STRUCTURAL CALCULATIONS

19 Pages Total
(Including Cover Page)

Structural Codes and References:

The perimeter wall shall be designed and constructed in accordance with the following design codes and references:

     A.   ASCE Standard 07–10, Minimum Design Loads for Buildings and Other Structures

     B.   2016 California Building Code

Design Loads:

     A.   Dead Load (DL) - Masonry wall and foundation

              Unit Weight of Materials:

CMU (Vert. cores grouted at 16" O.C.)	=	63 #/ft^2
CMU (Solid grouted)	=	78 #/ft^2
Concrete	=	150 #/ft^3
Soil	=	120 #/ft^3

     B.   Wind Loads (WL) and Seismic Loads (EQ)

Basic Wind Speed	=	116 mph *(Per City of Fontana requirements)*
Risk Category	=	I *(Per City of Fontana requirements)*
Exposure Category	=	C

Material Specifications:

CMU (8" x 8" x 16")	=	f'm = 1500 psi
Concrete Footing	=	3000 psi (Foundation for masonry wall)
Rebars	=	ASTM A615 Grade 60

CMU WALL   - WIND LOAD CALCULATION

DESCRIPTION: **6'-4" Exposed Ht (max) with 5'-0 high (max) retaining cmu wall**
Wall total Height =   11'-4" max

Design Data:

Wall Geometry:
    Tributary Width of wall, b: 1.00 ft.
    Width of wall in the direction under consideration, B: 270 ft.
    Wall Exposed Height,**h** :   6.33 ft.

Wind Design Parameters:
    $F = q_h\, G\, C_f\, A_s$ (ASCE 7-10 Sec. 29.4-1)
    $P_w = q_h\, G\, C_f$ (ASCE 7-10 Sec. 26.7.3)
    ASD factor: 0.6   Exposure Category: C

Where:
    F = Design wind force, = Pw As (*lbs.*)   (ASCE 7-10 Eq. 29.4-1)
    qh = velocity pressure evaluated at height, h   (ASCE 7-10 Sec. 29.3.2)
    Cf = Net force coefficient   (ASCE 7-10 Fig. 29.4-1)
    As = Gross area of the solid freestanding wall (ft^2)
    G = Gust Factor   (ASCE 7-10 Sec. 26.9)
    Pw = Design Wind Pressure, = qh G Cf (*psf*)

Calculate Design Wind Pressure, Pw:

Net Force Coefficient, Cf: (ASCE 7-10 Sec. 29.4)
  Case: A & B   (Fig. 29.4-1)
    height of free standing wall or fence, s: (Exposed height)   6.33 ft
    Height from top of wall to ground surface, h: 6.33 ft
    Clearance ratio, s/h: $\dfrac{6.33}{6.33}$ = **1.00**

    Aspect ratio of the fence, B/s: $\dfrac{270.00}{6.33}$ = **42.65**

By Interpolation,
        Cf: **1.30**

Gust Factor Coefficient, G: (ASCE 7-10 Sec. 26.9)
        G =   **0.850**

Velocity pressure, qh: (ASCE 7-10 Sec. 29.3)

    $q_h = 0.00256\, K_z\, K_{zt}\, K_d\, V^2$ (psf)   Sec. 29.3.2)

Wind Directionality, Kd:
(Per Section 26.6, Kd shall only be included when the load combinations in Sec. 2.3 and 2.4 are used in the design)

        kd =   **0.85**   (ASCE 7-10 Table 26.6-1)

	DESIGN CALCULATION	PROJECT:	RET. WALL_CERES
		LOCATION:	CERES AVE. FONTANA
		DESIGNER:	GATS&M

Velocity Pressure Exposure Coefficient, Kz: (ASCE 7-10 Table 29.3-1)

$$kz = 0.570$$

Topographic Factor, Kzt:

$$Kzt = 1 + (k_1 k_2 k_3)^2$$ (ASCE 7-10 Sec. 26.8.2)

$$Kzt = 1.0$$ *(site conditions do not meet Sec 26.8.1)*

Basic Wind speed, V   (ASCE 7-10 Table 1.5-1)

Risk Category: II

$$V = 116 \text{ mph}$$

$$qh = 0.00256 \; Kz \; Kzt \; Kd \; V^2 = 19.6350$$ *(note: Kd not considered)*

$$qh = 19.63 \text{ psf}$$

Design Wind Pressure, Pw:

$$Pw = qh \; G \; Cf \; x \; (ASD \; Factor)$$

$$Pw = (19.63) \; x \; (0.850) \; x \; (1.30) \; x \; 0.6 = 13.02 \text{ psf}$$

say: = 16.00 psf

$$Pw = 16.00 \text{ psf (ASD)}$$

Design Wind Force, F: *(consider 1 ft strip of wall)*

$$F = Pw \; x \; As; \qquad Where \; As = b \; x \; h$$

Wind Force Acting on Masonry Wall, **F**:

$$F = (16.00) \; x \; (1.00) \; x \; (6.33') = \textbf{101 lbs}$$

≋USGS   **Design Maps Summary Report**

User–Specified Input

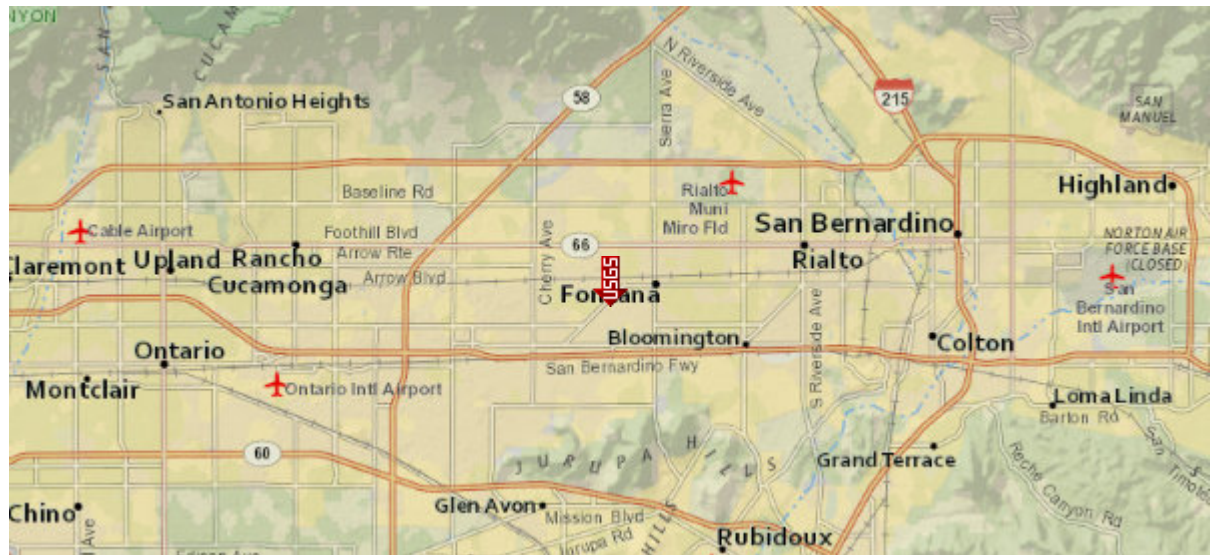|	
Report Title	Ceres 3 Lots
	Thu July 19, 2018 06:13:24 UTC
Building Code Reference Document	ASCE 7-10 Standard
	(which utilizes USGS hazard data available in 2008)
Site Coordinates	34.09343°N, 117.45535°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

USGS–Provided Output

S_S = 1.500 g	S_{MS} = 1.500 g	S_{DS} = 1.000 g
S_1 = 0.600 g	S_{M1} = 0.900 g	S_{D1} = 0.600 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.
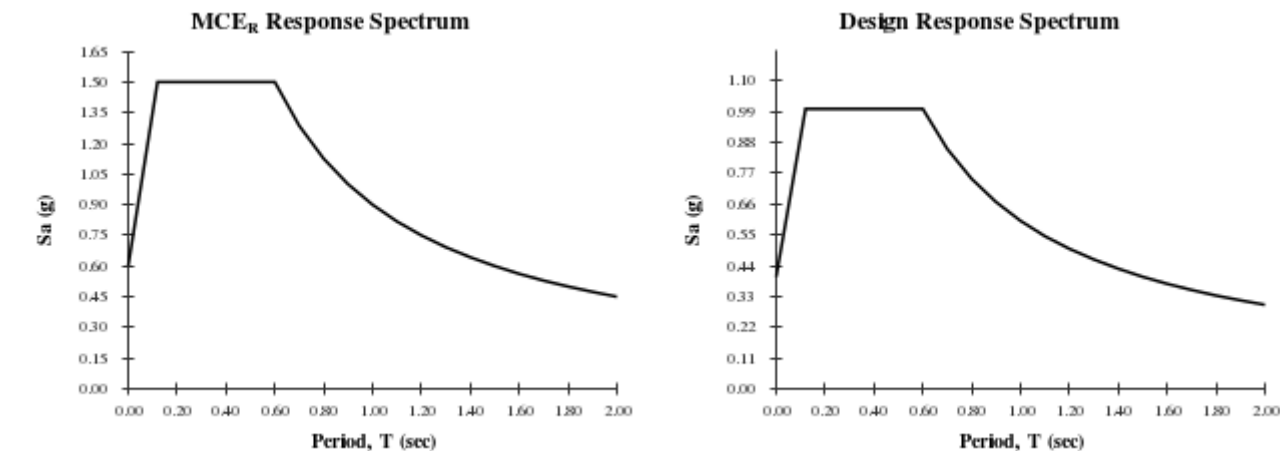
For PGA_M, T_L, C_{RS}, and C_{R1} values, please [view the detailed report](#).

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

CMU WALL - SEISMIC LOAD CALCULATION

DESCRIPTION: **6'-4" Exposed Ht (max) with 5'-0 high (max) retaining cmu wall**
Wall total Height =   11'-4" max

Block Wall - medium weight 8" CMU: (consider 1 ft strip)

  8" CMU - Vert. cores grouted @ 16" O.C.

   grouted wall height: 7.33 ft

   Material Weight: (7.33') (63.0 psf) = $W_{8"CMU}$:   461.8 lbs

  8" CMU - Solid Grouted.

   grouted wall height: 4.00 ft

   Material Weight: (4.00') (78.0 psf) = $W_{8"CMU}$:   312.0 lbs

   Total Est. Dead Weight of Wall, W_{DL}: W_{DL}:   **774 lbs**

Seismic Shear, F_{SEIS}:

$V_{SEIS} = C_s W_{DL}$ (ASCE 7-10 Sec. 12.8.1)   ASD Factor: 0.7

Calculate Cs:

   R: 3   (ASCE 7-10 Table 15.4-2)
   I: 1   (ASCE 7-10 Table 1.5-2) - Risk Category I
   S_{DS} :   1.000   (See USGS Design Maps Summary Report)
   S1 :   0.600
   Cs : $S_{DS} / (R / I)$ =   0.333

Since S1 >= 0.6, check $C_{s min}$ per   (ASCE 7-10 Equation 15.4-2)

  Check $C_{s min}$: =   0.8 S1 / (R / I) =   0.160   <   0.333   *ok!*

Also check Csmin per   (ASCE 7-10 Equation 15.4-1)

  Check $C_{s min}$: =   0.044 SDS (I) =   0.044   <   0.333   *ok!*

                                 Use Cs: *0.333*

Calculate Design Seismic Shear, V_{seis} :   =

        V_{seis} =   0.7x (0.333) x (774 lbs) =   *181 lbs (ASD)*

Check Section ASCE 7-10 Sec. 15.4.2:

  V = 0.3 SDs W_{DL} I   (0.3) (1.000) x   (774 lbs) x   (1.00)   (0.7) =   **774 lbs (ASD)**

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Title **Ceres: 3 Lots**
Job # :   Dsgnr: **GATS&M**
Description....
Retaining wall with Seismic Load

Page : 1
Date: 3 SEP 2018

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# Cantilevered Retaining Wall

Code: CBC 2016,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	6.33 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	11.33 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	30.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in
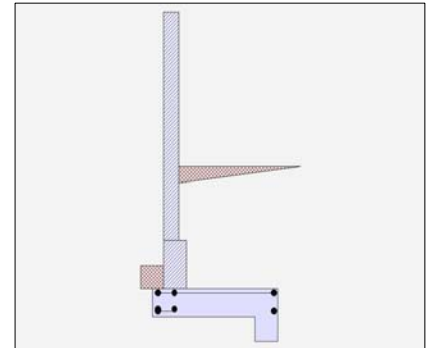
Surcharge Loads

Surcharge Over Heel	=	150.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
NOT Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	774.0 #/ft
...Height to Top	=	7.60 ft
...Height to Bottom	=	7.55 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

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

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	=	5.67 OK
Sliding	=	3.47 OK
Total Bearing Load	=	4,850 lbs
...resultant ecc.	=	3.49 in
Soil Pressure @ Toe	=	1,161 psf OK
Soil Pressure @ Heel	=	602 psf OK
Allowable	=	1,333 psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,626 psf
ACI Factored @ Heel	=	843 psf
Footing Shear @ Toe	=	4.2 psi OK
Footing Shear @ Heel	=	0.5 psi OK
Allowable	=	82.2 psi

Sliding Calcs

Lateral Sliding Force	=	801.8 lbs
less 100% Passive Force	= -	1,084.7 lbs
less 100% Friction Force	= -	1,700.1 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 pressures.

Load Factors

Building Code	CBC 2016,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	2.00	2.00	0.00
Wall Material Above "Ht"	=	Masonry	Masonry	Masonry
Design Method	=	ASD	ASD	ASD
Thickness	=	8.00	12.00	12.00
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	16.00	16.00	16.00
Rebar Placed at	=	Center	Center	Center
Design Data				
fb/FB + fa/Fa	=	**0.345**	**0.223**	**0.717**
Total Force @ Section				
Service Level	lbs =	296.4	296.4	618.2
Strength Level	lbs =			
Moment....Actual				
Service Level	ft-# =	534.8	534.8	1,429.5
Strength Level	ft-# =			
Moment.....Allowable	ft-# =	1,550.4	2,393.1	1,994.2
Shear.....Actual				
Service Level	psi =	6.2	4.1	8.5
Strength Level	psi =			
Shear.....Allowable	psi =	46.1	45.3	45.9
Anet (Masonry)	in2 =	47.54	73.02	73.02
Rebar Depth 'd'	in =	3.75	5.75	5.75
Masonry Data				
f'm	psi =	1,500	1,500	1,500
Fs	psi =	32,000	24,000	20,000
Solid Grouting	=	No	No	No
Modular Ratio 'n'	=	21.48	21.48	21.48
Wall Weight	psf =	63.0	94.0	94.0
Short Term Factor	=	1.000	1.000	1.000
Equiv. Solid Thick.	in =	5.80	8.50	8.50
Masonry Block Type	=	Medium Weight		
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =			
Fy	psi =			

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Title **Ceres:3 Lots**
Job # :   Dsgnr: **GATS&M**
Description....
Retaining wall with Seismic Load

Page : 2
Date: 3 SEP 2018

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Cantilevered Retaining Wall

Code: CBC 2016,ACI 318-14,ACI 530-13

Footing Dimensions & Strengths

Toe Width	=	0.50 ft
Heel Width	=	5.00
Total Footing Width	=	5.50
Footing Thickness	=	14.00 in
Key Width	=	12.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	4.50 ft

f'c =   3,000 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	=	1,626	843	psf
Mu' : Upward	=	200	8,265	ft-#
Mu' : Downward	=	84	9,990	ft-#
Mu: Design	=	117	1,725	ft-#
Actual 1-Way Shear	=	4.22	0.50	psi
Allow 1-Way Shear	=	43.82	43.82	psi
Toe Reinforcing	=	# 5 @ 16.00 in		
Heel Reinforcing	=	# 5 @ 16.00 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: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm

Min footing T&S reinf Area	1.66	in2
Min footing T&S reinf Area per foot	0.30	in2 /ft

If one layer of horizontal bars: If two layers of horizontal bars:
  #4@ 7.94 in   #4@ 15.87 in
  #5@ 12.30 in   #5@ 24.60 in
  #6@ 17.46 in   #6@ 34.92 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	=	570.4	2.06	1,172.5	Soil Over Heel	=	2,200.0	3.50	7,700.0
Surcharge over Heel	=	192.7	3.08	594.2	Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=	38.7	8.74	338.3	Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	51.9	0.25	13.0
					Surcharge Over Toe	=			
Total		801.8	**O.T.M.**	2,105.0	Stem Weight(s)	=	775.8	0.87	677.8
	=		=		Earth @ Stem Transitions	=	110.0	1.33	146.7
Resisting/Overturning Ratio		=	**5.67**		Footing Weight	=	962.5	2.75	2,646.9
Vertical Loads used for Soil Pressure =		4,850.2	lbs		Key Weight	=	150.0	5.00	750.0
					Vert. Component	=			
					Total =		4,250.2 lbs	**R.M.=**	11,934.3

* 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
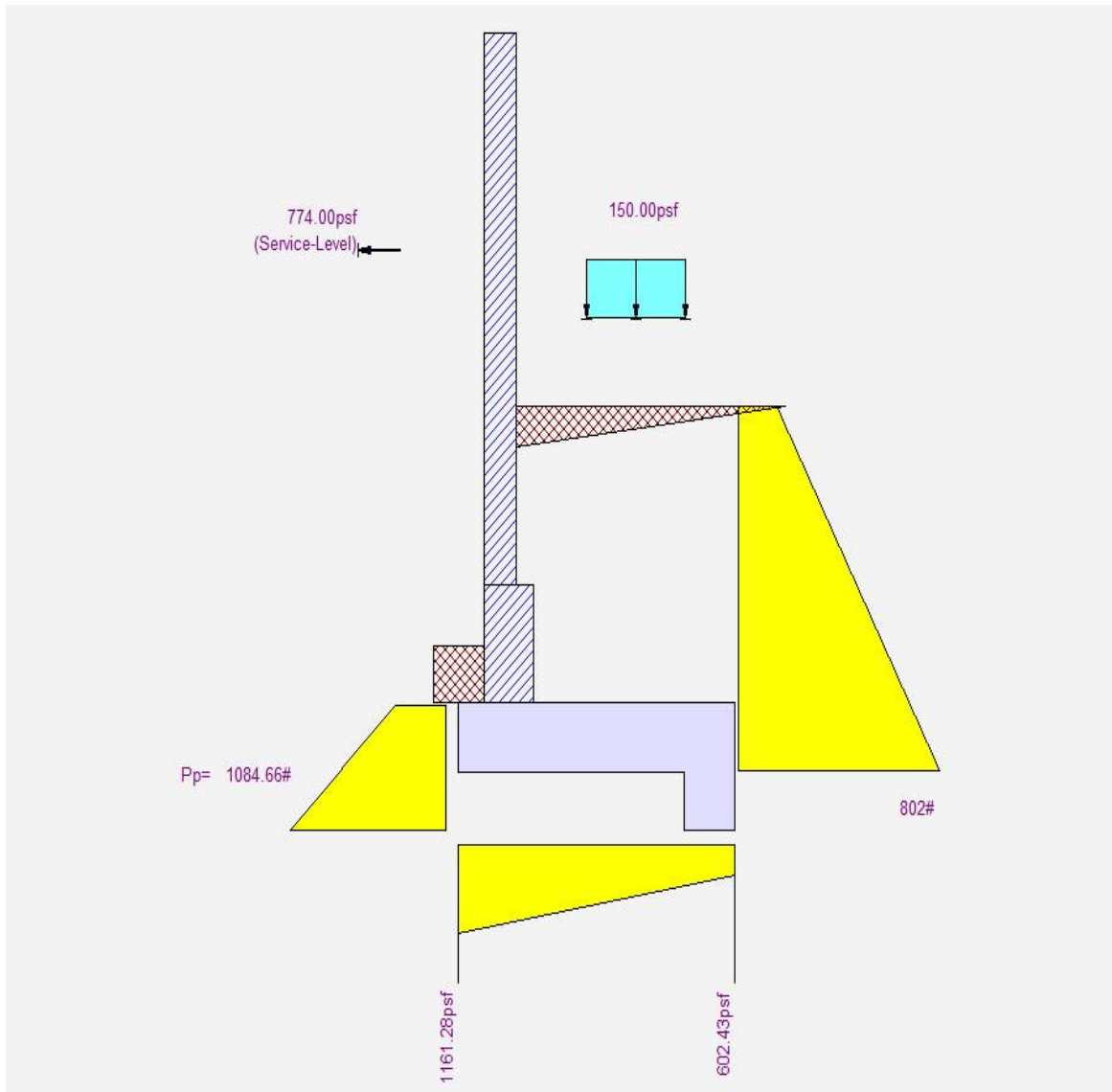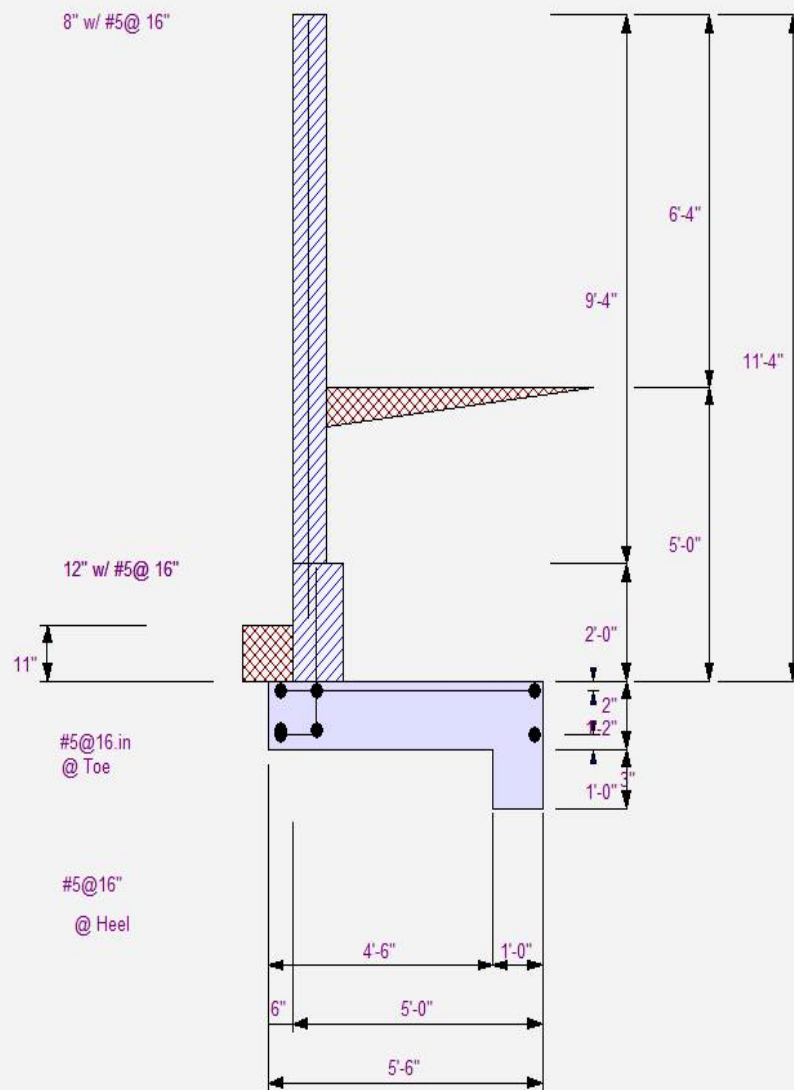the calculation of Overturning Resistance.

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)	0.066	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.

774.00psf
(Service-Level)

150.00psf

Pp=   1084.66#

802#

1161.28psf

602.43psf

8" w/ #5@ 16"

12" w/ #5@ 16"

11"

#5@16.in
@ Toe

#5@16"
@ Heel

6'-4"

9'-4"

11'-4"

5'-0"

2'-0"

2"
2"

1'-0"

3"

4'-6"

1'-0"

6"

5'-0"

5'-6"

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Title   **Ceres: 3 Lots**
Job # :   Dsgnr: **GATS&M**
Description....
Retaining wall with Seismic Load

Page : 1
Date: 3 SEP 2018

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Cantilevered Retaining Wall

Code: CBC 2016,ACI 318-14,ACI 530-13

Wall: ☐ Concrete ▨ Masonry

Designer to determine bar cutoff locations

| 0.0 lbs | 60.0 lbs | 120.0 lbs | 180.0 lbs | 240.0 lbs | 300.0 lbs | 360.0 lbs | 420.0 lbs | 480.0 lbs | 540.0 lbs |

11.33 ft

5.00 ft   Top of Soil

2.00 ft

Applied Shear Diagram

0.00 ft

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Title **Ceres: 3 Lots**
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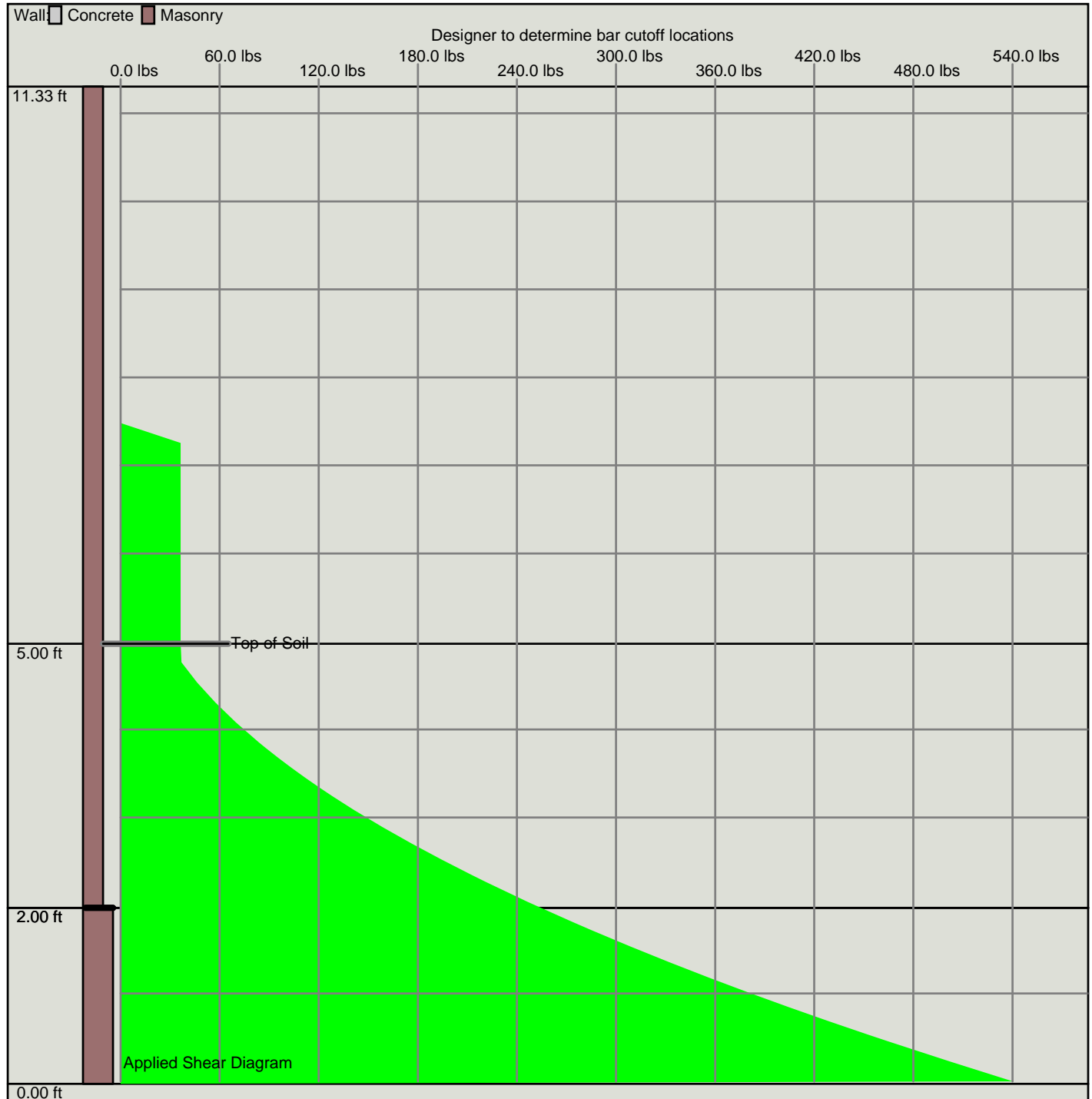Description....
Retaining wall with Seismic Load

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Cantilevered Retaining Wall

Code: CBC 2016,ACI 318-14,ACI 530-13

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Job # :   Dsgnr: **Gats&m**
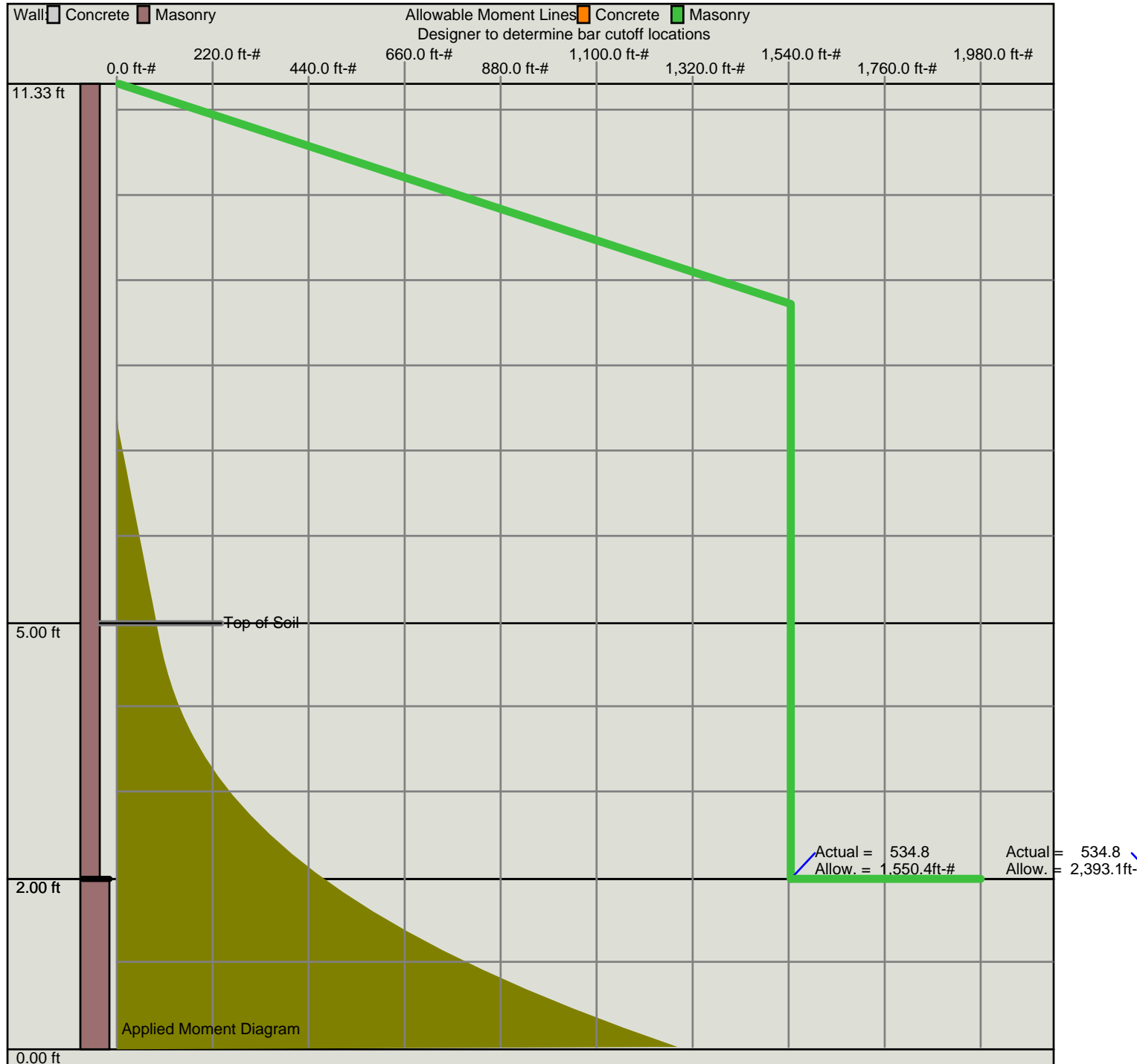Description....
Retaining Wall with wind loads

Page : 1
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Cantilevered Retaining Wall
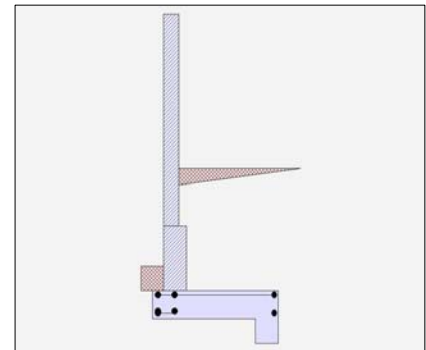
Code: IBC 2012,ACI 318-11,ACI 530-11

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	6.33 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	30.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Surcharge Loads

Surcharge Over Heel	=	150.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

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

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)	=	16.0 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	=	4.40 OK
Sliding	=	3.27 OK
Total Bearing Load	=	4,849 lbs
...resultant ecc.	=	4.99 in
Soil Pressure @ Toe	=	1,282 psf OK
Soil Pressure @ Heel	=	482 psf OK
Allowable	=	1,333 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,795 psf
ACI Factored @ Heel	=	674 psf
Footing Shear @ Toe	=	4.7 psi OK
Footing Shear @ Heel	=	0.8 psi OK
Allowable	=	82.2 psi

Sliding Calcs

Lateral Sliding Force	=	864.4 lbs
less 100% Passive Force	= -	1,128.5 lbs
less 100% Friction Force	= -	1,699.8 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 pressures.

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

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	2.67	2.67	0.00
Wall Material Above "Ht"	=	Masonry	Masonry	Masonry
Design Method	=	ASD	ASD	ASD
Thickness	=	8.00	12.00	12.00
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	16.00	16.00	16.00
Rebar Placed at	=	Center	Center	Center
Design Data				
fb/FB + fa/Fa	=	**0.471**	**0.305**	**0.984**
Total Force @ Section				
Service Level	lbs =	278.0	278.0	680.8
Strength Level	lbs =			
Moment....Actual				
Service Level	ft-# =	730.8	730.8	1,963.3
Strength Level	ft-# =			
Moment.....Allowable	ft-# =	1,550.4	2,393.1	1,994.2
Shear.....Actual				
Service Level	psi =	5.8	3.8	9.3
Strength Level	psi =			
Shear.....Allowable	psi =	45.9	45.2	45.9
Anet (Masonry)	in2 =	47.54	73.02	73.02
Rebar Depth 'd'	in =	3.75	5.75	5.75
Masonry Data				
f'm	psi =	1,500	1,500	1,500
Fs	psi =	32,000	24,000	20,000
Solid Grouting	=	No	No	No
Modular Ratio 'n'	=	21.48	21.48	21.48
Wall Weight	psf =	63.0	94.0	94.0
Short Term Factor	=	1.000	1.000	1.000
Equiv. Solid Thick.	in =	5.80	8.50	8.50
Masonry Block Type	=	Medium Weight		
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =			
Fy	psi =			

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Title **Ceres:3 Lots**
Job # :   Dsgnr: **Gats&m**
Description....
Retaining Wall with wind loads

Page : 2
Date: 3 SEP 2018

This Wall in File: c:\users\gerry\documents\retainpro 10 project files\ceres1.rpx

Cantilevered Retaining Wall

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

Footing Dimensions & Strengths

Toe Width	=	0.50 ft
Heel Width	=	5.00
Total Footing Width	=	5.50
Footing Thickness	=	14.00 in
Key Width	=	12.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	4.50 ft

f'c =   3,000 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	=	1,795	674	psf
Mu' : Upward	=	220	7,566	ft-#
Mu' : Downward	=	86	9,990	ft-#
Mu: Design	=	135	2,424	ft-#
Actual 1-Way Shear	=	4.71	0.79	psi
Allow 1-Way Shear	=	43.82	43.82	psi
Toe Reinforcing	=	# 5 @ 16.00 in		
Heel Reinforcing	=	# 5 @ 16.00 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: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm

Min footing T&S reinf Area	1.66	in2
Min footing T&S reinf Area per foot	0.30	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 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	=	570.4	2.06	1,172.5	Soil Over Heel	=	2,200.0	3.50	7,700.0
Surcharge over Heel	=	192.7	3.08	594.2	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	=	101.3	9.33	945.1	* Axial Live Load on Stem	=			
	=				Soil Over Toe	=	55.0	0.25	13.8
					Surcharge Over Toe	=			
Total		864.4	**O.T.M.**	2,711.8	Stem Weight(s)	=	796.6	0.89	705.6
	=		=		Earth @ Stem Transitions	=	85.4	1.33	113.9
Resisting/Overturning Ratio		=	**4.40**		Footing Weight	=	962.5	2.75	2,646.9
Vertical Loads used for Soil Pressure =		4,849.5	lbs		Key Weight	=	150.0	5.00	750.0
					Vert. Component	=			
					Total =		4,249.5 lbs	**R.M.=**	11,930.2

* 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
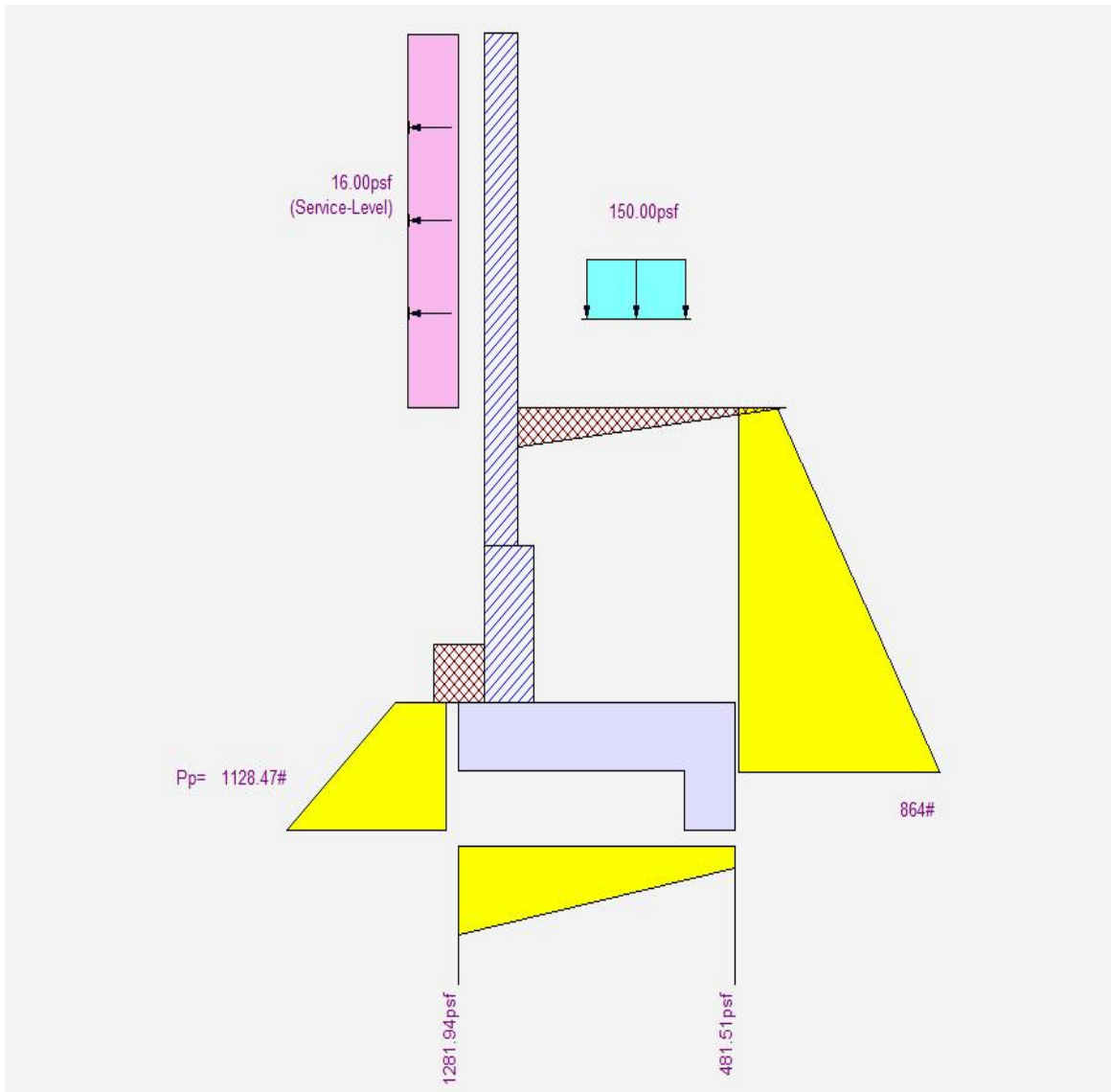the calculation of Overturning Resistance.

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)	0.073	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.

16.00psf
(Service-Level)

150.00psf

Pp= 1128.47#

864#

1281.94psf

481.51psf

8" w/ #5@ 16"

12" w/ #5@ 16"

1'-0"

#5@16.in
@ Toe

#5@16"

@ Heel

6'-4"

8'-8"

11'-4"

5'-0"

2'-8"

2"

2"

1'-0"

4'-6"

1'-0"

6"

5'-0"

5'-6"

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Page : 1
Date: 3 SEP 2018

This Wall in File: c:\users\gerry\documents\retainpro 10 project files\ceres1.rpx

Cantilevered Retaining Wall

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

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Title   **Ceres: 3 Lots**
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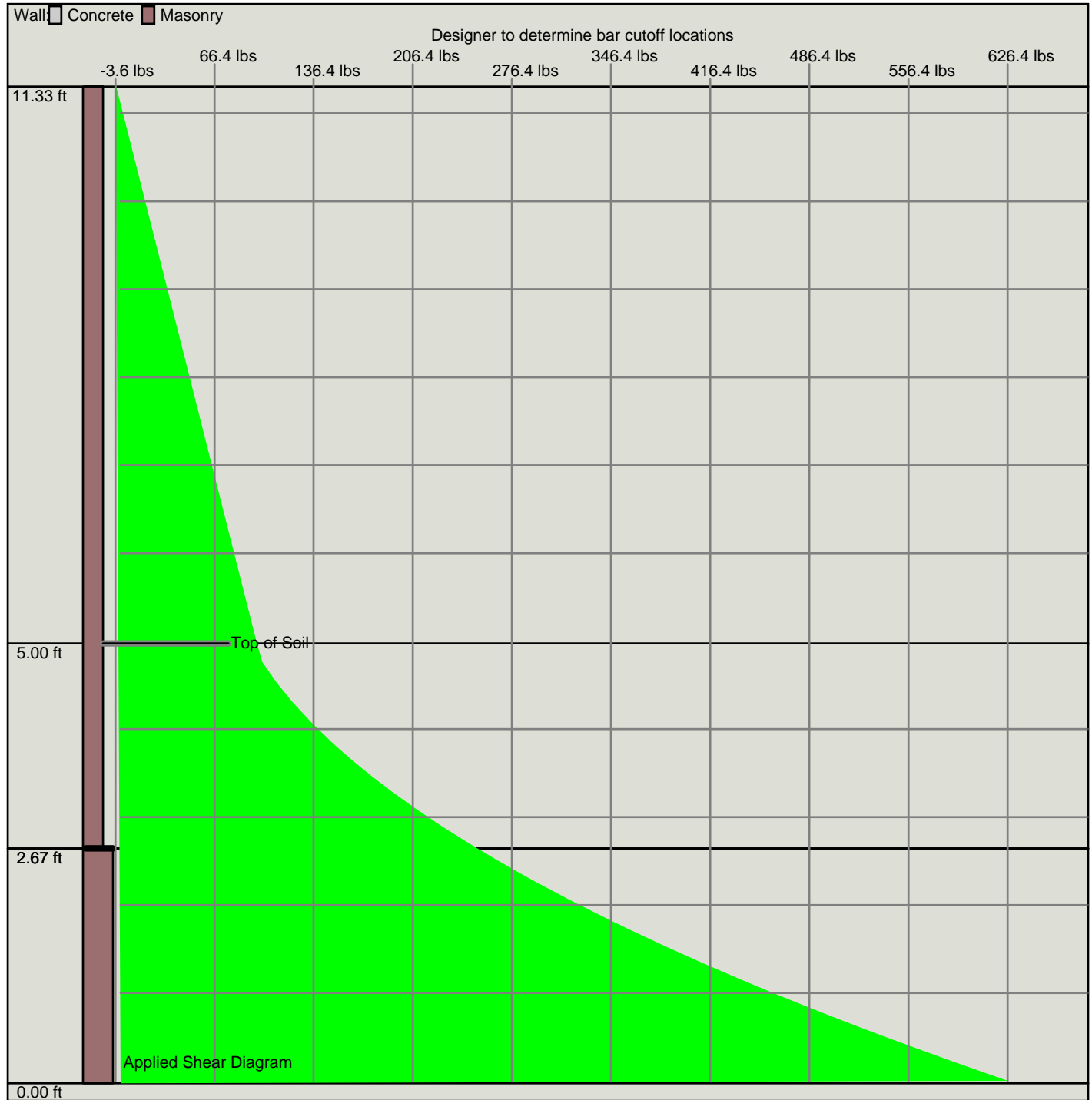Description....
Retaining Wall with wind loads

Page : 1
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Cantilevered Retaining Wall

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

Wall: ☐ Concrete ☐ Masonry   Allowable Moment Lines ☐ Concrete ☐ Masonry
Designer to determine bar cutoff locations

| 0.0 ft-# | 220.0 ft-# | 440.0 ft-# | 660.0 ft-# | 880.0 ft-# | 1,100.0 ft-# | 1,320.0 ft-# | 1,540.0 ft-# | 1,760.0 ft-# | 1,980.0 ft-# |

11.33 ft

5.00 ft — Top of Soil

2.67 ft

Actual =   730.8
Allow. = 1,550.4ft-#

Actual =   730.8
Allow. = 2,393.1ft-#

Applied Moment Diagram

0.00 ft

OUTSIDE PROPERTY | INSIDE PROPERTY

PROPERTY LINE

MORTAR CAP

8"

FS
SEE PLAN

#5 @ 24" O.C.
HORIZONTAL BARS

8" x 8" x 16" CMU

#5 @ 16" O.C.
(GROUT ALL CELLS
WITH REBAR)

FINISH GRADE

VARIES FROM 9.33'* TO 11.33' (MAX.)

6.0' MIN.

5.0' MAX.

EQ EQ

#5 @ 16" O.C.
(GROUT ALL CELLS WITH REBAR)

MORTAR

8" x 12" x 16" CMU

3" DIA. PVC PIPE WEEP HOLES SPACED
AT EVERY 10' O.C. WITH 1 CU.FT.
CLEAN GRAVEL WRAPPED BY
NON-WOVEN MATERIAL (MIRAFI 140N OR
APPROVED EQUAL WITH

EX. GRADE

12"

4' LAP

2' SOLID GROUTED

2"

12" MIN.

6"

OVER-EXCAVATE & RECOMPACT
TO 95% PER ASTM D1557

3" CLR
TYP

1'-2"

2'-0" MIN.

3" CLR TYP.

6" MIN.

3" CLR.

12" MIN.

12"

12"

#5 @ 16" O.C.
TOP & BOTTOM

#5 @ 16" O.C.

#5 @ 16" O.C.

IMPERVIOUS
MATERIAL

6" SCARIFIED AND COMPACTED
TO AT LEAST 90% OF THE
MAXIMUM DRY DENSITY AT
MOISTURE CONTENT WITHIN 3%
OF OPTIMUM PER ASTM D1557

12"
MIN.

2' MIN.

5.5'

2.0'

* KEEP EXPOSED WALL HEIGHT
TO 6' MIN. AS POSSIBLE.

TYPICAL WALL SECTION
NOT TO SCALE

(4)