

**Structural Calculations
Project #25186**

**USDC
Equestrian Center
American Fork, Utah**

CLIENT INFORMATION:

**Design Sequence
350 S 200 E, 106
Salt Lake City, Utah 84111**



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WCA Structural Engineering, Inc.

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Bountiful, Utah 84010
(801) 298-1118

JOB TITLE USDC - Equestrian Center

American Fork, Utah

JOB NO. 25186

SHEET NO. _____

CALCULATED BY JC

DATE 9/23/25

CHECKED BY _____

DATE _____

CS2021 Ver 2023-05-14

STRUCTURAL CALCULATIONS

FOR

USDC - Equestrian Center

American Fork, Utah



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Code Search

Code: International Building Code 2021

Risk Category & Importance Factors:

Risk Category = II

Wind factor = 1.00

Snow factor = 1.00

Seismic factor = 1.00

Building Geometry:

Roof angle (θ) 2.00 / 12 9.5 deg

Building length Least 100.0 ft

width 70.0 ft

Live Loads:

Roof 0 to 200 sf: 20 psf

200 to 600 sf: 24 - 0.02Area, but not less than 12 psf

over 600 sf: 12 psf

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Wind Loads :

ASCE 7- 16

Ultimate Wind Speed	103 mph
Nominal Wind Speed	79.8 mph
Risk Category	II
Exposure Category	C
Enclosure Classif.	Enclosed Building
Internal pressure	+/-0.18
Directionality (Kd)	0.85
Kh case 1	0.902
Kh case 2	0.902
Type of roof	Monoslope

Topographic Factor (Kzt)

Topography	Flat
Hill Height (H)	80.0 ft
Half Hill Length (Lh)	100.0 ft
Actual H/Lh =	0.80
Use H/Lh =	0.50
Modified Lh =	160.0 ft
From top of crest: x =	50.0 ft
Bldg up/down wind?	downwind

H/Lh= 0.50 $K_1 = 0.000$

x/Lh = 0.31 $K_2 = 0.792$

z/Lh = 0.13 $K_3 = 1.000$

At Mean Roof Ht:

$$K_{zt} = (1+K_1K_2K_3)^2 = 1.00$$

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Wind Loads - MWFRS $h \leq 60'$ (Low-rise Buildings) except for open buildings

$K_z = K_h$ (case 1) = 0.90
 Base pressure (q_h) = 17.5 psf
 GC_{pi} = +/-0.18

Edge Strip (a) = 7.0 ft
 End Zone (2a) = 14.0 ft
 Zone 2 length = 35.0 ft

Wind Pressure Coefficients

Surface	CASE A $\theta = 9.5 \text{ deg}$			CASE B		
	GC _{pf}	w/GC _{pi}	w/+GC _{pi}	GC _{pf}	w/GC _{pi}	w/+GC _{pi}
1	0.44	0.62	0.26	-0.45	-0.27	-0.63
2	-0.69	-0.51	-0.87	-0.69	-0.51	-0.87
3	-0.40	-0.22	-0.58	-0.37	-0.19	-0.55
4	-0.33	-0.15	-0.51	-0.45	-0.27	-0.63
5				0.40	0.58	0.22
6				-0.29	-0.11	-0.47
1E	0.67	0.85	0.49	-0.48	-0.30	-0.66
2E	-1.07	-0.89	-1.25	-1.07	-0.89	-1.25
3E	-0.58	-0.40	-0.76	-0.53	-0.35	-0.71
4E	-0.49	-0.31	-0.67	-0.48	-0.30	-0.66
5E				0.61	0.79	0.43
6E				-0.43	-0.25	-0.61

Ultimate Wind Surface Pressures (psf)

1	10.8	4.5	-4.7	-11.0
2	-8.9	-15.2	-8.9	-15.2
3	-3.9	-10.2	-3.3	-9.6
4	-2.7	-9.0	-4.7	-11.0
5			10.2	3.9
6			-1.9	-8.2
1E	14.8	8.5	-5.3	-11.6
2E	-15.6	-21.9	-15.6	-21.9
3E	-7.0	-13.3	-6.1	-12.4
4E	-5.5	-11.8	-5.3	-11.6
5E			13.8	7.5
6E			-4.4	-10.7

Parapet

Windward parapet = 26.3 psf (GC_{pn} = +1.5)
 Leeward parapet = -17.5 psf (GC_{pn} = -1.0)

Windward roof overhangs = 12.3 psf (upward) add to windward roof pressure

Horizontal MWFRS Simple Diaphragm Pressures (psf)

Transverse direction (normal to L)

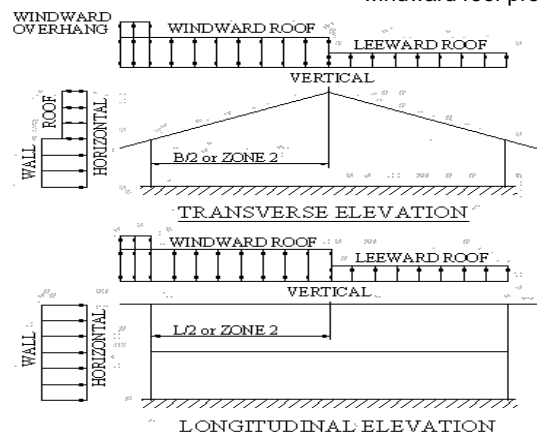
Interior Zone: Wall 13.5 psf
 Roof -5.0 psf **
 End Zone: Wall 20.3 psf
 Roof -8.6 psf **

Longitudinal direction (parallel to L)

Interior Zone: Wall 12.1 psf
 End Zone: Wall 18.2 psf

** NOTE: Total horiz force shall not be less than that determined by neglecting roof forces (except for MWFRS moment frames).

The code requires the MWFRS be designed for a min ultimate force of 16 psf multiplied by the wall area plus an 8 psf force applied to the vertical projection of the roof.



Seismic Loads:

IBC 2021

Strength Level Forces

Risk Category : II
 Importance Factor (Ie) : 1.00
 Site Class :) - code default

Ss (0.2 sec) = 134.70 %g
 S1 (1.0 sec) = 49.80 %g

A site specific ground motion analysis is required for seismically isolated structures or with damping systems, see ASCE7 11.4.8

Site specific ground motion analysis performed:

Fa = 1.200	Sms = 1.616	S _{DS} = 1.078	Design Category = D
Fv = 1.802	Sm1 = 0.897	S _{D1} = 0.598	Design Category = D

Seismic Design Category = **D**
 Redundancy Coefficient ρ = 1.00 Code exception must be met for ρ to equal 1.0
 Number of Stories: 1

Structure Type: All other building systems

Horizontal Struct Irregularities: No plan Irregularity

Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: Yes

Building System: **Moment-resisting Frame Systems**

Seismic resisting system: **Steel ordinary moment frames**

System Structural Height Limit: **System Not Permitted (see code footnote or 1613.4.1 for exceptions)**

Actual Structural Height (hn) = 20.0 ft

See ASCE7 Section 12.2.5 for exceptions and other system limitations

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 3.5
 Over-Strength Factor (Ωo) = 2.5
 Deflection Amplification Factor (Cd) = 3
 S_{DS} = 1.000 (Sds modified for Cs & Ev calculation since
 S_{D1} = 0.598 meets ASCE 7 section 12.8.1.3)

Seismic Load Effect (E) = Eh +/- Ev = ρ Q_E +/- 0.2S_{DS}D = Q_E +/- 0.200D Q_E = horizontal seismic force
 Special Seismic Load Effect (Em) = Emh +/- Ev = Ωo Q_E +/- 0.2S_{DS}D = 2.5Q_E +/- 0.216D D = dead load

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Snow Loads : ASCE 7- 16

Nominal Snow Forces

Roof slope = 9.5 deg
 Horiz. eave to ridge dist (W) = 70.0 ft
 Roof length parallel to ridge (L) = 100.0 ft

Type of Roof Monoslope
 Ground Snow Load Pg = 36.0 psf
 Risk Category = II
 Importance Factor I = 1.0
 Thermal Factor Ct = 1.20
 Exposure Factor Ce = 1.0

Pf = $0.7 \cdot Ce \cdot Ct \cdot I \cdot Pg$ = 30.0 psf
 Unobstructed Slippery Surface no

Sloped-roof Factor Cs = 1.00
 Balanced Snow Load = **30.0 psf**

Rain on Snow Surcharge Angle 1.40 deg
 Code Maximum Rain Surcharge 5.0 psf
 Rain on Snow Surcharge = 0.0 psf
 Ps plus rain surcharge = 30.2 psf
 Minimum Snow Load Pm = 20.0 psf

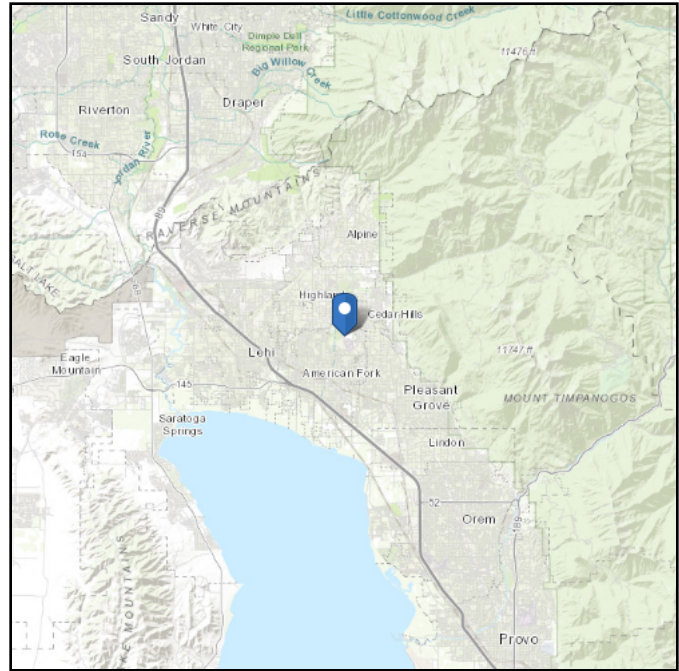
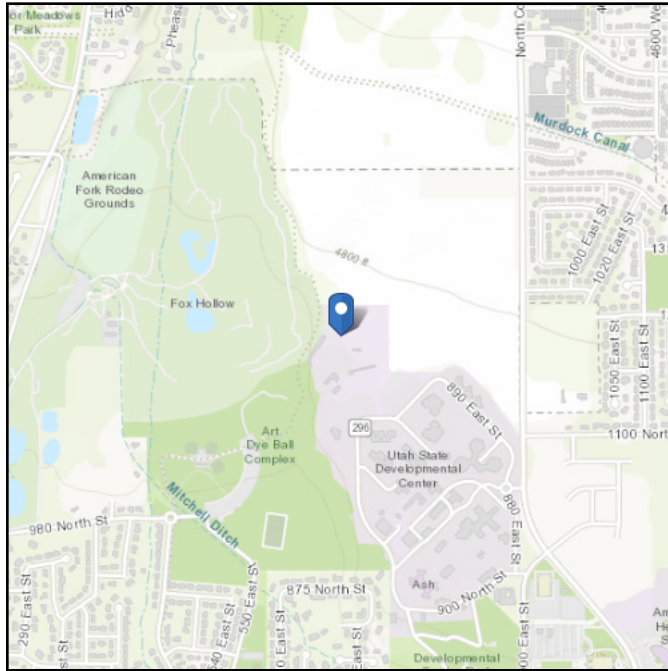
Uniform Roof Design Snow Load = **30.0 psf**

ASCE Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see Section 11.4.3)

Latitude: 40.401793
Longitude: -111.779809
Elevation: 4795.132287348428 ft (NAVD 88)



Wind

Results:

Wind Speed	103 Vmph
10-year MRI	73 Vmph
25-year MRI	79 Vmph
50-year MRI	84 Vmph
100-year MRI	89 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Mon Sep 22 2025

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_s :	1.347	S_{D1} :	N/A
S_1 :	0.498	T_L :	8
F_a :	1.2	PGA :	0.612
F_v :	N/A	PGA _M :	0.734
S_{MS} :	1.616	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.078	C_v :	1.369

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Mon Sep 22 2025

Date Source: [USGS Seismic Design Maps](#)

Snow

Results:

Mapped Elevation: 4795.1 ft
Data Source: ASCE/SEI 7-16, Table 7.2-8
Date Accessed: Mon Sep 22 2025

In "Case Study" areas, site-specific case studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2 percent annual probability of being exceeded (50-year mean recurrence interval).

Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow loads at elevations not covered.

Snow load values are mapped to a 0.5 mile resolution. This resolution can create a mismatch between the mapped elevation and the site-specific elevation in topographically complex areas. Engineers should consult the local authority having jurisdiction in locations where the reported 'elevation' and 'mapped elevation' differ significantly from each other.

Rain

Results:

15-minute Precipitation Intensity: 4.06 in./h

60-minute Precipitation Intensity: 1.69 in./h

Data Source: NOAA National Weather Service, Precipitation Frequency Data Server, Atlas 14
(<https://www.nws.noaa.gov/oh/hdsc/>)

Date Accessed: Mon Sep 22 2025

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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Utah Ground Snow Load Map

USDC Equestrian Center



Latitude: 40.402

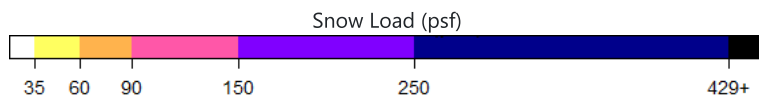
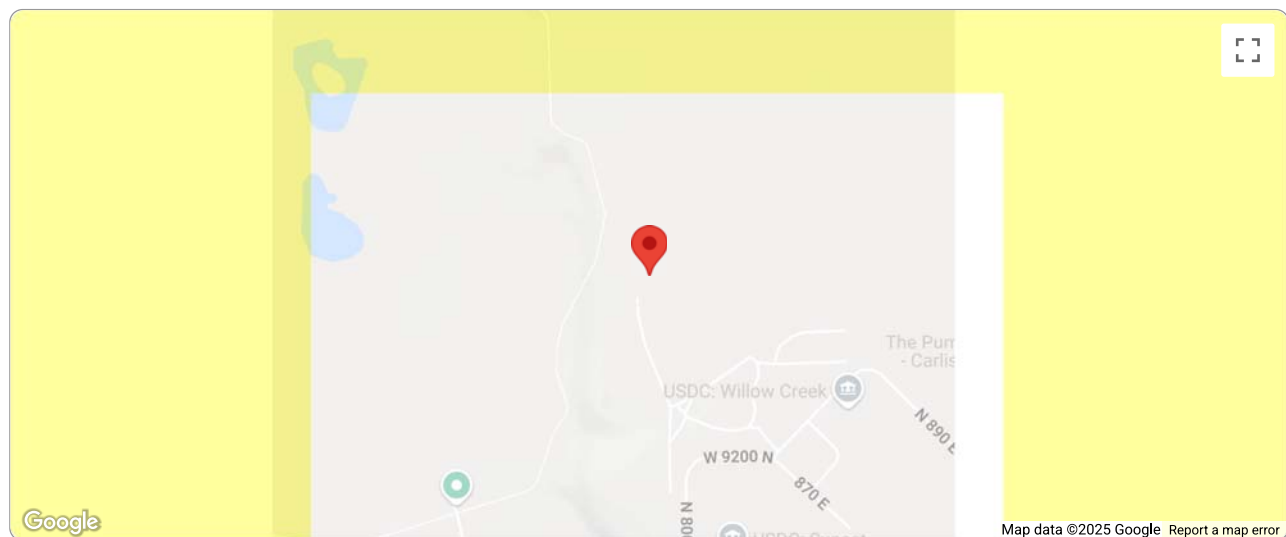
Longitude: -111.780

Elevation: 4,790 ft

Ground Snow Load:

36 psf / 1.72 kPa

*This document is not legally binding. The user is urged to verify ground snow load values with the local authority having jurisdiction.



These ground snow load values represent 50-year ground snow load estimated value at a 2% probability of exceedance for the location given. The grid used in the map is 3350ft by 3350ft. Elevations for these grid cells were estimated by aggregating data from 100ft by 100ft USGS digital elevation models and may not coincide with the actual site elevation. These predictions are calculated using the process outlined in The Utah Snow Load Study.¹

Final predictions given are bounded at a lower limit for a minimum ground snow load of 21 psf to meet ASCE 7. Estimated values for snow loads at elevations significantly higher than all nearby stations lead to unreasonably high snow load estimates, therefore, the predictions in the map are not allowed to extend beyond the highest 50-year station ground snow load of 429 psf. Elevations over 9,000 ft are also considered less accurate due to the limited number of stations at these elevations. The results shown in this report have included a warning if the results have reached or exceeded the upper limit.

While great efforts have been made to ensure these predictions are as accurate as possible, designers must use expert judgement to ensure that such predictions are appropriate for their particular project. The SEAU and the authors cannot accept responsibility for prediction errors or any consequences resulting therefrom.

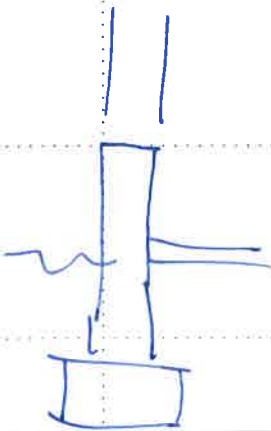
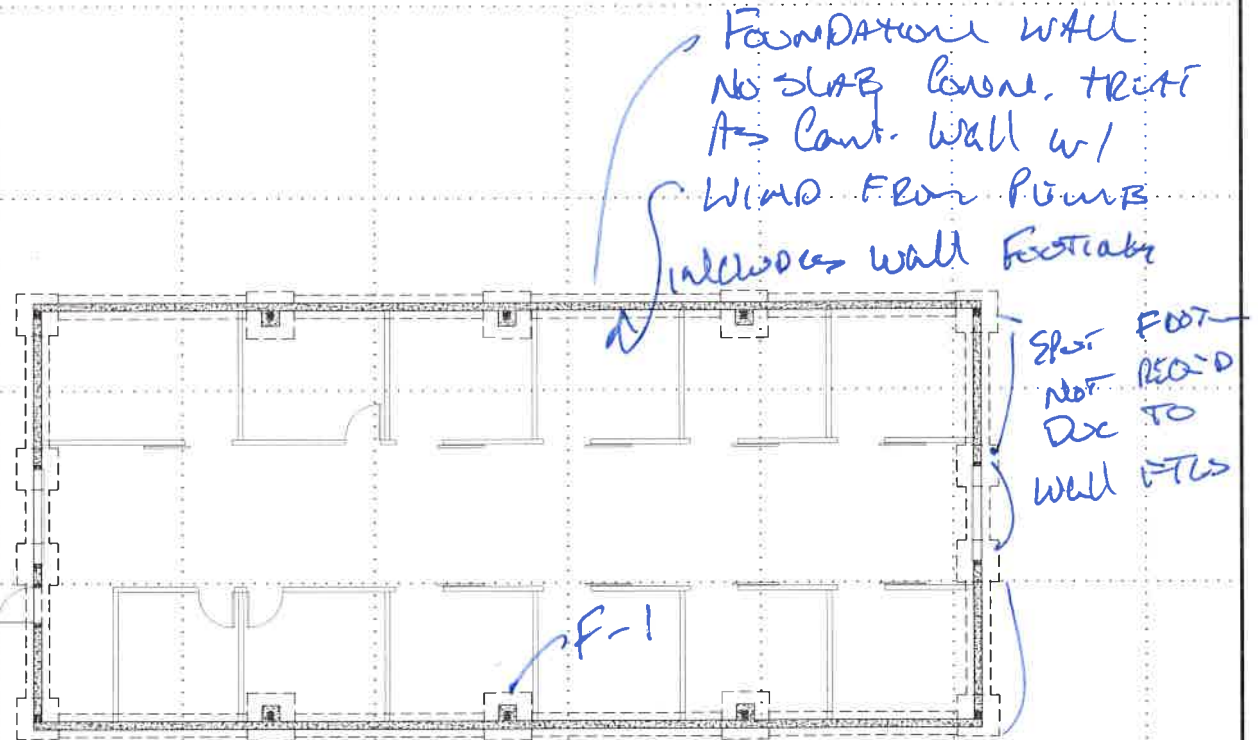
¹ Bean, Brennan; Maguire, Marc; and Sun, Yan, "The Utah Snow Load Study" (2018). Civil and Environmental Engineering Faculty Publications. Paper 3589.

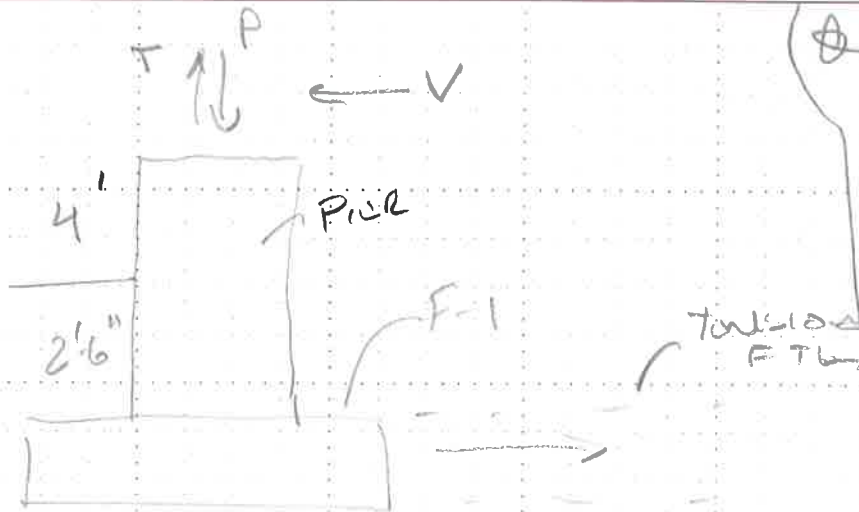


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CLIENT: _____ DATE: _____
TOPIC: STABLE ENGINEER: _____





⊗ Footings AND PRELIMINARY AND WILL BE UPDATED WHEN PERMS IS SUBMITTED

$P_{max} = 15k \downarrow$
 $T_{max} = 1.3k \uparrow$
 $V_{wind} = 6.1k \rightarrow$ (WIND)
 (ASD LOADS)

$F=1$
 $B = \sqrt{\frac{15.6}{1.5k/ft}} = 3.2k$

USE 4'-0" min w/ WIND RESISTANCE

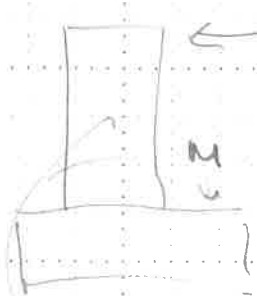
UPLIFT

4'-0" FTG PLUS + SOILS + FOUNDATION WILL IS SUFFICIENT FOR UPLIFT.

TENSION FOOTING

$A_s = \frac{P}{0.9(F_y)} = \frac{(6.1k)}{0.9(60k)} = 0.19in^2$

USE (2) # 4 min



$$V = \frac{6.16}{0.6} = 10.2 \text{ k (UCT)}$$

$$M_U = 10.2 \text{ k} (4' + 2.5') = 67 \text{ kip} \cdot \text{ft}$$

Pile 18" x 24" w/ (8) #6 & #3 TIES @ 12" O.C.

$$\phi M_n = 158 \text{ kip} \cdot \text{ft} > 67 \text{ kip} \cdot \text{ft}$$

$$\phi V_n = 62.6 \text{ k} > 10.2 \text{ k} \cdot \text{p}$$

OK

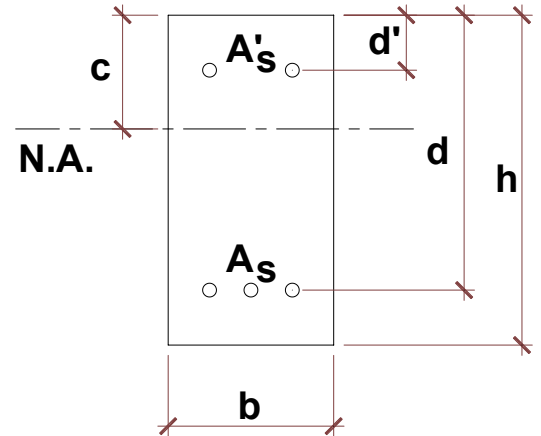
Concrete Beam Capacity - Doubly Reinforced w/ Shear steel

ACI 318-19 Building Code and Commentary
(Member capacity calculations)

Member:
Stable 18x24 Pier capacity

Concrete beam criteria:

- Beam span: $L := 6.5ft$
- Beam width: $b := 18in$
- Beam depth: $h := 24in$
- Depth to tensile steel: $d := 21in$
- Reinforcing bar size: #6
- Number of tension bars: $N := 4$
- Depth to compression steel: $d' := 3in$
- Reinforcing bar size: #6
- Number of tension bars: $N_c := 4$
- Shear reinforcing bar size: #4
- Number of shear bars: $N_v := 2$
- Spacing of shear bars/stirrups: $s := 12in$
- Support condition: Simply supported
- Concrete compressive strength: 3000 psi
- Reinforcing steel yield strength: 60 ksi
- Normal/light weight conc: Normal-weight Conc.
- Concrete weight: $w_c = 145.pcf$



Strength reduction factors (ACI 318-19, Table 21.2.1):

- Flexure reduction factor: $\phi_f := 0.9$
- Shear reduction factor: $\phi_v := 0.75$
- Factor β_1 (ACI 318-19, Table 22.2.2.4.3): $\beta_1 = 0.85$

Concrete capacity design: (ACI 318-19 Chapters 9 & 22)

Concrete calculations

Flexural capacity:

$$\phi M_n = 157.5 \cdot kip \cdot ft$$

Flexural reinforcing checks:

Percent of steel:

$$A_{s_check} = \text{"OK"}$$

Shear capacity:

Shear capacity based on concrete alone (no shear steel):

$$\phi V_c = 15.5 \cdot kip$$

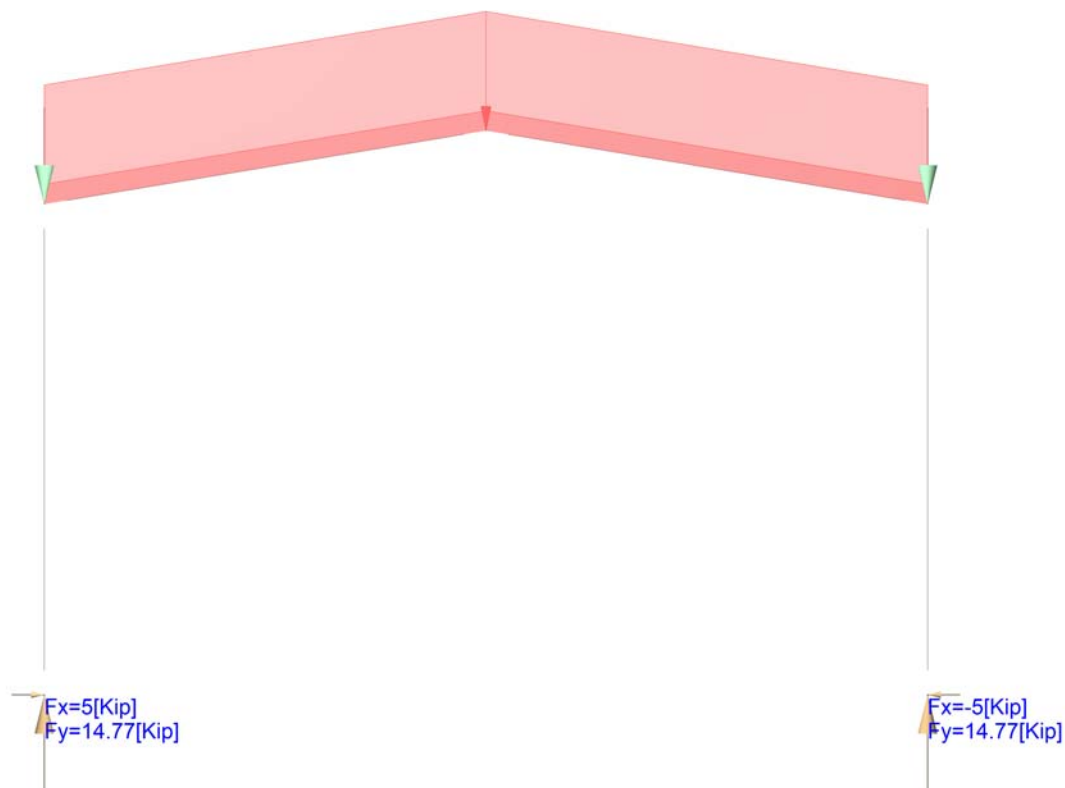
Shear capacity based on concrete and shear steel:

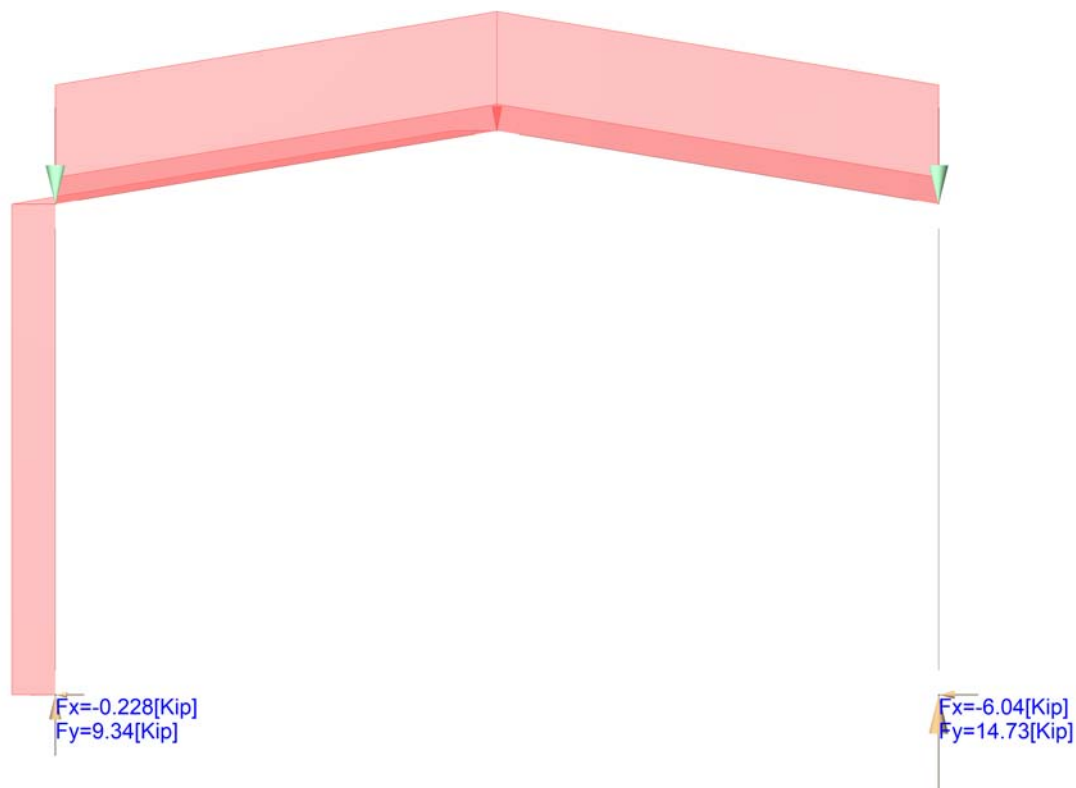
$$\phi V_n = 62.6 \cdot kip$$

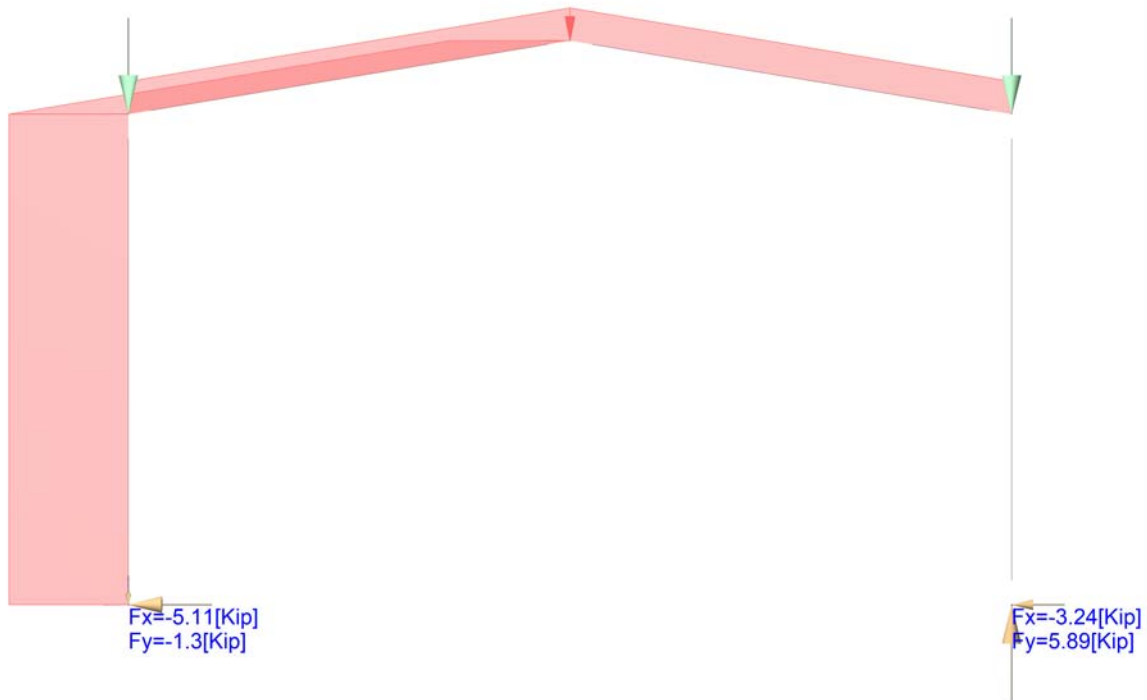
Minimum beam depth:

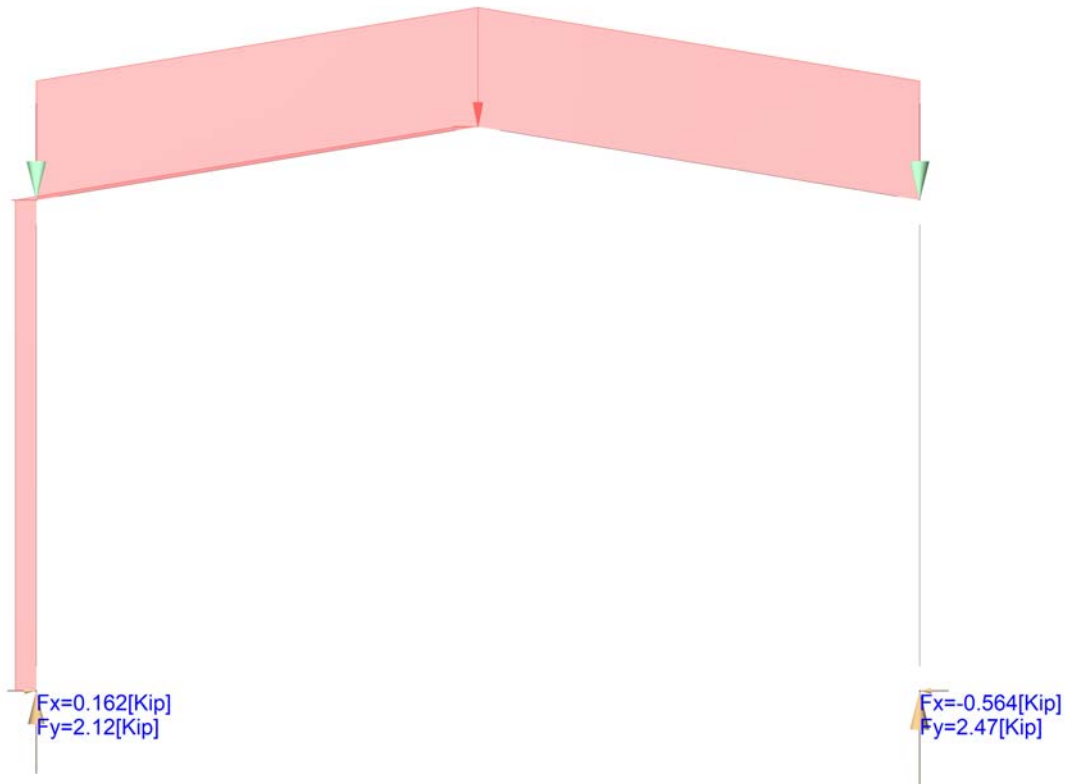
$$h_{min} = 4.9 \cdot in$$

$$h_{check} = \text{"OK"}$$







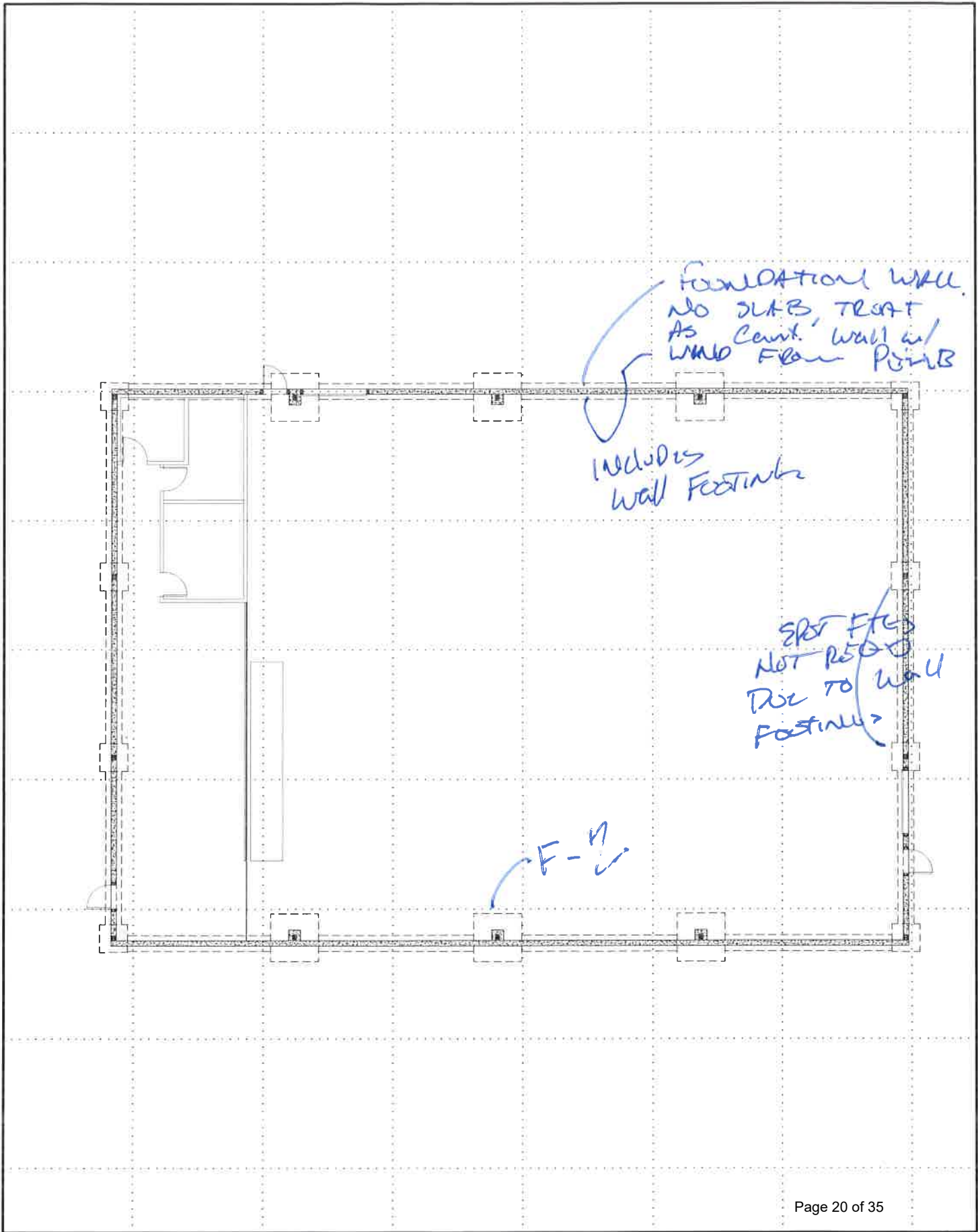




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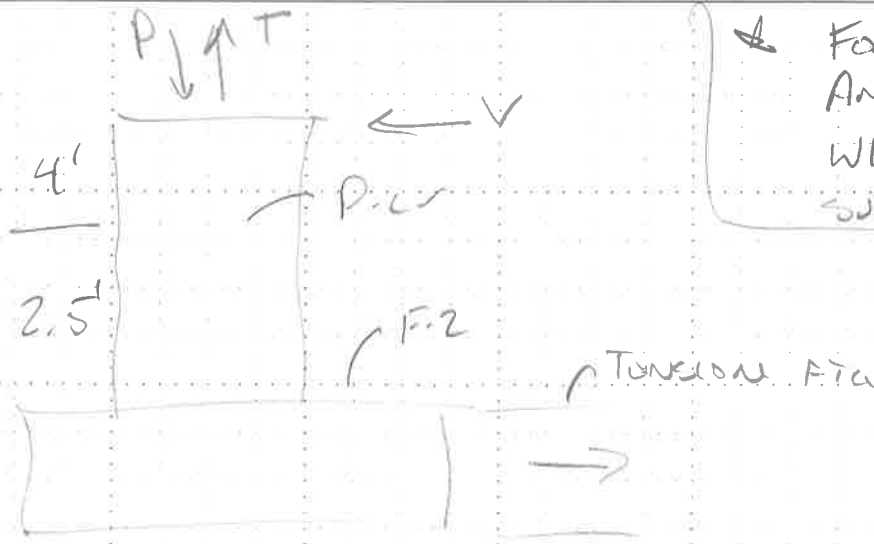
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PROJECT: USDG PROJECT #: _____
CLIENT: _____ DATE: _____
TOPIC: ARENA ENGINEER: _____





1 OF 2



FOOTINGS ARE PRELIM AND WILL BE UPDATED WHEN PERMB IS SUBMITTED

$P_{max} = 35k \uparrow$
 $T_{max} = 0k$
 $V_{max} = 24kip \rightarrow$ (WIND)
 (ADD LOADS)

F-2
 $B = \sqrt{\frac{35k}{1.5k/ft}} = 4.8ft$
 USE 6'-0"
 w/wind reinforcement

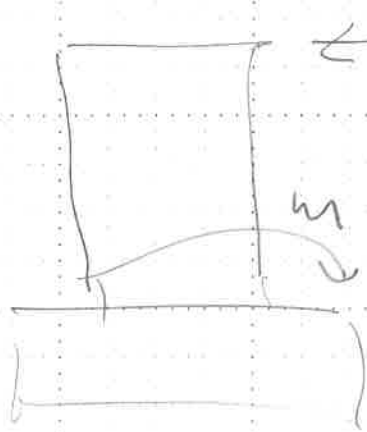
UPLIFT
 NONE

TENSION TIE

$A_s = \frac{P}{0.9F_y} = \frac{(24kip)}{0.9(60ksi)} = 0.74in^2$
 USE (2) #6



2 OF 2



$$\leftarrow V_u = \frac{24k}{0.6} = 40k$$

$$M_u = 40k(4 + 2.5)ft = 260 \text{ kip}\cdot\text{ft}$$

$$Pier = 20 \times 28'' \text{ w/}(12) \#6 \text{ \& } 4 \#3 \text{ ties}$$

$$\phi M_u = 278 \text{ kip}\cdot\text{ft} > 260 \text{ kip}\cdot\text{ft}$$

$$\phi V_u = 79 \text{ kip} > 40 \text{ k}$$

OK

Concrete Beam Capacity - Doubly Reinforced w/ Shear steel

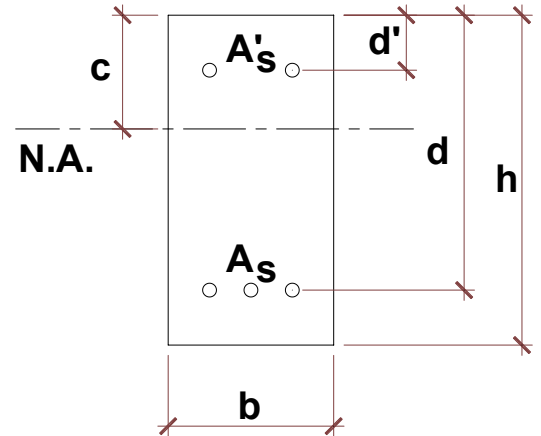
ACI 318-19 Building Code and Commentary
(Member capacity calculations)

Member:

Arena 20x28 Pier capacity

Concrete beam criteria:

- Beam span: $L := 6.5ft$
- Beam width: $b := 20in$
- Beam depth: $h := 28in$
- Depth to tensile steel: $d := 25in$
- Reinforcing bar size: #6
- Number of tension bars: $N := 6$
- Depth to compression steel: $d' := 3in$
- Reinforcing bar size: #6
- Number of tension bars: $N_c := 6$
- Shear reinforcing bar size: #4
- Number of shear bars: $N_v := 2$
- Spacing of shear bars/stirrups: $s := 12in$
- Support condition: Simply supported
- Concrete compressive strength: 3000 psi
- Reinforcing steel yield strength: 60 ksi
- Normal/light weight conc: Normal-weight Conc.
- Concrete weight: $w_c = 145.pcf$



Strength reduction factors (ACI 318-19, Table 21.2.1):

- Flexure reduction factor: $\phi_f := 0.9$
- Shear reduction factor: $\phi_v := 0.75$
- Factor β_1 (ACI 318-19, Table 22.2.2.4.3): $\beta_1 = 0.85$

Concrete capacity design: (ACI 318-19 Chapters 9 & 22)

Concrete calculations

Flexural capacity:

$$\phi M_n = 278.5 \cdot kip \cdot ft$$

Flexural reinforcing checks:

Percent of steel:

$$A_{s_check} = \text{"OK"}$$

Shear capacity:

Shear capacity based on concrete alone (no shear steel):

$$\phi V_c = 20.5 \cdot kip$$

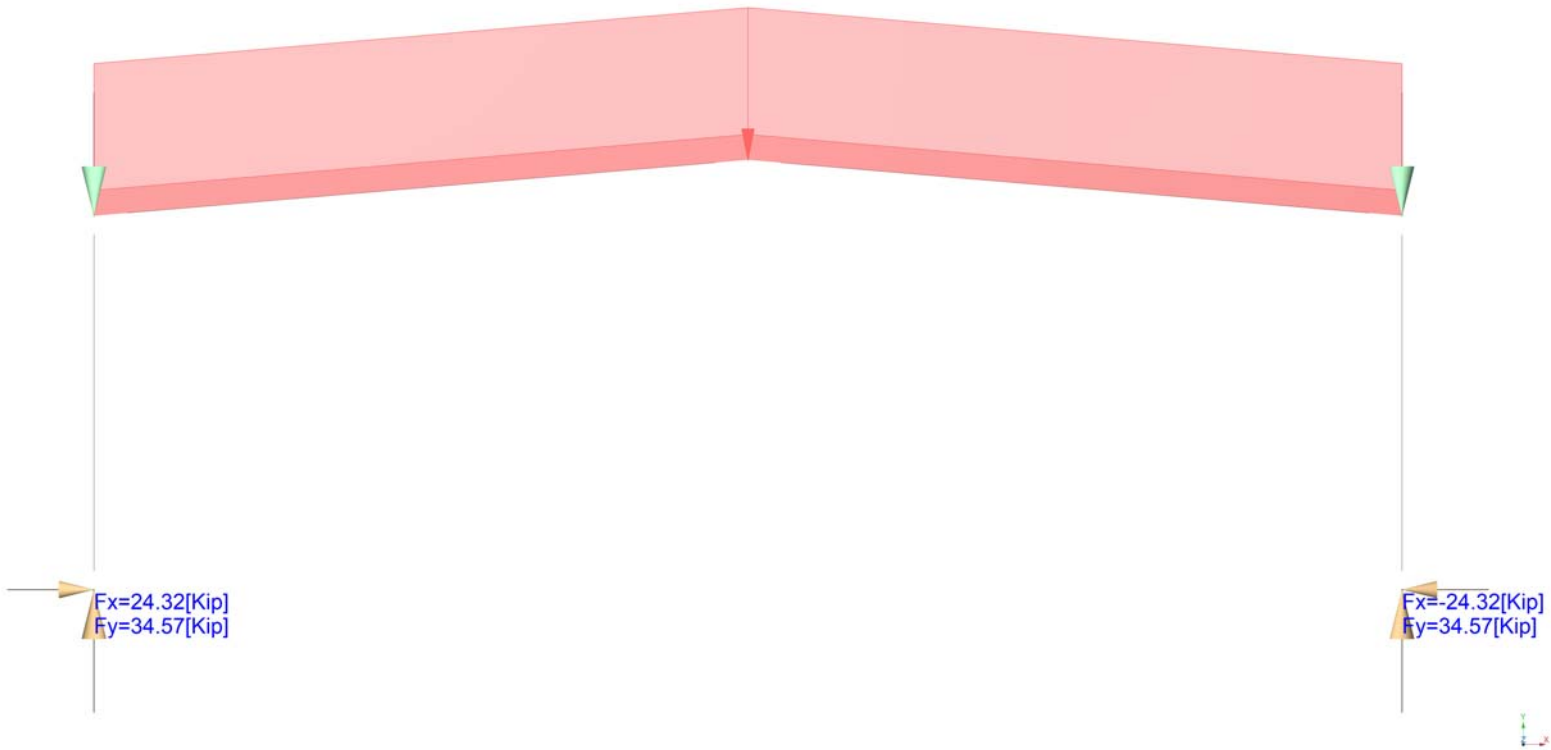
Shear capacity based on concrete and shear steel:

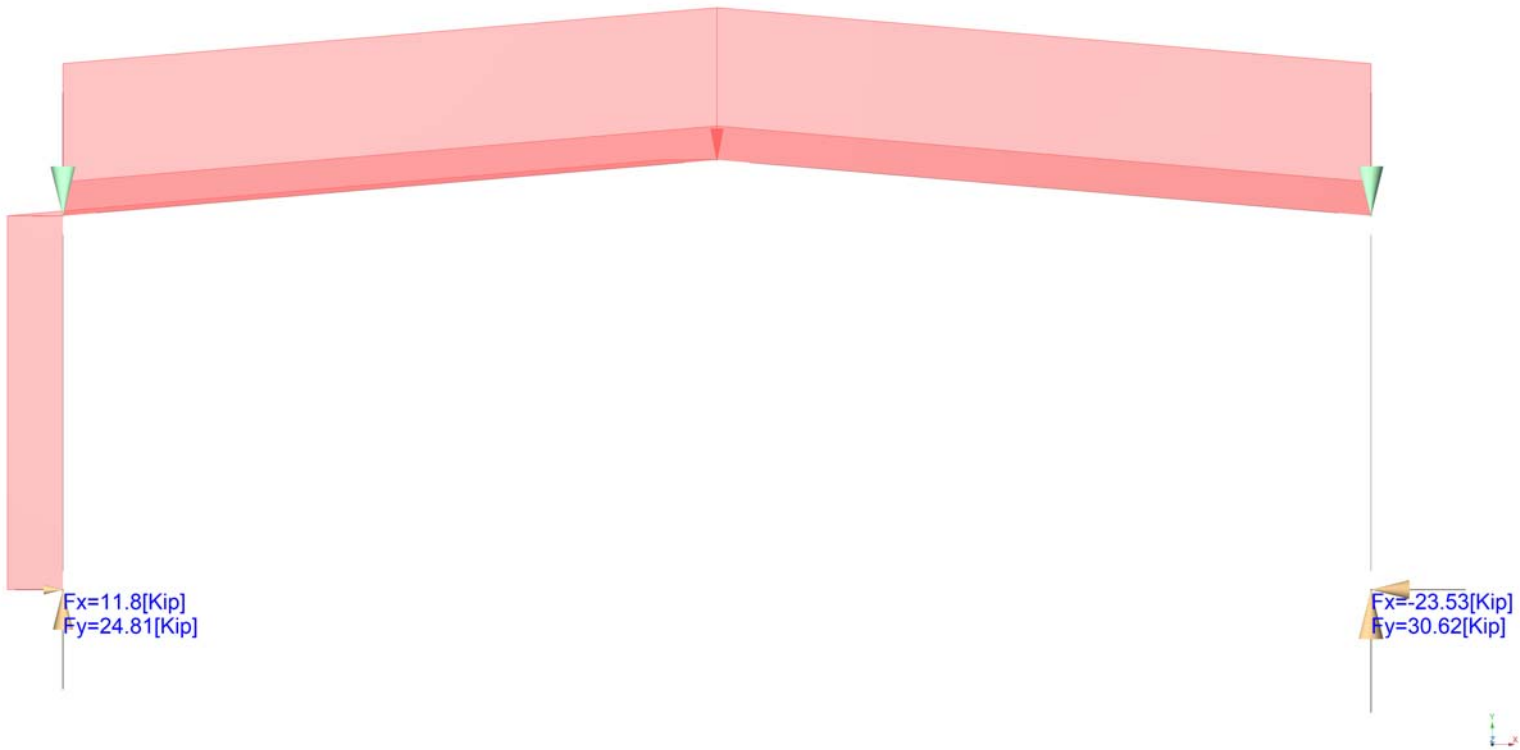
$$\phi V_n = 78.6 \cdot kip$$

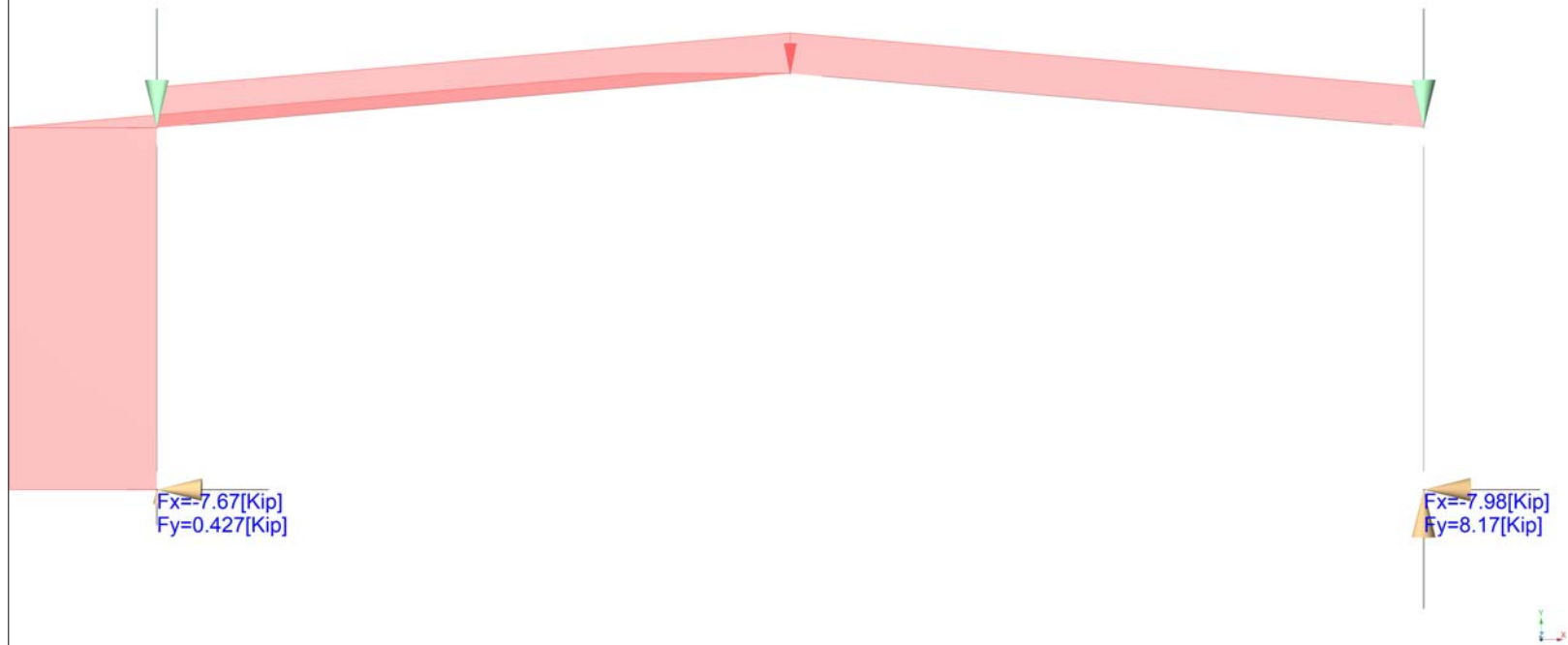
Minimum beam depth:

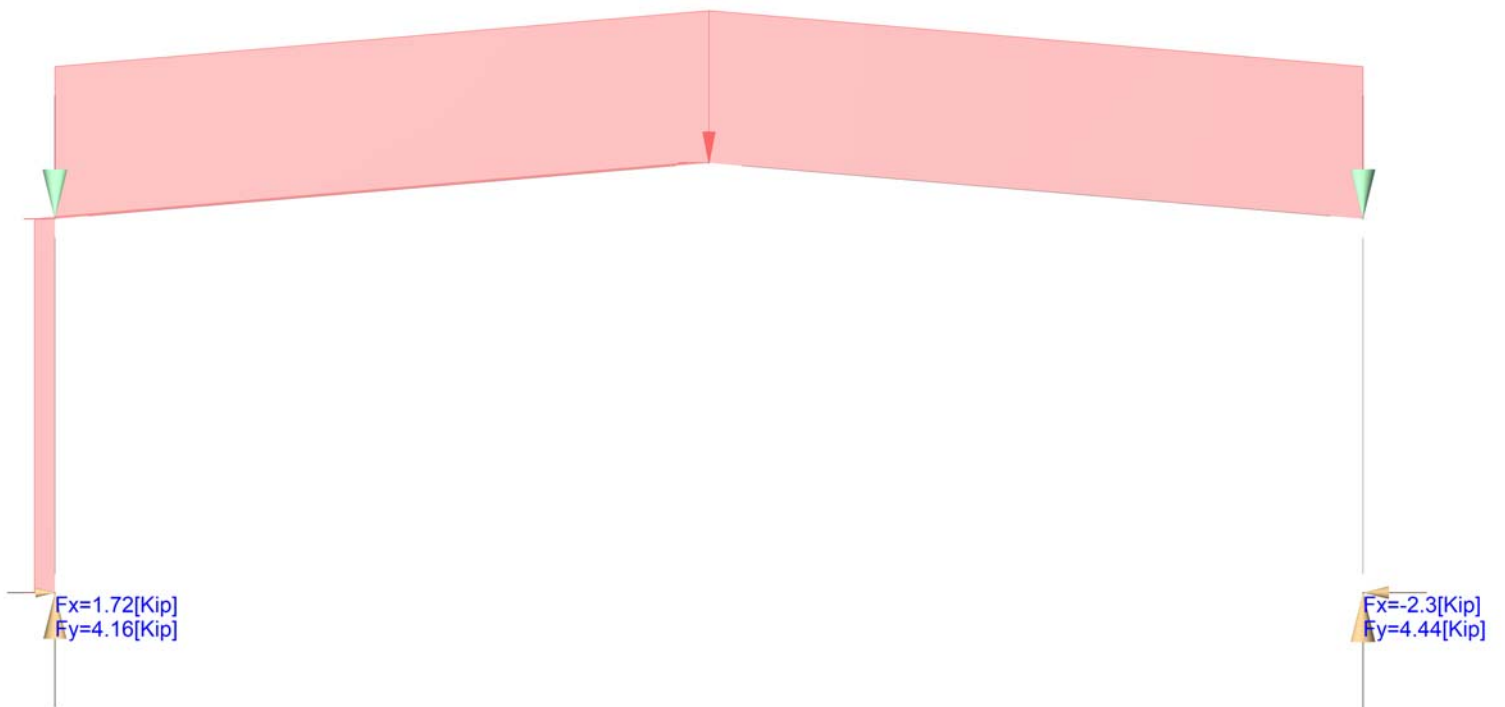
$$h_{min} = 4.9 \cdot in$$

$$h_check = \text{"OK"}$$











Structural
Engineering inc.

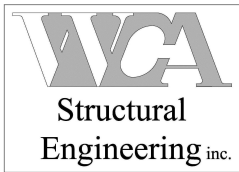
442 North Main Street, Bountiful, Utah 84010
801-298-1118 Office 801-298-1122 Fax
wca@wcaeng.com

PROJECT: _____ PROJECT #: _____

CLIENT: _____ DATE: _____

TOPIC: Anchor Rods ENGINEER: Jc

All Anchor Rods will be designed
upon RMB Design Submittal
and Review. Note has been
placed on plan noting design is
preliminary and must be reviewed
prior to construction.



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Project Title: **USDC - Equestrian Center**
 Engineer: **JSC**
 Project ID: **25186**
 Project Descr:

Printed: 23 SEP 2025, 3:23PM

Cantilevered Retaining Wall

Project File: 25186.ec6

LIC# : KW-06017521, Build:20.25.05.07

WCA STRUCTURAL ENGINEERING INC.

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Code Reference

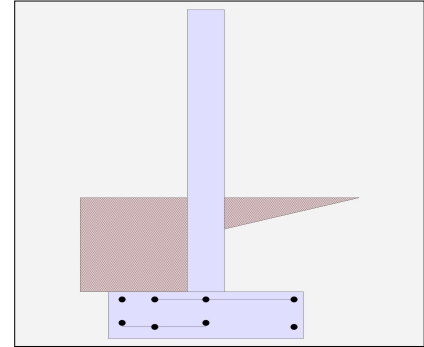
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	2.00 ft
Wall height above soil	=	4.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	24.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	55.0 psf/ft
Passive Pressure	=	300.0 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	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

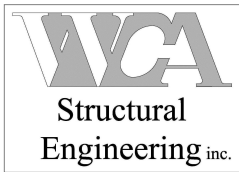
Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	360.0 #/ft
...Height to Top	=	6.00 ft
...Height to Bottom	=	5.00 ft
Load Type	=	Wind (W) (Strength Level)
Wind on Exposed Stem	=	22.4 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	=	Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300



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Design Summary

Wall Stability Ratios

Overtuning	=	1.73	OK
Sliding	=	3.73	OK
Global Stability	=	5.02	
Total Bearing Load	=	1,825	lbs
...resultant ecc.	=	13.18	in
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,789	psf OK
Soil Pressure @ Heel	=	0	psf OK
Allowable	=	2,000	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,504	psf
ACI Factored @ Heel	=	0	psf
Footing Shear @ Toe	=	10.5	psi OK
Footing Shear @ Heel	=	5.5	psi OK
Allowable	=	82.2	psi

Sliding Calcs

Lateral Sliding Force	=	517.3	lbs
-----------------------	---	-------	-----

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

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

Design Height Above Ftc	ft =	Stem OK		
		0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 5		
Rebar Spacing	=	16.00		
Rebar Placed at	=	Center		

Design Data

fb/FB + fa/Fa	=	0.977
---------------	---	-------

Total Force @ Section

Service Level	lbs =	
Strength Level	lbs =	895.4

Moment....Actual

Service Level	ft-# =	
Strength Level	ft-# =	3,858.8

Moment.....Allowable	=	3,945.8
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Shear.....Actual

Service Level	psi =	
Strength Level	psi =	18.7

Shear.....Allowable	psi =	55.6
---------------------	-------	------

Anet (Masonry)	in2 =	
----------------	-------	--

Wall Weight	psf =	100.0
-------------	-------	-------

Rebar Depth 'd'	in =	4.00
-----------------	------	------

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

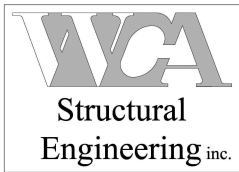
Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

Summary of Sliding Forces

	<u>FS = 1.0</u>	<u>FS = 1.5</u>
Lateral Force @ Base of Footing	517.26 lbs	775.89 lbs
less 100% Passive Force	- 1,200.0 lbs	- 1,200.0 lbs
less 100% Friction Force	- 730.10 lbs	- 730.10 lbs
Added Resisting Force Required	0.0 lbs	
Added Resisting Force Required for 1.5 Factor of Safety		0.00 lbs

Sliding Factor of Safety = 3.731: 1.00



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Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2329 in ² /ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in ² /ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.2329 in ² /ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in ² /ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.6503 in ² /ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.42 ft
Heel Width	=	2.08
Total Footing Width	=	3.50
Footing Thickness	=	12.00 in

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	= 2,504	0	psf
Mu' : Upward	= 1,906	0	ft-#
Mu' : Downward	= 446	446	ft-#
Mu: Design	= 1,460	446	ft-#
φ Mn	= 8,851	11,003	ft-#
Actual 1-Way Shear	= 10.54	5.52	psi
Allow 1-Way Shear	= 42.94	42.93	psi
Toe Reinforcing	= # 5 @ 16.00 in		
Heel Reinforcing	= # 5 @ 14.35 in		
Key Reinforcing	= None Spec'd		
Footing Torsion, Tu	=	0.00	ft-lbs
Footing Allow. Torsion, φ Tn	=	0.00	ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 0.91 in²
 Min footing T&S reinf Area per foot 0.26 in² /ft

If one layer of horizontal bars:

#4@ 9.26 in
 #5@ 14.35 in
 #6@ 20.37 in

If two layers of horizontal bars:

#4@ 18.52 in
 #5@ 28.70 in
 #6@ 40.74 in



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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)	247.5	1.00	247.5	Soil Over HL (ab. water tbl)	311.7	2.79	870.1
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.79	870.1
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 =			
Added Lateral Load =	216.0	6.50	1,404.0	* Axial Live Load on Stem =			
Load @ Stem Above Soil =	53.8	5.00	268.8	Soil Over Toe =	311.7	0.71	220.8
				Surcharge Over Toe =			
				Stem Weight(s) =	600.0	1.75	1,050.0
				Earth @ Stem Transitions =			
Total	= 517.3	O.T.M. =	1,920.3	Footing Weight =	525.0	1.75	918.8
				Key Weight =		1.58	
				Vert. Component =	76.9	3.50	269.2
Resisting/Overturning Ratio		= 1.73		Total =	1,825.3 lbs	R.M.=	3,328.8
Vertical Loads used for Soil Pressure =		1,825.3 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 considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

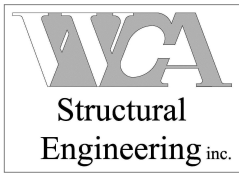
Tilt

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) 0.085 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.



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Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

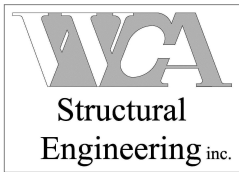
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) = 21.36 in

Development length for #5 bar specified in this stem design segment = 16.43 in

Hooked embedment length into footing for #5 bar specified in this stem design segment = 7.87 in

As Provided = 0.2325 in²/ft

As Required = 0.2329 in²/ft



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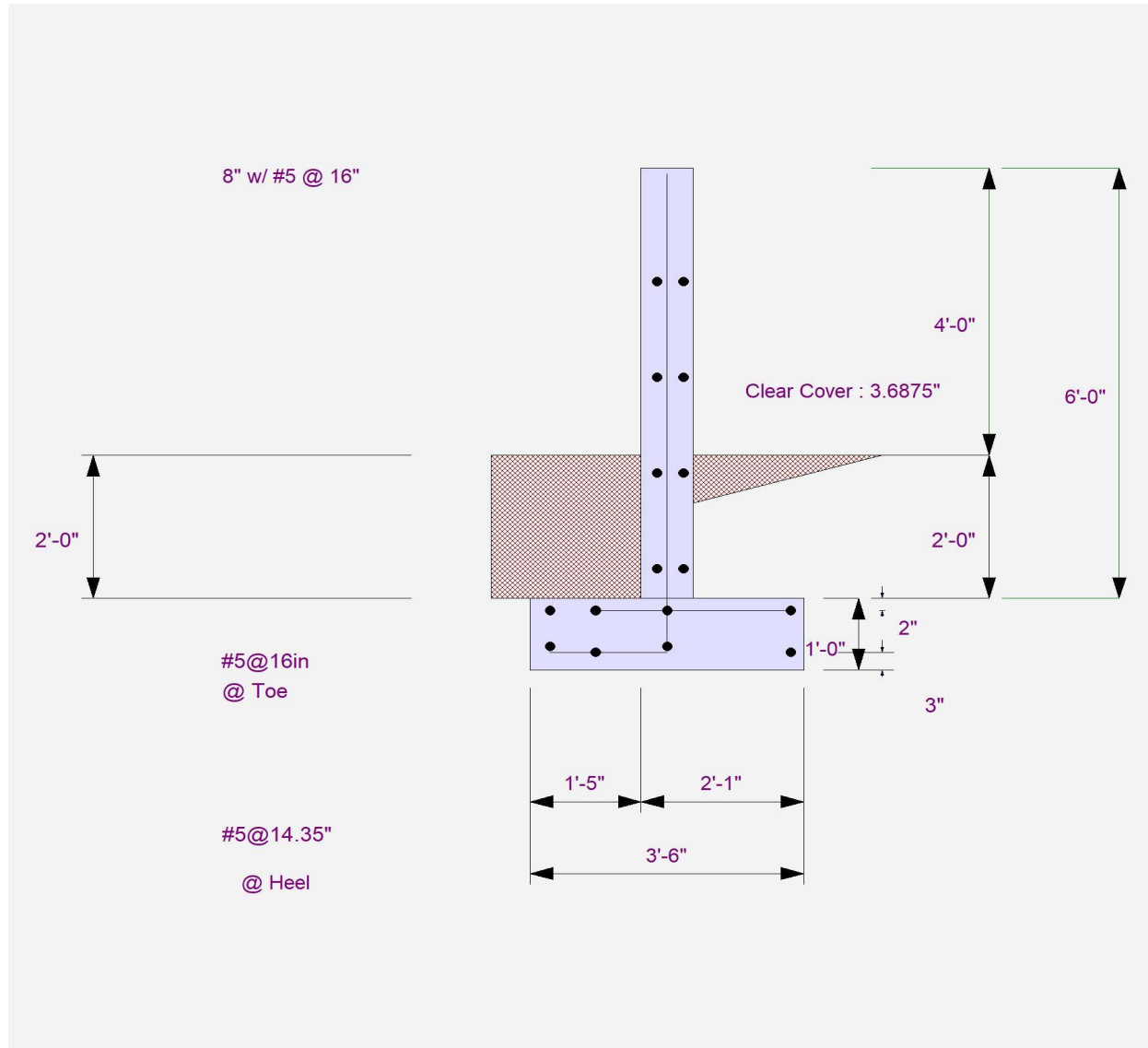
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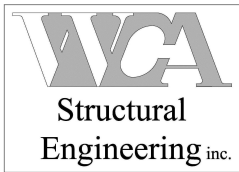
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