



# NOUS ENGINEERING STRUCTURAL CALCULATIONS

Plan Check R01

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BY: MEM DATE: 07/11/18

**WEST COAST CODE CONSULTANTS, INC.**

## Summit Powder Mountain

8645 E. Copper Crest, Lot 44, Summit Eden Phase 1C, Summit Powder Mountain Resort,  
Weber County, Utah.

JOB NO. 18035

July 2018



July 2018



<b>REV</b>	<b>Description</b>	<b>Author</b>	<b>Date</b>	<b>Checked</b>
00	Structural Calculations	MG	05/30/18	MJM
01	Structural Calculations	MG	07/06/18	MJM

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The structural design criteria are provided for informational purposes and does not modify or override the requirements of the drawings, specifications, or any other part of the contract documents.



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## 1.0 Executive Summary

The single-family residence is located at 8645 E. Copper Crest, Lot 44, Summit Eden Phase 1C, Summit Powder Mountain Resort, Weber County, Utah. The approximately 6400 GSF residence is located on a sloped site. The house has retaining walls along the upslope perimeter of the floorplan that have been designed by others as a permanent shoring wall system with tie-backs independent from the house and are not a part of this report. Deep pile foundations have been used for the house to resist gravity loads and to satisfy setback requirements.







## 2.0 Design Criteria

### 2.01 Dead and Live Loads

#### LOAD TAKE OFF TABLE

##### Rooftop / Low Roof

Gravity Loading - Superimposed Dead	psf
Zinc Panels	2
Wood Liner	3
Purlins @ 24" OC	5
Insulation	5
MEP	3
MISC	2
<b>Total Superimposed Dead</b>	<b>20</b>
Steel Framing	2.5

<b>Total Dead</b>	=	<b>22.5</b>
<b>Roof Live Load</b>	=	<b>20</b>

Seismic Mass - Dead Load	psf
Zinc Panels	2
Wood Liner	3
Purlins @ 24" OC	5
Insulation	5
MEP	3
MISC	2
<b>Total Superimposed Dead - Mass</b>	<b>20</b>
Steel Framing	2.5

<b>Total Seismic Mass</b>	=	<b>23</b>
<b>Additional Mass (psf)/ gr<sub>z</sub></b>	=	<b>0.70</b>

##### Rooftop Deck

Gravity Loading - Superimposed Dead	psf
Finish Surface	10
Wood Liner	3
Purlins @ 24" OC	5
Insulation	5
MEP	3
MISC	2
<b>Total Superimposed Dead</b>	<b>28</b>
Steel Framing	2.5

<b>Total Dead</b>	=	<b>30.5</b>
<b>Roof Live Load</b>	=	<b>60</b>

Seismic Mass - Dead Load	psf
Finish Surface	10
Wood Liner	3
Purlins @ 24" OC	5
Insulation	5
MEP	3
MISC	2
<b>Total Superimposed Dead - Mass</b>	<b>28</b>
Steel Framing	2.5

<b>Total Seismic Mass</b>	=	<b>31</b>
<b>Additional Mass (psf)/ gr<sub>z</sub></b>	=	<b>0.95</b>

##### Study/ Office

Gravity Loading - Superimposed Dead	psf
1" Wood Flooring	3
Sheathing	2
Joists @24"	4
Insulation	2
MEP	2
MISC	2
<b>Total Superimposed Dead</b>	<b>15</b>
Steel Framing	0

<b>Total Dead</b>	=	<b>15</b>
<b>Live Load</b>	=	<b>40</b>

Seismic Mass - Dead Load	
1" Wood Flooring	3
Sheathing	2
Joists @24"	4
Insulation	2
MEP	2
MISC	2
<b>Total Superimposed Dead - Mass</b>	<b>15</b>
Steel Framing	0

<b>Total Seismic Mass</b>	=	<b>15</b>
<b>Additional Mass (psf)/ gravity (ft/s<sup>2</sup>)</b>	=	<b>0.47</b>



**Entry Foyer**

Gravity Loading - Superimposed Dead		psf
LW Concrete over Metal deck		30
Floor Finish		3
Insulation		5
MEP (radiant)		3
MISC		2
<b>Total Superimposed Dead</b>		<b>43</b>
Steel Framing		15

<b>Total Dead</b>	=	<b>58</b>
<b>Live Load</b>	=	<b>40</b>

Seismic Mass - Dead Load		
LW Concrete over Metal deck		30
Floor Finish		3
Insulation		5
MEP (radiant)		3
MISC		2
<b>Total Superimposed Dead - Mass</b>		<b>43</b>
Steel Framing		15

<b>Total Seismic Mass</b>	=	<b>58</b>
<b>Additional Mass (psf)/ gravity (ft/s<sup>2</sup>) =</b>		<b>1.80</b>

**Garage**

Gravity Loading - Superimposed Dead		psf
2" LW Concrete + 2" MD		30
Insulation		5
MEP (radiant)		3
Soffit		10
MISC		2
<b>Total Superimposed Dead</b>		<b>50</b>
Steel Framing		15

<b>Total Dead</b>	=	<b>65</b>
<b>Live Load</b>	=	<b>40</b>

Seismic Mass - Dead Load		
2" LW Concrete + 2" MD		30
Insulation		5
MEP (radiant)		3
Soffit		10
MISC		2
<b>Total Superimposed Dead - Mass</b>		<b>50</b>
Steel Framing		15

<b>Total Seismic Mass</b>	=	<b>65</b>
<b>Additional Mass (psf)/ gravity (ft/s<sup>2</sup>) =</b>		<b>2.02</b>

**Kitchen and Dining**

Gravity Loading - Superimposed Dead		psf
2" LW Concrete + 2" MD		30
1" Wood Flooring		3
Insulation		5
MEP (radiant)		3
MISC		2
<b>Total Superimposed Dead</b>		<b>43</b>
Steel Framing		5

<b>Total Dead</b>	=	<b>48</b>
<b>Live Load</b>	=	<b>40</b>

Seismic Mass - Dead Load		
2" LW Concrete + 2" MD		30
1" Wood Flooring		3
Insulation		5
MEP (radiant)		3
MISC		2
<b>Total Superimposed Dead - Mass</b>		<b>43</b>
Steel Framing		5

<b>Total Seismic Mass</b>	=	<b>48</b>
<b>Additional Mass (psf)/ gravity (ft/s<sup>2</sup>) =</b>		<b>1.49</b>

**Master Bedroom/Living Room**

Gravity Loading - Superimposed Dead		psf
2" LW Concrete + 2" MD		35
Floor Finish		3
Soffit		10
Insulation		5
MEP (+radiant)		3
MISC		2
<b>Total Superimposed Dead</b>		<b>58</b>
Steel Framing		25

<b>Total Dead</b>	=	<b>83</b>
<b>Live Load</b>	=	<b>40</b>

Seismic Mass - Dead Load		
2" LW Concrete + 2" MD		35
Floor Finish		3
Soffit		10
Insulation		5
MEP (+radiant)		3
MISC		2
<b>Total Superimposed Dead - Mass</b>		<b>58</b>
Steel Framing		25

<b>Total Seismic Mass</b>	=	<b>83</b>
<b>Additional Mass (psf)/ gravity (ft/s<sup>2</sup>) =</b>		<b>2.58</b>



**Open Air Decks (Lower Level)**

Gravity Loading - Superimposed Dead	psf
2" LW Concrete + 2" MD	35
Paver Finish	10
Soffit	10
Insulation	5
MEP (radiant)	3
MISC	2
<b>Total Superimposed Dead</b>	<b>65</b>
Steel Framing	25

<b>Total Dead</b>	=	<b>90</b>
<b>Live Load</b>	=	<b>60</b>

Seismic Mass - Dead Load	
2" LW Concrete + 2" MD	35
Paver Finish	10
Soffit	10
Insulation	5
MEP (radiant)	3
MISC	2
<b>Total Superimposed Dead - Mass</b>	<b>65</b>
Steel Framing	25

<b>Total Seismic Mass</b>	=	<b>90</b>
<b>Additional Mass (psf)/ gravity (ft/s<sup>2</sup>) =</b>		<b>2.80</b>

**Jacuzzi**

Gravity Loading - Superimposed Dead	psf
Jacuzzi	190
Soffit	10
Insulation	5
MEP (radiant)	3
MISC	2
<b>Total Superimposed Dead</b>	<b>210</b>
Steel Framing	25

<b>Total Dead</b>	=	<b>235</b>
<b>Live Load</b>	=	<b>60</b>

Seismic Mass - Dead Load	
Jacuzzi	190
Soffit	10
Insulation	5
MEP (radiant)	3
MISC	2
<b>Total Superimposed Dead - Mass</b>	<b>210</b>
Steel Framing	25

<b>Total Seismic Mass</b>	=	<b>235</b>
<b>Additional Mass (psf)/ gravity (ft/s<sup>2</sup>) =</b>		<b>7.30</b>

**Exterior Deck**

Gravity Loading - Superimposed Dead	psf
Floor Finish	75
MISC	5
<b>Total Superimposed Dead</b>	<b>80</b>

<b>Total Dead</b>	=	<b>80</b>
<b>Live Load</b>	=	<b>100</b>

**Entry Driveway**

Gravity Loading - Superimposed Dead	psf
Finsh and topping slab	75
MISC	5
<b>Total Superimposed Dead</b>	<b>80</b>

<b>Total Dead</b>	=	<b>80</b>
<b>Live Load</b>	=	<b>100</b>

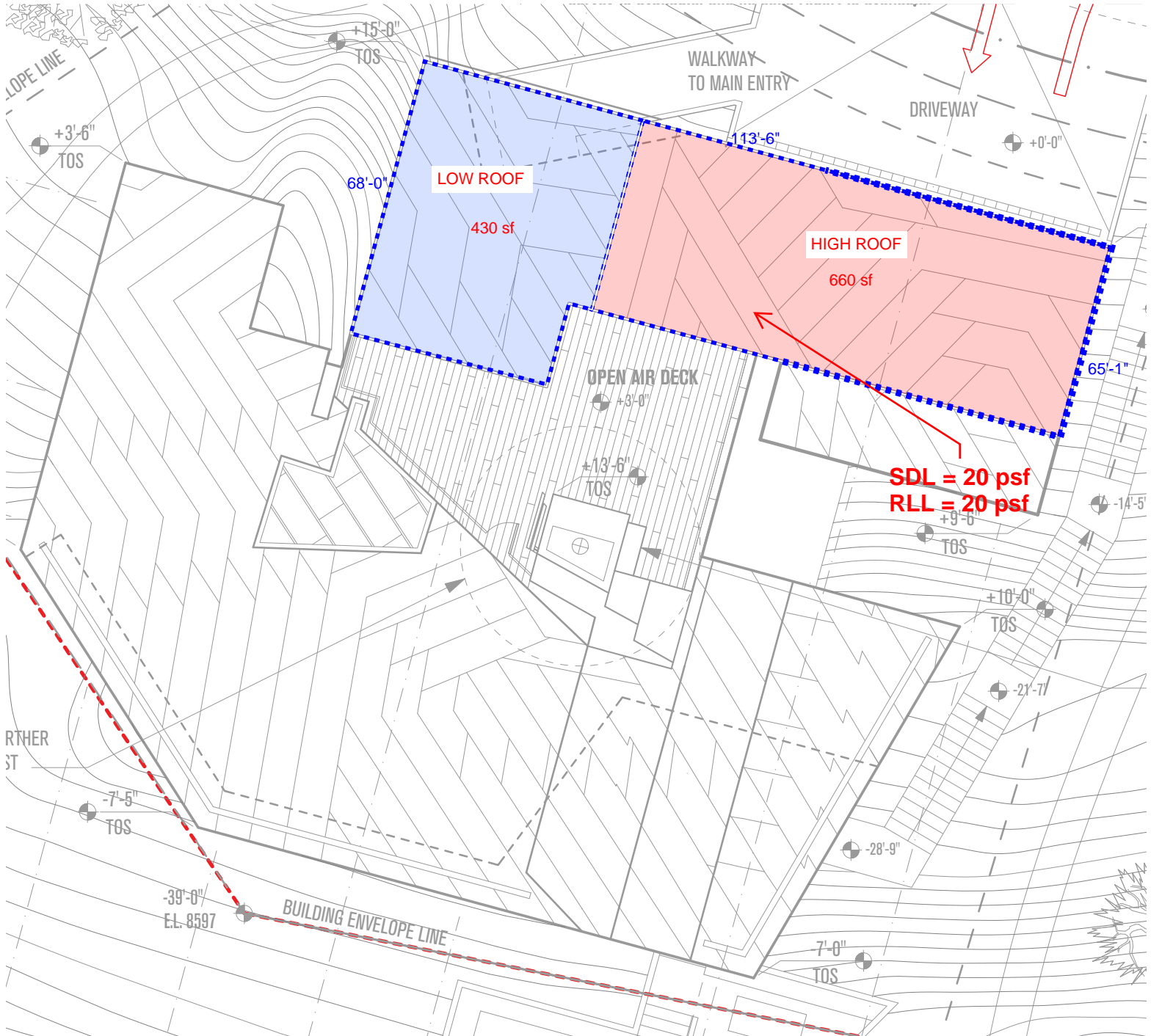
<b>Fireplace</b>	=	<b>10000 lbs</b>
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**Cladding/ Wall Weight**

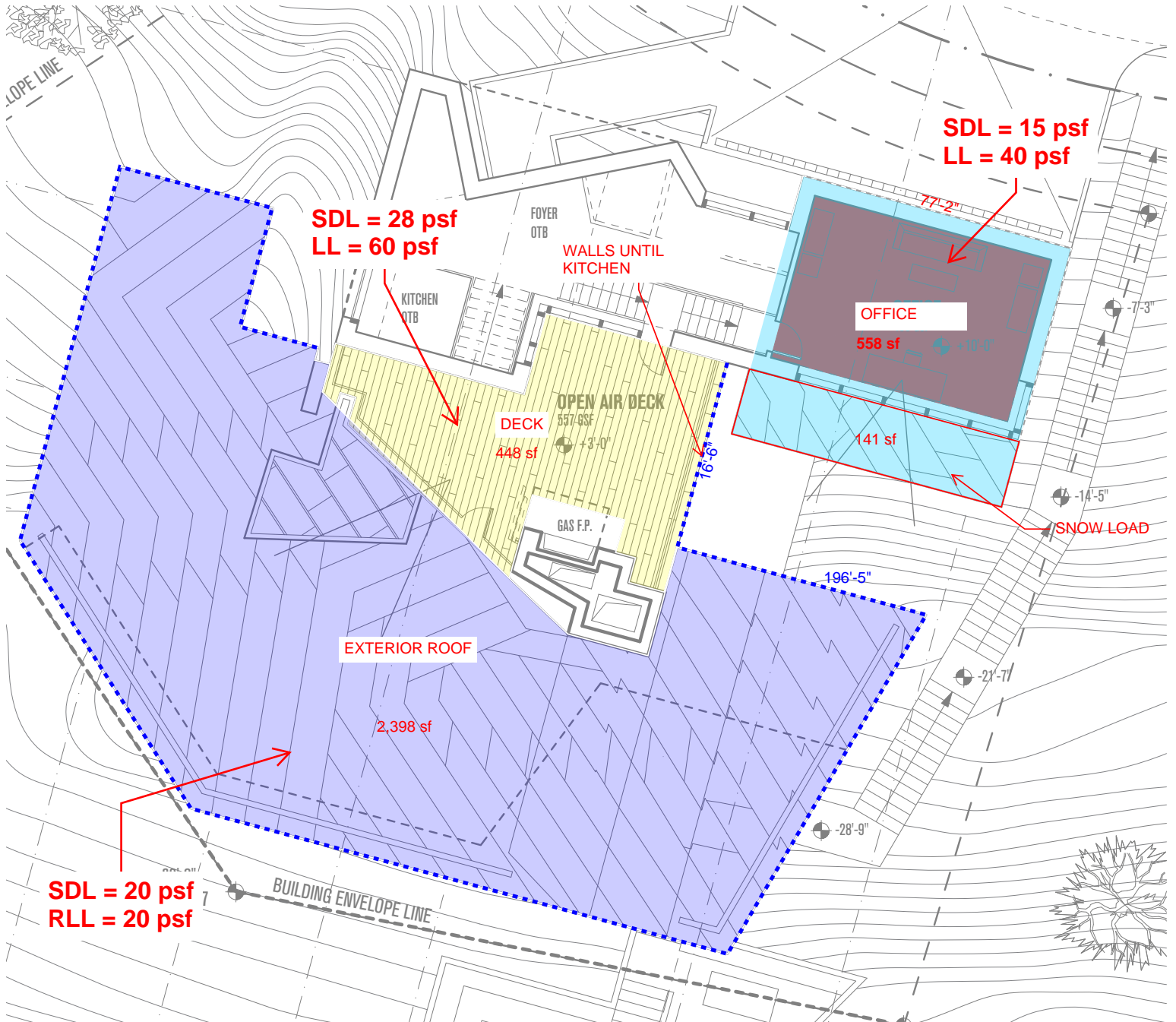
	psf
Interior Walls	15
10" RC Walls	125
Exterior Walls	20

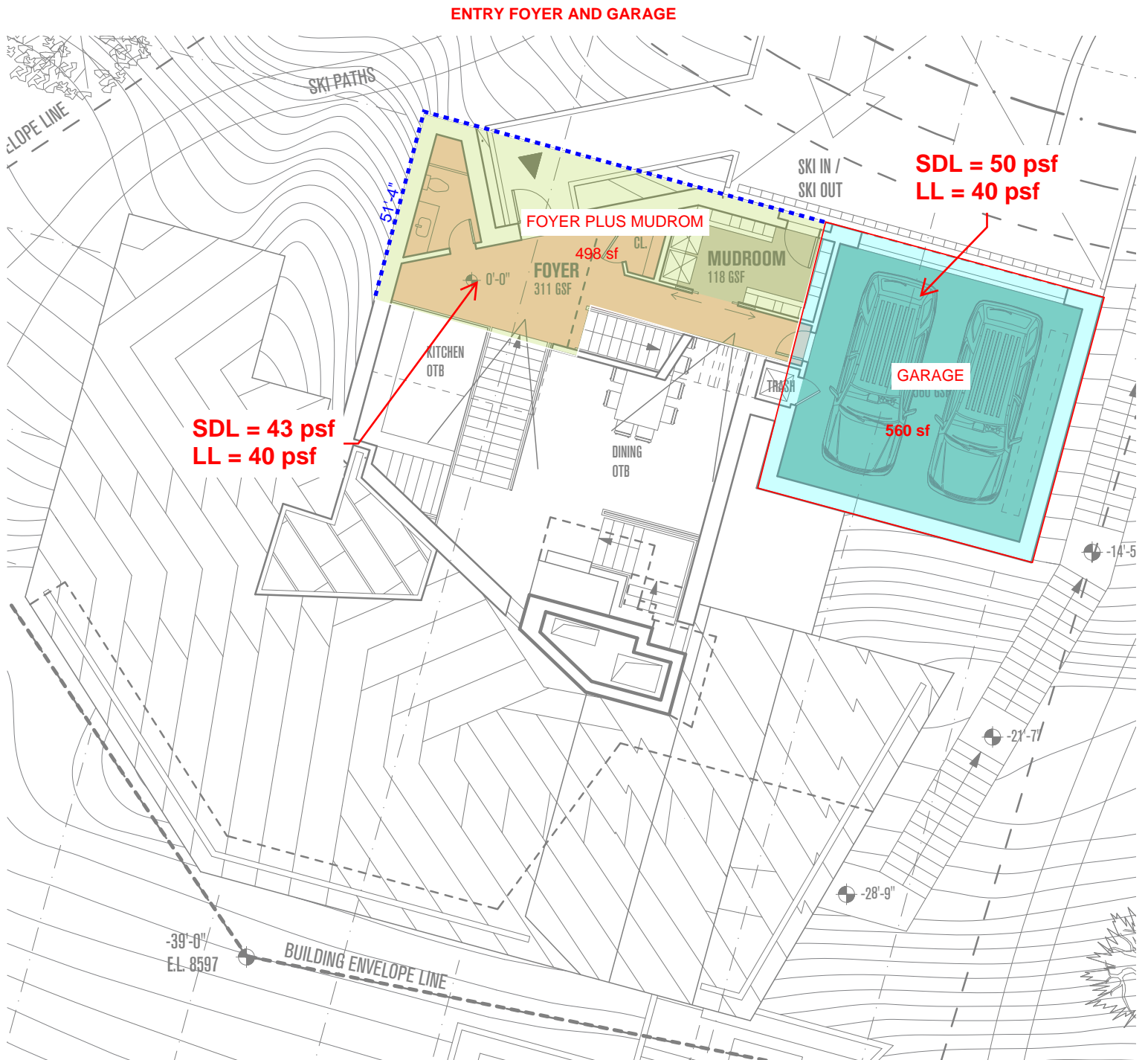
AREA LOAD MAPS

HIGH AND LOW ROOFS



**OFFICE, DECK AND EXTERIOR SLOPING ROOF (SKIN)**



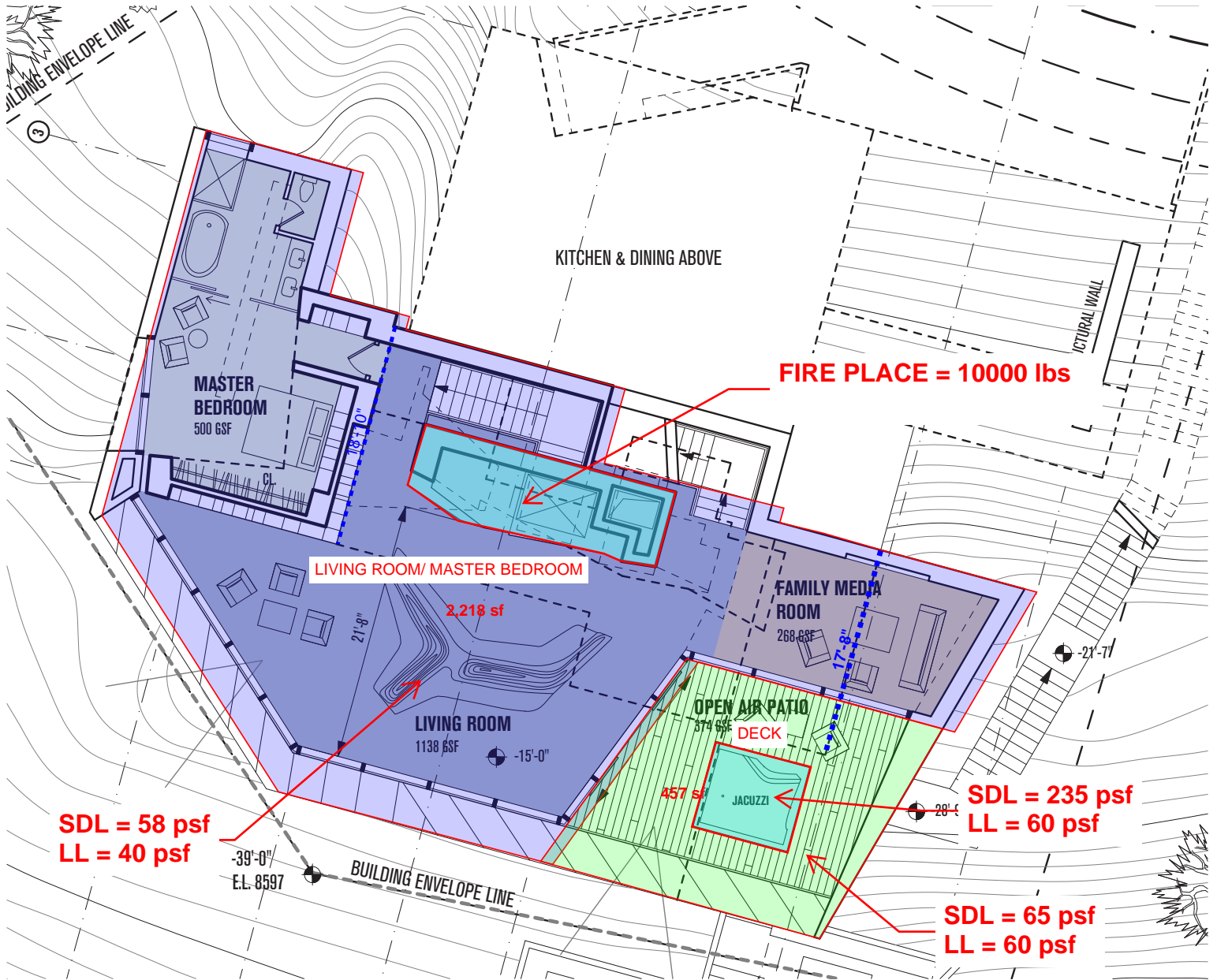




**KITCHEN AND DINING**

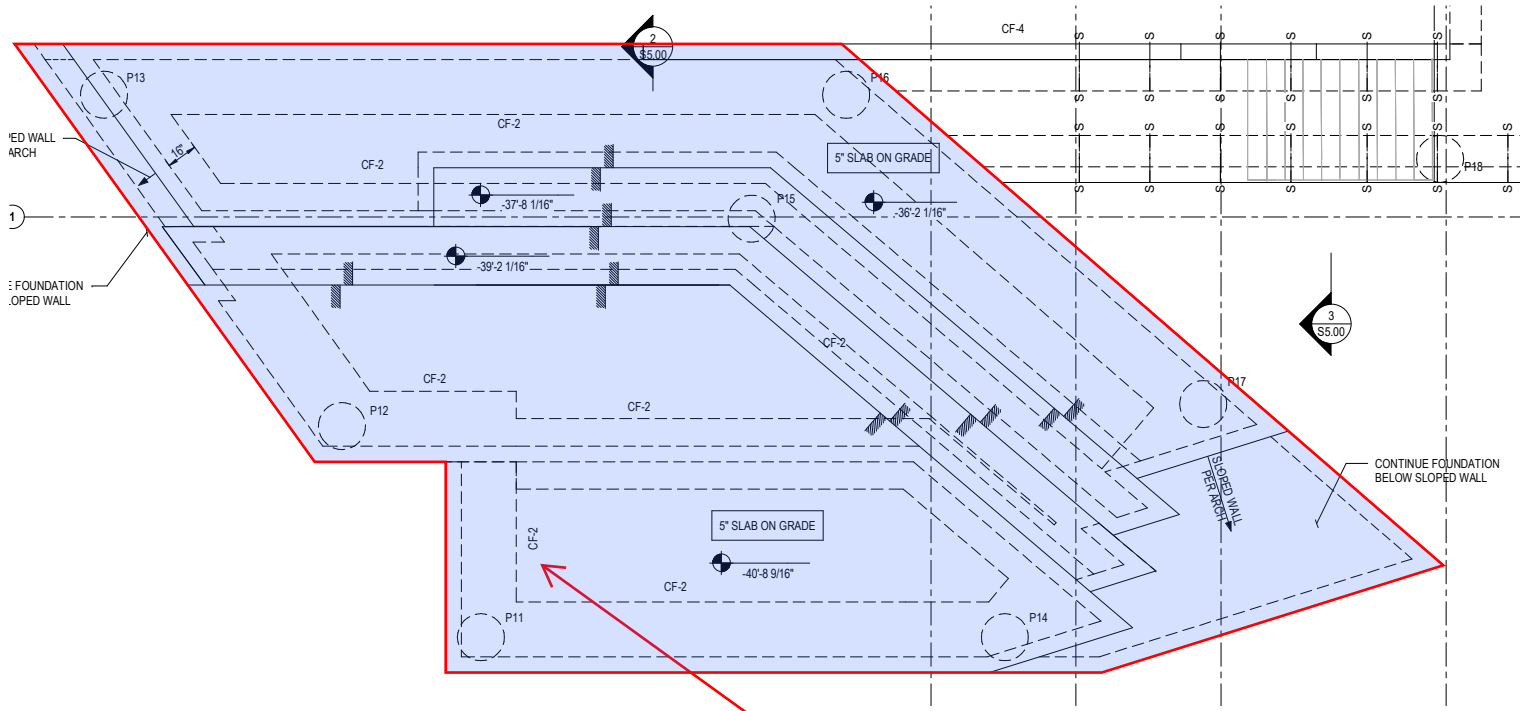


**LIVING ROOM AND MASTER BEDROOM**





**EXTERIOR DECK**



**SDL = 80 psf**  
**LL = 100 psf**



## 2.02 Soil Design Parameters

*The foundation system design is based upon criteria and recommendations contained in the geotechnical investigation report "Geotechnical and Geologic Hazard investigation, Lot 44R of Summit Eden Phase 1C, 8647 E. Copper Crest, Summit Powder Mountain Resort, Weber County, Utah, Project No. 02732-001" dated March 19, 2018 produced by IGES*

### Conventional Footing Design Parameters:

Vertical Bearing (psf): **3400**

Passive Pressure co-efficient: **3**

Equivalent fluid Density (Passive) (pcf): **375**

Coefficient of Friction: **0.47**

### Deep Foundation Design Parameters:

Skin Friction (psf): **per Geotech table, see below**

Passive Pressure co-efficient: **3**

Equivalent fluid Density (Passive) (pcf): **375**

### Retaining Wall Design Parameters:

**Per Geotech table, see below**

**Table 5.4.2**  
**Preliminary Allowable Capacity for Concrete Cast-in-Place Pile Foundations**

Concrete Pile diameter (in)	Pile Length (ft)*	Allowable axial compression (kips)	Allowable axial uplift (kips)
24	20	179	27
30		270	37
36		380	48
24	30	296	55
30		440	74
36		612	94
24	40	429	94
30		630	123
36		869	154

\*Length measured from bottom of pile cap to tip of shaft

**Table 5.6**  
**Lateral Earth Pressure Coefficients**

Condition	Level Backfill		2H:1V Backfill	
	Lateral Pressure Coefficient	Equivalent Fluid Density (pcf)	Lateral Pressure Coefficient	Equivalent Fluid Density (pcf)
Active (Ka)	0.33	41.7	0.53	66.5
At-rest (Ko)	0.50	55	0.80	85
Passive (Kp)	3.0	375	—	—
Seismic Active	0.12	15.1	0.38	47.4
Seismic Passive	-0.33	-40.8	—	—
Seismic At-rest	0.18	22.5	0.57	71.7

## 2.03 Wind Loads

Wind load on buildings *MWFRS*, envelope procedure, as defined by ASCE Chapters 26- 28.

Basic Wind Speed:  $V = 115$  mph (3 Second Gust)

Exposure Category: C

$K_d = 0.85$  Wind directionality factor Table 26.6-1

$K_{zt} = 1.28$  Topographic factor Section 26.8

$K_z = 0.96$  Table 28.3-1

$G = 0.85$  Gust effect factor, low rise building per 26.9.2

Enclosure Classification = **Enclosed**

Risk Category = **II**

$q_z, q_h = 0.00256K_zK_{zt}K_dV^2 = 35.3$  psf

Wind loads on *MWFRS* as defined by ASCE Chapter 27, Part as applicable to monoslope roofs.

$C_p = 0.8$  Walls, Windward

$C_p = -0.5$  Walls, Leeward

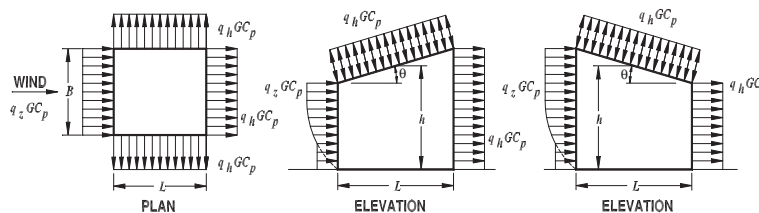
$C_p = 0.7$  Side Walls

$C_p = -0.3, 0.2$  Roof Co-efficients

$GC_{pi} = +0.18$  Internal Pressure coefficient Table 26.11-1

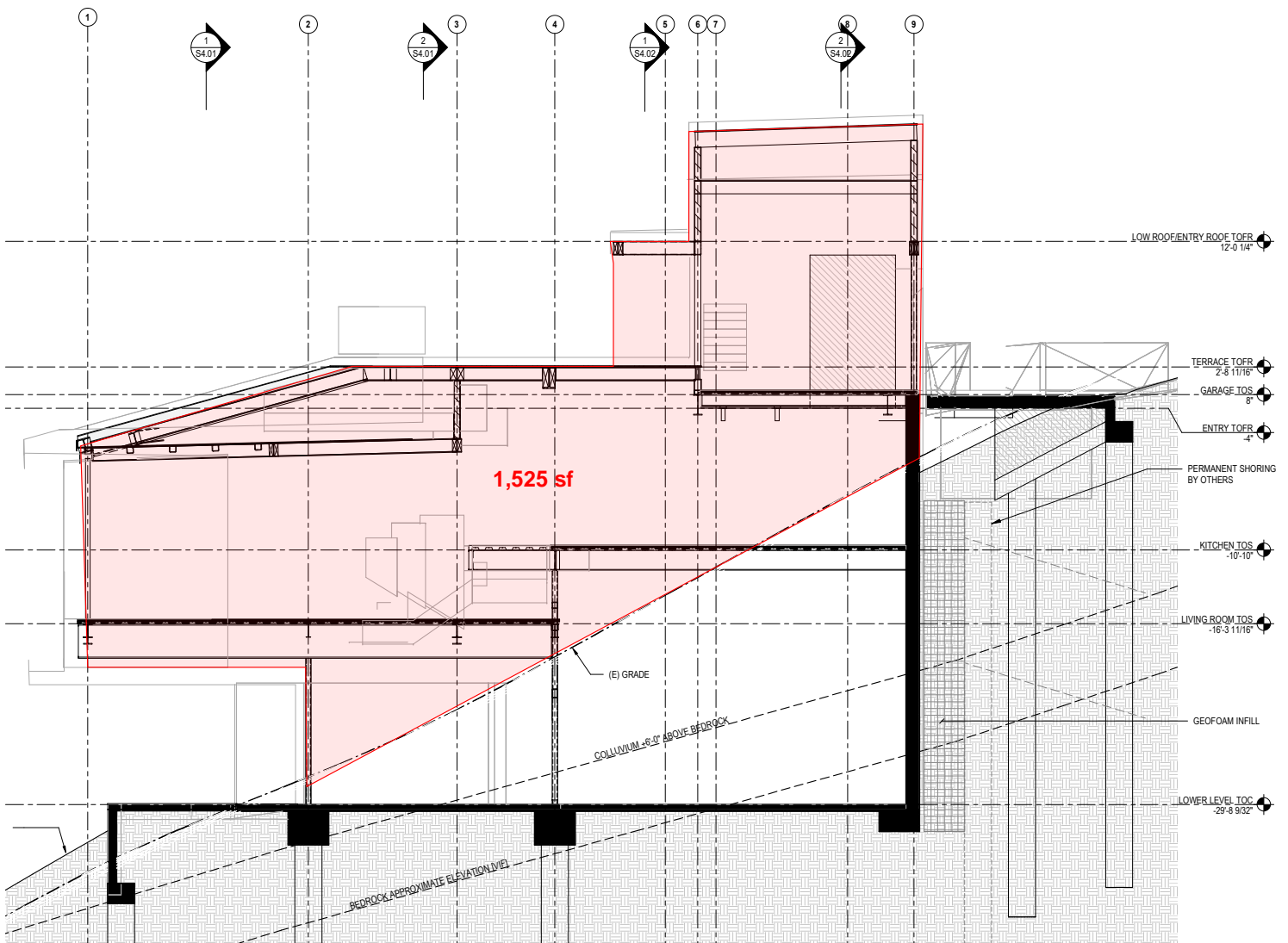
$P = qGC_p - q_iGC_{pi}$

**Thus Seismic load Governs as shown further**



**MONOSLOPE ROOF (NOTE 4)**

WIND LOADS



THUS TOTAL WIND LOAD = WINDWARD + LEEWARD LOAD

$$= q \times G \times C_p + q \times G \times C_p$$

$$= 2 \times 35.3 \times 0.85 \times 0.7 \times 1525$$

$$= 64 \text{ kips}$$

Thus Seismic Load Governs

## 2.04 Snow Loads

The snow loads have been calculated in accordance with Chapter 16 of IBC 2015, amendments to the chapter per 15A-3-107 to include "1608.1.2 Utah Snow Loads and ASCE 7-10.

Importance Factor,  $I_s = 1$

$P_o =$	<b>43 psf</b>	Base Ground snow Load, From Table no. 1608.1.2 (a) for Weber County
$A_o =$	<b>4.5(ft/1000)</b>	Base ground snow elevation, table no.1608.1.2 (a) for Weber County
$S =$	<b>63(psf/100 ft)</b>	Change in ground snow load with elevation, table 1608.1.2 (a)
$A =$	<b>8.6(ft/1000)</b>	Elevation above sea level at site.

$$P_g = (P_o^2 + S^2(A-A_o)^2)^{0.5} = 262 \text{ psf}$$

For Flat roof snow loads,

$C_e =$	<b>0.7</b>	From Table 7-2, ASCE 7-10, Above treeline in windswept mountain areas
$C_t =$	<b>1</b>	Per (8) of amendment 15A-3-107 to IBC Chapter 16 per Utah Code
$S =$	<b>63(psf/100 ft)</b>	Change in ground snow load with elevation, table 1608.1.2 (a)
$A =$	<b>8.6(ft/1000)</b>	Elevation above sea level at site.

$$p_f = 0.7 C_e C_t I_s p_g = 128.4 \text{ psf}$$

$C_s =$	<b>0.85</b>	Figure 7.2(a) ASCE 7-10 for roof slope of 15°
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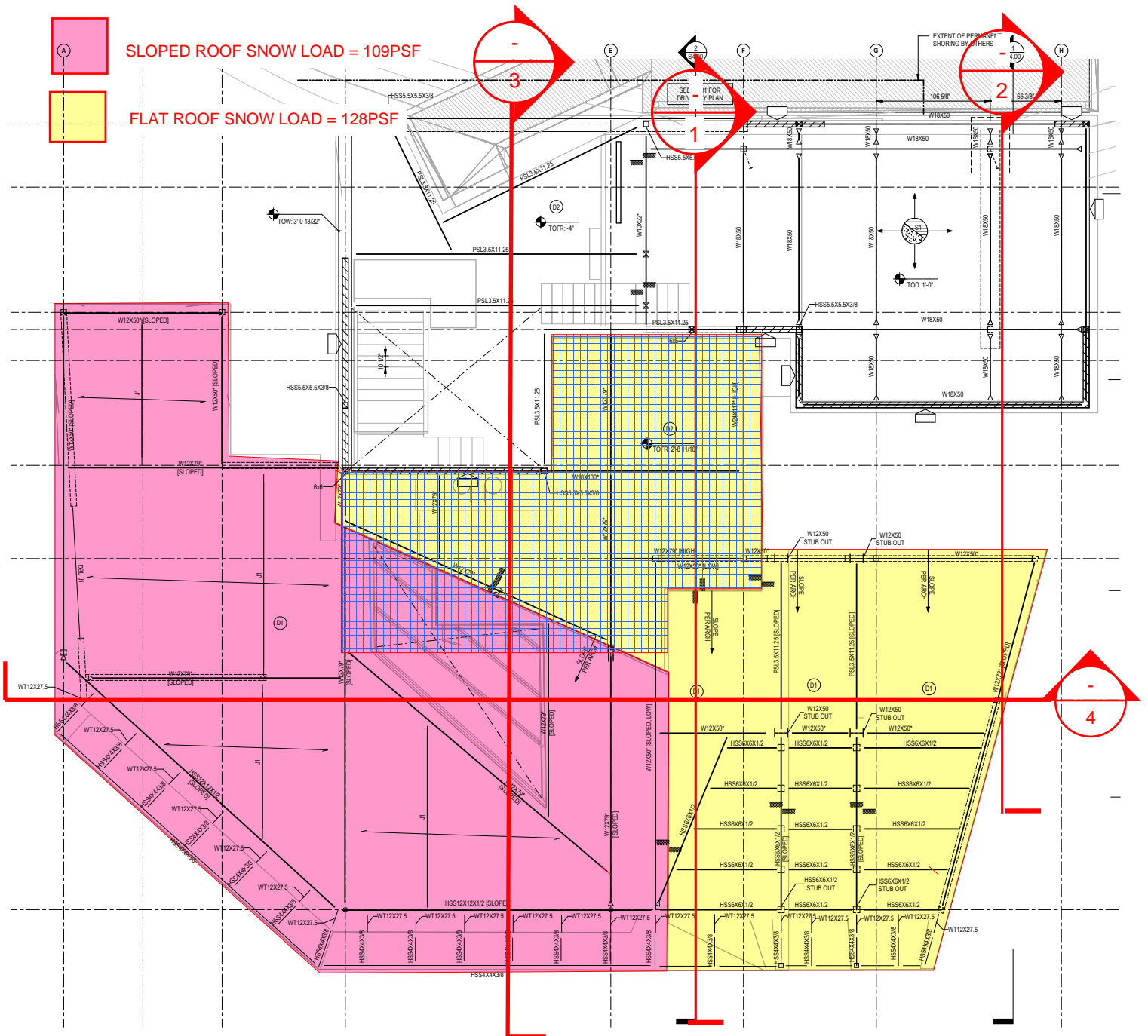
$$p_s = C_s p_f = 109 \text{ psf}$$

Snow Load for seismic design,

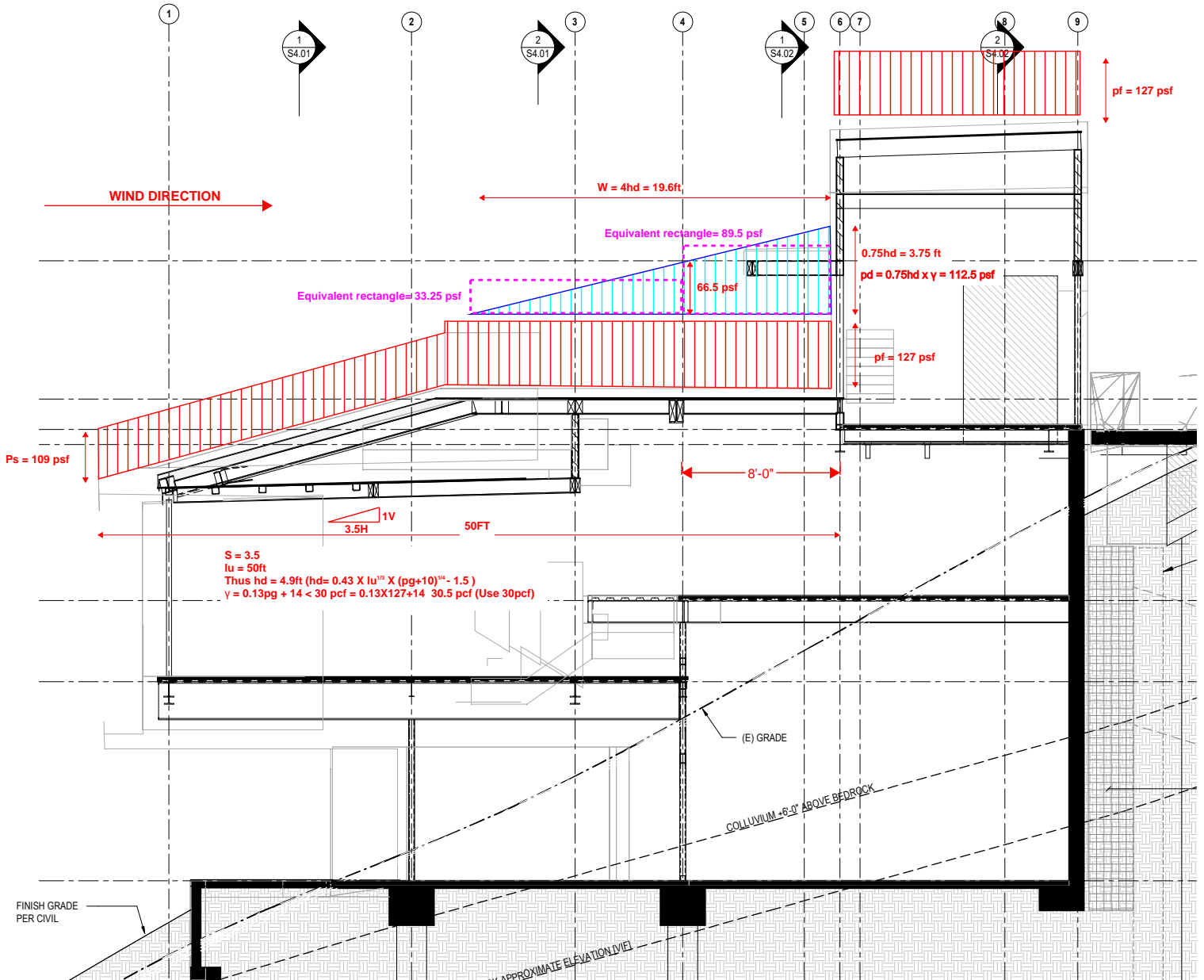
$$W_s = (0.2 + 0.025 (A-5)) p_f = 37 \text{ psf}$$

2.04a Unbalanced Snow Loads

Unbalanced snow loads have been evaluated in accordance with 7.7- ASCE 7-10 for wind drift. Refer to the following for unbalanced snow loads evaluation:

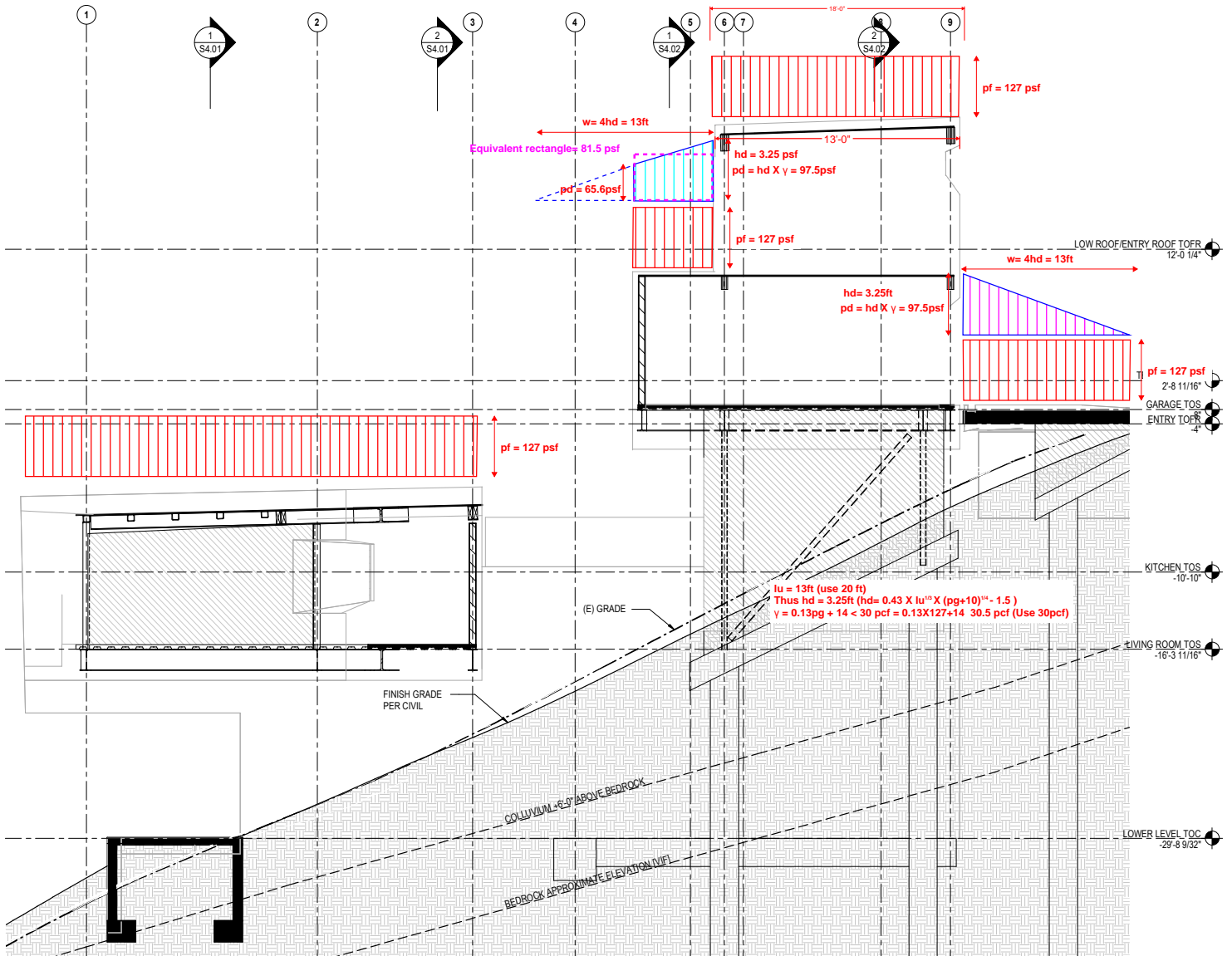


**UNBALANCED SNOW LOAD- DRIFT(WINDWARD)**

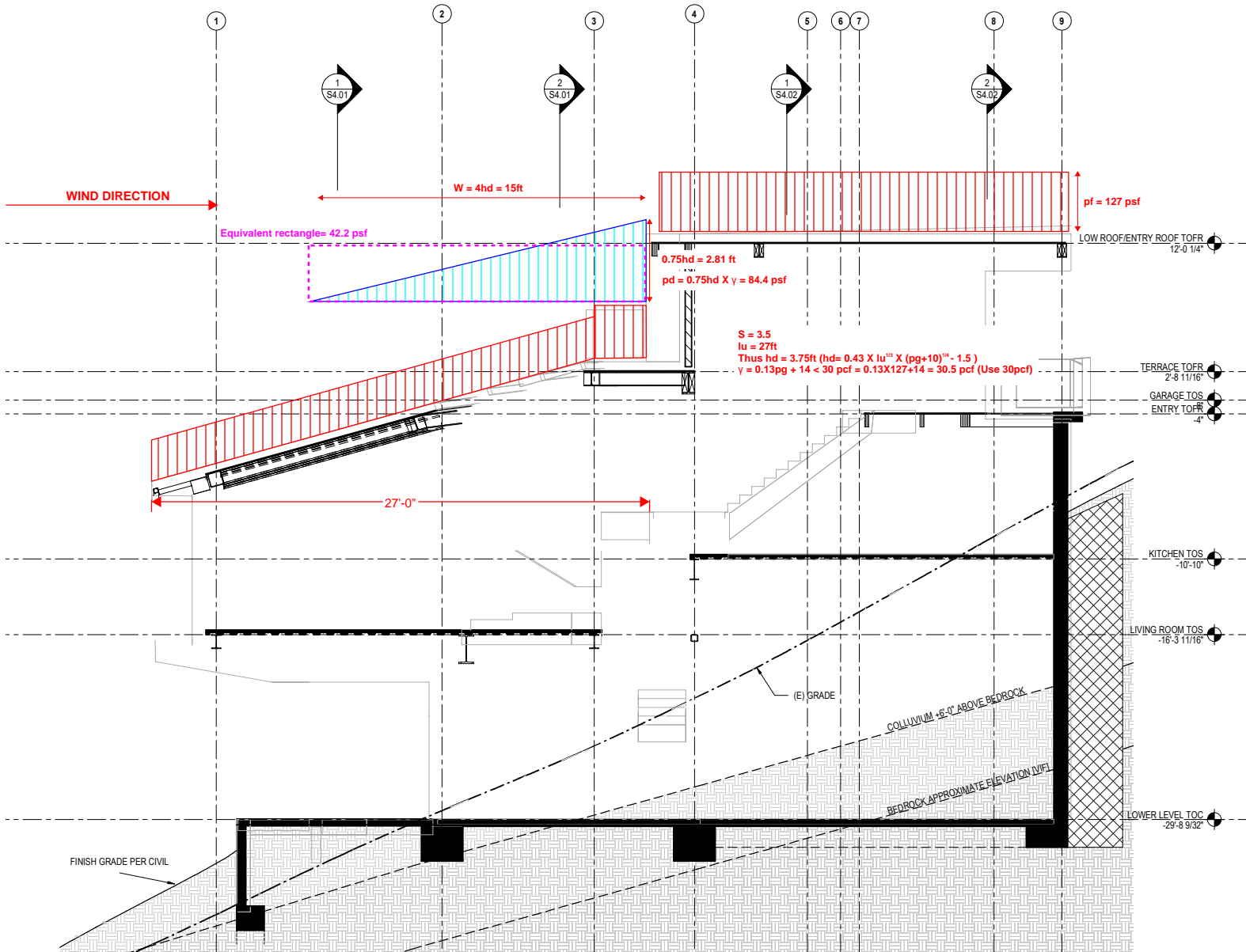


**SECTION 1**



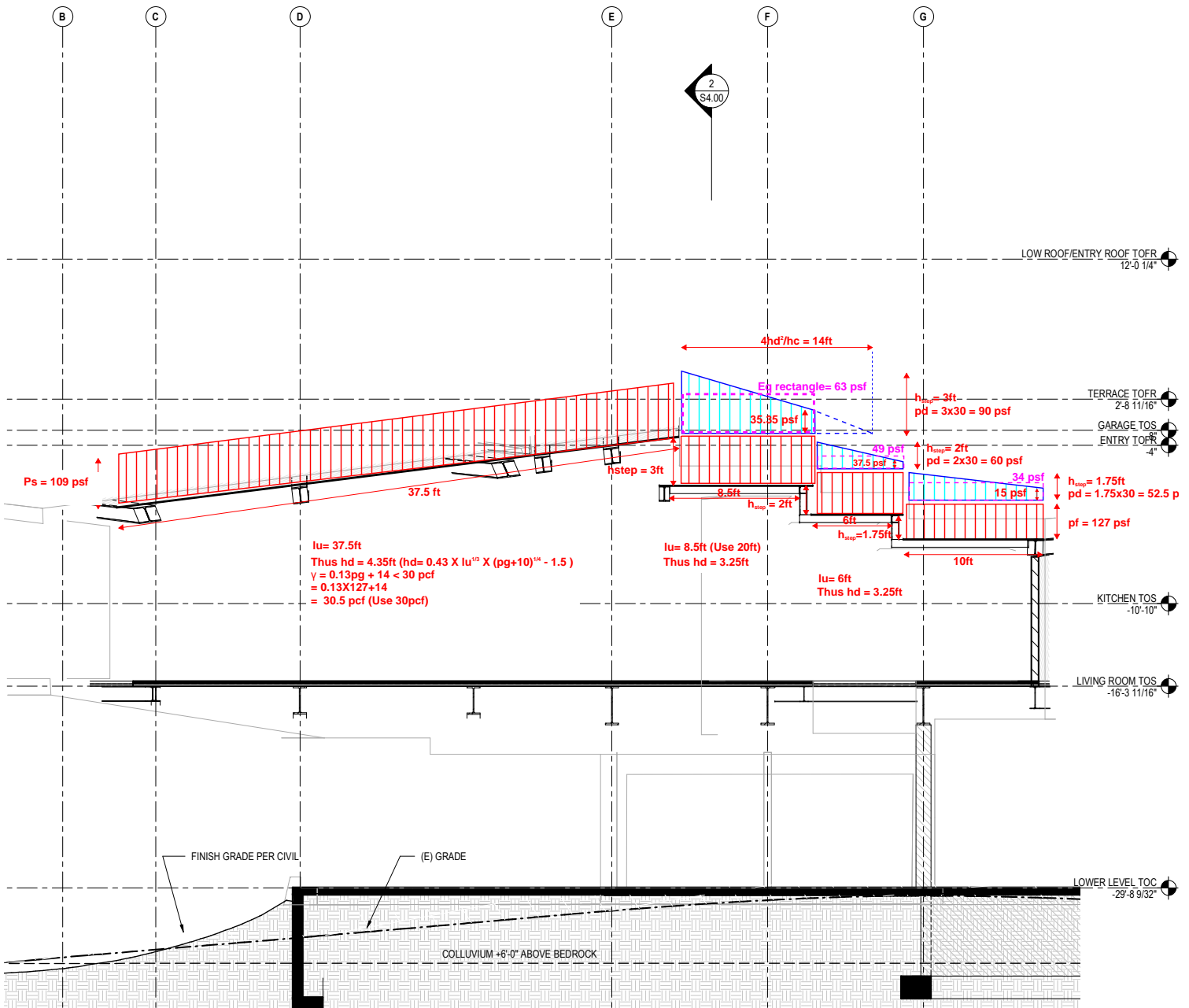


**SECTION 2**



**SECTION 3**

**UNBALANCED SNOW LOAD- DRIFT(ROOF STEP)**



**SECTION 4**

## 2.04 Seismic Loads

The seismic design classification of the site is in accordance with the International Building Code 2015 (IBC 2015). The Seismic Design Parameters are in accordance with the Geotech Report. Refer to the following spreadsheet listing parameters and the derived base shear.

**Table 3.6**  
**Short- and Long-Period Spectral Accelerations for MCE**

<b>Parameter</b>	<b>Short Period (0.2 sec)</b>	<b>Long Period (1.0 sec)</b>
MCE Spectral Response Acceleration (g)	$S_s = 0.813$	$S_1 = 0.270$
MCE Spectral Response Acceleration Site Class C (g)	$S_{MS} = S_s F_a = 0.874$	$S_{M1} = S_1 F_v = 0.413$
Design Spectral Response Acceleration (g)	$S_{DS} = S_{MS}^{2/3} = 0.582$	$S_{D1} = S_{M1}^{2/3} = 0.275$

# SEISMIC LOADING- X DIRECTION

<b>PROJECT:</b> Summit Powder Mountain	<b>PROJECT#:</b> 18035	<b>PAGE#:</b>
<b>DESCRIPTION:</b> Seismic Loading Criteria- X Direction		<b>AUTHOR/DATE:</b>
		<b>CHECKED BY/DATE:</b>

**Seismic Calculations per ASCE 7-10**  
As referenced by CBC 2016

Site Class = **C** Per Geotech Report  
 Risk Cat. = **II** (ASCE 7-10 1.5-1 Classification of Bldgs and other Structures)  
 Seis. Dgn Cat. = **D** (ASCE 7-10 11.6-1 Seismic Design Category)  
 $S_s = 0.813$  Per Geotech Report  
 $S_1 = 0.270$  Per Geotech Report

GOVERNING, LOWEST R

**LFRS= Intermediate Moment Frames**

$I_e = 1.0$  (Sect. 11.5.1)  
 $R = 4.5$  (Table 12.2-1)  
 $C_d = 4.0$   
 Omega = **3**  
 Height = **14** ft  
 $T_n = 0.14$  sec       $C_t = 0.02$  (ASCE 7-10 Table 12.8-2)  
 $T_L = 8$  sec

$S_{MS} = 0.874$        $S_{M1} = 0.424$   
 $S_{DS} = 0.583$        $S_{D1} = 0.283$

$\rho = 1.3$

Site Coeff $F_a$ ≤      ≥						Site Coeff $F_v$ ≤      ≥							
		0.25	0.50	0.75	1.00	1.25			0.1	0.20	0.3	0.40	0.5
A		0.8	0.8	0.8	0.8	0.8	A		0.8	0.8	0.8	0.8	0.8
B		1.0	1.0	1.0	1.0	1.0	B		1.0	1.0	1.0	1.0	1.0
C		1.2	1.2	1.1	1.0	1.0	C		1.7	1.6	1.5	1.4	1.3
D		1.6	1.4	1.2	1.1	1.0	D		2.4	2.0	1.8	1.6	1.5
E		2.5	1.7	1.2	0.9	0.9	E		3.5	3.2	2.8	2.4	2.4

Seis. Dsgn Cat. (per $S_{DS}$ )			Risk Category		
			I or II	III	IV
0	$\leq S_{DS} <$	0.167	A	A	A
0.167	$\leq S_{DS} <$	0.33	B	B	C
0.33	$\leq S_{DS} <$	0.50	C	C	D
0.50	$\leq S_{DS}$		D	D	D

Seis. Dsgn Cat. (per $S_{D1}$ )			Risk Category		
			I or II	III	IV
0	$\leq S_{D1} <$	0.067	A	A	A
0.067	$\leq S_{D1} <$	0.13	B	B	C
0.13	$\leq S_{D1} <$	0.20	C	C	D
0.20	$\leq S_{D1}$		D	D	D

July 2018

<b>PROJECT:</b> Summit Powder Mountain	<b>PROJECT#:</b> 18035	<b>PAGE#:</b>
		<b>AUTHOR/DATE:</b>
<b>DESCRIPTION:</b> Seismic Loading Criteria- X Direction		<b>CHECKED BY/DATE:</b>

<b>Seismic Response Coefficient</b>		
<b>(ASCE 7-10 12.8.1.1)</b>		
$C_s = S_{DS}/(R/I_e)$	$C_s =$	0.129 (12.8-2)
$C_s = S_{D1} / [T(R/I_e)]$ (need not exceed, for $T \leq T_L$ )	$C_s \leq$	0.434 (12.8-3)
$C_s = S_{D1} T_L / [T^2(R/I_e)]$ (need not exceed, for $T > T_L$ )	$C_s \geq$	24.008 (12.8-4)
$C_s$ shall not be less than 0.01		(12.8-5)
$C_s = 0.5S_1/(R/I_e)$ (shall not be less than, for areas where $S_1 \geq 0.6g$ )	$C_s \geq$	0.030 (12.8-6)
Base Shear	<b>V =</b>	<b>0.129 W</b> (12.8-1)

Level	Area (sqft)	Height (ft)	Walls Below (ft)	Walls Above (ft)
<b>High Roof</b>	660	20	113.5	
<b>Low Roof</b>	430	9	68	
<b>Office</b>	558	9	77	65
<b>Deck and Exterior Roof</b>				
Deck	448	14	16.5	
Exterior Roof	2398	23	196.5	
<b>Entry Level</b>				
Mudroom plus Foyer	500	10	51.25	
Garage	560			
<b>Kitchen plus Dining</b>	1219	18.5	97.25	
<b>Living Room Level</b>				
Master Bed and Living Room	2218	13	36.5	
Roof Snow Load	128	psf	Elevation above MSL of Structure=	8600 ft
Snow Load for Seismic Calculations =	<b>37.12</b>	psf		

July 2018

Seismic Weight (DL from Gravity Loading Criteria)									
Floor	Story Height	Floor Area (sf)	Wall Length (ft)	UDL (psf)	DL (k)	w*h	wihi/wxhx	Fx (k)	Fstory (k)
High Roof	20	660		23	14.85	1127	0.66	9.79	9.79
Snow Load		660		37.1	24.50				
Ext Walls			113.5	15	17.0				
Low Roof	11	430		23	9.675	332	0.19	2.89	12.68
Snow Load		430		37.1	15.96				
Ext Walls			68	15	4.59				
Office	9	558		15	8.37	257	0.15	2.23	14.91
Snow Load		141		37.1	5.23				
Ext Walls Above			65	15	9.75				
Ext Walls Below			77	15	5.20				

Σ W = 115.15      1716.94      1.00

Total Applied Seismic Load, **V** = Cs W                      **14.91**      kips  
Cs W x ρ                      **19.38**      kips

Deck and Ext Roof	23					4422	1.00	24.89	24.89
Deck		448		31	13.66				
Ext Walls			16.5	15	1.7325				
Exterior Roof		2398		23	53.96				
Ext Walls			196.5	15	33.90				
Snow Loads		2398		37.1	89.0				

Σ W = 192.3      4422.0

Total Applied Seismic Load, **V** = Cs W                      **24.89**      kips  
Cs W x ρ                      **32.36**      kips

Entry level	10					1097	1.00	14.20	14.20
Foyer & Mudroom		500		58	29				
Ext Walls Above			181.5	15	12.25				
Ext Walls Below			51.25	125	32.0				
Garage		560		65	36.4				

Σ W = 109.68      1096.8

Total Applied Seismic Load, **V** = Cs W                      **14.20**      kips  
Cs W x ρ                      **18.46**      kips

Kitchen Plus Dining	19.5	1219		48	58.51	3958	1.00	26.28	26.28
Ext Walls Above			51.25	125	32.03				
Ext Walls Below			97.25	125	112.45				

Σ W = 202.99      3958.3

Total Applied Seismic Load, **V** = Cs W                      **26.28**      kips  
Cs W x ρ                      **34.16**      kips

Living Room	13	2218		83	184.09	3443	1.00	34.29	114.56
Deck		457		90	41.13				
Ext Walls Below			36.5	125	29.66				
Fireplace					10				

Σ W = 265      3443      1      114.56

Note: DL for walls = Tributary Height x Perimeter x UDL

Total Applied Seismic Load, **V** = Cs W                      **34.29**      kips  
Cs W x ρ                      **44.58**      kips

# SEISMIC LOADING- Z DIRECTION

<b>PROJECT:</b> Summit Powder Mountain	<b>PROJECT#:</b> 18035	<b>PAGE#:</b>
<b>DESCRIPTION:</b> Seismic Loading Criteria- Z Direction		<b>AUTHOR/DATE:</b>
		<b>CHECKED BY/DATE:</b>

## Seismic Calculations per ASCE 7-10

As referenced by CBC 2016

Site Class = **C** Per Geotech Report  
 Risk Cat. = **II** (ASCE 7-10 1.5-1 Classification of Bldgs and other Structures)  
 Seis. Dgn Cat. = **D** (ASCE 7-10 11.6-1 Seismic Design Category)  
 $S_s = 0.813$  Per Geotech Report  
 $S_1 = 0.270$  Per Geotech Report

GOVERNING, LOWEST R

LFRS= Concrete Special Reinforced Shear Walls

$I_e = 1.0$  (Sect. 11.5.1)

**R = 5.0** (Table 12.2-1)

$C_d = 5.0$

Omega= **2.5**

Height = **14** ft

$T_n = 0.14$  sec

$T_L = 8$  sec

$C_t = 0.02$

(ASCE 7-10 Table 12.8-2)

$S_{MS} = 0.874$

$S_{M1} = 0.424$

$S_{DS} = 0.583$

$S_{D1} = 0.283$

$\rho = 1.3$

Site Coeff $F_a$						Site Coeff $F_v$									
		$\leq$				$\geq$				$\leq$				$\geq$	
		$S_s$	0.25	0.50	0.75	1.00	1.25			$S_1$	0.1	0.20	0.3	0.40	0.5
A		0.8	0.8	0.8	0.8	0.8		A		0.8	0.8	0.8	0.8	0.8	0.8
B		1.0	1.0	1.0	1.0	1.0		B		1.0	1.0	1.0	1.0	1.0	1.0
C		1.2	1.2	1.1	1.0	1.0		C		1.7	1.6	1.5	1.4	1.3	
D		1.6	1.4	1.2	1.1	1.0		D		2.4	2.0	1.8	1.6	1.5	
E		2.5	1.7	1.2	0.9	0.9		E		3.5	3.2	2.8	2.4	2.4	

Seis. Dsgn Cat. (per $S_{DS}$ )			Risk Category		
			I or II	III	IV
0	$\leq S_{DS} <$	0.167	A	A	A
0.167	$\leq S_{DS} <$	0.33	B	B	C
0.33	$\leq S_{DS} <$	0.50	C	C	D
0.50	$\leq S_{DS}$		D	D	D

Seis. Dsgn Cat. (per $S_{D1}$ )			Risk Category		
			I or II	III	IV
0	$\leq S_{D1} <$	0.067	A	A	A
0.067	$\leq S_{D1} <$	0.13	B	B	C
0.13	$\leq S_{D1} <$	0.20	C	C	D
0.20	$\leq S_{D1}$		D	D	D



<b>PROJECT:</b> Summit Powder Mountain	<b>PROJECT#:</b> 18035	<b>PAGE#:</b>
		<b>AUTHOR/DATE:</b>
<b>DESCRIPTION:</b> Seismic Loading Criteria- Z Direction		<b>CHECKED BY/DATE:</b>

<b>Seismic Response Coefficient</b>		
<b>(ASCE 7-10 12.8.1.1)</b>		
$C_s = S_{DS}/(R/I_e)$	$C_s = 0.117$	(12.8-2)
$C_s = S_{D1} / [T(R/I_e)]$ (need not exceed, for $T \leq T_L$ )	$C_s \leq 0.391$	(12.8-3)
$C_s = S_{D1} T_L / [T^2(R/I_e)]$ (need not exceed, for $T > T_L$ )	$C_s \geq 21.607$	(12.8-4)
$C_s$ shall not be less than 0.01		(12.8-5)
$C_s = 0.5S_1/(R/I_e)$ (shall not be less than, for areas where $S_1 \geq 0.6g$ )	$C_s \geq 0.027$	(12.8-6)
Base Shear	<b>V = 0.117 W</b>	(12.8-1)

Level	Area (sqft)	Height (ft)	Walls Below (ft)	Walls Above (ft)
<b>High Roof</b>	660	20	113.5	
<b>Low Roof</b>	430	9	68	
<b>Office</b>	558	9	77	65
<b>Deck and Exterior Roof</b>				
Deck	448	14	16.5	
Exterior Roof	2398	23	196.5	
<b>Entry Level</b>				
Mudroom plus Foyer	500	10	51.25	
Garage	560			
<b>Kitchen plus Dining</b>	1219	18.5	97.25	
<b>Living Room Level</b>				
Master Bed and Living Room	2218	13	36.5	
Roof Snow Load	128	psf	Elevation above MSL of Structure=	8600 ft
Snow Load for Seismic Calculations =	<b>37.12</b>	psf		

Seismic Weight (DL from Gravity Loading Criteria)									
Floor	Story Height	Floor Area (sf)	Wall Length (ft)	UDL (psf)	DL (k)	w*h	wihi/wxhx	Fx (k)	Fstory (k)
High Roof	20	660		23	14.85	1127	0.66	8.81	8.81
Snow Load		660		37.1	24.50				
Ext Walls			113.5	15	17.0				
Low Roof	11	430		23	9.675	332	0.19	2.60	11.41
Snow Load		430		37.1	15.96				
Ext Walls			68	15	4.59				
Office	9	558		15	8.37	257	0.15	2.01	13.42
Snow Load		141		37.1	5.23				
Ext Walls Above			65	15	9.75				
Ext Walls Below			77	15	5.20				

Σ W = 115.15      1716.94      1.00

Total Applied Seismic Load, **V** = Cs W                      13.42              kips  
Cs W x ρ                      17.44              kips

8.81  
2.60

Deck and Ext Roof	23					4422	1.00	22.40	22.40
Deck		448		31	13.66				
Ext Walls			16.5	15	1.7325				
Exterior Roof		2398		23	53.96				
Ext Walls			196.5	15	33.90				
Snow Loads		2398		37.1	89.0				

Σ W = 192.3      4422.0

Total Applied Seismic Load, **V** = Cs W                      22.40              kips  
Cs W x ρ                      29.12              kips

Entry level	10					1097	1.00	12.78	12.78
Foyer & Mudroom		500		58	29				
Ext Walls Above			181.5	15	12.25				
Ext Walls Below			51.25	125	32.0				
Garage		560		65	36.4				

Σ W = 109.68      1096.8

Total Applied Seismic Load, **V** = Cs W                      12.78              kips  
Cs W x ρ                      16.61              kips

Kitchen Plus Dining	19.5	1219		48	58.51	3958	1.00	23.65	23.65
Ext Walls Above			51.25	125	32.03				
Ext Walls Below			97.25	125	112.45				

Σ W = 202.99      3958.3

Total Applied Seismic Load, **V** = Cs W                      23.65              kips  
Cs W x ρ                      30.74              kips

Living Room	13	2218		83	184.09	3443	1.00	30.86	103.11
Deck		457		90	41.13				
Ext Walls Below			36.5	125	29.66				
Fireplace					10				

Σ W = 265      3443      1      103.11

Note: DL for walls = Tributary Height x Perimeter x UDL

Total Applied Seismic Load, **V** = Cs W                      30.86              kips  
Cs W x ρ                      40.12              kips

### 3.0 Three-Dimensional Analysis

The analysis model is in accordance with the plan check drawings dated April 2018 and follows load criteria assumptions stated in Chapter 2. The Structure has been modeled within RISA 3D and follows the Design Criteria stated in Chapter 2. Refer to respective design chapters for member analysis results and design.

See following pages for modeling input and analysis images.

The following specific items are addressed:

1. No upslope pressures have been applied on the upslope perimeter retaining walls. The house has a permanent shoring wall (designed by others) behind the structure shown that is assumed to take all the lateral soil loads. The permanent wall is assumed to be an independent structure and imposes no load on the main house.
2. Concrete floors and walls have been modeled using effective ACI stiffness properties. Auto cookie cut mesh is applied to shell elements and meshed at beams and walls edges.
3. A rigid diaphragm constraint has been defined at levels with metal deck with concrete topping.
4. The sloped roof shell has been modeled and meshed in RISA 3D as plate elements to account for a semi-rigid distribution.
5. A flexible distribution has been assumed on the high roof.
6. Pin supports are applied to all gravity columns and walls.
7. Seismic Loads have been assigned manually within the program and match the criteria stated in Chapter 2.
8. RISA load combinations have been auto-generated in accordance with AISC 360-10 for steel frame elements and ACI 318-14 for concrete elements.
9. Lateral frames have been designed considering seismic loading, including  $\rho = 1.3$ ,
10. Transfer frames have been designed considering seismic loading and special seismic loading including over-strength factors and designed within RISA 3D.
11. The model was used to generate all gravity forces used to design foundation elements.

Figure 3.0-1 – Three Dimensional Mathematical Model, Isometric View 1

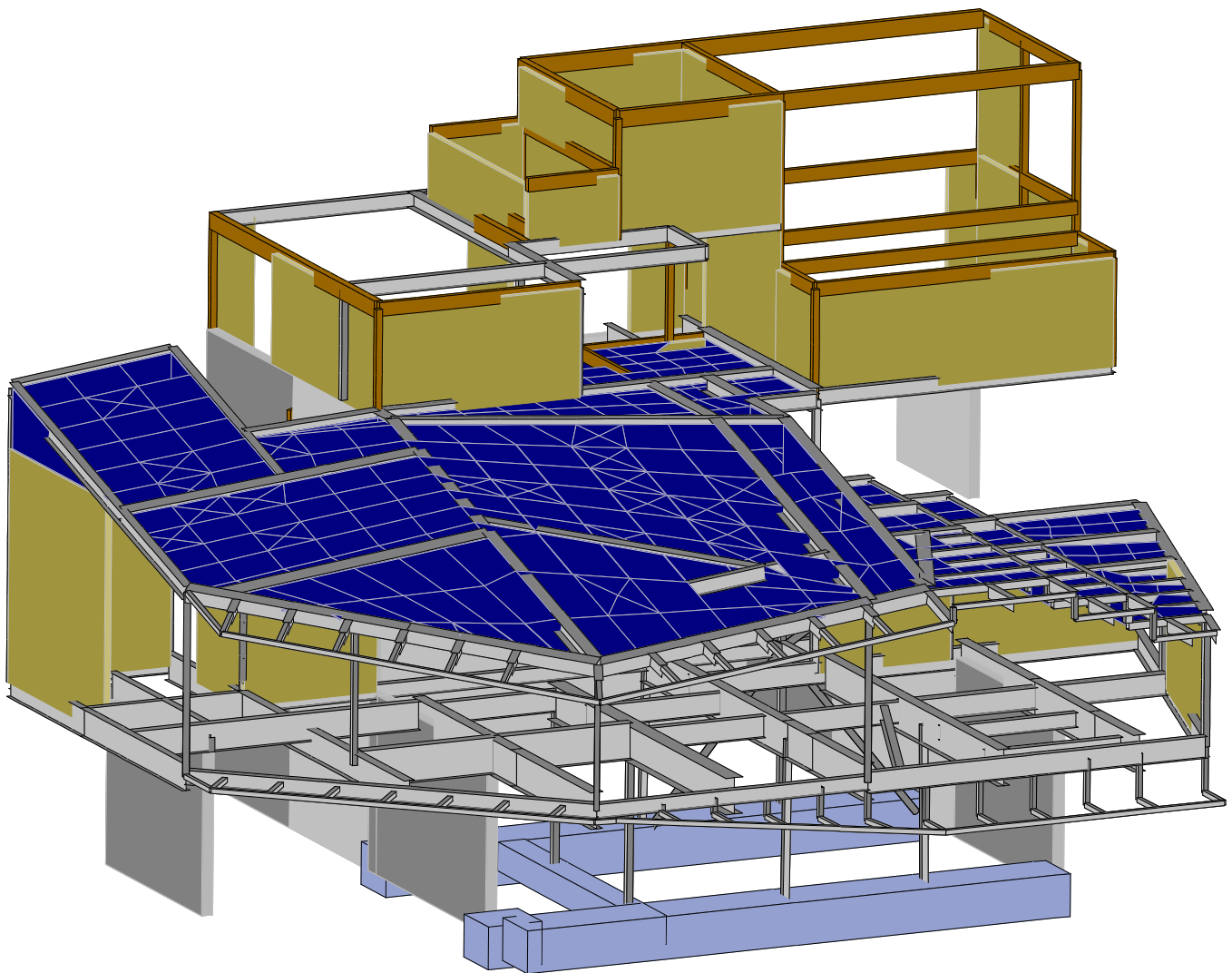
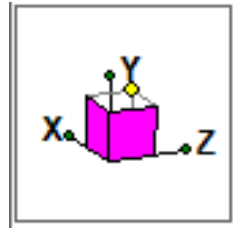


Figure 3.0-2 – Three Dimensional Mathematical Model, Isometric View 2

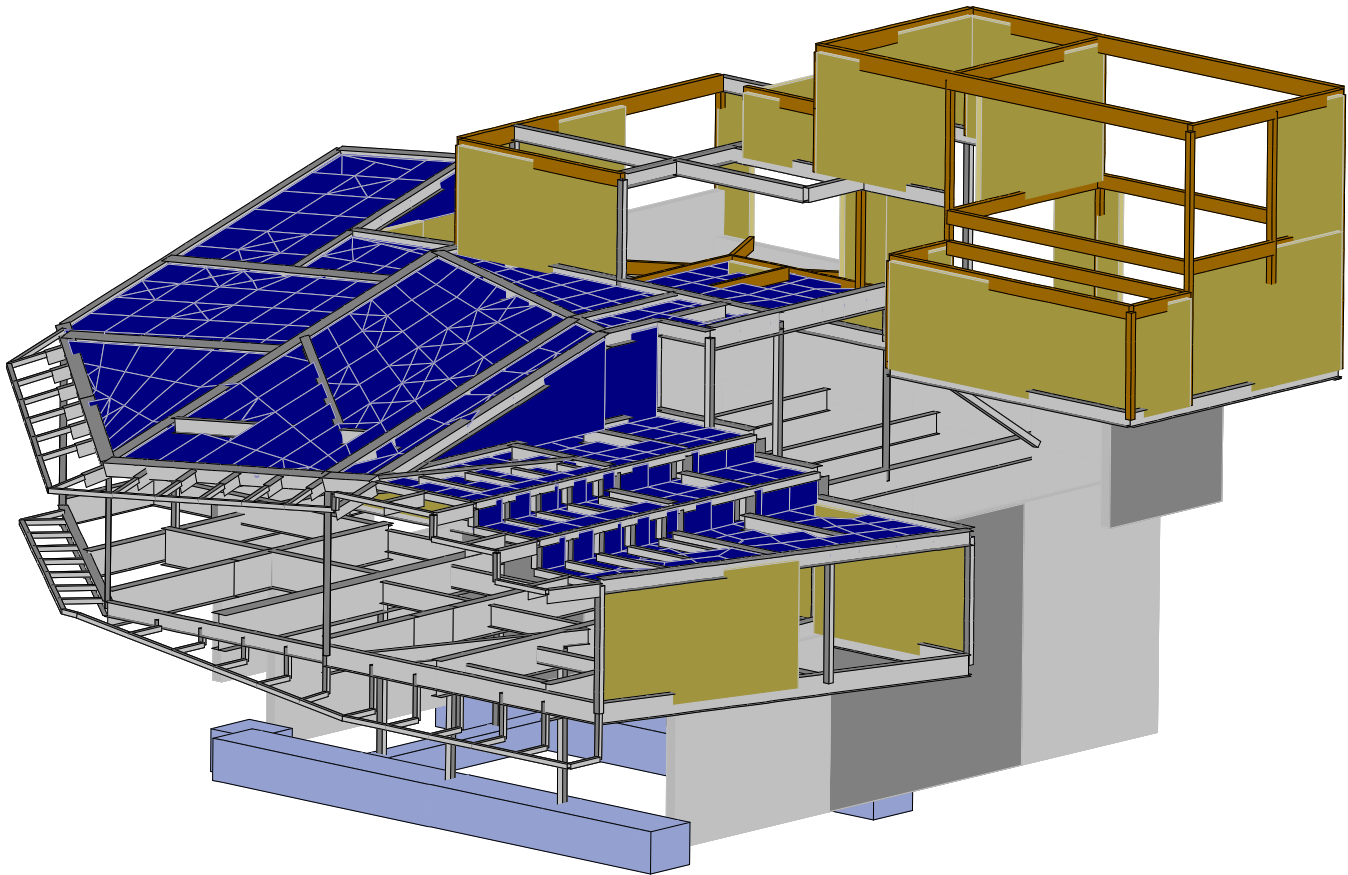
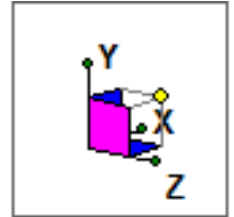
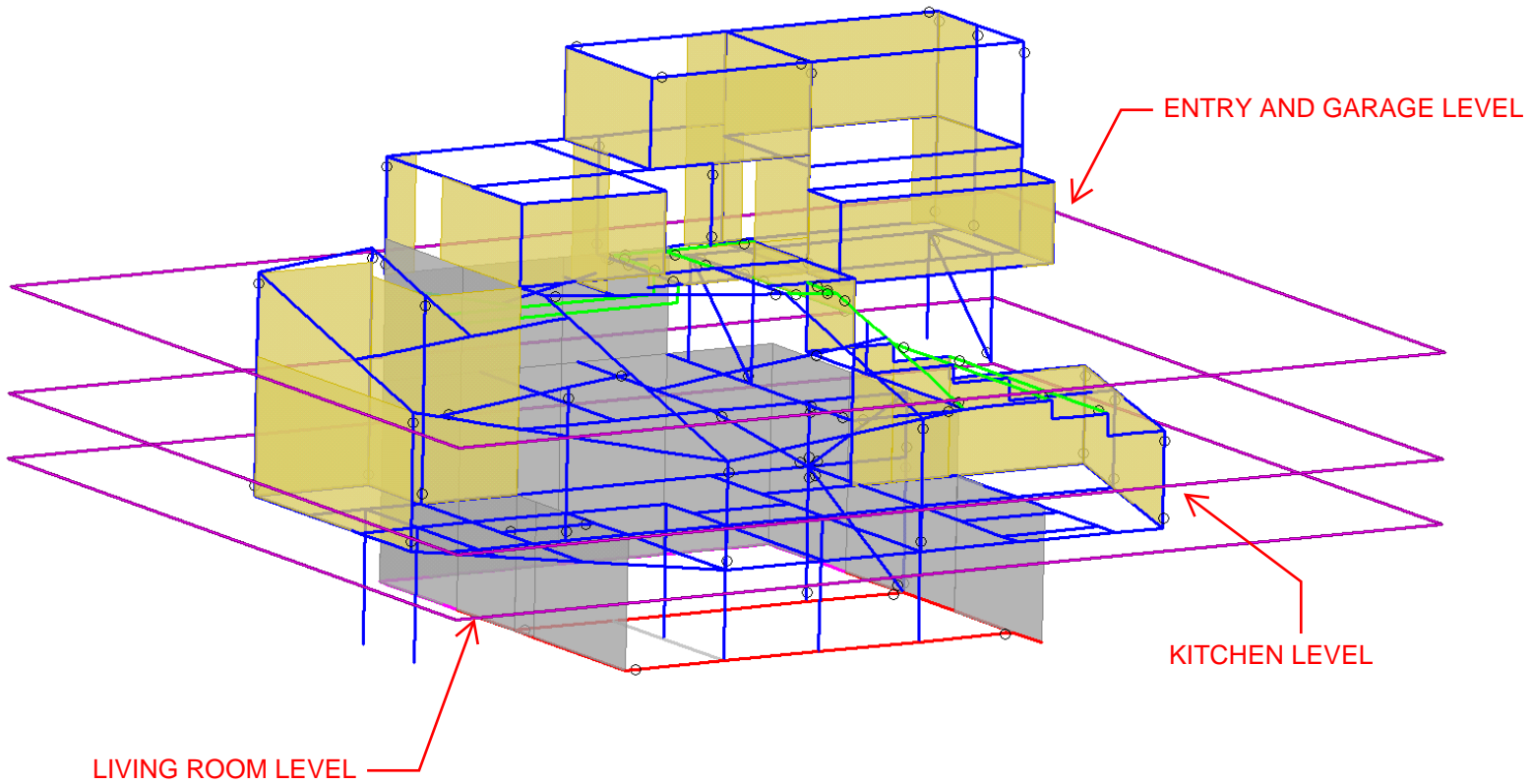


Figure 3.0-3 –Diaphragm Assignment

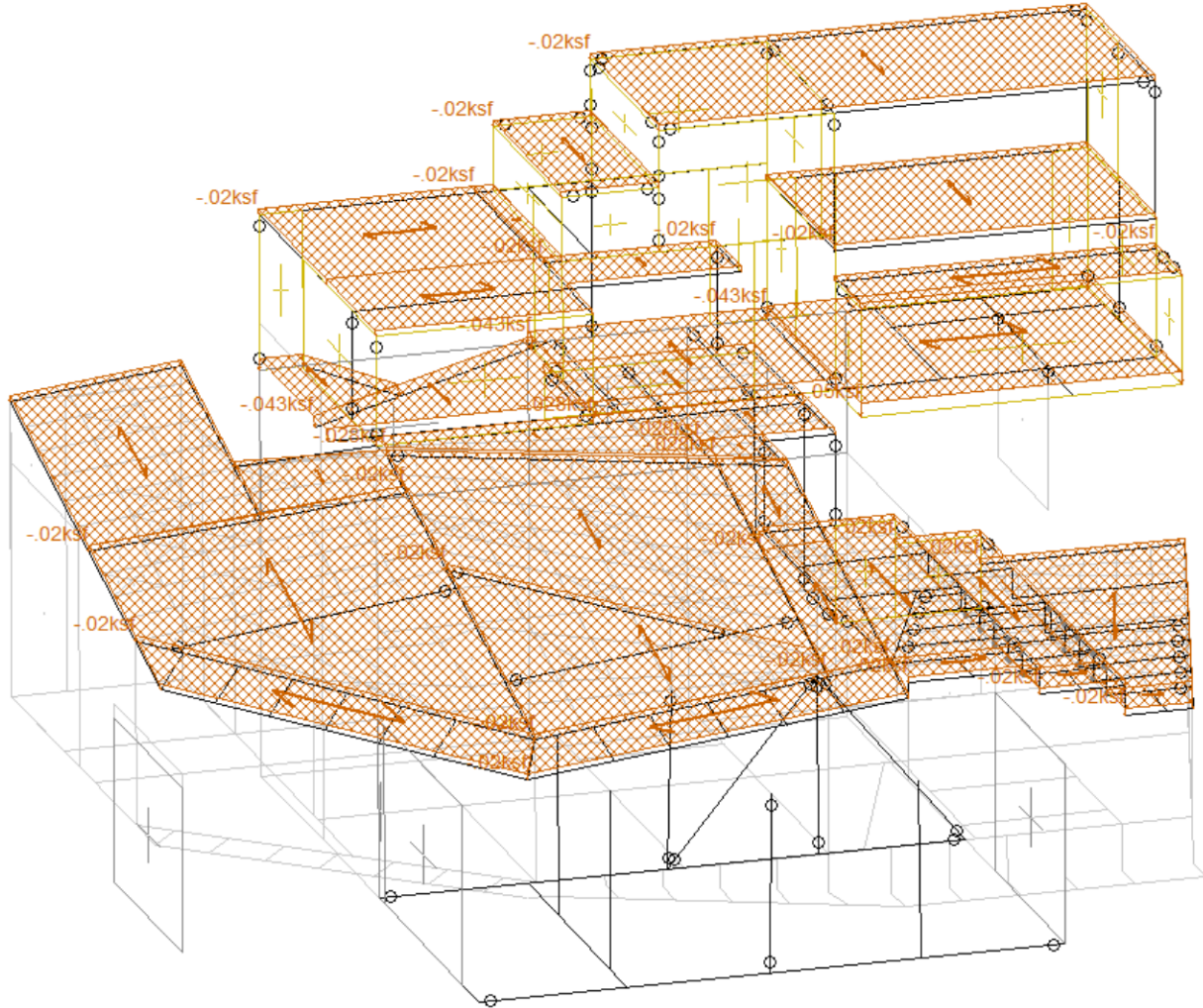


**ASSIGNED RIGID DIAPHRAGMS**





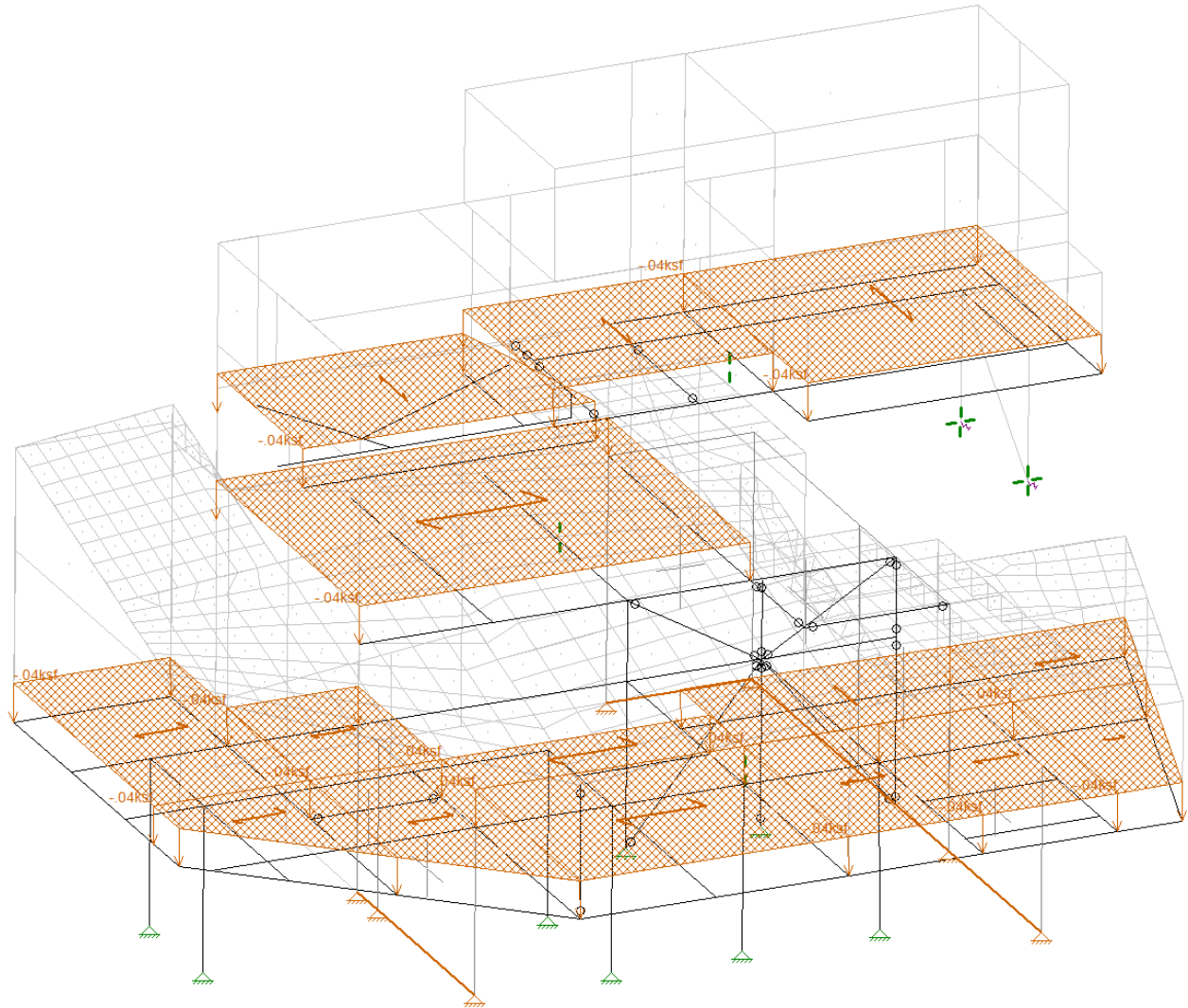
**Assigned Dead Load**



**ROOF, GARAGE, ENTRY AND DECK DEAD LOAD PER CHAPTER 2**

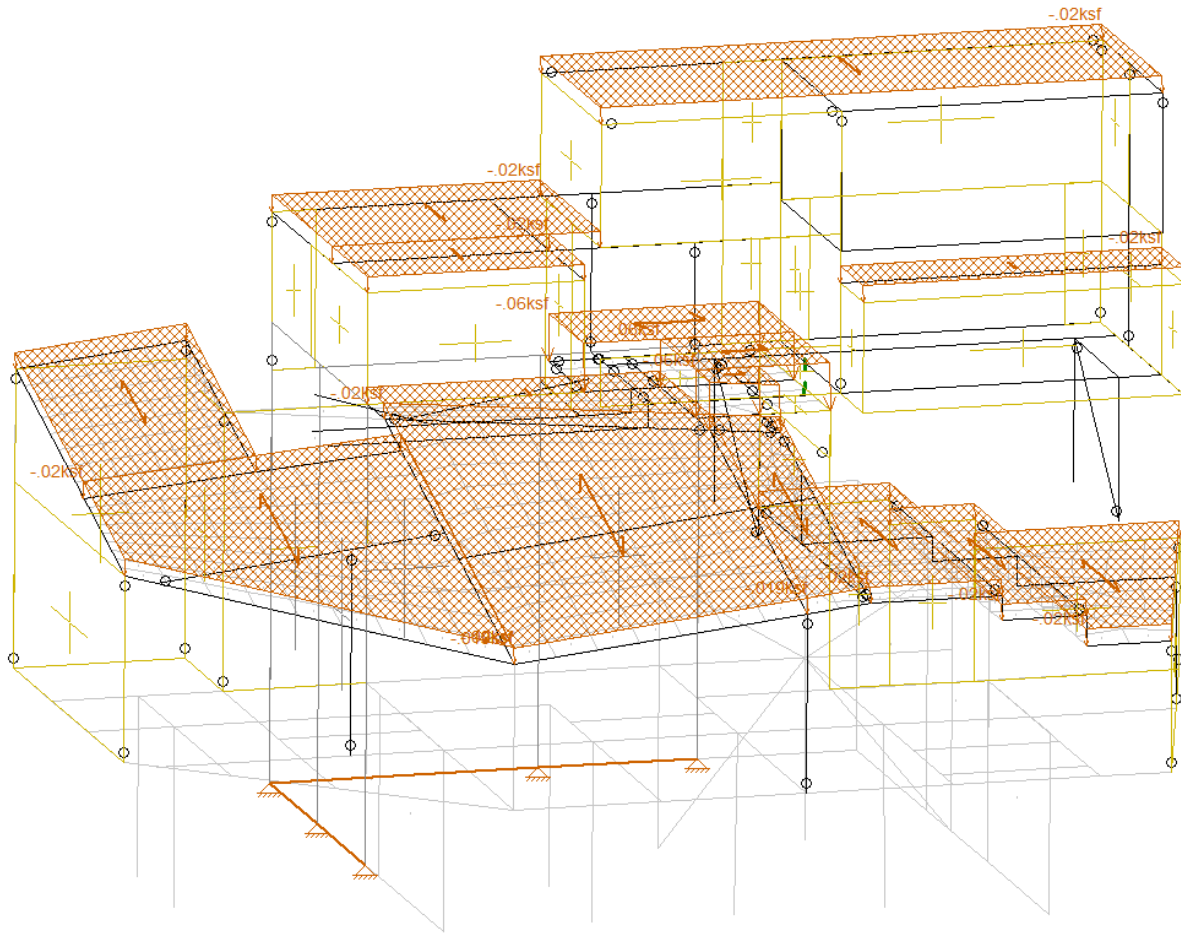


**Assigned Live Load**



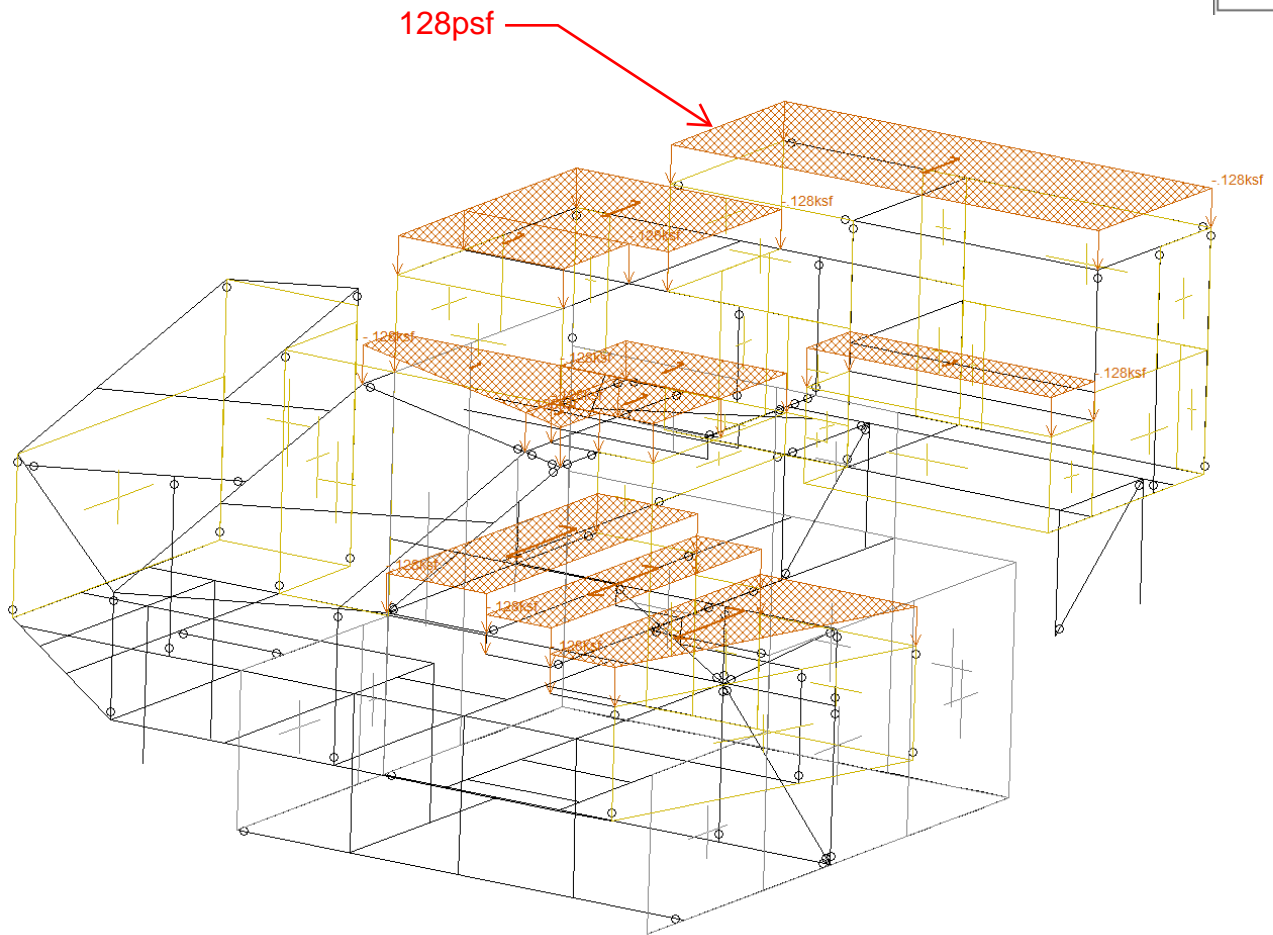
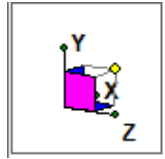
**LIVING ROOM, ENTRY, GARAGE AND KITCHEN LIVE LOAD PER CHAPTER 2**

**Assigned Roof Live Load**



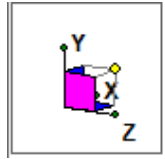
**LIVING ROOM AND KICTHEN DEAD LOAD PER CHAPTER 2**

**ASSIGNED FLAT ROOF SNOW LOAD**

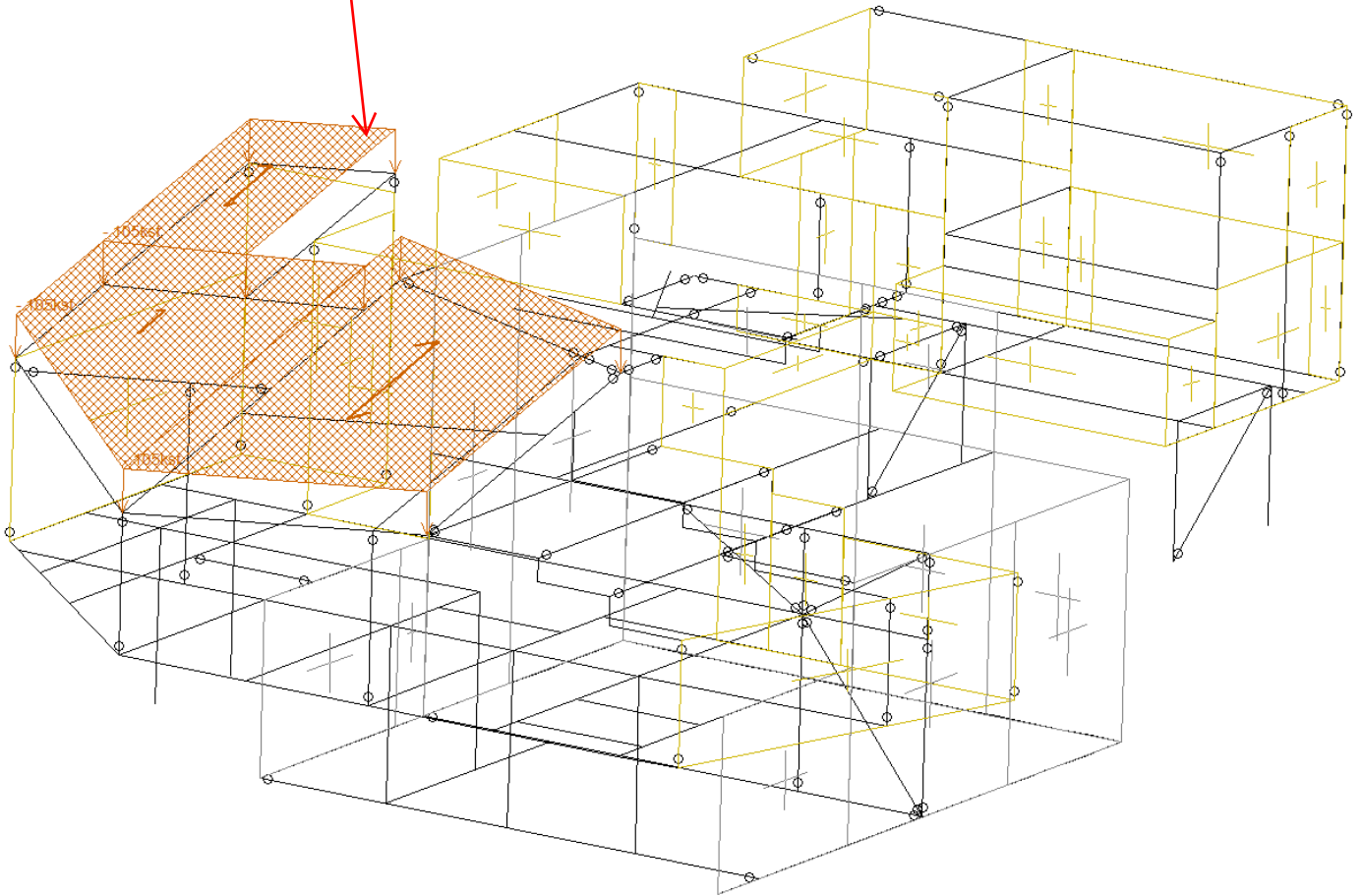


**Snow Load per Chapter 2**

**ASSIGNED SLOPED ROOF SNOW LOAD**

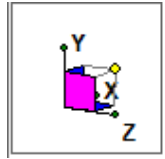


109psf (Projected Load)

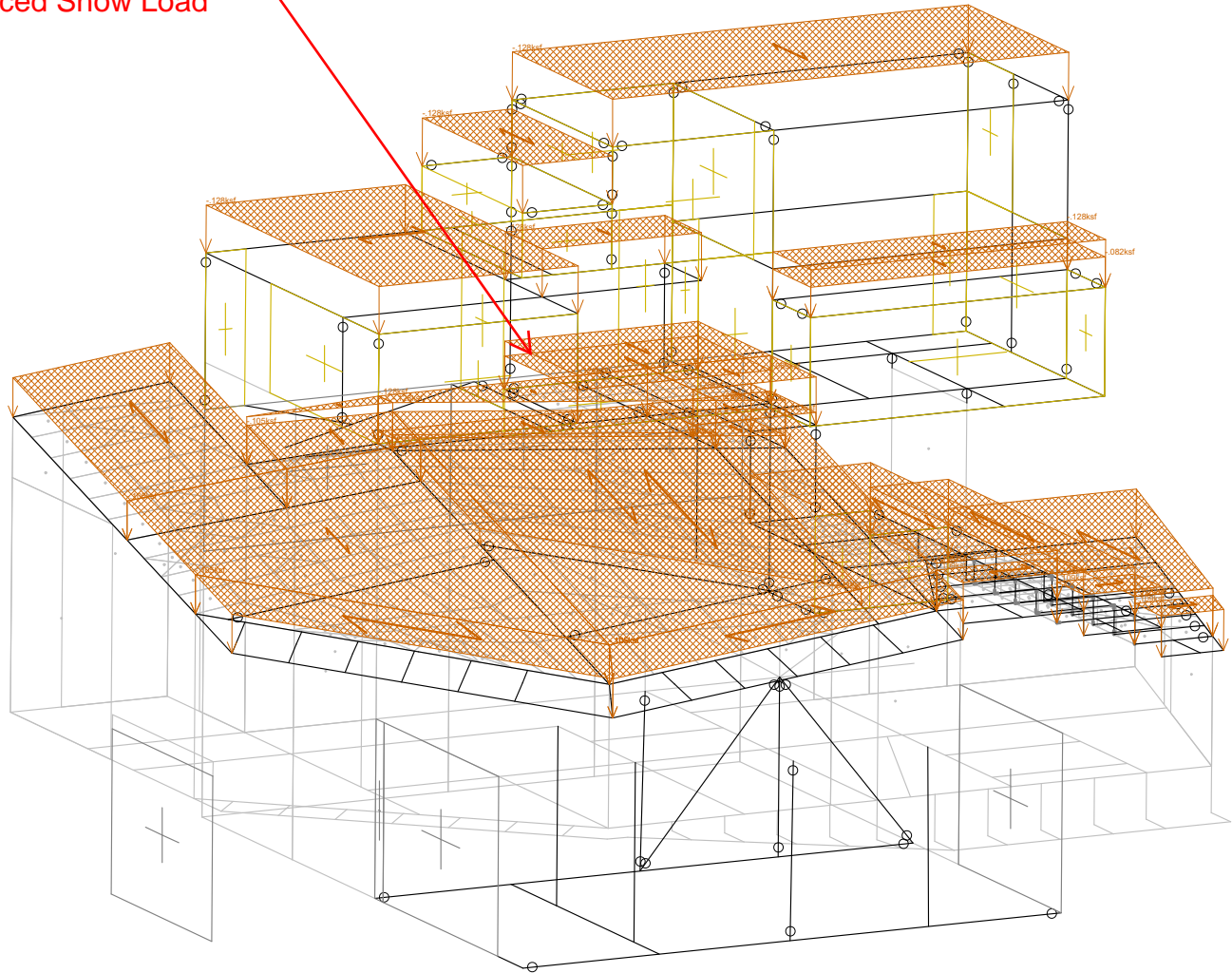


**Snow Load per Chapter 2**

**ASSIGNED UNBALANCED SNOW LOAD-1**



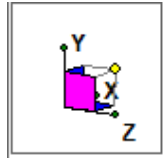
Balanced plus  
 Unbalanced Snow Load



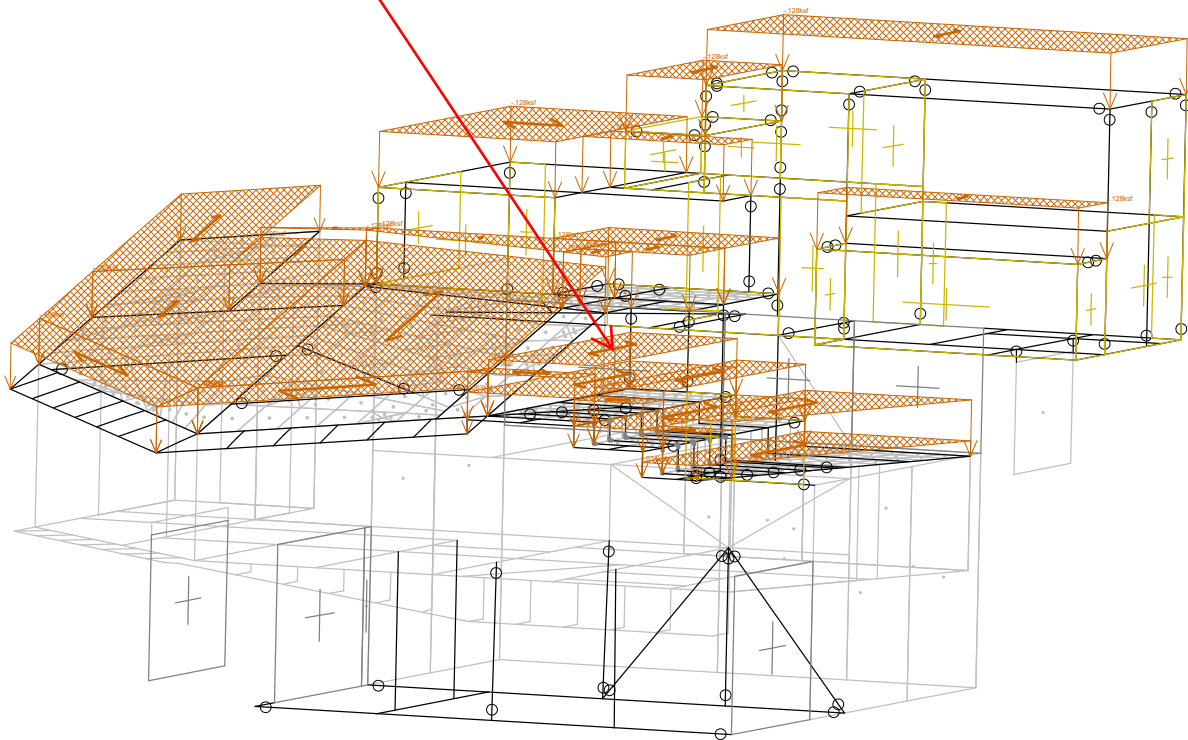
**Unbalanced Snow Load per Chapter 2**



**ASSIGNED UNBALANCED SNOW LOAD-2**

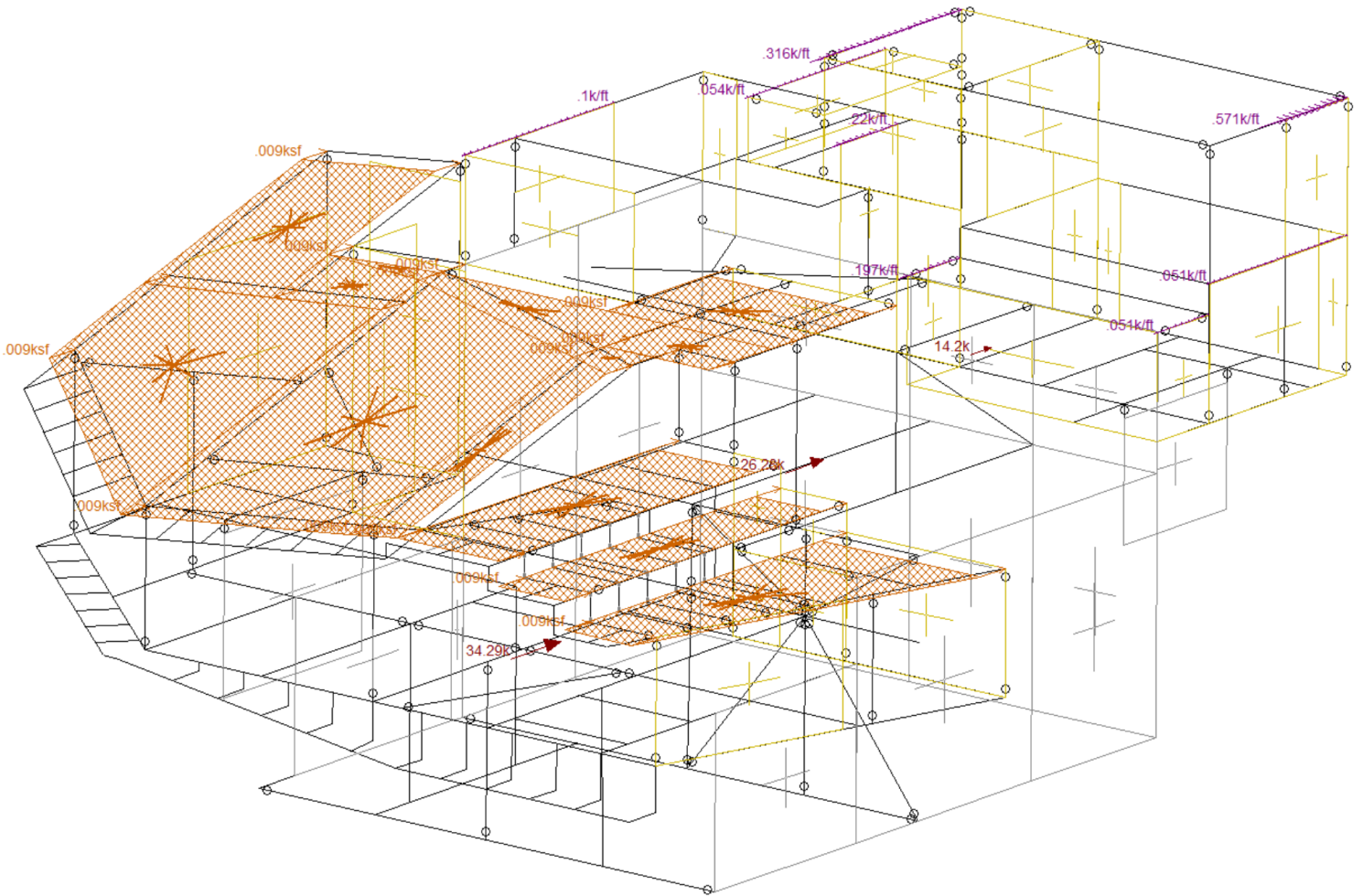


Balanced plus  
 Unbalanced Snow Load



**Unbalanced Snow Load per Chapter 2**

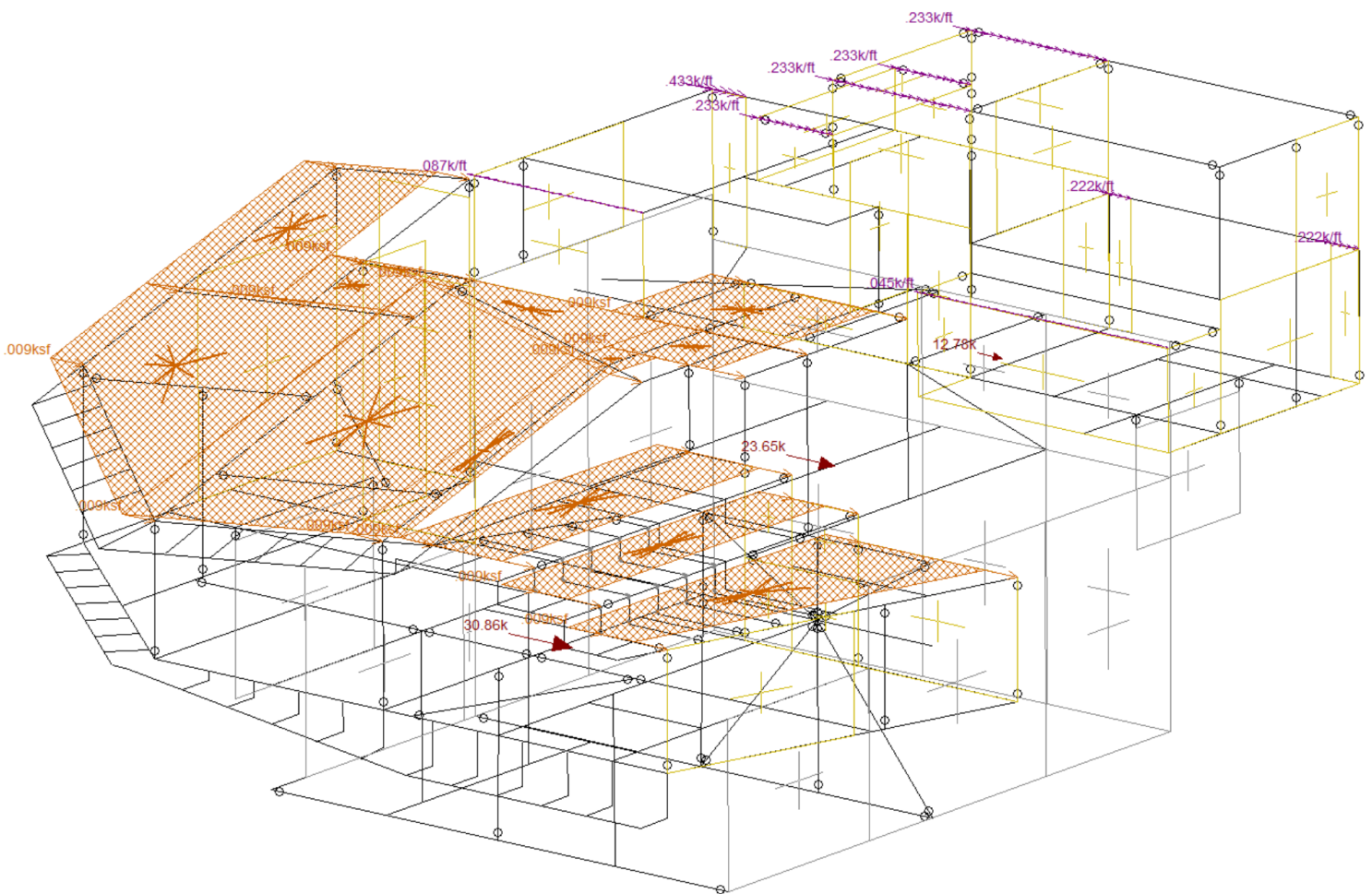
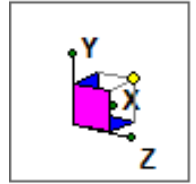
**Assigned EQX Load**



**EQX LOAD PER CHAPTER 2**



Assigned EQZ Load



EQZ LOAD PER CHAPTER 2





### Concrete Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (1...	Density[k/ft^3]	f'c[ksi]	Lambda	Flex Steel...	Shear Ste...
1	Conc3000NW	3156	1372	.15	.6	.145	3	1	60	60
2	Conc5000NW	4030	1752.17	.15	.6	.145	5	1	60	60
3	CONC3000NW 0 ...	3156	1372	.15	.6	0	3	1	60	60

### Design Size and Code Check Parameters

	Label	Max Depth[in]	Min Depth[in]	Max Width[in]	Min Width[in]	Max Bending Chk	Max Shear Chk
1	CF2 Long					1	1
2	CF1 long					1	1
3	Horizontal reinf CF2					1	1
4	DR1					1	1
5	DR1					1	1

### Wall Panel U.C. Parameters

	Label	Max Bending Chk	Max Shear Chk
1	12' WALLS	1	1

### Wood Wall Panel Parameters

	Label	Top Plate	Sill Plate	Studs	Min Stud Space[in]	Max Stud Space[in]	Green Lu...	Header Size	Header Matl
1	12' WALLS	2-2X6	2X6	2X6	16	16		6x8	Same as ...

### Concrete Wall Panel Rebar Parameters

	Label	Vert Bar S...	Max Vert Ba...	Min Vert Bar...	Vert Bar I...	Horz Bar ...	Max Horz Ba...	Min Horz Ba...	Horz Bar I...	Group ...
1	12' WALLS	#6	12	12	2	#4	12	12	2	

### Rigid Diaphragms

	Joint Label	Plane	Inactive	No Wind/Drift
1	N1	ZX		
2	N219	ZX	Yes	
3	N111	ZX		

### Basic Load Cases

	BLC Description	Category	X Grav...	Y Grav...	Z Grav...	Joint	Point	Distrib...	Area(...	Surfac...
2	SDL	DL						12	50	
3	LL	LL							20	
4	Flat Roof Snow Load	SL							17	
5	Sloping Roof Snow Load	SL							9	
6		None						6		
7	Roof Live Load	RLL							23	
8	Unbalanced snow Load 1	OL1							28	
9		None						291		
10	EQX	ELX				3		6	13	
11	EQZ	ELZ				3		9	13	
12	Static HL	HL								
13	Seismic HL	OL2								
16	Unbalanced Snow Load 2	OL2							25	

### Load Combinations

	Description	Sol.	PD.	S...	BLC	F...	BLC	Fac...	BLC	Fa...	BLC	Fa...	BLC	Fa...	BLC	Fa...	F.....	F.....	F.....	F.....	F.....
1	SW		Y		1	1															
2	Deflection 1		Y		DL	1															
3	Deflection 2		Y		LL	1	RLL	1													
4	Deflection 3		Y		DL	1	LL	1	RLL	1											
5	ASCE ASD 1		Y		DL	1	HL	1													
6	ASCE ASD 2		Y		DL	1	LL	1	LLS	1	HL	1									
7	ASCE ASD 3 (a)		Y		DL	1	RLL	1	HL	1											
8	ASCE ASD 3 (b)		Y		DL	1	SL	1	SLN	1	HL	1									
9	ASCE ASD 4 (a)		Y		DL	1	LL	.75	LLS	.75	RLL	.75	HL	1							
10	ASCE ASD 4 (b)		Y		DL	1	LL	.75	LLS	.75	SL	.75	SLN	.75	...	1					
11	Snow Load		Y		SL	1															
12	Unbalanced Snow Load ...		Y		DL	1	OL1	1	HL	1											
13	Unbalanced Snow Load ...		Y		DL	1	OL1	.75	LL	.75	HL	1									
14	Unbalanced Snow Load ...		Y		DL	1	OL2	1	HL	1											
15	Unbalanced Snow Load ...		Y		DL	1	OL2	.75	LL	.75	HL	1									
16	EQX		Y		ELX	-1															
17	EQZ		Y		ELZ	-1															
18	HL		Y		HL	1	13	1													
19	ASCE ASD 5 (b) (a)		Y		DL	1	Rho*E...	.7													
20	ASCE ASD 5 (b) (b)		Y		DL	1	Rho*E...	.7													
21	ASCE ASD 5 (b) (c)		Y		DL	1	Rho*E...	-.7													
22	ASCE ASD 5 (b) (d)		Y		DL	1	Rho*E...	-.7													
23	ASCE ASD 6 (b) (a)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	RLL	.75							
24	ASCE ASD 6 (b) (b)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	RLL	.75							
25	ASCE ASD 6 (b) (c)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	RLL	.75							
26	ASCE ASD 6 (b) (d)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	RLL	.75							
27	ASCE ASD 6 (d) (a)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75					
28	ASCE ASD 6 (d) (b)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75					
29	ASCE ASD 6 (d) (c)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75					
30	ASCE ASD 6 (d) (d)		Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75					
31	ASCE ASD 8 (a)		Y		DL	.6	Rho*E...	.7													
32	ASCE ASD 8 (b)		Y		DL	.6	Rho*E...	.7													
33	ASCE ASD 8 (c)		Y		DL	.6	Rho*E...	-.7													
34	ASCE ASD 8 (d)		Y		DL	.6	Rho*E...	-.7													
35	ASCE Strength 5 (a)		Y		DL	1.2	ELX	1	LL	.5	LLS	1	SL	.2	...	.2					
36	ASCE Strength 5 (b)		Y		DL	1.2	ELZ	1	LL	.5	LLS	1	SL	.2	...	.2					
37	ASCE Strength 5 (c)		Y		DL	1.2	ELX	-1	LL	.5	LLS	1	SL	.2	...	.2					
38	ASCE Strength 5 (d)		Y		DL	1.2	ELZ	-1	LL	.5	LLS	1	SL	.2	...	.2					
39	ASCE Strength 7 (a)		Y		DL	.9	ELX	1	HL	1.6	13	1									
40	ASCE Strength 7 (b)		Y		DL	.9	ELZ	1	HL	1.6	13	1									
41	ASCE Strength 7 (c)		Y		DL	.9	ELX	-1	HL	1.6	13	1									
42	ASCE Strength 7 (d)		Y		DL	.9	ELZ	-1	HL	1.6	13	1									
43	ASCE Strength 1		Y		DL	1.4															
44	ASCE Strength 2 (a)		Y		DL	1.2	LL	1.6	LLS	1.6	RLL	.5									
45	ASCE Strength 2 (b)		Y		DL	1.2	LL	1.6	LLS	1.6	SL	.5	SLN	.5							
46	ASCE Strength 2 (c)		Y		DL	1.2	LL	1.6	LLS	1.6											
47	ASCE Strength 3 (a)		Y		DL	1.2	RLL	1.6	LL	.5	LLS	1									
48	ASCE Strength 3 (c)		Y		DL	1.2	SL	1.6	SLN	1.6	LL	.5	LLS	1							
49	ASCE ASD 5 (b) (a)		Y		DL	1	ELX	.7													
50	ASCE ASD 5 (b) (b)		Y		DL	1	ELZ	.7													
51	ASCE ASD 6 (b) (a)		Y		DL	1	ELX	.525	LL	.75	LLS	.75	RLL	.75							
52	ASCE ASD 6 (b) (b)		Y		DL	1	ELZ	.525	LL	.75	LLS	.75	RLL	.75							
53	ASCE ASD 6 (d) (a)		Y		DL	1	ELX	.525	LL	.75	LLS	.75	SL	.75	...	.75					
54	ASCE ASD 6 (d) (b)		Y		DL	1	ELZ	.525	LL	.75	LLS	.75	SL	.75	...	.75					
55	ASCE ASD 6 (f) (a)		Y		DL	1	ELX	.525	LL	.75	LLS	.75									
56	ASCE ASD 6 (f) (b)		Y		DL	1	ELZ	.525	LL	.75	LLS	.75									

UNBALANCED SNOW LOAD COMBOS

EARTHQUAKE LOAD COMBOS WITH RHO

STRENGTH DESIGN COMBOS FOR CONCRETE WALL DESIGN



**Load Combinations (Continued)**

**OVERSTRENGTH DESIGN COMBOS**

Description	Sol.	PD	S	BLC	F	BLC	Fac	BLC	Fa	BLC	Fa	BLC	Fa	BLC	Fa	BLC	Fa	BLC	Fa
57 ASCE ASD 8 (a)		Y		DL	.6	ELX	.7												
58 ASCE ASD 8 (b)		Y		DL	.6	ELZ	.7												
59 ASCE ASD 5 (b) (os-a)		Y		DL	1	Om*E...	.7												
60 ASCE ASD 5 (b) (os-b)		Y		DL	1	Om*E...	.7												
61 ASCE ASD 5 (b) (os-c)		Y		DL	1	Om*E...	-.7												
62 ASCE ASD 5 (b) (os-d)		Y		DL	1	Om*E...	-.7												
63 ASCE ASD 6 (b) (os-a)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	RLL	.75						
64 ASCE ASD 6 (b) (os-b)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	RLL	.75						
65 ASCE ASD 6 (b) (os-c)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	RLL	.75						
66 ASCE ASD 6 (b) (os-d)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	RLL	.75						
67 ASCE ASD 6 (d) (os-a)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75				
68 ASCE ASD 6 (d) (os-b)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75				
69 ASCE ASD 6 (d) (os-c)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75				
70 ASCE ASD 6 (d) (os-d)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75				
71 ASCE ASD 6 (f) (os-a)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75								
72 ASCE ASD 6 (f) (os-b)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75								
73 ASCE ASD 6 (f) (os-c)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75								
74 ASCE ASD 6 (f) (os-d)		Y		DL	1	Om*E...	.525	LL	.75	LLS	.75								
75 ASCE ASD 8 (os-a)		Y		DL	.6	Om*E...	.7												
76 ASCE ASD 8 (os-b)		Y		DL	.6	Om*E...	.7												
77 ASCE ASD 8 (os-c)		Y		DL	.6	Om*E...	-.7												
78 ASCE ASD 8 (os-d)		Y		DL	.6	Om*E...	-.7												
79 EQX ASD		Y		DL	.6	ELX	.7												
80 ASCE ASD 5 (b) (a)		Y		DL	1	ELX	.7	ELZ	.21										
81 ASCE ASD 5 (b) (b)		Y		DL	1	ELZ	.7	ELX	.21										
82 ASCE ASD 5 (b) (c)		Y		DL	1	ELX	.7	ELZ	-.21										
83 ASCE ASD 5 (b) (d)		Y		DL	1	ELZ	.7	ELX	-.21										
84 ASCE ASD 5 (b) (e)		Y		DL	1	ELX	-.7	ELZ	-.21										
85 ASCE ASD 5 (b) (f)		Y		DL	1	ELZ	-.7	ELX	-.21										
86 ASCE ASD 5 (b) (g)		Y		DL	1	ELX	-.7	ELZ	.21										
87 ASCE ASD 5 (b) (h)		Y		DL	1	ELZ	-.7	ELX	.21										
88 ASCE ASD 6 (b) (a)	Yes	Y		DL	1	ELX	.525	ELZ	.158	LL	.75	LLS	.75	...	.75				
89 ASCE ASD 6 (b) (b)	Yes	Y		DL	1	ELZ	.525	ELX	.158	LL	.75	LLS	.75	...	.75				
90 ASCE ASD 6 (b) (c)	Yes	Y		DL	1	ELX	.525	ELZ	-.1...	LL	.75	LLS	.75	...	.75				
91 ASCE ASD 6 (b) (d)	Yes	Y		DL	1	ELZ	.525	ELX	-.1...	LL	.75	LLS	.75	...	.75				
92 ASCE ASD 6 (b) (e)	Yes	Y		DL	1	ELX	-.525	ELZ	-.1...	LL	.75	LLS	.75	...	.75				
93 ASCE ASD 6 (b) (f)	Yes	Y		DL	1	ELZ	-.525	ELX	-.1...	LL	.75	LLS	.75	...	.75				
94 ASCE ASD 6 (b) (g)	Yes	Y		DL	1	ELX	-.525	ELZ	.158	LL	.75	LLS	.75	...	.75				
95 ASCE ASD 6 (b) (h)	Yes	Y		DL	1	ELZ	-.525	ELX	.158	LL	.75	LLS	.75	...	.75				
96 ASCE ASD 6 (d) (a)	Yes	Y		DL	1	ELX	.525	ELZ	.158	LL	.75	LLS	.75	SL	.75	...	.75		
97 ASCE ASD 6 (d) (b)	Yes	Y		DL	1	ELZ	.525	ELX	.158	LL	.75	LLS	.75	SL	.75	...	.75		
98 ASCE ASD 6 (d) (c)	Yes	Y		DL	1	ELX	.525	ELZ	-.1...	LL	.75	LLS	.75	SL	.75	...	.75		
99 ASCE ASD 6 (d) (d)	Yes	Y		DL	1	ELZ	.525	ELX	-.1...	LL	.75	LLS	.75	SL	.75	...	.75		
100 ASCE ASD 6 (d) (e)	Yes	Y		DL	1	ELX	-.525	ELZ	-.1...	LL	.75	LLS	.75	SL	.75	...	.75		
101 ASCE ASD 6 (d) (f)	Yes	Y		DL	1	ELZ	-.525	ELX	-.1...	LL	.75	LLS	.75	SL	.75	...	.75		
102 ASCE ASD 6 (d) (g)	Yes	Y		DL	1	ELX	-.525	ELZ	.158	LL	.75	LLS	.75	SL	.75	...	.75		
103 ASCE ASD 6 (d) (h)	Yes	Y		DL	1	ELZ	-.525	ELX	.158	LL	.75	LLS	.75	SL	.75	...	.75		
104 ASCE ASD 6 (f) (a)	Yes	Y		DL	1	ELX	.525	ELZ	.158	LL	.75	LLS	.75						
105 ASCE ASD 6 (f) (b)	Yes	Y		DL	1	ELZ	.525	ELX	.158	LL	.75	LLS	.75						
106 ASCE ASD 6 (f) (c)	Yes	Y		DL	1	ELX	.525	ELZ	-.1...	LL	.75	LLS	.75						
107 ASCE ASD 6 (f) (d)	Yes	Y		DL	1	ELZ	.525	ELX	-.1...	LL	.75	LLS	.75						
108 ASCE ASD 6 (f) (e)	Yes	Y		DL	1	ELX	-.525	ELZ	-.1...	LL	.75	LLS	.75						
109 ASCE ASD 6 (f) (f)	Yes	Y		DL	1	ELZ	-.525	ELX	-.1...	LL	.75	LLS	.75						
110 ASCE ASD 6 (f) (g)	Yes	Y		DL	1	ELX	-.525	ELZ	.158	LL	.75	LLS	.75						
111 ASCE ASD 6 (f) (h)	Yes	Y		DL	1	ELZ	-.525	ELX	.158	LL	.75	LLS	.75						
112 ASCE ASD 8 (a)	Yes	Y		DL	.6	ELX	.7	ELZ	.21										
113 ASCE ASD 8 (b)	Yes	Y		DL	.6	ELZ	.7	ELX	.21										

LOAD COMBINATIONS FOR  
 NON-PARALLEL SYSTEM  
 IRREGULARITIES. 100% ONE  
 DIRECTION + 30%  
 PERPENDICULAR DIRECTION

**Load Combinations (Continued)**

Description	Sol	PD	S	BLC	F	BLC	Fac	BLC	Fa	BLC	Fa	BLC	Fa	F	F	F	F	F
114 ASCE ASD 8 (c)	Yes	Y		DL	.6	ELX	.7	ELZ	-.21									
115 ASCE ASD 8 (d)	Yes	Y		DL	.6	ELZ	.7	ELX	-.21									
116 ASCE ASD 8 (e)	Yes	Y		DL	.6	ELX	-.7	ELZ	-.21									
117 ASCE ASD 8 (f)	Yes	Y		DL	.6	ELZ	-.7	ELX	-.21									
118 ASCE ASD 8 (g)	Yes	Y		DL	.6	ELX	-.7	ELZ	.21									
119 ASCE ASD 8 (h)	Yes	Y		DL	.6	ELZ	-.7	ELX	.21									
120 ASCE ASD 5 (b) (os-a)		Y		DL	1	Om*E...	.7	Om*ELZ	.21									
121 ASCE ASD 5 (b) (os-b)		Y		DL	1	Om*E...	.7	Om*E...	.21									
122 ASCE ASD 5 (b) (os-c)		Y		DL	1	Om*E...	.7	Om*ELZ	-.21									
123 ASCE ASD 5 (b) (os-d)		Y		DL	1	Om*E...	.7	Om*E...	-.21									
124 ASCE ASD 6 (b) (os-a)		Y		DL	1	Om*E...	.525	Om*ELZ	.158	LL	.75	LLS	.75	...	.75			
125 ASCE ASD 6 (b) (os-b)		Y		DL	1	Om*E...	.525	Om*E...	.158	LL	.75	LLS	.75	...	.75			
126 ASCE ASD 6 (b) (os-c)		Y		DL	1	Om*E...	.525	Om*ELZ	-.1...	LL	.75	LLS	.75	...	.75			
127 ASCE ASD 6 (b) (os-d)		Y		DL	1	Om*E...	.525	Om*E...	-.1...	LL	.75	LLS	.75	...	.75			
128 ASCE ASD 6 (d) (os-a)		Y		DL	1	Om*E...	.525	Om*ELZ	.158	LL	.75	LLS	.75	SL	.75	...	.75	
129 ASCE ASD 6 (d) (os-b)		Y		DL	1	Om*E...	.525	Om*E...	.158	LL	.75	LLS	.75	SL	.75	...	.75	
130 ASCE ASD 6 (d) (os-c)		Y		DL	1	Om*E...	.525	Om*ELZ	-.1...	LL	.75	LLS	.75	SL	.75	...	.75	
131 ASCE ASD 6 (d) (os-d)		Y		DL	1	Om*E...	.525	Om*E...	-.1...	LL	.75	LLS	.75	SL	.75	...	.75	
132 ASCE ASD 6 (f) (os-a)		Y		DL	1	Om*E...	.525	Om*ELZ	.158	LL	.75	LLS	.75					
133 ASCE ASD 6 (f) (os-b)		Y		DL	1	Om*E...	.525	Om*E...	.158	LL	.75	LLS	.75					
134 ASCE ASD 6 (f) (os-c)		Y		DL	1	Om*E...	.525	Om*ELZ	-.1...	LL	.75	LLS	.75					
135 ASCE ASD 6 (f) (os-d)		Y		DL	1	Om*E...	.525	Om*E...	-.1...	LL	.75	LLS	.75					
136 ASCE ASD 8 (os-a)		Y		DL	.6	Om*E...	.7	Om*ELZ	.21									
137 ASCE ASD 8 (os-b)		Y		DL	.6	Om*E...	.7	Om*E...	.21									
138 ASCE ASD 8 (os-c)		Y		DL	.6	Om*E...	.7	Om*ELZ	-.21									
139 ASCE ASD 8 (os-d)		Y		DL	.6	Om*E...	.7	Om*E...	-.21									

LOAD COMBINATIONS FOR NON-PARALLEL SYSTEM IRREGULARITIES. 100% ONE DIRECTION + 30% PERPENDICULAR DIRECTION

**(Global) Model Settings, Continued**

Seismic Code	ASCE 7-10
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	No
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	2.5
Om X	2.5
Cd Z	4
Cd X	4
Rho Z	1.3
Rho X	1.3



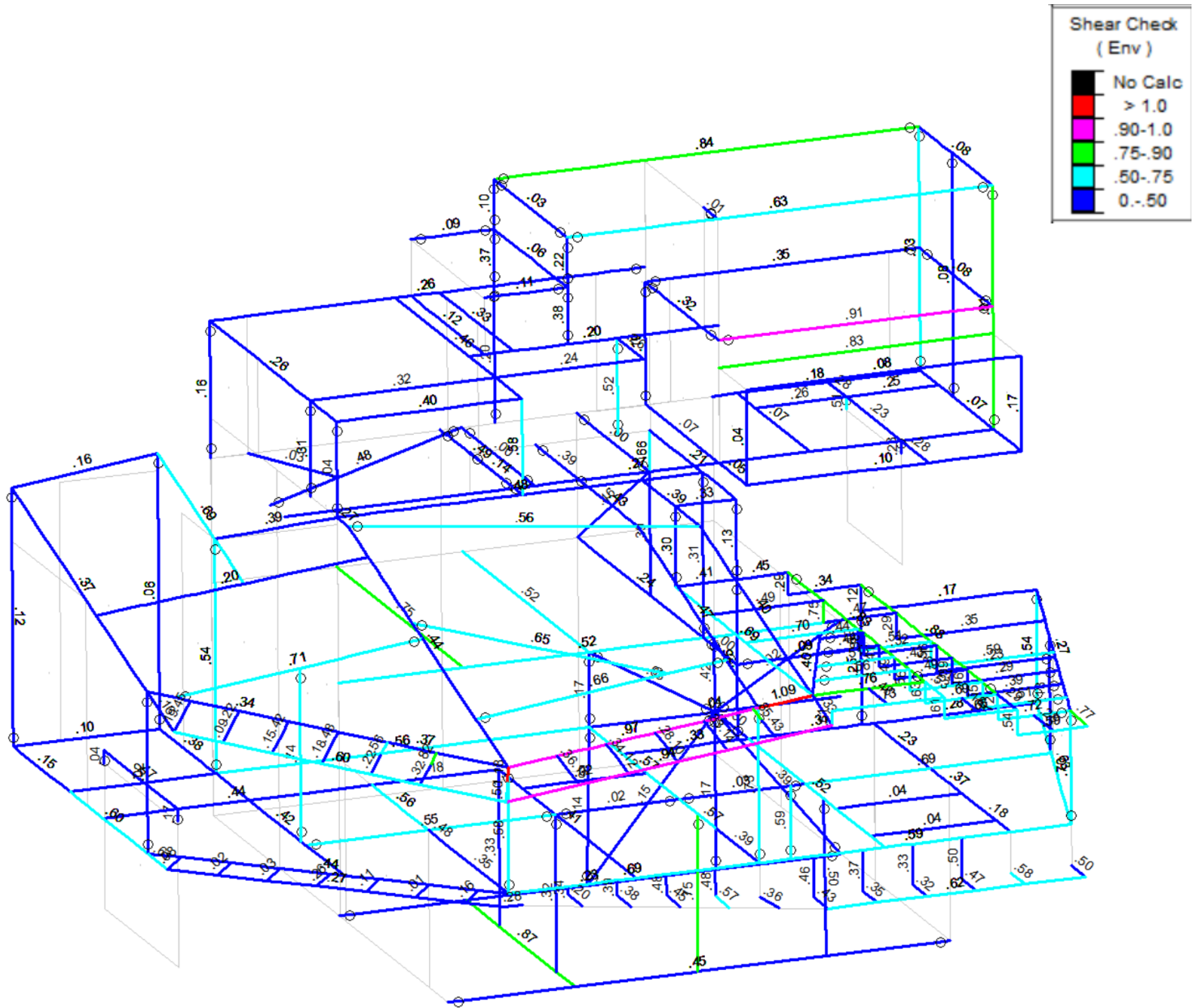


## RESULTS

**Refer to the following pages for analysis results and design. Reactions have been exported to RISA Foundation for design of Continuous Footings**

# RESULTS

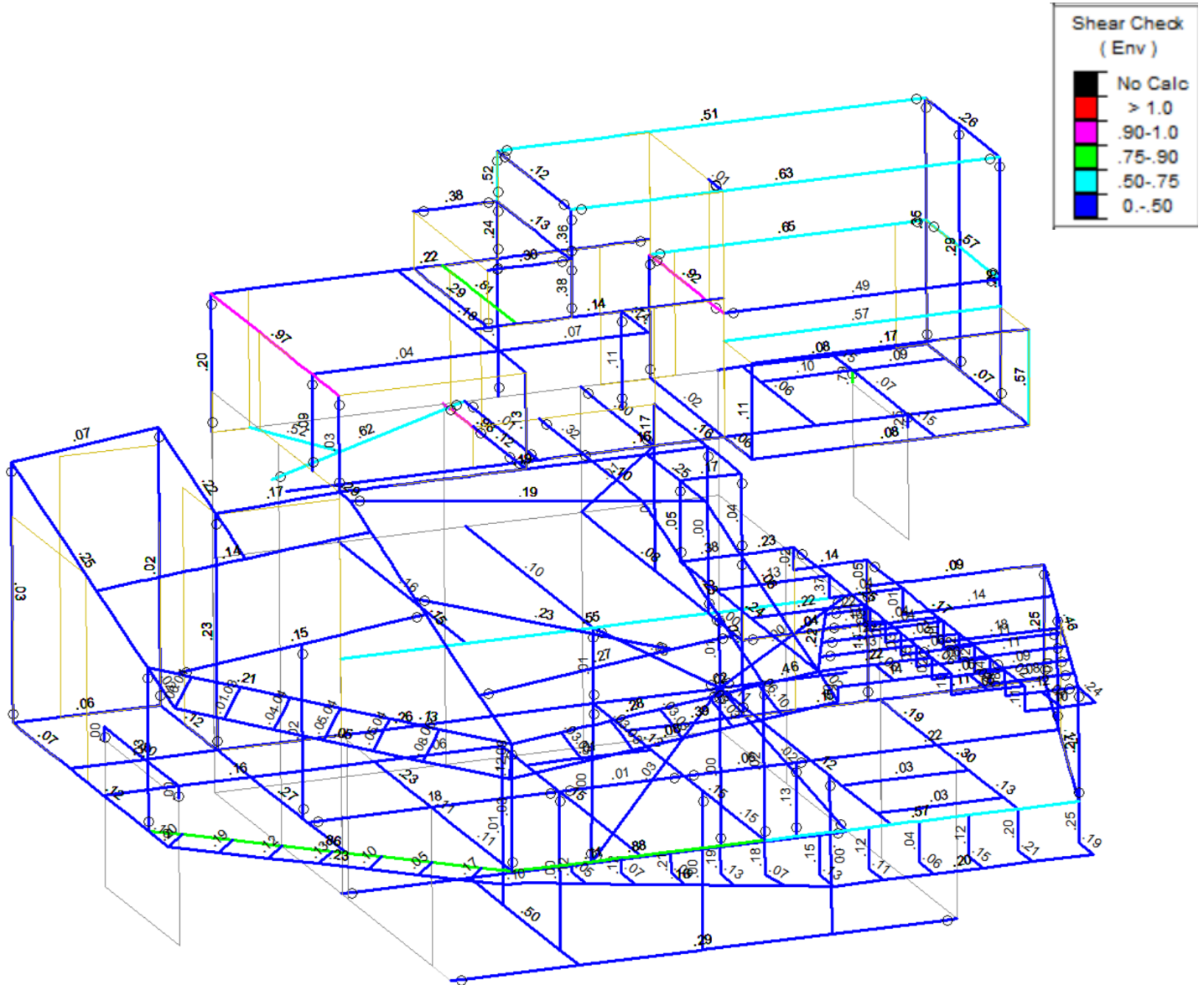
## MEMBER UNITY CHECK - ENVELOPE OF GRAVITY LOAD COMBINATIONS (LC1- LC15)



**THUS ALL MEMBERS OKAY**

# RESULTS

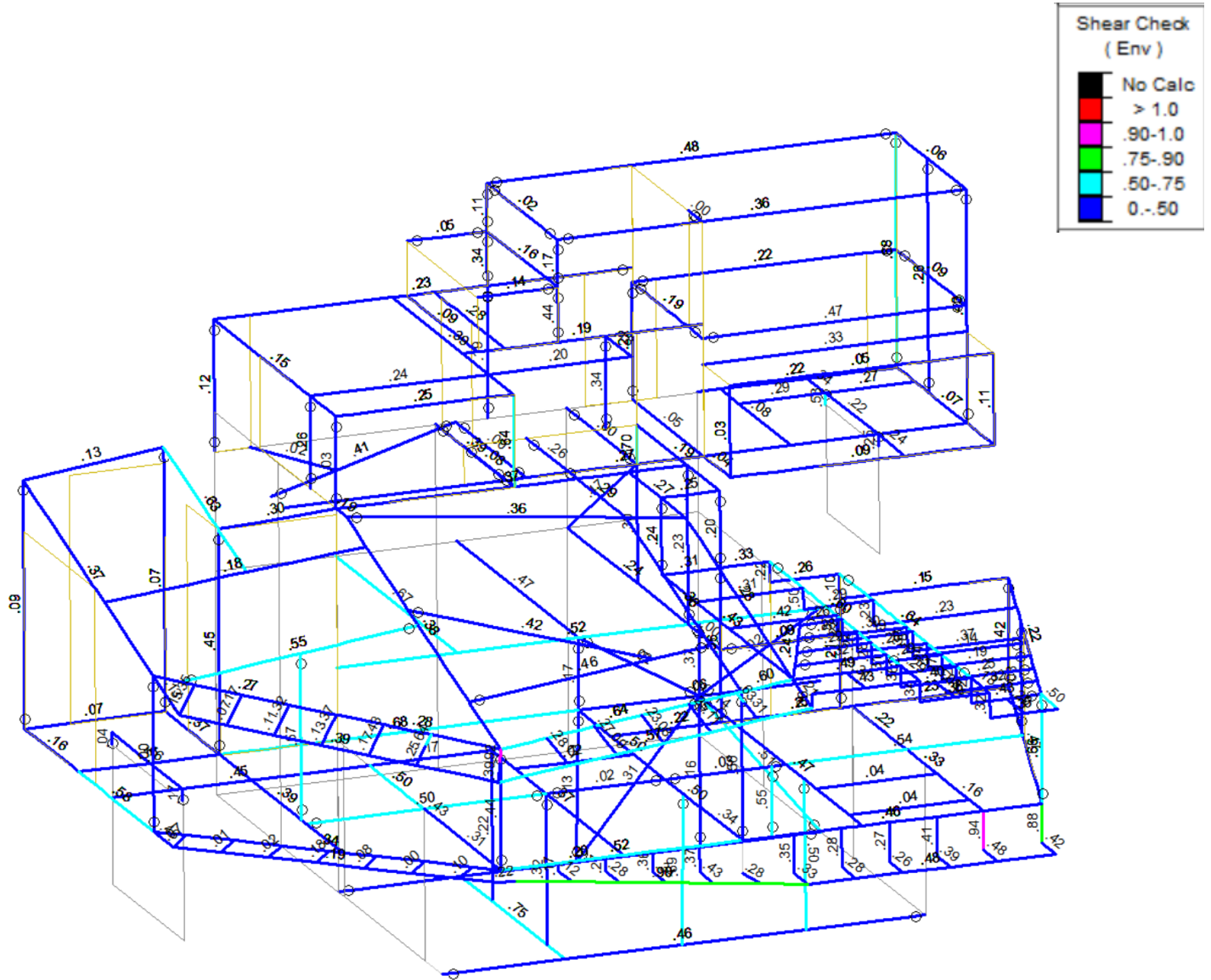
## MEMBER SHEAR CHECK - ENVELOPE OF GRAVITY LOAD COMBINATIONS (LC1- LC15)



**THUS ALL MEMBERS OKAY**

# RESULTS

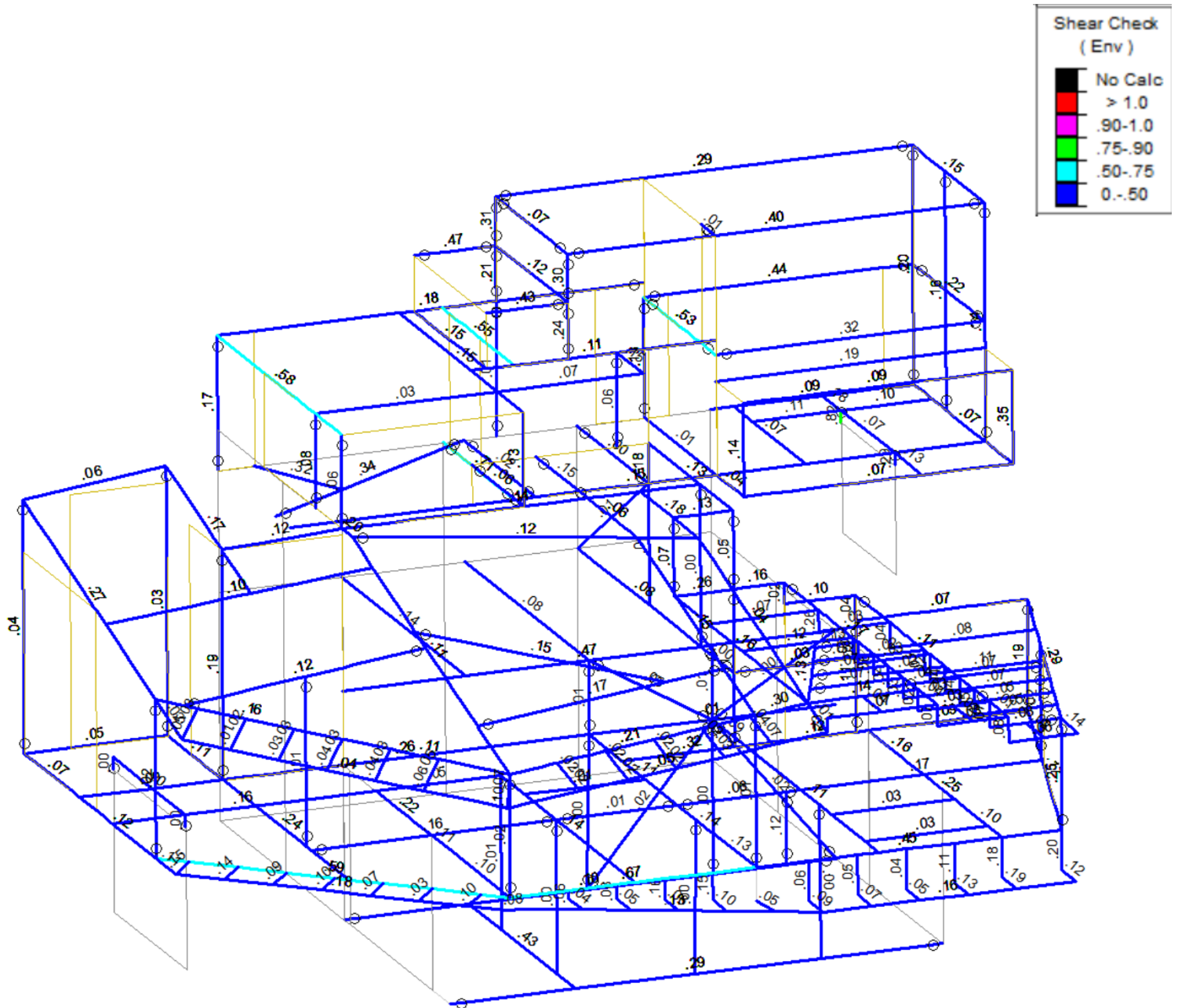
## MEMBER UNITY CHECK - ENVELOPE OF LATERAL LOAD COMBINATIONS (LC19- LC34) (RHO=1.3 INCLUDED)



**THUS ALL MEMBERS OKAY**

# RESULTS

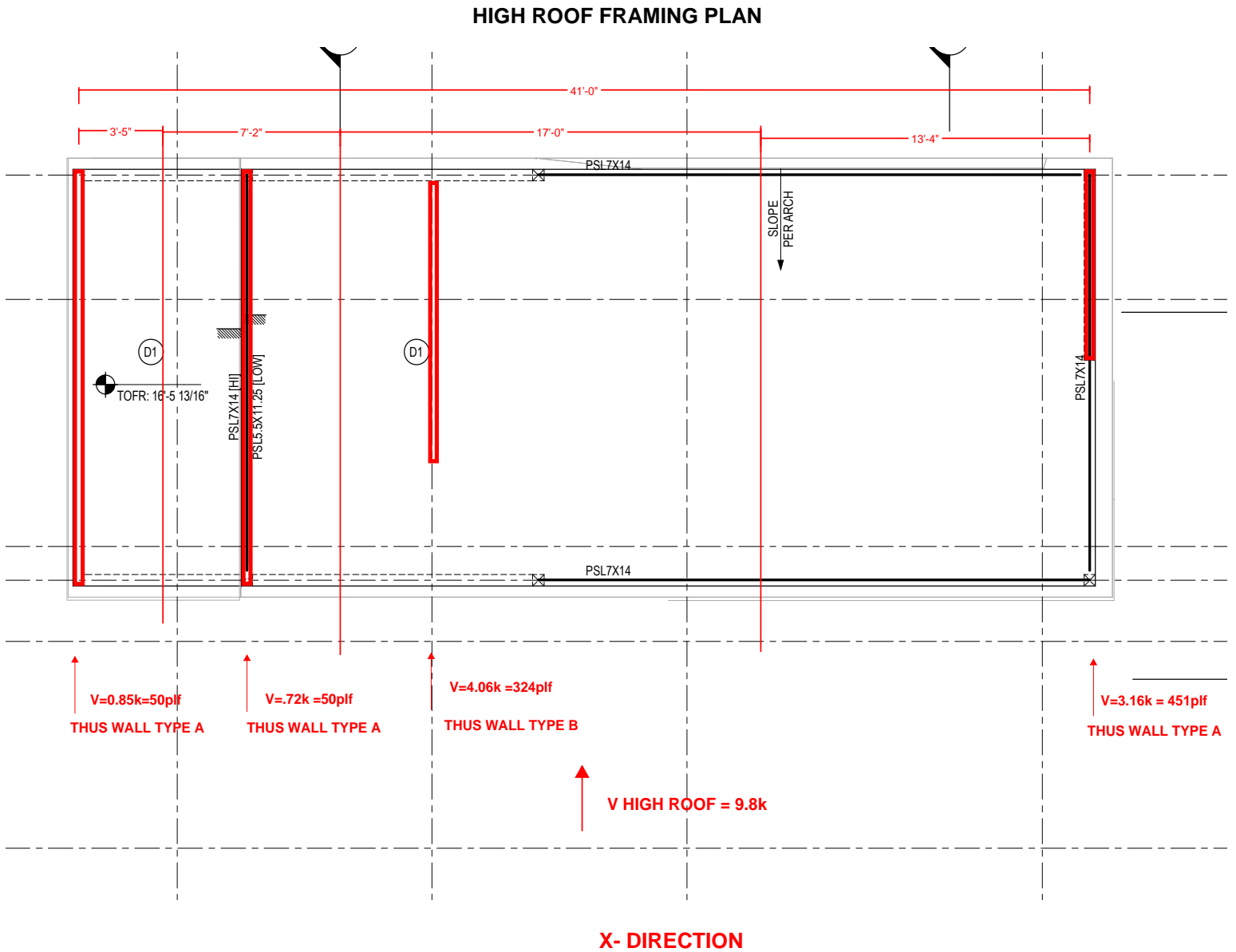
## MEMBER SHEAR CHECK - ENVELOPE OF LATERAL LOAD COMBINATIONS (LC19- LC34) (RHO=1.3 INCLUDED)



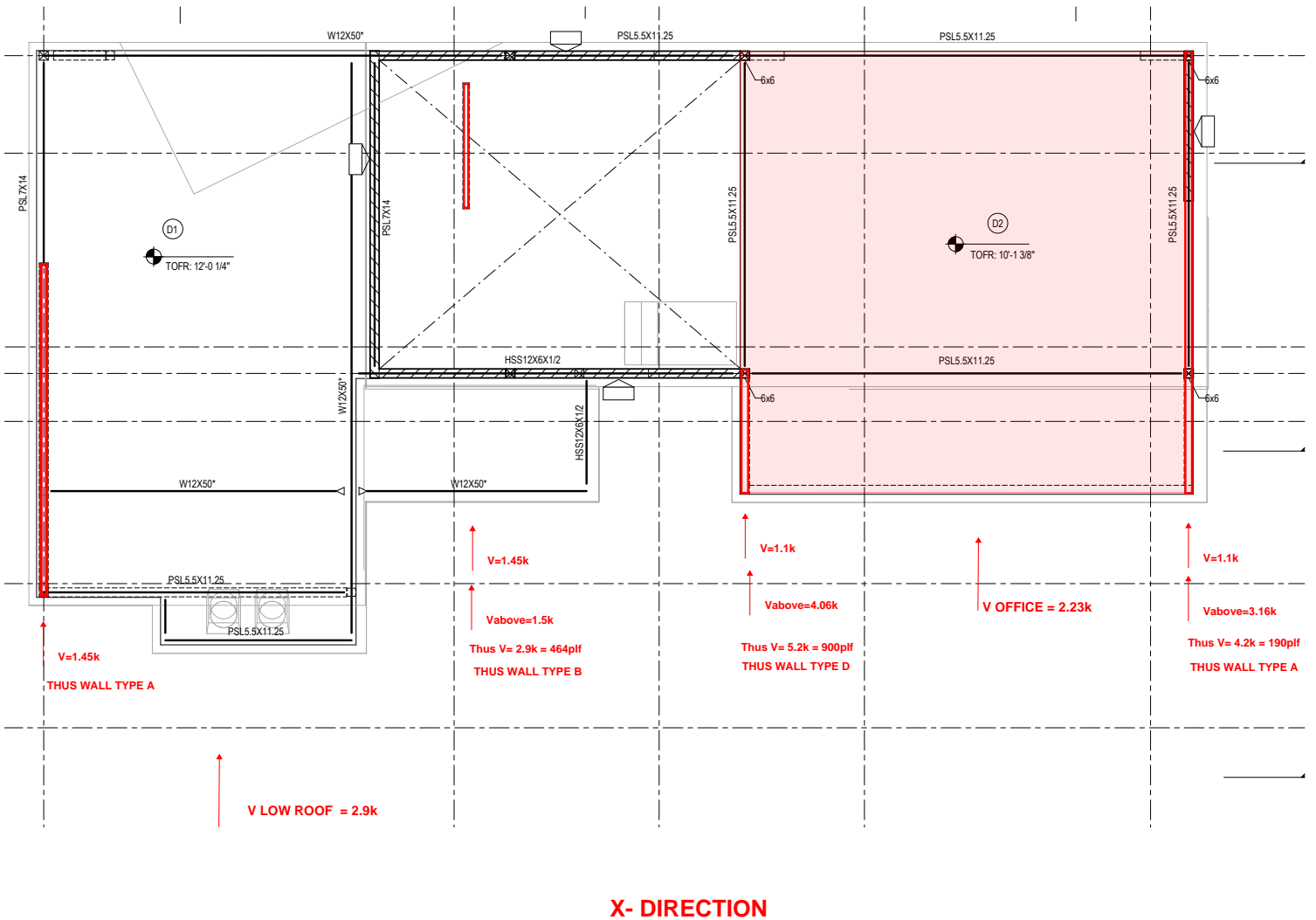
**THUS ALL MEMBERS OKAY**

# RESULTS

## TIMBER SHEAR WALL FLEXIBLE DIAPHRAGM DISTRIBUTION AND CALCULATIONS

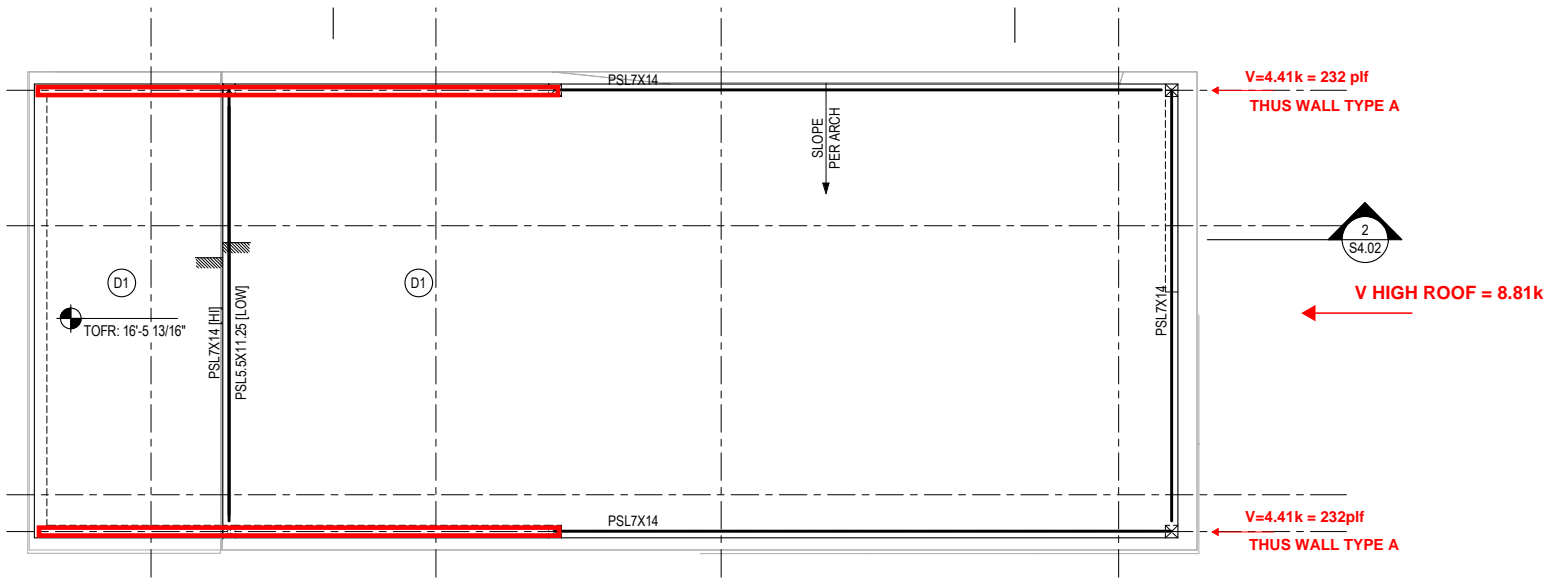


**LOW ROOF AND OFFICE FRAMING PLAN**



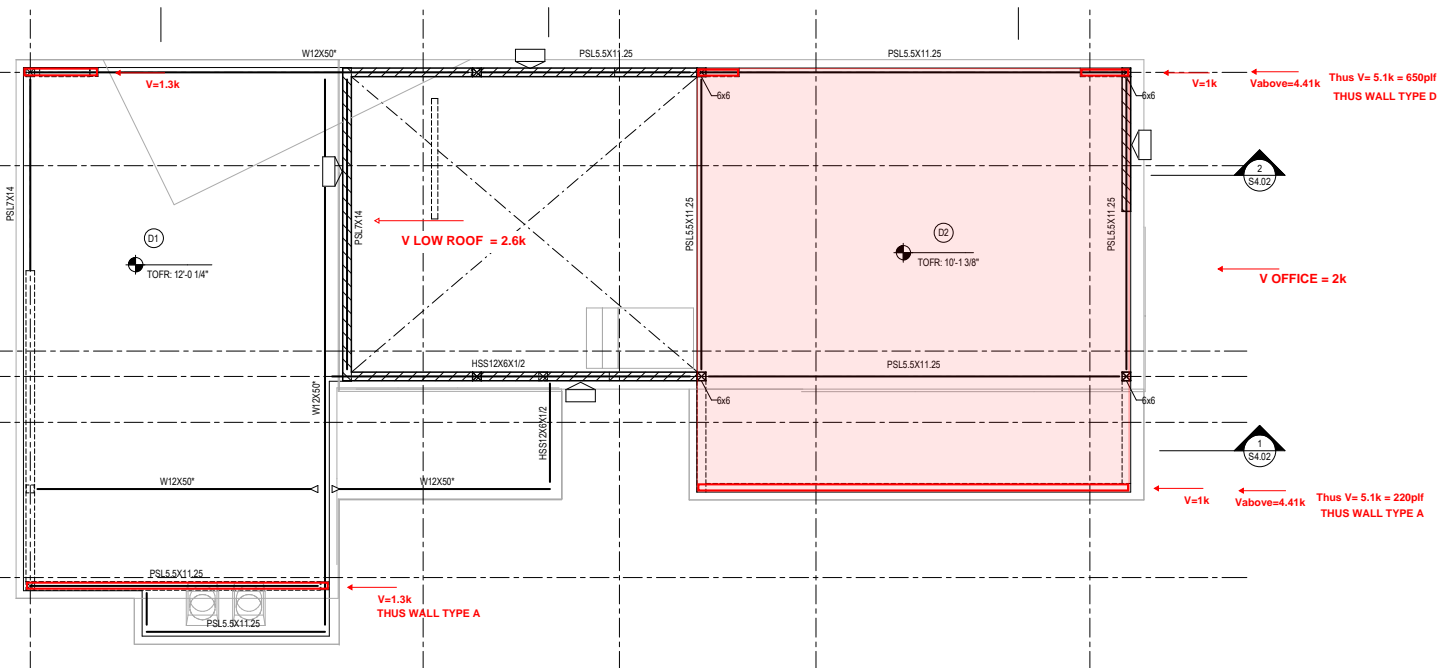


**HIGH ROOF FRAMING PLAN**



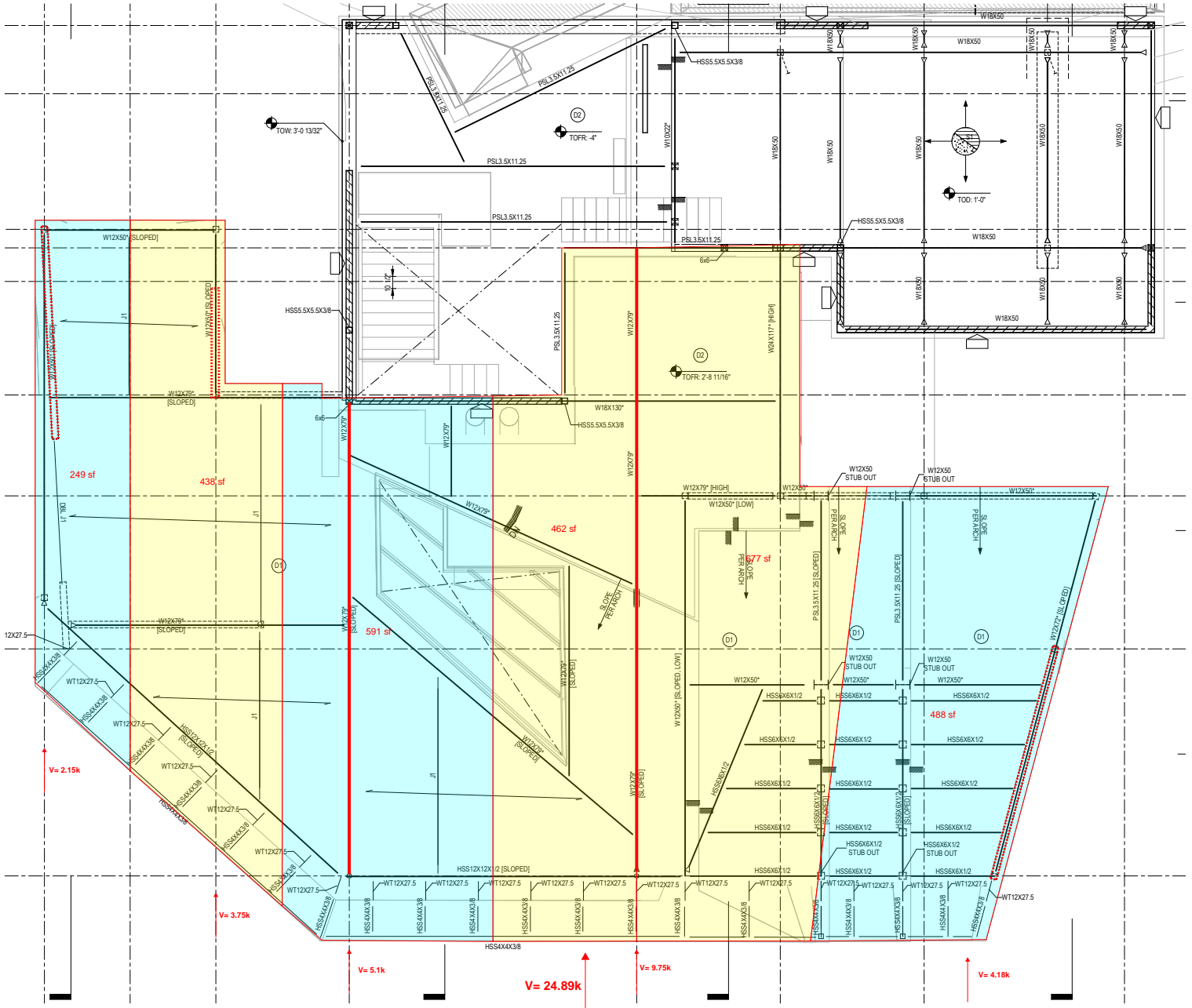
**Z- DIRECTION**

**LOW ROOF AND OFFICE FRAMING PLAN**

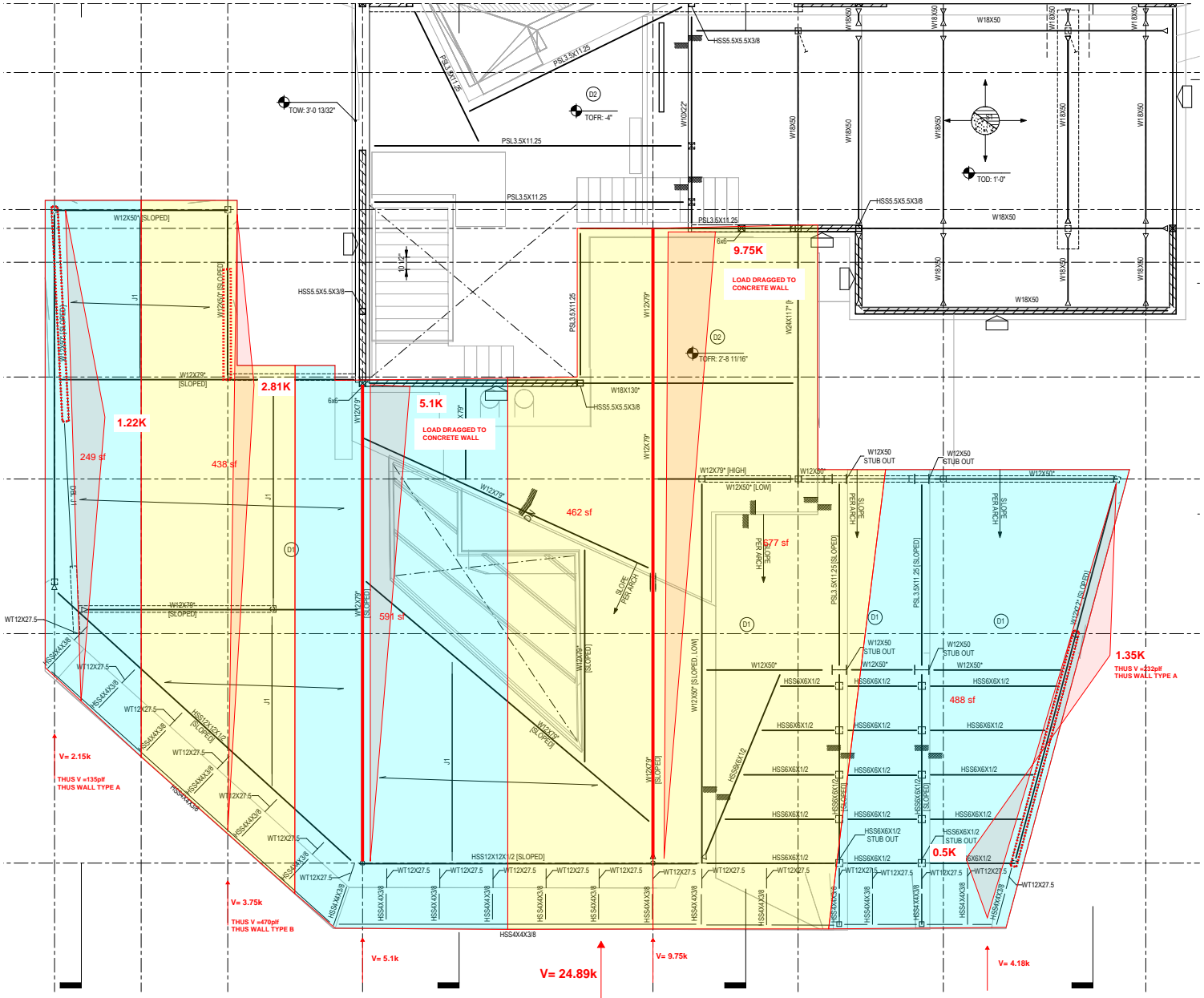


**Z- DIRECTION**

SLOPED ROOF LATERAL LOAD DISTRIBUTION- X DIRECTION

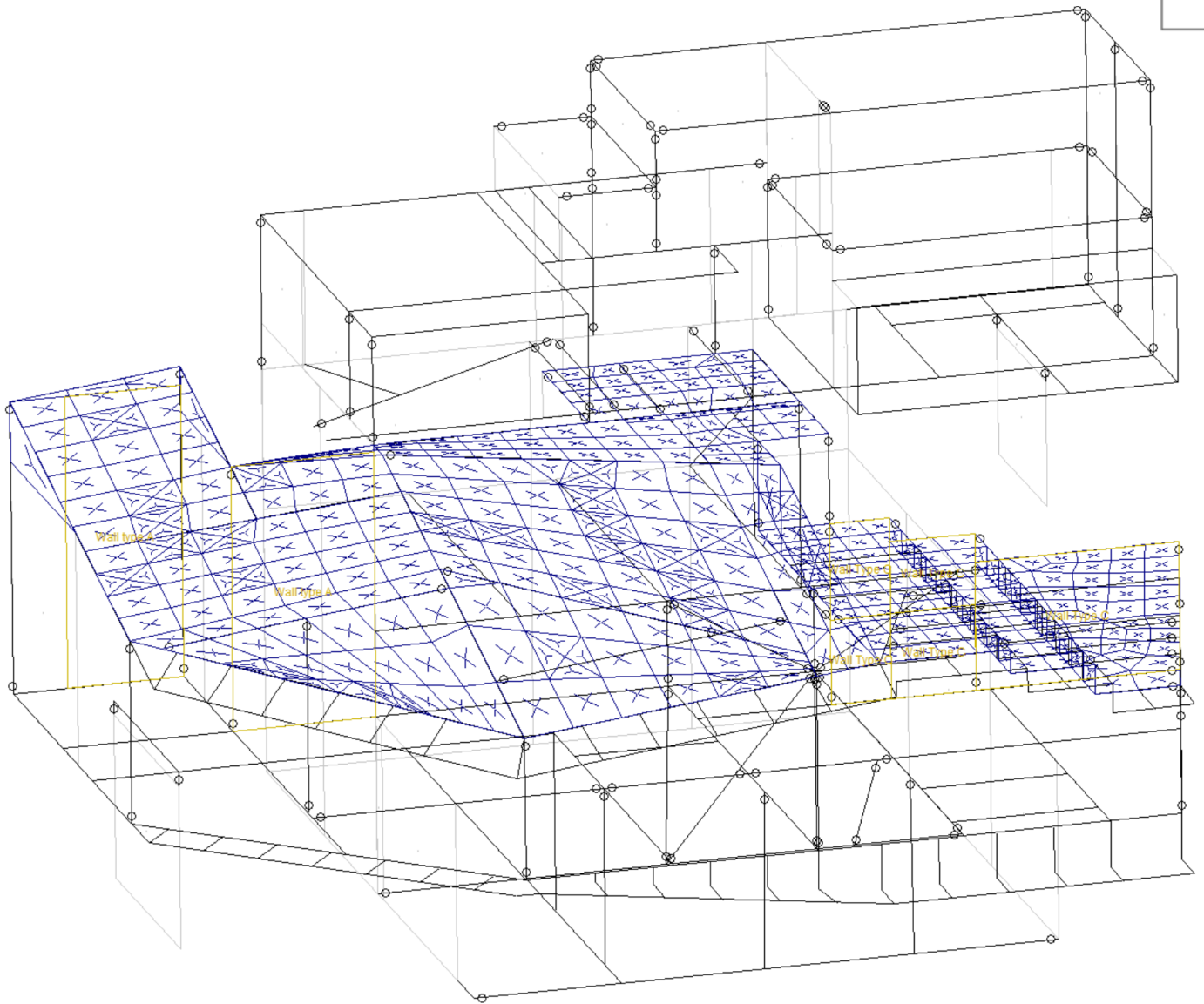


SLOPED ROOF LATERAL DRAG- X DIRECTION

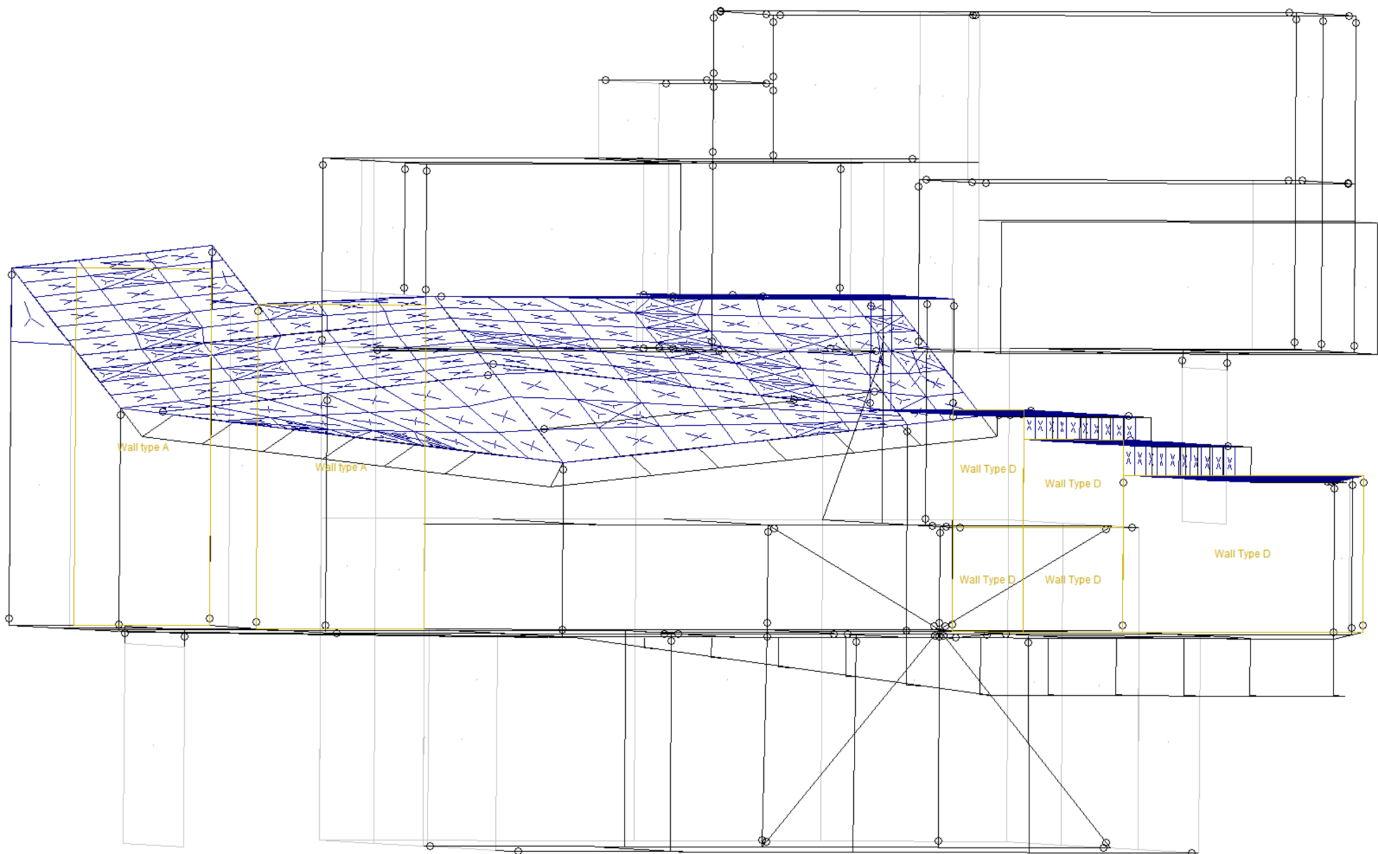
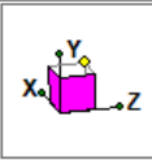


**SLOPED ROOF LATERAL LOAD DISTRIBUTION- Z DIRECTION**

The roof Diaphragm is a Cantilevered Diaphragm in the Z Direction and thus analyzed as a Semi-Rigid Diaphragm in RISA per 4.2.5.2-3 of AWC SDPW



**SEMI- RIGID DIAPHRAGM IN Z- DIRECTION**



**ASSIGNED WALL TYPES**

# GOVERNOR WALL DETAILED REPORT

Company : Nous  
 Designer : MG  
 Job Number :  
 Model Name : Powder Mountain

WP45I (In-Plane)

May 31, 2018  
 4:41 PM  
 Checked By: \_\_\_\_\_

## GENERAL

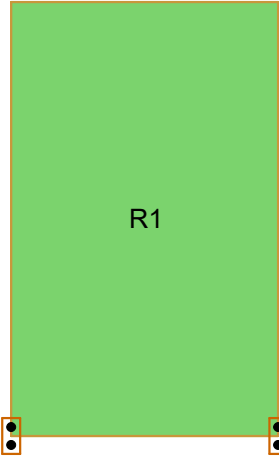
Code : **AWC NDS-15:ASD**  
 Design Method : **Segmented**  
 Wall Material : **DF**  
 Panel Schedule : **User Selected**  
 Sel. Shear Panel : **S1\_(2)15/32\_10d@2**

## GEOMETRY

Total Height : **6.75 ft**  
 Total Length : **4.16 ft**  
 Max H/W Ratio : **1.62**  
 K : **1.00**

## MATERIALS

Description	Material	Size
Top PI	DF	2-2X6
Sill	DF	2X6
Wall Stud	DF	2X6
Chord	DF	3-2X6



## DESIGN DETAILS

### ENVELOPED RESULTS

Controlling Shear Region	Shear Panel	Shear UC	Shear LC	Strap Force (k)	Strap LC	Chord UC	Chord LC	Stud UC	Stud LC
<b>R1</b>	<b>S1_(2)15/32...</b>	<b>0.830</b>	<b>28 (S)</b>	<b>Not Req'd</b>	<b>Not Req'd</b>	<b>0.988</b>	<b>28 (S)</b>	<b>N/C</b>	<b>N/C</b>

### REGION INFORMATION

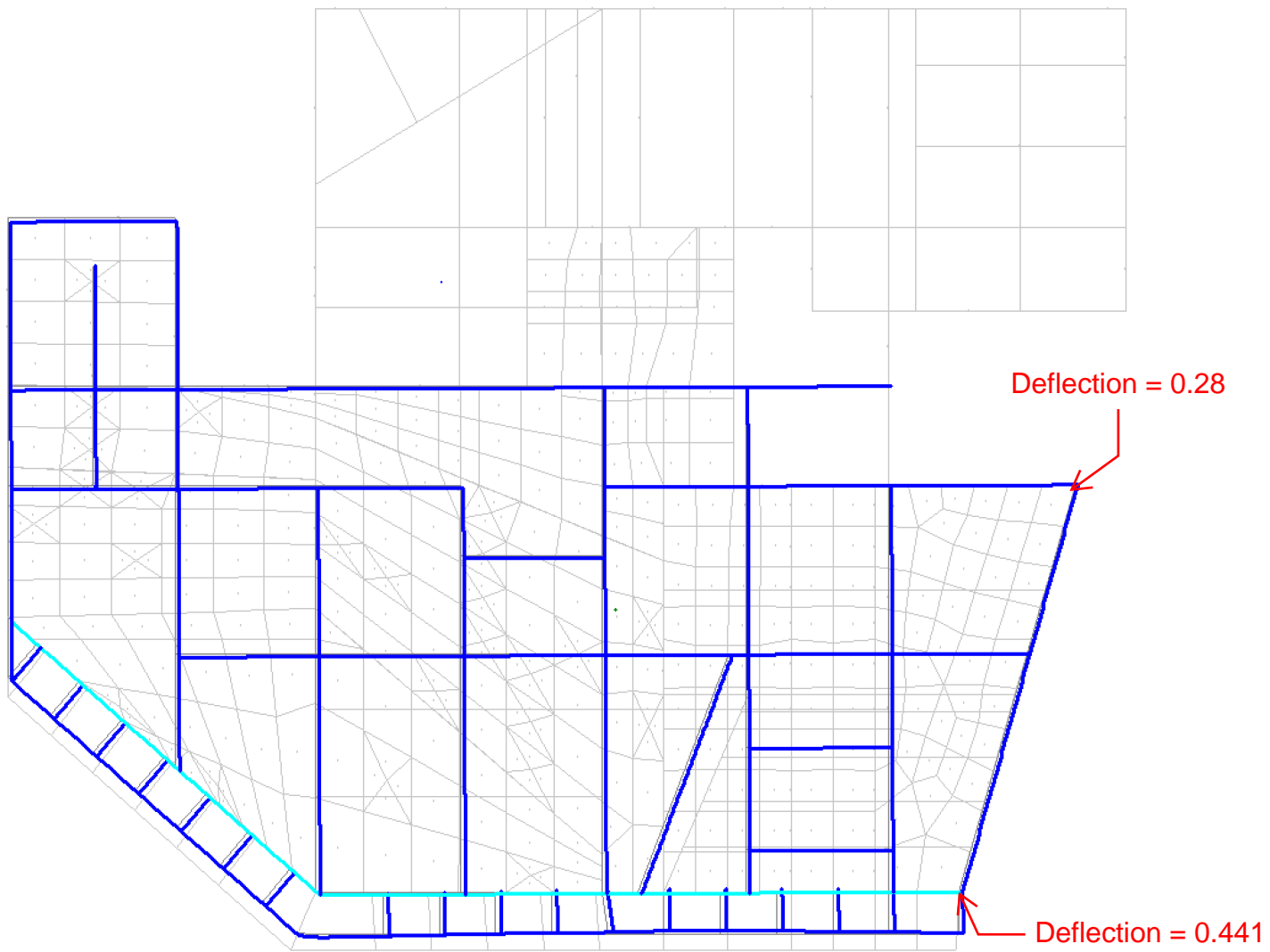
Full-Height Region Label	H/W Ratio	Shear UC	Shear LC	Strap Force (k)	Strap LC	Chord UC	Chord LC	Stud UC	Stud LC
<b>R1</b>	<b>1.62</b>	<b>0.830</b>	<b>28 (S)</b>	<b>Not Req'd</b>	<b>Not Req'd</b>	<b>0.988</b>	<b>28 (S)</b>	<b>N/C</b>	<b>N/C</b>

### DEFLECTION RESULTS

Maximum Region Deflection (in)	Deflection LC	Finite Element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
<b>.116 (R1)</b>	<b>28</b>	<b>.017</b>	<b>1</b>



**CHECK FOR TORSIONAL IRREGULARITY**



**GOVERNING DEFLECTION- LC 36**



**CHECK FOR TORSIONAL IRREGULARITY**

**THUS AVERAGE OF THE END DEFLECTIONS =  $(0.441 + 0.28) / 2 = 0.361$**   
**1.2 X AVG DEFLECTION = 0.432"**  
**1.2 X AVG DEFLECTION < MAX DEFLECTION.**

**THUS TORSIONAL IRREGULARITY EXISTS**

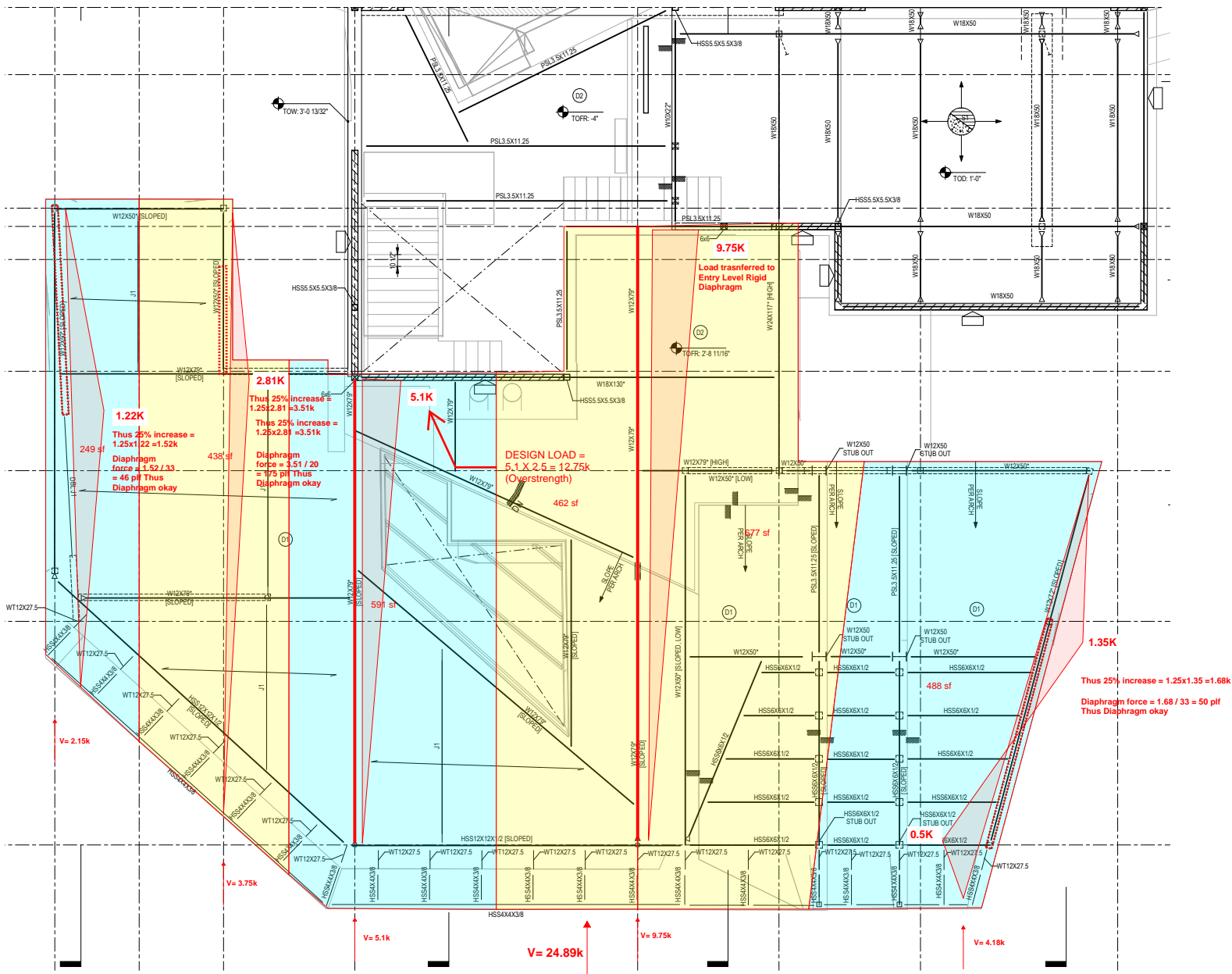
**1.4 X AVG DEFLECTION = 0.505"**  
**1.4 X AVG DEFLECTION > MAX DEFLECTION.**

**THUS EXTREME TORSIONAL IRREGULARITY DOESNT EXIST.**

**FOR TORSIONAL IRREGULARITY, CONNECTIONS OF DIAPHRAGMS, COLLECTORS AND THEIR CONNECTIONS TO THE LFRS HAVE BEEN DESIGNED FOR OVER STRENGTH.**

**AMPLIFICATION FACTOR  $A_x = (Defl\ max / 1.2\ Avg\ Defl)^2 = 1.04$  PER ASCE 7-10 12.8.4.3**

**DESIGN OF MEMBER CONNECTIONS FOR INCREASED FORCES PER 12.3.3.4 AND OVERSTRENGTH.**



**DRAG FORCES AS SHOWN EARLIER**



Company:		Date:	7/6/2018
Engineer:		Page:	1/4
Project:			
Address:			
Phone:			
E-mail:			

**1. Project information**

Customer company:  
 Customer contact name:  
 Customer e-mail:  
 Comment:

Project description:  
 Location:  
 Fastening description:

**2. Input Data & Anchor Parameters**

**General**

Design method: ACI 318-11  
 Units: Imperial units

**Anchor Information:**

Anchor type: Cast-in-place  
 Material: AB  
 Diameter (inch): 0.750  
 Effective Embedment depth,  $h_{ef}$  (inch): 24.000  
 Anchor category: -  
 Anchor ductility: Yes  
 $h_{min}$  (inch): 26.25  
 $C_{min}$  (inch): 4.50  
 $S_{min}$  (inch): 4.50

**Load and Geometry**

Load factor source: ACI 318 Section 9.2  
 Load combination: not set  
 Seismic design: Yes  
 Anchors subjected to sustained tension: Not applicable  
 Ductility section for tension: D.3.3.4.2 not applicable  
 Ductility section for shear: D.3.3.5.2 not applicable  
 $\Omega_0$  factor: not set  
 Apply entire shear load at front row: No  
 Anchors only resisting wind and/or seismic loads: No

**Base Material**

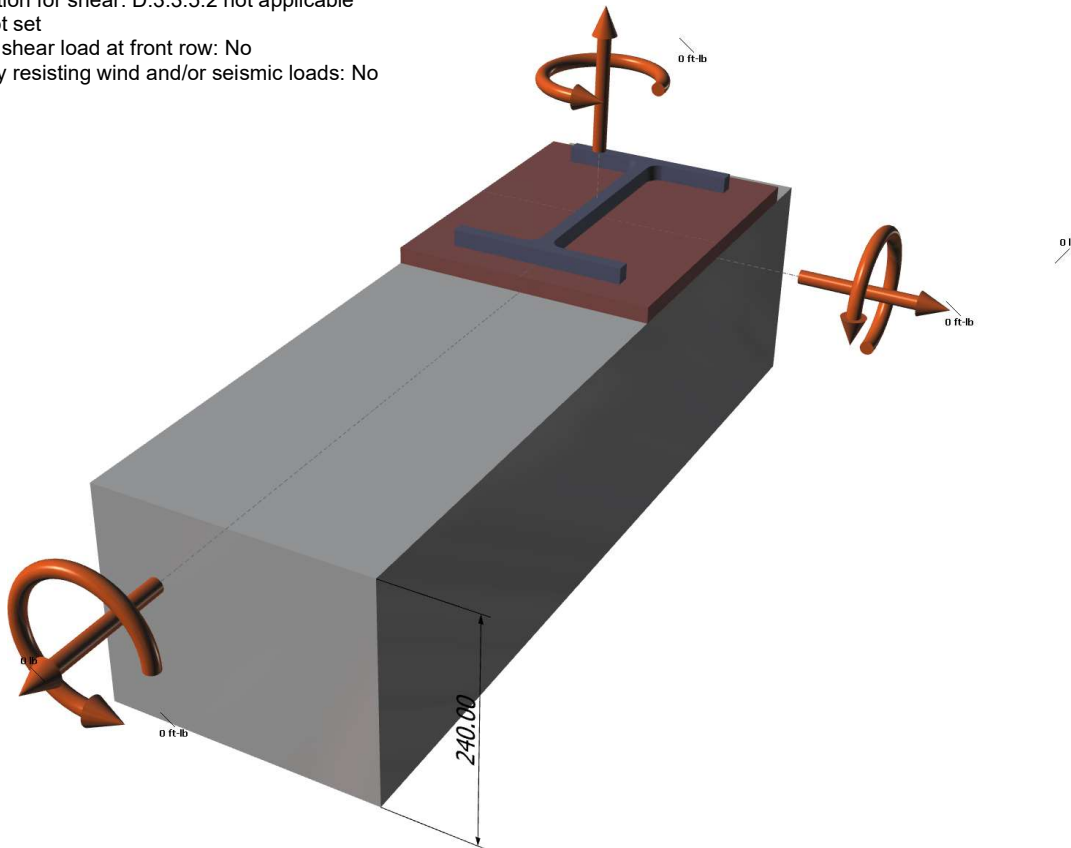
Concrete: Normal-weight  
 Concrete thickness,  $h$  (inch): 240.00  
 State: Cracked  
 Compressive strength,  $f'_c$  (psi): 5000  
 $\Psi_{e,v}$ : 1.0  
 Reinforcement condition: A tension, A shear  
 Supplemental reinforcement: Not applicable  
 Reinforcement provided at corners: Yes  
 Ignore concrete breakout in tension: Yes  
 Ignore concrete breakout in shear: No  
 Ignore 6do requirement: No  
 Build-up grout pad: No

**Base Plate**

Length x Width x Thickness (inch): 15.00 x 12.00 x 0.75  
 Yield stress: 50000 psi

**Profile type/size:** W12X50

<Figure 1>



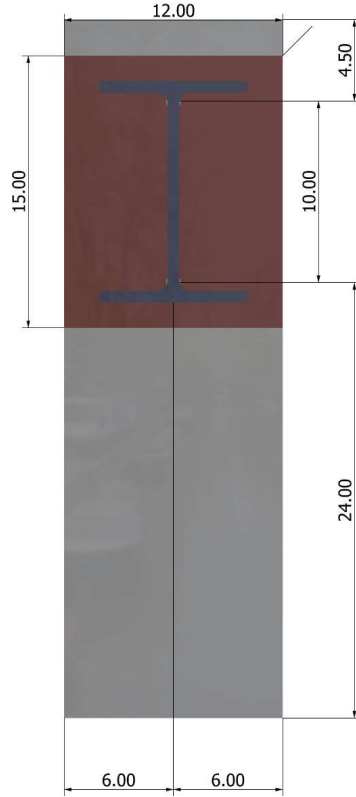
Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



Anchor Designer™  
Software  
Version 2.5.6582.0

Company:		Date:	7/6/2018
Engineer:		Page:	2/4
Project:			
Address:			
Phone:			
E-mail:			

<Figure 2>



**Recommended Anchor**

Anchor Name: PAB Pre-Assembled Anchor Bolt - PAB6 (3/4"Ø)





**Anchor Designer™**  
**Software**  
 Version 2.5.6582.0

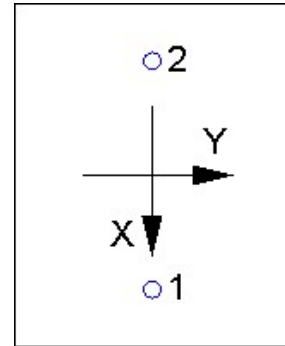
Company:		Date:	7/6/2018
Engineer:		Page:	3/4
Project:			
Address:			
Phone:			
E-mail:			

**3. Resulting Anchor Forces**

Anchor	Tension load, N <sub>ua</sub> (lb)	Shear load x, V <sub>uax</sub> (lb)	Shear load y, V <sub>uay</sub> (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	6375.0	0.0	0.0	0.0
2	6375.0	0.0	0.0	0.0
<b>Sum</b>	<b>12750.0</b>	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00  
 Maximum concrete compression stress (psi): 0  
 Resultant tension force (lb): 0  
 Resultant compression force (lb): 0  
 Eccentricity of resultant tension forces in x-axis, e'<sub>Nx</sub> (inch): 0.00  
 Eccentricity of resultant tension forces in y-axis, e'<sub>Ny</sub> (inch): 0.00

<Figure 3>



**4. Steel Strength of Anchor in Tension (Sec. D.5.1)**

N <sub>sa</sub> (lb)	φ	φN <sub>sa</sub> (lb)
19370	0.75	14528

**6. Pullout Strength of Anchor in Tension (Sec. D.5.3)**

$0.75\phi N_{pn} = 0.75\phi\psi_{c,P}N_p = 0.75\phi\psi_{c,P}8A_{brg}f_c$  (Sec. D.4.1, Eq. D-13 & D-14)

$\psi_{c,P}$	A <sub>brg</sub> (in <sup>2</sup> )	f <sub>c</sub> (psi)	φ	0.75φN <sub>pn</sub> (lb)
1.0	3.53	5000	0.70	74214

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



**Anchor Designer™**  
**Software**  
 Version 2.5.6582.0

Company:		Date:	7/6/2018
Engineer:		Page:	4/4
Project:			
Address:			
Phone:			
E-mail:			

**7. Side-Face Blowout Strength of Anchor in Tension (Sec. D.5.3)**

$$0.75\phi N_{sb} = 0.75\phi \left\{ (1+c_{a2}/c_{a1})/4 \right\} (1+s/6c_{a1}) N_{sb} = 0.75\phi \left\{ (1+c_{a2}/c_{a1})/4 \right\} (1+s/6c_{a1}) (160c_{a1} \sqrt{A_{brg}}) \lambda \sqrt{f'_c} \text{ (Sec. D.4.1, Eq. D-16 \& D-17)}$$

s (in)	c <sub>a1</sub> (in)	c <sub>a2</sub> (in)	A <sub>brg</sub> (in <sup>2</sup> )	λ <sub>a</sub>	f' <sub>c</sub> (psi)	φ	0.75φN <sub>sb</sub> (lb)
10.00	6.00	4.50	3.53	1.00	5000	0.75	45860

**11. Results**

**11. Interaction of Tensile and Shear Forces (Sec. D.7)?**

Tension	Factored Load, N <sub>ua</sub> (lb)	Design Strength, φN <sub>n</sub> (lb)	Ratio	Status
<b>Steel</b>	<b>6375</b>	<b>14528</b>	<b>0.44</b>	<b>Pass (Governs)</b>
Pullout	6375	74214	0.09	Pass
Side-face blowout	12750	45860	0.28	Pass

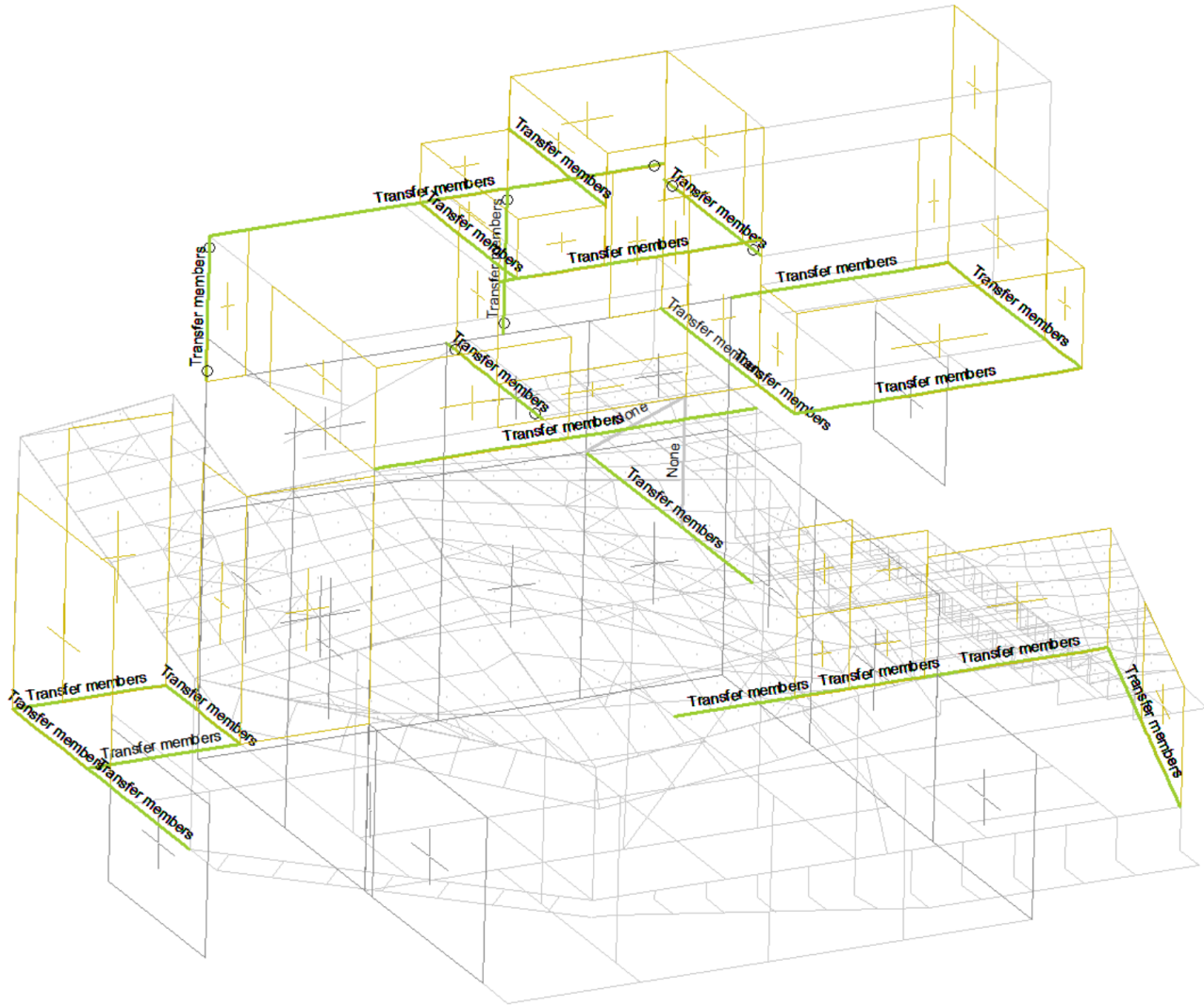
**PAB6 (3/4"Ø) with hef = 24.000 inch meets the selected design criteria.**

**12. Warnings**

- Concrete breakout strength in tension has not been evaluated against applied tension load(s) per designer option. Refer to ACI 318 Section D.4.2.1 for conditions where calculations of the concrete breakout strength may not be required.
- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 D.3.3.4.3 for tension need not be satisfied – designer to verify.
- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 D.3.3.5.3 for shear need not be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.



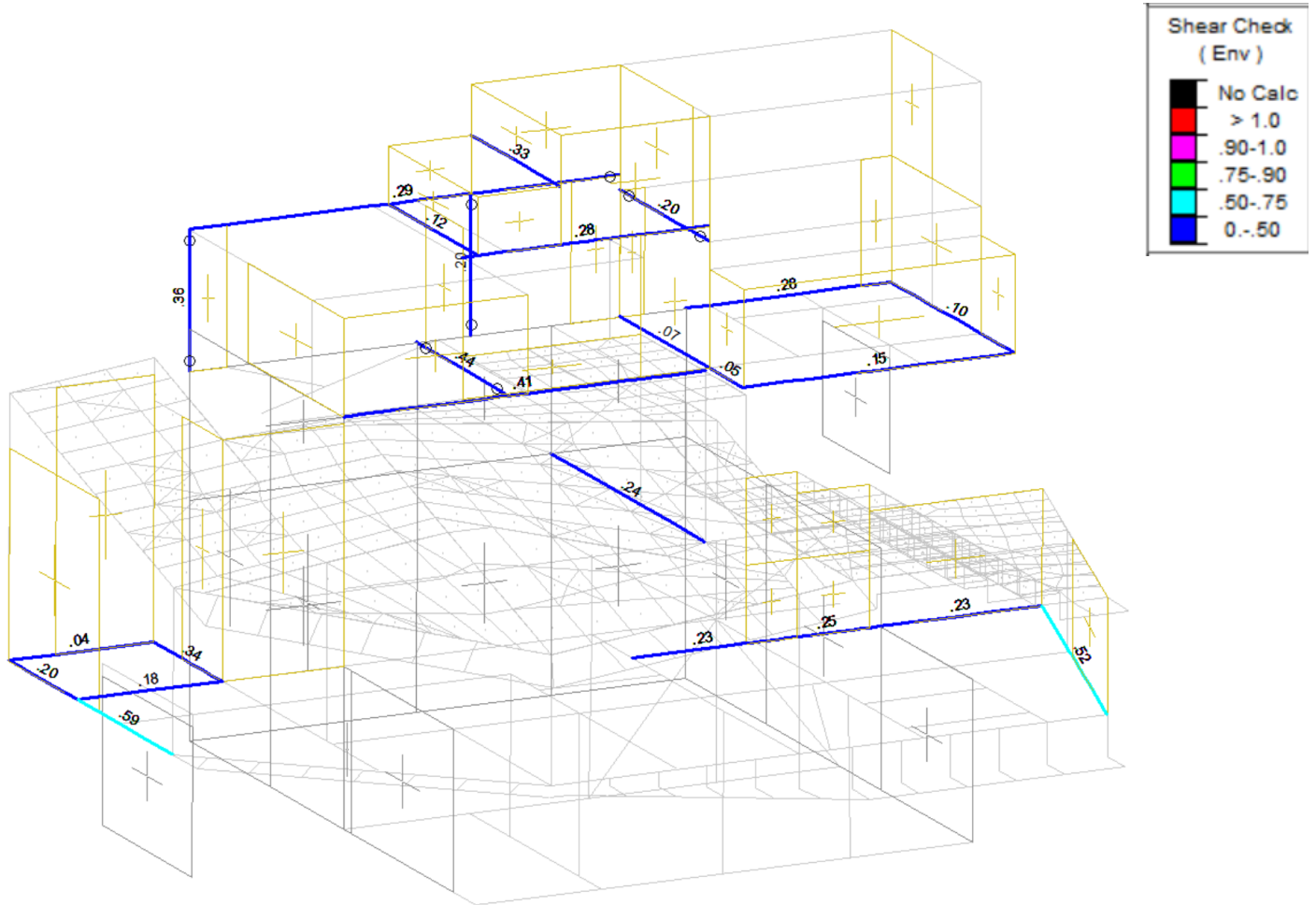
DESIGN OF MEMBERS FOR OVERSTRENGTH (OHM = 2.5)



**MEMBERS CHECKED FOR OVERSTRENGTH**

**RESULTS**

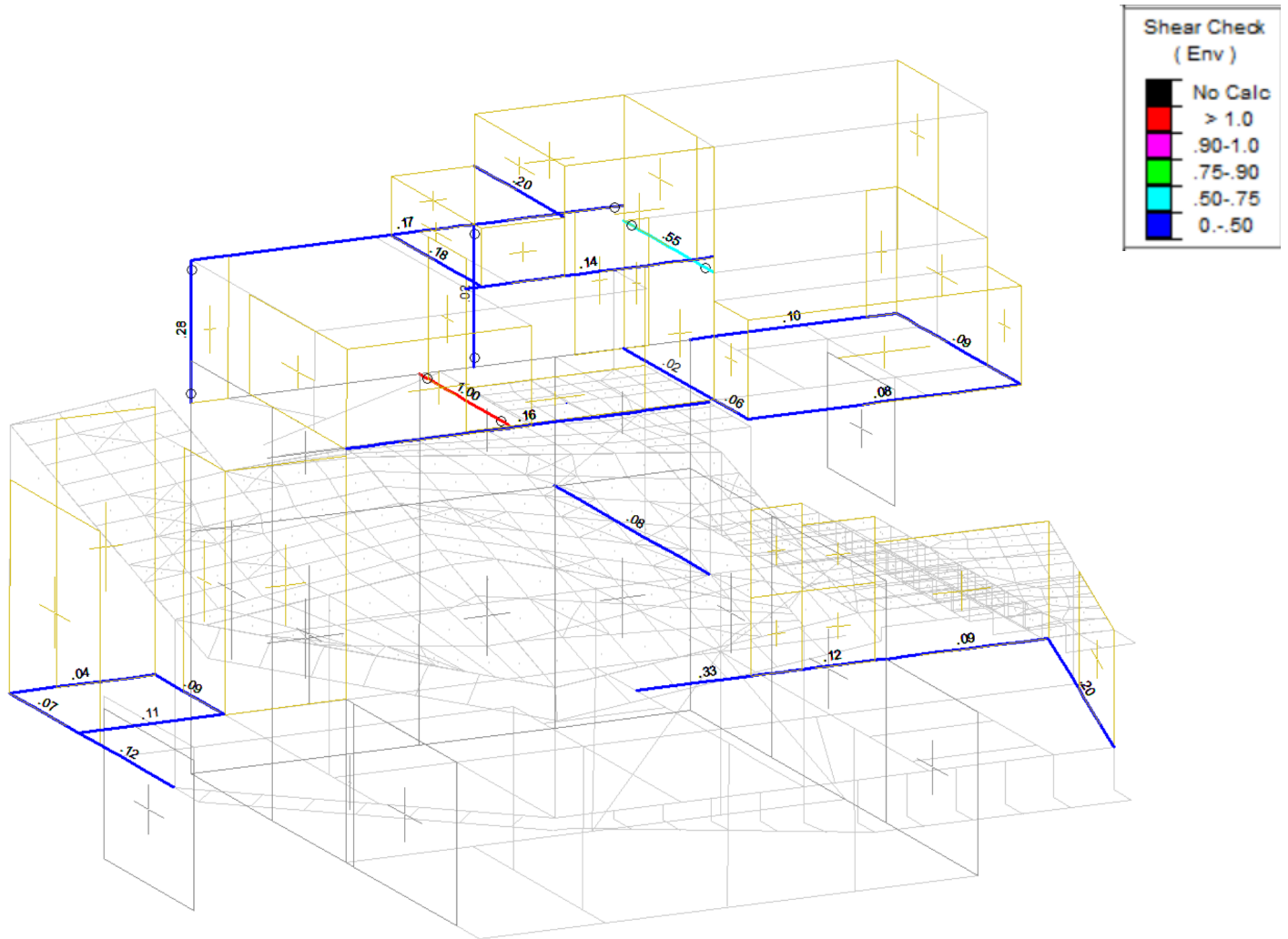
**ENVELOPE UNITY CHECK OF MEMBERS DESIGNED FOR OVERSTRENGTH (LC59 - LC78)**



**THUS ALL MEMBERS OKAY**

**RESULTS**

**ENVELOPE SHEAR CHECK OF MEMBERS DESIGNED FOR OVERSTRENGTH (LC59 - LC78)**

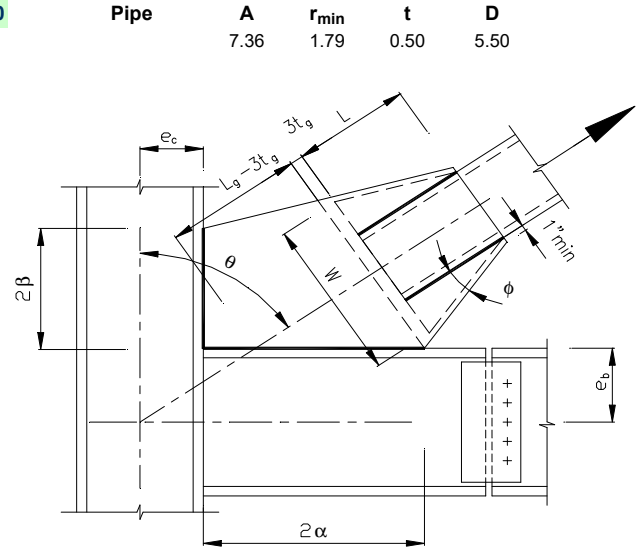


**THUS ALL MEMBERS OKAY**

**Seismic Design for Special Concentrically Braced Frames Based on CBC/IBC & AISC**

**INPUT DATA & DESIGN SUMMARY**

BRACE SECTION (Tube or Pipe) => **HSS5.500X0.500** Pipe  
 BRACE AXIAL LOAD AT SERVICE LEVEL D = **8.6** kips  
 L = **9.6** kips  
 SEISMIC AXIAL LOAD (ASCE 7-10 12.4.2.1) Q<sub>E</sub> = **44** kips  
 SEISMIC PARAMETER (ASCE 7-10 11.4.4) S<sub>DS</sub> = **0.583**  
 REDUNDANCY FACTOR (ASCE 7-10 12.3.4) ρ = **1.3**  
 UNBRACED LENGTH OF THE BRACE L = **16** ft  
 ANGLE BETWEEN BRACE & COLUMN θ = **51** °  
 ANGLE BTW BRACE & GUSSET EDGE φ = **35** °  
 COLUMN SECTION e<sub>c</sub> = **2.75** in  
 BEAM SECTION e<sub>b</sub> = **6** in



LENGTH OF END BRACE TO JUNCTION L<sub>g</sub> = 13.994 in  
 LENGTH OF GUSSET TO COLUMN 2β = 14.7 in  
 LENGTH OF GUSSET TO BEAM 2α = 20.3 in  
 THE WHITMORE WIDTH W = 11.3 in

2016 CBC Chapter A (DSA or OSHPD) APPLY? **No**  
 (3/4 in Gusset Plate with 5 in Length, 4 leg, 1/2" Fillet Weld at Brace.)

**THE BRACE DESIGN IS ADEQUATE.**

**ANALYSIS**

CHECK LIMITING WIDTH THICKNESS RATIO FOR COMPRESSION ELEMENT, LOCAL BUCKLING (AISC 341 Tab.D1.1)  
 $D/t = 0.053 E_s / (R_y F_y) = 27.95$ , for Pipe  
 $h/t = 0.65 (E_s / (R_y F_y))^{0.5} = 14.93$ , for Tube  
 Where E<sub>s</sub> = 29000 ksi, F<sub>y</sub> = **50** ksi  
 R<sub>y</sub> = **1.1**, (AISC 341-16 Table A3.1)  
 > Actual **[Satisfactory]**

CHECK LIMITING SLENDERNESS RATIO FOR V OR INVERTED-V CONFIGURATIONS (AISC 341 F2.5b)  
 200 >  $K L / r = 107.4$  **[Satisfactory]**  
 Where K = 1.0 (KL = L<sub>c</sub>)

DETERMINE FACTORED DESIGN LOADS (CBC 1605.2 & ASCE 7-10 12.4.2.3)  
 P<sub>ut</sub> = 0.9D - ρQ<sub>E</sub> - 0.2S<sub>DS</sub>D = -50.463 kips (Tension)  
 P<sub>uc</sub> = 1.2D + L + ρQ<sub>E</sub> + 0.2S<sub>DS</sub>D = 78.12 kips (Compression, Governs)

CHECK DESIGN STRENGTH IN COMPRESSION (AISC 360 E3)  
 $\phi_c P_n = \phi_c A_g F_{cr} = 142.39$  kips > P<sub>uc</sub> **[Satisfactory]**  
 Where φ<sub>c</sub> = 0.9  
 $F_e = \pi^2 E / (L_c / r)^2 = 24.791$  ksi  
 $\lambda_c = (L_c / r) (F_y / E)^{0.5} = 4.46$   
 $F_{cr} = \begin{cases} (0.658^{(F_y/F_e)}) F_y = 21.50 \text{ kis, for } \lambda_c \leq 4.71 \\ 0.877 F_e = \text{N/A kis, for } \lambda_c > 4.71 \end{cases}$

DETERMINE CONNECTION DESIGN FORCE (AISC 341 F2.3)  
 P<sub>ut</sub> = MIN(R<sub>y</sub>F<sub>y</sub>A<sub>g</sub>, P<sub>max</sub>) = 108.92 kips (Tension)  
 Where R<sub>y</sub> = 1.1  
 P<sub>max</sub> = **108.92** kips, (the estimated maximum earthquake force, that can be transferred to the brace by the system.)

DETERMINE BEST FILLET WELD SIZE (AISC 360 J2.2b)  
 w = 1/2 in > w<sub>MIN</sub> = 0.25 in  
 (USE w = **0.25** in) < w<sub>MAX</sub> = (φ 0.6 F<sub>u</sub> t) / (φ 0.707 F<sub>EXX</sub>) = (0.75 x 0.6 x 58 ksi) t / (0.75 x 0.707 x 70 ksi)  
 = 1.1795 t = 0.59 in  
**[Satisfactory]**

## DETERMINE REQUIRED WELD LENGTH (AISC 360 J2.4)

$$L = P_{ut} / [(4) \phi F_w (0.707 w)]$$

$$= 108.92 / [(4) 0.75 (0.6 \times 70)(0.707 \times 1/2)] = 4.89 \text{ in}$$

(USE 5.00 in)

## CHECK SHEAR RUPTURE CAPACITY OF SLOTTED BRACE

(AISC 360 J4.2)

$$\phi P_n = \phi(0.6F_u)A_{nv} = 270.00 \text{ kips} > P_{ut}$$

Where  $\phi = 0.75$  [Satisfactory]

$$F_u = 60 \text{ ksi}$$

$$A_{nv} = 4 t L = 4 \times 0.5 \times 5 = 10.00 \text{ in}^2$$

## DETERMINE REQUIRED THICKNESS OF GUSSET PLATE (AISC 360 Tab. J2.4)

$$t_g = 1/2 \text{ in} \quad (\text{USE } 0.75 \text{ in})$$

## CHECK SHEAR RUPTURE CAPACITY OF GUSSET PLATE (AISC 360 J4.2)

$$\phi P_n = \phi(0.6F_u)A_{nv} = 195.75 \text{ kips} > P_{ut} \quad \text{[Satisfactory]}$$

Where  $\phi = 0.75$

$$F_u = 58 \text{ ksi (A36 Steel)}$$

$$A_{nv} = 2 t_g L = 2 \times 3/4 \times 5 = 7.50 \text{ in}^2$$

## CHECK GUSSET BLOCK SHEAR CAPACITY (AISC 360 J4.3)

$$\phi R_n = \phi(0.6F_u)A_{nv} + \phi F_y A_{gt} = 195.75 + \phi F_y A_{gt}$$

$$> P_{ut} = 108.92$$

[Satisfactory]

## GUSSET COMPRESSION CAPACITY (AISC 341 F2.3)

$$\phi_c P_n = \phi_c F_{cr} L_w t_g = 245.07 \text{ kips} > 1.1 R_y P_n$$

Where  $\phi_c = 0.9$  [Satisfactory]

$$K = 1.2 \quad (\text{SEAOC Vol.3 page 40})$$

$$r_g = t_g / (12)^{0.5} = 0.22 \text{ in}$$

$$K L_g / r_g < 200 \quad \text{[Satisfactory]}$$

$$\lambda_c = (K L_g / r_g) (F_y / E)^{0.5} = 3.221$$

$$F_e = 47.575 \text{ ksi (AISC 360 E3)}$$

$$F_{cr} = 32.206 \text{ ksi (AISC 360 E3)}$$

## CHECK GUSSET TENSION YIELDING CAPACITY (AISC 360 D2 a)

$$\phi_t P_n = \phi_t F_y L_w t_g = 380.48 \text{ kips} > P_{ut}$$

Where  $\phi_t = 0.9$  [Satisfactory]

$$F_y = 50 \text{ ksi (plate value)}$$

$$L_w = W = 11.3 \text{ in}$$

## CHECK SHEAR LAG FRACTURE OF BRACE (AISC 360 D.2 b)

$$\phi P_n = \phi R_t F_u A_e = 246.54 \text{ kips} > P_{ut} \quad \text{[Satisfactory]}$$

Where  $\phi = 0.75$

$$F_u = 60 \text{ ksi}$$

$$x = B^2 + 2BH / 4(B+H) = \text{#####}, \text{ for Tube (AISC Tab. D3.1)}$$

$$D / \pi = 1.75, \text{ for Pipe (AISC 360 Tab. D3.1)}$$

$$U = \text{MIN}(1 - x / L, 0.9) = 0.65, \text{ (AISC 360 Tab. D3.1.)}$$

$$A_n = A_g - 2(t_g + 1/8)t = 6.49 \text{ in}^2$$

$$A_e = U A_n = 4.21 \text{ in}^2$$

$$R_t = 1.3 \quad (\text{AISC 341 Tab. A3.1})$$

Try Cover Plate 0 x 3, at Each Sides.

(0 for no cover required)

Region	x	0.5 A <sub>n</sub>	x A
HSS	1.75	3.24	5.68
Cover Plate	2.48	0.00	0.00
Σ		3.24	5.68

$$x = 5.68 / 3.24 = 1.75$$

$$U = \text{MIN}(1 - x / L, 0.9) = 0.65$$

$$A_n = 6.49 + 0.00 = 6.49$$

$$A_e = U A_n = 4.21 \text{ in}^2$$

Thus,  $\phi P_n = \phi R_t F_u A_e = 238.32 \text{ kips} > P_{ut} \quad \text{[Satisfactory]}$

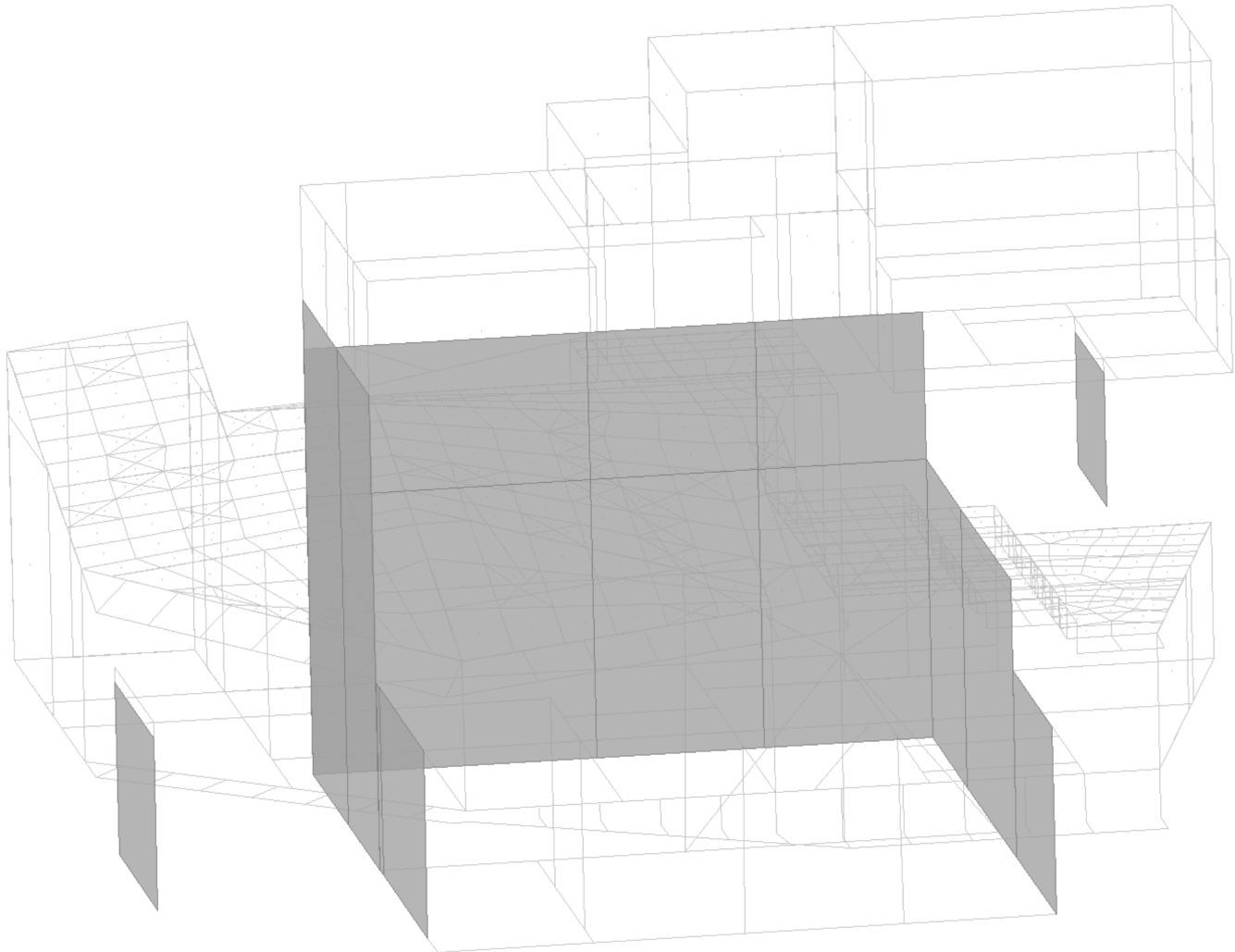
Where  $F_u = 58 \text{ ksi (plate value)}$

## Technical References:

1. AISC 341-10/16: "Seismic Provisions for Structural Steel Buildings", American Institute of Steel Construction, 2010/2016.
2. AISC 360-10/16: "Specification for Structural Steel Buildings", American Institute of Steel Construction, 2010/2016.

**RESULTS**

**DESIGN OF CONCRETE WALLS FOR STRENGTH LOAD COMBINATIONS (LC35 - LC48)**



**RESULTS**



Company : Nous  
 Designer : MG  
 Job Number :  
 Model Name : Powder Mountain

May 31, 2018  
 5:22 PM  
 Checked By: \_\_\_\_\_

**Wall Panel ACI 318-14: Concrete Code Checks (In Plane)**

	Wall Panel	Region	Max UC	LC	Shear UC	LC	Pn*phi[k]	Mn*phi[k-ft]	Vn*phi[k]
1	WP7	R1	.237	48	.248	48	1066.719	13547.253	446.342
2	WP8	R1	.143	48	.628	48	NC	50.205	39.601
3	WP8B	R1	.109	38	.138	48	NC	4934.131	516.014
4	WP9A	R2	.003	48	.016	36	NC	2250.101	340.318
5		R3	.004	36	.022	48	NC	3110.521	340.318
6	WP38B	R1	.038	48	.066	38	NC	2277.235	377.28
7	WP39A	R2	.032	48	.053	38	3198.963	2778.925	340.318
8		R3	.035	48	.064	38	3040.208	3672.678	340.318
9	WP40	R1	.026	48	.057	38	NC	7810.447	636.575
10	WP41	R2	.053	36	.064	38	NC	7706.438	574.21
11		R3	.038	48	.057	38	NC	7706.438	574.21
12	WP40A	R2	.068	48	.135	48	NC	3595.962	379.572
13		R3	.063	48	.098	48	NC	3595.962	379.572
14		R4	.043	48	.125	48	NC	3595.962	379.572
15		R5	.02	48	.025	48	NC	3595.962	379.572
16	WP41A	R2	.082	48	.206	48	1961.114	1515.553	304.893
17		R3	.081	48	.071	48	1961.114	1684.701	305.279
18		R4	.07	48	.08	48	1556.007	2976.786	301.313
19		R5	.044	48	.173	48	NC	2412.503	285.086
20	WP41B	R2	.027	48	.037	37	NC	4612.275	379.572
21		R3	.028	36	.024	37	NC	4612.275	379.572
22	WP42	R2	.027	48	.057	38	NC	8927.41	535.962
23		R3	.004	48	.052	48	NC	7499.994	535.962
24	WP43	R1	.162	47	.099	48	NC	1504.575	214.574
25	WP44	R1	.171	37	.109	48	NC	3034.253	375.574
26	WP45B	R1	.07	48	.062	48	NC	3143.865	377.28

**ALL >1 , THUS OKAY**



**Wall Panel ACI 318-14: Concrete Code Checks (Out Plane)**

Wall Panel	Region	Max UC	LC	Shear UC	LC	Pn*phi[k/ft]	Mn*phi[k-ft/ft]	Vn*phi[k/ft]	
1	WP7	R1	.071 (Int)	48	.022	48	212.558	39.094	11.788
2	WP8	R1	.295 (Int)	48	.502	48	NC	25.823	10.87
3	WP8B	R1	.104 (Ext)	38	.031	48	NC	17.552	11.476
4	WP9A	R2	.082 (Ext)	48	.026	48	NC	17.399	11.024
5		R3	.366 (Ext)	48	.107	48	NC	17.399	11.043
6	WP38B	R1	.1 (Ext)	48	.037	48	NC	21.375	13.731
7	WP39A	R2	.144 (Ext)	44	.05	48	NC	17.399	11.408
8		R3	.304 (Ext)	46	.079	48	NC	17.399	11.422
9	WP40	R1	.142 (Int)	46	.031	46	NC	21.829	13.537
10	WP41	R2	.096 (Ext)	45	.018	45	NC	17.759	11.039
11		R3	.191 (Ext)	45	.026	45	NC	17.759	11.048
12	WP40A	R2	.019 (Int)	45	.007	48	NC	16.469	8.518
13		R3	.018 (Int)	45	.007	45	NC	16.469	8.541
14		R4	.061 (Ext)	36	.042	38	NC	16.469	8.525
15		R5	.058 (Ext)	36	.034	48	NC	16.469	8.526
16	WP41A	R2	.082 (Int)	48	.017	48	186.773	14.008	9.043
17		R3	.081 (Int)	48	.015	48	186.773	NC	9.04
18		R4	.12 (Int)	45	.076	48	NC	17.15	8.69
19		R5	.161 (Ext)	48	.099	48	NC	17.15	8.591
20	WP41B	R2	.024 (Ext)	48	.008	48	NC	16.469	8.608
21		R3	.023 (Ext)	48	.011	48	NC	16.469	8.595
22	WP42	R2	.022 (Ext)	48	.009	48	NC	16.643	8.604
23		R3	.029 (Ext)	48	.018	48	NC	16.643	8.579
24	WP43	R1	.044 (Int)	48	0	48	290.149	21.761	11.56
25	WP44	R1	.038 (Int)	48	0	35	291.882	21.891	11.221
26	WP45B	R1	.116 (Ext)	48	.017	48	NC	21.375	13.533

**ALL >1 , THUS OKAY**

**REFER TO THE FOLLOWING PAGES FOR GOVERNING WALL DETAILED REPORT**

**CRITERIA**

Code : **ACI 318-14**  
 Design Rule : **12' WALLS**  
 Seismic Rule : **None**  
 Loc of r/f : **Each Face**  
 Outer Bars : **Vertical**  
  
 Vert Bar Size : **#6**  
 Horz Bar Size : **#4**  
  
 Vert Bar Spac : **12 in**  
 Horz Bar Spac : **12 in**  
 Group Wall? : **No**

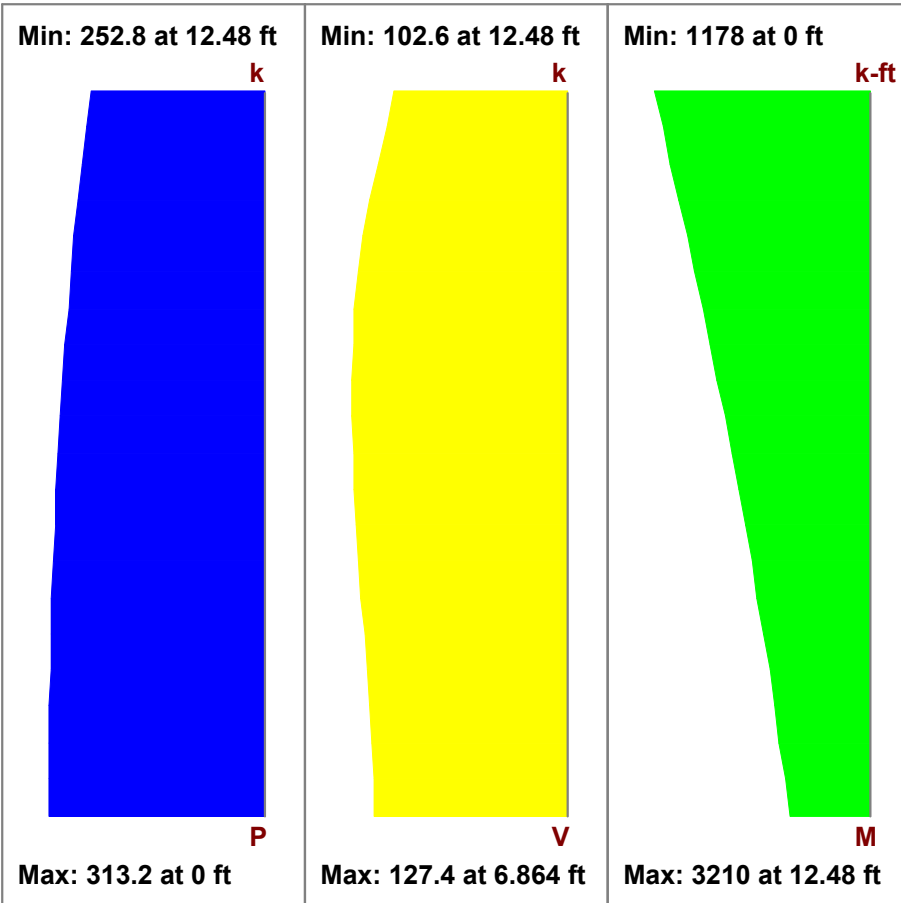
**MATERIALS**

Material Set : **Conc5000NW**  
 Concrete f'c : **5 ksi**  
 Concrete E : **4030 ksi**  
 Concrete G : **1752.17 ksi**  
 Conc Density : **.145 k/ft^3**  
 Lambda : **1**  
 Conc Str Blk : **Rectangular**  
  
 Vert Bar Fy : **60 ksi**  
 Horz Bar Fy : **60 ksi**  
 Steel E : **29000 ksi**

**GEOMETRY**

Total Height : **12.48 ft**  
 Total Length : **17.68 ft**  
 Thickness : **10 in**  
  
 Int Cover (-z) : **1 in**  
 Ext Cover (+z) : **1 in**  
 Cover Open/Edge : **2 in**  
 K : **1**  
 Use Cracked? : **Yes**  
 Icr Factor : **.05**

**ENVELOPE DIAGRAMS**



**ACI 318-14 Code Check**

**AXIAL/BENDING DETAILS**

UC Max : **.237**  
 Location : **12.48 ft**  
  
 Gov Pu : **252.769 k**  
 phi\*Pn : **1066.719 k**  
  
 Gov Mu : **3210.15 k-ft**  
 phi\*Mn : **13547.253 k-ft**  
  
 phi eff. : **.9**  
 Gov LC : **48**

**SHEAR DETAILS**

UC Max : **.248**  
 Location : **11.232 ft**  
  
 Gov Vu : **110.883 k**  
 phi\*Vn : **446.342 k**  
  
 Vnmax : **1200.158 k**  
  
 Vc : **261.862 k**  
 Vs : **333.26 k**  
  
 Gov LC : **48**

**DEFLECTION DETAILS**

Delta max : **.039 in**  
  
 Deflection Ratio : **H/319**  
 Location : **12.48 ft**  
 Gov LC : **48**

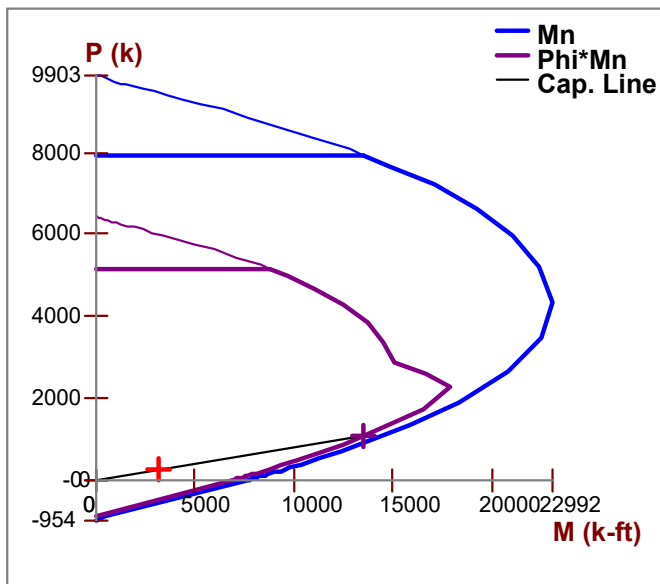
**WALL SEGMENT SECTION PROPERTIES**

Total Length	: 17.68	ft	r	: 13.695	in	As Provided (H)	: 5.105	in <sup>2</sup>
A	: 2121.6	in <sup>2</sup>	KL/r	: 10.935		rho Provided (H)	: .0034	
I <sub>gross</sub>	: 7.9581e+6	in <sup>4</sup>				As min (H)	: 3.744	in <sup>2</sup>
I <sub>cracked</sub>	: 397904.892	in <sup>4</sup>				rho min (H)	: .0025	
Cracked Mom, M <sub>cr</sub>	: 3315.437	k-ft				As Provided (V)	: 15.904	in <sup>2</sup>
						rho Provided (V)	: .0075	
						As min (V)	: 7.034	in <sup>2</sup>
						rho min (V)	: .0033	

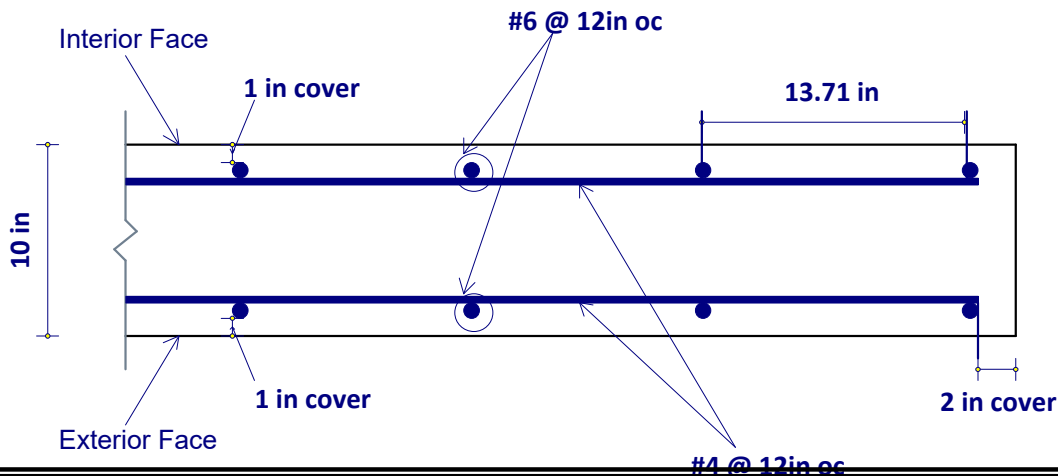
**SLENDER BENDING SPAN RESULTS**

KL/r in	C <sub>m</sub> in	L <sub>u</sub> in (ft)	P <sub>c</sub> (k)	deltaNS	M <sub>act</sub> (k-ft)	M <sub>2 min</sub> (k-ft)	M <sub>c in</sub> (k-ft)
10.935	.747	12.48	0	N/A	0	0	N/A

**In-Plane Wall Interaction Diagram**



**CROSS SECTION DETAILING**

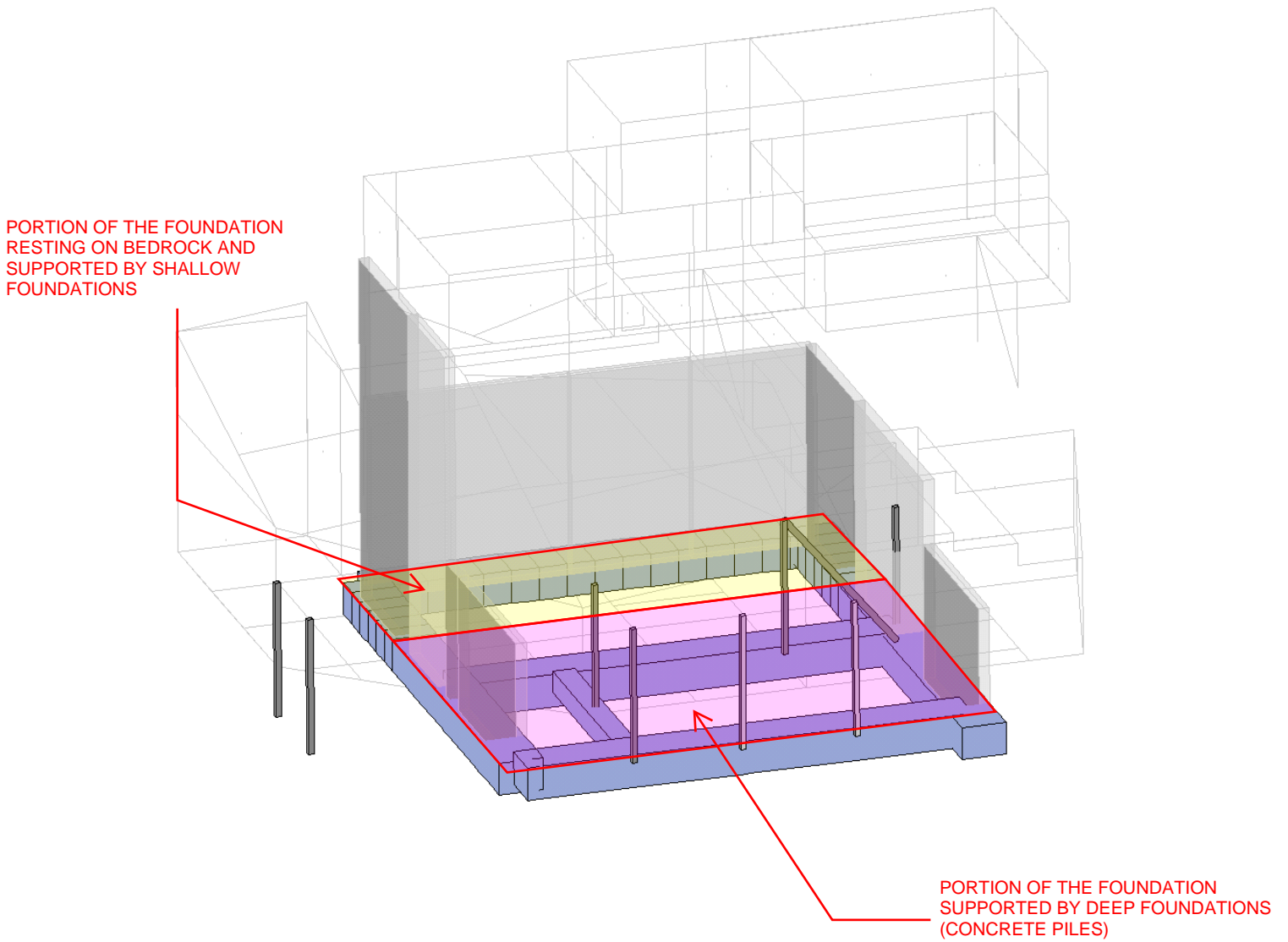




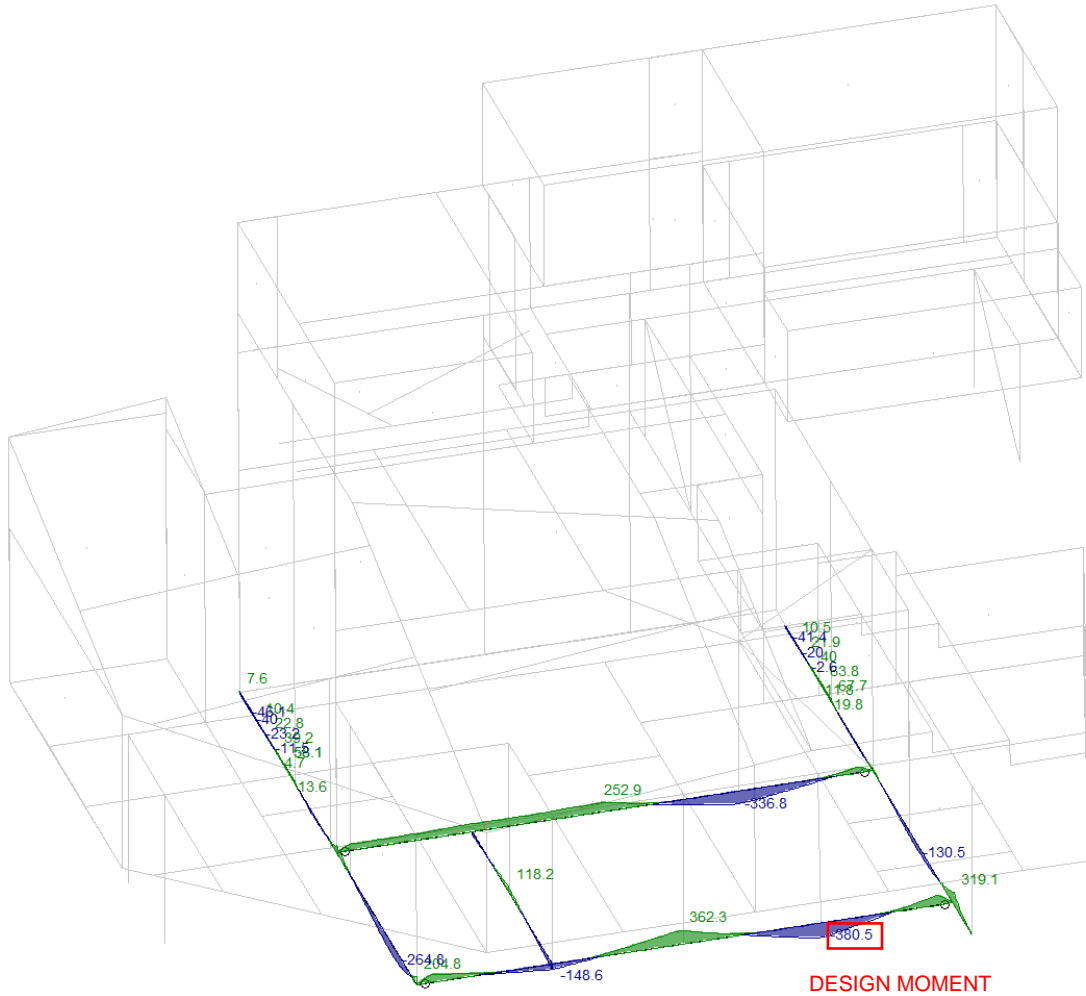
### **3.1 Foundation Design**

Foundations have been designed in accordance with ACI 318 and IBC 2015. Reactions from RISA 3D have been exported to RISA Foundation using RISA Integrator for Foundation Designs.

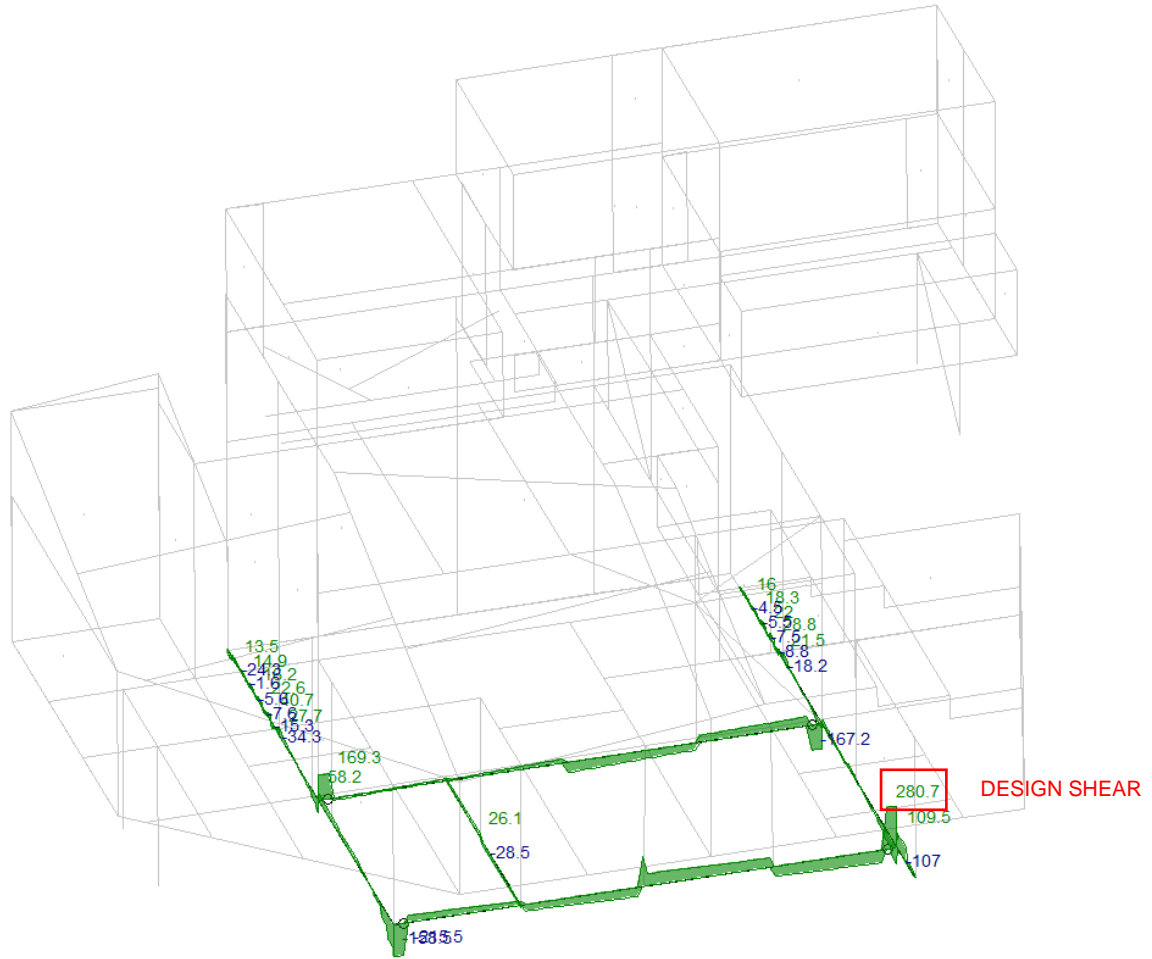
**BASE RESULTS**



**GRADE BEAM DESIGN**



**GRADE BEAM ENVELOPE MOMENTS FOR LRFD COMBINATIONS**



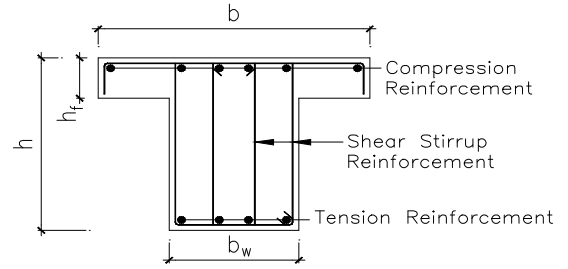
**GRADE BEAM ENVELOPE SHEAR FOR LRFD COMBINATIONS**



**Concrete Beam Design, for New or Existing, Based on ACI 318-14**

**INPUT DATA & DESIGN SUMMARY**

CONCRETE STRENGTH	$f'_c =$	5	ksi, (34 MPa)	
REBAR STRENGTH	MAIN	$f_y =$	60	ksi, (414 MPa)
	STIRRUP	$f_y =$	60	ksi, (414 MPa)
FACTORED BENDING MOMENT	$M_u =$	370	ft-kips, (502 kN-m)	
FACTORED SHEAR FORCE	$V_u =$	280	kips, (1246 kN)	
FACTORED TORSIONAL MOMENT	$T_u =$	0	ft-kips, (0 kN-m)	
SECTION DIMENSIONS	$b_w =$	36	in, (914 mm)	
	$h =$	36	in, (914 mm)	
	$h_f =$	0	in, (0 mm)	
	$b =$	36	in, (914 mm), (ACI 318-14 6.3.2.1 & 9.2.4.4)	



**THE DESIGN IS ADEQUATE.**

COMPRESSION REINFORCEMENT	6	#	8
TENSION REINFORCEMENT	6	#	8
SHEAR REINFORCEMENT	4	legs #	4

@ 6 in, (152 mm), o.c.

**ANALYSIS**

**CHECK FLEXURAL CAPACITY**

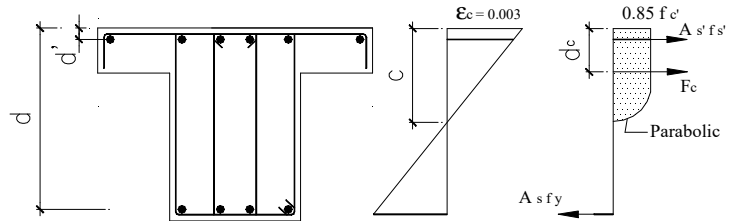
$$\epsilon_o = \frac{2(0.85f'_c)}{E_c}, E_c = 57\sqrt{f'_c}, E_s = 29000\text{ksi}$$

$$f_c = \begin{cases} 0.85f'_c \left[ 2 \left( \frac{\epsilon_c}{\epsilon_o} \right) - \left( \frac{\epsilon_c}{\epsilon_o} \right)^2 \right], & \text{for } 0 < \epsilon_c < \epsilon_o \\ 0.85f'_c, & \text{for } \epsilon_c \geq \epsilon_o \end{cases}$$

$$f_s = \begin{cases} \epsilon_s E_s, & \text{for } \epsilon_s \leq \epsilon_t \\ f_y, & \text{for } \epsilon_s > \epsilon_t \end{cases}$$

Cover =	1.5	in, (ACI 318 20.6.1)
d =	33.50	in
d' =	2.50	in
$\phi =$	0.90	, (ACI 318-14 21.2)
$\epsilon_{c,max} =$	0.0008	
$\epsilon_{s,max} =$	0.0050	, (ACI 318-14 21.2.2)

$\phi M_n = 695.07 \text{ ft-k} > M_u$



$\rho_{prov'd} = 0.0039 < \rho_{max} = 0.0272$ , (ACI 318 9.3.3.1)  
 $> \rho_{min} = 0.0035$ , (ACI 318 9.6.1)

**[Satisfactory]**

$c = 4.65 \text{ in}$ , by pure math method  
 $F_c = 233.23 \text{ kips}$   
 $d_c = 1.66 \text{ in}$

**[Satisfactory]**

**CHECK SHEAR CAPACITY**

Check section limitation (ACI 22.5.5 & 22.5.1.2)

$V_u \leq 10\phi b_w d \sqrt{f'_c}$   
 $280.0 < 639.6 \text{ kips}$  **[Satisfactory]**  
 where  $\phi = 0.75$

Check shear reinforcement (ACI 22.5)

$$\left( \frac{A_v}{s} \right)_{Req'd} = \begin{cases} 0, & \text{for } V_u < \frac{\phi V_c}{2} \\ MAX \left( \frac{50b_w}{f_y}, \frac{0.75\sqrt{f'_c} b_w}{f_y} \right), & \text{for } \frac{\phi V_c}{2} \leq V_u \leq \phi V_c \\ \frac{V_u - \phi V_c}{\phi d f_y}, & \text{for } \phi V_c \leq V_u \end{cases}$$

$= 1.191 \text{ in}^2 / \text{ft} < \left( \frac{A_v}{s} \right)_{Prov'd} = 1.600 \text{ in}^2 / \text{ft}$  **[Satisfactory]**

Check spacing limits for shear reinforcement (ACI 22.6.9.5)

$V_s = \frac{V_u - \phi V_c}{\phi} = 0.00 \text{ kips}$ , (ACI 22.5.1.1)

$S_{max, shear} = \begin{cases} MIN \left( \frac{d}{2}, 24 \right) & \text{for } V_s \leq 4b_w d \sqrt{f'_c} \\ MIN \left( \frac{d}{4}, 12 \right) & \text{for } V_s > 4b_w d \sqrt{f'_c} \end{cases} = 16 > S = 6 \text{ in}$  **[Satisfactory]**

Determine concrete capacity (ACI 22.5.5.1)

$V_c = 2b_w d \sqrt{f'_c} = 170.55 \text{ kips}$   
 $V_c = (1.9A + 2500\rho_w B) b_w d = 173.88 \text{ kips}$ ,  $\leq$  applicable

where  $A = MIN \left( \sqrt{f'_c}, 100 \right) = 70.71$

$B = MIN \left( \frac{V_u d}{M_u}, 1.0 \right) = 1.000$

CHECK TORSION CAPACITY

Check section limitation (ACI 22.7.7.1)

$$\sqrt{\left(\frac{V_u}{b_w d}\right)^2 + \left(\frac{T_u P_h}{1.7 A_{oh}^2}\right)^2} \leq \phi \left(\frac{V_c}{b_w d} + 8\sqrt{f'_c}\right)$$

where  $\phi = 0.75$  (ACI 21.2)  
 $P_h = 130$  in, (perimeter of centerline of outermost closed transverse torsional reinforcement.)  
 $A_{oh} = 1,056$  in<sup>2</sup> (area enclosed by centerline of the outermost closed transverse torsional reinforcement.)

0.232 < 0.530 **[Not Apply since Tu = 0]**

Check if torsional reinforcement required (ACI 9.5.4.1)

$$T_u \leq \phi \sqrt{f'_c} \left(\frac{A_{cp}^2}{P_{cp}}\right)$$

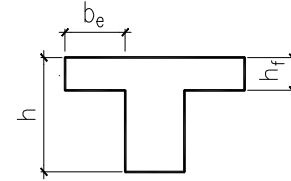
where  $b_e = \text{MIN}(h-h_f, 4h_f) = 0$  in, (one side, ACI 9.2.4.4)  
 $P_{cp} = 144$  in, (outside perimeter of the concrete cross section.)  
 $A_{cp} = 1,296$  in<sup>2</sup> (area enclosed by outside perimeter of concrete cross section.)

0.0 < 51.5 ft-k  
**Torsional reinforcement NOT reqD.**

Check the max factored torque causing cracking (ACI 22.7.3.2)

$$T_u \leq 4\phi \sqrt{f'_c} \left(\frac{A_{cp}^2}{P_{cp}}\right)$$

0.0 < 206.2  
**Reduction of the torsional moment can occur.**



Determine the area of one leg of a closed stirrup (ACI 22.7.6.1)

$$\frac{A_t}{s} = \frac{T_u}{2\phi A_{oh} f_{yv}} = \frac{T_u}{1.7\phi A_{oh} f_{yv}} = 0.00 \text{ in}^2 / \text{ft} < \text{actual} = 0.4 \text{ [Satisfactory]}$$

Determine the corresponding area of longitudinal reinforcement (derived from ACI 22.7.6.1 & 9.6.4.3)

$$A_L = \text{MAX} \left[ \frac{A_t}{s} P_h \frac{f_{yv}}{f_{yL}}, \frac{5A_{cp} \sqrt{f'_c}}{f_{yL}} - P_h \frac{f_{yv}}{f_{yL}} \text{MAX} \left( \frac{A_t}{s}, \frac{25b_w}{f_{yv}} \right) \right] = 0.00 \text{ in}^2$$

Determine minimum combined area of longitudinal reinforcement

$$A_{L, \text{top}} = A_s' + 0.5A_L = 0.00 \text{ in}^2 < \text{actual} \text{ [Not Apply]}$$

$$A_{L, \text{bot}} = A_s + 0.5A_L = 2.52 \text{ in}^2 < \text{actual} \text{ [Not Apply]}$$

Determine minimum diameter for longitudinal reinforcement (ACI 25.7.1.2)

$$d_{bL} = \text{MAX}(0.042 S, 3/8) = 0.38 \text{ in} < 1.00 \text{ in} \text{ [Not Apply]}$$

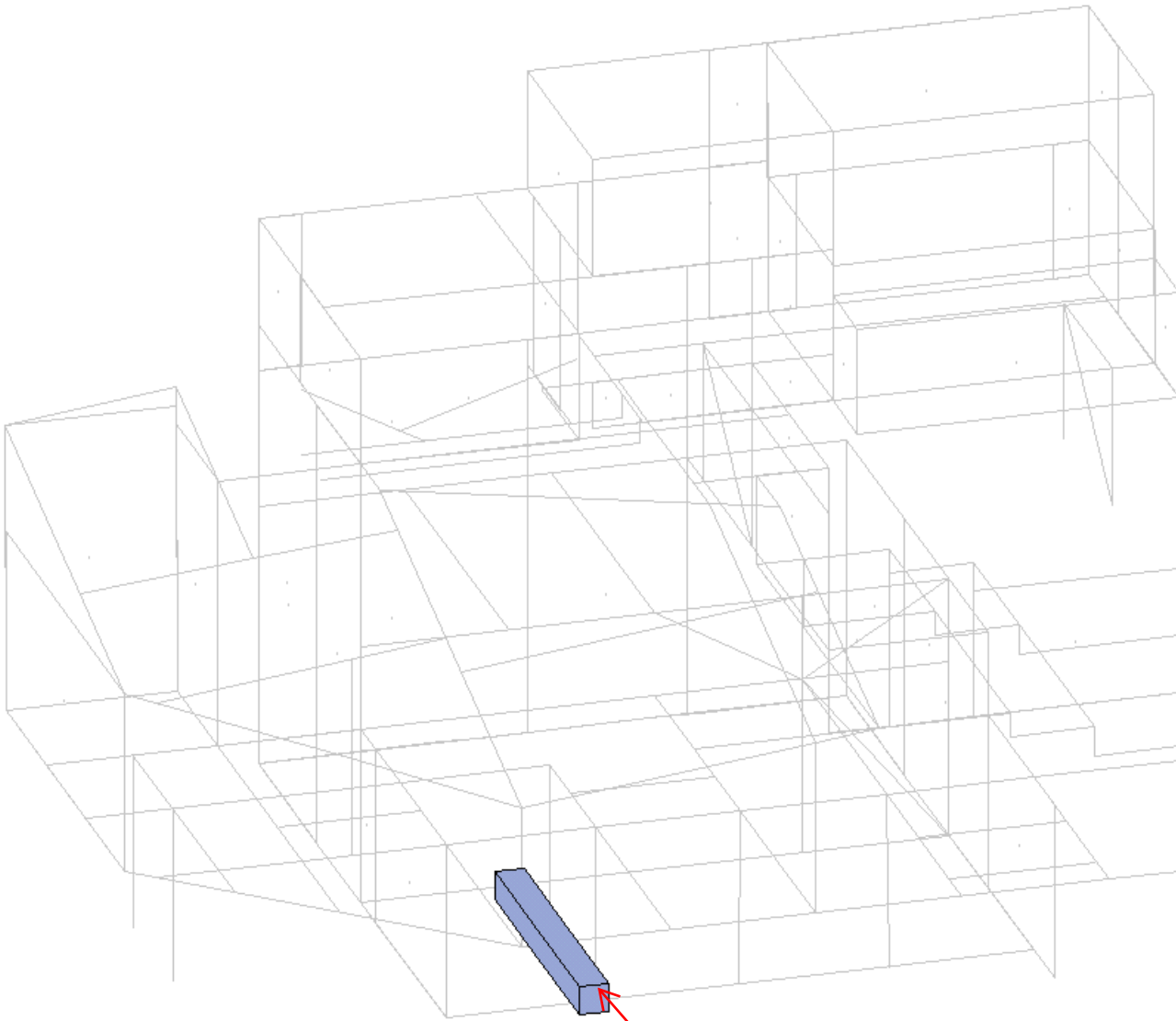
Determine minimum combined area of stirrups (ACI 9.6.4.2 & 9.7.6.3.3)

$$(A_v + 2A_t) / S = 0.80 \text{ in}^2 / \text{ft} > \text{MAX} [ 0.75(f'_c)^{0.5} b_w / f_{yv}, 50b_w / f_{yv} ] = 0.36 \text{ in}^2 / \text{ft}$$

$$S_{\text{max, tor}} = \text{MIN}[(P_h/8), 12] = 12 \text{ in} \text{ [Not Apply]}$$

$$S_{\text{reqD}} = \text{MIN}(S_{\text{max, shear}}, S_{\text{max, tor}}) = 0 \text{ in} < \text{actual} \text{ [Not Apply]}$$

**GRADE BEAM-2 DESIGN**



REFER TO THE FOLLOWING PAGES FOR GRADE BEAM TYPE 2 DETAILED REPORT

## GRADE BEAM 2 DETAILED REPORT

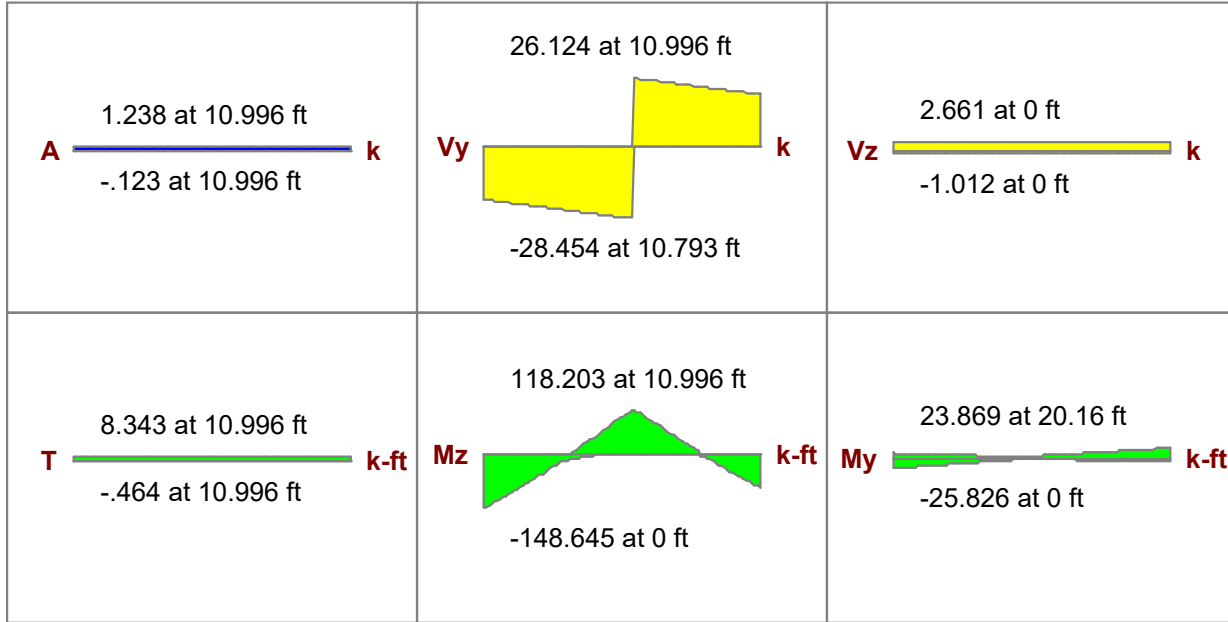
Beam: **M190**

Shape: **CRECT24X24**  
 Material: **Conc3000NW**  
 Length: **20.16 ft**  
 I Joint: **N867**  
 J Joint: **N890**

Concrete Stress Block: **Rectangular**  
 Cracked Sections Used: **Yes**  
 Cracked 'I' Factor: **.35**  
 Effective 'I': **9676.8 in<sup>4</sup>**

Code Check: **0.704 (bending)**

Report Based On 100 Sections



Beam Design does not consider any 'T' & 'My' Moments, nor 'A' & 'Vz' Forces.

### ACI 318-14 Code Check

Top Bending Check	<b>0.704 (LC 46)</b>	Bot Bending Check	<b>0.623 (LC 46)</b>	Shear Check	<b>0.353 (LC 46)</b>
Location	<b>10.996 ft</b>	Location	<b>2.036 ft</b>	Location	<b>10.793 ft</b>
Gov Muz Top	<b>118.203 k-ft</b>	Gov Muz Bot	<b>-104.556 k-ft</b>	Gov Vuy	<b>28.454 k</b>
phi*Mnz Top	<b>167.862 k-ft</b>	phi*Mnz Bot	<b>167.862 k-ft</b>	phi*Vny	<b>80.621 k</b>
Tension Bar Fy	<b>60 ksi</b>	Concrete Weight	<b>.145 k/ft<sup>3</sup></b>	Top Cover	<b>1.5 in</b>
Shear Bar Fy	<b>60 ksi</b>	λ	<b>1</b>	Bottom Cover	<b>1.5 in</b>
F'c	<b>3 ksi</b>	E_Concrete	<b>3156 ksi</b>	Side Cover	<b>1.5 in</b>
Flex. Rebar Set	<b>ASTM A615</b>	Min 1 Bar Dia Spac.	<b>No</b>	Legs/Stirrup	<b>2</b>
Shear Rebar Set	<b>ASTM A615</b>	Threshold Torsion	<b>11.831 k-ft</b>		

### Span Information

Span	Span Length (ft)	I-Face Dist. (in)	J-Face Dist. (in)
<b>1</b>	<b>0 - 20.2</b>	<b>24</b>	<b>24</b>

### Bending Steel

Span	Loc	Top/Bot	Bars Provided
<b>1</b>	<b>Left</b>	<b>T</b>	<b>-</b>
	<b>Left</b>	<b>B</b>	<b>3 #7</b>
	<b>Mid</b>	<b>T</b>	<b>3 #7</b>
	<b>Mid</b>	<b>B</b>	<b>-</b>
	<b>Right</b>	<b>T</b>	<b>-</b>
	<b>Right</b>	<b>B</b>	<b>3 #6</b>

## GRADE BEAM 2 DETAILED REPORT

### Bending Span Results

Span	Loc (ft)	Top/Bot	Mnz (k-ft)	Rho Min	Rho Max	Rho	As Prvd (in <sup>2</sup> )	As Reqd (in <sup>2</sup> )
1	2	T	0	0	0	0	0	0
	2	B	186.513	.0033	.015	.0035	1.804	1.116
	11	T	186.513	.0033	.015	.0035	1.804	1.266
	-	B	0	0	0	0	0	0
	18.1	T	0	0	0	0	0	0
	18.1	B	138.999	.0033	.015	.0026	1.325	.53

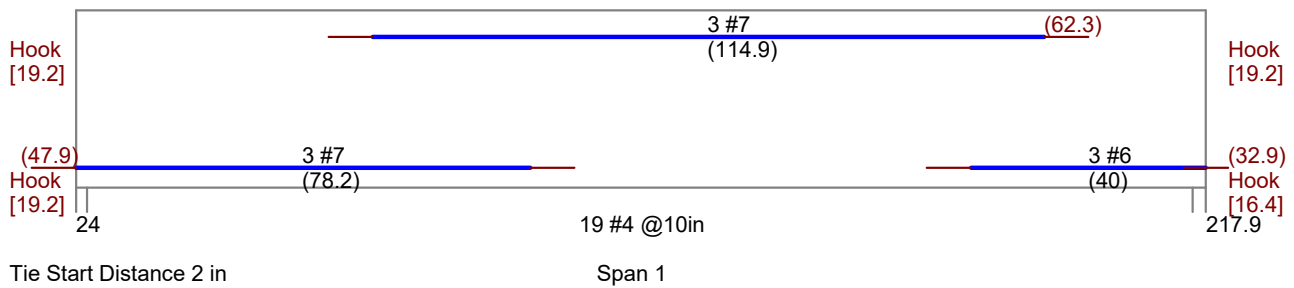
### Shear Steel

Span	Region (ft)	Bars Provided
1	2 - 16.3	19 #4 @10in
	-	-
	-	-

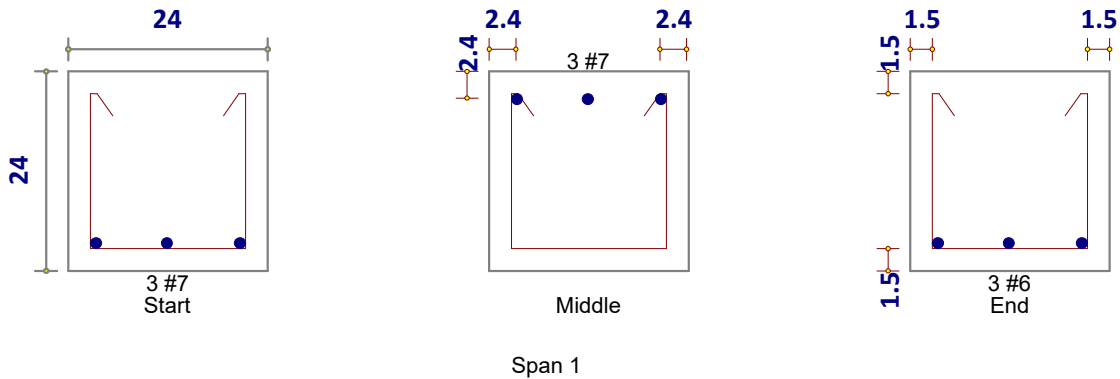
### Shear Span Results

Span	Region (ft)	Vn (k)	Vc (k)	Vs (k)	As Reqd (in <sup>2</sup> /ft)	As Prvd (in <sup>2</sup> /ft)
1	2 - 16.3	107.495	56.689	50.805	0	.471
	-	0	0	0	0	0
	-	0	0	0	0	0
	-	0	0	0	0	0

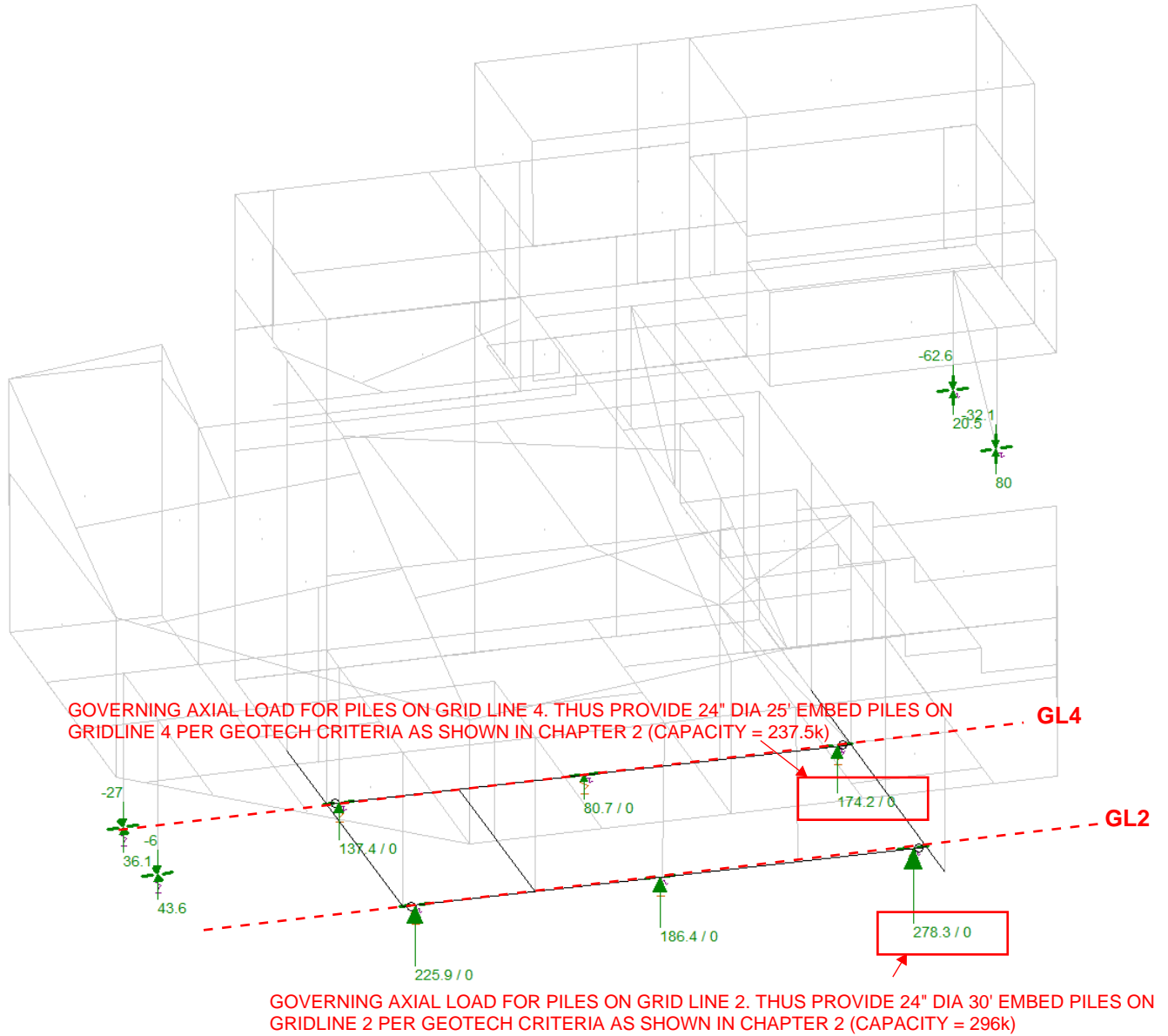
### Rebar Detailing, face of support to face of support of each span(Units: in)



### Cross Section Detailing(All Bars Equally Spaced, Units: in)



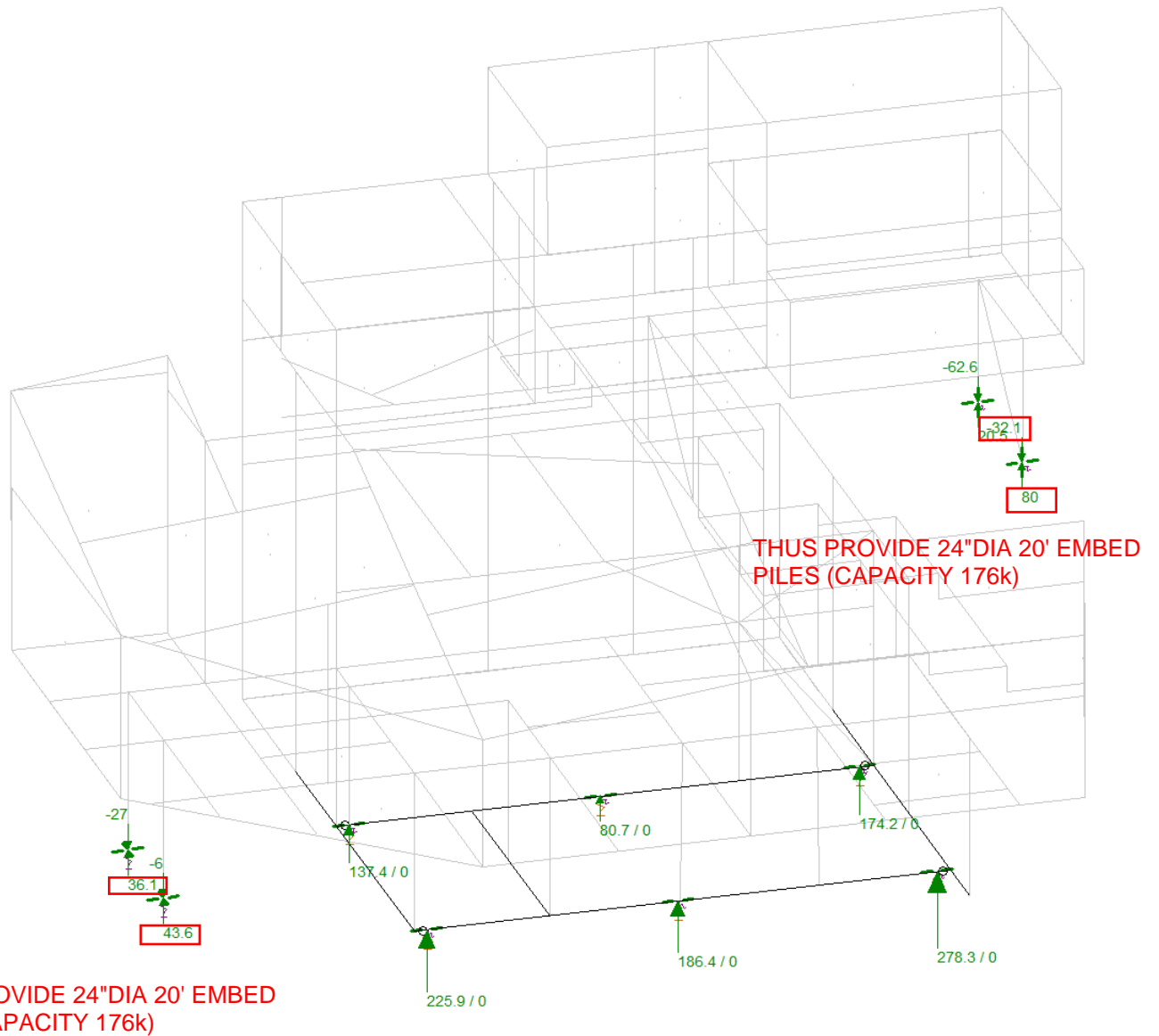
PILE DESIGN- EMBED



**ENVELOPE ASD AXIAL LOADS FOR PILE EMBED DEPTH DESIGN**

(PILES DONOT RESIST ANY LATERAL LOAD, ALL LATERAL LOAD RESISTED BY FRICTION AS SHOWN FURTHER)

PILE DESIGN- EMBED

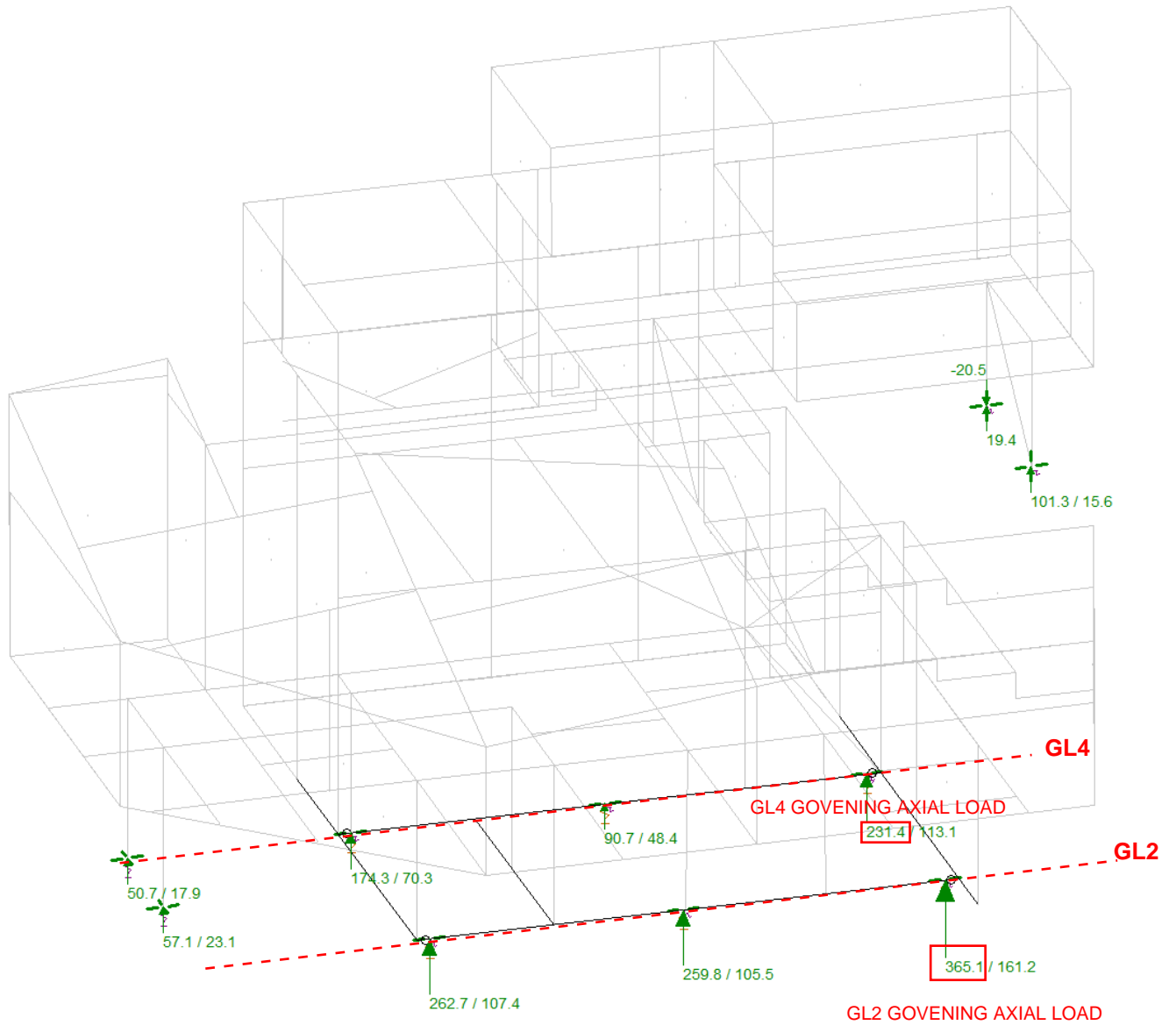


**ENVELOPE ASD AXIAL LOADS FOR PILE EMBED DEPTH DESIGN**

(PILES DONOT RESIST ANY LATERAL LOAD, ALL LATERAL LOAD RESISTED BY FRICTION AS SHOWN FURTHER)



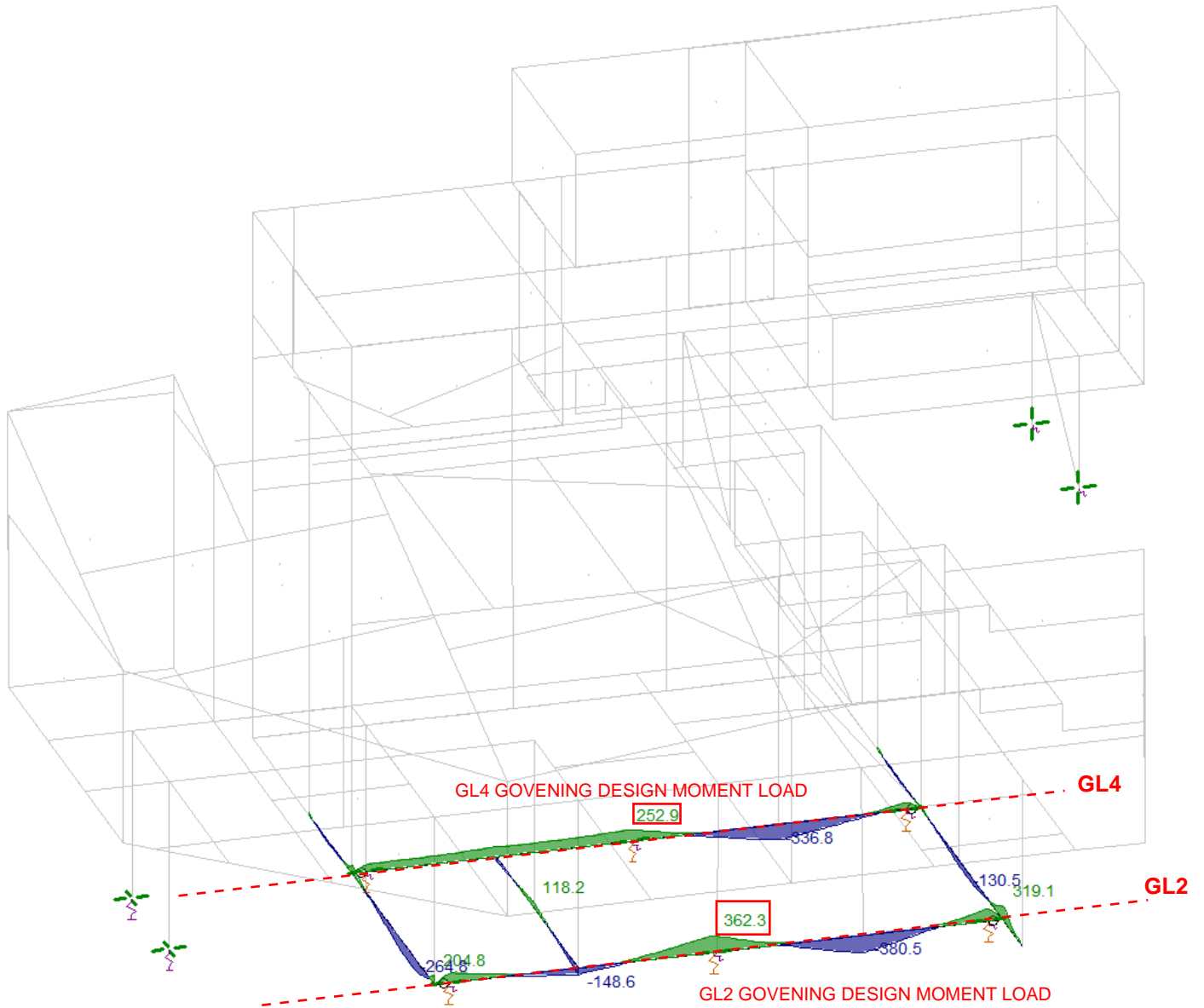
PILE DESIGN- STRENGTH



**ENVELOPE LRFD AXIAL LOADS FOR PILE STRENGTH DESIGN**

(PILES DONOT RESIST ANY LATERAL LOAD, ALL LATERAL LOAD RESISTED BY FRICTION AS SHOWN FURTHER)

PILE DESIGN- STRENGTH



**ENVELOPE LRFD MOMENT LOADS FOR PILE STRENGTH DESIGN**

(PILES DONOT RESIST ANY LATERAL LOAD, ALL LATERAL LOAD RESISTED BY FRICTION AS SHOWN FURTHER)

# GRIDLINE 2 PILES STRENGTH DESIGN

**NOUS  
ENGINEERING**

PROJECT : **SUMMIT POWDER MOUNTAIN**  
 CLIENT :   
 JOB NO. :   
 DATE :

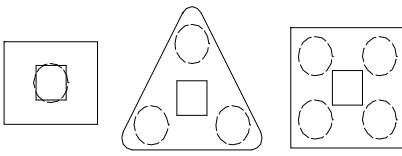
PAGE :   
 DESIGN BY :   
 REVIEW BY :

**Drilled Cast-in-place Pile Design Based on ACI 318-14**

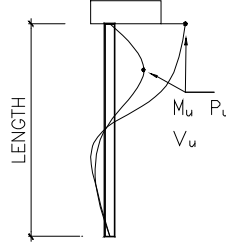
**Typ Garage Pile**

**DESIGN CRITERIA**

1. ASSUME FIX HEAD CONDITION IF  $L_{dh}$  &  $L_{hk}$  COMPLY WITH THE TENSION DEVELOPMENT. OTHERWISE PINNED AT TOP.
2. FROM PILE CAP BALANCED LOADS & REACTIONS, DETERMINE MAX SECTION FORCES OF SINGLE PILE,  $P_u$ ,  $M_u$ , &  $V_u$ .



PILE PATTERN

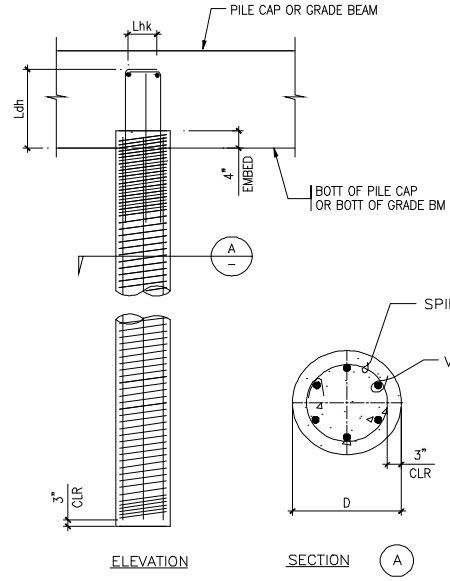


**INPUT DATA & DESIGN SUMMARY**

CONCRETE STRENGTH	$f'_c =$	5	ksi
VERT. REBAR YIELD STRESS	$f_y =$	60	ksi
PILE DIAMETER	$D =$	24	in
PILE LENGTH	$L =$	30	ft
FACTORED AXIAL LOAD	$P_u =$	365	k
FACTORED MOMENT LOAD	$M_u =$	362	ft-k
FACTORED SHEAR LOAD	$V_u =$	0	k
PILE VERT. REINF.		12 #	8
SEISMIC DESIGN (ACI 18.13.4) ?		no	
LATERAL REINF. OPTION (0=Spirals, 1=Ties)		1	Ties
LATERAL REINFORCEMENT	#	4 @ 6	in o.c.
		(spacing 3.0 in o.c. at top end of 2.0 ft.) (2015 IBC 1810.3.9)	

(  $L_{dh} =$  10 in &  $L_{hk} =$  16 in )

**THE PILE DESIGN IS ADEQUATE.**

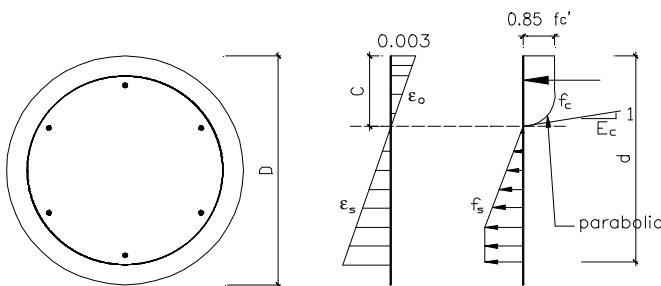


**ANALYSIS**

**CHECK PILE LIMITATIONS**

$f'_c =$	5	ksi	>	4	ksi	<b>[Satisfactory]</b>	(2015 IBC Table 1808.8.1)
$D =$	24	in	>	MAX( L / 30 , 12 in )		<b>[Satisfactory]</b>	(2015 IBC 1810.3.5.2)

**CHECK FLEXURAL & AXIAL CAPACITY**



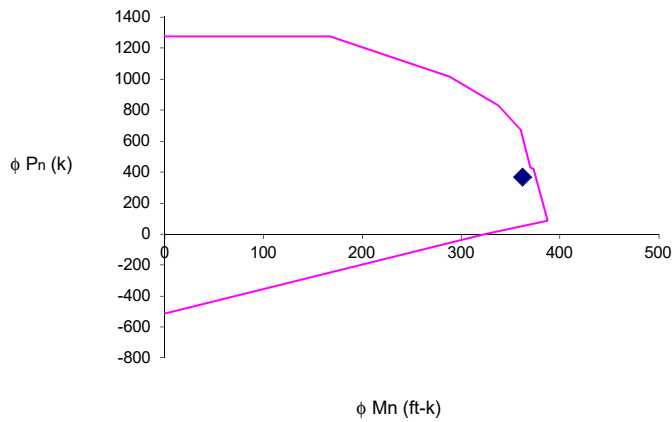
$$\epsilon_o = \frac{2(0.85f'_c)}{E_c} , E_c = 57\sqrt{f'_c} , E_s = 29000ksi$$

$$f_c = \begin{cases} 0.85f'_c \left[ 2\left(\frac{\epsilon_c}{\epsilon_o}\right) - \left(\frac{\epsilon_c}{\epsilon_o}\right)^2 \right] , & \text{for } 0 < \epsilon_c < \epsilon_o \\ 0.85f'_c , & \text{for } \epsilon_c \geq \epsilon_o \end{cases}$$

$$f_s = \begin{cases} \epsilon_s E_s , & \text{for } \epsilon_s \leq \epsilon_y \\ f_y , & \text{for } \epsilon_s > \epsilon_y \end{cases}$$

$\phi P_{max} = F \phi [ 0.85 f'_c (A_g - A_{st}) + f_y A_{st} ] =$  1274.6 kips., (at max axial load, ACI 318-14 22.4.2)

where	$F =$	0.8	, ACI 318-14 22.4.2
	$\phi =$	0.65	(ACI 318-14 21.2)
	$A_g =$	452	in <sup>2</sup> .
	$A_{st} =$	9.48	in <sup>2</sup> .
			> $P_u$ <b>[Satisfactory]</b>



	$\phi P_n$ (kips)	$\phi M_n$ (ft-kips)
AT COMPRESSION ONLY	1275	0
AT MAXIMUM LOAD	1275	167
AT 0 % TENSION	1014	288
AT 25 % TENSION	830	338
AT 50 % TENSION	674	360
AT $\epsilon_t = 0.002$	431	370
AT BALANCED CONDITION	419	373
AT $\epsilon_t = 0.005$	85	387
AT FLEXURE ONLY	0	324
AT TENSION ONLY	-512	0

$$a = C_b \beta_1 = 9 \text{ in (at balanced strain condition, ACI 21.2.2)}$$

$$\phi = \frac{0.75 + (\epsilon_t - 0.002)(50)}{0.65 + (\epsilon_t - 0.002)(250/3)} = 0.656 \text{ (ACI 318-14 21.2)}$$

$$\text{where } C_b = d \epsilon_c / (\epsilon_c + \epsilon_s) = 12 \text{ in} \quad \epsilon_t = 0.002069 \quad \epsilon_c = 0.003$$

$$d = 20 \text{ in, (ACI 20.6)} \quad \beta_1 = 0.8 \text{ (ACI 318-14 22.2.2.4.3)}$$

$$\phi M_n = 0.9 M_n = 324 \text{ ft-kips @ } P_n = 0, \text{ (ACI 318-14 21.2) , \& } \epsilon_{t,max} = 0.004, \text{ (ACI 318-14 21.2.3)}$$

$$\phi M_n = 376 \text{ ft-kips @ } P_u = 365 \text{ kips} > M_u \quad \text{[Satisfactory]}$$

$$\rho_{max} = 0.08 \text{ (ACI 318-14 10.6)} \quad \rho_{prov} = 0.021$$

$$\rho_{min} = 0.005 \text{ (2015 IBC 1810.3.9.4.2)} \quad \text{[Satisfactory]}$$

#### CHECK SHEAR CAPACITY

$$\phi V_n = \phi (V_s + V_c) = 93 \text{ kips, (ACI 318-14 22.5)}$$

$$\text{where } \phi = 0.75 \text{ (ACI 318-14 21.2)} > V_u \quad \text{[Satisfactory]}$$

$$A_0 = 314 \text{ in}^2, \quad A_v = 0.40 \text{ in}^2, \quad f_y = 60 \text{ ksi}$$

$$V_c = 2 (f_c')^{0.5} A_0 = 44.4 \text{ kips, (ACI 318-14 22.5)}$$

$$V_s = \text{MIN} (d f_y A_v / s, 8 (f_c')^{0.5} A_0) = 80.0 \text{ kips, (ACI 318-14 22.5.1)}$$

$$s_{max} = 12 \text{ (2015 IBC 1810.3.9.4.2)} \quad s_{prov} = 6 \text{ in}$$

$$s_{min} = 1 \quad \text{[Satisfactory]}$$

$$\rho_s = 0.12 f_c' / f_{yt} = 0.010 > \rho_{s,prov} = 0.008 \quad \text{[Satisfactory]} \text{ (ACI 318-14 18.13.4.3 \& 18.7.5.1)}$$

#### DETERMINE FIX HEAD CONDITION

$$L_{dh} = \text{MAX} \left( \eta \frac{\rho_{required}}{\rho_{provided}} \frac{0.02 \psi_e d_b f_y}{\lambda \sqrt{f_c}}, 8 d_b, 6 \text{ in} \right) = 10 d_b = 10 \text{ in} \text{ (ACI 318-14 25.4.3)}$$

$$L_{hk} = 16 \text{ in, (ACI 318-14 25.4)}$$

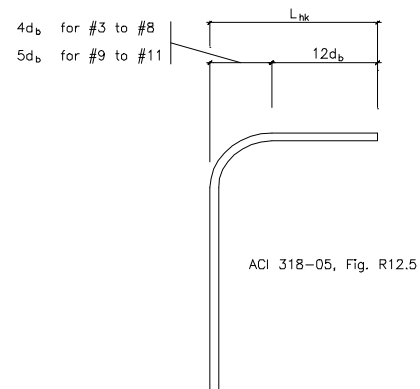
$$\text{where } d_b = 1 \text{ in}$$

$$\rho_{required} / \rho_{provided} = 0.8 \text{ ( } A_{s,req} / A_{s,prov}, \text{ ACI 318 25.4.10.1)}$$

$$\psi_e = 1.0 \text{ (1.2 for epoxy-coated, ACI 318-14 25.4.2.4)}$$

$$\lambda = 1.0 \text{ (normal weight)}$$

$$\eta = 0.7 \text{ (\#11 or smaller, cover } > 2.5" \text{ \& side } > 2.0", \text{ ACI 318-14 25.4.3.2)}$$



**GRIDLINE 4 PILES STRENGTH DESIGN**

**NOUS ENGINEERING**

PROJECT : **SUMMIT POWDER MOUNTAIN**  
 CLIENT :  
 JOB NO. : DATE :

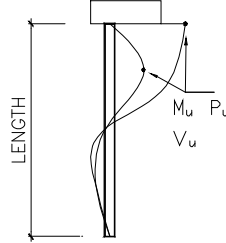
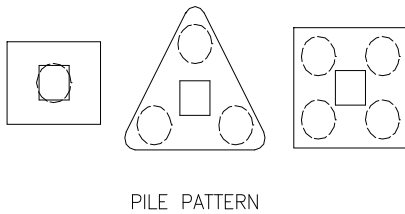
PAGE :  
 DESIGN BY :  
 REVIEW BY :

**Drilled Cast-in-place Pile Design Based on ACI 318-14**

**Typ Garage Pile**

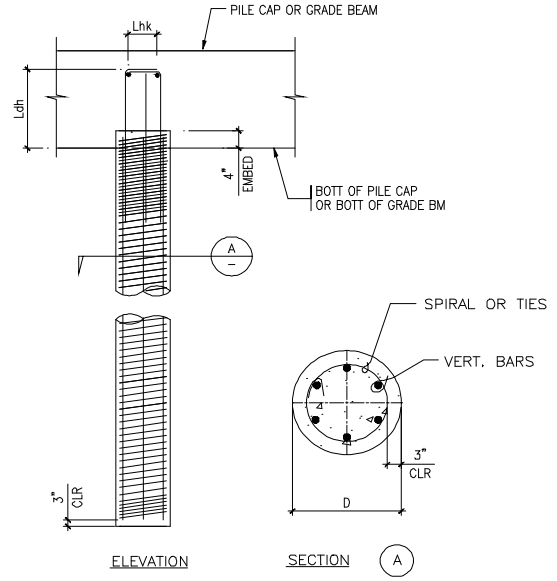
**DESIGN CRITERIA**

1. ASSUME FIX HEAD CONDITION IF  $L_{dh}$  &  $L_{hk}$  COMPLY WITH THE TENSION DEVELOPMENT. OTHERWISE PINNED AT TOP.
2. FROM PILE CAP BALANCED LOADS & REACTIONS, DETERMINE MAX SECTION FORCES OF SINGLE PILE,  $P_u$ ,  $M_u$ , &  $V_u$ .



**INPUT DATA & DESIGN SUMMARY**

CONCRETE STRENGTH	$f'_c =$	5	ksi
VERT. REBAR YIELD STRESS	$f_y =$	60	ksi
PILE DIAMETER	$D =$	24	in
PILE LENGTH	$L =$	25	ft
FACTORED AXIAL LOAD	$P_u =$	232	k
FACTORED MOMENT LOAD	$M_u =$	252	ft-k
FACTORED SHEAR LOAD	$V_u =$	0	k
PILE VERT. REINF.		8 #	8
SEISMIC DESIGN (ACI 18.13.4) ?		no	
LATERAL REINF. OPTION (0=Spirals, 1=Ties)		1	Ties
LATERAL REINFORCEMENT	#	4 @ 6	in o.c.
		(spacing 3.0 in o.c. at top end of 2.0 ft.) (2015 IBC 1810.3.9)	



(  $L_{dh} =$  10 in &  $L_{hk} =$  16 in )

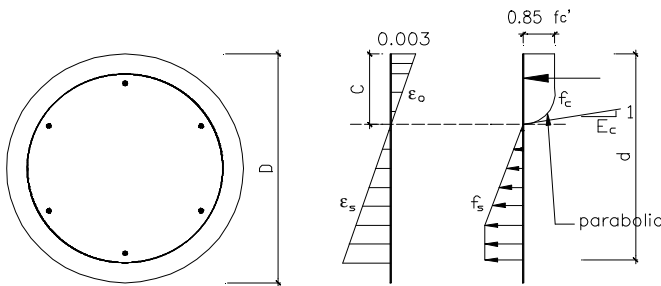
**THE PILE DESIGN IS ADEQUATE.**

**ANALYSIS**

**CHECK PILE LIMITATIONS**

$f'_c =$	5	ksi	>	4	ksi	<b>[Satisfactory]</b>	(2015 IBC Table 1808.8.1)
$D =$	24	in	>	MAX( L / 30 , 12 in )		<b>[Satisfactory]</b>	(2015 IBC 1810.3.5.2)

**CHECK FLEXURAL & AXIAL CAPACITY**



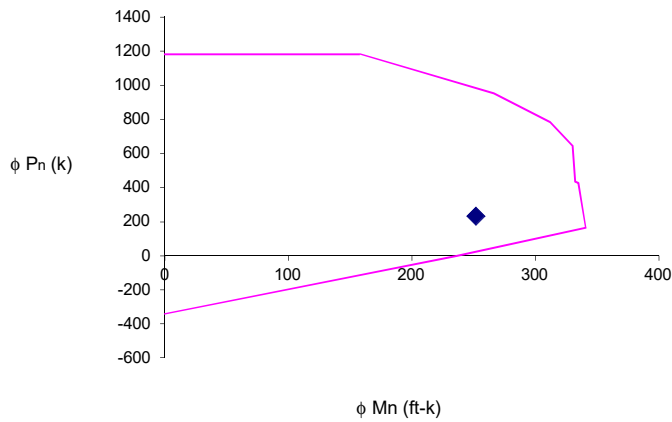
$$\epsilon_o = \frac{2(0.85f'_c)}{E_c}, E_c = 57\sqrt{f'_c}, E_s = 29000ksi$$

$$f_c = \begin{cases} 0.85f'_c \left[ 2\left(\frac{\epsilon_c}{\epsilon_o}\right) - \left(\frac{\epsilon_c}{\epsilon_o}\right)^2 \right], & \text{for } 0 < \epsilon_c < \epsilon_o \\ 0.85f'_c, & \text{for } \epsilon_c \geq \epsilon_o \end{cases}$$

$$f_s = \begin{cases} \epsilon_s E_s, & \text{for } \epsilon_s \leq \epsilon_y \\ f_y, & \text{for } \epsilon_s > \epsilon_y \end{cases}$$

$\phi P_{max} = F \phi [ 0.85 f'_c (A_g - A_{st}) + f_y A_{st} ] =$  1183 kips., (at max axial load, ACI 318-14 22.4.2)

where  $F = 0.8$ , ACI 318-14 22.4.2  
 $\phi = 0.65$  (ACI 318-14 21.2)  
 $A_g = 452 \text{ in}^2$   
 $A_{st} = 6.32 \text{ in}^2$   
 $\phi P_{max} > P_u$  **[Satisfactory]**



	$\phi P_n$ (kips)	$\phi M_n$ (ft-kips)
AT COMPRESSION ONLY	1183	0
AT MAXIMUM LOAD	1183	158
AT 0 % TENSION	954	266
AT 25 % TENSION	785	312
AT 50 % TENSION	645	330
AT $\epsilon_t = 0.002$	436	332
AT BALANCED CONDITION	426	335
AT $\epsilon_t = 0.005$	164	341
AT FLEXURE ONLY	0	237
AT TENSION ONLY	-341	0

$$a = C_b \beta_1 = 9 \text{ in (at balanced strain condition, ACI 21.2.2)}$$

$$\phi = \frac{0.75 + (\epsilon_t - 0.002)(50)}{0.65 + (\epsilon_t - 0.002)(250/3)} = 0.656 \text{ (ACI 318-14 21.2)}$$

$$\text{where } C_b = d \epsilon_c / (\epsilon_c + \epsilon_s) = 12 \text{ in} \quad \epsilon_t = 0.002069 \quad \epsilon_c = 0.003$$

$$d = 20 \text{ in, (ACI 20.6)} \quad \beta_1 = 0.8 \text{ (ACI 318-14 22.2.2.4.3)}$$

$$\phi M_n = 0.9 M_n = 237 \text{ ft-kips @ } P_n = 0, \text{ (ACI 318-14 21.2) , \& } \epsilon_{t,max} = 0.004, \text{ (ACI 318-14 21.2.3)}$$

$$\phi M_n = 339 \text{ ft-kips @ } P_u = 232 \text{ kips} > M_u \quad \text{[Satisfactory]}$$

$$\rho_{max} = 0.08 \text{ (ACI 318-14 10.6)} \quad \rho_{provd} = 0.014$$

$$\rho_{min} = 0.005 \text{ (2015 IBC 1810.3.9.4.2)} \quad \text{[Satisfactory]}$$

#### CHECK SHEAR CAPACITY

$$\phi V_n = \phi (V_s + V_c) = 93 \text{ kips, (ACI 318-14 22.5)}$$

$$\text{where } \phi = 0.75 \text{ (ACI 318-14 21.2)} \quad \text{[Satisfactory]}$$

$$A_0 = 314 \text{ in}^2, \quad A_v = 0.40 \text{ in}^2, \quad f_y = 60 \text{ ksi}$$

$$V_c = 2 (f_c')^{0.5} A_0 = 44.4 \text{ kips, (ACI 318-14 22.5)}$$

$$V_s = \text{MIN} (d f_y A_v / s, 8 (f_c')^{0.5} A_0) = 80.0 \text{ kips, (ACI 318-14 22.5.1)}$$

$$s_{max} = 12 \text{ (2015 IBC 1810.3.9.4.2)} \quad s_{provd} = 6 \text{ in}$$

$$s_{min} = 1 \quad \text{[Satisfactory]}$$

$$\rho_s = 0.12 f_c' / f_{yt} = 0.010 > \rho_{s,provd} = 0.008 \text{ [Satisfactory] (ACI 318-14 18.13.4.3 \& 18.7.5.1)}$$

#### DETERMINE FIX HEAD CONDITION

$$L_{dh} = \text{MAX} \left( \eta \frac{\rho_{required}}{\rho_{provided}} \frac{0.02 \psi_e d_b f_y}{\lambda \sqrt{f_c}}, 8 d_b, 6 \text{ in} \right) = 10 d_b = 10 \text{ in}$$

(ACI 318-14 25.4.3)

$$L_{hk} = 16 \text{ in, (ACI 318-14 25.4)}$$

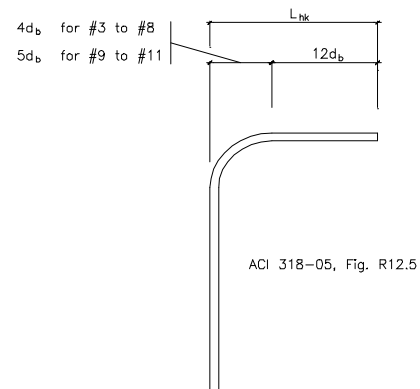
$$\text{where } d_b = 1 \text{ in}$$

$$\rho_{required} / \rho_{provided} = 0.8 \quad (A_{s,reqd} / A_{s,provd}, \text{ ACI 318 25.4.10.1})$$

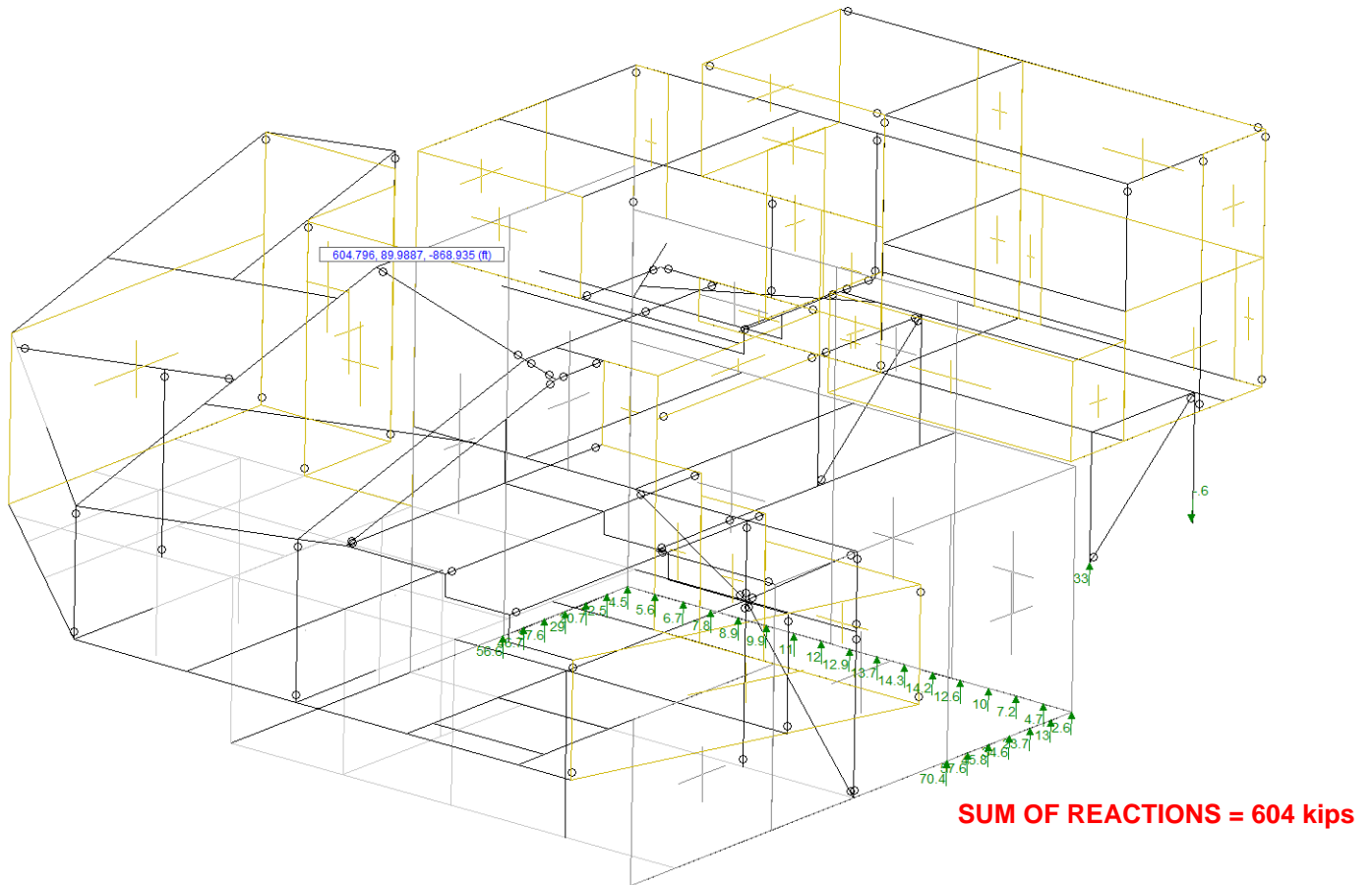
$$\psi_e = 1.0 \text{ (1.2 for epoxy-coated, ACI 318-14 25.4.2.4)}$$

$$\lambda = 1.0 \text{ (normal weight)}$$

$$\eta = 0.7 \text{ (\#11 or smaller, cover } > 2.5" \text{ \& side } > 2.0", \text{ ACI 318-14 25.4.3.2)}$$



**SLIDING CHECK**



**DEAD LOAD REACTIONS (LC-2) ACTING ON THE SHALLOW FOUNDATIONS ON BEDROCK ONLY**

**CO-EFFICIENT OF FRICTION = 0.47  
 THUS SLIDING RESISTANCE = 0.47 X 604 = 284 kips**

**TOTAL SLIDING FORCE = 110kips (AS SHOWN ON THE FOLLOWING PAGE)  
 THUS FOS AGAINST SLIDING = 284/110 = 2.58 THUS OKAY**



**Envelope Joint Reactions**

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N233	max	1.803	14	20.521	25	4.705	15	0	1	0	1	0	1
2		min	-.33	15	-62.642	14	-.203	16	0	1	0	1	0	1
3	N234	max	53.652	14	79.987	27	6.851	15	0	1	0	1	0	1
4		min	-17.557	15	-32.107	15	-.203	16	0	1	0	1	0	1
5	N235B	max	.302	14	36.138	28	-.03	1	0	1	0	1	0	1
6		min	-.071	12	-27.034	14	-.271	13	0	1	0	1	0	1
7	N236	max	.128	14	43.559	13	.225	15	0	1	0	1	0	1
8		min	-.273	12	-6.039	16	-.4	12	0	1	0	1	0	1
9	N251	max	0	1	0	1	0	1	0	1	0	1	0	1
10		min	0	1	0	1	0	1	0	1	0	1	0	1
11	N264	max	0	1	0	1	0	1	0	1	0	1	0	1
12		min	0	1	0	1	0	1	0	1	0	1	0	1
13	N270	max	0	1	0	1	0	1	0	1	0	1	0	1
14		min	0	1	0	1	0	1	0	1	0	1	0	1
15	N20	max	10.212	31	9.018	30	36.732	32	0	1	0	1	0	1
16		min	-6.777	17	0	1	-28.228	18	0	1	0	1	0	1
17	N19	max	8.05	14	14.657	20	58.388	4	0	1	0	1	0	1
18		min	-9.851	17	0	3	-89.987	16	0	1	0	1	0	1
19	N880	max	7.91	14	137.402	27	16.094	15	0	1	0	1	0	1
20		min	-9.68	17	0	14	-95.025	8	0	1	0	1	0	1
21	N883	max	5.005	31	80.744	28	.785	14	0	1	0	1	0	1
22		min	-5.713	17	0	14	-1.255	20	0	1	0	1	0	1
23	N887	max	9.906	31	174.233	27	127.158	32	0	1	0	1	0	1
24		min	-6.713	17	0	14	-35.664	4	0	1	0	1	0	1
25	N885A	max	7.983	14	225.92	12	16.065	15	0	1	0	1	0	1
26		min	-9.657	17	0	15	-9.076	12	0	1	0	1	0	1
27	N887A	max	5.005	31	186.366	28	3.107	15	0	1	0	1	0	1
28		min	-5.737	17	0	14	-1.536	14	0	1	0	1	0	1
29	N889	max	9.955	31	278.306	27	38.06	28	0	1	0	1	0	1
30		min	-6.631	17	0	14	-4.379	14	0	1	0	1	0	1
31	N854A	max	0	1	81.314	27	0	1	0	1	0	1	0	1
32		min	0	1	0	14	0	1	0	1	0	1	0	1
33	N855A	max	0	1	91.455	26	0	1	0	1	0	1	0	1
34		min	0	1	0	14	0	1	0	1	0	1	0	1
35	N862A	max	0	1	74.506	26	0	1	0	1	0	1	0	1
36		min	0	1	0	14	0	1	0	1	0	1	0	1
37	N863A	max	0	1	58.863	26	0	1	0	1	0	1	0	1
38		min	0	1	0	14	0	1	0	1	0	1	0	1
39	N864A	max	0	1	43.993	26	0	1	0	1	0	1	0	1
40		min	0	1	0	11	0	1	0	1	0	1	0	1
41	N865A	max	0	1	30.799	18	0	1	0	1	0	1	0	1
42		min	0	1	0	3	0	1	0	1	0	1	0	1
43	N866A	max	0	1	20.186	18	0	1	0	1	0	1	0	1
44		min	0	1	0	3	0	1	0	1	0	1	0	1
45	N872	max	0	1	13.767	18	0	1	0	1	0	1	0	1
46		min	0	1	0	3	0	1	0	1	0	1	0	1
47	N873B	max	7.368	31	17.281	18	0	1	0	1	0	1	0	1
48		min	-6.593	17	0	3	0	1	0	1	0	1	0	1
49	N874B	max	0	1	20.366	18	0	1	0	1	0	1	0	1
50		min	0	1	0	3	0	1	0	1	0	1	0	1
51	N875A	max	4.961	31	22.884	18	0	1	0	1	0	1	0	1
52		min	-6.077	17	0	11	0	1	0	1	0	1	0	1
53	N876A	max	0	1	23.084	18	0	1	0	1	0	1	0	1
54		min	0	1	0	11	0	1	0	1	0	1	0	1
55	N877A	max	3.166	31	21.067	26	0	1	0	1	0	1	0	1
56		min	-5.773	17	0	11	0	1	0	1	0	1	0	1



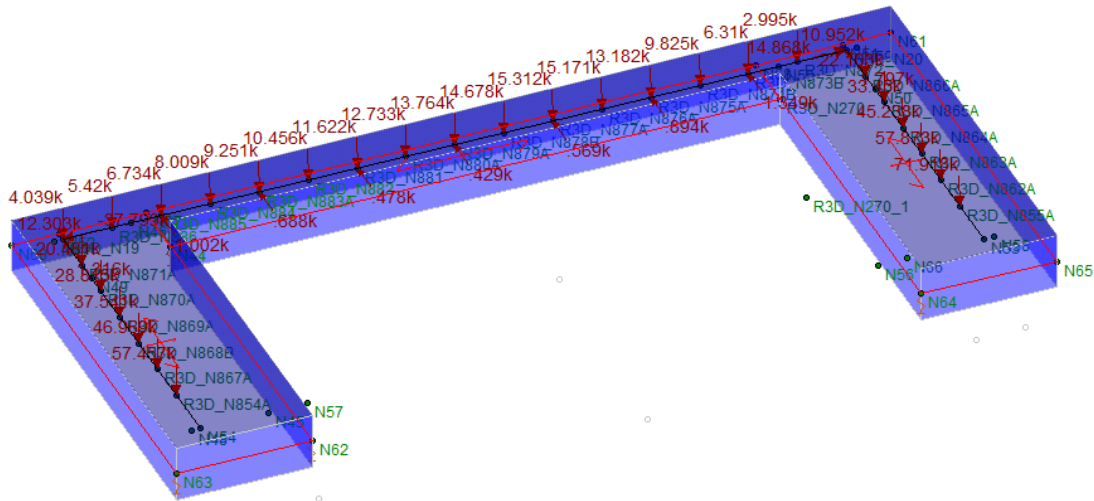
**Envelope Joint Reactions (Continued)**

Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
57	N878B	max	0	1	18.344	26	0	1	0	0	1	0	1
58		min	0	1	0	11	0	1	0	1	0	1	0
59	N879A	max	2.39	14	16.923	25	0	1	0	1	0	1	0
60		min	-5.98	17	0	11	0	1	0	1	0	1	0
61	N880A	max	0	1	15.881	25	0	1	0	1	0	1	0
62		min	0	1	0	11	0	1	0	1	0	1	0
63	N881	max	3.546	14	14.787	17	0	1	0	1	0	1	0
64		min	-6.771	17	0	11	0	1	0	1	0	1	0
65	N882	max	0	1	13.989	20	0	1	0	1	0	1	0
66		min	0	1	0	11	0	1	0	1	0	1	0
67	N883A	max	5.015	14	14.398	20	0	1	0	1	0	1	0
68		min	-8	17	0	11	0	1	0	1	0	1	0
69	N884	max	0	1	14.823	20	0	1	0	1	0	1	0
70		min	0	1	0	11	0	1	0	1	0	1	0
71	N885	max	6.636	14	15.231	20	0	1	0	1	0	1	0
72		min	-9.265	17	0	11	0	1	0	1	0	1	0
73	N886	max	0	1	15.425	20	0	1	0	1	0	1	0
74		min	0	1	0	3	0	1	0	1	0	1	0
75	N871A	max	0	1	21.942	28	0	1	0	1	0	1	0
76		min	0	1	0	14	0	1	0	1	0	1	0
77	N870A	max	0	1	32.181	28	0	1	0	1	0	1	0
78		min	0	1	0	14	0	1	0	1	0	1	0
79	N869A	max	0	1	42.414	28	0	1	0	1	0	1	0
80		min	0	1	0	14	0	1	0	1	0	1	0
81	N868B	max	0	1	52.98	28	0	1	0	1	0	1	0
82		min	0	1	0	14	0	1	0	1	0	1	0
83	N867A	max	0	1	65.578	27	0	1	0	1	0	1	0
84		min	0	1	0	14	0	1	0	1	0	1	0
85	Totals:	max	110.101	14	1885.871	28	112.056	15					
86		min	-100.199	29	0	14	-109.731	18					

MAXIMUM LATERAL FORCES



RISA FOUNDATION IMPORTED REACTIONS



**RISA FOUNDATION INPUT PARAMETERS**



Company : Nous  
 Designer : MG  
 Job Number :  
 Model Name : Powder Mountain

Apr 13, 2018  
 6:19 PM  
 Checked By: \_\_\_\_\_

**Concrete Properties**

	Label	E [ksi]	G [ksi]	Nu	Therm (1/E...)	Density[k/ft...]	f'c[ksi]	Lambda	Flex Steel[...]	Shear Steel...
1	Conc3000NW	3156	1372	.15	.6	.145	3	1	60	60
2	Conc5000NW	4030	1752.17	.15	.6	.145	5	1	60	60
3	CONC3000NW 0 d...	3156	1372	.15	.6	0	3	1	60	60

**General Design Parameters**

	Label	Max Bending Chk	Max Shear Chk	Top Cover[in]	Bottom Cover[in]
1	CF2 Long	1	1	1.5	1.5
2	CF1 long	1	1	1.5	1.5
3	Horizontal reinf CF2	1	1	1.5	1.5

**Slab Rebar Parameters**

	Label	Top Bar	Bottom B...	Max Top Bar ...	Min Top Bar ...	Max Bot Bar ...	Min Bot Bar S...	Spacing In...	Rebar Options
1	CF2 Long	#6	#6	12	12	12	12	1	Optimize
2	CF1 long	#8	#8	12	12	12	12	2	Optimize
3	Horizontal reinf...	#5	#5	8	8	8	8	2	Optimize

**Soil Definitions**

	Label	Subgrade Modulus[k/ft^3]	Allowable Bearing[k/f]	Depth Properties	Default?
1	Default	100	3.4	None	Yes

**Slabs**

	Label	Thickness [in]	Material	Local Axis Angle [deg]	Analysis Offset [in]
1	S1	36	Conc3000NW	0	0

**Design Strips**

	Label	Rebar Angle from Pl...	No. of Design Cuts	Design Rule
1	DS1	90	50	CF2 Long
2	DS2	90	50	CF2 Long
3	DS3	0	50	CF1 long
4	DS4	0	50	Horizontal reinf CF2
5	DS5	0	50	Horizontal reinf CF2
6	DS6	90	50	Horizontal reinf CF2

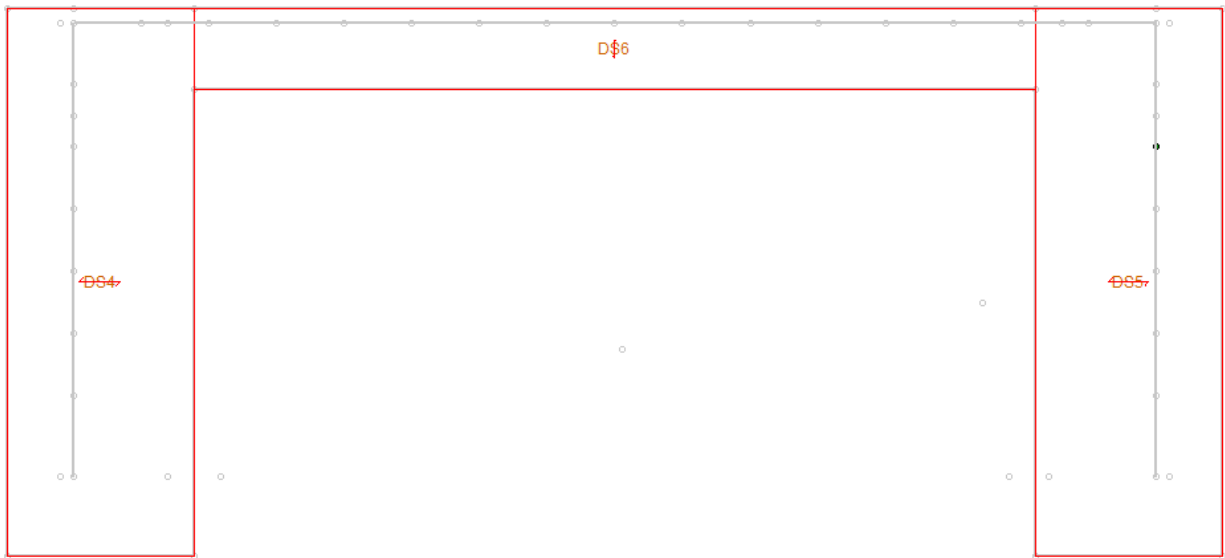
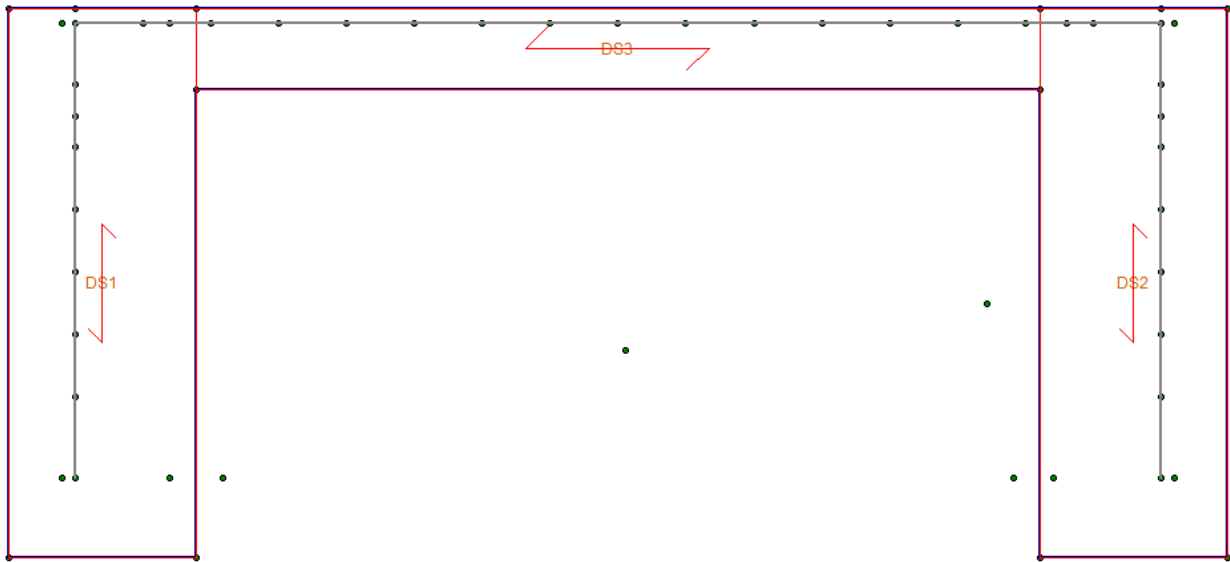
**Load Combinations**

	Label	Solve	Service AB...	Catego...	F...	Catego...	F...	Catego...	F...	Catego...	F...	C...	F...	C...	F...	C...	F...	C...	F...
1	Service	Yes	Yes		DL	1	LL	1	HL	1									
2	Strength	Yes			DL	1.2	LL	1.6	HL	1.6									
3	ASCE 1	Yes	Yes	1...	DL	1													
4	ASCE 2	Yes	Yes	1...	DL	1	HL	1	LL	1	LLS	1							
5	ASCE 3 (a)	Yes	Yes	1...	DL	1	HL	1	RLL	1									
6	ASCE 3 (b)	Yes	Yes	1...	DL	1	HL	1	SL	1									
7	ASCE 3 (c)	Yes	Yes	1...	DL	1	HL	1	RL	1									
8	ASCE 4 (a)	Yes	Yes	1...	DL	1	HL	1	LL	.75	LLS	.75	RLL	.75					
9	ASCE 4 (b)	Yes	Yes	1...	DL	1	HL	1	LL	.75	LLS	.75	SL	.75	SLN	.75			
10	ASCE 4 (c)	Yes	Yes	1...	DL	1	HL	1	LL	.75	LLS	.75	RL	.75					
11	ASCE 5 (b) (a)	Yes	Yes	1.33	DL	1	HL	1	ELX	.7									
12	ASCE 5 (b) (b)	Yes	Yes	1.33	DL	1	HL	1	ELZ	.7	OL2	.7							
13	ASCE 5 (b) (c)	Yes	Yes	1.33	DL	1	HL	1	ELX	-.7									
14	ASCE 5 (b) (d)	Yes	Yes	1.33	DL	1	HL	1	ELZ	-.7	OL2	.7							
15	ASCE 6 (b) (a)	Yes	Yes	1.33	DL	1	HL	1	ELX	.5...	LL	.75	LLS	.75	RLL	.75			
16	ASCE 6 (b) (b)	Yes	Yes	1.33	DL	1	HL	1	ELZ	.5...	LL	.75	LLS	.75	RLL	.75	O...	5...	
17	ASCE 6 (b) (c)	Yes	Yes	1.33	DL	1	HL	1	ELX	...	LL	.75	LLS	.75	RLL	.75			
18	ASCE 6 (b) (d)	Yes	Yes	1.33	DL	1	HL	1	ELZ	...	LL	.75	LLS	.75	RLL	.75	O...	5...	
19	ASCE 6 (d) (a)	Yes	Yes	1.33	DL	1	HL	1	ELX	.5...	LL	.75	LLS	.75	SL	.75			

**Load Combinations (Continued)**

Label	Solve	Service	AB	.....	Catego	F	Catego	F	Catego	F	Catego	F	Cat	F	C	F	C	F	C	F	C	F	
20	ASCE 6 (d) (b)	Yes	Yes	1.33	1...	DL	1	HL	1	ELZ	.5...	LL	.75	LLS	.75	SL	.75	O...	.5...				
21	ASCE 6 (d) (c)	Yes	Yes	1.33	1...	DL	1	HL	1	ELX	-.5...	LL	.75	LLS	.75	SL	.75						
22	ASCE 6 (d) (d)	Yes	Yes	1.33	1...	DL	1	HL	1	ELZ	-.5...	LL	.75	LLS	.75	SL	.75	O...	.5...				
23	ASCE 6 (f) (a)	Yes	Yes	1.33	1...	DL	1	HL	1	ELX	.5...	LL	.75	LLS	.75	RL	.75						
24	ASCE 6 (f) (b)	Yes	Yes	1.33	1...	DL	1	HL	1	ELZ	.5...	LL	.75	LLS	.75	RL	.75	O...	.5...				
25	ASCE 6 (f) (c)	Yes	Yes	1.33	1...	DL	1	HL	1	ELX	-.5...	LL	.75	LLS	.75	RL	.75						
26	ASCE 6 (f) (d)	Yes	Yes	1.33	1...	DL	1	HL	1	ELZ	-.5...	LL	.75	LLS	.75	RL	.75	O...	.5...				
27	ASCE 8 (a) (a)	Yes	Yes	1.33		DL	.6	HL	1	ELX	.7												
28	ASCE 8 (a) (b)	Yes	Yes	1.33		DL	.6	HL	1	ELZ	.7	OL2	.7										
29	ASCE 8 (a) (c)	Yes	Yes	1.33		DL	.6	HL	1	ELX	-.7												
30	ASCE 8 (a) (d)	Yes	Yes	1.33		DL	.6	HL	1	ELZ	-.7	OL2	.7										
31	ASCE 8 (b) (a)	Yes	Yes	1.33		DL	.6	HL	.6	ELX	.7												
32	ASCE 8 (b) (b)	Yes	Yes	1.33		DL	.6	HL	.6	ELZ	.7	OL2	.7										
33	ASCE 8 (b) (c)	Yes	Yes	1.33		DL	.6	HL	.6	ELX	-.7												
34	ASCE 8 (b) (d)	Yes	Yes	1.33		DL	.6	HL	.6	ELZ	-.7	OL2	.7										

1/3 INCREASE IN BEARING FOR LATERAL LOADS PER GEOTECH



**DESIGN STRIP LABELS**

# RISA FOUNDATION RESULTS



Company : Nous  
 Designer : MG  
 Job Number :  
 Model Name : Powder Mountain

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 Checked By: \_\_\_\_\_

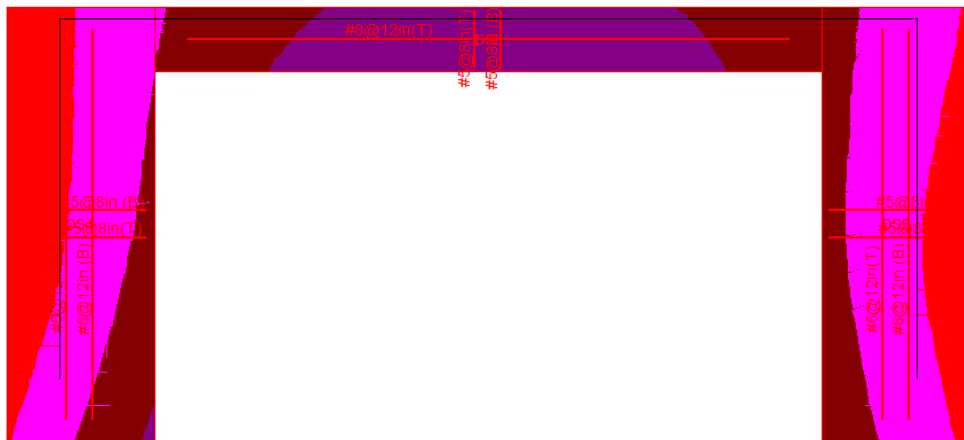
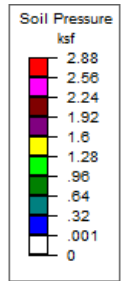
## Strip Reinforcing

	Label	UC Top	LC	Top Bars	Governin...	UC Bot	LC	Bot Bars/...	Governin...	UC Shear	LC	Governin...
1	DS1	.114	2	#6@12in	DS1-X42	.461	2	#6@12in	DS1-X21	.312	2	DS1-X15
2	DS2	.115	2	#6@12in	DS2-X42	.561	2	#6@12in	DS2-X21	.357	2	DS2-X15
3	DS3	.421	2	#8@12in	DS3-X50	0	N/A		NA	.228	2	DS3-X42
4	DS4	.096	2	#5@8in	DS4-X50	.159	2	#5@8in	DS4-X19	.218	2	DS4-X19
5	DS5	.135	2	#5@8in	DS5-X1	.12	2	#5@8in	DS5-X32	.233	2	DS5-X32
6	DS6	.037	2	#5@8in	DS6-X17	.008	2	#5@8in	DS6-X42	.114	2	DS6-X39

ALL <1 , THUS OKAY

## Envelope Slab Soil Pressures

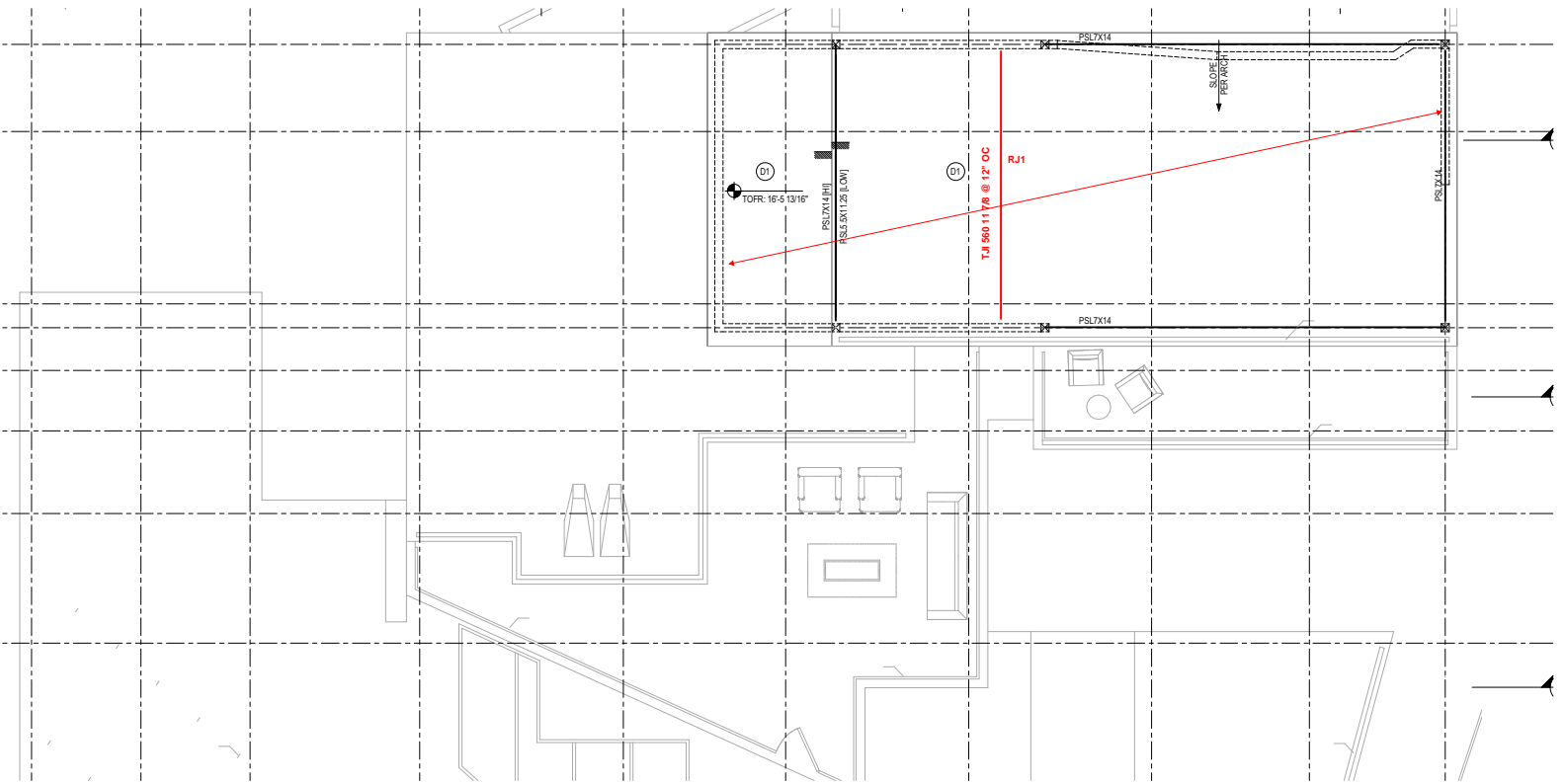
	Label	UC	LC	Soil Pressure[ksf]	Allowable Bearing[ksf]	Point
1	S1	.84	6	2.855	3.4	N698



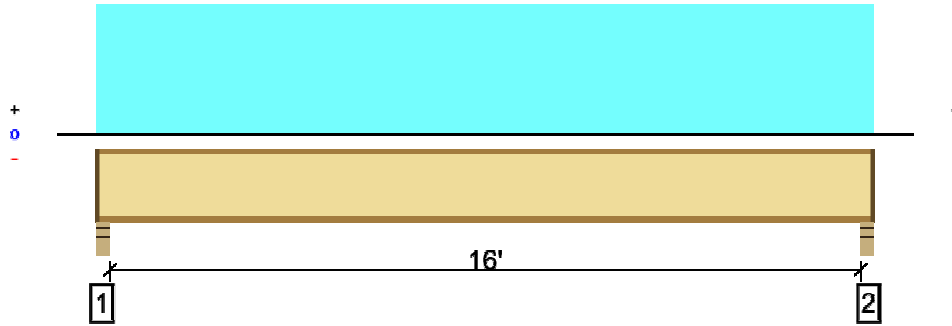
MAXIMUM SOIL PRESSURE CONTOUR- LC6

3.2 Design of Joists

HIGH ROOF JOISTS





**Overall Length: 16' 7"**


All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	1204 @ 2 1/2"	1606 (2.25")	Passed (75%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1176 @ 3 1/2"	2358	Passed (50%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4803 @ 8' 3 1/2"	10925	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.341 @ 8' 3 1/2"	0.404	Passed (L/568)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.395 @ 8' 3 1/2"	0.808	Passed (L/491)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	59	40	Passed	--	--

System : Floor

Member Type : Joist

Building Use : Residential

Building Code : IBC 2015

Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 1" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' 5" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	166	166	1053	1385	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	166	166	1053	1385	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Loads	Location (Side)	Spacing	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 7"	12"	20.0	20.0	127.0	Residential - Living Areas

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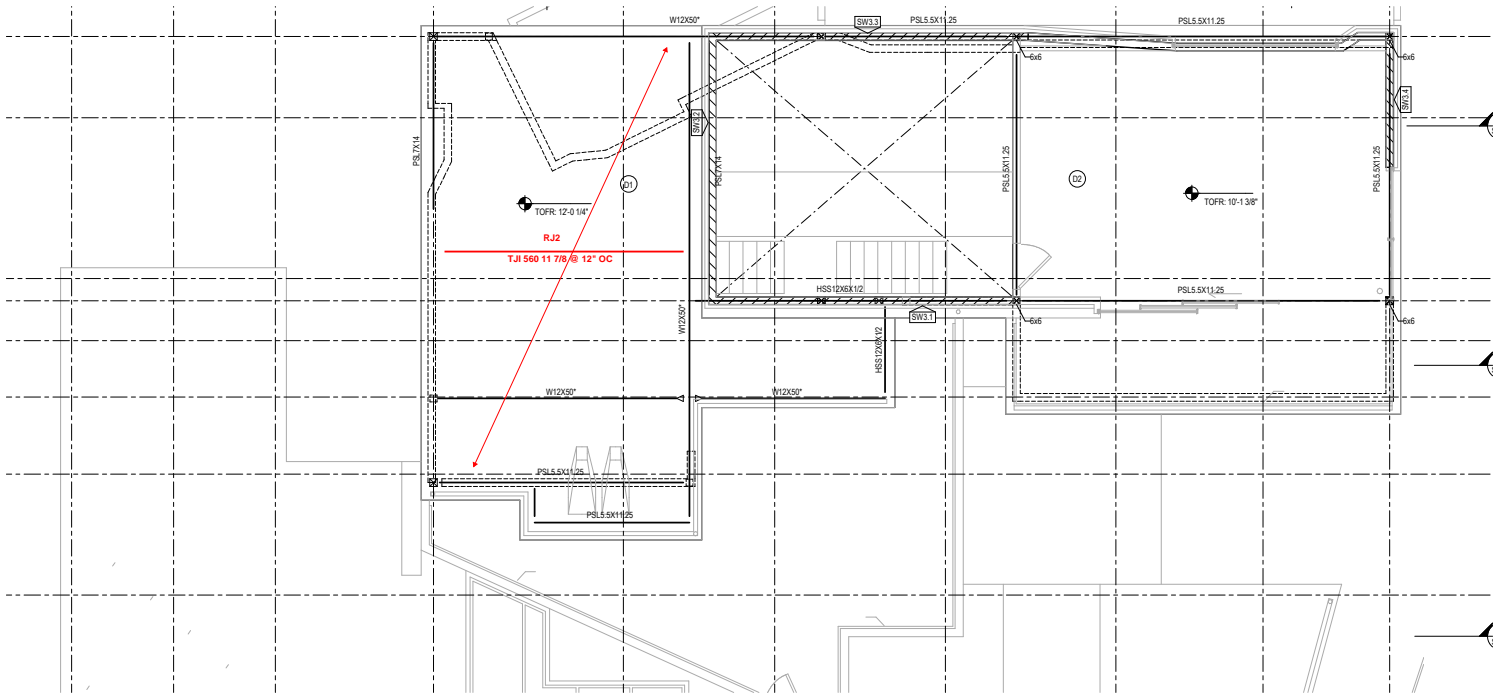
The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



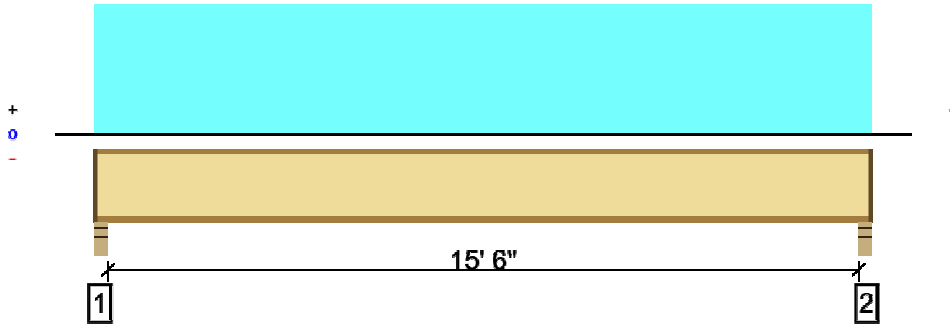
Forte Software Operator	Job Notes
MIT GALA NOUS ENGINEERING (213) 627-6687 mit.gala@nousengineering.com	SummitPowder Mountain

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 Forte v5.3, Design Engine: V7.0.0.5  
 180530 Joist Design.4te

**LOW ROOF JOISTS**



Overall Length: 16' 1"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	1167 @ 2 1/2"	1606 (2.25")	Passed (73%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1139 @ 3 1/2"	2358	Passed (48%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	4510 @ 8' 1/2"	10925	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.305 @ 8' 1/2"	0.392	Passed (L/617)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.353 @ 8' 1/2"	0.783	Passed (L/533)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	60	40	Passed	--	--

System : Floor  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2015  
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 4" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' 11" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	161	161	1021	1343	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	161	161	1021	1343	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Loads	Location (Side)	Spacing	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 1"	12"	20.0	20.0	127.0	Residential - Living Areas

**Weyerhaeuser Notes**

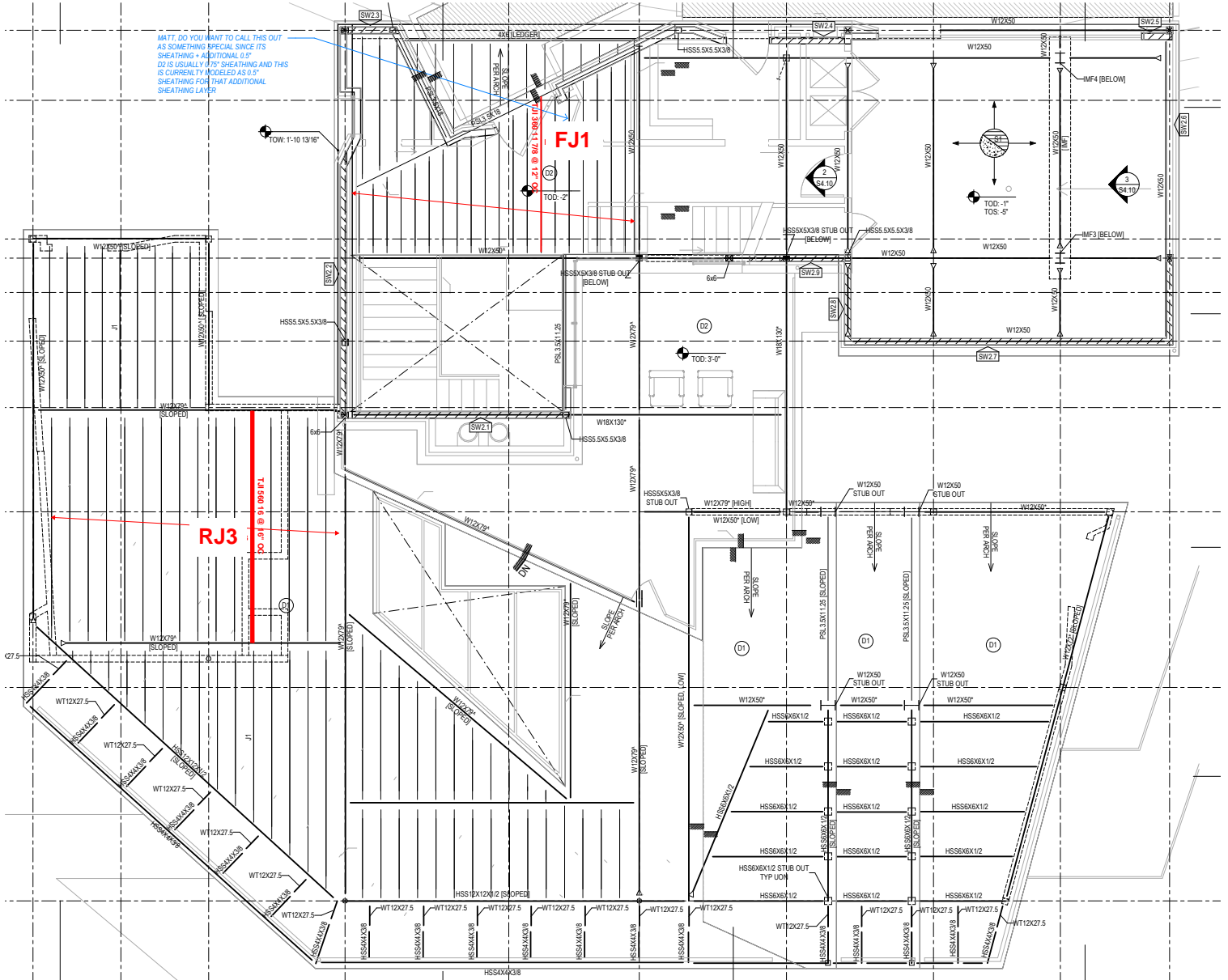
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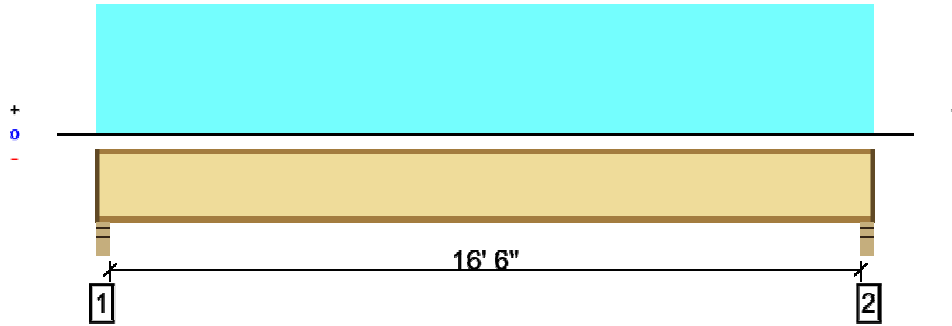
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**SLOPED ROOF AND ENTRY LEVEL JOISTS**



**Overall Length: 17' 1"**


All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDf	Load: Combination (Pattern)
Member Reaction (lbs)	1451 @ 2 1/2"	1606 (2.25")	Passed (90%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1419 @ 3 1/2"	3117	Passed (46%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5972 @ 8' 6 1/2"	14864	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.237 @ 8' 6 1/2"	0.417	Passed (L/842)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.281 @ 8' 6 1/2"	0.833	Passed (L/712)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	61	40	Passed	--	--

System : Floor

Member Type : Joist

Building Use : Residential

Building Code : IBC 2015

Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' 11" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	228	228	1241	1697	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	228	228	1241	1697	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Loads	Location (Side)	Spacing	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 17' 1"	16"	20.0	20.0	109.0	Residential - Living Areas

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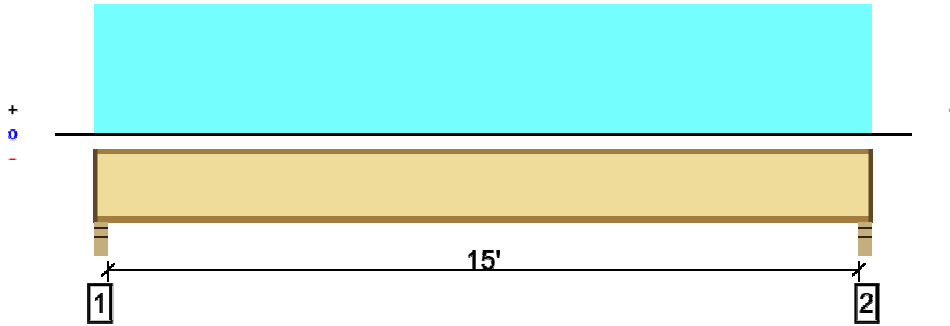
The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



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MIT GALA NOUS ENGINEERING (213) 627-6687 mit.gala@nousengineering.com	SummitPowder Mountain

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 180530 Joist Design.4te

Overall Length: 15' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	851 @ 2 1/2"	1202 (2.25")	Passed (71%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	830 @ 3 1/2"	1705	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3182 @ 7' 9 1/2"	6180	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.155 @ 7' 9 1/2"	0.379	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.322 @ 7' 9 1/2"	0.758	Passed (L/565)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	51	40	Passed	--	--

System : Floor  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2015  
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 3" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' 5" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.75"	447	416	863	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.75"	447	416	863	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 15' 7"	16"	43.0	40.0	Residential - Living Areas

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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator



Forte Software Operator	Job Notes
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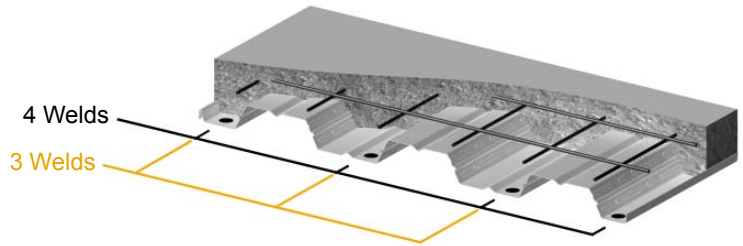






# PLW2™ or W2 FORMLOK™

- 4 in. TOTAL SLAB DEPTH
- Light Weight Concrete (110 pcf)  
27.5 psf
- Galvanized or Phosphatized/Painted



## Deck Weight and Section Properties

Gage	Weight (psf)		I <sub>d</sub> for Deflection		Moment		Allowable Reactions per ft of Width (lb)					
	Galv G60	Phos/Painted	Single Span (in.4/ft)	Multiple Spans (in.4/ft)	+S <sub>eff</sub> (in.3/ft)	-S <sub>eff</sub> (in.3/ft)	End Bearing			Interior Bearing		
							2"	3"	4"	4"	5"	6"
22	1.8	1.7	0.340	0.340	0.246	0.256	412	475	527	793	855	911
21	2.0	1.9	0.381	0.381	0.283	0.294	492	565	626	945	1018	1084
20	2.1	2.0	0.422	0.422	0.323	0.333	577	661	732	1109	1193	1269
19	2.4	2.3	0.503	0.503	0.405	0.415	765	874	966	1472	1580	1678
18	2.7	2.5	0.564	0.564	0.471	0.481	940	1071	1182	1808	1939	2056
16	3.3	3.1	0.707	0.707	0.623	0.638	1424	1613	1773	2738	2926	3097

## Allowable Superimposed Loads (psf)

Gage	Spans	Max. UCS <sup>1</sup>	Span (ft-in.)										
			7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"	12'-0"
22	1	8'-6"	261	232	209	189	144	129	116	105	95	86	78
	2	9'-10"	261	232	209	189	171	157	116	105	95	86	78
	3	10'-1"	261	232	209	189	171	157	144	105	95	86	78
21	1	9'-4"	292	260	234	211	192	147	133	120	109		
	2	10'-6"	292	260	234	211	192	175	156	134	109		
	3	10'-11"	292	260	234	211	192	175	156	134	109	100	90
20	1	10'-2"	324	288	259	234	213	188	161	136	121	106	93
	2	11'-2"	324	288	259	234	213	188	161	139	121	106	93
	3	11'-7"	324	288	259	234	213	188	161	139	121	106	93
19	1	10'-11"	389	347	308	270	237	201	173	149	130	113	100
	2	12'-5"	389	347	308	270	237	201	173	149	130	113	100
	3	12'-11"	389	347	308	270	237	201	173	149	130	113	100
18	1	11'-4"	400	376	328	288	249	211	181	157	136	119	105
	2	13'-5"	400	376	328	288	249	211	181	157	136	119	105
	3	13'-3"	400	376	328	288	249	211	181	157	136	119	105
16	1	11'-11"	400	396	356	322	276	235	201	174	151	132	116
	2	14'-10"	400	396	356	322	276	235	201	174	151	132	116
	3	13'-11"	400	396	356	322	276	235	201	174	151	132	116

THUS OKAY

<sup>1</sup> Max. UCS = Maximum Unshored Clear Span (ft-in.)

Shoring required in shaded areas to right of heavy line.

## Allowable Diaphragm Shear Values, q (plf)

Gage	Welds	Span (ft-in.)										
		7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"	12'-0"
22	q3	1310	1295	1281	1269	1258	1249	1240	1232	1225	1219	1213
	q4	1438	1409	1384	1362	1342	1324	1309	1294	1281	1269	1258
21	q3	1313	1296	1281	1268	1256	1245	1236	1227	1220	1212	1206
	q4	1463	1432	1404	1380	1358	1339	1321	1305	1291	1278	1266
20	q3	1318	1300	1283	1269	1256	1244	1234	1225	1216	1209	1201
	q4	1491	1457	1427	1400	1376	1355	1336	1319	1303	1289	1276
19	q3	1335	1313	1294	1277	1262	1249	1237	1226	1216	1207	1199
	q4	1552	1512	1477	1446	1418	1393	1371	1351	1333	1316	1301
18	q3	1353	1329	1307	1289	1272	1257	1243	1231	1220	1210	1201
	q4	1607	1562	1522	1487	1457	1429	1404	1382	1361	1342	1325
16	q3	1408	1378	1351	1327	1306	1287	1271	1255	1241	1229	1217
	q4	1747	1690	1641	1597	1558	1524	1493	1464	1439	1415	1394

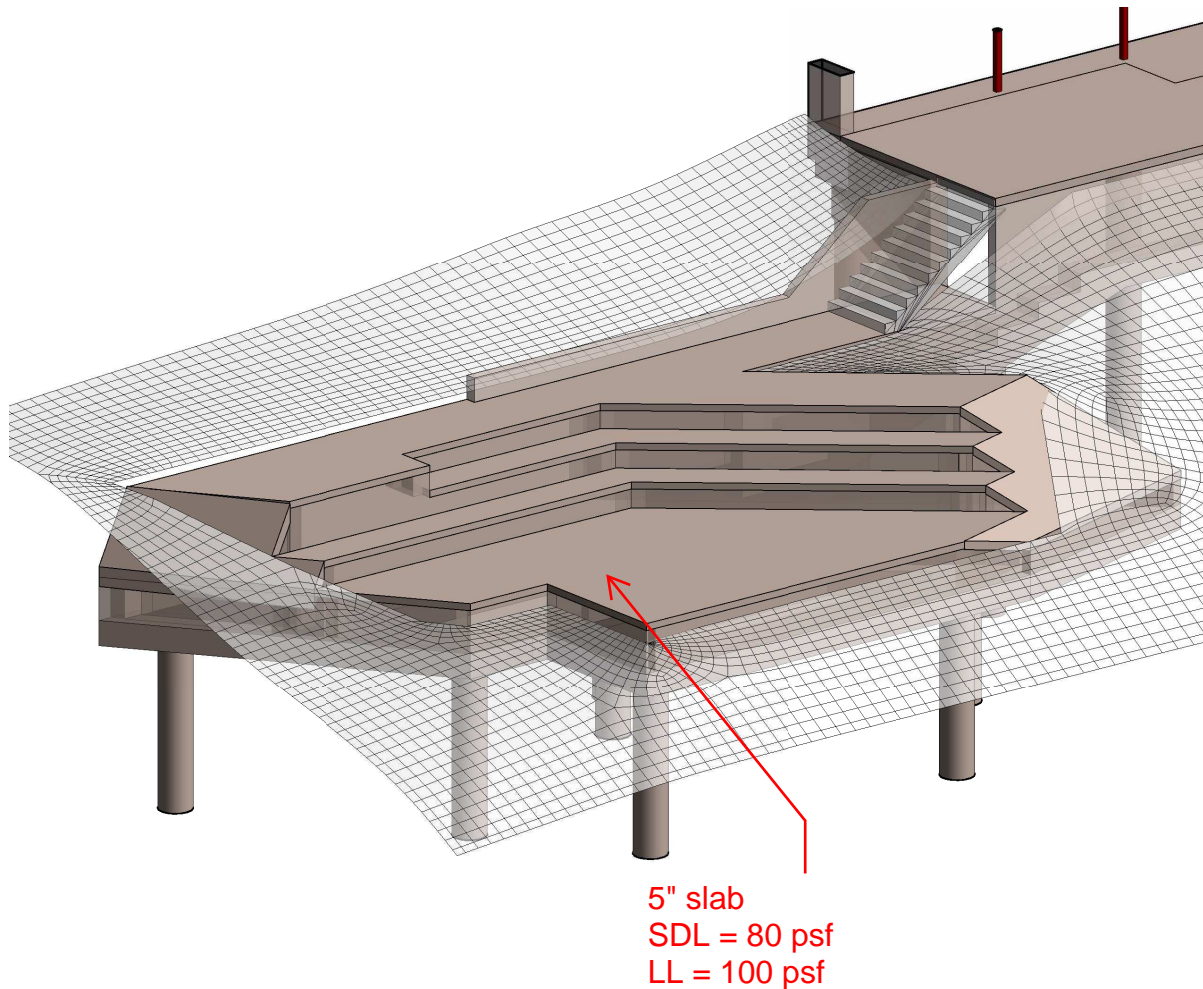
PLW2 and W2 FORMLOK decks with structural concrete fill may be assumed to have a Flexibility Factor, F < 1.

W2<sup>4"</sup>LW

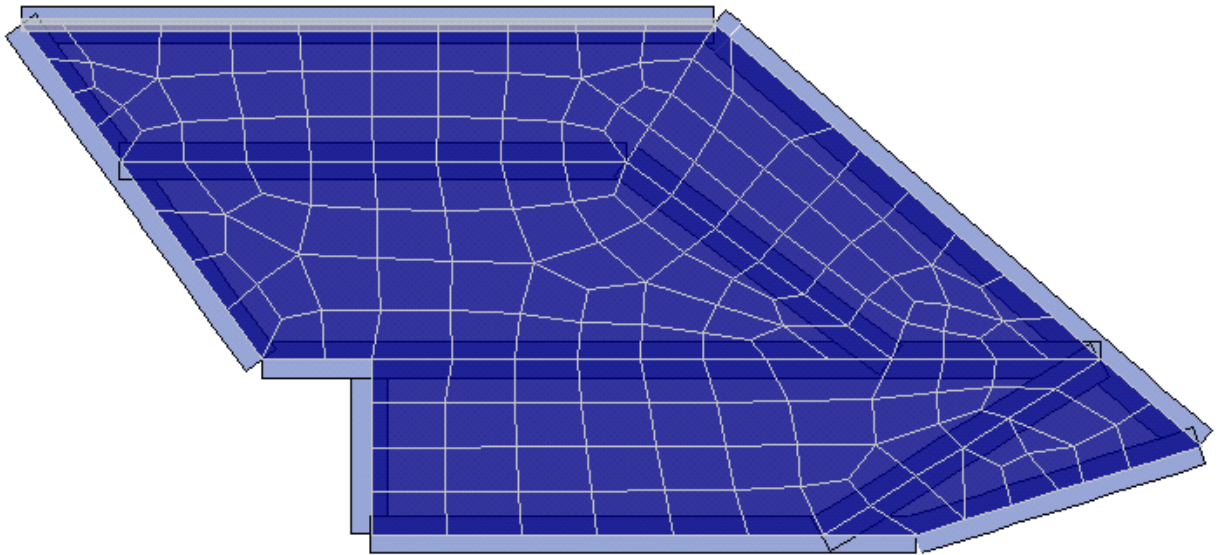
**4.0 Miscellaneous Structure Design**

**4.1 Exterior Deck and Foundation Design**

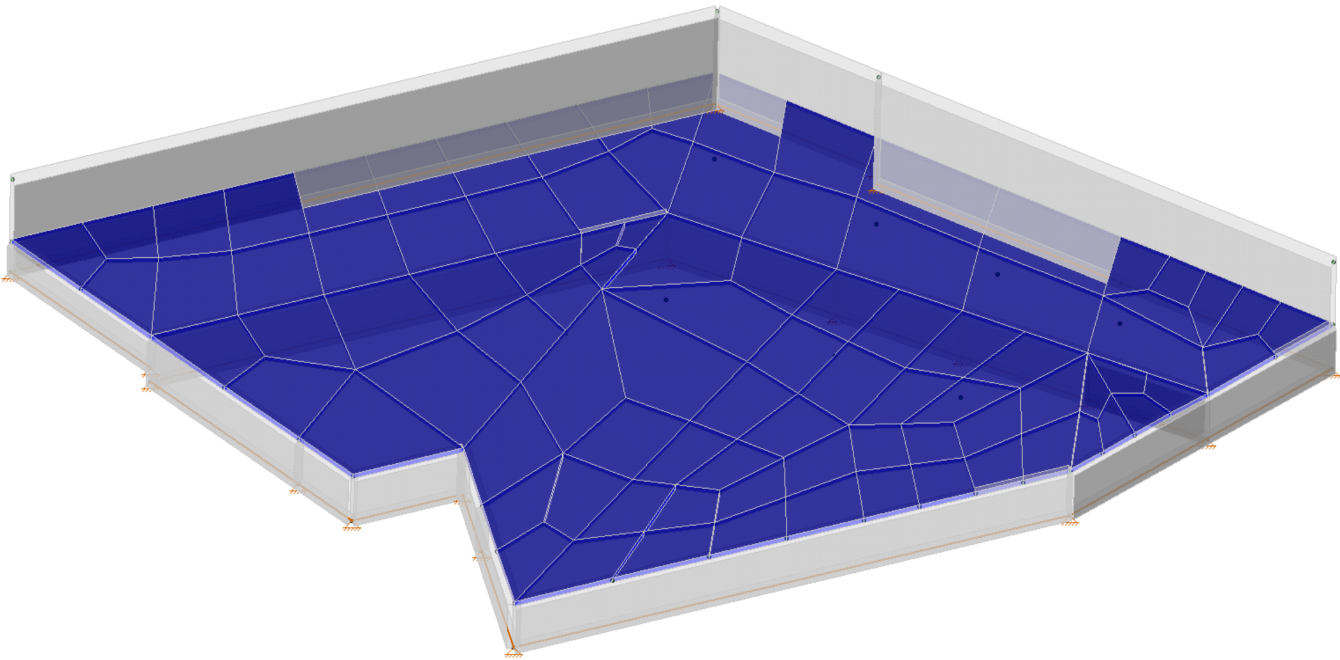
The exterior deck slab has been modeled in RISA and follows the loading criteria assumptions stated in Chapter 2. The reactions from RISA have been used to design the pile embed. Lateral force acting on piles are as shown in this section and the piles have been checked in DEEPEX for those lateral loads. Refer to the spreadsheet that follows for the strength design of piles.



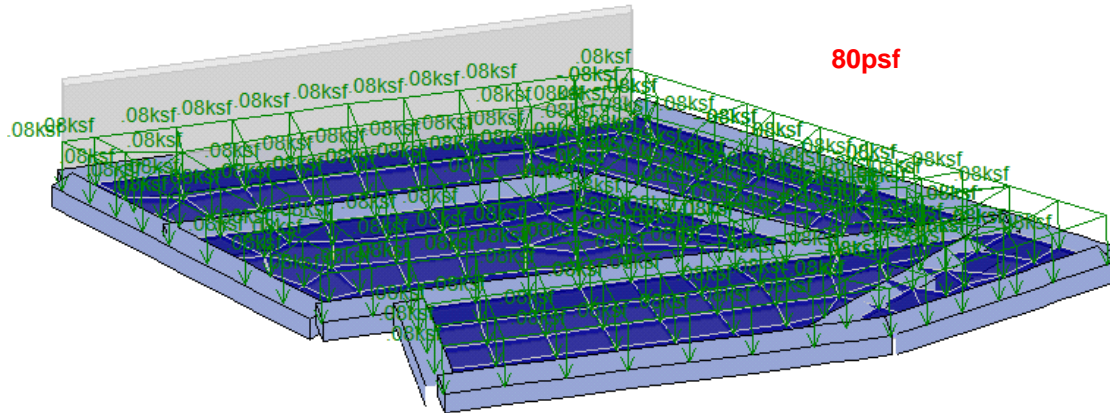
**RISA MODEL - PLAN VIEW**



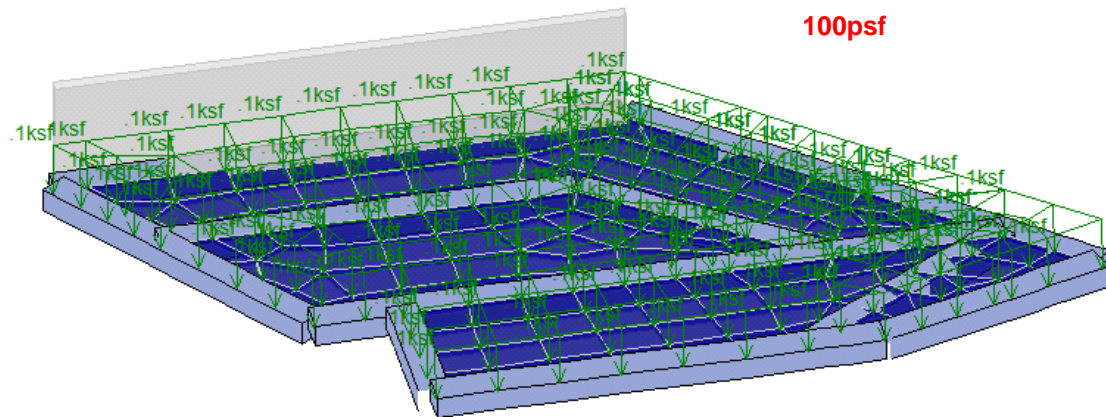
**RISA MODEL - ISOMETRIC VIEW**



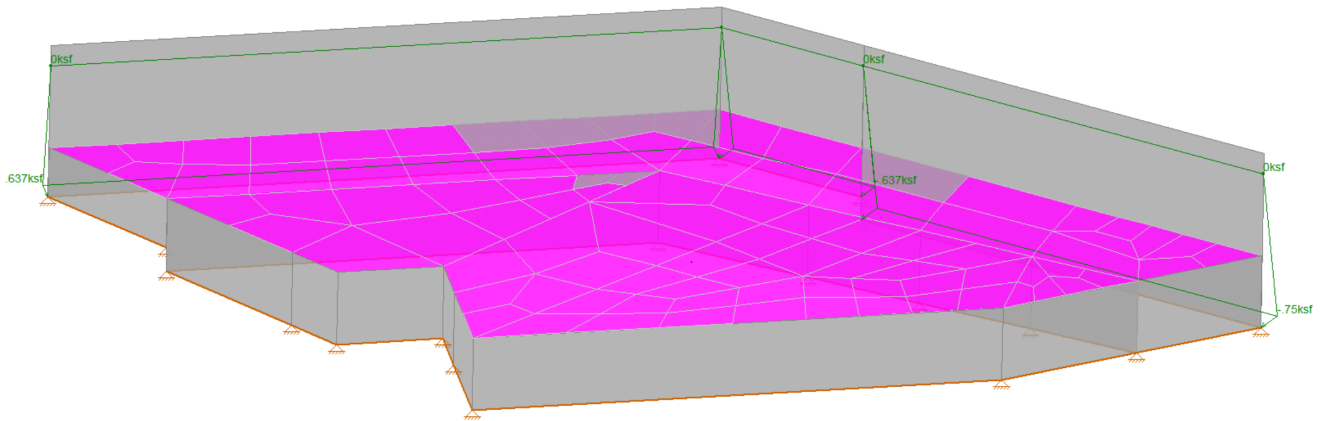
**RISA MODEL - APPLIED SDL**



**RISA MODEL - APPLIED LIVE LOAD**



RISA MODEL - APPLIED SOIL LOAD





**RISA INPUT PARAMETERS**



Company :  
 Designer :  
 Job Number :  
 Model Name :

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**Wall Panel U.C. Parameters**

	Label	Max Bending Chk	Max Shear Chk
1	Typical	1	1

**Concrete Wall Panel Rebar Parameters**

	Label	Vert Bar S...	Max Vert Ba...	Min Vert Bar...	Vert Bar I...	Horz Bar ...	Max Horz Ba...	Min Horz Ba...	Horz Bar I...	Group ...
1	Typical	#5	18	4	2	#4	18	4	2	

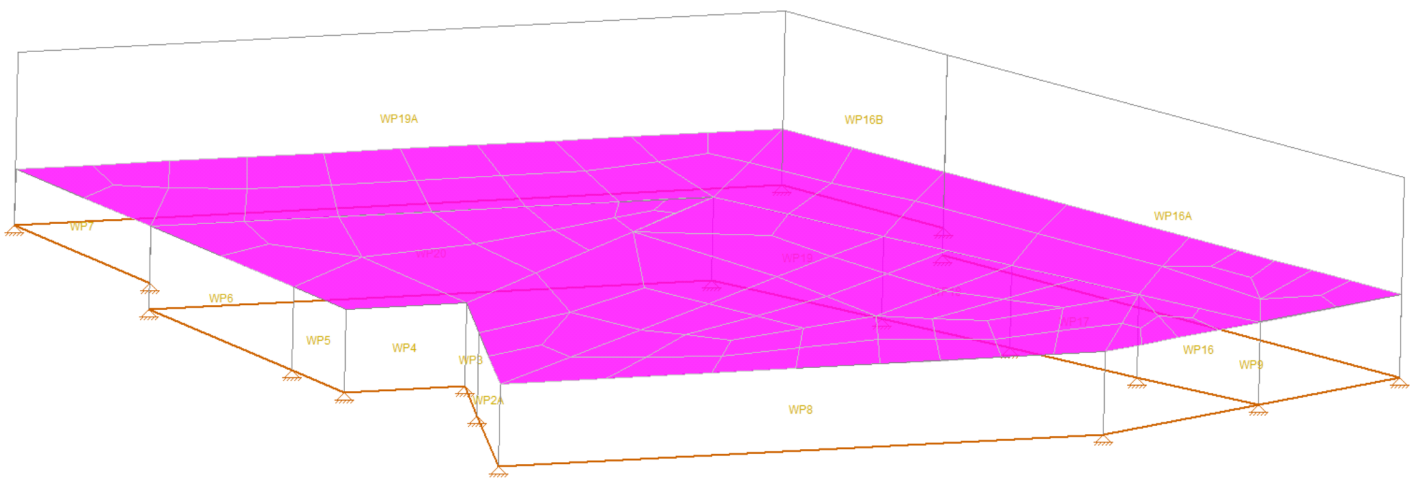
**Basic Load Cases**

	BLC Description	Category	X Grav...	Y Grav...	Z Grav...	Joint	Point	Distrib...	Area(...	Surfac...
1	SW	DL		-1						
2	SDL	DL								89
3	LL	LL								89
4	Soil Load	HL								3

**Load Combinations**

	Description	Sol..PD..S...	BLC	F...	BLC	Fac...	BLC	Fa...	BLC	Fa...	BLC	Fa...	F.....	F.....	F.....	F.....	F.....
1	Deflection 1	Yes Y	DL	1													
2	Deflection 2	Yes Y	LL	1													
3	Deflection 3	Yes Y	DL	1	LL	1	HL	1									
4	ASCE ASD 1	Yes Y	DL	1	HL	1											
5	ASCE ASD 2	Yes Y	DL	1	LL	1	LLS	1	HL	1							
6	Deflection 1	Yes Y	DL	1													
7	Deflection 2	Yes Y	LL	1													
8	Deflection 3	Yes Y	DL	1	LL	1											
9	ASCE Strength 1	Yes Y	DL	1.4	HL	1.6											
10	ASCE Strength 2 (a)	Yes Y	DL	1.2	LL	1.6	LLS	1.6	HL	1.6							

RISA MODEL - WALL LABELS





**RESULTS- WALL PANEL DESIGN**



Company :  
 Designer :  
 Job Number :  
 Model Name :

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**Wall Panel ACI 318-14: Concrete Code Checks (Out Plane)**

	Wall Panel	Region	Max UC	LC	Shear UC	LC	Pn*phi[k/ft]	Mn*phi[k-ft/ft]	Vn*phi[k/ft]
1	WP2A	R1	.218 (Int)	1	.024	1	NC	3.695	7.917
2	WP3	R1	.417 (Int)	1	.124	1	NC	4.677	7.955
3	WP4	R1	.162 (Int)	1	.053	1	NC	3.752	7.933
4	WP5	R1	.134 (Ext)	1	.057	1	NC	4.645	7.888
5	WP6	R1	.033 (Int)	1	.004	1	NC	3.45	7.889
6	WP7	R1	.014 (Int)	1	.004	1	NC	3.643	7.889
7	WP8	R1	.369 (Int)	1	.042	1	NC	3.567	7.94
8	WP9	R1	.153 (Ext)	1	.042	1	NC	3.466	7.871
9	WP16	R1	.314 (Ext)	1	.062	1	NC	3.389	7.919
10	WP17	R1	.109 (Int)	1	.016	1	NC	4.002	7.985
11	WP18	R1	.175 (Ext)	1	.023	1	NC	4.001	7.984
12	WP19	R1	.235 (Ext)	1	.03	1	NC	3.605	7.948
13	WP20	R1	.133 (Ext)	1	.018	1	NC	3.633	7.927
14	WP19A	R1	.038 (Int)	1	.011	1	NC	3.557	7.928
15	WP16A	R1	.023 (Int)	1	.006	1	NC	3.663	7.919
16	WP16B	R1	.034 (Int)	1	.008	1	NC	3.648	7.959

**THUS ALL OKAY**

**REFER TO THE FOLLOWING PAGE FOR GOVERNING WALL DETAILED REPORT**

**CRITERIA**

Code : **ACI 318-14**  
 Design Rule : **Typical**  
 Seismic Rule : **None**  
 Loc of r/f : **Centered**  
 Outer Bars : **Vertical**  
  
 Vert Bar Size : **#5**  
 Horz Bar Size : **#4**  
  
 Vert Bar Spac : **18 in**  
 Horz Bar Spac : **18 in**  
 Group Wall? : **No**

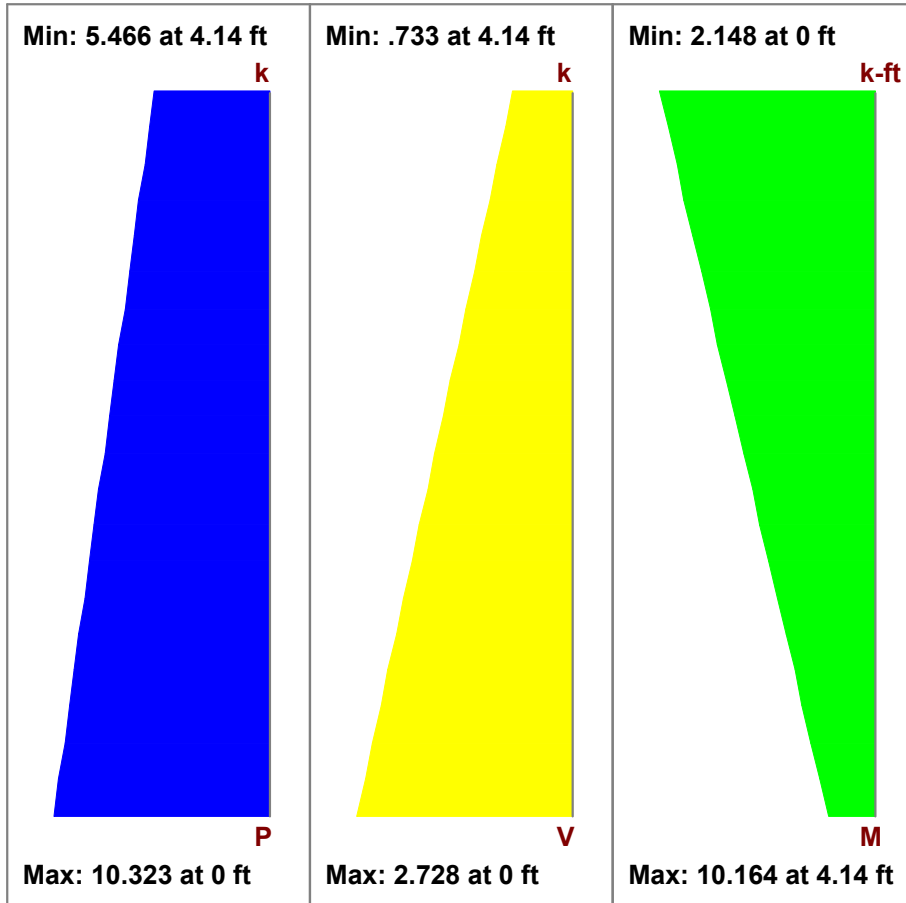
**MATERIALS**

Material Set : **Conc3000NW**  
 Concrete f'c : **3 ksi**  
 Concrete E : **3156 ksi**  
 Concrete G : **1372 ksi**  
 Conc Density : **.145 k/ft^3**  
 Lambda : **1**  
 Conc Str Blk : **Rectangular**  
  
 Vert Bar Fy : **60 ksi**  
 Horz Bar Fy : **60 ksi**  
 Steel E : **29000 ksi**

**GEOMETRY**

Total Height : **4.14 ft**  
 Total Length : **3.3 ft**  
 Thickness : **8 in**  
  
 Int Cover (-z) : **1 in**  
 Ext Cover (+z) : **1 in**  
 Cover Open/Edge : **2 in**  
 K : **1**  
 Use Cracked? : **Yes**  
 Icr Factor : **.7**

**ENVELOPE DIAGRAMS**



**ACI 318-14 Code Check**

**AXIAL/BENDING DETAILS**

UC Max : **.134**  
 Location : **4.14 ft**  
  
 Gov Pu : **0 k**  
 phi\*Pn : **NC**  
  
 Gov Mu : **10.164 k-ft**  
 phi\*Mn : **75.939 k-ft**  
  
 phi eff. : **.9**  
 Gov LC : **1**

**SHEAR DETAILS**

UC Max : **.053**  
 Location : **0 ft**  
  
 Gov Vu : **2.728 k**  
 phi\*Vn : **51.456 k**  
  
 Vnmax : **138.815 k**  
  
 Vc : **47.873 k**  
 Vs : **20.735 k**  
  
 Gov LC : **1**

**DEFLECTION DETAILS**

Delta max : **0 in**  
  
 Deflection Ratio : **H/10000**  
 Location : **4.14 ft**  
 Gov LC : **1**

# GOVERNING WALL DETAILED REPORT

Company :  
 Designer :  
 Job Number :  
 Model Name :

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WP3 : R1

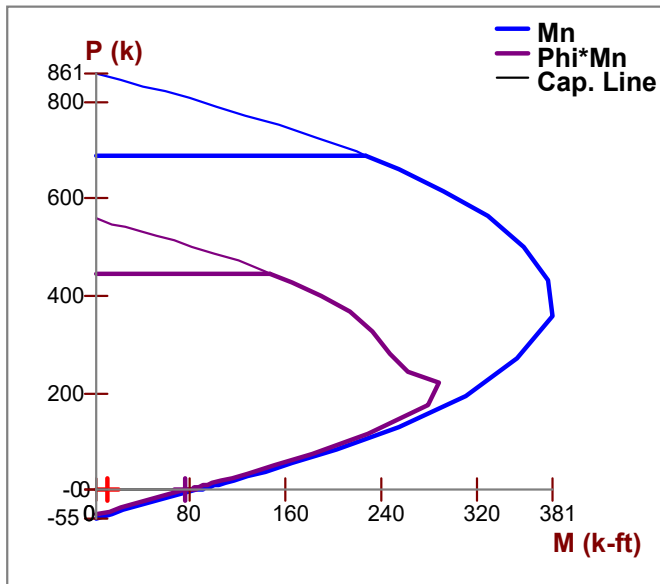
## WALL SEGMENT SECTION PROPERTIES

Total Length	: 3.3	ft	r	: 9.564	in	As Provided (H)	: .982	in <sup>2</sup>
A	: 316.8	in <sup>2</sup>	KL/r	: 4.346		rho Provided (H)	: .0025	
I <sub>gross</sub>	: 41399.424	in <sup>4</sup>				As min (H)	: .795	in <sup>2</sup>
I <sub>cracked</sub>	: 28979.597	in <sup>4</sup>				rho min (H)	: .002	
Cracked Mom, M <sub>cr</sub>	: 71.576	k-ft				As Provided (V)	: .92	in <sup>2</sup>
						rho Provided (V)	: .0029	
						As min (V)	: .38	in <sup>2</sup>
						rho min (V)	: .0012	

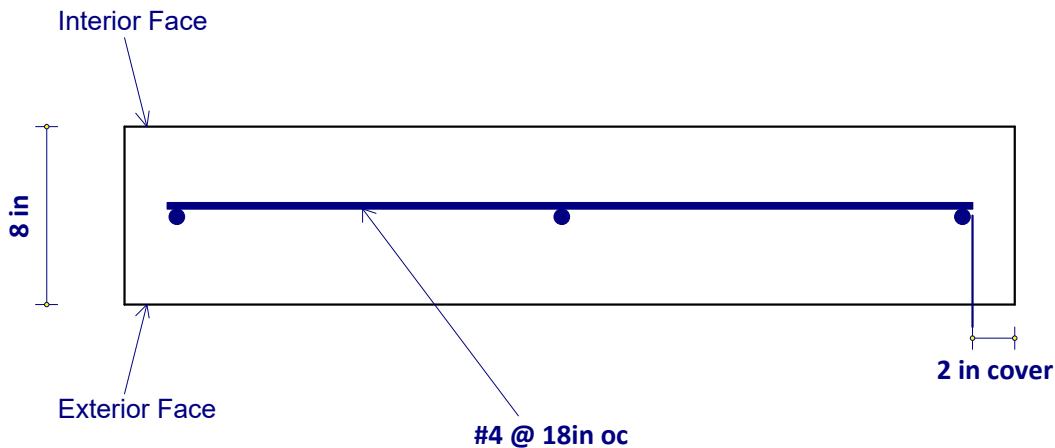
## SLENDER BENDING SPAN RESULTS

KL/r in	Cm in	Lu in (ft)	Pc (k)	deltaNS	M act (k-ft)	M2 min (k-ft)	Mc in (k-ft)
<b>4.346</b>	<b>.685</b>	<b>4.14</b>	<b>0</b>	<b>N/A</b>	<b>0</b>	<b>0</b>	<b>N/A</b>

## In-Plane Wall Interaction Diagram

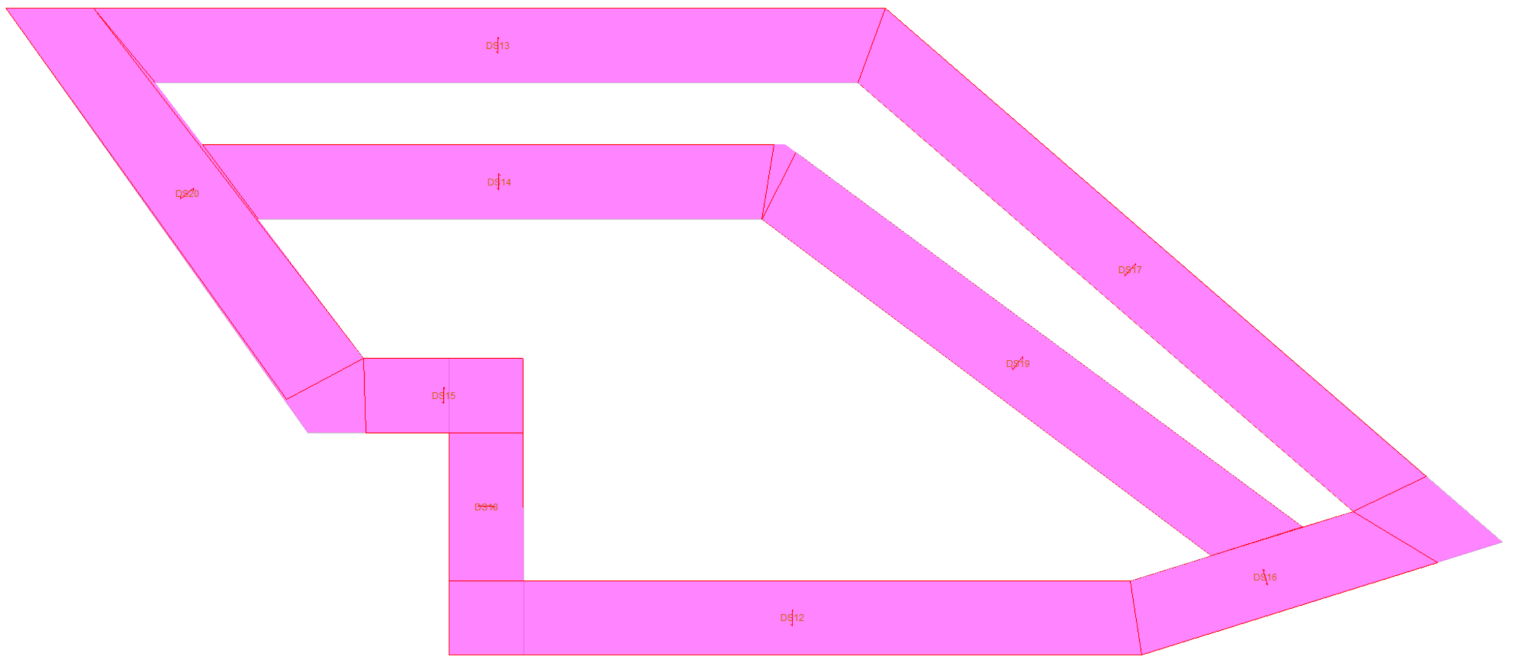
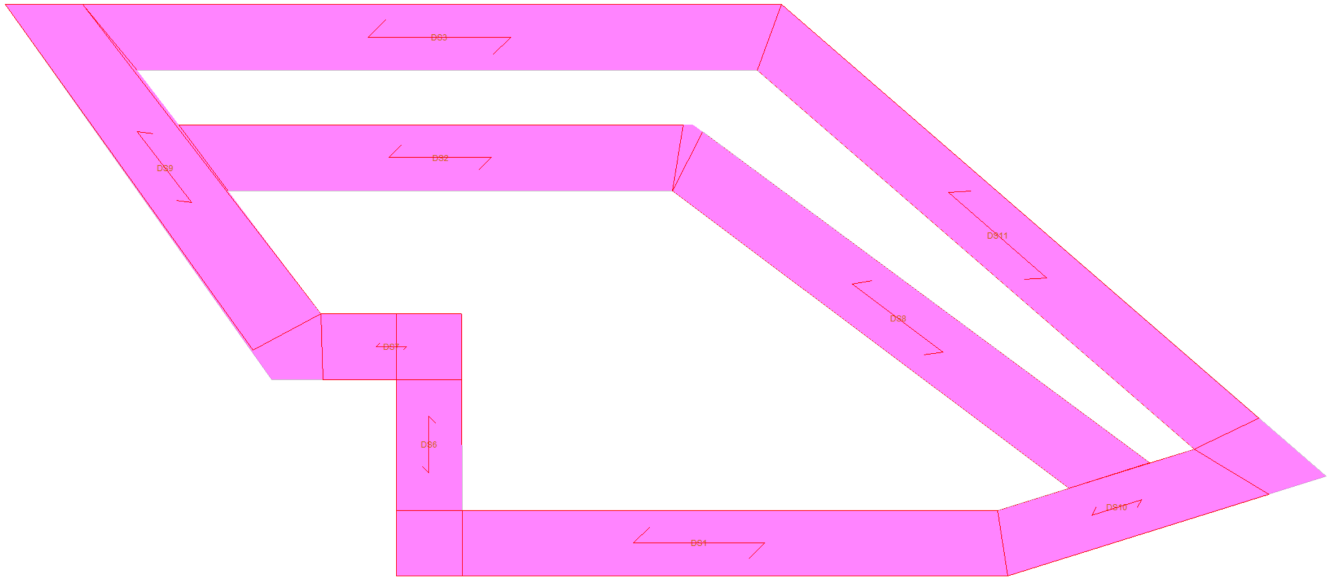


## CROSS SECTION DETAILING





**AMPHITHEATER FOUNDATION DESIGN- DESIGN STRIP LABELS**



**RISA FOUNDATION INPUT PARAMETERS**



Company :  
 Designer :  
 Job Number :  
 Model Name :

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**Slab Rebar Parameters**

	Label	Top Bar Bottom B...	Max Top Bar ...	Min Top Bar ...	Max Bot Bar ...	Min Bot Bar S...	Spacing In...	Rebar Options
1	Longitudnal Bars	#5	#5	8	8	8	1	Optimize
2	Horizontal Bars	#5	#5	12	12	12	2	Optimize

**Soil Definitions**

	Label	Subgrade Modulus[k/ft^3]	Allowable Bearing[ksf]	Depth Properties	Default?
1	Default	100	3.4	None	Yes

**Slabs**

	Label	Thickness [in]	Material	Local Axis Angle [deg]	Analysis Offset [in]
1	S1	18	Conc3000NW	0	0

**Design Strips**

	Label	Rebar Angle from PI...	No. of Design Cuts	Design Rule
1	DS1	0	50	Longitudnal Bars
2	DS2	0	50	Longitudnal Bars
3	DS3	0	50	Longitudnal Bars
4	DS6	90	50	Longitudnal Bars
5	DS7	0	50	Longitudnal Bars
6	DS10	17.37	50	Longitudnal Bars
7	DS11	139.1	50	Longitudnal Bars
8	DS8	143.17	50	Longitudnal Bars
9	DS9	127.6	50	Longitudnal Bars
10	DS12	90	50	Horizontal Bars
11	DS13	90	50	Horizontal Bars
12	DS14	90	50	Horizontal Bars
13	DS15	90	50	Horizontal Bars
14	DS16	107.33	50	Horizontal Bars
15	DS17	49.1	50	Horizontal Bars
16	DS18	0	50	Horizontal Bars
17	DS19	53.17	50	Horizontal Bars
18	DS20	37.6	50	Horizontal Bars

**Load Combinations**

	Label	Solve	Service AB...	Catego..F...	Catego..F...	Catego..F...	Catego..F...	F...Cat...	F...C...	F...C...	F...C...	F...C...	F...C...	F...C...
1	Service	Yes	Yes	DL	1	LL	1	HL	1					
2	Strength	Yes		DL	1.2	LL	1.6	HL	1.6					
3	ASCE 1	Yes	Yes	DL	1									
4	ASCE 2	Yes	Yes	DL	1	HL	1	LL	1	LLS	1			
5	ASCE 3 (a)	Yes	Yes	DL	1	HL	1	RLL	1					
6	ASCE 3 (b)	Yes	Yes	DL	1	HL	1	SL	1					
7	ASCE 3 (c)	Yes	Yes	DL	1	HL	1	RL	1					
8	ASCE 4 (a)	Yes	Yes	DL	1	HL	1	LL	.75	LLS	.75	RLL	.75	
9	ASCE 4 (b)	Yes	Yes	DL	1	HL	1	LL	.75	LLS	.75	SL	.75	SLN
10	ASCE 4 (c)	Yes	Yes	DL	1	HL	1	LL	.75	LLS	.75	RL	.75	
11	ASCE 1	Yes		DL	1.4									
12	ASCE 2 (a)	Yes		DL	1.2	LL	1.6	LLS	1.6	HL	1.6	RLL	.5	
13	ASCE 2 (b)	Yes		DL	1.2	LL	1.6	LLS	1.6	HL	1.6	SL	.5	
14	ASCE 2 (c)	Yes		DL	1.2	LL	1.6	LLS	1.6	HL	1.6	RL	.5	
15	ASCE 3 (a)	Yes		DL	1.2	RLL	1.6	LL	1	LLS	1			
16	ASCE 3 (c)	Yes		DL	1.2	SL	1.6	LL	1	LLS	1			
17	ASCE 3 (e)	Yes		DL	1.2	RL	1.6	LL	1	LLS	1			

# RESULTS



Company :  
 Designer :  
 Job Number :  
 Model Name :

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## Envelope Slab Soil Pressures

	Label	UC	LC	Soil Pressure[ksf]	Allowable Bearing[ksf]	Point
1	S1	.599	1	2.037	3.4	N125

**THUS OKAY**

## Strip Reinforcing

	Label	UC Top	LC	Top Bars	Governin...	UC Bot	LC	Bot Bars/...	Governin...	UC Shear	LC	Governin...
1	DS1	.467	2	#5@8in	DS1-X16	.224	2	#5@8in	DS1-X50	.405	15	DS1-X50
2	DS2	.579	2	#5@8in	DS2-X5	.211	2	#5@8in	DS2-X36	.255	2	DS2-X2
3	DS3	.273	2	#5@8in	DS3-X47	.126	2	#5@8in	DS3-X27	.237	15	DS3-X2
4	DS6	.4	2	#5@8in	DS6-X37	.083	15	#5@8in	DS6-X37	.328	2	DS6-X1
5	DS7	0	N/A		NA	.271	2	#5@8in	DS7-X1	.276	2	DS7-X7
6	DS10	.515	15	#5@8in	DS10-X39	.458	2	#5@8in	DS10-X16	.951	2	DS10-X1
7	DS11	.274	2	#5@8in	DS11-X48	.092	2	#5@8in	DS11-X29	.295	2	DS11-X1
8	DS8	.454	2	#5@8in	DS8-X5	.192	2	#5@8in	DS8-X30	.354	2	DS8-X6
9	DS9	.464	15	#5@8in	DS9-X34	.166	2	#5@8in	DS9-X17	.391	2	DS9-X1
10	DS12	.073	2	#5@12in	DS12-X24	0	N/A	#5@12in	NA	.131	2	DS12-X2
11	DS13	.057	15	#5@12in	DS13-X26	.003	2	#5@12in	DS13-X49	.077	2	DS13-X49
12	DS14	.019	2	#5@12in	DS14-X2	.039	2	#5@12in	DS14-X26	.096	2	DS14-X14
13	DS15	.343	2	#5@12in	DS15-X5	.067	15	#5@12in	DS15-X2	.17	15	DS15-X2
14	DS16	.34	2	#5@12in	DS16-X50	0	N/A	#5@12in	NA	.206	2	DS16-X2
15	DS17	.047	11	#5@12in	DS17-X26	0	N/A	#5@12in	NA	.08	11	DS17-X47
16	DS18	.073	2	#5@12in	DS18-X22	.023	15	#5@12in	DS18-X2	.166	15	DS18-X2
17	DS19	.013	11	#5@12in	DS19-X49	.086	2	#5@12in	DS19-X25	.109	2	DS19-X9
18	DS20	.241	2	#5@12in	DS20-X49	.097	2	#5@12in	DS20-X1	.101	2	DS20-X7

**THUS OKAY**

**THUS OKAY**