

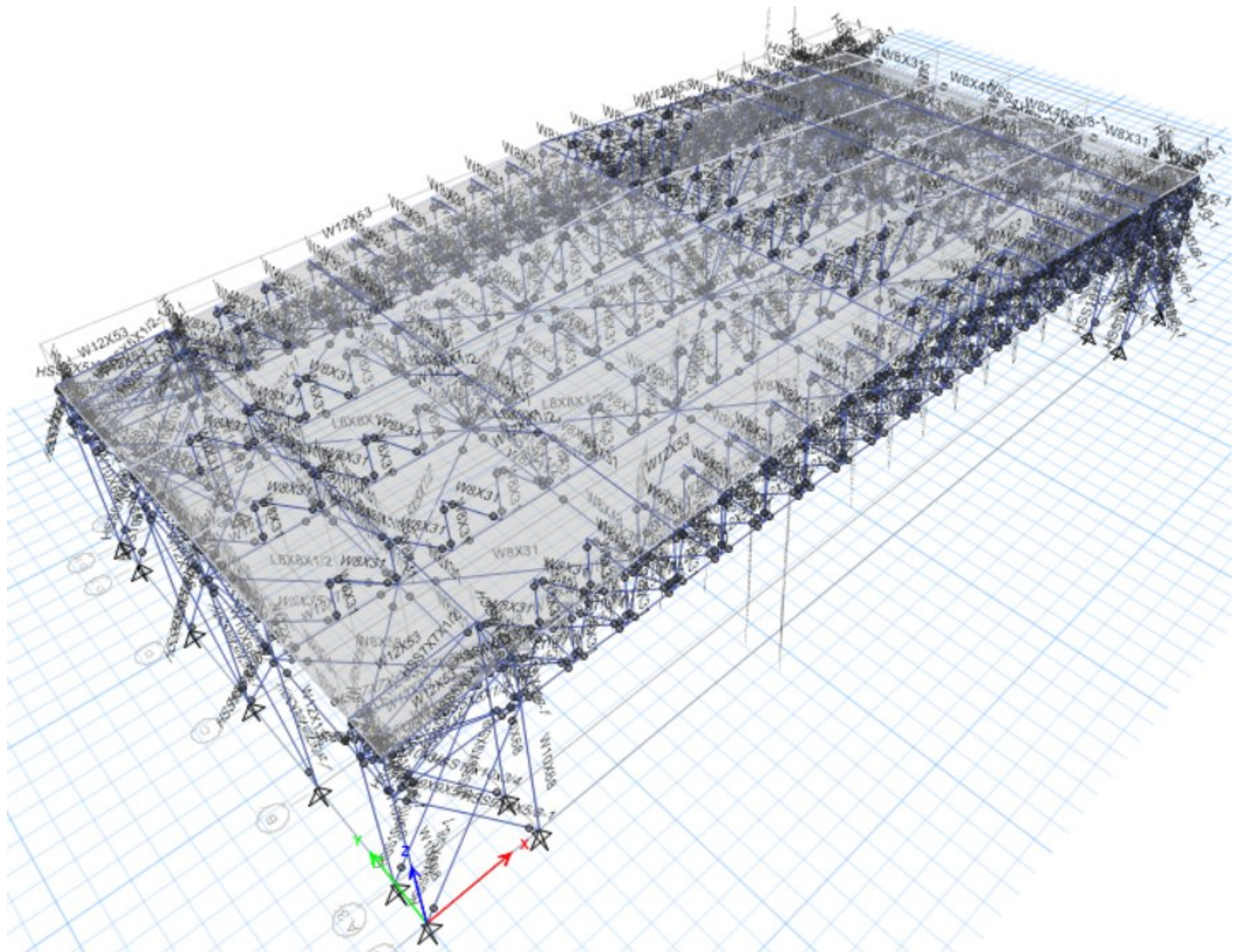
Creech DRP Phase 2
Aircraft Maintenance Facility (AMF)

Structural Calculations

Structural Calculation Index	Page
Criteria and Model Information	C1 to C51
Model Overview	C2
Structural Load Data (UFC 3-301-01)	C5
Design Criteria	C8
Loading Criteria	C10
Seismic Criteria	C12
Wind Criteria	C14
Wind Components & Cladding	C18
Snow Criteria	C21
Load Combinations	C24
Load Envelopes	C29
Model Elevations and Member Numbers	C30
Gravity System Calculations	G1 to G76
Roof Deck Design	G2
Roof Framing Plans	G3
Roof Joist Designs	G4
Mezzanine Deck Design	G6
Steel Beam Design Summary	G7
Steel Beam Designs	G22
Steel Column Design Summary	G32
Steel Column Designs	G38
Lateral System Calculations	L1 to L531
Lateral Loads	L2
Base Reactions	L42
SCBF Beam Design Summary	L52
SCBF Beam Designs	L67
SCBF Brace Design Summary	L96
SCBF Brace Designs	L105
SCBF Column Design Summary	L115
SCBF Column Designs	L121
Axial Load Distribution Elevations	L129
SCBF Gusset Designs	L143
Bracing Connection Designs	L209
Baseplate Connection Designs	L368
Wind Girt Anchor Design	L504
Torsional Irregularity Check	L511
Lateral System Overview	L514
Diaphragm Loads	L515
Diaphragm Capacity	L518
Bottom Chord Beams and Bracing	L521

Foundation Calculations	F1 to F59
Base Overview	F2
Wall Loads and Continuous Footing Layout	F3
Wall Footing Designs	F4

Criteria and Model Information



Steel Frame Design

Steel Frame Design Preferences - AISC 360-16

Item	Value
Multi-Response Design	Step-by-Step - All
Frame Type	SCBF
Seismic Design Category	D
Importance Factor	1.25
Design System Rho	1
Design System Sds	0.59
Design System R	6
Design System Omega0	2
Design System Cd	5
Design Provision	LRFD
Analysis Method	Direct Analysis
Second Order Method	General 2nd Order
Stiffness Reduction Method	Tau-b Fixed
Add Notional Load Case	Yes
Beta Factor	1.3
Beta Omega Factor	1.6
Phi (Bending)	0.9
Phi (Compression)	0.9
Phi (Tension-Yielding)	0.9
Phi (Tension-Fracture)	0.75
Phi (Shear)	0.9
Phi (Shear-Short Webbed Rolled I)	1
Phi (Torsion)	0.9
Ignore Seismic Code?	No
Ignore Special Seismic Load?	No
Doubler Plate Plug-Welded?	Yes
HSS Welding Type	ERW
Reduced HSS Thickness	No
Consider Deflection?	Yes
DL Ratio	120
SDL+LL Ratio	120
LL Ratio	360
Total Ratio	240
Total Camber Limit	240
Pattern Live Load Factor	0.75
D/C Ratio Limit	0.75
Maximum Iterations	1

ASCE Hazards Report

Address:

No Address at This Location

Standard:

ASCE/SEI 7-22

Risk Category: III**Soil Class:**

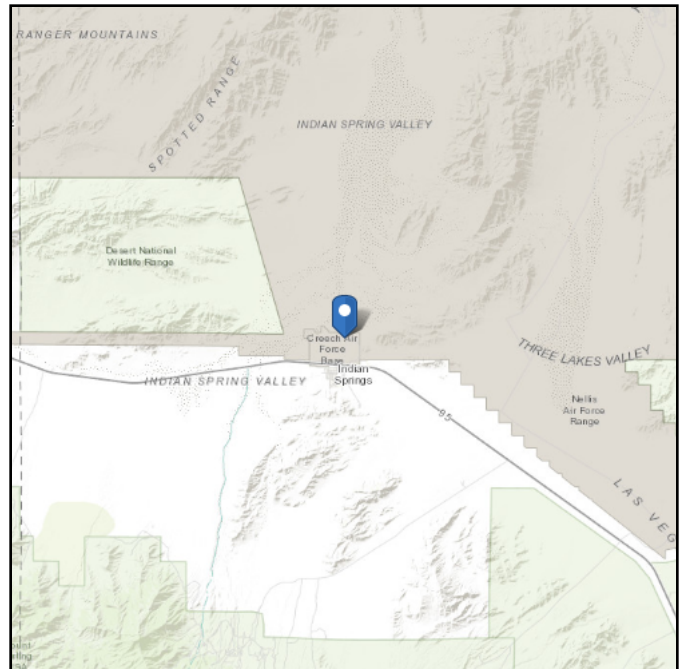
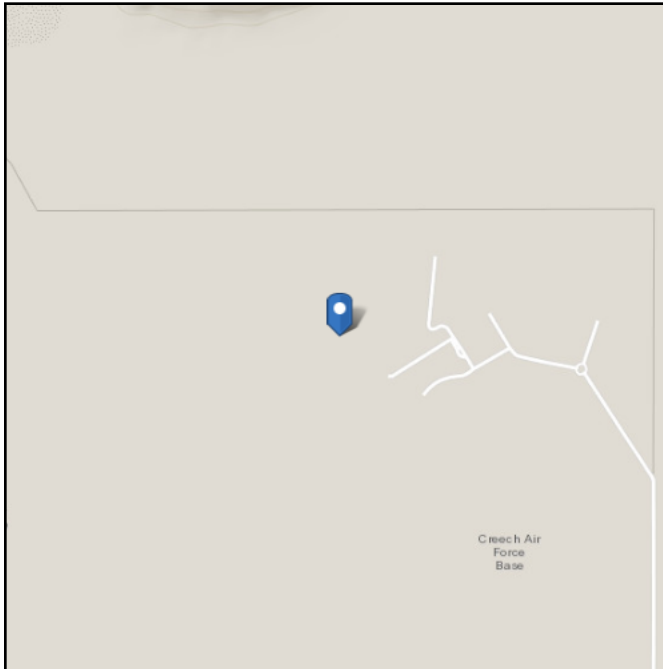
D - Stiff Soil

Latitude:

36.592935

Longitude: -115.66473**Elevation:**

3096.745107028911 ft
(NAVD 88)



Wind

Results:

Wind Speed	105 Vmph
10-year MRI	69 Vmph
25-year MRI	75 Vmph
50-year MRI	80 Vmph
100-year MRI	84 Vmph
300-year MRI	92 Vmph
700-year MRI	98 Vmph
1,700-year MRI	105 Vmph
3,000-year MRI	108 Vmph
10,000-year MRI	117 Vmph
100,000-year MRI	135 Vmph
1,000,000-year MRI	153 Vmph

Data Source:

ASCE/SEI 7-22, Fig. 26.5-1C and Figs. CC.2-1–CC.2-4, and Section 26.5.2

Date Accessed:

Wed Jun 18 2025



Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-22 Standard. Wind speeds correspond to approximately a 3% probability of exceedance in 50 years (annual exceedance probability = 0.000588, MRI = 1,700 years). Values for 10-year MRI, 25-year MRI, 50-year MRI and 100-year MRI are Service Level wind speeds, all other wind speeds are Ultimate wind speeds.

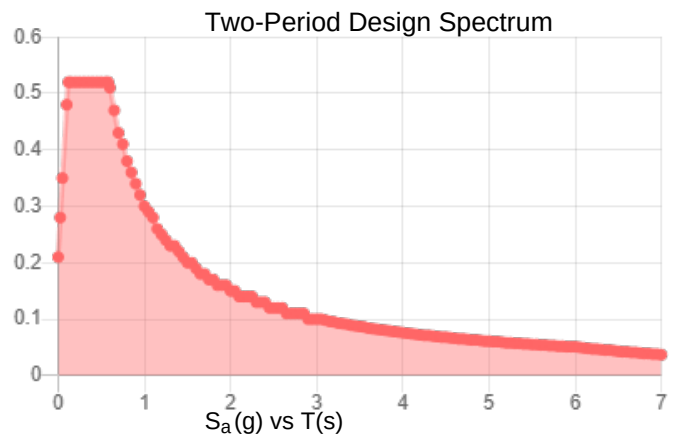
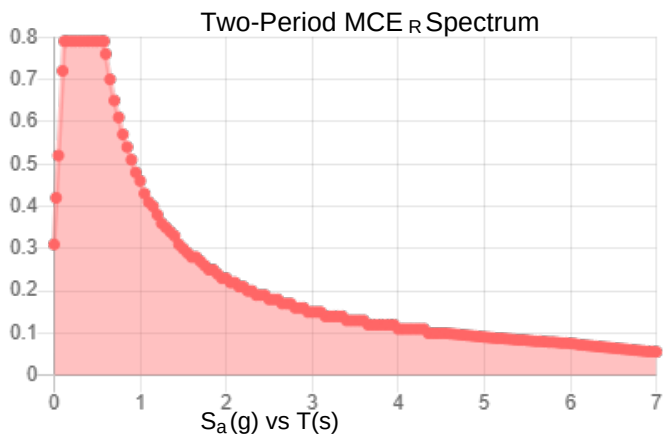
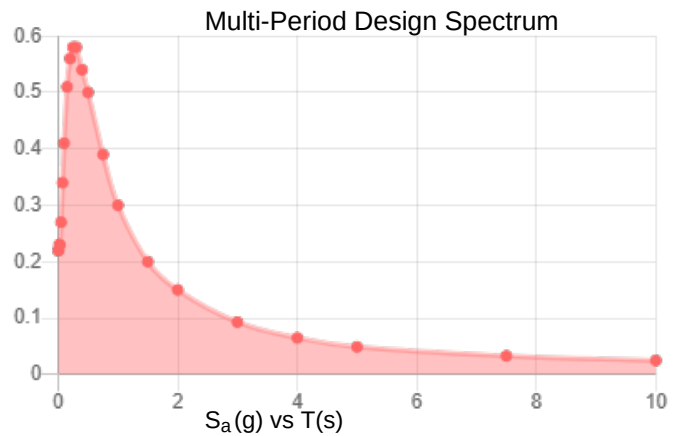
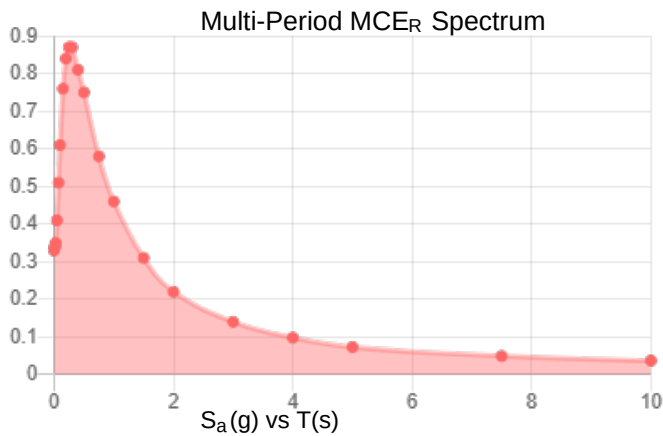
Site is not in a hurricane-prone region as defined in ASCE/SEI 7-22 Section 26.2.

Site Soil Class: D - Stiff Soil

Results:

PGA _M :	0.31	T _L :	6
S _{MS} :	0.79	S _S :	0.58
S _{M1} :	0.46	S ₁ :	0.17
S _{DS} :	0.52	V _{S30} :	260
S _{D1} :	0.3		

Seismic Design Category: D



MCE_R Vertical Response Spectrum
Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum
Vertical ground motion data has not yet been made available by USGS.

Data Accessed: Wed Jun 18 2025

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

Results:

Ground Snow Load, p_g :	21 lb/ft ²
20-year MRI Value:	3.88 lb/ft ²
Winter Wind Parameter:	0.35
Mapped Elevation:	3109.2 ft
Data Source:	ASCE/SEI 7-22, Figures 7.6-1 and 7.6-2 A-D
Date Accessed:	Wed Jun 18 2025

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

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

Ground Snow Loads for IRC only, $p_{g(asd)}$:	14.7 lb/ft ²
--	-------------------------

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

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE Hazard Tool.

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____

CALCULATED BY _____

CHECKED BY _____

SHEET NO. _____

DATE _____

DATE _____

www.struware.com**Code Search****Code:** International Building Code 2024**Occupancy:**

Occupancy Group = B Business

Risk Category & Importance Factors:

Risk Category = III

Wind Factor = 1.00

Snow Factor = 1.00

Seismic Importance factor = 1.25

Type of Construction:

Fire Rating:

Roof = 0.0 hr

Floor = 0.0 hr

Building Geometry:Roof angle (θ) 1.00 / 12 4.8 deg

Building length 242.0 ft

Least width 117.0 ft

Mean Roof Ht (h) 48.0 ft

Parapet ht above grd 48.0 ft

Minimum parapet ht 0.0 ft

hb for Elevated bldg 0.0 ft

Live Loads:

Roof 0 to 200 sf: 20 psf
200 to 600 sf: 24 - 0.02Area, but not less than 12 psf
over 600 sf: 12 psf

0 psf

Floor:

Typical Floor N/A

Partitions N/A

Partitions N/A

Partitions N/A

Partitions N/A

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____

CALCULATED BY _____

CHECKED BY _____

SHEET NO. _____

DATE _____

DATE _____

Roof Design Loads

Items	Description	Multiple	psf (max)	psf (min)
			0.0	0.0
Decking	Metal Roof deck, 1.5, 20 ga.		2.5	2.0
Framing	Steel roof joists & girders		3.0	2.0
Insulation	Rigid insulation, per 1" x 5.0		7.5	3.5
Ceiling	1/2" gypsum board		2.2	2.0
Mech & Elec	Mech. & Elec.		4.0	0.0
Misc.	Misc.		0.0	0.0
			2.0	0.0
Actual Dead Load ☐			21.2 ☐	9.5
Use this DL instead ☒			25.0 ☒	9.0
Live Load			20.0	0.0
Snow Load			5.0	0.0
Ultimate Wind (zone 2 - 100 sf)			19.4	-60.1
ASD Loading				
D + Lr			45.0	-
D + 0.75(0.6W + Lr)			48.7	-
0.6*D + 0.6*W			-	-30.6
LRFD Loading				
1.2D + 1.6 Lr + 0.5W			71.7	-
1.2D + 1.0W + 0.5Lr			59.4	-
0.9D + 1.0W			-	-52.0

Roof Live Load Reduction

Roof angle 1.00 / 12 4.8 deg

0 to 200 sf: 20.0 psf
 200 to 600 sf: 24 - 0.02Area, but not less than 12 psf
 over 600 sf: 12.0 psf

	300 sf	18.0 psf
	400 sf	16.0 psf
	500 sf	14.0 psf
User Input:	450 sf	15.0 psf

Michael Baker International
100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE			
JOB NO.			SHEET NO.
CALCULATED BY			DATE
CHECKED BY			DATE

Wall Design Load #1

Items	Description	Multiple	psf (max)	psf (min)
			0.0	0.0
Sheathing	5/8" gypsum		2.8	2.5
Framing	CMU wall		83.0	81.0
veneer	4" Clay Brick		40.0	38.0
			0.0	0.0
Insulation	Rigid insulation, per 1"		1.5	0.7
			0.0	0.0
Misc.	Misc.		0.5	0.0
Actual Dead Load ☒			127.8	☐ 122.2
Use this DL instead ☒			130.0	☒ 120.0

CMU walls

Size =

8" CMU

Unit Density =

Normal weight (135 pcf)

Grout Spacing =

Full Grout

CMU wall weight = 83 psf

Seismic Loads:

IBC 2024

Strength Level Forces

Risk Category : III
Importance Factor (I_e) : 1.25
Site Class : D

S_s (0.2 sec) = 0.72 g
S₁ (1.0 sec) = 0.23 g

Site specific ground motion analysis performed:

S_{ms} = 0.890 S_{DS} = 0.593 Design Category = D
S_{m1} = 0.480 S_{D1} = 0.320 Design Category = D

Seismic Design Category = D
Redundancy Coefficient ρ = 1.00 Code exception must be met for ρ to equal 1.0
Number of Stories: 0

Structure Type: All other building systems

Horizontal Struct Irregularities: No plan Irregularity

Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: Yes

Building System: **Building Frame Systems**

Seismic resisting system: **Steel special concentrically braced frames**

System Structural Height Limit: **160 ft**

Actual Structural Height (h_n) = 48.0 ft

See ASCE7 Section 12.2.5 for exceptions and other system limitations

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 6 To = 0.2(S_{d1}/S_{ds}) = 0.108
Over-Strength Factor (Ω_o) = 2 Ts = S_{d1}/S_{ds} = 0.539
Deflection Amplification Factor (C_d) = 5 Long Period Transition Period (T_L) = 6 sec

S_{DS} = 0.593
S_{D1} = 0.320

Seismic Load Effect (E) = E_h +/- E_v = ρ Q_E +/- 0.2S_{DS}D = Q_E +/- 0.119D Q_E = horizontal seismic force
Special Seismic Load Effect (E_m) = E_{mh} +/- E_v = Ω_o Q_E +/- 0.2S_{DS}D = 2Q_E +/- 0.119D D = dead load

ALLOWABLE STORY DRIFT

Structure Type: All other structures

Allowable story drift Δ_a = 0.015h_{sx} where h_{sx} is the story height below level x

PERMITTED ANALYTICAL PROCEDURES

Index Force Analysis - Method Not Permitted (only applies to Seismic Category A)

Model & Seismic Response Analysis - Permitted (see code for procedure)

Equivalent Lateral-Force (ELF) Analysis - Permitted

Building period coer. (C_T) = 0.020 Cu = 1.40
Approx fundamental period (T_a) = C_Th_n^x = 0.365 sec x = 0.75 Tmax = CuT_a = 0.511 sec
User calculated fundamental period = T = 0.365 sec

Method 2: Seismic response coef. (C_s) = S_{ds}/R = 0.124
need not exceed C_s = S_{d1}/RT = 0.183
but not less than C_s = 0.044S_{ds}*I = 0.033
USE C_s = 0.124

Design Base Shear V = 0.124W

Method 1: Enter S_a =
Seismic response coef. (C_s) = S_a/R = 0.000
but not less than C_s = 0.044S_{ds}*I = 0.033
C_s = Method not applicable

SEISMIC FORCES AT FLOORS - ELF Procedure

Total Stories = 1
 Building length L = 242.0 ft
 Building width W = 117.0 ft
 hn = 48.0 ft
 k = 1.000
 V = 0.124W
 Bottom Floor (level 1) is a slab on grade

Floor Dead Load = 0.0 psf
 Floor LL to include = 0.0 psf
 Floor Equip wt = 0.0 kips
 Partition weight = 0.0 psf
 Ext Wall Weight = 29.7 psf
 Roof Dead Load = 25.0 psf

Roof Snow Load = 0.0 psf
 Roof Equip wt = 0.0 kips
 Parapet weight = 0.0 psf
 Parapet height = 0.0 ft

Diaphragm shall be designed for level force Fx,
 but not less than $F_x = (\sum F_i / \sum w_i) w_{px}$, but :
 $F_{px \text{ min}} = 0.2S_{DS} I_e w_{px} = 0.148 w_{px}$
 $F_{px \text{ max}} = 0.4S_{DS} I_e w_{px} = 0.297 w_{px}$

Seismic Forces (Including all exterior walls)

Level (x)	EL above Seismic Base hx (ft)	Level Weight Wx (kips)	Wx hx ² (ft-kips)	Cvx = $\frac{W_x h_x^2}{\sum W_i h_i^k}$	V = 150.8k Base Shear Distribution			Diaphragm Force Fpx		
					Fx=CvxV	$\sum F_x$ (k)	Story M	$\sum W_i$ (k)	Fpx	Design Fpx
Roof	48.00	1,220	58,543	1.000	150.76	150.8	0	1,220	150.8	180.9
1	0.00	0	0	0.000	0.00	0.0	0	0	0.0	0.0
Base		1,220		1.000		150.8	7,237			
7,237 = Base M										

Diaphragm Forces excluding parallel exterior walls

Diaphragm Force Fpx Parallel to Bldg Length V= 108k						Diaphragm Force Fpx Normal to Bldg Length V= 130k					
Cvx =	Fx=CvxV	$\sum F_x$ (k)	$\sum W_i$ (k)	Fpx	Design Fpx	Level (x)	Cvx =	Fx=CvxV	$\sum F_x$ (k)	$\sum W_i$ (k)	Design Fpx
1.000	108.12	108.1	875	108.1	129.7	Roof	1.000	130.1	130.1	1,053	156.2
0.000	0.00	0.0	0	0.0	0.0	1	0.000	0.0	0.0	0	0.0
1.000		108.1				Base	1.000		130.1		

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____

CALCULATED BY _____

CHECKED BY _____

SHEET NO. _____

DATE _____

DATE _____

Wind Loads :

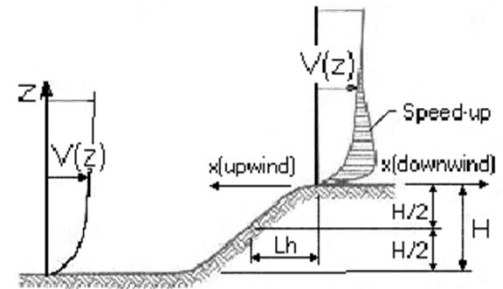
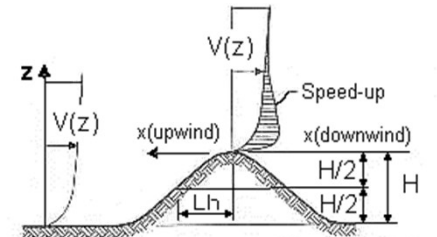
ASCE 7- 22

Ultimate Wind Speed 105 mph
Nominal Wind Speed 81.3 mph
Risk Category III
Exposure Category C
Enclosure Classif. Partially Enclosed
Internal pressure +/-0.55
Bldg Directionality (Kd) 0.85
Kh MWFRS<=60 1.079
Kh all other 1.079
Type of roof Gable

Topographic Factor (Kzt)

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

H/Lh = 0.50 $K_1 = 0.000$
x/Lh = 0.31 $K_2 = 0.792$
z/Lh = 0.30 $K_3 = 1.000$
At Mean Roof Ht:
 $K_{zt} = (1 + K_1 K_2 K_3)^2 = 1.00$

**ESCARPMENT****2D RIDGE or 3D AXISYMMETRICAL HILL****Gust Effect Factor**

h = 48.0 ft
B = 117.0 ft
/z (0.6h) = 28.8 ft

Flexible structure if natural frequency < 1 Hz (T > 1 second).

If building h/B > 4 then may be flexible and should be investigated.

h/B = 0.41

Rigid structure (low rise bldg)

G = 0.85 Using rigid structure default**Rigid Structure**

$\bar{e} = 0.20$
 $l = 500$ ft
 $Z_{min} = 15$ ft
c = 0.20
 $g_Q, g_v = 3.4$
 $L_z = 486.6$ ft
Q = 0.87
 $I_z = 0.20$
G = **0.86** use G = 0.85

Flexible or Dynamically Sensitive Structure

Natural Frequency (η_1) = 0.7 Hz
Damping ratio (β) = 0.01
/b = 0.660
/α = 0.156
Vz = 99.5
N₁ = 3.42
R_n = 0.064
R_h = 0.446 $\eta = 1.553$ h = 48.0 ft
R_B = 0.229 $\eta = 3.786$
R_L = 0.037 $\eta = 26.218$
g_R = 4.104
R = 0.600
G_f = 0.992

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____ SHEET NO. _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

Ground Elevation Factor (Ke)

Grd level above sea level = 0 ft
Constant = 0.00256
0.00256Ke = 0.00256

Ke = 1.0000

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____
CALCULATED BY _____
CHECKED BY _____

SHEET NO. _____
DATE _____
DATE _____

Wind Loads - MWFRS all h (Except for Open Buildings)

Base pressure (q_h) = 30.5 psf K_h = 1.079 G_{Cpi} = +/-0.55
($K_d q_h$) = **25.9 psf** Bldg dim parallel to ridge = 242.0 ft G = 0.85
Roof Angle (θ) = 4.8 deg Bldg dim normal to ridge = 117.0 ft z for q_i : 48.0 ft
Roof tributary area: h = 48.0 ft $K_d q_i$ = 25.9 psf for positive internal pressures
Wind normal to ridge $=(h/2)*L$: 5808 sf ridge ht = 53.0 ft
Wind parallel to ridge $=(h/2)*L$: 2808 sf

Ultimate Wind Surface Pressures (psf)

Surface	Wind Normal to Ridge				Wind Parallel to Ridge				
	L/B = 0.48		h/L = 0.41		L/B = 2.07		h/L = 0.20		
	Cp	qhGCp	w/+qiGCpi	w/-qhGCpi	Dist.*	Cp	qhGCp	w/+qiGCpi	w/-qhGCpi
Windward Wall (WW)	0.80	17.6	see table below			0.80	17.6	see table below	
Leeward Wall (LW)	-0.50	-11.0	-25.2	3.2		-0.30	-6.5	-20.8	7.7
Side Wall (SW)	-0.70	-15.4	-29.6	-1.2		-0.70	-15.4	-29.6	-1.2
Leeward Roof (LR)	**					Included in windward roof			
Neg Windward Roof: 0 to h/2*	-0.90	-19.8	-34.0	-5.6	0 to h/2*	-0.90	-19.8	-34.0	-5.6
h/2 to h*	-0.90	-19.8	-34.0	-5.6	h/2 to h*	-0.90	-19.8	-34.0	-5.6
h to 2h*	-0.50	-11.0	-25.2	3.2	h to 2h*	-0.50	-11.0	-25.2	3.2
> 2h*	-0.30	-6.6	-20.8	7.6	> 2h*	-0.30	-6.6	-20.8	7.6
Pos/min windward roof press.	-0.18	-4.0	-18.2	10.3	Min press.	-0.18	-4.0	-18.2	10.3

*Horizontal distance from windward edge

**Roof angle < 10 degrees. Therefore, leeward roof is included in windward roof pressure zones.

Windward roof overhangs : 17.6 psf (upward : add to $q_h G_{Cp}$ windward roof pressure)

Parapet

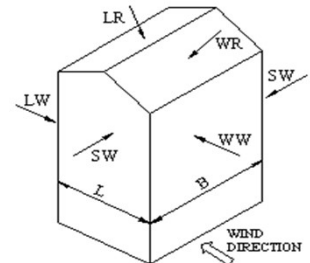
z	K_z	K_{zt}	$K_d q_p$ (psf)
48.0 ft	1.079	1.00	25.9

windward parapet: 38.8 psf ($G_{Cpn} = +1.5$)

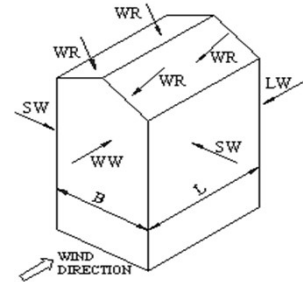
leeward parapet: -25.9 psf ($G_{Cpn} = -1.0$)

Windward Wall Pressures at "z" (psf)

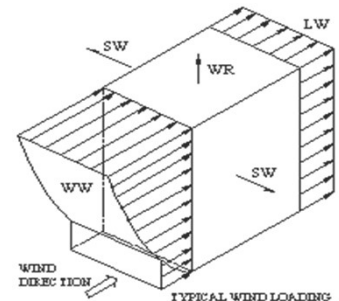
z	K_z	K_{zt}	Windward Wall			Combined WW + LW	
			$q_z G_{Cp}$	$w/+q_i G_{Cpi}$	$w/-q_h G_{Cpi}$	Wind Normal to Ridge	Wind Parallel to Ridge
0 to 15'	0.85	1.00	13.9	-0.4	28.1	24.9	20.4
20.0 ft	0.90	1.00	14.7	0.5	29.0	25.7	21.3
25.0 ft	0.94	1.00	15.4	1.2	29.7	26.4	21.9
30.0 ft	0.98	1.00	16.0	1.8	30.2	27.0	22.5
40.0 ft	1.04	1.00	17.0	2.7	31.2	28.0	23.5
h = 48.0 ft	1.08	1.00	17.6	3.4	31.8	28.6	24.1
ridge = 53.0 ft	1.10	1.00	18.0	3.7	32.2	29.0	24.5



WIND NORMAL TO RIDGE



WIND PARALLEL TO RIDGE



TYPICAL WIND LOADING

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____

CALCULATED BY _____

CHECKED BY _____

SHEET NO. _____

DATE _____

DATE _____

Elevated Buildings**Horizontal MWFRS wind pressures on objects below hb**

h = 48.0 ft
hb = 0.0 ft
z = 12.0 ft

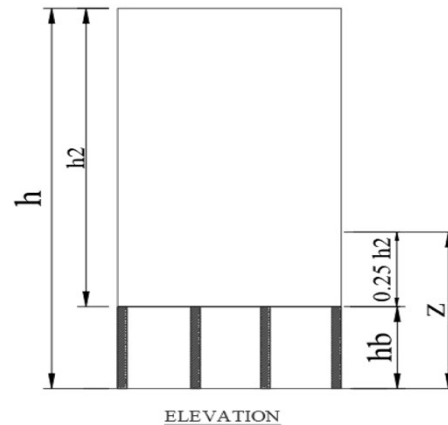
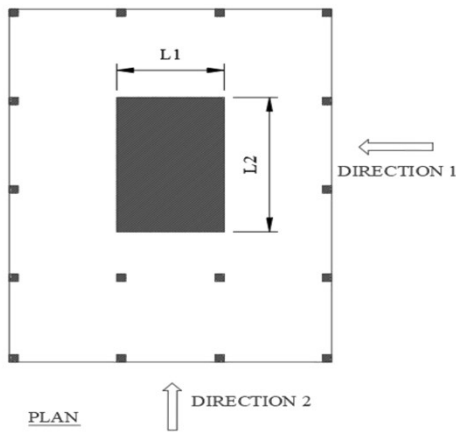
Elevated Building Geometry limitation 1

Bldg Length =	242.0 ft	Area of below elements / Area of Bldg above =	0.4%
Bldg Width =	117.0 ft		
Area of elevated building above =	28,314 sf		
Cross sectional area of all columns below bldg =	64.0 sf	Direction 1 L/B =	0.48 Max L/B = 0.500 OK
Area of enclosed areas below bldg =	50.0 sf	Direction 2 L/B =	2.07 Max L/B = 0.500 OK
Total cross sectional area below bldg =	114.0 sf	Meets geometry Limitation No 1 for both directions	

Elevated Building Geometry limitation 2

<u>Direction 1</u>		<u>Direction 2</u>	
Projected width of all columns facing direction 1 =	32.0 ft	Projected width of columns direction 2 =	30.0 ft
Projected L2 width of enclosed areas below bldg =	40.0 ft	Projected L1 width of enclosed areas =	42.0 ft
Total projected width below bldg (width) =	72.0 ft	Total projected width below bldg (width) =	72.0 ft
Projected area ratio =	29.8% OK	Projected area ratio =	61.5% OK
		Meets geometry Limitation No 2 for both directions	

hb = 0, therefore building is not an elevated building



Combined MWFRS windward and leeward wind pressure on surfaces from 0 to hb (Kd qzGCp) =	0.0 psf
MWFRS direction 1 force at height hb (width*hb/2) =	0.0 k
MWFRS direction 2 force at height hb (width*hb/2) =	0.0 k

Vertical MWFRS wind pressures on bottom surface of the elevated building

Base pressure (Kd qz) = 0.0 psf

Ultimate Vertical MWFRS Wind Surface Pressures (psf) at horizontal bottom surface of elevated building

	Wind Normal to Ridge				Wind Parallel to Ridge				
	L/B = 0.48		hb/L = 0.00		L/B = 2.07		hb/L = 0.00		
	Cp	qhGCp	w/+qiGCpi	w/-qhGCpi	Dist.*	Cp	qhGCp	w/+qiGCpi	w/-qhGCpi
Downward pressure: 0 to hb/2*	-0.90	0.0	0.0	0.0	0 to hb/2*	-0.90	0.0	0.0	0.0
hb/2 to hb*	-0.90	0.0	0.0	0.0	hb/2 to hb*	-0.90	0.0	0.0	0.0
hb to 2hb*	-0.50	0.0	0.0	0.0	hb to 2hb*	-0.50	0.0	0.0	0.0
> 2hb*	-0.30	0.0	0.0	0.0	> 2hb*	-0.30	0.0	0.0	0.0
Upward or min wind pressure	-0.18	0.0	0.0	0.0	Min press.	-0.18	0.0	0.0	0.0

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____

CALCULATED BY _____

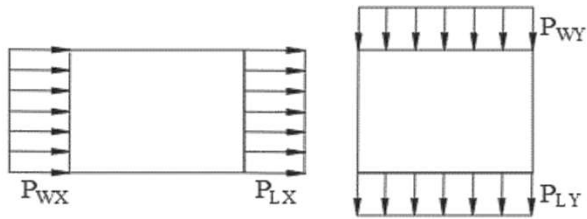
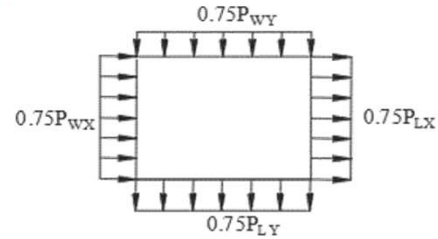
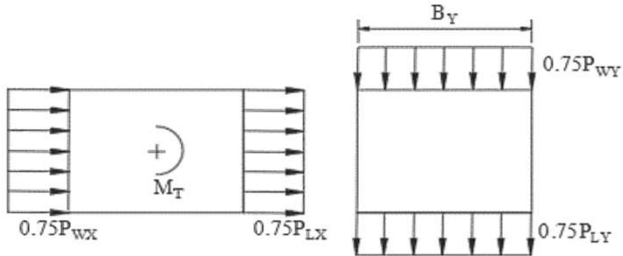
CHECKED BY _____

SHEET NO. _____

DATE _____

DATE _____

NOTE: ASCE 7 requires the application of full and partial loading of the wind pressures per the 4 cases below.

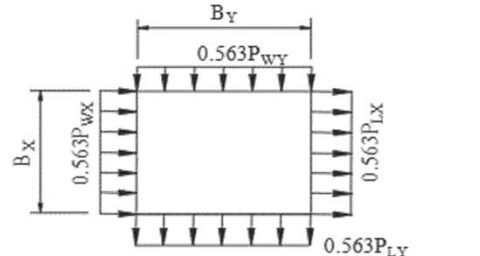
**CASE 1****CASE 3**

$$M_T = 0.75(P_{WX} + P_{LX})B_x e_x$$

$$e_x = \pm 0.15 B_x$$

$$M_T = 0.75(P_{WY} + P_{LY})B_y e_y$$

$$e_y = \pm 0.15 B_y$$

CASE 2

$$M_T = 0.563(P_{WX} + P_{LX})B_x e_x + 0.563(P_{WY} + P_{LY})B_y e_y$$

$$e_x = \pm 0.15 B_x$$

$$e_y = \pm 0.15 B_y$$

CASE 4**Wind Forces at Floors**

Total Floors above grade = 0
T/Fdn (dist below grade) = 2.0 ft

Building dimension (parallel with ridge) = 242.0 ft
Building dimension (normal to ridge) = 117.0 ft
L is the building dimension parallel to the wind direction

e = 36.30 ft
e = 17.55 ft

Level	Elevation Above Grade (ft)	Height of Centroid to Fdn (ft)	Wind Normal to Ridge						Wind Parallel to Ridge			
			L	B	Area (sf)	Applied Force (k)	Story Shear (k)	Overturning Moment (k')	Area	Applied Force (k)	Story Shear (k)	Overturning Moment (k')
Equip, etc	0.00	2.00	wind on equip, screenwalls, etc =				2			0		
Parapet	48.00	50.00	117.0	242.0	0.0	0.0			0.0	0.0		
T/Ridge	53.00	52.50	117.0	242.0	1,210.0	0.0			292.5	7.2		
Roof	48.00	50.00	117.0	242.0	5,808.0	166.2	168.2	-96.0	2,808.0	67.8	74.9	17.9 Roof
GRD	0.00	2.00						7,975.7				3,614.4 GRD
FDN	0.00	0.00						8,312.0				3,764.3 FDN

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____
CALCULATED BY _____
CHECKED BY _____

SHEET NO. _____
DATE _____
DATE _____

Ultimate Wind Pressures**Wind Loads - Components & Cladding : $h \leq 60'$**

Base pressure (qh) = 30.5 psf Kh = 1.079
(Kd qh) = **25.9 psf** h = 48.0 ft 0.2h = 9.6 ft
Minimum parapet ht = 0.0 ft 0.6h = 28.8 ft
Roof Angle (θ) = 4.8 deg GCpi = +/-0.55
Type of roof = Gable Kd qi = 25.9 psf for positive internal pressures

Roof

Area	GCp +/- GCpi				Surface Pressure (psf)			
	10 sf	100 sf	500 sf	1000 sf	10 sf	100 sf	500 sf	1000 sf
Negative Zone 1	-2.25	-1.84	-1.55	-1.55	-58.3	-47.6	-40.1	-40.1
Negative Zone 1'	-1.45	-1.45	-1.10	-0.95	-37.5	-37.5	-28.5	-24.6
Negative Zone 2	-2.85	-2.32	-1.95	-1.95	-73.8	-60.1	-50.5	-50.5
Negative Zone 3	-3.75	-2.69	-1.95	-1.95	-97.1	-69.7	-50.5	-50.5
Positive All Zones	0.85	0.75	0.75	0.75	22.0	19.4	19.4	19.4
Overhang Zone 1&1'	-1.70	-1.60	-1.00	-1.00	-44.0	-41.4	-25.9	-25.9
Overhang Zone 2	-2.30	-1.59	-1.10	-1.10	-59.5	-41.3	-28.5	-28.5
Overhang Zone 3	-3.20	-1.96	-1.10	-1.10	-82.8	-50.8	-28.5	-28.5

Overhang pressures in the table above assume an internal pressure coefficient (GCpi) of 0.0
Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 14.2 psf)

User input	
100 sf	100 sf
-47.6	-47.6
-37.5	-37.5
-60.1	-60.1
-69.7	-69.7
19.4	19.4
-41.4	-41.4
-41.3	-41.3
-50.8	-50.8

Parapet

Kd qp = 25.9 psf

Solid Parapet Pressure		Surface Pressure (psf)					
		10 sf	20 sf	50 sf	100 sf	200 sf	500 sf
CASE A:	Zone 2 :	0.0	0.0	0.0	0.0	0.0	0.0
	Zone 3 :	0.0	0.0	0.0	0.0	0.0	0.0
CASE B:	Interior zone :	0.0	0.0	0.0	0.0	0.0	0.0
	Corner zone :	0.0	0.0	0.0	0.0	0.0	0.0

User input	
50 sf	
0.0	
0.0	
0.0	
0.0	

wall a = 11.7 ft

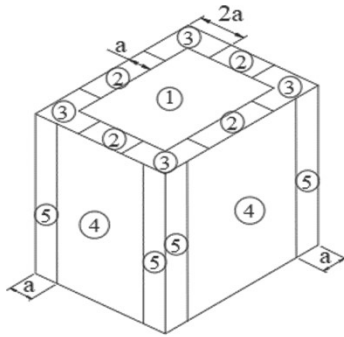
Walls

Area	GCp +/- GCpi				Surface Pressure at h			
	10 sf	100 sf	200 sf	500 sf	10 sf	100 sf	200 sf	500 sf
Negative Zone 4	-1.54	-1.38	-1.33	-1.27	-39.9	-35.8	-34.5	-32.9
Negative Zone 5	-1.81	-1.49	-1.40	-1.27	-46.9	-38.6	-36.2	-32.9
Positive Zone 4 & 5	1.45	1.29	1.24	1.18	37.5	33.4	32.2	30.6

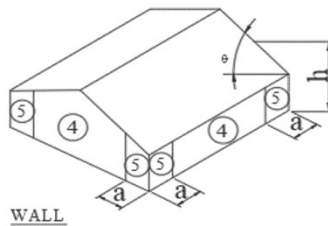
Note: GCp reduced by 10% due to roof angle ≤ 10 deg.

User input	
100 sf	200 sf
-35.8	-34.5
-38.6	-36.2
33.4	32.2

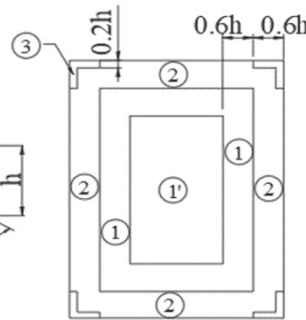
Location of C&C Wind Pressure Zones - ASCE 7-22



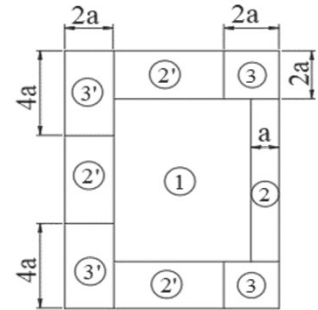
Roofs w/ $\theta \leq 10^\circ$
and all walls
 $h > 60'$



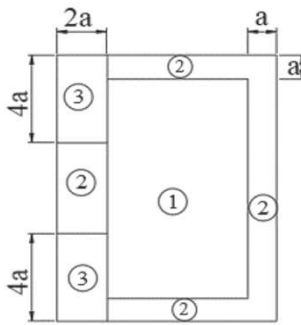
Walls $h \leq 60'$
& alt design $h < 90'$



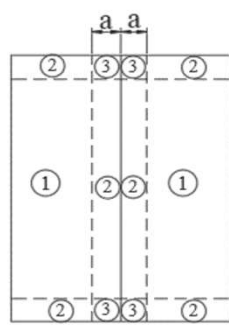
Multispan Gable & Sawtooth $\leq 10^\circ$
& Gable $\theta \leq 7$ degrees &
Monoslope ≤ 3 degrees
 $h \leq 60'$ & alt design $h < 90'$



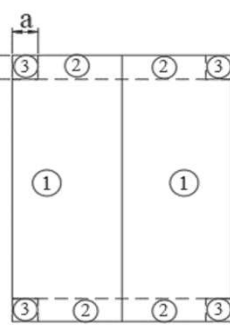
Monoslope roofs
 $3^\circ < \theta \leq 10^\circ$
 $h \leq 60'$ & alt design $h < 90'$



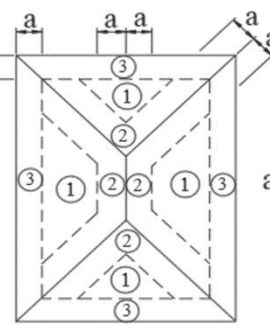
Monoslope roofs
 $10^\circ < \theta \leq 30^\circ$
 $h \leq 60'$ & alt design $h < 90'$



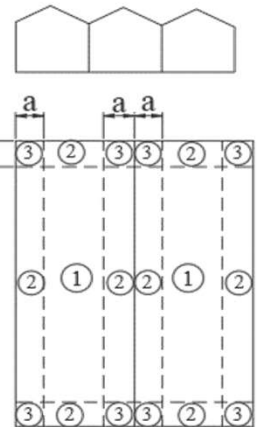
Gable $7^\circ < \theta \leq 27^\circ$



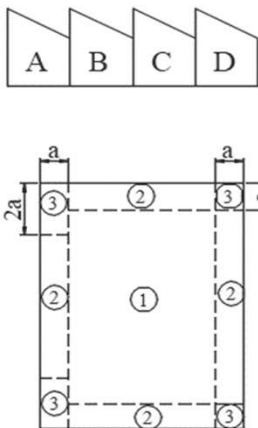
Gable $27^\circ < \theta \leq 45^\circ$



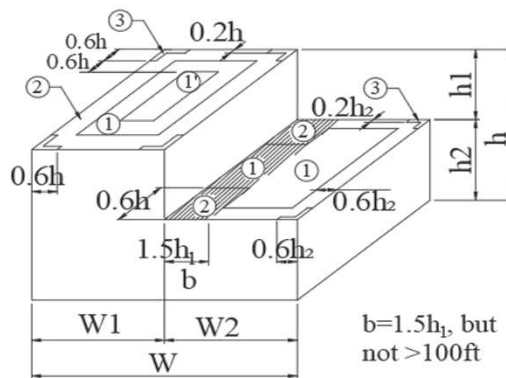
Hip $7^\circ < \theta \leq 45^\circ$



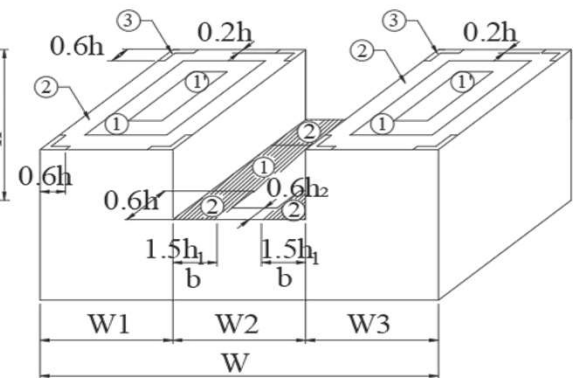
Multispan gable $10^\circ < \theta \leq 45^\circ$
 $h \leq 60'$ & alt design $h < 90'$



Sawtooth $10^\circ < \theta \leq 45^\circ$
 $h \leq 60'$ & alt design $h < 90'$



Stepped roofs $\theta \leq 3^\circ$
 $h \leq 60'$ & alt design $h < 90'$



Note: The hatched area indicates where roof positive pressures are equal to the adjacent wall positive pressure.

Michael Baker International

100 Airside Drive
Moon Township, PA 15108
412.269.6300

JOB TITLE _____

JOB NO. _____

SHEET NO. _____

CALCULATED BY _____

DATE _____

CHECKED BY _____

DATE _____

Snow Loads : ASCE 7- 22

Ultimate Snow Forces

Roof slope = 4.8 deg
Horiz. eave to ridge dist (W) = 58.5 ft
Roof length parallel to ridge (L) = 242.0 ft

Type of Roof Hip and gable w/ trussed systems

Ground Snow Load Pg = 21.0 psf

Risk Category = III

Snow Factor = 1.0

Roof R value Rroof = 30

Thermal Factor Ct = 1.188

Exposure Factor Ce = 1.00

Pf = $0.7 \cdot Ce \cdot Ct \cdot I \cdot Pg$ = 17.5 psf

Unobstructed Slippery Surface no

Sloped-roof Factor Cs = 1.00

Balanced Snow Load = **17.5 psf**Near ground level surface balanced snow load = **21.0 psf**

Rain on Snow Surcharge Angle 1.17 deg

Code Maximum Rain Surcharge 8.0 psf

Rain on Snow Surcharge = 0.0 psf

Ps plus rain surcharge = 17.5 psf

Minimum Snow Load Pm = 21.0 psf

Uniform Roof Design Snow Load = **21.0 psf**

NOTE: Alternate spans of continuous beams shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code for loading diagrams and exceptions for gable roofs

Unbalanced Snow Loads - for Hip & Gable roofs only

Winter Wind Parameter W2 = 0.55

Required if slope is between 7 on 12 = 30.26 deg

and 2.38 deg = 2.38 deg

Unbalanced snow loads must be appliedWindward snow load = 5.2 psf = $0.3P_s$ Leeward snow load from ridge to 26.12' = 31.1 psf = $hdy / \sqrt{S} + P_s$ Leeward snow load from 26.12' to the eave = 17.5 psf = P_s

Load Patterns

Load Pattern Definitions

Name	Is Auto Load	Type	Self Weight Multiplier	Auto Load
~LLRF	Yes	Other	0	
Dead	No	Dead	1	
Exx	No	Seismic	0	ASCE 7-22
Exx(1/3)	Yes	Seismic	0	ASCE 7-22
Exx(2/3)	Yes	Seismic	0	ASCE 7-22
Exx(3/3)	Yes	Seismic	0	ASCE 7-22
Eyy	No	Seismic	0	ASCE 7-22
Eyy(1/3)	Yes	Seismic	0	ASCE 7-22
Eyy(2/3)	Yes	Seismic	0	ASCE 7-22
Eyy(3/3)	Yes	Seismic	0	ASCE 7-22
Live	No	Roof Live	0	
Mass	No	Other	0	
Sb	No	Snow	0	
Su1	No	Snow	0	
Su2	No	Snow	0	
Wx	No	Wind	0	None
Wxx	No	Wind	0	None
Wy	No	Wind	0	None
Wyy	No	Wind	0	None

Load Cases

Load Case Definitions

Name	Type
Dead	Linear Static
Live	Linear Static
Exx	Linear Static
Eyy	Linear Static
Mass	Linear Static
Wx	Linear Static
Wy	Linear Static
Wxx	Linear Static
Wyy	Linear Static
Sb	Linear Static
Su1	Linear Static
Su2	Linear Static

Load Combinations

Load Combination Definitions

Name	Type	Is Auto	Load Name	SF	Notes
DStID1	Linear Add	Yes	Dead	1	Dead [Deflections]
DStIS1	Linear Add	Yes	Dead	1.4	Dead [Strength]
DStIS2-1	Linear Add	No	Dead	1.2	Dead + Live + Snow [Strength]
DStIS2-1			Sb	1.6	
DStIS2-2	Linear Add	No	Dead	1.2	Dead + Live + Snow [Strength]
DStIS2-2			Su1	1.6	
DStIS2-3	Linear Add	No	Dead	1.2	Dead + Live + Snow [Strength]
DStIS2-3			Su2	1.6	
DStIS3	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live [Strength]
DStIS3			Live	1.6	
DStIS4-1	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS4-1			Sb	0.5	
DStIS4-1			Wx	1	
DStIS4-2	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS4-2			Su1	0.5	
DStIS4-2			Wx	1	
DStIS4-3	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS4-3			Su2	0.5	
DStIS4-3			Wx	1	
DStIS5-1	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS5-1			Sb	0.5	
DStIS5-1			Wx	-1	
DStIS5-2	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS5-2			Su1	0.5	
DStIS5-2			Wx	-1	
DStIS5-3	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS5-3			Su2	0.5	
DStIS5-3			Wx	-1	
DStIS6-1	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS6-1			Sb	0.5	
DStIS6-1			Wy	1	
DStIS6-2	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS6-2			Su1	0.5	
DStIS6-2			Wy	1	
DStIS6-3	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS6-3			Su2	0.5	
DStIS6-3			Wy	1	
DStIS7-1	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS7-1			Sb	0.5	
DStIS7-1			Wy	-1	
DStIS7-2	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS7-2			Su1	0.5	
DStIS7-2			Wy	-1	
DStIS7-3	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS7-3			Su2	0.5	
DStIS7-3			Wy	-1	
DStIS8-1	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS8-1			Sb	0.5	
DStIS8-1			Wxx	1	
DStIS8-2	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS8-2			Su1	0.5	
DStIS8-2			Wxx	1	
DStIS8-3	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS8-3			Su2	0.5	

Name	Type	Is Auto	Load Name	SF	Notes
DStIS8-3			Wxx	1	
DStIS9-1	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS9-1			Sb	0.5	
DStIS9-1			Wxx	-1	
DStIS9-2	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS9-2			Su1	0.5	
DStIS9-2			Wxx	-1	
DStIS9-3	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS9-3			Su2	0.5	
DStIS9-3			Wxx	-1	
DStIS10-1	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS10-1			Sb	0.5	
DStIS10-1			Wyy	1	
DStIS10-2	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS10-2			Su1	0.5	
DStIS10-2			Wyy	1	
DStIS10-3	Linear Add	No	Dead	1.2	Dead + Live + Wind + Snow [Strength]
DStIS10-3			Su2	0.5	
DStIS10-3			Wyy	1	
DStIS11-1	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS11-1			Sb	0.5	
DStIS11-1			Wyy	-1	
DStIS11-2	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS11-2			Su1	0.5	
DStIS11-2			Wyy	-1	
DStIS11-3	Linear Add	No	Dead	1.2	Dead + Live - Wind + Snow [Strength]
DStIS11-3			Su2	0.5	
DStIS11-3			Wyy	-1	
DStIS12	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live + Wind [Strength]
DStIS12			Live	0.5	
DStIS12			Wx	1	
DStIS13	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live - Wind [Strength]
DStIS13			Live	0.5	
DStIS13			Wx	-1	
DStIS14	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live + Wind [Strength]
DStIS14			Live	0.5	
DStIS14			Wy	1	
DStIS15	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live - Wind [Strength]
DStIS15			Live	0.5	
DStIS15			Wy	-1	
DStIS16	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live + Wind [Strength]
DStIS16			Live	0.5	
DStIS16			Wxx	1	
DStIS17	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live - Wind [Strength]
DStIS17			Live	0.5	
DStIS17			Wxx	-1	
DStIS18	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live + Wind [Strength]
DStIS18			Live	0.5	
DStIS18			Wyy	1	
DStIS19	Linear Add	Yes	Dead	1.2	Dead + Live + Roof Live - Wind [Strength]
DStIS19			Live	0.5	
DStIS19			Wyy	-1	
DStIS20-1	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStIS20-1			Sb	1.6	
DStIS20-1			Wx	0.5	
DStIS20-2	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStIS20-2			Su1	1.6	

Name	Type	Is Auto	Load Name	SF	Notes
DStlS20-2			Wx	0.5	
DStlS20-3	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS20-3			Su2	1.6	
DStlS20-3			Wx	0.5	
DStlS21-1	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS21-1			Sb	1.6	
DStlS21-1			Wx	-0.5	
DStlS21-2	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS21-2			Su1	1.6	
DStlS21-2			Wx	-0.5	
DStlS21-3	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS21-3			Su2	1.6	
DStlS21-3			Wx	-0.5	
DStlS22-1	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS22-1			Sb	1.6	
DStlS22-1			Wy	0.5	
DStlS22-2	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS22-2			Su1	1.6	
DStlS22-2			Wy	0.5	
DStlS22-3	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS22-3			Su2	1.6	
DStlS22-3			Wy	0.5	
DStlS23-1	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS23-1			Sb	1.6	
DStlS23-1			Wy	-0.5	
DStlS23-2	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS23-2			Su1	1.6	
DStlS23-2			Wy	-0.5	
DStlS23-3	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS23-3			Su2	1.6	
DStlS23-3			Wy	-0.5	
DStlS24-1	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS24-1			Sb	1.6	
DStlS24-1			Wxx	0.5	
DStlS24-2	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS24-2			Su1	1.6	
DStlS24-2			Wxx	0.5	
DStlS24-3	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS24-3			Su2	1.6	
DStlS24-3			Wxx	0.5	
DStlS25-1	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS25-1			Sb	1.6	
DStlS25-1			Wxx	-0.5	
DStlS25-2	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS25-2			Su1	1.6	
DStlS25-2			Wxx	-0.5	
DStlS25-3	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStlS25-3			Su2	1.6	
DStlS25-3			Wxx	-0.5	
DStlS26-1	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS26-1			Sb	1.6	
DStlS26-1			Wyy	0.5	
DStlS26-2	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS26-2			Su1	1.6	
DStlS26-2			Wyy	0.5	
DStlS26-3	Linear Add	No	Dead	1.2	Dead + Snow + Wind [Strength]
DStlS26-3			Su2	1.6	

Name	Type	Is Auto	Load Name	SF	Notes
DStIS26-3			Wyy	0.5	
DStIS27-1	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStIS27-1			Sb	1.6	
DStIS27-1			Wyy	-0.5	
DStIS27-2	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStIS27-2			Su1	1.6	
DStIS27-2			Wyy	-0.5	
DStIS27-3	Linear Add	No	Dead	1.2	Dead + Snow - Wind [Strength]
DStIS27-3			Su2	1.6	
DStIS27-3			Wyy	-0.5	
DStIS28	Linear Add	Yes	Dead	1.2	Dead + Roof Live + Wind [Strength]
DStIS28			Live	1.6	
DStIS28			Wx	0.5	
DStIS29	Linear Add	Yes	Dead	1.2	Dead + Roof Live - Wind [Strength]
DStIS29			Live	1.6	
DStIS29			Wx	-0.5	
DStIS30	Linear Add	Yes	Dead	1.2	Dead + Roof Live + Wind [Strength]
DStIS30			Live	1.6	
DStIS30			Wy	0.5	
DStIS31	Linear Add	Yes	Dead	1.2	Dead + Roof Live - Wind [Strength]
DStIS31			Live	1.6	
DStIS31			Wy	-0.5	
DStIS32	Linear Add	Yes	Dead	1.2	Dead + Roof Live + Wind [Strength]
DStIS32			Live	1.6	
DStIS32			Wxx	0.5	
DStIS33	Linear Add	Yes	Dead	1.2	Dead + Roof Live - Wind [Strength]
DStIS33			Live	1.6	
DStIS33			Wxx	-0.5	
DStIS34	Linear Add	Yes	Dead	1.2	Dead + Roof Live + Wind [Strength]
DStIS34			Live	1.6	
DStIS34			Wyy	0.5	
DStIS35	Linear Add	Yes	Dead	1.2	Dead + Roof Live - Wind [Strength]
DStIS35			Live	1.6	
DStIS35			Wyy	-0.5	
DStIS36	Linear Add	Yes	Dead	0.9	Dead (min) + Wind [Strength]
DStIS36			Wx	1	
DStIS37	Linear Add	Yes	Dead	0.9	Dead (min) - Wind [Strength]
DStIS37			Wx	-1	
DStIS38	Linear Add	Yes	Dead	0.9	Dead (min) + Wind [Strength]
DStIS38			Wy	1	
DStIS39	Linear Add	Yes	Dead	0.9	Dead (min) - Wind [Strength]
DStIS39			Wy	-1	
DStIS40	Linear Add	Yes	Dead	0.9	Dead (min) + Wind [Strength]
DStIS40			Wxx	1	
DStIS41	Linear Add	Yes	Dead	0.9	Dead (min) - Wind [Strength]
DStIS41			Wxx	-1	
DStIS42	Linear Add	Yes	Dead	0.9	Dead (min) + Wind [Strength]
DStIS42			Wyy	1	
DStIS43	Linear Add	Yes	Dead	0.9	Dead (min) - Wind [Strength]
DStIS43			Wyy	-1	
DStIS44-1	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS44-1			Sb	0.2	
DStIS44-1			Exx	1	
DStIS44-10	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS44-10			Sb	0.2	
DStIS44-10			Exx	2	
DStIS44-2	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]

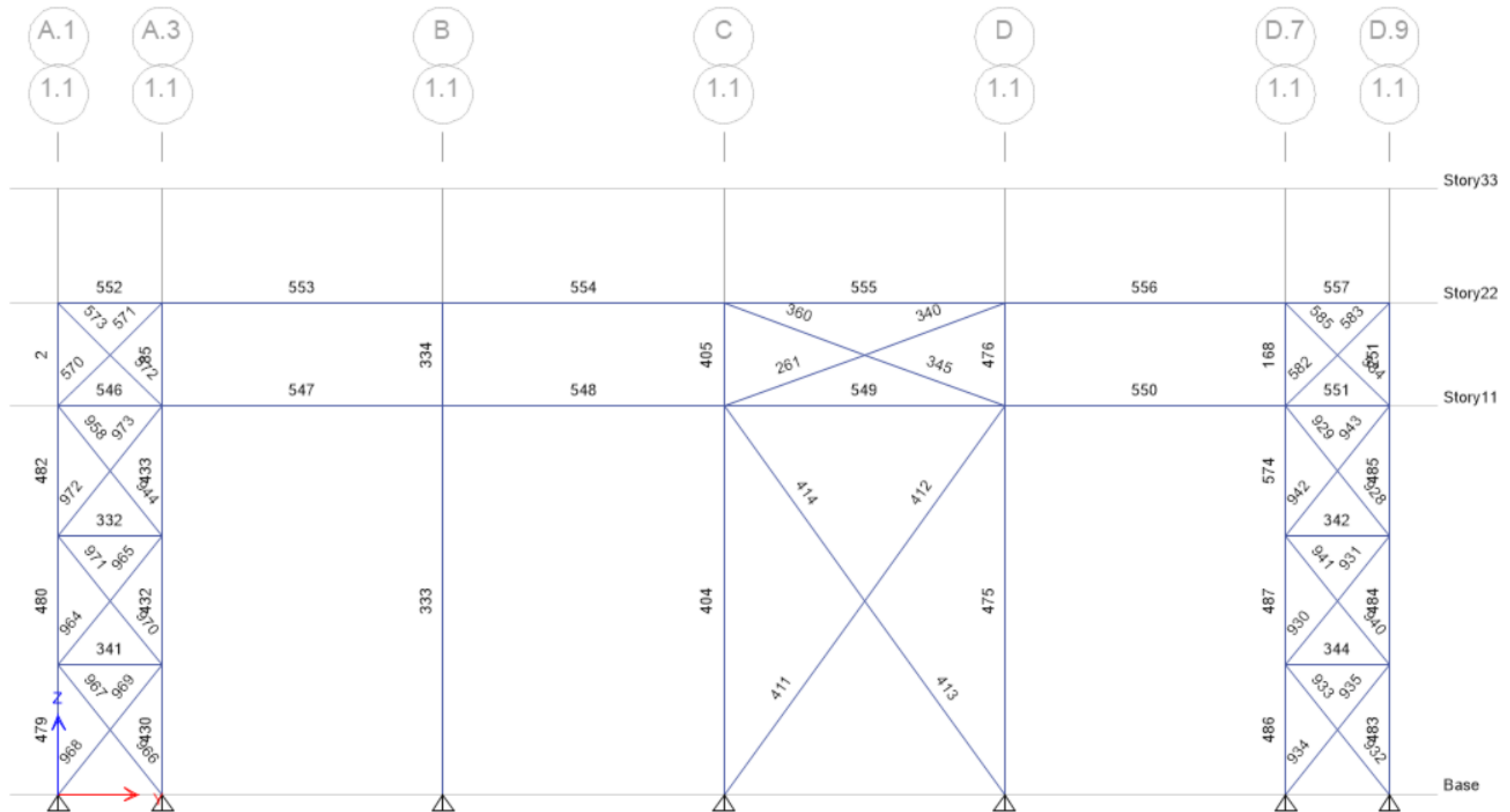
Name	Type	Is Auto	Load Name	SF	Notes
DStIS44-2			Su1	0.2	
DStIS44-2			Exx	1	
DStIS44-2O	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS44-2O			Su1	0.2	
DStIS44-2O			Exx	2	
DStIS44-3	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS44-3			Su2	0.2	
DStIS44-3			Exx	1	
DStIS44-3O	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS44-3O			Su2	0.2	
DStIS44-3O			Exx	2	
DStIS45-1	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS45-1			Sb	0.2	
DStIS45-1			Exx	-1	
DStIS45-1O	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS45-1O			Sb	0.2	
DStIS45-1O			Exx	-2	
DStIS45-2	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS45-2			Su1	0.2	
DStIS45-2			Exx	-1	
DStIS45-2O	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS45-2O			Su1	0.2	
DStIS45-2O			Exx	-2	
DStIS45-3	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS45-3			Su2	0.2	
DStIS45-3			Exx	-1	
DStIS45-3O	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS45-3O			Su2	0.2	
DStIS45-3O			Exx	-2	
DStIS46-1	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS46-1			Sb	0.2	
DStIS46-1			Eyy	1	
DStIS46-1O	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS46-1O			Sb	0.2	
DStIS46-1O			Eyy	2	
DStIS46-2	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS46-2			Su1	0.2	
DStIS46-2			Eyy	1	
DStIS46-2O	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS46-2O			Su1	0.2	
DStIS46-2O			Eyy	2	
DStIS46-3	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS46-3			Su2	0.2	
DStIS46-3			Eyy	1	
DStIS46-3O	Linear Add	No	Dead	1.318	Dead + Live + Static Earthquake [Strength]
DStIS46-3O			Su2	0.2	
DStIS46-3O			Eyy	2	
DStIS47-1	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS47-1			Sb	0.2	
DStIS47-1			Eyy	-1	
DStIS47-1O	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS47-1O			Sb	0.2	
DStIS47-1O			Eyy	-2	
DStIS47-2	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS47-2			Su1	0.2	
DStIS47-2			Eyy	-1	
DStIS47-2O	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]

Name	Type	Is Auto	Load Name	SF	Notes
DStIS47-2O			Su1	0.2	
DStIS47-2O			Eyy	-2	
DStIS47-3	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS47-3			Su2	0.2	
DStIS47-3			Eyy	-1	
DStIS47-3O	Linear Add	No	Dead	1.318	Dead + Live - Static Earthquake [Strength]
DStIS47-3O			Su2	0.2	
DStIS47-3O			Eyy	-2	
DStIS48	Linear Add	Yes	Dead	0.782	Dead (min) + Static Earthquake [Strength]
DStIS48			Exx	1	
DStIS48-O	Linear Add	No	Dead	0.782	Dead (min) + Static Earthquake [Strength]
DStIS48-O			Exx	2	
DStIS49	Linear Add	Yes	Dead	0.782	Dead (min) - Static Earthquake [Strength]
DStIS49			Exx	-1	
DStIS49-O	Linear Add	No	Dead	0.782	Dead (min) - Static Earthquake [Strength]
DStIS49-O			Exx	-2	
DStIS50	Linear Add	Yes	Dead	0.782	Dead (min) + Static Earthquake [Strength]
DStIS50			Eyy	1	
DStIS50-O	Linear Add	No	Dead	0.782	Dead (min) + Static Earthquake [Strength]
DStIS50-O			Eyy	2	
DStIS51	Linear Add	Yes	Dead	0.782	Dead (min) - Static Earthquake [Strength]
DStIS51			Eyy	-1	
DStIS51-O	Linear Add	No	Dead	0.782	Dead (min) - Static Earthquake [Strength]
DStIS51-O			Eyy	-2	
ENV	Envelope	No	DStIS1	1	
ENV			DStIS2-1	1	
ENV			DStIS2-2	1	
ENV			DStIS2-3	1	
ENV			DStIS3	1	
ENV			DStIS4-1	1	
ENV			DStIS4-2	1	
ENV			DStIS4-3	1	
ENV			DStIS5-1	1	
ENV			DStIS5-2	1	
ENV			DStIS5-3	1	
ENV			DStIS6-1	1	
ENV			DStIS6-2	1	
ENV			DStIS6-3	1	
ENV			DStIS7-1	1	
ENV			DStIS7-2	1	
ENV			DStIS7-3	1	
ENV			DStIS8-1	1	
ENV			DStIS8-2	1	
ENV			DStIS8-3	1	
ENV			DStIS9-1	1	
ENV			DStIS9-2	1	
ENV			DStIS9-3	1	
ENV			DStIS10-1	1	
ENV			DStIS10-2	1	
ENV			DStIS10-3	1	
ENV			DStIS11-1	1	
ENV			DStIS11-2	1	
ENV			DStIS11-3	1	
ENV			DStIS12	1	
ENV			DStIS13	1	
ENV			DStIS14	1	
ENV			DStIS15	1	

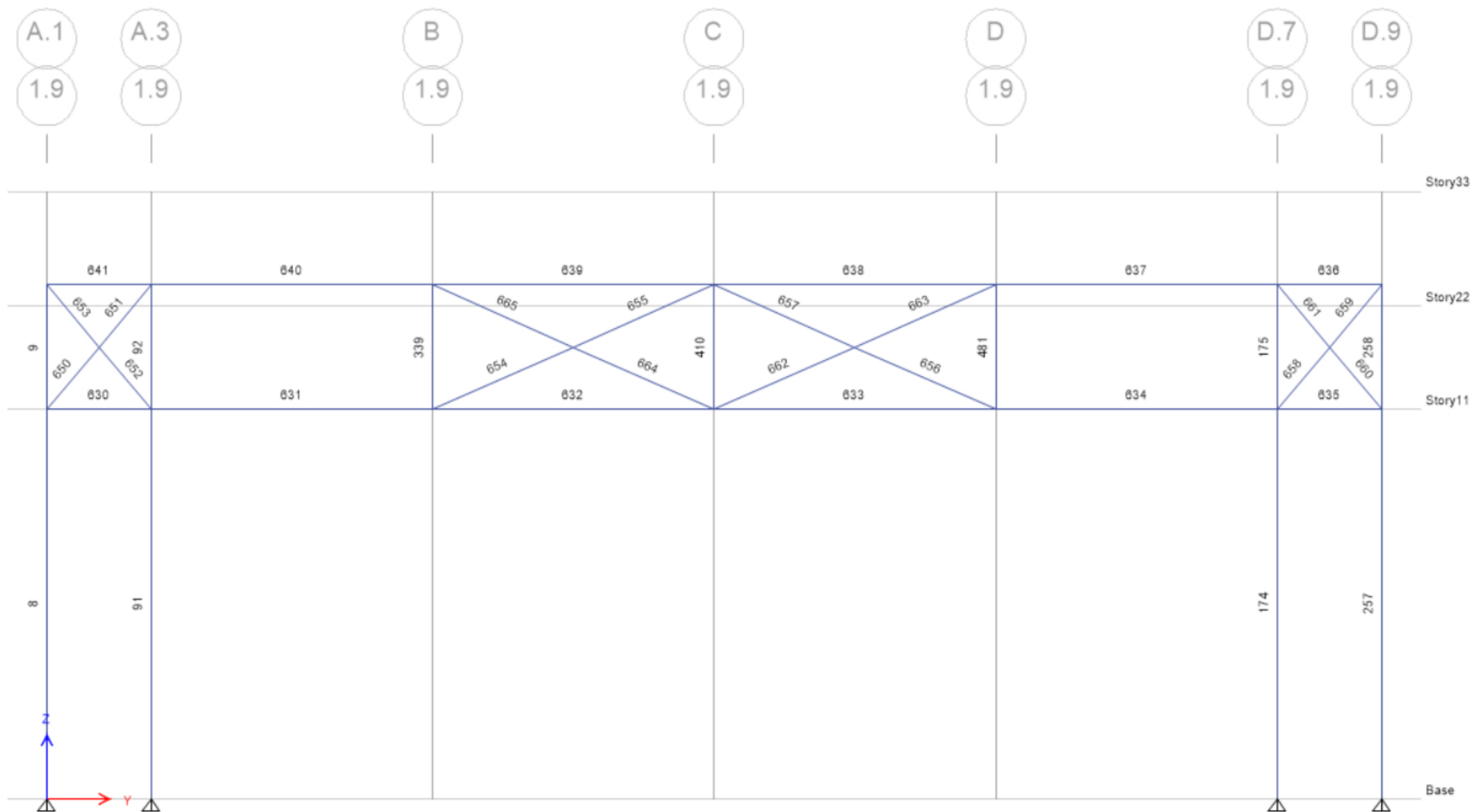
Name	Type	Is Auto	Load Name	SF	Notes
ENV			DStIS16	1	
ENV			DStIS17	1	
ENV			DStIS18	1	
ENV			DStIS19	1	
ENV			DStIS20-1	1	
ENV			DStIS20-2	1	
ENV			DStIS20-3	1	
ENV			DStIS21-1	1	
ENV			DStIS21-2	1	
ENV			DStIS21-3	1	
ENV			DStIS22-1	1	
ENV			DStIS22-2	1	
ENV			DStIS22-3	1	
ENV			DStIS23-1	1	
ENV			DStIS23-2	1	
ENV			DStIS23-3	1	
ENV			DStIS24-1	1	
ENV			DStIS24-2	1	
ENV			DStIS24-3	1	
ENV			DStIS25-1	1	
ENV			DStIS25-2	1	
ENV			DStIS25-3	1	
ENV			DStIS26-1	1	
ENV			DStIS26-2	1	
ENV			DStIS26-3	1	
ENV			DStIS27-1	1	
ENV			DStIS27-2	1	
ENV			DStIS27-3	1	
ENV			DStIS28	1	
ENV			DStIS29	1	
ENV			DStIS30	1	
ENV			DStIS31	1	
ENV			DStIS32	1	
ENV			DStIS33	1	
ENV			DStIS34	1	
ENV			DStIS35	1	
ENV			DStIS36	1	
ENV			DStIS37	1	
ENV			DStIS38	1	
ENV			DStIS39	1	
ENV			DStIS40	1	
ENV			DStIS41	1	
ENV			DStIS42	1	
ENV			DStIS43	1	
ENV			DStIS44-1O	1	
ENV			DStIS44-2O	1	
ENV			DStIS44-3O	1	
ENV			DStIS45-1O	1	
ENV			DStIS45-2O	1	
ENV			DStIS45-3O	1	
ENV			DStIS46-1O	1	
ENV			DStIS46-2O	1	
ENV			DStIS46-3O	1	
ENV			DStIS47-1O	1	
ENV			DStIS47-2O	1	
ENV			DStIS47-3O	1	
ENV			DStIS48-O	1	

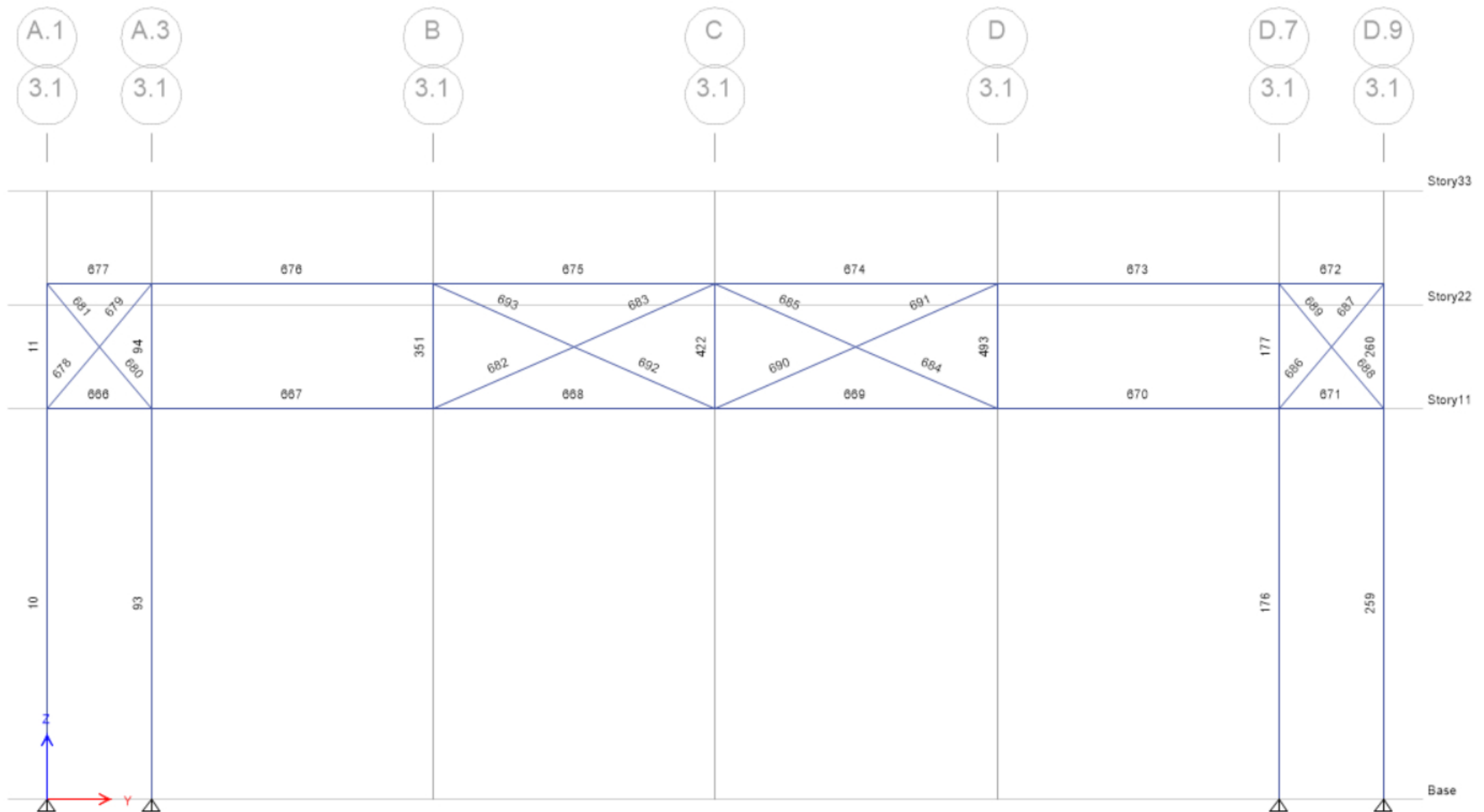
Name	Type	Is Auto	Load Name	SF	Notes
ENV			DStIS49-O	1	
ENV			DStIS50-O	1	
ENV			DStIS51-O	1	

Hangar Framing - Elevation 1.1

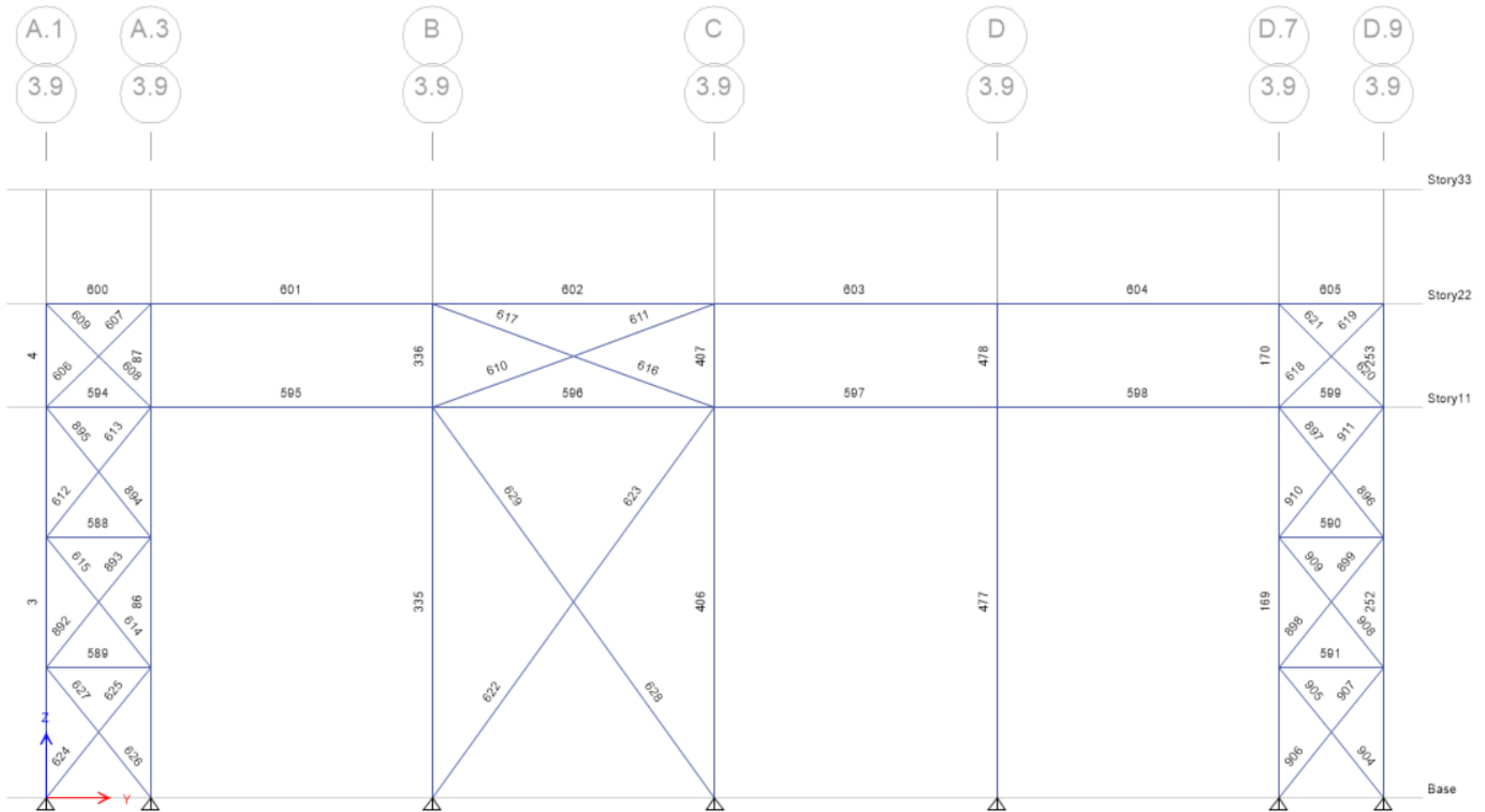


Hangar Framing - Elevation 1.9

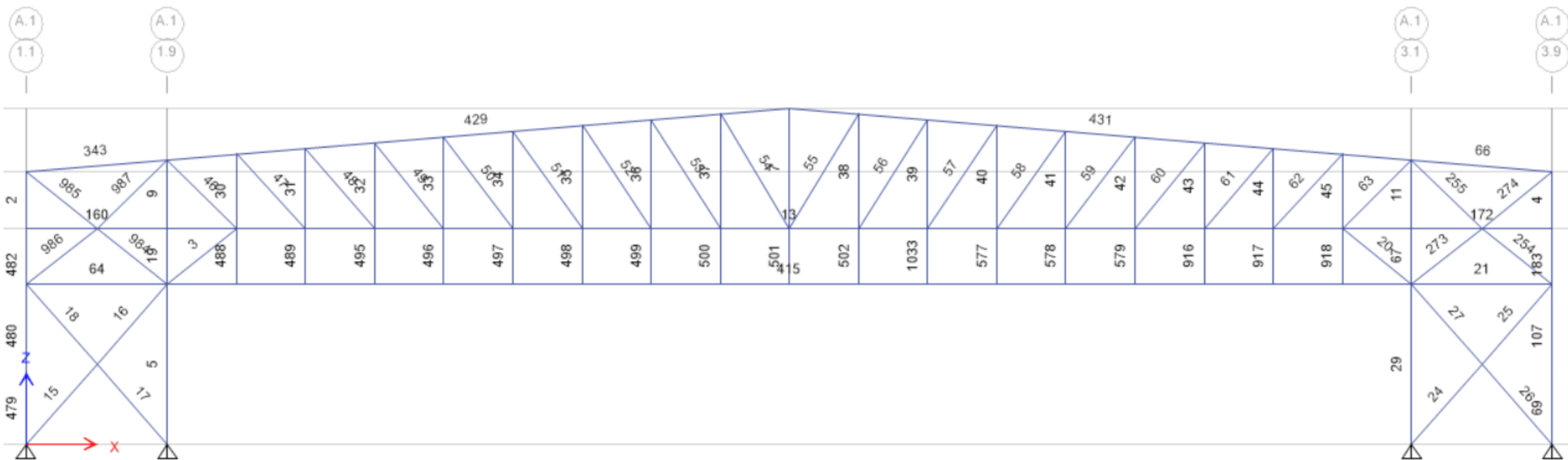




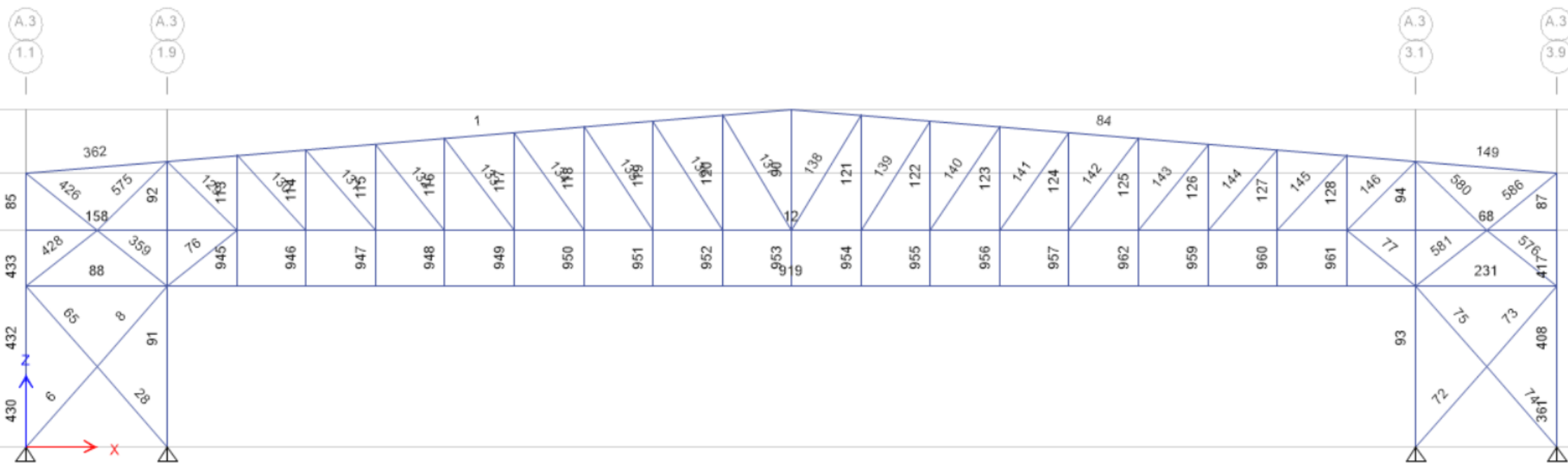
Hangar Framing - Elevation 3.9



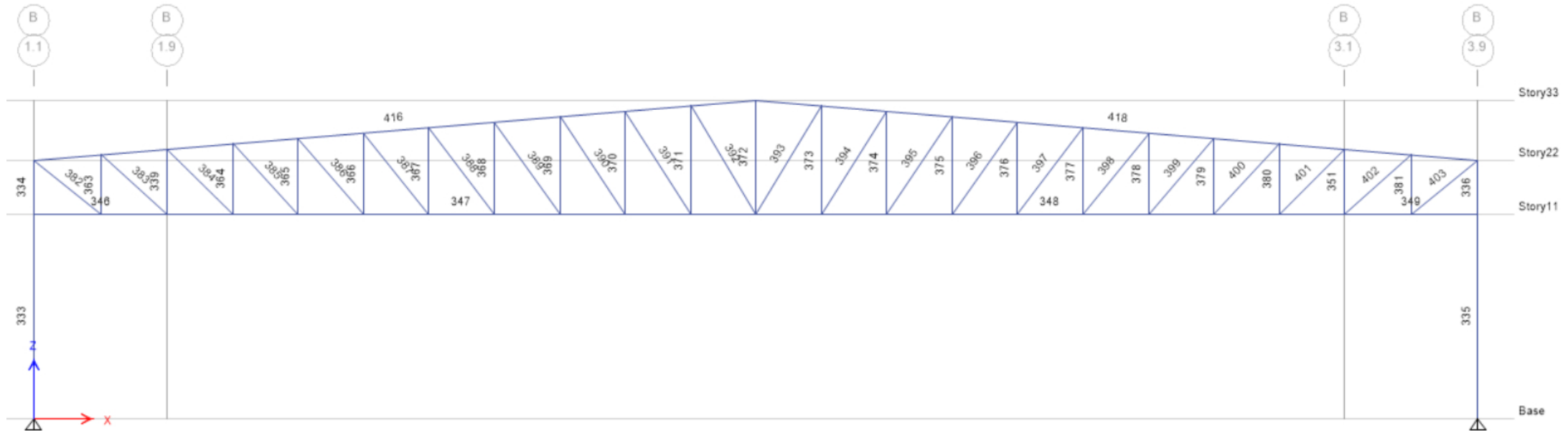
Hangar Framing - Elevation A.1



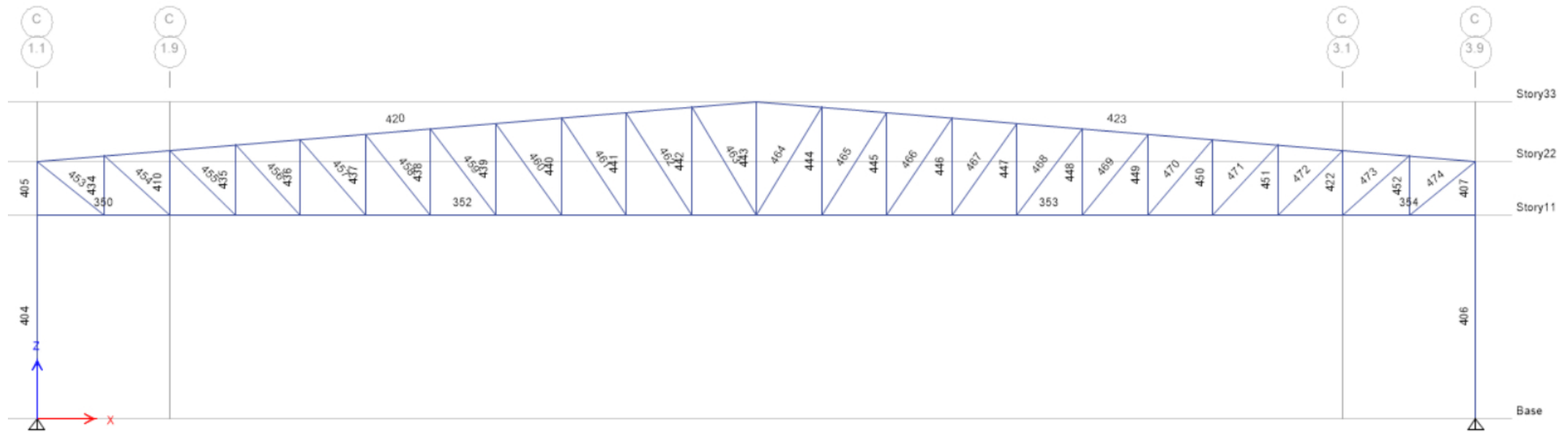
Hangar Framing - Elevation A.3



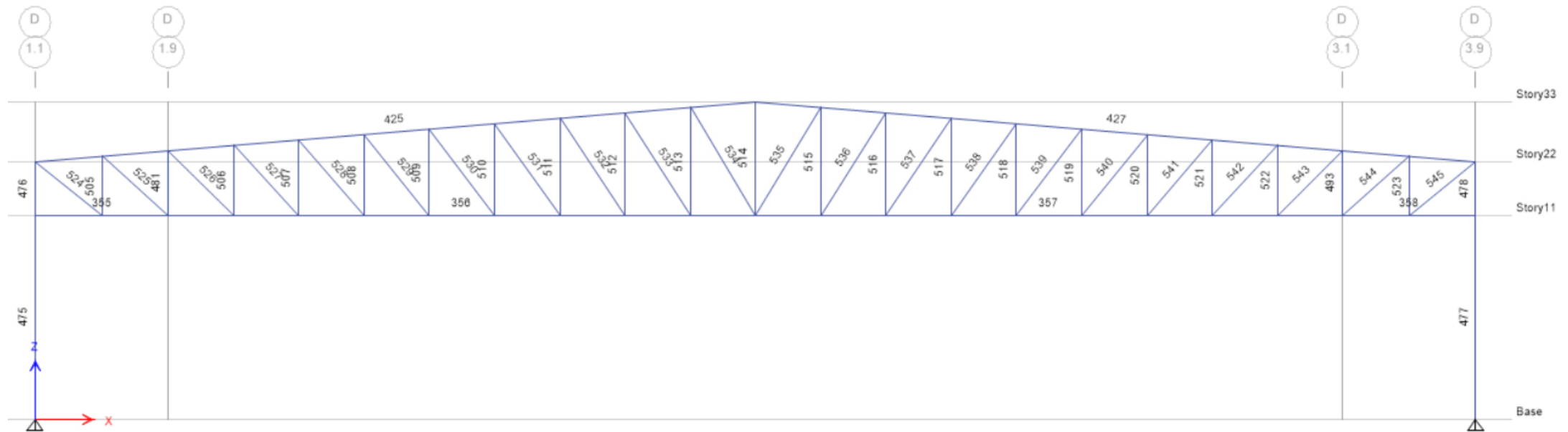
Hangar Framing - Elevation B



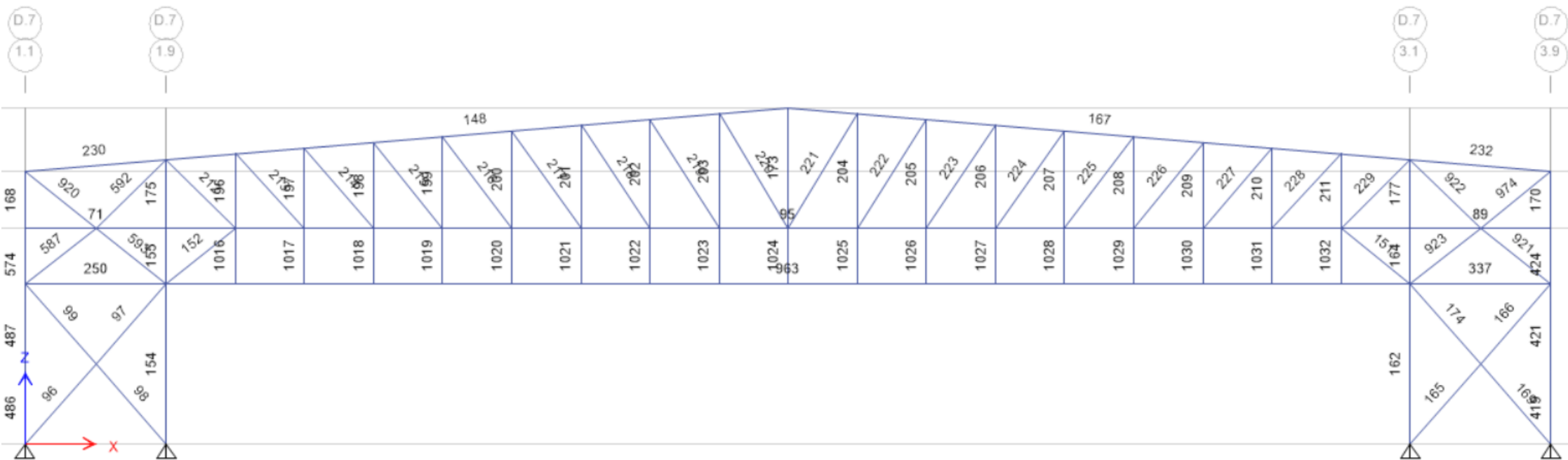
Hangar Framing - Elevation C



Hangar Framing - Elevation D



Hangar Framing - Elevation D.7



Hangar Framing - Elevation D.9



Gravity Framing and Column Calculations

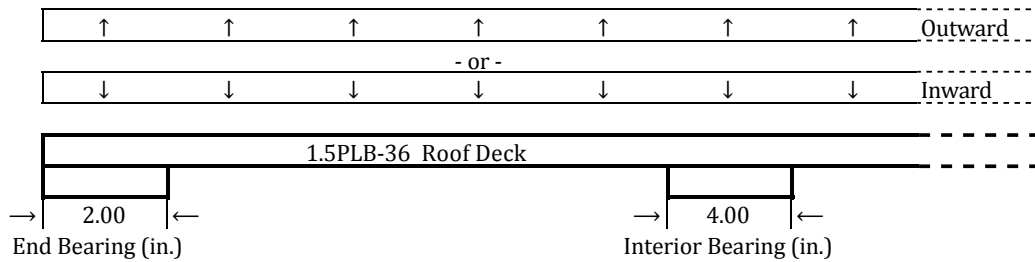
20 Gage 1.5PLB-36 Grade 50**Uniform Design Load Table, LRFD (psf)**

For End Lapped Deck



36 / 7 / 4 Connection Pattern to Supports with
Hilti X-HSN 24 PAF

Support Member A572 GR50
 $0.25 \leq t_2 \text{ (in.)} \leq 0.375$

**Inward Uniform Design Load Table, LRFD (psf)**

Span	(ft-in)	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"
1	ΦWn	269	222	187	159	137	119	105	93
	L/240	103	78	60	47	38	31	25	21
2	ΦWn	271	224	189	161	139	121	107	95
	L/240	274	206	159	125	100	81	67	56
3	ΦWn	336	279	235	201	173	151	133	118
	L/240	215	161	124	98	78	64	52	44

$$> 1.2D + 0.5S = 1.2*25 + 0.5*32 = 46 \text{ psf}$$

Uplift (Outward) Uniform Design Load Table, LRFD (psf)

Span	(ft-in)	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"
1	ΦWn	275	227	191	163	140	122	107	95
	ΦRn	386	351	322	297	276	257	241	227
	L/240	114	86	66	52	41	34	28	23
2	ΦWn	176	160	147	136	126	118	104	93
	ΦRn	176	160	147	136	126	118	110	104
	L/240	249	187	144	113	91	74	61	51
3	ΦWn	201	182	167	154	143	134	125	115
	ΦRn	201	182	167	154	143	134	125	118
	L/240	195	147	113	89	71	58	48	40

$$> 0.9D + W = -0.9*9.5 + 67 = 58 \text{ psf}$$

Steel Deck Properties

t	Fy	wdd	Id+	Id-	Se+	Se-	ΦMn+	ΦMn-	ΦVn
in	ksi	psf	in. ⁴ /ft	in. ⁴ /ft	in. ³ /ft	in. ³ /ft	lbs-ft/ft	lbs-ft/ft	lbs/ft
0.0358	50	2	0.197	0.217	0.224	0.229	840	859	4874

Where: $W \leq \Phi W_n$ W = Required strength of the governing LRFD load combination ΦW_n = Design Strength

Bare Deck Uniform Load V3.1 in accordance with:

AISI S100-16 (2020) w/ S2-20

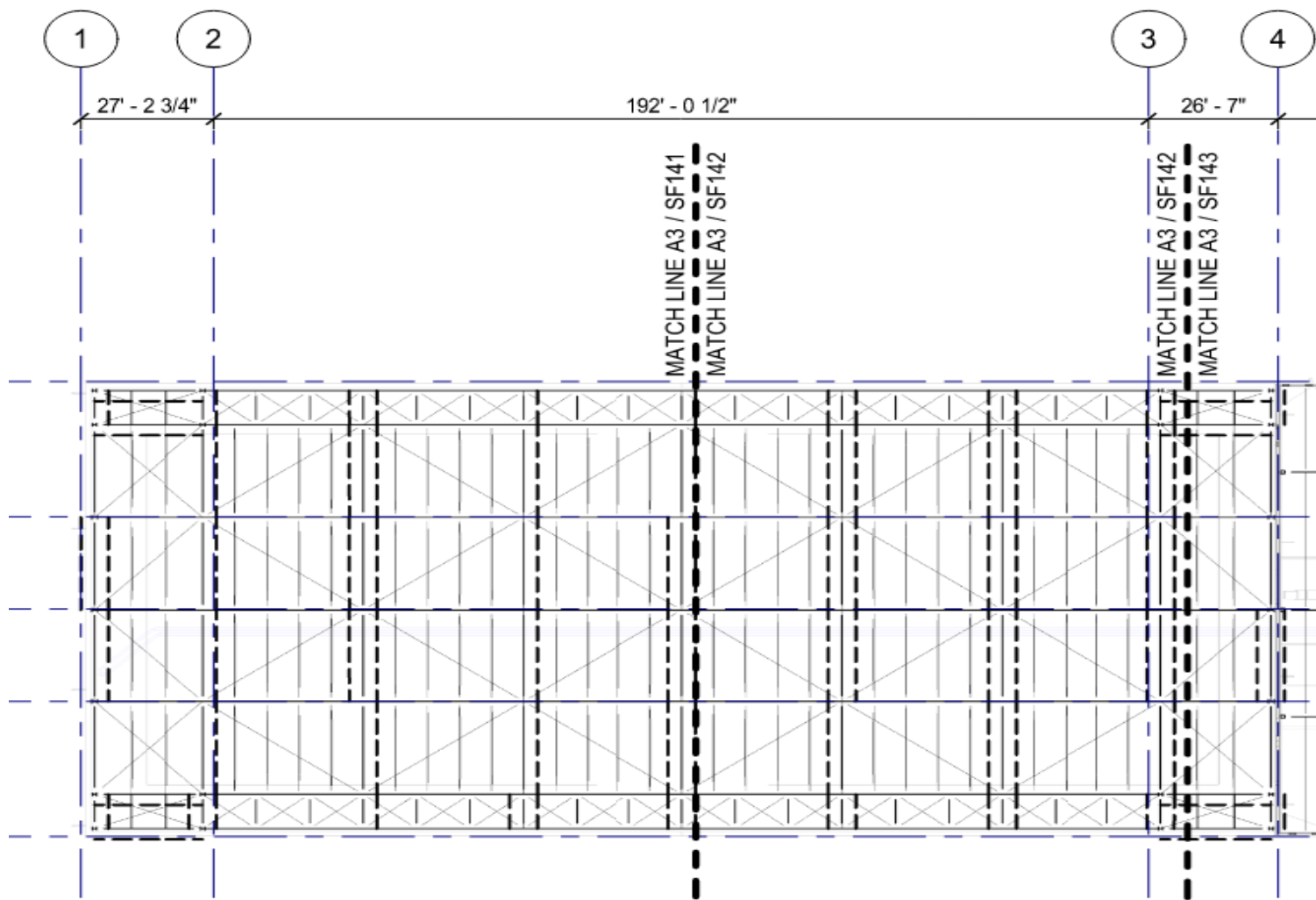
IAPMO UES ER-0423

IAPMO UES ER-0652

CAN/CSA-S136 (R2021) for Canadian references

Date: 10/7/2025

NOTICE: Design defects that could cause injury or death may result from relying on the information in this document without independent verification by a qualified professional. The information in this document is provided "AS IS". Nucor Corporation and its affiliates expressly disclaim: (i) any and all representations, warranties and conditions and (ii) all liability arising out of or related to this document and the information in it.



PROJECT INFO							
Project Number	Project Name	Design Mark	Engineer	Design Method	Load Type	Design Code	Date
-	-	-	-	ASD	Not Reduced	ASCE 7-22	10/08/2025
SPECIFICATIONS							
Designation*	Span (ft)	Tributary Width (ft)	TCXL (ft)	TCXR (ft)	Slope (in/ft)	LL Deflection Limit (L/X)	Min I (in ⁴)
24K345/158	25	7.5	0	0	0	240	0
UNIFORM LOADS							
All uniform loads are included in designation loading for non-SP joists.							
Dead (psf)	Dead Collateral (psf)	Live (psf)	Live Roof (psf)	Rain (psf)	Snow [1.0S] (psf)	Downward Wind [1.0W] (psf)	
25	0	0	20	0	21	0	
UPLIFT ZONES							
Type		Magnitude (psf)		Start Location (ft)**		Length (ft)	
Gross (1.0W)		16		0		25	
ESTIMATED PROPERTIES							
All provided properties are accurate for comparison. Contact Vulcraft if exact values are required.							
Self Weight (psf)***	I (in ⁴)****	LL Deflection (L/X)*****	TC Width (in)	Bridging (T/X/EX/B)	Seat Depth (in)	Max Duct Sizes (Rd Sq H x W)*****	
1.5	173	991 [0.3]	4.00	1/0/0/2	2.50	11" 9" 8" x 9"	

*Designation loads are unfactored

**Negative value indicates TCXL location

***Ensure joist self weight has been included in specified dead load

****Minimum moment of inertia should be provided to Vulcraft if required for structural performance

*****Calculated deflections have been increased by 15% to account for shear deformation

*****Actual duct sizes and locations should be provided to Vulcraft to ensure clearance during final design

RECORD KEY
-

Hangar – All beam sections with DC ratios (Gravity Design)

Label	Section	D/C Ratio
1	W12X53	$0.309 = 0.001 + 0.238 + 0.07$
6	W12X45	$0.396 = 0.381 + 0.015 + 0$
12	W12X53	$0.319 = 0.316 + 0.003 + 0$
13	W12X53	$0.321 = 0.319 + 0.003 + 0$
14	W12X53	$0.082 = 0.079 + 0.003 + 0$
15	W12X53	$0.012 = 0.009 + 0.003 + 0$
16	W12X53	$0.043 = 0.04 + 0.003 + 0$
17	W12X53	$0.083 = 0.079 + 0.003 + 0$
18	W12X53	$0.231 = 0.228 + 0.003 + 0$
19	W12X53	$0.267 = 0.264 + 0.003 + 0$
20	W12X53	$0.272 = 0.269 + 0.003 + 0$
21	W12X53	$0.27 = 0.267 + 0.003 + 0$
22	W12X53	$0.27 = 0.267 + 0.003 + 0$
23	W12X53	$0.272 = 0.269 + 0.003 + 0$
24	W12X53	$0.267 = 0.264 + 0.003 + 0$
25	W12X53	$0.23 = 0.228 + 0.003 + 0$
26	W12X53	$0.082 = 0.079 + 0.003 + 0$
27	W12X53	$0.043 = 0.04 + 0.003 + 0$
28	W12X53	$0.013 = 0.009 + 0.003 + 0$
29	W12X53	$0.082 = 0.079 + 0.003 + 0$
66	W12X53	$0.12 = 0.024 + 0.091 + 0.006$
84	W12X53	$0.309 = 2.377\text{E-}04 + 0.237 + 0.072$
89	W12X45	$0.094 = 0.077 + 0.017 + 0$
95	W12X53	$0.321 = 0.318 + 0.003 + 0$
96	W12X53	$0.323 = 0.32 + 0.003 + 0$
97	W12X53	$0.083 = 0.08 + 0.003 + 0$
98	W12X53	$0.033 = 0.03 + 0.003 + 0$
99	W12X53	$0.094 = 0.091 + 0.003 + 0$
100	W12X53	$0.229 = 0.226 + 0.003 + 0$
101	W12X53	$0.248 = 0.245 + 0.003 + 0$
102	W12X53	$0.271 = 0.268 + 0.003 + 0$
103	W12X53	$0.301 = 0.298 + 0.003 + 0$
104	W12X53	$0.315 = 0.312 + 0.003 + 0$
105	W12X53	$0.315 = 0.312 + 0.003 + 0$
106	W12X53	$0.301 = 0.298 + 0.003 + 0$
107	W12X53	$0.271 = 0.268 + 0.003 + 0$
108	W12X53	$0.248 = 0.245 + 0.003 + 0$
109	W12X53	$0.229 = 0.226 + 0.003 + 0$
110	W12X53	$0.094 = 0.091 + 0.003 + 0$

111	W12X53	$0.034 = 0.031 + 0.003 + 0$
112	W12X53	$0.084 = 0.081 + 0.003 + 0$
148	W12X53	$0.31 = 0.001 + 0.238 + 0.07$
149	W12X53	$0.275 = 0.028 + 0.242 + 0.004$
167	W12X53	$0.307 = 0.001 + 0.236 + 0.07$
171	W12X45	$0.09 = 0.073 + 0.017 + 0$
172	W12X45	$0.088 = 0.071 + 0.017 + 0$
178	W12X45	$0.417 = 0.402 + 0.015 + 0$
179	W12X53	$0.32 = 0.317 + 0.003 + 0$
180	W12X53	$0.085 = 0.081 + 0.003 + 0$
181	W12X53	$0.035 = 0.032 + 0.003 + 0$
182	W12X53	$0.094 = 0.09 + 0.003 + 0$
183	W12X53	$0.228 = 0.225 + 0.003 + 0$
184	W12X53	$0.247 = 0.244 + 0.003 + 0$
185	W12X53	$0.27 = 0.267 + 0.003 + 0$
186	W12X53	$0.3 = 0.297 + 0.003 + 0$
187	W12X53	$0.314 = 0.311 + 0.003 + 0$
188	W12X53	$0.315 = 0.312 + 0.003 + 0$
189	W12X53	$0.301 = 0.298 + 0.003 + 0$
190	W12X53	$0.271 = 0.268 + 0.003 + 0$
191	W12X53	$0.248 = 0.245 + 0.003 + 0$
192	W12X53	$0.229 = 0.226 + 0.003 + 0$
193	W12X53	$0.094 = 0.091 + 0.003 + 0$
194	W12X53	$0.034 = 0.03 + 0.003 + 0$
195	W12X53	$0.084 = 0.081 + 0.003 + 0$
230	W12X53	$0.276 = 0.028 + 0.244 + 0.004$
232	W12X53	$0.273 = 0.028 + 0.241 + 0.004$
233	W12X53	$0.195 = 0.011 + 0.093 + 0.091$
254	W12X45	$0.423 = 0.407 + 0.015 + 0$
255	W12X45	$0.383 = 0.368 + 0.015 + 0$
262	W12X53	$0.322 = 0.319 + 0.003 + 0$
263	W12X53	$0.327 = 0.324 + 0.003 + 0$
264	W12X53	$0.084 = 0.081 + 0.003 + 0$
265	W12X53	$0.014 = 0.01 + 0.003 + 0$
266	W12X53	$0.042 = 0.039 + 0.003 + 0$
267	W12X53	$0.082 = 0.078 + 0.003 + 0$
268	W12X53	$0.229 = 0.226 + 0.003 + 0$
269	W12X53	$0.266 = 0.263 + 0.003 + 0$
270	W12X53	$0.271 = 0.268 + 0.003 + 0$
271	W12X53	$0.27 = 0.267 + 0.003 + 0$
272	W12X53	$0.27 = 0.267 + 0.003 + 0$
273	W12X53	$0.272 = 0.269 + 0.003 + 0$

274	W12X53	$0.267 = 0.264 + 0.003 + 0$
275	W12X53	$0.231 = 0.228 + 0.003 + 0$
276	W12X53	$0.083 = 0.08 + 0.003 + 0$
277	W12X53	$0.044 = 0.04 + 0.003 + 0$
278	W12X53	$0.012 = 0.009 + 0.003 + 0$
313	W12X53	$0.119 = 0.025 + 0.089 + 0.006$
314	W12X53	$0.199 = 0.014 + 0.094 + 0.091$
315	W12X53	$0.12 = 0.023 + 0.091 + 0.006$
341	W12X53	$0.08 = 0.077 + 0.003 + 0$
342	W12X53	$0.315 = 0.312 + 0.003 + 0$
343	W12X53	$0.119 = 0.025 + 0.089 + 0.005$
346	W12X72	$0.305 = 0.295 + 0.006 + 0.004$
347	W12X72	$0.536 = 0.499 + 0.037 + 2.166\text{E-}04$
348	W12X72	$0.536 = 0.498 + 0.037 + 2.125\text{E-}04$
349	W12X72	$0.304 = 0.294 + 0.006 + 0.004$
350	W12X72	$0.088 = 0.065 + 0.023 + 0$
352	W12X72	$0.563 = 0.523 + 0.04 + 0$
353	W12X72	$0.562 = 0.523 + 0.04 + 0$
354	W12X72	$0.088 = 0.066 + 0.022 + 2.324\text{E-}04$
355	W12X72	$0.307 = 0.297 + 0.006 + 0.004$
356	W12X72	$0.536 = 0.499 + 0.037 + 2.025\text{E-}04$
357	W12X72	$0.536 = 0.498 + 0.037 + 2.138\text{E-}04$
358	W12X72	$0.29 = 0.279 + 0.006 + 0.006$
359	W12X45	$0.089 = 0.072 + 0.017 + 0$
362	W12X53	$0.276 = 0.029 + 0.244 + 0.004$
416	W12X87	$5.711 = 5.632 + 0.035 + 0.043$
418	W12X87	$5.731 = 5.652 + 0.036 + 0.043$
420	W12X87	$5.248 = 5.2 + 0.049 + 0$
423	W12X87	$5.246 = 5.197 + 0.049 + 0$
425	W12X87	$5.707 = 5.628 + 0.035 + 0.043$
427	W12X87	$5.707 = 5.63 + 0.035 + 0.042$
429	W12X53	$0.194 = 0.011 + 0.093 + 0.091$
431	W12X53	$0.201 = 0.013 + 0.094 + 0.094$
546	W8X40	$0.041 = 0.039 + 0.003 + 0$
547	W8X31	$0.09 = 0.065 + 0.026 + 0$
548	W8X40	$0.302 = 0.282 + 0.02 + 0$
549	W8X40	$0.303 = 0.283 + 0.02 + 0$
550	W8X31	$0.092 = 0.066 + 0.026 + 0$
551	W8X40	$0.041 = 0.038 + 0.003 + 0$
552	W8X40	$0.018 = 0.016 + 0.003 + 0$
553	W8X31	$0.067 = 0.039 + 0.028 + 0$
554	W8X40	$0.071 = 0.047 + 0.024 + 0$

555	W8X40	$0.072 = 0.048 + 0.024 + 0$
556	W8X31	$0.067 = 0.04 + 0.027 + 0$
557	W8X40	$0.018 = 0.016 + 0.003 + 0$
558	W8X48	$0.015 = 0.012 + 0.003 + 0$
559	W8X48	$0.672 = 0.648 + 0.024 + 0$
560	W8X48	$0.557 = 0.533 + 0.024 + 0$
561	W8X48	$0.557 = 0.533 + 0.024 + 0$
562	W8X48	$0.674 = 0.65 + 0.024 + 0$
563	W8X48	$0.014 = 0.011 + 0.003 + 0$
564	W8X48	$0.042 = 0.039 + 0.003 + 0$
565	W8X48	$0.12 = 0.092 + 0.027 + 0$
566	W8X48	$0.577 = 0.553 + 0.024 + 0$
567	W8X48	$0.577 = 0.553 + 0.024 + 0$
568	W8X48	$0.119 = 0.092 + 0.027 + 0$
569	W8X48	$0.042 = 0.039 + 0.003 + 0$
588	W8X40	$0.008 = 0.005 + 0.003 + 0$
589	W8X40	$0.006 = 0.003 + 0.003 + 0$
590	W8X40	$0.008 = 0.005 + 0.003 + 0$
591	W8X40	$0.006 = 0.003 + 0.003 + 0$
594	W8X31	$0.061 = 0.058 + 0.003 + 0$
595	W8X31	$0.076 = 0.049 + 0.027 + 0$
596	W8X40	$0.318 = 0.298 + 0.02 + 0$
597	W8X40	$0.32 = 0.3 + 0.02 + 0$
598	W8X31	$0.054 = 0.026 + 0.028 + 0$
599	W8X31	$0.074 = 0.071 + 0.003 + 0$
600	W8X31	$0.02 = 0.017 + 0.003 + 0$
601	W8X31	$0.066 = 0.039 + 0.028 + 0$
602	W8X40	$0.067 = 0.043 + 0.024 + 0$
603	W8X40	$0.079 = 0.056 + 0.023 + 0$
604	W8X31	$0.071 = 0.044 + 0.027 + 0$
605	W8X31	$0.022 = 0.019 + 0.003 + 0$
630	W8X31	$0.26 = 0.258 + 0.002 + 0$
631	W8X31	$0.093 = 0.061 + 0.032 + 0$
632	W8X31	$0.605 = 0.575 + 0.03 + 0$
633	W8X31	$0.607 = 0.577 + 0.03 + 0$
634	W8X31	$0.094 = 0.062 + 0.032 + 0$
635	W8X31	$0.262 = 0.259 + 0.002 + 0$
636	W8X31	$0.148 = 0.028 + 0.111 + 0.01$
637	W8X31	$0.363 = 0.001 + 0.328 + 0.034$
638	W8X31	$0.302 = 0.055 + 0.224 + 0.023$
639	W8X31	$0.302 = 0.055 + 0.224 + 0.023$
640	W8X31	$0.363 = 0.001 + 0.327 + 0.034$

641	W8X31	$0.147 = 0.027 + 0.11 + 0.009$
642	W8X48	$0.03 = 0.027 + 0.003 + 0$
643	W8X48	$0.623 = 0.599 + 0.024 + 0$
644	W8X48	$0.678 = 0.654 + 0.024 + 0$
645	W8X48	$0.676 = 0.652 + 0.024 + 0$
646	W8X48	$0.624 = 0.6 + 0.024 + 0$
647	W8X48	$0.03 = 0.027 + 0.003 + 0$
648	W8X48	$0.042 = 0.039 + 0.003 + 0$
649	W8X48	$0.12 = 0.092 + 0.027 + 0$
666	W8X31	$0.261 = 0.259 + 0.002 + 0$
667	W8X31	$0.09 = 0.058 + 0.032 + 0$
668	W8X31	$0.649 = 0.619 + 0.03 + 0$
669	W8X31	$0.625 = 0.595 + 0.03 + 0$
670	W8X31	$0.077 = 0.044 + 0.032 + 0$
671	W8X31	$0.252 = 0.25 + 0.002 + 0$
672	W8X31	$0.152 = 0.025 + 0.112 + 0.015$
673	W8X31	$0.366 = 0.004 + 0.328 + 0.034$
674	W8X31	$0.303 = 0.056 + 0.224 + 0.023$
675	W8X31	$0.304 = 0.056 + 0.226 + 0.023$
676	W8X31	$0.367 = 0.001 + 0.33 + 0.035$
677	W8X31	$0.153 = 0.028 + 0.11 + 0.015$
694	W8X48	$0.575 = 0.551 + 0.024 + 0$
695	W8X48	$0.575 = 0.551 + 0.024 + 0$
696	W8X48	$0.119 = 0.092 + 0.027 + 0$
697	W8X48	$0.042 = 0.039 + 0.003 + 0$
698	W8X48	$0.015 = 0.012 + 0.003 + 0$
699	W8X48	$0.675 = 0.651 + 0.024 + 0$
700	W8X48	$0.56 = 0.536 + 0.024 + 0$
701	W8X48	$0.554 = 0.53 + 0.024 + 0$
702	W8X48	$0.669 = 0.645 + 0.024 + 0$
703	W8X48	$0.014 = 0.011 + 0.003 + 0$
704	W8X31	$0.041 = 0.007 + 0.028 + 0.005$
705	L6X6X7/8	$0.129 = 0.051 + 0.047 + 0.031$
706	L6X6X7/8	$0.463 = 0.427 + 0.016 + 0.02$
707	L6X6X7/8	$0.16 = 0.064 + 0.069 + 0.027$
708	L6X6X5/16	$0.217 = 0.19 + 0.018 + 0.009$
709	L6X6X5/16	$0.302 = 0.216 + 0.062 + 0.024$
710	L6X6X5/16	$0.055 = 0.026 + 0.016 + 0.013$
711	L6X6X5/16	$0.183 = 0.115 + 0.043 + 0.026$
712	L6X6X5/16	$0.204 = 0.154 + 0.037 + 0.013$
713	L6X6X5/16	$0.195 = 0.132 + 0.052 + 0.01$
714	L6X6X5/16	$0.194 = 0.132 + 0.052 + 0.011$

715	L6X6X5/16	0.204 = 0.154 + 0.037 + 0.013
716	L6X6X5/16	0.183 = 0.115 + 0.042 + 0.026
717	L6X6X5/16	0.056 = 0.027 + 0.016 + 0.013
718	L6X6X5/16	0.303 = 0.216 + 0.062 + 0.024
719	L6X6X5/16	0.218 = 0.191 + 0.018 + 0.009
720	L6X6X7/8	0.161 = 0.064 + 0.069 + 0.027
721	L6X6X7/8	0.466 = 0.429 + 0.017 + 0.02
722	L6X6X7/8	0.129 = 0.051 + 0.047 + 0.031
723	W8X31	0.034 = 0.001 + 0.03 + 0.003
724	W8X31	0.12 = 0.085 + 0.023 + 0.012
725	L6X6X7/8	0.546 = 0.514 + 0.003 + 0.029
726	L6X6X7/8	0.129 = 0.025 + 0.072 + 0.033
727	L6X6X7/8	0.328 = 0.296 + 0.018 + 0.013
728	L6X6X5/16	0.289 = 0.187 + 0.079 + 0.023
729	L6X6X5/16	0.118 = 0.092 + 0.007 + 0.019
730	L6X6X5/16	0.314 = 0.238 + 0.05 + 0.026
731	L6X6X5/16	0.186 = 0.145 + 0.027 + 0.014
732	L6X6X5/16	0.188 = 0.124 + 0.058 + 0.006
733	L6X6X5/16	0.217 = 0.162 + 0.044 + 0.01
734	L6X6X5/16	0.217 = 0.163 + 0.044 + 0.01
735	L6X6X5/16	0.188 = 0.123 + 0.059 + 0.006
736	L6X6X5/16	0.186 = 0.146 + 0.027 + 0.014
737	L6X6X5/16	0.314 = 0.238 + 0.05 + 0.026
738	L6X6X5/16	0.117 = 0.091 + 0.007 + 0.019
739	L6X6X5/16	0.288 = 0.187 + 0.078 + 0.023
740	L6X6X7/8	0.325 = 0.293 + 0.018 + 0.013
741	L6X6X7/8	0.129 = 0.025 + 0.072 + 0.032
742	L6X6X7/8	0.544 = 0.512 + 0.004 + 0.028
743	W8X31	0.123 = 0.09 + 0.021 + 0.013
744	W8X31	0.049 = 0.046 + 0.003 + 0
745	W8X31	0.024 = 0.021 + 0.003 + 0
746	W8X31	0.029 = 0.025 + 0.003 + 0
747	W8X31	0.037 = 0.033 + 0.003 + 0
748	W8X31	0.046 = 0.043 + 0.003 + 0
749	W8X31	0.049 = 0.045 + 0.003 + 0
750	W8X31	0.049 = 0.045 + 0.003 + 0
751	W8X31	0.046 = 0.043 + 0.003 + 0
752	W8X31	0.037 = 0.033 + 0.003 + 0
753	W8X31	0.029 = 0.025 + 0.003 + 0
754	W8X31	0.024 = 0.02 + 0.003 + 0
755	W8X31	0.049 = 0.046 + 0.003 + 0
756	W8X31	0.04 = 0.007 + 0.028 + 0.005

757	L6X6X7/8	$0.137 = 0.033 + 0.07 + 0.034$
758	L6X6X7/8	$0.474 = 0.435 + 0.021 + 0.019$
759	L6X6X7/8	$0.163 = 0.064 + 0.077 + 0.023$
760	L6X6X5/16	$0.225 = 0.194 + 0.03 + 0.001$
761	L6X6X5/16	$0.304 = 0.217 + 0.058 + 0.03$
762	L6X6X5/16	$0.056 = 0.03 + 0.014 + 0.012$
763	L6X6X5/16	$0.184 = 0.115 + 0.043 + 0.026$
764	L6X6X5/16	$0.196 = 0.152 + 0.033 + 0.011$
765	L6X6X5/16	$0.181 = 0.133 + 0.044 + 0.005$
766	L6X6X5/16	$0.179 = 0.131 + 0.043 + 0.005$
767	L6X6X5/16	$0.199 = 0.155 + 0.034 + 0.01$
768	L6X6X5/16	$0.182 = 0.114 + 0.042 + 0.026$
769	L6X6X5/16	$0.05 = 0.024 + 0.014 + 0.012$
770	L6X6X5/16	$0.303 = 0.216 + 0.058 + 0.03$
771	L6X6X5/16	$0.216 = 0.185 + 0.031 + 0.001$
772	L6X6X7/8	$0.162 = 0.062 + 0.077 + 0.023$
773	L6X6X7/8	$0.459 = 0.418 + 0.022 + 0.019$
774	L6X6X7/8	$0.147 = 0.042 + 0.071 + 0.034$
775	W8X31	$0.033 = 3.188\text{E-}04 + 0.03 + 0.002$
776	W8X31	$0.118 = 0.083 + 0.024 + 0.012$
777	L6X6X7/8	$0.547 = 0.503 + 0.036 + 0.008$
778	L6X6X7/8	$0.13 = 0.023 + 0.077 + 0.03$
779	L6X6X7/8	$0.32 = 0.285 + 0.022 + 0.014$
780	L6X6X5/16	$0.291 = 0.187 + 0.072 + 0.032$
781	L6X6X5/16	$0.114 = 0.09 + 0.018 + 0.006$
782	L6X6X5/16	$0.314 = 0.237 + 0.049 + 0.027$
783	L6X6X5/16	$0.185 = 0.146 + 0.026 + 0.013$
784	L6X6X5/16	$0.182 = 0.123 + 0.056 + 0.004$
785	L6X6X5/16	$0.214 = 0.163 + 0.044 + 0.007$
786	L6X6X5/16	$0.211 = 0.161 + 0.043 + 0.008$
787	L6X6X5/16	$0.184 = 0.124 + 0.056 + 0.004$
788	L6X6X5/16	$0.182 = 0.144 + 0.025 + 0.013$
789	L6X6X5/16	$0.315 = 0.238 + 0.05 + 0.027$
790	L6X6X5/16	$0.122 = 0.099 + 0.018 + 0.006$
791	L6X6X5/16	$0.291 = 0.187 + 0.072 + 0.032$
792	L6X6X7/8	$0.337 = 0.301 + 0.022 + 0.013$
793	L6X6X7/8	$0.131 = 0.025 + 0.076 + 0.03$
794	L6X6X7/8	$0.561 = 0.516 + 0.036 + 0.009$
795	W8X31	$0.124 = 0.09 + 0.021 + 0.013$
796	W8X31	$0.049 = 0.046 + 0.003 + 0$
797	W8X31	$0.023 = 0.02 + 0.003 + 0$
798	W8X31	$0.029 = 0.025 + 0.003 + 0$

799	W8X31	$0.037 = 0.033 + 0.003 + 0$
800	W8X31	$0.046 = 0.043 + 0.003 + 0$
801	W8X31	$0.049 = 0.045 + 0.003 + 0$
802	W8X31	$0.049 = 0.045 + 0.003 + 0$
803	W8X31	$0.046 = 0.043 + 0.003 + 0$
804	W8X31	$0.036 = 0.033 + 0.003 + 0$
805	W8X31	$0.028 = 0.025 + 0.003 + 0$
806	W8X31	$0.024 = 0.021 + 0.003 + 0$
807	W8X31	$0.049 = 0.046 + 0.003 + 0$
808	W8X58	$0.382 = 0.258 + 0.118 + 0.007$
809	W8X58	$0.635 = 0.497 + 0.134 + 0.004$
810	W8X31	$0.429 = 0.35 + 0.079 + 0$
811	W8X31	$0.246 = 0.217 + 0.029 + 0$
812	W8X31	$0.3 = 0.206 + 0.095 + 0$
813	W8X31	$0.299 = 0.204 + 0.095 + 0$
814	W8X31	$0.229 = 0.2 + 0.029 + 0$
815	W8X31	$0.427 = 0.348 + 0.079 + 0$
816	W8X58	$0.605 = 0.467 + 0.133 + 0.005$
817	W8X58	$0.386 = 0.259 + 0.119 + 0.009$
818	L8X8X1/2	$0.29 = 0.062 + 0.126 + 0.103$
819	L8X8X1/2	$0.439 = 0.049 + 0.229 + 0.161$
820	L8X8X1/2	$0.629 = 0.295 + 0.196 + 0.138$
821	L8X8X1/2	$0.555 = 0.221 + 0.196 + 0.138$
822	L8X8X1/2	$0.55 = 0.216 + 0.196 + 0.138$
823	L8X8X1/2	$0.632 = 0.298 + 0.196 + 0.138$
824	L8X8X1/2	$0.435 = 0.045 + 0.229 + 0.161$
825	L8X8X1/2	$0.297 = 0.1 + 0.108 + 0.088$
826	L8X8X1/2	$0.282 = 0.053 + 0.126 + 0.103$
827	L8X8X1/2	$0.436 = 0.046 + 0.229 + 0.161$
828	L8X8X1/2	$0.628 = 0.294 + 0.196 + 0.138$
829	L8X8X1/2	$0.555 = 0.221 + 0.196 + 0.138$
830	L8X8X1/2	$0.55 = 0.216 + 0.196 + 0.138$
831	L8X8X1/2	$0.633 = 0.299 + 0.196 + 0.138$
832	L8X8X1/2	$0.436 = 0.046 + 0.229 + 0.161$
833	L8X8X1/2	$0.293 = 0.064 + 0.126 + 0.103$
834	W8X58	$0.388 = 0.261 + 0.119 + 0.009$
835	W8X58	$0.609 = 0.47 + 0.133 + 0.006$
836	W8X31	$0.429 = 0.35 + 0.079 + 0$
837	W8X31	$0.255 = 0.085 + 0.17 + 0$
838	W8X31	$0.301 = 0.207 + 0.094 + 0$
839	W8X31	$0.298 = 0.204 + 0.095 + 0$
840	W8X31	$0.216 = 0.187 + 0.029 + 0$

841	W8X31	$0.427 = 0.348 + 0.079 + 0$
842	W8X58	$0.634 = 0.5 + 0.131 + 0.002$
843	W8X58	$0.362 = 0.242 + 0.118 + 0.002$
844	W8X31	$0.347 = 0.006 + 0.295 + 0.046$
845	W8X31	$0.34 = 0.04 + 0.294 + 0.005$
846	W8X31	$0.397 = 0.072 + 0.298 + 0.026$
847	W8X31	$0.397 = 0.072 + 0.297 + 0.027$
848	W8X31	$0.339 = 0.04 + 0.294 + 0.005$
849	W8X31	$0.346 = 0.006 + 0.295 + 0.046$
850	W8X31	$0.16 = 0.004 + 0.155 + 4.708E-04$
851	W8X31	$0.447 = 0.007 + 0.44 + 0$
852	W8X31	$0.183 = 0.007 + 0.176 + 1.177E-04$
853	W8X31	$0.18 = 0.004 + 0.176 + 0$
854	W8X31	$0.444 = 0.006 + 0.439 + 1.299E-04$
855	W8X31	$0.158 = 0.004 + 0.154 + 0.001$
856	W8X31	$0.346 = 0.006 + 0.296 + 0.045$
857	W8X31	$0.341 = 0.041 + 0.295 + 0.005$
858	W8X31	$0.399 = 0.073 + 0.299 + 0.027$
859	W8X31	$0.395 = 0.072 + 0.296 + 0.026$
860	W8X31	$0.339 = 0.041 + 0.293 + 0.005$
861	W8X31	$0.343 = 0.006 + 0.293 + 0.044$
862	W8X31	$0.021 = 4.23E-04 + 0.002 + 0.018$
863	W8X31	$0.028 = 0.002 + 0.004 + 0.022$
864	W8X31	$0.017 = 0.011 + 0.002 + 0.004$
865	W8X31	$0.018 = 0.003 + 0.001 + 0.014$
866	W8X31	$0.028 = 0.001 + 0.001 + 0.025$
867	W8X31	$0.034 = 0.001 + 0.002 + 0.032$
868	W8X31	$0.041 = 0.002 + 0.003 + 0.036$
869	W8X31	$0.026 = 0.001 + 0.004 + 0.02$
870	W8X31	$0.018 = 2.774E-04 + 0.003 + 0.015$
871	W8X31	$0.018 = 0.011 + 0.002 + 0.004$
872	W8X31	$0.018 = 0.003 + 0.001 + 0.014$
873	W8X31	$0.028 = 0.001 + 0.001 + 0.025$
874	W8X31	$0.035 = 0.001 + 0.002 + 0.032$
875	W8X31	$0.042 = 0.002 + 0.003 + 0.037$
876	W8X31	$0.021 = 4.221E-04 + 0.002 + 0.018$
877	W8X31	$0.028 = 0.002 + 0.004 + 0.022$
878	W8X31	$0.035 = 0.001 + 0.002 + 0.032$
879	W8X31	$0.027 = 0.001 + 0.001 + 0.025$
880	W8X31	$0.017 = 0.003 + 0.001 + 0.014$
881	W8X31	$0.018 = 0.011 + 0.002 + 0.004$
882	W8X31	$0.017 = 0.011 + 0.002 + 0.003$

883	W8X31	$0.018 = 0.003 + 0.001 + 0.014$
884	W8X31	$0.027 = 0.001 + 0.001 + 0.025$
885	W8X31	$0.034 = 0.001 + 0.002 + 0.032$
886	W8X31	$0.041 = 0.002 + 0.003 + 0.036$
887	W8X31	$0.042 = 0.002 + 0.003 + 0.037$
888	W8X31	$0.025 = 0.001 + 0.004 + 0.019$
889	W8X31	$0.017 = 1.984\text{E-}04 + 0.003 + 0.014$

Hangar - Beam 347

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	B166	347	58.28148	DStIS2-1	Special Concentrically Braced Frame	W12X72	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
98.35000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-0.449	-1.313	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1465	0.000141	0.028791	0.009404	0.1117	0.0367

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.056177	0.018808	0.0625	0.028472	0.44327	0.25333	0.002185

Material Properties

E (lb/ft ²)	f _y (lb/ft ²)	R _y	C _{pr}	α
4176000000	7200000	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	98.35	0.44327	221.876	200	221.876	300
Minor (2-2)	1	32.78333	0.25333	129.407	200	129.407	300

Stress Check Forces and Moments

Location (ft)	P _u (lb)	M _{u33} (lb-ft)	M _{u22} (lb-ft)	V _{u2} (lb)	V _{u3} (lb)	T _u (lb-ft)
58.28148	473556.76	15169.01	-44.96	-1374.77	-5.76	0.31

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1a)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	0.333	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.333	1	1.284

Demand/Capacity (D/C) Ratio Eqn.(H1.2,H1-1a)

D/C Ratio =	$(P_r/P_c) + (8/9)(M_{r33}/M_{c33}) + (8/9)(M_{r22}/M_{c22})$
0.536 =	0.499 + 0.037 + 2.166E-04

Axial Force and Capacities

P_u Force (lb)	φP_{nc} Capacity (lb)	φP_{nt} Capacity (lb)
473556.76	96828.43	949500

Moments and Capacities

	M_u Moment (lb-ft)	φM_n (lb-ft)	φM_n No LTB (lb-ft)	φM_n Cb=1 (lb-ft)
Major Bending	15169.01	360979.13	405000	281179.04
Minor Bending	44.96	184500		

Shear Design

	V_u Force (lb)	φV_n Capacity (lb)	Stress Ratio
Major Shear	1374.77	158670	0.009
Minor Shear	5.76	434160	1.327E-05

Hangar - Beam 418

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story33	B192	418	0.55074	DStIS2-1	Special Concentrically Braced Frame	W12X87	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
121.06371	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.256	0.1	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1778	0.000246	0.035687	0.011622	0.1361	0.0447

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.068519	0.023052	0.076389	0.034954	0.44804	0.25569	0.002736

Material Properties

E (lb/ft ²)	f _y (lb/ft ²)	R _y	C _{pr}	α
4176000000	7200000	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	11.18823	0.44804	24.972	200	24.972	300
Minor (2-2)	1	12.10637	0.25569	47.349	200	47.349	300

Stress Check Forces and Moments

Location (ft)	P _u (lb)	M _{u33} (lb-ft)	M _{u22} (lb-ft)	V _{u2} (lb)	V _{u3} (lb)	T _u (lb-ft)
0.55074	-328073.13	-146993.13	-192.78	-18942.29	25.53	146.1

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.092	1	1	1	1	1
Minor Bending	0.1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.1	1	1.293

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r/P_c) + (8/9)(M_{r33}/M_{c33}) + (8/9)(M_{r22}/M_{c22})$
0.6 =	0.336 + 0.264 + 0.001

Axial Force and Capacities

P_u Force (lb)	φP_{nc} Capacity (lb)	φP_{nt} Capacity (lb)
328073.13	977828.47	1152000

Moments and Capacities

	M_u Moment (lb-ft)	φM_n (lb-ft)	φM_n No LTB (lb-ft)	φM_n Cb=1 (lb-ft)
Major Bending	146993.13	495000	495000	487687.42
Minor Bending	192.78	226500		

Shear Design

	V_u Force (lb)	φV_n Capacity (lb)	Stress Ratio
Major Shear	18942.29	193125	0.098
Minor Shear	25.53	529254	4.823E-05

End Reaction Major Shear Forces

Left End Reaction (lb)	Load Combo	Right End Reaction (lb)	Load Combo
		16120.49	DSIS2-2

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	B126	668	13.24615	DStIS2-1	Special Concentrically Braced Frame	W8X31	Non-Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
24.60000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.13	0.489	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.0634	0.000026	0.005305	0.001789	0.0483	0.0158

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.015914	0.005367	0.017593	0.00816	0.28925	0.16798	0.000178

Material Properties

E (lb/ft ²)	f _y (lb/ft ²)	R _y	C _{pr}	α
4176000000	7200000	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	24.6	0.28925	85.046	200	85.046	300
Minor (2-2)	1	24.6	0.16798	146.442	200	146.442	300

Stress Check Forces and Moments

Location (ft)	P _u (lb)	M _{u33} (lb-ft)	M _{u22} (lb-ft)	V _{u2} (lb)	V _{u3} (lb)	T _u (lb-ft)
13.24615	-59552.85	2803.42	0	27.77	-25.73	-2.89

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.136

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r/P_c) + (8/9)(M_{r33}/M_{c33}) + (8/9)(M_{r22}/M_{c22})$
0.649 =	0.619 + 0.03 + 0

Axial Force and Capacities

P_u Force (lb)	φP_{nc} Capacity (lb)	φP_{nt} Capacity (lb)
59552.85	96179.16	410850

Moments and Capacities

	M_u Moment (lb-ft)	φM_n (lb-ft)	φM_n No LTB (lb-ft)	φM_n Cb=1 (lb-ft)
Major Bending	2803.42	82519.11	113877.37	72616.82
Minor Bending	0	52791.33		

Shear Design

	V_u Force (lb)	φV_n Capacity (lb)	Stress Ratio
Major Shear	27.77	68400	4.059E-04
Minor Shear	25.73	187920	1.369E-04

Hangar – All column sections with DC ratios (Gravity Design)

Label	Section	D/C Ratio
2	W10X68	$0.05 = 0.024 + 0.009 + 0.017$
3	W10X68	$0.047 = 0.043 + 0.004 + 0.001$
4	W10X68	$0.056 = 0.026 + 0.009 + 0.021$
5	W10X68	$0.032 = 0.006 + 0.01 + 0.016$
7	W8X31	$0.007 = 0.007 + 0 + 0$
8	W10X68	$0.336 = 0.313 + 0.017 + 0.006$
9	W10X68	$0.102 = 0.072 + 0.021 + 0.009$
10	W10X68	$0.345 = 0.321 + 0.017 + 0.007$
11	W10X68	$0.105 = 0.074 + 0.021 + 0.01$
30	W8X31	$0.092 = 0.092 + 0 + 0$
31	W8X31	$0.085 = 0.085 + 0 + 0$
32	W8X31	$0.071 = 0.071 + 0 + 0$
33	W8X31	$0.067 = 0.067 + 0 + 0$
34	W8X31	$0.055 = 0.055 + 0 + 0$
35	W8X31	$0.041 = 0.041 + 0 + 0$
36	W8X31	$0.027 = 0.027 + 0 + 0$
37	W8X31	$0.014 = 0.014 + 0 + 0$
38	W8X31	$0.014 = 0.014 + 0 + 0$
39	W8X31	$0.027 = 0.027 + 0 + 0$
40	W8X31	$0.041 = 0.041 + 0 + 0$
41	W8X31	$0.055 = 0.055 + 0 + 0$
42	W8X31	$0.067 = 0.067 + 0 + 0$
43	W8X31	$0.071 = 0.071 + 0 + 0$
44	W8X31	$0.085 = 0.085 + 0 + 0$
45	W8X31	$0.092 = 0.092 + 0 + 0$
85	W10X68	$0.077 = 0.023 + 0.031 + 0.023$
86	W10X68	$0.103 = 0.046 + 0.031 + 0.027$
87	W10X68	$0.088 = 0.022 + 0.032 + 0.034$
90	W8X31	$0.013 = 0.013 + 0 + 0$
91	W10X68	$0.306 = 0.263 + 0.023 + 0.02$
92	W10X68	$0.389 = 0.256 + 0.005 + 0.128$
93	W10X68	$0.286 = 0.242 + 0.023 + 0.021$
94	W10X68	$0.386 = 0.252 + 0.005 + 0.129$
113	W8X31	$0.506 = 0.506 + 0 + 0$
114	W8X31	$0.473 = 0.473 + 0 + 0$
115	W8X31	$0.402 = 0.402 + 0 + 0$
116	W8X31	$0.32 = 0.32 + 0 + 0$
117	W8X31	$0.26 = 0.26 + 0 + 0$
118	W8X31	$0.098 = 0.098 + 0 + 0$

119	W8X31	$0.069 = 0.069 + 0 + 0$
120	W8X31	$0.043 = 0.043 + 0 + 0$
121	W8X31	$0.043 = 0.043 + 0 + 0$
122	W8X31	$0.069 = 0.069 + 0 + 0$
123	W8X31	$0.098 = 0.098 + 0 + 0$
124	W8X31	$0.26 = 0.26 + 0 + 0$
125	W8X31	$0.32 = 0.32 + 0 + 0$
126	W8X31	$0.402 = 0.402 + 0 + 0$
127	W8X31	$0.473 = 0.473 + 0 + 0$
128	W8X31	$0.506 = 0.506 + 0 + 0$
147	W10X68	$0.255 = 0.215 + 0.027 + 0.014$
168	W10X68	$0.077 = 0.023 + 0.031 + 0.023$
169	W10X68	$0.116 = 0.052 + 0.031 + 0.034$
170	W10X68	$0.093 = 0.019 + 0.032 + 0.042$
173	W8X31	$0.013 = 0.013 + 0 + 0$
174	W10X68	$0.293 = 0.251 + 0.023 + 0.02$
175	W10X68	$0.389 = 0.256 + 0.005 + 0.128$
176	W10X68	$0.307 = 0.265 + 0.023 + 0.019$
177	W10X68	$0.385 = 0.254 + 0.004 + 0.127$
196	W8X31	$0.507 = 0.507 + 0 + 0$
197	W8X31	$0.475 = 0.475 + 0 + 0$
198	W8X31	$0.403 = 0.403 + 0 + 0$
199	W8X31	$0.322 = 0.322 + 0 + 0$
200	W8X31	$0.261 = 0.261 + 0 + 0$
201	W8X31	$0.098 = 0.098 + 0 + 0$
202	W8X31	$0.07 = 0.07 + 0 + 0$
203	W8X31	$0.044 = 0.044 + 0 + 0$
204	W8X31	$0.043 = 0.043 + 0 + 0$
205	W8X31	$0.069 = 0.069 + 0 + 0$
206	W8X31	$0.097 = 0.097 + 0 + 0$
207	W8X31	$0.259 = 0.259 + 0 + 0$
208	W8X31	$0.319 = 0.319 + 0 + 0$
209	W8X31	$0.401 = 0.401 + 0 + 0$
210	W8X31	$0.472 = 0.472 + 0 + 0$
211	W8X31	$0.504 = 0.504 + 0 + 0$
251	W10X68	$0.05 = 0.024 + 0.009 + 0.017$
252	W10X68	$0.063 = 0.057 + 0.004 + 0.002$
253	W10X68	$0.066 = 0.03 + 0.009 + 0.027$
256	W8X31	$0.007 = 0.007 + 0 + 0$
257	W10X68	$0.321 = 0.301 + 0.015 + 0.005$
258	W10X68	$0.102 = 0.072 + 0.021 + 0.009$
259	W10X68	$0.346 = 0.325 + 0.017 + 0.005$

260	W10X68	$0.101 = 0.073 + 0.021 + 0.007$
279	W8X31	$0.092 = 0.092 + 0 + 0$
280	W8X31	$0.084 = 0.084 + 0 + 0$
281	W8X31	$0.071 = 0.071 + 0 + 0$
282	W8X31	$0.066 = 0.066 + 0 + 0$
283	W8X31	$0.054 = 0.054 + 0 + 0$
284	W8X31	$0.041 = 0.041 + 0 + 0$
285	W8X31	$0.027 = 0.027 + 0 + 0$
286	W8X31	$0.014 = 0.014 + 0 + 0$
287	W8X31	$0.014 = 0.014 + 0 + 0$
288	W8X31	$0.028 = 0.028 + 0 + 0$
289	W8X31	$0.042 = 0.042 + 0 + 0$
290	W8X31	$0.055 = 0.055 + 0 + 0$
291	W8X31	$0.067 = 0.067 + 0 + 0$
292	W8X31	$0.071 = 0.071 + 0 + 0$
293	W8X31	$0.085 = 0.085 + 0 + 0$
294	W8X31	$0.092 = 0.092 + 0 + 0$
333	W12X136	$0.626 = 0.432 + 0.182 + 0.012$
334	W12X136	$0.302 = 0.077 + 0.21 + 0.015$
335	W12X136	$0.61 = 0.418 + 0.183 + 0.01$
336	W12X136	$0.302 = 0.079 + 0.21 + 0.013$
339	W8X31	$0.57 = 0.57 + 0 + 0$
344	W10X68	$0.27 = 0.229 + 0.027 + 0.014$
351	W8X31	$0.571 = 0.571 + 0 + 0$
361	W10X68	$0.031 = 0.005 + 0.01 + 0.016$
363	W8X31	$0.696 = 0.696 + 0 + 0$
364	W8X31	$0.5 = 0.5 + 0 + 0$
365	W8X31	$0.407 = 0.407 + 0 + 0$
366	W8X31	$0.252 = 0.252 + 0 + 0$
367	W8X31	$0.093 = 0.093 + 0 + 0$
368	W8X31	$0.052 = 0.052 + 0 + 0$
369	W8X31	$0.017 = 0.017 + 0 + 0$
370	W8X31	$0.042 = 0.042 + 0 + 0$
371	W8X31	$0.073 = 0.073 + 0 + 0$
372	W8X31	$0.321 = 0.321 + 0 + 0$
373	W8X31	$0.074 = 0.074 + 0 + 0$
374	W8X31	$0.043 = 0.043 + 0 + 0$
375	W8X31	$0.018 = 0.018 + 0 + 0$
376	W8X31	$0.052 = 0.052 + 0 + 0$
377	W8X31	$0.092 = 0.092 + 0 + 0$
378	W8X31	$0.251 = 0.251 + 0 + 0$
379	W8X31	$0.406 = 0.406 + 0 + 0$

380	W8X31	$0.499 = 0.499 + 0 + 0$
381	W8X31	$0.704 = 0.704 + 0 + 0$
404	W10X88	$0.64 = 0.465 + 0.175 + 0$
405	W10X88	$0.395 = 0.201 + 0.194 + 0$
406	W10X88	$0.769 = 0.595 + 0.171 + 0.003$
407	W10X88	$0.288 = 0.09 + 0.196 + 0.003$
410	W8X31	$0.419 = 0.419 + 0 + 0$
422	W8X31	$0.415 = 0.415 + 0 + 0$
434	W8X31	$0.476 = 0.476 + 0 + 0$
435	W8X31	$0.439 = 0.439 + 0 + 0$
436	W8X31	$0.357 = 0.357 + 0 + 0$
437	W8X31	$0.229 = 0.229 + 0 + 0$
438	W8X31	$0.096 = 0.096 + 0 + 0$
439	W8X31	$0.055 = 0.055 + 0 + 0$
440	W8X31	$0.014 = 0.014 + 0 + 0$
441	W8X31	$0.036 = 0.036 + 0 + 0$
442	W8X31	$0.066 = 0.066 + 0 + 0$
443	W8X31	$0.236 = 0.236 + 0 + 0$
444	W8X31	$0.066 = 0.066 + 0 + 0$
445	W8X31	$0.036 = 0.036 + 0 + 0$
446	W8X31	$0.014 = 0.014 + 0 + 0$
447	W8X31	$0.055 = 0.055 + 0 + 0$
448	W8X31	$0.096 = 0.096 + 0 + 0$
449	W8X31	$0.23 = 0.23 + 0 + 0$
450	W8X31	$0.358 = 0.358 + 0 + 0$
451	W8X31	$0.441 = 0.441 + 0 + 0$
452	W8X31	$0.47 = 0.47 + 0 + 0$
475	W12X136	$0.63 = 0.437 + 0.182 + 0.012$
476	W12X136	$0.302 = 0.077 + 0.209 + 0.015$
477	W12X136	$0.647 = 0.449 + 0.182 + 0.016$
478	W12X136	$0.303 = 0.076 + 0.208 + 0.02$
481	W8X31	$0.57 = 0.57 + 0 + 0$
493	W8X31	$0.569 = 0.569 + 0 + 0$
505	W8X31	$0.697 = 0.697 + 0 + 0$
506	W8X31	$0.5 = 0.5 + 0 + 0$
507	W8X31	$0.407 = 0.407 + 0 + 0$
508	W8X31	$0.252 = 0.252 + 0 + 0$
509	W8X31	$0.092 = 0.092 + 0 + 0$
510	W8X31	$0.052 = 0.052 + 0 + 0$
511	W8X31	$0.017 = 0.017 + 0 + 0$
512	W8X31	$0.042 = 0.042 + 0 + 0$
513	W8X31	$0.073 = 0.073 + 0 + 0$

514	W8X31	$0.321 = 0.321 + 0 + 0$
515	W8X31	$0.073 = 0.073 + 0 + 0$
516	W8X31	$0.042 = 0.042 + 0 + 0$
517	W8X31	$0.017 = 0.017 + 0 + 0$
518	W8X31	$0.053 = 0.053 + 0 + 0$
519	W8X31	$0.093 = 0.093 + 0 + 0$
520	W8X31	$0.253 = 0.253 + 0 + 0$
521	W8X31	$0.408 = 0.408 + 0 + 0$
522	W8X31	$0.501 = 0.501 + 0 + 0$
523	W8X31	$0.696 = 0.696 + 0 + 0$

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	C7	10	32.99167	DStIS2-1	Special Concentrically Braced Frame	W10X68	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
34.00000	0.858	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.062	0.253	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1382	0.000172	0.019001	0.006462	0.108	0.0339

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.043848	0.015356	0.049363	0.023206	0.3708	0.21624	0.001027

Material Properties

E (lb/ft ²)	f _y (lb/ft ²)	R _y	C _{pr}	α
4176000000	7200000	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	32.99167	0.3708	88.974	200	88.974	300
Minor (2-2)	1	32.99167	0.21624	152.567	200	152.567	300

Stress Check Forces and Moments

Location (ft)	P _u (lb)	M _{u33} (lb-ft)	M _{u22} (lb-ft)	V _{u2} (lb)	V _{u3} (lb)	T _u (lb-ft)
32.99167	-61920.42	-6231.24	-1210.7	160.63	25	-2.08

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.97	1	1	1	1	0.6
Minor Bending	0.97	1	1	1	1	0.6

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.97	1	1.585

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r/P_c) + (8/9)(M_{r33}/M_{c33}) + (8/9)(M_{r22}/M_{c22})$
0.345 =	0.321 + 0.017 + 0.007

Axial Force and Capacities

P_u Force (lb)	φP_{nc} Capacity (lb)	φP_{nt} Capacity (lb)
61920.42	193140.59	895500

Moments and Capacities

	M_u Moment (lb-ft)	φM_n (lb-ft)	φM_n No LTB (lb-ft)	φM_n Cb=1 (lb-ft)
Major Bending	6231.24	319875	319875	227792.59
Minor Bending	1210.7	150375		

Shear Design

	V_u Force (lb)	φV_n Capacity (lb)	Stress Ratio
Major Shear	160.63	146640	0.001
Minor Shear	25	419958	5.954E-05

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	C116	333	32.975	DStIS2-1	Special Concentrically Braced Frame	W12X136	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
34.00000	0.4	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.124	0.341	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.2771	0.000892	0.059799	0.019194	0.2153	0.0735

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.107103	0.037149	0.123843	0.056713	0.46456	0.26319	0.004909

Material Properties

E (lb/ft ²)	f _y (lb/ft ²)	R _y	C _{pr}	α
4176000000	7200000	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	32.975	0.46456	70.981	200	70.981	300
Minor (2-2)	1	32.975	0.26319	125.288	200	125.288	300

Stress Check Forces and Moments

Location (ft)	P _u (lb)	M _{u33} (lb-ft)	M _{u22} (lb-ft)	V _{u2} (lb)	V _{u3} (lb)	T _u (lb-ft)
32.975	-247831.29	164567.27	4886.33	-4543.92	-70.55	64.85

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.97	1	1	1	1	0.6
Minor Bending	0.97	1	1	1	1	0.6

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.97	1	1.566

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r/P_c) + (8/9)(M_{r33}/M_{c33}) + (8/9)(M_{r22}/M_{c22})$
0.626 =	0.432 + 0.182 + 0.012

Axial Force and Capacities

P_u Force (lb)	φP_{nc} Capacity (lb)	φP_{nt} Capacity (lb)
247831.29	574236.38	1795500

Moments and Capacities

	M_u Moment (lb-ft)	φM_n (lb-ft)	φM_n No LTB (lb-ft)	φM_n Cb=1 (lb-ft)
Major Bending	164567.27	802500	802500	670448.6
Minor Bending	4886.33	367500		

Shear Design

	V_u Force (lb)	φV_n Capacity (lb)	Stress Ratio
Major Shear	4543.92	317580	0.014
Minor Shear	70.55	837000	8.429E-05

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	C171	406	32.975	DStIS2-1	Special Concentrically Braced Frame	W10X88	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
34.00000	0.418	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.118	0.47	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1806	0.000363	0.025752	0.008632	0.1416	0.0454

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.057227	0.020114	0.065394	0.030729	0.37766	0.21865	0.001453

Material Properties

E (lb/ft ²)	f _y (lb/ft ²)	R _y	C _{pr}	α
4176000000	7200000	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	32.975	0.37766	87.314	200	87.314	300
Minor (2-2)	1	32.975	0.21865	150.809	200	150.809	300

Stress Check Forces and Moments

Location (ft)	P _u (lb)	M _{u33} (lb-ft)	M _{u22} (lb-ft)	V _{u2} (lb)	V _{u3} (lb)	T _u (lb-ft)
32.975	-153630.74	-81555.47	-617.81	2132.97	0.5	35.25

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.97	1	1	1	1	0.6
Minor Bending	0.97	1	1	1	1	0.6

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.97	1	1.521

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r/P_c) + (8/9)(M_{r33}/M_{c33}) + (8/9)(M_{r22}/M_{c22})$
0.769 =	0.595 + 0.171 + 0.003

Axial Force and Capacities

P_u Force (lb)	φP_{nc} Capacity (lb)	φP_{nt} Capacity (lb)
153630.74	258262.15	1170000

Moments and Capacities

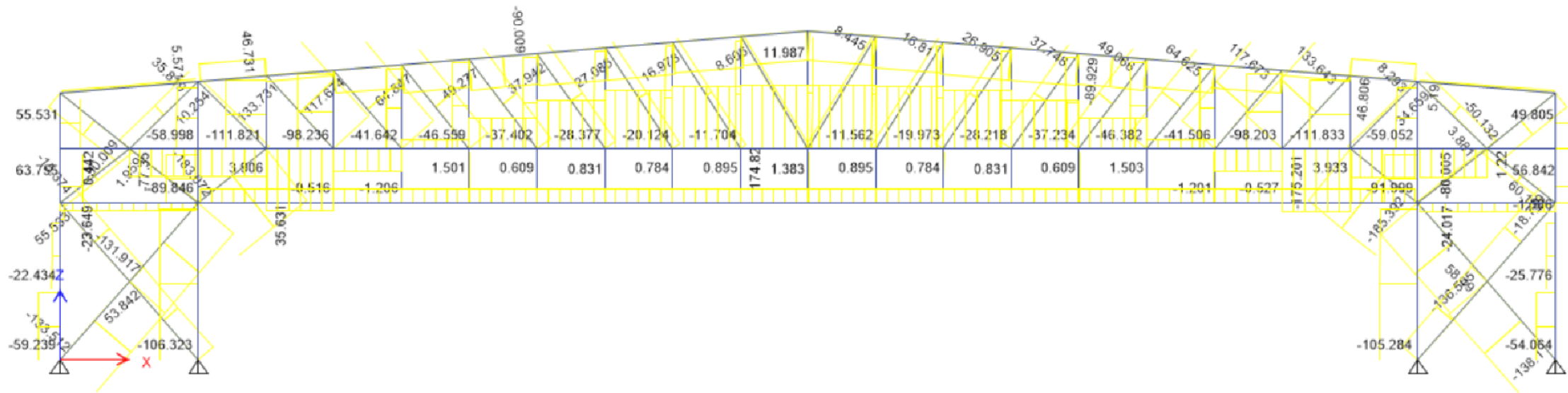
	M_u Moment (lb-ft)	φM_n (lb-ft)	φM_n No LTB (lb-ft)	φM_n Cb=1 (lb-ft)
Major Bending	81555.47	423750	423750	330608.17
Minor Bending	617.81	199125		

Shear Design

	V_u Force (lb)	φV_n Capacity (lb)	Stress Ratio
Major Shear	2132.97	196020	0.011
Minor Shear	0.5	550638	0

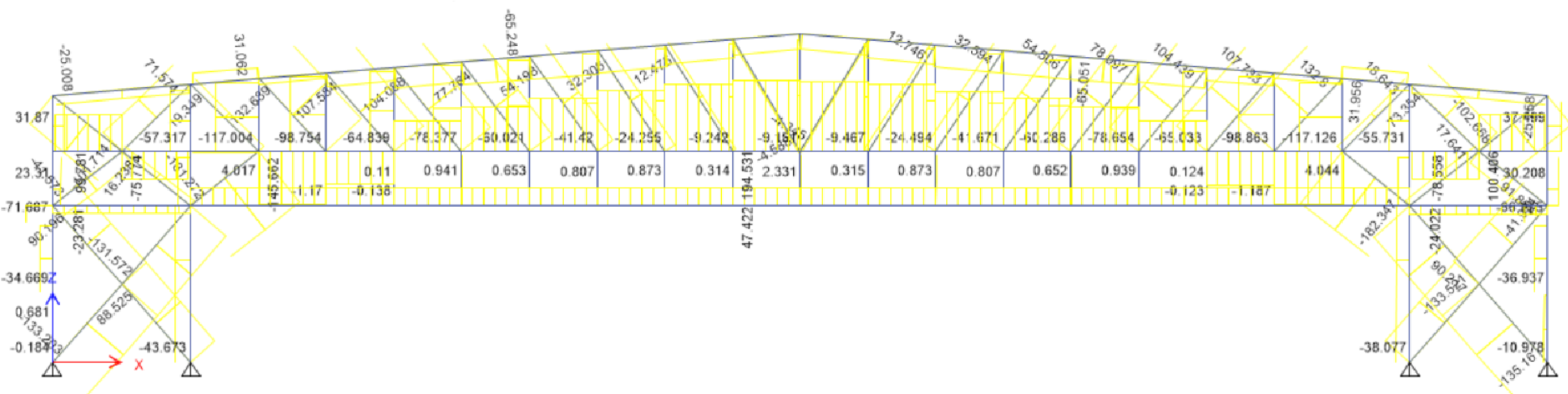
Hangar - Axial Load Distribution (1.2DL+1.6LL)

Elevation A.1



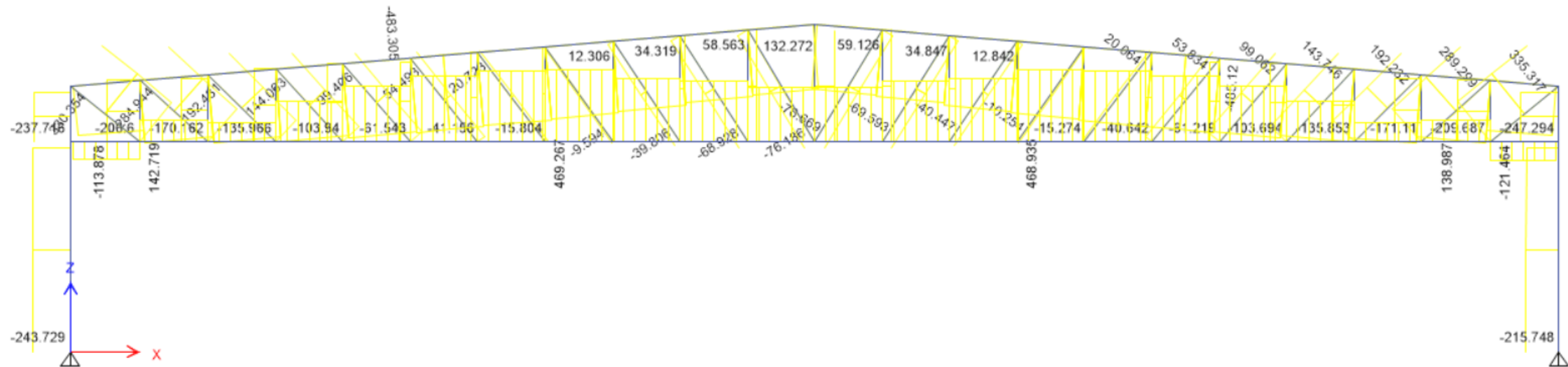
Hangar - Axial Load Distribution (1.2DL+1.6LL)

Elevation A.3



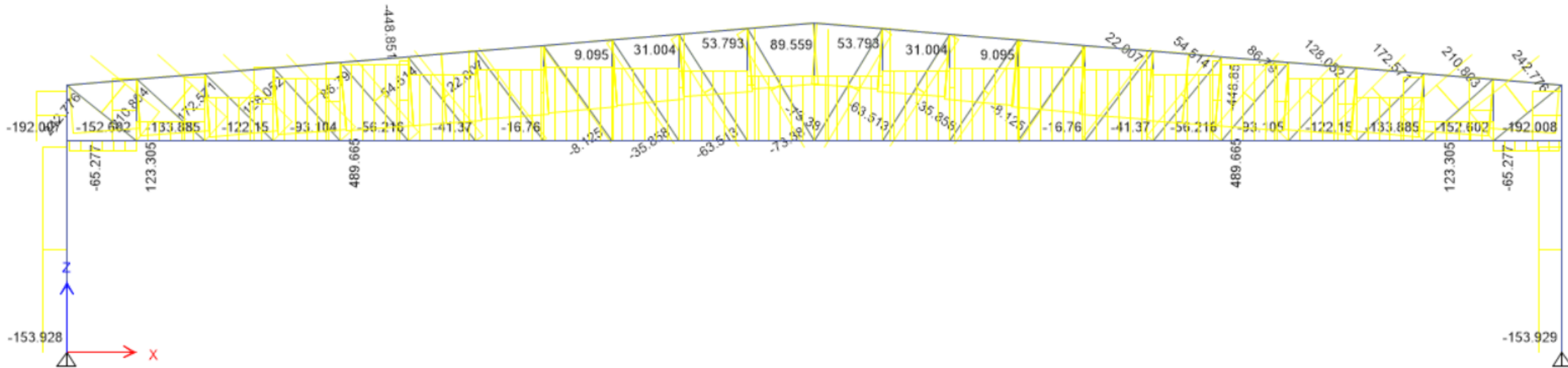
Hangar - Axial Load Distribution (1.2DL+1.6LL)

Elevation B



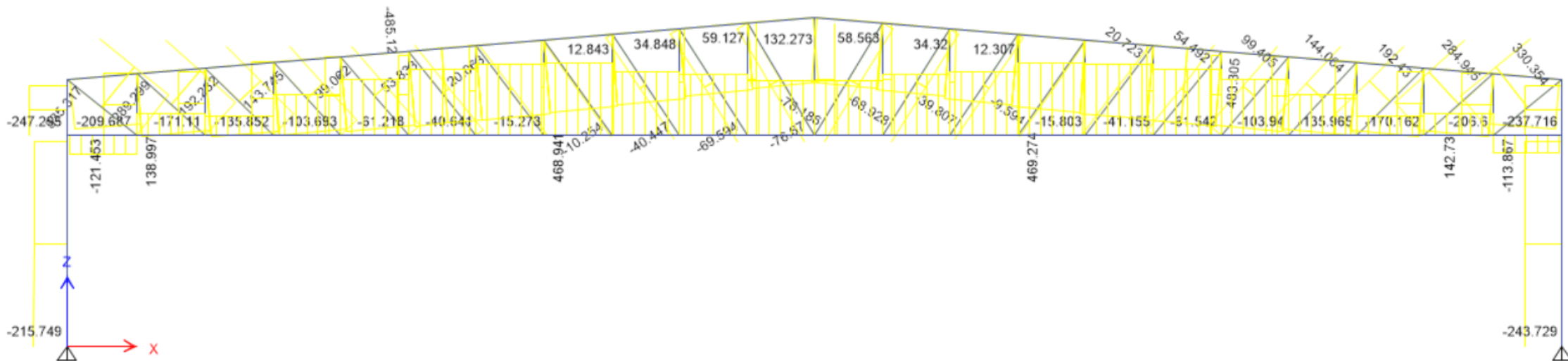
Hangar - Axial Load Distribution (1.2DL+1.6LL)

Elevation C



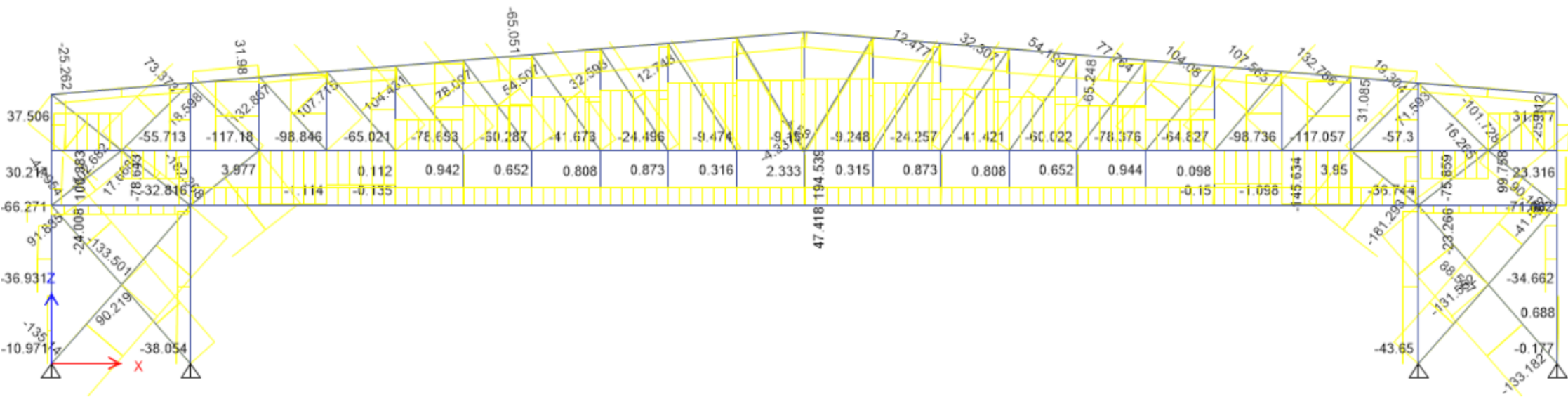
Hangar - Axial Load Distribution (1.2DL+1.6LL)

Elevation D



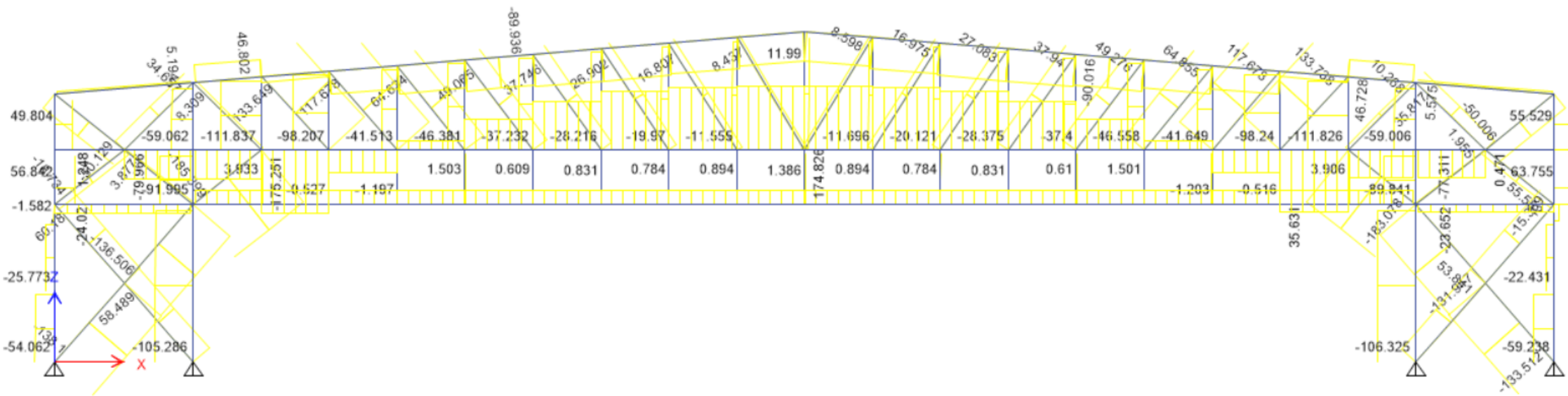
Hangar - Axial Load Distribution (1.2DL+1.6LL)

Elevation D.7



Hangar - Axial Load Distribution (1.2DL+1.6LL)

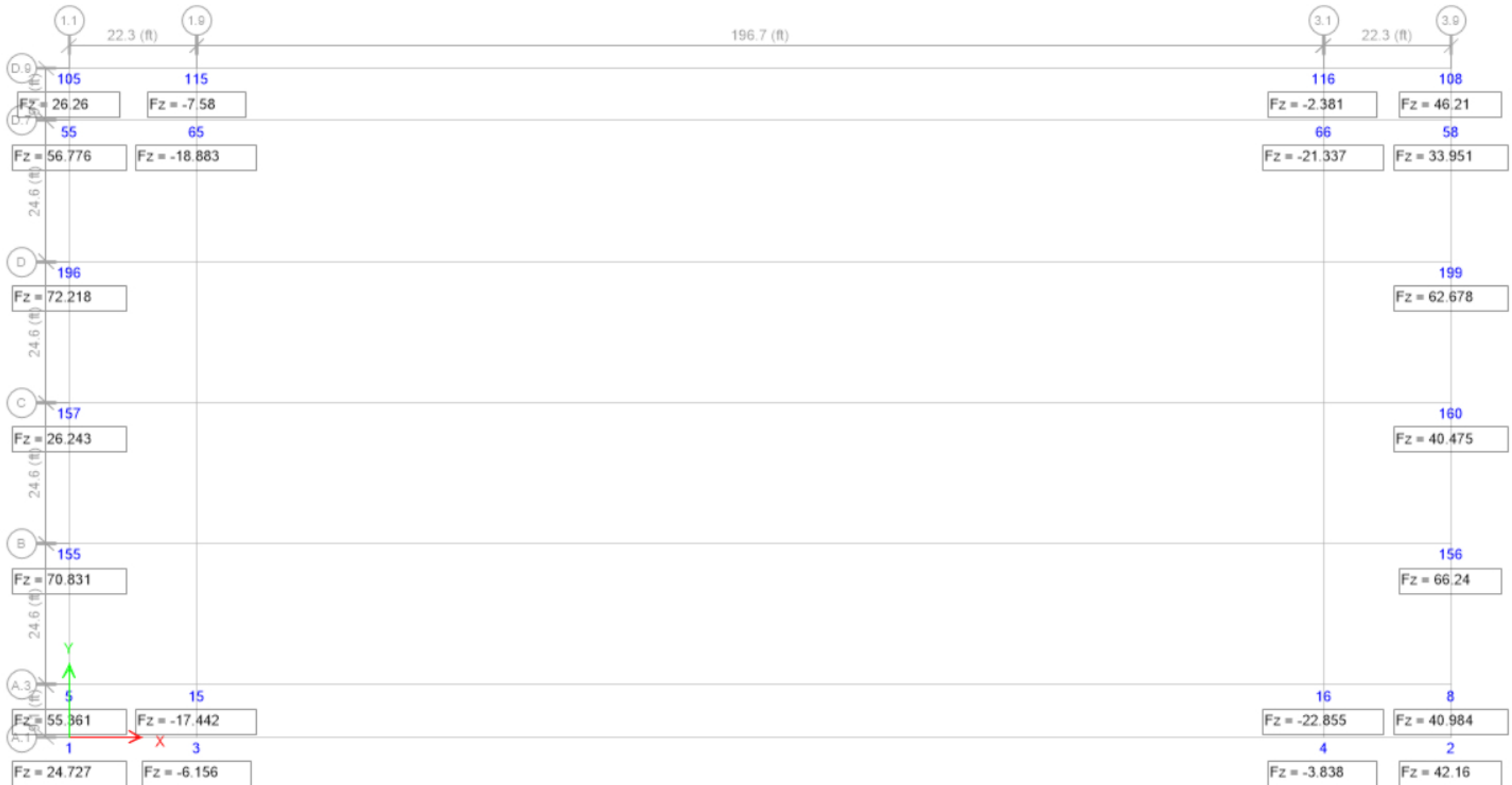
Elevation D.9



Hangar - Base Reactions (Dead)



Hangar - Base Reactions (Live)



Masonry Slender Wall

Project File: AOF.ec6

LIC# : KW-06019202, Build:20.24.10.03

Michael Baker International

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Exterior Masonry Walls (MW8)

Code References

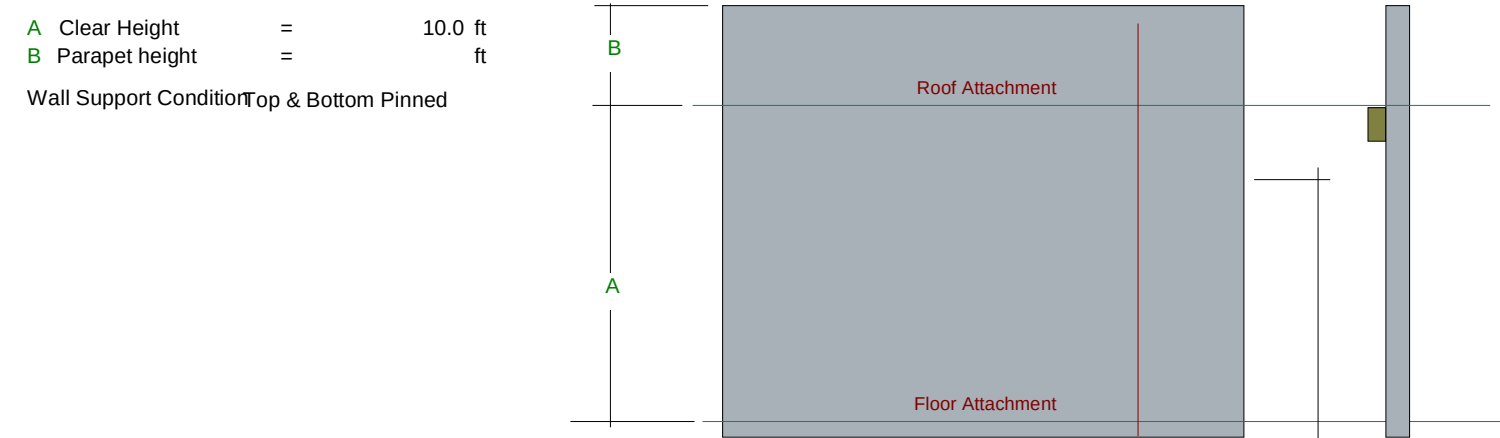
Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Calculations per TMS 402-16, IBC 2021, ASCE 7-16

Construction Type : Grouted Hollow Concrete Masonry					
F'm	=	2.0 ksi	Nom. Wall Thickness	8 in	Temp Diff across thickness = deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	7.625 in	Min Allow Out-of-plane Defl Rε= 0.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	3.8125 in	
Em = f'm *	=	900.0	Lower Level Rebar . . .		Minimum Vertical Steel % = 0.0020
Max % of ρ bal.	=	0.009228	Bar Size	# 5	
Grout Density	=	140 pcf	Bar Spacing	32 in	
Block Weight	Normal Weight				
Wall Weight	=	51.0 psf			
Wall is grouted at rebar cells only					

One-Story Wall Dimensions



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)		DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity in	1.0	1.0			k/ft
Concentric Load						k/ft

Lateral Loads

Wind Loads :		Seismic Loads :	
Full area WIND load	16.0 psf	Wall Weight Seismic Load Input Method :ASCE seismic factors entered	
		SDS Value per ASCE 12.11.1	S _{DS} * I = 0.740
		Fp = Wall Wt. * 0.2960	= 15.096 psf

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Masonry Slender Wall

Project File: AOF.ec6

LIC# : KW-06019202, Build:20.24.10.03

Michael Baker International

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Exterior Masonry Walls (MW8)

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

Governing Load Combination . . .		Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.90D+W	Maximum Bending Stress Ratio0.09920			
		Max Mu	0.2001 k-ft	Phi * Mn	2.017 k-ft
PASS	Service Deflection Check W Only	Actual Defl. Ratio L/	20590	Allowable Defl. Ratio	400.0
		Max. Deflection	0.005828 in		
PASS	Axial Load Check +1.20D+0.50Lr+W	Max Pu / Ag	44.091 psi	Max. Allow. Defl.	0.30 in
		Location	4.833 ft	0.2 * f'm	400.0 psi
	Reinforcing Limit Check				
		Actual As/bd	0.002541	Max Allow As/bd	0.009228
		Maximum Reactions for Load Combination...			
		Top Horizontal	W Only		0.080 k
		Base Horizontal	W Only		0.080 k
		Vertical Reaction	+D+Lr		2.510 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load		Mcr k-ft	Mu k-ft	Moment Values			As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	Pu k	0.2*f'm*b*t k			Phi	Phi Mn k-ft					
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00	
+1.20D+1.60Lr+0.50W at 4.67 to 5.00	3.126	18.384	0.46	0.10	0.90	2.53	0.116	0.0025	0.0084	0.00	
+1.20D+1.60Lr-0.50W at 4.67 to 5.00	3.126	18.384	0.46	0.10	0.90	2.53	0.116	0.0025	0.0084	0.00	
+1.20D+0.50W at 4.67 to 5.00	1.526	18.384	0.46	0.10	0.90	2.12	0.116	0.0025	0.0090	0.00	
+1.20D-0.50W at 4.67 to 5.00	1.526	18.384	0.46	0.10	0.90	2.12	0.116	0.0025	0.0090	0.00	
+1.20D+0.50Lr+W at 4.67 to 5.00	2.026	18.384	0.46	0.20	0.90	2.25	0.116	0.0025	0.0088	0.00	
+1.20D+0.50Lr-W at 4.67 to 5.00	2.026	18.384	0.46	0.20	0.90	2.25	0.116	0.0025	0.0088	0.00	
+1.20D+W at 4.67 to 5.00	1.526	18.384	0.46	0.20	0.90	2.12	0.116	0.0025	0.0090	0.00	
+1.20D-W at 4.67 to 5.00	1.526	18.384	0.46	0.20	0.90	2.12	0.116	0.0025	0.0090	0.00	
+0.90D+W at 4.67 to 5.00	1.145	18.384	0.46	0.20	0.90	2.02	0.116	0.0025	0.0091	0.00	
+0.90D-W at 4.67 to 5.00	1.145	18.384	0.46	0.20	0.90	2.02	0.116	0.0025	0.0091	0.00	
+1.318D+E at 4.67 to 5.00	1.676	18.384	0.46	0.19	0.90	2.16	0.116	0.0025	0.0089	0.00	
+1.318D-E at 4.67 to 5.00	1.676	18.384	0.46	0.19	0.90	2.16	0.116	0.0025	0.0089	0.00	
+0.7820D+E at 4.67 to 5.00	0.995	18.384	0.46	0.19	0.90	1.98	0.116	0.0025	0.0092	0.00	
+0.7820D-E at 4.67 to 5.00	0.995	18.384	0.46	0.19	0.90	1.98	0.116	0.0025	0.0092	0.00	

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values		I gross in^4	Stiffness		Deflections	
		Mcr k-ft	Mactual k-ft		I cracked in^4	I effective in^4	Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.60W at 4.67 to 5.00	1.272	0.46	0.12	342.40	21.51	342.400	0.004	34,214.4
+D-0.60W at 4.67 to 5.00	1.272	0.46	0.12	342.40	21.51	342.400	0.004	34,214.4
+D+0.750Lr+0.450W at 4.67 to 5.00	2.022	0.46	0.09	342.40	23.07	342.400	0.003	45,538.2
+D+0.750Lr-0.450W at 4.67 to 5.00	2.022	0.46	0.09	342.40	23.07	342.400	0.003	45,538.2
+D+0.450W at 4.67 to 5.00	1.272	0.46	0.09	342.40	21.51	342.400	0.003	45,619.2
+D-0.450W at 4.67 to 5.00	1.272	0.46	0.09	342.40	21.51	342.400	0.003	45,619.2

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Masonry Slender Wall

Project File: AOF.ec6

LIC# : KW-06019202, Build:20.24.10.03

Michael Baker International

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Exterior Masonry Walls (MW8)

+0.60D+0.60W at 4.67 to 5.00	0.763	0.46	0.12	342.40	20.43	342.400	0.004	34,255.1
+0.60D-0.60W at 4.67 to 5.00	0.763	0.46	0.12	342.40	20.43	342.400	0.004	34,255.1
+D+0.70E at 4.67 to 5.00	1.272	0.46	0.13	342.40	21.51	342.400	0.004	31,082.8
+D-0.70E at 4.67 to 5.00	1.272	0.46	0.13	342.40	21.51	342.400	0.004	31,082.8

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values		I gross in^4	Stiffness		Deflections	
		Mcr k-ft	Mactual k-ft		I cracked in^4	I effective in^4	Deflection in	Defl. Ratio
+D+0.5250E at 4.67 to 5.00	1.272	0.46	0.10	342.40	21.51	342.400	0.003	41,443.8
+D-0.5250E at 4.67 to 5.00	1.272	0.46	0.10	342.40	21.51	342.400	0.003	41,443.8
+0.60D+0.70E at 4.67 to 5.00	0.763	0.46	0.13	342.40	20.43	342.400	0.004	31,119.8
+0.60D-0.70E at 4.67 to 5.00	0.763	0.46	0.13	342.40	20.43	342.400	0.004	31,119.8
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
W Only at 5.00 to 5.33	0.000	0.46	0.20	342.40	18.78	342.400	0.006	20,589.7
-W at 5.00 to 5.33	0.000	0.46	0.20	342.40	18.78	342.400	0.006	20,589.7
E Only at 5.00 to 5.33	0.000	0.46	0.19	342.40	18.78	342.400	0.005	21,822.7
E Only * -1.0 at 5.00 to 5.33	0.000	0.46	0.19	342.40	18.78	342.400	0.005	21,822.7

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	1.510 k
+D+Lr	0.0 k	0.00 k	2.510 k
+D+0.750Lr	0.0 k	0.00 k	2.260 k
+D+0.60W	0.0 k	0.05 k	1.510 k
+D-0.60W	0.0 k	0.05 k	1.510 k
+D+0.750Lr+0.450W	0.0 k	0.04 k	2.260 k
+D+0.750Lr-0.450W	0.0 k	0.04 k	2.260 k
+D+0.450W	0.0 k	0.04 k	1.510 k
+D-0.450W	0.0 k	0.04 k	1.510 k
+0.60D+0.60W	0.0 k	0.05 k	0.906 k
+0.60D-0.60W	0.0 k	0.05 k	0.906 k
+D+0.70E	0.1 k	0.05 k	1.510 k
+D-0.70E	0.1 k	0.05 k	1.510 k
+D+0.5250E	0.0 k	0.04 k	1.510 k
+D-0.5250E	0.0 k	0.04 k	1.510 k
+0.60D+0.70E	0.1 k	0.05 k	0.906 k
+0.60D-0.70E	0.1 k	0.05 k	0.906 k
Lr Only	0.0 k	0.00 k	1.000 k
W Only	0.1 k	0.08 k	0.000 k
-W	0.1 k	0.08 k	0.000 k
E Only	0.1 k	0.08 k	0.000 k
E Only * -1.0	0.1 k	0.08 k	0.000 k

HANGAR-CREECH PH 2



LOADS FROM ROOF/FLOOR

	<u>ROOF</u>	<u>FLOOR</u>
DEAD:	30.0 psf	0.0 psf
LIVE:	20.0 psf	0.0 psf
SNOW/Lr:	0.0 psf	0.0 psf

WALL DESIGN INFORMATION

f'm:	2000 psi
Fy:	60 ksi
Solid Opening:	Y
Interior Wall:	N

OUT OF PLANE LOADS

Wall Type	Wall Weight (Finishes Only)		
1	45 psf	W:	16 psf
2	0 psf	Sds:	0.59
3	0 psf		
4	0 psf		

[illegible]

MASONRY WALL DESIGN

[illegible]

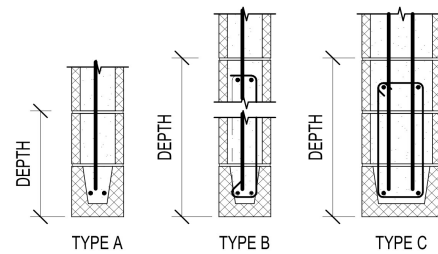
DESIGN MODULE - MASONRY WALL OPENING

HANGAR-CREECH PH 2



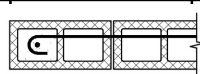
MASONRY LINTEL SCHEDULE

MARK	DEPTH	TYPE	LINTEL REINFORCING		SUPPORT COLUMN	COMMENTS
			HORIZONTAL	STIRRUPS		
ML1	16 "	TYPE A	(2) #5	--	ML1 C	



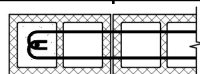
MASONRY JAMB COLUMN SCHEDULE

MARK	SIZE	TYPE	COLUMN REINFORCING		COMMENTS
			VERTICAL	TIES	
ML1 C	8x16	TYPE A2	(3) #5	--	



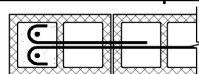
TYPE A1

TYPE A1#1



TYPE B1

TYPE B1#1



TYPE C1

TYPE C1#1



TYPE D1

TYPE D1#1

Lateral System Calculations

Auto Seismic Loading

Load Pattern Definitions - Auto Seismic - ASCE 7-22 (Part 1 of 4)

Name	Period Used sec	Coeff Used	Weight Used kip	Base Shear kip	Is Auto Load	X Dir?	X Dir Plus Ecc?	X Dir Minus Ecc?	Y Dir?	Y Dir Plus Ecc?	Y Dir Minus Ecc?	Ecc Ratio
Exx					No	Yes	Yes	Yes	No	No	No	0.05
Exx(1/3)	0.393	0.122333	1232.4286	150.767	Yes	Yes	No	No	No	No	No	0.05
Exx(2/3)	0.393	0.122333	1232.4286	150.767	Yes	No	Yes	No	No	No	No	0.05
Exx(3/3)	0.393	0.122333	1232.4286	150.767	Yes	No	No	Yes	No	No	No	0.05
Eyy					No	No	No	No	Yes	Yes	Yes	0.05
Eyy(1/3)	0.393	0.122333	1232.4286	150.767	Yes	No	No	No	Yes	No	No	0.05
Eyy(2/3)	0.393	0.122333	1232.4286	150.767	Yes	No	No	No	No	Yes	No	0.05
Eyy(3/3)	0.393	0.122333	1232.4286	150.767	Yes	No	No	No	No	No	Yes	0.05

Load Pattern Definitions - Auto Seismic - ASCE 7-22 (Part 2 of 4)

Name	Period Used sec	Coeff Used	Weight Used kip	Base Shear kip	Top Story	Bottom Story	Period Type	Ct and X	MethodType	RSFunc
Exx					Story33	Base	Approximate	0.02; 0.75	Method 2	
Exx(1/3)	0.393	0.122333	1232.4286	150.767	Story33	Base	Approximate	0.02; 0.75	Method 2	
Exx(2/3)	0.393	0.122333	1232.4286	150.767	Story33	Base	Approximate	0.02; 0.75	Method 2	
Exx(3/3)	0.393	0.122333	1232.4286	150.767	Story33	Base	Approximate	0.02; 0.75	Method 2	
Eyy					Story33	Base	Approximate	0.02; 0.75	Method 2	
Eyy(1/3)	0.393	0.122333	1232.4286	150.767	Story33	Base	Approximate	0.02; 0.75	Method 2	
Eyy(2/3)	0.393	0.122333	1232.4286	150.767	Story33	Base	Approximate	0.02; 0.75	Method 2	
Eyy(3/3)	0.393	0.122333	1232.4286	150.767	Story33	Base	Approximate	0.02; 0.75	Method 2	

Load Pattern Definitions - Auto Seismic - ASCE 7-22 (Part 3 of 4)

Name	Period Used sec	Coeff Used	Weight Used kip	Base Shear kip	Smax	Tmax	Sds	Sd1	TL sec	Site Class	S1	R
Exx							0.5872	0.3281	6	D	0.23	6
Exx(1/3)	0.393	0.122333	1232.4286	150.767			0.5872	0.3281	6	D	0.23	6
Exx(2/3)	0.393	0.122333	1232.4286	150.767			0.5872	0.3281	6	D	0.23	6
Exx(3/3)	0.393	0.122333	1232.4286	150.767			0.5872	0.3281	6	D	0.23	6
Eyy							0.5872	0.3281	6	D	0.23	6
Eyy(1/3)	0.393	0.122333	1232.4286	150.767			0.5872	0.3281	6	D	0.23	6
Eyy(2/3)	0.393	0.122333	1232.4286	150.767			0.5872	0.3281	6	D	0.23	6
Eyy(3/3)	0.393	0.122333	1232.4286	150.767			0.5872	0.3281	6	D	0.23	6

Load Pattern Definitions - Auto Seismic - ASCE 7-22 (Part 4 of 4)

Name	Period Used sec	Coeff Used	Weight Used kip	Base Shear kip	I	Omega	Cd
Exx					1.25	2	5
Exx(1/3)	0.393	0.122333	1232.4286	150.767	1.25	2	5
Exx(2/3)	0.393	0.122333	1232.4286	150.767	1.25	2	5
Exx(3/3)	0.393	0.122333	1232.4286	150.767	1.25	2	5
Eyy					1.25	2	5
Eyy(1/3)	0.393	0.122333	1232.4286	150.767	1.25	2	5
Eyy(2/3)	0.393	0.122333	1232.4286	150.767	1.25	2	5
Eyy(3/3)	0.393	0.122333	1232.4286	150.767	1.25	2	5

ASCE 7-22 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern Exx according to ASCE 7-22, as calculated by ETABS.

Direction and Eccentricity

Direction = Multiple

Eccentricity Ratio = 5% for all diaphragms

Structural Period

Period Calculation Method = Approximate

Coefficient, C_t [ASCE Table 12.8-2]

Coefficient, x [ASCE Table 12.8-2]

$C_t=0.02ft$

Structure Height Above Base, h_n

Approximate Fundamental Period, T_a [ASCE 12.8.2.1 Eq. 12.8-8] $T_a=C_t \times h_n^x$

$T_a=0.393 \text{ sec}$

Long-Period Transition Period, T_L [ASCE 11.4.6]

$T_L=6 \text{ sec}$

Factors and Coefficients

Response Modification Factor, R [ASCE Table 12.2-1]

System Overstrength Factor, Ω_0 [ASCE Table 12.2-1]

$R=6$

Deflection Amplification Factor, C_d [ASCE Table 12.2-1]

Importance Factor, I [ASCE Table 1.5-2]

Sds and Sd1 Source

Mapped MCE Spectral Response Acceleration, S_{ds} [ASCE 11.4.4]

Mapped MCE Spectral Response Acceleration, S_{d1} [ASCE 11.4.4]

$S_{ds}=0.5872g$

Site Class [ASCE Table 20.2-1] = D - Medium dense sand or stiff clay

Seismic Response

Design Spectral Response Acceleration, S_{DS} [ASCE 11.4.5, 11.4.8]

Design Spectral Response Acceleration, S_{D1} [ASCE 11.4.5, 11.4.6]

$S_{DS}=0.5872g$

Design Spectral Response Acceleration, S_1 [ASCE 11.4.5.1]

Equivalent Lateral Forces

Seismic Response Coefficient, C_s [ASCE 12.8.1.1, Eq. 12.8-3]

$$C_s = S_{DS} / (R/I)$$

[ASCE 12.8.1.1, Eq. 12.8-4]

$$C_{s,max} = S_{D1} / T(R/I)$$

[ASCE 12.8.1.1, Eq. 12.8-6]

$$C_{s,min} = \max(0.044 S_{DS} / I, 0.01) = 0.032296$$

[ASCE 12.8.1.1, Eq. 12.8-7]

$$C_{s,min} = 0.5 S_1 / (R/I) \text{ for } S_1 = 0.6g$$

$$C_{s,min} \leq C_s \leq C_{s,max}$$

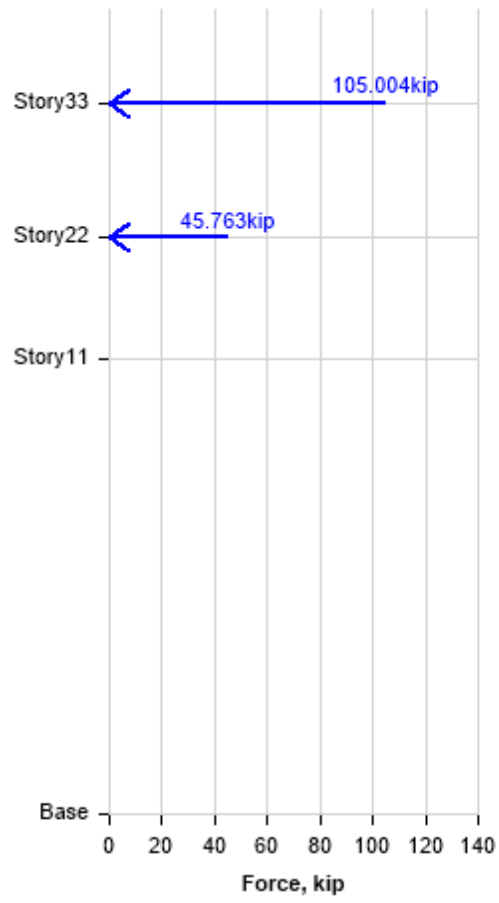
Calculated Base Shear

Direction	Period Used (sec)	C_s	W (kip)	V (kip)
X	0.393	0.122333	1232.4286	150.7671
X + Ecc. Y	0.393	0.122333	1232.4286	150.7671
X - Ecc. Y	0.393	0.122333	1232.4286	150.7671

Applied Story Forces

Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Story33	53	105.004	0
Story22	43	45.763	0
Story11	34	0	0
Base	0	0	0

Lateral Load to Stories - X



Set 1

ASCE 7-22 Auto Seismic Load Calculation

This calculation presents the automatically generated lateral seismic loads for load pattern Eyy according to ASCE 7-22, as calculated by ETABS.

Direction and Eccentricity

Direction = Multiple

Eccentricity Ratio = 5% for all diaphragms

Structural Period

Period Calculation Method = Approximate

Coefficient, C_t [ASCE Table 12.8-2]

Coefficient, x [ASCE Table 12.8-2]

$C_t=0.02ft$

Structure Height Above Base, h_n

Approximate Fundamental Period, T_a [ASCE 12.8.2.1 Eq. 12.8-8] $T_a=<C_t><h_n>^x$

$T_a=0.393\text{ sec}$

Long-Period Transition Period, T_L [ASCE 11.4.6]

$T_L=6\text{ sec}$

Factors and Coefficients

Response Modification Factor, R [ASCE Table 12.2-1]

System Overstrength Factor, Ω_0 [ASCE Table 12.2-1]

$R=6$

Deflection Amplification Factor, C_d [ASCE Table 12.2-1]

Importance Factor, I [ASCE Table 1.5-2]

Sds and Sd1 Source

Mapped MCE Spectral Response Acceleration, S_{ds} [ASCE 11.4.4]

Mapped MCE Spectral Response Acceleration, S_{d1} [ASCE 11.4.4]

$S_{ds}=0.5872g$

Site Class [ASCE Table 20.2-1] = D - Medium dense sand or stiff clay

Seismic Response

Design Spectral Response Acceleration, S_{DS} [ASCE 11.4.5, 11.4.8]

Design Spectral Response Acceleration, S_{D1} [ASCE 11.4.5, 11.4.6]

$S_{DS}=0.5872g$

Design Spectral Response Acceleration, S_1 [ASCE 11.4.5.1]

Equivalent Lateral Forces

Seismic Response Coefficient, C_s [ASCE 12.8.1.1, Eq. 12.8-3]

$$C_s = S_{DS} / (R/I)$$

[ASCE 12.8.1.1, Eq. 12.8-4]

$$C_{s,max} = S_{D1} / T(R/I)$$

[ASCE 12.8.1.1, Eq. 12.8-6]

$$C_{s,min} = \max(0.044 S_{DS} / I, 0.01) = 0.032296$$

[ASCE 12.8.1.1, Eq. 12.8-7]

$$C_{s,min} = 0.5 S_1 / (R/I) \text{ for } S_1 = 0.6g$$

$$C_{s,min} \leq C_s \leq C_{s,max}$$

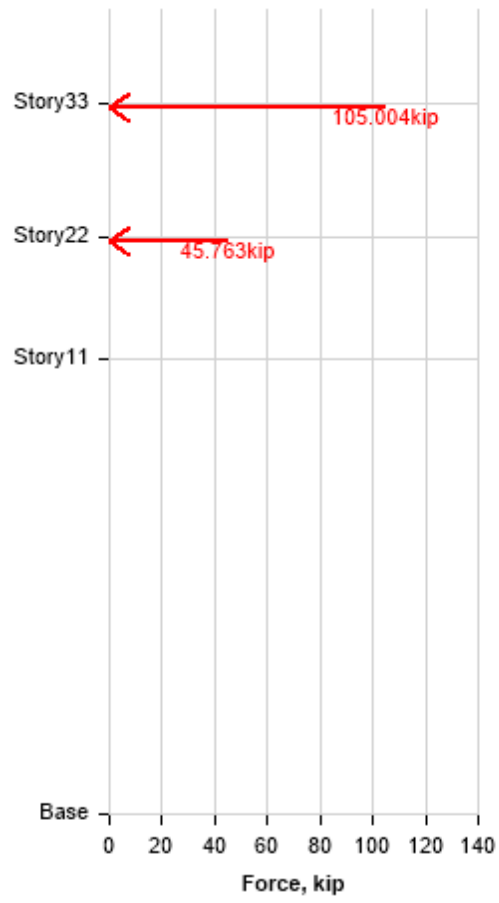
Calculated Base Shear

Direction	Period Used (sec)	C_s	W (kip)	V (kip)
Y	0.393	0.122333	1232.4286	150.7671
Y + Ecc. X	0.393	0.122333	1232.4286	150.7671
Y - Ecc. X	0.393	0.122333	1232.4286	150.7671

Applied Story Forces

Story	Elevation	X-Dir	Y-Dir
	ft	kip	kip
Story33	53	0	105.004
Story22	43	0	45.763
Story11	34	0	0
Base	0	0	0

Lateral Load to Stories - Y



Set 1

Structure Results

Base Reactions

Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft	MZ kip-ft
Dead	LinStatic		0	0	1394.444	81222.3969	-167974.4189	-0.1083
Live	LinStatic		0	0	564.641	32919.8283	-68123.7611	-0.0556
Exx	LinStatic	Max	-150.767	0	0	0.0662	-7300.8034	8789.7183
Exx	LinStatic	Min	-150.767	0	0	0.0662	-7300.8034	8789.7183
Eyy	LinStatic	Max	0	-150.767	0	7318.6474	-0.0432	-18190.0017
Eyy	LinStatic	Min	0	-150.767	0	7318.6474	-0.0432	-18190.0017
Mass	LinStatic		0	0	1232.429	71853.3026	-148692.088	-0.1207
Wx	LinStatic		-184.41	0	-408.28	-23803.3973	44100.733	10751.1311
Wy	LinStatic		0	-374.555	-408.28	-12529.0104	49258.5665	-45189.9363
Wxx	LinStatic		0	0	0	0.0144	0.0086	-0.0004
Wyy	LinStatic		0	0	0	-0.0019	-0.0301	-0.0004
Sb	LinStatic		0	0	594.423	34656.1642	-71716.9102	-0.0584
Su1	LinStatic		0	0	361.482	21075.3422	-54561.5371	-0.0408
Su2	LinStatic		0	0	361.482	21075.044	-32663.7205	-0.0319

Applied Loads

Line Loads

Frame Loads Assignments - Distributed (Part 1 of 2)

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
343	Dead	Story33	B26	Force	Gravity	Relative	0	0.3333	0	7.4588
343	Dead	Story33	B26	Force	Gravity	Relative	0.3333	0.6667	7.4588	14.9176
343	Dead	Story33	B26	Force	Gravity	Relative	0.6667	1	14.9176	22.3765
66	Dead	Story33	B28	Force	Gravity	Relative	0	1	0	22.3765
362	Dead	Story33	B45	Force	Gravity	Relative	0	0.3333	0	7.4588
362	Dead	Story33	B45	Force	Gravity	Relative	0.3333	0.6667	7.4588	14.9176
362	Dead	Story33	B45	Force	Gravity	Relative	0.6667	1	14.9176	22.3765
149	Dead	Story33	B47	Force	Gravity	Relative	0	1	0	22.3765
230	Dead	Story33	B69	Force	Gravity	Relative	0	1	0	22.3765
232	Dead	Story33	B71	Force	Gravity	Relative	0	1	0	22.3765
313	Dead	Story33	B117	Force	Gravity	Relative	0	1	0	22.3765
315	Dead	Story33	B119	Force	Gravity	Relative	0	1	0	22.3765
429	Dead	Story33	B29	Force	Gravity	Relative	0	0.7778	0	76.7567
429	Dead	Story33	B29	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
431	Dead	Story33	B46	Force	Gravity	Relative	0	0.7778	0	76.7567
431	Dead	Story33	B46	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
1	Dead	Story33	B48	Force	Gravity	Relative	0	0.7778	0	76.7567
1	Dead	Story33	B48	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
84	Dead	Story33	B70	Force	Gravity	Relative	0	0.7778	0	76.7567
84	Dead	Story33	B70	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
148	Dead	Story33	B72	Force	Gravity	Relative	0	0.7778	0	76.7567
148	Dead	Story33	B72	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
167	Dead	Story33	B118	Force	Gravity	Relative	0	0.7778	0	76.7567
167	Dead	Story33	B118	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
233	Dead	Story33	B120	Force	Gravity	Relative	0	0.7778	0	76.7567
233	Dead	Story33	B120	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
314	Dead	Story33	B124	Force	Gravity	Relative	0	0.7778	0	76.7567
314	Dead	Story33	B124	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
416	Dead	Story33	B125	Force	Gravity	Relative	0	0.8189	0	99.1332
416	Dead	Story33	B125	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
418	Dead	Story33	B192	Force	Gravity	Relative	0	0.8189	0	99.1332
418	Dead	Story33	B192	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
420	Dead	Story33	B193	Force	Gravity	Relative	0	0.8189	0	99.1332
420	Dead	Story33	B193	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
423	Dead	Story33	B216	Force	Gravity	Relative	0	0.8189	0	99.1332
423	Dead	Story33	B216	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
425	Dead	Story33	B217	Force	Gravity	Relative	0	0.8189	0	99.1332
425	Dead	Story33	B217	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
427	Dead	Story33	B218	Force	Gravity	Relative	0	0.8189	0	99.1332
427	Dead	Story33	B218	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
343	Live	Story33	B26	Force	Gravity	Relative	0	0.3333	0	7.4588
343	Live	Story33	B26	Force	Gravity	Relative	0.3333	0.6667	7.4588	14.9176
343	Live	Story33	B26	Force	Gravity	Relative	0.6667	1	14.9176	22.3765
66	Live	Story33	B28	Force	Gravity	Relative	0	1	0	22.3765
362	Live	Story33	B45	Force	Gravity	Relative	0	0.3333	0	7.4588
362	Live	Story33	B45	Force	Gravity	Relative	0.3333	0.6667	7.4588	14.9176
362	Live	Story33	B45	Force	Gravity	Relative	0.6667	1	14.9176	22.3765
149	Live	Story33	B47	Force	Gravity	Relative	0	1	0	22.3765
230	Live	Story33	B69	Force	Gravity	Relative	0	1	0	22.3765

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
232	Live	Story33	B71	Force	Gravity	Relative	0	1	0	22.3765
313	Live	Story33	B117	Force	Gravity	Relative	0	1	0	22.3765
315	Live	Story33	B119	Force	Gravity	Relative	0	1	0	22.3765
429	Live	Story33	B29	Force	Gravity	Relative	0	0.7778	0	76.7567
429	Live	Story33	B29	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
431	Live	Story33	B46	Force	Gravity	Relative	0	0.7778	0	76.7567
431	Live	Story33	B46	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
1	Live	Story33	B48	Force	Gravity	Relative	0	0.7778	0	76.7567
1	Live	Story33	B48	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
84	Live	Story33	B70	Force	Gravity	Relative	0	0.7778	0	76.7567
84	Live	Story33	B70	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
148	Live	Story33	B72	Force	Gravity	Relative	0	0.7778	0	76.7567
148	Live	Story33	B72	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
167	Live	Story33	B118	Force	Gravity	Relative	0	0.7778	0	76.7567
167	Live	Story33	B118	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
233	Live	Story33	B120	Force	Gravity	Relative	0	0.7778	0	76.7567
233	Live	Story33	B120	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
314	Live	Story33	B124	Force	Gravity	Relative	0	0.7778	0	76.7567
314	Live	Story33	B124	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
416	Live	Story33	B125	Force	Gravity	Relative	0	0.8189	0	99.1332
416	Live	Story33	B125	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
418	Live	Story33	B192	Force	Gravity	Relative	0	0.8189	0	99.1332
418	Live	Story33	B192	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
420	Live	Story33	B193	Force	Gravity	Relative	0	0.8189	0	99.1332
420	Live	Story33	B193	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
423	Live	Story33	B216	Force	Gravity	Relative	0	0.8189	0	99.1332
423	Live	Story33	B216	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
425	Live	Story33	B217	Force	Gravity	Relative	0	0.8189	0	99.1332
425	Live	Story33	B217	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
427	Live	Story33	B218	Force	Gravity	Relative	0	0.8189	0	99.1332
427	Live	Story33	B218	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
343	Mass	Story33	B26	Force	Gravity	Relative	0	0.3333	0	7.4588
343	Mass	Story33	B26	Force	Gravity	Relative	0.3333	0.6667	7.4588	14.9176
343	Mass	Story33	B26	Force	Gravity	Relative	0.6667	1	14.9176	22.3765
66	Mass	Story33	B28	Force	Gravity	Relative	0	1	0	22.3765
362	Mass	Story33	B45	Force	Gravity	Relative	0	0.3333	0	7.4588
362	Mass	Story33	B45	Force	Gravity	Relative	0.3333	0.6667	7.4588	14.9176
362	Mass	Story33	B45	Force	Gravity	Relative	0.6667	1	14.9176	22.3765
149	Mass	Story33	B47	Force	Gravity	Relative	0	1	0	22.3765
230	Mass	Story33	B69	Force	Gravity	Relative	0	1	0	22.3765
232	Mass	Story33	B71	Force	Gravity	Relative	0	1	0	22.3765
313	Mass	Story33	B117	Force	Gravity	Relative	0	1	0	22.3765
315	Mass	Story33	B119	Force	Gravity	Relative	0	1	0	22.3765
429	Mass	Story33	B29	Force	Gravity	Relative	0	0.7778	0	76.7567
429	Mass	Story33	B29	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
431	Mass	Story33	B46	Force	Gravity	Relative	0	0.7778	0	76.7567
431	Mass	Story33	B46	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
1	Mass	Story33	B48	Force	Gravity	Relative	0	0.7778	0	76.7567
1	Mass	Story33	B48	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
84	Mass	Story33	B70	Force	Gravity	Relative	0	0.7778	0	76.7567
84	Mass	Story33	B70	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
148	Mass	Story33	B72	Force	Gravity	Relative	0	0.7778	0	76.7567
148	Mass	Story33	B72	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
167	Mass	Story33	B118	Force	Gravity	Relative	0	0.7778	0	76.7567

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
167	Mass	Story33	B118	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
233	Mass	Story33	B120	Force	Gravity	Relative	0	0.7778	0	76.7567
233	Mass	Story33	B120	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
314	Mass	Story33	B124	Force	Gravity	Relative	0	0.7778	0	76.7567
314	Mass	Story33	B124	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
416	Mass	Story33	B125	Force	Gravity	Relative	0	0.8189	0	99.1332
416	Mass	Story33	B125	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
418	Mass	Story33	B192	Force	Gravity	Relative	0	0.8189	0	99.1332
418	Mass	Story33	B192	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
420	Mass	Story33	B193	Force	Gravity	Relative	0	0.8189	0	99.1332
420	Mass	Story33	B193	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
423	Mass	Story33	B216	Force	Gravity	Relative	0	0.8189	0	99.1332
423	Mass	Story33	B216	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
425	Mass	Story33	B217	Force	Gravity	Relative	0	0.8189	0	99.1332
425	Mass	Story33	B217	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
427	Mass	Story33	B218	Force	Gravity	Relative	0	0.8189	0	99.1332
427	Mass	Story33	B218	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
343	Wx	Story33	B26	Force	Global-Y	Relative	0	0.3333	0	7.4588
343	Wx	Story33	B26	Force	Global-Y	Relative	0.3333	0.6667	7.4588	14.9176
343	Wx	Story33	B26	Force	Global-Y	Relative	0.6667	1	14.9176	22.3765
66	Wx	Story33	B28	Force	Global-Y	Relative	0	1	0	22.3765
362	Wx	Story33	B45	Force	Local-2	Relative	0	0.3333	0	7.4588
362	Wx	Story33	B45	Force	Local-2	Relative	0.3333	0.6667	7.4588	14.9176
362	Wx	Story33	B45	Force	Local-2	Relative	0.6667	1	14.9176	22.3765
149	Wx	Story33	B47	Force	Local-2	Relative	0	1	0	22.3765
230	Wx	Story33	B69	Force	Local-2	Relative	0	1	0	22.3765
232	Wx	Story33	B71	Force	Local-2	Relative	0	1	0	22.3765
313	Wx	Story33	B117	Force	Global-Y	Relative	0	1	0	22.3765
315	Wx	Story33	B119	Force	Global-Y	Relative	0	1	0	22.3765
429	Wx	Story33	B29	Force	Global-Y	Relative	0	0.7778	0	76.7567
429	Wx	Story33	B29	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
431	Wx	Story33	B46	Force	Global-Y	Relative	0	0.7778	0	76.7567
431	Wx	Story33	B46	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
1	Wx	Story33	B48	Force	Local-2	Relative	0	0.7778	0	76.7567
1	Wx	Story33	B48	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
84	Wx	Story33	B70	Force	Local-2	Relative	0	0.7778	0	76.7567
84	Wx	Story33	B70	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
148	Wx	Story33	B72	Force	Local-2	Relative	0	0.7778	0	76.7567
148	Wx	Story33	B72	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
167	Wx	Story33	B118	Force	Local-2	Relative	0	0.7778	0	76.7567
167	Wx	Story33	B118	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
233	Wx	Story33	B120	Force	Global-Y	Relative	0	0.7778	0	76.7567
233	Wx	Story33	B120	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
314	Wx	Story33	B124	Force	Global-Y	Relative	0	0.7778	0	76.7567
314	Wx	Story33	B124	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
416	Wx	Story33	B125	Force	Local-2	Relative	0	0.8189	0	99.1332
416	Wx	Story33	B125	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
418	Wx	Story33	B192	Force	Local-2	Relative	0	0.8189	0	99.1332
418	Wx	Story33	B192	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
420	Wx	Story33	B193	Force	Local-2	Relative	0	0.8189	0	99.1332
420	Wx	Story33	B193	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
423	Wx	Story33	B216	Force	Local-2	Relative	0	0.8189	0	99.1332
423	Wx	Story33	B216	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
425	Wx	Story33	B217	Force	Local-2	Relative	0	0.8189	0	99.1332

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
425	Wx	Story33	B217	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
427	Wx	Story33	B218	Force	Local-2	Relative	0	0.8189	0	99.1332
427	Wx	Story33	B218	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
9	Wx	Story33	C9	Force	Global-Y	Relative	0	1	0	10.8483
11	Wx	Story33	C10	Force	Global-Y	Relative	0	1	0	10.8483
258	Wx	Story33	C97	Force	Global-Y	Relative	0	1	0	10.8483
260	Wx	Story33	C99	Force	Global-Y	Relative	0	1	0	10.8483
552	Wx	Story22	B73	Force	Global-X	Relative	0	1	0	9.1
553	Wx	Story22	B74	Force	Global-X	Relative	0	1	0	24.6
554	Wx	Story22	B75	Force	Global-X	Relative	0	1	0	24.6
555	Wx	Story22	B76	Force	Global-X	Relative	0	1	0	24.6
556	Wx	Story22	B77	Force	Global-X	Relative	0	1	0	24.6
557	Wx	Story22	B78	Force	Global-X	Relative	0	1	0	9.1
600	Wx	Story22	B80	Force	Global-X	Relative	0	1	0	9.1
601	Wx	Story22	B81	Force	Global-X	Relative	0	1	0	24.6
602	Wx	Story22	B82	Force	Global-X	Relative	0	1	0	24.6
603	Wx	Story22	B83	Force	Global-X	Relative	0	1	0	24.6
604	Wx	Story22	B84	Force	Global-X	Relative	0	1	0	24.6
605	Wx	Story22	B85	Force	Global-X	Relative	0	1	0	9.1
2	Wx	Story22	C1	Force	Global-X	Relative	0	1	0	9
4	Wx	Story22	C2	Force	Global-X	Relative	0	1	0	9
85	Wx	Story22	C3	Force	Global-X	Relative	0	1	0	9
87	Wx	Story22	C6	Force	Global-X	Relative	0	1	0	9
168	Wx	Story22	C47	Force	Global-X	Relative	0	1	0	9
170	Wx	Story22	C48	Force	Global-X	Relative	0	1	0	9
251	Wx	Story22	C93	Force	Global-X	Relative	0	1	0	9
253	Wx	Story22	C94	Force	Global-X	Relative	0	1	0	9
334	Wx	Story22	C116	Force	Global-X	Relative	0	1	0	9
336	Wx	Story22	C117	Force	Global-X	Relative	0	1	0	9
405	Wx	Story22	C170	Force	Global-X	Relative	0	1	0	9
407	Wx	Story22	C171	Force	Global-X	Relative	0	1	0	9
476	Wx	Story22	C193	Force	Global-X	Relative	0	1	0	9
478	Wx	Story22	C194	Force	Global-X	Relative	0	1	0	9
178	Wx	Story11	B1	Force	Global-Y	Relative	0	0.3333	0	7.4333
178	Wx	Story11	B1	Force	Global-Y	Relative	0.3333	0.6667	7.4333	14.8667
178	Wx	Story11	B1	Force	Global-Y	Relative	0.6667	1	14.8667	22.3
6	Wx	Story11	B3	Force	Global-Y	Relative	0	1	0	22.3
254	Wx	Story11	B97	Force	Global-Y	Relative	0	1	0	22.3
255	Wx	Story11	B98	Force	Global-Y	Relative	0	1	0	22.3
546	Wx	Story11	B73	Force	Global-X	Relative	0	1	0	9.1
547	Wx	Story11	B74	Force	Global-X	Relative	0	1	0	24.6
548	Wx	Story11	B75	Force	Global-X	Relative	0	1	0	24.6
549	Wx	Story11	B76	Force	Global-X	Relative	0	1	0	24.6
550	Wx	Story11	B77	Force	Global-X	Relative	0	1	0	24.6
551	Wx	Story11	B78	Force	Global-X	Relative	0	1	0	9.1
594	Wx	Story11	B80	Force	Global-X	Relative	0	1	0	9.1
595	Wx	Story11	B81	Force	Global-X	Relative	0	1	0	24.6
596	Wx	Story11	B82	Force	Global-X	Relative	0	1	0	24.6
597	Wx	Story11	B83	Force	Global-X	Relative	0	1	0	24.6
598	Wx	Story11	B84	Force	Global-X	Relative	0	1	0	24.6
599	Wx	Story11	B85	Force	Global-X	Relative	0	1	0	9.1
13	Wx	Story11	B5	Force	Global-Y	Relative	0	1	0	10.9278
14	Wx	Story11	B6	Force	Global-Y	Relative	0	1	0	10.9278
15	Wx	Story11	B7	Force	Global-Y	Relative	0	1	0	10.9278

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
16	Wx	Story11	B8	Force	Global-Y	Relative	0	1	0	10.9278
17	Wx	Story11	B9	Force	Global-Y	Relative	0	1	0	10.9278
18	Wx	Story11	B10	Force	Global-Y	Relative	0	1	0	10.9278
19	Wx	Story11	B11	Force	Global-Y	Relative	0	1	0	10.9278
20	Wx	Story11	B12	Force	Global-Y	Relative	0	1	0	10.9278
21	Wx	Story11	B13	Force	Global-Y	Relative	0	1	0	10.9278
22	Wx	Story11	B14	Force	Global-Y	Relative	0	1	0	10.9278
23	Wx	Story11	B15	Force	Global-Y	Relative	0	1	0	10.9278
24	Wx	Story11	B16	Force	Global-Y	Relative	0	1	0	10.9278
25	Wx	Story11	B17	Force	Global-Y	Relative	0	1	0	10.9278
26	Wx	Story11	B18	Force	Global-Y	Relative	0	1	0	10.9278
27	Wx	Story11	B19	Force	Global-Y	Relative	0	1	0	10.9278
28	Wx	Story11	B20	Force	Global-Y	Relative	0	1	0	10.9278
29	Wx	Story11	B21	Force	Global-Y	Relative	0	1	0	10.9278
96	Wx	Story11	B22	Force	Global-Y	Relative	0	1	0	10.9278
263	Wx	Story11	B99	Force	Global-Y	Relative	0	1	0	10.9278
264	Wx	Story11	B100	Force	Global-Y	Relative	0	1	0	10.9278
265	Wx	Story11	B101	Force	Global-Y	Relative	0	1	0	10.9278
266	Wx	Story11	B102	Force	Global-Y	Relative	0	1	0	10.9278
267	Wx	Story11	B103	Force	Global-Y	Relative	0	1	0	10.9278
268	Wx	Story11	B104	Force	Global-Y	Relative	0	1	0	10.9278
269	Wx	Story11	B105	Force	Global-Y	Relative	0	1	0	10.9278
270	Wx	Story11	B106	Force	Global-Y	Relative	0	1	0	10.9278
271	Wx	Story11	B107	Force	Global-Y	Relative	0	1	0	10.9278
272	Wx	Story11	B108	Force	Global-Y	Relative	0	1	0	10.9278
273	Wx	Story11	B109	Force	Global-Y	Relative	0	1	0	10.9278
274	Wx	Story11	B110	Force	Global-Y	Relative	0	1	0	10.9278
275	Wx	Story11	B111	Force	Global-Y	Relative	0	1	0	10.9278
276	Wx	Story11	B112	Force	Global-Y	Relative	0	1	0	10.9278
277	Wx	Story11	B113	Force	Global-Y	Relative	0	1	0	10.9278
278	Wx	Story11	B114	Force	Global-Y	Relative	0	1	0	10.9278
341	Wx	Story11	B115	Force	Global-Y	Relative	0	1	0	10.9278
342	Wx	Story11	B116	Force	Global-Y	Relative	0	1	0	10.9278
5	Wx	Story11	C1	Force	Global-X	Relative	0	0.3333	0	11.3333
5	Wx	Story11	C1	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
5	Wx	Story11	C1	Force	Global-X	Relative	0.6667	1	22.6667	34
3	Wx	Story11	C2	Force	Global-X	Relative	0	1	0	34
8	Wx	Story11	C5	Force	Global-Y	Relative	0	1	0	34
10	Wx	Story11	C7	Force	Global-Y	Relative	0	1	0	34
147	Wx	Story11	C3	Force	Global-X	Relative	0	0.3333	0	11.3333
147	Wx	Story11	C3	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
147	Wx	Story11	C3	Force	Global-X	Relative	0.6667	1	22.6667	34
86	Wx	Story11	C6	Force	Global-X	Relative	0	1	0	34
344	Wx	Story11	C47	Force	Global-X	Relative	0	0.3333	0	11.3333
344	Wx	Story11	C47	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
344	Wx	Story11	C47	Force	Global-X	Relative	0.6667	1	22.6667	34
169	Wx	Story11	C48	Force	Global-X	Relative	0	1	0	34
361	Wx	Story11	C93	Force	Global-X	Relative	0	0.3333	0	11.3333
361	Wx	Story11	C93	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
361	Wx	Story11	C93	Force	Global-X	Relative	0.6667	1	22.6667	34
252	Wx	Story11	C94	Force	Global-X	Relative	0	1	0	34
257	Wx	Story11	C96	Force	Global-Y	Relative	0	1	0	34
259	Wx	Story11	C98	Force	Global-Y	Relative	0	1	0	34
333	Wx	Story11	C116	Force	Global-X	Relative	0	1	0	34

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
335	Wx	Story11	C117	Force	Global-X	Relative	0	1	0	34
404	Wx	Story11	C170	Force	Global-X	Relative	0	1	0	34
406	Wx	Story11	C171	Force	Global-X	Relative	0	1	0	34
475	Wx	Story11	C193	Force	Global-X	Relative	0	1	0	34
477	Wx	Story11	C194	Force	Global-X	Relative	0	1	0	34
343	Wy	Story33	B26	Force	Global-Y	Relative	0	0.3333	0	7.4588
343	Wy	Story33	B26	Force	Global-Y	Relative	0.3333	0.6667	7.4588	14.9176
343	Wy	Story33	B26	Force	Global-Y	Relative	0.6667	1	14.9176	22.3765
66	Wy	Story33	B28	Force	Global-Y	Relative	0	1	0	22.3765
362	Wy	Story33	B45	Force	Local-2	Relative	0	0.3333	0	7.4588
362	Wy	Story33	B45	Force	Local-2	Relative	0.3333	0.6667	7.4588	14.9176
362	Wy	Story33	B45	Force	Local-2	Relative	0.6667	1	14.9176	22.3765
149	Wy	Story33	B47	Force	Local-2	Relative	0	1	0	22.3765
230	Wy	Story33	B69	Force	Local-2	Relative	0	1	0	22.3765
232	Wy	Story33	B71	Force	Local-2	Relative	0	1	0	22.3765
313	Wy	Story33	B117	Force	Global-Y	Relative	0	1	0	22.3765
315	Wy	Story33	B119	Force	Global-Y	Relative	0	1	0	22.3765
429	Wy	Story33	B29	Force	Global-Y	Relative	0	0.7778	0	76.7567
429	Wy	Story33	B29	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
431	Wy	Story33	B46	Force	Global-Y	Relative	0	0.7778	0	76.7567
431	Wy	Story33	B46	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
1	Wy	Story33	B48	Force	Local-2	Relative	0	0.7778	0	76.7567
1	Wy	Story33	B48	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
84	Wy	Story33	B70	Force	Local-2	Relative	0	0.7778	0	76.7567
84	Wy	Story33	B70	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
148	Wy	Story33	B72	Force	Local-2	Relative	0	0.7778	0	76.7567
148	Wy	Story33	B72	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
167	Wy	Story33	B118	Force	Local-2	Relative	0	0.7778	0	76.7567
167	Wy	Story33	B118	Force	Local-2	Relative	0.7778	1	76.7567	98.6872
233	Wy	Story33	B120	Force	Global-Y	Relative	0	0.7778	0	76.7567
233	Wy	Story33	B120	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
314	Wy	Story33	B124	Force	Global-Y	Relative	0	0.7778	0	76.7567
314	Wy	Story33	B124	Force	Global-Y	Relative	0.7778	1	76.7567	98.6872
416	Wy	Story33	B125	Force	Local-2	Relative	0	0.8189	0	99.1332
416	Wy	Story33	B125	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
418	Wy	Story33	B192	Force	Local-2	Relative	0	0.8189	0	99.1332
418	Wy	Story33	B192	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
420	Wy	Story33	B193	Force	Local-2	Relative	0	0.8189	0	99.1332
420	Wy	Story33	B193	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
423	Wy	Story33	B216	Force	Local-2	Relative	0	0.8189	0	99.1332
423	Wy	Story33	B216	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
425	Wy	Story33	B217	Force	Local-2	Relative	0	0.8189	0	99.1332
425	Wy	Story33	B217	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
427	Wy	Story33	B218	Force	Local-2	Relative	0	0.8189	0	99.1332
427	Wy	Story33	B218	Force	Local-2	Relative	0.8189	1	99.1332	121.0637
9	Wy	Story33	C9	Force	Global-Y	Relative	0	1	0	10.8483
11	Wy	Story33	C10	Force	Global-Y	Relative	0	1	0	10.8483
258	Wy	Story33	C97	Force	Global-Y	Relative	0	1	0	10.8483
260	Wy	Story33	C99	Force	Global-Y	Relative	0	1	0	10.8483
552	Wy	Story22	B73	Force	Global-X	Relative	0	1	0	9.1
553	Wy	Story22	B74	Force	Global-X	Relative	0	1	0	24.6
554	Wy	Story22	B75	Force	Global-X	Relative	0	1	0	24.6
555	Wy	Story22	B76	Force	Global-X	Relative	0	1	0	24.6
556	Wy	Story22	B77	Force	Global-X	Relative	0	1	0	24.6

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
557	Wy	Story22	B78	Force	Global-X	Relative	0	1	0	9.1
600	Wy	Story22	B80	Force	Global-X	Relative	0	1	0	9.1
601	Wy	Story22	B81	Force	Global-X	Relative	0	1	0	24.6
602	Wy	Story22	B82	Force	Global-X	Relative	0	1	0	24.6
603	Wy	Story22	B83	Force	Global-X	Relative	0	1	0	24.6
604	Wy	Story22	B84	Force	Global-X	Relative	0	1	0	24.6
605	Wy	Story22	B85	Force	Global-X	Relative	0	1	0	9.1
2	Wy	Story22	C1	Force	Global-Y	Relative	0	1	0	9
4	Wy	Story22	C2	Force	Global-Y	Relative	0	1	0	9
85	Wy	Story22	C3	Force	Global-X	Relative	0	1	0	9
87	Wy	Story22	C6	Force	Global-X	Relative	0	1	0	9
168	Wy	Story22	C47	Force	Global-X	Relative	0	1	0	9
170	Wy	Story22	C48	Force	Global-X	Relative	0	1	0	9
251	Wy	Story22	C93	Force	Global-Y	Relative	0	1	0	9
253	Wy	Story22	C94	Force	Global-Y	Relative	0	1	0	9
334	Wy	Story22	C116	Force	Global-X	Relative	0	1	0	9
336	Wy	Story22	C117	Force	Global-X	Relative	0	1	0	9
405	Wy	Story22	C170	Force	Global-X	Relative	0	1	0	9
407	Wy	Story22	C171	Force	Global-X	Relative	0	1	0	9
476	Wy	Story22	C193	Force	Global-X	Relative	0	1	0	9
478	Wy	Story22	C194	Force	Global-X	Relative	0	1	0	9
178	Wy	Story11	B1	Force	Global-Y	Relative	0	0.3333	0	7.4333
178	Wy	Story11	B1	Force	Global-Y	Relative	0.3333	0.6667	7.4333	14.8667
178	Wy	Story11	B1	Force	Global-Y	Relative	0.6667	1	14.8667	22.3
6	Wy	Story11	B3	Force	Global-Y	Relative	0	1	0	22.3
254	Wy	Story11	B97	Force	Global-Y	Relative	0	1	0	22.3
255	Wy	Story11	B98	Force	Global-Y	Relative	0	1	0	22.3
546	Wy	Story11	B73	Force	Global-X	Relative	0	1	0	9.1
547	Wy	Story11	B74	Force	Global-X	Relative	0	1	0	24.6
548	Wy	Story11	B75	Force	Global-X	Relative	0	1	0	24.6
549	Wy	Story11	B76	Force	Global-X	Relative	0	1	0	24.6
550	Wy	Story11	B77	Force	Global-X	Relative	0	1	0	24.6
551	Wy	Story11	B78	Force	Global-X	Relative	0	1	0	9.1
594	Wy	Story11	B80	Force	Global-X	Relative	0	1	0	9.1
595	Wy	Story11	B81	Force	Global-X	Relative	0	1	0	24.6
596	Wy	Story11	B82	Force	Global-X	Relative	0	1	0	24.6
597	Wy	Story11	B83	Force	Global-X	Relative	0	1	0	24.6
598	Wy	Story11	B84	Force	Global-X	Relative	0	1	0	24.6
599	Wy	Story11	B85	Force	Global-X	Relative	0	1	0	9.1
13	Wy	Story11	B5	Force	Global-Y	Relative	0	1	0	10.9278
14	Wy	Story11	B6	Force	Global-Y	Relative	0	1	0	10.9278
15	Wy	Story11	B7	Force	Global-Y	Relative	0	1	0	10.9278
16	Wy	Story11	B8	Force	Global-Y	Relative	0	1	0	10.9278
17	Wy	Story11	B9	Force	Global-Y	Relative	0	1	0	10.9278
18	Wy	Story11	B10	Force	Global-Y	Relative	0	1	0	10.9278
19	Wy	Story11	B11	Force	Global-Y	Relative	0	1	0	10.9278
20	Wy	Story11	B12	Force	Global-Y	Relative	0	1	0	10.9278
21	Wy	Story11	B13	Force	Global-Y	Relative	0	1	0	10.9278
22	Wy	Story11	B14	Force	Global-Y	Relative	0	1	0	10.9278
23	Wy	Story11	B15	Force	Global-Y	Relative	0	1	0	10.9278
24	Wy	Story11	B16	Force	Global-Y	Relative	0	1	0	10.9278
25	Wy	Story11	B17	Force	Global-Y	Relative	0	1	0	10.9278
26	Wy	Story11	B18	Force	Global-Y	Relative	0	1	0	10.9278
27	Wy	Story11	B19	Force	Global-Y	Relative	0	1	0	10.9278

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
28	Wy	Story11	B20	Force	Global-Y	Relative	0	1	0	10.9278
29	Wy	Story11	B21	Force	Global-Y	Relative	0	1	0	10.9278
96	Wy	Story11	B22	Force	Global-Y	Relative	0	1	0	10.9278
263	Wy	Story11	B99	Force	Global-Y	Relative	0	1	0	10.9278
264	Wy	Story11	B100	Force	Global-Y	Relative	0	1	0	10.9278
265	Wy	Story11	B101	Force	Global-Y	Relative	0	1	0	10.9278
266	Wy	Story11	B102	Force	Global-Y	Relative	0	1	0	10.9278
267	Wy	Story11	B103	Force	Global-Y	Relative	0	1	0	10.9278
268	Wy	Story11	B104	Force	Global-Y	Relative	0	1	0	10.9278
269	Wy	Story11	B105	Force	Global-Y	Relative	0	1	0	10.9278
270	Wy	Story11	B106	Force	Global-Y	Relative	0	1	0	10.9278
271	Wy	Story11	B107	Force	Global-Y	Relative	0	1	0	10.9278
272	Wy	Story11	B108	Force	Global-Y	Relative	0	1	0	10.9278
273	Wy	Story11	B109	Force	Global-Y	Relative	0	1	0	10.9278
274	Wy	Story11	B110	Force	Global-Y	Relative	0	1	0	10.9278
275	Wy	Story11	B111	Force	Global-Y	Relative	0	1	0	10.9278
276	Wy	Story11	B112	Force	Global-Y	Relative	0	1	0	10.9278
277	Wy	Story11	B113	Force	Global-Y	Relative	0	1	0	10.9278
278	Wy	Story11	B114	Force	Global-Y	Relative	0	1	0	10.9278
341	Wy	Story11	B115	Force	Global-Y	Relative	0	1	0	10.9278
342	Wy	Story11	B116	Force	Global-Y	Relative	0	1	0	10.9278
5	Wy	Story11	C1	Force	Global-Y	Relative	0	0.3333	0	11.3333
5	Wy	Story11	C1	Force	Global-Y	Relative	0.3333	0.6667	11.3333	22.6667
5	Wy	Story11	C1	Force	Global-Y	Relative	0.6667	1	22.6667	34
3	Wy	Story11	C2	Force	Global-Y	Relative	0	1	0	34
8	Wy	Story11	C5	Force	Global-Y	Relative	0	1	0	34
10	Wy	Story11	C7	Force	Global-Y	Relative	0	1	0	34
147	Wy	Story11	C3	Force	Global-X	Relative	0	0.3333	0	11.3333
147	Wy	Story11	C3	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
147	Wy	Story11	C3	Force	Global-X	Relative	0.6667	1	22.6667	34
86	Wy	Story11	C6	Force	Global-X	Relative	0	1	0	34
344	Wy	Story11	C47	Force	Global-X	Relative	0	0.3333	0	11.3333
344	Wy	Story11	C47	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
344	Wy	Story11	C47	Force	Global-X	Relative	0.6667	1	22.6667	34
169	Wy	Story11	C48	Force	Global-X	Relative	0	1	0	34
361	Wy	Story11	C93	Force	Global-Y	Relative	0	0.3333	0	11.3333
361	Wy	Story11	C93	Force	Global-Y	Relative	0.3333	0.6667	11.3333	22.6667
361	Wy	Story11	C93	Force	Global-Y	Relative	0.6667	1	22.6667	34
252	Wy	Story11	C94	Force	Global-Y	Relative	0	1	0	34
257	Wy	Story11	C96	Force	Global-Y	Relative	0	1	0	34
259	Wy	Story11	C98	Force	Global-Y	Relative	0	1	0	34
333	Wy	Story11	C116	Force	Global-X	Relative	0	1	0	34
335	Wy	Story11	C117	Force	Global-X	Relative	0	1	0	34
404	Wy	Story11	C170	Force	Global-X	Relative	0	1	0	34
406	Wy	Story11	C171	Force	Global-X	Relative	0	1	0	34
475	Wy	Story11	C193	Force	Global-X	Relative	0	1	0	34
477	Wy	Story11	C194	Force	Global-X	Relative	0	1	0	34
2	Wxx	Story22	C1	Force	Global-Y	Relative	0	1	0	9
4	Wxx	Story22	C2	Force	Global-Y	Relative	0	1	0	9
251	Wxx	Story22	C93	Force	Global-Y	Relative	0	1	0	9
253	Wxx	Story22	C94	Force	Global-Y	Relative	0	1	0	9
5	Wxx	Story11	C1	Force	Global-Y	Relative	0	0.3333	0	11.3333
5	Wxx	Story11	C1	Force	Global-Y	Relative	0.3333	0.6667	11.3333	22.6667
5	Wxx	Story11	C1	Force	Global-Y	Relative	0.6667	1	22.6667	34

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
3	Wxx	Story11	C2	Force	Global-Y	Relative	0	1	0	34
361	Wxx	Story11	C93	Force	Global-Y	Relative	0	0.3333	0	11.3333
361	Wxx	Story11	C93	Force	Global-Y	Relative	0.3333	0.6667	11.3333	22.6667
361	Wxx	Story11	C93	Force	Global-Y	Relative	0.6667	1	22.6667	34
252	Wxx	Story11	C94	Force	Global-Y	Relative	0	1	0	34
2	Wyy	Story22	C1	Force	Global-X	Relative	0	1	0	9
4	Wyy	Story22	C2	Force	Global-X	Relative	0	1	0	9
251	Wyy	Story22	C93	Force	Global-X	Relative	0	1	0	9
253	Wyy	Story22	C94	Force	Global-X	Relative	0	1	0	9
5	Wyy	Story11	C1	Force	Global-X	Relative	0	0.3333	0	11.3333
5	Wyy	Story11	C1	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
5	Wyy	Story11	C1	Force	Global-X	Relative	0.6667	1	22.6667	34
3	Wyy	Story11	C2	Force	Global-X	Relative	0	1	0	34
361	Wyy	Story11	C93	Force	Global-X	Relative	0	0.3333	0	11.3333
361	Wyy	Story11	C93	Force	Global-X	Relative	0.3333	0.6667	11.3333	22.6667
361	Wyy	Story11	C93	Force	Global-X	Relative	0.6667	1	22.6667	34
252	Wyy	Story11	C94	Force	Global-X	Relative	0	1	0	34
343	Sb	Story33	B26	Force	Gravity	Relative	0	1	0	22.3765
66	Sb	Story33	B28	Force	Gravity	Relative	0	1	0	22.3765
362	Sb	Story33	B45	Force	Gravity	Relative	0	1	0	22.3765
149	Sb	Story33	B47	Force	Gravity	Relative	0	1	0	22.3765
230	Sb	Story33	B69	Force	Gravity	Relative	0	1	0	22.3765
232	Sb	Story33	B71	Force	Gravity	Relative	0	1	0	22.3765
313	Sb	Story33	B117	Force	Gravity	Relative	0	1	0	22.3765
315	Sb	Story33	B119	Force	Gravity	Relative	0	1	0	22.3765
429	Sb	Story33	B29	Force	Gravity	Relative	0	0.7778	0	76.7567
429	Sb	Story33	B29	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
431	Sb	Story33	B46	Force	Gravity	Relative	0	0.7778	0	76.7567
431	Sb	Story33	B46	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
1	Sb	Story33	B48	Force	Gravity	Relative	0	0.7778	0	76.7567
1	Sb	Story33	B48	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
84	Sb	Story33	B70	Force	Gravity	Relative	0	0.7778	0	76.7567
84	Sb	Story33	B70	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
148	Sb	Story33	B72	Force	Gravity	Relative	0	0.7778	0	76.7567
148	Sb	Story33	B72	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
167	Sb	Story33	B118	Force	Gravity	Relative	0	0.7778	0	76.7567
167	Sb	Story33	B118	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
233	Sb	Story33	B120	Force	Gravity	Relative	0	0.7778	0	76.7567
233	Sb	Story33	B120	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
314	Sb	Story33	B124	Force	Gravity	Relative	0	0.7778	0	76.7567
314	Sb	Story33	B124	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
416	Sb	Story33	B125	Force	Gravity	Relative	0	0.8189	0	99.1332
416	Sb	Story33	B125	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
418	Sb	Story33	B192	Force	Gravity	Relative	0	0.8189	0	99.1332
418	Sb	Story33	B192	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
420	Sb	Story33	B193	Force	Gravity	Relative	0	0.8189	0	99.1332
420	Sb	Story33	B193	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
423	Sb	Story33	B216	Force	Gravity	Relative	0	0.8189	0	99.1332
423	Sb	Story33	B216	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
425	Sb	Story33	B217	Force	Gravity	Relative	0	0.8189	0	99.1332
425	Sb	Story33	B217	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
427	Sb	Story33	B218	Force	Gravity	Relative	0	0.8189	0	99.1332
427	Sb	Story33	B218	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
343	Su1	Story33	B26	Force	Gravity	Relative	0	1	0	22.3765

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
66	Su1	Story33	B28	Force	Gravity	Relative	0	1	0	22.3765
362	Su1	Story33	B45	Force	Gravity	Relative	0	1	0	22.3765
149	Su1	Story33	B47	Force	Gravity	Relative	0	1	0	22.3765
230	Su1	Story33	B69	Force	Gravity	Relative	0	1	0	22.3765
232	Su1	Story33	B71	Force	Gravity	Relative	0	1	0	22.3765
313	Su1	Story33	B117	Force	Gravity	Relative	0	1	0	22.3765
315	Su1	Story33	B119	Force	Gravity	Relative	0	1	0	22.3765
429	Su1	Story33	B29	Force	Gravity	Relative	0	0.7778	0	76.7567
429	Su1	Story33	B29	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
431	Su1	Story33	B46	Force	Gravity	Relative	0	0.7778	0	76.7567
431	Su1	Story33	B46	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
1	Su1	Story33	B48	Force	Gravity	Relative	0	0.7778	0	76.7567
1	Su1	Story33	B48	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
84	Su1	Story33	B70	Force	Gravity	Relative	0	0.7778	0	76.7567
84	Su1	Story33	B70	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
148	Su1	Story33	B72	Force	Gravity	Relative	0	0.7778	0	76.7567
148	Su1	Story33	B72	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
167	Su1	Story33	B118	Force	Gravity	Relative	0	0.7778	0	76.7567
167	Su1	Story33	B118	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
233	Su1	Story33	B120	Force	Gravity	Relative	0	0.7778	0	76.7567
233	Su1	Story33	B120	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
314	Su1	Story33	B124	Force	Gravity	Relative	0	0.7778	0	76.7567
314	Su1	Story33	B124	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
416	Su1	Story33	B125	Force	Gravity	Relative	0	0.8189	0	99.1332
416	Su1	Story33	B125	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
418	Su1	Story33	B192	Force	Gravity	Relative	0	0.8189	0	99.1332
418	Su1	Story33	B192	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
420	Su1	Story33	B193	Force	Gravity	Relative	0	0.8189	0	99.1332
420	Su1	Story33	B193	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
423	Su1	Story33	B216	Force	Gravity	Relative	0	0.8189	0	99.1332
423	Su1	Story33	B216	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
425	Su1	Story33	B217	Force	Gravity	Relative	0	0.8189	0	99.1332
425	Su1	Story33	B217	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
427	Su1	Story33	B218	Force	Gravity	Relative	0	0.8189	0	99.1332
427	Su1	Story33	B218	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
343	Su2	Story33	B26	Force	Gravity	Relative	0	1	0	22.3765
66	Su2	Story33	B28	Force	Gravity	Relative	0	1	0	22.3765
362	Su2	Story33	B45	Force	Gravity	Relative	0	1	0	22.3765
149	Su2	Story33	B47	Force	Gravity	Relative	0	1	0	22.3765
230	Su2	Story33	B69	Force	Gravity	Relative	0	1	0	22.3765
232	Su2	Story33	B71	Force	Gravity	Relative	0	1	0	22.3765
313	Su2	Story33	B117	Force	Gravity	Relative	0	1	0	22.3765
315	Su2	Story33	B119	Force	Gravity	Relative	0	1	0	22.3765
429	Su2	Story33	B29	Force	Gravity	Relative	0	0.7778	0	76.7567
429	Su2	Story33	B29	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
431	Su2	Story33	B46	Force	Gravity	Relative	0	0.7778	0	76.7567
431	Su2	Story33	B46	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
1	Su2	Story33	B48	Force	Gravity	Relative	0	0.7778	0	76.7567
1	Su2	Story33	B48	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
84	Su2	Story33	B70	Force	Gravity	Relative	0	0.7778	0	76.7567
84	Su2	Story33	B70	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
148	Su2	Story33	B72	Force	Gravity	Relative	0	0.7778	0	76.7567
148	Su2	Story33	B72	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
167	Su2	Story33	B118	Force	Gravity	Relative	0	0.7778	0	76.7567

Unique Name	Load Pattern	Story	Label	Load Type	Direction	Distance Type	Relative Distance A	Relative Distance B	Absolute Distance A ft	Absolute Distance B ft
167	Su2	Story33	B118	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
233	Su2	Story33	B120	Force	Gravity	Relative	0	0.7778	0	76.7567
233	Su2	Story33	B120	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
314	Su2	Story33	B124	Force	Gravity	Relative	0	0.7778	0	76.7567
314	Su2	Story33	B124	Force	Gravity	Relative	0.7778	1	76.7567	98.6872
416	Su2	Story33	B125	Force	Gravity	Relative	0	0.8189	0	99.1332
416	Su2	Story33	B125	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
418	Su2	Story33	B192	Force	Gravity	Relative	0	0.8189	0	99.1332
418	Su2	Story33	B192	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
420	Su2	Story33	B193	Force	Gravity	Relative	0	0.8189	0	99.1332
420	Su2	Story33	B193	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
423	Su2	Story33	B216	Force	Gravity	Relative	0	0.8189	0	99.1332
423	Su2	Story33	B216	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
425	Su2	Story33	B217	Force	Gravity	Relative	0	0.8189	0	99.1332
425	Su2	Story33	B217	Force	Gravity	Relative	0.8189	1	99.1332	121.0637
427	Su2	Story33	B218	Force	Gravity	Relative	0	0.8189	0	99.1332
427	Su2	Story33	B218	Force	Gravity	Relative	0.8189	1	99.1332	121.0637

Frame Loads Assignments - Distributed (Part 2 of 2)

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
343	Dead	0.114	0.114
343	Dead	0.114	0.114
343	Dead	0.114	0.114
66	Dead	0.114	0.114
362	Dead	0.421	0.421
362	Dead	0.421	0.421
362	Dead	0.421	0.421
149	Dead	0.421	0.421
230	Dead	0.421	0.421
232	Dead	0.421	0.421
313	Dead	0.114	0.114
315	Dead	0.114	0.114
429	Dead	0.114	0.114
429	Dead	0.114	0.114
431	Dead	0.114	0.114
431	Dead	0.114	0.114
1	Dead	0.421	0.421
1	Dead	0.421	0.421
84	Dead	0.421	0.421
84	Dead	0.421	0.421
148	Dead	0.421	0.421
148	Dead	0.421	0.421
167	Dead	0.421	0.421
167	Dead	0.421	0.421
233	Dead	0.114	0.114
233	Dead	0.114	0.114
314	Dead	0.114	0.114
314	Dead	0.114	0.114
416	Dead	0.615	0.615
416	Dead	0.615	0.615
418	Dead	0.615	0.615

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
418	Dead	0.615	0.615
420	Dead	0.615	0.615
420	Dead	0.615	0.615
423	Dead	0.615	0.615
423	Dead	0.615	0.615
425	Dead	0.615	0.615
425	Dead	0.615	0.615
427	Dead	0.615	0.615
427	Dead	0.615	0.615
343	Live	0.091	0.091
343	Live	0.091	0.091
343	Live	0.091	0.091
66	Live	0.091	0.091
362	Live	0.337	0.337
362	Live	0.337	0.337
362	Live	0.337	0.337
149	Live	0.337	0.337
230	Live	0.337	0.337
232	Live	0.337	0.337
313	Live	0.091	0.091
315	Live	0.091	0.091
429	Live	0.091	0.091
429	Live	0.091	0.091
431	Live	0.091	0.091
431	Live	0.091	0.091
1	Live	0.337	0.337
1	Live	0.337	0.337
84	Live	0.337	0.337
84	Live	0.337	0.337
148	Live	0.337	0.337
148	Live	0.337	0.337
167	Live	0.337	0.337
167	Live	0.337	0.337
233	Live	0.091	0.091
233	Live	0.091	0.091
314	Live	0.091	0.091
314	Live	0.091	0.091
416	Live	0.492	0.492
416	Live	0.492	0.492
418	Live	0.492	0.492
418	Live	0.492	0.492
420	Live	0.492	0.492
420	Live	0.492	0.492
423	Live	0.492	0.492
423	Live	0.492	0.492
425	Live	0.492	0.492
425	Live	0.492	0.492
427	Live	0.492	0.492
427	Live	0.492	0.492
343	Mass	0.205	0.205
343	Mass	0.205	0.205
343	Mass	0.205	0.205
66	Mass	0.205	0.205
362	Mass	0.735	0.735
362	Mass	0.735	0.735

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
362	Mass	0.735	0.735
149	Mass	0.735	0.735
230	Mass	0.735	0.735
232	Mass	0.735	0.735
313	Mass	0.205	0.205
315	Mass	0.205	0.205
429	Mass	0.205	0.205
429	Mass	0.205	0.205
431	Mass	0.205	0.205
431	Mass	0.205	0.205
1	Mass	0.735	0.735
1	Mass	0.735	0.735
84	Mass	0.735	0.735
84	Mass	0.735	0.735
148	Mass	0.735	0.735
148	Mass	0.735	0.735
167	Mass	0.735	0.735
167	Mass	0.735	0.735
233	Mass	0.205	0.205
233	Mass	0.205	0.205
314	Mass	0.205	0.205
314	Mass	0.205	0.205
416	Mass	1.07	1.07
416	Mass	1.07	1.07
418	Mass	1.07	1.07
418	Mass	1.07	1.07
420	Mass	1.07	1.07
420	Mass	1.07	1.07
423	Mass	1.07	1.07
423	Mass	1.07	1.07
425	Mass	1.07	1.07
425	Mass	1.07	1.07
427	Mass	1.07	1.07
427	Mass	1.07	1.07
343	Wx	-0.06	-0.06
343	Wx	-0.06	-0.06
343	Wx	-0.06	-0.06
66	Wx	-0.06	-0.06
362	Wx	0.27	0.27
362	Wx	0.27	0.27
362	Wx	0.27	0.27
149	Wx	0.27	0.27
230	Wx	0.27	0.27
232	Wx	0.27	0.27
313	Wx	0.06	0.06
315	Wx	0.06	0.06
429	Wx	-0.06	-0.06
429	Wx	-0.06	-0.06
431	Wx	-0.06	-0.06
431	Wx	-0.06	-0.06
1	Wx	0.27	0.27
1	Wx	0.27	0.27
84	Wx	0.27	0.27
84	Wx	0.27	0.27
148	Wx	0.27	0.27

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
148	Wx	0.27	0.27
167	Wx	0.27	0.27
167	Wx	0.27	0.27
233	Wx	0.06	0.06
233	Wx	0.06	0.06
314	Wx	0.06	0.06
314	Wx	0.06	0.06
416	Wx	0.384	0.384
416	Wx	0.384	0.384
418	Wx	0.384	0.384
418	Wx	0.384	0.384
420	Wx	0.384	0.384
420	Wx	0.384	0.384
423	Wx	0.384	0.384
423	Wx	0.384	0.384
425	Wx	0.384	0.384
425	Wx	0.384	0.384
427	Wx	0.384	0.384
427	Wx	0.384	0.384
9	Wx	-0.85	-0.85
11	Wx	-0.85	-0.85
258	Wx	0.85	0.85
260	Wx	0.85	0.85
552	Wx	0.05	0.05
553	Wx	0.05	0.05
554	Wx	0.05	0.05
555	Wx	0.05	0.05
556	Wx	0.05	0.05
557	Wx	0.05	0.05
600	Wx	0.05	0.05
601	Wx	0.05	0.05
602	Wx	0.05	0.05
603	Wx	0.05	0.05
604	Wx	0.05	0.05
605	Wx	0.05	0.05
2	Wx	0.05	0.05
4	Wx	0.05	0.05
85	Wx	0.15	0.15
87	Wx	0.15	0.15
168	Wx	0.15	0.15
170	Wx	0.15	0.15
251	Wx	0.05	0.05
253	Wx	0.05	0.05
334	Wx	0.247	0.247
336	Wx	0.247	0.247
405	Wx	0.247	0.247
407	Wx	0.247	0.247
476	Wx	0.247	0.247
478	Wx	0.247	0.247
178	Wx	-0.31	-0.31
178	Wx	-0.31	-0.31
178	Wx	-0.31	-0.31
6	Wx	-0.31	-0.31
254	Wx	0.31	0.31
255	Wx	0.31	0.31

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
546	Wx	0.32	0.32
547	Wx	0.32	0.32
548	Wx	0.32	0.32
549	Wx	0.32	0.32
550	Wx	0.32	0.32
551	Wx	0.32	0.32
594	Wx	0.32	0.32
595	Wx	0.32	0.32
596	Wx	0.32	0.32
597	Wx	0.32	0.32
598	Wx	0.32	0.32
599	Wx	0.32	0.32
13	Wx	-0.31	-0.31
14	Wx	-0.31	-0.31
15	Wx	-0.31	-0.31
16	Wx	-0.31	-0.31
17	Wx	-0.31	-0.31
18	Wx	-0.31	-0.31
19	Wx	-0.31	-0.31
20	Wx	-0.31	-0.31
21	Wx	-0.31	-0.31
22	Wx	-0.31	-0.31
23	Wx	-0.31	-0.31
24	Wx	-0.31	-0.31
25	Wx	-0.31	-0.31
26	Wx	-0.31	-0.31
27	Wx	-0.31	-0.31
28	Wx	-0.31	-0.31
29	Wx	-0.31	-0.31
96	Wx	-0.31	-0.31
263	Wx	0.31	0.31
264	Wx	0.31	0.31
265	Wx	0.31	0.31
266	Wx	0.31	0.31
267	Wx	0.31	0.31
268	Wx	0.31	0.31
269	Wx	0.31	0.31
270	Wx	0.31	0.31
271	Wx	0.31	0.31
272	Wx	0.31	0.31
273	Wx	0.31	0.31
274	Wx	0.31	0.31
275	Wx	0.31	0.31
276	Wx	0.31	0.31
277	Wx	0.31	0.31
278	Wx	0.31	0.31
341	Wx	0.31	0.31
342	Wx	0.31	0.31
5	Wx	0.05	0.05
5	Wx	0.05	0.05
5	Wx	0.05	0.05
3	Wx	0.05	0.05
8	Wx	-0.85	-0.85
10	Wx	-0.85	-0.85
147	Wx	0.15	0.15

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
147	Wx	0.15	0.15
147	Wx	0.15	0.15
86	Wx	0.15	0.15
344	Wx	0.15	0.15
344	Wx	0.15	0.15
344	Wx	0.15	0.15
169	Wx	0.15	0.15
361	Wx	0.05	0.05
361	Wx	0.05	0.05
361	Wx	0.05	0.05
252	Wx	0.05	0.05
257	Wx	0.85	0.85
259	Wx	0.85	0.85
333	Wx	0.247	0.247
335	Wx	0.247	0.247
404	Wx	0.247	0.247
406	Wx	0.247	0.247
475	Wx	0.247	0.247
477	Wx	0.247	0.247
343	Wy	0.06	0.06
343	Wy	0.06	0.06
343	Wy	0.06	0.06
66	Wy	0.06	0.06
362	Wy	0.27	0.27
362	Wy	0.27	0.27
362	Wy	0.27	0.27
149	Wy	0.27	0.27
230	Wy	0.27	0.27
232	Wy	0.27	0.27
313	Wy	0.06	0.06
315	Wy	0.06	0.06
429	Wy	0.06	0.06
429	Wy	0.06	0.06
431	Wy	0.06	0.06
431	Wy	0.06	0.06
1	Wy	0.27	0.27
1	Wy	0.27	0.27
84	Wy	0.27	0.27
84	Wy	0.27	0.27
148	Wy	0.27	0.27
148	Wy	0.27	0.27
167	Wy	0.27	0.27
167	Wy	0.27	0.27
233	Wy	0.06	0.06
233	Wy	0.06	0.06
314	Wy	0.06	0.06
314	Wy	0.06	0.06
416	Wy	0.384	0.384
416	Wy	0.384	0.384
418	Wy	0.384	0.384
418	Wy	0.384	0.384
420	Wy	0.384	0.384
420	Wy	0.384	0.384
423	Wy	0.384	0.384
423	Wy	0.384	0.384

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
425	Wy	0.384	0.384
425	Wy	0.384	0.384
427	Wy	0.384	0.384
427	Wy	0.384	0.384
9	Wy	0.85	0.85
11	Wy	0.85	0.85
258	Wy	0.85	0.85
260	Wy	0.85	0.85
552	Wy	-0.05	-0.05
553	Wy	-0.05	-0.05
554	Wy	-0.05	-0.05
555	Wy	-0.05	-0.05
556	Wy	-0.05	-0.05
557	Wy	-0.05	-0.05
600	Wy	0.05	0.05
601	Wy	0.05	0.05
602	Wy	0.05	0.05
603	Wy	0.05	0.05
604	Wy	0.05	0.05
605	Wy	0.05	0.05
2	Wy	0.07	0.07
4	Wy	0.07	0.07
85	Wy	-0.14	-0.14
87	Wy	0.14	0.14
168	Wy	-0.14	-0.14
170	Wy	0.14	0.14
251	Wy	0.07	0.07
253	Wy	0.07	0.07
334	Wy	-0.2	-0.2
336	Wy	0.2	0.2
405	Wy	-0.2	-0.2
407	Wy	0.2	0.2
476	Wy	-0.2	-0.2
478	Wy	0.2	0.2
178	Wy	0.375	0.375
178	Wy	0.375	0.375
178	Wy	0.375	0.375
6	Wy	0.375	0.375
254	Wy	0.375	0.375
255	Wy	0.375	0.375
546	Wy	-0.28	-0.28
547	Wy	-0.28	-0.28
548	Wy	-0.28	-0.28
549	Wy	-0.28	-0.28
550	Wy	-0.28	-0.28
551	Wy	-0.28	-0.28
594	Wy	0.28	0.28
595	Wy	0.28	0.28
596	Wy	0.28	0.28
597	Wy	0.28	0.28
598	Wy	0.28	0.28
599	Wy	0.28	0.28
13	Wy	0.375	0.375
14	Wy	0.375	0.375
15	Wy	0.375	0.375

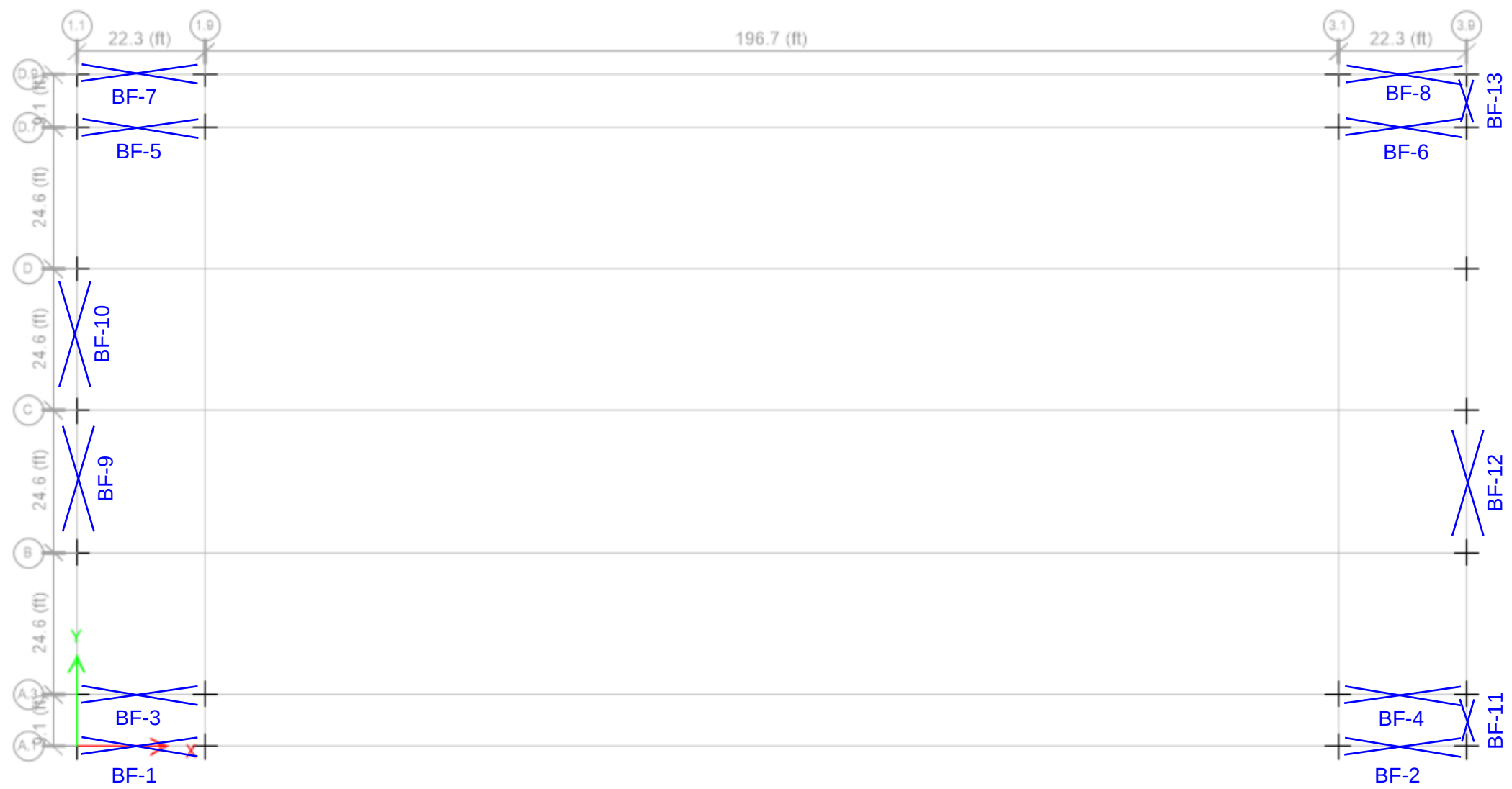
Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
16	Wy	0.375	0.375
17	Wy	0.375	0.375
18	Wy	0.375	0.375
19	Wy	0.375	0.375
20	Wy	0.375	0.375
21	Wy	0.375	0.375
22	Wy	0.375	0.375
23	Wy	0.375	0.375
24	Wy	0.375	0.375
25	Wy	0.375	0.375
26	Wy	0.375	0.375
27	Wy	0.375	0.375
28	Wy	0.375	0.375
29	Wy	0.375	0.375
96	Wy	0.375	0.375
263	Wy	0.375	0.375
264	Wy	0.375	0.375
265	Wy	0.375	0.375
266	Wy	0.375	0.375
267	Wy	0.375	0.375
268	Wy	0.375	0.375
269	Wy	0.375	0.375
270	Wy	0.375	0.375
271	Wy	0.375	0.375
272	Wy	0.375	0.375
273	Wy	0.375	0.375
274	Wy	0.375	0.375
275	Wy	0.375	0.375
276	Wy	0.375	0.375
277	Wy	0.375	0.375
278	Wy	0.375	0.375
341	Wy	0.375	0.375
342	Wy	0.375	0.375
5	Wy	0.07	0.07
5	Wy	0.07	0.07
5	Wy	0.07	0.07
3	Wy	0.07	0.07
8	Wy	0.85	0.85
10	Wy	0.85	0.85
147	Wy	-0.14	-0.14
147	Wy	-0.14	-0.14
147	Wy	-0.14	-0.14
86	Wy	0.14	0.14
344	Wy	-0.14	-0.14
344	Wy	-0.14	-0.14
344	Wy	-0.14	-0.14
169	Wy	0.14	0.14
361	Wy	0.07	0.07
361	Wy	0.07	0.07
361	Wy	0.07	0.07
252	Wy	0.07	0.07
257	Wy	0.85	0.85
259	Wy	0.85	0.85
333	Wy	-0.2	-0.2
335	Wy	0.2	0.2

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
404	Wy	-0.2	-0.2
406	Wy	0.2	0.2
475	Wy	-0.2	-0.2
477	Wy	0.2	0.2
2	Wxx	-0.07	-0.07
4	Wxx	-0.07	-0.07
251	Wxx	0.07	0.07
253	Wxx	0.07	0.07
5	Wxx	-0.07	-0.07
5	Wxx	-0.07	-0.07
5	Wxx	-0.07	-0.07
3	Wxx	-0.07	-0.07
361	Wxx	0.07	0.07
361	Wxx	0.07	0.07
361	Wxx	0.07	0.07
252	Wxx	0.07	0.07
2	Wyy	-0.05	-0.05
4	Wyy	0.05	0.05
251	Wyy	-0.05	-0.05
253	Wyy	0.05	0.05
5	Wyy	-0.05	-0.05
5	Wyy	-0.05	-0.05
5	Wyy	-0.05	-0.05
3	Wyy	0.05	0.05
361	Wyy	-0.05	-0.05
361	Wyy	-0.05	-0.05
361	Wyy	-0.05	-0.05
252	Wyy	0.05	0.05
343	Sb	0.095	0.095
66	Sb	0.095	0.095
362	Sb	0.357	0.357
149	Sb	0.357	0.357
230	Sb	0.357	0.357
232	Sb	0.357	0.357
313	Sb	0.095	0.095
315	Sb	0.095	0.095
429	Sb	0.095	0.095
429	Sb	0.095	0.095
431	Sb	0.095	0.095
431	Sb	0.095	0.095
1	Sb	0.357	0.357
1	Sb	0.357	0.357
84	Sb	0.357	0.357
84	Sb	0.357	0.357
148	Sb	0.357	0.357
148	Sb	0.357	0.357
167	Sb	0.357	0.357
167	Sb	0.357	0.357
233	Sb	0.095	0.095
233	Sb	0.095	0.095
314	Sb	0.095	0.095
314	Sb	0.095	0.095
416	Sb	0.517	0.517
416	Sb	0.517	0.517
418	Sb	0.517	0.517

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
418	Sb	0.517	0.517
420	Sb	0.517	0.517
420	Sb	0.517	0.517
423	Sb	0.517	0.517
423	Sb	0.517	0.517
425	Sb	0.517	0.517
425	Sb	0.517	0.517
427	Sb	0.517	0.517
427	Sb	0.517	0.517
343	Su1	0.024	0.024
66	Su1	0.08	0.08
362	Su1	0.089	0.089
149	Su1	0.298	0.298
230	Su1	0.089	0.089
232	Su1	0.298	0.298
313	Su1	0.024	0.024
315	Su1	0.08	0.08
429	Su1	0.024	0.024
429	Su1	0.024	0.024
431	Su1	0.08	0.08
431	Su1	0.151	0.151
1	Su1	0.089	0.089
1	Su1	0.089	0.089
84	Su1	0.298	0.298
84	Su1	0.561	0.561
148	Su1	0.089	0.089
148	Su1	0.089	0.089
167	Su1	0.298	0.298
167	Su1	0.561	0.561
233	Su1	0.024	0.024
233	Su1	0.024	0.024
314	Su1	0.08	0.08
314	Su1	0.151	0.151
416	Su1	0.128	0.128
416	Su1	0.128	0.128
418	Su1	0.431	0.431
418	Su1	0.812	0.812
420	Su1	0.128	0.128
420	Su1	0.128	0.128
423	Su1	0.431	0.431
423	Su1	0.812	0.812
425	Su1	0.128	0.128
425	Su1	0.128	0.128
427	Su1	0.431	0.431
427	Su1	0.812	0.812
343	Su2	0.08	0.08
66	Su2	0.024	0.024
362	Su2	0.298	0.298
149	Su2	0.089	0.089
230	Su2	0.298	0.298
232	Su2	0.089	0.089
313	Su2	0.08	0.08
315	Su2	0.024	0.024
429	Su2	0.08	0.08
429	Su2	0.151	0.151

Unique Name	Load Pattern	Force A kip/ft	Force B kip/ft
431	Su2	0.024	0.024
431	Su2	0.024	0.024
1	Su2	0.298	0.298
1	Su2	0.561	0.561
84	Su2	0.089	0.089
84	Su2	0.089	0.089
148	Su2	0.298	0.298
148	Su2	0.561	0.561
167	Su2	0.089	0.089
167	Su2	0.089	0.089
233	Su2	0.08	0.08
233	Su2	0.151	0.151
314	Su2	0.024	0.024
314	Su2	0.024	0.024
416	Su2	0.431	0.431
416	Su2	0.812	0.812
418	Su2	0.128	0.128
418	Su2	0.128	0.128
420	Su2	0.431	0.431
420	Su2	0.812	0.812
423	Su2	0.128	0.128
423	Su2	0.128	0.128
425	Su2	0.431	0.431
425	Su2	0.812	0.812
427	Su2	0.128	0.128
427	Su2	0.128	0.128

Lateral System Overview



$$\left\{ \begin{array}{l} N/S \rightarrow V_{\text{Seismic}} = 151^k \\ V_{ax\ 1.1} = \frac{151}{2} = 75.5^k \quad V_{ax\ 3.9} = 75.5^k \\ V_{BF-9} = V_{BF-10} = \frac{75.5 \times 1000}{2 \times 24.6} = 1535 \text{ plf} \\ V_{BF-11} = V_{BF-12} = V_{BF-13} = 1764 \text{ plf} \end{array} \right.$$

$$\left\{ \begin{array}{l} E/W \rightarrow V_{\text{Seismic}} = 151^k \\ \begin{array}{c} \text{Diagram: A horizontal beam with four supports labeled A.1, A.3, D.7, and D.9. A distributed load of 1.3k/ft is shown above the beam between supports A.3 and D.7. The distance between A.1 and A.3 is 9.1/2, and between D.7 and D.9 is 49.2. The total length between A.3 and D.7 is 58.35 (9.1/2 + 49.2).} \end{array} \\ V_{ax\ A.1, D.9} = 1.3 \times 9.1/2 = 6^k \\ V_{ax\ A.3, D.7} = 1.3 \left(\frac{9.1}{2} + 49.2 \right) = 70^k \\ V_{BF-1} = V_{BF-2} = V_{BF-7} = V_{BF-8} = \frac{6 \times 1000}{2 \times 22.3} = 135 \text{ plf} \\ V_{BF-3} = V_{BF-4} = V_{BF-5} = V_{BF-6} = \frac{70 \times 1000}{2 \times 22.3} = 1570 \text{ plf} \end{array} \right.$$

$$\left\{ \begin{array}{l} N/S \rightarrow V_{\text{wind}} = 372^k \\ V_{ax\ 1.1} = \frac{372}{2} = 186^k \quad V_{ax\ 3.9} = 186^k \\ V_{BF-9} = V_{BF-10} = \frac{186 \times 1000}{2 \times 24.6} = 3781 \text{ plf} \\ V_{BF-11} = V_{BF-12} = V_{BF-13} = 4346 \text{ plf} \end{array} \right.$$

$$\left\{ \begin{array}{l} E/W \rightarrow V_{\text{wind}} = 180^k \\ V_{ax\ A.1} = V_{ax\ D.9} = 1.54 \times 9.1/2 = 7^k \\ V_{ax\ A.3} = V_{ax\ D.7} = 1.54 \times \left(9.1/2 + 49.2 \right) = 83^k \\ V_{BF-1} = V_{BF-2} = V_{BF-7} = V_{BF-8} = \frac{7 \times 1000}{2 \times 22.3} = 157 \text{ plf} \\ V_{BF-3} = V_{BF-4} = V_{BF-5} = V_{BF-6} = \frac{83 \times 1000}{2 \times 22.3} = 1861 \text{ plf} \end{array} \right.$$

20 ga 1.5PLB-36 Grade 50 Roof Deck

Diaphragm Shear & Wind Uplift Interaction

For Both Ends Lapped Deck
with MWFRS Design Net Wind Uplift (LRFD) of 16 psf

NUCOR
VULCRAFT GROUP

Hilti X-HSN24 PAF Connections to Supports
36 / 7 / 4 Perpendicular Connection Pattern to Supports
PunchLok II Connection Sidelap Connections

A572 GR50 Support Member or Equivalent
0.188 ≤ Support Thickness (in.) ≤ 0.375
6 in. Minimum Deck End Bearing Length

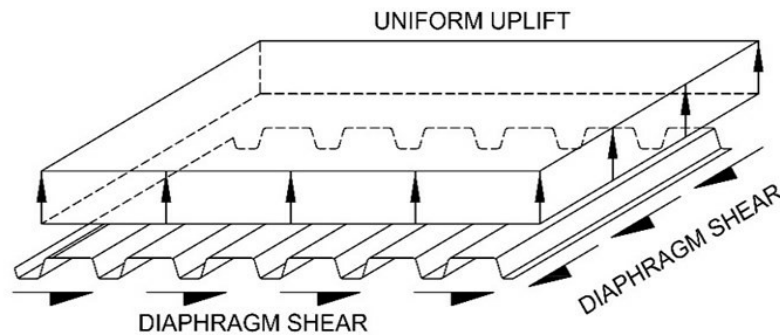
LRFD Design Combined Wind Uplift & Diaphragm Shear Strength ΦS_n (plf)

Generic 3 Span Condition

Sidelap Connection Spacing (in.)	6'-0"	6'-6"	7'-0"	7'-6"	Span 8'-0"	8'-6"	9'-0"	9'-6"	10'-0"
4	2559	2533	2507	2481	2377	2105	1878	1685	1521
6	2559	2533	2507	2481	2377	2105	1878	1685	1521
8	2361	2359	2354	2347	2277	2105	1878	1685	1521
12	1999	2048	1957	2000	1921	1958	1878	1685	1521
18	1612	1724	1633	1549	1644	1571	1503	1583	1521
24	1360	1515	1428	1348	1276	1402	1337	1277	1222
36	1065	1270	1190	1119	1055	997	945	1096	1046

Average Connection Spacing to Supports at Parallel Chords & Collectors (in.)

Sidelap Connection Spacing (in.)	6'-0"	6'-6"	7'-0"	7'-6"	Span 8'-0"	8'-6"	9'-0"	9'-6"	10'-0"
4	6	6	6	6	6	6	6	6	6
6	7	7	7	6	6	7	8	9	9
8	7	7	7	7	7	7	8	9	10
12	8	8	8	8	8	8	8	9	10
18	10	10	11	10	10	10	10	10	10
24	12	11	12	13	12	11	12	11	12
36	18	13	14	15	16	17	18	14	15



20 ga 1.5PLB-36 Grade 50 Roof Deck**Seismic Diaphragm Shear**

For Both Ends Lapped Deck



Hilti X-HSN24 PAF Connections to Supports
 36 / 7 / 4 Perpendicular Connection Pattern to Supports
 PunchLok II Connection Sidelap Connections

A572 GR50 Support Member or Equivalent
 $0.188 \leq \text{Support Thickness (in.)} \leq 0.375$
 6 in. Minimum Deck End Bearing Length

Seismic or Wind Diaphragm Shear Stiffness, G' (kip/in.)

Generic 3 Span Condition

Sidelap Connection Spacing (in.)	Span								
	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"
4	228	229	228	228	227	228	227	227	226
6	208	207	207	207	206	206	206	205	205
8	192	193	193	194	190	190	191	192	188
12	169	172	167	170	165	168	164	167	163
18	147	153	148	143	148	144	140	145	141
24	132	141	136	131	126	134	129	126	122
36	115	127	121	117	112	108	104	114	110

LRFD Design Seismic Diaphragm Shear Strength ΦS_n (plf)

Generic 3 Span Condition

Sidelap Connection Spacing (in.)	Span								
	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"
4	2513	2513	2513	2513	2377	2105	1878	1685	1521
6	2445	2440	2436	2433	2377	2105	1878	1685	1521
8	2224	2238	2249	2259	2199	2105	1878	1685	1521
12	1854	1912	1830	1884	1812	1861	1797	1685	1521
18	1480	1592	1510	1434	1531	1464	1402	1488	1431
24	1245	1393	1314	1243	1178	1300	1241	1187	1136
36	977	1165	1094	1030	973	922	875	1016	971

Average Connection Spacing to Supports at Parallel Chords & Collectors (in.)

Sidelap Connection Spacing (in.)	Span								
	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"
4	6	6	6	6	6	6	6	6	6
6	7	7	7	6	7	7	8	9	9
8	7	7	7	7	7	7	8	10	11
12	9	9	8	8	9	9	9	10	11
18	12	10	11	11	11	11	12	10	11
24	14	11	12	13	14	13	14	14	15
36	18	16	17	18	16	17	18	16	17

Bare Deck Diaphragm V5.4 in accordance with:

Date: 5/13/2025

AISI S100-16 (2020) w/ S2-20

IAPMO UES ER-0423

IAPMO UES ER-0652

CAN/CSA-S136 (R2021) for Canadian references

NOTICE: Design defects that could cause injury or death may result from relying on the information in this document without independent verification by a qualified professional. The information in this document is provided "AS IS". Nucor Corporation and its affiliates expressly disclaim: (i) any and all representations, warranties and conditions and (ii) all liability arising out of or related to this document and the information in it.

Deck-Slab Diaphragm Shear Strength

20 ga 1.5VL-36 Grade 50 Composite Deck

4 in. total slab depth, $f'_c = 4000$ psi, 145 pcf NWC

Single Mat of Rebar #4 x #4 - 12 x 12 in o.c.



Hilti X-HSN-24 PAF at Chords & Collectors for Shear Transfer

Perpendicular Connection Pattern ¹			2 per rib
Parallel Connection Attachment (maximum)	1	row at	3 in. o.c.

Minimum Connections to Supporting Members²

Minimum connections to all supports may be any of the following: arc spot welds, fillet welds, PAF's, screws, Shearflex® anchors, welded studs or other mechanical connections³.

Perpendicular Connection Pattern ¹		1 every other rib
Parallel Perimeter Connections for deck spans greater than 5 ft		36 in. o.c.

Governing Deck-Slab Strength and Stiffness

Available Diaphragm Design Strength
Controlled by Connections to Chords and Collectors

$$V_a = (\Phi P_n)N = 5028 \text{ plf}$$

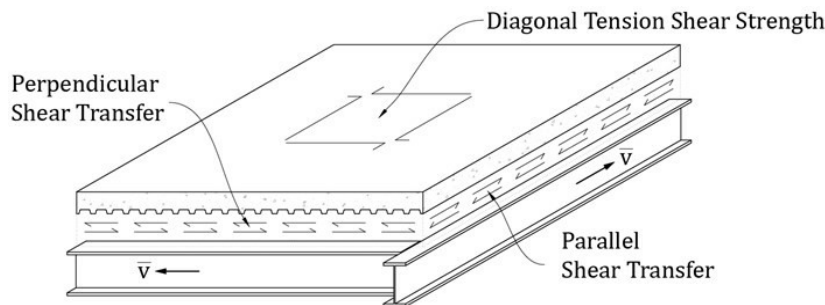
Deck-Slab Diaphragm Design Shear Stiffness	$G' =$	1050	kip/in
--	--------	------	--------

Deck-Slab Shear Strength

Reinforced Concrete Slab Design Shear Strength	$V_u =$	11384	plf
--	---------	-------	-----

Chords & Collector Shear Transfer Strength

Chord & Collectors Design Shear Transfer Strength	$(\Phi P_n)N =$	5028	plf
---	-----------------	------	-----



Notes:

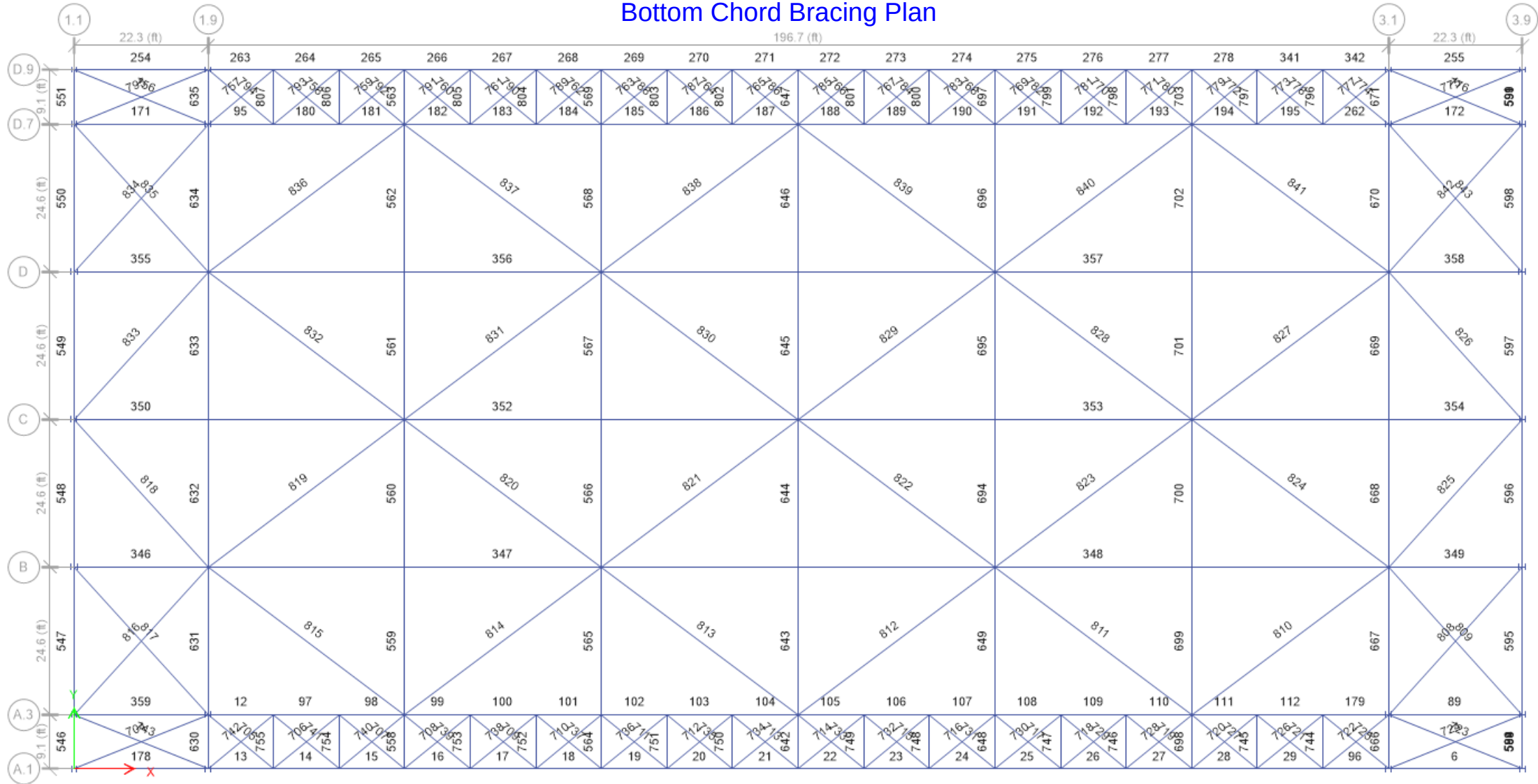
1. For UL Fire rated assemblies, refer to UL Design Number for support and sidelap connection requirements.
2. Minimum connections to supporting members do not contribute to the diaphragm shear strength.
3. Support welds at interlocking sidelaps may be 3/8" x 1-1/4" arc seam welds in lieu of arc spot welds.
4. Sidelap connections between steel deck panels may be VSC2, button punch, screw, 1-1/2 in. arc seam weld or 1-1/2 in. top arc seam weld. The maximum sidelap connection spacing shall not exceed 36 in. o.c.
5. Dramix Steel Fibers up to 66 lb/cy are approved in lieu of welded wire fabric in all UL D700, D800, and 900 Series Designs, and G229.

Deck-Slab Diaphragm V2.1 in accordance with:
AISI S100-16 (2020) w/ S2-20 & AISI S310-16 as modified by IAPMO ER-0652 or ER-0423

Date: 5/13/2025

NOTICE: Design defects that could cause injury or death may result from relying on the information in this document without independent verification by a qualified professional. The information in this document is provided "AS IS". Nucor Corporation and its affiliates expressly disclaim: (i) any and all representations, warranties and conditions and (ii) all liability arising out of or related to this document and the information in it.

Bottom Chord Bracing Plan



Hangar – Horizontal bottom chord beams and braces showing DC ratio (designed with omega seismic load combinations)

Label	Section	D/C Ratio	
6	W12X45	$0.354 = 0.337 + 0.017 + 0$	DStlS44-1_O
12	W12X53	$0.22 = 0.217 + 0.003 + 0$	DStlS45-1_O
13	W12X53	$0.243 = 0.24 + 0.003 + 0$	DStlS45-1_O
14	W12X53	$0.062 = 0.058 + 0.004 + 0$	DStlS45-1_O
15	W12X53	$0.008 = 0.004 + 0.004 + 0$	DStlS45-2_O
16	W12X53	$0.035 = 0.031 + 0.004 + 0$	DStlS44-1_O
17	W12X53	$0.064 = 0.06 + 0.004 + 0$	DStlS44-1_O
18	W12X53	$0.089 = 0.085 + 0.004 + 0$	DStlS47-1_O
19	W12X53	$0.102 = 0.098 + 0.004 + 0$	DStlS47-1_O
20	W12X53	$0.204 = 0.2 + 0.003 + 0$	DStlS47-1_O
21	W12X53	$0.103 = 0.099 + 0.004 + 0$	DStlS47-1_O
22	W12X53	$0.103 = 0.099 + 0.004 + 0$	DStlS47-1_O
23	W12X53	$0.203 = 0.2 + 0.003 + 0$	DStlS47-1_O
24	W12X53	$0.102 = 0.098 + 0.004 + 0$	DStlS47-1_O
25	W12X53	$0.089 = 0.085 + 0.004 + 0$	DStlS47-1_O
26	W12X53	$0.064 = 0.06 + 0.004 + 0$	DStlS47-1_O
27	W12X53	$0.035 = 0.031 + 0.004 + 0$	DStlS45-1_O
28	W12X53	$0.008 = 0.004 + 0.004 + 0$	DStlS44-3_O
29	W12X53	$0.063 = 0.059 + 0.004 + 0$	DStlS44-1_O
89	W12X45	$0.073 = 0.055 + 0.019 + 0$	DStlS47-1_O
95	W12X53	$0.222 = 0.219 + 0.003 + 0$	DStlS45-1_O
96	W12X53	$0.244 = 0.242 + 0.003 + 0$	DStlS44-1_O
97	W12X53	$0.056 = 0.053 + 0.004 + 0$	DStlS45-1_O
98	W12X53	$0.017 = 0.014 + 0.004 + 0$	DStlS45-2_O
99	W12X53	$0.069 = 0.066 + 0.004 + 0$	DStlS44-1_O
100	W12X53	$0.086 = 0.082 + 0.004 + 0$	DStlS47-1_O
101	W12X53	$0.093 = 0.09 + 0.004 + 0$	DStlS47-1_O
102	W12X53	$0.102 = 0.098 + 0.004 + 0$	DStlS47-1_O
103	W12X53	$0.222 = 0.219 + 0.003 + 0$	DStlS47-1_O
104	W12X53	$0.233 = 0.23 + 0.003 + 0$	DStlS47-1_O
105	W12X53	$0.232 = 0.229 + 0.003 + 0$	DStlS47-1_O
106	W12X53	$0.222 = 0.219 + 0.003 + 0$	DStlS47-1_O
107	W12X53	$0.102 = 0.098 + 0.004 + 0$	DStlS47-1_O
108	W12X53	$0.093 = 0.09 + 0.004 + 0$	DStlS47-1_O
109	W12X53	$0.086 = 0.082 + 0.004 + 0$	DStlS47-1_O
110	W12X53	$0.069 = 0.066 + 0.004 + 0$	DStlS45-1_O
111	W12X53	$0.018 = 0.014 + 0.004 + 0$	DStlS44-3_O
112	W12X53	$0.057 = 0.053 + 0.004 + 0$	DStlS44-1_O

171	W12X45	0.091 = 0.072 + 0.019 + 0	DStIS46-1_O
172	W12X45	0.088 = 0.069 + 0.019 + 0	DStIS46-1_O
178	W12X45	0.366 = 0.35 + 0.017 + 0	DStIS45-1_O
179	W12X53	0.221 = 0.218 + 0.003 + 0	DStIS44-1_O
180	W12X53	0.057 = 0.054 + 0.004 + 0	DStIS45-1_O
181	W12X53	0.018 = 0.015 + 0.004 + 0	DStIS45-2_O
182	W12X53	0.069 = 0.066 + 0.004 + 0	DStIS44-1_O
183	W12X53	0.085 = 0.082 + 0.004 + 0	DStIS46-1_O
184	W12X53	0.093 = 0.089 + 0.004 + 0	DStIS46-1_O
185	W12X53	0.102 = 0.098 + 0.004 + 0	DStIS46-1_O
186	W12X53	0.221 = 0.218 + 0.003 + 0	DStIS46-1_O
187	W12X53	0.232 = 0.229 + 0.003 + 0	DStIS46-1_O
188	W12X53	0.233 = 0.23 + 0.003 + 0	DStIS46-1_O
189	W12X53	0.222 = 0.219 + 0.003 + 0	DStIS46-1_O
190	W12X53	0.102 = 0.099 + 0.004 + 0	DStIS46-1_O
191	W12X53	0.093 = 0.09 + 0.004 + 0	DStIS46-1_O
192	W12X53	0.086 = 0.082 + 0.004 + 0	DStIS46-1_O
193	W12X53	0.07 = 0.066 + 0.004 + 0	DStIS46-1_O
194	W12X53	0.017 = 0.014 + 0.004 + 0	DStIS44-3_O
195	W12X53	0.057 = 0.053 + 0.004 + 0	DStIS44-1_O
254	W12X45	0.37 = 0.353 + 0.017 + 0	DStIS45-1_O
255	W12X45	0.344 = 0.328 + 0.017 + 0	DStIS44-1_O
262	W12X53	0.223 = 0.22 + 0.003 + 0	DStIS44-1_O
263	W12X53	0.246 = 0.243 + 0.003 + 0	DStIS45-1_O
264	W12X53	0.063 = 0.06 + 0.004 + 0	DStIS45-1_O
265	W12X53	0.008 = 0.005 + 0.004 + 0	DStIS45-2_O
266	W12X53	0.034 = 0.031 + 0.004 + 0	DStIS44-1_O
267	W12X53	0.063 = 0.06 + 0.004 + 0	DStIS44-1_O
268	W12X53	0.088 = 0.085 + 0.004 + 0	DStIS46-1_O
269	W12X53	0.102 = 0.098 + 0.004 + 0	DStIS46-1_O
270	W12X53	0.104 = 0.1 + 0.004 + 0	DStIS46-1_O
271	W12X53	0.103 = 0.099 + 0.004 + 0	DStIS46-1_O
272	W12X53	0.103 = 0.099 + 0.004 + 0	DStIS46-1_O
273	W12X53	0.203 = 0.2 + 0.003 + 0	DStIS46-1_O
274	W12X53	0.102 = 0.098 + 0.004 + 0	DStIS46-1_O
275	W12X53	0.089 = 0.085 + 0.004 + 0	DStIS46-1_O
276	W12X53	0.064 = 0.06 + 0.004 + 0	DStIS46-1_O
277	W12X53	0.035 = 0.031 + 0.004 + 0	DStIS45-1_O
278	W12X53	0.007 = 0.004 + 0.004 + 0	DStIS44-3_O
341	W12X53	0.061 = 0.057 + 0.004 + 0	DStIS44-1_O
342	W12X53	0.239 = 0.236 + 0.003 + 0	DStIS44-1_O
346	W12X72	0.208 = 0.202 + 0.004 + 0.002	DStIS47-1_O

347	W12X72	$0.379 = 0.351 + 0.028 + 2.286E-04$	DStIS47-1_O
348	W12X72	$0.378 = 0.35 + 0.028 + 2.24E-04$	DStIS47-1_O
349	W12X72	$0.207 = 0.201 + 0.004 + 0.002$	DStIS47-1_O
350	W12X72	$0.061 = 0.046 + 0.015 + 0$	DStIS46-1_O
352	W12X72	$0.395 = 0.366 + 0.029 + 0$	DStIS45-1_O
353	W12X72	$0.395 = 0.366 + 0.029 + 0$	DStIS47-1_O
354	W12X72	$0.061 = 0.046 + 0.014 + 1.69E-04$	DStIS47-1_O
355	W12X72	$0.209 = 0.203 + 0.004 + 0.002$	DStIS46-1_O
356	W12X72	$0.378 = 0.35 + 0.028 + 2.173E-04$	DStIS46-1_O
357	W12X72	$0.378 = 0.35 + 0.028 + 2.241E-04$	DStIS46-1_O
358	W12X72	$0.103 = 0.096 + 0.004 + 0.004$	DStIS46-1_O
359	W12X45	$0.09 = 0.072 + 0.019 + 0$	DStIS47-1_O
546	W8X40	$0.036 = 0.033 + 0.003 + 0$	DStIS46-1_O
547	W8X31	$0.074 = 0.044 + 0.03 + 0$	DStIS47-1_O
548	W8X40	$0.241 = 0.219 + 0.022 + 0$	DStIS47-1_O
549	W8X40	$0.242 = 0.22 + 0.022 + 0$	DStIS46-1_O
550	W8X31	$0.075 = 0.045 + 0.03 + 0$	DStIS46-1_O
551	W8X40	$0.036 = 0.033 + 0.003 + 0$	DStIS47-1_O
558	W8X48	$0.015 = 0.011 + 0.003 + 0$	DStIS44-1_O
559	W8X48	$0.497 = 0.471 + 0.027 + 0$	DStIS47-1_O
560	W8X48	$0.409 = 0.383 + 0.027 + 0$	DStIS47-1_O
561	W8X48	$0.41 = 0.384 + 0.027 + 0$	DStIS46-1_O
562	W8X48	$0.499 = 0.472 + 0.027 + 0$	DStIS46-1_O
563	W8X48	$0.014 = 0.011 + 0.003 + 0$	DStIS44-1_O
564	W8X48	$0.033 = 0.03 + 0.003 + 0$	DStIS47-1_O
565	W8X48	$0.095 = 0.065 + 0.03 + 0$	DStIS47-1_O
566	W8X48	$0.415 = 0.388 + 0.027 + 0$	DStIS45-1_O
567	W8X48	$0.415 = 0.388 + 0.027 + 0$	DStIS45-1_O
568	W8X48	$0.095 = 0.065 + 0.03 + 0$	DStIS46-1_O
569	W8X48	$0.033 = 0.03 + 0.003 + 0$	DStIS46-1_O
594	W8X31	$0.042 = 0.039 + 0.003 + 0$	DStIS45-1_O
595	W8X31	$0.065 = 0.035 + 0.031 + 0$	DStIS47-1_O
596	W8X40	$0.24 = 0.218 + 0.022 + 0$	DStIS44-1_O
597	W8X40	$0.262 = 0.24 + 0.022 + 0$	DStIS46-1_O
598	W8X31	$0.05 = 0.019 + 0.032 + 0$	DStIS46-1_O
599	W8X31	$0.051 = 0.048 + 0.003 + 0$	DStIS46-1_O
630	W8X31	$0.094 = 0.091 + 0.003 + 0$	DStIS47-1_O
631	W8X31	$0.076 = 0.041 + 0.036 + 0$	DStIS46-1_O
632	W8X31	$0.427 = 0.394 + 0.033 + 0$	DStIS47-1_O
633	W8X31	$0.428 = 0.395 + 0.033 + 0$	DStIS46-1_O
634	W8X31	$0.077 = 0.042 + 0.036 + 0$	DStIS47-1_O
635	W8X31	$0.094 = 0.091 + 0.003 + 0$	DStIS46-1_O

642	W8X48	$0.025 = 0.022 + 0.003 + 0$	DStIS47-1_O
643	W8X48	$0.474 = 0.447 + 0.027 + 0$	DStIS47-1_O
644	W8X48	$0.493 = 0.466 + 0.027 + 0$	DStIS47-1_O
645	W8X48	$0.493 = 0.466 + 0.027 + 0$	DStIS46-1_O
646	W8X48	$0.476 = 0.449 + 0.027 + 0$	DStIS46-1_O
647	W8X48	$0.025 = 0.022 + 0.003 + 0$	DStIS46-1_O
648	W8X48	$0.034 = 0.03 + 0.003 + 0$	DStIS47-1_O
649	W8X48	$0.095 = 0.065 + 0.03 + 0$	DStIS47-1_O
666	W8X31	$0.094 = 0.091 + 0.003 + 0$	DStIS47-1_O
667	W8X31	$0.075 = 0.039 + 0.036 + 0$	DStIS46-1_O
668	W8X31	$0.455 = 0.422 + 0.033 + 0$	DStIS47-1_O
669	W8X31	$0.439 = 0.406 + 0.033 + 0$	DStIS44-1_O
670	W8X31	$0.066 = 0.03 + 0.036 + 0$	DStIS47-1_O
671	W8X31	$0.091 = 0.088 + 0.003 + 0$	DStIS46-1_O
694	W8X48	$0.414 = 0.388 + 0.027 + 0$	DStIS44-1_O
695	W8X48	$0.414 = 0.388 + 0.027 + 0$	DStIS44-1_O
696	W8X48	$0.096 = 0.066 + 0.03 + 0$	DStIS46-1_O
697	W8X48	$0.034 = 0.03 + 0.003 + 0$	DStIS46-1_O
698	W8X48	$0.015 = 0.011 + 0.003 + 0$	DStIS45-1_O
699	W8X48	$0.5 = 0.474 + 0.027 + 0$	DStIS47-1_O
700	W8X48	$0.413 = 0.386 + 0.027 + 0$	DStIS47-1_O
701	W8X48	$0.407 = 0.38 + 0.027 + 0$	DStIS46-1_O
702	W8X48	$0.494 = 0.467 + 0.027 + 0$	DStIS46-1_O
703	W8X48	$0.014 = 0.011 + 0.003 + 0$	DStIS45-1_O
704	W8X31	$0.036 = 0.004 + 0.029 + 0.004$	DStIS45-2_O
705	L6X6X7/8	$0.131 = 0.055 + 0.044 + 0.031$	DStIS45-3_O
706	L6X6X7/8	$0.367 = 0.349 + 0.007 + 0.012$	DStIS45-1_O
707	L6X6X7/8	$0.128 = 0.05 + 0.058 + 0.02$	DStIS44-1_O
708	L6X6X5/16	$0.132 = 0.109 + 0.013 + 0.01$	DStIS45-1_O
709	L6X6X5/16	$0.227 = 0.151 + 0.028 + 0.047$	DStIS47-1_O
710	L6X6X5/16	$0.031 = 0.005 + 0.004 + 0.022$	DStIS44-3_O
711	L6X6X5/16	$0.147 = 0.084 + 0.016 + 0.047$	DStIS47-1_O
712	L6X6X5/16	$0.152 = 0.115 + 0.005 + 0.032$	DStIS47-1_O
713	L6X6X5/16	$0.144 = 0.096 + 0.012 + 0.036$	DStIS47-1_O
714	L6X6X5/16	$0.144 = 0.096 + 0.012 + 0.036$	DStIS47-1_O
715	L6X6X5/16	$0.152 = 0.114 + 0.005 + 0.033$	DStIS47-1_O
716	L6X6X5/16	$0.147 = 0.084 + 0.016 + 0.047$	DStIS47-1_O
717	L6X6X5/16	$0.031 = 0.005 + 0.004 + 0.022$	DStIS45-2_O
718	L6X6X5/16	$0.227 = 0.151 + 0.028 + 0.047$	DStIS47-1_O
719	L6X6X5/16	$0.134 = 0.111 + 0.012 + 0.011$	DStIS44-1_O
720	L6X6X7/8	$0.13 = 0.052 + 0.059 + 0.02$	DStIS47-1_O
721	L6X6X7/8	$0.37 = 0.351 + 0.007 + 0.012$	DStIS44-1_O

722	L6X6X7/8	$0.134 = 0.056 + 0.047 + 0.03$	DStIS46-2_O
723	W8X31	$0.038 = 0.008 + 0.027 + 0.003$	DStIS44-3_O
724	W8X31	$0.087 = 0.051 + 0.027 + 0.009$	DStIS44-1_O
725	L6X6X7/8	$0.462 = 0.422 + 0.021 + 0.019$	DStIS44-1_O
726	L6X6X7/8	$0.106 = 0.021 + 0.061 + 0.024$	DStIS47-1_O
727	L6X6X7/8	$0.261 = 0.25 + 0.004 + 0.006$	DStIS44-1_O
728	L6X6X5/16	$0.216 = 0.13 + 0.038 + 0.048$	DStIS47-1_O
729	L6X6X5/16	$0.065 = 0.04 + 0.019 + 0.006$	DStIS44-1_O
730	L6X6X5/16	$0.236 = 0.167 + 0.021 + 0.048$	DStIS47-1_O
731	L6X6X5/16	$0.141 = 0.109 + 0.006 + 0.026$	DStIS47-1_O
732	L6X6X5/16	$0.146 = 0.09 + 0.013 + 0.043$	DStIS47-1_O
733	L6X6X5/16	$0.165 = 0.121 + 0.008 + 0.036$	DStIS47-1_O
734	L6X6X5/16	$0.165 = 0.121 + 0.008 + 0.036$	DStIS47-1_O
735	L6X6X5/16	$0.146 = 0.09 + 0.013 + 0.043$	DStIS47-1_O
736	L6X6X5/16	$0.141 = 0.109 + 0.006 + 0.026$	DStIS47-1_O
737	L6X6X5/16	$0.236 = 0.167 + 0.021 + 0.048$	DStIS47-1_O
738	L6X6X5/16	$0.064 = 0.039 + 0.019 + 0.006$	DStIS45-1_O
739	L6X6X5/16	$0.215 = 0.129 + 0.038 + 0.048$	DStIS47-1_O
740	L6X6X7/8	$0.258 = 0.248 + 0.007 + 0.004$	DStIS45-1_O
741	L6X6X7/8	$0.104 = 0.021 + 0.061 + 0.023$	DStIS44-1_O
742	L6X6X7/8	$0.46 = 0.42 + 0.022 + 0.019$	DStIS45-1_O
743	W8X31	$0.089 = 0.055 + 0.026 + 0.009$	DStIS45-1_O
744	W8X31	$0.036 = 0.033 + 0.004 + 0$	DStIS44-1_O
745	W8X31	$0.017 = 0.014 + 0.004 + 0$	DStIS44-1_O
746	W8X31	$0.022 = 0.019 + 0.004 + 0$	DStIS47-1_O
747	W8X31	$0.028 = 0.025 + 0.004 + 0$	DStIS47-1_O
748	W8X31	$0.035 = 0.032 + 0.004 + 0$	DStIS47-1_O
749	W8X31	$0.037 = 0.034 + 0.004 + 0$	DStIS47-1_O
750	W8X31	$0.037 = 0.034 + 0.004 + 0$	DStIS47-1_O
751	W8X31	$0.035 = 0.032 + 0.004 + 0$	DStIS47-1_O
752	W8X31	$0.028 = 0.025 + 0.004 + 0$	DStIS47-1_O
753	W8X31	$0.022 = 0.019 + 0.004 + 0$	DStIS44-1_O
754	W8X31	$0.017 = 0.014 + 0.004 + 0$	DStIS45-1_O
755	W8X31	$0.036 = 0.033 + 0.004 + 0$	DStIS45-1_O
756	W8X31	$0.037 = 0.004 + 0.029 + 0.004$	DStIS45-2_O
757	L6X6X7/8	$0.139 = 0.056 + 0.056 + 0.028$	DStIS45-3_O
758	L6X6X7/8	$0.366 = 0.354 + 0.002 + 0.009$	DStIS45-1_O
759	L6X6X7/8	$0.13 = 0.049 + 0.063 + 0.018$	DStIS46-1_O
760	L6X6X5/16	$0.136 = 0.113 + 0.009 + 0.014$	DStIS45-1_O
761	L6X6X5/16	$0.228 = 0.152 + 0.024 + 0.052$	DStIS46-1_O
762	L6X6X5/16	$0.03 = 0.004 + 0.003 + 0.023$	DStIS45-2_O
763	L6X6X5/16	$0.148 = 0.084 + 0.017 + 0.047$	DStIS46-1_O

764	L6X6X5/16	0.151 = 0.114 + 0.002 + 0.035	DStlS46-1_O
765	L6X6X5/16	0.146 = 0.097 + 0.006 + 0.043	DStlS46-1_O
766	L6X6X5/16	0.144 = 0.096 + 0.006 + 0.043	DStlS46-1_O
767	L6X6X5/16	0.153 = 0.115 + 0.002 + 0.036	DStlS46-1_O
768	L6X6X5/16	0.147 = 0.084 + 0.017 + 0.046	DStlS46-1_O
769	L6X6X5/16	0.032 = 0.005 + 0.003 + 0.023	DStlS45-2_O
770	L6X6X5/16	0.227 = 0.151 + 0.024 + 0.052	DStlS46-1_O
771	L6X6X5/16	0.131 = 0.107 + 0.01 + 0.014	DStlS44-1_O
772	L6X6X7/8	0.13 = 0.049 + 0.063 + 0.018	DStlS46-1_O
773	L6X6X7/8	0.355 = 0.343 + 0.002 + 0.01	DStlS44-1_O
774	L6X6X7/8	0.146 = 0.062 + 0.057 + 0.028	DStlS44-1_O
775	W8X31	0.038 = 0.008 + 0.027 + 0.002	DStlS44-3_O
776	W8X31	0.086 = 0.05 + 0.028 + 0.009	DStlS44-1_O
777	L6X6X7/8	0.438 = 0.414 + 0.011 + 0.013	DStlS44-1_O
778	L6X6X7/8	0.106 = 0.018 + 0.064 + 0.024	DStlS46-1_O
779	L6X6X7/8	0.25 = 0.242 + 0.005 + 0.004	DStlS44-1_O
780	L6X6X5/16	0.216 = 0.129 + 0.031 + 0.056	DStlS46-1_O
781	L6X6X5/16	0.064 = 0.037 + 0.006 + 0.021	DStlS44-3_O
782	L6X6X5/16	0.236 = 0.167 + 0.02 + 0.049	DStlS46-1_O
783	L6X6X5/16	0.141 = 0.109 + 0.005 + 0.027	DStlS46-1_O
784	L6X6X5/16	0.146 = 0.089 + 0.011 + 0.045	DStlS46-1_O
785	L6X6X5/16	0.166 = 0.122 + 0.006 + 0.039	DStlS46-1_O
786	L6X6X5/16	0.164 = 0.12 + 0.006 + 0.038	DStlS46-1_O
787	L6X6X5/16	0.147 = 0.09 + 0.011 + 0.045	DStlS46-1_O
788	L6X6X5/16	0.14 = 0.108 + 0.005 + 0.027	DStlS46-1_O
789	L6X6X5/16	0.237 = 0.168 + 0.021 + 0.049	DStlS46-1_O
790	L6X6X5/16	0.069 = 0.042 + 0.006 + 0.021	DStlS45-2_O
791	L6X6X5/16	0.217 = 0.13 + 0.031 + 0.056	DStlS46-1_O
792	L6X6X7/8	0.262 = 0.253 + 0.005 + 0.004	DStlS45-1_O
793	L6X6X7/8	0.107 = 0.021 + 0.064 + 0.022	DStlS44-1_O
794	L6X6X7/8	0.447 = 0.422 + 0.011 + 0.014	DStlS45-1_O
795	W8X31	0.09 = 0.055 + 0.026 + 0.009	DStlS45-1_O
796	W8X31	0.036 = 0.033 + 0.004 + 0	DStlS44-1_O
797	W8X31	0.017 = 0.013 + 0.004 + 0	DStlS44-1_O
798	W8X31	0.022 = 0.019 + 0.004 + 0	DStlS46-1_O
799	W8X31	0.028 = 0.025 + 0.004 + 0	DStlS46-1_O
800	W8X31	0.035 = 0.032 + 0.004 + 0	DStlS46-1_O
801	W8X31	0.037 = 0.034 + 0.004 + 0	DStlS46-1_O
802	W8X31	0.037 = 0.033 + 0.004 + 0	DStlS46-1_O
803	W8X31	0.035 = 0.031 + 0.004 + 0	DStlS46-1_O
804	W8X31	0.028 = 0.025 + 0.004 + 0	DStlS46-1_O
805	W8X31	0.022 = 0.019 + 0.004 + 0	DStlS44-1_O

806	W8X31	0.018 = 0.014 + 0.004 + 0	DStlS45-1_O
807	W8X31	0.037 = 0.033 + 0.004 + 0	DStlS45-1_O
808	W8X58	0.307 = 0.202 + 0.099 + 0.006	DStlS47-1_O
809	W8X58	0.459 = 0.373 + 0.081 + 0.004	DStlS47-1_O
810	W8X31	0.338 = 0.239 + 0.099 + 0	DStlS44-1_O
811	W8X31	0.186 = 0.003 + 0.183 + 0	DStlS44-3_O
812	W8X31	0.202 = 0.073 + 0.129 + 0	DStlS47-1_O
813	W8X31	0.201 = 0.072 + 0.129 + 0	DStlS47-1_O
814	W8X31	0.186 = 0.003 + 0.182 + 0	DStlS45-3_O
815	W8X31	0.336 = 0.237 + 0.099 + 0	DStlS45-1_O
816	W8X58	0.429 = 0.343 + 0.081 + 0.004	DStlS45-1_O
817	W8X58	0.31 = 0.202 + 0.101 + 0.007	DStlS47-1_O
818	L8X8X1/2	0.273 = 0.063 + 0.119 + 0.091	DStlS47-1_O
819	L8X8X1/2	0.412 = 0.053 + 0.215 + 0.143	DStlS44-3_O
820	L8X8X1/2	0.565 = 0.207 + 0.215 + 0.143	DStlS47-1_O
821	L8X8X1/2	0.516 = 0.158 + 0.215 + 0.143	DStlS44-1_O
822	L8X8X1/2	0.513 = 0.154 + 0.215 + 0.143	DStlS45-1_O
823	L8X8X1/2	0.568 = 0.209 + 0.215 + 0.143	DStlS47-1_O
824	L8X8X1/2	0.409 = 0.05 + 0.215 + 0.143	DStlS46-2_O
825	L8X8X1/2	0.279 = 0.069 + 0.119 + 0.091	DStlS47-1_O
826	L8X8X1/2	0.265 = 0.055 + 0.119 + 0.091	DStlS46-1_O
827	L8X8X1/2	0.409 = 0.051 + 0.215 + 0.143	DStlS45-2_O
828	L8X8X1/2	0.565 = 0.207 + 0.215 + 0.143	DStlS46-1_O
829	L8X8X1/2	0.516 = 0.158 + 0.215 + 0.143	DStlS45-1_O
830	L8X8X1/2	0.513 = 0.154 + 0.215 + 0.143	DStlS44-1_O
831	L8X8X1/2	0.568 = 0.21 + 0.215 + 0.143	DStlS46-1_O
832	L8X8X1/2	0.409 = 0.051 + 0.215 + 0.143	DStlS44-3_O
833	L8X8X1/2	0.276 = 0.066 + 0.119 + 0.091	DStlS46-1_O
834	W8X58	0.312 = 0.204 + 0.101 + 0.008	DStlS46-1_O
835	W8X58	0.431 = 0.345 + 0.081 + 0.004	DStlS45-1_O
836	W8X31	0.338 = 0.238 + 0.099 + 0	DStlS45-1_O
837	W8X31	0.186 = 0.002 + 0.184 + 0	DStlS46-2_O
838	W8X31	0.202 = 0.073 + 0.129 + 0	DStlS46-1_O
839	W8X31	0.201 = 0.072 + 0.129 + 0	DStlS46-1_O
840	W8X31	0.185 = 0.004 + 0.182 + 0	DStlS44-3_O
841	W8X31	0.336 = 0.237 + 0.099 + 0	DStlS44-1_O
842	W8X58	0.459 = 0.376 + 0.081 + 0.002	DStlS46-1_O
843	W8X58	0.208 = 0.093 + 0.113 + 0.002	DStlS46-1_O

Hangar – All beam sections with DC ratios (Lateral Design)

Label	Section	D/C Ratio
1	W12X53	$0.344 = 0.004 + 0.26 + 0.08$
6	W12X45	$0.61 = 0.329 + 0.015 + 0.266$
12	W12X53	$0.326 = 0.323 + 0.003 + 0$
13	W12X53	$0.37 = 0.35 + 0.003 + 0.017$
14	W12X53	$0.125 = 0.079 + 0.003 + 0.042$
15	W12X53	$0.062 = 0.007 + 0.003 + 0.051$
16	W12X53	$0.097 = 0.043 + 0.003 + 0.051$
17	W12X53	$0.136 = 0.081 + 0.003 + 0.051$
18	W12X53	$0.287 = 0.262 + 0.003 + 0.023$
19	W12X53	$0.328 = 0.302 + 0.003 + 0.023$
20	W12X53	$0.335 = 0.309 + 0.003 + 0.023$
21	W12X53	$0.331 = 0.305 + 0.003 + 0.023$
22	W12X53	$0.331 = 0.305 + 0.003 + 0.023$
23	W12X53	$0.335 = 0.31 + 0.003 + 0.023$
24	W12X53	$0.329 = 0.303 + 0.003 + 0.023$
25	W12X53	$0.289 = 0.263 + 0.003 + 0.023$
26	W12X53	$0.138 = 0.084 + 0.003 + 0.051$
27	W12X53	$0.1 = 0.046 + 0.003 + 0.051$
28	W12X53	$0.066 = 0.012 + 0.003 + 0.051$
29	W12X53	$0.116 = 0.061 + 0.003 + 0.051$
66	W12X53	$0.141 = 0.027 + 0.097 + 0.017$
84	W12X53	$0.343 = 0.001 + 0.259 + 0.083$
89	W12X45	$0.104 = 0.087 + 0.017 + 0$
95	W12X53	$0.327 = 0.325 + 0.003 + 0$
96	W12X53	$0.364 = 0.34 + 0.003 + 0.021$
97	W12X53	$0.082 = 0.079 + 0.003 + 0$
98	W12X53	$0.033 = 0.03 + 0.003 + 0$
99	W12X53	$0.215 = 0.212 + 0.003 + 0$
100	W12X53	$0.26 = 0.257 + 0.003 + 0$
101	W12X53	$0.279 = 0.277 + 0.003 + 0$
102	W12X53	$0.304 = 0.301 + 0.003 + 0$
103	W12X53	$0.335 = 0.332 + 0.003 + 0$
104	W12X53	$0.352 = 0.349 + 0.003 + 0$
105	W12X53	$0.353 = 0.35 + 0.003 + 0$
106	W12X53	$0.336 = 0.333 + 0.003 + 0$
107	W12X53	$0.304 = 0.301 + 0.003 + 0$
108	W12X53	$0.28 = 0.277 + 0.003 + 0$
109	W12X53	$0.261 = 0.258 + 0.003 + 0$
110	W12X53	$0.217 = 0.214 + 0.003 + 0$

111	W12X53	$0.03 = 0.027 + 0.003 + 0$
112	W12X53	$0.081 = 0.077 + 0.003 + 0$
148	W12X53	$0.345 = 0.004 + 0.261 + 0.081$
149	W12X53	$0.304 = 0.03 + 0.269 + 0.005$
167	W12X53	$0.34 = 0.002 + 0.26 + 0.079$
171	W12X45	$0.096 = 0.079 + 0.017 + 0$
172	W12X45	$0.092 = 0.075 + 0.017 + 0$
178	W12X45	$0.666 = 0.384 + 0.015 + 0.266$
179	W12X53	$0.323 = 0.32 + 0.003 + 0$
180	W12X53	$0.084 = 0.08 + 0.003 + 0$
181	W12X53	$0.035 = 0.032 + 0.003 + 0$
182	W12X53	$0.206 = 0.203 + 0.003 + 0$
183	W12X53	$0.255 = 0.252 + 0.003 + 0$
184	W12X53	$0.274 = 0.271 + 0.003 + 0$
185	W12X53	$0.298 = 0.296 + 0.003 + 0$
186	W12X53	$0.332 = 0.329 + 0.003 + 0$
187	W12X53	$0.346 = 0.343 + 0.003 + 0$
188	W12X53	$0.349 = 0.346 + 0.003 + 0$
189	W12X53	$0.336 = 0.333 + 0.003 + 0$
190	W12X53	$0.302 = 0.299 + 0.003 + 0$
191	W12X53	$0.278 = 0.275 + 0.003 + 0$
192	W12X53	$0.26 = 0.257 + 0.003 + 0$
193	W12X53	$0.211 = 0.208 + 0.003 + 0$
194	W12X53	$0.029 = 0.026 + 0.003 + 0$
195	W12X53	$0.082 = 0.079 + 0.003 + 0$
230	W12X53	$0.309 = 0.034 + 0.27 + 0.004$
232	W12X53	$0.306 = 0.034 + 0.268 + 0.004$
233	W12X53	$0.213 = 0.014 + 0.096 + 0.103$
254	W12X45	$0.622 = 0.387 + 0.015 + 0.22$
255	W12X45	$0.609 = 0.328 + 0.015 + 0.266$
262	W12X53	$0.331 = 0.329 + 0.003 + 0$
263	W12X53	$0.375 = 0.355 + 0.003 + 0.017$
264	W12X53	$0.127 = 0.081 + 0.003 + 0.042$
265	W12X53	$0.063 = 0.009 + 0.003 + 0.051$
266	W12X53	$0.086 = 0.031 + 0.003 + 0.051$
267	W12X53	$0.116 = 0.062 + 0.003 + 0.051$
268	W12X53	$0.274 = 0.252 + 0.003 + 0.019$
269	W12X53	$0.314 = 0.292 + 0.003 + 0.019$
270	W12X53	$0.319 = 0.297 + 0.003 + 0.019$
271	W12X53	$0.319 = 0.297 + 0.003 + 0.019$
272	W12X53	$0.32 = 0.298 + 0.003 + 0.019$
273	W12X53	$0.32 = 0.299 + 0.003 + 0.019$

274	W12X53	$0.317 = 0.296 + 0.003 + 0.019$
275	W12X53	$0.278 = 0.257 + 0.003 + 0.019$
276	W12X53	$0.122 = 0.076 + 0.003 + 0.042$
277	W12X53	$0.089 = 0.043 + 0.003 + 0.042$
278	W12X53	$0.065 = 0.01 + 0.003 + 0.051$
313	W12X53	$0.131 = 0.025 + 0.091 + 0.015$
314	W12X53	$0.215 = 0.017 + 0.096 + 0.102$
315	W12X53	$0.133 = 0.023 + 0.094 + 0.015$
341	W12X53	$0.127 = 0.072 + 0.003 + 0.051$
342	W12X53	$0.351 = 0.327 + 0.003 + 0.021$
343	W12X53	$0.139 = 0.029 + 0.093 + 0.017$
346	W12X72	$0.361 = 0.351 + 0.006 + 0.004$
347	W12X72	$0.594 = 0.554 + 0.04 + 1.933\text{E-}04$
348	W12X72	$0.591 = 0.551 + 0.04 + 1.989\text{E-}04$
349	W12X72	$0.359 = 0.349 + 0.006 + 0.004$
350	W12X72	$0.101 = 0.076 + 0.025 + 0$
352	W12X72	$0.623 = 0.58 + 0.043 + 0$
353	W12X72	$0.615 = 0.572 + 0.043 + 0$
354	W12X72	$0.095 = 0.07 + 0.025 + 2.439\text{E-}04$
355	W12X72	$0.327 = 0.315 + 0.007 + 0.005$
356	W12X72	$0.594 = 0.554 + 0.04 + 1.808\text{E-}04$
357	W12X72	$0.591 = 0.55 + 0.041 + 2.018\text{E-}04$
358	W12X72	$0.323 = 0.309 + 0.007 + 0.006$
359	W12X45	$0.101 = 0.084 + 0.017 + 0$
362	W12X53	$0.304 = 0.03 + 0.269 + 0.004$
416	W12X87	$0.656 = 0.366 + 0.289 + 0.001$
418	W12X87	$0.656 = 0.367 + 0.288 + 0.001$
420	W12X87	$0.649 = 0.366 + 0.283 + 0$
423	W12X87	$0.647 = 0.367 + 0.28 + 2.541\text{E-}04$
425	W12X87	$0.656 = 0.37 + 0.286 + 0.001$
427	W12X87	$0.654 = 0.369 + 0.284 + 0.001$
429	W12X53	$0.221 = 0.017 + 0.096 + 0.108$
431	W12X53	$0.23 = 0.02 + 0.098 + 0.113$
546	W8X40	$0.079 = 0.039 + 0.003 + 0.038$
547	W8X31	$0.506 = 0.055 + 0.026 + 0.424$
548	W8X40	$0.555 = 0.249 + 0.02 + 0.287$
549	W8X40	$0.556 = 0.25 + 0.02 + 0.287$
550	W8X31	$0.507 = 0.056 + 0.026 + 0.424$
551	W8X40	$0.079 = 0.044 + 0.003 + 0.033$
552	W8X40	$0.023 = 0.017 + 0.003 + 0.003$
553	W8X31	$0.13 = 0.036 + 0.028 + 0.066$
554	W8X40	$0.117 = 0.043 + 0.024 + 0.05$

555	W8X40	$0.118 = 0.043 + 0.024 + 0.05$
556	W8X31	$0.13 = 0.036 + 0.028 + 0.066$
557	W8X40	$0.024 = 0.015 + 0.003 + 0.006$
558	W8X48	$0.022 = 0.019 + 0.003 + 0$
559	W8X48	$0.79 = 0.765 + 0.024 + 0$
560	W8X48	$0.655 = 0.631 + 0.024 + 0$
561	W8X48	$0.656 = 0.631 + 0.024 + 0$
562	W8X48	$0.791 = 0.767 + 0.024 + 0$
563	W8X48	$0.022 = 0.018 + 0.003 + 0$
564	W8X48	$0.049 = 0.046 + 0.003 + 0$
565	W8X48	$0.261 = 0.237 + 0.024 + 0$
566	W8X48	$0.67 = 0.646 + 0.024 + 0$
567	W8X48	$0.67 = 0.646 + 0.024 + 0$
568	W8X48	$0.261 = 0.237 + 0.024 + 0$
569	W8X48	$0.049 = 0.046 + 0.003 + 0$
588	W8X40	$0.008 = 0.004 + 0.003 + 0$
589	W8X40	$0.007 = 0.003 + 0.003 + 0$
590	W8X40	$0.008 = 0.005 + 0.003 + 0$
591	W8X40	$0.007 = 0.003 + 0.003 + 0$
594	W8X31	$0.107 = 0.055 + 0.003 + 0.05$
595	W8X31	$0.493 = 0.041 + 0.027 + 0.424$
596	W8X40	$0.554 = 0.248 + 0.02 + 0.287$
597	W8X40	$0.552 = 0.245 + 0.02 + 0.287$
598	W8X31	$0.475 = 0.022 + 0.029 + 0.424$
599	W8X31	$0.118 = 0.066 + 0.003 + 0.05$
600	W8X31	$0.025 = 0.015 + 0.003 + 0.008$
601	W8X31	$0.128 = 0.034 + 0.028 + 0.066$
602	W8X40	$0.112 = 0.038 + 0.024 + 0.05$
603	W8X40	$0.122 = 0.048 + 0.024 + 0.05$
604	W8X31	$0.133 = 0.039 + 0.028 + 0.066$
605	W8X31	$0.028 = 0.018 + 0.003 + 0.008$
630	W8X31	$0.32 = 0.318 + 0.002 + 0$
631	W8X31	$0.288 = 0.259 + 0.029 + 0$
632	W8X31	$0.694 = 0.664 + 0.03 + 0$
633	W8X31	$0.696 = 0.666 + 0.03 + 0$
634	W8X31	$0.29 = 0.261 + 0.029 + 0$
635	W8X31	$0.277 = 0.274 + 0.002 + 0$
636	W8X31	$0.197 = 0.027 + 0.156 + 0.014$
637	W8X31	$0.426 = 0.024 + 0.363 + 0.038$
638	W8X31	$0.333 = 0.058 + 0.249 + 0.025$
639	W8X31	$0.332 = 0.058 + 0.249 + 0.025$
640	W8X31	$0.426 = 0.024 + 0.363 + 0.039$

641	W8X31	$0.233 = 0.031 + 0.164 + 0.038$
642	W8X48	$0.036 = 0.033 + 0.003 + 0$
643	W8X48	$0.714 = 0.69 + 0.024 + 0$
644	W8X48	$0.772 = 0.747 + 0.024 + 0$
645	W8X48	$0.769 = 0.745 + 0.024 + 0$
646	W8X48	$0.716 = 0.691 + 0.024 + 0$
647	W8X48	$0.036 = 0.033 + 0.003 + 0$
648	W8X48	$0.05 = 0.046 + 0.003 + 0$
649	W8X48	$0.26 = 0.236 + 0.024 + 0$
666	W8X31	$0.318 = 0.316 + 0.002 + 0$
667	W8X31	$0.238 = 0.21 + 0.029 + 0$
668	W8X31	$0.706 = 0.675 + 0.03 + 0$
669	W8X31	$0.681 = 0.65 + 0.03 + 0$
670	W8X31	$0.127 = 0.095 + 0.032 + 0$
671	W8X31	$0.265 = 0.262 + 0.002 + 0$
672	W8X31	$0.202 = 0.023 + 0.159 + 0.02$
673	W8X31	$0.409 = 0.01 + 0.361 + 0.038$
674	W8X31	$0.332 = 0.06 + 0.247 + 0.025$
675	W8X31	$0.333 = 0.06 + 0.249 + 0.025$
676	W8X31	$0.421 = 0.017 + 0.364 + 0.039$
677	W8X31	$0.248 = 0.033 + 0.166 + 0.049$
694	W8X48	$0.659 = 0.635 + 0.024 + 0$
695	W8X48	$0.659 = 0.635 + 0.024 + 0$
696	W8X48	$0.26 = 0.236 + 0.024 + 0$
697	W8X48	$0.05 = 0.046 + 0.003 + 0$
698	W8X48	$0.023 = 0.02 + 0.003 + 0$
699	W8X48	$0.777 = 0.752 + 0.024 + 0$
700	W8X48	$0.644 = 0.62 + 0.024 + 0$
701	W8X48	$0.639 = 0.614 + 0.024 + 0$
702	W8X48	$0.77 = 0.746 + 0.024 + 0$
703	W8X48	$0.022 = 0.019 + 0.003 + 0$
704	W8X31	$0.049 = 0.014 + 0.026 + 0.01$
705	L6X6X7/8	$0.178 = 0.132 + 0.044 + 0.002$
706	L6X6X7/8	$0.535 = 0.487 + 0.024 + 0.024$
707	L6X6X7/8	$0.186 = 0.081 + 0.076 + 0.028$
708	L6X6X5/16	$0.278 = 0.235 + 0.001 + 0.041$
709	L6X6X5/16	$0.345 = 0.25 + 0.034 + 0.061$
710	L6X6X5/16	$0.12 = 0.087 + 0.017 + 0.017$
711	L6X6X5/16	$0.214 = 0.14 + 0.014 + 0.06$
712	L6X6X5/16	$0.221 = 0.175 + 0.034 + 0.012$
713	L6X6X5/16	$0.203 = 0.153 + 0.045 + 0.004$
714	L6X6X5/16	$0.202 = 0.153 + 0.044 + 0.005$

715	L6X6X5/16	$0.222 = 0.176 + 0.034 + 0.012$
716	L6X6X5/16	$0.214 = 0.14 + 0.014 + 0.06$
717	L6X6X5/16	$0.099 = 0.065 + 0.017 + 0.017$
718	L6X6X5/16	$0.345 = 0.25 + 0.034 + 0.061$
719	L6X6X5/16	$0.273 = 0.23 + 0.002 + 0.041$
720	L6X6X7/8	$0.186 = 0.082 + 0.077 + 0.028$
721	L6X6X7/8	$0.517 = 0.469 + 0.025 + 0.023$
722	L6X6X7/8	$0.187 = 0.14 + 0.044 + 0.002$
723	W8X31	$0.052 = 0.022 + 0.023 + 0.006$
724	W8X31	$0.118 = 0.083 + 0.026 + 0.009$
725	L6X6X7/8	$0.601 = 0.557 + 0.008 + 0.036$
726	L6X6X7/8	$0.152 = 0.038 + 0.079 + 0.035$
727	L6X6X7/8	$0.378 = 0.337 + 0.026 + 0.015$
728	L6X6X5/16	$0.342 = 0.228 + 0.05 + 0.064$
729	L6X6X5/16	$0.14 = 0.098 + 0.01 + 0.032$
730	L6X6X5/16	$0.354 = 0.271 + 0.022 + 0.061$
731	L6X6X5/16	$0.21 = 0.169 + 0.025 + 0.016$
732	L6X6X5/16	$0.198 = 0.139 + 0.008 + 0.052$
733	L6X6X5/16	$0.239 = 0.196 + 0.04 + 0.003$
734	L6X6X5/16	$0.239 = 0.196 + 0.039 + 0.004$
735	L6X6X5/16	$0.199 = 0.139 + 0.008 + 0.052$
736	L6X6X5/16	$0.208 = 0.167 + 0.013 + 0.027$
737	L6X6X5/16	$0.354 = 0.271 + 0.022 + 0.061$
738	L6X6X5/16	$0.146 = 0.104 + 0.01 + 0.032$
739	L6X6X5/16	$0.341 = 0.228 + 0.05 + 0.063$
740	L6X6X7/8	$0.399 = 0.358 + 0.025 + 0.016$
741	L6X6X7/8	$0.15 = 0.037 + 0.078 + 0.035$
742	L6X6X7/8	$0.624 = 0.578 + 0.009 + 0.037$
743	W8X31	$0.122 = 0.088 + 0.023 + 0.01$
744	W8X31	$0.049 = 0.046 + 0.003 + 0$
745	W8X31	$0.023 = 0.02 + 0.003 + 0$
746	W8X31	$0.033 = 0.03 + 0.003 + 0$
747	W8X31	$0.042 = 0.039 + 0.003 + 0$
748	W8X31	$0.052 = 0.048 + 0.003 + 0$
749	W8X31	$0.055 = 0.051 + 0.003 + 0$
750	W8X31	$0.055 = 0.051 + 0.003 + 0$
751	W8X31	$0.052 = 0.048 + 0.003 + 0$
752	W8X31	$0.041 = 0.038 + 0.003 + 0$
753	W8X31	$0.033 = 0.029 + 0.003 + 0$
754	W8X31	$0.024 = 0.02 + 0.003 + 0$
755	W8X31	$0.051 = 0.048 + 0.003 + 0$
756	W8X31	$0.052 = 0.016 + 0.027 + 0.009$

757	L6X6X7/8	0.197 = 0.096 + 0.064 + 0.037
758	L6X6X7/8	0.546 = 0.495 + 0.03 + 0.021
759	L6X6X7/8	0.189 = 0.081 + 0.083 + 0.024
760	L6X6X5/16	0.232 = 0.191 + 0.018 + 0.024
761	L6X6X5/16	0.338 = 0.241 + 0.027 + 0.07
762	L6X6X5/16	0.124 = 0.091 + 0.015 + 0.018
763	L6X6X5/16	0.193 = 0.119 + 0.015 + 0.059
764	L6X6X5/16	0.216 = 0.167 + 0.011 + 0.038
765	L6X6X5/16	0.208 = 0.154 + 0.004 + 0.05
766	L6X6X5/16	0.206 = 0.152 + 0.005 + 0.05
767	L6X6X5/16	0.221 = 0.171 + 0.011 + 0.039
768	L6X6X5/16	0.192 = 0.118 + 0.014 + 0.059
769	L6X6X5/16	0.122 = 0.091 + 0.013 + 0.017
770	L6X6X5/16	0.337 = 0.24 + 0.026 + 0.07
771	L6X6X5/16	0.213 = 0.17 + 0.019 + 0.024
772	L6X6X7/8	0.188 = 0.08 + 0.084 + 0.024
773	L6X6X7/8	0.506 = 0.454 + 0.031 + 0.021
774	L6X6X7/8	0.204 = 0.1 + 0.065 + 0.038
775	W8X31	0.051 = 0.022 + 0.024 + 0.006
776	W8X31	0.119 = 0.085 + 0.026 + 0.009
777	L6X6X7/8	0.604 = 0.546 + 0.045 + 0.013
778	L6X6X7/8	0.153 = 0.036 + 0.084 + 0.033
779	L6X6X7/8	0.37 = 0.325 + 0.03 + 0.015
780	L6X6X5/16	0.315 = 0.2 + 0.038 + 0.078
781	L6X6X5/16	0.136 = 0.097 + 0.029 + 0.01
782	L6X6X5/16	0.354 = 0.27 + 0.021 + 0.063
783	L6X6X5/16	0.212 = 0.17 + 0.014 + 0.028
784	L6X6X5/16	0.195 = 0.136 + 0.004 + 0.055
785	L6X6X5/16	0.221 = 0.172 + 0.003 + 0.045
786	L6X6X5/16	0.217 = 0.169 + 0.004 + 0.044
787	L6X6X5/16	0.198 = 0.137 + 0.005 + 0.055
788	L6X6X5/16	0.207 = 0.165 + 0.014 + 0.028
789	L6X6X5/16	0.355 = 0.272 + 0.021 + 0.063
790	L6X6X5/16	0.149 = 0.11 + 0.029 + 0.011
791	L6X6X5/16	0.315 = 0.2 + 0.038 + 0.077
792	L6X6X7/8	0.413 = 0.367 + 0.03 + 0.016
793	L6X6X7/8	0.153 = 0.037 + 0.082 + 0.034
794	L6X6X7/8	0.643 = 0.583 + 0.046 + 0.015
795	W8X31	0.122 = 0.089 + 0.023 + 0.01
796	W8X31	0.051 = 0.048 + 0.003 + 0
797	W8X31	0.023 = 0.019 + 0.003 + 0
798	W8X31	0.033 = 0.03 + 0.003 + 0

799	W8X31	$0.042 = 0.039 + 0.003 + 0$
800	W8X31	$0.052 = 0.049 + 0.003 + 0$
801	W8X31	$0.055 = 0.051 + 0.003 + 0$
802	W8X31	$0.054 = 0.051 + 0.003 + 0$
803	W8X31	$0.051 = 0.048 + 0.003 + 0$
804	W8X31	$0.041 = 0.038 + 0.003 + 0$
805	W8X31	$0.032 = 0.029 + 0.003 + 0$
806	W8X31	$0.024 = 0.021 + 0.003 + 0$
807	W8X31	$0.052 = 0.049 + 0.003 + 0$
808	W8X58	$0.431 = 0.299 + 0.124 + 0.008$
809	W8X58	$0.709 = 0.559 + 0.145 + 0.005$
810	W8X31	$0.467 = 0.391 + 0.076 + 0$
811	W8X31	$0.268 = 0.098 + 0.17 + 0$
812	W8X31	$0.321 = 0.229 + 0.091 + 0$
813	W8X31	$0.322 = 0.23 + 0.091 + 0$
814	W8X31	$0.323 = 0.294 + 0.029 + 0$
815	W8X31	$0.467 = 0.391 + 0.076 + 0$
816	W8X58	$0.669 = 0.517 + 0.145 + 0.007$
817	W8X58	$0.437 = 0.3 + 0.126 + 0.01$
818	L8X8X1/2	$0.773 = 0.626 + 0.081 + 0.066$
819	L8X8X1/2	$0.542 = 0.291 + 0.147 + 0.104$
820	L8X8X1/2	$0.67 = 0.344 + 0.196 + 0.13$
821	L8X8X1/2	$0.567 = 0.241 + 0.196 + 0.13$
822	L8X8X1/2	$0.564 = 0.238 + 0.196 + 0.13$
823	L8X8X1/2	$0.674 = 0.347 + 0.196 + 0.13$
824	L8X8X1/2	$0.685 = 0.435 + 0.147 + 0.104$
825	L8X8X1/2	$0.705 = 0.558 + 0.081 + 0.066$
826	L8X8X1/2	$0.43 = 0.283 + 0.081 + 0.066$
827	L8X8X1/2	$0.784 = 0.534 + 0.147 + 0.104$
828	L8X8X1/2	$0.647 = 0.321 + 0.196 + 0.13$
829	L8X8X1/2	$0.572 = 0.245 + 0.196 + 0.13$
830	L8X8X1/2	$0.568 = 0.242 + 0.196 + 0.13$
831	L8X8X1/2	$0.656 = 0.33 + 0.196 + 0.13$
832	L8X8X1/2	$0.892 = 0.641 + 0.147 + 0.104$
833	L8X8X1/2	$0.472 = 0.325 + 0.081 + 0.066$
834	W8X58	$0.419 = 0.282 + 0.128 + 0.009$
835	W8X58	$0.668 = 0.513 + 0.149 + 0.006$
836	W8X31	$0.463 = 0.387 + 0.076 + 0$
837	W8X31	$0.333 = 0.305 + 0.029 + 0$
838	W8X31	$0.32 = 0.228 + 0.091 + 0$
839	W8X31	$0.315 = 0.223 + 0.092 + 0$
840	W8X31	$0.249 = 0.079 + 0.17 + 0$

841	W8X31	$0.451 = 0.374 + 0.077 + 0$
842	W8X58	$0.679 = 0.532 + 0.145 + 0.003$
843	W8X58	$0.38 = 0.252 + 0.126 + 0.002$
844	W8X31	$0.371 = 0.006 + 0.316 + 0.05$
845	W8X31	$0.372 = 0.043 + 0.324 + 0.005$
846	W8X31	$0.436 = 0.08 + 0.327 + 0.029$
847	W8X31	$0.436 = 0.081 + 0.327 + 0.028$
848	W8X31	$0.375 = 0.045 + 0.324 + 0.006$
849	W8X31	$0.371 = 0.006 + 0.315 + 0.05$
850	W8X31	$0.16 = 0.004 + 0.155 + 3.824\text{E-}04$
851	W8X31	$0.492 = 0.006 + 0.485 + 0$
852	W8X31	$0.201 = 0.007 + 0.193 + 1.12\text{E-}04$
853	W8X31	$0.203 = 0.005 + 0.198 + 0$
854	W8X31	$0.491 = 0.006 + 0.485 + 1.239\text{E-}04$
855	W8X31	$0.16 = 0.003 + 0.156 + 0.001$
856	W8X31	$0.367 = 0.006 + 0.314 + 0.047$
857	W8X31	$0.373 = 0.044 + 0.323 + 0.006$
858	W8X31	$0.436 = 0.08 + 0.326 + 0.029$
859	W8X31	$0.435 = 0.081 + 0.326 + 0.028$
860	W8X31	$0.374 = 0.045 + 0.323 + 0.006$
861	W8X31	$0.366 = 0.006 + 0.312 + 0.048$
862	W8X31	$0.022 = 0.001 + 0.002 + 0.019$
863	W8X31	$0.03 = 0.002 + 0.005 + 0.023$
864	W8X31	$0.017 = 0.012 + 0.003 + 0.002$
865	W8X31	$0.022 = 0.003 + 0.001 + 0.018$
866	W8X31	$0.032 = 0.001 + 0.001 + 0.029$
867	W8X31	$0.039 = 0.001 + 0.002 + 0.036$
868	W8X31	$0.045 = 0.003 + 0.004 + 0.039$
869	W8X31	$0.028 = 0.002 + 0.003 + 0.023$
870	W8X31	$0.023 = 0.002 + 3.997\text{E-}04 + 0.021$
871	W8X31	$0.018 = 0.012 + 0.003 + 0.002$
872	W8X31	$0.022 = 0.003 + 0.001 + 0.018$
873	W8X31	$0.033 = 0.002 + 0.001 + 0.03$
874	W8X31	$0.04 = 0.001 + 0.002 + 0.037$
875	W8X31	$0.047 = 0.003 + 0.003 + 0.041$
876	W8X31	$0.021 = 0 + 0.002 + 0.019$
877	W8X31	$0.029 = 0.002 + 0.005 + 0.023$
878	W8X31	$0.04 = 0.001 + 0.002 + 0.037$
879	W8X31	$0.033 = 0.002 + 0.001 + 0.03$
880	W8X31	$0.022 = 0.003 + 0.001 + 0.018$
881	W8X31	$0.018 = 0.011 + 0.001 + 0.006$
882	W8X31	$0.017 = 0.012 + 0.003 + 0.002$

883	W8X31	$0.022 = 0.003 + 0.001 + 0.019$
884	W8X31	$0.033 = 0.001 + 0.001 + 0.03$
885	W8X31	$0.04 = 0.001 + 0.002 + 0.036$
886	W8X31	$0.046 = 0.003 + 0.004 + 0.04$
887	W8X31	$0.047 = 0.003 + 0.003 + 0.041$
888	W8X31	$0.027 = 0.002 + 0.005 + 0.021$
889	W8X31	$0.018 = 1.181\text{E-}04 + 0.002 + 0.016$

Hangar - Beam 178

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	B1	178	12.12424	DStIS7-1	Special Concentrically Braced Frame	W12X45	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
22.30000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.101	0.305	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.091	0.000061	0.016782	0.002411	0.0643	0.0281

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.033287	0.007189	0.037153	0.010995	0.42951	0.16281	0.000556

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	21.43333	0.42951	49.902	200	49.902	300
Minor (2-2)	1	21.43333	0.16281	131.65	200	131.65	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
12.12424	-65.995	3.0463	-21.3558	0.059	-0.341	-0.0521

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	0.961	1	1	1	1	1

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	0.961	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.961	1	1.136

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.668 =	0.386 + 0.015 + 0.266

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
65.995	170.753	589.5

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	3.0463	178.4817	240.75	157.0639
Minor Bending	21.3558	71.25		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.059	121.605	4.835E-04
Minor Shear	0.341	249.953	0.001

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.659	DStIS1	0.679	DStIS1

Hangar - Beam 352

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	B181	352	98.35	DSIS47-3	Special Concentrically Braced Frame	W12X72	Seismic MD

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
98.35000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-0.279	-0.815	1	0.8	0.8

Seismic Parameters

Ignore Seismic Code?	Ignore Special EQ Load?	Plug Welded?	SDC	I	Rho	S _{DS}	R	Ω_0	C _d
No	No	Yes	D	1.25	1	0.59	6	2	5

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R1}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1465	0.000141	0.028791	0.009404	0.1117	0.0367

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.056177	0.018808	0.0625	0.028472	0.44327	0.25333	0.002185

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	98.35	0.44327	221.876	200	221.876	300
Minor (2-2)	1	32.78333	0.25333	129.407	200	129.407	300

Stress Check Message - Section is not seismically compact for highly ductile members (AISC 341-16 F2.5a, D1.1, Table D1.1)

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
98.35	293.994	0	0	1.473	0.006	-0.0001

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	1	1	1	1	1
Minor Bending	0.333	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
0.333	1	1.249

Demand/Capacity (D/C) Ratio Eqn.(H1.2,H1-1a)

D/C Ratio =	$(P_r / P_c) + (8/9)(M_{r33} / M_{c33}) + (8/9)(M_{r22} / M_{c22})$
0.31 =	0.31 + 0 + 0

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
293.994	96.828	949.5

Moments and Capacities

	M _u Moment (kip-ft)	φM _n (kip-ft)	φM _n No LTB (kip-ft)	φM _n Cb=1 (kip-ft)
Major Bending	0	351.2678	405	281.179
Minor Bending	0	184.5		

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	1.473	158.67	0.009
Minor Shear	0.006	434.16	1.301E-05

Hangar - Beam 420

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story33	B193	420	120.73491	DStIS47-3	Special Concentrically Braced Frame	W12X87	Seismic MD

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
121.06371	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.212	0.083	1	0.8	0.8

Seismic Parameters

Ignore Seismic Code?	Ignore Special EQ Load?	Plug Welded?	SDC	I	Rho	S _{DS}	R	Ω_0	C _d
No	No	Yes	D	1.25	1	0.59	6	2	5

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R1}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1778	0.000246	0.035687	0.011622	0.1361	0.0447

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.068519	0.023052	0.076389	0.034954	0.44804	0.25569	0.002736

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	11.18823	0.44804	24.972	200	24.972	300
Minor (2-2)	1	12.10637	0.25569	47.349	200	47.349	300

Stress Check Message - Section is not seismically compact for highly ductile members (AISC 341-16 F2.5a, D1.1, Table D1.1)

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
120.73491	-271.754	-35.4919	-0.0387	8.5	-0.023	0.0026

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	0.092	1	1	1	1	1
Minor Bending	0.1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
0.1	1	1.295

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r / P_c) + (8/9)(M_{r33} / M_{c33}) + (8/9)(M_{r22} / M_{c22})$
0.342 =	0.278 + 0.064 + 1.521E-04

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
271.754	977.828	1152

Moments and Capacities

	M _u Moment (kip-ft)	φM _n (kip-ft)	φM _n No LTB (kip-ft)	φM _n C _b =1 (kip-ft)
Major Bending	35.4919	495	495	487.6874
Minor Bending	0.0387	226.5		

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	8.5	193.125	0.044
Minor Shear	0.023	529.254	4.387E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
		16.54	DS1S21-3

Hangar - Beam 668

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	B126	668	24.6	DSIS47-3	Special Concentrically Braced Frame	W8X31	Non-Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
24.60000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.096	0.36	1	0.8	0.8

Seismic Parameters

Ignore Seismic Code?	Ignore Special EQ Load?	Plug Welded?	SDC	I	Rho	S _{DS}	R	Ω_0	C _d
No	No	Yes	D	1.25	1	0.59	6	2	5

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R1}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.0634	0.000026	0.005305	0.001789	0.0483	0.0158

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.015914	0.005367	0.017593	0.00816	0.28925	0.16798	0.000178

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	24.6	0.28925	85.046	200	85.046	300
Minor (2-2)	1	24.6	0.16798	146.442	200	146.442	300

Stress Check Message - Section is not seismically compact for highly ductile members (AISC 341-16 F2.5a, D1.1, Table D1.1)

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
24.6	-43.812	0	0	0.489	-0.017	-0.002

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
1	1	1.136

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r / P_c) + (8/9)(M_{r33} / M_{c33}) + (8/9)(M_{r22} / M_{c22})$
0.456 =	0.456 + 0 + 0

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
43.812	96.179	410.85

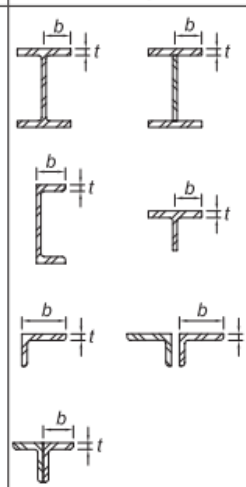
Moments and Capacities

	M _u Moment (kip-ft)	φM _n (kip-ft)	φM _n No LTB (kip-ft)	φM _n Cb=1 (kip-ft)
Major Bending	0	82.5191	113.8774	72.6168
Minor Bending	0	52.7913		

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	0.489	68.4	0.007
Minor Shear	0.017	187.92	8.82E-05

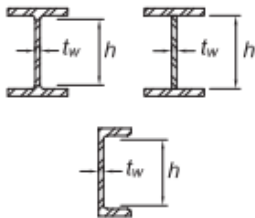
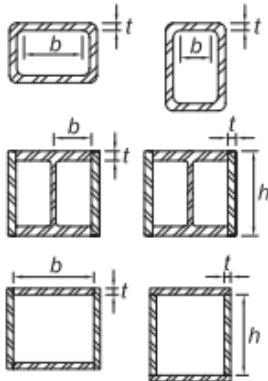
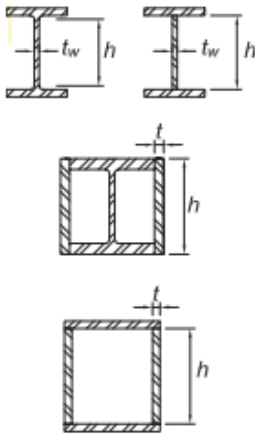
Highly Ductile Requirement and Unbraced Lengths from AISC 341 for SCBF Beams:

TABLE D1.1 Limiting Width-to-Thickness Ratios for Compression Elements for Moderately Ductile and Highly Ductile Members				
Description of Element	Width-to-Thickness Ratio	Limiting Width-to-Thickness Ratio		Example
		λ_{hd} Highly Ductile Members	λ_{md} Moderately Ductile Members	
Unstiffened Elements Flanges of rolled or built-up I-shaped sections, channels and tees; legs of single angles or double-angle members with separators; outstanding legs of pairs of angles in continuous contact	b/t	$0.32 \sqrt{\frac{E}{R_y F_y}}$	$0.40 \sqrt{\frac{E}{R_y F_y}}$	

W8x40: $b/t (=7.2) \leq 0.32 \sqrt{\frac{29000}{1.1 \times 50}} = 7.35$

W12x45: $b/t (=7) \leq 0.32 \sqrt{\frac{29000}{1.1 \times 50}} = 7.35$

TABLE D1.1 (continued)
Limiting Width-to-Thickness Ratios for
Compression Elements for Moderately Ductile
and Highly Ductile Members

Description of Element	Width-to-Thickness Ratio	Limiting Width-to-Thickness Ratio		Example
		λ_{hd} Highly Ductile Members	λ_{md} Moderately Ductile Members	
Webs of rolled or built-up I shaped sections and channels used as diagonal braces	h/t_w	$1.57 \sqrt{\frac{E}{R_y F_y}}$	$1.57 \sqrt{\frac{E}{R_y F_y}}$	
Where used in beams or columns as flanges in uniform compression due to axial, flexure, or combined axial and flexure: 1) Walls of rectangular HSS 2) Flanges and side plates of boxed I-shaped sections, webs and flanges of built-up box shapes	b/t h/t	$0.65 \sqrt{\frac{E}{R_y F_y}}$	$1.18 \sqrt{\frac{E}{R_y F_y}}$	
Where used in beams, columns, or links, as webs in flexure, or combined axial and flexure: 1) Webs of rolled or built-up I-shaped sections or channels ^[b] 2) Side plates of boxed I-shaped sections 3) Webs of built-up box sections	h/t_w h/t h/t	For $C_a \leq 0.114$ $2.57 \sqrt{\frac{E}{R_y F_y}} (1 - 1.04 C_a)$ For $C_a > 0.114$ $0.88 \sqrt{\frac{E}{R_y F_y}} (2.68 - C_a)$ $\geq 1.57 \sqrt{\frac{E}{R_y F_y}}$ where $C_a = \frac{P_u}{\phi_c P_y}$ (LRFD) $C_a = \frac{\Omega_c P_a}{P_y}$ (ASD) $P_y = R_y F_y A_g$	For $C_a \leq 0.114$ $3.96 \sqrt{\frac{E}{R_y F_y}} (1 - 3.04 C_a)$ For $C_a > 0.114$ $1.29 \sqrt{\frac{E}{R_y F_y}} (2.12 - C_a)$ $\geq 1.57 \sqrt{\frac{E}{R_y F_y}}$ where $C_a = \frac{P_u}{\phi_c P_y}$ (LRFD) $C_a = \frac{\Omega_c P_a}{P_y}$ (ASD) $P_y = R_y F_y A_g$	

Stiffened Elements

$$\mathbf{W8x40:} \ C_a = \frac{40}{0.9 \times 1.1 \times 50 \times 11.7} = 0.07 \leq 0.114$$

$$h/t_w (=23) \leq 2.57 \sqrt{\frac{29000}{1.1 \times 50}} (1 - 1.04 \times 0.07) = 55$$

$$\mathbf{W12x45:} \ C_a = \frac{40}{0.9 \times 1.1 \times 50 \times 13.1} = 0.06 \leq 0.114$$

$$h/t_w (=36) \leq 2.57 \sqrt{\frac{29000}{1.1 \times 50}} (1 - 1.04 \times 0.06) = 55$$

Highly Ductile Members

In addition to the requirements of Sections D1.2a.1(a) and (b), and D1.2a.2(a) and (b), the bracing of highly ductile beam members shall have a maximum spacing of $L_b = 0.095 r_y E / (R_y F_y)$. For concrete-encased composite beams, the material properties of the steel section shall be used and the calculation for r_y in the plane of buckling shall be based on the elastic transformed section.

$$\text{W8x40: } L_b = 0.095 \times 2.04 \times \frac{29000}{1.1 \times 50} = 8.5'$$

$$\text{W12x45: } L_b = 0.095 \times 1.95 \times \frac{29000}{1.1 \times 50} = 8.1'$$

Hangar

SCBF Beam Section	Frame	Label	Actual Length (ft)	Calculated L _b Length (ft)	Bracing Required (brace size /spacing of brace)	P _{br} (kips)	φ _c P _n (kips)	β _{br} (K/in)	K _{brace} (K/in)
W12x45	A.1	64	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.1	160	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.1	343	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W12x45	A.1	21	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.1	172	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.1	66	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W12x45	A.3	88	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.3	158	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.3	362	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W12x45	A.3	231	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.3	68	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	A.3	149	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W12x45	D.7	250	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.7	71	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.7	230	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W12x45	D.7	337	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.7	89	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.7	232	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W12x45	D.9	409	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.9	112	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.9	313	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W12x45	D.9	338	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.9	150	22	8.1	L4x4x1/4 / 7.3'	6.5	28	45	483
W12x45	D.9	315	22	8.1	W8x31 / 7.3'	6.5	283	45	1471
W8x40	1.1	549	24	8.5	L4x4x1/4 / 8'	6	28	38	405
W8x40	1.1	555	24	8.5	L4x4x1/4 / 8'	6	28	38	405
W8x40	1.1	341	8.2	8.5	-	-	-	-	-
W8x40	1.1	332	8.2	8.5	-	-	-	-	-

W8x40	1.1	546	8.2	8.5	-	-	-	-	-
W8x40	1.1	552	8.2	8.5	-	-	-	-	-
W8x40	1.1	344	8.2	8.5	-	-	-	-	-
W8x40	1.1	342	8.2	8.5	-	-	-	-	-
W8x40	1.1	551	8.2	8.5	-	-	-	-	-
W8x40	1.1	557	8.2	8.5	-	-	-	-	-
W8x40	3.9	589	8.2	8.5	-	-	-	-	-
W8x40	3.9	588	8.2	8.5	-	-	-	-	-
W8x40	3.9	594	8.2	8.5	-	-	-	-	-
W8x40	3.9	600	8.2	8.5	-	-	-	-	-
W8x40	3.9	591	8.2	8.5	-	-	-	-	-
W8x40	3.9	590	8.2	8.5	-	-	-	-	-
W8x40	3.9	599	8.2	8.5	-	-	-	-	-
W8x40	3.9	605	8.2	8.5	-	-	-	-	-
W8x40	3.9	596	24	8.5	L4x4x1/4 / 8'	6	28	38	405
W8x40	3.9	602	24	8.5	L4x4x1/4 / 8'	6	28	38	405

Hangar – All column sections with DC ratios (Lateral Design)

Label	Section	D/C Ratio
2	W10X68	0.09
3	W10X68	0.1
4	W10X68	0.074
5	W10X68	0.07
7	W8X31	0.011
8	W10X68	0.842
9	W10X68	0.767
10	W10X68	0.912
11	W10X68	0.772
30	W8X31	0.095
31	W8X31	0.087
32	W8X31	0.074
33	W8X31	0.07
34	W8X31	0.058
35	W8X31	0.045
36	W8X31	0.031
37	W8X31	0.017
38	W8X31	0.016
39	W8X31	0.03
40	W8X31	0.044
41	W8X31	0.057
42	W8X31	0.069
43	W8X31	0.073
44	W8X31	0.087
45	W8X31	0.094
85	W10X68	0.123
86	W10X68	0.133
87	W10X68	0.134
90	W8X31	0.015
91	W10X68	0.462
92	W10X68	0.432
93	W10X68	0.457
94	W10X68	0.427
113	W8X31	0.554
114	W8X31	0.08
115	W8X31	0.772
116	W8X31	0.352
117	W8X31	0.286
118	W8X31	0.215

119	W8X31	0.076
120	W8X31	0.046
121	W8X31	0.045
122	W8X31	0.075
123	W8X31	0.212
124	W8X31	0.283
125	W8X31	0.349
126	W8X31	0.437
127	W8X31	0.515
128	W8X31	0.55
147	W10X68	0.274
168	W10X68	0.117
169	W10X68	0.127
170	W10X68	0.137
173	W8X31	0.354
174	W10X68	0.457
175	W10X68	0.412
176	W10X68	0.481
177	W10X68	0.406
196	W8X31	0.555
197	W8X31	0.52
198	W8X31	0.42
199	W8X31	0.353
200	W8X31	0.287
201	W8X31	0.216
202	W8X31	0.077
203	W8X31	0.047
204	W8X31	0.044
205	W8X31	0.073
206	W8X31	0.21
207	W8X31	0.28
208	W8X31	0.346
209	W8X31	0.435
210	W8X31	0.513
211	W8X31	0.548
251	W10X68	0.098
252	W10X68	0.1
253	W10X68	0.084
256	W8X31	0.011
257	W10X68	0.87
258	W10X68	0.752
259	W10X68	0.919

260	W10X68	0.756
279	W8X31	0.095
280	W8X31	0.087
281	W8X31	0.074
282	W8X31	0.069
283	W8X31	0.057
284	W8X31	0.044
285	W8X31	0.031
286	W8X31	0.017
287	W8X31	0.016
288	W8X31	0.03
289	W8X31	0.044
290	W8X31	0.057
291	W8X31	0.069
292	W8X31	0.073
293	W8X31	0.087
294	W8X31	0.094
333	W12X136	0.743
334	W12X136	0.343
335	W12X136	0.745
336	W12X136	0.348
339	W8X31	0.624
344	W10X68	0.282
351	W8X31	0.627
361	W10X68	0.071
363	W8X31	0.762
364	W8X31	0.549
365	W8X31	0.446
366	W8X31	0.278
367	W8X31	0.205
368	W8X31	0.057
369	W8X31	0.019
370	W8X31	0.046
371	W8X31	0.08
372	W8X31	0.353
373	W8X31	0.046
374	W8X31	0.018
375	W8X31	0.056
376	W8X31	0.203
377	W8X31	0.202
378	W8X31	0.277
379	W8X31	0.448

380	W8X31	0.55
381	W8X31	0.627
404	W10X88	0.721
405	W10X88	0.457
406	W10X88	0.868
407	W10X88	0.351
410	W8X31	0.463
422	W8X31	0.461
434	W8X31	0.527
435	W8X31	0.482
436	W8X31	0.391
437	W8X31	0.252
438	W8X31	0.213
439	W8X31	0.06
440	W8X31	0.015
441	W8X31	0.04
442	W8X31	0.072
443	W8X31	0.26
444	W8X31	0.072
445	W8X31	0.039
446	W8X31	0.015
447	W8X31	0.061
448	W8X31	0.215
449	W8X31	0.253
450	W8X31	0.395
451	W8X31	0.485
452	W8X31	0.527
475	W12X136	0.678
476	W12X136	0.347
477	W12X136	0.721
478	W12X136	0.35
481	W8X31	0.629
493	W8X31	0.626
505	W8X31	0.766
506	W8X31	0.553
507	W8X31	0.451
508	W8X31	0.278
509	W8X31	0.203
510	W8X31	0.056
511	W8X31	0.019
512	W8X31	0.046
513	W8X31	0.08

514	W8X31	0.354
515	W8X31	0.079
516	W8X31	0.045
517	W8X31	0.018
518	W8X31	0.057
519	W8X31	0.206
520	W8X31	0.28
521	W8X31	0.452
522	W8X31	0.554
523	W8X31	0.764

Hangar - Column 8

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	C5	8	32.99167	DStIS6-1	Special Concentrically Braced Frame	W10X68	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
34.00000	0.837	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.061	0.248	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1382	0.000172	0.019001	0.006462	0.108	0.0339

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.043848	0.015356	0.049363	0.023206	0.3708	0.21624	0.001027

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	32.99167	0.3708	88.974	200	88.974	300
Minor (2-2)	1	32.99167	0.21624	152.567	200	152.567	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
32.99167	-60.654	3.747	87.354	-0.102	-16.725	0.161

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	0.97	1	1	1	1	0.6

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	0.97	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.97	1	1.584

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.841 =	0.314 + 0.01 + 0.516

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
60.654	193.141	895.5

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	3.747	319.875	319.875	227.7926
Minor Bending	87.354	150.375		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.102	146.64	0.001
Minor Shear	16.725	419.958	0.04

Hangar - Column 147

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	C3	147	0	DSIS45-3	Special Concentrically Braced Frame	W10X68	Seismic HD

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
34.00000	0.531	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.038	0.154	1	0.8	0.8

Seismic Parameters

Ignore Seismic Code?	Ignore Special EQ Load?	Plug Welded?	SDC	I	Rho	S _{DS}	R	Ω_0	C _d
No	No	Yes	D	1.25	1	0.59	6	2	5

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1382	0.000172	0.019001	0.006462	0.108	0.0339

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.043848	0.015356	0.049363	0.023206	0.3708	0.21624	0.001027

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	32.99167	0.3708	88.974	200	88.974	300
Minor (2-2)	1	32.99167	0.21624	152.567	200	152.567	300

(ASCE 2.3.6-6, 12.4.2.2, 12.4.3.1: $(1.2+0.2*S_{Ds})*D + 1.0*L - \Omega_0*Q_e$)

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	-52.978	0	0	-0.214	-0.041	0

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	0.97	1	1	1	1	0.6
Minor Bending	0.97	1	1	1	1	0.6

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
0.97	1	1.629

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	$(P_r / P_c) + (8/9)(M_{r33} / M_{c33}) + (8/9)(M_{r22} / M_{c22})$
0.274 =	0.274 + 0 + 0

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
52.978	193.141	895.5

Moments and Capacities

	M _u Moment (kip-ft)	φM _n (kip-ft)	φM _n No LTB (kip-ft)	φM _n Cb=1 (kip-ft)
Major Bending	0	319.875	319.875	227.7926
Minor Bending	0	150.375		

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	0.214	146.64	0.001
Minor Shear	0.041	419.958	9.785E-05

Hangar - Column 176

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	C52	176	32.99167	DSIS21-1	Special Concentrically Braced Frame	W10X68	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
34.00000	0.607	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.083	0.338	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1382	0.000172	0.019001	0.006462	0.108	0.0339

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.043848	0.015356	0.049363	0.023206	0.3708	0.21624	0.001027

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	32.99167	0.3708	88.974	200	88.974	300
Minor (2-2)	1	32.99167	0.21624	152.567	200	152.567	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
32.99167	-82.78	-10.419	3.6029	0.273	-0.098	0.0051

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	0.97	1	1	1	1	0.6

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	0.97	1	1	1	1	0.6

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.97	1	1.572

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.479 =	0.429 + 0.029 + 0.021

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
82.78	193.141	895.5

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	10.419	319.875	319.875	227.7926
Minor Bending	3.6029	150.375		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.273	146.64	0.002
Minor Shear	0.098	419.958	2.323E-04

Hangar - Column 406

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	C171	406	32.975	DSIS21-1	Special Concentrically Braced Frame	W10X88	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
34.00000	0.418	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.13	0.515	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1806	0.000363	0.025752	0.008632	0.1416	0.0454

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.057227	0.020114	0.065394	0.030729	0.37766	0.21865	0.001453

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.1	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	32.975	0.37766	87.314	200	87.314	300
Minor (2-2)	1	32.975	0.21865	150.809	200	150.809	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
32.975	-168.381	-101.4835	-0.6494	4.75	2.602E-04	0.0523

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	0.97	1	1	1	1	1

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	0.97	1	1	1	1	0.6

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.97	1	1.809

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.868 =	0.652 + 0.213 + 0.003

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
168.381	258.262	1170

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	101.4835	423.75	423.75	330.6082
Minor Bending	0.6494	199.125		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	4.75	196.02	0.024
Minor Shear	2.602E-04	550.638	0

Hangar – All brace sections with DC ratios (Lateral Design)

Label	Section	D/C Ratio
46	W8X31	0.207
47	W8X31	0.092
48	W8X31	0.074
49	W8X31	0.064
50	W8X31	0.051
51	W8X31	0.04
52	W8X31	0.029
53	W8X31	0.021
54	W8X31	0.026
55	W8X31	0.025
56	W8X31	0.02
57	W8X31	0.029
58	W8X31	0.039
59	W8X31	0.051
60	W8X31	0.064
61	W8X31	0.073
62	W8X31	0.092
63	W8X31	0.2
68	HSS9X9X5/8-1	0.714
69	HSS9X9X5/8-1	0.703
70	HSS5X5X1/2-1	0.637
71	HSS5X5X1/2-1	0.615
72	HSS9X9X5/8-1	0.074
73	HSS9X9X5/8-1	0.072
74	HSS5X5X1/2-1	0.076
75	HSS5X5X1/2-1	0.082
76	HSS9X9X5/8-1	0.058
77	HSS9X9X5/8-1	0.061
78	HSS5X5X1/2-1	0.092
79	HSS5X5X1/2-1	0.096
80	HSS5X5X1/2-1	0.713
81	HSS5X5X1/2-1	0.694
82	HSS9X9X5/8-1	0.698
83	HSS9X9X5/8-1	0.7
129	W8X31	0.584
130	W8X31	0.5
131	W8X31	0.395
132	W8X31	0.287
133	W8X31	0.215

134	W8X31	0.081
135	W8X31	0.056
136	W8X31	0.036
137	W8X31	0.066
138	W8X31	0.069
139	W8X31	0.035
140	W8X31	0.055
141	W8X31	0.08
142	W8X31	0.213
143	W8X31	0.284
144	W8X31	0.391
145	W8X31	0.497
146	W8X31	0.58
151	HSS9X9X5/8-1	0.884
152	HSS9X9X5/8-1	0.878
153	HSS7X7X1/2	0.826
154	HSS7X7X1/2	0.81
155	HSS9X9X5/8-1	0.094
156	HSS9X9X5/8-1	0.09
157	HSS7X7X1/2	0.293
158	HSS7X7X1/2	0.297
159	HSS9X9X5/8-1	0.098
160	HSS9X9X5/8-1	0.096
161	HSS7X7X1/2	0.279
162	HSS7X7X1/2	0.284
163	HSS7X7X1/2	0.801
164	HSS7X7X1/2	0.784
165	HSS9X9X5/8-1	0.853
166	HSS9X9X5/8-1	0.852
212	W8X31	0.585
213	W8X31	0.501
214	W8X31	0.396
215	W8X31	0.288
216	W8X31	0.216
217	W8X31	0.082
218	W8X31	0.056
219	W8X31	0.036
220	W8X31	0.069
221	W8X31	0.07
222	W8X31	0.034
223	W8X31	0.054
224	W8X31	0.079

225	W8X31	0.212
226	W8X31	0.282
227	W8X31	0.39
228	W8X31	0.495
229	W8X31	0.578
234	HSS9X9X5/8-1	0.896
235	HSS9X9X5/8-1	0.891
236	HSS7X7X1/2	0.825
237	HSS7X7X1/2	0.81
238	HSS9X9X5/8-1	0.095
239	HSS9X9X5/8-1	0.092
240	HSS7X7X1/2	0.293
241	HSS7X7X1/2	0.297
242	HSS9X9X5/8-1	0.088
243	HSS9X9X5/8-1	0.087
244	HSS7X7X1/2	0.274
245	HSS7X7X1/2	0.28
246	HSS7X7X1/2	0.798
247	HSS7X7X1/2	0.783
248	HSS9X9X5/8-1	0.828
249	HSS9X9X5/8-1	0.828
261	HSS4X4X3/8-1	0.256
295	W8X31	0.207
296	W8X31	0.092
297	W8X31	0.074
298	W8X31	0.064
299	W8X31	0.051
300	W8X31	0.04
301	W8X31	0.029
302	W8X31	0.021
303	W8X31	0.026
304	W8X31	0.024
305	W8X31	0.02
306	W8X31	0.029
307	W8X31	0.039
308	W8X31	0.051
309	W8X31	0.064
310	W8X31	0.073
311	W8X31	0.091
312	W8X31	0.2
317	HSS9X9X5/8-1	0.73
318	HSS9X9X5/8-1	0.719

319	HSS5X5X1/2-1	0.608
320	HSS5X5X1/2-1	0.597
321	HSS9X9X5/8-1	0.076
322	HSS9X9X5/8-1	0.072
323	HSS5X5X1/2-1	0.075
324	HSS5X5X1/2-1	0.079
325	HSS9X9X5/8-1	0.061
326	HSS9X9X5/8-1	0.058
327	HSS5X5X1/2-1	0.09
328	HSS5X5X1/2-1	0.092
329	HSS5X5X1/2-1	0.68
330	HSS5X5X1/2-1	0.662
331	HSS9X9X5/8-1	0.655
332	HSS9X9X5/8-1	0.647
340	HSS4X4X3/8-1	0.24
345	HSS4X4X3/8-1	0.288
360	HSS4X4X3/8-1	0.295
382	W8X35	0.843
383	W8X31	0.817
384	W8X31	0.548
385	W8X31	0.413
386	W8X31	0.29
387	W8X31	0.086
388	W8X31	0.048
389	W8X31	0.048
390	W8X31	0.298
391	W8X31	0.563
392	W8X31	0.721
393	W8X31	0.718
394	W8X31	0.561
395	W8X31	0.296
396	W8X31	0.046
397	W8X31	0.047
398	W8X31	0.085
399	W8X31	0.291
400	W8X31	0.415
401	W8X31	0.55
402	W8X31	0.827
403	W8X35	0.854
411	HSS9X9X5/8-1	0.298
412	HSS9X9X5/8-1	0.296
413	HSS9X9X5/8-1	0.485

414	HSS9X9X5/8-1	0.482
453	W8X31	0.654
454	W8X31	0.567
455	W8X31	0.482
456	W8X31	0.36
457	W8X31	0.247
458	W8X31	0.088
459	W8X31	0.05
460	W8X31	0.035
461	W8X31	0.255
462	W8X31	0.508
463	W8X31	0.68
464	W8X31	0.677
465	W8X31	0.505
466	W8X31	0.252
467	W8X31	0.034
468	W8X31	0.051
469	W8X31	0.089
470	W8X31	0.25
471	W8X31	0.363
472	W8X31	0.485
473	W8X31	0.567
474	W8X31	0.654
490	L8X8X1/2	0.563
491	L8X8X1/2	0.553
492	L8X8X1/2	0.564
494	L8X8X1/2	0.553
503	L8X8X1/2	0.157
504	L8X8X1/2	0.145
524	W8X35	0.847
525	W8X31	0.82
526	W8X31	0.553
527	W8X31	0.418
528	W8X31	0.293
529	W8X31	0.085
530	W8X31	0.047
531	W8X31	0.048
532	W8X31	0.298
533	W8X31	0.563
534	W8X31	0.721
535	W8X31	0.715
536	W8X31	0.556

537	W8X31	0.291
538	W8X31	0.044
539	W8X31	0.048
540	W8X31	0.086
541	W8X31	0.295
542	W8X31	0.419
543	W8X31	0.554
544	W8X31	0.818
545	W8X35	0.845
570	HSS4X4X3/8-1	0.266
571	HSS4X4X3/8-1	0.259
572	HSS4X4X3/8-1	0.429
573	HSS4X4X3/8-1	0.424
574	HSS4X4X3/8-1	0.273
575	HSS4X4X3/8-1	0.278
580	HSS4X4X3/8-1	0.304
581	HSS4X4X3/8-1	0.285
582	HSS4X4X3/8-1	0.429
583	HSS4X4X3/8-1	0.428
584	HSS4X4X3/8-1	0.261
585	HSS4X4X3/8-1	0.255
586	HSS9X9X5/8-1	0.563
587	HSS9X9X5/8-1	0.56
592	HSS9X9X5/8-1	0.304
593	HSS9X9X5/8-1	0.301
606	HSS4X4X3/8-1	0.259
607	HSS4X4X3/8-1	0.253
608	HSS4X4X3/8-1	0.449
609	HSS4X4X3/8-1	0.439
610	HSS4X4X3/8-1	0.222
611	HSS4X4X3/8-1	0.224
612	HSS4X4X3/8-1	0.107
613	HSS4X4X3/8-1	0.12
614	HSS4X4X3/8-1	0.08
615	HSS4X4X3/8-1	0.083
616	HSS4X4X3/8-1	0.078
617	HSS4X4X3/8-1	0.076
618	HSS4X4X3/8-1	0.518
619	HSS4X4X3/8-1	0.516
620	HSS4X4X3/8-1	0.29
621	HSS4X4X3/8-1	0.283
622	HSS9X9X5/8-1	0.564

623	HSS9X9X5/8-1	0.571
624	HSS4X4X3/8-1	0.112
625	HSS4X4X3/8-1	0.112
626	HSS4X4X3/8-1	0.089
627	HSS4X4X3/8-1	0.091
628	HSS9X9X5/8-1	0.459
629	HSS9X9X5/8-1	0.456
650	HSS4X4X3/8-1	0.883
651	HSS4X4X3/8-1	0.883
652	HSS4X4X3/8-1	0.282
653	HSS4X4X3/8-1	0.262
654	HSS5X5X1/2-1	0.817
655	HSS5X5X1/2-1	0.802
656	HSS5X5X1/2-1	0.821
657	HSS5X5X1/2-1	0.806
658	HSS4X4X3/8-1	0.283
659	HSS4X4X3/8-1	0.264
660	HSS4X4X3/8-1	0.886
661	HSS4X4X3/8-1	0.885
662	HSS5X5X1/2-1	0.07
663	HSS5X5X1/2-1	0.074
664	HSS5X5X1/2-1	0.071
665	HSS5X5X1/2-1	0.075
678	HSS4X4X3/8-1	0.888
679	HSS4X4X3/8-1	0.887
680	HSS4X4X3/8-1	0.283
681	HSS4X4X3/8-1	0.263
682	HSS5X5X1/2-1	0.86
683	HSS5X5X1/2-1	0.846
684	HSS5X5X1/2-1	0.795
685	HSS5X5X1/2-1	0.781
686	HSS4X4X3/8-1	0.266
687	HSS4X4X3/8-1	0.246
688	HSS4X4X3/8-1	0.854
689	HSS4X4X3/8-1	0.854
690	HSS5X5X1/2-1	0.093
691	HSS5X5X1/2-1	0.098
692	HSS5X5X1/2-1	0.053
693	HSS5X5X1/2-1	0.056
890	L8X8X1/2	0.157
891	L8X8X1/2	0.144
892	HSS4X4X3/8-1	0.102

893	HSS4X4X3/8-1	0.103
894	HSS4X4X3/8-1	0.065
895	HSS4X4X3/8-1	0.073
896	HSS4X4X3/8-1	0.224
897	HSS4X4X3/8-1	0.213
898	HSS4X4X3/8-1	0.082
899	HSS4X4X3/8-1	0.081
900	L8X8X1/2	0.113
901	L8X8X1/2	0.081
902	L8X8X1/2	0.104
903	L8X8X1/2	0.071
904	HSS4X4X3/8-1	0.127
905	HSS4X4X3/8-1	0.124
906	HSS4X4X3/8-1	0.1
907	HSS4X4X3/8-1	0.103
908	HSS4X4X3/8-1	0.101
909	HSS4X4X3/8-1	0.1
910	HSS4X4X3/8-1	0.079
911	HSS4X4X3/8-1	0.077
912	L8X8X1/2	0.157
913	L8X8X1/2	0.124
914	L8X8X1/2	0.153
915	L8X8X1/2	0.12
924	L8X8X1/2	0.551
925	L8X8X1/2	0.541
926	L8X8X1/2	0.554
927	L8X8X1/2	0.545
936	L8X8X1/2	0.151
937	L8X8X1/2	0.139
938	L8X8X1/2	0.147
939	L8X8X1/2	0.135

Hangar - Brace 80

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story22	D37	80	13.14354	DStIS23-1	Special Concentrically Braced Frame	HSS5X5X1/2-1	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
13.14354	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.152	0.542	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.0547	0.002151	0.001254	0.001254	0.0233	0.0233

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.006019	0.006019	0.007581	0.007581	0.15137	0.15137	Not required

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.3	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	0.9	13.14354	0.15137	78.147	200	86.83	300
Minor (2-2)	0.9	24.04766	0.15137	142.979	200	158.866	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
13.14354	-59.851	-0.7644	-0.4399	0.233	0.001	1.6827

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	0.9	0.9	1	1	1

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	1.83	0.9	0.9	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1.83	1	2.36

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.709 =	0.687 + 0.014 + 0.008

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
59.851	87.08	354.6

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.7644	49.125	49.125	49.125
Minor Bending	0.4399	49.125		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
1.6827	46.8455	42.161

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.233	90.522	0.003
Minor Shear	0.001	90.522	1.584E-05

End Reaction Axial Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
-60.009	DStIS23-1	-60.009	DStIS23-1

Hangar - Brace 151

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story11	D53	151	20.33033	DStIS21-1	Special Concentrically Braced Frame	HSS9X9X5/8-1	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
20.33033	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.233	0.68	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-R}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.1299	0.017168	0.010417	0.010417	0.0586	0.0586

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.027778	0.027778	0.033623	0.033623	0.28322	0.28322	Not required

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.3	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	0.9	20.33033	0.28322	64.604	200	71.783	300
Minor (2-2)	0.9	40.66067	0.28322	129.209	200	143.565	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
20.33033	-218.068	-2.0884	-3.3891	0.448	0.113	-0.0069

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	0.9	0.9	1	1	1

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	2	0.9	0.9	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
2	1	2.029

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.884 =	0.862 + 0.009 + 0.014

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
218.068	253.045	841.5

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	2.0884	217.875	217.875	217.875
Minor Bending	3.3891	217.875		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-0.0069	204.0111	183.61

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.448	227.681	0.002
Minor Shear	0.113	227.681	4.978E-04

End Reaction Axial Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
-219.366	DStIS21-1	-219.366	DStIS21-1

Hangar - Brace 153

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story22	D55	153	13.14352	DStIS21-1	Special Concentrically Braced Frame	HSS7X7X1/2	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
13.14352	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.354	0.601	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_T	ϕ_{TF}	ϕ_v	ϕ_{V-R}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.0806	0.006414	0.003882	0.003882	0.0362	0.0362

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.01331	0.01331	0.016146	0.016146	0.21953	0.21953	Not required

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.3	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	0.9	13.14352	0.21953	53.885	200	59.872	300
Minor (2-2)	0.9	24.04766	0.21953	98.589	200	109.543	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
13.14352	-205.181	0.0902	3.1246	0.254	-0.017	1.9775

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	0.9	0.9	1	1	1

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	1.83	0.9	0.9	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1.83	1	1.299

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.827 =	0.8 + 0.001 + 0.027

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
205.181	256.463	522

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.0902	104.625	104.625	104.625
Minor Bending	3.1246	104.625		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
1.9775	98.321	88.4889

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.254	140.742	0.002
Minor Shear	0.017	140.742	1.187E-04

End Reaction Axial Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
-205.414	DStIS21-1	-205.414	DStIS21-1

Hangar - Brace 650

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Strength Summary)

Element Details

Level	Element	Unique Name	Location (ft)	Combo	Element Type	Section	Classification
Story22	D267	650	7.07983	DStIS21-1	Special Concentrically Braced Frame	HSS4X4X3/8-1	Compact

LLRF and Demand/Capacity Ratio

L (ft)	LLRF	Stress Ratio Limit
7.07983	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.352	0.668	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_c	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (ft ²)	J (ft ⁴)	I ₃₃ (ft ⁴)	I ₂₂ (ft ⁴)	A _{v3} (ft ²)	A _{v2} (ft ²)
0.0332	0.000844	0.000497	0.000497	0.0143	0.0143

Design Properties

S ₃₃ (ft ³)	S ₂₂ (ft ³)	Z ₃₃ (ft ³)	Z ₂₂ (ft ³)	r ₃₃ (ft)	r ₂₂ (ft)	C _w (ft ⁶)
0.00298	0.00298	0.003698	0.003698	0.12233	0.12233	Not required

Material Properties

E (kip/ft ²)	f _y (kip/ft ²)	R _y	C _{pr}	α
4176000	7200	1.3	1.4	NA

Slenderness Check

Buckling Mode	K Factor	L Length (ft)	r (ft)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	0.9	7.07983	0.12233	52.089	200	57.876	300
Minor (2-2)	0.9	14.15966	0.12233	104.177	200	115.752	300

Stress Check Forces and Moments

Location (ft)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
7.07983	-84.206	0.1915	0.2651	0.009	-0.066	0.5821

Axial Force & Biaxial Moment Design Factors (H1-1a)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	0.9	0.9	1	1	1

	L Factor	K₁	K₂	B₁	B₂	C_m
Minor Bending	2	0.9	0.9	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
2	1	1.146

Demand/Capacity (D/C) Ratio Eqn.(H1-1a)

D/C Ratio =	(P_r /P_c) + (8/9)(M_{r33} /M_{c33}) + (8/9)(M_{r22} /M_{c22})
0.883 =	0.866 + 0.007 + 0.01

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
84.206	97.278	215.1

Moments and Capacities

	M_u Moment (kip-ft)	φM_n (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.1915	23.9625	23.9625	23.9625
Minor Bending	0.2651	23.9625		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0.5821	22.85	20.565

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.009	55.652	1.618E-04
Minor Shear	0.066	55.652	0.001

End Reaction Axial Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
-84.312	DStIS21-1	-84.312	DStIS21-1

Highly Ductile Requirement and Unbraced Lengths from AISC 341 for SCBF Braces:

Requirements Square HSS					
Shape	Highly Ductile				
	ASTM A500/A500M Grade C				
	Diagonal Braces	Beams, Columns		Diagonal Braces	
		P_r max, kips			
		ASD	LRFD		
HSS22×22×1	—	—	—	—	
HSS20×20×1	—	—	—	—	
×7/8	—	—	—	—	
HSS18×18×1	—	—	—	—	
×7/8	—	—	—	—	
×3/4	—	—	—	—	
HSS16×16×1	—	—	—	•	
×7/8	—	—	—	—	
×3/4	—	—	—	—	
HSS14×14×1	•	—	—	•	
×7/8	—	—	—	•	
×3/4	—	—	—	—	
×5/8	—	—	—	—	
HSS12×12×1	•	NL	NL	•	
×7/8	•	—	—	•	
×3/4	—	—	—	•	
×5/8	—	—	—	—	
×1/2	—	—	—	—	
HSS10×10×3/4	•	NL	NL	•	
×5/8	—	—	—	•	
×1/2	—	—	—	—	
HSS9×9×5/8	•	—	—	•	
×1/2	—	—	—	—	
×3/8	—	—	—	—	
HSS8×8×5/8	•	NL	NL	•	
×1/2	—	—	—	•	
×3/8	—	—	—	—	
HSS7×7×5/8	•	NL	NL	•	
×1/2	•	—	—	—	
×3/8	—	—	—	—	
×5/16	—	—	—	—	

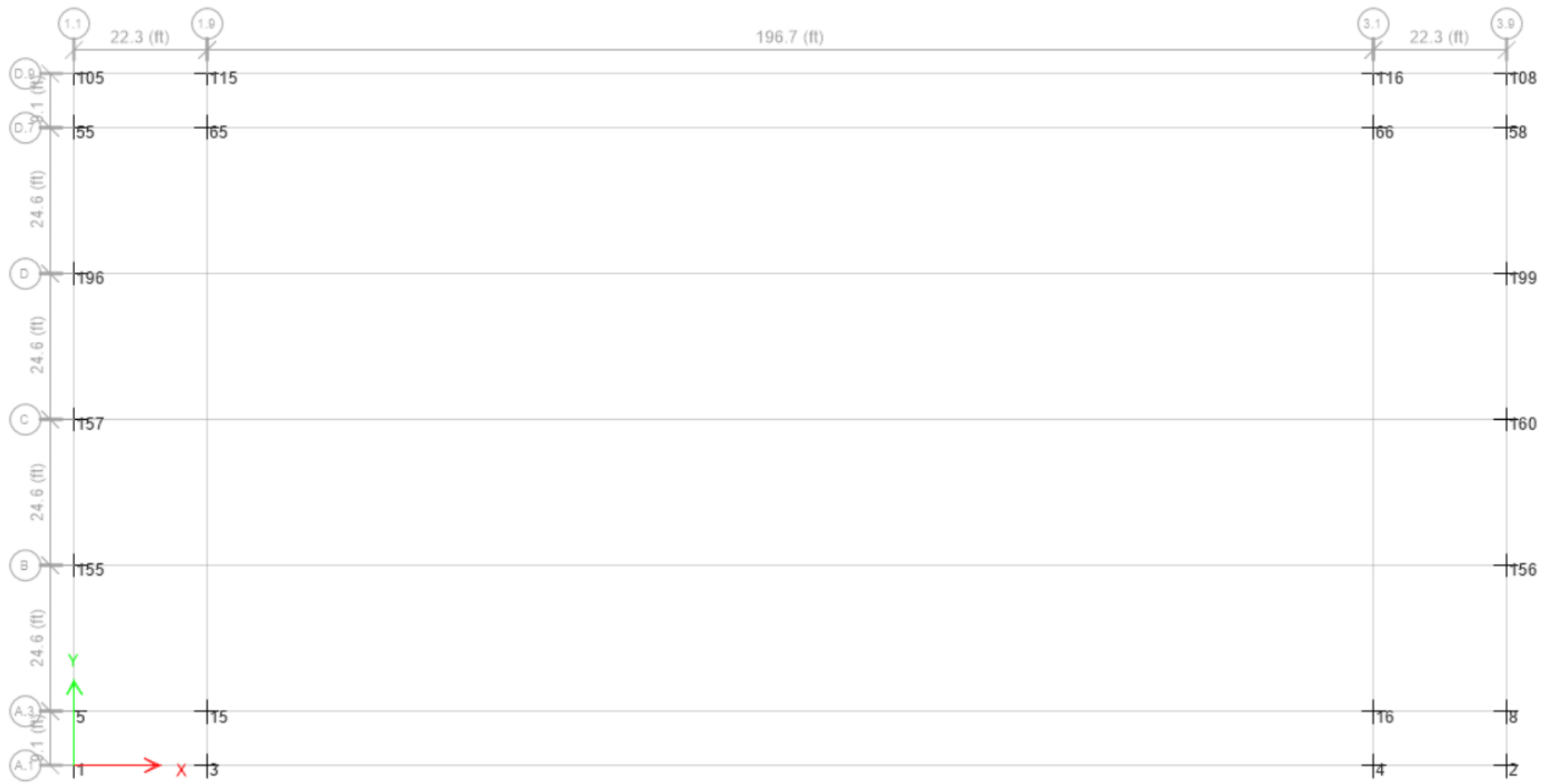
Notes: Confirm ASTM A1085/A1085M material availability before specifying, as discussed in AISC 341. NL = Not limited by width-thickness requirements. P_r is limited by member strength.

(continued)
Width-to-Thickness
Requirements
Square HSS

Shape	HSS					
	ASTM A500/A500M Grade C					
	Diagonal Braces	Beams, Columns		Highly Ductile		ASTM A1085
		P_r max, kips		Diagonal Braces	B	
ASD		LRFD				
HSS6×6× $\frac{5}{8}$	•	NL	NL			
× $\frac{1}{2}$	•	NL	NL	•		
× $\frac{3}{8}$	—	—	—	•		
× $\frac{5}{16}$	—	—	—	—		
× $\frac{1}{4}$	—	—	—	—		
HSS5 $\frac{1}{2}$ ×5 $\frac{1}{2}$ × $\frac{3}{8}$	•	—	—	•		
× $\frac{5}{16}$	—	—	—	—		
× $\frac{1}{4}$	—	—	—	—		
HSS5×5× $\frac{1}{2}$	•	NL	NL	•		
× $\frac{3}{8}$	•	NL	NL	•		
× $\frac{5}{16}$	—	—	—	•		
× $\frac{1}{4}$	—	—	—	—		
HSS4 $\frac{1}{2}$ ×4 $\frac{1}{2}$ × $\frac{1}{2}$	•	NL	NL	•		
× $\frac{3}{8}$	•	NL	NL	•		
× $\frac{5}{16}$	•	—	—	•		
× $\frac{1}{4}$	—	—	—	—		
× $\frac{3}{16}$	—	—	—	—		
HSS4×4× $\frac{1}{2}$	•	NL	NL	•		
× $\frac{3}{8}$	•	NL	NL	•		
× $\frac{5}{16}$	•	NL	NL	•		
× $\frac{1}{4}$	—	—	—	•		
× $\frac{3}{16}$	—	—	—	—		
HSS3 $\frac{1}{2}$ ×3 $\frac{1}{2}$ × $\frac{3}{8}$	•	NL	NL	•		
× $\frac{5}{16}$	•	NL	NL	•		
× $\frac{1}{4}$	•	—	—	•		
× $\frac{3}{16}$	—	—	—	—		
HSS3×3× $\frac{3}{8}$	•	NL	NL	•		
× $\frac{5}{16}$	•	NL	NL	•		
× $\frac{1}{4}$	•	NL	NL	•		
× $\frac{3}{16}$	—	—	—	•		

Notes: Confirm ASTM A1085/A1085M material availability before specifying, as discussed.
 NL = Not limited by width-to-thickness requirements. P_r max is limited by member P_r .
 • The member width-to-thickness requirements are satisfied for the given steel grade.

Hangar - Base Labels



Point Results

Joint Reactions

Story	Label	Unique Name	Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip
Base	1	1	Dead	LinStatic		48.022	8.509	95.948
Base	1	1	Live	LinStatic		19.021	4.15	40.91
Base	1	1	Exx	LinStatic	Max	-9.65	-1.779	-30.177
Base	1	1	Exx	LinStatic	Min	-9.65	-1.779	-30.177
Base	1	1	Eyy	LinStatic	Max	-5.551	-6.177	-50.792
Base	1	1	Eyy	LinStatic	Min	-5.551	-6.177	-50.792
Base	1	1	Mass	LinStatic		41.598	9.023	89.214
Base	1	1	Sb	LinStatic		20.029	4.363	43.031
Base	1	1	Su1	LinStatic		12.327	2.714	27.989
Base	1	1	Su2	LinStatic		13.352	2.76	26.604
Base	1	1	Wx	LinStatic		-51.315	36.05	-45.525
Base	1	1	Wy	LinStatic		-11.979	-42.916	-96.354
Base	1	1	Wxx	LinStatic		-11.314	37.263	-13.436
Base	1	1	Wyy	LinStatic		-7.164	34.242	29.211
Base	1	1	Exx-O	LinStatic	Max	-19.3	-3.559	-60.355
Base	1	1	Exx-O	LinStatic	Min	-19.3	-3.559	-60.355
Base	1	1	Eyy-O	LinStatic	Max	-11.102	-12.354	-101.584
Base	1	1	Eyy-O	LinStatic	Min	-11.102	-12.354	-101.584
Base	2	2	Dead	LinStatic		-49.542	6.931	93.09
Base	2	2	Live	LinStatic		-19.775	3.361	39.489
Base	2	2	Exx	LinStatic	Max	-9.673	1.663	29.721
Base	2	2	Exx	LinStatic	Min	-9.673	1.663	29.721
Base	2	2	Eyy	LinStatic	Max	5.802	-5.627	-49.287
Base	2	2	Eyy	LinStatic	Min	5.802	-5.627	-49.287
Base	2	2	Mass	LinStatic		-43.239	7.306	86.124
Base	2	2	Sb	LinStatic		-20.822	3.533	41.537
Base	2	2	Su1	LinStatic		-13.857	2.193	25.452
Base	2	2	Su2	LinStatic		-12.825	2.228	27.234
Base	2	2	Wx	LinStatic		10.812	36.754	-14.43
Base	2	2	Wy	LinStatic		12.502	-41.869	-93.533
Base	2	2	Wxx	LinStatic		50.828	35.532	-46.647
Base	2	2	Wyy	LinStatic		6.85	33.317	26.884
Base	2	2	Exx-O	LinStatic	Max	-19.346	3.327	59.441
Base	2	2	Exx-O	LinStatic	Min	-19.346	3.327	59.441
Base	2	2	Eyy-O	LinStatic	Max	11.604	-11.254	-98.573
Base	2	2	Eyy-O	LinStatic	Min	11.604	-11.254	-98.573
Base	3	3	Dead	LinStatic		18.341	-0.029	40.666
Base	3	3	Live	LinStatic		8.279	-0.016	11.245
Base	3	3	Exx	LinStatic	Max	-8.665	0.001	25.621
Base	3	3	Exx	LinStatic	Min	-8.665	0.001	25.621
Base	3	3	Eyy	LinStatic	Max	3.919	0.011	-12.36
Base	3	3	Eyy	LinStatic	Min	3.919	0.011	-12.36
Base	3	3	Mass	LinStatic		18.08	-0.034	24.812
Base	3	3	Sb	LinStatic		8.717	-0.016	11.869
Base	3	3	Su1	LinStatic		6.567	-0.01	0.173
Base	3	3	Su2	LinStatic		4.852	-0.011	14.08
Base	3	3	Wx	LinStatic		-16.282	0.001	-16.491
Base	3	3	Wy	LinStatic		2.561	0.006	-60.7
Base	3	3	Wxx	LinStatic		-3.61	0.002	-50.629
Base	3	3	Wyy	LinStatic		-12.77	-0.002	-26.745
Base	3	3	Exx-O	LinStatic	Max	-17.33	0.002	51.242
Base	3	3	Exx-O	LinStatic	Min	-17.33	0.002	51.242
Base	3	3	Eyy-O	LinStatic	Max	7.838	0.022	-24.72
Base	3	3	Eyy-O	LinStatic	Min	7.838	0.022	-24.72

Story	Label	Unique Name	Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip
Base	4	4	Dead	LinStatic		-19.887	-0.032	38.369
Base	4	4	Live	LinStatic		-9.037	-0.017	10.14
Base	4	4	Exx	LinStatic	Max	-8.719	-0.001	-25.65
Base	4	4	Exx	LinStatic	Min	-8.719	-0.001	-25.65
Base	4	4	Eyy	LinStatic	Max	-3.721	0.011	-12.569
Base	4	4	Eyy	LinStatic	Min	-3.721	0.011	-12.569
Base	4	4	Mass	LinStatic		-19.73	-0.037	22.405
Base	4	4	Sb	LinStatic		-9.514	-0.018	10.706
Base	4	4	Su1	LinStatic		-5.38	-0.012	13.331
Base	4	4	Su2	LinStatic		-7.053	-0.011	-0.563
Base	4	4	Wx	LinStatic		3.036	0.002	-51.641
Base	4	4	Wy	LinStatic		-2.082	0.006	-60.72
Base	4	4	Wxx	LinStatic		15.687	0.001	-17.577
Base	4	4	Wyy	LinStatic		12.746	-0.003	-25.488
Base	4	4	Exx-O	LinStatic	Max	-17.438	-0.003	-51.301
Base	4	4	Exx-O	LinStatic	Min	-17.438	-0.003	-51.301
Base	4	4	Eyy-O	LinStatic	Max	-7.442	0.021	-25.137
Base	4	4	Eyy-O	LinStatic	Min	-7.442	0.021	-25.137
Base	6	5	Dead	LinStatic		47.834	5.888	48.369
Base	6	5	Live	LinStatic		18.926	3.039	17.279
Base	6	5	Exx	LinStatic	Max	-9.917	0.906	-27.704
Base	6	5	Exx	LinStatic	Min	-9.917	0.906	-27.704
Base	6	5	Eyy	LinStatic	Max	1.144	-5.632	38.344
Base	6	5	Eyy	LinStatic	Min	1.144	-5.632	38.344
Base	6	5	Mass	LinStatic		41.379	6.61	37.79
Base	6	5	Sb	LinStatic		19.955	3.197	18.222
Base	6	5	Su1	LinStatic		11.909	1.726	12.883
Base	6	5	Su2	LinStatic		13.454	2.325	9.86
Base	6	5	Wx	LinStatic		-34.262	6.006	-65.203
Base	6	5	Wy	LinStatic		-25.931	-9.945	31.338
Base	6	5	Wxx	LinStatic		-23.137	4.48	-33.948
Base	6	5	Wyy	LinStatic		-28.492	11.344	-90.536
Base	6	5	Exx-O	LinStatic	Max	-19.835	1.812	-55.407
Base	6	5	Exx-O	LinStatic	Min	-19.835	1.812	-55.407
Base	6	5	Eyy-O	LinStatic	Max	2.288	-11.264	76.689
Base	6	5	Eyy-O	LinStatic	Min	2.288	-11.264	76.689
Base	25	8	Dead	LinStatic		-48.481	4.066	56.823
Base	25	8	Live	LinStatic		-19.241	2.13	21.449
Base	25	8	Exx	LinStatic	Max	-9.913	-1.023	28.189
Base	25	8	Exx	LinStatic	Min	-9.913	-1.023	28.189
Base	25	8	Eyy	LinStatic	Max	-1.381	-5.072	36.734
Base	25	8	Eyy	LinStatic	Min	-1.381	-5.072	36.734
Base	25	8	Mass	LinStatic		-42.065	4.634	46.862
Base	25	8	Sb	LinStatic		-20.286	2.241	22.606
Base	25	8	Su1	LinStatic		-13.664	1.679	12.834
Base	25	8	Su2	LinStatic		-12.119	1.158	15.48
Base	25	8	Wx	LinStatic		22.881	3.878	-30.909
Base	25	8	Wy	LinStatic		25.659	-8.864	27.868
Base	25	8	Wxx	LinStatic		33.996	5.395	-62.039
Base	25	8	Wyy	LinStatic		29.035	10.455	-89.032
Base	25	8	Exx-O	LinStatic	Max	-19.827	-2.046	56.378
Base	25	8	Exx-O	LinStatic	Min	-19.827	-2.046	56.378
Base	25	8	Eyy-O	LinStatic	Max	-2.763	-10.143	73.467
Base	25	8	Eyy-O	LinStatic	Min	-2.763	-10.143	73.467
Base	26	15	Dead	LinStatic		29.903	-0.093	-3.866
Base	26	15	Live	LinStatic		13.899	-0.046	-10.779
Base	26	15	Exx	LinStatic	Max	-9.435	0.002	27.738

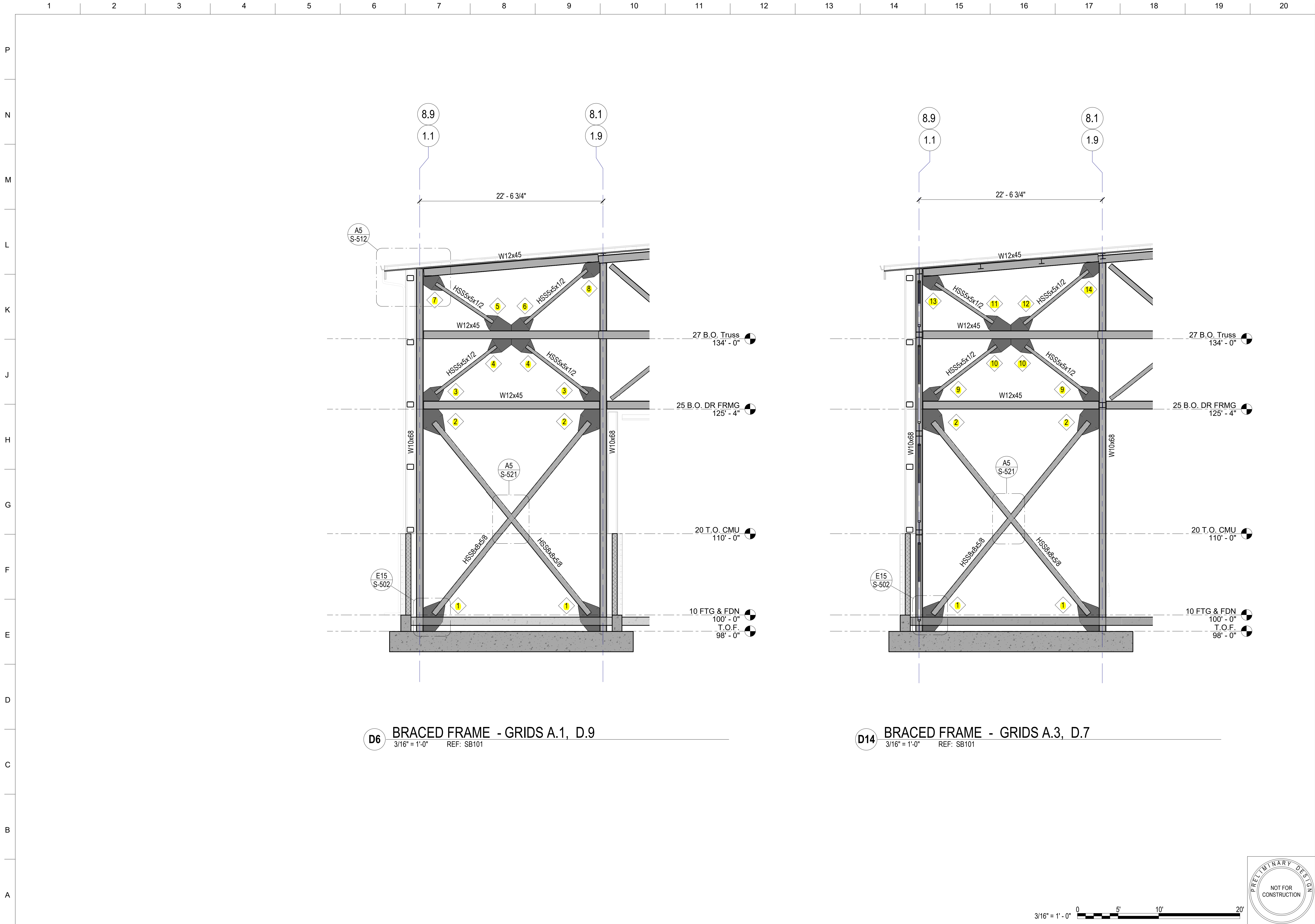
Story	Label	Unique Name	Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip
Base	26	15	Exx	LinStatic	Min	-9.435	0.002	27.738
Base	26	15	Eyy	LinStatic	Max	-7.586	-0.012	21.694
Base	26	15	Eyy	LinStatic	Min	-7.586	-0.012	21.694
Base	26	15	Mass	LinStatic		30.312	-0.1	-23.152
Base	26	15	Sb	LinStatic		14.626	-0.048	-11.217
Base	26	15	Su1	LinStatic		9.982	-0.028	-14.179
Base	26	15	Su2	LinStatic		8.982	-0.034	-1.493
Base	26	15	Wx	LinStatic		-17.045	0.01	-13.363
Base	26	15	Wy	LinStatic		-19.59	-0.026	-14.616
Base	26	15	Wxx	LinStatic		-6.636	0.011	-42.758
Base	26	15	Wyy	LinStatic		-2.449	0.039	-51.1
Base	26	15	Exx-O	LinStatic	Max	-18.87	0.004	55.476
Base	26	15	Exx-O	LinStatic	Min	-18.87	0.004	55.476
Base	26	15	Eyy-O	LinStatic	Max	-15.172	-0.025	43.388
Base	26	15	Eyy-O	LinStatic	Min	-15.172	-0.025	43.388
Base	27	16	Dead	LinStatic		-30.457	-0.102	-7.297
Base	27	16	Live	LinStatic		-14.178	-0.051	-12.499
Base	27	16	Exx	LinStatic	Max	-9.401	-0.003	-27.744
Base	27	16	Exx	LinStatic	Min	-9.401	-0.003	-27.744
Base	27	16	Eyy	LinStatic	Max	7.38	-0.012	21.933
Base	27	16	Eyy	LinStatic	Min	7.38	-0.012	21.933
Base	27	16	Mass	LinStatic		-30.921	-0.111	-26.892
Base	27	16	Sb	LinStatic		-14.92	-0.054	-13.025
Base	27	16	Su1	LinStatic		-9.149	-0.037	-2.624
Base	27	16	Su2	LinStatic		-10.182	-0.031	-15.322
Base	27	16	Wx	LinStatic		6.5	0.009	-43.722
Base	27	16	Wy	LinStatic		19.328	-0.024	-14.017
Base	27	16	Wxx	LinStatic		16.935	0.008	-14.251
Base	27	16	Wyy	LinStatic		2.692	0.037	-51.634
Base	27	16	Exx-O	LinStatic	Max	-18.803	-0.005	-55.489
Base	27	16	Exx-O	LinStatic	Min	-18.803	-0.005	-55.489
Base	27	16	Eyy-O	LinStatic	Max	14.759	-0.023	43.867
Base	27	16	Eyy-O	LinStatic	Min	14.759	-0.023	43.867
Base	87	55	Dead	LinStatic		48.472	-4.066	56.806
Base	87	55	Live	LinStatic		19.24	-2.13	21.447
Base	87	55	Exx	LinStatic	Max	-9.913	-1.023	-28.189
Base	87	55	Exx	LinStatic	Min	-9.913	-1.023	-28.189
Base	87	55	Eyy	LinStatic	Max	-1.381	-5.072	-36.734
Base	87	55	Eyy	LinStatic	Min	-1.381	-5.072	-36.734
Base	87	55	Mass	LinStatic		42.061	-4.634	46.858
Base	87	55	Sb	LinStatic		20.284	-2.241	22.604
Base	87	55	Su1	LinStatic		12.118	-1.158	15.479
Base	87	55	Su2	LinStatic		13.663	-1.679	12.833
Base	87	55	Wx	LinStatic		-20.558	-7.99	-63.975
Base	87	55	Wy	LinStatic		-15.594	-13.054	-90.992
Base	87	55	Wxx	LinStatic		-9.433	-6.584	-33.368
Base	87	55	Wyy	LinStatic		-12.218	6.264	25.909
Base	87	55	Exx-O	LinStatic	Max	-19.826	-2.046	-56.378
Base	87	55	Exx-O	LinStatic	Min	-19.826	-2.046	-56.378
Base	87	55	Eyy-O	LinStatic	Max	-2.763	-10.143	-73.467
Base	87	55	Eyy-O	LinStatic	Min	-2.763	-10.143	-73.467
Base	88	58	Dead	LinStatic		-47.825	-5.888	48.352
Base	88	58	Live	LinStatic		-18.925	-3.039	17.278
Base	88	58	Exx	LinStatic	Max	-9.917	0.906	27.704
Base	88	58	Exx	LinStatic	Min	-9.917	0.906	27.704
Base	88	58	Eyy	LinStatic	Max	1.144	-5.632	-38.344
Base	88	58	Eyy	LinStatic	Min	1.144	-5.632	-38.344

Story	Label	Unique Name	Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip
Base	88	58	Mass	LinStatic		-41.376	-6.611	37.787
Base	88	58	Sb	LinStatic		-19.953	-3.197	18.22
Base	88	58	Su1	LinStatic		-13.452	-2.325	9.859
Base	88	58	Su2	LinStatic		-11.908	-1.726	12.882
Base	88	58	Wx	LinStatic		9.721	-7.119	-36.369
Base	88	58	Wy	LinStatic		15.083	-13.877	-92.461
Base	88	58	Wxx	LinStatic		20.857	-8.533	-67.103
Base	88	58	Wyy	LinStatic		12.523	7.413	29.412
Base	88	58	Exx-O	LinStatic	Max	-19.835	1.812	55.407
Base	88	58	Exx-O	LinStatic	Min	-19.835	1.812	55.407
Base	88	58	Eyy-O	LinStatic	Max	2.288	-11.264	-76.689
Base	88	58	Eyy-O	LinStatic	Min	2.288	-11.264	-76.689
Base	89	65	Dead	LinStatic		30.454	0.102	-7.318
Base	89	65	Live	LinStatic		14.176	0.051	-12.498
Base	89	65	Exx	LinStatic	Max	-9.401	-0.003	27.745
Base	89	65	Exx	LinStatic	Min	-9.401	-0.003	27.745
Base	89	65	Eyy	LinStatic	Max	7.379	-0.012	-21.933
Base	89	65	Eyy	LinStatic	Min	7.379	-0.012	-21.933
Base	89	65	Mass	LinStatic		30.917	0.111	-26.89
Base	89	65	Sb	LinStatic		14.918	0.054	-13.024
Base	89	65	Su1	LinStatic		10.181	0.031	-15.322
Base	89	65	Su2	LinStatic		9.148	0.037	-2.623
Base	89	65	Wx	LinStatic		-7.512	0.001	-7.55
Base	89	65	Wy	LinStatic		6.744	-0.029	-44.979
Base	89	65	Wxx	LinStatic		3.024	-0.0003863	-37.192
Base	89	65	Wyy	LinStatic		-9.891	0.032	-7.363
Base	89	65	Exx-O	LinStatic	Max	-18.802	-0.005	55.489
Base	89	65	Exx-O	LinStatic	Min	-18.802	-0.005	55.489
Base	89	65	Eyy-O	LinStatic	Max	14.759	-0.023	-43.867
Base	89	65	Eyy-O	LinStatic	Min	14.759	-0.023	-43.867
Base	90	66	Dead	LinStatic		-29.901	0.092	-3.888
Base	90	66	Live	LinStatic		-13.897	0.046	-10.778
Base	90	66	Exx	LinStatic	Max	-9.435	0.002	-27.738
Base	90	66	Exx	LinStatic	Min	-9.435	0.002	-27.738
Base	90	66	Eyy	LinStatic	Max	-7.586	-0.012	-21.694
Base	90	66	Eyy	LinStatic	Min	-7.586	-0.012	-21.694
Base	90	66	Mass	LinStatic		-30.308	0.1	-23.15
Base	90	66	Sb	LinStatic		-14.624	0.048	-11.217
Base	90	66	Su1	LinStatic		-8.98	0.034	-1.493
Base	90	66	Su2	LinStatic		-9.98	0.028	-14.179
Base	90	66	Wx	LinStatic		-2.91	-0.002	-36.367
Base	90	66	Wy	LinStatic		-7.012	-0.03	-44.586
Base	90	66	Wxx	LinStatic		7.599	-0.001	-6.804
Base	90	66	Wyy	LinStatic		10.13	0.035	-8.102
Base	90	66	Exx-O	LinStatic	Max	-18.87	0.004	-55.476
Base	90	66	Exx-O	LinStatic	Min	-18.87	0.004	-55.476
Base	90	66	Eyy-O	LinStatic	Max	-15.172	-0.025	-43.388
Base	90	66	Eyy-O	LinStatic	Min	-15.172	-0.025	-43.388
Base	173	105	Dead	LinStatic		49.54	-6.931	93.087
Base	173	105	Live	LinStatic		19.776	-3.361	39.491
Base	173	105	Exx	LinStatic	Max	-9.673	1.663	-29.721
Base	173	105	Exx	LinStatic	Min	-9.673	1.663	-29.721
Base	173	105	Eyy	LinStatic	Max	5.802	-5.627	49.287
Base	173	105	Eyy	LinStatic	Min	5.802	-5.627	49.287
Base	173	105	Mass	LinStatic		43.242	-7.306	86.127
Base	173	105	Sb	LinStatic		20.823	-3.533	41.539
Base	173	105	Su1	LinStatic		12.826	-2.228	27.235

Story	Label	Unique Name	Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip
Base	173	105	Su2	LinStatic		13.858	-2.193	25.453
Base	173	105	Wx	LinStatic		-36.78	-35.208	-52.101
Base	173	105	Wy	LinStatic		7.216	-33.001	21.512
Base	173	105	Wxx	LinStatic		3.226	-36.443	-20.647
Base	173	105	Wyy	LinStatic		1.563	42.185	-98.904
Base	173	105	Exx-O	LinStatic	Max	-19.346	3.327	-59.442
Base	173	105	Exx-O	LinStatic	Min	-19.346	3.327	-59.442
Base	173	105	Eyy-O	LinStatic	Max	11.605	-11.254	98.574
Base	173	105	Eyy-O	LinStatic	Min	11.605	-11.254	98.574
Base	174	108	Dead	LinStatic		-48.021	-8.509	95.945
Base	174	108	Live	LinStatic		-19.022	-4.15	40.911
Base	174	108	Exx	LinStatic	Max	-9.65	-1.779	30.178
Base	174	108	Exx	LinStatic	Min	-9.65	-1.779	30.178
Base	174	108	Eyy	LinStatic	Max	-5.551	-6.177	50.792
Base	174	108	Eyy	LinStatic	Min	-5.551	-6.177	50.792
Base	174	108	Mass	LinStatic		-41.601	-9.023	89.217
Base	174	108	Sb	LinStatic		-20.03	-4.363	43.032
Base	174	108	Su1	LinStatic		-13.353	-2.76	26.605
Base	174	108	Su2	LinStatic		-12.328	-2.715	27.99
Base	174	108	Wx	LinStatic		-2.755	-36.882	-19.744
Base	174	108	Wy	LinStatic		-6.933	-33.854	23.749
Base	174	108	Wxx	LinStatic		37.235	-35.655	-51.071
Base	174	108	Wyy	LinStatic		-2.118	43.304	-101.816
Base	174	108	Exx-O	LinStatic	Max	-19.301	-3.559	60.355
Base	174	108	Exx-O	LinStatic	Min	-19.301	-3.559	60.355
Base	174	108	Eyy-O	LinStatic	Max	-11.102	-12.354	101.585
Base	174	108	Eyy-O	LinStatic	Min	-11.102	-12.354	101.585
Base	175	115	Dead	LinStatic		19.885	0.032	38.373
Base	175	115	Live	LinStatic		9.038	0.017	10.139
Base	175	115	Exx	LinStatic	Max	-8.719	-0.001	25.651
Base	175	115	Exx	LinStatic	Min	-8.719	-0.001	25.651
Base	175	115	Eyy	LinStatic	Max	-3.721	0.011	12.568
Base	175	115	Eyy	LinStatic	Min	-3.721	0.011	12.568
Base	175	115	Mass	LinStatic		19.732	0.037	22.404
Base	175	115	Sb	LinStatic		9.515	0.018	10.705
Base	175	115	Su1	LinStatic		7.053	0.011	-0.563
Base	175	115	Su2	LinStatic		5.38	0.012	13.33
Base	175	115	Wx	LinStatic		-3.732	0.003	-13.237
Base	175	115	Wy	LinStatic		-0.786	0.006	-21.158
Base	175	115	Wxx	LinStatic		9.188	0.002	-47.888
Base	175	115	Wyy	LinStatic		14.042	-0.002	-56.39
Base	175	115	Exx-O	LinStatic	Max	-17.438	-0.003	51.301
Base	175	115	Exx-O	LinStatic	Min	-17.438	-0.003	51.301
Base	175	115	Eyy-O	LinStatic	Max	-7.442	0.021	25.137
Base	175	115	Eyy-O	LinStatic	Min	-7.442	0.021	25.137
Base	176	116	Dead	LinStatic		-18.339	0.029	40.669
Base	176	116	Live	LinStatic		-8.28	0.016	11.244
Base	176	116	Exx	LinStatic	Max	-8.665	0.001	-25.621
Base	176	116	Exx	LinStatic	Min	-8.665	0.001	-25.621
Base	176	116	Eyy	LinStatic	Max	3.919	0.011	12.36
Base	176	116	Eyy	LinStatic	Min	3.919	0.011	12.36
Base	176	116	Mass	LinStatic		-18.082	0.034	24.811
Base	176	116	Sb	LinStatic		-8.718	0.016	11.868
Base	176	116	Su1	LinStatic		-4.852	0.011	14.079
Base	176	116	Su2	LinStatic		-6.568	0.01	0.173
Base	176	116	Wx	LinStatic		-8.594	0.002	-46.719
Base	176	116	Wy	LinStatic		0.831	0.006	-22.256

Story	Label	Unique Name	Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip
Base	176	116	Wxx	LinStatic		4.347	0.003	-11.991
Base	176	116	Wyy	LinStatic		-14.5	-0.002	-56.211
Base	176	116	Exx-O	LinStatic	Max	-17.33	0.002	-51.243
Base	176	116	Exx-O	LinStatic	Min	-17.33	0.002	-51.243
Base	176	116	Eyy-O	LinStatic	Max	7.837	0.022	24.719
Base	176	116	Eyy-O	LinStatic	Min	7.837	0.022	24.719
Base	216	155	Dead	LinStatic		1.458	0.004	123.557
Base	216	155	Live	LinStatic		0.722	0.003	59.663
Base	216	155	Exx	LinStatic	Max	-0.004	2.774E-05	-0.781
Base	216	155	Exx	LinStatic	Min	-0.004	2.774E-05	-0.781
Base	216	155	Eyy	LinStatic	Max	-0.028	0.074	-5.621
Base	216	155	Eyy	LinStatic	Min	-0.028	0.074	-5.621
Base	216	155	Mass	LinStatic		1.57	0.006	129.759
Base	216	155	Sb	LinStatic		0.759	0.003	62.696
Base	216	155	Su1	LinStatic		0.43	0.002	28.293
Base	216	155	Su2	LinStatic		0.53	0.002	47.719
Base	216	155	Wx	LinStatic		-0.074	-9.22E-05	-2.151
Base	216	155	Wy	LinStatic		-0.105	0.091	-5.08
Base	216	155	Wxx	LinStatic		-0.069	0.0004678	-1.836
Base	216	155	Wyy	LinStatic		-0.067	-0.086	2.618
Base	216	155	Exx-O	LinStatic	Max	-0.008	5.549E-05	-1.561
Base	216	155	Exx-O	LinStatic	Min	-0.008	5.549E-05	-1.561
Base	216	155	Eyy-O	LinStatic	Max	-0.055	0.147	-11.241
Base	216	155	Eyy-O	LinStatic	Min	-0.055	0.147	-11.241
Base	217	156	Dead	LinStatic		-1.452	15.588	131.865
Base	217	156	Live	LinStatic		-0.719	7.134	62.301
Base	217	156	Exx	LinStatic	Max	-0.001	-0.117	0.973
Base	217	156	Exx	LinStatic	Min	-0.001	-0.117	0.973
Base	217	156	Eyy	LinStatic	Max	0.017	-26.857	-84.46
Base	217	156	Eyy	LinStatic	Min	0.017	-26.857	-84.46
Base	217	156	Mass	LinStatic		-1.564	15.516	135.5
Base	217	156	Sb	LinStatic		-0.756	7.497	65.47
Base	217	156	Su1	LinStatic		-0.529	5.895	49.573
Base	217	156	Su2	LinStatic		-0.427	3.068	29.964
Base	217	156	Wx	LinStatic		0.074	0.768	2.562
Base	217	156	Wy	LinStatic		0.089	-35.756	-109.647
Base	217	156	Wxx	LinStatic		0.078	0.756	2.241
Base	217	156	Wyy	LinStatic		0.087	38.026	110.467
Base	217	156	Exx-O	LinStatic	Max	-0.002	-0.233	1.946
Base	217	156	Exx-O	LinStatic	Min	-0.002	-0.233	1.946
Base	217	156	Eyy-O	LinStatic	Max	0.034	-53.715	-168.919
Base	217	156	Eyy-O	LinStatic	Min	0.034	-53.715	-168.919
Base	310	157	Dead	LinStatic		1.053	10.205	93.528
Base	310	157	Live	LinStatic		0.522	4.455	43.123
Base	310	157	Exx	LinStatic	Max	-0.004	0.35	0.261
Base	310	157	Exx	LinStatic	Min	-0.004	0.35	0.261
Base	310	157	Eyy	LinStatic	Max	0.006	-26.09	-78.919
Base	310	157	Eyy	LinStatic	Min	0.006	-26.09	-78.919
Base	310	157	Mass	LinStatic		1.136	9.69	93.792
Base	310	157	Sb	LinStatic		0.549	4.681	45.318
Base	310	157	Su1	LinStatic		0.312	1.363	18.501
Base	310	157	Su2	LinStatic		0.383	4.031	35.694
Base	310	157	Wx	LinStatic		-0.042	-1.416	-0.021
Base	310	157	Wy	LinStatic		-0.033	-35.614	-104.81
Base	310	157	Wxx	LinStatic		-0.038	-1.39	-0.032
Base	310	157	Wyy	LinStatic		-0.049	37.891	107.548
Base	310	157	Exx-O	LinStatic	Max	-0.009	0.701	0.523

Story	Label	Unique Name	Output Case	Case Type	Step Type	FX kip	FY kip	FZ kip
Base	310	157	Exx-O	LinStatic	Min	-0.009	0.701	0.523
Base	310	157	Eyy-O	LinStatic	Max	0.011	-52.179	-157.839
Base	310	157	Eyy-O	LinStatic	Min	0.011	-52.179	-157.839
Base	311	160	Dead	LinStatic		-1.053	-10.205	93.528
Base	311	160	Live	LinStatic		-0.522	-4.455	43.122
Base	311	160	Exx	LinStatic	Max	-0.004	0.35	-0.261
Base	311	160	Exx	LinStatic	Min	-0.004	0.35	-0.261
Base	311	160	Eyy	LinStatic	Max	0.006	-26.09	78.919
Base	311	160	Eyy	LinStatic	Min	0.006	-26.09	78.919
Base	311	160	Mass	LinStatic		-1.136	-9.69	93.792
Base	311	160	Sb	LinStatic		-0.549	-4.681	45.318
Base	311	160	Su1	LinStatic		-0.383	-4.03	35.694
Base	311	160	Su2	LinStatic		-0.312	-1.363	18.501
Base	311	160	Wx	LinStatic		0.034	3.222	-4.904
Base	311	160	Wy	LinStatic		0.045	-36.123	102.92
Base	311	160	Wxx	LinStatic		0.038	3.214	-4.739
Base	311	160	Wyy	LinStatic		0.029	37.382	-109.438
Base	311	160	Exx-O	LinStatic	Max	-0.009	0.701	-0.523
Base	311	160	Exx-O	LinStatic	Min	-0.009	0.701	-0.523
Base	311	160	Eyy-O	LinStatic	Max	0.011	-52.179	157.839
Base	311	160	Eyy-O	LinStatic	Min	0.011	-52.179	157.839
Base	353	196	Dead	LinStatic		1.453	-15.587	131.865
Base	353	196	Live	LinStatic		0.719	-7.134	62.301
Base	353	196	Exx	LinStatic	Max	-0.001	-0.117	-0.973
Base	353	196	Exx	LinStatic	Min	-0.001	-0.117	-0.973
Base	353	196	Eyy	LinStatic	Max	0.017	-26.857	84.46
Base	353	196	Eyy	LinStatic	Min	0.017	-26.857	84.46
Base	353	196	Mass	LinStatic		1.564	-15.516	135.499
Base	353	196	Sb	LinStatic		0.756	-7.497	65.469
Base	353	196	Su1	LinStatic		0.427	-3.068	29.964
Base	353	196	Su2	LinStatic		0.529	-5.895	49.573
Base	353	196	Wx	LinStatic		-0.025	1.91	-2.194
Base	353	196	Wy	LinStatic		-0.034	-35.39	106.129
Base	353	196	Wxx	LinStatic		-0.021	1.939	-2.059
Base	353	196	Wyy	LinStatic		-0.036	38.391	-113.985
Base	353	196	Exx-O	LinStatic	Max	-0.002	-0.233	-1.945
Base	353	196	Exx-O	LinStatic	Min	-0.002	-0.233	-1.945
Base	353	196	Eyy-O	LinStatic	Max	0.034	-53.715	168.919
Base	353	196	Eyy-O	LinStatic	Min	0.034	-53.715	168.919
Base	354	199	Dead	LinStatic		-1.458	-0.004	123.557
Base	354	199	Live	LinStatic		-0.722	-0.003	59.663
Base	354	199	Exx	LinStatic	Max	-0.004	2.763E-05	0.781
Base	354	199	Exx	LinStatic	Min	-0.004	2.763E-05	0.781
Base	354	199	Eyy	LinStatic	Max	-0.028	0.074	5.621
Base	354	199	Eyy	LinStatic	Min	-0.028	0.074	5.621
Base	354	199	Mass	LinStatic		-1.57	-0.006	129.759
Base	354	199	Sb	LinStatic		-0.759	-0.003	62.695
Base	354	199	Su1	LinStatic		-0.53	-0.002	47.719
Base	354	199	Su2	LinStatic		-0.43	-0.002	28.292
Base	354	199	Wx	LinStatic		0.021	-0.001	-1.546
Base	354	199	Wy	LinStatic		0.019	0.086	2.949
Base	354	199	Wxx	LinStatic		0.026	0.000183	-1.827
Base	354	199	Wyy	LinStatic		0.057	-0.09	-4.749
Base	354	199	Exx-O	LinStatic	Max	-0.008	5.527E-05	1.561
Base	354	199	Exx-O	LinStatic	Min	-0.008	5.527E-05	1.561
Base	354	199	Eyy-O	LinStatic	Max	-0.055	0.147	11.241
Base	354	199	Eyy-O	LinStatic	Min	-0.055	0.147	11.241



US Army Corps
of Engineers®

MARK		DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
A. VALENIA	NOVEMBER 4, 2025
DRAWN BY:	SOLICITATION NO.:
R. CARLSON	W912PL25RA0012
CHECKED BY:	CONTRACT NO.:
D. CLAYSON	W912PL25C0037
SUBMITTED BY:	
P. PASZCZUK	
SIZE:	ANSI D

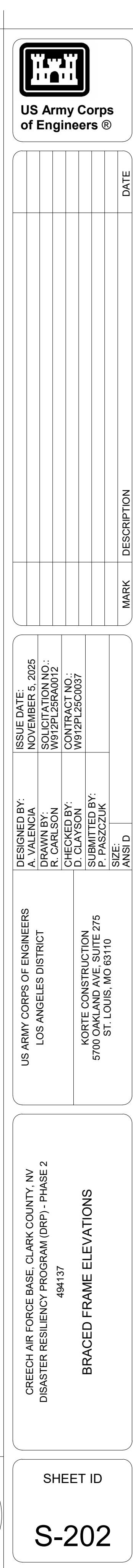
US ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT	KORTE CONSTRUCTION 5700 OAKLAND AVE, SUITE 275 ST. LOUIS, MO 63110
--	--

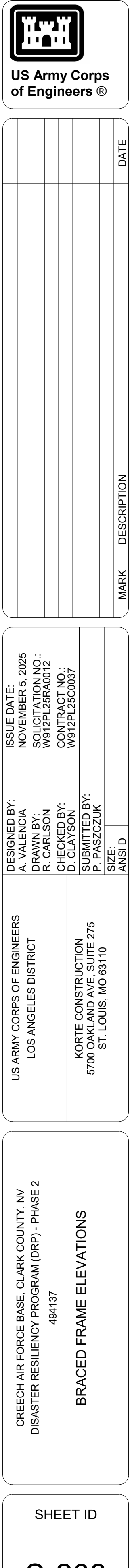
CREECH AIR FORCE BASE, CLARK COUNTY, NV
DISASTER RESILIENCY PROGRAM (DRP) - PHASE 2
494.37

BRACED FRAME ELEVATIONS

SHEET ID

S-201





DESIGN MODULE - SCBF Gusset Design

Creech DRP Phase 2

TYPICAL BRACED FRAME DESIGN INFORMATION

Frame Height:	20.00 ft	Gusset Plate Fy:	50 ksi
Floor Thickness:	0.00 in	Weld Size Brace to Gusset:	5 /16
Gusset Thickness:	0.75 in	Corner Snip:	1.00 in
Measured from Top of Slab:	No		
Beam Size Above:	W12X45		
Beam Size Below:	BasePlate		
Column Size:	W10X68		
Brace Size:	HSS8X8X5/8		
Brace Grade:	A500 Gr C		

BRACED FRAME GUSSET SUMMARY SCHEDULE

FRAME ID	GUSSET MARK	LENGTH	HEIGHT	BEAM		COLUMN	BRACE	STATUS
BF1	1	22.56 ft	27.84 ft	TOP	W12X45	W10X68	HSS8X8X5/8	PASS
	2			BTM	BasePlate			PASS
BF2	3	11.28 ft	8.66 ft	TOP	W12X45	W10X68	HSS5X5X1/2	PASS
	4			BTM	W12X45			PASS
BF3	5	11.28 ft	7.59 ft	TOP	W12X45	W10X68	HSS5X5X1/2	PASS
	6			BTM	W12X45			PASS
BF4	7	11.28 ft	9.47 ft	TOP	W12X45	W10X68	HSS5X5X1/2	PASS
	8			BTM	W12X45			PASS
BF5	9	24.58 ft	36.51 ft	TOP	W8X40	BasePlate	HSS8X8X5/8	PASS
	10			BTM	BasePlate			PASS
BF6	11	24.58 ft	7.79 ft	TOP	W8X40	BasePlate	HSS4X4X3/8	PASS
	12			BTM	W8X40			PASS
BF7	13	9.08 ft	12.17 ft	TOP	W8X40	BasePlate	HSS4X4X3/8	PASS
	14			BTM	BasePlate			PASS
BF8	15	9.08 ft	7.79 ft	TOP	W8X40	BasePlate	HSS4X4X3/8	PASS
	16			BTM	W8X40			PASS

DESIGN MODULE - SCBF Gusset Plate

Creech DRP Phase 2

Steel Gusset Plate Geometry and Modeling Information

Mark	Frame	Gusset Thickness	Angle from Horizontal	Brace Information		Length Along Beam	Length Along Column	Comment
				Brace Weld Length	Brace Width			
1	BF1	1.00 in	50.98 deg	39 in	8.00 in	37 in	46 in	
2		1.00 in	50.98 deg	39 in	8.00 in	32 in	52 in	
3	BF2	0.88 in	37.52 deg	19 in	5.00 in	29 in	18 in	
4		0.88 in	37.52 deg	19 in	5.00 in	29 in	18 in	
5	BF3	0.88 in	33.92 deg	19 in	5.00 in	32 in	17 in	
6		0.88 in	33.92 deg	19 in	5.00 in	32 in	17 in	
7	BF4	0.88 in	40.00 deg	19 in	5.00 in	27 in	19 in	
8		0.88 in	40.00 deg	19 in	5.00 in	27 in	19 in	
9	BF5	0.88 in	56.05 deg	39 in	8.00 in	38 in	47 in	
10		0.88 in	56.05 deg	39 in	8.00 in	35 in	52 in	
11	BF6	0.75 in	17.59 deg	12 in	4.00 in	49 in	8 in	
12		0.75 in	17.59 deg	12 in	4.00 in	49 in	8 in	
13	BF7	0.75 in	53.27 deg	12 in	4.00 in	17 in	14 in	
14		0.75 in	53.27 deg	12 in	4.00 in	14 in	19 in	
15	BF8	0.75 in	40.63 deg	12 in	4.00 in	22 in	11 in	
16		0.75 in	40.63 deg	12 in	4.00 in	22 in	11 in	

Steel Gusset Plate Connection Schedule

Mark	Gusset Thickness	Geometry + Welding Information					Cover Plate Info	
		W1 Size	L1 Length	W2 Size	L2 Length	W3 Size	Plate Size	Weld
1	1.00 in	5 /16	39 in	7 /16	37 in	6 /16		
2	1.00 in	5 /16	39 in	6 /16	32 in	7 /16		
3	0.88 in	5 /16	19 in	5 /16	29 in	6 /16		
4	0.88 in	5 /16	19 in	5 /16	29 in	6 /16		
5	0.88 in	5 /16	19 in	5 /16	32 in	6 /16		
6	0.88 in	5 /16	19 in	5 /16	32 in	6 /16		
7	0.88 in	5 /16	19 in	5 /16	27 in	6 /16		
8	0.88 in	5 /16	19 in	5 /16	27 in	6 /16		
9	0.88 in	5 /16	39 in	7 /16	38 in	6 /16		
10	0.88 in	5 /16	39 in	7 /16	35 in	7 /16		
11	0.75 in	5 /16	12 in	3 /16	49 in	3 /16		
12	0.75 in	5 /16	12 in	3 /16	49 in	3 /16		
13	0.75 in	5 /16	12 in	6 /16	17 in	4 /16		
14	0.75 in	5 /16	12 in	5 /16	14 in	5 /16		
15	0.75 in	5 /16	12 in	5 /16	22 in	4 /16		
16	0.75 in	5 /16	12 in	5 /16	22 in	4 /16		

SCBF GUSSET DESIGN

BF1 Top, Gusset 1

GENERAL CRITERIA

Frame Height:	27.84 ft	Beam Size:	W12X45
Frame Length:	22.56 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS8X8X5/8
Gusset Thickness:	1.00 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5/16
		Corner Snip:	1.00 in

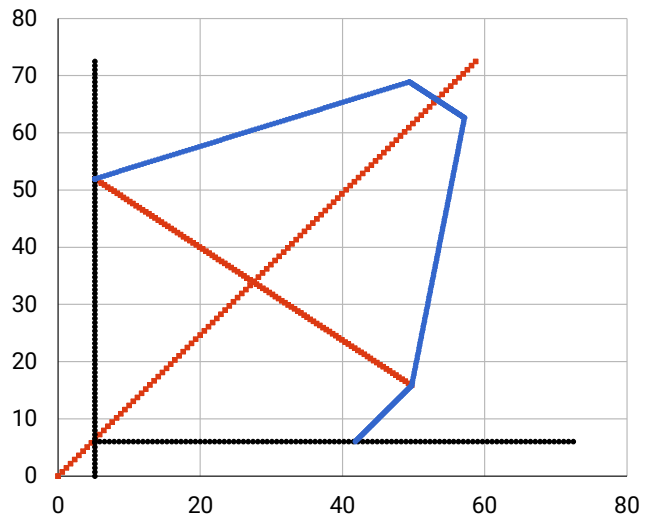
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	27.84 ft
Frame Length:	22.56 ft
Brace Length:	35.84 ft
Angle from Horz:	50.98 deg
Angle from Vert:	39.02 deg

Gusset Plate Geometry

Brace on Gusset:	39.00 in
Length along Beam:	36.61 in
Length along Column:	45.91 in



DESIGN OUTPUT

Uniform Force Method

ec:	5.20 in
eb:	6.05 in
a:	18.76 in
b:	23.51 in
r:	38.05

Max Brace Force, Pu = 1066 kips

Vub:	0.159 x Pu	= 170 kips	V= Vertical Force
Hub:	0.493 x Pu	= 526 kips	H= Horizontal Force
Vuc:	0.618 x Pu	= 659 kips	b= Beam Side
Huc:	0.137 x Pu	= 146 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	7/16	Weld to Column Size:	6/16
Interaction for Vub:	0.155	Interaction for Vuc:	0.839
Interaction for Hub:	0.720	Interaction for Huc:	0.124
Total Interaction:	0.875	Total Interaction:	0.963

Gusset Design

Buckling Capacity:	238k OK
Yielding Capacity:	2476k OK
Block Shear Capacity:	2145k OK

SCBF GUSSET DESIGN

BF1 Bottom, Gusset 2

GENERAL CRITERIA

Frame Height:	27.84 ft	Beam Size:	BasePlate
Frame Length:	22.56 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS8X8X5/8
Gusset Thickness:	1.00 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

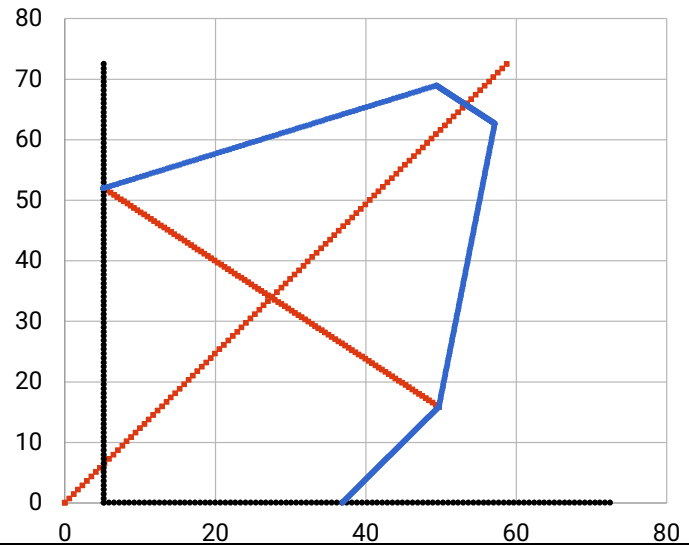
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	27.84 ft
Frame Length:	22.56 ft
Brace Length:	35.84 ft
Angle from Horz:	50.98 deg
Angle from Vert:	39.02 deg

Gusset Plate Geometry

Brace on Gusset:	39.00 in
Length along Beam:	31.70 in
Length along Column:	51.96 in



DESIGN OUTPUT

Uniform Force Method

ec:	5.20 in
eb:	0.00 in
a:	16.32 in
b:	26.55 in
r:	34.18

Max Brace Force, Pu = **1066 kips**

Vub:	0.000 x Pu	= 0 kips	V= Vertical Force
Hub:	0.477 x Pu	= 509 kips	H= Horizontal Force
Vuc:	0.777 x Pu	= 829 kips	b= Beam Side
Huc:	0.152 x Pu	= 163 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	6/16
Interaction for Vub:	0.000
Interaction for Hub:	0.934
Total Interaction:	0.934

Weld to Column Size:	7/16
Interaction for Vuc:	0.801
Interaction for Huc:	0.105
Total Interaction:	0.906

Gusset Design

Buckling Capacity:	238k OK
Yielding Capacity:	2476k OK
Block Shear Capacity:	2145k OK

SCBF GUSSET DESIGN

BF2 Top, Gusset 3

GENERAL CRITERIA

Frame Height:	8.66 ft	Beam Size:	W12X45
Frame Length:	11.28 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS5X5X1/2
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

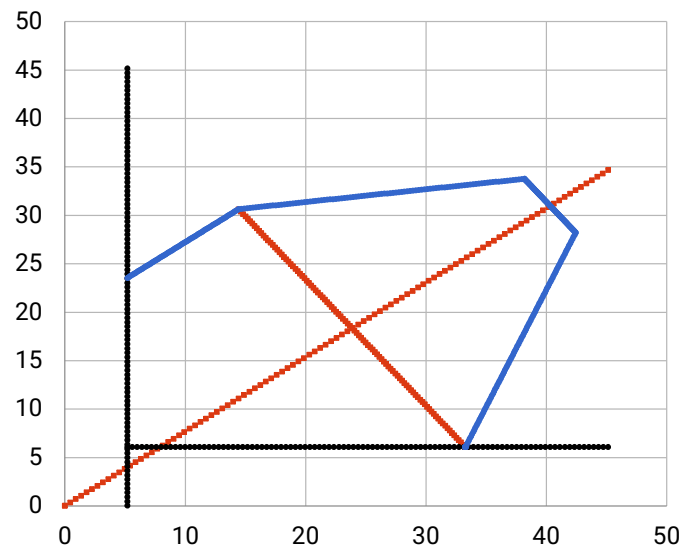
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	8.66 ft
Frame Length:	11.28 ft
Brace Length:	14.22 ft
Angle from Horiz:	37.52 deg
Angle from Vert:	52.48 deg

Gusset Plate Geometry

Brace on Gusset:	19.00 in
Length along Beam:	28.10 in
Length along Column:	17.46 in



DESIGN OUTPUT

Uniform Force Method

ec:	5.20 in
eb:	6.05 in
a:	14.64 in
b:	9.18 in
r:	25.01

Max Brace Force, Pu = **512 kips**

Vub:	0.242 x Pu	= 124 kips	V= Vertical Force
Hub:	0.585 x Pu	= 300 kips	H= Horizontal Force
Vuc:	0.367 x Pu	= 189 kips	b= Beam Side
Huc:	0.208 x Pu	= 107 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	5/16
Interaction for Vub:	0.203
Interaction for Hub:	0.736
Total Interaction:	0.939

Weld to Column Size:	6/16
Interaction for Vuc:	0.616
Interaction for Huc:	0.233
Total Interaction:	0.849

Gusset Design

Buckling Capacity:	303k OK
Yielding Capacity:	1139k OK
Block Shear Capacity:	961k OK

SCBF GUSSET DESIGN

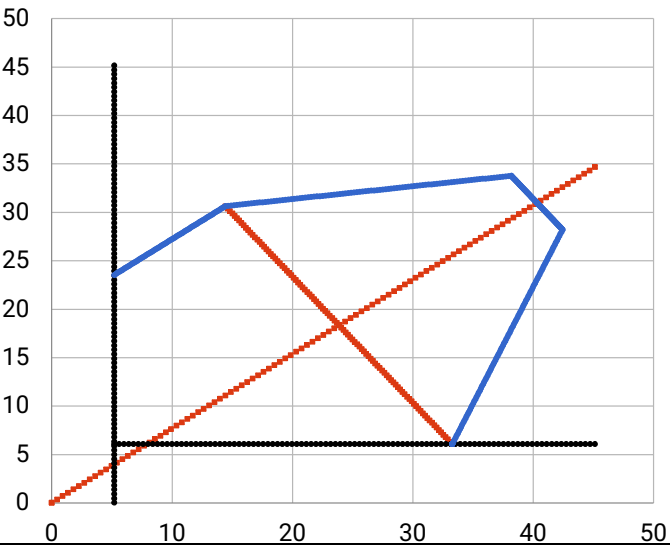
BF2 Bottom, Gusset 4

GENERAL CRITERIA

Frame Height:	8.66 ft	Beam Size:	W12X45
Frame Length:	11.28 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS5X5X1/2
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)	
Frame Height:	8.66 ft
Frame Length:	11.28 ft
Brace Length:	14.22 ft
Angle from Horz:	37.52 deg
Angle from Vert:	52.48 deg
Gusset Plate Geometry	
Brace on Gusset:	19.00 in
Length along Beam:	28.10 in
Length along Column:	17.46 in



DESIGN OUTPUT

Uniform Force Method		Max Brace Force, Pu = 512 kips	
ec:	5.20 in	Vub:	0.242 x Pu = 124 kips
eb:	6.05 in	Hub:	0.585 x Pu = 300 kips
a:	14.64 in	Vuc:	0.367 x Pu = 189 kips
b:	9.18 in	Huc:	0.208 x Pu = 107 kips
r:	25.01		
Welding of Gusset Connection		Gusset Design	
Weld to Beam Size:	5/16	Weld to Column Size:	6/16
Interaction for Vub:	0.203	Interaction for Vuc:	0.616
Interaction for Hub:	0.736	Interaction for Huc:	0.233
Total Interaction:	0.939	Total Interaction:	0.849
		Buckling Capacity:	303k OK
		Yielding Capacity:	1139k OK
		Block Shear Capacity:	961k OK

SCBF GUSSET DESIGN

BF3 Top, Gusset 5

GENERAL CRITERIA

Frame Height:	7.59 ft	Beam Size:	W12X45
Frame Length:	11.28 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS5X5X1/2
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

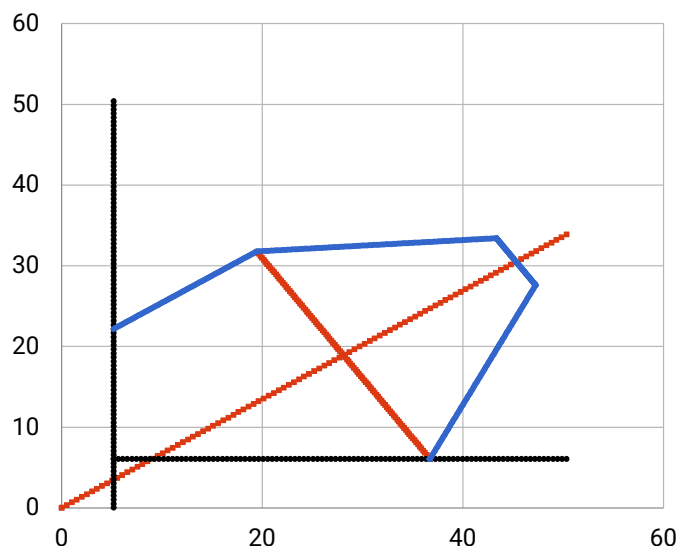
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	7.59 ft
Frame Length:	11.28 ft
Brace Length:	13.60 ft
Angle from Horiz:	33.92 deg
Angle from Vert:	56.08 deg

Gusset Plate Geometry

Brace on Gusset:	19.00 in
Length along Beam:	31.54 in
Length along Column:	16.10 in



DESIGN OUTPUT

Uniform Force Method

ec:	5.20 in
eb:	6.05 in
a:	16.42 in
b:	8.49 in
r:	26.05

Max Brace Force, Pu = **512 kips**

Vub:	$0.232 \times Pu$	= 119 kips	V= Vertical Force
Hub:	$0.630 \times Pu$	= 323 kips	H= Horizontal Force
Vuc:	$0.326 \times Pu$	= 167 kips	b= Beam Side
Huc:	$0.200 \times Pu$	= 103 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	5/16
Interaction for Vub:	0.174
Interaction for Hub:	0.707
Total Interaction:	0.880

Weld to Column Size:	6/16
Interaction for Vuc:	0.589
Interaction for Huc:	0.242
Total Interaction:	0.831

Gusset Design

Buckling Capacity:	303k OK
Yielding Capacity:	1139k OK
Block Shear Capacity:	961k OK

SCBF GUSSET DESIGN

BF3 Bottom, Gusset 6

GENERAL CRITERIA

Frame Height:	7.59 ft	Beam Size:	W12X45
Frame Length:	11.28 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS5X5X1/2
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

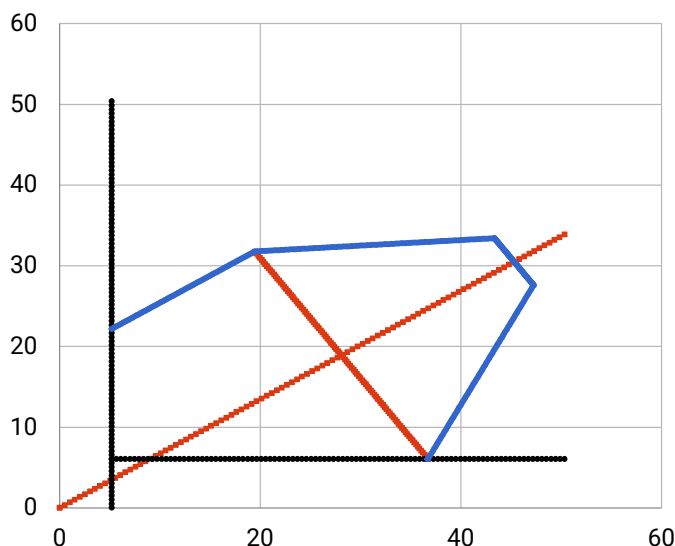
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	7.59 ft
Frame Length:	11.28 ft
Brace Length:	13.60 ft
Angle from Horiz:	33.92 deg
Angle from Vert:	56.08 deg

Gusset Plate Geometry

Brace on Gusset:	19.00 in
Length along Beam:	31.54 in
Length along Column:	16.10 in



DESIGN OUTPUT

Uniform Force Method

ec:	5.20 in
eb:	6.05 in
a:	16.42 in
b:	8.49 in
r:	26.05

Max Brace Force, Pu = **512 kips**

Vub:	$0.232 \times P_u$	= 119 kips	V= Vertical Force
Hub:	$0.630 \times P_u$	= 323 kips	H= Horizontal Force
Vuc:	$0.326 \times P_u$	= 167 kips	b= Beam Side
Huc:	$0.200 \times P_u$	= 103 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	5/16
Interaction for Vub:	0.174
Interaction for Hub:	0.707
Total Interaction:	0.880

Weld to Column Size:	6/16
Interaction for Vuc:	0.589
Interaction for Huc:	0.242
Total Interaction:	0.831

Gusset Design

Buckling Capacity:	303k OK
Yielding Capacity:	1139k OK
Block Shear Capacity:	961k OK

SCBF GUSSET DESIGN

BF4 Top, Gusset 7

GENERAL CRITERIA

Frame Height:	9.47 ft	Beam Size:	W12X45
Frame Length:	11.28 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS5X5X1/2
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

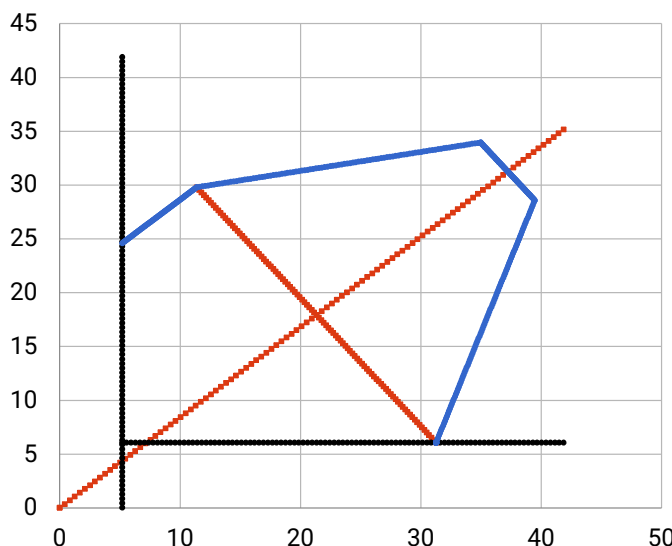
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	9.47 ft
Frame Length:	11.28 ft
Brace Length:	14.73 ft
Angle from Horiz:	40.00 deg
Angle from Vert:	50.00 deg

Gusset Plate Geometry

Brace on Gusset:	19.00 in
Length along Beam:	26.09 in
Length along Column:	18.52 in



DESIGN OUTPUT

Uniform Force Method

ec:	5.20 in
eb:	6.05 in
a:	13.60 in
b:	9.73 in
r:	24.54

Max Brace Force, Pu = **512 kips**

Vub:	0.247 x Pu	= 127 kips	V= Vertical Force
Hub:	0.554 x Pu	= 284 kips	H= Horizontal Force
Vuc:	0.396 x Pu	= 203 kips	b= Beam Side
Huc:	0.212 x Pu	= 109 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	5/16
Interaction for Vub:	0.224
Interaction for Hub:	0.750
Total Interaction:	0.974

Weld to Column Size:	6/16
Interaction for Vuc:	0.625
Interaction for Huc:	0.224
Total Interaction:	0.848

Gusset Design

Buckling Capacity:	303k OK
Yielding Capacity:	1139k OK
Block Shear Capacity:	961k OK

SCBF GUSSET DESIGN

BF4 Bottom, Gusset 8

GENERAL CRITERIA

Frame Height:	9.47 ft	Beam Size:	W12X45
Frame Length:	11.28 ft	Column Size:	W10X68
Floor Thickness:	0.00 in	Brace Size:	HSS5X5X1/2
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

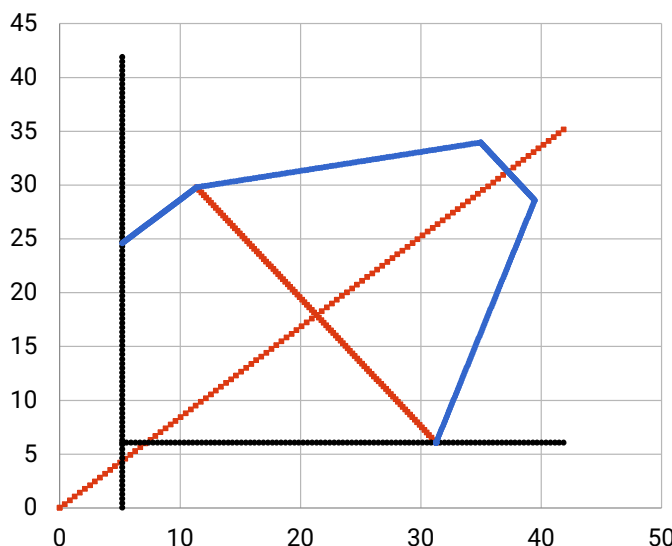
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	9.47 ft
Frame Length:	11.28 ft
Brace Length:	14.73 ft
Angle from Horiz:	40.00 deg
Angle from Vert:	50.00 deg

Gusset Plate Geometry

Brace on Gusset:	19.00 in
Length along Beam:	26.09 in
Length along Column:	18.52 in



DESIGN OUTPUT

Uniform Force Method

ec:	5.20 in
eb:	6.05 in
a:	13.60 in
b:	9.73 in
r:	24.54

Max Brace Force, Pu = **512 kips**

Vub:	0.247 x Pu	= 127 kips	V= Vertical Force
Hub:	0.554 x Pu	= 284 kips	H= Horizontal Force
Vuc:	0.396 x Pu	= 203 kips	b= Beam Side
Huc:	0.212 x Pu	= 109 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	5/16
Interaction for Vub:	0.224
Interaction for Hub:	0.750
Total Interaction:	0.974

Weld to Column Size:	6/16
Interaction for Vuc:	0.625
Interaction for Huc:	0.224
Total Interaction:	0.848

Gusset Design

Buckling Capacity:	303k OK
Yielding Capacity:	1139k OK
Block Shear Capacity:	961k OK

SCBF GUSSET DESIGN

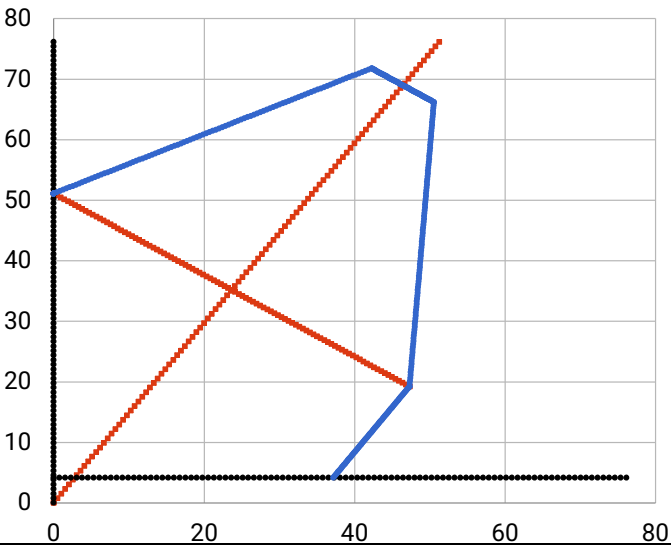
BF5 Top, Gusset 9

GENERAL CRITERIA

Frame Height:	36.51 ft	Beam Size:	W8X40
Frame Length:	24.58 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS8X8X5/8
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)	
Frame Height:	36.51 ft
Frame Length:	24.58 ft
Brace Length:	44.02 ft
Angle from Horz:	56.05 deg
Angle from Vert:	33.95 deg
Gusset Plate Geometry	
Brace on Gusset:	39.00 in
Length along Beam:	37.17 in
Length along Column:	46.95 in



DESIGN OUTPUT

Uniform Force Method		Max Brace Force, Pu = 1066 kips	
ec:	0.00 in	Vub:	0.121 x Pu = 130 kips
eb:	4.13 in	Hub:	0.558 x Pu = 596 kips
a:	18.99 in	Vuc:	0.708 x Pu = 755 kips
b:	24.08 in	Huc:	0.000 x Pu = 0 kips
r:	34.00		
Welding of Gusset Connection		Gusset Design	
Weld to Beam Size:	7/16	Weld to Column Size:	6/16
Interaction for Vub:	0.117	Interaction for Vuc:	0.939
Interaction for Hub:	0.805	Interaction for Huc:	0.000
Total Interaction:	0.922	Total Interaction:	0.939
		Buckling Capacity:	159k OK
		Yielding Capacity:	2167k OK
		Block Shear Capacity:	1877k OK

SCBF GUSSET DESIGN

BF5 Bottom, Gusset 10

GENERAL CRITERIA

Frame Height:	36.51 ft	Beam Size:	BasePlate
Frame Length:	24.58 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS8X8X5/8
Gusset Thickness:	0.88 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

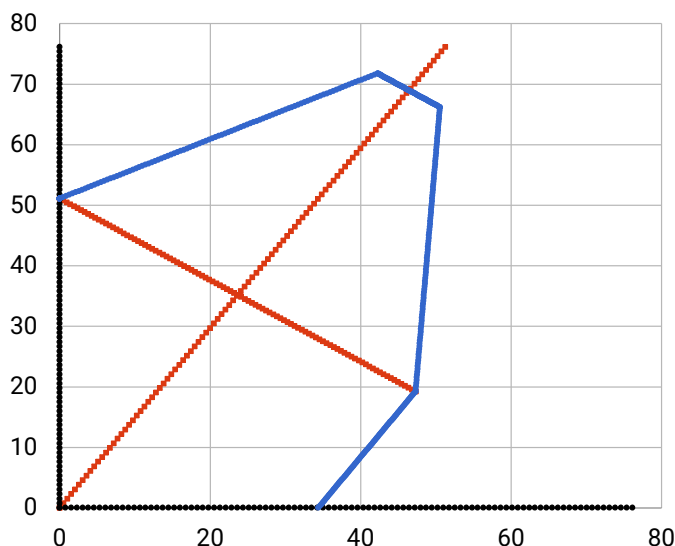
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	36.51 ft
Frame Length:	24.58 ft
Brace Length:	44.02 ft
Angle from Horz:	56.05 deg
Angle from Vert:	33.95 deg

Gusset Plate Geometry

Brace on Gusset:	39.00 in
Length along Beam:	34.39 in
Length along Column:	51.08 in



DESIGN OUTPUT

Uniform Force Method

ec:	0.00 in
eb:	0.00 in
a:	17.61 in
b:	26.16 in
r:	31.54

Max Brace Force, P_u = 1066 kips

Vub:	$0.000 \times P_u$	= 0 kips	V= Vertical Force
Hub:	$0.558 \times P_u$	= 596 kips	H= Horizontal Force
Vuc:	$0.830 \times P_u$	= 885 kips	b= Beam Side
Huc:	$0.000 \times P_u$	= 0 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	7/16
Interaction for Vub:	0.000
Interaction for Hub:	0.868
Total Interaction:	0.868

Weld to Column Size:	7/16
Interaction for Vuc:	0.868
Interaction for Huc:	0.000
Total Interaction:	0.868

Gusset Design

Buckling Capacity:	159k OK
Yielding Capacity:	2167k OK
Block Shear Capacity:	1877k OK

SCBF GUSSET DESIGN

BF6 Top, Gusset 11

GENERAL CRITERIA

Frame Height:	7.79 ft	Beam Size:	W8X40
Frame Length:	24.58 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS4X4X3/8
Gusset Thickness:	0.75 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

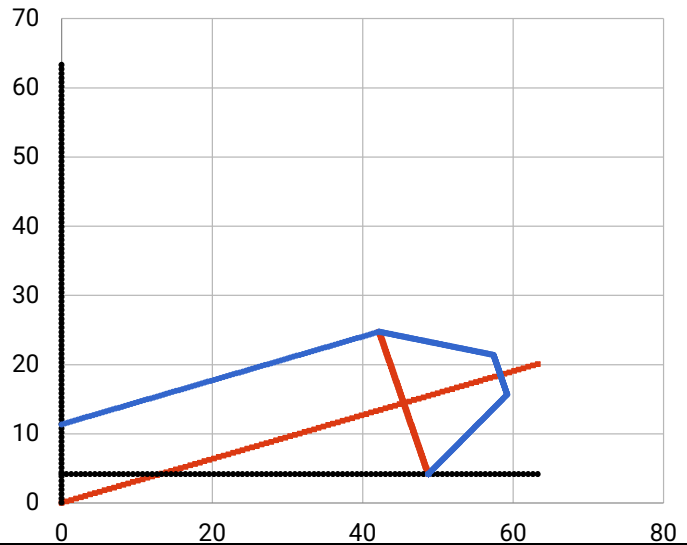
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	7.79 ft
Frame Length:	24.58 ft
Brace Length:	25.79 ft
Angle from Horz:	17.59 deg
Angle from Vert:	72.41 deg

Gusset Plate Geometry

Brace on Gusset:	12.00 in
Length along Beam:	48.74 in
Length along Column:	7.20 in



DESIGN OUTPUT

Uniform Force Method

ec:	0.00 in
eb:	4.13 in
a:	25.72 in
b:	4.03 in
r:	26.98

Max Brace Force, Pu = **312 kips**

Vub:	0.153 x Pu	= 48 kips	V= Vertical Force
Hub:	0.953 x Pu	= 298 kips	H= Horizontal Force
Vuc:	0.149 x Pu	= 47 kips	b= Beam Side
Huc:	0.000 x Pu	= 0 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	3/16
Interaction for Vub:	0.075
Interaction for Hub:	0.694
Total Interaction:	0.768

Weld to Column Size:	3/16
Interaction for Vuc:	0.699
Interaction for Huc:	0.000
Total Interaction:	0.699

Gusset Design

Buckling Capacity:	276k OK
Yielding Capacity:	670k OK
Block Shear Capacity:	551k OK

SCBF GUSSET DESIGN

BF6 Bottom, Gusset 12

GENERAL CRITERIA

Frame Height:	7.79 ft	Beam Size:	W8X40
Frame Length:	24.58 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS4X4X3/8
Gusset Thickness:	0.75 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

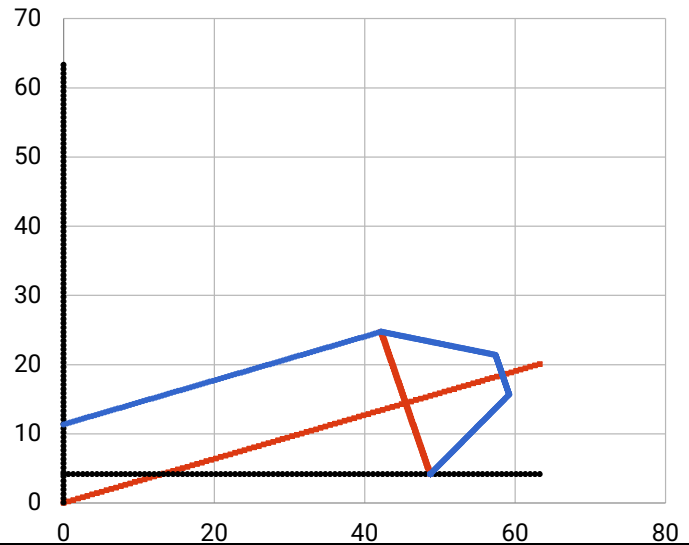
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	7.79 ft
Frame Length:	24.58 ft
Brace Length:	25.79 ft
Angle from Horz:	17.59 deg
Angle from Vert:	72.41 deg

Gusset Plate Geometry

Brace on Gusset:	12.00 in
Length along Beam:	48.74 in
Length along Column:	7.20 in



DESIGN OUTPUT

Uniform Force Method

ec:	0.00 in
eb:	4.13 in
a:	25.72 in
b:	4.03 in
r:	26.98

Max Brace Force, Pu = **312 kips**

Vub:	0.153 x Pu	= 48 kips	V= Vertical Force
Hub:	0.953 x Pu	= 298 kips	H= Horizontal Force
Vuc:	0.149 x Pu	= 47 kips	b= Beam Side
Huc:	0.000 x Pu	= 0 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	3/16
Interaction for Vub:	0.075
Interaction for Hub:	0.694
Total Interaction:	0.768

Weld to Column Size:	3/16
Interaction for Vuc:	0.699
Interaction for Huc:	0.000
Total Interaction:	0.699

Gusset Design

Buckling Capacity:	276k OK
Yielding Capacity:	670k OK
Block Shear Capacity:	551k OK

SCBF GUSSET DESIGN

BF7 Top, Gusset 13

GENERAL CRITERIA

Frame Height:	12.17 ft	Beam Size:	W8X40
Frame Length:	9.08 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS4X4X3/8
Gusset Thickness:	0.75 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

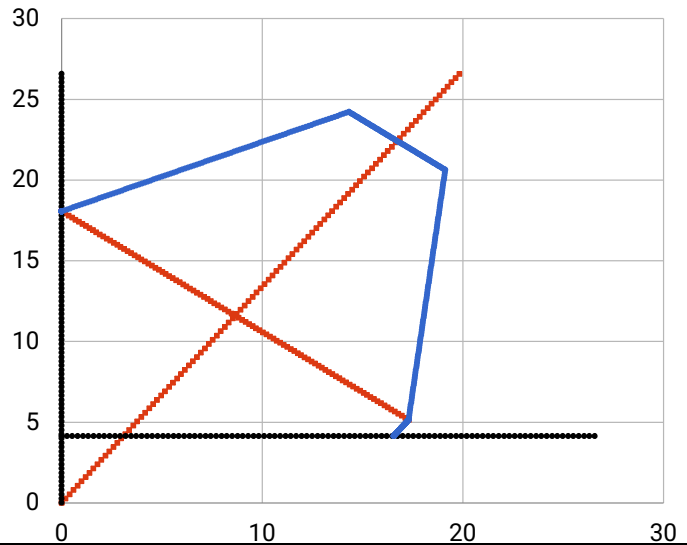
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	12.17 ft
Frame Length:	9.08 ft
Brace Length:	15.19 ft
Angle from Horz:	53.27 deg
Angle from Vert:	36.73 deg

Gusset Plate Geometry

Brace on Gusset:	12.00 in
Length along Beam:	16.55 in
Length along Column:	13.92 in



DESIGN OUTPUT

Uniform Force Method

ec:	0.00 in
eb:	4.13 in
a:	8.68 in
b:	7.51 in
r:	14.52

Max Brace Force, Pu = **312 kips**

Vub:	0.284 x Pu	= 89 kips	V= Vertical Force
Hub:	0.598 x Pu	= 187 kips	H= Horizontal Force
Vuc:	0.517 x Pu	= 162 kips	b= Beam Side
Huc:	0.000 x Pu	= 0 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	6/16
Interaction for Vub:	0.205
Interaction for Hub:	0.645
Total Interaction:	0.849

Weld to Column Size:	4/16
Interaction for Vuc:	0.969
Interaction for Huc:	0.000
Total Interaction:	0.969

Gusset Design

Buckling Capacity:	276k OK
Yielding Capacity:	670k OK
Block Shear Capacity:	551k OK

SCBF GUSSET DESIGN

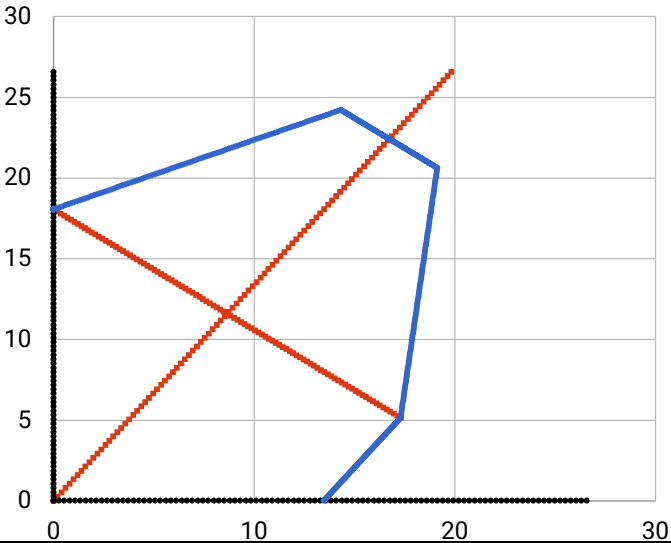
BF7 Bottom, Gusset 14

GENERAL CRITERIA

Frame Height:	12.17 ft	Beam Size:	BasePlate
Frame Length:	9.08 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS4X4X3/8
Gusset Thickness:	0.75 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)	
Frame Height:	12.17 ft
Frame Length:	9.08 ft
Brace Length:	15.19 ft
Angle from Horz:	53.27 deg
Angle from Vert:	36.73 deg
Gusset Plate Geometry	
Brace on Gusset:	12.00 in
Length along Beam:	13.47 in
Length along Column:	18.05 in



DESIGN OUTPUT

Uniform Force Method		Max Brace Force, Pu = 312 kips	
ec:	0.00 in	Vub: 0.000 x Pu	= 0 kips
eb:	0.00 in	Hub: 0.598 x Pu	= 187 kips
a:	7.17 in	Vuc: 0.801 x Pu	= 251 kips
b:	9.61 in	Huc: 0.000 x Pu	= 0 kips
r:	11.99		
Welding of Gusset Connection		Gusset Design	
Weld to Beam Size:	5/16	Weld to Column Size:	5/16
Interaction for Vub:	0.000	Interaction for Vuc:	0.939
Interaction for Hub:	0.937	Interaction for Huc:	0.000
Total Interaction:	0.937	Total Interaction:	0.939
		Buckling Capacity:	276k OK
		Yielding Capacity:	670k OK
		Block Shear Capacity:	551k OK

SCBF GUSSET DESIGN

BF8 Top, Gusset 15

GENERAL CRITERIA

Frame Height:	7.79 ft	Beam Size:	W8X40
Frame Length:	9.08 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS4X4X3/8
Gusset Thickness:	0.75 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

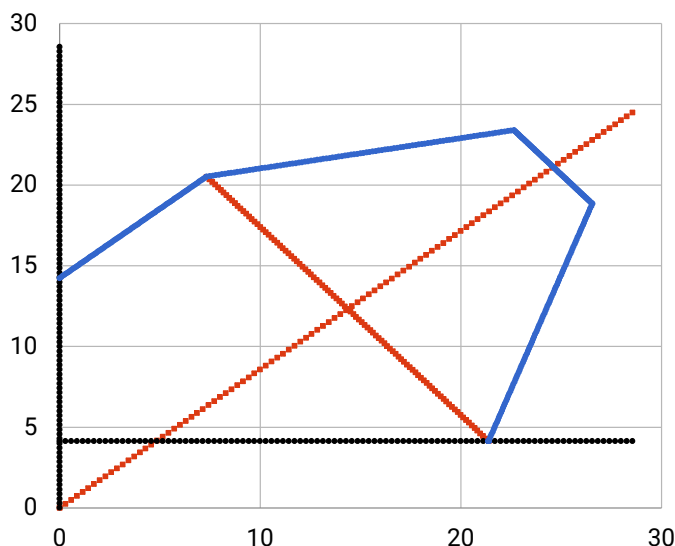
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	7.79 ft
Frame Length:	9.08 ft
Brace Length:	11.97 ft
Angle from Horiz:	40.63 deg
Angle from Vert:	49.37 deg

Gusset Plate Geometry

Brace on Gusset:	12.00 in
Length along Beam:	21.39 in
Length along Column:	10.10 in



DESIGN OUTPUT

Uniform Force Method

ec:	0.00 in
eb:	4.13 in
a:	11.26 in
b:	5.53 in
r:	14.83

Max Brace Force, P_u = **312 kips**

Vub:	$0.278 \times P_u$	= 87 kips	V= Vertical Force
Hub:	$0.759 \times P_u$	= 237 kips	H= Horizontal Force
Vuc:	$0.373 \times P_u$	= 117 kips	b= Beam Side
Huc:	$0.000 \times P_u$	= 0 kips	c= Column Side

Welding of Gusset Connection

Weld to Beam Size:	5/16
Interaction for Vub:	0.185
Interaction for Hub:	0.756
Total Interaction:	0.942

Weld to Column Size:	4/16
Interaction for Vuc:	0.950
Interaction for Huc:	0.000
Total Interaction:	0.950

Gusset Design

Buckling Capacity:	276k OK
Yielding Capacity:	670k OK
Block Shear Capacity:	551k OK

SCBF GUSSET DESIGN

BF8 Bottom, Gusset 16

GENERAL CRITERIA

Frame Height:	7.79 ft	Beam Size:	W8X40
Frame Length:	9.08 ft	Column Size:	BasePlate
Floor Thickness:	0.00 in	Brace Size:	HSS4X4X3/8
Gusset Thickness:	0.75 in	Brace Grade:	A500 Gr C
Measured from Top of Slab:	No	Gusset Plate Fy:	50 ksi
		Weld Size Brace to Gusset:	5 /16
		Corner Snip:	1.00 in

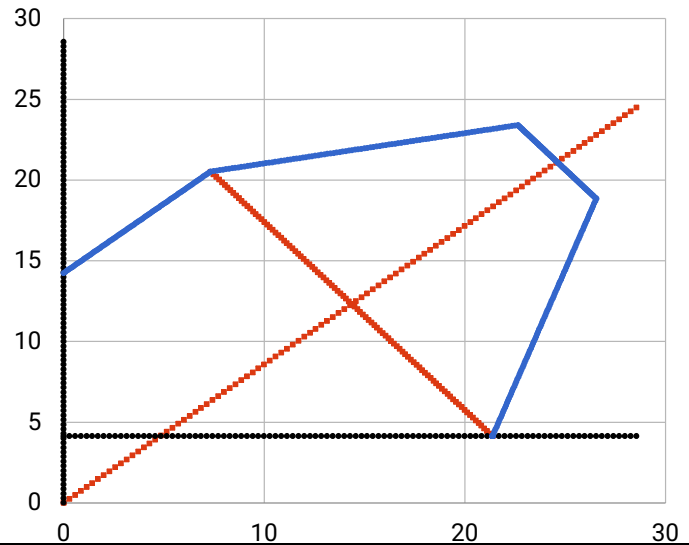
ANALYSIS AND CALCULATIONS

Frame Geometry (Work-Point to Work-Point)

Frame Height:	7.79 ft
Frame Length:	9.08 ft
Brace Length:	11.97 ft
Angle from Horiz:	40.63 deg
Angle from Vert:	49.37 deg

Gusset Plate Geometry

Brace on Gusset:	12.00 in
Length along Beam:	21.39 in
Length along Column:	10.10 in



DESIGN OUTPUT

Uniform Force Method

ec:	0.00 in
eb:	4.13 in
a:	11.26 in
b:	5.53 in
r:	14.83

Max Brace Force, Pu = **312 kips**

Vub:	$0.278 \times Pu$	= 87 kips	V= Vertical Force
Hub:	$0.759 \times Pu$	= 237 kips	H= Horizontal Force
Vuc:	$0.373 \times Pu$	= 117 kips	b= Beam Side
Huc:	$0.000 \times Pu$	= 0 kips	c= Column Side

Welding of Gusset Connection

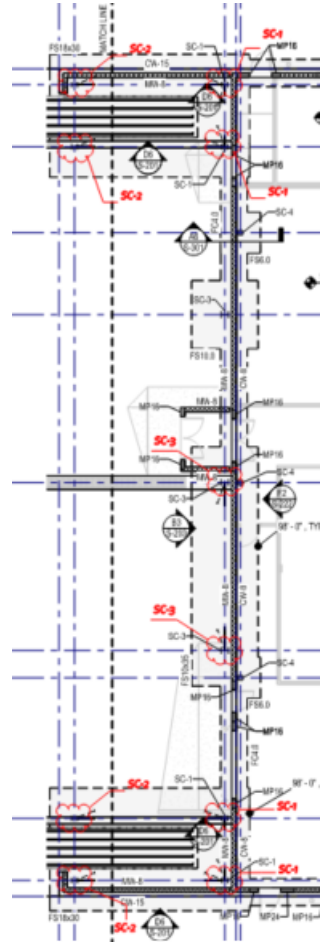
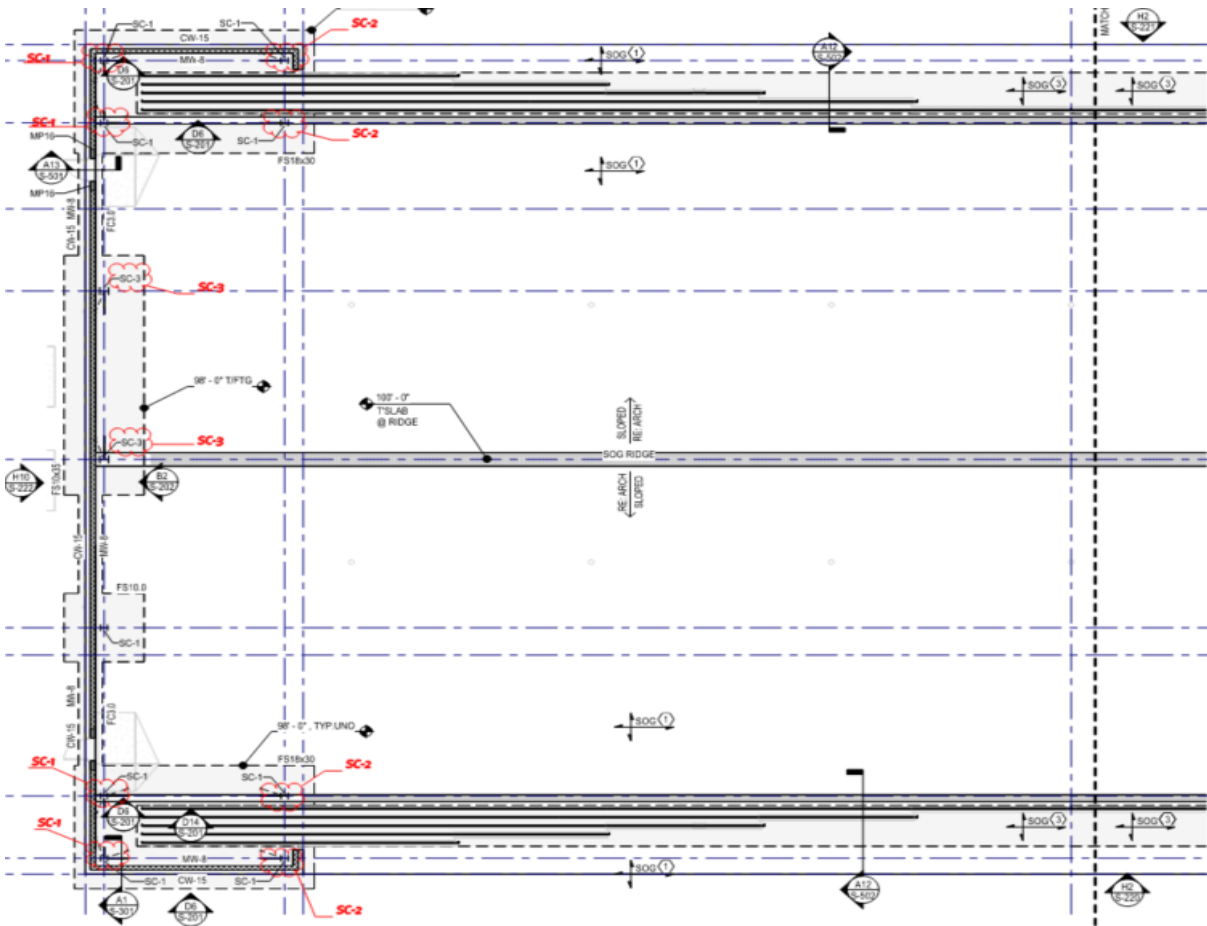
Weld to Beam Size:	5/16
Interaction for Vub:	0.185
Interaction for Hub:	0.756
Total Interaction:	0.942

Weld to Column Size:	4/16
Interaction for Vuc:	0.950
Interaction for Huc:	0.000
Total Interaction:	0.950

Gusset Design

Buckling Capacity:	276k OK
Yielding Capacity:	670k OK
Block Shear Capacity:	551k OK

BASEPLATE PLAN LOCATIONS



SCBF Column Axial Loads

	Cloumn Label	Axial load D (kips)	Axial load Ex (kips)	Axial load Ey (kips)
Grid 3.9	69	28	17	35
	361	7	16	28
	335	116	2	49
	406	86	1	45
	419	1	16	29
	184	31	17	36
Grid 1.1	479	30	17	36
	430	1	16	29
	404	86	1	45
	475	116	2	48
	486	7	16	28
	483	28	17	35
Grid A.1	5	61	16	8
	29	61	16	8
Grid A.3	91	30	17	14
	93	28	17	14
Grid D.7	154	28	17	14
	162	30	17	14
Grid D.9	108	61	16	8
	110	61	16	8

	HSS 4x4x3/8	HSS 8x8x5/8	HSS 8x8x5/8
Lc	11.75 ft	36 ft	44 ft
r	1.47 in	2.99 in	2.99 in
Ag	4.78 sq in	16.4 sq in	16.4 sq in
Lc/r	95.918367	144.4816	176.5886
Ry	1.3	1.3	1.3
Fy	50 ksi	50 ksi	50 ksi
E	29000 ksi	29000 ksi	29000 ksi
4.71 (E/RyFy)^.5	99.486288	99.48629	99.48629
Fe	31.109583 ksi	13.71111 ksi	9.178512 ksi
Fne	27.109197 ksi	12.02464 ksi	8.049555 ksi
Pn	130 kip	197 kip	132 kip
RyFyAg	310.7 kip	1066 kip	1066 kip
(1/.877)*Fne*Ag	148 kip	225 kip	151 kip

Base Plate	SC1	SC1	SC2	SC3
Gr Anchor	105 ksi	105 ksi	105 ksi	105 ksi
tp	1.875 in	1.5 in	1.75 in	1.875 in
M	48 in	30	48	45
N	20 in	20	20	20
Brace angle	52.81 deg from horiz	52.81 deg from horiz	50.96 deg from horiz	55.51 deg from horiz
P(DL)	28	1	28	86
P(E)	35	29	17	45
Pu Column	48	57	12	23
Tension	897 k	305 k	840 k	901 k
# Anchors	10	6	6	6
Pu anchor	90 k	51 k	140 k	150 k
As rod	0.95 sq in	0.54 sq in	1.48 sq in	1.59 sq in
phi rod	1.10 sq in	0.83 sq in	1.37 sq in	1.42 sq in
Check base plate in bending to confirm rigid body assumption				
e	1.75 in	1.75 in	1.75 in	1.75 in
Mu	314.1 k-in	177.8 k-in	490.0 k-in	525.8 k-in
Z	12.3 cu in	7.9 cu in	10.7 cu in	12.3 cu in
stress	25.52 ksi	22.57 ksi	45.72 ksi	42.73 ksi
Embed plate				
wu	59.8 k-in	20.3 k-in	56.0 k-in	60.1 k-in
Mu	1682.5 k-in	571.4 k-in	1575.1 k-in	1690.1 k-in
Zx	37.4 cu in	12.7 cu in	35.0 cu in	37.6 cu in
t	1.77 in	1.30 in	1.71 in	1.83 in
Conc Breakout				
d	27 in	27 in	27 in	27 in
bo	224 in	188 in	224 in	218 in
phi Vc	1217 k	1022 k	1217 k	1185 k
Shear	644 k	188 k	671 k	604 k
See shear lug calculation				

Shear Lug Design

SC 1 - HSS8x8x5/8 Brace



GENERAL DESIGN CRITERIA

Base Plate Length:	48.00 in
Base Plate Width:	20.00 in
Shear Lug Width:	20.00 in
Base Plate Thickness:	1.875 in
# of Lugs Used:	2

Factored Shear Load (V_u):	644 kips
Grout Thickness:	2.00 in
Concrete Strength (f'_c):	4500 psi
Lug Yield Strength (F_y):	50 ksi

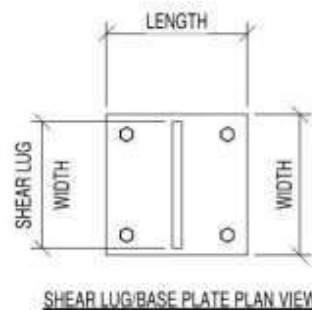
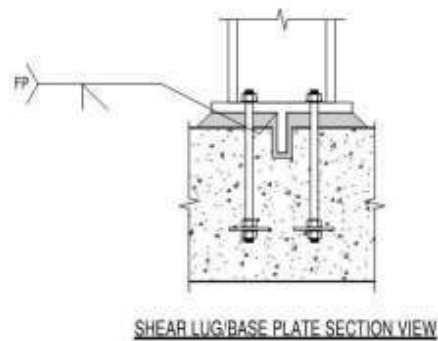
ANALYSIS AND DESIGN CALCULATION

Single Shear Lug Design

Max Shear (V_u):	322.00	kips
Lug Area Req'd:	129.51	in ²
Min Lug Depth:	8.48	in
Actual Lug Depth:	8.50	in
Lug Moment (M_u):	84.53	k-in
Min Lug Thickness:	2.741	in
Lug Thickness:	2.750	in

Final Shear Lug Design

Shear Lug Size:	(2) 8.5 in x 2.3/4 in x 20 in.	
Shear Lug Thickness:	2.750	in.
Shear Lug Depth:	8.50	in.
Lug Face to Base Plate edge:	15.00 in	in.
Spacing Between Lugs:	12.50 in	in.



Shear Lug Design

SC 2 - HSS8x8x5/8 Brace



GENERAL DESIGN CRITERIA

Base Plate Length:	48.00 in
Base Plate Width:	20.00 in
Shear Lug Width:	20.00 in
Base Plate Thickness:	1.750 in
# of Lugs Used:	2

Factored Shear Load (V_u):	671 kips
Grout Thickness:	2.00 in
Concrete Strength (f'_c):	4500 psi
Lug Yield Strength (F_y):	50 ksi

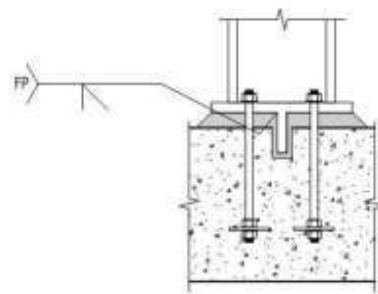
ANALYSIS AND DESIGN CALCULATION

Single Shear Lug Design

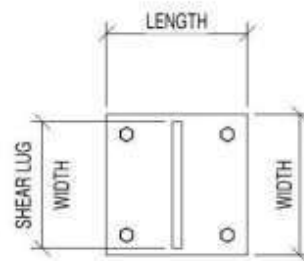
Max Shear (V_u):	335.50	kips
Lug Area Req'd:	134.94	in ²
Min Lug Depth:	8.75	in
Actual Lug Depth:	9.00	in
Lug Moment (M_u):	92.26	k-in
Min Lug Thickness:	2.864	in
Lug Thickness:	3.000	in

Final Shear Lug Design

Shear Lug Size:	(2) 9 in x 3 in x 20 in.
Shear Lug Thickness:	3.000 in.
Shear Lug Depth:	9.00 in.
Lug Face to Base Plate edge:	14.50 in.
Spacing Between Lugs:	13.00 in.



SHEAR LUG/BASE PLATE SECTION VIEW



SHEAR LUG/BASE PLATE PLAN VIEW

Shear Lug Design

SC 3 - HSS8x8x5/8 Brace



GENERAL DESIGN CRITERIA

Base Plate Length:	45.00 in
Base Plate Width:	20.00 in
Shear Lug Width:	20.00 in
Base Plate Thickness:	1.875 in
# of Lugs Used:	2

Factored Shear Load (V_u):	604 kips
Grout Thickness:	2.00 in
Concrete Strength (f'_c):	4500 psi
Lug Yield Strength (F_y):	50 ksi

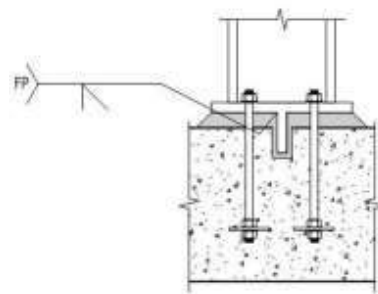
ANALYSIS AND DESIGN CALCULATION

Single Shear Lug Design

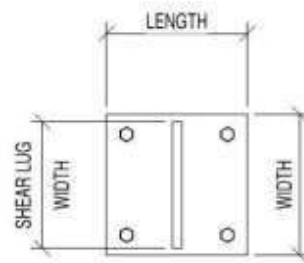
Max Shear (V_u):	302.00	kips
Lug Area Req'd:	121.47	in ²
Min Lug Depth:	8.07	in
Actual Lug Depth:	8.50	in
Lug Moment (M_u):	79.28	k-in
Min Lug Thickness:	2.655	in
Lug Thickness:	2.750	in

Final Shear Lug Design

Shear Lug Size:	(2) 8.5 in x 2.3/4 in x 20 in.	
Shear Lug Thickness:	2.750	in.
Shear Lug Depth:	8.50	in.
Lug Face to Base Plate edge:	13.50 in	in.
Spacing Between Lugs:	12.50 in	in.



SHEAR LUG/BASE PLATE SECTION VIEW



SHEAR LUG/BASE PLATE PLAN VIEW

COLUMN BASE PLATE DESIGN

In accordance with AISC Steel Design Guide 1 and AISC 360-22

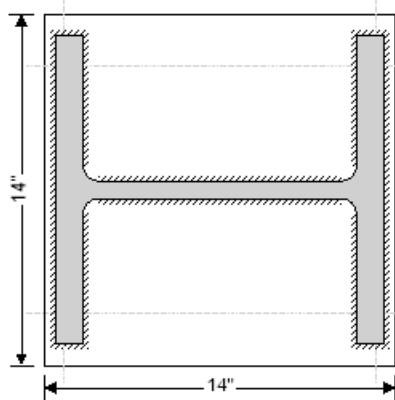
Tedds calculation version 2.1.14

Design summary

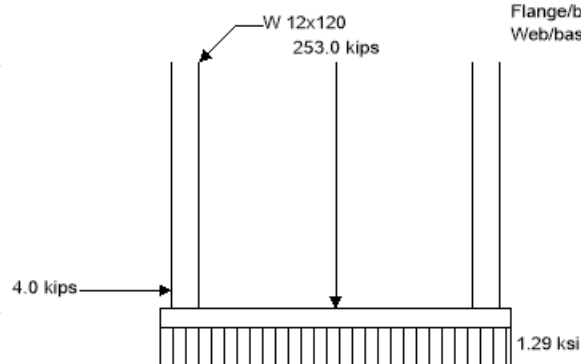
Overall design status

PASS

Description	Unit	Required	Provided	Utilization	Result
Plate thickness	(in)	0.587	0.750	0.783	PASS
Bearing strength	(kips)	253.00	974.61	0.260	PASS
Flange weld strength	(kips/in)	0.000	10.441	0.000	PASS
Shear weld strength	(kips/in)	0.184	6.961	0.026	PASS
Frictional shear resistance	(kips)	4.00	68.31	0.059	PASS



Plan on baseplate



Elevation on baseplate

Design forces and moments

Axial force

$P_u = 253.0$ kips (Compression)

Bending moment

$M_u = 0.0$ kip_in

Shear force

$F_v = 4.0$ kips

Column details

Column section

W 12x120

Depth

$d = 13.100$ in

Breadth

$b_f = 12.300$ in

Flange thickness

$t_f = 1.110$ in

Web thickness

$t_w = 0.710$ in

Baseplate details

Depth

$N = 14.000$ in

Breadth

$B = 14.000$ in

Thickness

$t_p = 0.750$ in

Design strength

$F_y = 36.0$ ksi

Foundation geometry

Member thickness

$h_a = 30.000$ in

Dist center of baseplate to left edge foundation

$x_{ce1} = 30.000$ in

Dist center of baseplate to right edge foundation

$x_{ce2} = 30.000$ in

Dist center of baseplate to bot edge foundation

$y_{ce1} = 30.000$ in

Dist center of baseplate to top edge foundation

$$y_{ce2} = 30.000 \text{ in}$$

Minimum tensile strength, base plate

$$F_y = 36 \text{ ksi}$$

Minimum tensile strength, column

$$F_{yCol} = 50 \text{ ksi}$$

Compressive strength of concrete

$$f'_c = 4.5 \text{ ksi}$$

Strength reduction factors

Compression

$$\phi_c = 0.65$$

Flexure

$$\phi_b = 0.90$$

Weld shear

$$\phi_v = 0.75$$

Plate cantilever dimensions

Minimum distance to edge of concrete

$$l_{min} = \min(\min(x_{ce1}, x_{ce2}) - N / 2, \min(y_{ce1}, y_{ce2}) - B / 2) = 23.000 \text{ in}$$

Area of base plate

$$A_1 = B \times N = 196.000 \text{ in}^2$$

Maximum area of supporting surface

$$A_2 = (N + 2 \times l_{min})^2 \times (B / N) = 3600.000 \text{ in}^2$$

Nominal strength of concrete under base plate

$$P_p = 0.85 \times f'_c \times A_1 \times \min(\sqrt{A_2 / A_1}, 2) = 1499.4 \text{ kips}$$

Plate bending coefficient X

$$X = (4 \times d \times b_f) / (d + b_f)^2 \times \min(1.0, P_u / (P_p \times \phi_c)) = 0.26$$

Plate bending coefficient λ

$$\lambda_l = \min(1, 2 \times \sqrt{X} / (1 + \sqrt{(1 - X)})) = 0.55$$

Bending line cantilever distance m

$$m = (N - 0.95 \times d) / 2 = 0.778 \text{ in}$$

Bending line cantilever distance n

$$n = (B - 0.8 \times b_f) / 2 = 2.080 \text{ in}$$

Yield line theory cantilever distance n'

$$n' = \sqrt{(d \times b_f) / 4} = 3.173 \text{ in}$$

Maximum bending line cantilever

$$l = \max(m, n, \lambda_l \times n') = 2.080 \text{ in}$$

Plate thickness

Required plate thickness

$$t_{p,req} = l \times \sqrt{(2 \times P_u) / (\phi_b \times F_y \times B \times N)} = 0.587 \text{ in}$$

Specified plate thickness

$$t_p = 0.750 \text{ in}$$

PASS - Thickness of plate exceeds required thickness

Design bearing strength (AISC 360-05-J8)

Design bearing strength

$$P_p = 1499.40 \text{ kips}$$

Factored bearing strength

$$\phi_c P_p = 974.61 \text{ kips}$$

PASS - Allowable bearing stress exceeds applied bearing stress

Frictional shear resistance

Steel / concrete friction coefficient

$$\mu = 0.4$$

Frictional shear resistance

$$\phi V_n = \min(\phi_v \times \mu \times P_u, \phi_v \times 0.2 \times f'_c \times A_1, \phi_v \times 800 \text{ psi} \times A_1) = 68.31 \text{ kips}$$

PASS - Frictional shear resistance exceeds applied shear

Flange weld

Flange weld leg length

$$t_{wf} = 0.3125 \text{ in}$$

Tension capacity of flange

$$P_{tf} = b_f \times t_f \times F_{yCol} = 682.7 \text{ kips}$$

Force in tension flange

$$F_{tf} = M_u / (d - t_f) - P_u \times (b_f \times t_f) / A_{col} = -98.1 \text{ kips}$$

Critical force in flange

$$F_f = \min(P_{tf}, \max(F_{tf}, 0 \text{ kips})) = 0.0 \text{ kips}$$

Flange weld force per in

$$R_{wf} = F_f / (2 \times b_f - t_w) = 0.0 \text{ kips/in}$$

Electrode classification number

$$F_{EXX} = 70.0 \text{ ksi}$$

Design weld stress

$$\phi F_{nw} = \phi_v \times 0.60 \times F_{EXX} \times (1.0 + 0.5 \times (\sin(90 \text{ deg}))^{1.5}) = 47.250 \text{ ksi}$$

Design strength of weld per in

$$\phi R_{nf} = \phi F_{nw} \times t_{wf} / \sqrt{2} = 10.4 \text{ kips/in}$$

PASS - Available strength of flange weld exceeds force in flange weld

Project Creech DRP 2				Job Ref.	
Section AMF Grid D/3.9 Base Plate				Sheet no./rev. 3	
Calc. by BT	Date 11/6/2025	Chk'd by	Date	App'd by	Date

Shear weld

Shear web weld leg length

$$t_{ww} = \mathbf{0.3125 \text{ in}}$$

Shear web weld force per in

$$R_w = F_v / (2 \times (d - 2 \times t_r)) = \mathbf{0.184 \text{ kips/in}}$$

Electrode classification number

$$F_{EXX} = \mathbf{70.0 \text{ ksi}}$$

Design weld stress

$$\phi F_{nw} = \phi_v \times 0.60 \times F_{EXX} \times (1.0 + 0.5 \times (\sin(0\text{deg}))^{1.5}) = \mathbf{31.500 \text{ ksi}}$$

Design strength of weld per in

$$\phi R_{nl} = \phi F_{nw} \times t_{ww} / \sqrt{2} = \mathbf{7.0 \text{ kips/in}}$$

PASS - Available strength of shear weld exceeds force in shear weld

www.hilti.com			
Company:		Page:	1
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Masonry - Apr 23, 2025 (1)	Date:	4/23/2025
Fastening point:	Wind Girt Anchor		

Specifiier's comments:

1 Input data

Anchor type and diameter:	HY 270 + threaded rod 5.8 5/8
Item number:	385428 HAS 5.8 5/8"x8" (element) / 2194247 HIT-HY 270 (adhesive)
Specification text:	Hilti Ø 5/8 HY 270 + threaded rod 5.8 with 5.625 in nominal embedment depth per Technical data , Hammer drilled installation per MPII,
Effective embedment depth:	h _{ef} = 5.625 in.
Material:	5.8
Evaluation Service Report:	Hilti Technical Data
Issued Valid:	- -
Proof:	Design Method ASD Masonry
Stand-off installation:	
Profile:	
Base material:	Grout-filled CMU, L x W x H: 16.000 in. x 8.000 in. x 8.000 in.;
	Joints: vertical: 0.375 in.; horizontal: 0.375 in.
	Base material temperature: 68 °F
Installation:	Face installation
Seismic loads	no





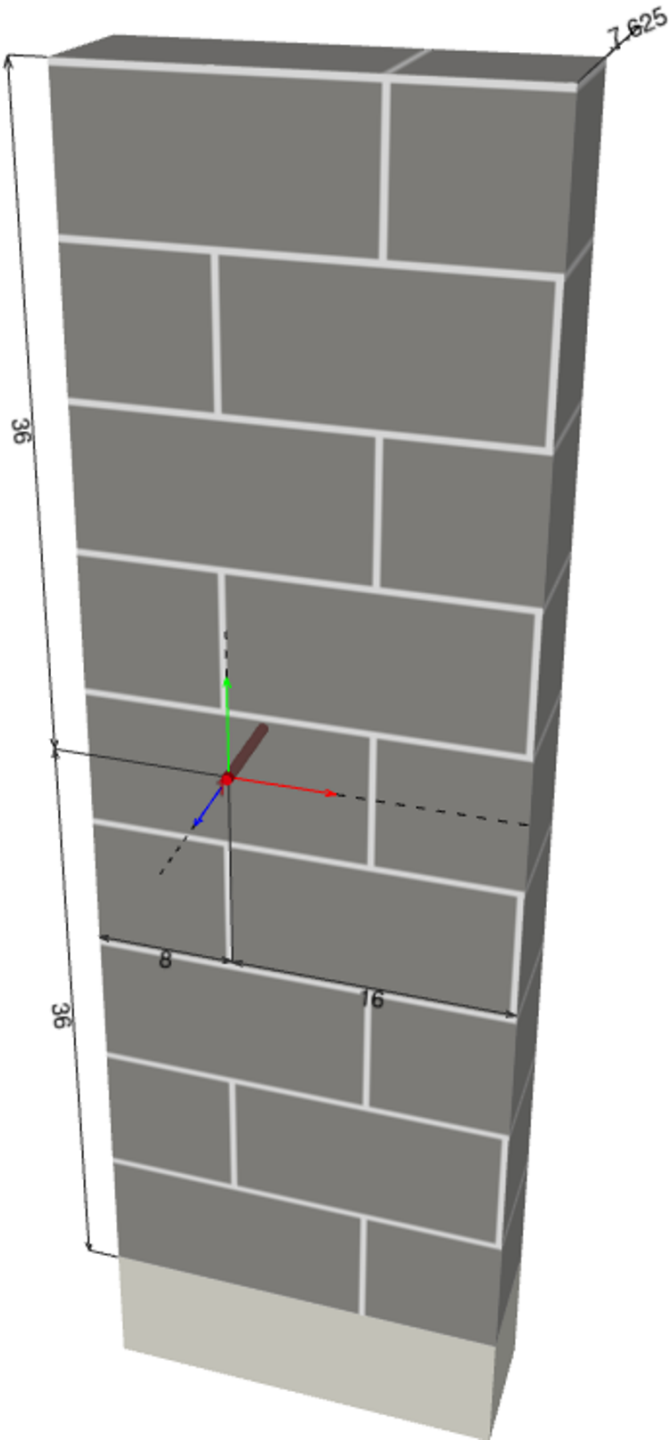
www.hilti.com

Company:
Address:
Phone | Fax:
Design:
Fastening point:

|
Masonry - Apr 23, 2025 (1)
Wind Grit Anchor

Page: 2
Specifier:
E-Mail:
Date: 4/23/2025

Geometry [in.]



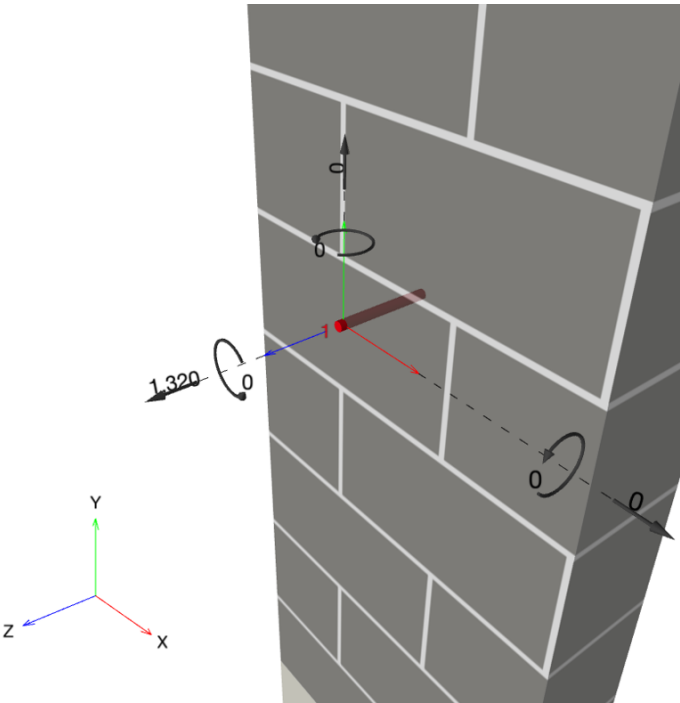
Input data and results must be checked for conformity with the existing conditions and for plausibility!
PROFIS Engineering (c) 2003-2025 Hilti AG, FL-9494 Schaan Hilti is a registered Trademark of Hilti AG, Schaan

www.hilti.com

Company:
Address:
Phone | Fax: |
Design: Masonry - Apr 23, 2025 (1)
Fastening point: Wind Grit Anchor

Page: 3
Specifier:
E-Mail:
Date: 4/23/2025

Geometry [in.] & Loading [lb, in.lb]



1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 1,320; V _x = 0; V _y = 0; M _x = 0; M _y = 0; M _z = 0;	no	65

$$W_p = 126 \times 10 \times 16 / 12 = 1700 \text{ lb}$$
$$K_a = 1 + L_f / 100 = 1 + 10 / 100 = 1.1$$
$$F_p = 0.4 \text{ SDS } K_a I_e W_p = 0.4 \times 0.59 \times 1.1 \times 1.25 \times 1700 = 552 \text{ lb}$$

2 Load case/Resulting anchor forces

Load case: Service loads

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	1,320	0	0	0



Hilti PROFIS Engineering 3.1.14

www.hilti.com

Company:		Page:	4
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Masonry - Apr 23, 2025 (1)	Date:	4/23/2025
Fastening point:	Wind Grit Anchor		

3 Tension load (Most utilized anchor 1)

	Load P_s [lb]	Capacity P_t [lb]	Utilization $\beta_p = P_s/P_t$ [%]	Status
Steel strength	1,320	7,340	18	OK
Bond strength	1,320	2,061	65	OK

3.1 Steel strength

$P_{t,s}$ = Value refer to Hilti Technical Data

$P_{t,s} \geq P_s$

Results

$P_{t,s}$ [lb]	P_s [lb]
7,340	1,320

3.2 Bond strength

$P_{t,b,Base}$ = Value refer to Hilti Technical Data

$P_{t,b} = P_{t,b,Base} \cdot f_{red,E} \cdot f_{red,s} \cdot f_{red,Temp} \cdot f_{red,Bedjoint}$

$P_{t,b} \geq P_s$

Variables

c_{min} [in.]	c_{cr} [in.]	s_{min} [in.]	s_{cr} [in.]	Temperature [°F]
4.000	20.000	4.000	22.500	68

Results

$P_{t,b}$ [lb]	$P_{t,b,Base}$ [lb]	P_s [lb]	$f_{red,E}$	$f_{red,s}$	$f_{red,Temp}$	$f_{red,Bedjoint}$
2,061	2,840	1,320	0.726	1.000	1.000	1.000



Hilti PROFIS Engineering 3.1.14

www.hilti.com

Company:		Page:	5
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Masonry - Apr 23, 2025 (1)	Date:	4/23/2025
Fastening point:	Wind Grit Anchor		

4 Shear load (Most utilized anchor 1)

	Load V_s [lb]	Capacity V_t [lb]	Utilization $\beta_V = V_s/V_t$ [%]	Status
Overall strength	N/A	N/A	N/A	N/A

5 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- The min. sizes of the bricks, the masonry compressive strength, the type / strength of the mortar and the grout (in case of fully grouted CMU walls) has to fulfill the requirements given in the relevant ESR-approval or in the PTG.
- Only the local load transfer from the anchor(s) to the wall is considered, a further load transfer in the wall is not covered by PROFIS!
- Wall is assumed as being perfectly aligned vertically – checking required(!): Noncompliance can lead to significantly different distribution of forces and higher tension loads than those calculated by PROFIS. Masonry wall must not have any damages (neither visible nor not visible)! While installation, the positioning of the anchors needs to be maintained as in the design phase i.e. either relative to the brick or relative to the mortar joints.
- The effect of the joints on the compressive stress distribution on the plate / bricks was not taken into consideration.
- If no significant resistance is felt over the entire depth of the hole when drilling (e.g. in unfilled butt joints), the anchor should not be set at this position or the area should be assessed and reinforced. Hilti recommends the anchoring in masonry always with sieve sleeve. Anchors can only be installed without sieve sleeves in solid bricks when it is guaranteed that it has not any hole or void.
- The accessories and installation remarks listed on this report are for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- The compliance with current standards (e.g. 2018, 2015, 2012, 2009 and 2006 IBC) is the responsibility of the user.
- Drilling method (hammer, rotary) to be in accordance with the approval!
- Masonry should be built according to industry standards.

Fastening meets the design criteria!



www.hilti.com

Company:
Address:
Phone | Fax: |
Design: Masonry - Apr 23, 2025 (1)
Fastening point: Wind Grit Anchor

Page: 6
Specifier:
E-Mail:
Date: 4/23/2025

6 Installation data

Profile: -

Hole diameter in the fixture: -

Plate thickness (input): -

Drilling method: Drilled in hammer mode

Anchor type and diameter: HY 270 + threaded rod 5.8 5/8
Item number: 385428 HAS 5.8 5/8"x8" (element) / 2194247
HIT-HY 270 (adhesive)

Maximum installation torque: 90 in.lb

Hole diameter in the base material: 0.750 in.

Hole depth in the base material: 5.625 in.

Minimum thickness of the base material: 7.625 in.

Hilti Ø 5/8 HY 270 + threaded rod 5.8 with 5.625 in nominal embedment depth per Technical data , Hammer drilled installation per MPII

Coordinates Anchor in.

Anchor	x	y	c _{-x}	c _{+x}	c _{-y}	c _{+y}
1	0.000	0.000	8.000	16.000	36.000	36.000



www.hilti.com

Company:		Page:	7
Address:		Specifier:	
Phone Fax:		E-Mail:	
Design:	Masonry - Apr 23, 2025 (1)	Date:	4/23/2025
Fastening point:	Wind Grit Anchor		

7 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

S.O. No. _____

Subject: Hangar - Extreme Torsional Irregularity and Drift Check

Sheet No. _____ of _____

Drawing No. _____

Computed by BT Checked by _____ Date 10/10/2025

$$\delta_{ave} = \frac{\delta_{max} + \delta_{min}}{2} \quad \frac{\delta_{max}}{\delta_{ave}} > 1.4 \rightarrow \text{extreme}$$

under E_x (Seismic E/W direction) in ETABS:

$$\delta_{max} = 0.078'' \quad \delta_{min} = 0.05'' \quad \delta_{ave} = 0.064''$$

$$\frac{\delta_{max}}{\delta_{ave}} < 1.4 \checkmark$$

under E_y (Seismic N/S direction) in ETABS:

$$\delta_{max} = 0.15'' \quad \delta_{min} = 0.095'' \quad \delta_{ave} = 0.1225''$$

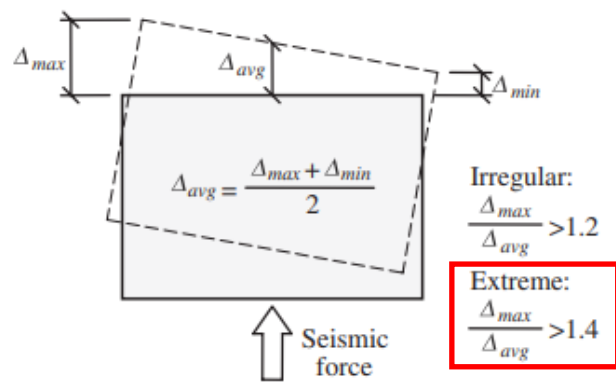
$$\frac{\delta_{max}}{\delta_{ave}} < 1.4 \checkmark$$

Allowable story drift for Seismic:

$$\text{Risk category III} \rightarrow \Delta_a = 0.015 h_x = 6.12'' > 0.15'' \checkmark$$

max drift under wind from ETABS = 0.5''

$$\text{Allow drift for wind} = \frac{H}{600} = \frac{48 \times 12}{600} = 0.96'' > 0.5'' \checkmark$$



ties required by this section shall be in addition to the diaphragm sheathing. Anchorage shall not be accomplished by use of toenails or nails subject to withdrawal, nor shall wood ledgers or framing be used in cross-grain bending or cross-grain tension. The diaphragm sheathing shall not be considered effective for providing the ties or struts required by this section.

12.11.2.2.4 Metal Deck Diaphragms. In metal deck diaphragms, the metal deck shall not be used as the continuous ties required by this section in the direction perpendicular to the deck span.

12.11.2.2.5 Embedded Straps. Diaphragm to structural wall anchorage using embedded straps shall be attached to, or hooked around, the reinforcing steel or otherwise terminated so as to effectively transfer forces to the reinforcing steel.

12.12.3 Structural Separation. All portions of the structure shall be designed and constructed to act as an integral unit in resisting seismic forces unless separated structurally by a distance sufficient to avoid damaging contact as set forth in this section.

Separations shall allow for the maximum inelastic response displacement (δ_M). δ_M shall be determined at critical locations with consideration for translational and torsional displacements of the structure including torsional amplifications, where applicable, using the following equation:

$$\delta_M = \frac{C_d \delta_{max}}{I_e} \quad (12.12-1)$$

where δ_{max} = maximum elastic displacement at the critical location.

Table 12.12-1 Allowable Story Drift, $\Delta_a^{a,b}$

Structure	Risk Category		
	I or II	III	IV
Structures, other than masonry shear wall structures, four stories or less above the base as defined in Section 11.2, with interior walls, partitions, ceilings, and exterior wall systems that have been designed to accommodate the story drifts	$0.025h_{sx}^c$	$0.020h_{sx}$	$0.015h_{sx}$
Masonry cantilever shear wall structures ^d	$0.010h_{sx}$	$0.010h_{sx}$	$0.010h_{sx}$
Other masonry shear wall structures	$0.007h_{sx}$	$0.007h_{sx}$	$0.007h_{sx}$
All other structures	$0.020h_{sx}$	$0.015h_{sx}$	$0.010h_{sx}$

^a h_{sx} is the story height below level x .

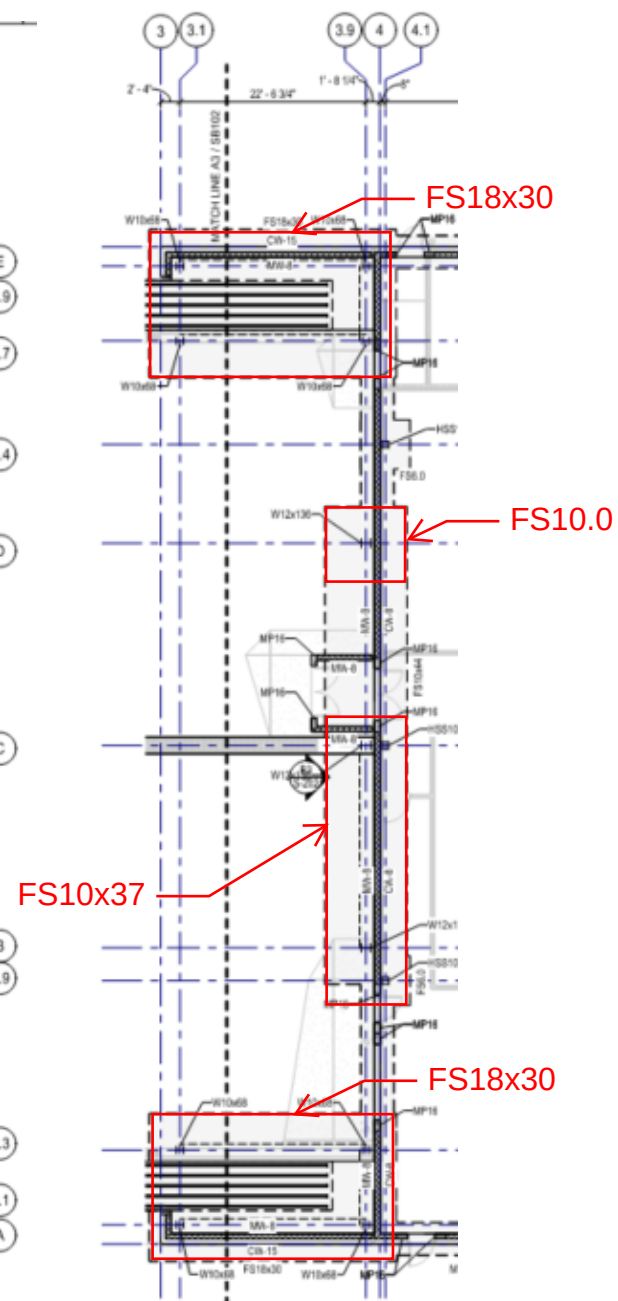
^bFor seismic force-resisting systems solely comprising moment frames in Seismic Design Categories D, E, and F, the allowable story drift shall comply with the requirements of Section 12.12.1.1.

^cThere shall be no drift limit for single-story structures with interior walls, partitions, ceilings, and exterior wall systems that have been designed to accommodate the story drifts. The structure separation requirement of Section 12.12.3 is not waived.

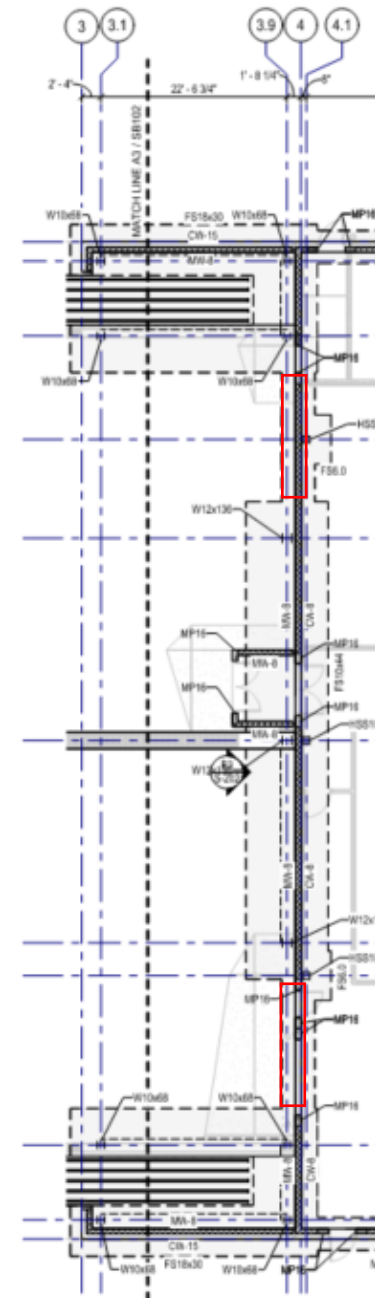
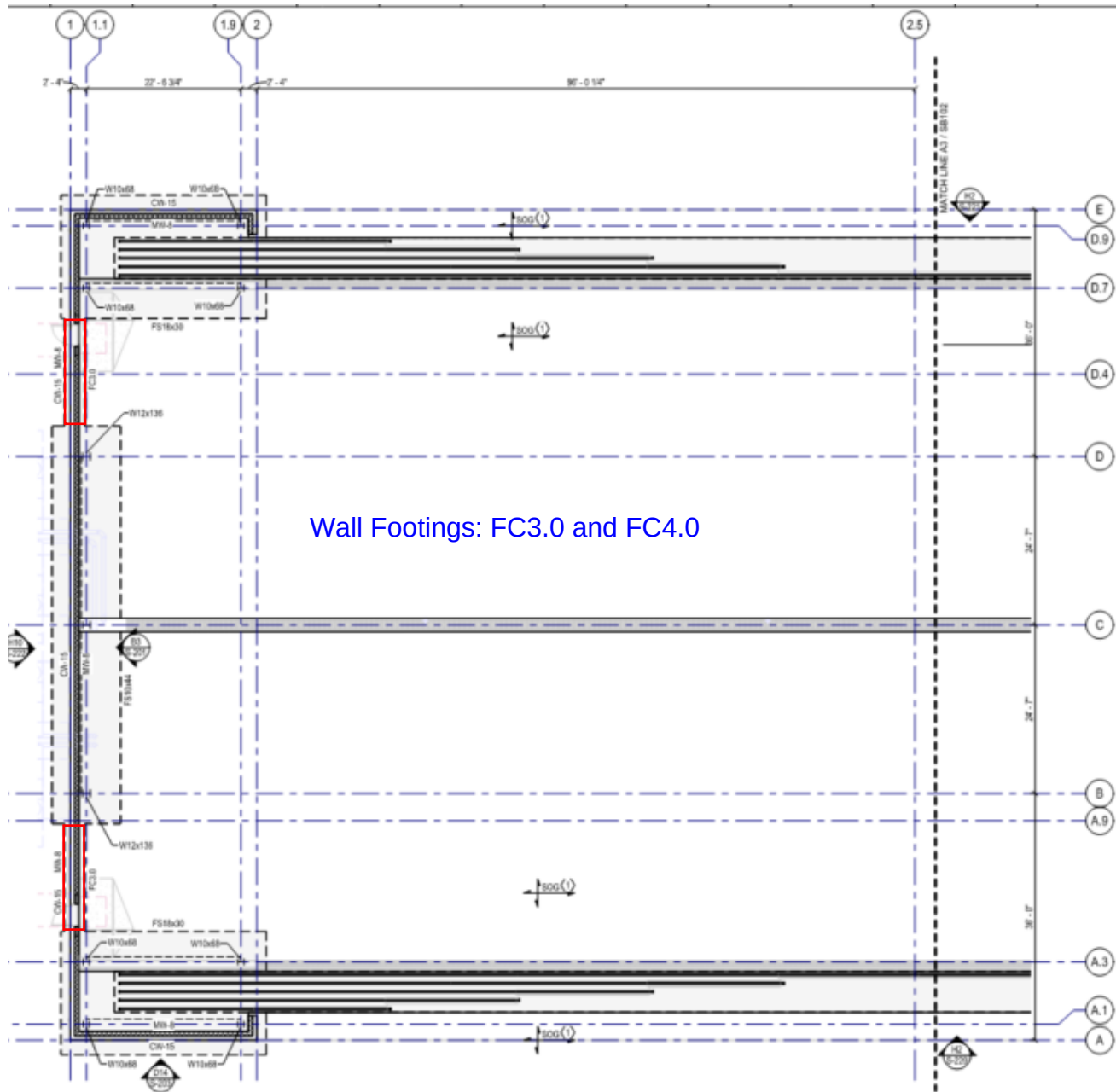
^dStructures in which the basic structural system consists of masonry shear walls designed as vertical elements cantilevered from their base or foundation support that are so constructed that moment transfer between shear walls (coupling) is negligible.

CC.2.2 Drift of Walls and Frames. Drifts (lateral deflections) of concern in serviceability checking arise primarily from the effects of wind. Drift limits in common usage for building design are on the order of 1/600 to 1/400 of the building or story height (ASCE Task Committee on Drift Control of Steel Building Structures 1988; Griffis 1993). These limits generally are

Foundation Calculations

[illegible]

Wall Loads and Wall Footing Layout



As CMU walls are only self-weight and do not act as bearing or shear walls, wall loads are only their self-weight.

8" CMU walls: $DL = 126 \times 29.5 = 3717 \text{ plf}$

FOOTING ANALYSIS

In accordance with ACI318-19 (22)

Tedds calculation version 3.3.11

Summary results

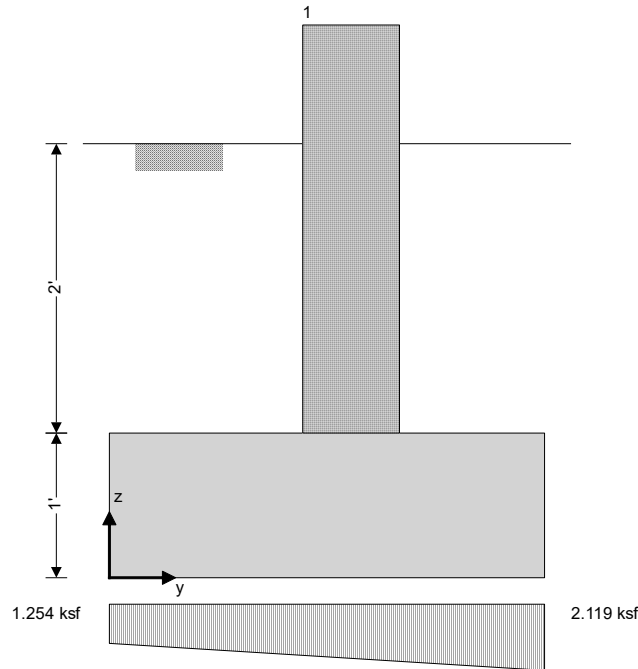
Overall design status **PASS**

Overall design utilisation **0.706**

Description	Unit	Applied	Resisting	FoS	Result
Uplift verification	kips	5.1			Pass
Description	Unit	Applied	Resisting	Utilization	Result
Soil bearing	ksf	2.119	3	0.706	Pass
Description	Unit	Required	Provided	Utilization	Result
Moment, positive, y-direction	kip_ft	1.4	11.8	0.116	Pass
Shear, one-way, y-direction	kips	0.9	5.7	0.159	Pass
Min.area of reinf, bot., y-direction	in ²	0.259	0.310		Pass
Max.reinf.spacing, bot, y-direction	in	18.0	12.0		Pass
Min.area of reinf, S&T, x-direction	in ²	0.778	0.930		Pass
Max.reinf.spacing, S&T, x-direction	in	18.0	12.0		Pass

Strip footing details - considering a one foot strip

Length of footing	$L_x = 1$ ft
Width of footing	$L_y = 3$ ft
Footing area	$A = L_x \times L_y = 3$ ft ²
Depth of footing	$h = 12$ in
Depth of soil over footing	$h_{soil} = 24$ in
Density of concrete	$\gamma_{conc} = 150.0$ lb/ft ³



Wall no.1 details

Width of wall
position in y-axis

$l_{y1} = 8$ in
 $y_1 = 20$ in

Soil properties

Gross allowable bearing pressure
Density of soil
Angle of internal friction
Design base friction angle
Coefficient of base friction
Self weight
Soil weight

$q_{allow_Gross} = 3$ ksf
 $\gamma_{soil} = 120.0$ lb/ft³
 $\phi_b = 30.0$ deg
 $\delta_{bb} = 30.0$ deg
 $\tan(\delta_{bb}) = 0.577$
 $F_{swt} = h \times \gamma_{conc} = 150$ psf
 $F_{soil} = h_{soil} \times \gamma_{soil} = 240$ psf

Wall no.1 loads per linear foot

Dead load in z
Live load in z
Live roof load in z
Snow load in z
Rain load in z

$F_{Dz1} = 1.5$ kips
 $F_{Lz1} = 2.5$ kips
 $F_{Lrz1} = 0.9$ kips
 $F_{Sz1} = 0.8$ kips
 $F_{Rz1} = 0.3$ kips

Footing analysis for soil and stability

Load combinations per ASCE 7-22

1.0D (0.329)
1.0D + 1.0L (0.699)
1.0D + 1.0Lr (0.462)
1.0D + 0.7S (0.406)

1.0D + 1.0R (0.373)
 1.0D + 0.75L + 0.75Lr (0.706)
 1.0D + 0.75L + 0.525S (0.665)
 1.0D + 0.75L + 0.75R (0.640)
 1.0D + 0.6W (0.329)
 (1.0 + 0.14 × S_{DS})D + 0.7E (0.355)
 1.0D + 0.75L + 0.75Lr + 0.45W (0.706)
 1.0D + 0.75L + 0.525S + 0.45W (0.665)
 1.0D + 0.75L + 0.75R + 0.45W (0.640)
 (1.0 + 0.105 × S_{DS})D + 0.75L + 0.1S + 0.525E (0.637)
 0.6D + 0.6W (0.197)
 (0.6 - 0.14 × S_{DS})D + 0.7E (0.170)

Combination 6 results: 1.0D + 0.75L + 0.75Lr

Forces on footing per linear foot

Force in z-axis

$$F_{dz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_L \times F_{Lz1} + \gamma_{Lr} \times F_{Lrz1} = \mathbf{5.1 \text{ kips}}$$

Moments on footing per linear foot

Moment in y-axis, about y is 0

$$M_{dy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1) + \gamma_L \times (F_{Lz1} \times y_1) + \gamma_{Lr} \times (F_{Lrz1} \times y_1) = \mathbf{8.2 \text{ kip_ft}}$$

Uplift verification

Vertical force

$$F_{dz} = \mathbf{5.06 \text{ kips}}$$

PASS - Footing is not subject to uplift

Stability against sliding

Resistance due to base friction

$$F_{R\text{Friction}} = \max(F_{dz}, 0 \text{ kN}) \times \tan(\delta_{bb}) = \mathbf{2.921 \text{ kips}}$$

Bearing resistance

Eccentricity of base reaction

Eccentricity of base reaction in y-axis

$$e_{dy} = M_{dy} / F_{dz} - L_y / 2 = \mathbf{1.538 \text{ in}}$$

Strip base pressures

$$q_1 = F_{dz} \times (1 - 6 \times e_{dy} / L_y) / (L_y \times 1 \text{ ft}) = \mathbf{1.254 \text{ ksf}}$$

$$q_2 = F_{dz} \times (1 + 6 \times e_{dy} / L_y) / (L_y \times 1 \text{ ft}) = \mathbf{2.119 \text{ ksf}}$$

Minimum base pressure

$$q_{\min} = \min(q_1, q_2) = \mathbf{1.254 \text{ ksf}}$$

Maximum base pressure

$$q_{\max} = \max(q_1, q_2) = \mathbf{2.119 \text{ ksf}}$$

Allowable bearing capacity

Allowable bearing capacity

$$q_{\text{allow}} = q_{\text{allow_Gross}} = \mathbf{3 \text{ ksf}}$$

$$q_{\max} / q_{\text{allow}} = \mathbf{0.706}$$

PASS - Allowable bearing capacity exceeds design base pressure

FOOTING DESIGN

In accordance with ACI318-19 (22)

Tedds calculation version 3.3.11

Material details

Compressive strength of concrete

$$f'_c = \mathbf{4000 \text{ psi}}$$

Yield strength of reinforcement

$f_y = 60000$ psi

Compression-controlled strain limit (21.2.2)

$\epsilon_{ty} = 0.00200$

Cover to top of footing

$C_{nom_t} = 3$ in

Cover to side of footing

$C_{nom_s} = 3$ in

Cover to bottom of footing

$C_{nom_b} = 3$ in

Concrete type

Normal weight

Concrete modification factor

$\lambda = 1.00$

Wall type

Concrete

Analysis and design of concrete footing

Load combinations per ASCE 7-22

1.4D (0.049)

1.2D + 1.6L + 0.5Lr (0.159)

1.2D + 1.6L + 0.3S (0.153)

1.2D + 1.6L + 0.5R (0.151)

1.2D + 1.0L + 1.6Lr (0.146)

1.2D + 1.0L + 1.0S (0.127)

1.2D + 1.0L + 1.6R (0.120)

Combination 2 results: 1.2D + 1.6L + 0.5Lr

Forces on footing per linear foot

Ultimate force in z-axis

$F_{uz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_L \times F_{Lz1} + \gamma_{Lr} \times F_{Lrz1} = 7.5$ kips

Moments on footing per linear foot

Ultimate moment in y-axis, about y is 0

$M_{uy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1) + \gamma_L \times (F_{Lz1} \times y_1) + \gamma_{Lr} \times (F_{Lrz1} \times y_1) = 12.2$ kip_ft

Eccentricity of base reaction

Eccentricity of base reaction in y-axis

$e_{uy} = M_{uy} / F_{uz} - L_y / 2 = 1.624$ in

Strip base pressures

$q_{u1} = F_{uz} \times (1 - 6 \times e_{uy} / L_y) / (L_y \times 1 \text{ ft}) = 1.814$ ksf

$q_{u2} = F_{uz} \times (1 + 6 \times e_{uy} / L_y) / (L_y \times 1 \text{ ft}) = 3.16$ ksf

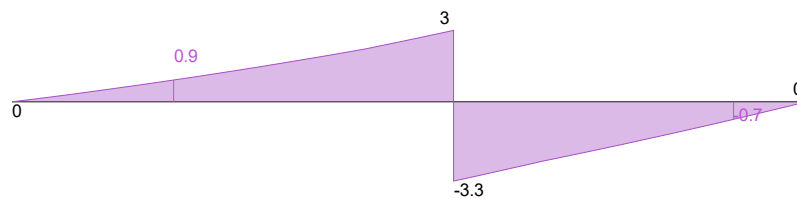
Minimum ultimate base pressure

$q_{umin} = \min(q_{u1}, q_{u2}) = 1.814$ ksf

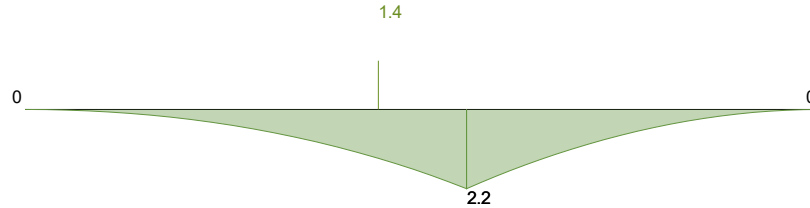
Maximum ultimate base pressure

$q_{umax} = \max(q_{u1}, q_{u2}) = 3.16$ ksf

Shear diagram (kips)



Moment diagram (kip_ft)



Moment design, y direction, positive moment

Ultimate bending moment

$$M_{u,y,max} = 1.375 \text{ kip_ft}$$

Tension reinforcement provided

No.5 bars at 12.0 in c/c bottom

Area of tension reinforcement provided

$$A_{sy,bot,prov} = 0.31 \text{ in}^2$$

Minimum area of reinforcement (7.6.1.1)

$$A_{s,min} = 0.0018 \times L_x \times h = 0.259 \text{ in}^2$$

PASS - Area of reinforcement provided exceeds minimum

Maximum spacing of reinforcement (7.7.2.3)

$$s_{max} = \min(3 \times h, 18 \text{ in}) = 18 \text{ in}$$

PASS - Maximum permissible reinforcement spacing exceeds actual spacing

Depth to tension reinforcement

$$d = h - c_{nom,b} - \phi_{y,bot} / 2 = 8.688 \text{ in}$$

Depth of compression block

$$a = A_{sy,bot,prov} \times f_y / (0.85 \times f'_c \times L_x) = 0.456 \text{ in}$$

Neutral axis factor

$$\beta_1 = 0.85$$

Depth to neutral axis

$$c = a / \beta_1 = 0.536 \text{ in}$$

Strain in tensile reinforcement

$$\epsilon_t = 0.003 \times d / c - 0.003 = 0.04559$$

Minimum tensile strain(7.3.3.1)

$$\epsilon_{min} = \epsilon_{ty} + 0.003 = 0.00500$$

PASS - Tensile strain exceeds minimum required

Nominal moment capacity

$$M_n = A_{sy,bot,prov} \times f_y \times (d - a / 2) = 13.112 \text{ kip_ft}$$

Flexural strength reduction factor

$$\phi_f = \min(\max(0.65 + 0.25 \times (\epsilon_t - \epsilon_{ty}) / (0.003), 0.65), 0.9) = 0.900$$

Design moment capacity

$$\phi M_n = \phi_f \times M_n = 11.801 \text{ kip_ft}$$

$$M_{u,y,max} / \phi M_n = 0.116$$

PASS - Design moment capacity exceeds ultimate moment load

One-way shear design, y direction

Ultimate shear force

$$V_{u,y} = 0.904 \text{ kips}$$

Depth to reinforcement

$$d_v = h - c_{nom,b} - \phi_{y,bot} / 2 = 8.687 \text{ in}$$

Size effect factor (22.5.5.1.3)

$$\lambda_s = 1$$

Ratio of longitudinal reinforcement

$$\rho_w = A_{sy,bot,prov} / (L_x \times d_v) = 0.00297$$

Shear strength reduction factor

$$\phi_v = 0.75$$

Nominal shear capacity (Eq. 22.5.5.1)

$$V_n = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3} \times \sqrt{(f'_c \times 1 \text{ psi})} \times L_x \times d_v, 5 \times \lambda \times \sqrt{(f'_c \times 1 \text{ psi})} \times L_x \times d_v) = 7.585 \text{ kips}$$

Design shear capacity

$$\phi V_n = \phi_v \times V_n = 5.689 \text{ kips}$$

$$V_{u,y} / \phi V_n = 0.159$$

PASS - Design shear capacity exceeds ultimate shear load

Shrinkage and temperature requirements, x direction

Reinforcement provided

No.5 bars at 12.0 in c/c bottom

Reinforcement area provided in full width

$$A_{sx,prov} = 0.93 \text{ in}^2$$

Minimum area of reinforcement (24.4.4.3.2)

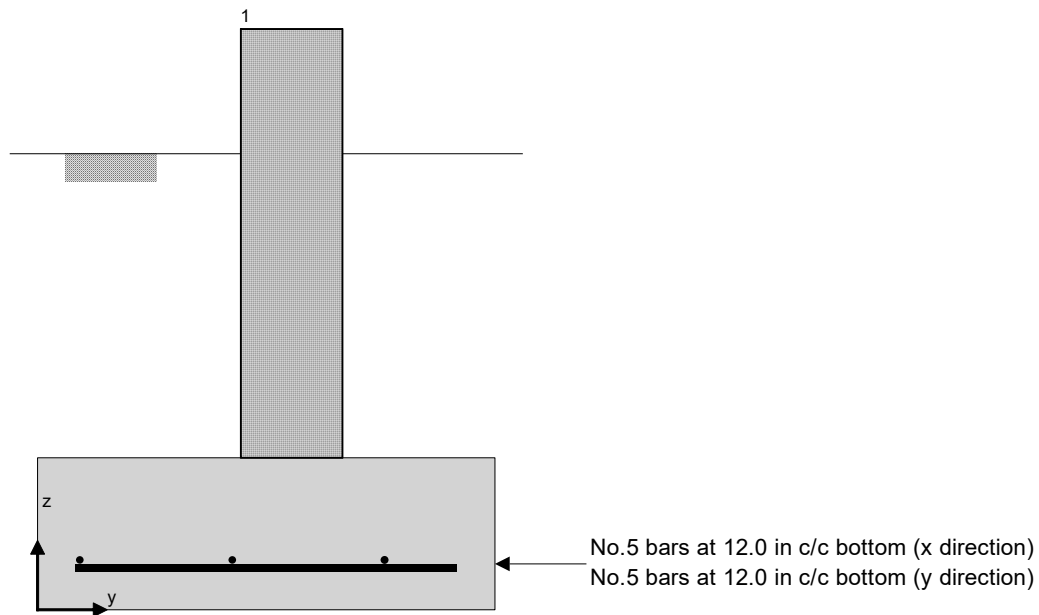
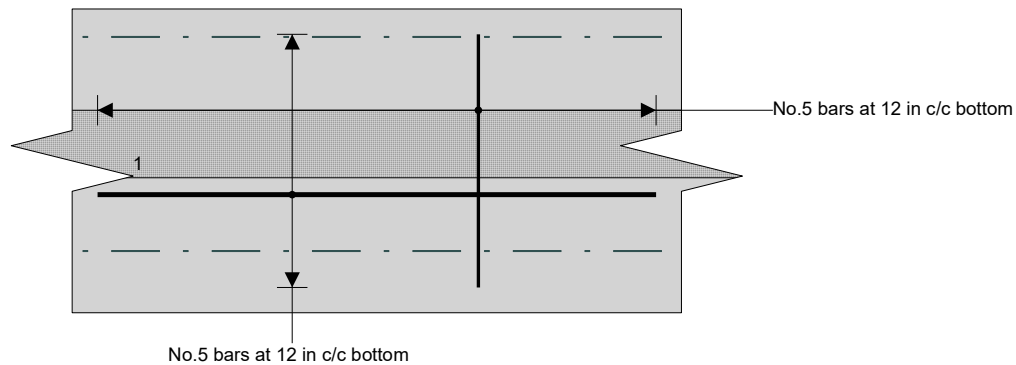
$$A_{s,min,ST} = 0.0018 \times L_y \times h = 0.778 \text{ in}^2$$

PASS - Area of reinforcement provided exceeds minimum

Maximum reinforcement spacing (24.4.4.3.3)

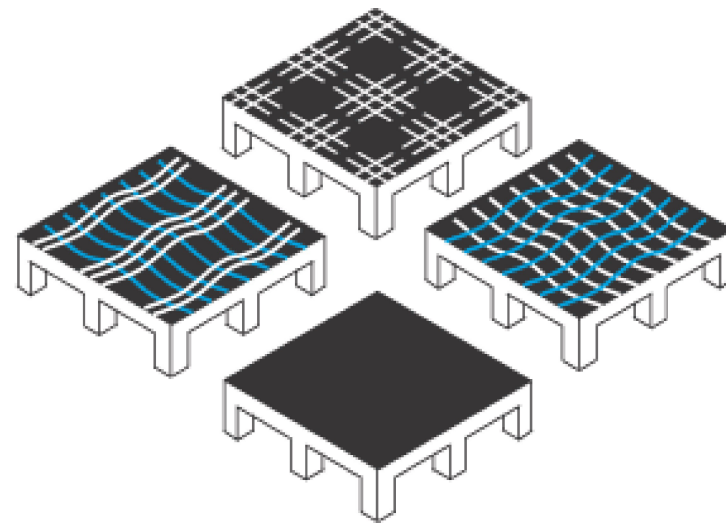
$$s_{max,ST} = \min(5 \times h, 18 \text{ in}) = 18 \text{ in}$$

PASS - Maximum permissible reinforcement spacing exceeds actual spacing



Creech DRP Part 2

Mat Foundations



DP2 Mat Foundation-102825.cpt
Tue Nov 4 2025

Table of Contents

Units	3
Materials	4
Loadings	6
Load Combinations	7
Element: Slab Summary Plan	20
Other Dead Loading: All Loads Plan	21
Live (Roof) Loading: All Loads Plan	22
Snow Loading: All Loads Plan	23
Snow unbalanced 1: All Loads Plan	24
Snow unbalanced 2: All Loads Plan	25
Wxx: All Loads Plan	26
Wyy: All Loads Plan	27
Ex: All Loads Plan	28
Ey: All Loads Plan	29
Wx: All Loads Plan	30
Wy: All Loads Plan	31
Factored Wind LC: 1.2D + f1L + 0.5Lr + 1.0W: Max Mx Plan	32
Code Minimum Design: Status Plan	33
Service Design: Status Plan	34
Sustained Service Design: Status Plan	35
Strength Design: Status Plan	36
Soil Bearing Design: Max Soil Bearing Pressure Plan	37
Design Status: Status Plan	38
Design Status: Top Reinforcement Plan	39
Design Status: Bottom Reinforcement Plan	40
Design Status: Punching Shear Status Plan	41

Units

Geometry Units

Plan Dimensions: feet	Slab Thickness: inches	Support Dimensions: inches
Angles: degrees	Elevations: inches	Support Height: feet

Loading and Reaction Units

Point Force: Kips	Line Force: kips/ft	Area Force: psf
- Report As Zero: 0 Kips	- Report As Zero: 0 kips/ft	- Report As Zero: 0 psf
Point Moment: kip-ft	Line Moment: Kips	Area Moment: #/foot
- Report As Zero: 0 kip-ft	- Report As Zero: 0 Kips	- Report As Zero: 0 #/foot

Spring and Stiffness Units

Point Force Spring: kips/in	Line Force Spring: ksi	Area Force Spring: pci
Point Moment Spring: k-ft/°	Line Moment Spring: k/°	Area Moment Spring: k/ft°

Slab Analysis Units

Force: Kips	Moment: kip-ft	Concrete Stress: psi
- Report As Zero: 0 Kips	- Report As Zero: 0 kip-ft	- Report As Zero: 0 psi
Force Per Width: kips/ft	Moment Per Width: Kips	Deflection: inches
- Report As Zero: 0 kips/ft	- Report As Zero: 0 Kips	- Report As Zero: 0 inches

Materials Units

Concrete Volume: yd³	Reinforcing Area: in²	Reinforcement Weight: tons
Tendon Force: Kips	Tendon Force Per Width: kips/ft	Tendon Profile: inches
Reinforcing Stress: ksi	PT Weight: pounds	Cover: inches

Miscellaneous Units

Floor Area: ft²	Density: pcf	Elongations: inches
Tendon Angles (for friction): radians	Temperature Change: °F	

Materials

Concrete Mix

Mix Name	Density (pcf)	Density For Loads (pcf)	f'ci (psi)	f'c (psi)	fcui (psi)	fcu (psi)	Poissons Ratio	Thermal Exp Coeff	Ec Calc	User Eci (psi)	User Ec (psi)
3000 psi	150	150	3000	3000	3725	3725	0.2	5.556e-6	Code	2500000	3000000
4000 psi	150	150	3000	4000	3725	4975	0.2	5.556e-6	Code	2500000	3000000
5000 psi	150	150	3000	5000	3725	6399	0.2	5.556e-6	Code	2500000	3000000
6000 psi	150	150	3000	6000	3725	7450	0.2	5.556e-6	Code	2500000	3000000
4500 psi	150	150	3000	4500	3725	5590	0.2	5.556e-6	Code	2500000	3000000

PT Systems

System Name	Strand	Duct	Anchor	fse (ksi)	Long-Term Losses (ksi)	Min Radius (feet)
½" Unbonded	½" 7-Wire Strand	½" Unbonded Sheathing	Monostrand Anchor	175	22	6
0.6" Unbonded	0.6" 7-Wire Strand	0.6" Unbonded Sheathing	Monostrand Anchor	175	22	8
½" Bonded Flat Duct	½" 7-Wire Strand	½" Bonded Flat Duct	Flat Duct Anchor	175	22	6
0.6" Bonded Flat Duct	0.6" 7-Wire Strand	0.6" Bonded Flat Duct	Flat Duct Anchor	175	22	8

Strand Materials

Strand Name	Aps (in ²)	Eps (ksi)	fpy (ksi)	fpu (ksi)
½" 7-Wire Strand	0.153	28000	243	270
0.6" 7-Wire Strand	0.217	28000	243	270

Duct Systems

Duct Name	Type	Shape	Material	Duct Height (inches)	Duct Width (inches)	Max Strands Per Duct	Wobble Friction (1/feet)	Angular Friction (1/radians)
½" Unbonded Sheathing	unbonded	Round	Tightly Sheathed	0.5	0.5	1	0.0014	0.07
0.6" Unbonded Sheathing	unbonded	Round	Tightly Sheathed	0.6	0.6	1	0.0014	0.07
½" Bonded Flat Duct	bonded	Flat	Corrugated Plastic	1	3	5	0.0002	0.14
0.6" Bonded Flat Duct	bonded	Flat	Corrugated Plastic	1	3	4	0.0002	0.14

Anchor Systems

Anchor Name	Type	Jacking Stress (ksi)	Anchor Friction	Seating Distance (inches)
Monostrand Anchor	Monostrand	216	0	0.25
Flat Duct Anchor	Flat Multi-Plane	216	0.02	0.25

Materials (2)

Reinforcing Bars

<i>Bar Name</i>	<i>As (in²)</i>	<i>Es (ksi)</i>	<i>Fy (ksi)</i>	<i>Coating</i>	<i>Straight Ld/Db</i>	<i>90 Hook Ld/Db</i>	<i>180 Hook Ld/Db</i>
#3	0.11	29000	60	None	Code	Code	Code
#4	0.2	29000	60	None	Code	Code	Code
#5	0.31	29000	60	None	Code	Code	Code
#6	0.44	29000	60	None	Code	Code	Code
#7	0.6	29000	60	None	Code	Code	Code
#8	0.79	29000	60	None	Code	Code	Code
#9	1	29000	60	None	Code	Code	Code
#10	1.27	29000	60	None	Code	Code	Code
#11	1.56	29000	60	None	Code	Code	Code

SSR Systems

<i>SSR System Name</i>	<i>Stud Area (in²)</i>	<i>Head Area (in²)</i>	<i>Min Clear Head Spacing (inches)</i>	<i>Specified Stud Spacing (inches)</i>	<i>Fy (ksi)</i>	<i>Stud Spacing Rounding Increment (inches)</i>	<i>Min Studs Per Rail</i>	<i>System Type</i>
3/8" SSR	0.11	1.11	0.5	infinite	50	0.25	2	Rail
1/2" SSR	0.196	1.96	0.5	infinite	50	0.25	2	Rail
5/8" SSR	0.307	3.07	0.5	infinite	50	0.25	2	Rail
3/4" SSR	0.442	4.42	0.5	infinite	50	0.25	2	Rail

Loadings

<i>Loading Name</i>	<i>Type</i>	<i>Analysis</i>	<i>On-Pattern Factor</i>	<i>Off-Pattern Factor</i>
Self-Dead Loading	Self-Weight	Normal	1	1
Balance Loading	Balance	Normal	1	1
Hyperstatic Loading	Hyperstatic	Hyperstatic	1	1
Temporary Construction (At Stressing) Loading	Stressing Dead	Normal	1	1
Other Dead Loading	Dead	Normal	1	1
Live (Reducible) Loading	Live (Reducible)	Normal	1	0
Live (Unreducible) Loading	Live (Unreducible)	Normal	1	0
Live (Storage) Loading	Live (Storage)	Normal	1	0
Live (Parking) Loading	Live (Parking)	Normal	1	0
Live (Roof) Loading	Live (Roof)	Normal	1	0
Snow Loading	Snow	Normal	1	1
Snow unbalanced 1	Snow	Normal	1	1
Snow unbalanced 2	Snow	Normal	1	1
Wy	Ultimate Wind 1	Normal	1	1
Wyy	Ultimate Wind 1	Normal	1	1
Wx	Ultimate Wind 2	Normal	1	1
Wxx	Ultimate Wind 2	Normal	1	1
Ey	Ultimate Seismic 1	Normal	1	1
Ex	Ultimate Seismic 2	Normal	1	1

Load Combinations

All Dead LC

Active Design Criteria: <none>

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Other Dead Loading	1

Dead + Balance LC

Active Design Criteria: <none>

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1

Initial Service LC

Active Design Criteria: Initial Service Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1.13
Temporary Construction (At Stressing) Loading	1

Service LC: D + L

Active Design Criteria: User Minimum Design, Code Minimum Design, Service Design, Soil Bearing Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	1
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1

Service LC: D

Active Design Criteria: User Minimum Design, Code Minimum Design, Service Design, Soil Bearing Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1

Load Combinations (2)

Service LC: D + Lr

Active Design Criteria: User Minimum Design, Code Minimum Design, Service Design, Soil Bearing Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Roof) Loading	1

Service LC: D + S

Active Design Criteria: User Minimum Design, Code Minimum Design, Service Design, Soil Bearing Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Snow Loading	1

Service LC: D + 0.75L + 0.75Lr

Active Design Criteria: User Minimum Design, Code Minimum Design, Service Design, Soil Bearing Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Live (Roof) Loading	0.75

Service LC: D + 0.75L + 0.75S

Active Design Criteria: User Minimum Design, Code Minimum Design, Service Design, Soil Bearing Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Snow Loading	0.75

Load Combinations (3)

Service Wind LC: D + 0.6W

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 0.6

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1

Service Wind LC: D - 0.6W

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -0.6

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1

Service Wind LC: D + 0.75L + 0.75Lr + 0.45W

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 0.45

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Live (Roof) Loading	0.75

Service Wind LC: D + 0.75L + 0.75Lr - 0.45W

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -0.45

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Live (Roof) Loading	0.75

Load Combinations (4)

Service Wind LC: $D + 0.75L + 0.75S + 0.45W$

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 0.45

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Snow Loading	0.75

Service Wind LC: $D + 0.75L + 0.75S - 0.45W$

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -0.45

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Snow Loading	0.75

Service Wind LC: $0.6D + 0.6W$

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 0.6

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.6
Balance Loading	1
Other Dead Loading	0.6

Load Combinations (5)

Service Wind LC: 0.6D - 0.6W

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -0.6

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.6
Balance Loading	1
Other Dead Loading	0.6

Service Seismic LC: D + 0.7E

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: 0.7

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1

Service Seismic LC: D - 0.7E

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: -0.7

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1

Service Seismic LC: D + 0.75L + 0.75S + 0.525E

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: 0.525

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Snow Loading	0.75

Load Combinations (6)

Service Seismic LC: D + 0.75L + 0.75S - 0.525E

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: -0.525

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.75
Live (Unreducible) Loading	0.75
Live (Storage) Loading	0.75
Live (Parking) Loading	0.75
Snow Loading	0.75

Service Seismic LC: 0.6D + 0.7E

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: 0.7

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.6
Balance Loading	1
Other Dead Loading	0.6

Service Seismic LC: 0.6D - 0.7E

Active Design Criteria: Soil Bearing Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: -0.7

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.6
Balance Loading	1
Other Dead Loading	0.6

Sustained Service LC

Active Design Criteria: Sustained Service Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1
Balance Loading	1
Other Dead Loading	1
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	0.5
Live (Storage) Loading	1
Live (Parking) Loading	0.5
Live (Roof) Loading	0.5

Load Combinations (7)

Factored LC: 1.4D

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.4
Hyperstatic Loading	1
Other Dead Loading	1.4

Factored LC: 0.9D

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9

Factored LC: 1.2D + 1.6L + 0.5Lr

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	1.6
Live (Unreducible) Loading	1.6
Live (Storage) Loading	1.6
Live (Parking) Loading	1.6
Live (Roof) Loading	0.5

Factored LC: 1.2D + 1.6L + 0.5S

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	1.6
Live (Unreducible) Loading	1.6
Live (Storage) Loading	1.6
Live (Parking) Loading	1.6
Snow Loading	0.5

Load Combinations (8)

Factored LC: 0.9D + 1.6L + 0.5Lr

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9
Live (Reducible) Loading	1.6
Live (Unreducible) Loading	1.6
Live (Storage) Loading	1.6
Live (Parking) Loading	1.6
Live (Roof) Loading	0.5

Factored LC: 0.9D + 1.6L + 0.5S

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9
Live (Reducible) Loading	1.6
Live (Unreducible) Loading	1.6
Live (Storage) Loading	1.6
Live (Parking) Loading	1.6
Snow Loading	0.5

Factored LC: 1.2D + f1L + 1.6Lr

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Live (Roof) Loading	1.6

Load Combinations (9)

Factored LC: 1.2D + f1L + 1.6S

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Snow Loading	1.6

Factored LC: 0.9D + f1L + 1.6Lr

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Live (Roof) Loading	1.6

Factored LC: 0.9D + f1L + 1.6S

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Snow Loading	1.6

Load Combinations (10)

Factored Wind LC: 1.2D + f1L + 0.5Lr + 1.0W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Live (Roof) Loading	0.5

Factored Wind LC: 1.2D + f1L + 0.5Lr - 1.0W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Live (Roof) Loading	0.5

Factored Wind LC: 1.2D + f1L + 0.5S + 1.0W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Snow Loading	0.5

Load Combinations (11)

Factored Wind LC: 1.2D + f1L + 0.5S - 1.0W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Snow Loading	0.5

Factored Wind LC: 1.2D + 1.6Lr + 0.5W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 0.5

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Roof) Loading	1.6

Factored Wind LC: 1.2D + 1.6Lr - 0.5W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -0.5

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Roof) Loading	1.6

Factored Wind LC: 1.2D + 1.6S + 0.5W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 0.5

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Snow Loading	1.6

Load Combinations (12)

Factored Wind LC: 1.2D + 1.6S - 0.5W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -0.5

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Snow Loading	1.6

Factored Wind LC: 0.9D + W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: 1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9

Factored Wind LC: 0.9D - W

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Wind-Ultimate Standard Factor: -1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9

Factored Seismic LC: 1.2D + f1L + 0.2S + E

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: 1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Snow Loading	0.2

Load Combinations (13)

Factored Seismic LC: 1.2D + f1L + 0.2S - E

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: -1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	1.2
Hyperstatic Loading	1
Other Dead Loading	1.2
Live (Reducible) Loading	0.5
Live (Unreducible) Loading	1
Live (Storage) Loading	1
Live (Parking) Loading	1
Snow Loading	0.2

Factored Seismic LC: 0.9D + E

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

Key Lateral Loading: Seismic-Ultimate Standard Factor: 1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9

Factored Seismic LC: 0.9D - E

Active Design Criteria: User Minimum Design, Code Minimum Design, Strength Design, Ductility Design

Analysis: Zero-Tension

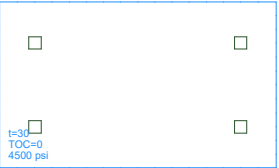
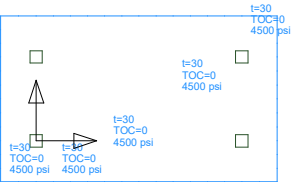
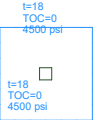
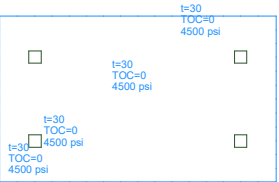
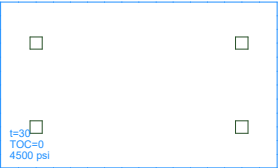
Key Lateral Loading: Seismic-Ultimate Standard Factor: -1

<i>Loading</i>	<i>Standard Factor</i>
Self-Dead Loading	0.9
Hyperstatic Loading	1
Other Dead Loading	0.9

Element: Slab Summary Plan

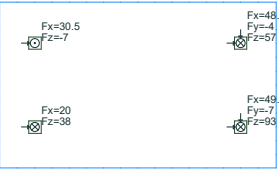
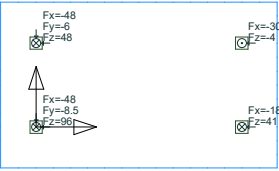
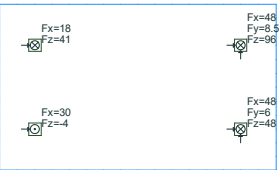
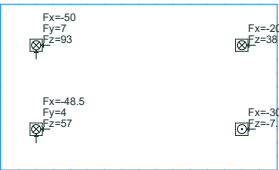
Element: User Lines; User Notes; User Dimensions; Wall Elements Below; Wall Elements Above; Column Elements Below; Column Elements Above; Point Springs; Point Spring Icons; Line Springs; Line Spring Icons; Slab Elements; Slab Element Outline Only; Slab Element Thicknesses; Slab Element Elevations; Slab Element Concrete Models;

Scale = 1:250



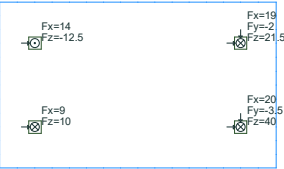
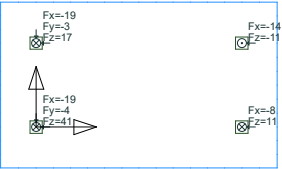
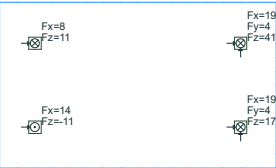
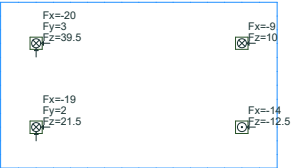
Other Dead Loading: All Loads Plan

Other Dead Loading: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



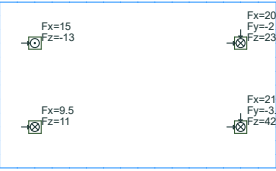
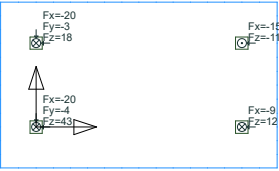
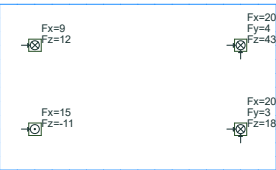
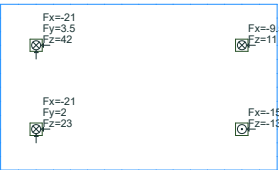
Live (Roof) Loading: All Loads Plan

Live (Roof) Loading: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



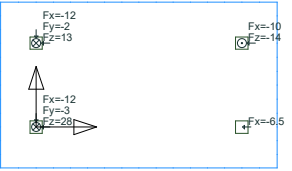
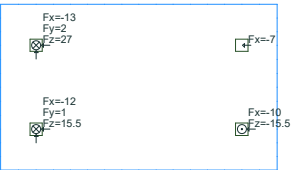
Snow Loading: All Loads Plan

Snow Loading: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



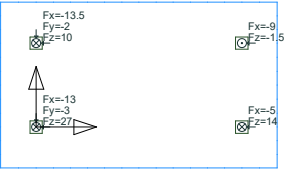
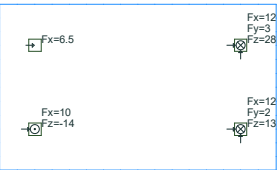
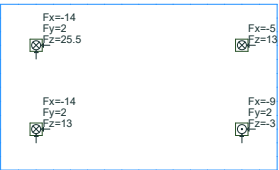
Snow unbalanced 1: All Loads Plan

Show unbalanced 1: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



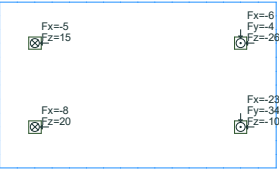
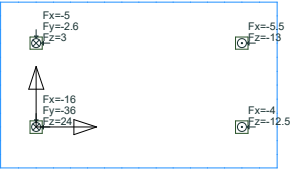
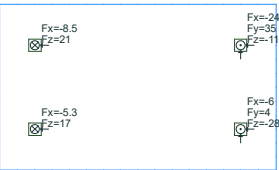
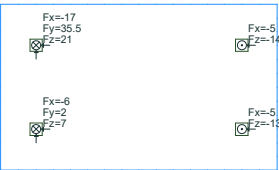
Snow unbalanced 2: All Loads Plan

Show unbalanced 2: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



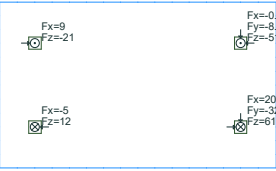
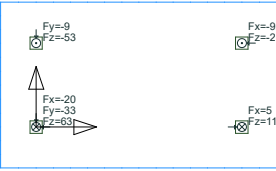
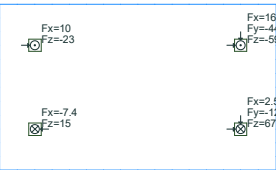
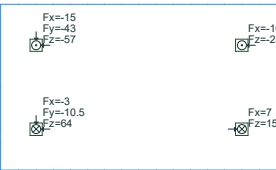
Wxx: All Loads Plan

Wxx: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



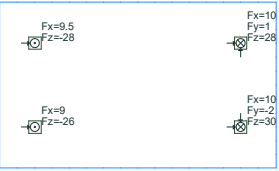
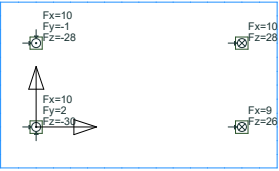
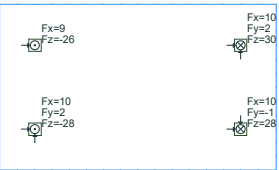
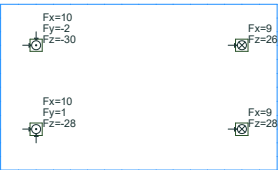
Wyy: All Loads Plan

Wyy: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



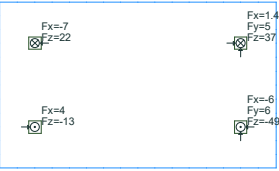
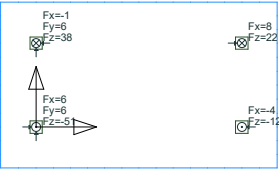
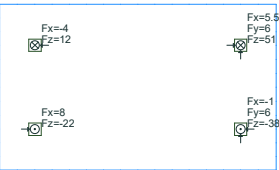
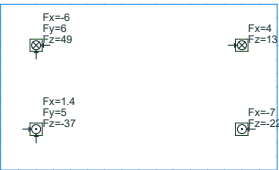
Ex: All Loads Plan

Ex: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



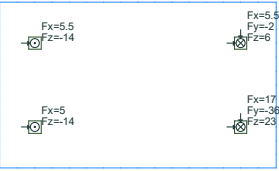
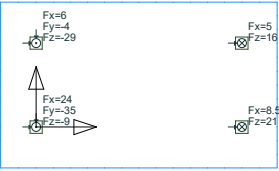
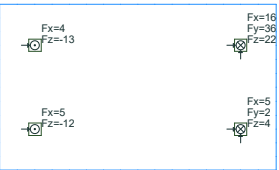
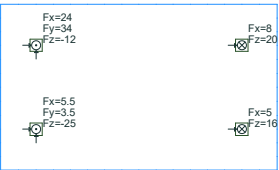
Ey: All Loads Plan

Ey: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



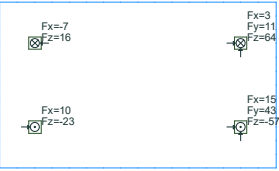
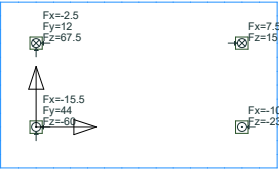
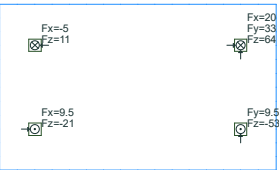
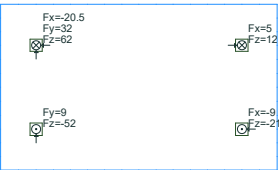
Wx: All Loads Plan

Wx: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



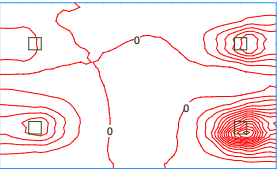
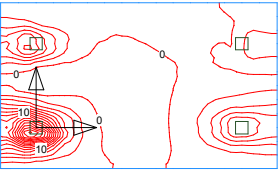
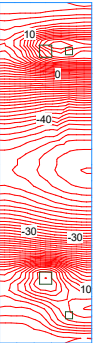
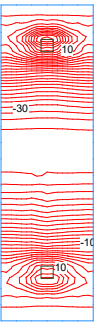
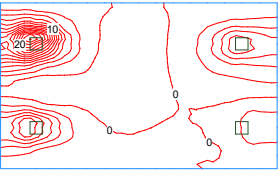
Wy: All Loads Plan

Wy: User Lines; User Notes; User Dimensions; Point Loads; Point Load Icons; Point Load Values; Line Loads; Line Load Icons; Line Load Values; Area Loads; Area Load Icons; Area Load Values;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



Factored Wind LC: 1.2D + f1L + 0.5Lr + 1.0W: Max Mx Plan

Factored Wind LC: 1.2D + f1L + 0.5Lr + 1.0W: User Lines; User Notes; User Dimensions;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250
Factored Wind LC: 1.2D + f1L + 0.5Lr + 1.0W - Bending Moment Plot (Maximum Values) (X-Axis Direction)
One Contour = 2 Kips
Min Value = -56.11 Kips @ (246.3,45.12) Max Value = 29 Kips @ (0,-0.7421)



7C-3 OK

7C-2 OK

19C-2 OK

6C-2 OK

6C-1 OK

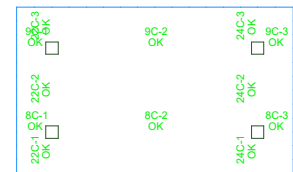
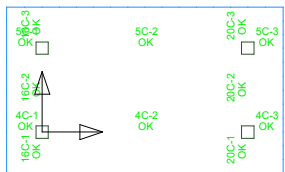
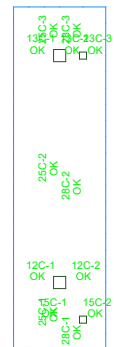
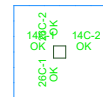
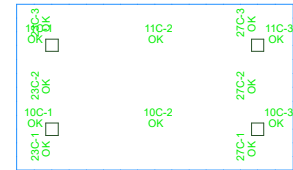
19C-1 OK

21C-1 OK

21C-3 OK

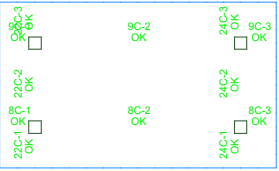
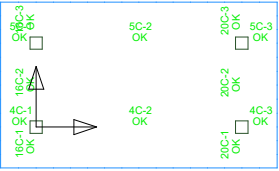
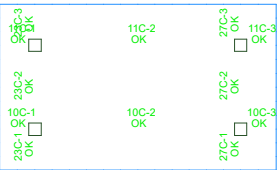
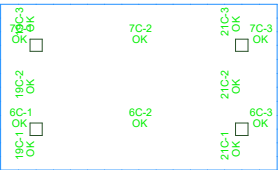
7C-3 OK

6C-3 OK



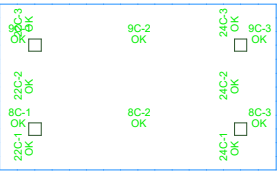
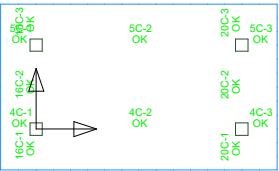
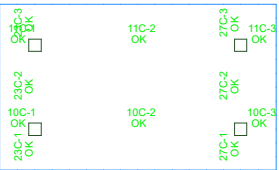
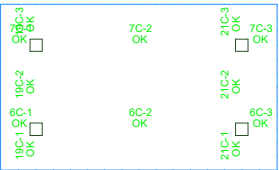
Service Design: Status Plan

Service Design: User Lines; User Notes; User Dimensions; Latitude Span Designs; Longitude Span Designs; Span Design Numbers; Span Design Status; Latitude DS Designs; Longitude DS Designs; DS Design Numbers; DS Design Status; PC Designs; PC Design Numbers; PC Design Status; Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only; Scale = 1:250



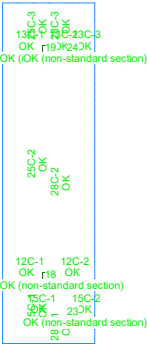
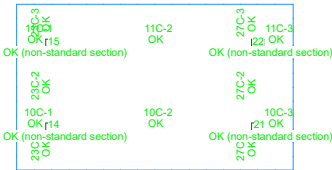
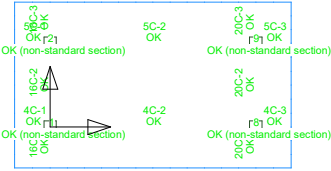
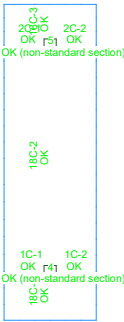
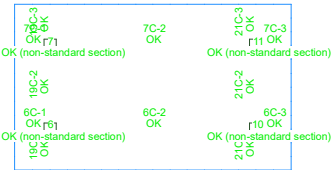
Sustained Service Design: Status Plan

Sustained Service Design: User Lines; User Notes; User Dimensions; Latitude Span Designs; Longitude Span Designs; Span Design Numbers; Span Design Status; Latitude DS Designs; Longitude DS Designs; DS Design Numbers; DS Design Status; PC Designs; PC Design Numbers; PC Design Status;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



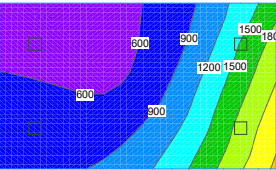
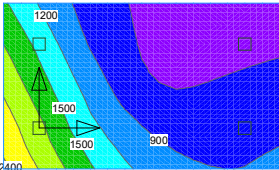
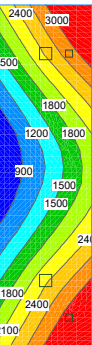
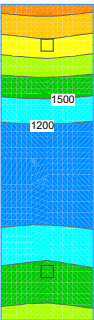
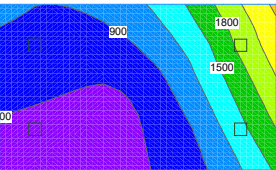
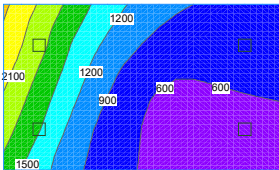
Strength Design: Status Plan

Strength Design: User Lines; User Notes; User Dimensions; Latitude Span Designs; Longitude Span Designs; Span Design Numbers; Span Design Status; Latitude DS Designs; Longitude DS Designs; DS Design Numbers; DS Design Status; PC Designs; PC Design Numbers; PC Design Status; Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only; Scale = 1:250



Soil Bearing Design: Max Soil Bearing Pressure Plan

Soil Bearing Design: User Lines; User Notes; User Dimensions; Latitude Span Designs; Longitude Span Designs; Latitude DS Designs; Longitude DS Designs; PC Designs;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250
Soil Bearing Design - Area Spring Vertical Reactions Plot (Maximum Values)
600 900 1200 1500 1800 2100 2400 2700 3000
Min Value = 356.9 psf @ (22.3,103) Max Value = 3830 psf @ (246.3,26.66)

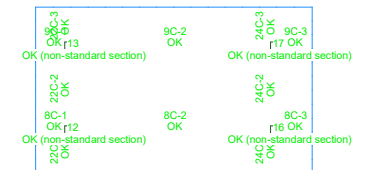
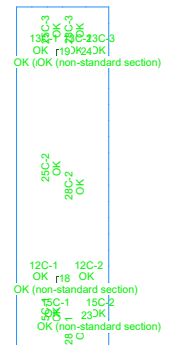
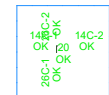
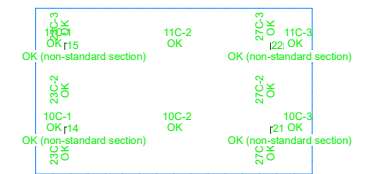
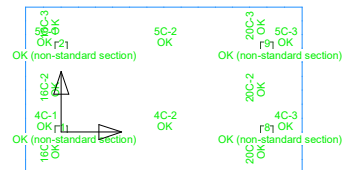
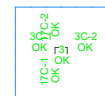
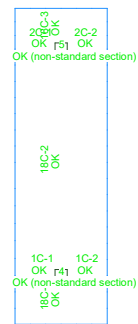
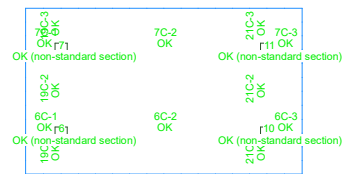


To check sliding: seismic mass x coefficient of friction = $0.36W = 0.36 \times 1220 = 439 \text{ K}$
Seismic base shear = seismic mass x $C_s = 0.123W < 0.36W$
Wind base shear = $375 \text{ K} < 439 \text{ K}$

There is no tension in the soil, and the foundation is stable against overturning.

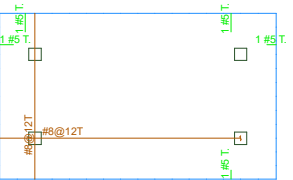
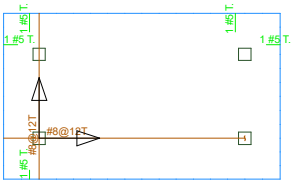
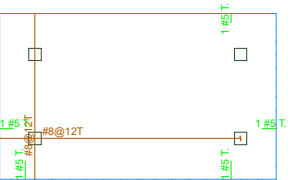
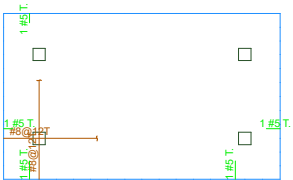
Design Status: Status Plan

Design Status: User Lines; User Notes; User Dimensions; Latitude Span Designs; Longitude Span Designs; Span Design Numbers; Span Design Status; Latitude DS Designs; Longitude DS Designs; DS Design Numbers; DS Design Status; PC Designs; PC Design Numbers; PC Design Status; Latitude Span Segment Deflection Checks; Longitude Span Segment Deflection Checks; Span Segment Deflection Check Status; Latitude Deflection Checks; Longitude Deflection Checks; Deflection Check Status; Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Scale = 1:250



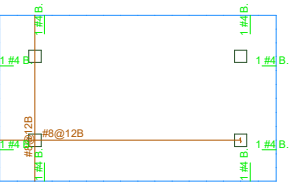
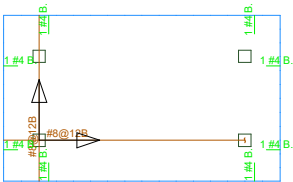
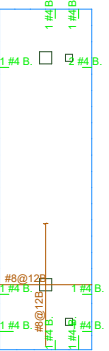
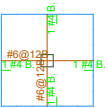
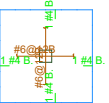
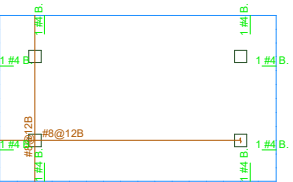
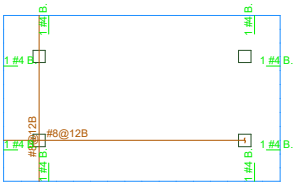
Design Status: Top Reinforcement Plan

Design Status: User Lines; User Notes; User Dimensions; Latitude Span Designs; Longitude Span Designs; Span Design Top Bars; Span Design Bar Descriptions; Latitude DS Designs; Longitude DS Designs; DS Design Top Bars;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Reinforcement: Top Face Concentrated Reinf.; Both Faces Concentrated Reinf.; Auto Face Concentrated Reinf.; Concentrated Reinf. Descriptions; Top Face Distributed Reinf.; Both Faces Distributed Reinf.; Auto Face Distributed Reinf.; Distributed Reinf. Descriptions; Latitude User Concentrated Reinf.; Longitude User Concentrated Reinf.; Latitude User Distributed Reinf.; Longitude User Distributed Reinf.;
Scale = 1:250



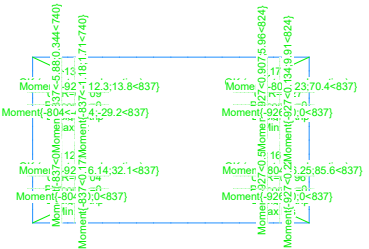
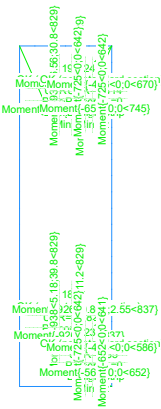
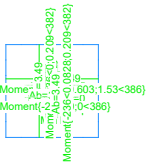
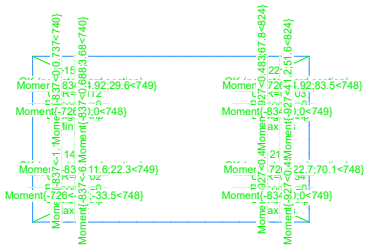
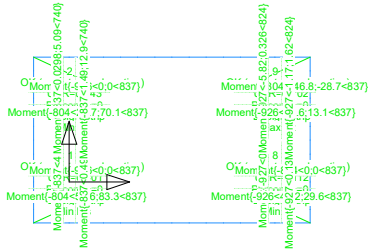
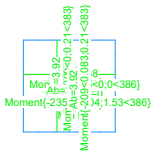
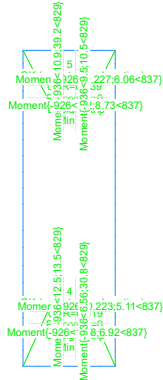
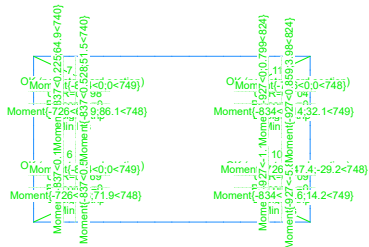
Design Status: Bottom Reinforcement Plan

Design Status: User Lines; User Notes; User Dimensions; Latitude Span Designs; Longitude Span Designs; Span Design Bottom Bars; Span Design Bar Descriptions; Latitude DS Designs; Longitude DS Designs; DS Design Bottom Bars;
Element: Wall Elements Below; Wall Elements Above; Wall Element Outline Only; Column Elements Below; Column Elements Above; Slab Elements; Slab Element Outline Only;
Reinforcement: Bottom Face Concentrated Reinf.; Both Faces Concentrated Reinf.; Auto Face Concentrated Reinf.; Concentrated Reinf. Descriptions; Bottom Face Distributed Reinf.; Both Faces Distributed Reinf.; Auto Face Distributed Reinf.; Distributed Reinf. Descriptions; Latitude User Concentrated Reinf.; Longitude User Concentrated Reinf.; Latitude User Distributed Reinf.; Longitude User Distributed Reinf.;
Scale = 1:250



Design Status: Punching Shear Status Plan

Design Status: PC Designs; PC Design Numbers; PC Design Status; PC Design Controlling; PC Design Stress Ratios; PC Design Prestress; PC Design Sections; SSR; PC Design Flexural Sections; PC Design Flexural Section Design; PC Design Flexural Section Analysis; User Notes; User Lines; User Dimensions;
Element: Wall Elements Above; Wall Elements Below; Wall Element Outline Only; Column Elements Above; Column Elements Below; Slab Elements; Slab Element Outline Only;
Scale = 1:250



FOOTING ANALYSIS

In accordance with ACI318-19 (22)

Tedds calculation version 3.3.11

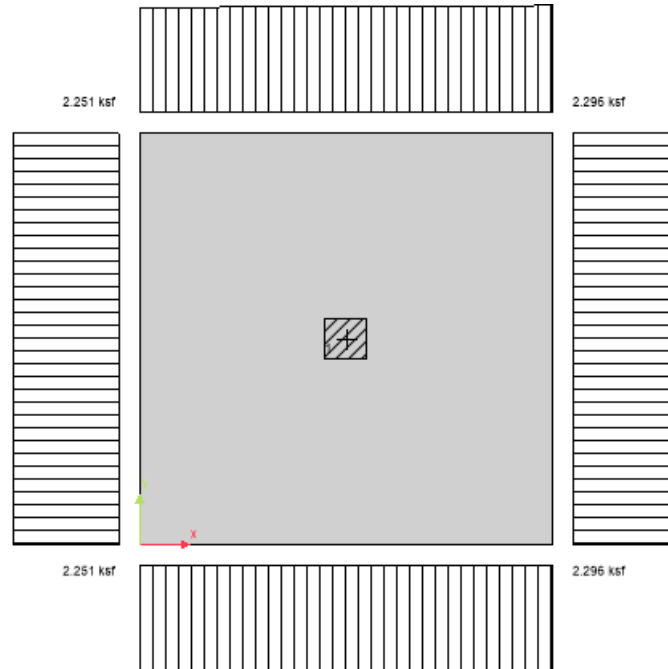
Summary results

Overall design status **PASS**
Overall design utilisation **0.937**

Description	Unit	Applied	Resisting	FoS	Result
Uplift verification	kips	227.3			Pass
Overturning stability, x	kip_ft	3.75	-1136.60	303.09	Pass
Sliding stability, x	kips	2.5	131.2	52.497	Pass
Description	Unit	Applied	Resisting	Utilization	Result
Soil bearing	ksf	2.296	3	0.765	Pass
Description	Unit	Required	Provided	Utilization	Result
Moment, positive, x-direction	kip_ft	252.1	269.0	0.937	Pass
Moment, positive, y-direction	kip_ft	250.0	283.9	0.881	Pass
Shear, one-way, x-direction	kips	83.2	92.7	0.898	Pass
Shear, one-way, y-direction	kips	82.6	92.7	0.891	Pass
Shear, two-way, Col 1	psi	156.962	201.246	0.788	Pass
Min.area of reinf, bot., x-direction	in ²	3.888	4.400		Pass
Max.reinf.spacing, bot, x-direction	in	18.0	12.5		Pass
Min.area of reinf, bot., y-direction	in ²	3.888	4.400		Pass
Max.reinf.spacing, bot, y-direction	in	18.0	12.5		Pass

Pad footing details

Length of footing **$L_x = 10$ ft**
Width of footing **$L_y = 10$ ft**
Footing area **$A = L_x \times L_y = 100$ ft²**
Depth of footing **$h = 18$ in**
Depth of soil over footing **$h_{soil} = 18$ in**
Density of concrete **$\gamma_{conc} = 150.0$ lb/ft³**



Column no.1 details

Length of column	$l_{x1} = 12.00$ in
Width of column	$l_{y1} = 12.00$ in
position in x-axis	$x_1 = 60.00$ in
position in y-axis	$y_1 = 60.00$ in

Soil properties

Gross allowable bearing pressure	$q_{allow_Gross} = 3$ ksf
Density of soil	$\gamma_{soil} = 120.0$ lb/ft ³
Angle of internal friction	$\phi_b = 30.0$ deg
Design base friction angle	$\delta_{bb} = 30.0$ deg
Coefficient of base friction	$\tan(\delta_{bb}) = 0.577$
Self weight	$F_{swt} = h \times \gamma_{conc} = 225$ psf
Soil weight	$F_{soil} = h_{soil} \times \gamma_{soil} = 180$ psf

Column no.1 loads

Dead load in z	$F_{Dz1} = 124.0$ kips
Live roof load in z	$F_{Lrz1} = 60.0$ kips
Snow load in z	$F_{Sz1} = 63.0$ kips
Wind load in z	$F_{Wz1} = -5.0$ kips
Seismic load in z	$F_{Ez1} = -6.0$ kips
Dead load in x	$F_{Dx1} = 1.5$ kips
Live roof load in x	$F_{Lrx1} = 1.0$ kips
Snow load in x	$F_{Sx1} = 1.0$ kips

Footing analysis for soil and stability

Load combinations per ASCE 7-16

1.0D (0.552)
 1.0D + 1.0L (0.552)
 1.0D + 1.0Lr (0.755)
 1.0D + 1.0S (0.765)
 1.0D + 1.0R (0.552)
 1.0D + 0.75L + 0.75Lr (0.704)
 1.0D + 0.75L + 0.75S (0.712)
 1.0D + 0.75L + 0.75R (0.552)
 1.0D + 0.6W (0.542)
 (1.0 + 0.14 × S_{DS})D + 0.7E (0.616)
 1.0D + 0.75L + 0.75Lr + 0.45W (0.697)
 1.0D + 0.75L + 0.75S + 0.45W (0.704)
 1.0D + 0.75L + 0.75R + 0.45W (0.545)
 (1.0 + 0.10 × S_{DS})D + 0.75L + 0.75S + 0.525E (0.757)
 0.6D + 0.6W (0.321)
 (0.6 - 0.14 × S_{DS})D + 0.7E (0.240)

Combination 4 results: 1.0D + 1.0S

Forces on footing

Force in x-axis

$$F_{dx} = \gamma_D \times F_{Dx1} + \gamma_S \times F_{Sx1} = \mathbf{2.5 \text{ kips}}$$

Force in z-axis

$$F_{dz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_S \times F_{Sz1} = \mathbf{227.3 \text{ kips}}$$

Moments on footing

Moment in x-axis, about x is 0

$$M_{dx} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times X_1 + F_{Dx1} \times (h)) + \gamma_S \times (F_{Sz1} \times X_1 + F_{Sx1} \times (h)) = \mathbf{1140.3 \text{ kip_ft}}$$

Moment in y-axis, about y is 0

$$M_{dy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1) + \gamma_S \times (F_{Sz1} \times y_1) = \mathbf{1136.6 \text{ kip_ft}}$$

Uplift verification

Vertical force

$$F_{dz} = \mathbf{227.32 \text{ kips}}$$

PASS - Footing is not subject to uplift

Stability against overturning in x direction, moment about x is L_x

Overturning moment

$$M_{OTxL} = \gamma_D \times (F_{Dx1} \times (h)) + \gamma_S \times (F_{Sx1} \times (h)) = \mathbf{3.75 \text{ kip_ft}}$$

Resisting moment

$$M_{RXL} = -1 \times (\gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2)) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times (X_1 - L_x)) + \gamma_S \times (F_{Sz1} \times (X_1 - L_x)) = \mathbf{-1136.6 \text{ kip_ft}}$$

Factor of safety

$$\text{abs}(M_{RXL} / M_{OTxL}) = \mathbf{303.093}$$

PASS - Overturning moment safety factor exceeds the minimum of 1.00

Stability against sliding

Resistance due to base friction

$$F_{R\text{Friction}} = \max(F_{dz}, 0 \text{ kN}) \times \tan(\delta_{bb}) = \mathbf{131.243 \text{ kips}}$$

Stability against sliding in x direction

Total sliding resistance

$$F_{Rx} = F_{R\text{Friction}} = \mathbf{131.243 \text{ kips}}$$

Factor of safety

$$\text{abs}(F_{RTx} / F_{dx}) = \mathbf{52.5}$$

PASS - Sliding factor of safety exceeds the minimum of 1.00

Bearing resistance

Eccentricity of base reaction

Eccentricity of base reaction in x-axis

$$e_{dx} = M_{dx} / F_{dz} - L_x / 2 = \mathbf{0.198 \text{ in}}$$

Eccentricity of base reaction in y-axis

$$e_{dy} = M_{dy} / F_{dz} - L_y / 2 = \mathbf{0 \text{ in}}$$

Pad base pressures

$$q_1 = F_{dz} \times (1 - 6 \times e_{dx} / L_x - 6 \times e_{dy} / L_y) / (L_x \times L_y) = \mathbf{2.251 \text{ ksf}}$$

$$q_2 = F_{dz} \times (1 - 6 \times e_{dx} / L_x + 6 \times e_{dy} / L_y) / (L_x \times L_y) = \mathbf{2.251 \text{ ksf}}$$

$$q_3 = F_{dz} \times (1 + 6 \times e_{dx} / L_x - 6 \times e_{dy} / L_y) / (L_x \times L_y) = \mathbf{2.296 \text{ ksf}}$$

$$q_4 = F_{dz} \times (1 + 6 \times e_{dx} / L_x + 6 \times e_{dy} / L_y) / (L_x \times L_y) = \mathbf{2.296 \text{ ksf}}$$

Minimum base pressure

$$q_{\min} = \min(q_1, q_2, q_3, q_4) = \mathbf{2.251 \text{ ksf}}$$

Maximum base pressure

$$q_{\max} = \max(q_1, q_2, q_3, q_4) = \mathbf{2.296 \text{ ksf}}$$

Allowable bearing capacity

Allowable bearing capacity

$$q_{\text{allow}} = q_{\text{allow_Gross}} = \mathbf{3 \text{ ksf}}$$

$$q_{\max} / q_{\text{allow}} = \mathbf{0.765}$$

PASS - Allowable bearing capacity exceeds design base pressure

FOOTING DESIGN

In accordance with ACI318-19 (22)

Tedds calculation version 3.3.11

Material details

Compressive strength of concrete

$$f'_c = \mathbf{4500 \text{ psi}}$$

Yield strength of reinforcement

$$f_y = \mathbf{60000 \text{ psi}}$$

Compression-controlled strain limit (21.2.2)

$$\epsilon_{ty} = \mathbf{0.00200}$$

Cover to top of footing

$$c_{\text{nom_t}} = \mathbf{3 \text{ in}}$$

Cover to side of footing

$$c_{\text{nom_s}} = \mathbf{3 \text{ in}}$$

Cover to bottom of footing

$$c_{\text{nom_b}} = \mathbf{3 \text{ in}}$$

Concrete type

Normal weight

Concrete modification factor

$$\lambda = \mathbf{1.00}$$

Column type

Concrete

Analysis and design of concrete footing

Load combinations per ASCE 7-16

1.4D (0.657)

1.2D + 1.6L + 0.5Lr (0.678)

1.2D + 1.6L + 0.5S (0.683)

1.2D + 1.6L + 0.5R (0.569)

1.2D + 1.0L + 1.6Lr (0.929)

1.2D + 1.0L + 1.6S (0.907)

1.2D + 1.0L + 1.6R (0.788)

1.2D + 1.6Lr + 0.5W (0.919)

1.2D + 1.6S + 0.5W (0.937)

1.2D + 1.6R + 0.5W (0.788)

1.2D + 1.0L + 0.5Lr + 1.0W (0.788)

1.2D + 1.0L + 0.5S + 1.0W (0.788)

$$1.2D + 1.0L + 0.5R + 1.0W \text{ (0.788)}$$

$$(1.2 + 0.2 \times S_{DS})D + 1.0L + 0.2S + 1.0E \text{ (0.788)}$$

$$0.9D + 1.0W \text{ (0.788)}$$

$$(0.9 - 0.2 \times S_{DS})D + 1.0E \text{ (0.788)}$$

Combination 9 results: 1.2D + 1.6S + 0.5W

Forces on footing

Ultimate force in x-axis

$$F_{ux} = \gamma_D \times F_{Dx1} + \gamma_S \times F_{Sx1} = \mathbf{3.4 \text{ kips}}$$

Ultimate force in z-axis

$$F_{uz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_S \times F_{Sz1} + \gamma_W \times F_{Wz1} = \mathbf{295.5 \text{ kips}}$$

Moments on footing

Ultimate moment in x-axis, about x is 0

$$M_{ux} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1 + F_{Dx1} \times (h)) + \gamma_S \times (F_{Sz1} \times x_1 + F_{Sx1} \times (h)) + \gamma_W \times (F_{Wz1} \times x_1) = \mathbf{1482.5 \text{ kip_ft}}$$

Ultimate moment in y-axis, about y is 0

$$M_{uy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1) + \gamma_S \times (F_{Sz1} \times y_1) + \gamma_W \times (F_{Wz1} \times y_1) = \mathbf{1477.4 \text{ kip_ft}}$$

Eccentricity of base reaction

Eccentricity of base reaction in x-axis

$$e_{ux} = M_{ux} / F_{uz} - L_x / 2 = \mathbf{0.207 \text{ in}}$$

Eccentricity of base reaction in y-axis

$$e_{uy} = M_{uy} / F_{uz} - L_y / 2 = \mathbf{0 \text{ in}}$$

Pad base pressures

$$q_{u1} = F_{uz} \times (1 - 6 \times e_{ux} / L_x - 6 \times e_{uy} / L_y) / (L_x \times L_y) = \mathbf{2.924 \text{ ksf}}$$

$$q_{u2} = F_{uz} \times (1 - 6 \times e_{ux} / L_x + 6 \times e_{uy} / L_y) / (L_x \times L_y) = \mathbf{2.924 \text{ ksf}}$$

$$q_{u3} = F_{uz} \times (1 + 6 \times e_{ux} / L_x - 6 \times e_{uy} / L_y) / (L_x \times L_y) = \mathbf{2.985 \text{ ksf}}$$

$$q_{u4} = F_{uz} \times (1 + 6 \times e_{ux} / L_x + 6 \times e_{uy} / L_y) / (L_x \times L_y) = \mathbf{2.985 \text{ ksf}}$$

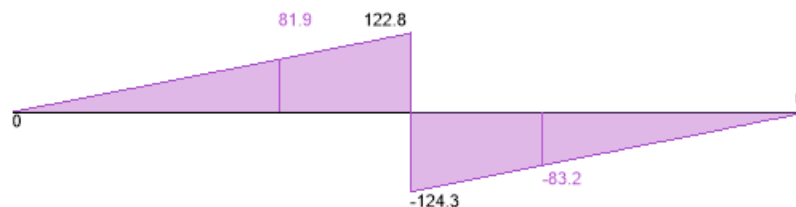
Minimum ultimate base pressure

$$q_{umin} = \min(q_{u1}, q_{u2}, q_{u3}, q_{u4}) = \mathbf{2.924 \text{ ksf}}$$

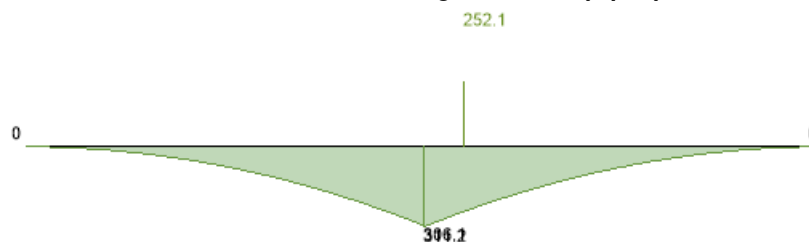
Maximum ultimate base pressure

$$q_{umax} = \max(q_{u1}, q_{u2}, q_{u3}, q_{u4}) = \mathbf{2.985 \text{ ksf}}$$

Shear diagram, x axis (kips)



Moment diagram, x axis (kip_ft)



Moment design, x direction, positive moment

Ultimate bending moment

$$M_{u.x.max} = \mathbf{252.139 \text{ kip_ft}}$$

Tension reinforcement provided

10 No.6 bottom bars (12.5 in c/c)

Area of tension reinforcement provided

 $A_{sx,bot,prov} = 4.4 \text{ in}^2$

Minimum area of reinforcement (8.6.1.1)

 $A_{s,min} = 0.0018 \times L_y \times h = 3.888 \text{ in}^2$
PASS - Area of reinforcement provided exceeds minimum

Maximum spacing of reinforcement (8.7.2.2)

 $s_{max} = \min(2 \times h, 18 \text{ in}) = 18 \text{ in}$
PASS - Maximum permissible reinforcement spacing exceeds actual spacing

Depth to tension reinforcement

 $d = h - c_{nom,b} - \phi_{x,bot} / 2 = 14.625 \text{ in}$

Depth of compression block

 $a = A_{sx,bot,prov} \times f_y / (0.85 \times f'_c \times L_y) = 0.575 \text{ in}$

Neutral axis factor

 $\beta_1 = 0.83$

Depth to neutral axis

 $c = a / \beta_1 = 0.697 \text{ in}$

Strain in tensile reinforcement

 $\epsilon_t = 0.003 \times d / c - 0.003 = 0.05993$

Minimum tensile strain(8.3.3.1)

 $\epsilon_{min} = \epsilon_{ty} + 0.003 = 0.00500$
PASS - Tensile strain exceeds minimum required

Nominal moment capacity

 $M_n = A_{sx,bot,prov} \times f_y \times (d - a / 2) = 315.423 \text{ kip_ft}$

Flexural strength reduction factor

 $\phi_f = \min(\max(0.65 + 0.25 \times (\epsilon_t - \epsilon_{ty}) / (0.003), 0.65), 0.9) = 0.900$

Design moment capacity

 $\phi M_n = \phi_f \times M_n = 283.881 \text{ kip_ft}$
 $M_{u,x,max} / \phi M_n = 0.888$
PASS - Design moment capacity exceeds ultimate moment load

One-way shear design, x direction

Ultimate shear force

 $V_{u,x} = 83.233 \text{ kips}$

Depth to reinforcement

 $d_v = h - c_{nom,b} - \phi_{x,bot} / 2 = 14.625 \text{ in}$

Size effect factor (22.5.5.1.3)

 $\lambda_s = 1$

Ratio of longitudinal reinforcement

 $\rho_w = A_{sx,bot,prov} / (L_y \times d_v) = 0.00251$

Shear strength reduction factor

 $\phi_v = 0.75$

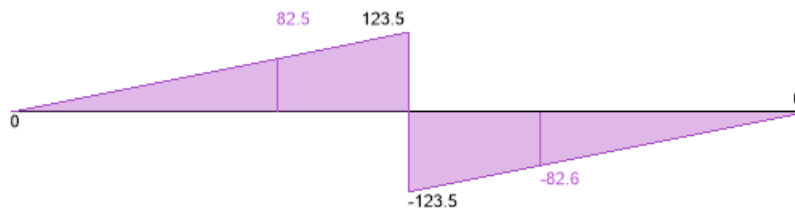
Nominal shear capacity (Eq. 22.5.5.1)

 $V_n = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3} \times \sqrt{(f'_c \times 1 \text{ psi})} \times L_y \times d_v, 5 \times \lambda \times \sqrt{(f'_c \times 1 \text{ psi})} \times L_y \times d_v) = 127.948 \text{ kips}$

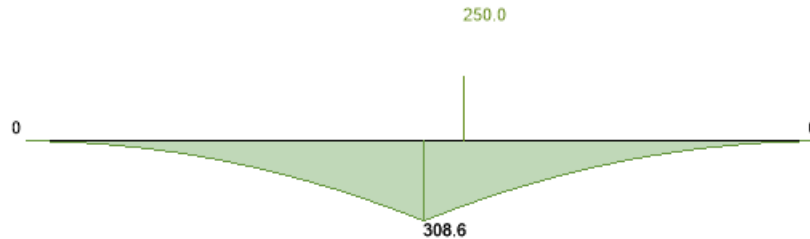
Design shear capacity

 $\phi V_n = \phi_v \times V_n = 95.961 \text{ kips}$
 $V_{u,x} / \phi V_n = 0.867$
PASS - Design shear capacity exceeds ultimate shear load

Shear diagram, y axis (kips)



Moment diagram, y axis (kip_ft)



Moment design, y direction, positive moment

Ultimate bending moment $M_{u,y,max} = 249.97$ kip_ft
Tension reinforcement provided 10 No.6 bottom bars (12.5 in c/c)
Area of tension reinforcement provided $A_{sy,bot,prov} = 4.4$ in²
Minimum area of reinforcement (8.6.1.1) $A_{s,min} = 0.0018 \times L_x \times h = 3.888$ in²

PASS - Area of reinforcement provided exceeds minimum

Maximum spacing of reinforcement (8.7.2.2) $s_{max} = \min(2 \times h, 18 \text{ in}) = 18$ in

PASS - Maximum permissible reinforcement spacing exceeds actual spacing

Depth to tension reinforcement $d = h - C_{nom,b} - \phi_{x,bot} - \phi_{y,bot} / 2 = 13.875$ in
Depth of compression block $a = A_{sy,bot,prov} \times f_y / (0.85 \times f'_c \times L_x) = 0.575$ in
Neutral axis factor $\beta_1 = 0.83$
Depth to neutral axis $c = a / \beta_1 = 0.697$ in
Strain in tensile reinforcement $\epsilon_t = 0.003 \times d / c - 0.003 = 0.005671$
Minimum tensile strain(8.3.3.1) $\epsilon_{min} = \epsilon_{ty} + 0.003 = 0.00500$

PASS - Tensile strain exceeds minimum required

Nominal moment capacity $M_n = A_{sy,bot,prov} \times f_y \times (d - a / 2) = 298.923$ kip_ft
Flexural strength reduction factor $\phi_f = \min(\max(0.65 + 0.25 \times (\epsilon_t - \epsilon_{ty}) / (0.003), 0.65), 0.9) = 0.900$
Design moment capacity $\phi M_n = \phi_f \times M_n = 269.031$ kip_ft
 $M_{u,y,max} / \phi M_n = 0.929$

PASS - Design moment capacity exceeds ultimate moment load

One-way shear design, y direction

Ultimate shear force $V_{u,y} = 82.552$ kips
Depth to reinforcement $d_v = h - C_{nom,b} - \phi_{x,bot} - \phi_{y,bot} / 2 = 13.875$ in
Size effect factor (22.5.5.1.3) $\lambda_s = 1$
Ratio of longitudinal reinforcement $\rho_w = A_{sy,bot,prov} / (L_x \times d_v) = 0.00264$
Shear strength reduction factor $\phi_v = 0.75$
Nominal shear capacity (Eq. 22.5.5.1) $V_n = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3} \times \sqrt{f'_c \times 1 \text{ psi}} \times L_x \times d_v, 5 \times \lambda \times \sqrt{f'_c \times 1 \text{ psi}} \times L_x \times d_v) = 123.535$ kips
Design shear capacity $\phi V_n = \phi_v \times V_n = 92.651$ kips
 $V_{u,y} / \phi V_n = 0.891$

PASS - Design shear capacity exceeds ultimate shear load

Two-way shear design at column 1

Depth to reinforcement $d_{v2} = 14.25$ in
Shear perimeter length (22.6.4) $l_{xp} = 26.250$ in

Shear perimeter width (22.6.4)

$$l_{yp} = \mathbf{26.250 \text{ in}}$$

Shear perimeter (22.6.4)

$$b_o = 2 \times (l_{x1} + d_{v2}) + 2 \times (l_{y1} + d_{v2}) = \mathbf{105.000 \text{ in}}$$

Shear area

$$A_p = l_{x,perim} \times l_{y,perim} = \mathbf{689.063 \text{ in}^2}$$

Surcharge loaded area

$$A_{sur} = A_p - l_{x1} \times l_{y1} = \mathbf{545.063 \text{ in}^2}$$

Ultimate bearing pressure at center of shear area

$$q_{up,avg} = \mathbf{2.955 \text{ ksf}}$$

Ultimate shear load

$$F_{up} = \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil}) + \gamma_S \times F_{Sz1} + \gamma_W \times F_{Wz1} + \gamma_D \times A_p \times F_{swt} + \gamma_D \times A_{sur} \times F_{soil} - q_{up,avg} \times A_p = \mathbf{234.854 \text{ kips}}$$

Ultimate shear stress from vertical load

$$v_{ug} = \max(F_{up} / (b_o \times d_{v2}), 0 \text{ psi}) = \mathbf{156.962 \text{ psi}}$$

Column geometry factor (Table 22.6.5.2)

$$\beta = l_{y1} / l_{x1} = \mathbf{1.00}$$

Column location factor (22.6.5.3)

$$\alpha_s = \mathbf{40}$$

Size effect factor (22.5.5.1.3)

$$\lambda_s = \mathbf{1}$$

Concrete shear strength (22.6.5.2)

$$v_{cpa} = (2 + 4 / \beta) \times \lambda_s \times \lambda \times \sqrt{f'_c \times 1 \text{ psi}} = \mathbf{402.492 \text{ psi}}$$

$$v_{cpb} = (\alpha_s \times d_{v2} / b_o + 2) \times \lambda_s \times \lambda \times \sqrt{f'_c \times 1 \text{ psi}} = \mathbf{498.324 \text{ psi}}$$

$$v_{cpc} = 4 \times \lambda_s \times \lambda \times \sqrt{f'_c \times 1 \text{ psi}} = \mathbf{268.328 \text{ psi}}$$

$$v_{cp} = \min(v_{cpa}, v_{cpb}, v_{cpc}) = \mathbf{268.328 \text{ psi}}$$

Shear strength reduction factor

$$\phi_v = \mathbf{0.75}$$

Nominal shear stress capacity (Eq. 22.6.1.2)

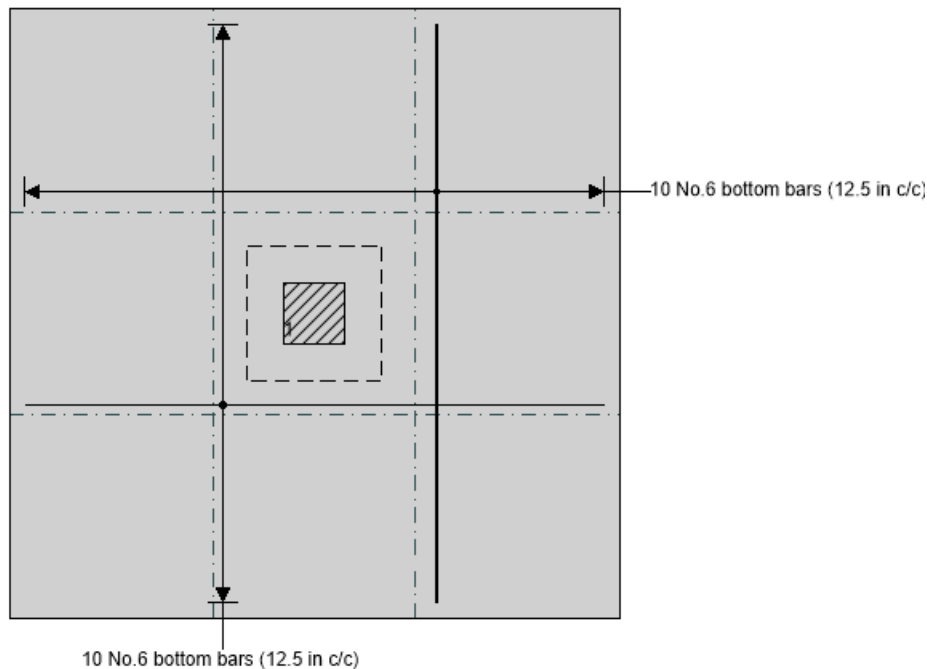
$$V_n = v_{cp} = \mathbf{268.328 \text{ psi}}$$

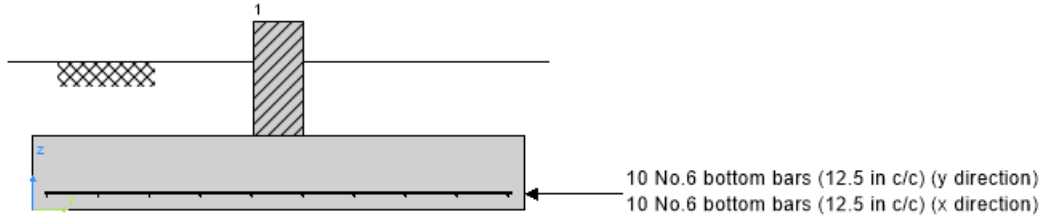
Design shear stress capacity (8.5.1.1(d))

$$\phi V_n = \phi_v \times V_n = \mathbf{201.246 \text{ psi}}$$

$$v_{ug} / \phi V_n = \mathbf{0.780}$$

PASS - Design shear stress capacity exceeds ultimate shear stress load





S.O. No. _____

Subject: Creech DRP Phase 2, Hangar SOG

Michael Baker

I N T E R N A T I O N A L

Sheet No. _____ of _____

Drawing No. _____

Computed by _____ Checked by _____ Date 10/10/2025

HANGAR BAY SOG CRITERIA

- From RFP: 01 10 10.06 Paragraph 1.4.8.6:

"Design the AOF hangar bay slabs on ground for the minimum wheel loads in accordance with latest edition of UFC 4-211-01. Determine the concrete slab on ground thickness for the AOF hangar bay slabs in accordance with the latest edition of UFC 3-260-02, utilizing a non-reinforced concrete section."

- From RFP Bidder Inquiry Response #10824885:

"The minimum design wheel load for the hangar slab is 30,000 pounds from a tire with a 240 psi pressure. The trench cover plate must be designed to withstand a minimum proof-load of 50,000 pounds from a tire with a 250 psi pressure. By: James Elsberry; SPL PPMD - Military Support Branch; (702-652-8443) On: May 28 2024"

-From UFC 4-211-01:

3-4.2.3.1 Aircraft Maintenance Bay - Slab on Ground Design

Determine the concrete slab on ground thickness for the Aircraft Maintenance Bay in accordance with UFC 3-260-02, utilizing a non-reinforced concrete section with the Service-specific minimum loads shown in this UFC. It is acceptable to design and install reinforcing for temperature and/or crack control but the reinforcing cannot be used to decrease the slab on ground thickness from the calculated non-reinforced slab thickness. If point loads other than wheel loads require a thicker slab section, then reinforcing can be utilized in the area of the point load to keep from increasing the slab thickness for the point load. A typical cross-section is shown in

- Minimum concrete slab on ground thickness will be 8 inches. Increase slab thickness in 1/2" increments.
 - Minimum concrete flexural strength will be 550 pounds per square inch (psi) at 90 days.
 - Maximum concrete flexural strength will be 650 psi at 90 days.
- \1\
- In hangar bays that allow for multiple aircraft parking positions, provide a uniform slab on ground design throughout the hangar bay. Do not reduce the slab on ground thickness in areas not subject to the design aircraft wheel loads.

S.O. No. _____

Subject: Creech DRP Phase 2, Hangar SOG**Michael Baker****INTERNATIONAL**

Sheet No. _____ of _____

Drawing No. _____

Computed by _____ Checked by _____ Date 10/10/2025**-From UFC 4-211-01:****3-4.2.3.2 Aircraft Maintenance Bay - Concrete Slab on Ground Joint Spacing**

Space the Aircraft Maintenance Bay slab on ground joints in accordance with Table 3-1: Aircraft Maintenance Bay Slab on Ground Joint Spacing. Locate the joints considering the column line spacing while not exceeding the maximums listed in Table 3-1: Aircraft Maintenance Bay Slab on Ground Joint Spacing.

Table 3-1: Aircraft Maintenance Bay Slab on Ground Joint Spacing

SLAB TYPE	CONCRETE THICKNESS* (T) MILLIMETERS (INCHES)	SPACING METERS (FEET)
NONREINFORCED SLAB	$205\text{ (8)} \leq T \leq 230\text{ (9)}$ $230\text{ (9)} < T \leq 305\text{ (12)}$ $T > 305\text{ (12)}$	3.8 TO 4.6 (12.5 TO 15) 4.6 TO 6.1 (15 TO 20) 6.1 (20) MAX
SLAB WITH REINFORCEMENT (MINIMUM 0.05% STEEL IN BOTH DIRECTIONS)	ALL THICKNESSES	7.6 (25) MAX

Table 3-2: Concrete Slab on Ground Dowel Size and Spacing

CONCRETE SLAB THICKNESS IN INCHES	MINIMUM DOWEL LENGTH IN INCHES <i>/2/</i>	MAXIMUM DOWEL SPACING IN INCHES <i>/2/</i>	DOWEL DIAMETER AND TYPE
8 TO AND INCLUDING 11.5	16	12	1 INCH BAR
12 TO AND INCLUDING 15.5	20	15	1 TO 1-1/4 INCH BAR
16 TO AND INCLUDING 20.5	20	18	1-1/4 TO 1-1/2 INCH BAR
21 TO AND INCLUDING 25.5	24	18	2 INCH BAR
OVER 26	30	18	3 INCH BAR

S.O. No. _____

Subject: Creech DRP Phase 2, Hangar SOG

Michael Baker

I N T E R N A T I O N A L

_____ Sheet No. _____ of _____

_____ Drawing No. _____

Computed by _____ Checked by _____ Date 10/10/2025

-From UFC 4-211-01:

5-4 STRUCTURAL

5-4.1 Aircraft Maintenance Bay - Slab on Ground Loading

Air Force traffic loadings are designated in Table 3-1 of UFC 3-260-02 Pavement Design for Airfields. Air Force hangar pavement thickness will be designed in accordance with UFC 3-260-02, Chapter 3, paragraph 2c, titled Type C Traffic Areas. Obtain approval for deviations of aircraft traffic mixes or deviation of airfield design type (heavy, modified-heavy, medium, light) from the AFCEC pavements engineer.

-From Geotech report: $k = 120$ pci

-From UFC 3-260-02:

Figure 12-6 - Plain concrete design curves for Air Force light-load pavements
Use 12.5" unreinforced pavement thickness (see next page)

Confirmed passing with ACI 360R check on following pages

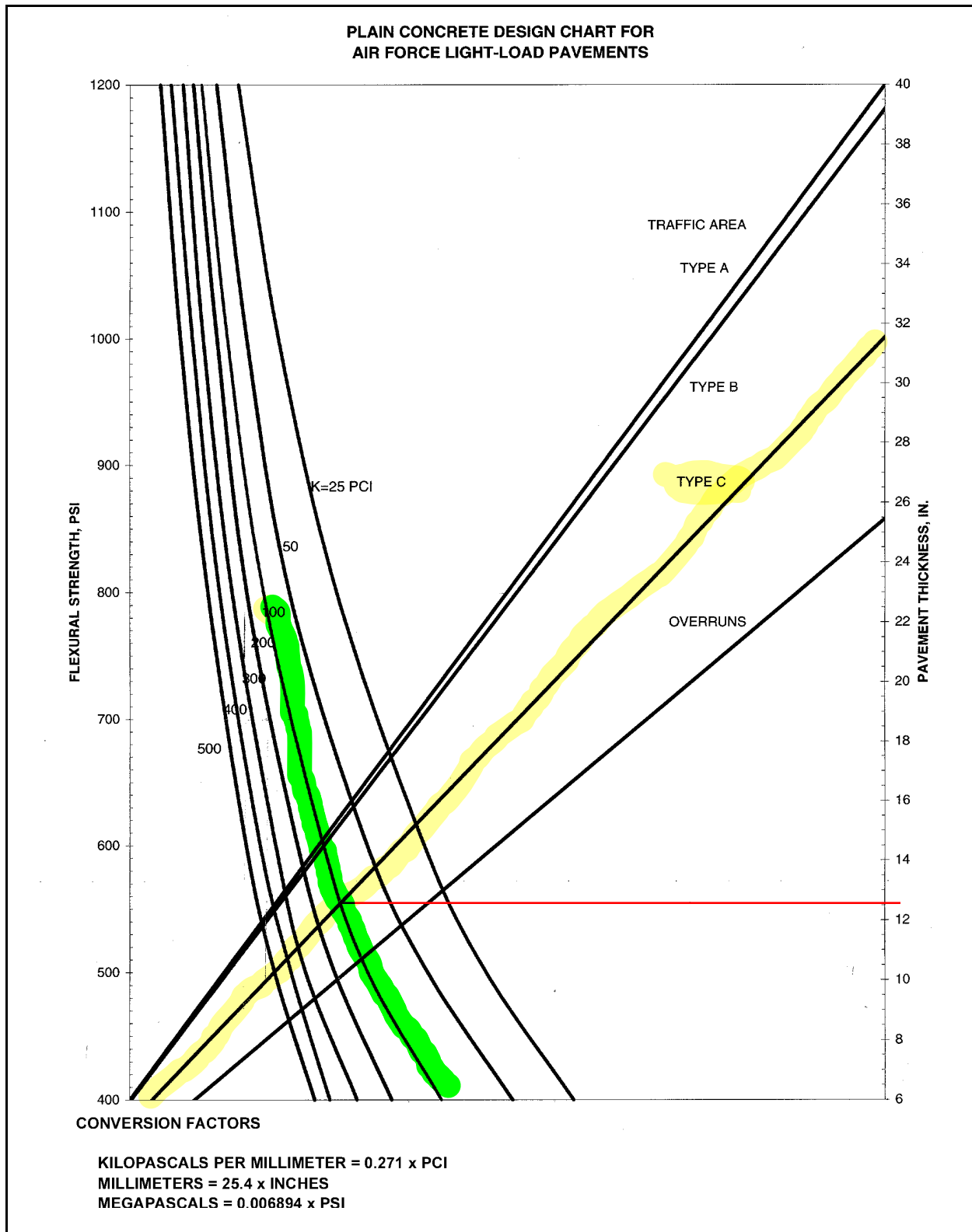


Figure 12-6. Plain concrete design curves for Air Force light-load pavements

SLAB ON GROUND (ACI 360R)

In accordance with Guide to Design of Slab-on-Ground per ACI 360R-10

Tedds calculation version 1.0.03

Design summary

Description	Unit	Provided	Required	Utilization	Result
Slab thickness	in	12.5	9.02	0.722	PASS
Joint spacing	ft	20	22.25	0.899	PASS



Slab foundation-refer to Section 4.1 of ACI 360R

Design method

Design method publisher

Wire Reinforcement Institute

Materials and site properties

Slab thickness

$h = 12.5$ in

Specified compressive strength of concrete

$f'_c = 5000$ psi

Subgrade modulus

$k = 120$ lb/in³

Concrete modulus of elasticity

$E = 3605$ ksi

Wheel specifications

Axle type

Single-axle

Number of wheels at end of each axle

Single wheel

Wheel center to center spacing

$S = 40$ in

Wheel contact area

$A_{\text{wheel}} = 125$ in²

Diameter of equivalent circle

$d_{\text{eq_circle}} = \sqrt{((A_{\text{wheel}} \times 4) / \pi)} = 12.6$ in

Loading details

Load location

Interior

Axle load

$P_a = 30$ kips

Wheel load

$P_{\text{wheel}} = P_a / 2 = 15$ kips

Safety factor

$FS = 2$

Slab thickness design

By iteration assumend trial thickness

$h_{\text{trial}} = 9$ in

The following output is based on the use of this trial thickness in the design charts in Appendix A of ACI 360R

Relative stiffness parameter (Fig. A2.1)

$D_{\text{byk}} = 1.94 \times 10^6$ in⁴

Modulus of rupture of concrete

$f_r = 9 \times \sqrt{(f'_c \times 1 \text{ psi})} = 636.4$ psi

Allowable tensile stress

$f_{t_allow} = f_r / FS = 318.2$ psi

Basic bending moments (Fig. A2.2)

$M_{\text{basic}} = 235.84$ lb_in/in/kips

Additional moments (Fig. A2.2)

$M_{\text{additional}} = 49.5$ lb_in/in/kips

Total unit moments

$M_{\text{unit}} = M_{\text{basic}} + M_{\text{additional}} = 285.34$ lb_in/in/kips

Design bending moments

$$M_{\text{design}} = M_{\text{unit}} \times P_{\text{wheel}} = 4280 \text{ lb_ft/ft}$$

Required slab thickness (Fig. A2.3)

$$h_{\text{min}} = 9.02 \text{ in}$$

$$h_{\text{min}} / h = 0.722$$

PASS - Slab thickness is adequate to avoid live load-induced cracks

Crack control options

Reinforcement type

Unreinforced

Concrete type

Typical concrete

Actual joint spacing

$$S_{\text{joint}} = 20.0 \text{ ft}$$

Recommended joint spacing (Fig.6.6)

$$S_{\text{joint_max}} = 22.3 \text{ ft}$$

$$S_{\text{joint}} / S_{\text{joint_max}} = 0.899$$

PASS - Joint spacing is adequate to avoid live load-induced cracks