NOUS ENGINEERING

STRUCTURAL CALCULATIONS

Plan Check R00

Summit Powder Mountain

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

JOB NO. 18035

May 2018

REV	Description	Author	Date	Checked
00	Structural Calculations	MG	05/30/18	MJM

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The structural design criteria are provided for informational purposes and does not modify of 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	Seismic Mass - Dead Load	psf
Zinc Panels	2	Zinc Panels	2
Wood Liner	3	Wood Liner	3
Purlins @ 24" OC	5	Purlins @ 24" OC	5
Insulation	5	Insulation	5
MEP	3	MEP	3
MISC	2	MISC	2
Total Superimposed Dead	**20**	**Total Superimposed Dead - Mass**	**20**
Steel Framing	2.5	Steel Framing	2.5
Total Dead =	**22.5**	**Total Seismic Mass =**	**23**
Roof Live Load =	**20**	**Additional Mass (psf)/ gra =**	**0.70**

Rooftop Deck

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	psf
Finish Surface	10	Finish Surface	10
Wood Liner	3	Wood Liner	3
Purlins @ 24" OC	5	Purlins @ 24" OC	5
Insulation	5	Insulation	5
MEP	3	MEP	3
MISC	2	MISC	2
Total Superimposed Dead	**28**	**Total Superimposed Dead - Mass**	**28**
Steel Framing	2.5	Steel Framing	2.5
Total Dead =	**30.5**	**Total Seismic Mass =**	**31**
Roof Live Load =	**60**	**Additional Mass (psf)/ gra =**	**0.95**

Study/ Office

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	
1" Wood Flooring	3	1" Wood Flooring	3
Sheathing	2	Sheathing	2
Joists @24"	4	Joists @24"	4
Insulation	2	Insulation	2
MEP	2	MEP	2
MISC	2	MISC	2
Total Superimposed Dead	**15**	**Total Superimposed Dead - Mass**	**15**
Steel Framing	0	Steel Framing	0
Total Dead =	**15**	**Total Seismic Mass =**	**15**
Live Load =	**40**	**Additional Mass (psf)/ gravity (ft/s^2) =**	**0.47**

Entry Foyer

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	
LW Concrete over Metal deck	30	LW Concrete over Metal deck	30
Floor Finish	3	Floor Finish	3
Insulation	5	Insulation	5
MEP (radiant)	3	MEP (radiant)	3
MISC	2	MISC	2
Total Superimposed Dead	**43**	**Total Superimposed Dead - Mass**	**43**
Steel Framing	15	Steel Framing	15
Total Dead =	**58**	**Total Seismic Mass =**	**58**
Live Load =	**40**	**Additional Mass (psf)/ gravity (ft/s^2) =**	**1.80**

Garage

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	
2" LW Concrete + 2" MD	30	2" LW Concrete + 2" MD	30
Insulation	5	Insulation	5
MEP (radiant)	3	MEP (radiant)	3
Soffit	10	Soffit	10
MISC	2	MISC	2
Total Superimposed Dead	**50**	**Total Superimposed Dead - Mass**	**50**
Steel Framing	15	Steel Framing	15
Total Dead =	**65**	**Total Seismic Mass =**	**65**
Live Load =	**40**	**Additional Mass (psf)/ gravity (ft/s^2) =**	**2.02**

Kitchen and Dining

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	
2" LW Concrete + 2" MD	30	2" LW Concrete + 2" MD	30
1" Wood Flooring	3	1" Wood Flooring	3
Insulation	5	Insulation	5
MEP (radiant)	3	MEP (radiant)	3
MISC	2	MISC	2
Total Superimposed Dead	**43**	**Total Superimposed Dead - Mass**	**43**
Steel Framing	5	Steel Framing	5
Total Dead =	**48**	**Total Seismic Mass =**	**48**
Live Load =	**40**	**Additional Mass (psf)/ gravity (ft/s^2) =**	**1.49**

Master Bedroom/Living Room

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	
2" LW Concrete + 2" MD	35	2" LW Concrete + 2" MD	35
Floor Finish	3	Floor Finish	3
Soffit	10	Soffit	10
Insulation	5	Insulation	5
MEP (+radiant)	3	MEP (+radiant)	3
MISC	2	MISC	2
Total Superimposed Dead	**58**	**Total Superimposed Dead - Mass**	**58**
Steel Framing	25	Steel Framing	25
Total Dead =	**83**	**Total Seismic Mass =**	**83**
Live Load =	**40**	**Additional Mass (psf)/ gravity (ft/s^2) =**	**2.58**

Open Air Decks (Lower Level)

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	
2" LW Concrete + 2" MD	35	2" LW Concrete + 2" MD	35
Paver Finish	10	Paver Finish	10
Soffit	10	Soffit	10
Insulation	5	Insulation	5
MEP (radiant)	3	MEP (radiant)	3
MISC	2	MISC	2
Total Superimposed Dead	**65**	**Total Superimposed Dead - Mass**	**65**
Steel Framing	25	Steel Framing	25
Total Dead =	**90**	**Total Seismic Mass =**	**90**
Live Load =	**60**	**Additional Mass (psf)/ gravity (ft/s^2) =**	**2.80**

Jacuzzi

Gravity Loading - Superimposed Dead	psf	Seismic Mass - Dead Load	
Jacuzzi	190	Jacuzzi	190
Soffit	10	Soffit	10
Insulation	5	Insulation	5
MEP (radiant)	3	MEP (radiant)	3
MISC	2	MISC	2
Total Superimposed Dead	**210**	**Total Superimposed Dead - Mass**	**210**
Steel Framing	25	Steel Framing	25
Total Dead =	**235**	**Total Seismic Mass =**	**235**
Live Load =	**60**	**Additional Mass (psf)/ gravity (ft/s^2) =**	**7.30**

Exterior Deck

Gravity Loading - Superimposed Dead	psf
Floor Finish	75
MISC	5
Total Superimposed Dead	**80**
Total Dead =	**80**
Live Load =	**100**

Entry Driveway

Gravity Loading - Superimposed Dead	psf
Finsh and topping slab	75
MISC	5
Total Superimposed Dead	**80**
Total Dead =	**80**
Live Load =	**100**

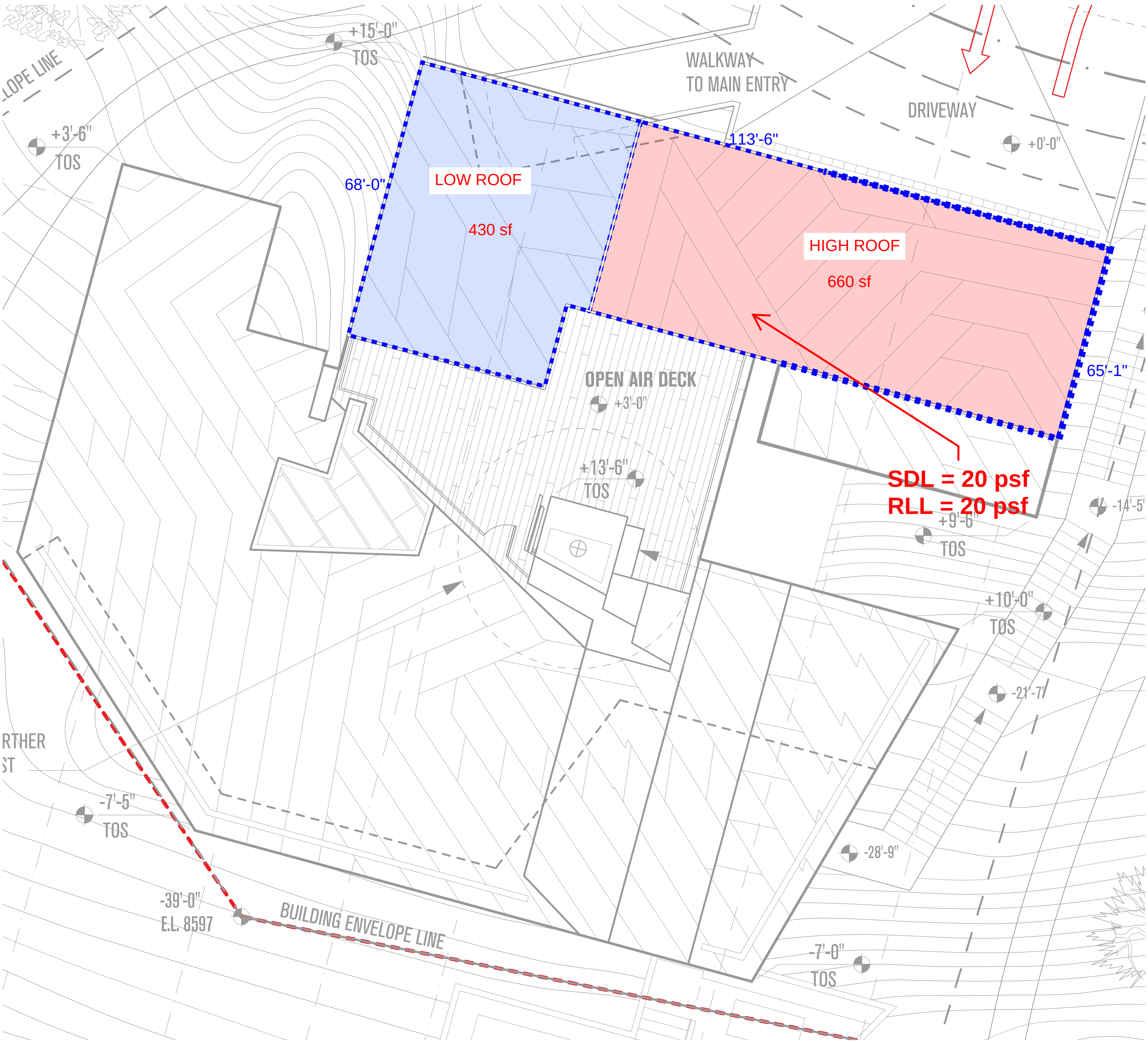
Fireplace = 10000 lbs

Cladding/ Wall Weight

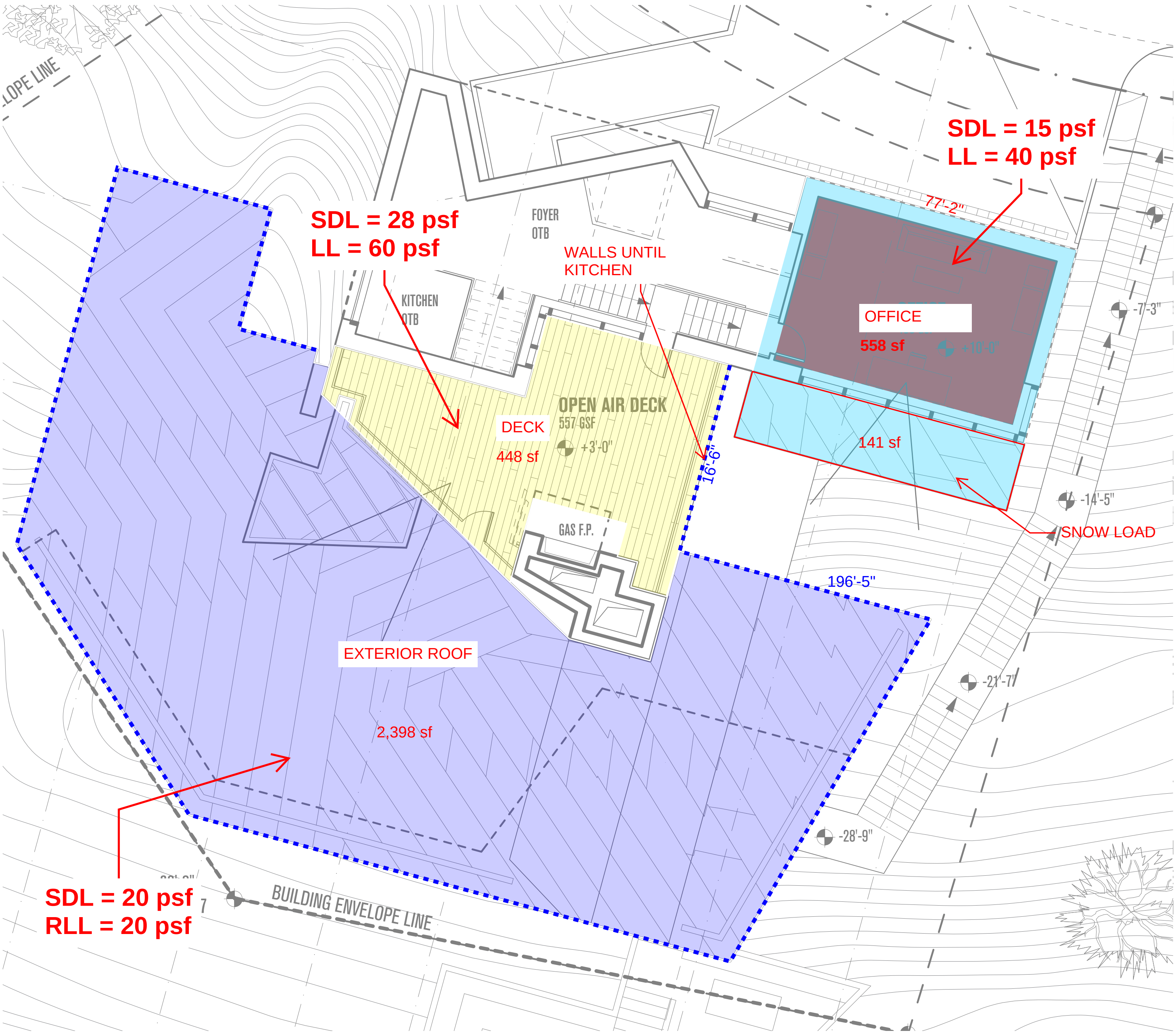
	psf
Interior Walls	15
10" RC Walls	125
Exterior Walls	20

AREA LOAD MAPS

HIGH AND LOW ROOFS



OFFICE, DECK AND EXTERIOR SLOPING ROOF (SKIN)



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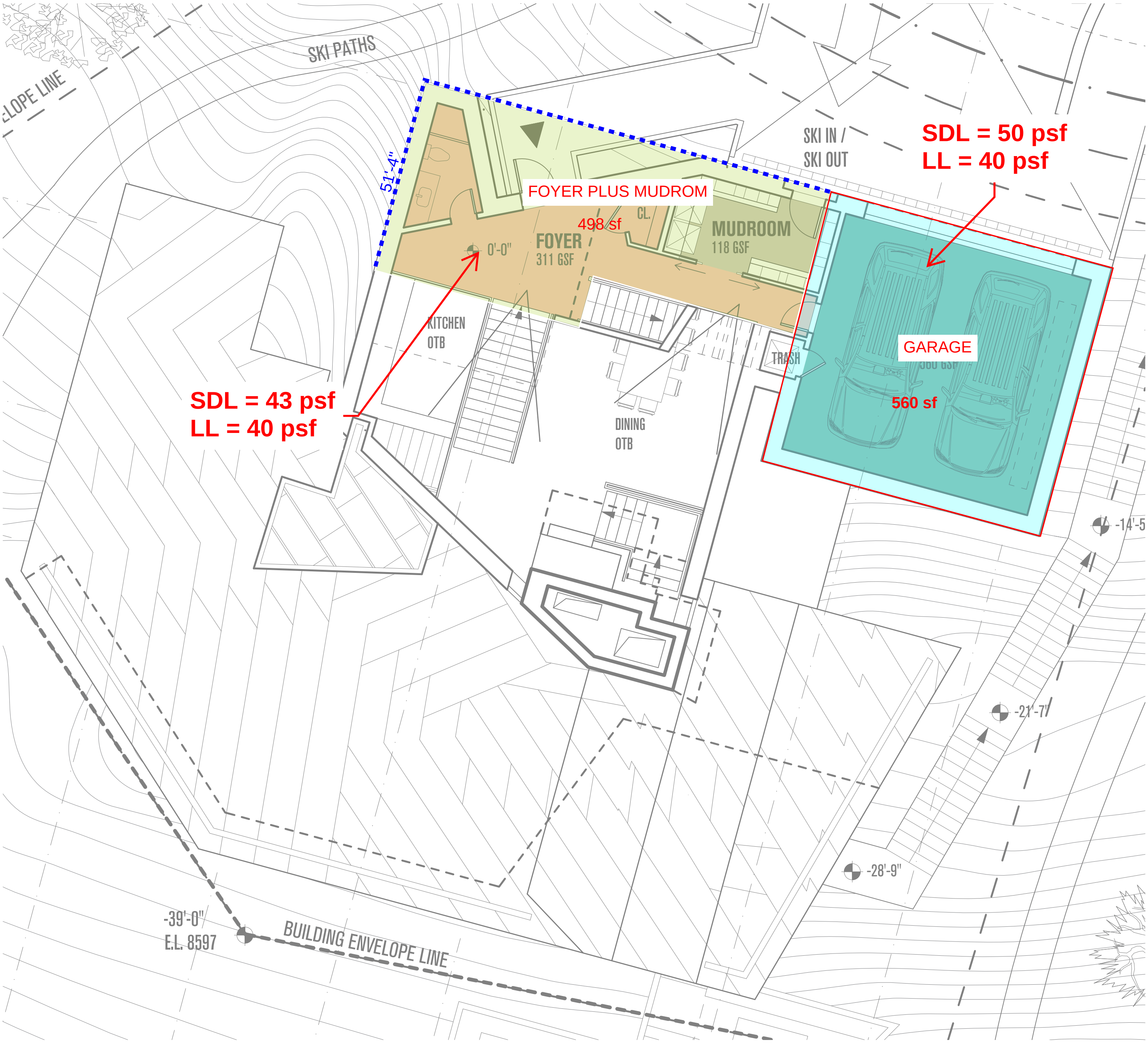
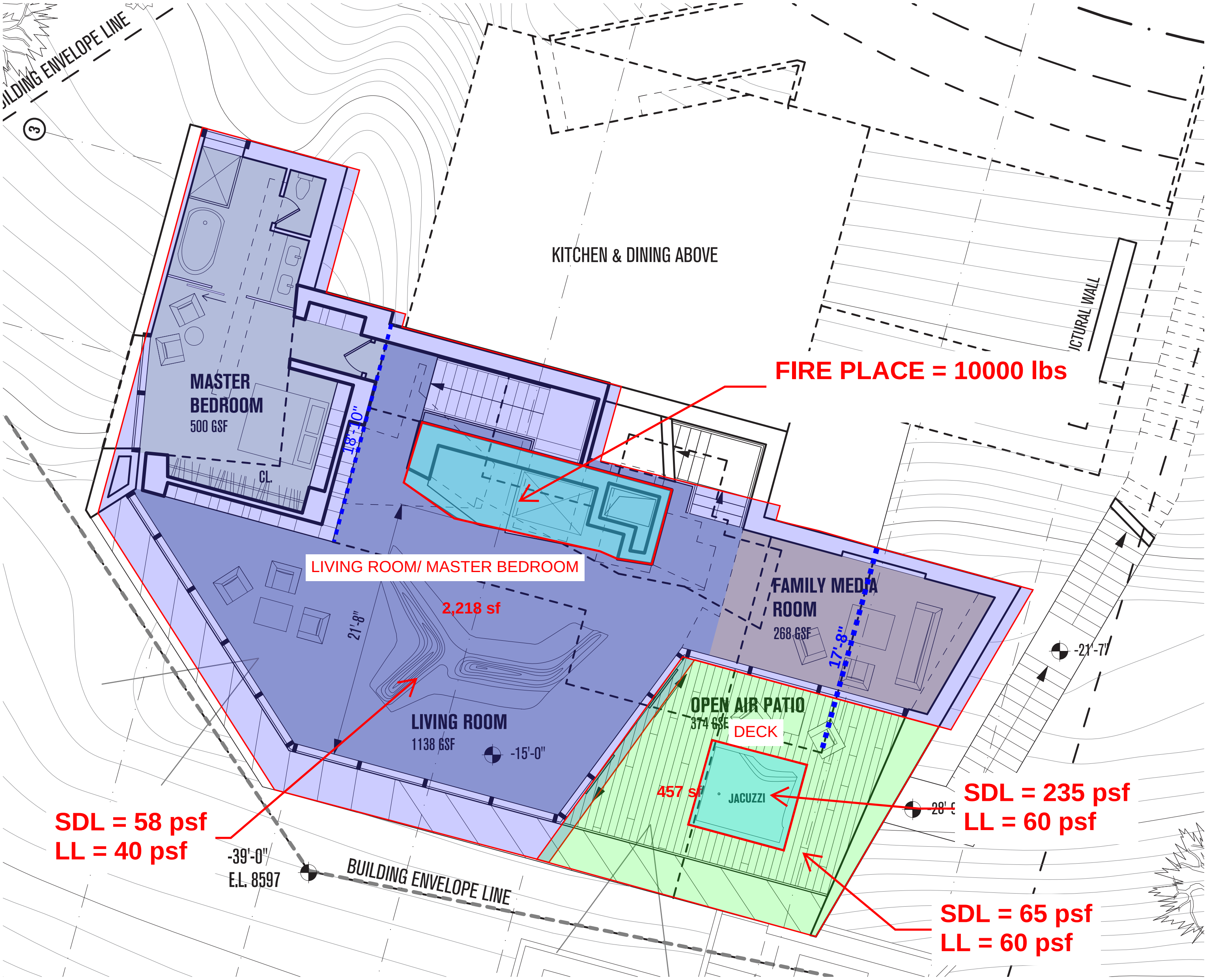
ENTRY FOYER AND GARAGE

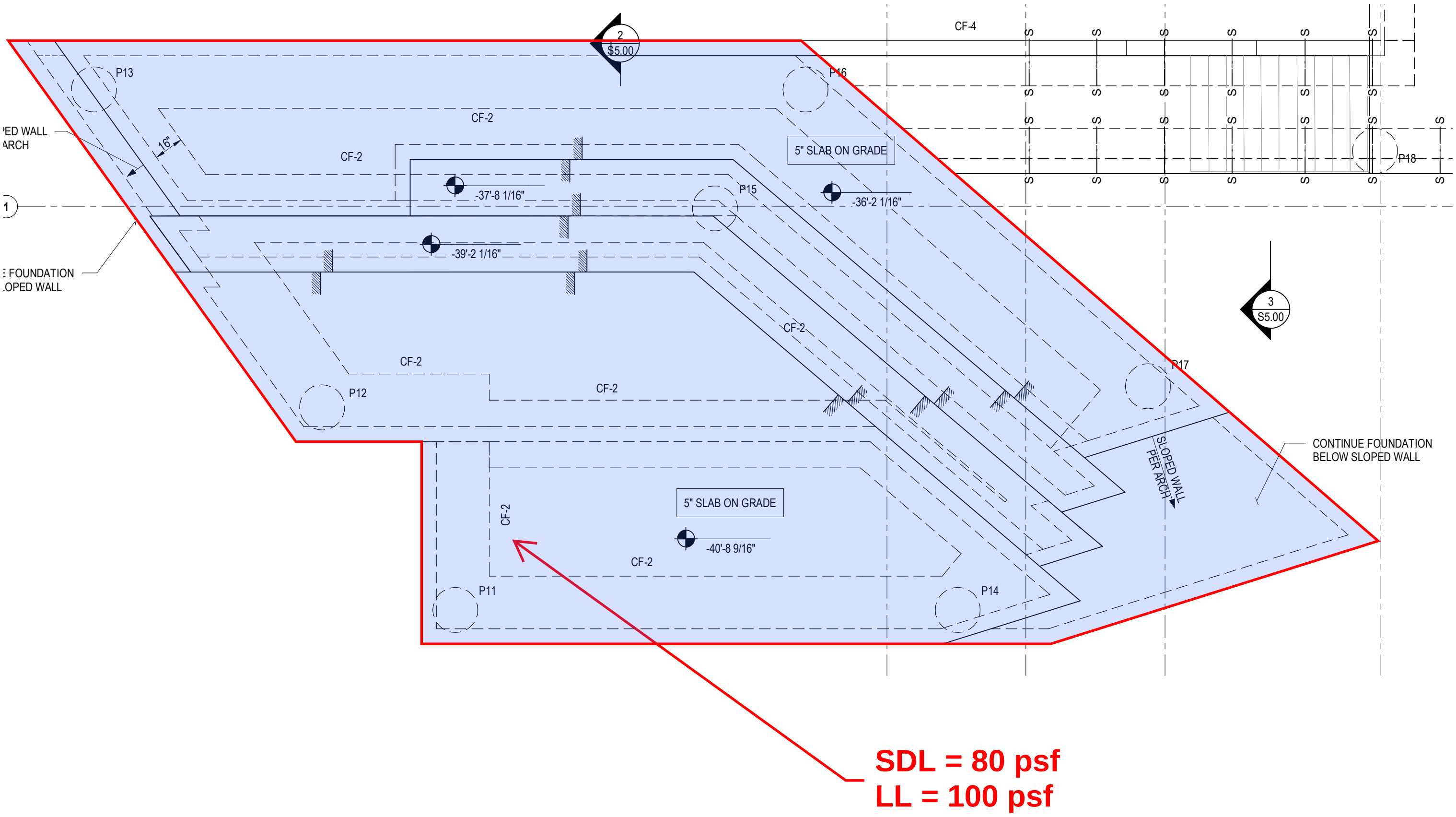


KITCHEN AND DINING

LIVING ROOM AND MASTER BEDROOM



EXTERIOR DECK



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 (Pasive) (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**

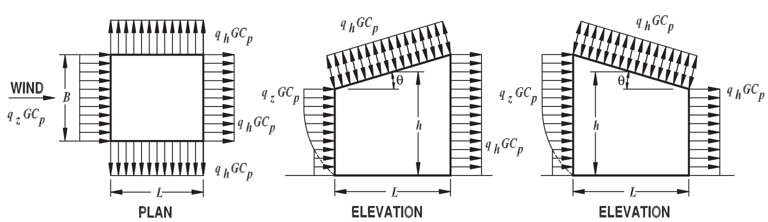
q_z, $q_h = 0.00256 K_z K_{zt} K_d V^2$ = **35.3** psf

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

Cp =	**0.8**	Walls, Windward
Cp =	**-0.5**	Walls, Leeward
Cp =	**0.7**	Side Walls
Cp =	**-0.3, 0.2**	Roof Co-efficients
GC_{pi} =	**+-0.18**	Internal Pressure coefficient Table 26.11-1

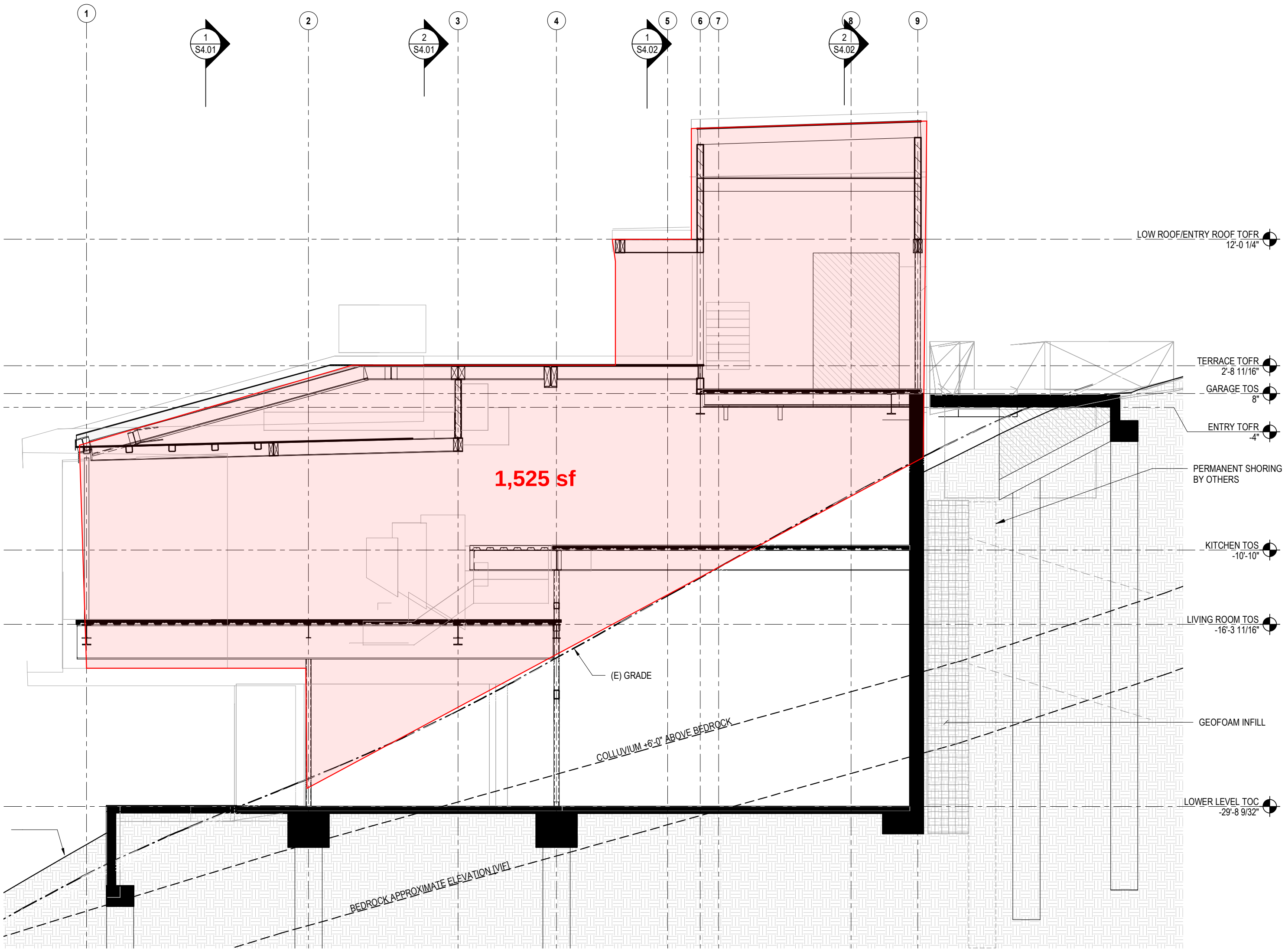
$P = qGC_p - q_i GC_{pi}$

Thus Seismic load Governs as shown further



MONOSLOPE ROOF (NOTE 4)

WIND LOADS



THUS TOTAL WIND LOAD = WINDWARD + LEEWARD LOAD
= q X G X Cp + q X G X Cp

= 2 X 35.3 X 0.85 X 0.7 X 1525

= 64 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

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

Pg = $(Po^2 + S^2(A\text{-}Ao)^2)^{0.5}$ = **262 psf**

For Flat roof snow loads,

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

$\mathbf{p_f} = 0.7\, C_e\, C_t\, I_s\, p_g$ = **128.4 psf**

Cs =	**0.85**	Figure 7.2(a) ASCE 7-10 for roof slope of 15^o

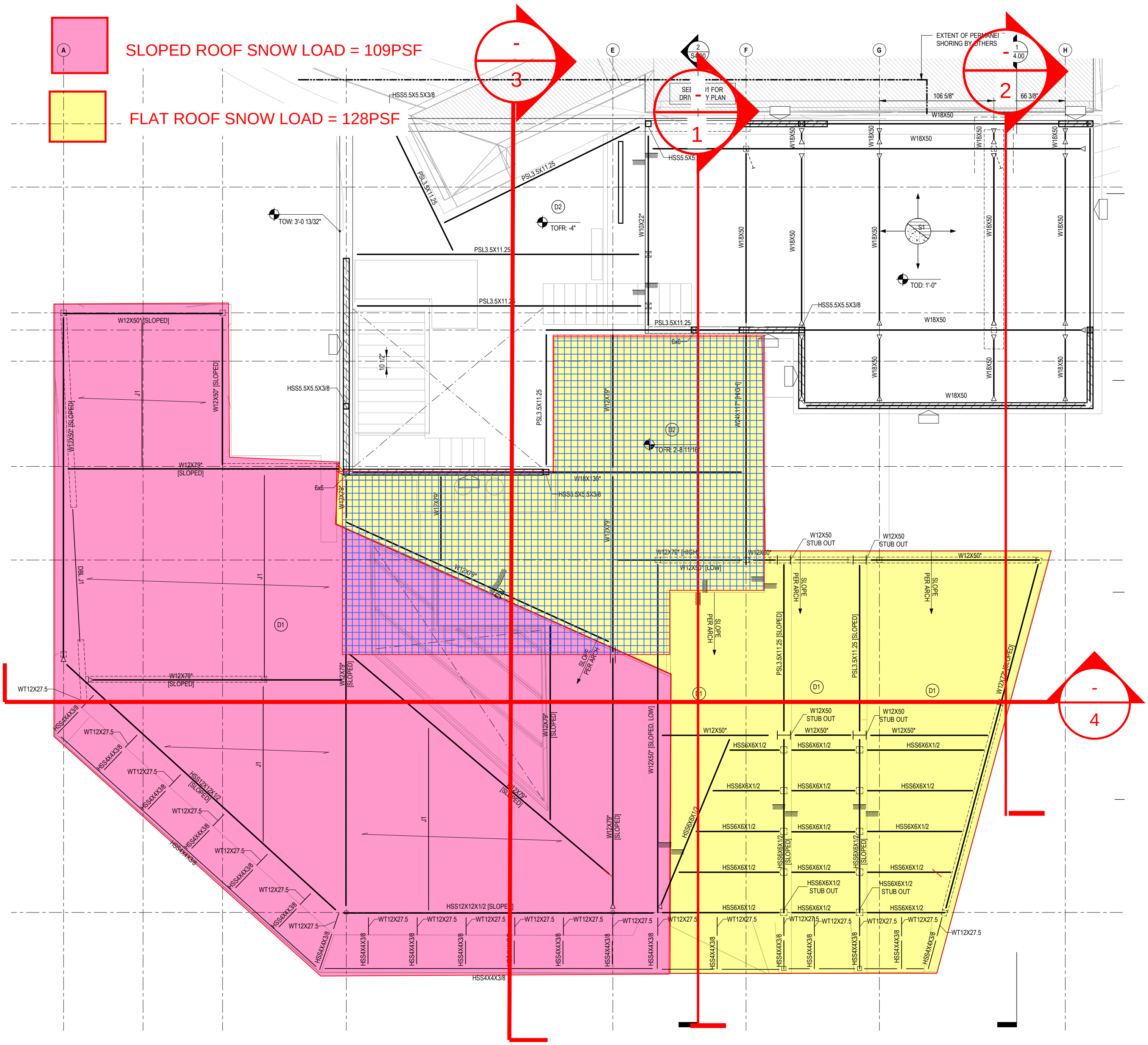
$\mathbf{p_s} = C_s p_f$ = **109 psf** Sloped roof snow loads

Snow Load for seismic design,

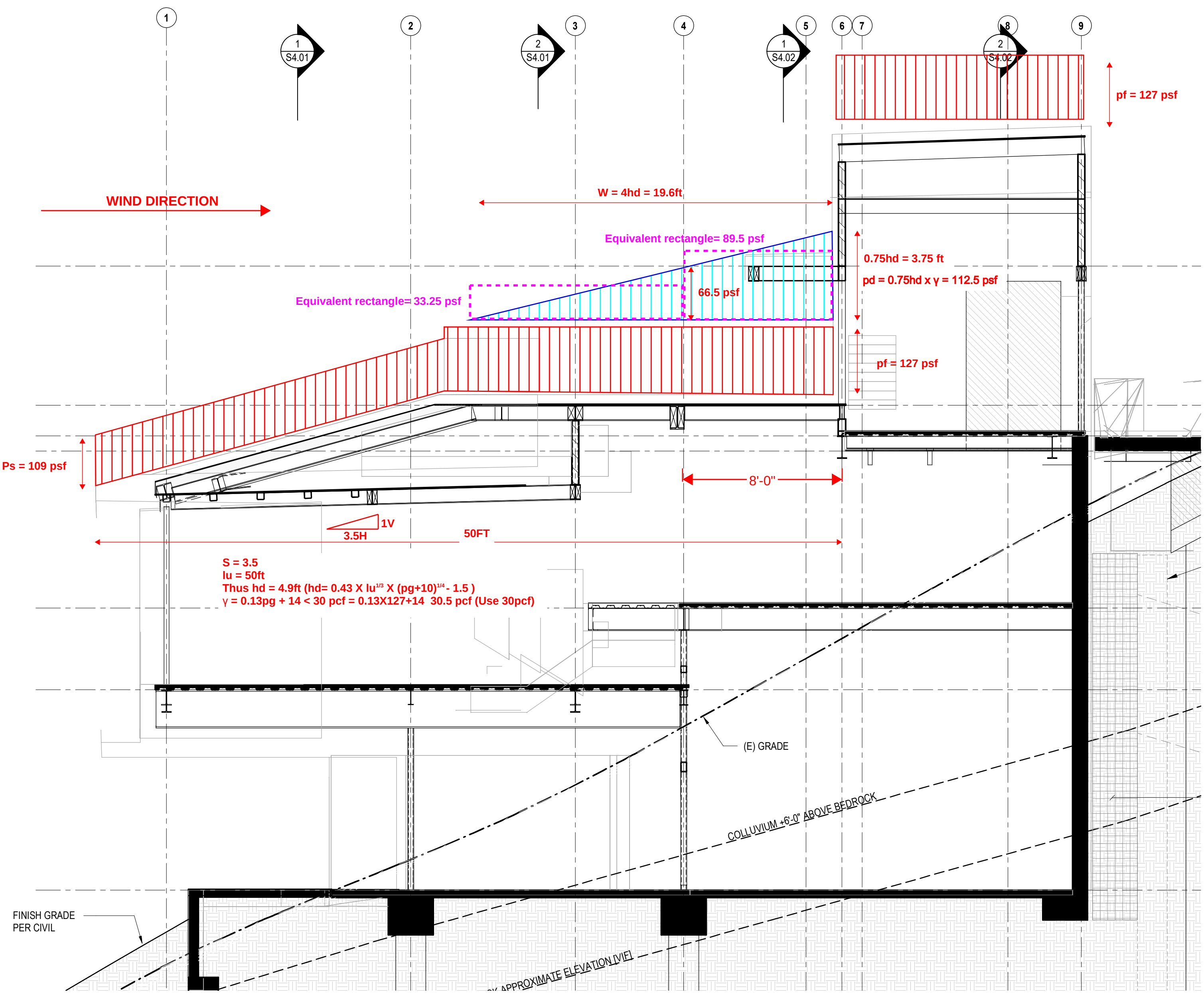
Ws = $(0.2 + 0.025\,(A-5))\, p_f$ = **37 psf**

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

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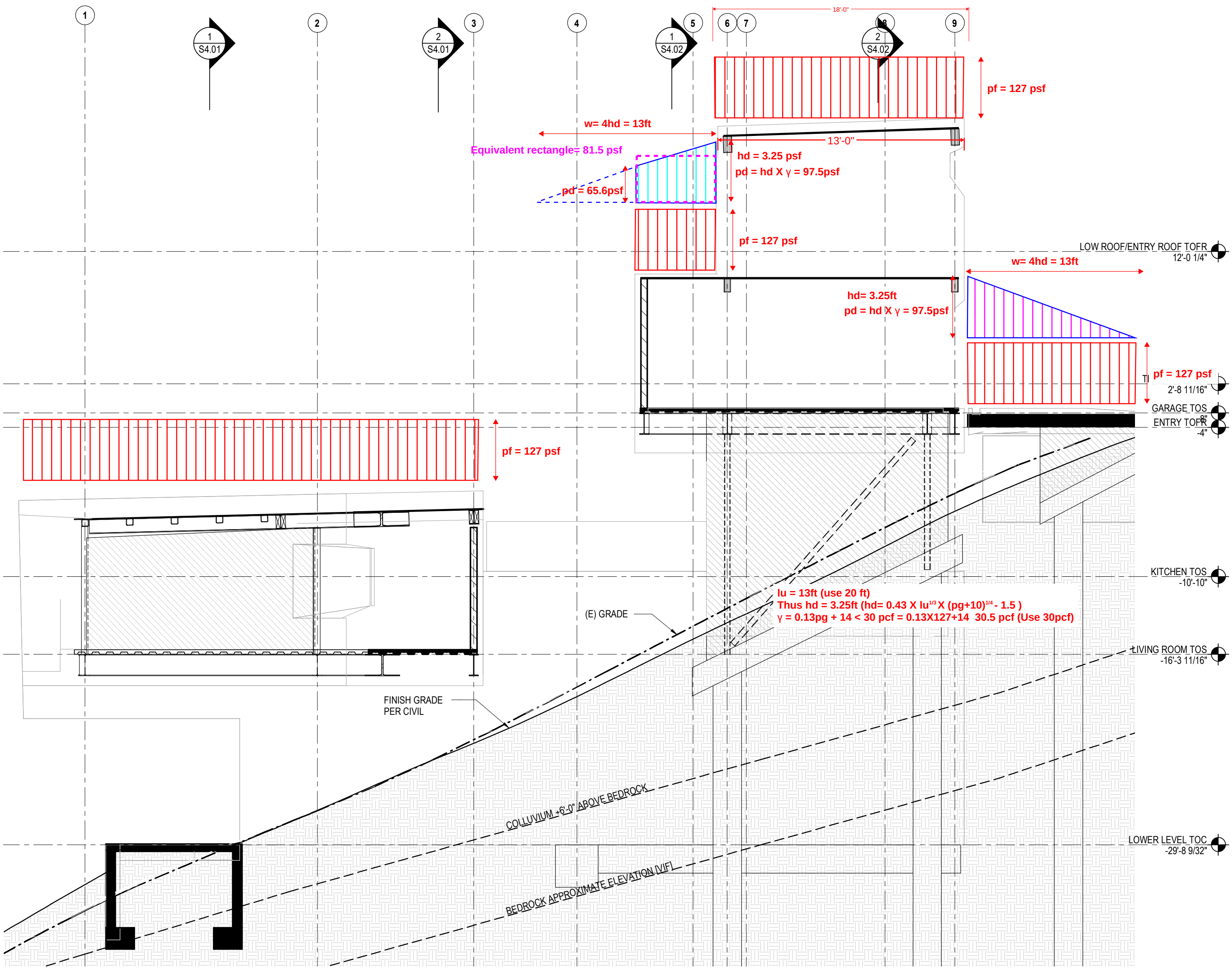
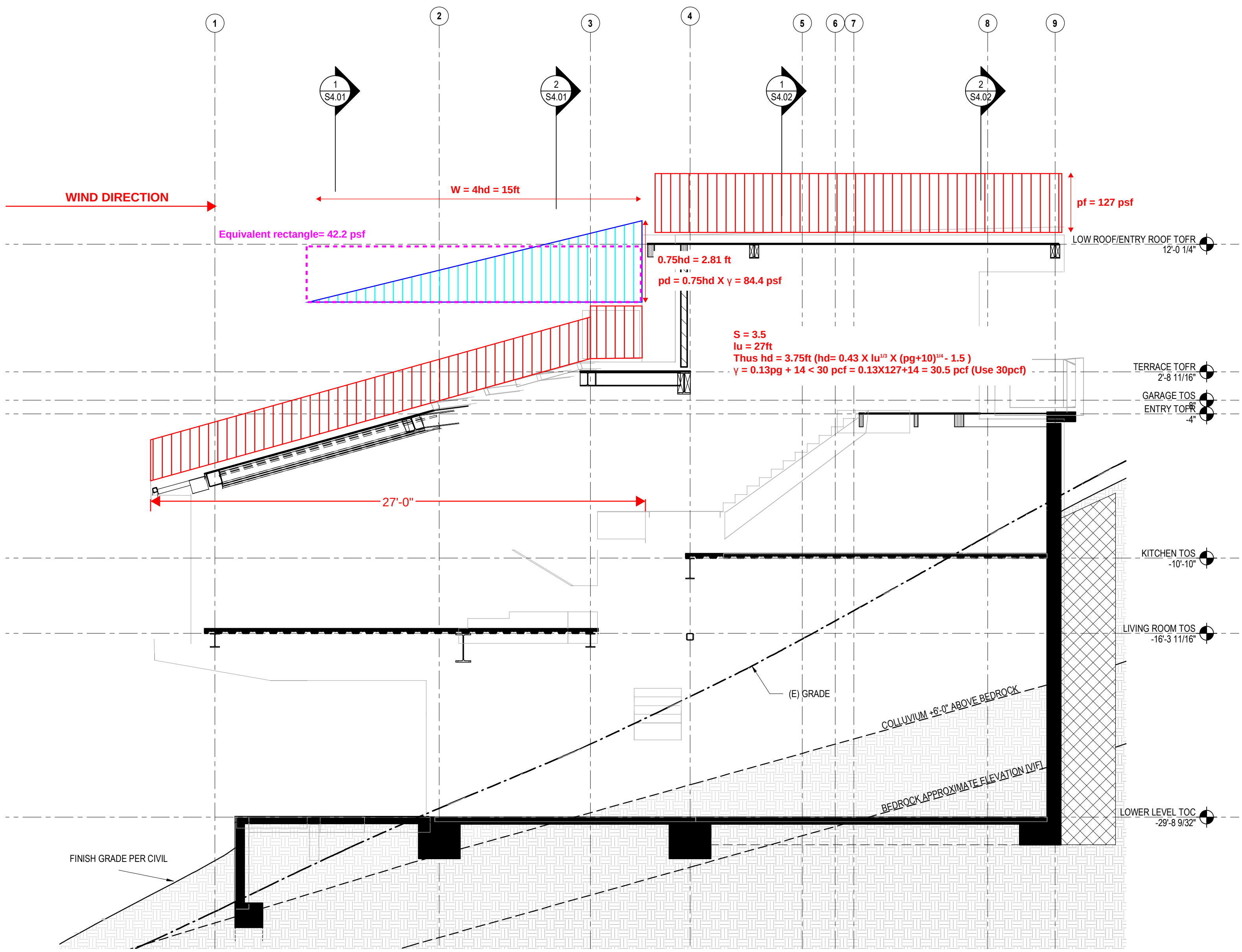
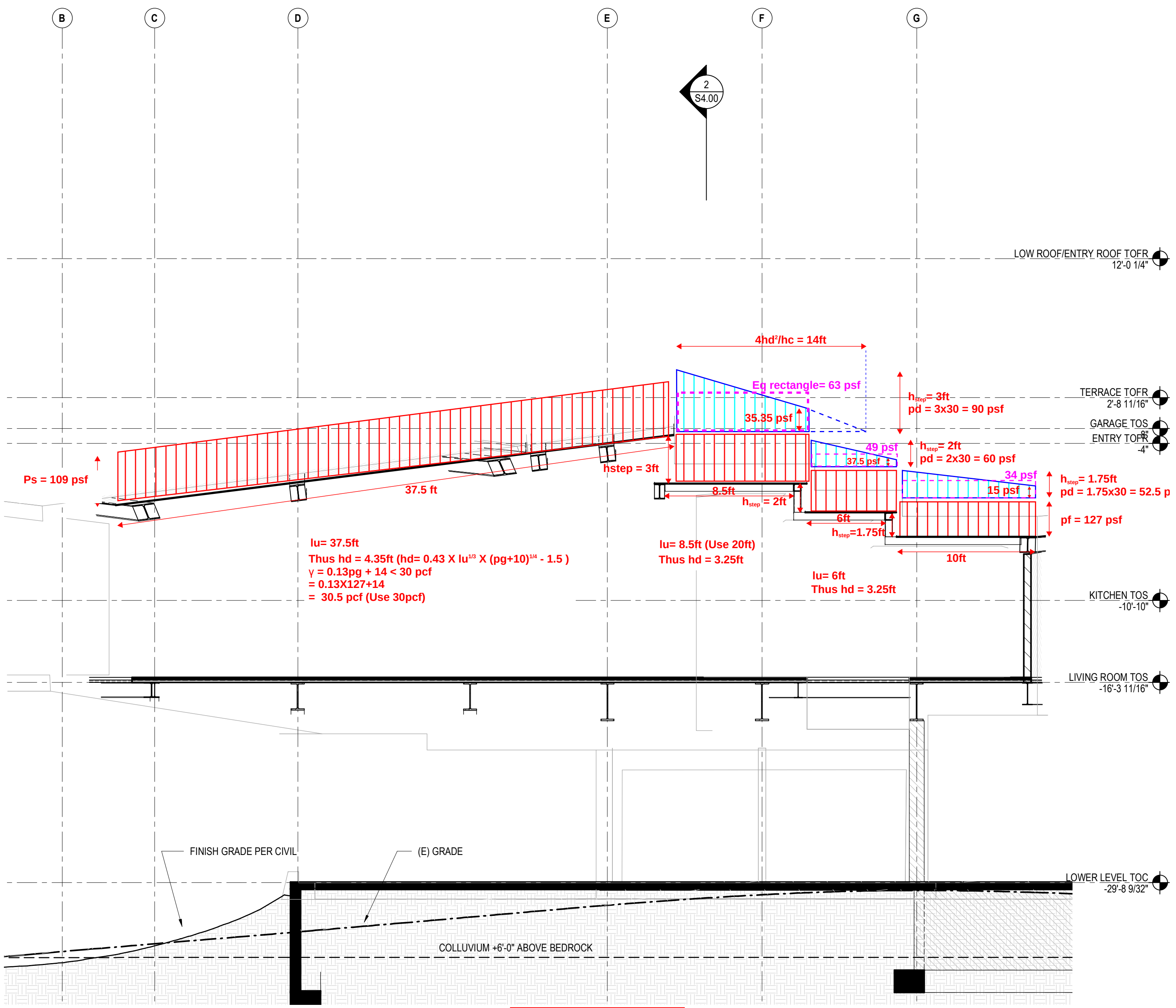


SECTION 2


WIND DIRECTION
W = 4hd = 15ft
pf = 127 psf
Equivalent rectangle= 42.2 psf
0.75hd = 2.81 ft
pd = 0.75hd X γ = 84.4 psf
S = 3.5
lu = 27ft
Thus hd = 3.75ft (hd= 0.43 X lu$^{1/3}$ X (pg+10)$^{1/4}$ - 1.5)
γ = 0.13pg + 14 < 30 pcf = 0.13X127+14 = 30.5 pcf (Use 30pcf)
27'-0"
LOW ROOF/ENTRY ROOF TOFR
12'-0 1/4"
TERRACE TOFR
2'-8 11/16"
GARAGE TOS
ENTRY TOFR
-4"
KITCHEN TOS
-10'-10"
LIVING ROOM TOS
-16'-3 11/16"
LOWER LEVEL TOC
-29'-8 9/32"
(E) GRADE
COLLUVIUM +6'-0" ABOVE BEDROCK
BEDROCK APPROXIMATE ELEVATION [VIF]
FINISH GRADE PER CIVIL
1 S4.01
2 S4.01
1 S4.02
2 S4.02
1
2
3
4
5
6
7
8
9

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

Parameter	Short Period (0.2 sec)	Long Period (1.0 sec)
MCE Spectral Response Acceleration (g)	$S_S = 0.813$	$S_1 = 0.270$
MCE Spectral Response Acceleration Site Class C (g)	$S_{MS} = S_sF_a = 0.874$	$S_{M1} = S_1F_v = 0.413$
Design Spectral Response Acceleration (g)	$S_{DS} = S_{MS*}{}^2/_3 = 0.582$	$S_{D1} = S_{M1*}{}^2/_3 = 0.275$

construction

SEISMIC LOADING- X DIRECTION

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

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***			
LFRS=	**Intermediate Moment Frames**	GOVERNING, LOWEST R			
I_e =	**1.0**	***(Sect. 11.5.1)***			
R =	**4.5**	***(Table 12.2-1)***			
Cd =	**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	
ρ =	**1.3**				

Site Coeff F_a	≤				≥
Ss	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9

Site Coeff F_v	≤				≥
S_1	**0.1**	**0.20**	**0.3**	**0.40**	**0.5**
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
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	≤ S_{DS} <	0.167	A	A	A
0.167	≤ S_{DS} <	0.33	B	B	C
0.33	≤ S_{DS} <	0.50	C	C	D
0.50	≤ S_{DS}		D	D	D

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

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

Seismic Response Coefficient			
(ASCE 7-10 12.8.1.1)			
$C_s = S_{DS}/(R/Ie)$	C_S =	0.129	(12.8-2)
$C_S = S_{D1} / [T(R/Ie)]$ (need not exceed, for $T <= T_L$)	C_S ≤	0.434	(12.8-3)
$C_S = S_{D1}T_L/[T^2(R/Ie)]$ (need not exceed, for $T > T_L$)	C_S ≥	24.008	(12.8-4)
C_S shall not be less than 0.01			(12.8-5)
$C_S = 0.5S_1/(R/Ie)$ (shall not be less than, for areas where S1 >= 0.6g)	C_S ≥	0.030	(12.8-6)
Base Shear	**V =**	**0.129** W	(12.8-1)

Level	Area (sqft)	Height (ft)	Walls Below (ft)	Walls Above (ft)
High Roof	660	20	113.5	
Low Roof	430	9	68	
Office	558	9	77	65
Deck and Exterior Roof				
Deck	448	14	16.5	
Exterior Roof	2398	23	196.5	
Entry Level				
Mudroom plus Foyer	500	10	51.25	
Garage	560			
Kitchen plus Dining	1219	18.5	97.25	
Living Room Level				
Master Bed and Living Room	2218	13	36.5	

Roof Snow Load 128 psf

Snow Load for Seismic Calculations = **37.12** psf

Elevation above MSL of Structure= 8600 ft

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					9.79
Snow Load		660		37.1	24.50	1127	0.66	9.79	9.79	
Ext Walls			113.5	15	17.0					
Low Roof	11	430		23	9.675					2.89
Snow Load		430		37.1	15.96	332	0.19	2.89	12.68	
Ext Walls			68	15	4.59					
Office	9	558		15	8.37					
Snow Load		141		37.1	5.23	257	0.15	2.23	14.91	
Ext Walls Above			65	15	9.75					
Ext Walls Below			77	15	5.20					
				∑ 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								
Deck		448		31	13.66				
Ext Walls			16.5	15	1.7325	4422	1.00	24.89	24.89
Exterior Roof		2398		23	53.96				
Ext Walls			196.5	15	33.90				
Snow Loads		2398		37.1	89.0				
				∑ 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								
Foyer & Mudroom		500		58	29				
Ext Walls Above			181.5	15	12.25	1097	1.00	14.20	14.20
Ext Walls Below			51.25	125	32.0				
Garage		560		65	36.4				
				∑ W =	**109.68**	1096.8			

Total Applied Seismic Load, **V** = Cs W **14.20**

Cs W x ρ **18.46** kips

Kitchen Plus Dining	19.5	1219		48	58.51				
Ext Walls Above			51.25	125	32.03	3958	1.00	26.28	26.28
Ext Walls Below			97.25	125	112.45				
				∑ 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				
Deck		457		90	41.13	3443	1.00	34.29	114.56
Ext Walls Below			36.5	125	29.66				
Fireplace					10				
				∑ 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

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

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***			
LFRS=	**Concrete Special Reinforced Shear Walls**				
I_e =	**1.0**	***(Sect. 11.5.1)***			
R =	**5.0**	***(Table 12.2-1)***			
Cd =	**5.0**				
Omega=	**2.5**				
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	
ρ **=**	**1.3**				

Site Coeff F_a

Ss	≤ 0.25	0.50	0.75	1.00	≥ 1.25
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9

Site Coeff F_v

S_1	≤ 0.1	0.20	0.3	0.40	≥ 0.5
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
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	≤ S_{DS} <	0.167	A	A	A
0.167	≤ S_{DS} <	0.33	B	B	C
0.33	≤ S_{DS} <	0.50	C	C	D
0.50	≤ S_{DS}		D	D	D

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

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

Seismic Response Coefficient			
(ASCE 7-10 12.8.1.1)			
$C_s = S_{DS}/(R/I_e)$	$C_S =$	0.117	(12.8-2)
$C_S = S_{D1} / [T(R/I_e)]$ (need not exceed, for $T \le T_L$)	$C_S \le$	0.391	(12.8-3)
$C_S = S_{D1}T_L/[T^2(R/I_e)]$ (need not exceed, for $T > T_L$)	$C_S \ge$	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 S1 >= 0.6g)	$C_S \ge$	0.027	(12.8-6)
Base Shear	**V =**	**0.117** W	(12.8-1)

Level	Area (sqft)	Height (ft)	Walls Below (ft)	Walls Above (ft)
High Roof	660	20	113.5	
Low Roof	430	9	68	
Office	558	9	77	65
Deck and Exterior Roof				
Deck	448	14	16.5	
Exterior Roof	2398	23	196.5	
Entry Level				
Mudroom plus Foyer	500	10	51.25	
Garage	560			
Kitchen plus Dining	1219	18.5	97.25	
Living Room Level				
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 = **37.12** 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	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	2.60
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					
				∑ W =	115.15	1716.94	1.00			

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

Cs W x ρ **17.44** kips

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				
				∑ 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				
				∑ W =	109.68	1096.8			

Total Applied Seismic Load, **V** = Cs W **12.78**

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				
				∑ 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				
				∑ 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 (deigned 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

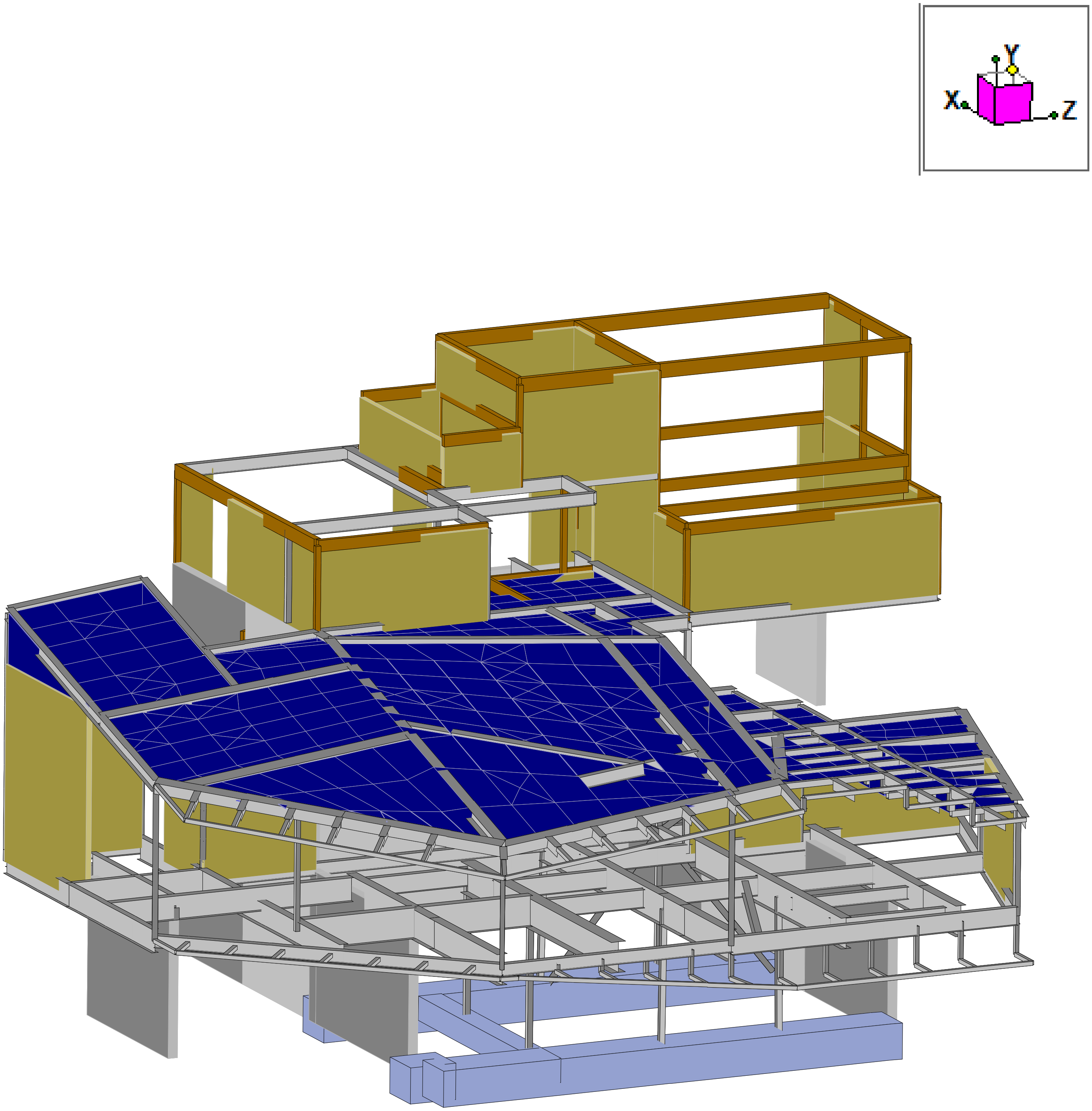


Figure 3.0-2 – Three Dimensional Mathematical Model, Isometric View 2

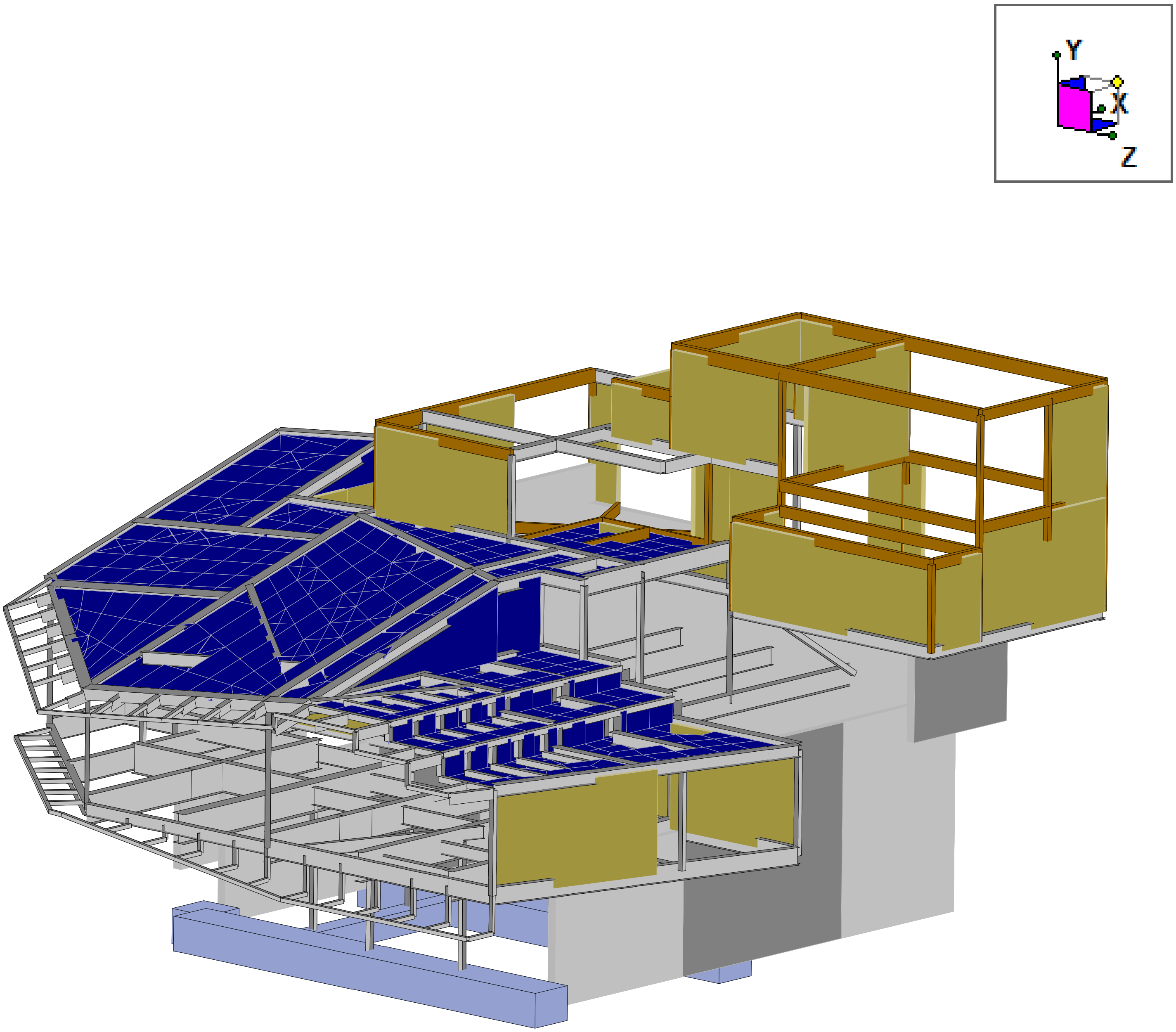
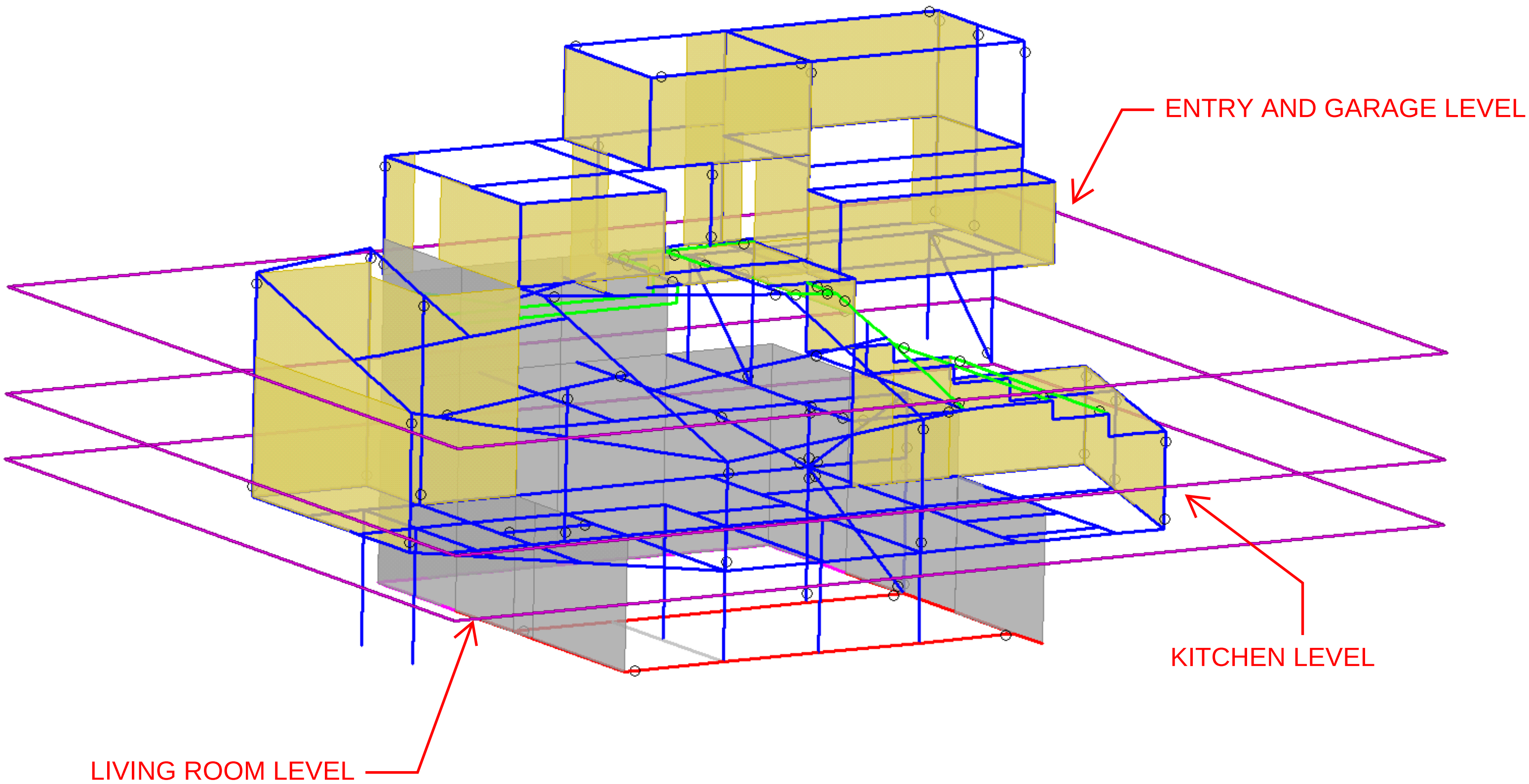
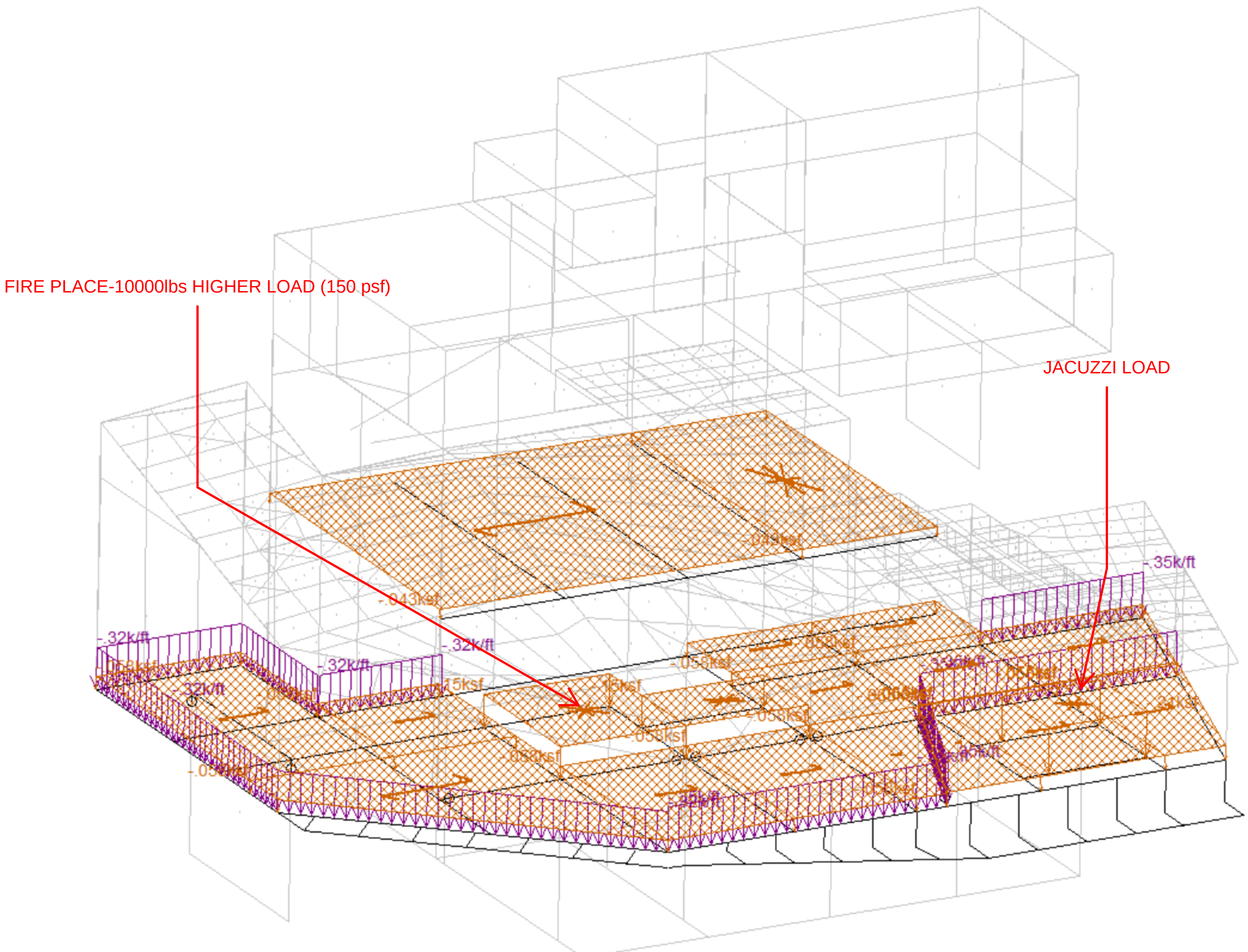


Figure 3.0-3 –Diaphragm Assignment



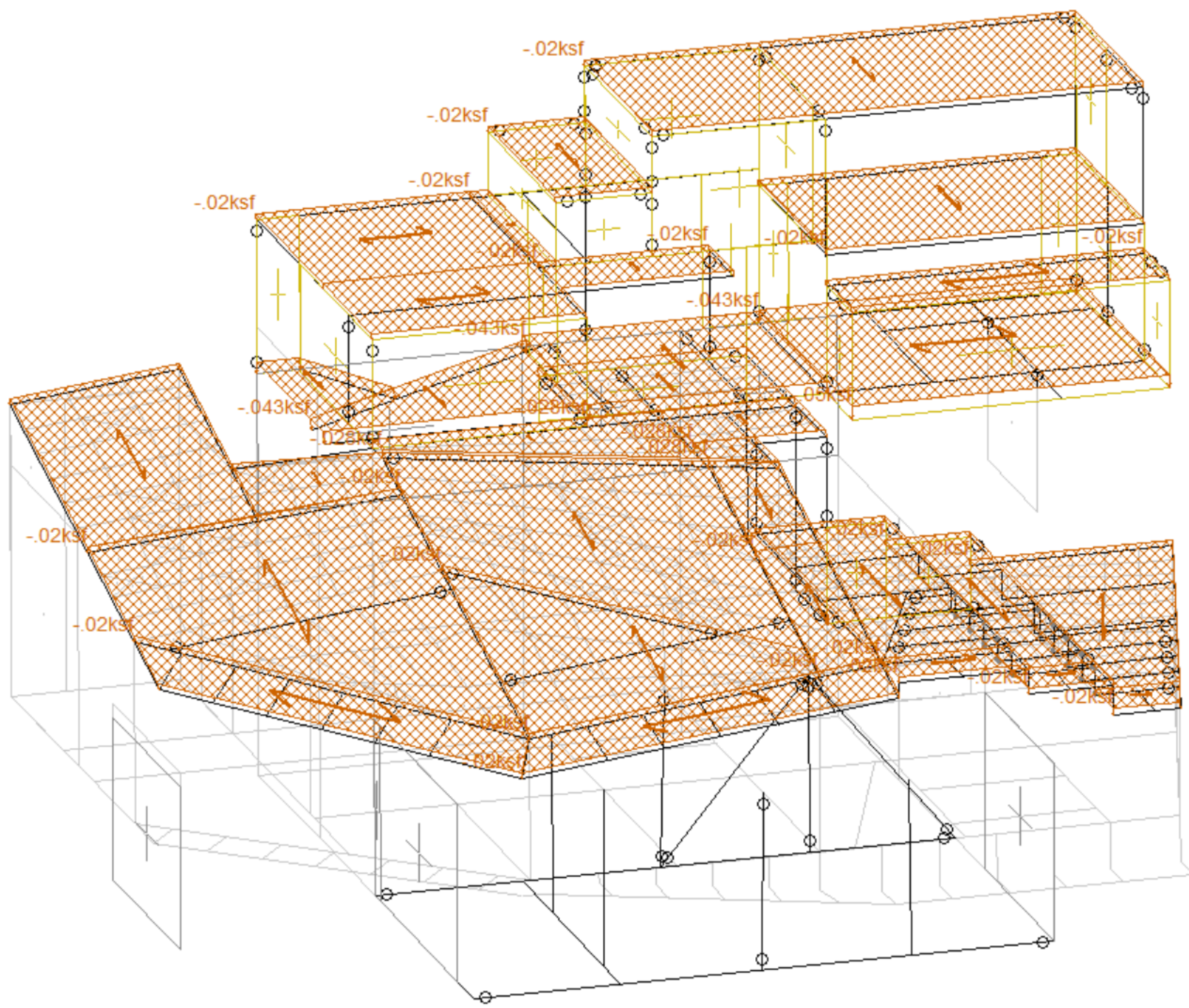
ASSIGNED RIGID DIAPHRAGMS

Assigned Dead Load



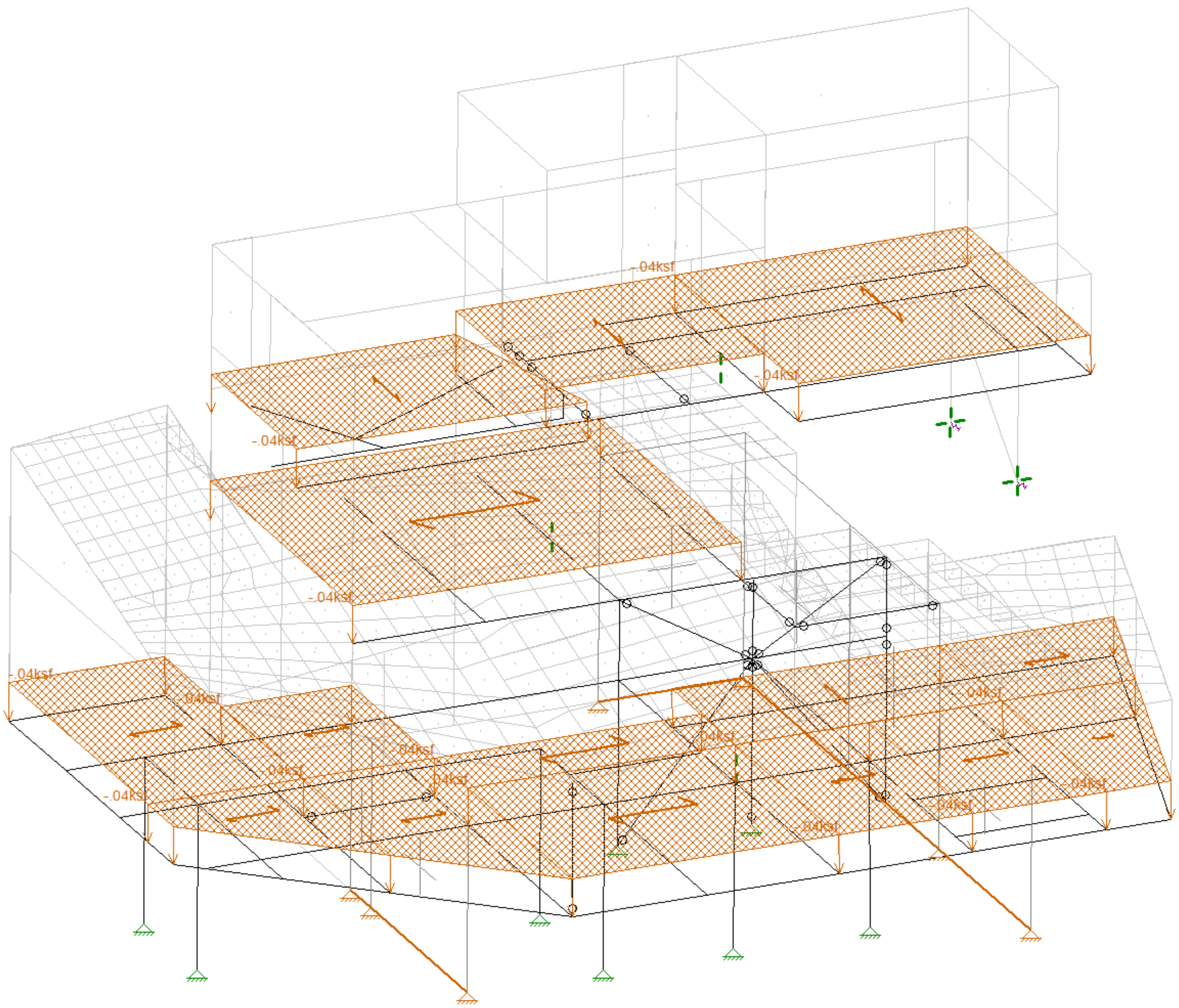
LIVING ROOM AND KICTHEN DEAD LOAD PER CHAPTER 2

Assigned Dead Load



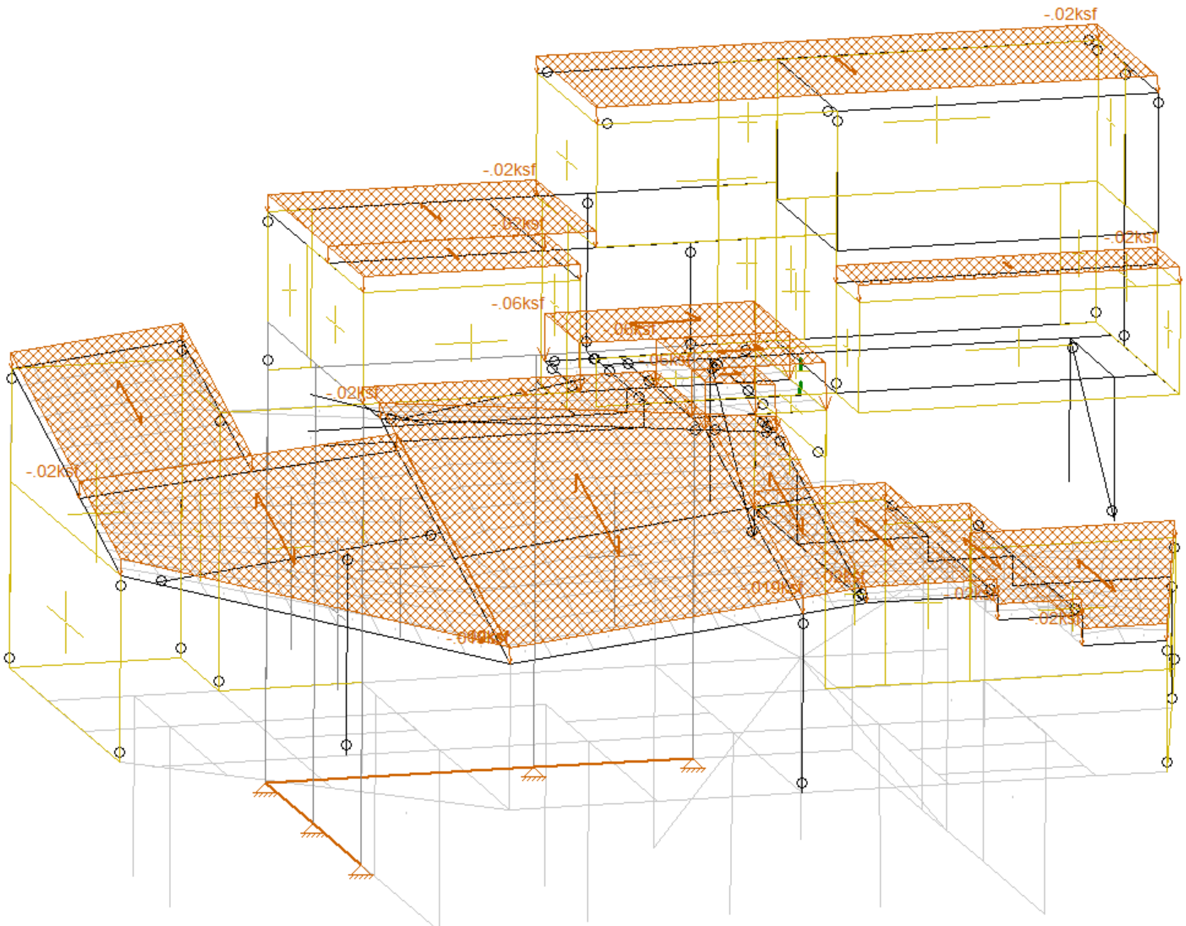
ROOF, GARAGE, ENTRY AND DECK DEAD LOAD PER CHAPTER 2

Assigned Live Load



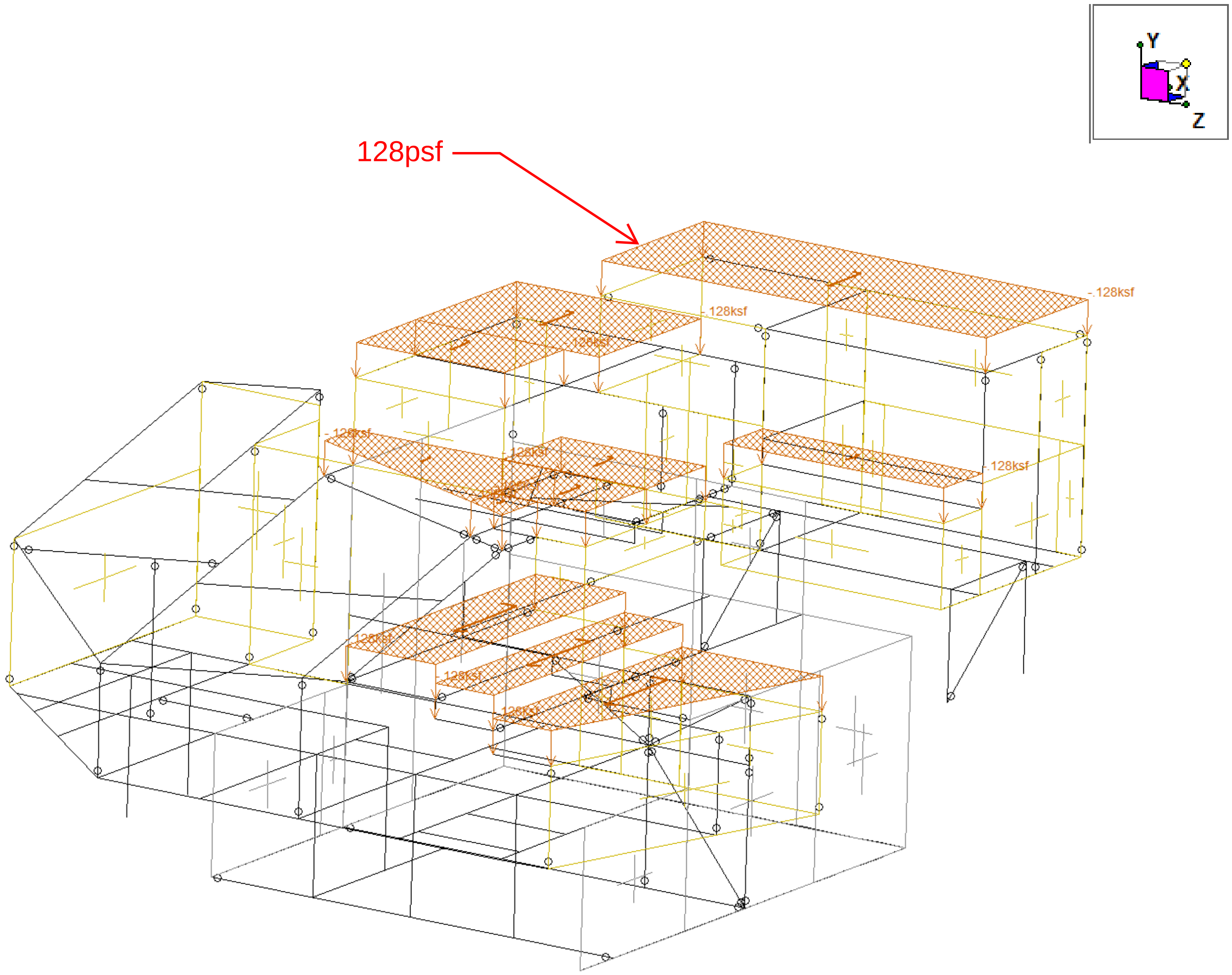
LIVING ROOM,ENTRY, GARAGE AND KICTHEN LIVE LOAD PER CHAPTER 2

Assigned Roof Live Load



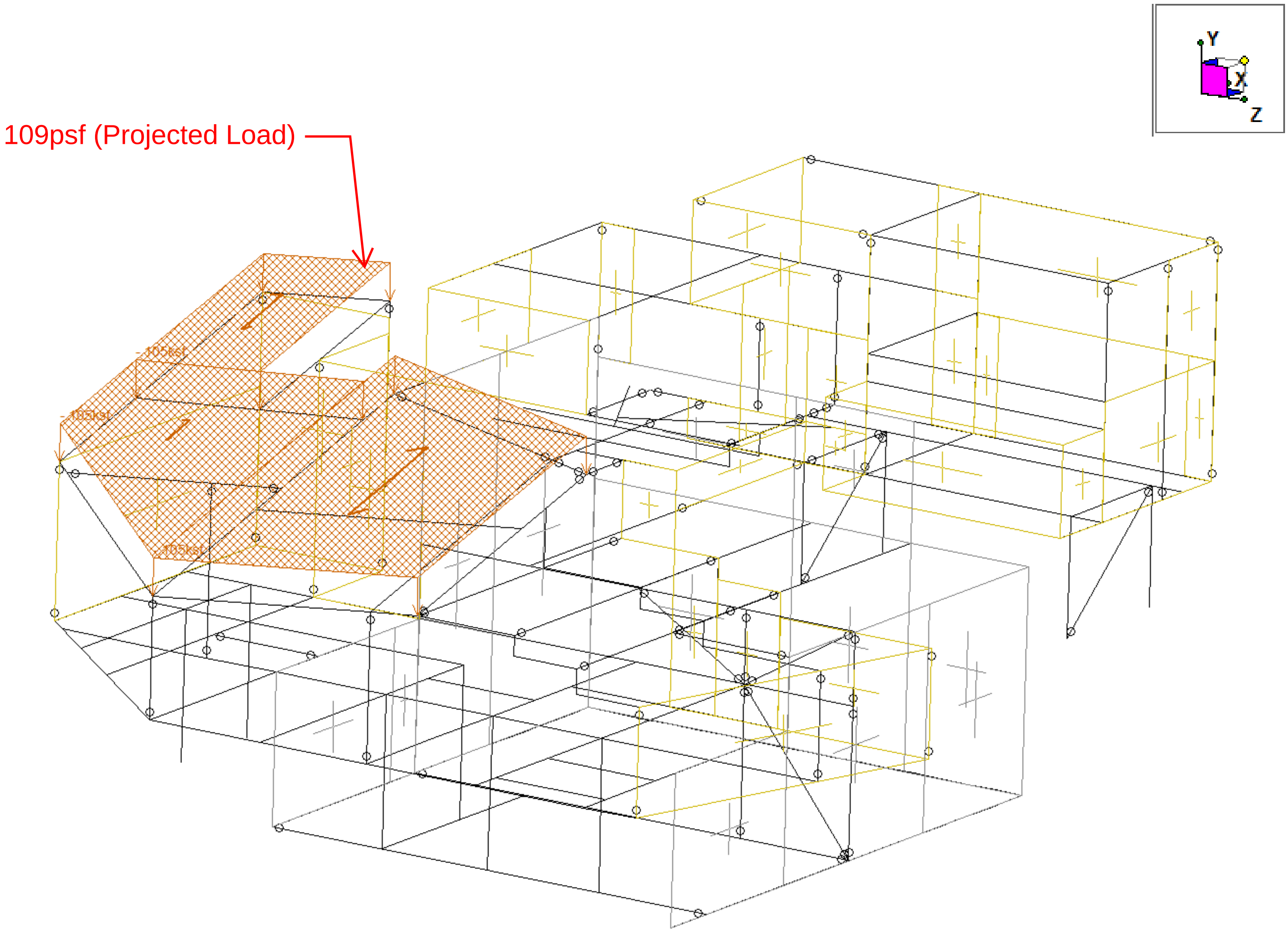
LIVING ROOM AND KICTHEN DEAD LOAD PER CHAPTER 2

ASSIGNED FLAT ROOF SNOW LOAD



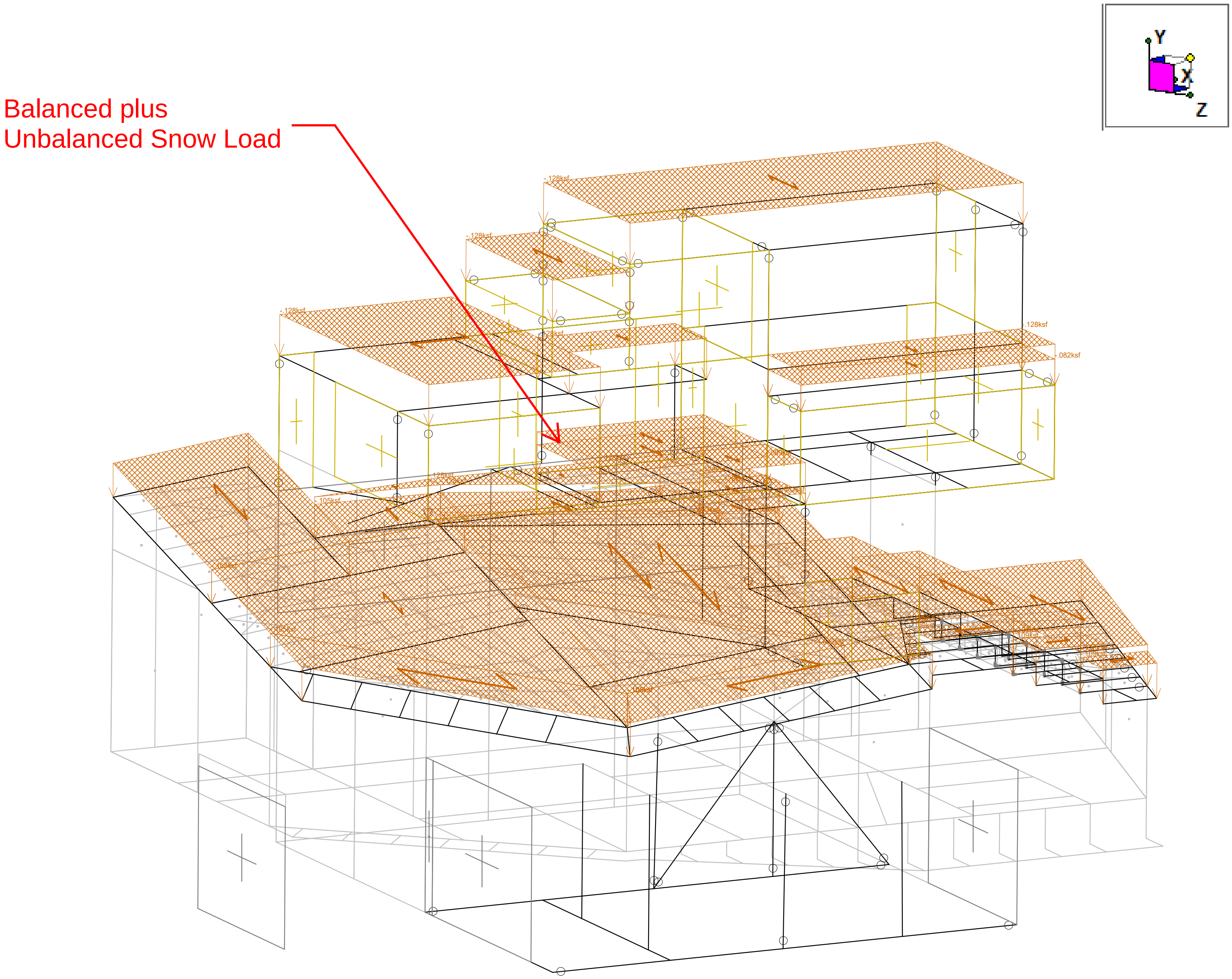
Snow Load per Chapter 2

ASSIGNED SLOPED ROOF SNOW LOAD



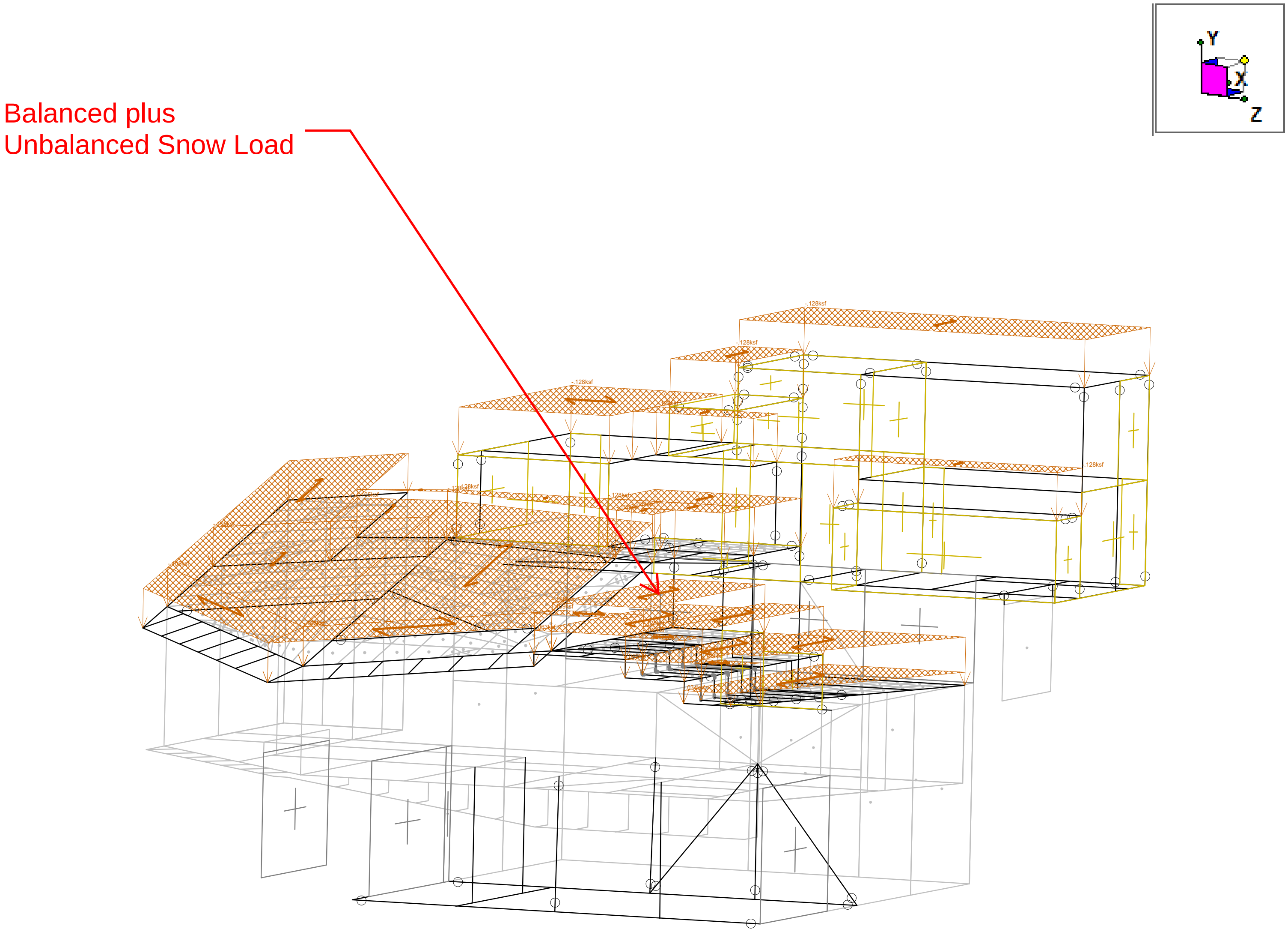
Snow Load per Chapter 2

ASSIGNED UNBALANCED SNOW LOAD-1



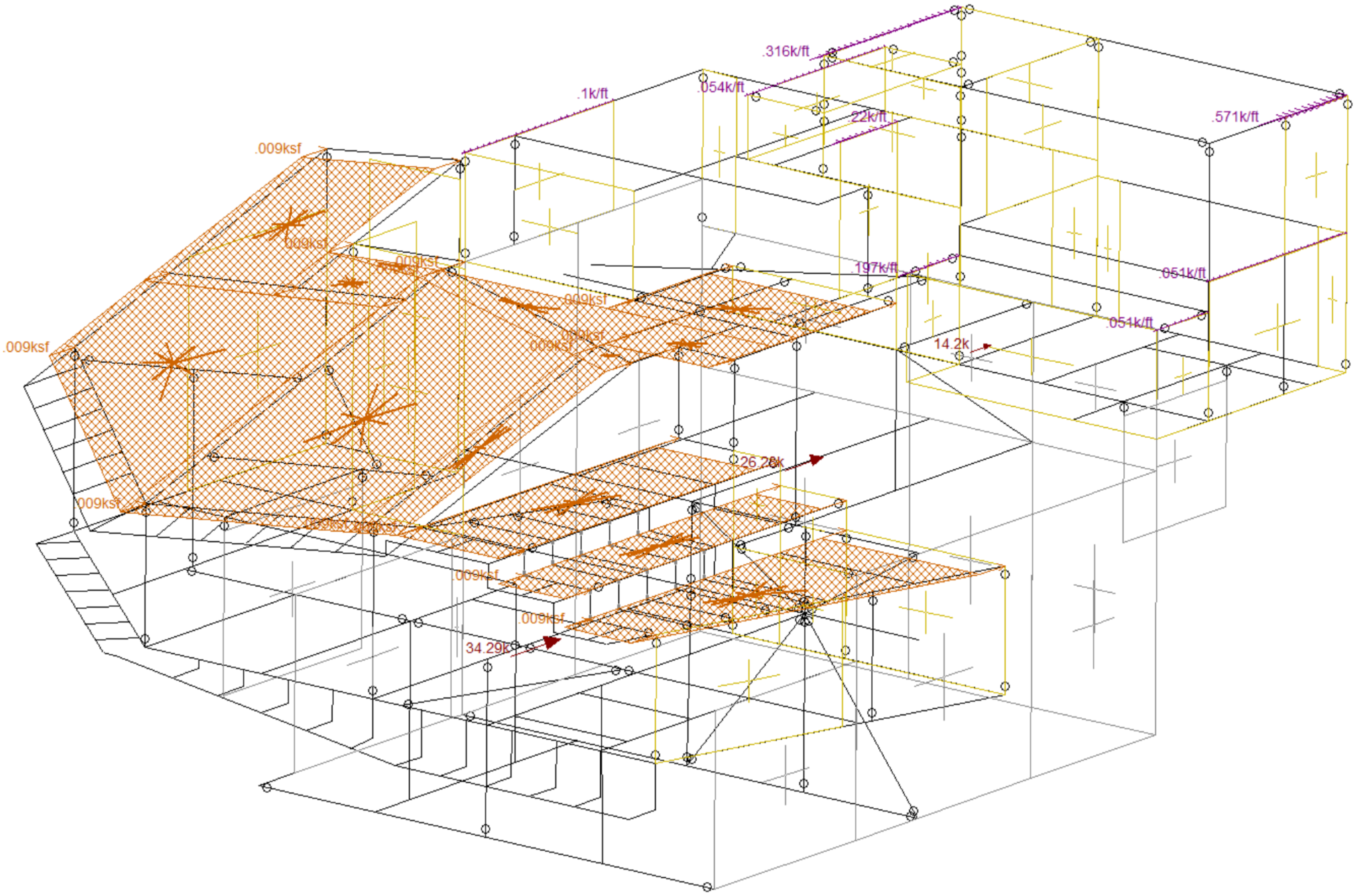
Unbalanced Snow Load per Chapter 2

ASSIGNED UNBALANCED SNOW LOAD-2



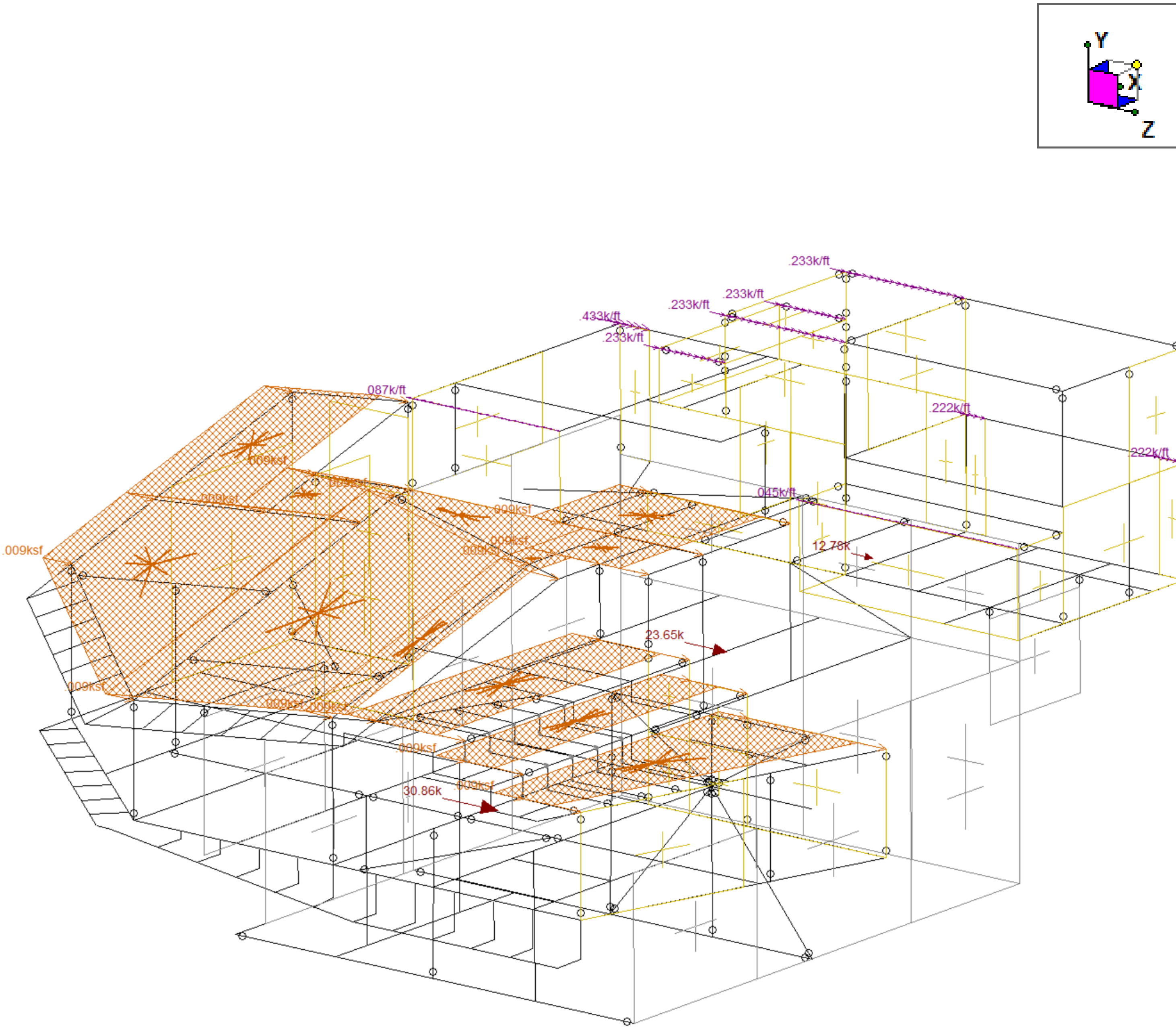
Unbalanced Snow Load per Chapter 2

Assigned EQX Load



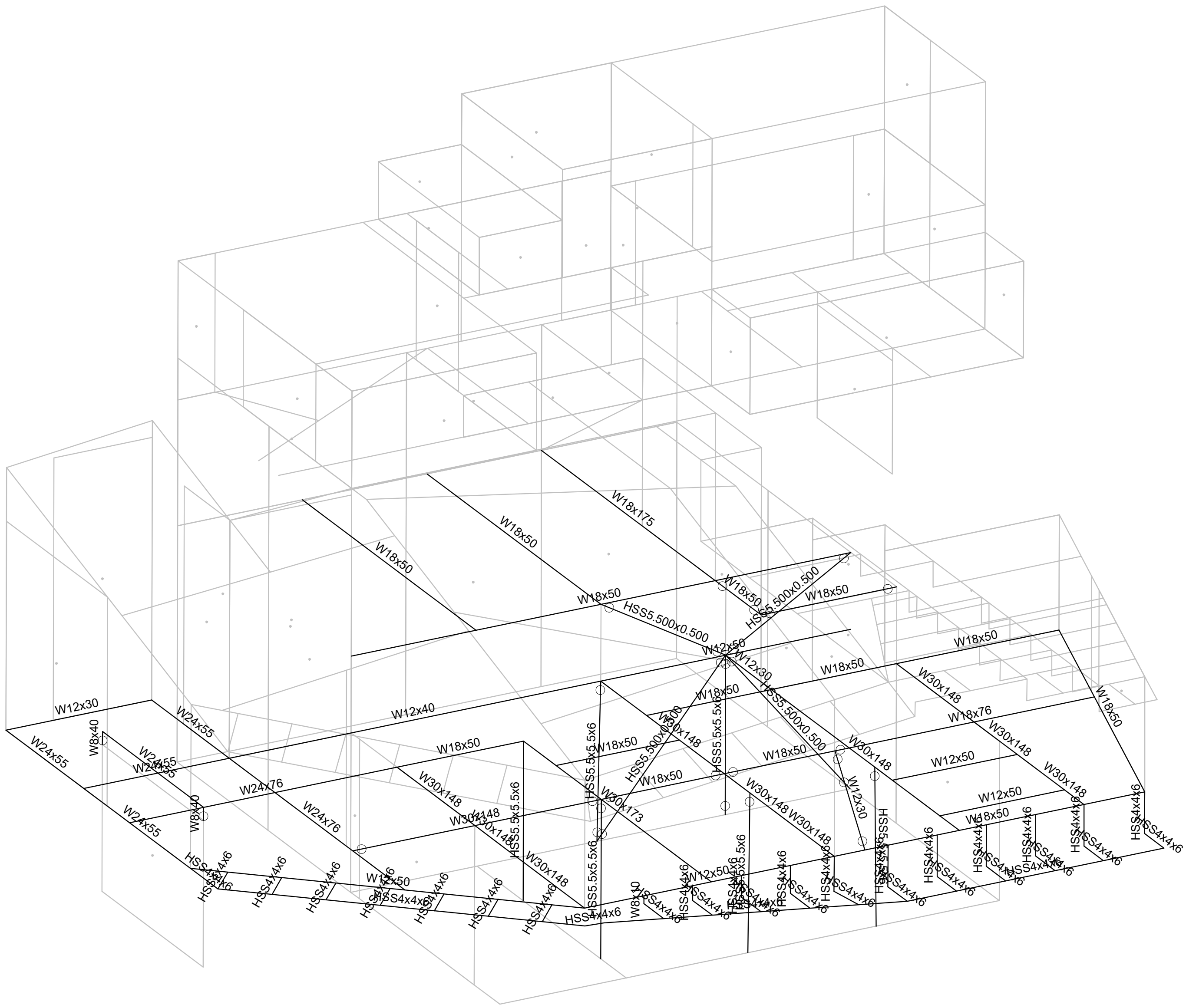
EQX LOAD PER CHAPTER 2

Assigned EQZ Load

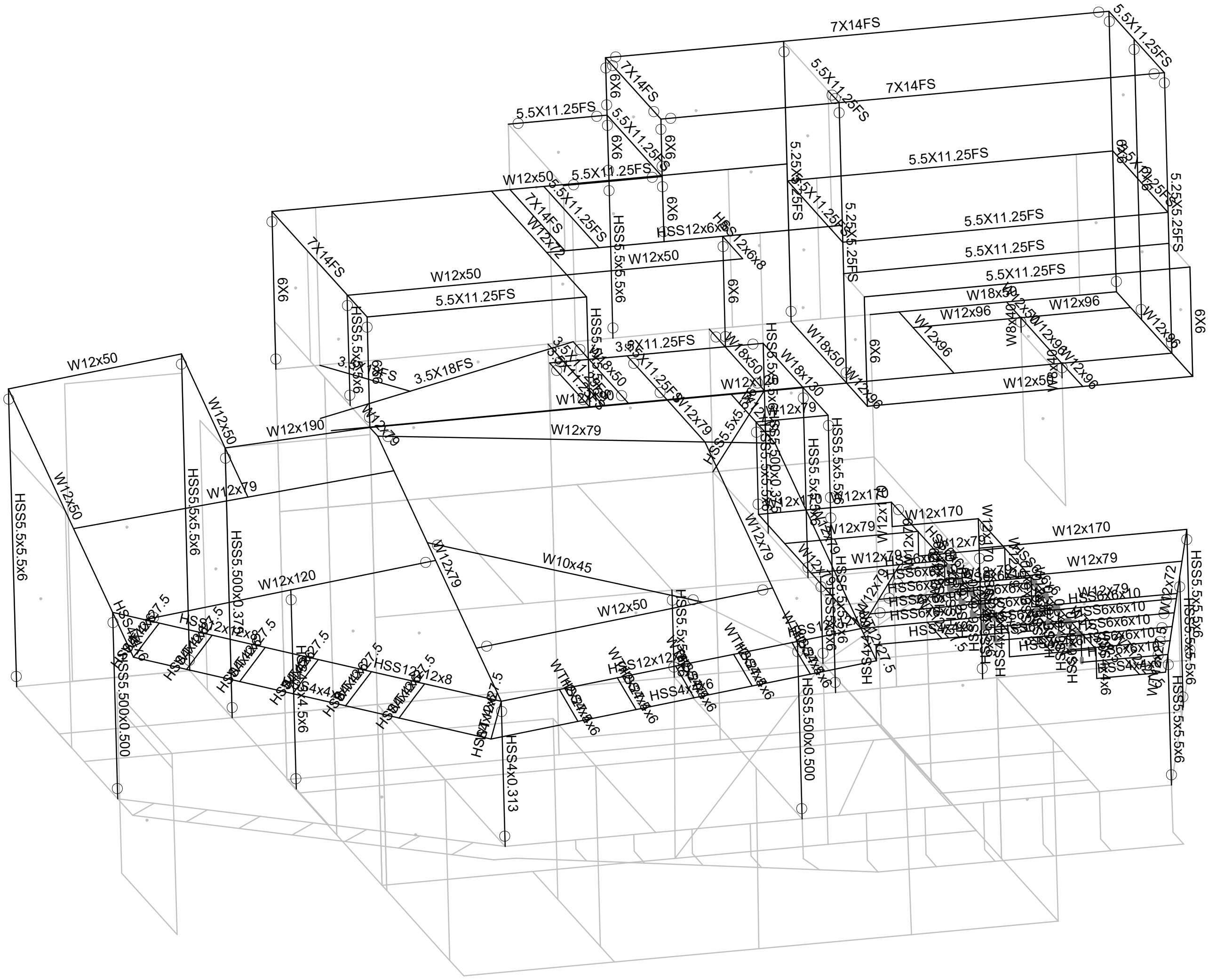


EQZ LOAD PER CHAPTER 2

Assigned Member Sizes- Floor



Assigned Member Sizes- Roof



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...	...	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)	Yes	Y		DL	1	Rho*E...	.7																
20	ASCE ASD 5 (b) (b)	Yes	Y		DL	1	Rho*E...	.7																
21	ASCE ASD 5 (b) (c)	Yes	Y		DL	1	Rho*E...	-.7																
22	ASCE ASD 5 (b) (d)	Yes	Y		DL	1	Rho*E...	-.7																
23	ASCE ASD 6 (b) (a)	Yes	Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	RLL	.75										
24	ASCE ASD 6 (b) (b)	Yes	Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	RLL	.75										
25	ASCE ASD 6 (b) (c)	Yes	Y		DL	1	Rho*E...	-.525	LL	.75	LLS	.75	RLL	.75										
26	ASCE ASD 6 (b) (d)	Yes	Y		DL	1	Rho*E...	-.525	LL	.75	LLS	.75	RLL	.75										
27	ASCE ASD 6 (d) (a)	Yes	Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75								
28	ASCE ASD 6 (d) (b)	Yes	Y		DL	1	Rho*E...	.525	LL	.75	LLS	.75	SL	.75	...	.75								
29	ASCE ASD 6 (d) (c)	Yes	Y		DL	1	Rho*E...	-.525	LL	.75	LLS	.75	SL	.75	...	.75								
30	ASCE ASD 6 (d) (d)	Yes	Y		DL	1	Rho*E...	-.525	LL	.75	LLS	.75	SL	.75	...	.75								
31	ASCE ASD 8 (a)	Yes	Y		DL	.6	Rho*E...	.7																
32	ASCE ASD 8 (b)	Yes	Y		DL	.6	Rho*E...	.7																
33	ASCE ASD 8 (c)	Yes	Y		DL	.6	Rho*E...	-.7																
34	ASCE ASD 8 (d)	Yes	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)

	Description	Sol..	PD..	S...	BLC	F...	BLC	Fac...	BLC	Fa...	BLC	Fa...	BLC	Fa...	...	F......		F......		F......		F......		F...
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																

OVERSTRENGTH DESIGN COMBOS

(Global) Model Settings, Continued

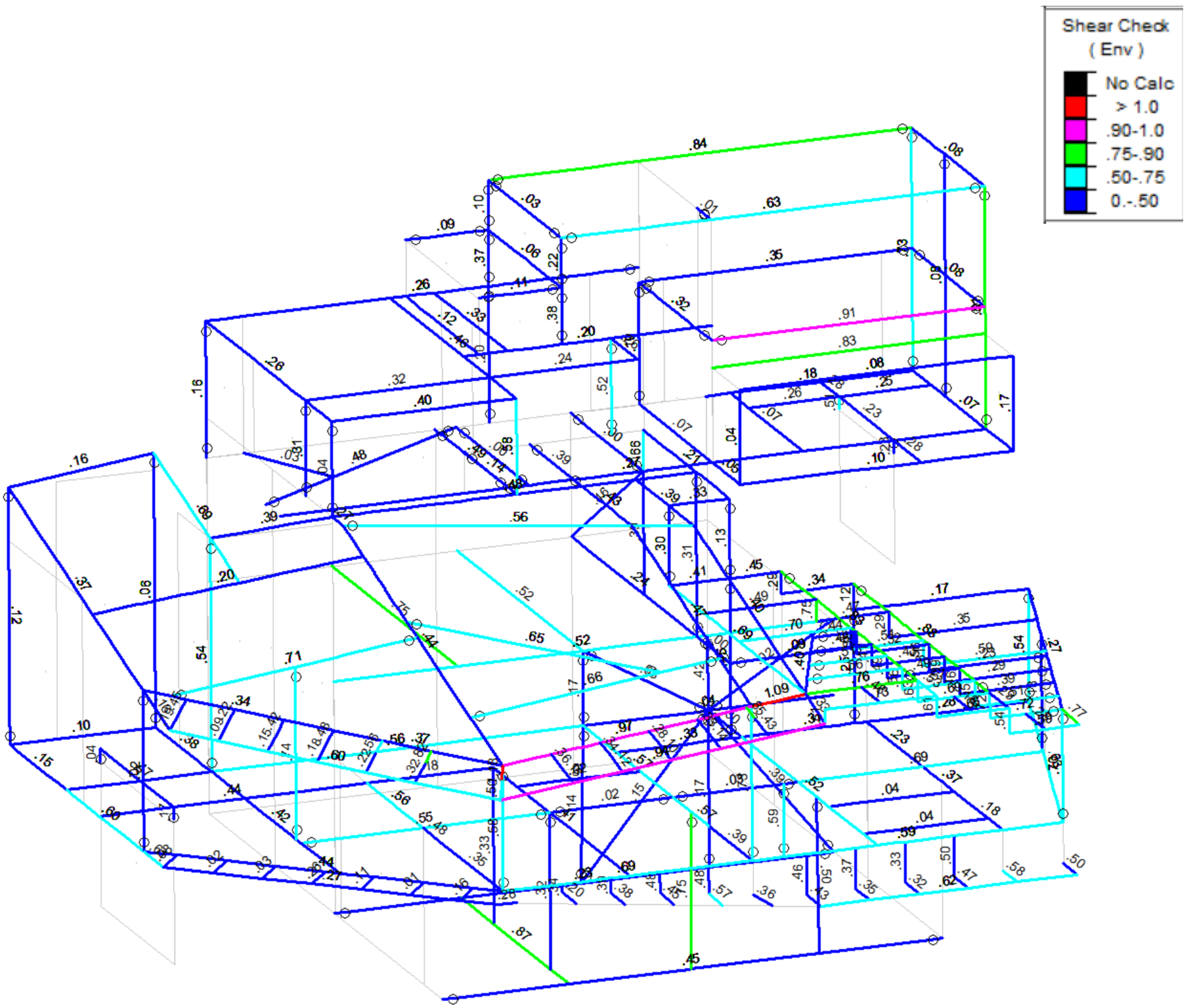
Seismic Code	ASCE 7-10
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	No
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	2.5
Om X	2.5
Cd Z	4
Cd X	4
Rho Z	1.3
Rho X	1.3

RESULTS

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

RESULTS

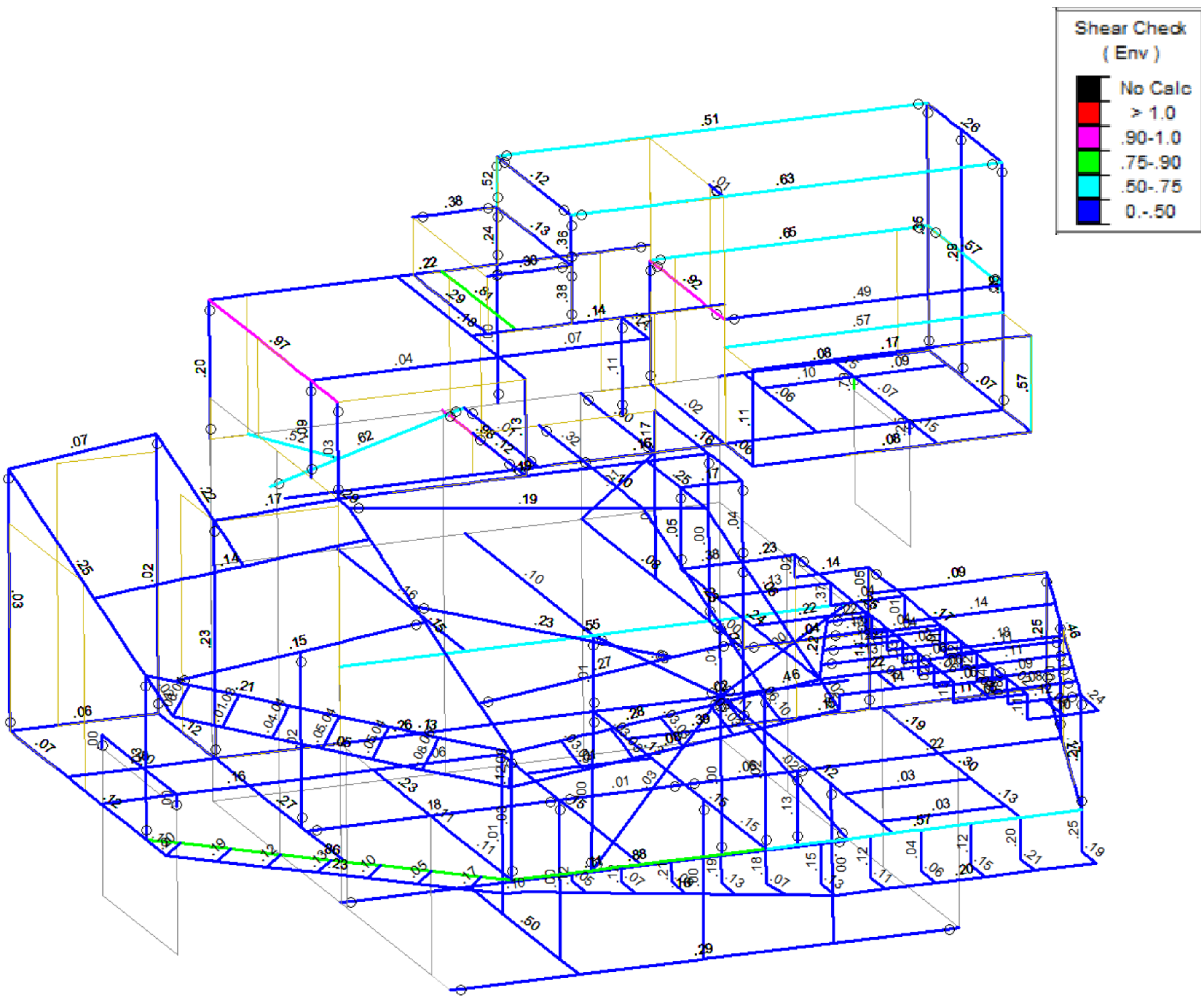
MEMBER UNITY CHECK - ENVELOPE OF GRAVITY LOAD COMBINATIONS (LC1- LC15)



THUS ALL MEMBERS OKAY

RESULTS

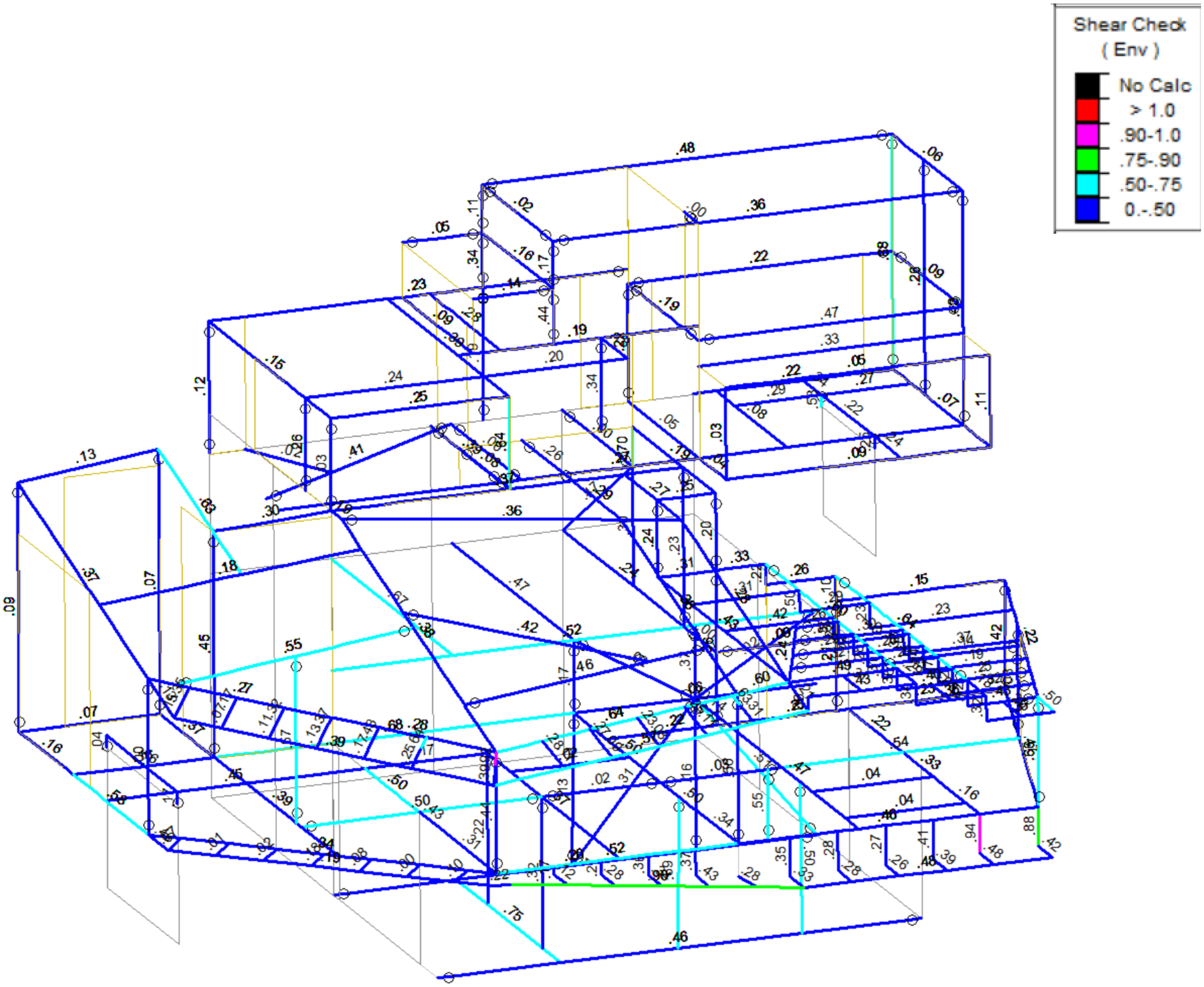
MEMBER SHEAR CHECK - ENVELOPE OF GRAVITY LOAD COMBINATIONS (LC1- LC15)



THUS ALL MEMBERS OKAY

RESULTS

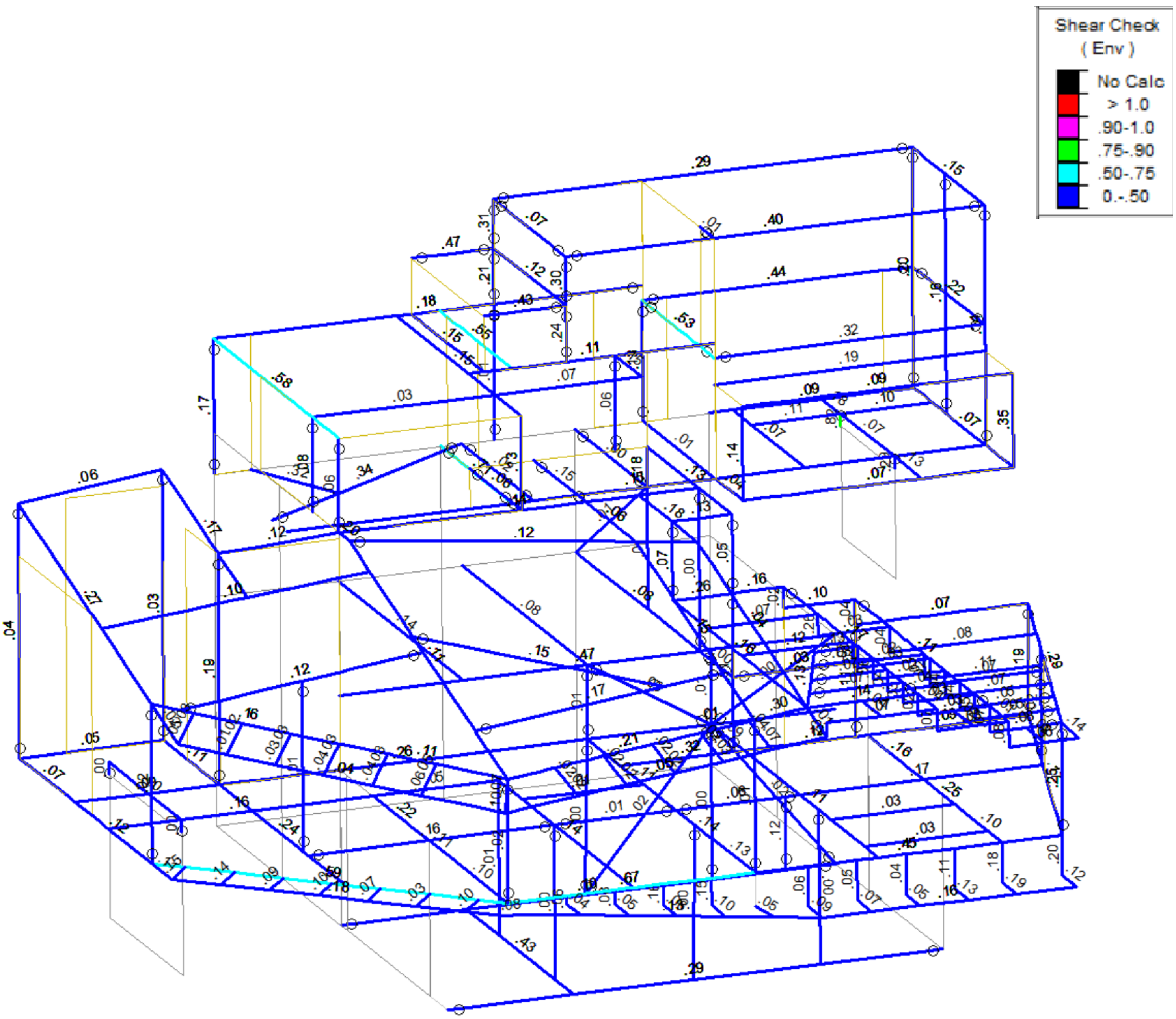
MEMBER UNITY CHECK - ENVELOPE OF LATERAL LOAD COMBINATIONS (LC19- LC34) (RHO=1.3 INCLUDED)



THUS ALL MEMBERS OKAY

RESULTS

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



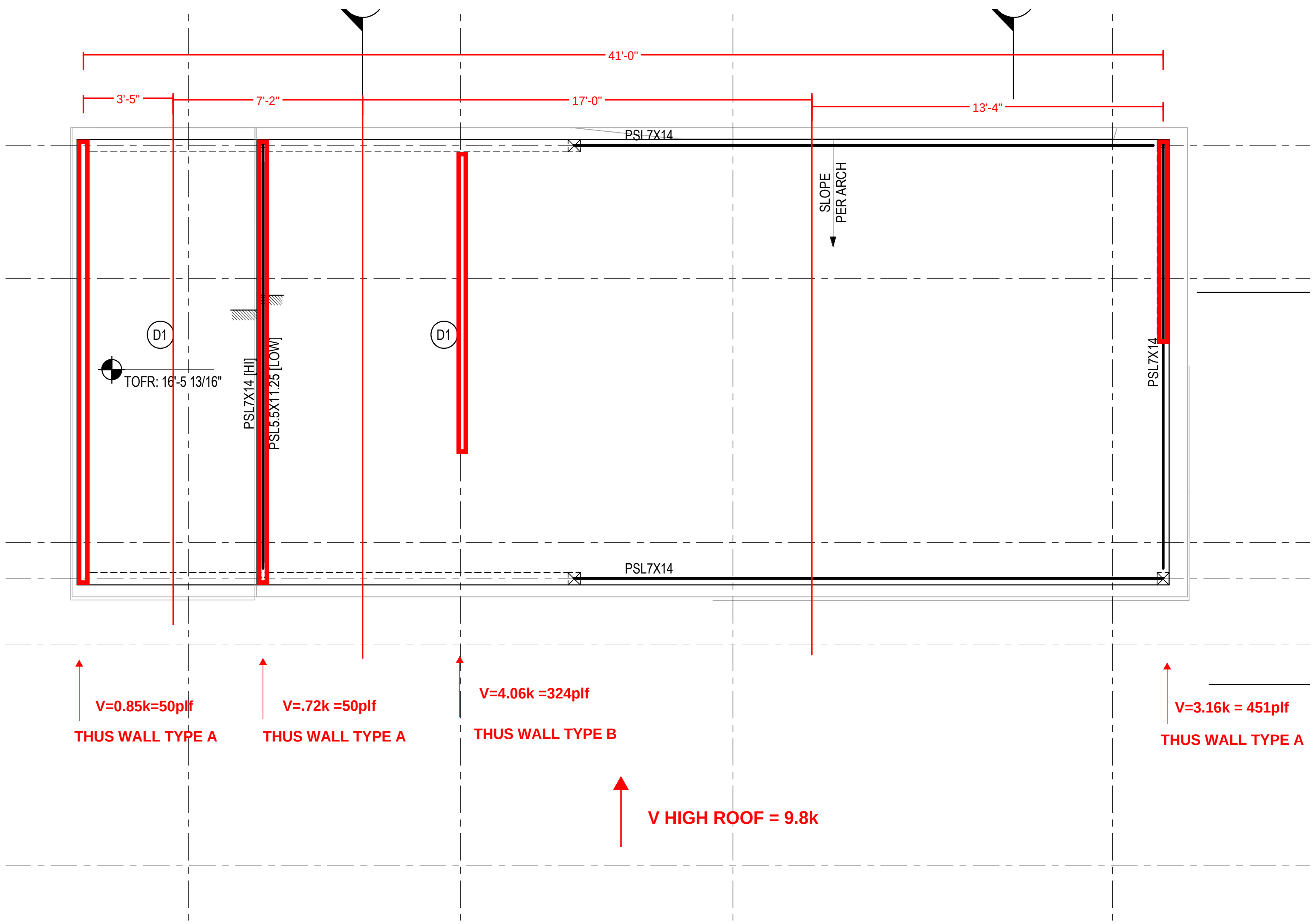
THUS ALL MEMBERS OKAY

NOUS ENGINEERING, INC
600 WILSHIRE BLVD, SUITE 760
LOS ANGELES, CA 90017

RESULTS

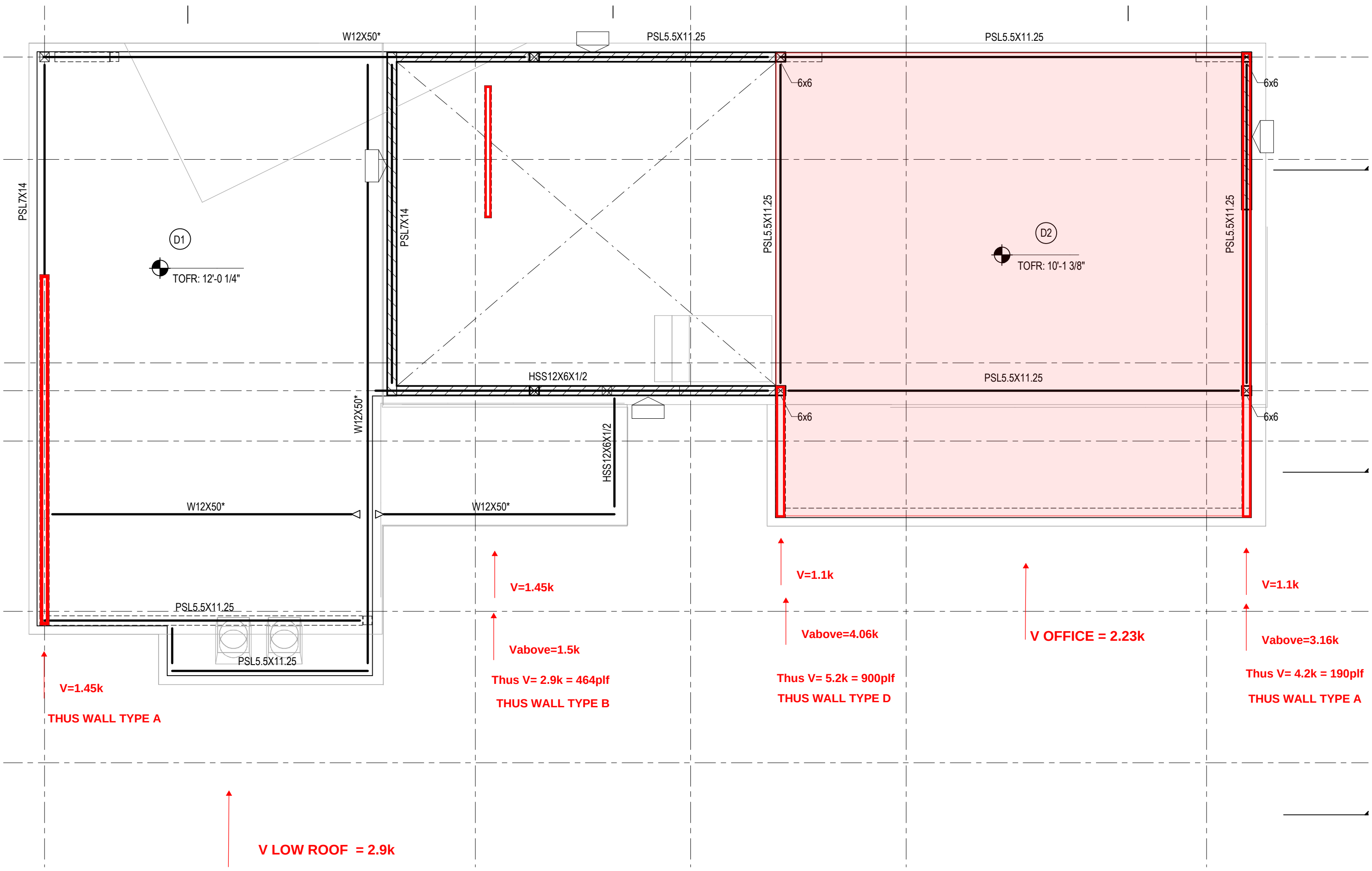
TIMBER SHEAR WALL FLEXIBLE DIAPHRAGM DISTRIBUTION AND CALCULATIONS

HIGH ROOF FRAMING PLAN



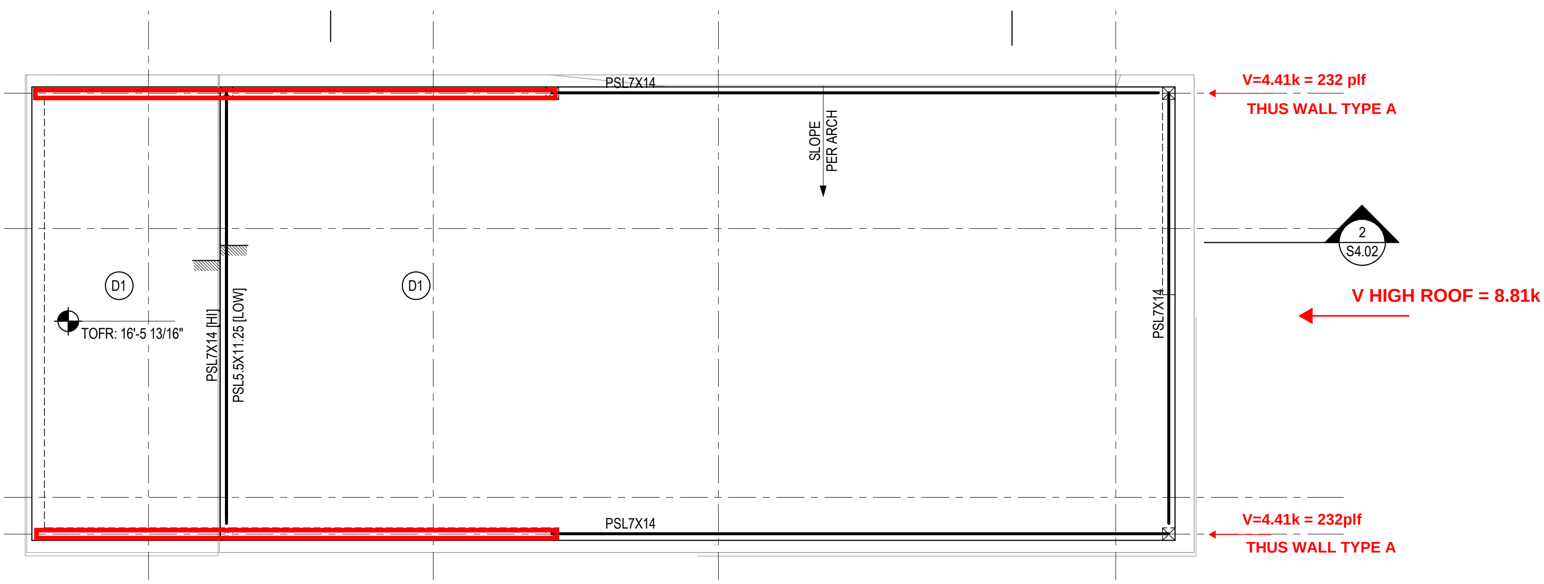
X- DIRECTION

LOW ROOF AND OFFICE FRAMING PLAN



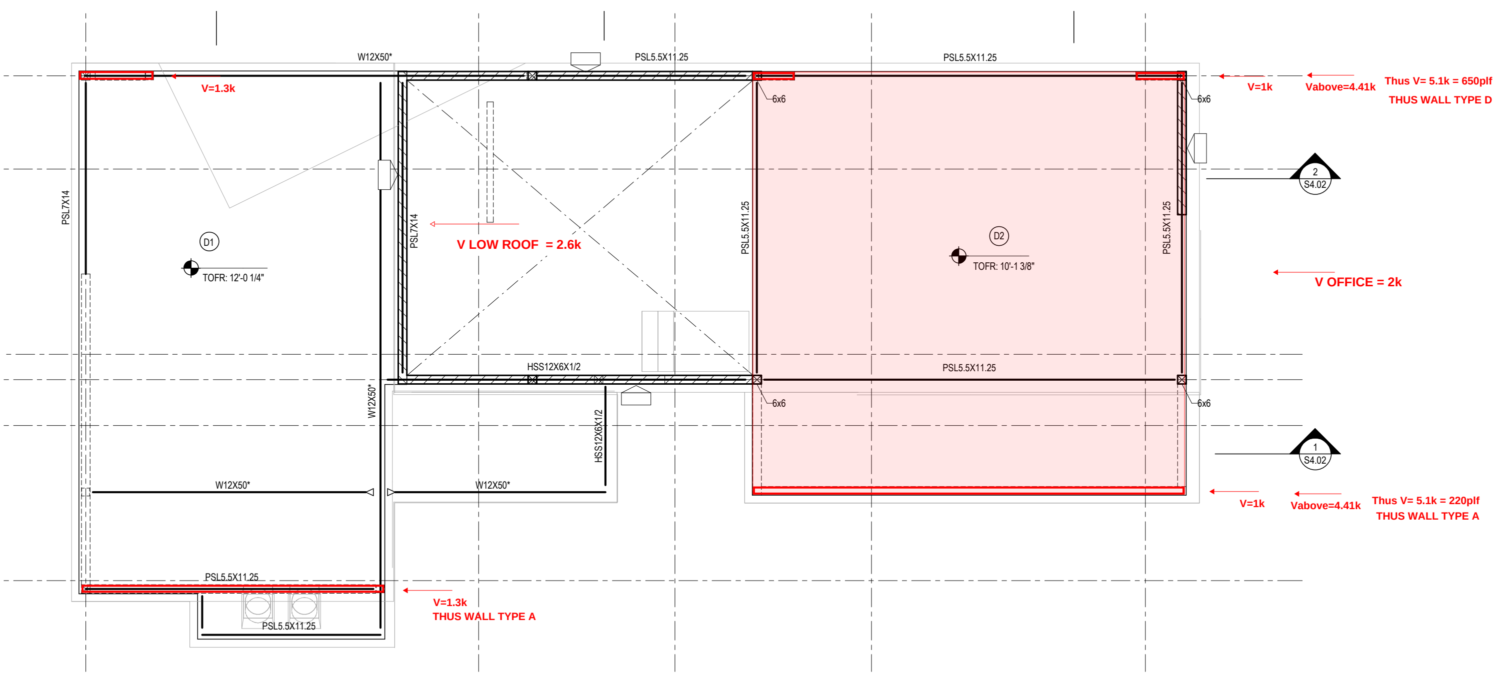
X- DIRECTION

HIGH ROOF FRAMING PLAN



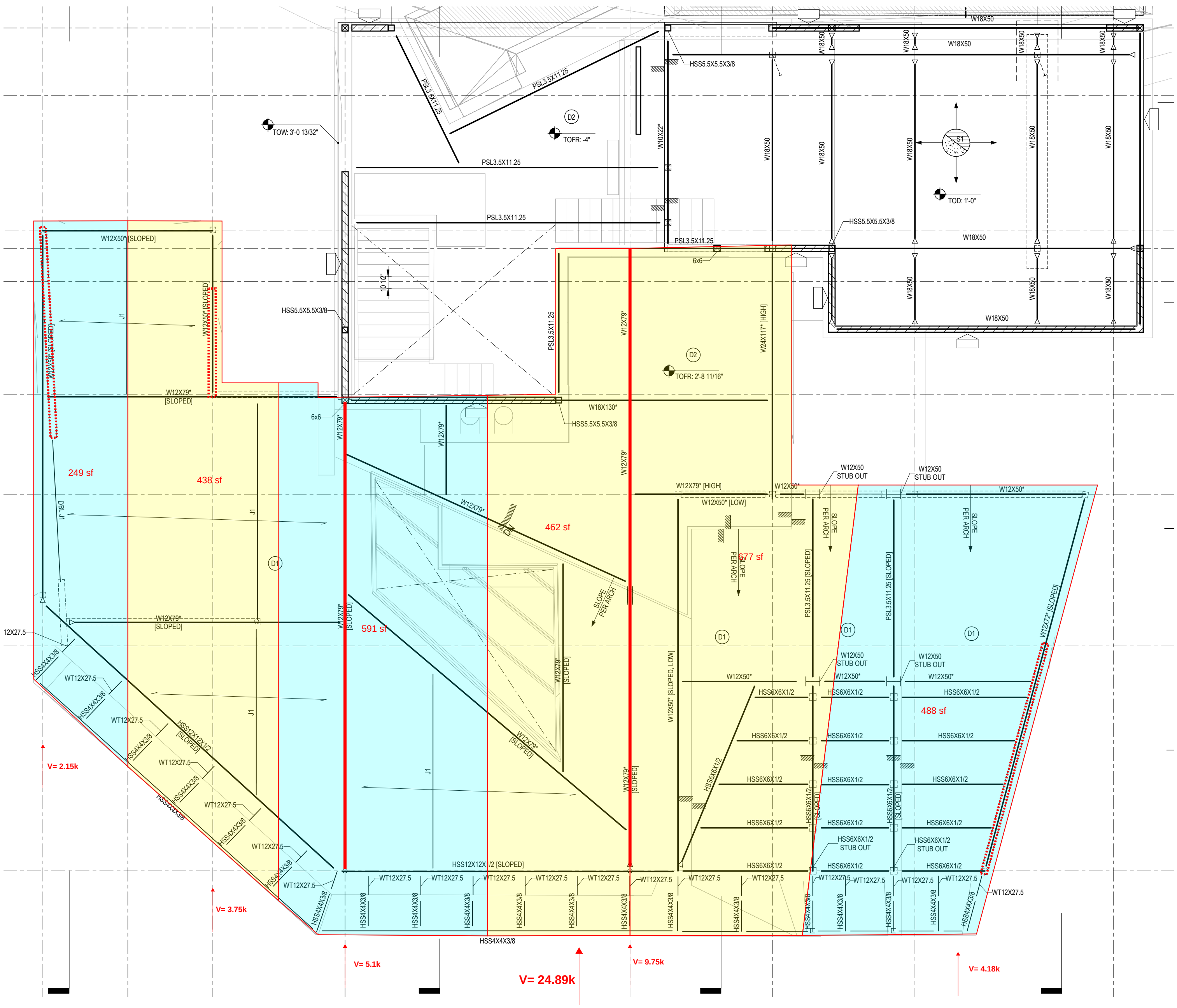
Z- DIRECTION

LOW ROOF AND OFFICE FRAMING PLAN

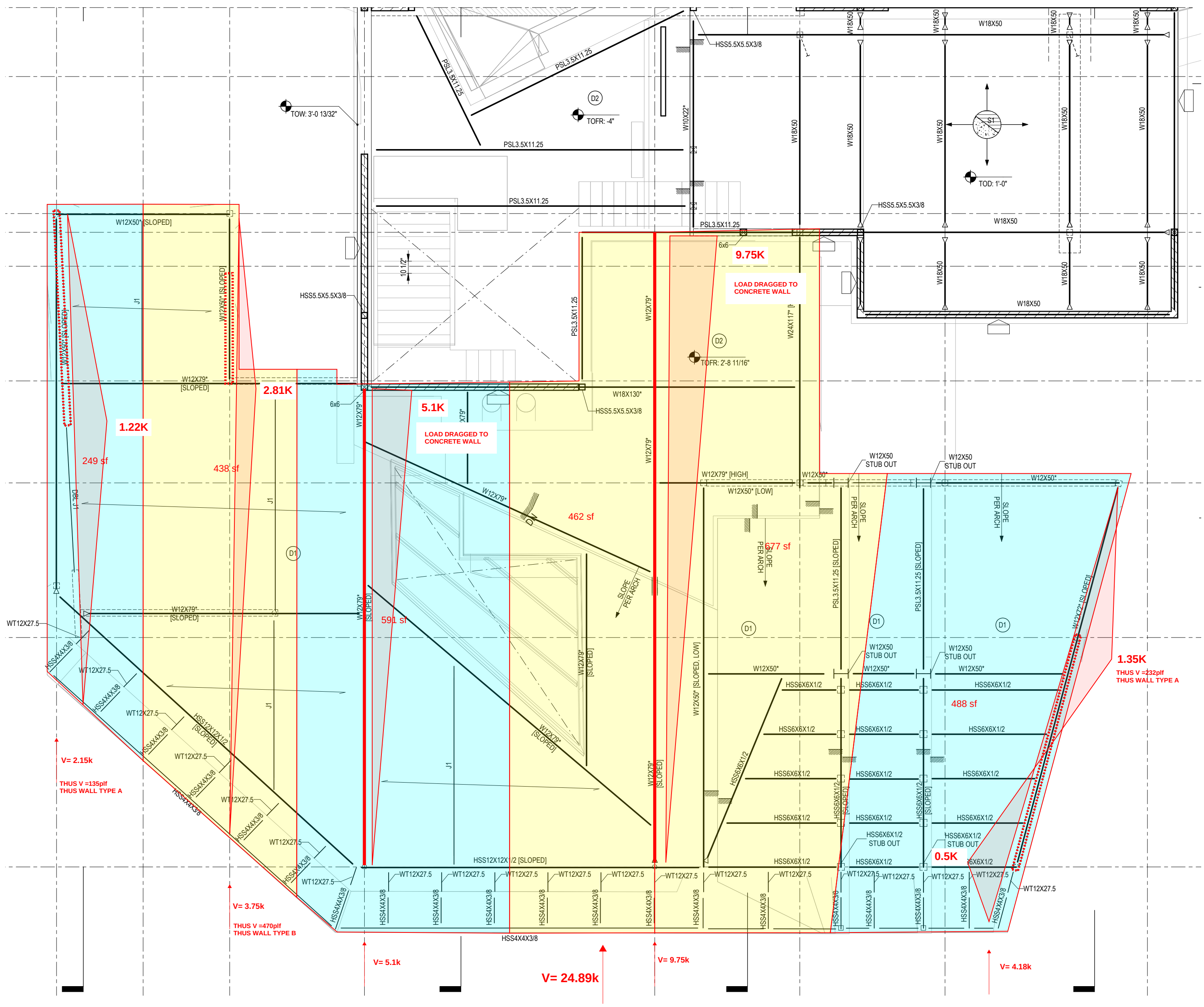


Z- DIRECTION

SLOPED ROOF LATERAL LOAD DISTRIBUTION- X DIRECTION

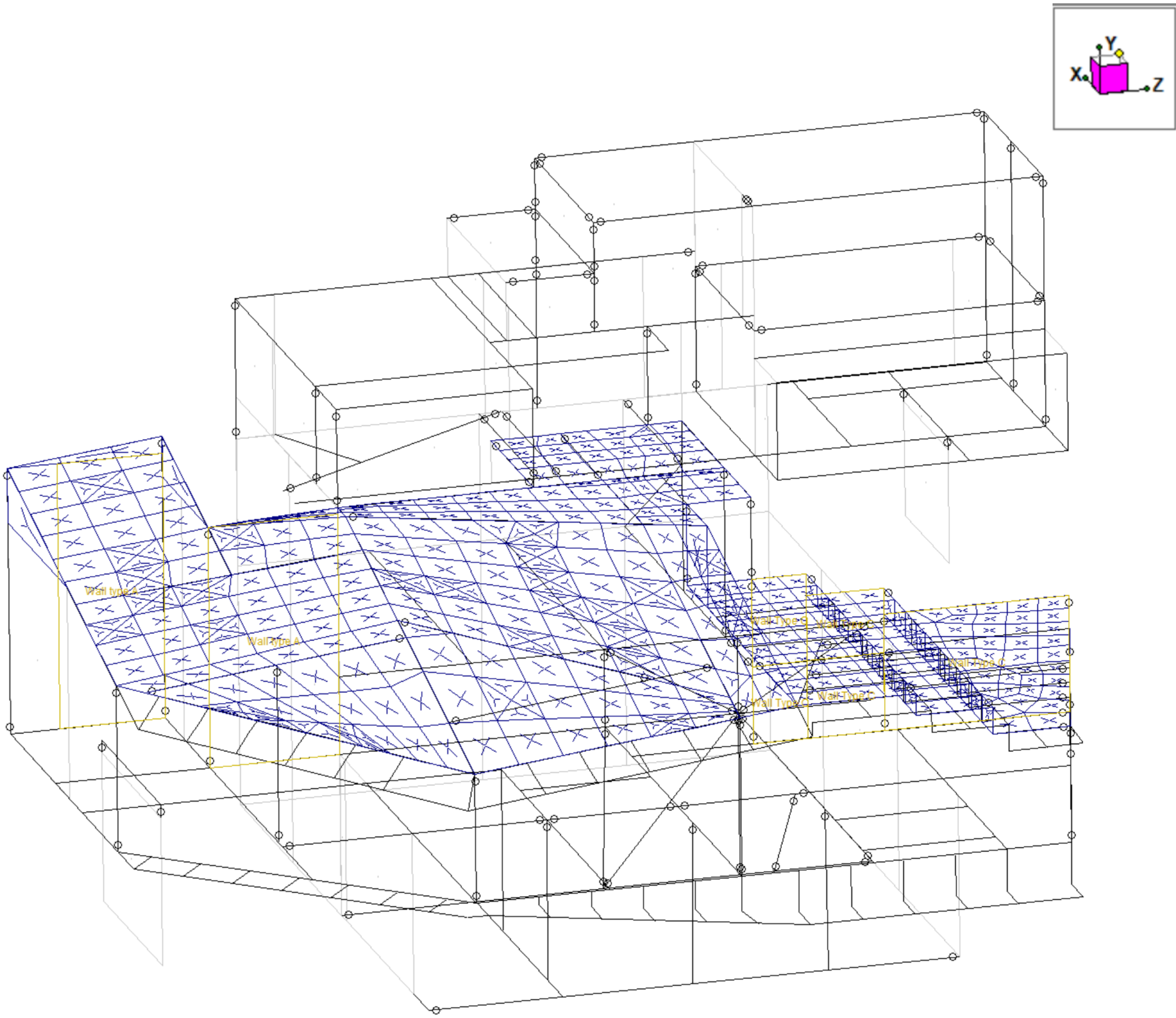


SLOPED ROOF LATERAL DRAG- X DIRECTION

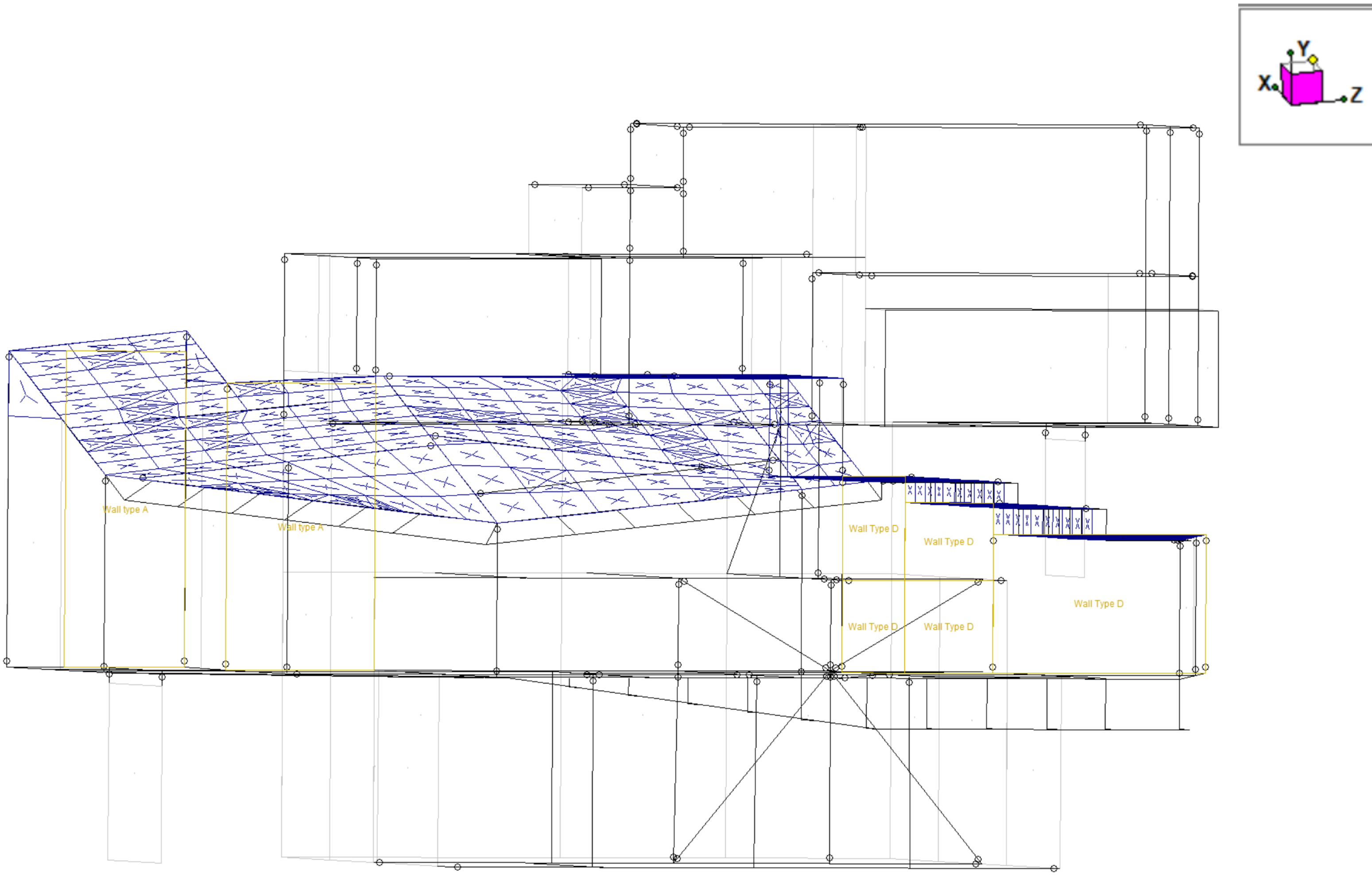


SLOPED ROOF LATERAL LOAD DISTRIBUTION- Z DIRECTION

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

GOVERNONG WALL DETAILED REPORT

Company	: Nous		May 31, 2018
Designer	: MG		4:41 PM
Job Number	:		Checked By:_____
Model Name	: Powder Mountain	WP45I (In-Plane)	

GENERAL

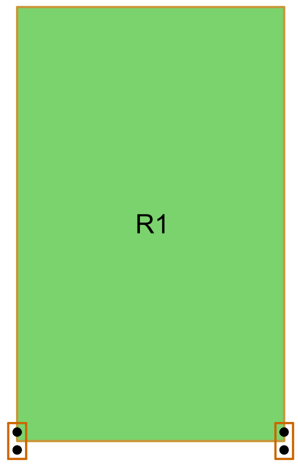
Code	: **AWC NDS-15:ASD**
Design Method	: **Segmented**
Wall Material	: **DF**
Panel Schedule	: **User Selected**
Sel. Shear Panel	: **S1_(2)15/32_10d@2**

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 Pl	**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
R1	**S1_(2)15/32...**	**0.830**	**28 (S)**	**Not Req'd**	**Not Req'd**	**0.988**	**28 (S)**	**N/C**	**N/C**

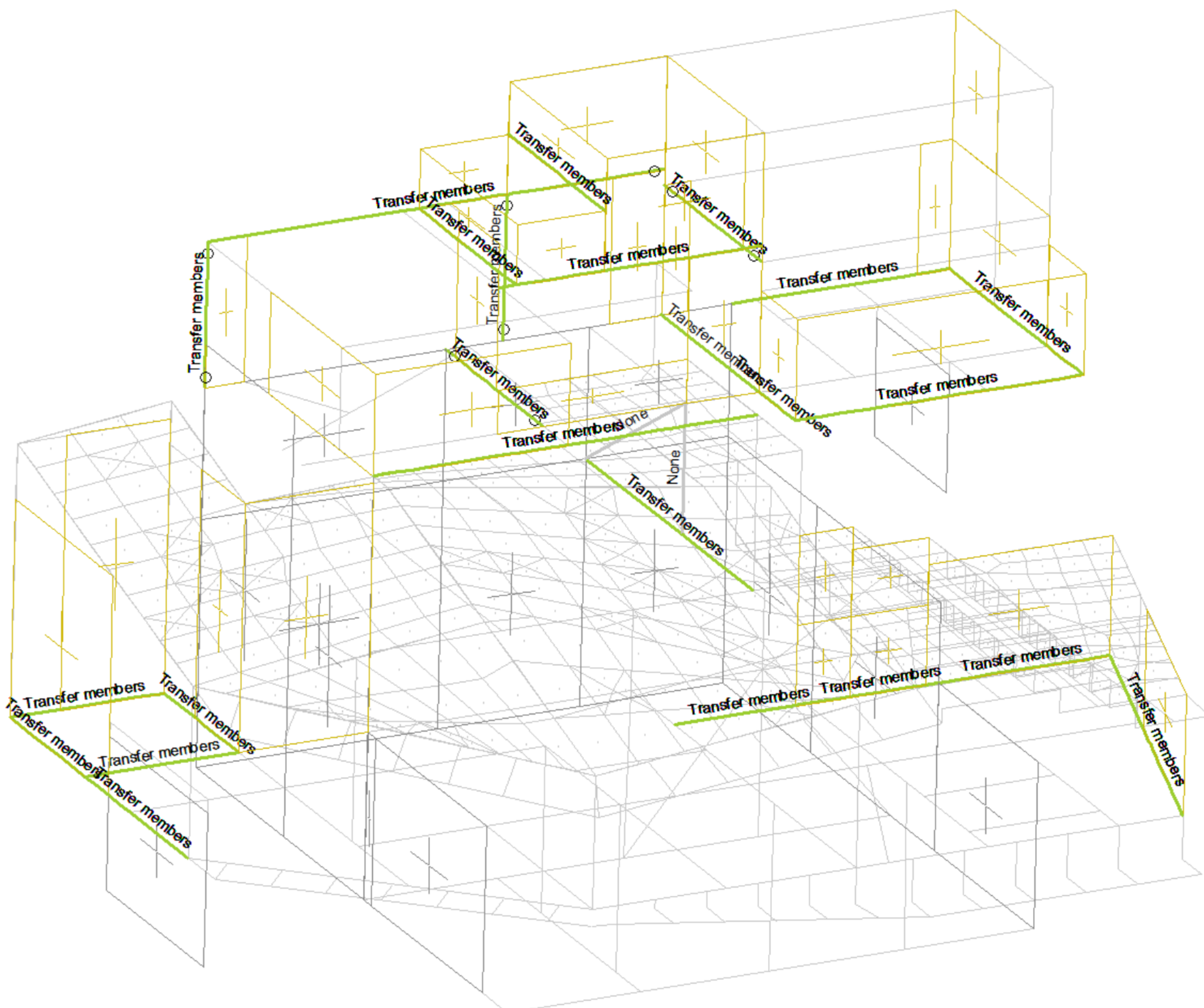
REGION INFORMATION

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

DEFLECTION RESULTS

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

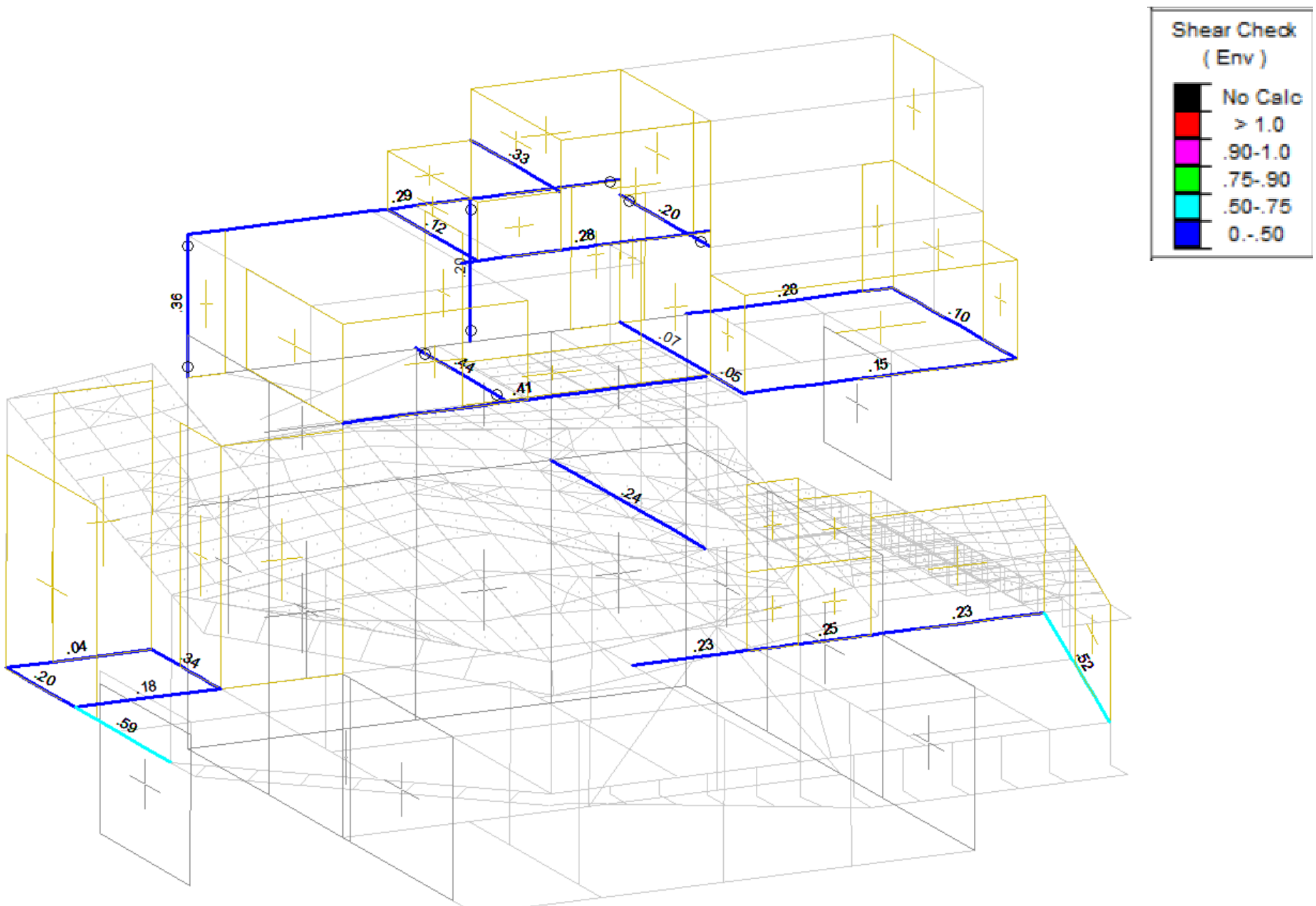
DESIGN OF MEMBERS FOR OVERSTRENGTH (OHM = 2.5)



MEMBERS CHECKED FOR OVERSTRENGTH

RESULTS

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

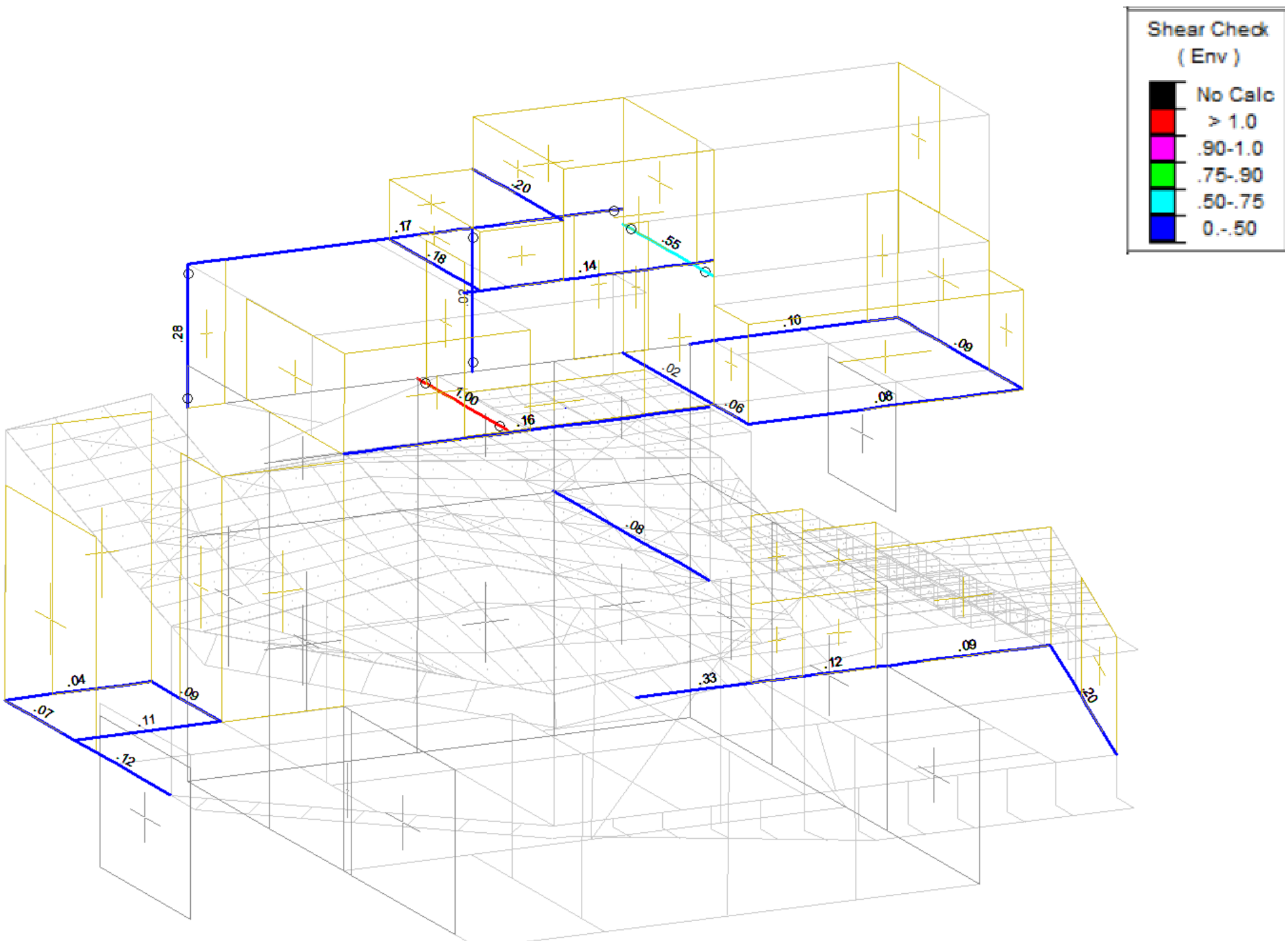


THUS ALL MEMBERS OKAY

NOUS ENGINEERING, INC
600 WILSHIRE BLVD, SUITE 760
LOS ANGELES, CA 90017

RESULTS

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



THUS ALL MEMBERS OKAY

NOUS ENGINEERING	PROJECT :	BEVERLY - SCBF 1	PAGE :
	CLIENT :		DESIGN BY :
	JOB NO. :	DATE :	REVIEW BY :

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

INPUT DATA & DESIGN SUMMARY

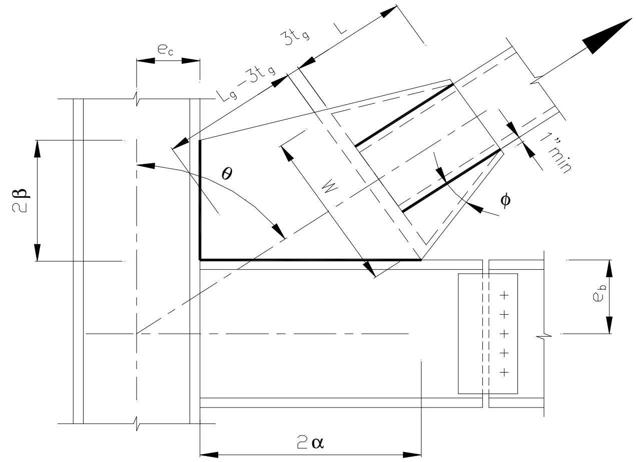
BRACE SECTION (Tube or Pipe) => **HSS5.500X0.500**

Pipe	A	r_{min}	t	D
	7.36	1.79	0.50	5.50

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_E = **44** kips
SEISMIC PARAMETER (ASCE 7-10 11.4.4) S_{DS} = **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_c = **2.75** in
BEAM SECTION e_b = **6** in

LENGTH OF END BRACE TO JUNCTION L_g = 13.994 in
LENGTH OF GUSSET TO COLUMN 2 β = 14.7 in
LENGTH OF GUSSET TO BEAM 2 α = 20.3 in
THE WHITMORE WIDTH W = 11.3 in



2016 CBC Chapter A (DSA or OSHPD) APPLY? **No**

(1/2 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

\> Actual **[Satisfactory]**

Where E_s = 29000 ksi, F_y = **50** ksi

R_y = **1.1** , (AISC 341-16 Table A3.1)

CHECK LIMITING SLENDERNESS RATIO FOR V OR INVERTED-V CONFIGURATIONS (AISC 341 F2.5b)

200 > $K \ell / r$ = 107.4 **[Satisfactory]**

Where K = 1.0 ($KL = L_c$)

DETERMINE FACTORED DESIGN LOADS (CBC 1605.2 & ASCE 7-10 12.4.2.3)

$P_{ut} = 0.9D - \rho Q_E - 0.2 S_{DS} D$ = -50.463 kips (Tension)

$P_{uc} = 1.2D + L + \rho Q_E + 0.2 S_{DS} D$ = 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_{uc} **[Satisfactory]**

Where ϕ_c = 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

$F_{cr} = \{$ $(0.658^{(Fy/Fe)}) F_y$ = 21.50 kis, for $\lambda_c \le 4.71$
$0.877\, F_e$ = N/A kis, for $\lambda_c > 4.71$

DETERMINE CONNECTION DESIGN FORCE (AISC 341 F2.3)

$P_{ut} = \mathrm{MIN}(R_y F_y A_g , P_{max})$ = 108.92 kips (Tension)

Where R_y = 1.1

P_{max} = 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_{MIN} = 0.25 in

(USE w = 0.25 in) < $w_{MAX} = (\phi\, 0.6\, F_u\, t) / (\phi\, 0.707\, F_{EXX})$ = (0.75 x 0.6 x 58 ksi) t / (0.75 x 0.707 x 70 ksi)

[Satisfactory] = 1.1795 t = 0.59 in

(cont'd)

DETERMINE REQUIRED WELD LENGTH (AISC 360 J2.4)

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

= 108.92 / [(4) 0.75 (0.6x70)(0.707x1/2)] = 4.89 in

(USE 5.00 in)

CHECK SHEAR RUPTURE CAPACITY OF SLOTED BRACE

(AISC 360 J4.2)

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

Where ϕ = 0.75 **[Satisfactory]**

F_u = 60 ksi

A_{nu} = 4 t L = 4 x 0.5 x 5 = 10.00 in^2

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

t_g = 1/2 in (USE 0.5 in)

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

$\phi P_n = \phi(0.6F_u)A_{nv}$ = 130.50 kips > P_{ut} **[Satisfactory]**

Where ϕ = 0.75

F_u = 58 ksi (A36 Steel)

A_{nv} = 2 tg L = 2 x 1/2 x 5 = 5.00 in^2

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

$\phi R_n = \phi(0.6F_u)A_{nv} + \phi F_y A_{gt}$ = 130.50 + $\phi F_y A_{gt}$

> P_{ut} = 108.92

[Satisfactory]

GUSSET COMPRESSION CAPACITY (AISC 341 F2.3)

$\phi_c P_n = \phi_c F_{cr} L_w t_g$ = 89.56 kips < 1.1 R_y P_n

Where ϕ_c = 0.9 **[Unsatisfactory]**

K = 1.2 (SEAOC Vol.3 page 40)

$r_g = t_g / (12)^{0.5}$ = 0.14 in

$K L_g / r_g$ < 200 **[Satisfactory]**

$\lambda_c = (K L_g / r_g)(F_y / E)^{0.5}$ = 4.099

F_e = 21.145 ksi (AISC 360 E3)

F_{cr} = 17.653 ksi (AISC 360 E3)

(Gusset Stiffer Reqd, or Increase tg.)

CHECK GUSSET TENSION YIELDING CAPACITY (AISC 360 D2 a)

$\phi_t P_n = \phi_t F_y L_w t_g$ = 182.63 kips > P_{ut}

Where ϕ_t = 0.9 **[Satisfactory]**

F_y = 36 ksi (plate value)

L_w = W = 11.3 in

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

$\phi P_n = \phi\ R_t\ F_u\ A_e$ = 256.04 kips > P_{ut} **[Satisfactory]**

Where ϕ = 0.75

F_u = 60 ksi

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

D / π = 1.75 , for Pipe (AISC 360 Tab. D3.1)

U = MIN(1 - x / L , 0.9) = 0.65 ,(AISC 360 Tab. D3.1.)

$A_n = A_g - 2\ (t_g + 1/8)\ t$ = 6.74 in^2

A_e = U A_n = 4.38 in^2

R_t = 1.3 (AISC 341 Tab. A3.1)

Try Cover Plate 0 x 3 , at Each Sides.

(0 for no cover required)

Region	x	0.5 A_n	x A
HSS	1.75	3.37	5.90
Cover Plate	2.48	0.00	0.00
Σ		3.37	5.90

x = 5.90 / 3.37 = 1.75

U = MIN(1 - x / L , 0.9) = 0.65

A_n = 6.74 + 0.00 = 6.74

A_e = U A_n = 4.38 in^2

Thus, $\phi P_n = \phi\ R_t\ F_u\ A_e$ = 247.51 kips > P_{ut} **[Satisfactory]**

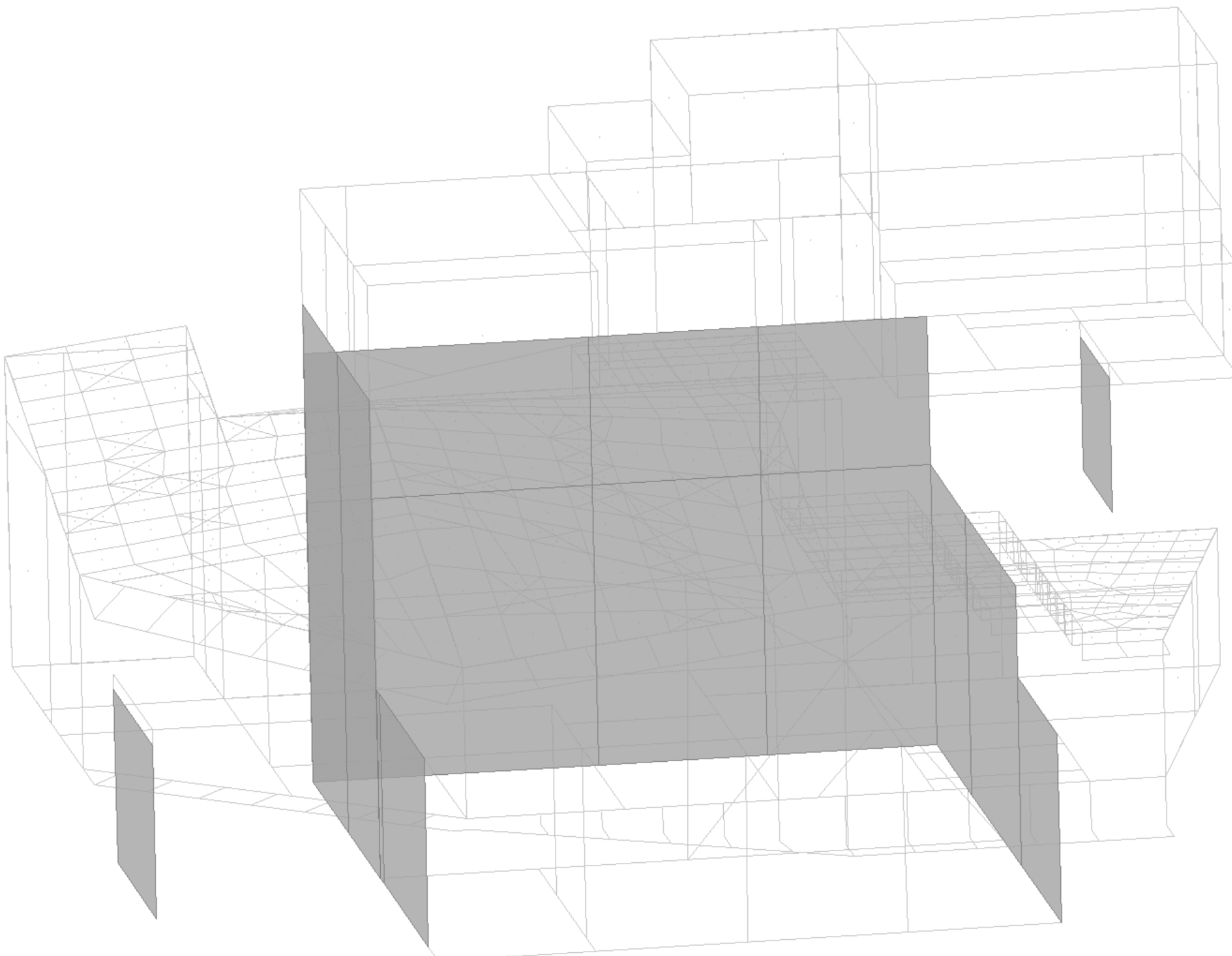
Where F_u = 58 ksi (plate value)

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

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	

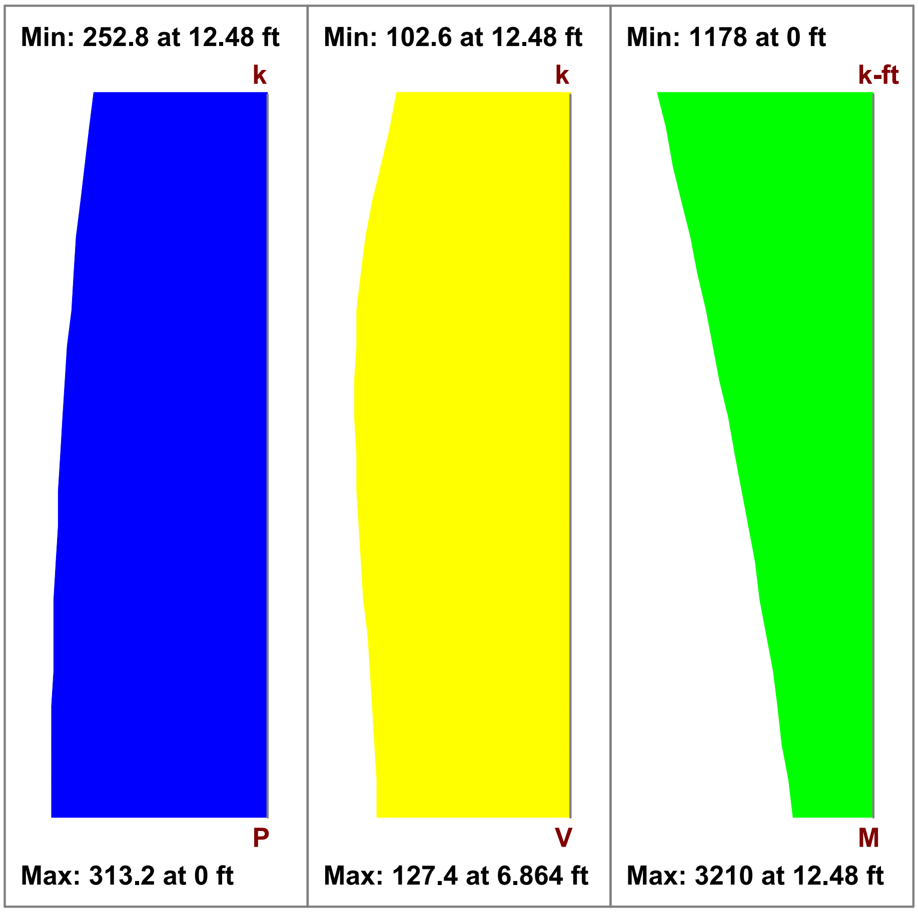
MATERIALS

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	

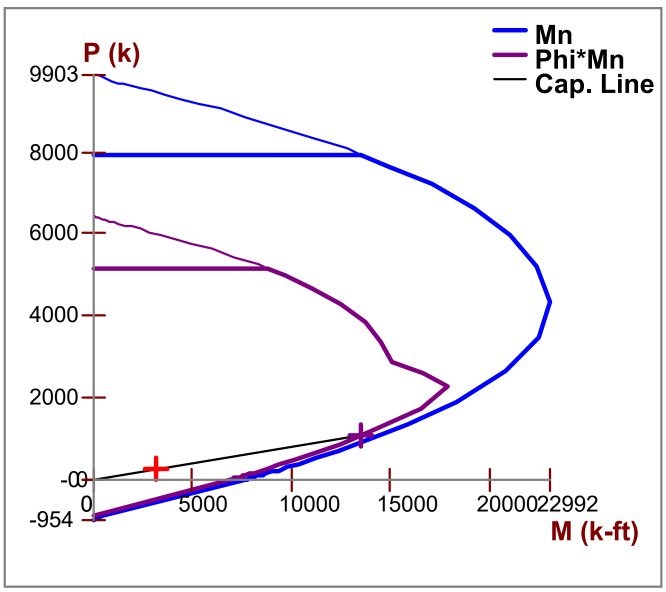
WALL SEGMENT SECTION PROPERTIES

Total Length	: 17.68	ft	r	: 13.695	in	As Provided (H)	: 5.105	in^2
A	: 2121.6	in^2	KL/r	: 10.935		rho Provided (H)	: .0034	
Igross	: 7.9581e+6	in^4				As min (H)	: 3.744	in^2
Icracked	: 397904.892	in^4				rho min (H)	: .0025	
Cracked Mom, Mcr	: 3315.437	k-ft						
						As Provided (V)	: 15.904	in^2
						rho Provided (V)	: .0075	
						As min (V)	: 7.034	in^2
						rho min (V)	: .0033	

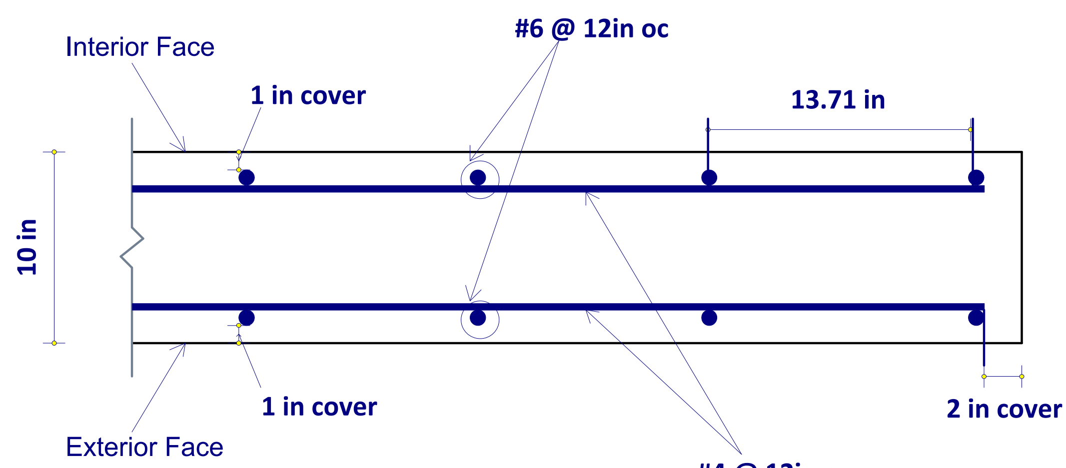
SLENDER BENDING SPAN RESULTS

KL/r in	Cm in	Lu in (ft)	Pc (k)	deltaNS	M act (k-ft)	M2 min (k-ft)	Mc in (k-ft)
10.935	.747	12.48	0	N/A	0	0	N/A

In-Plane Wall Interaction Diagram



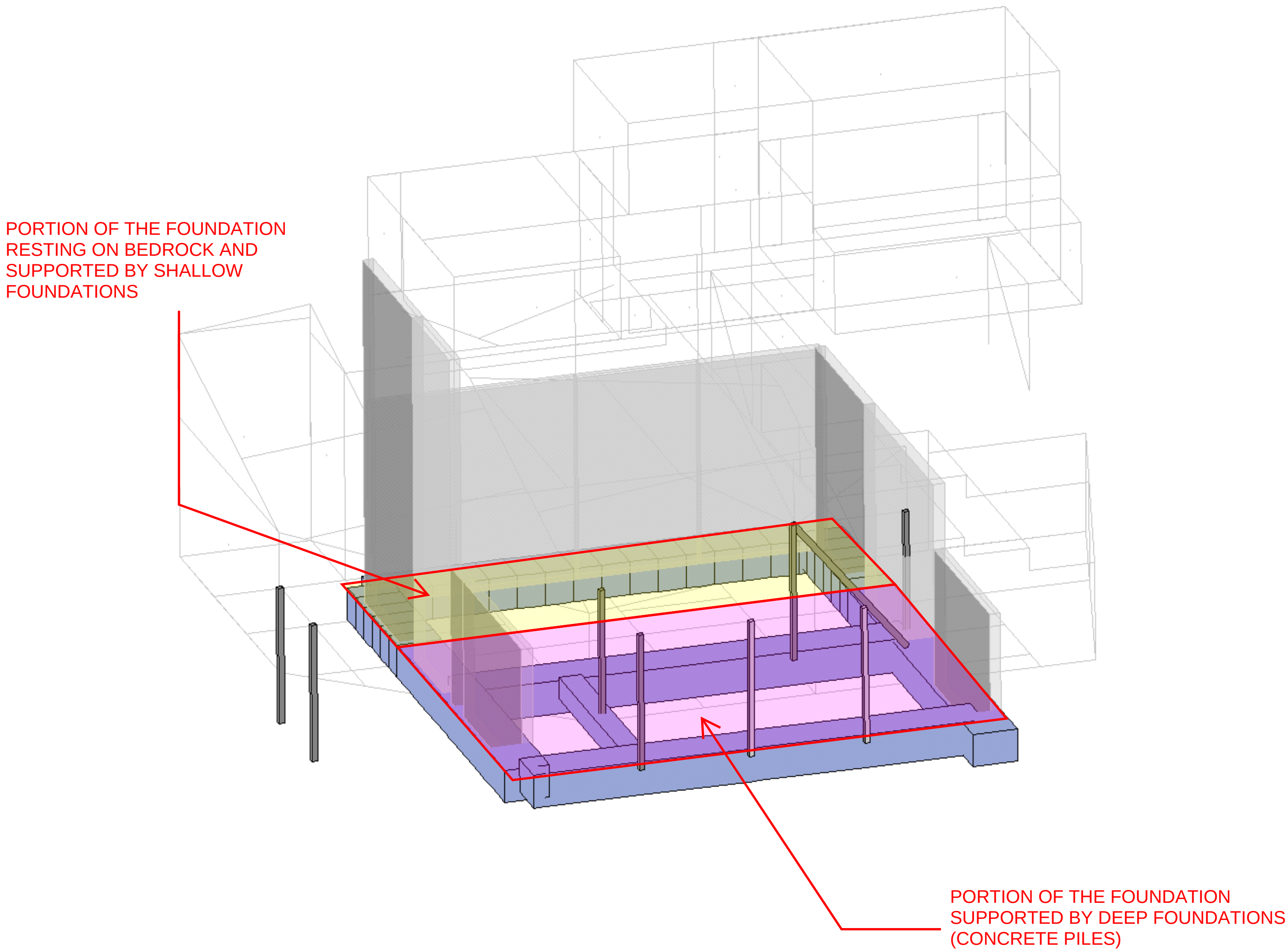
CROSS SECTION DETAILING



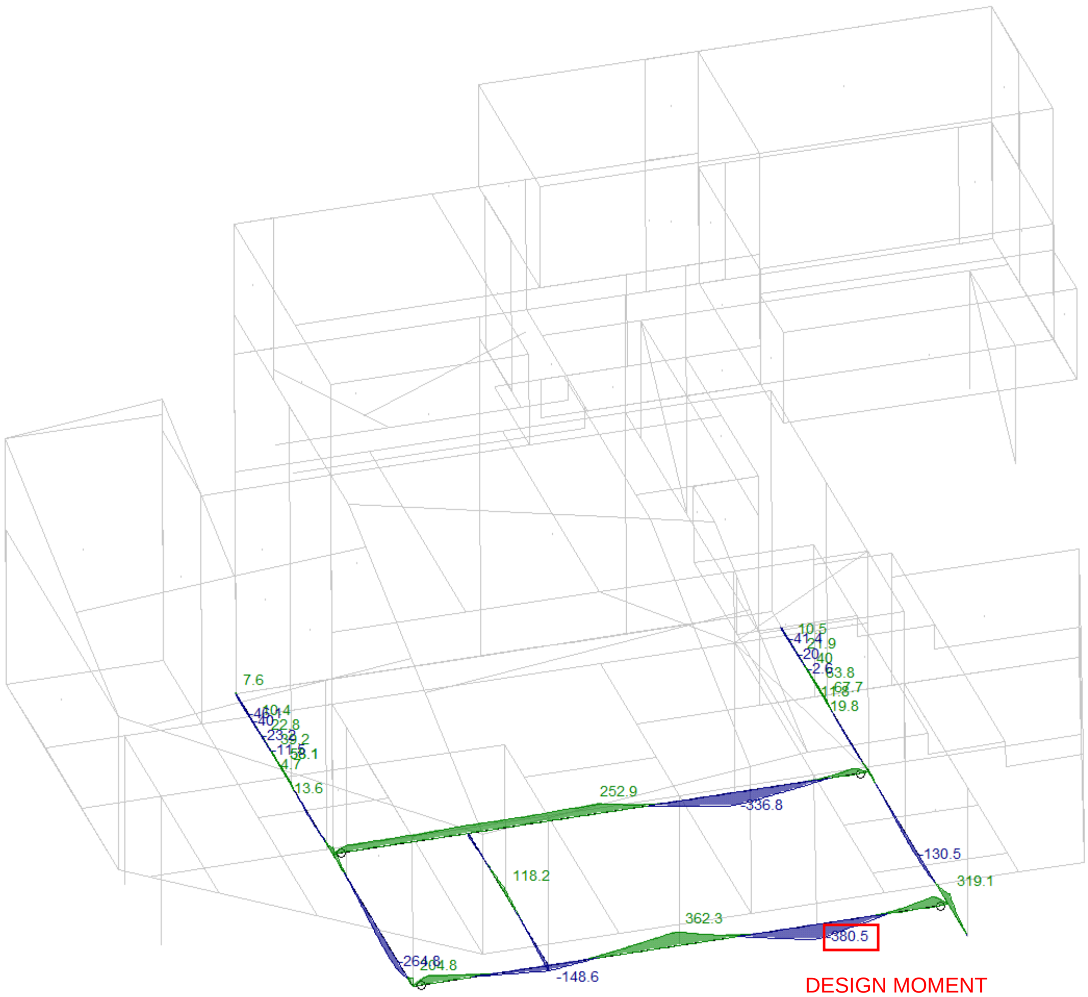
3.1 Foundation Design

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.

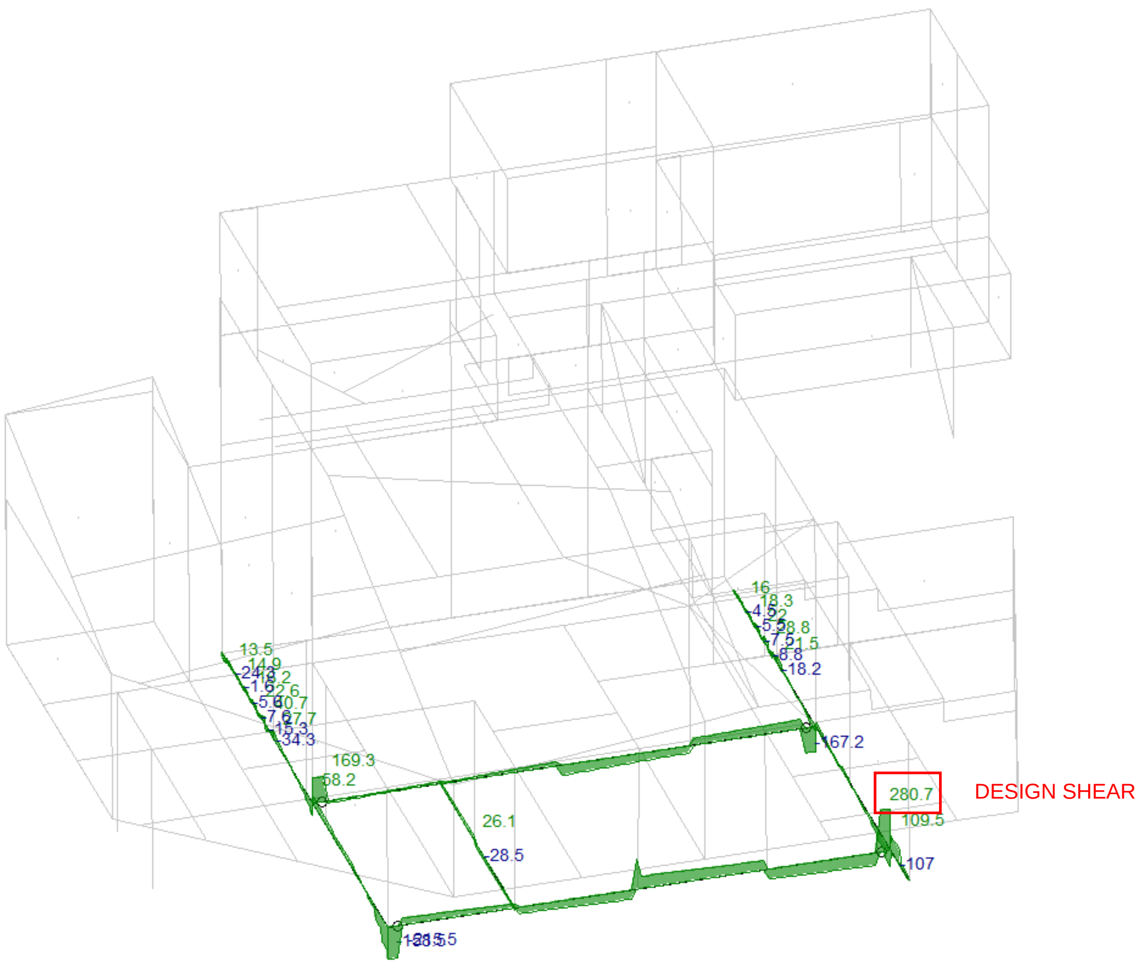
BASE RESULTS



GRADE BEAM DESIGN



GRADE BEAM ENVELOPE MOMENTS FOR LRFD COMBINATIONS



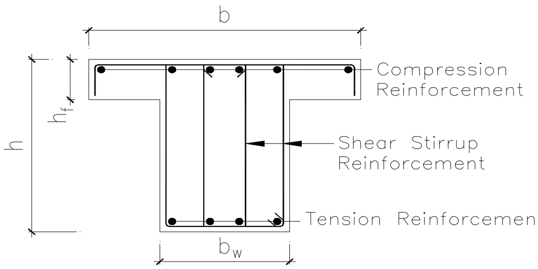
GRADE BEAM ENVELOPE SHEAR FOR LRFD COMBINATIONS

GRADE BEAM DESIGN

NOUS ENGINEERING	PROJECT :			PAGE :	
	CLIENT :			DESIGN BY :	
	JOB NO. :		DATE :	REVIEW BY :	

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

INPUT DATA & DESIGN SUMMARY



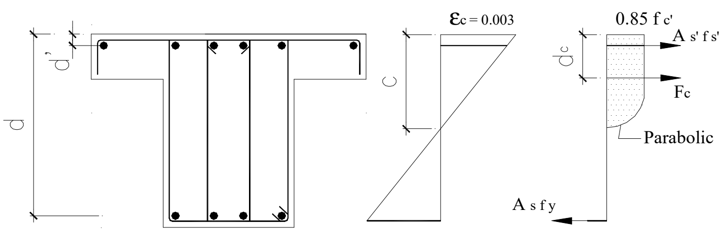
CONCRETE STRENGTH		f'_c =	5	ksi, (34 MPa)
REBAR STRENGTH	MAIN	f_y =	60	ksi, (414 MPa)
	STIRRUP	f_y =	60	ksi, (414 MPa)
FACTORED BENDING MOMENT		M_u =	370	ft-kips, (502 kN-m)
FACTORED SHEAR FORCE		V_u =	280	kips, (1246 kN)
FACTORED TORSIONAL MOMEN		T_u =	0	ft-kips, (0 kN-m)
SECTION DIMENSIONS		b_w =	36	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



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

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

$$f_s = \begin{cases} \varepsilon_s E_s\ , & for\ \ \varepsilon_s \leq \varepsilon_t \\ f_y\ , & for\ \ \varepsilon_s > \varepsilon_t \end{cases}$$

Cover =	1.5	in, (ACI 318 20.6.1)	$\rho_{prov'd}$ =	0.0039	< ρ_{max} =	0.0272 , (ACI 318 9.3.3.1)
d =	33.50	in			> ρ_{min} =	0.0035 , (ACI 318 9.6.1)
d' =	2.50	in			[Satisfactory]	
ϕ =	0.90	, (ACI 318-14 21.2)	c =	4.65	in, by pure math method	
$\varepsilon_{c,max}$ =	0.0008		F_c =	233.23	kips	
$\varepsilon_{s,max}$ =	0.0050	, (ACI 318-14 21.2.2)	d_c =	1.66	in	

ϕM_n = 695.07 ft-k > M_u **[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 kips **[Satisfactory]**

where ϕ = 0.75

Determine concrete capacity (ACI 22.5.5.1)

$$V_C = 2 b_w d\sqrt{f'_c} =$$ 170.55 kips

$$V_C = (1.9A + 2500\rho_w B) b_w d =$$ 173.88 kips ,<== 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 shear reinforcement (ACI 22.5)

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

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

Check spacing limits for shear reinforcement (ACI 22.6.9.5)

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

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

[Satisfactory]

(cont'd)

CHECK TORSION CAPACITY

Check section limitation (ACI 22.7.7.1)

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

where ϕ = 0.75 (ACI 21.2)

P_h = 130 in, (perimeter of centerline of outermost closed transverse torsional reinforcement.)

A_{oh} = 1,056 in^2 (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)

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

where b_e = 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^2 (area enclosed by outside perimeter of concrete cross section.)

0.0 < 51.5 ft-k

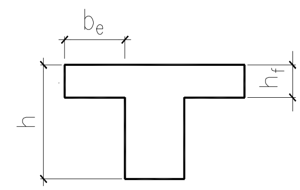
Torsional reinforcement NOT reqD.

Check the max factored torque causing cracking (ACI 22.7.3.2)

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

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)

$$\frac{A_t}{s}=\frac{T_u}{2\phi A_0 f_{yv}}=\frac{T_u}{1.7\phi A_{0h} f_{yv}}=$$ 0.00 in^2 / ft < actual = 0.4 **[Satisfactory]**

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

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

Determine minimum combined area of longitudinal reinforcement

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

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

Determine minimum diameter for longitudinal reinforcement (ACI 25.7.1.2)

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

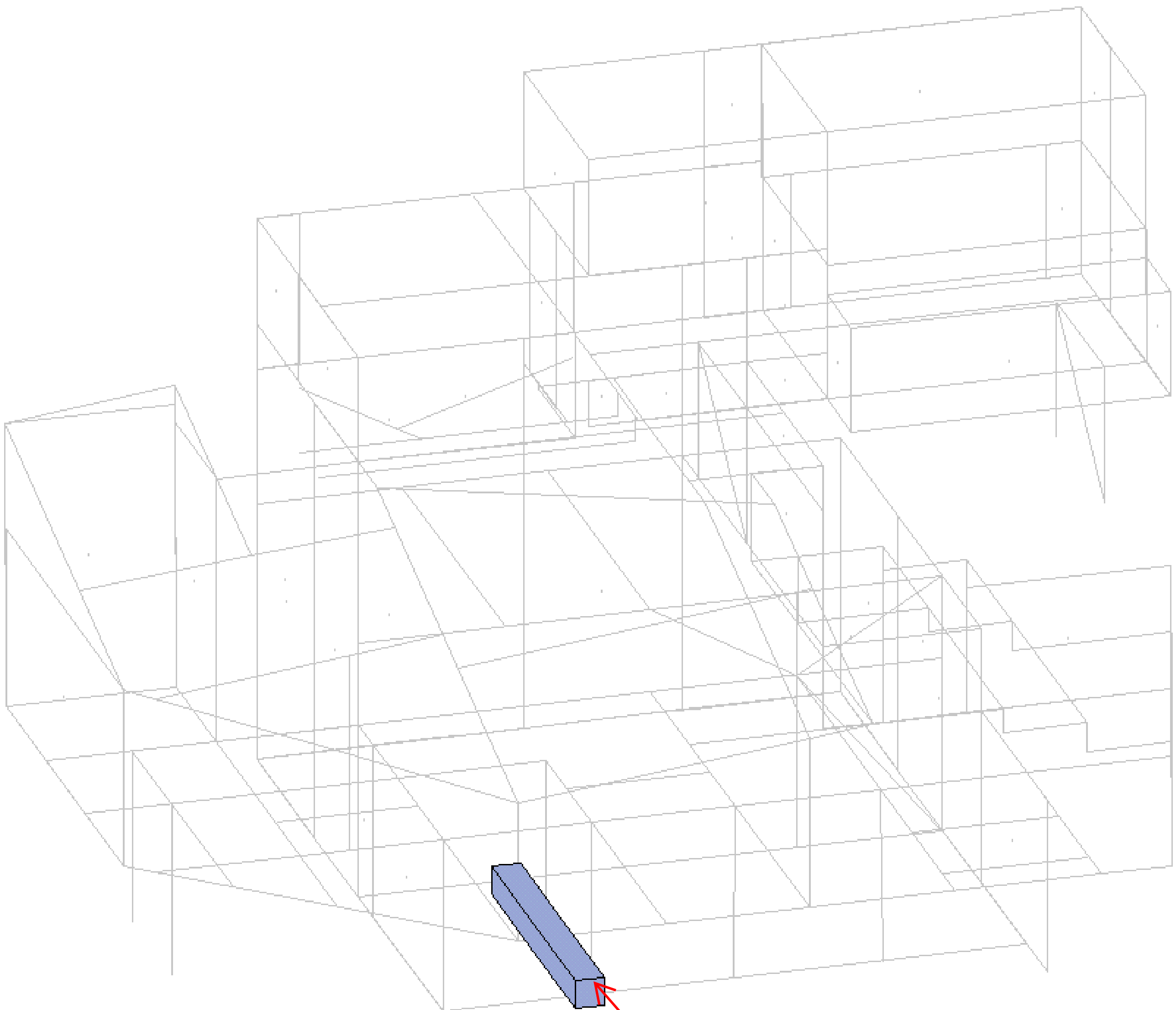
Determine minimum combined area of stirrups (ACI 9.6.4.2 & 9.7.6.3.3)

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

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

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

GRADE BEAM-2 DESIGN



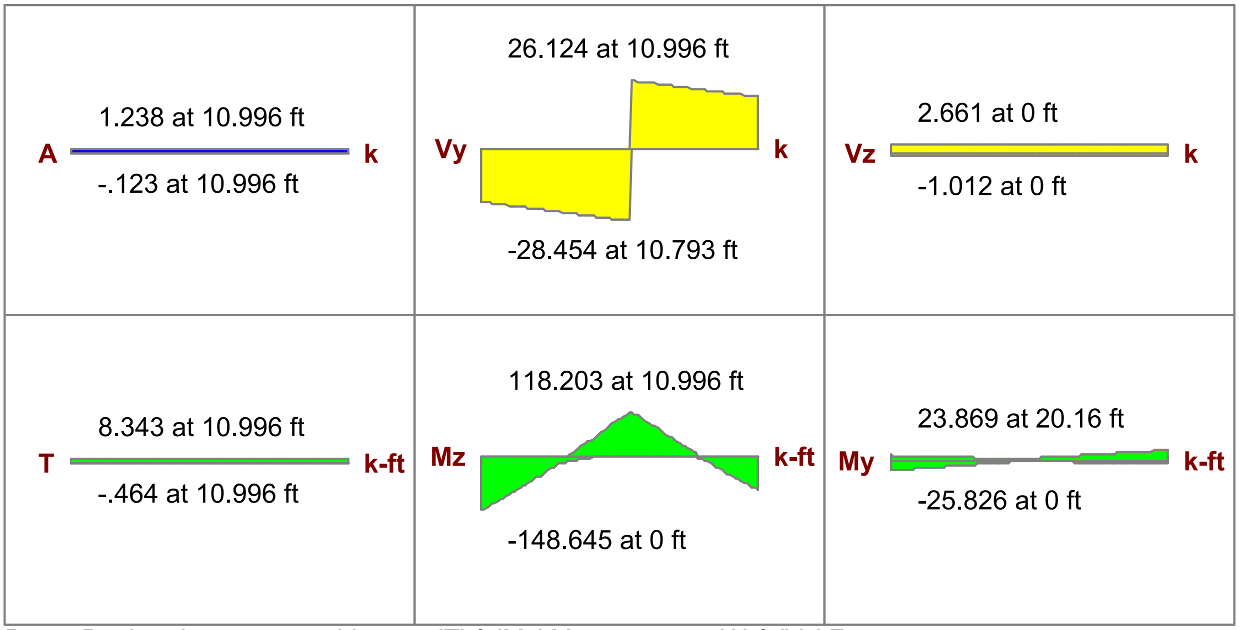
REFER TO THE FOLLOWING PAGES FOR GRADE BEAM TYPE 2 DETAILED REPORT

GRADE BEAM 2 DETAILED REPORT

Beam: ***M190***

Shape:	**CRECT24X24**	Concrete Stress Block:	**Rectangular**
Material:	**Conc3000NW**	Cracked Sections Used:	**Yes**
Length:	**20.16 ft**	Cracked 'I' Factor:	**.35**
I Joint:	**N867**	Effective 'I':	**9676.8 in^4**
J Joint:	**N890**		

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

Span Information

Span	Span Length (ft)	I-Face Dist. (in)	J-Face Dist. (in)
1	**0 - 20.2**	**24**	**24**

Bending Steel

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

GRADE BEAM 2 DETAILED REPORT

Bending Span Results

Span	Loc (ft)	Top/Bot	Mnz (k-ft)	Rho Min	Rho Max	Rho	As Prvd (in^2)	As Reqd (in^2)
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

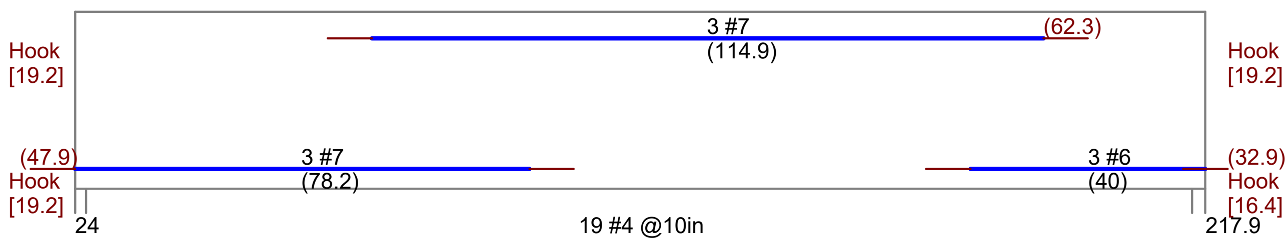
Shear Steel

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^2/ft)	As Prvd (in^2/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

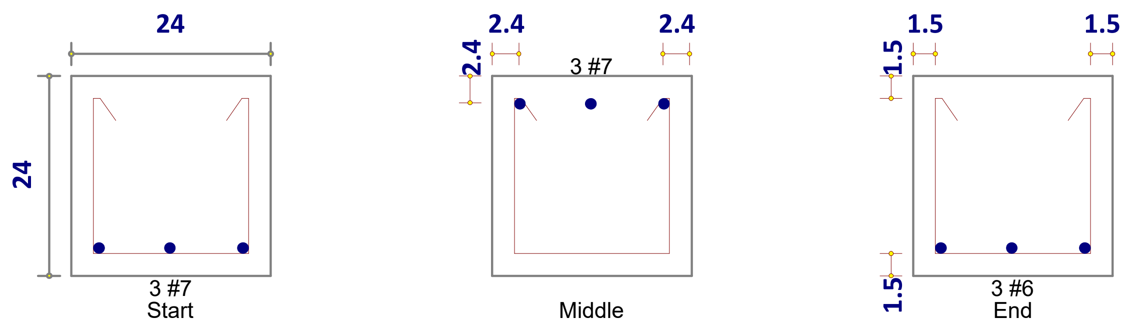
Rebar Detailing, face of support to face of support of each span(Units: in)



Tie Start Distance 2 in

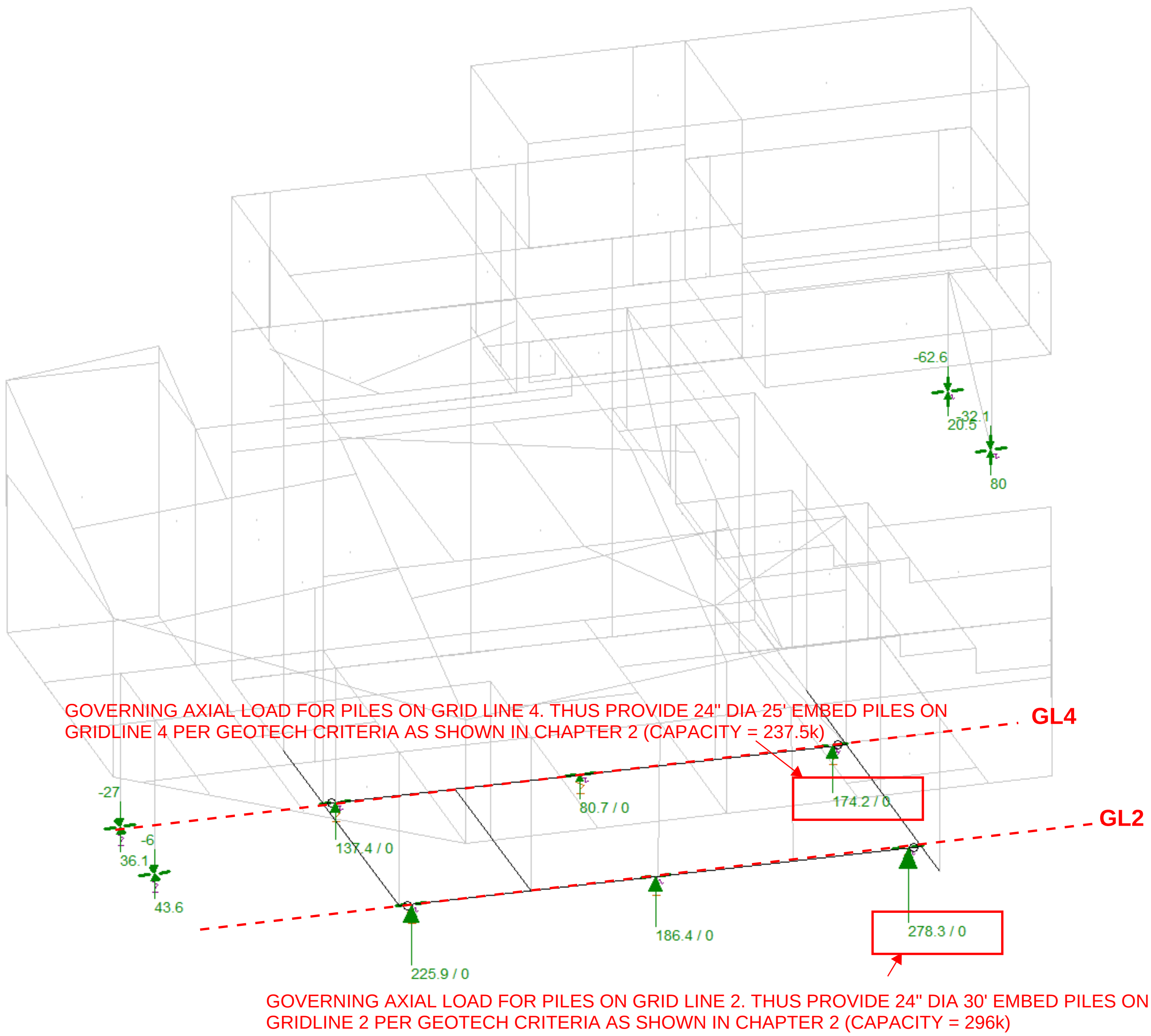
Span 1

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



Span 1

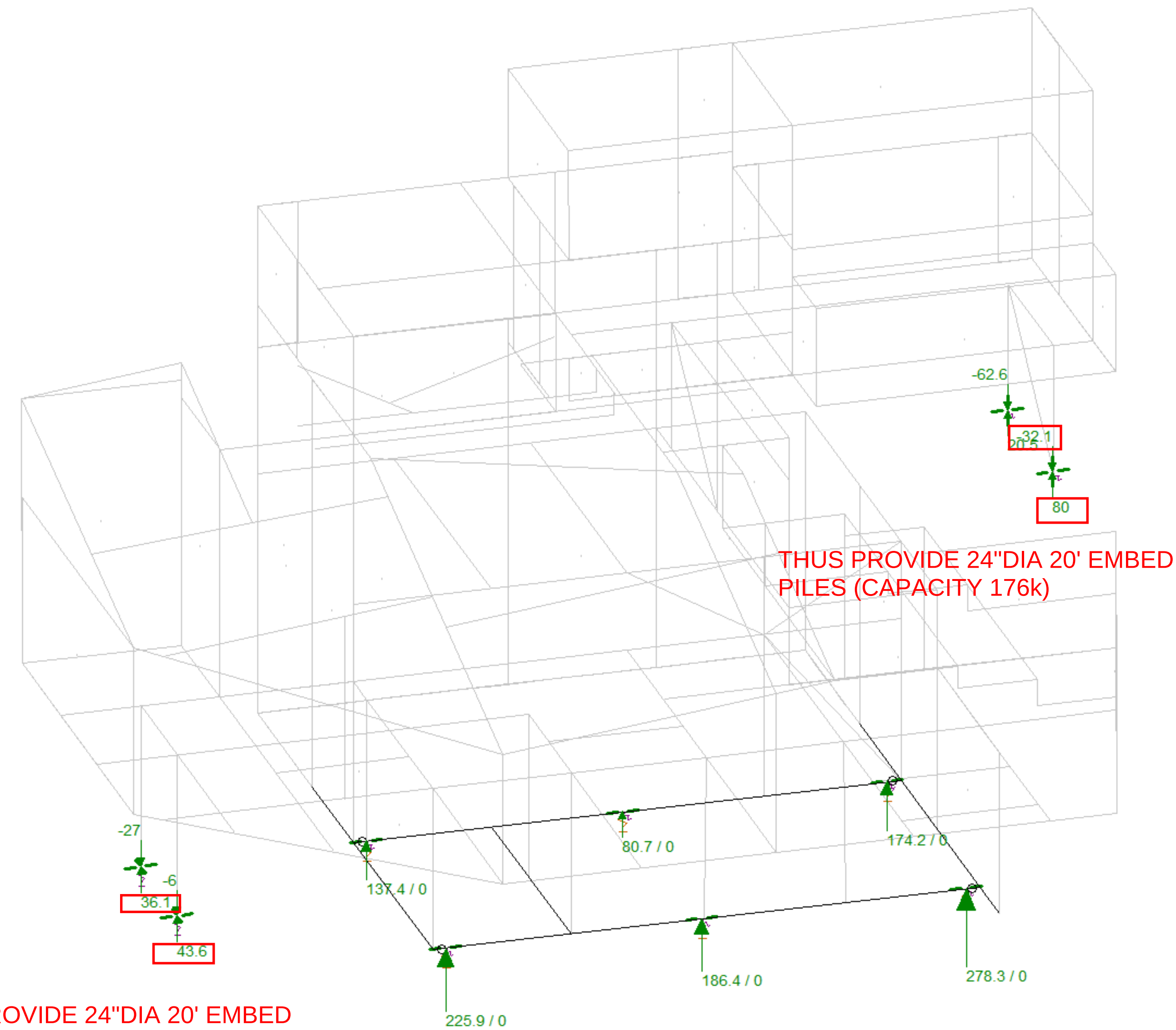
PILE DESIGN- EMBED



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

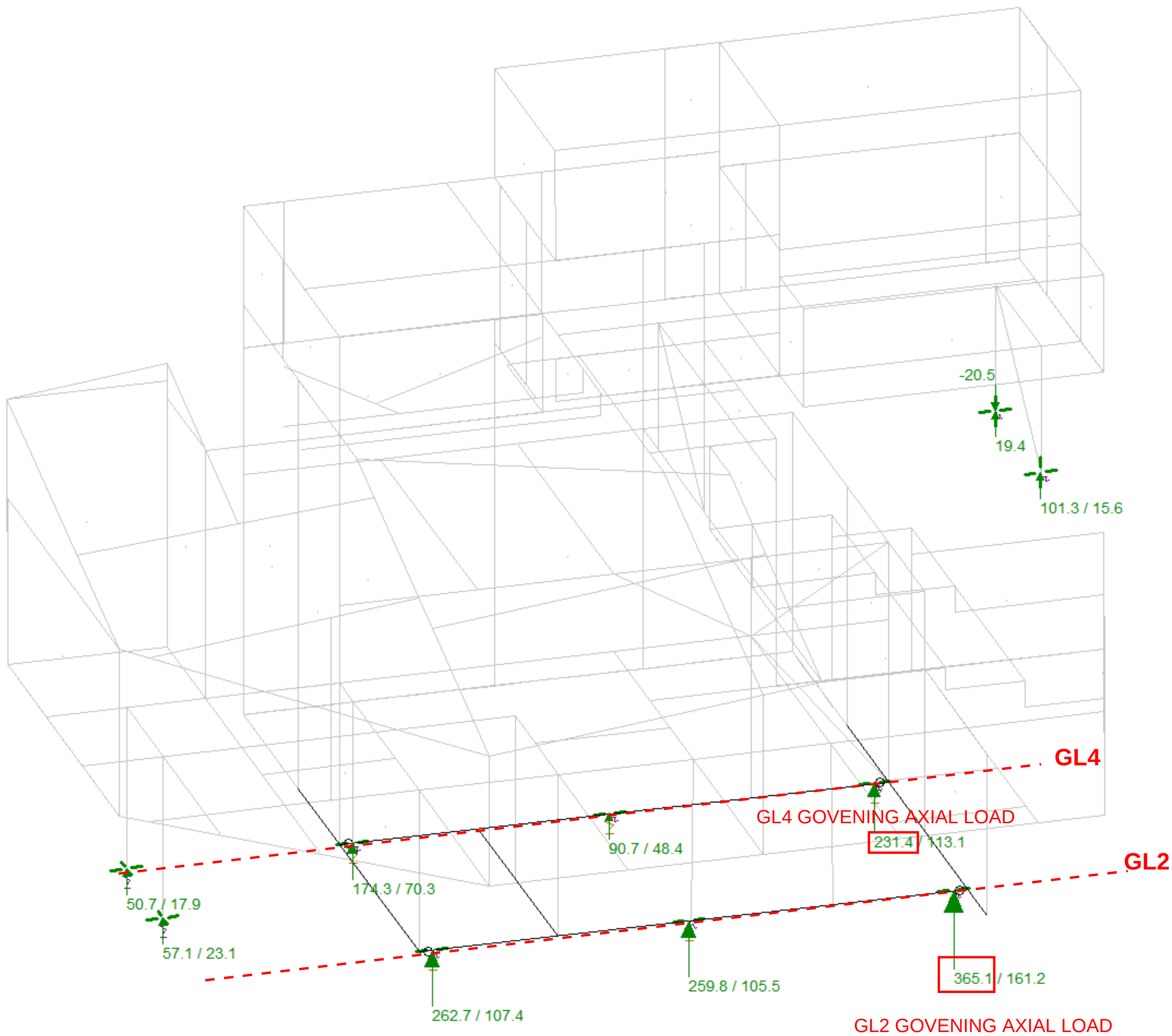


THUS PROVIDE 24"DIA 20' EMBED
PILES (CAPACITY 176k)

ENVELOPE ASD AXIAL LOADS FOR PILE EMBED DEPTH DESIGN

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

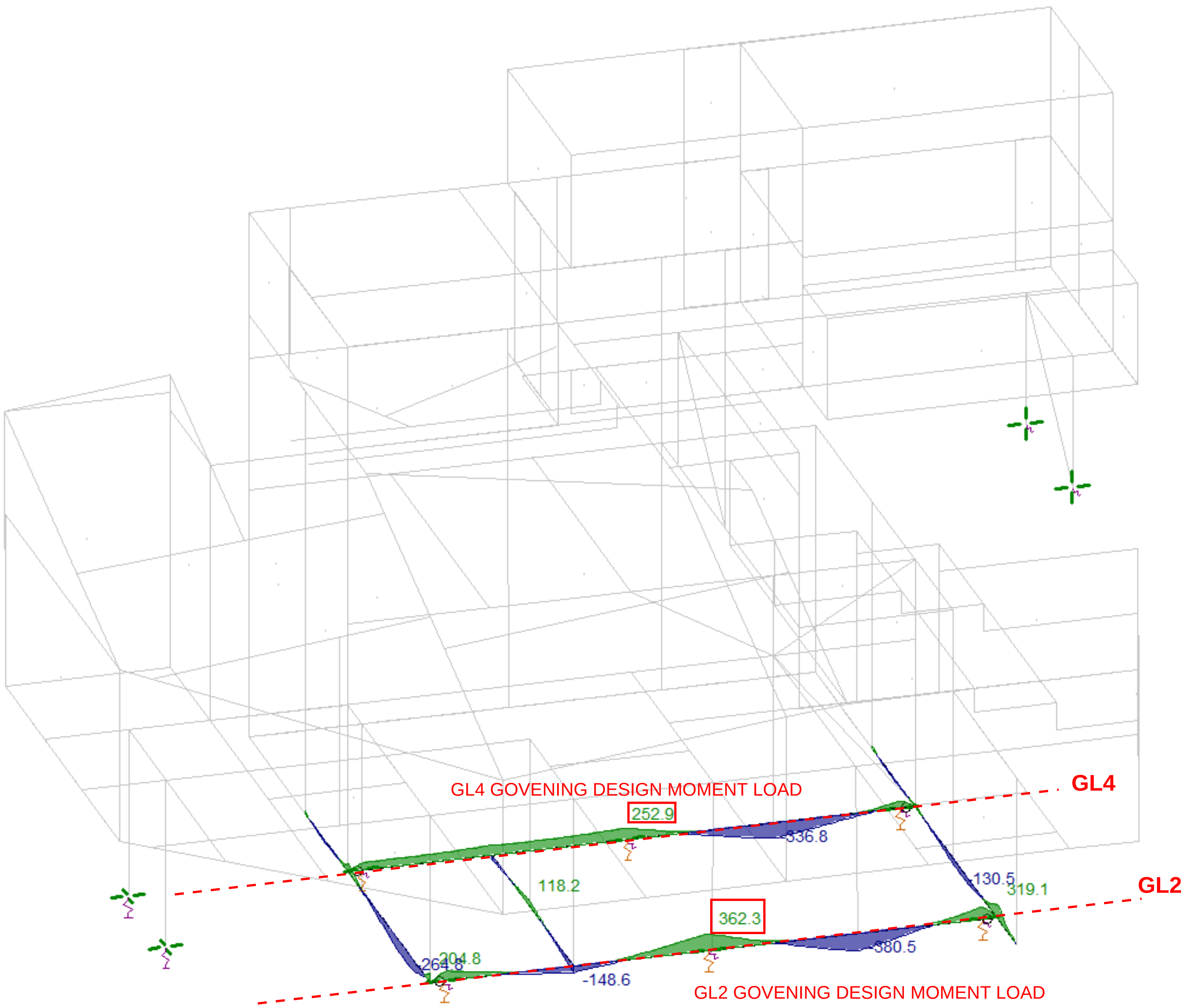
PILE DESIGN- STRENGTH



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

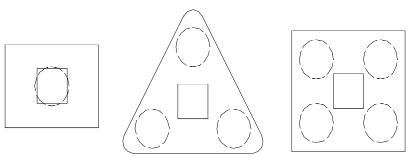
(PILES DONOT RESIST ANY LATERAL LOAD, ALL LATERAL LOAD RESISTED BY FRICTION AS SHOWN FURTHER)

NOUS ENGINEERING	PROJECT :	SUMMIT POWDER MOUNTAIN	PAGE :	
	CLIENT :		DESIGN BY :	
	JOB NO. :	DATE :	REVIEW BY :	

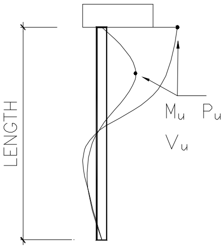
Drilled Cast-in-place Pile Design Based on ACI 318-14 — **Typ Garage Pile**

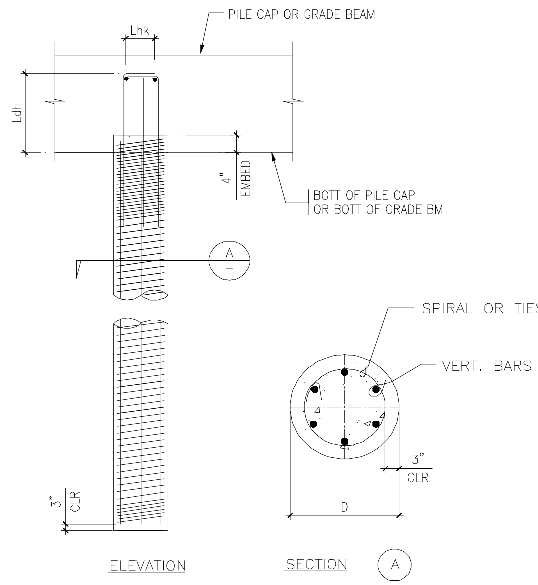
DESIGN CRITERIA

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)

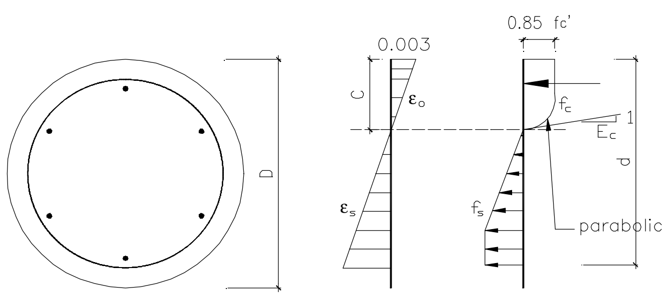
THE PILE DESIGN IS ADEQUATE.

ANALYSIS

CHECK PILE LIMITATIONS

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

CHECK FLEXURAL & AXIAL CAPACITY



STRAIN DIAGRAM FORCE DIAGRAM

$$\varepsilon_o = \frac{2(0.85 f_c')}{E_c} \ , \ E_c = 57\sqrt{f_c'} \ , \ E_s = 29000ksi$$

$$f_c = \begin{cases} 0.85 f_c' \left[2\left(\frac{\varepsilon_c}{\varepsilon_o}\right) - \left(\frac{\varepsilon_c}{\varepsilon_o}\right)^2 \right] \ , & for \ \ 0 < \varepsilon_c < \varepsilon_o \\ 0.85 f_c' \ , & for \ \ \varepsilon_c \ge \varepsilon_o \end{cases}$$

$$f_s = \begin{cases} \varepsilon_s E_s \ , & for \ \ \varepsilon_s \le \varepsilon_y \\ f_y \ , & for \ \ \varepsilon_s > \varepsilon_y \end{cases}$$

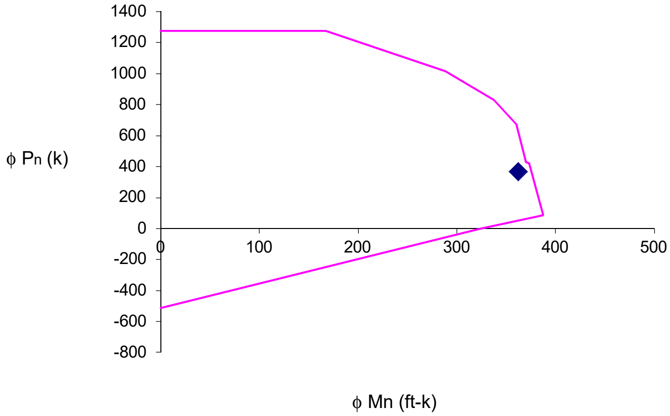
$\phi P_{max} = F \ \phi [0.85 f_c' (A_g - A_{st}) + f_y A_{st}]$ = 1274.6 kips., (at max axial load, ACI 318-14 22.4.2)

where F = 0.8 , ACI 318-14 22.4.2

ϕ = 0.65 (ACI 318-14 21.2) > Pu [Satisfactory]

A_g = 452 in^2. A_{st} = 9.48 in^2.

(cont'd)



	ϕ Pn (kips)	ϕ Mn (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 ε_t = 0.002	431	370
AT BALANCED CONDITION	419	373
AT ε_t = 0.005	85	387
AT FLEXURE ONLY	0	324
AT TENSION ONLY	-512	0

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

ϕ = 0.75 + (ε_t - 0.002) (50), for Spiral ; 0.65 + (ε_t - 0.002) (250 / 3), for Ties = 0.656 (ACI 318-14 21.2)

where C_b = d ε_c / (ε_c + ε_s) = 12 in ε_t = 0.002069 ε_c = 0.003

d = 20 in, (ACI 20.6) β_1 = 0.8 (ACI 318-14 22.2.2.4.3)

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

ϕM_n = 376 ft-kips @ P_u = 365 kips > Mu **[Satisfactory]**

ρ_{max} = 0.08 (ACI 318-14 10.6) ρ_{provd} = 0.021

ρ_{min} = 0.005 (2015 IBC 1810.3.9.4.2) **[Satisfactory]**

CHECK SHEAR CAPACITY

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

> Vu **[Satisfactory]**

where ϕ = 0.75 (ACI 318-14 21.2)

A_0 = 314 in^2. A_v = 0.40 in^2. f_y = 60 ksi

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

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

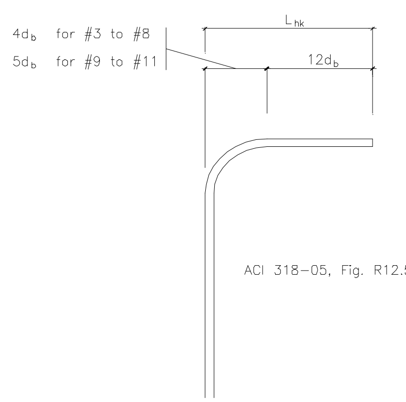
s_{max} = 12 (2015 IBC 1810.3.9.4.2) s_{provd} = 6 in

s_{min} = 1 **[Satisfactory]**

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

DETERMINE FIX HEAD CONDITION

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



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

where d_b = 1 in

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

ψ_e = 1.0 (1.2 for epoxy-coated, ACI 318-14 25.4.2.4)

λ = 1.0 (normal weight)

η = 0.7 (#11 or smaller, cover > 2.5" & side >2.0", ACI 318-14 25.4.3.2)

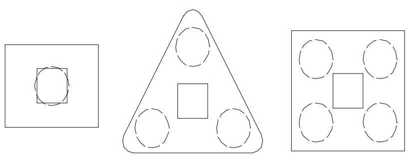
GRIDLINE 4 PILES STRENGTH DESIGN

NOUS ENGINEERING	PROJECT : **SUMMIT POWDER MOUNTAIN**		PAGE :
	CLIENT :		DESIGN BY :
	JOB NO. :	DATE :	REVIEW BY :

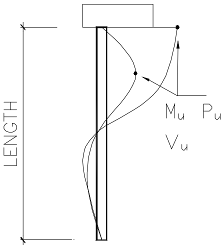
Drilled Cast-in-place Pile Design Based on ACI 318-14 — **Typ Garage Pile**

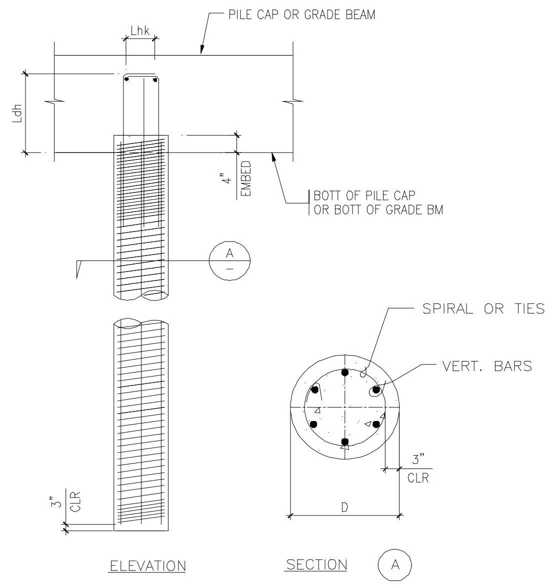
DESIGN CRITERIA

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	=	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)

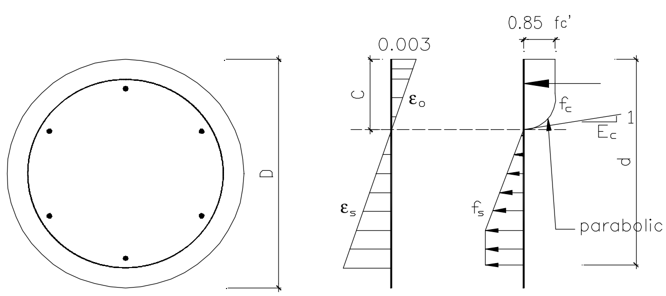
THE PILE DESIGN IS ADEQUATE.

ANALYSIS

CHECK PILE LIMITATIONS

f_c' =	5	ksi	>	4 ksi	**[Satisfactory]**	(2015 IBC Table 1808.8.1)
D =	24	in	>	MAX(L / 30 , 12 in)	**[Satisfactory]**	(2015 IBC 1810.3.5.2)

CHECK FLEXURAL & AXIAL CAPACITY



STRAIN DIAGRAM FORCE DIAGRAM

$$\varepsilon_o = \frac{2\left(0.85 f_c'\right)}{E_c} \ , \ E_c = 57\sqrt{f_c'} \ , \ E_s = 29000 ksi$$

$$f_c = \begin{cases} 0.85 f_c'\left[2\left(\frac{\varepsilon_c}{\varepsilon_o}\right) - \left(\frac{\varepsilon_c}{\varepsilon_o}\right)^2\right] \ , \ for \ \ 0 < \varepsilon_c < \varepsilon_o \\ 0.85 f_c' \ , \ for \ \ \varepsilon_c \geq \varepsilon_o \end{cases}$$

$$f_s = \begin{cases} \varepsilon_s E_s \ , \ for \ \ \varepsilon_s \leq \varepsilon_y \\ f_y \ , \ for \ \ \varepsilon_s > \varepsilon_y \end{cases}$$

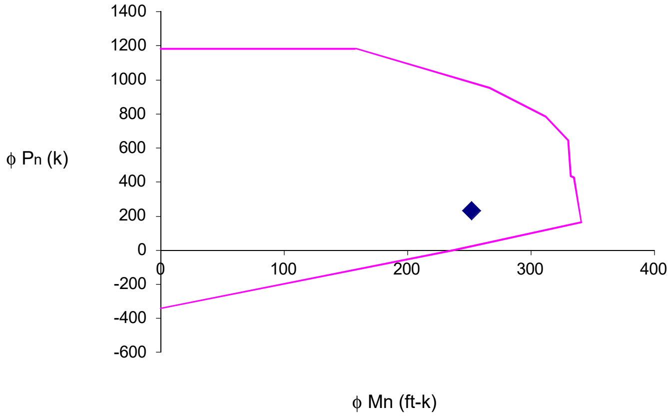
$\phi P_{max} = F \ \phi \left[0.85 f_c' (A_g - A_{st}) + f_y A_{st} \right]$ = 1183 kips., (at max axial load, ACI 318-14 22.4.2)

where F = 0.8 , ACI 318-14 22.4.2

ϕ = 0.65 (ACI 318-14 21.2) > Pu **[Satisfactory]**

A_g = 452 in². A_{st} = 6.32 in².

(cont'd)



	ϕ Pn (kips)	ϕ Mn (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 ε_t = 0.002	436	332
AT BALANCED CONDITION	426	335
AT ε_t = 0.005	164	341
AT FLEXURE ONLY	0	237
AT TENSION ONLY	-341	0

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

ϕ = 0.75 + (ε_t - 0.002) (50), for Spiral; 0.65 + (ε_t - 0.002) (250 / 3), for Ties = 0.656 (ACI 318-14 21.2)

where $C_b = d\,\varepsilon_c / (\varepsilon_c + \varepsilon_s)$ = 12 in ε_t = 0.002069 ε_c = 0.003

d = 20 in, (ACI 20.6) β_1 = 0.8 (ACI 318-14 22.2.2.4.3)

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

ϕM_n = 339 ft-kips @ P_u = 232 kips **>** Mu **[Satisfactory]**

ρ_{max} = 0.08 (ACI 318-14 10.6) ρ_{provd} = 0.014

ρ_{min} = 0.005 (2015 IBC 1810.3.9.4.2) **[Satisfactory]**

CHECK SHEAR CAPACITY

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

> Vu **[Satisfactory]**

where ϕ = 0.75 (ACI 318-14 21.2)

A_0 = 314 in^2. A_v = 0.40 in^2. f_y = 60 ksi

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

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

s_{max} = 12 (2015 IBC 1810.3.9.4.2) s_{provd} = 6 in

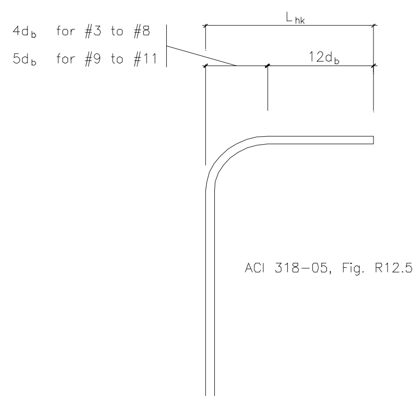
s_{min} = 1 **[Satisfactory]**

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

DETERMINE FIX HEAD CONDITION

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

(ACI 318-14 25.4.3)



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

where d_b = 1 in

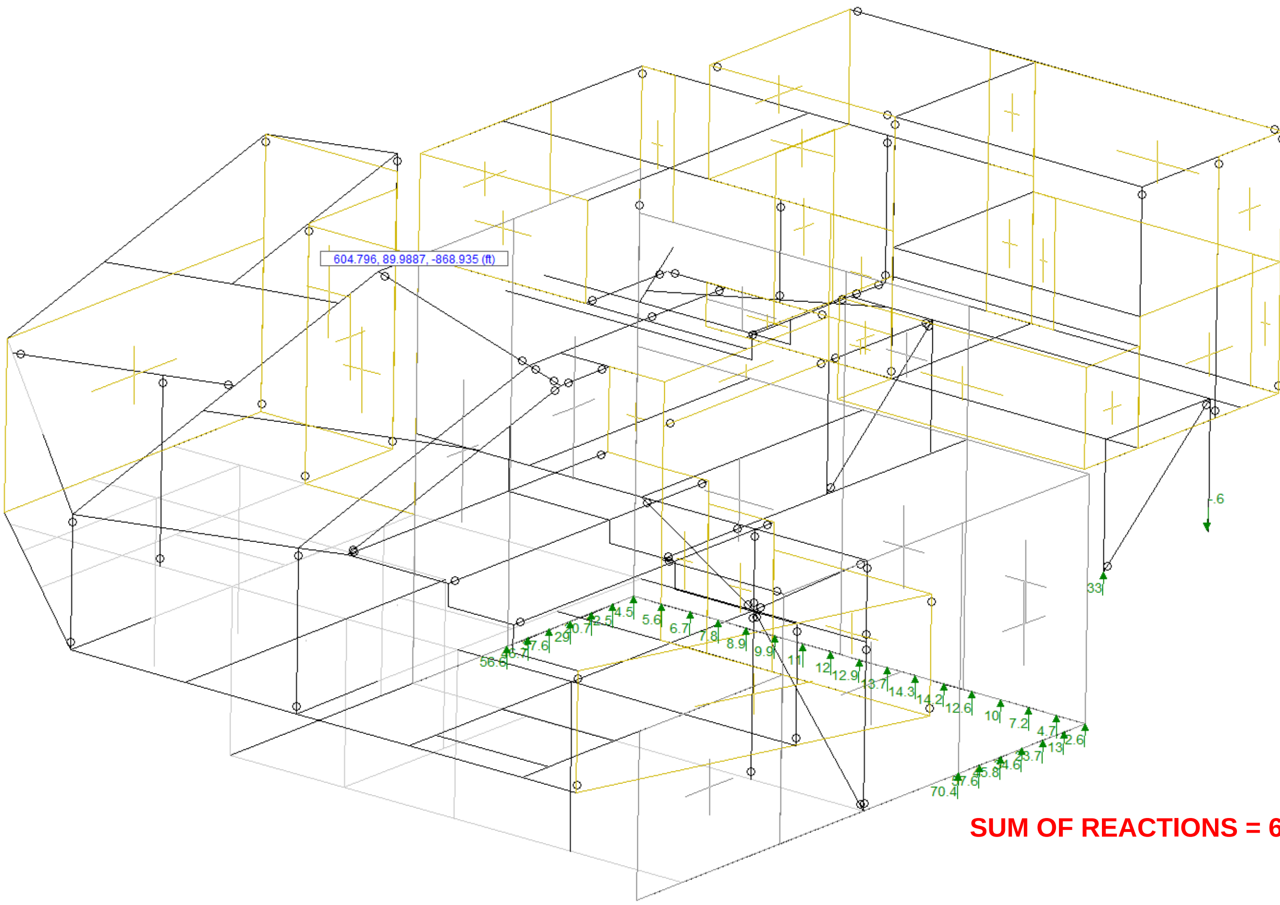
$\rho_{required} / \rho_{provided}$ = 0.8 ($A_{s,reqd} / A_{s,provd}$, ACI 318 25.4.10.1)

ψ_e = 1.0 (1.2 for epoxy-coated, ACI 318-14 25.4.2.4)

λ = 1.0 (normal weight)

η = 0.7 (#11 or smaller, cover > 2.5" & side >2.0", ACI 318-14 25.4.3.2)

SLIDING CHECK



SUM OF REACTIONS = 604 kips

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 AGAISNT SLIDING = 284/110 = 2.58 THUS OKAY

Envelope Joint Reactions

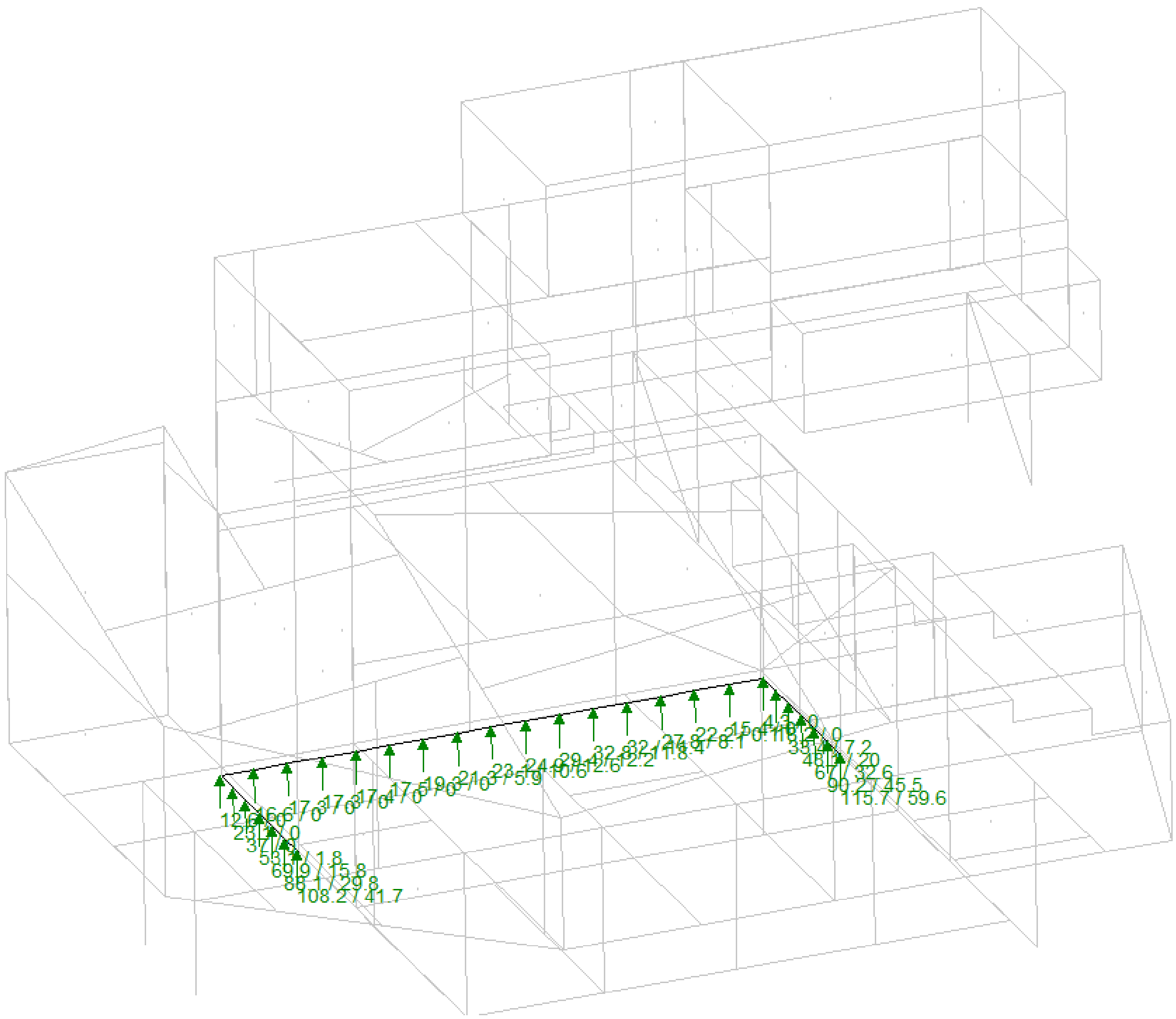
	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N233	max	1.803	14	20.521	25	4.705	15	0	1	0	1	0	1
2		min	-.33	15	-62.642	14	-.203	16	0	1	0	1	0	1
3	N234	max	53.652	14	79.987	27	6.851	15	0	1	0	1	0	1
4		min	-17.557	15	-32.107	15	-.203	16	0	1	0	1	0	1
5	N235B	max	.302	14	36.138	28	-.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	1	0	1	0	1
58		min	0	1	0	11	0	1	0	1	0	1	0	1
59	N879A	max	2.39	14	16.923	25	0	1	0	1	0	1	0	1
60		min	-5.98	17	0	11	0	1	0	1	0	1	0	1
61	N880A	max	0	1	15.881	25	0	1	0	1	0	1	0	1
62		min	0	1	0	11	0	1	0	1	0	1	0	1
63	N881	max	3.546	14	14.787	17	0	1	0	1	0	1	0	1
64		min	-6.771	17	0	11	0	1	0	1	0	1	0	1
65	N882	max	0	1	13.989	20	0	1	0	1	0	1	0	1
66		min	0	1	0	11	0	1	0	1	0	1	0	1
67	N883A	max	5.015	14	14.398	20	0	1	0	1	0	1	0	1
68		min	-8	17	0	11	0	1	0	1	0	1	0	1
69	N884	max	0	1	14.823	20	0	1	0	1	0	1	0	1
70		min	0	1	0	11	0	1	0	1	0	1	0	1
71	N885	max	6.636	14	15.231	20	0	1	0	1	0	1	0	1
72		min	-9.265	17	0	11	0	1	0	1	0	1	0	1
73	N886	max	0	1	15.425	20	0	1	0	1	0	1	0	1
74		min	0	1	0	3	0	1	0	1	0	1	0	1
75	N871A	max	0	1	21.942	28	0	1	0	1	0	1	0	1
76		min	0	1	0	14	0	1	0	1	0	1	0	1
77	N870A	max	0	1	32.181	28	0	1	0	1	0	1	0	1
78		min	0	1	0	14	0	1	0	1	0	1	0	1
79	N869A	max	0	1	42.414	28	0	1	0	1	0	1	0	1
80		min	0	1	0	14	0	1	0	1	0	1	0	1
81	N868B	max	0	1	52.98	28	0	1	0	1	0	1	0	1
82		min	0	1	0	14	0	1	0	1	0	1	0	1
83	N867A	max	0	1	65.578	27	0	1	0	1	0	1	0	1
84		min	0	1	0	14	0	1	0	1	0	1	0	1
85	Totals:	max	110.101	14	1885.871	28	112.056	15						
86		min	-100.199	29	0	14	-109.731	18						

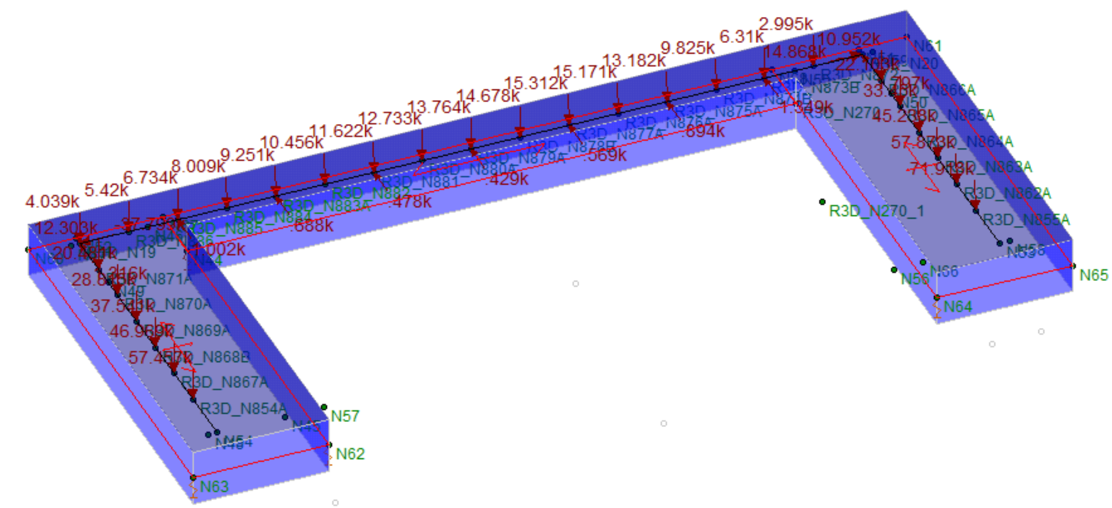
MAXIMUM LATERAL FORCES

SHALLOW FOUNDATION DESIGN



REACTIONS EXPORTED TO RISA 3D FOR DESIGN OF SHALLOW FOUNDATIONS

RISA FOUNDATION IMPORTED REACTIONS



Concrete Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E...	Density[k/ft...	f'c[ksi]	Lambda	Flex Steel[...	Shear Stee...
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[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	36	Conc3000NW	0	0

Design Strips

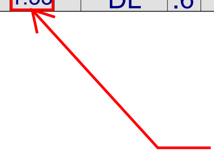
	Label	Rebar Angle from Pl...	No. of Design Cuts	Design Rule
1	DS1	90	50	CF2 Long
2	DS2	90	50	CF2 Long
3	DS3	0	50	CF1 long
4	DS4	0	50	Horizontal reinf CF2
5	DS5	0	50	Horizontal reinf CF2
6	DS6	90	50	Horizontal reinf CF2

Load Combinations

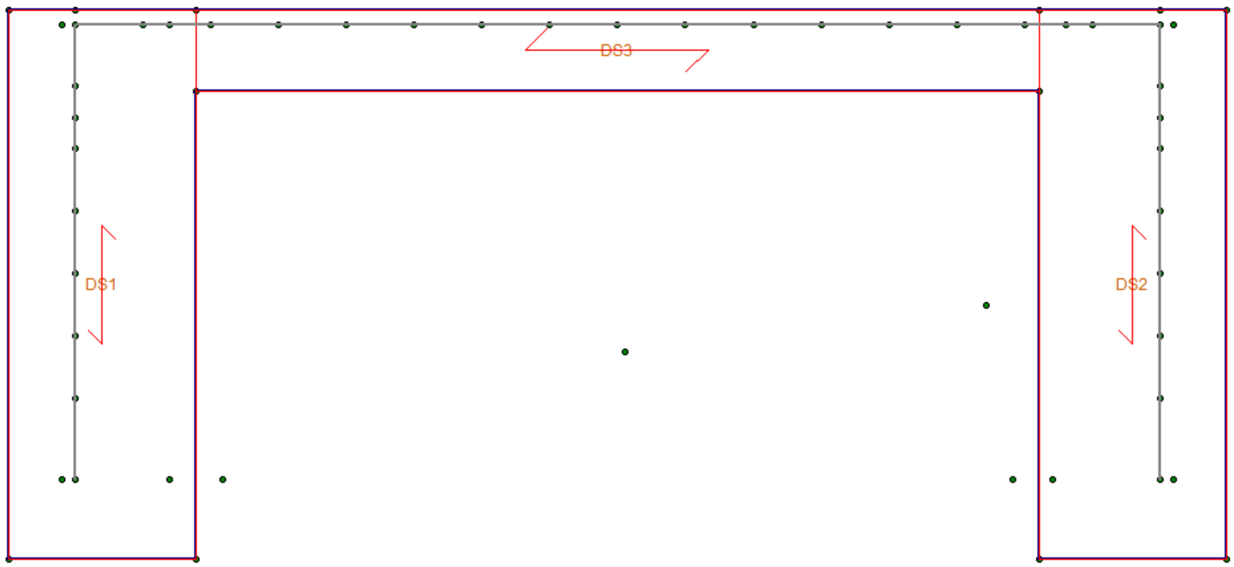
	Label	Solve	Service	AB...	...	Catego...	F...	Catego...	F...	Categ...	F...	Categ...	F...	Categ...	F...	Cat...	F...	C...	F...	C...	F...	C...	F...	C...	F...
1	Service	Yes	Yes			DL	1	LL	1	HL	1														
2	Strength	Yes				DL	1.2	LL	1.6	HL	1.6														
3	ASCE 1	Yes	Yes		1...	DL	1																	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

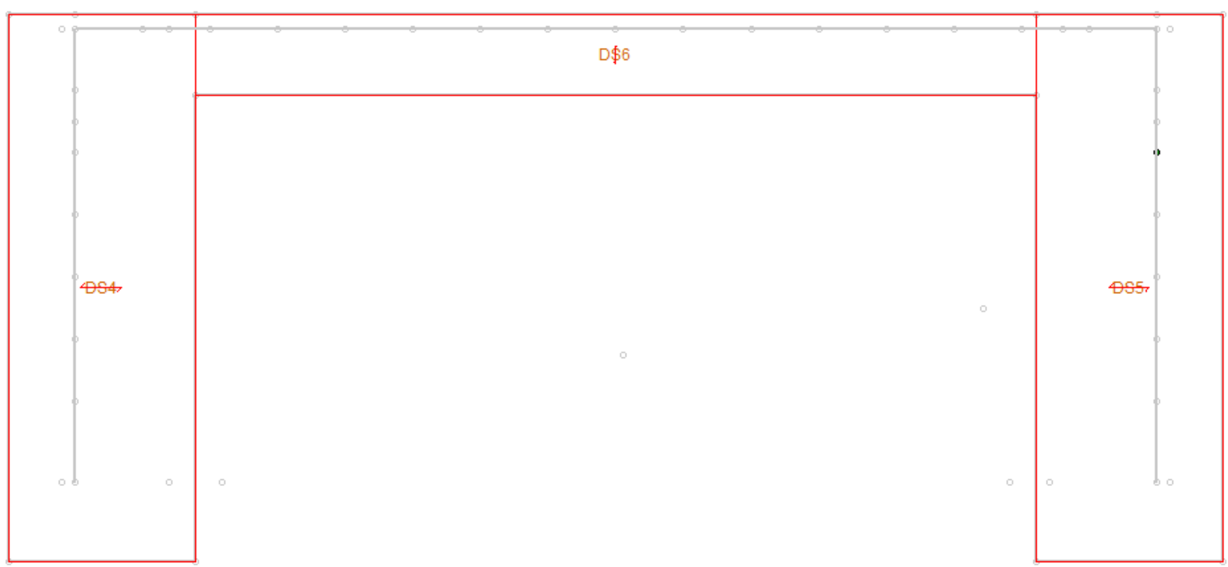
Load Combinations (Continued)

	Label	Solve	Service	AB...	...	Catego...	F...	Catego...	F...	Categ...	F...	Categ...	F...	Categ...	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	-....	LL	.75	LLS	.75	SL	.75								
22	ASCE 6 (d) (d)	Yes	Yes	1.33	1...	DL	1	HL	1	ELZ	-....	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	-....	LL	.75	LLS	.75	RL	.75								
26	ASCE 6 (f) (d)	Yes	Yes	1.33	1...	DL	1	HL	1	ELZ	-....	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	Apr 13, 2018
Designer	: MG	6:27 PM
Job Number	:	Checked By:_____
Model Name	: Powder Mountain	

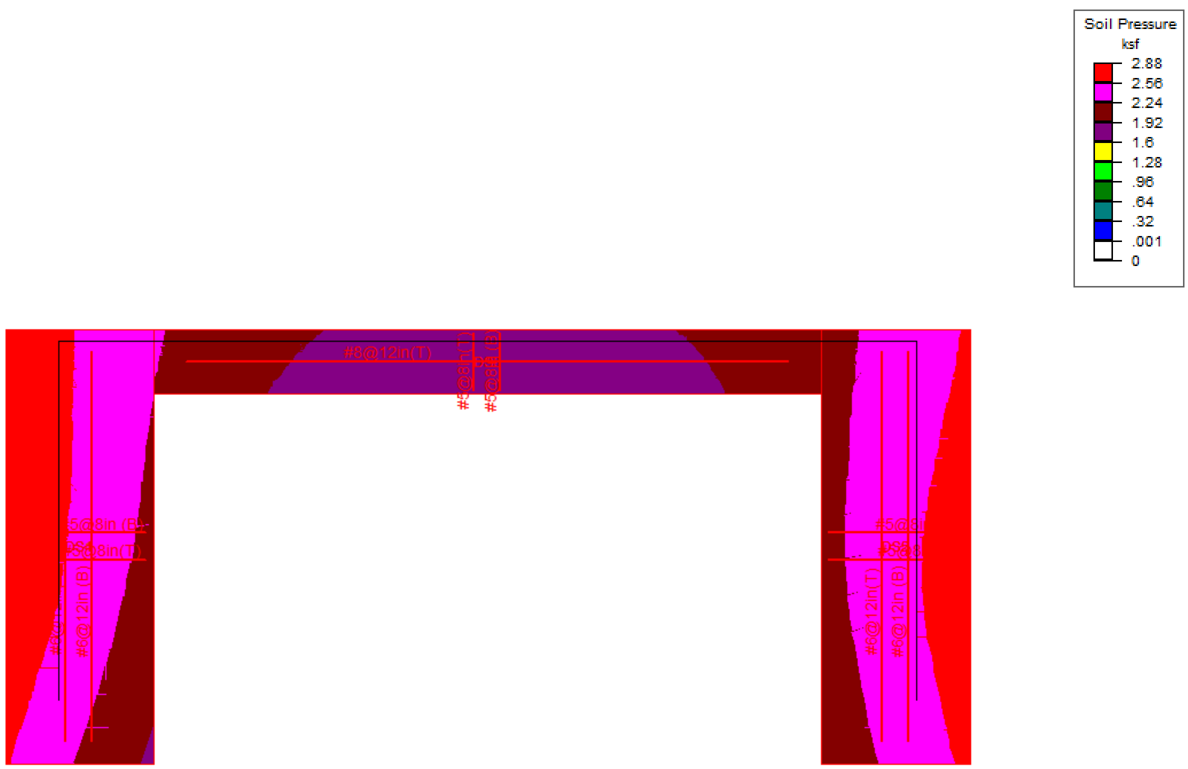
Strip Reinforcing

	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

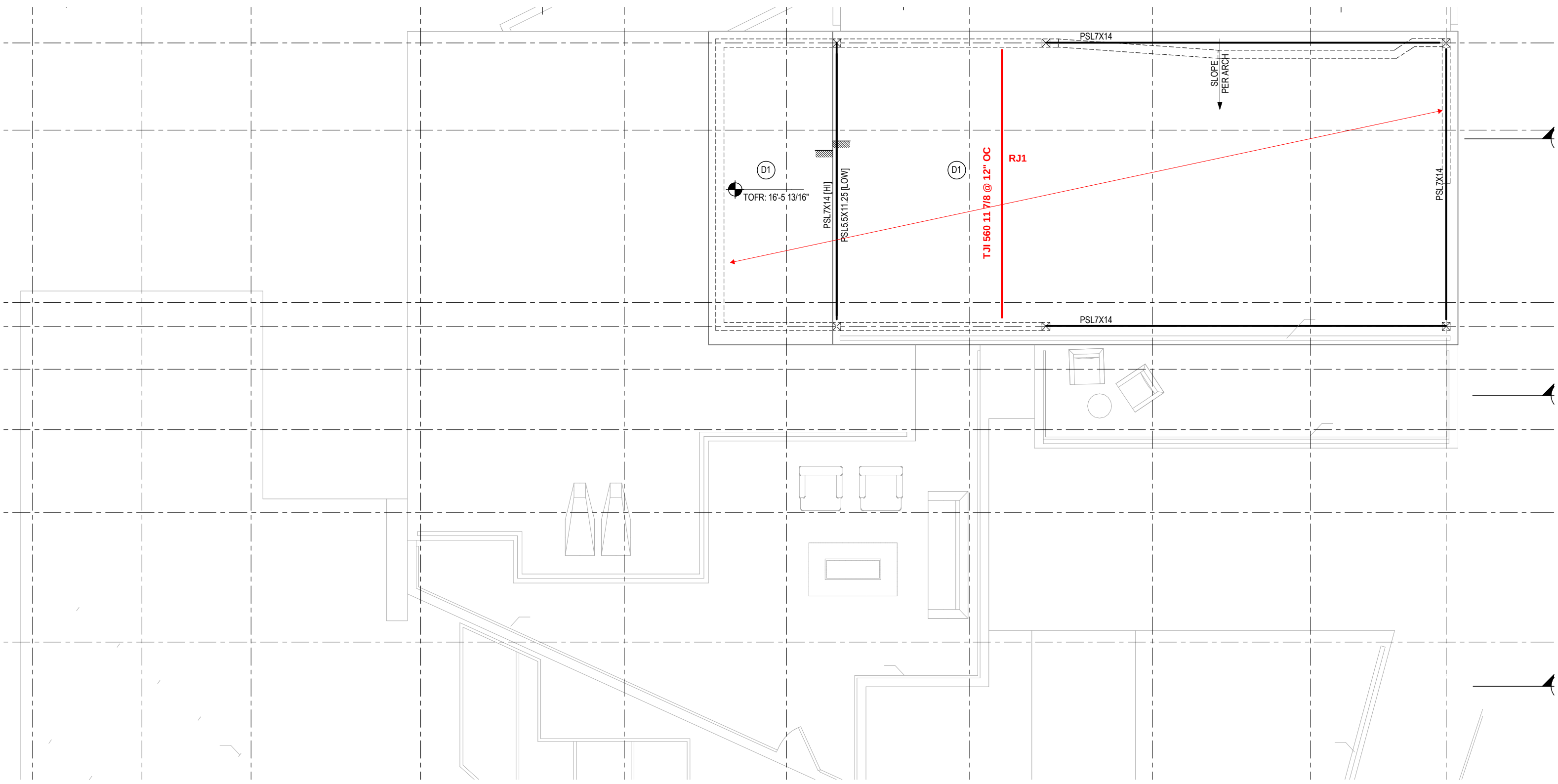
	Label	UC	LC	Soil Pressure[ksf]	Allowable Bearing[ksf]	Point
1	S1	.84	6	2.855	3.4	N698



MAXIMUM SOIL PRESSURE CONTOUR- LC6

3.2 Design of Joists

HIGH ROOF JOISTS

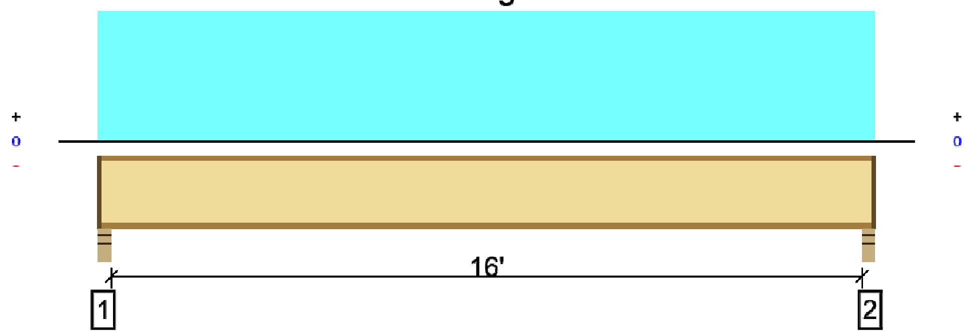


FORTE MEMBER REPORT *Roof, RJ1*

1 piece(s) 11 7/8" TJI® 560 @ 12" OC

PASSED

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

Weyerhaeuser Notes

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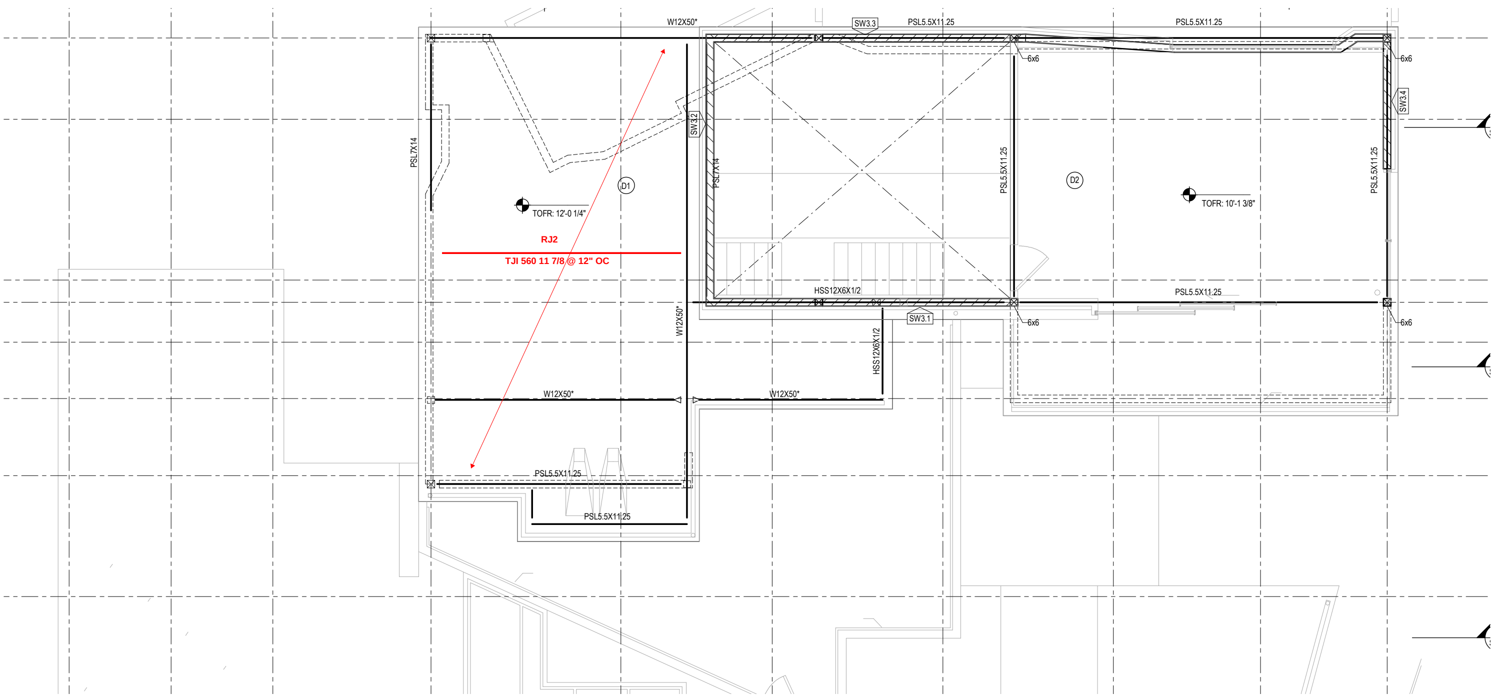
The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

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

5/31/2018 5:44:42 PM
Forte v5.3, Design Engine: V7.0.0.5
180530 Joist Design.4te

LOW ROOF JOISTS

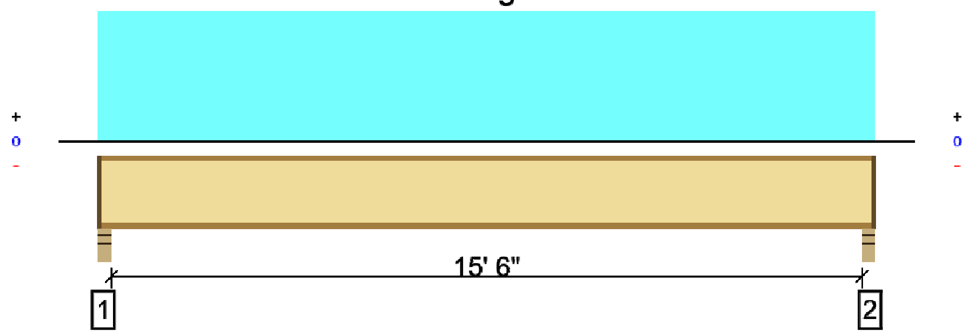


FORTE® MEMBER REPORT Roof, RJ2

1 piece(s) 11 7/8" TJI® 560 @ 12" OC

PASSED

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

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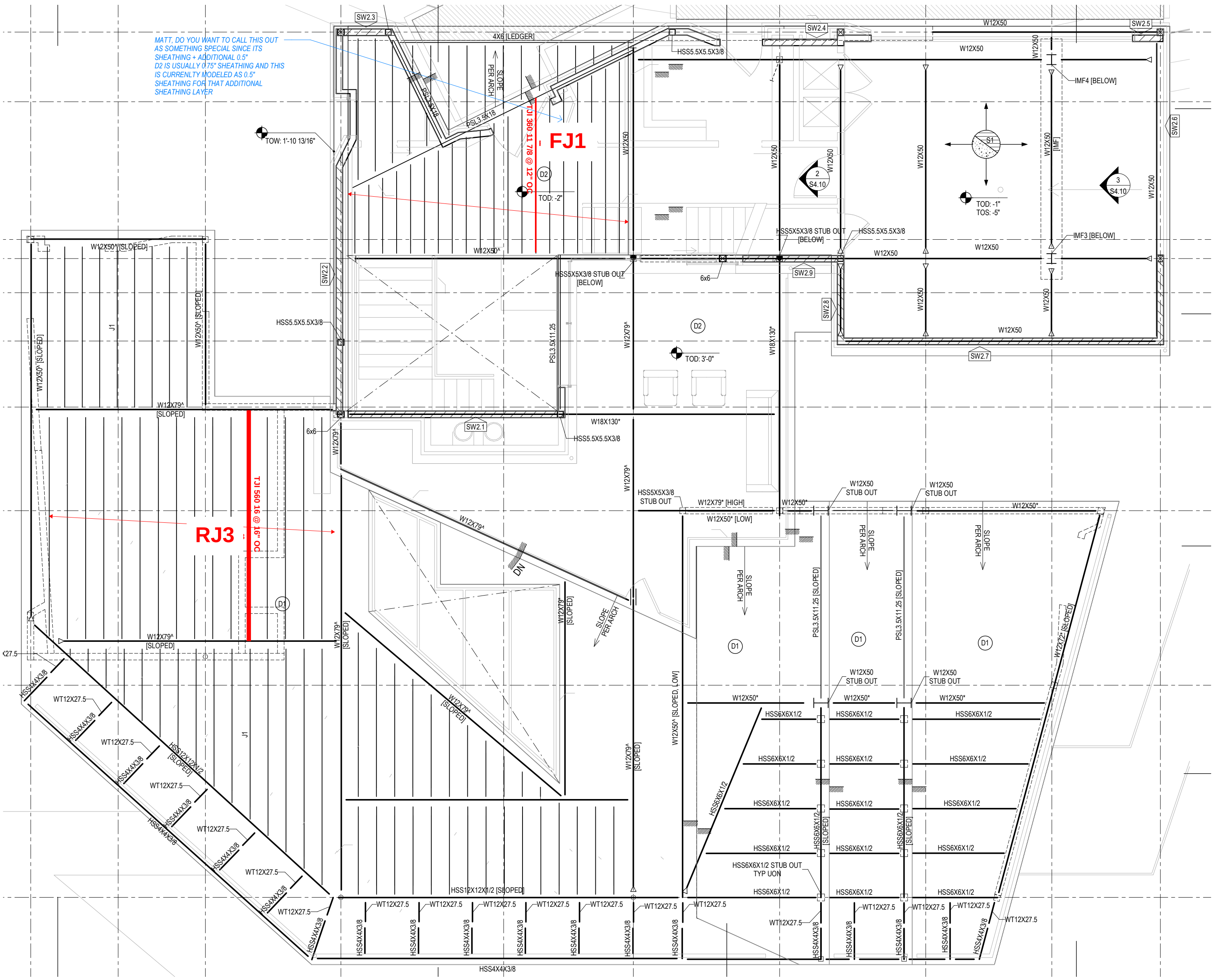
The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

SUSTAINABLE FORESTRY INITIATIVE

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

5/31/2018 5:46:41 PM
Forte v5.3, Design Engine: V7.0.0.5
180530 Joist Design.4te

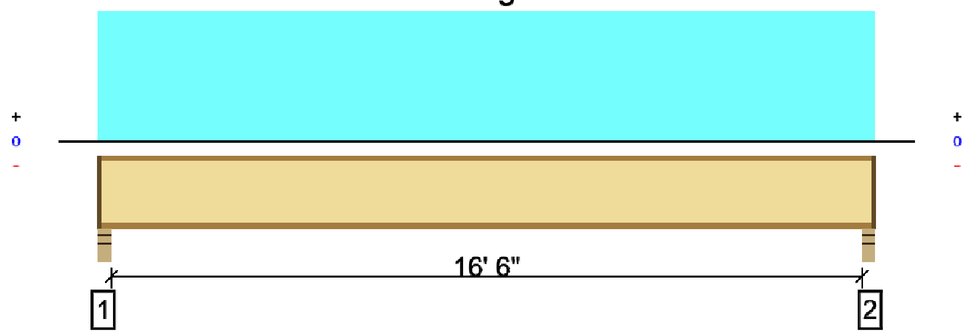
SLOPED ROOF AND ENTRY LEVEL JOISTS



1 piece(s) 16" TJI® 560 @ 16" OC

PASSED

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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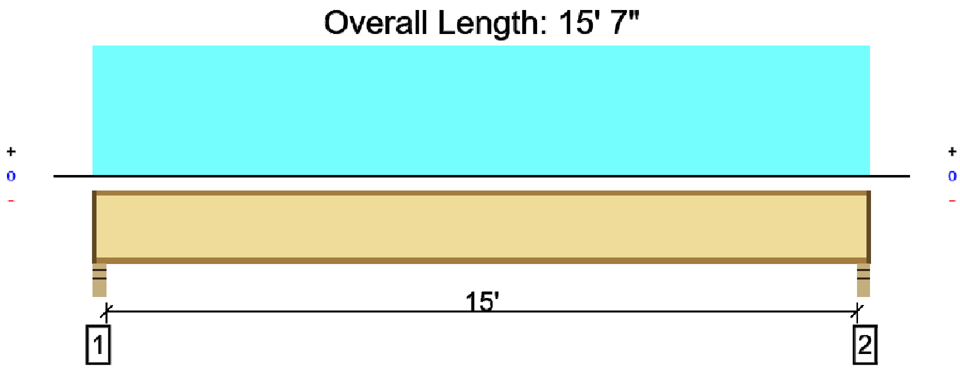
SUSTAINABLE FORESTRY INITIATIVE

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

5/31/2018 5:50:09 PM
Forte v5.3, Design Engine: V7.0.0.5
180530 Joist Design.4te

FORTE® MEMBER REPORT *Entry, FJ1* **PASSED**

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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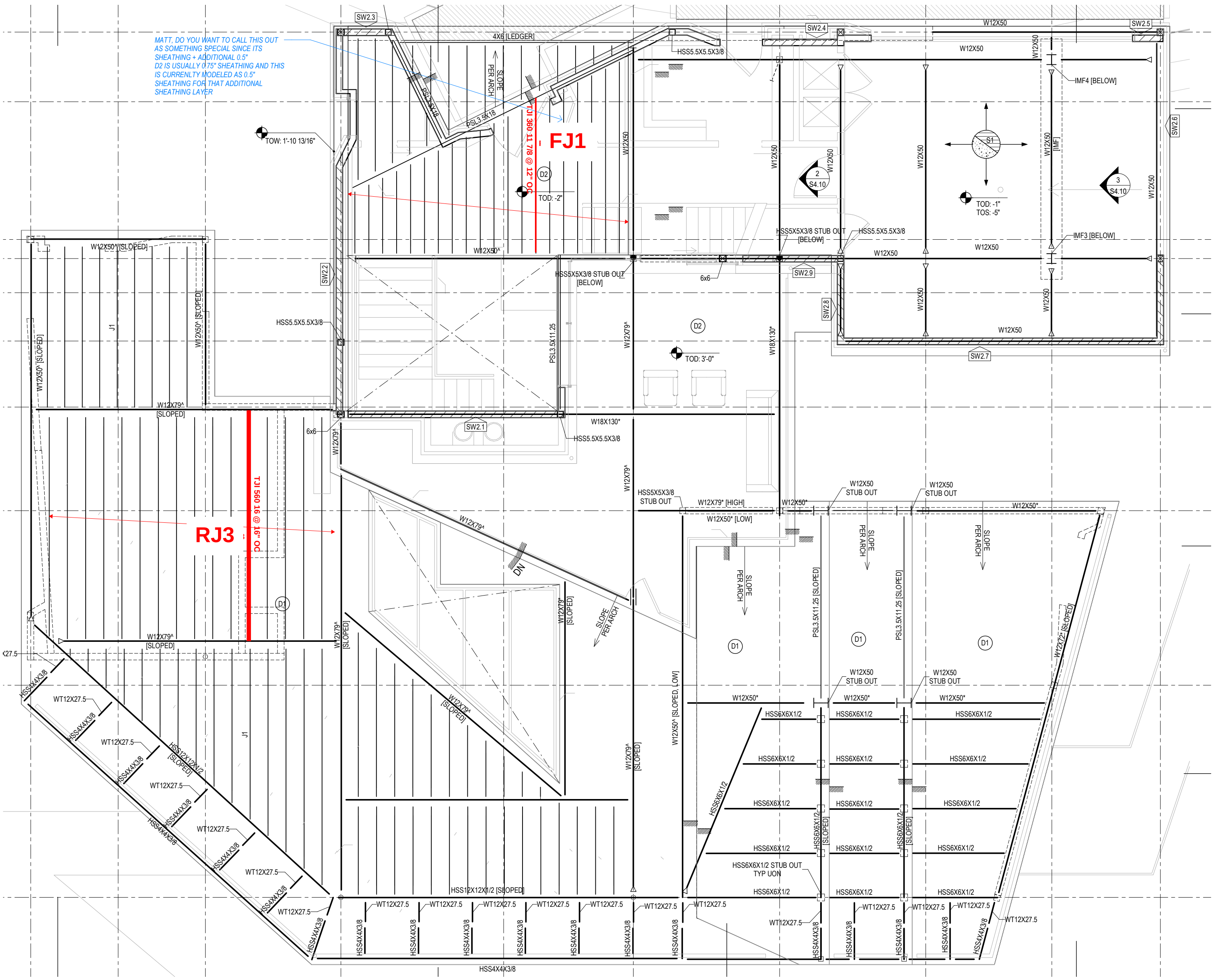
The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

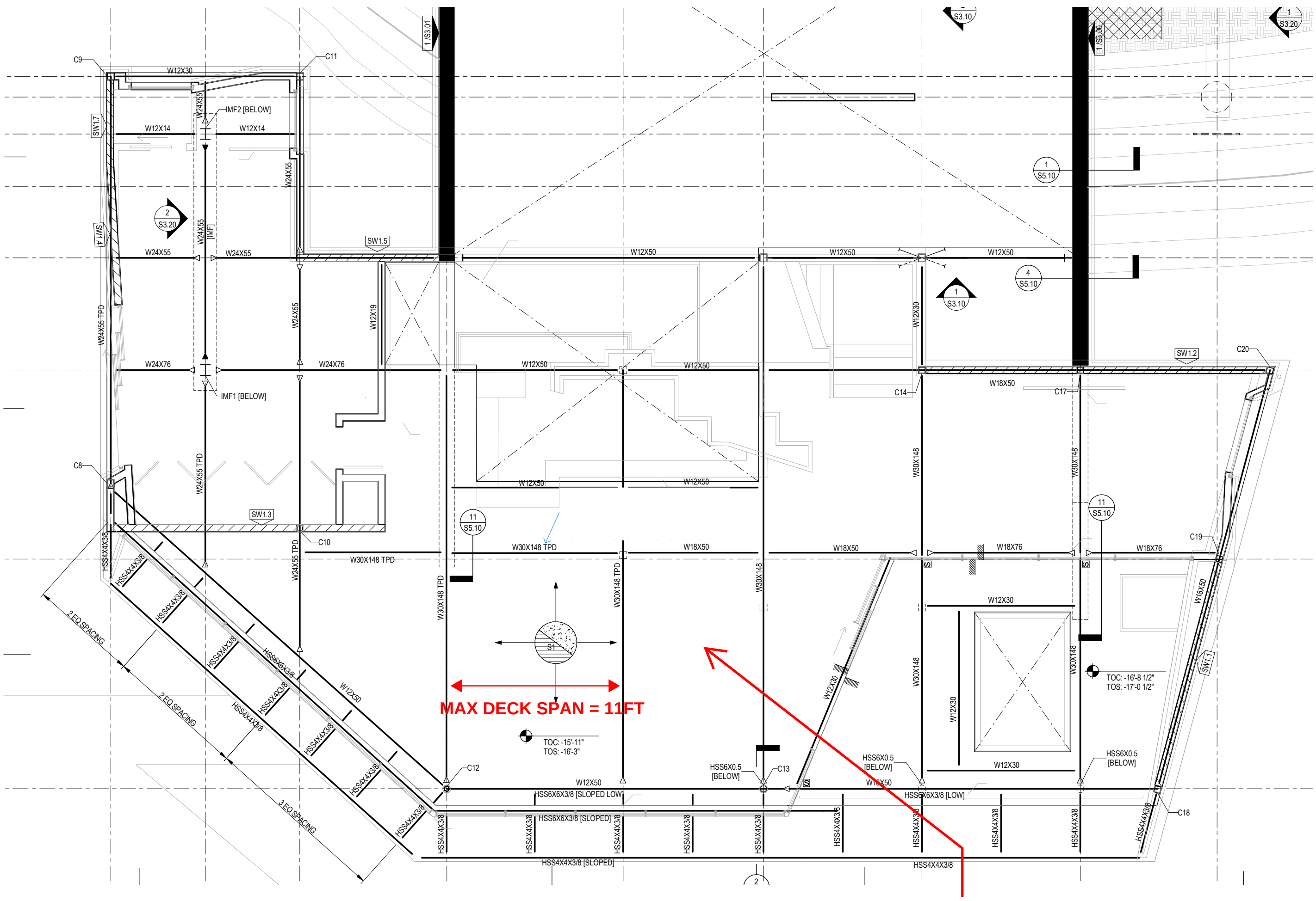
Forte Software Operator	Job Notes
MIT GALA NOUS ENGINEERING (213) 627-6687 mit.gala@nousengineering.com	SummitPowder Mountain

5/31/2018 5:51:44 PM
Forte v5.3, Design Engine: V7.0.0.5
180530 Joist Design.4te

SLOPED ROOF AND ENTRY LEVEL JOISTS



3.3 Design of Steel Deck

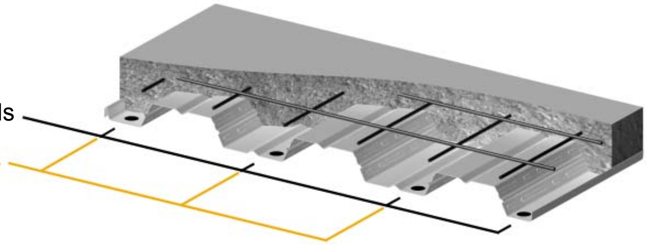


FLOOR LOAD = 58psf
LIVE LOAD 40psf
TOTAL LOAD = 98psf

PLW2™ or W2 FORMLOK™

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

W 2 4" LW



Deck Weight and Section Properties

Gage	Weight (psf)		I_d for Deflection		Moment		Allowable Reactions per ft of Width (lb)					
	Galv G60	Phos/ Painted	Single Span (in.^{4}/ft)	Multiple Spans (in.^{4}/ft)	$+S_{eff}$ (in.^{3}/ft)	$-S_{eff}$ (in.^{3}/ft)	End Bearing 2"	End Bearing 3"	End Bearing 4"	Interior Bearing 4"	Interior Bearing 5"	Interior Bearing 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[1]	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	[illegible]	[illegible]
	2	10'-6"	292	260	234	211	192	175	156	134	109	[illegible]	[illegible]
	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

[1] Max. UCS = Maximum Unshored Clear Span (ft-in.)

Shoring required in shaded areas to right of heavy line.

Allowable Diaphragm Shear Values, q (plf)

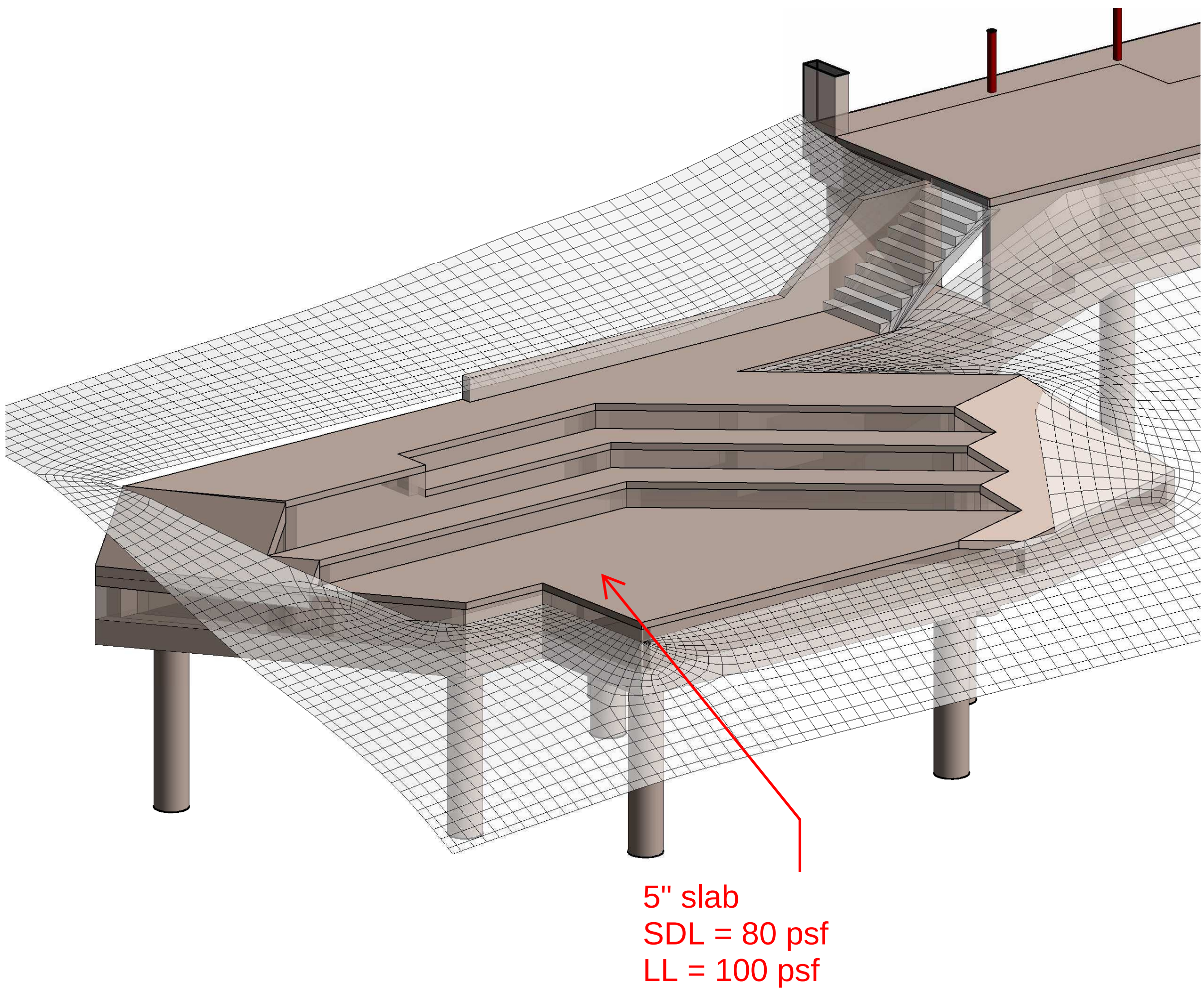
Gage	Welds	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"	12'-0"
22	q3	1310	1295	1281	1269	1258	1249	1240	1232	1225	1219	1213
	q4	1438	1409	1384	1362	1342	1324	1309	1294	1281	1269	1258
21	q3	1313	1296	1281	1268	1256	1245	1236	1227	1220	1212	1206
	q4	1463	1432	1404	1380	1358	1339	1321	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.

4.0 Miscellaneous Structure Design

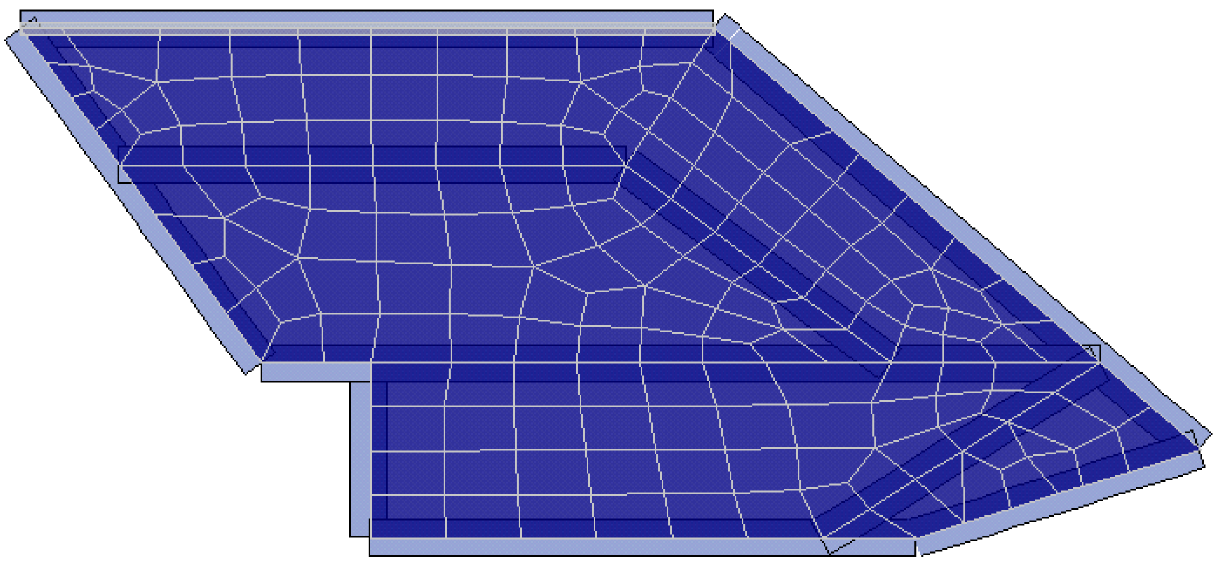
4.1 Exterior Deck and Foundation Design

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.

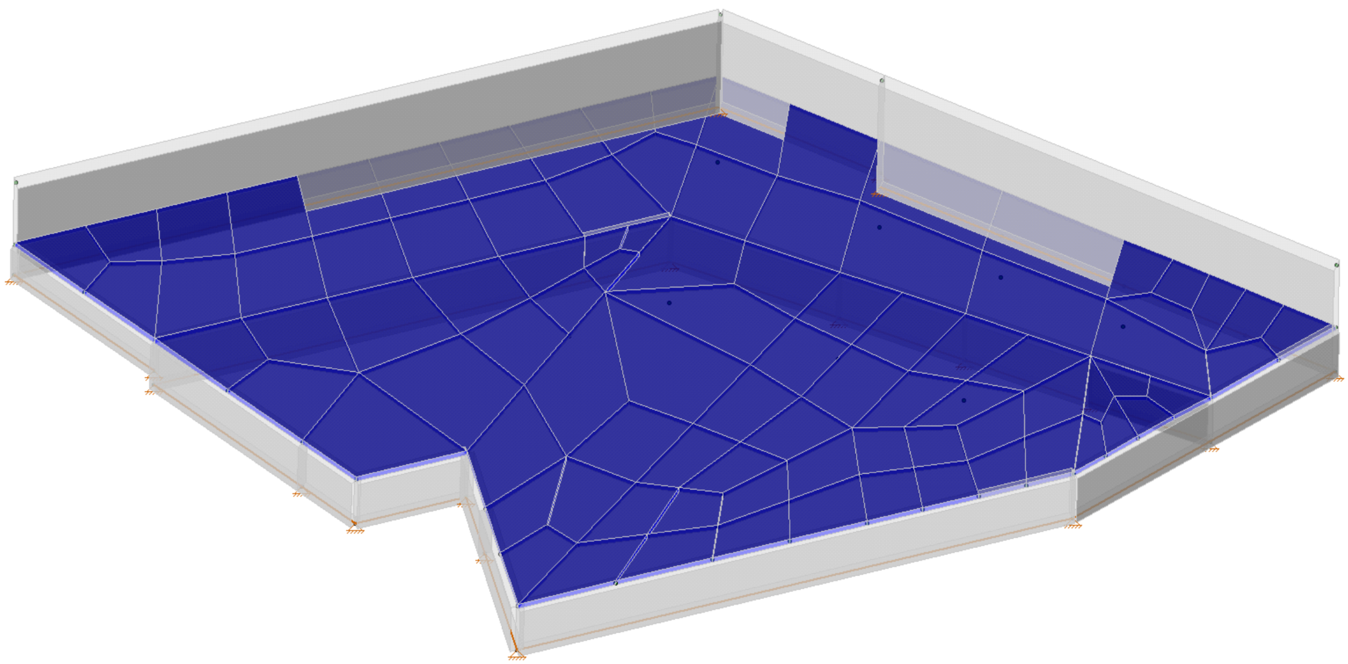


NOUS ENGINEERING, INC
600 WILSHIRE BLVD, SUITE 760
LOS ANGELES, CA 90017

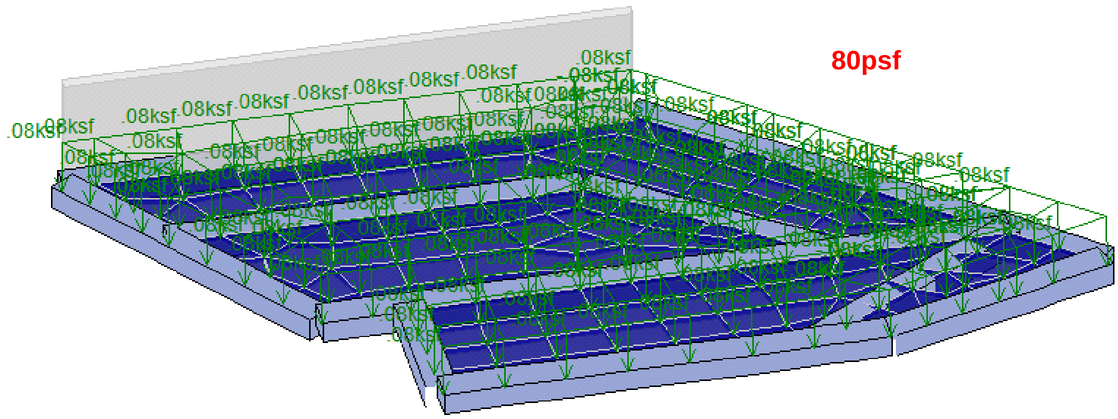
RISA MODEL - PLAN VIEW



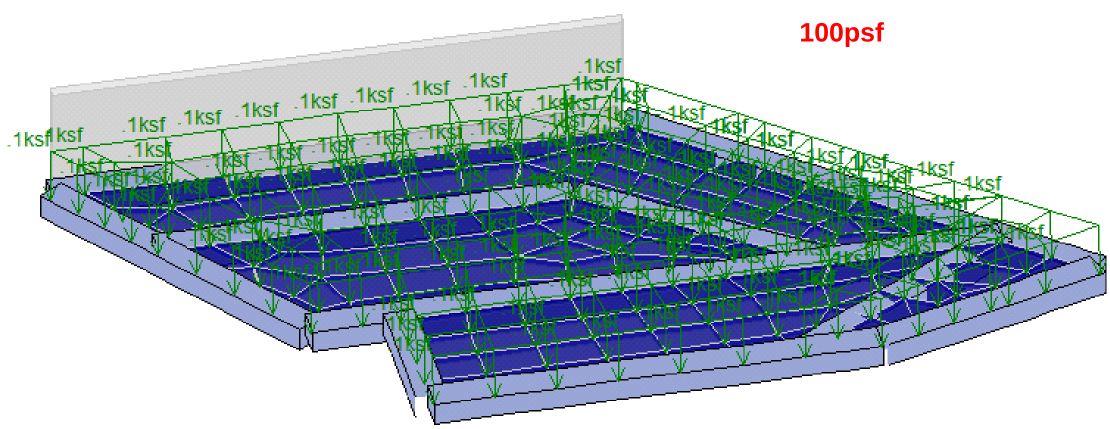
RISA MODEL - ISOMETRIC VIEW



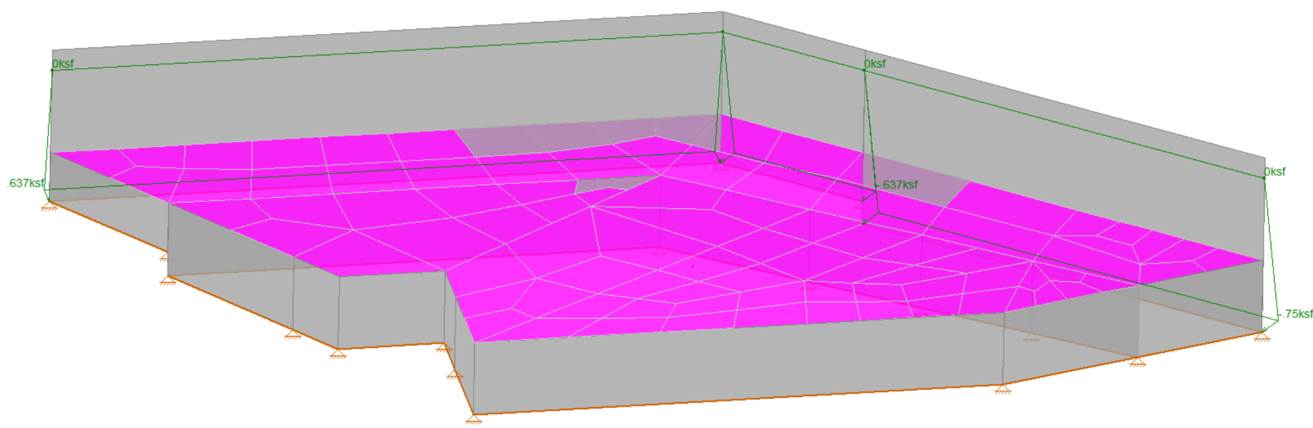
RISA MODEL - APPLIED SDL



RISA MODEL - APPLIED LIVE LOAD



RISA MODEL - APPLIED SOIL LOAD



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	

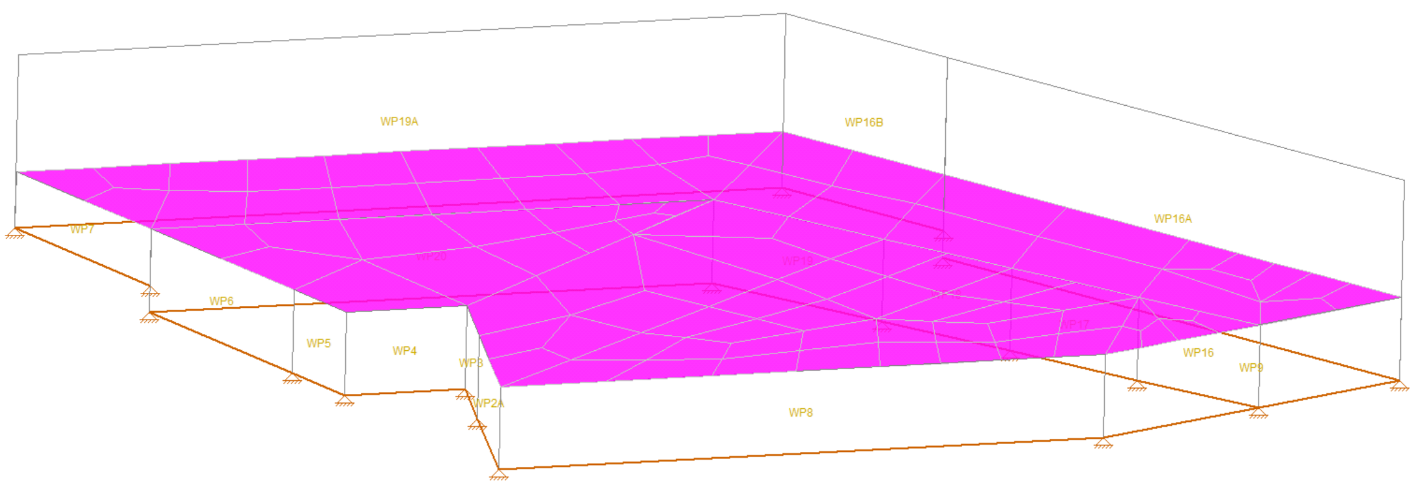
Basic Load Cases

	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



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

GOVERNING WALL DETAILED REPORT

WP3 : R1 (In-Plane)

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	

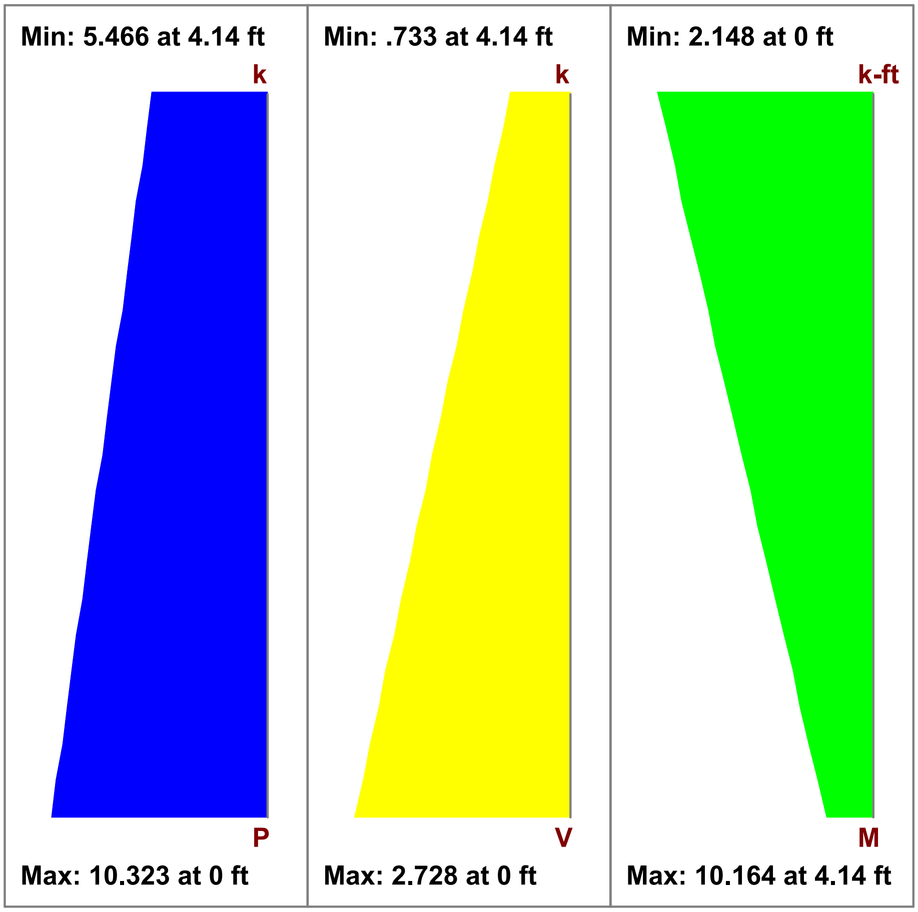
MATERIALS

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	:		May 31, 2018
Designer	:		6:48 PM
Job Number	:		Checked By:_____
Model Name	:	WP3 : R1	

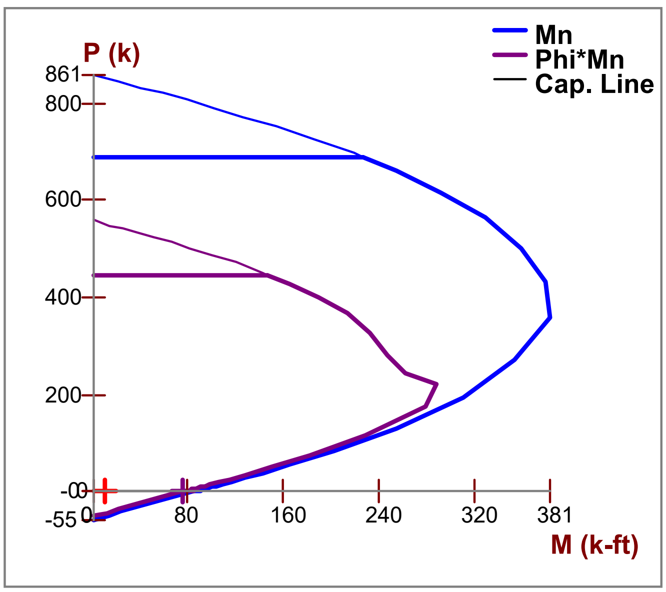
WALL SEGMENT SECTION PROPERTIES

Total Length	: **3.3**	**ft**	r	: **9.564**	**in**	As Provided (H)	: **.982**	**in^2**
A	: **316.8**	**in^2**	KL/r	: **4.346**		rho Provided (H)	: **.0025**	
Igross	: **41399.424**	**in^4**				As min (H)	: **.795**	**in^2**
Icracked	: **28979.597**	**in^4**				rho min (H)	: **.002**	
Cracked Mom, Mcr:	**71.576**	**k-ft**						
						As Provided (V)	: **.92**	**in^2**
						rho Provided (V)	: **.0029**	
						As min (V)	: **.38**	**in^2**
						rho min (V)	: **.0012**	

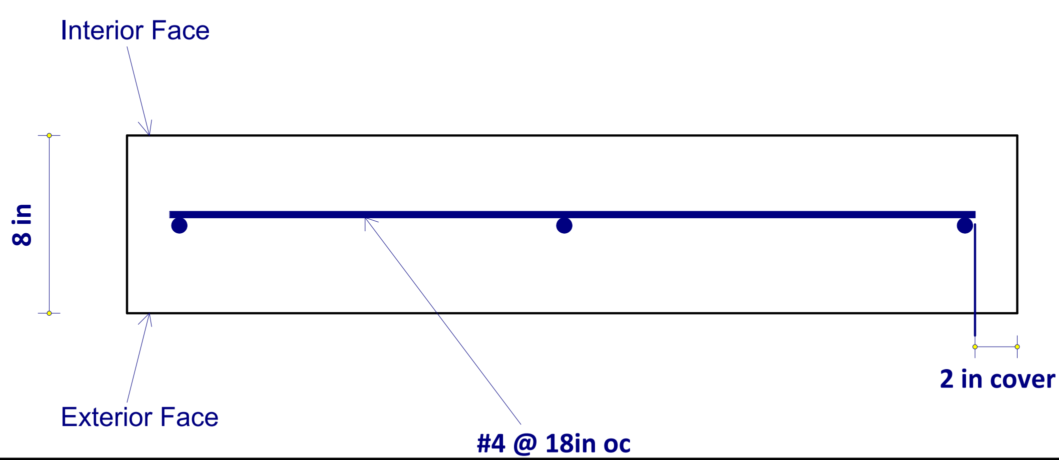
SLENDER BENDING SPAN RESULTS

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

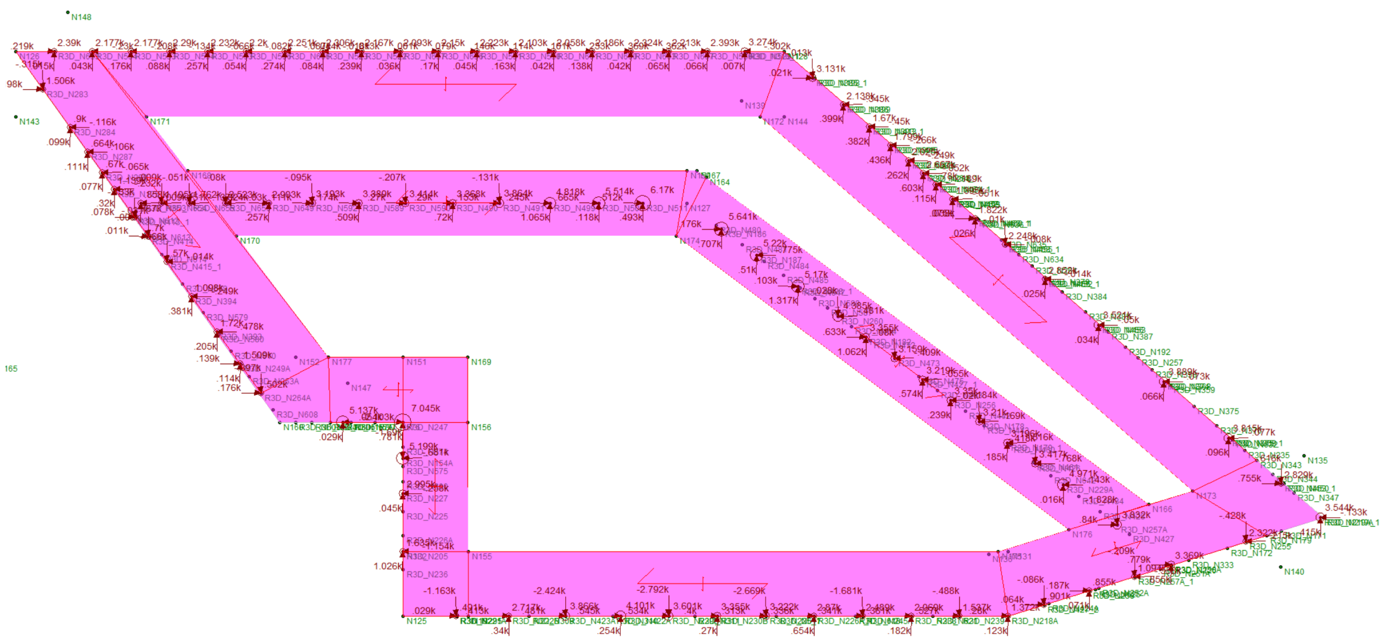
In-Plane Wall Interaction Diagram



CROSS SECTION DETAILING

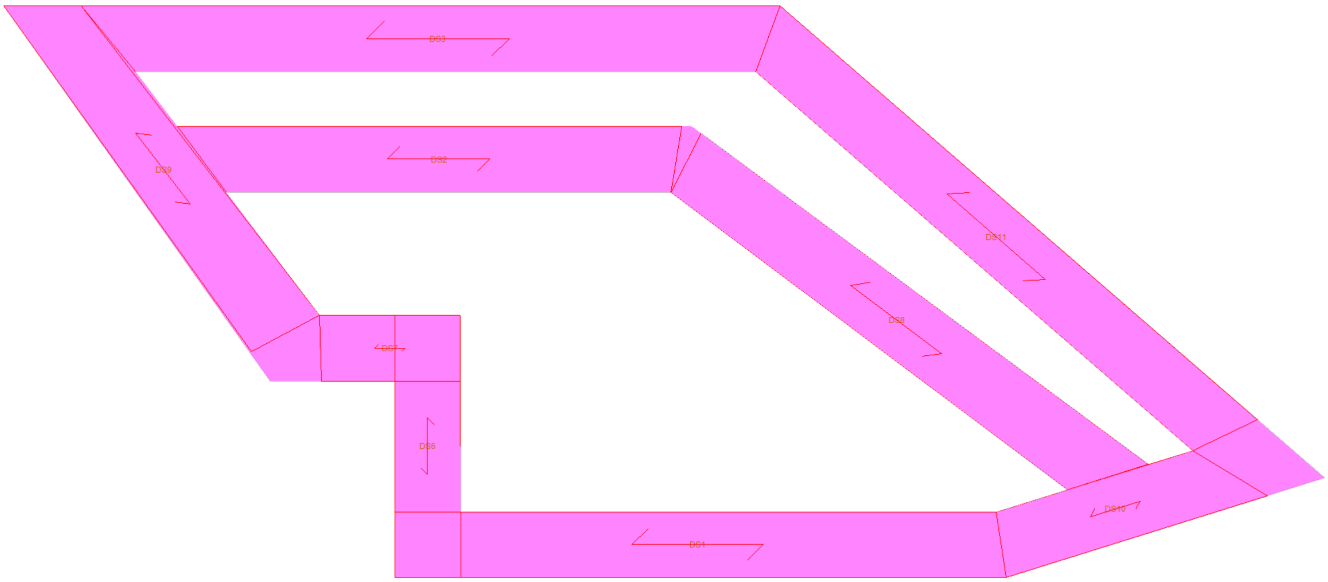


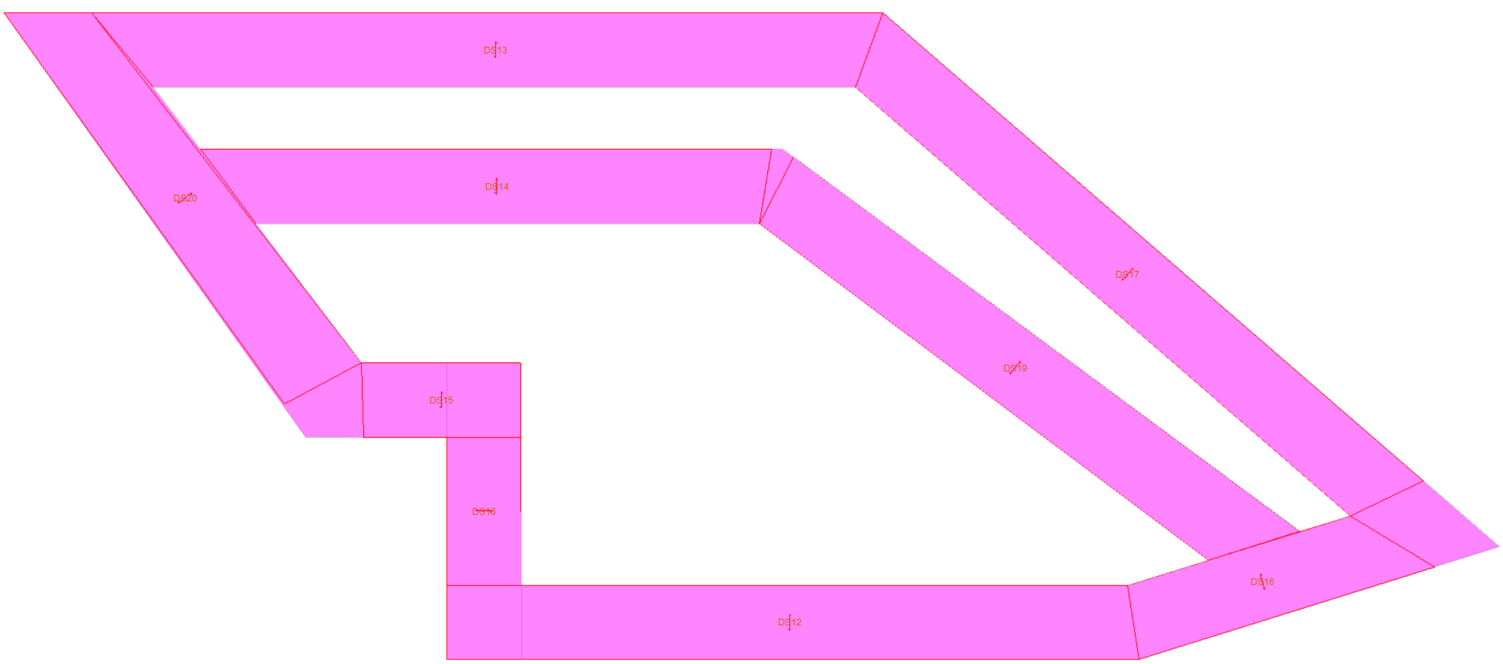
AMPHITHEATER FOUNDATION DESIGN-



LOADS FROM RISA 3D

AMPHITHEATER FOUNDATION DESIGN- DESIGN STRIP LABELS





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	8	1	Optimize
2	Horizintal Bars	#5	#5	12	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 Pl...	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	Horizintal Bars
11	DS13	90	50	Horizintal Bars
12	DS14	90	50	Horizintal Bars
13	DS15	90	50	Horizintal Bars
14	DS16	107.33	50	Horizintal Bars
15	DS17	49.1	50	Horizintal Bars
16	DS18	0	50	Horizintal Bars
17	DS19	53.17	50	Horizintal Bars
18	DS20	37.6	50	Horizintal Bars

Load Combinations

	Label	Solve	Service	AB...	...	Catego...	F...	Catego...	F...	Categ...	F...	Categ...	F...	Categ...	F...	Cat...	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 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

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

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