs	Wall Weight	psf =	100.0	
less 100% Friction Force	= - 392.2 lbs	Rebar Depth 'd'	in =	6.00	
Added Force Req'd	= 0.0 lbs OK	Masonry Data			
....for 1.5 Stability	= 0.0 lbs OK	f _m	psi =		
		F _s	psi =		
		Solid Grouting	=		
		Modular Ratio 'n'	=		
		Equiv. Solid Thick.	=		
		Masonry Block Type	=		
		Masonry Design Method	=	ASD	
		Concrete Data			
		f _c	psi =	2,500.0	
		F _y	psi =	60,000.0	

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

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

Project File: 3419 72nd PL SE.ec6

LIC# : KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 4ft Stem

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
Bottom Stem		
As (based on applied moment) :	0.0157 in2/ft	
(4/3) * As :	0.0209 in2/ft	Min Stem T&S Reinf Area 0.768 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 :
	=====	<u>One layer of :</u> <u>Two layers of :</u>
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 :	0.8128 in2/ft	#6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	0.58 ft
Heel Width	=	1.25
Total Footing Width	=	1.83
Footing Thickness	=	10.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.50 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

	<u>Toe</u>	<u>Heel</u>	
Factored Pressure	=	1,701	11 psf
Mu' : Upward	=	259	32 ft-#
Mu' : Downward	=	38	115 ft-#
Mu: Design	=	221 OK	82 ft-#
phiMn	=	1,600	1,600 ft-#
Actual 1-Way Shear	=	0.62	2.40 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

OK

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

Other Acceptable Sizes & Spacings

Toe: $\phi M_n = \phi'5' \lambda \sqrt{f_c} S_m$

Heel: $\phi M_n = \phi'5' \lambda \sqrt{f_c} S_m$

Key: No key defined

Min footing T&S reinf Area	0.40	in2
Min footing T&S reinf Area per foot	0.22	in2 /ft
<u>If one layer of horizontal bars:</u>		<u>If two layers of horizontal bars:</u>
#4@ 11.11 in		#4@ 22.22 in
#5@ 17.22 in		#5@ 34.44 in
#6@ 24.44 in		#6@ 48.89 in

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 4ft Stem

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	328.6	1.44	474.7	Soil Over HL (ab. water tbl)	255.1	1.54	393.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		1.54	393.3
Hydrostatic Force				Water 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 =	200.0	0.92	183.3
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =	36.4	0.29	10.6
				Surcharge Over Toe =			
				Stem Weight(s) =	400.0	0.92	366.6
				Earth @ Stem Transitions =			
Total	= 328.6	O.T.M. =	474.7	Footing Weight =	229.1	0.92	210.0
				Key Weight =		1.00	
				Vert. Component =			
Resisting/Overturning Ratio		= 2.45		Total =	1,120.7 lbs	R.M.=	1,163.8
Vertical Loads used for Soil Pressure =		1,120.7 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) 0.074 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.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 4ft Stem

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.3a) =	18.72 in
Development length for #4 bar specified in this stem design segment =	14.40 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.05 in
As Provided =	0.2400 in ² /ft
As Required =	0.1728 in ² /ft

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

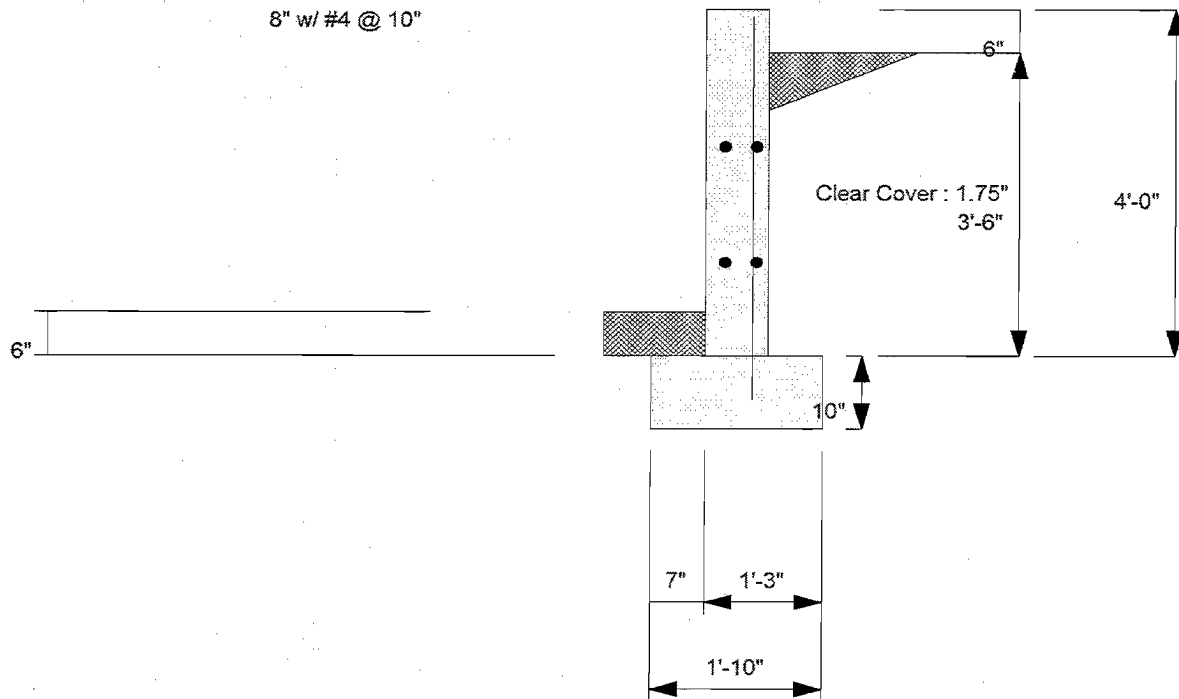
Project File: 3419 72nd PL SE.ec6

LIC#: KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

(c) ENERCALC INC 1983-2022

DESCRIPTION: 4ft Stem



Cantilevered Retaining Wall

Project File: 3419 72nd PL SE.ec6

LIC# : KW-06015659, Build:20.22.12.28

MYERS ENGINEERING

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DESCRIPTION: 4ft Stem

