STRUCTURAL ANALYSIS FOR:

UCDH MODULAR BUILDING

Date: 13NOV2020

Table of content

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1 DESIGN CRITERIA:

1.1 DESIGN CODES & REFERENCES

- 2019 Edition of the International Building Code
- 2019 Edition of the International Residential Code
- ASCE 7-16
- Steel design: AISC 360-10/05: ASD
- Seismic AISC 341-10/05
- Ultimate Strength Design Handbook (ACI)

Calculation performed by SCIA Engineer 19.1

1.2 CODE CRITERIA

2019 IBC

Seismic Design Category:	**D**
Wind Speed:	**94** MPH
Wind Exposure:	**B**
Snow Load (Roof):	**0** psf

1.3 MATERIALS

Hot Rolled Steel Grade	A36
ASTM A913 ST GRADE 50, TYPE H	54-97 mil GALV. STEEL
ASTM A913 ST GRADE 33, TYPE H	18-43 mil GALV. STEEL

1.4 STRUCTURAL LOADS

Dead Loads

Floor Dead Loads

Finish	5 psf
Floor Joists	4 psf
Insulation	1.05 psf
Add. flooring	3 psf
Total floor Dead Load	**13.05 psf**

Exterior Wall Dead Loads		
Cement board siding	3.15 psf	
ROK-ON SIS	3.72 psf	
LGS wall framing	2.2 psf	
Insulation	1.05 psf	
Drywall	2.5 psf	
Misc.	4 psf	
Total wall Dead Load	**16.62 psf**	
Interior Wall Dead Loads		
Drywall	2.5 psf	
LGS wall framing	2.2 psf	
Insulation	1.05 psf	
Drywall	2.5 psf	
Misc.	4 psf	
Total wall Dead Load	**12.25 psf**	
Ceiling Dead Load		
LGS ceiling framing	1 psf	
½” Gypsum board	2.2 psf	
Total ceiling Dead Load	**3.2 psf**	
Roof Dead Loads		
XPS	3.1 psf	
OSB	1.6 psf	
LGS truss	2.15 psf	
Misc.	2 psf	
HVAC	2100 lb	
Total roof Dead Load	**8.85 psf**	**2100 lb (HVAC)**
Floor Live Load	**125.00 psf**	
Roof Live Load	**20.00 psf**	

LOAD SUMMARY

	Dead load (DL), psf	Live Load (LL), psf	Dead load (DL equip)
Floor	13.05	125	
Exterior Wall	16.62		
Interior Wall	12.25		
Ceiling	3.2		
Roof	8.85	20	2100

Load Combinations for strength design (per 2.3.1 ASCE 7-16)

1.4D

1.2D + 1.6L + 0.5(RL or S or R)

1.2D + 1.6(RL or S or R) + (L or 0.5W)

1.2D + 1.0W + L + 0.5(RL or S or R)

0.9D + 1.0W

1.2D+1E+0.5LL

0.9D+1W

0.9D+1E

Per 2.2 ASCE 7-16

D =dead load:

L =live load

RL =roof live load

S =snow load

R =rain load

W =wind load

E =earthquake load

The maximum deflection limits L/240 according to table 1604.3 the code IBC 2019.

The maximum horizontal drift according to table 12.12-1 the code ASCE 7-16. Structure type / Risk category - “All other structures / II - the maximum story drift should not exceed - 0.020hsx.
hsx is the story height below level x.

Wind loads

Risk Category

Risk Category II

Project Address

1535 River Park Dr, Sacramento, CA 95815,

Basic Wind Speed

94 mph

Site Elevation

31.39 ft

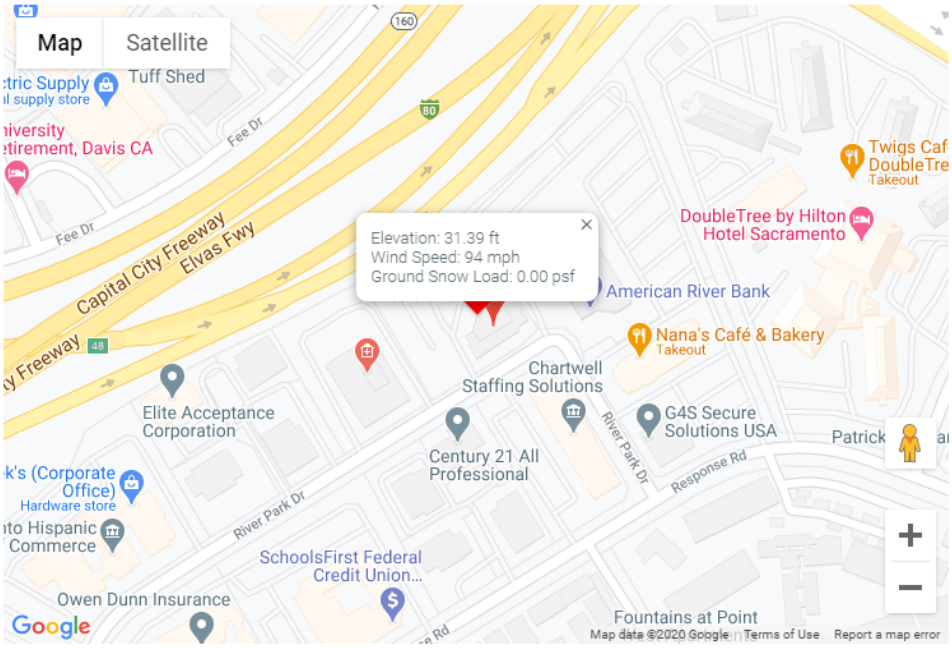
Ground Snow Load

0 psf

Exposure Category

B

View Map Contours



Structure

Building

Roof Profile

Gable/Duopitch

Building Length, L

35 ft

Building Width, B

28 ft

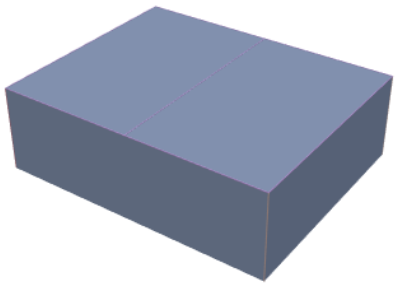
Mean Roof Height, h

11 ft

Roof Pitch Angle, θ

0 °

Figure | 3D Render



Type of Structure

ASCE 7-16 - Buildings - Main Wind Force Resisting System

Enclosure Classification

Enclosed Buildings

Floor Elevation (for windward wall pressure distribution)

+ Add Row

Floor Level	Elevation ft	Delete
2	11	✖

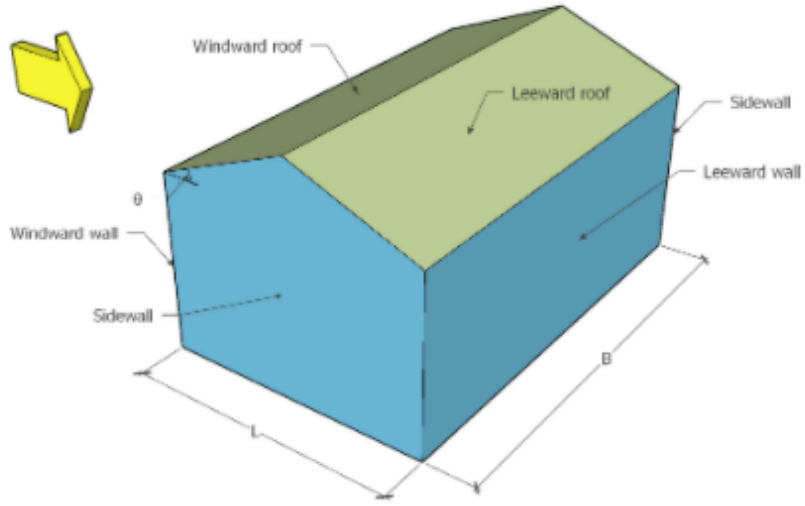
Wind Pressure Along L

Surface	Level	Elevation ft	Design Pressure psf	
			$p_{min} = qG(+C_p) - q_i(+GC_{pi})$	$p_{max} = qG(-C_p) - q_i(-GC_{pi})$
Windward Wall	2	11	5.470	9.410
Leeward Wall	All		-6.16	-2.22
Side Wall	All		-8.480	-4.540
Flat Roof	Worst Case	0 to h/2	-10.340	-6.400
		h/2 to h	-10.340	-6.400
		h to 2h	-6.620	-3.650
		> 2h	-4.760	-3.650

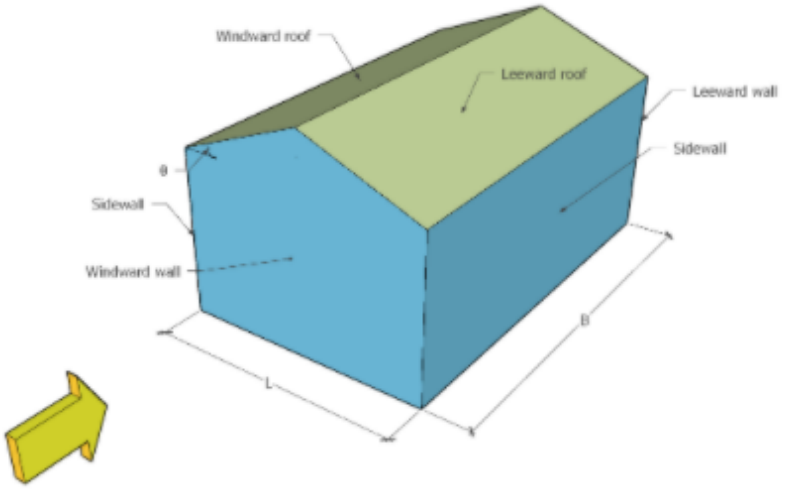
Wind Pressure Along B

Surface	Level	Elevation ft	Design Pressure psf	
			$p_{min} = qG(+C_p) - q_i(+GC_{pi})$	$p_{max} = qG(-C_p) - q_i(-GC_{pi})$
Windward Wall	2	11	5.470	9.410
Leeward Wall	All		-6.62	-2.68
Side Wall	All		-8.480	-4.540
Roof	Worst Case	0 to h/2	-10.340	-6.400
		h/2 to h	-10.340	-6.400
		h to 2h	-6.620	-2.680
		> 2h	-4.760	-0.820

Minimum design wind pressure for walls = 16 psf
Minimum design wind pressure for roof = 8 psf



Elevation - Wind along L



Elevation - Wind along B

Wind load on the parapet

Code:	ASCE 7-16,	
Wind speed:	94	mph
Exp.	B	
Category:	II	
Enclosed Building with Flat Roof		
Building Roof Height =	11	ft
Length =	36	ft
Width =	28	ft
Solid Parapet =	5,5	ft
Table 26.11-1 for Exp B,		
zmin=	30	ft
zg =	1200	ft
Alpha =	7	
Top of Parapet z =	16,5	ft

If h < 15 then: Kh = 2.01*(15/zg)^(2/a) (Table 28.3-1)

If h >= 15 then:Kh = 2.01*(z/zg)^(2/a) (Table 28.3-1)

(Note: z not < 30' for Exp. B)

z= 30 ft

Velocity Pressure: qz = 0.00256*Kz*Kzt*Kd*V^2

Kzt = 1 (Sect. 26.8 & Figure 26.8-1)

Kd = 0,85 (Table 26.6)

Kz = 0,70

qz= 13,47 psf

From Section 27.4.3 it is given that GCpn = +1.5 for windward parapet, and -1.0 for leeward parapet. Using this in combination with equation 27.3-3, the pressure on the parapet is as follows:

Pp=qp(GCpn) psf

Pp - combined net pressure on the parapet caused by the combination of the net pressures from the front and back parapet surfaces. Plus (and minus) signs signify net pressure acting toward (and away from) the front (exterior) side of the parapet.

qp - velocity pressure evaluated at the top of the parapet.

(GCpn) - combined net pressure coefficient:

+1.5 - for windward parapet or

−1.0 - for leeward parapet.

Pp = 20,21 psf - windward parapet

Pp = -13,47 psf -leeward parapet

Minimum design wind pressure for walls = 16 psf

Seismic loads.

Hazards by Location

Search Information

Address:	1535 River Park Dr, Sacramento, CA 95815, USA
Coordinates:	38.6002008, -121.436065
Elevation:	31 ft
Timestamp:	2020-11-06T12:28:17.864Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

Basic Parameters

Name	Value	Description
S_S	0.525	MCE_R ground motion (period=0.2s)
S_1	0.242	MCE_R ground motion (period=1.0s)
S_{MS}	0.725	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.483	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.38	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.954	Coefficient of risk (0.2s)
CR_1	0.943	Coefficient of risk (1.0s)
PGA	0.221	MCE_G peak ground acceleration
F_{PGA}	1.379	Site amplification factor at PGA
PGA_M	0.304	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	0.525	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.551	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.242	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.257	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

2. STRUCTURAL ANALYSIS

2.1 BUILDING DESCRIPTION

Project consists of 4 pre-fabricated modules. Module sizes are 35’-10 ¾” x 12’-8”, 15’-2 ¾” x 11’-7 ⅜”, 15’-2 ¾” x 12’-4 ⅜”, 15’-2 ¾” x 11’-11”. Smaller modules are mounted with the short side to the long side of the larger module. Walls, trusses and floor joist consists of LGS structural framing. The walls and floor beams are supported by the steel support beams HSS profile.

The design of the structure based on the requirements of the 2019 California Building Code and reference codes.

The analytical model is presented as a spatial model.

The structural rigidity of the containers in the longitudinal and transverse directions is achieved due to the steel walls of the containers.

Structural analysis is done in SCIA Engineer 20.0 software. This software allows automatic determination of the load combination that causes highest forces in structural members for further analysis and cross section selection. Governing load cases are shown in the sections "CHECKING STEEL ELEMENTS". Seismic Force-Resisting System - "A-17" according to (ASCE 7-16 TABLE 12.2-1)

To determine the design forces from dynamic loads (earthquake), two types of calculations are used: Modal Mode and Response Spectrum Method

Modal Mode:
This approach allows the modal analysis of the structure, setting the first n values and eigenvectors of the structure.
The available analysis methods: subspace iteration, Lanczos method and the basis reduction method.
Iterations will be completed if the following condition is met: where:

$$\frac{\left|\omega_i^k - \omega_i^{k-1}\right|}{\left|\omega_i^k\right|} < tolerance$$

i = 1,2,...,n vibration modes, k - number of iterations.
Upper limit is the period value (pulsation, frequency), which describes that in the range, (0, upper limit) the following values and eigenvectors will be set. Sturm check, which allows finding the skipped pulsations, is possible.

Response Spectrum Method:

Seismic analysis is based on the response spectrum method. All data is defined the same way as in modal analysis. Additionally, parameters required by a specific national code to establish the response spectrum shape must be specified. Calculations and results are the same as those for spectral analysis.

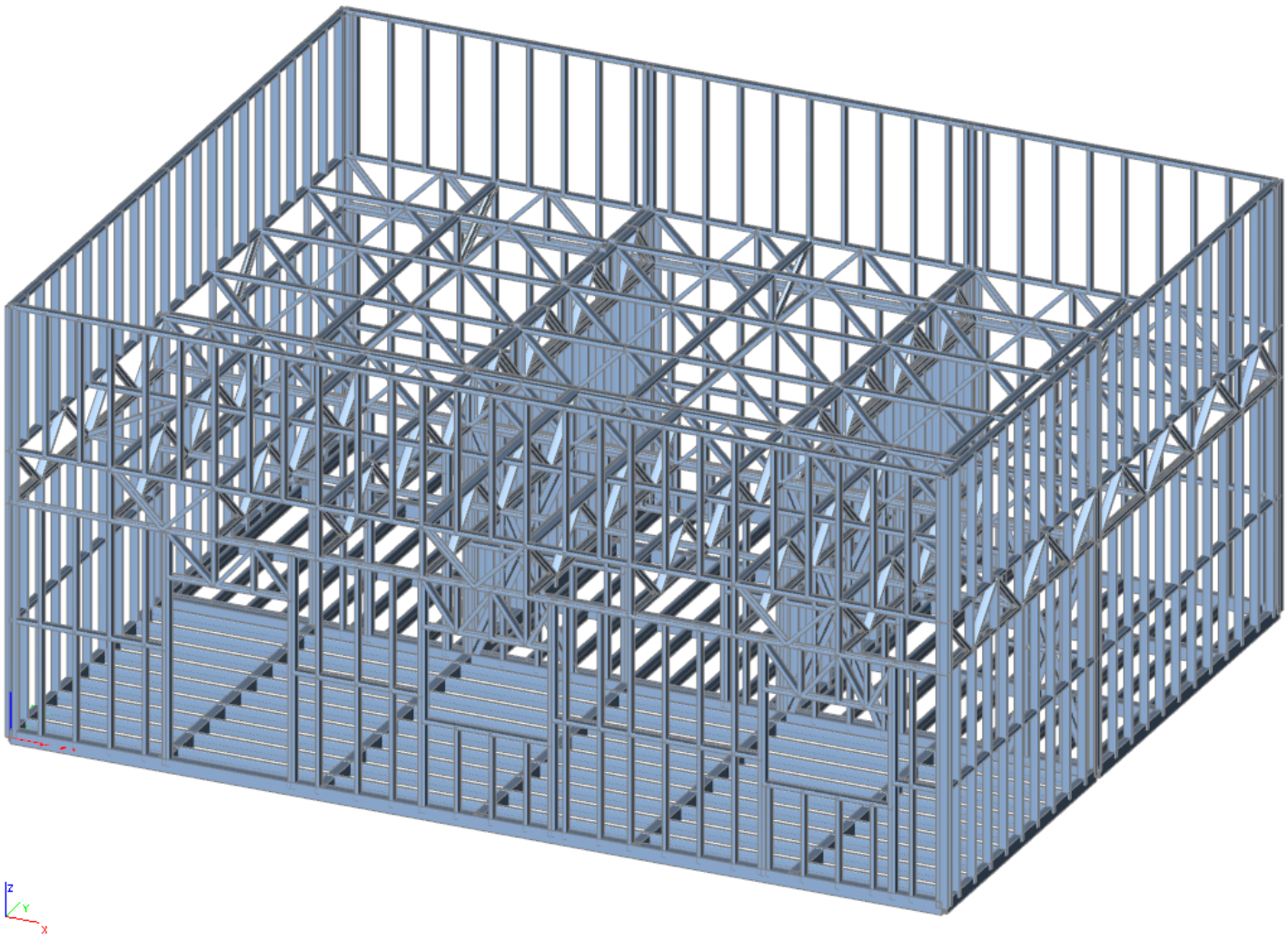
In addition to results obtained from modal analysis, for each eigenform the seismic analysis provides the following values:

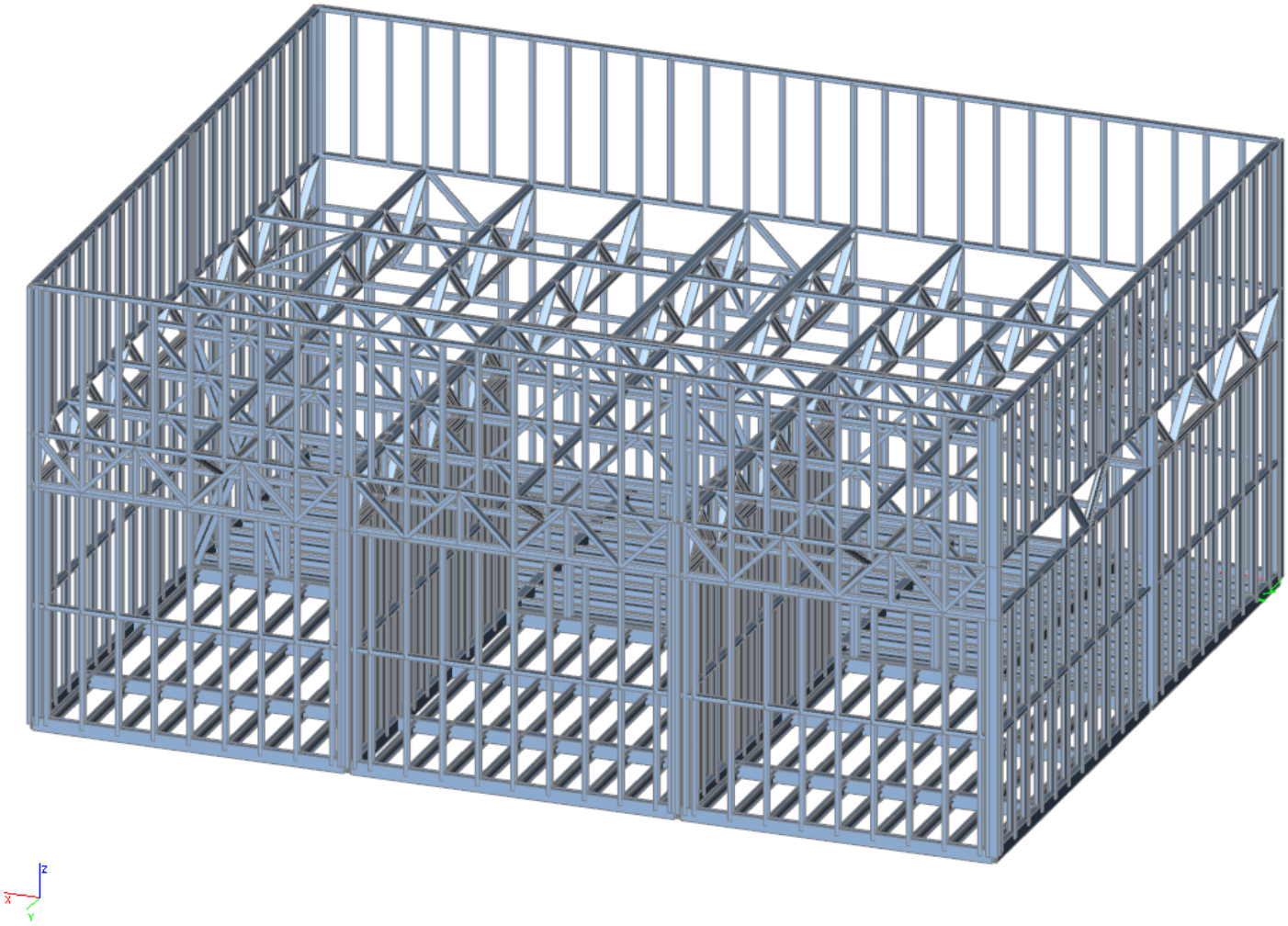
- Seismic excitation multiplier (value of the accelerating excitation spectrum).
- Seismic participation factors calculated as those for the modal analysis. However, vector D describing excitation direction is user defined. Coefficients are specified for each dynamic degree of freedom according to the method selected in Job Preferences. (Maximum or Distinct).
- Seismic mode coefficients as a product of the seismic excitation factor and the respective seismic participation factor for each dynamic degree of freedom.
- Displacements, internal forces and reactions for each form of vibration or quadratic combination calculated with the SRSS or CQC method.
- Pseudostatic forces, which are the external loads generated according to the seismic analysis assumptions.

For seismic analysis, the same quadratic combination methods as those for spectral analysis are available.

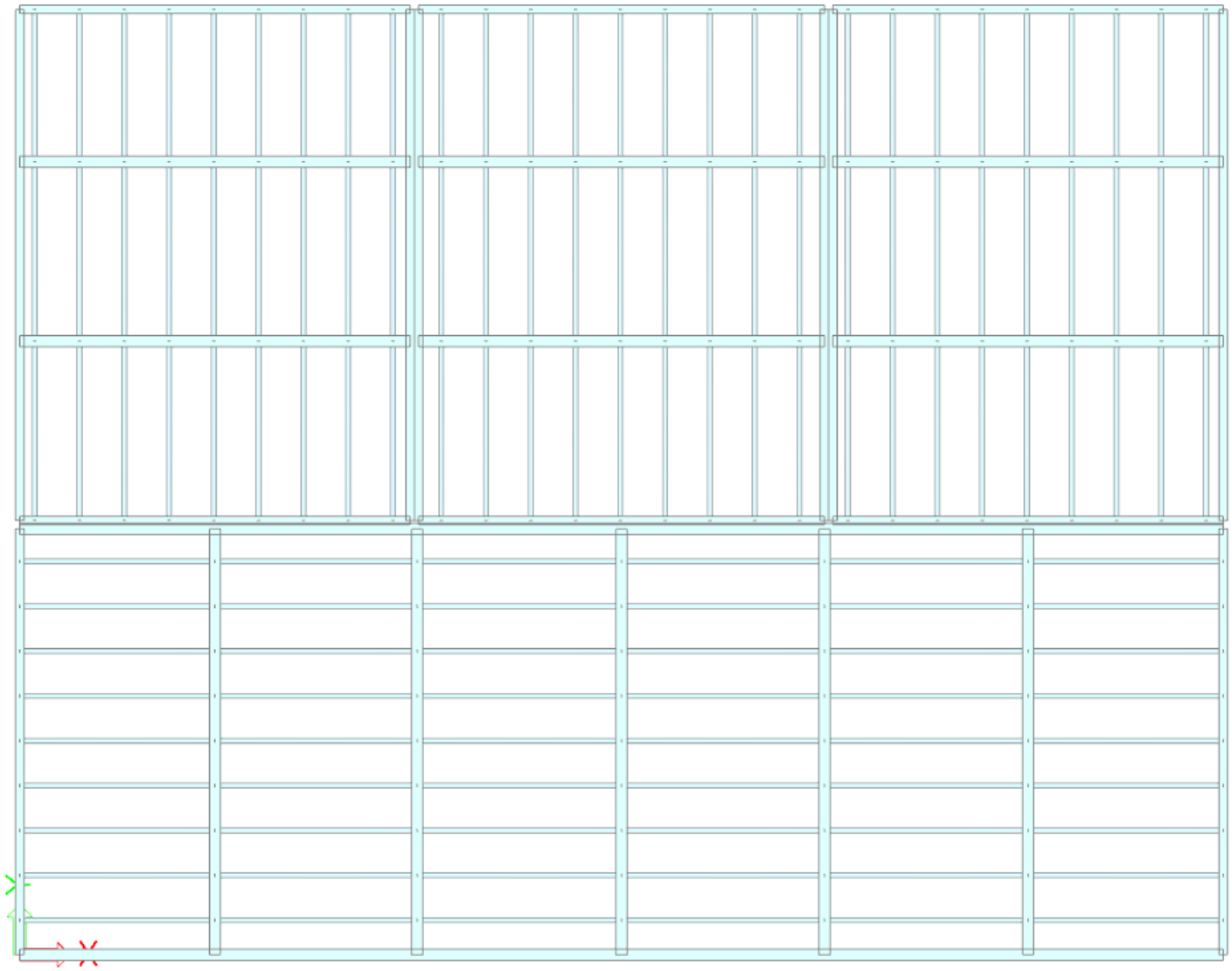
2.2 GENERAL SCHEME

General views

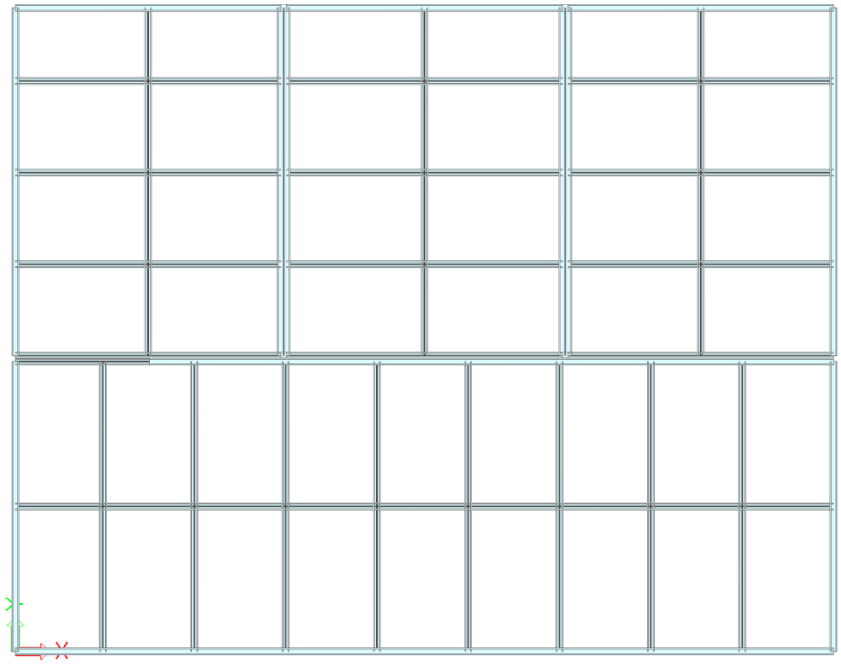



Z
X
Y

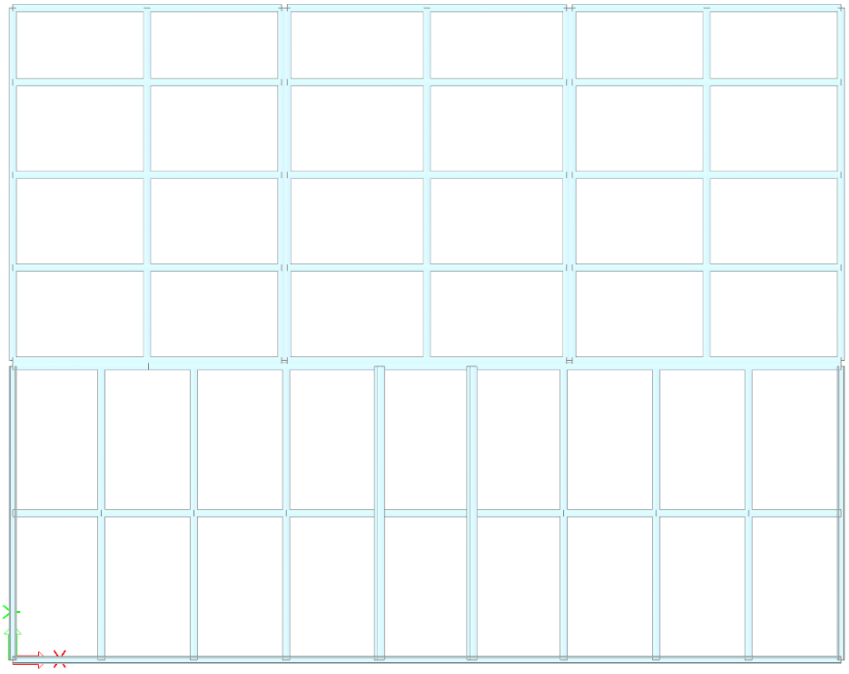
Floor plan



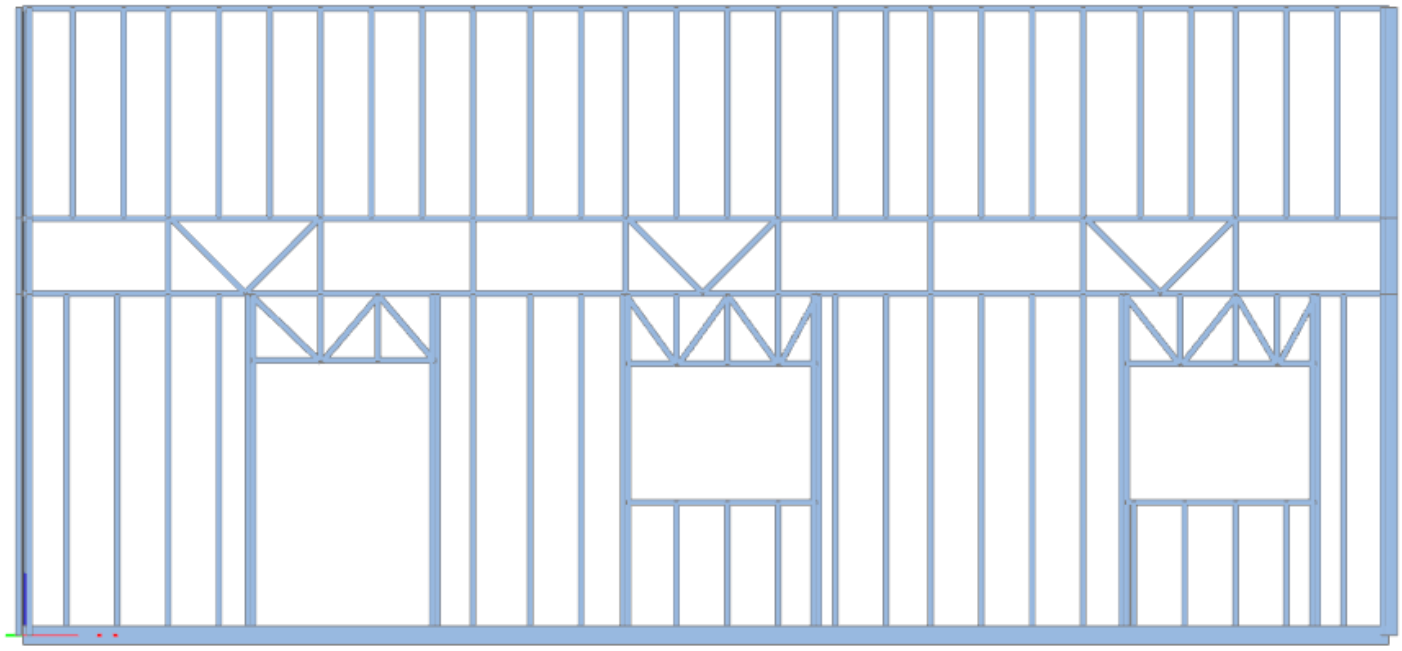
Ceiling plan



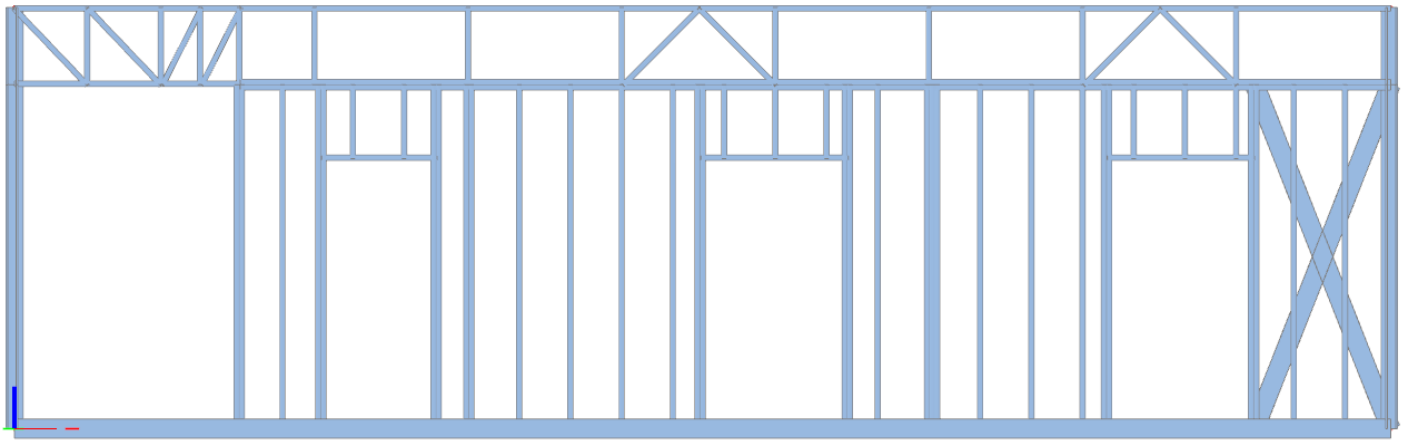
Roof plan view



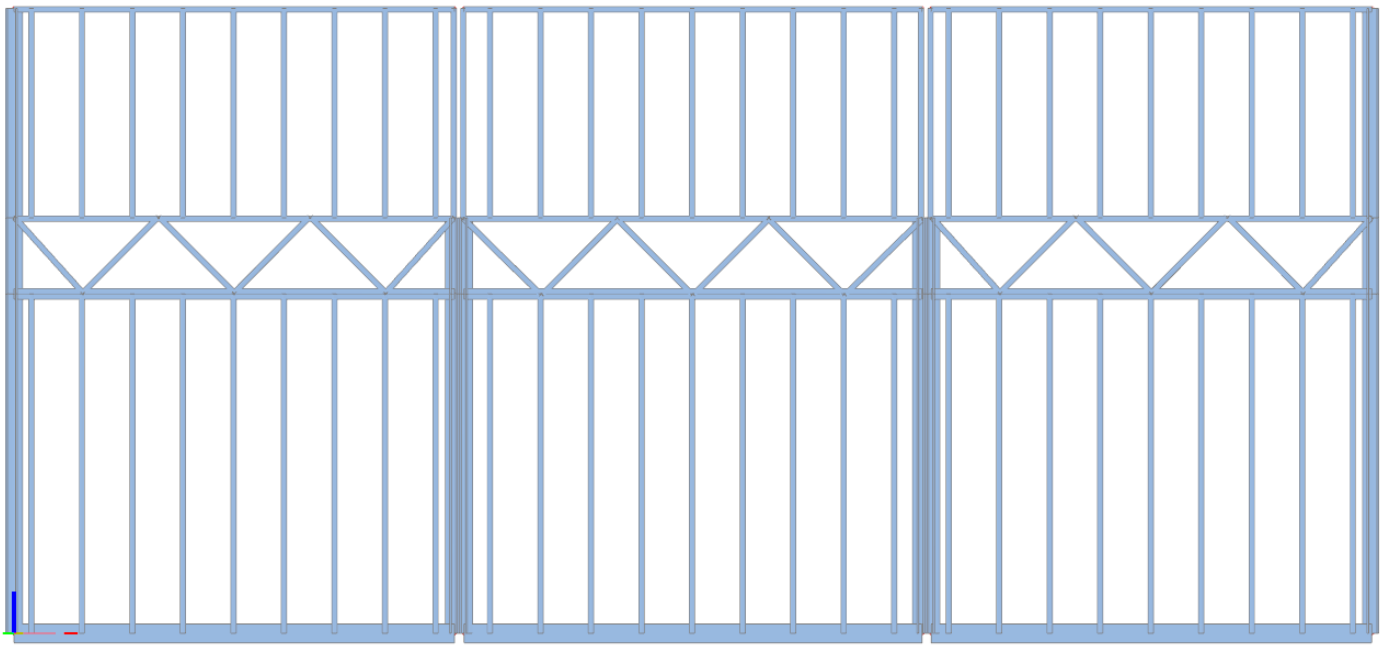
Longitudinal section 1



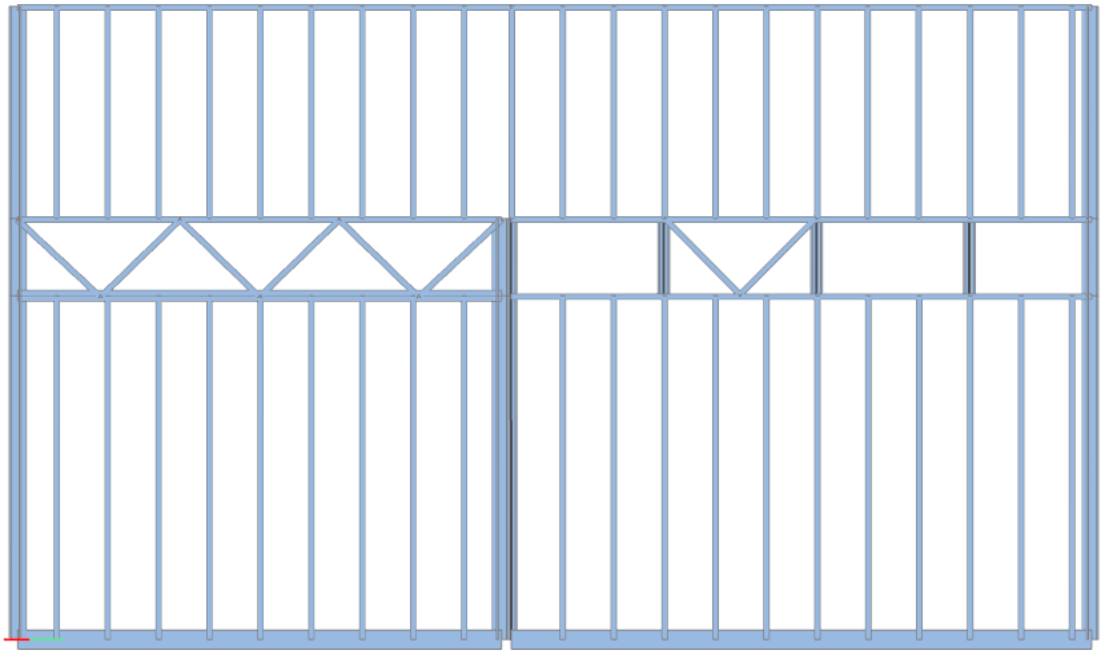
Longitudinal section 2



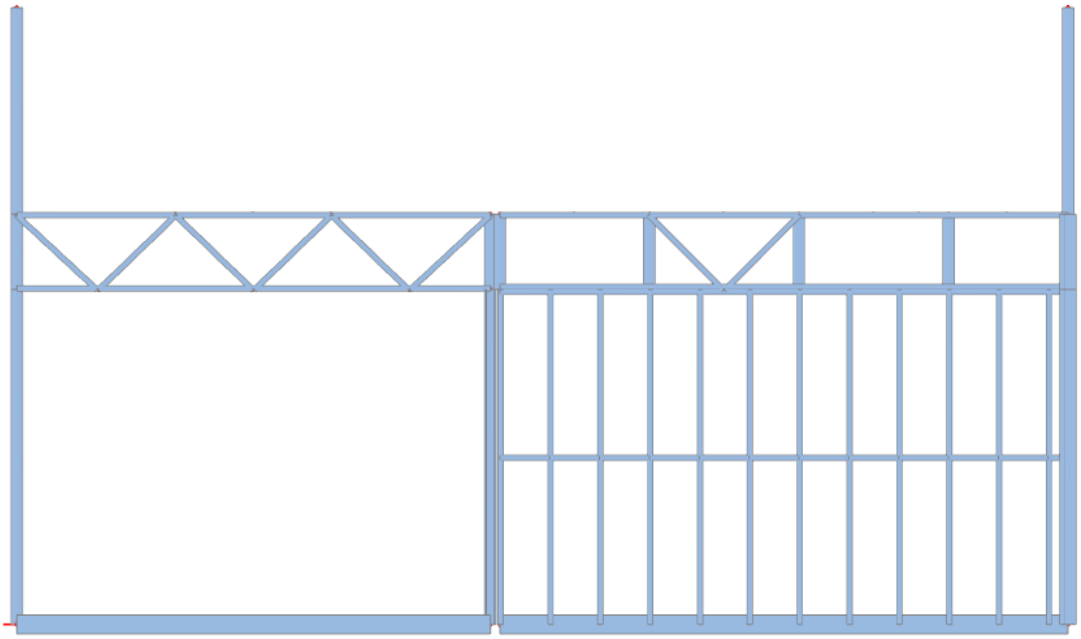
Longitudinal section 3



Cross section 1

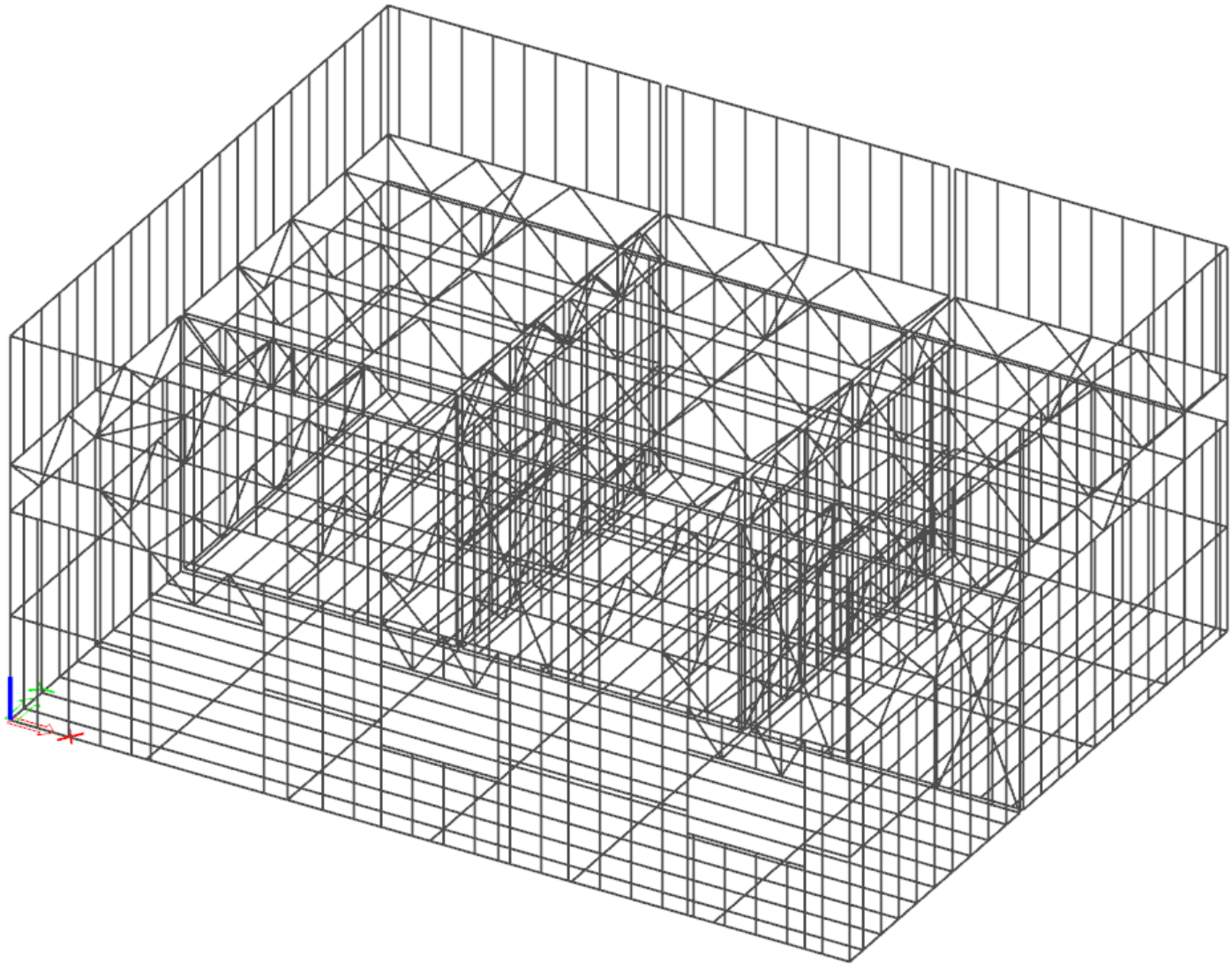


Cross section 2



2.3 APPLIED LOADS

Analytic model:

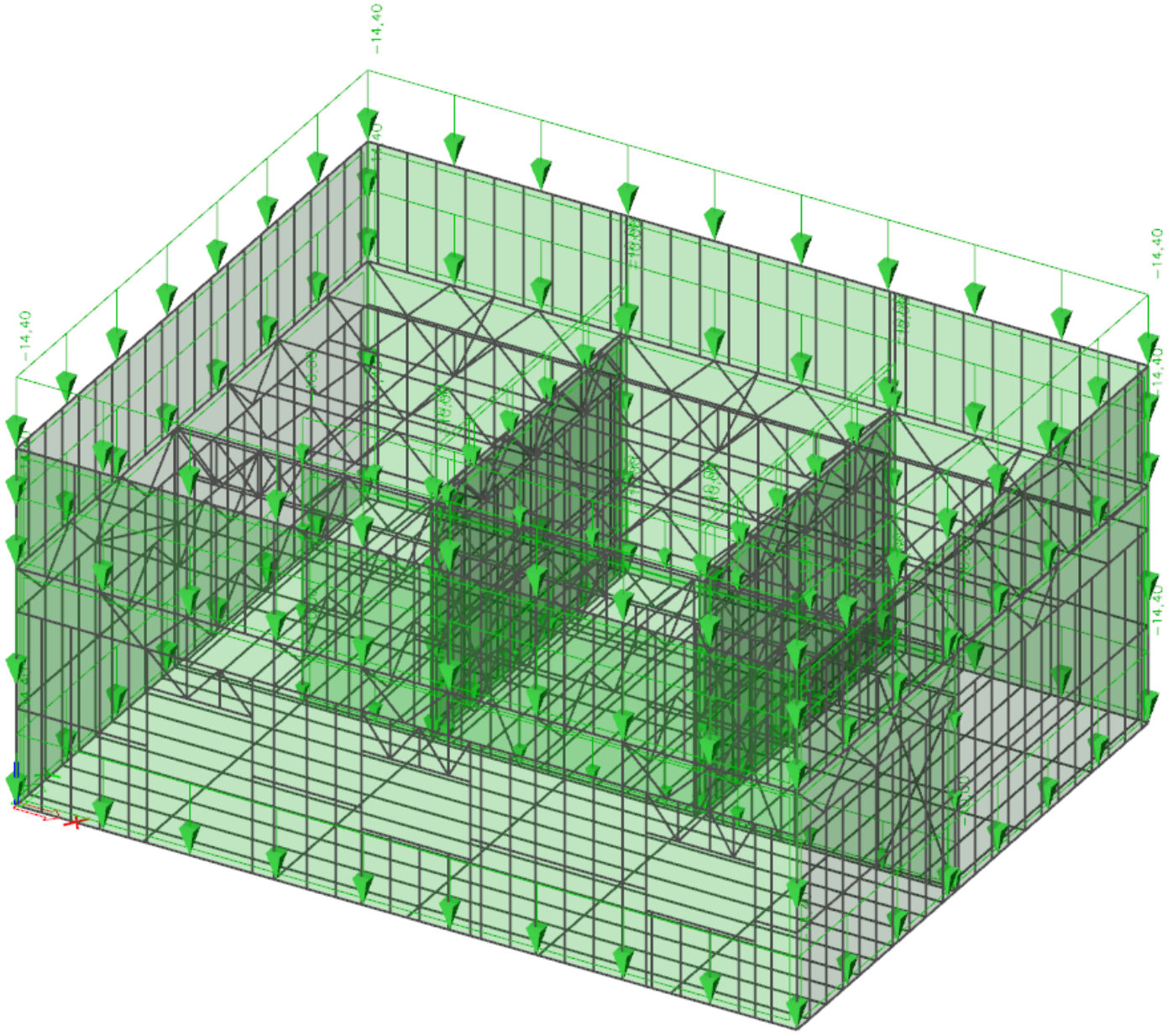


1. DL1 Self-weight of LGS profiles and weight of container structures (automatically)

2. DL2 Wall dead load

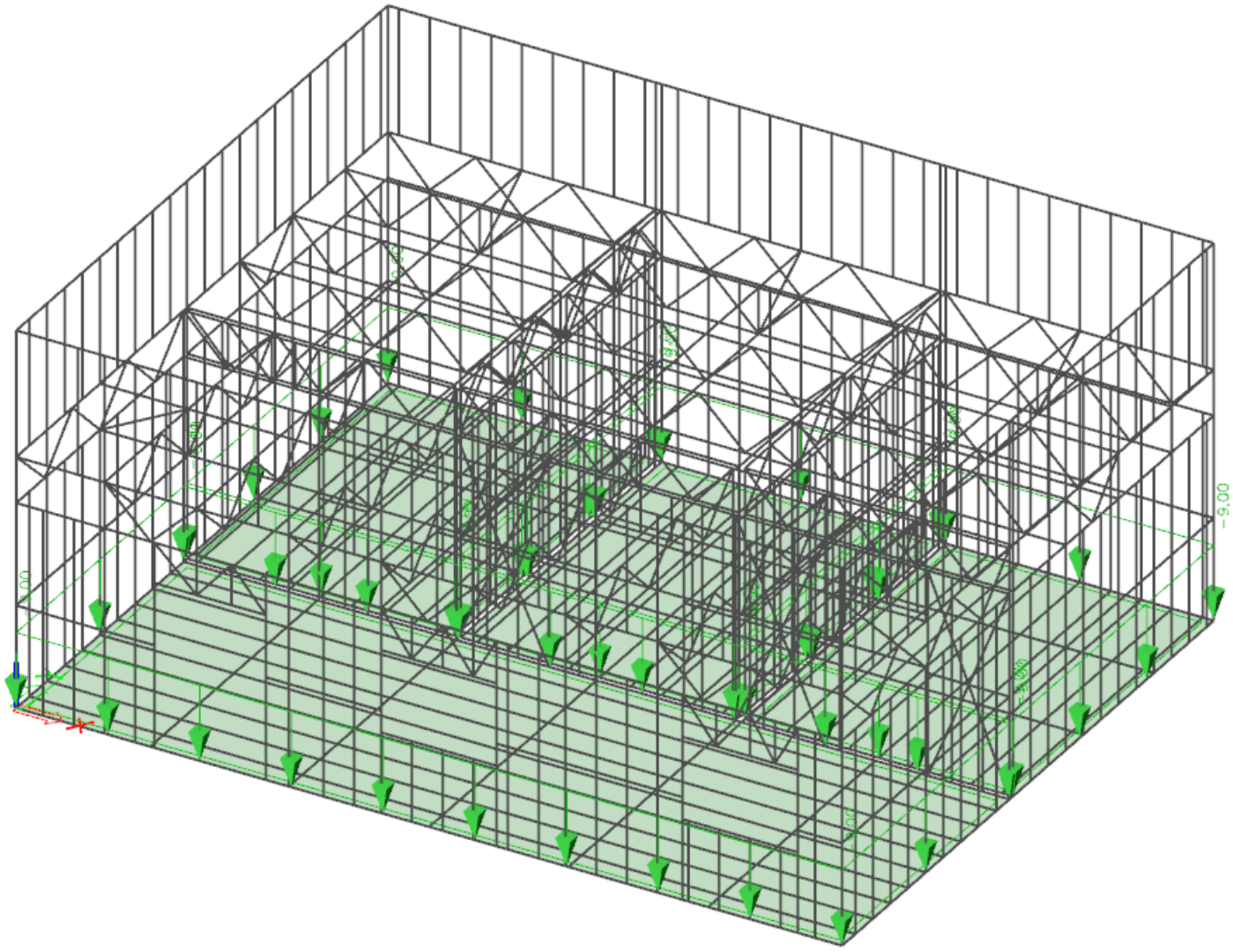
Exterior Wall dead load = 14.4 psf.

Interior Wall dead load = 10.0 psf.



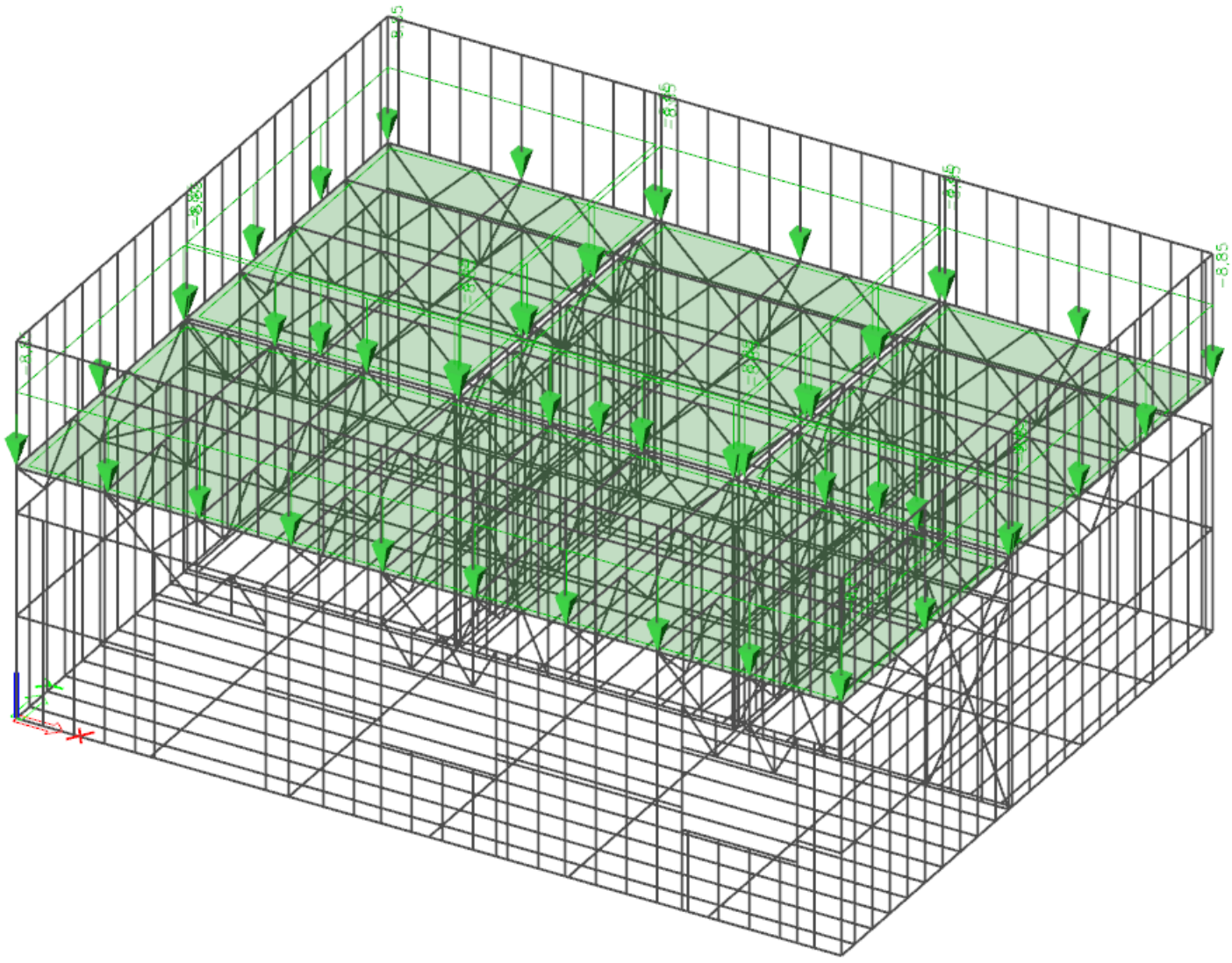
3. DL3 Floor dead load

Floor dead load = 9.0 psf.



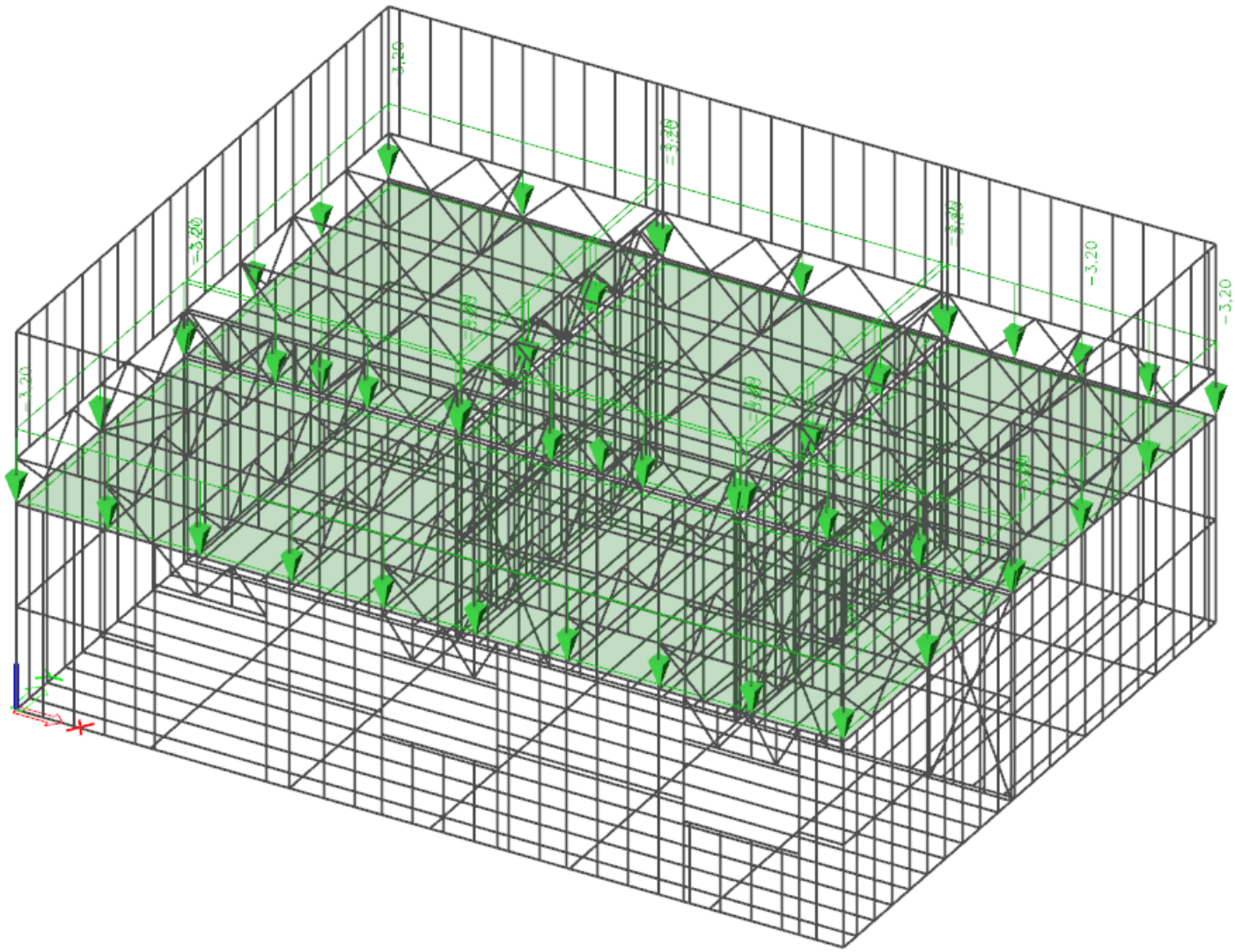
4. DL4 Roof dead load

Roof dead load = 8.85 psf.



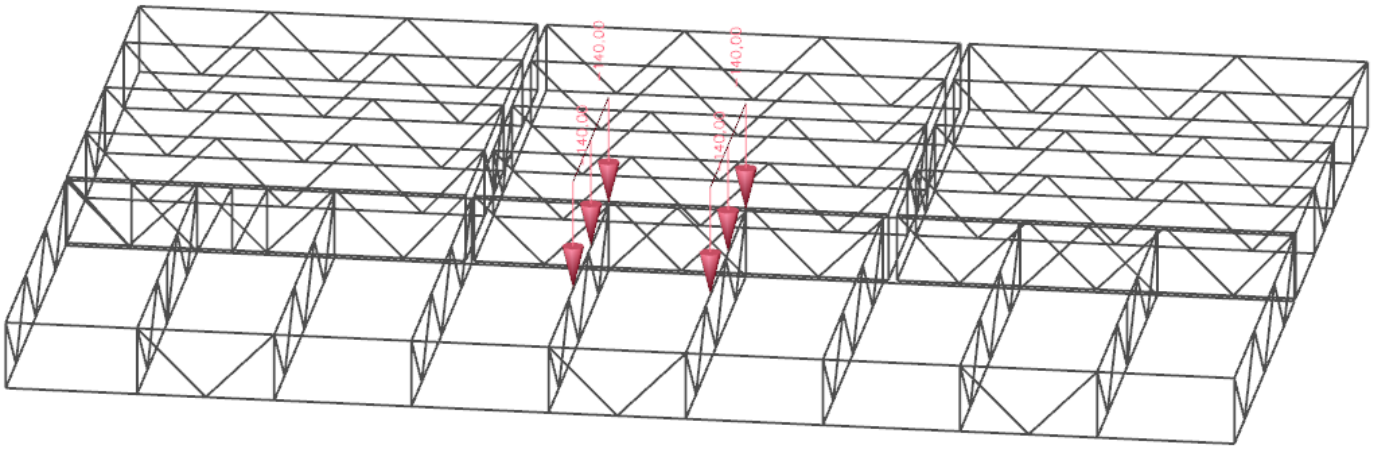
5. DL5 Ceiling dead load

Ceiling dead load = 3.2 psf.



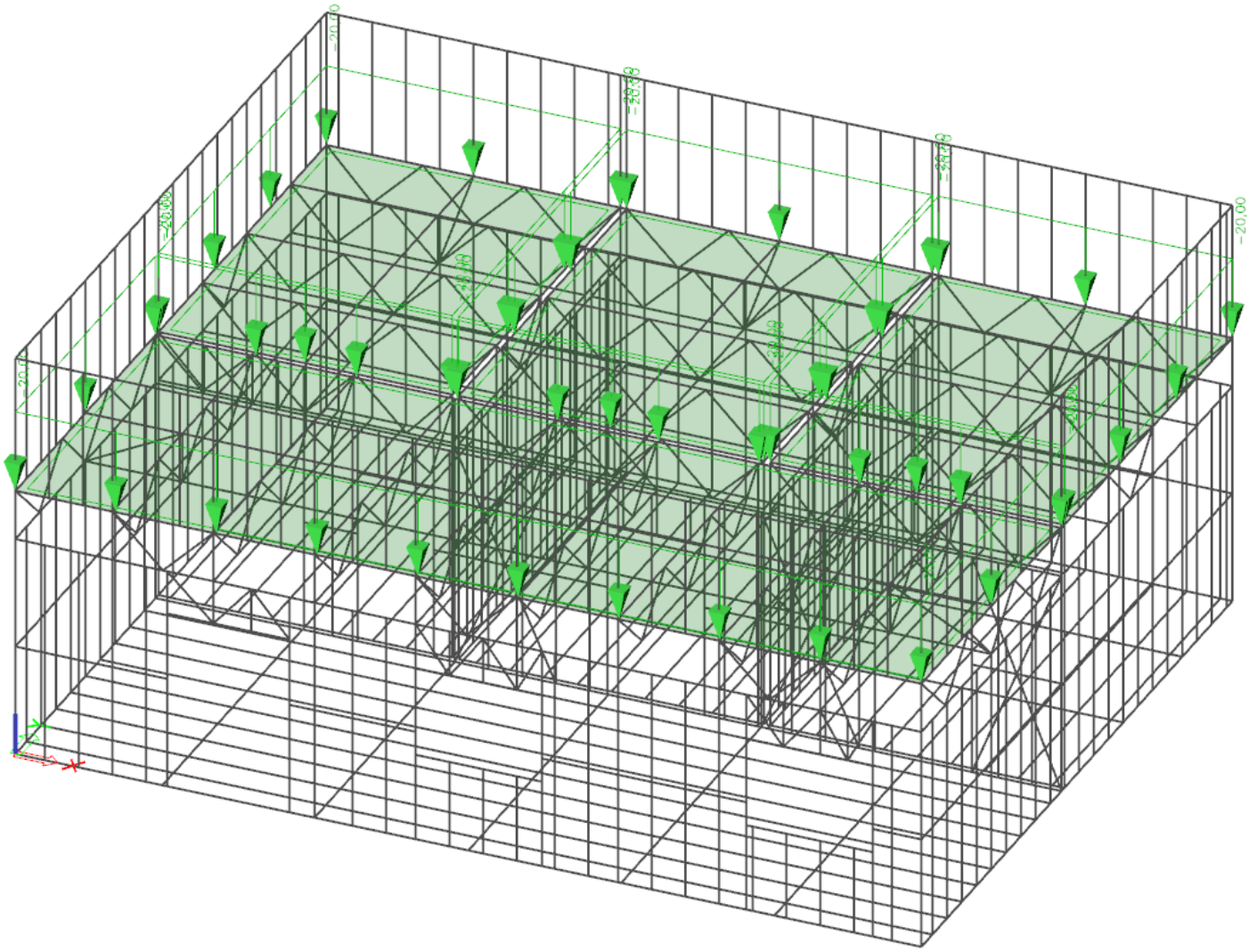
6. DL6 Equipment dead load

Equipment dead to roof trusses = 140 lbf/ft, total - 2100 lbf.



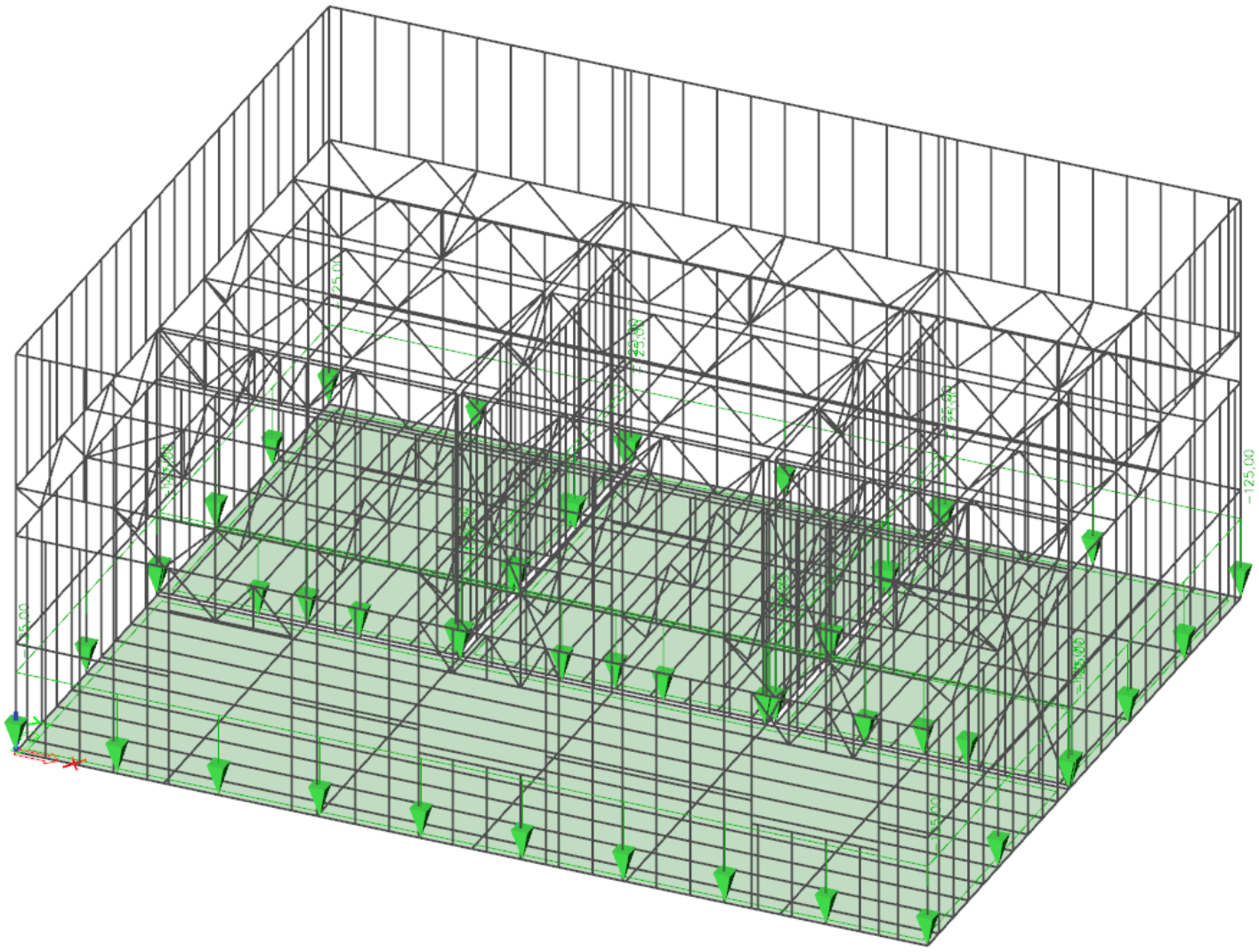
7. Lr Roof live load

Roof live load = 20 psf.

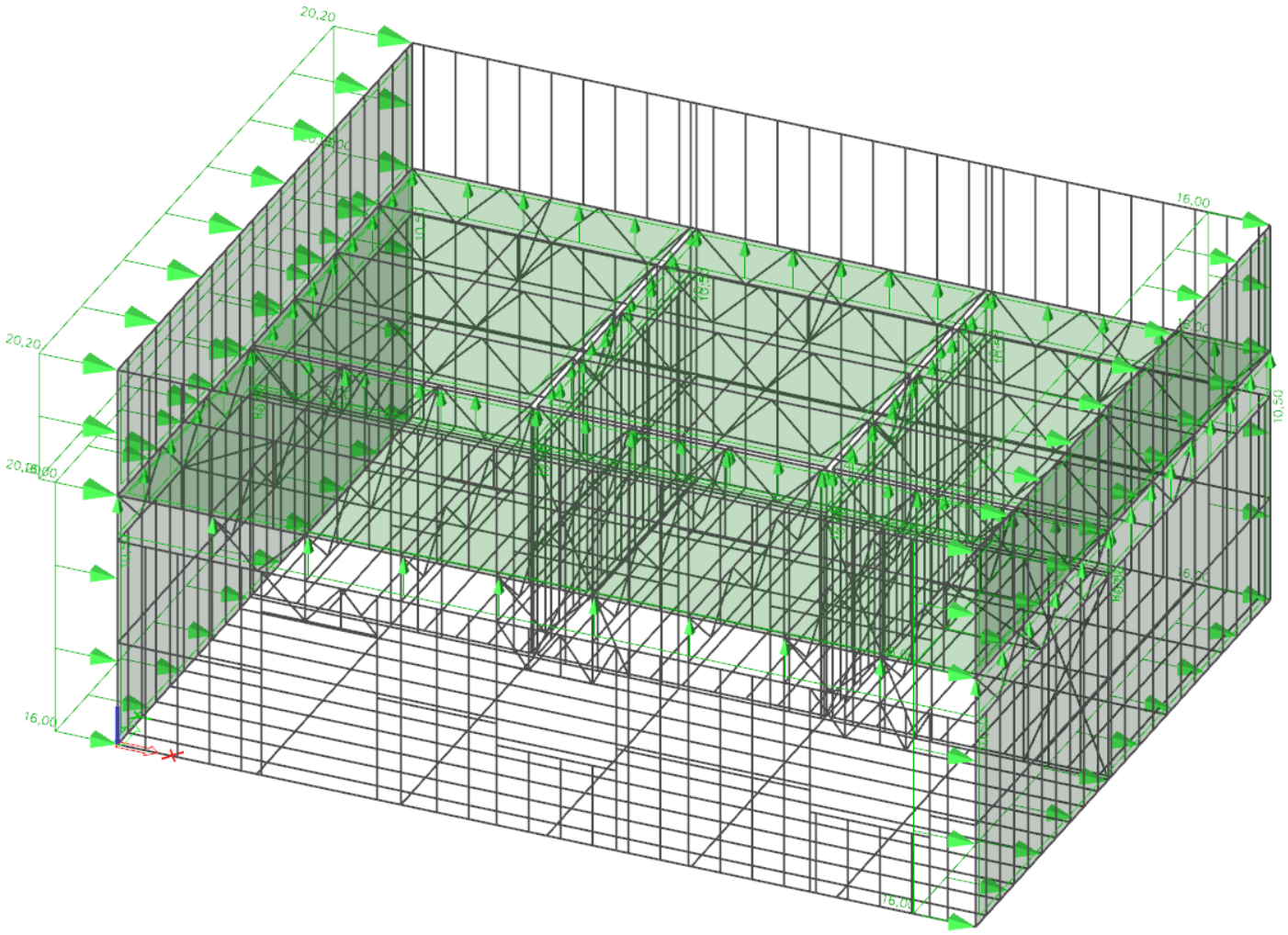


8. L Floor live load

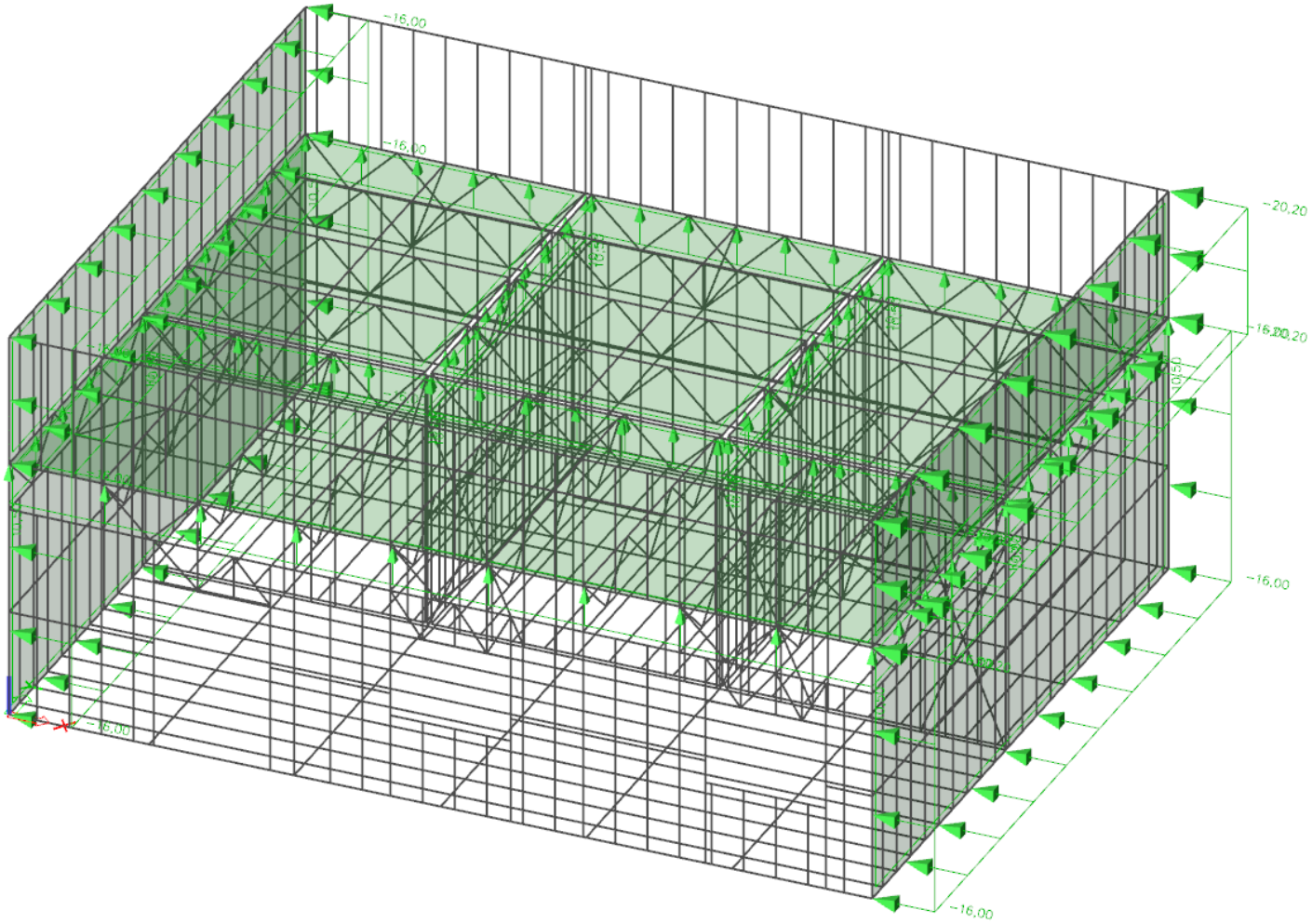
Floor live load = 125 psf.



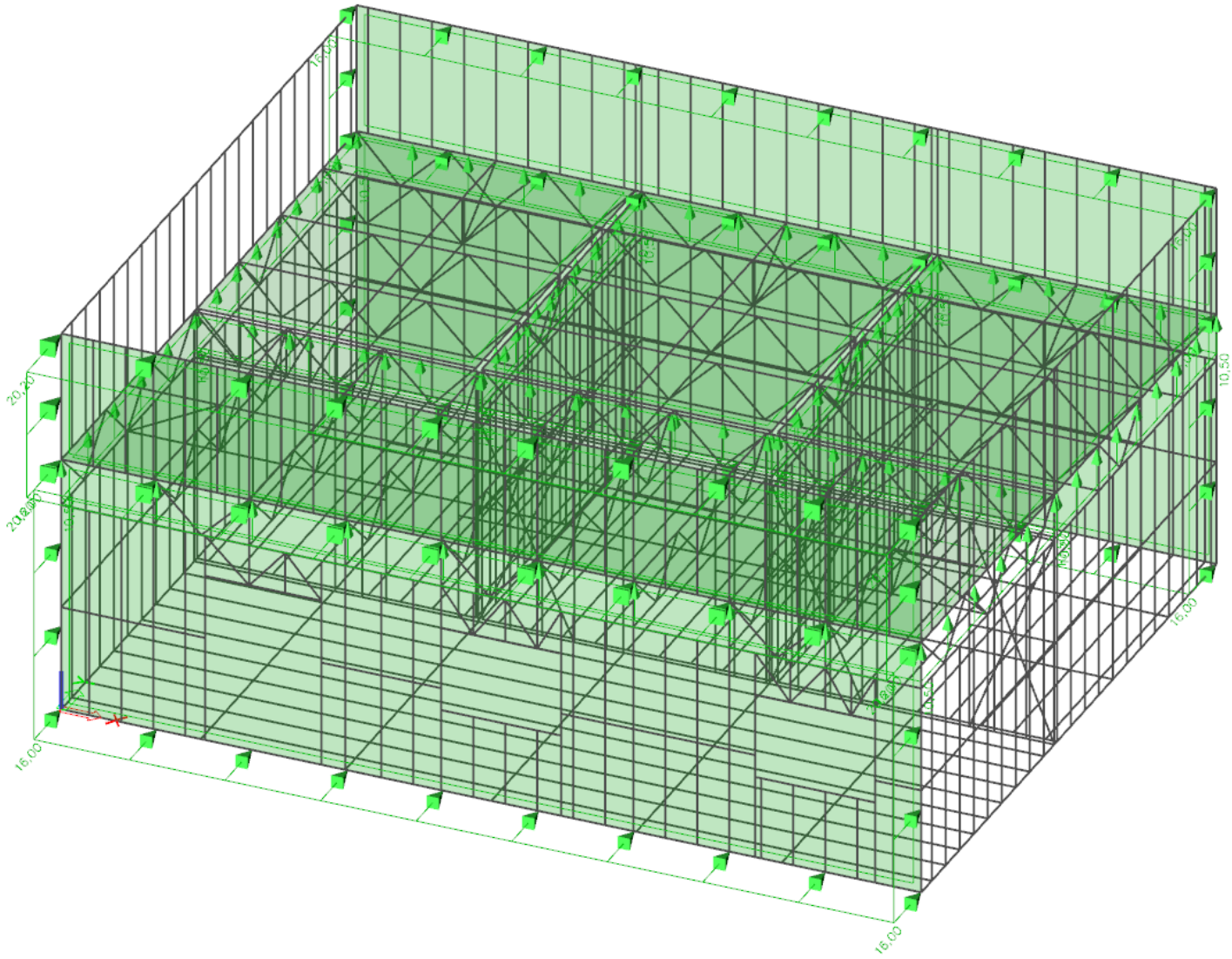
9. Wind loads X+



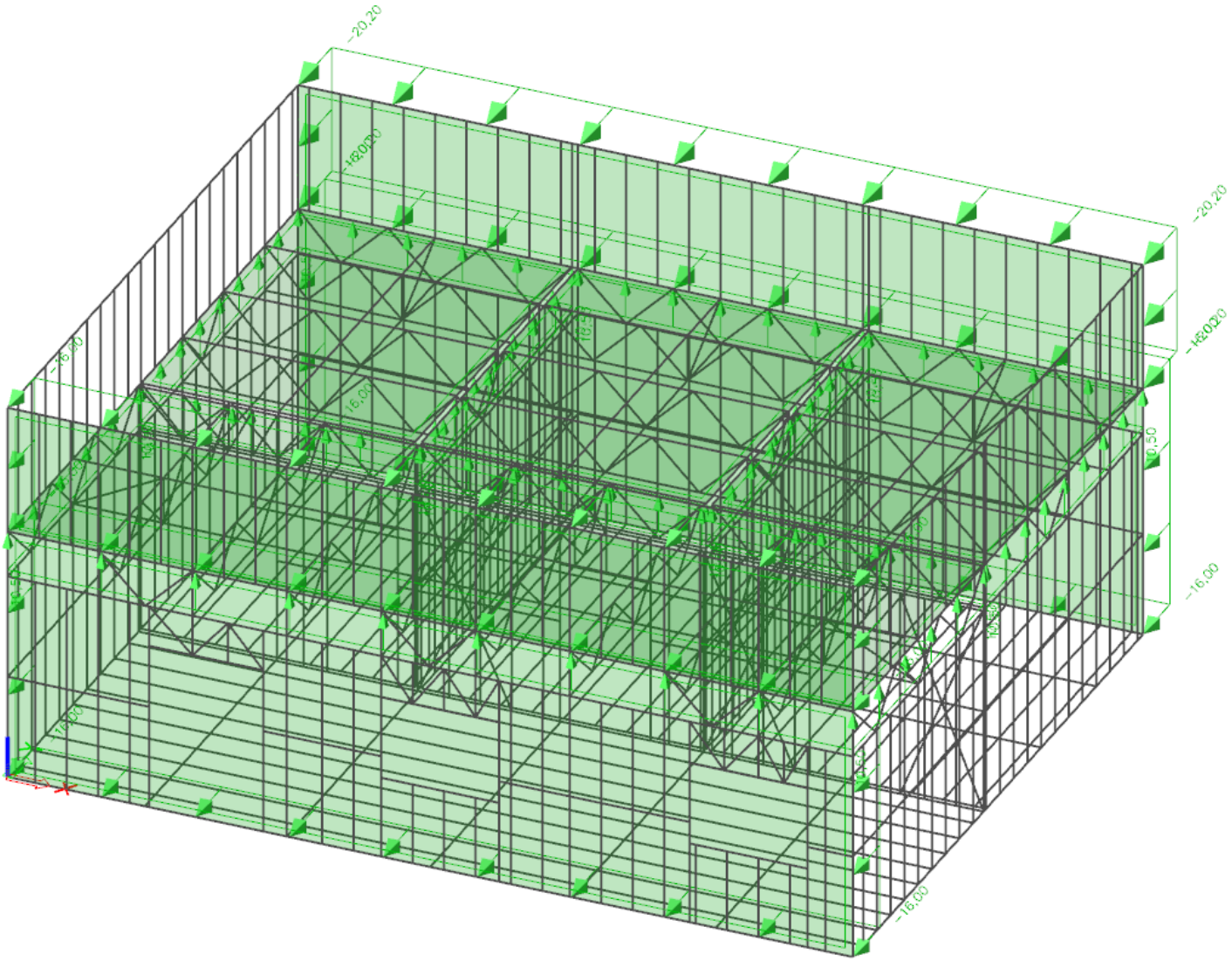
10. Wind loads X-



11. Wind loads Y+



12. Wind loads Y-



Case # **Case name**

Name	Description	Action type	Load group	Load type	Spec	Direction	Duration
DL1	Self weight	Permanent	DL	Self weight		-Z	
DL2	Wall dead load	Permanent	DL	Standard			
DL3	Roofdeadload	Permanent	DL	Standard			
DL4	Ceiling dead load	Permanent	DL	Standard			
DL5	Floor dead load	Permanent	DL	Standard			
DL6	Equipment dead load	Permanent	DL	Standard			
Lr	Roof live load	Variable	Lr	Static	Standard		Short
L	Floor live load	Variable	L	Static	Standard		Short
Wx+	Wind load	Variable	W	Static	Standard		Short
Wx-	Wind load	Variable	W	Static	Standard		Short
Wy+	Wind load	Variable	W	Static	Standard		Short
Wy-	Wind load	Variable	W	Static	Standard		Short
Se-X	Seismic load	Variable	E	Static equivalent	Seismicity		
Se-Y	Seismic load	Variable	E	Static equivalent	Seismicity		

Design force combinations.

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)1	Linear - ultimate	DL1 - Dead load	1.40
		DL2 - Wall dead load	1.40
		DL3 - Floor dead load	1.40
		DL4 - Roof dead load	1.40
		DL5 - Ceiling dead load	1.40
		DL6 - Equipment dead load	1.40
LRFD-Ult (auto)2	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
LRFD-Ult (auto)3	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)4	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	1.60
LRFD-Ult (auto)5	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		L - Floor live load	1.60
LRFD-Ult (auto)6	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)7	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	1.60
LRFD-Ult (auto)8	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	1.60
		L - Floor live load	0.50
LRFD-Ult (auto)9	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wx+ - Wind load	0.50

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)10	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wx- - Wind load	0.50
LRFD-Ult (auto)11	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wy+ - Wind load	0.50
LRFD-Ult (auto)12	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wy- - Wind load	0.50

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)13	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	1.60
		Wx+ - Wind load	0.50
LRFD-Ult (auto)14	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	1.60
		Wx- - Wind load	0.50

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)15	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	1.60
		Wy+ - Wind load	0.50
LRFD-Ult (auto)16	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	1.60
		Wy- - Wind load	0.50
LRFD-Ult (auto)17	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wx+ - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)18	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wx- - Wind load	1.00
LRFD-Ult (auto)19	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wy+ - Wind load	1.00
LRFD-Ult (auto)20	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Wy- - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)21	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		L - Floor live load	0.50
LRFD-Ult (auto)22	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		Wx+ - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)23	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Wx+ - Wind load	1.00
LRFD-Ult (auto)24	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		Wx- - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)25	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Wx- - Wind load	1.00
LRFD-Ult (auto)26	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		Wy+ - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)27	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Wy+ - Wind load	1.00
LRFD-Ult (auto)28	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		Wy- - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)29	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Wy- - Wind load	1.00
LRFD-Ult (auto)30	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		L - Floor live load	0.50
		Wx+ - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)31	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		L - Floor live load	0.50
		Wx- - Wind load	1.00
LRFD-Ult (auto)32	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		L - Floor live load	0.50
		Wy+ - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)33	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Lr - Roof live load	0.50
		L - Floor live load	0.50
		Wy- - Wind load	1.00
LRFD-Ult (auto)34	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Se-X - Seismic	1.00
LRFD-Ult (auto)34	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Se-X - Seismic	-1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)36	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Se-Y - Seismic	1.00
LRFD-Ult (auto)37	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		Se-Y - Seismic	-1.00
LRFD-Ult (auto)38	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Se-X - Seismic	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)39	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Se-X - Seismic	-1.00
LRFD-Ult (auto)40	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Se-Y - Seismic	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)41	Linear - ultimate	DL1 - Dead load	1.20
		DL2 - Wall dead load	1.20
		DL3 - Floor dead load	1.20
		DL4 - Roof dead load	1.20
		DL5 - Ceiling dead load	1.20
		DL6 - Equipment dead load	1.20
		L - Floor live load	0.50
		Se-Y - Seismic	-1.00
LRFD-Ult (auto)42	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
LRFD-Ult (auto)43	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Wx+ - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)44	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Wx- - Wind load	1.00
LRFD-Ult (auto)45	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Wy+ - Wind load	1.00
LRFD-Ult (auto)46	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Wy- - Wind load	1.00

Name	Type	Load cases	Coeff.
LRFD-Ult (auto)47	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Se-X - Seismic	1.00
LRFD-Ult (auto)48	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Se-X - Seismic	-1.00

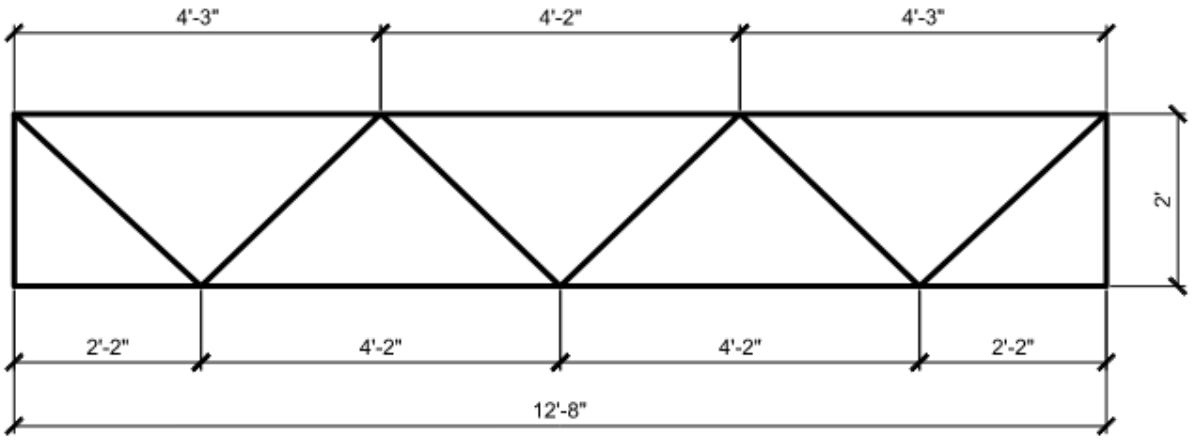
Name	Type	Load cases	Coeff.
LRFD-Ult (auto)49	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Se-Y - Seismic	1.00
LRFD-Ult (auto)50	Linear - ultimate	DL1 - Dead load	0.90
		DL2 - Wall dead load	0.90
		DL3 - Floor dead load	0.90
		DL4 - Roof dead load	0.90
		DL5 - Ceiling dead load	0.90
		DL6 - Equipment dead load	0.90
		Se-Y - Seismic	-1.00

2.4 STEEL STRUCTURE CHECK
2.4.1 TRUSS 1 CHECK

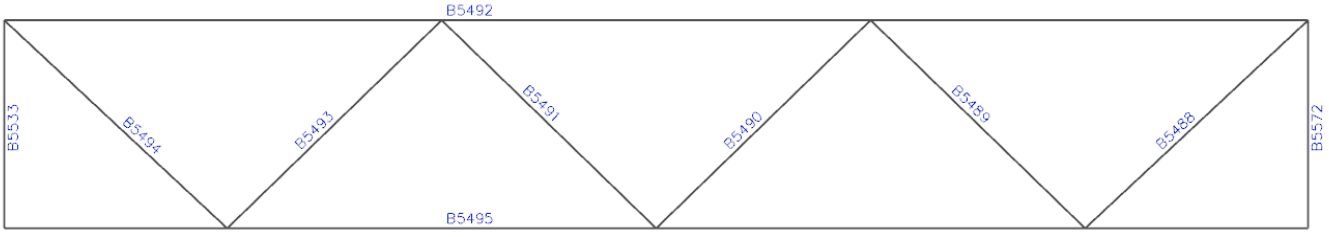
The main supporting structures of the coating we use truss.

Truss spacing 4 ft

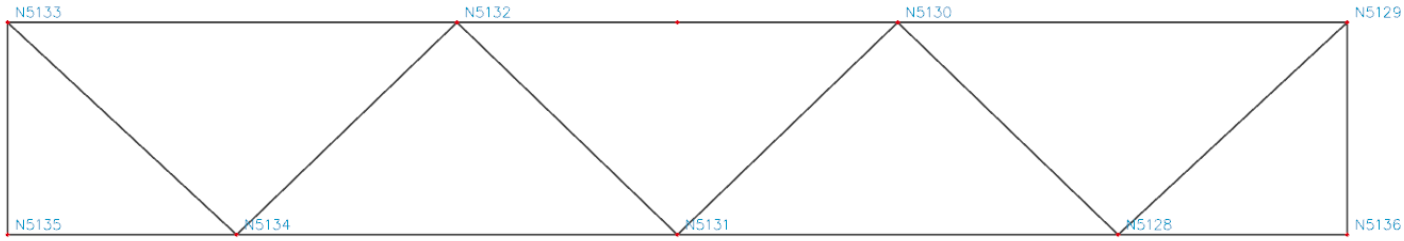
Analytic model



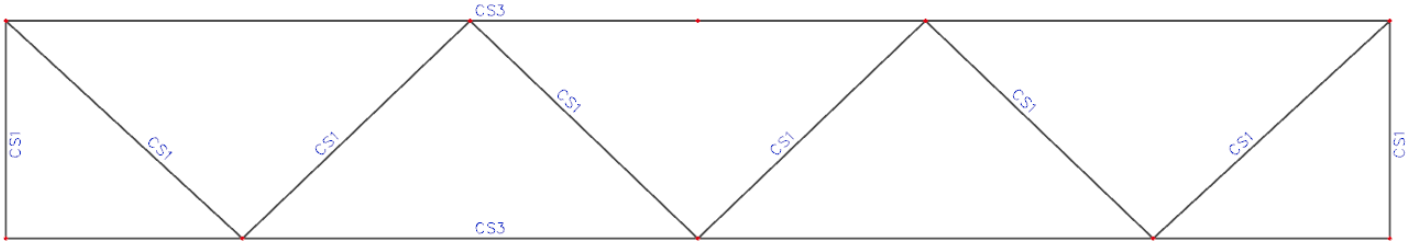
Member numbers



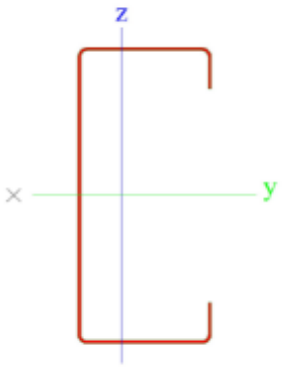
Node numbers



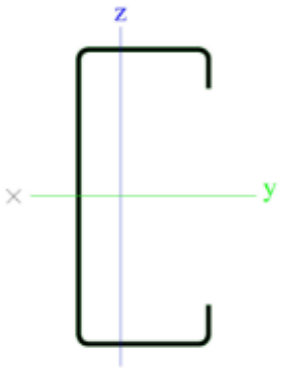
Cross-sections trusses element.



Cross-Section Properties: CS1 - 362S162-33

CS1		
Type	S362S162-33	
Formcode	114 - Cold formed C section	
Shape type	Thin-walled	
Item material	A653 grade 33	
Fabrication	cold formed	
Colour		
A [inch^2]	0.263	
A_y [inch^2], A_z [inch^2]	0.112	0.137
A_L [inch^2/inch], A_D [inch^2/inch]	1.52e+01	1.52e+01
$c_{y.ucs}$ [inch], $c_{z.ucs}$ [inch]	0.537	1.812
α [deg]	0.00	
I_y [inch^4], I_z [inch^4]	0.555	0.099
i_y [inch], i_z [inch]	1.452	0.614
$W_{el.y}$ [inch^3], $W_{el.z}$ [inch^3]	0.304	0.091
$W_{pl.y}$ [inch^3], $W_{pl.z}$ [inch^3]	0.351	0.135
$M_{pl.y.+}$ [lbfinch], $M_{pl.y.-}$ [lbfinch]	1.16e+04	1.16e+04
$M_{pl.z.+}$ [lbfinch], $M_{pl.z.-}$ [lbfinch]	4.45e+03	4.45e+03
d_y [inch], d_z [inch]	-1.314	0.000
I_t [inch^4], I_w [inch^6]	0.000	0.297
β_y [inch], β_z [inch]	0.000	4.162
Picture		

Cross-Section Properties: CS3 - 362S162-54

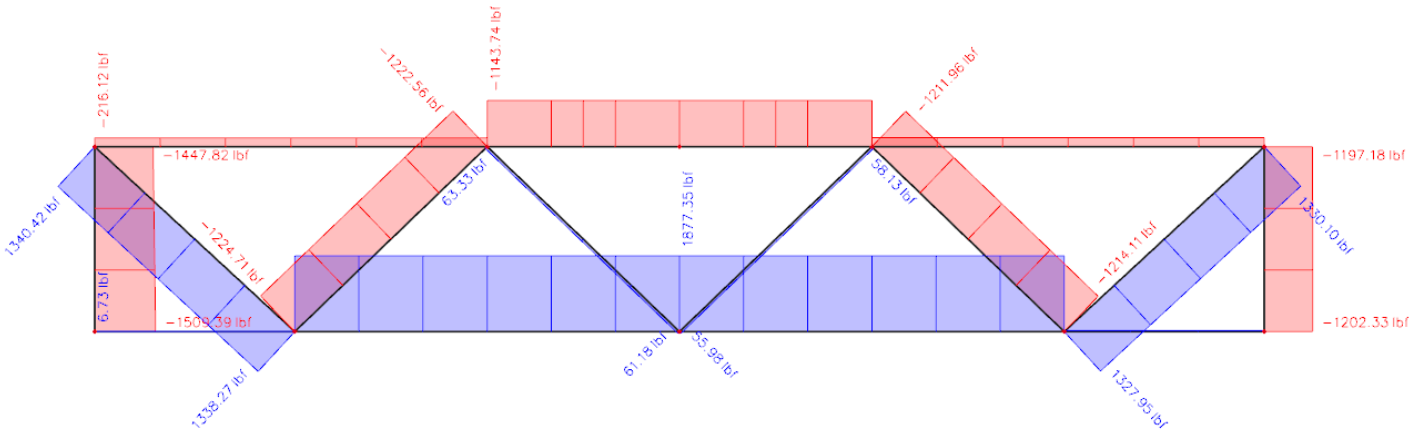
CS3		
Type	S362S162-54	
Formcode	114 - Cold formed C section	
Shape type	Thin-walled	
Item material	A913 grade 50	
Fabrication	cold formed	
Colour	■	
A [inch^2]	0.425	
A_y [inch^2], A_z [inch^2]	0.184	0.220
A_L [inch^2/inch], A_D [inch^2/inch]	1.50e+01	1.50e+01
$c_{Y,UCS}$ [inch], $c_{Z,UCS}$ [inch]	0.536	1.812
α [deg]	0.00	
I_y [inch^4], I_z [inch^4]	0.882	0.154
i_y [inch], i_z [inch]	1.441	0.603
$W_{el,y}$ [inch^3], $W_{el,z}$ [inch^3]	0.481	0.142
$W_{pl,y}$ [inch^3], $W_{pl,z}$ [inch^3]	0.559	0.212
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	2.80e+04	2.80e+04
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	1.06e+04	1.06e+04
d_y [inch], d_z [inch]	-1.290	0.000
I_t [inch^4], I_w [inch^6]	0.000	0.457
β_y [inch], β_z [inch]	0.000	4.130
Picture		

Explanations of symbols	
Formcode	s - Thickness r - Inner radius b - Flange width h - Height c - Lip
A	Area
A_y	Shear Area in principal y-direction
A_z	Shear Area in principal z-direction
A_L	Circumference per unit length
A_D	Drying surface per unit length
$c_{Y.UCS}$	Centroid coordinate in Y-direction of Input axis system
$c_{Z.UCS}$	Centroid coordinate in Z-direction of Input axis system
$I_{Y.LCS}$	Second moment of area about the YLCS axis
$I_{Z.LCS}$	Second moment of area about the ZLCS axis
$I_{YZ.LCS}$	Product moment of area in the LCS system
α	Rotation angle of the principal axis system
I_y	Second moment of area about the principal y-axis
I_z	Second moment of area about the principal z-axis
i_y	Radius of gyration about the principal y-axis

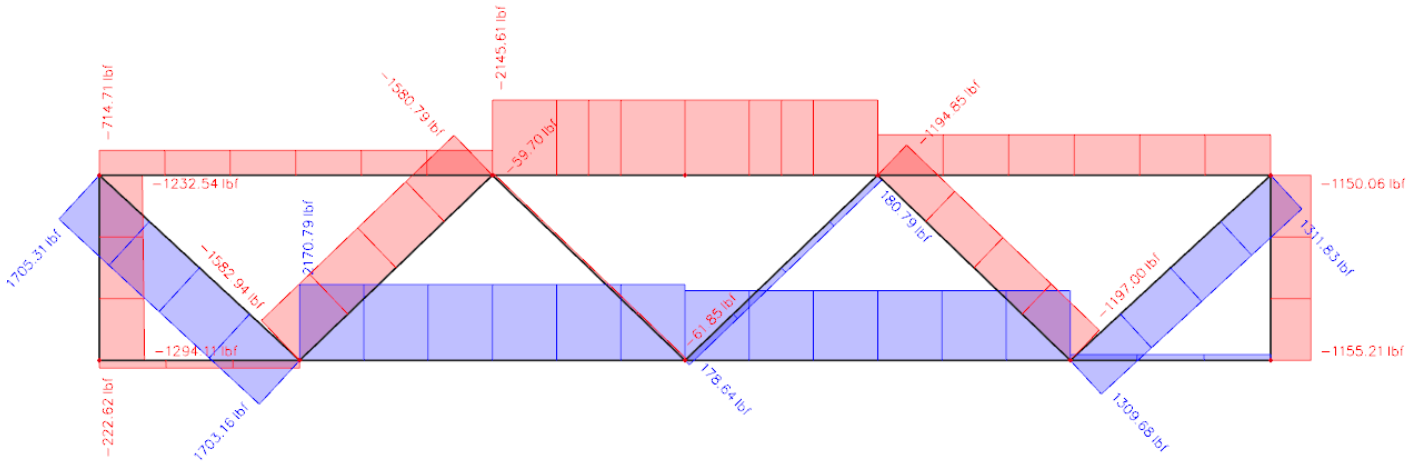
Explanations of symbols	
i_z	Radius of gyration about the principal z-axis
$W_{el.y}$	Elastic section modulus about the principal y-axis
$W_{el.z}$	Elastic section modulus about the principal z-axis
$W_{pl.y}$	Plastic section modulus about the principal y-axis
$W_{pl.z}$	Plastic section modulus about the principal z-axis
$M_{pl.y.+}$	Plastic moment about the principal y-axis for a positive My moment
$M_{pl.y.-}$	Plastic moment about the principal y-axis for a negative My moment
$M_{pl.z.+}$	Plastic moment about the principal z-axis for a positive Mz moment
$M_{pl.z.-}$	Plastic moment about the principal z-axis for a negative Mz moment
d_y	Shear center coordinate in principal y-direction measured from the centroid
d_z	Shear center coordinate in principal z-direction measured from the centroid
I_t	Torsional constant
I_w	Warping constant
β_y	Mono-symmetry constant about the principal y-axis
β_z	Mono-symmetry constant about the principal z-axis

Force diagram

Axial force diagram N, LRFD-Ult (auto)7 (1.2*D1+1.2*D2+1.2*D3+1.2*D4+1.2*D5+1.2*D6+1.6*Lr), lbf.

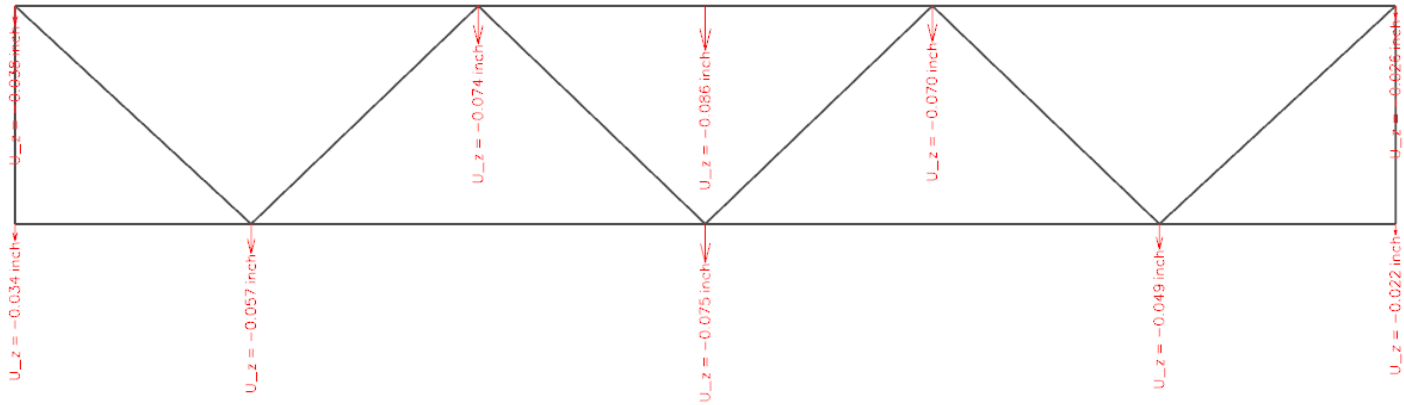


Axial force diagram N, LRFD-Ult (auto)15 (1.2*D1+1.2*D2+1.2*D3+1.2*D4+1.2*D5+1.2*D6+1.6*Lr+Wy+), lbf.

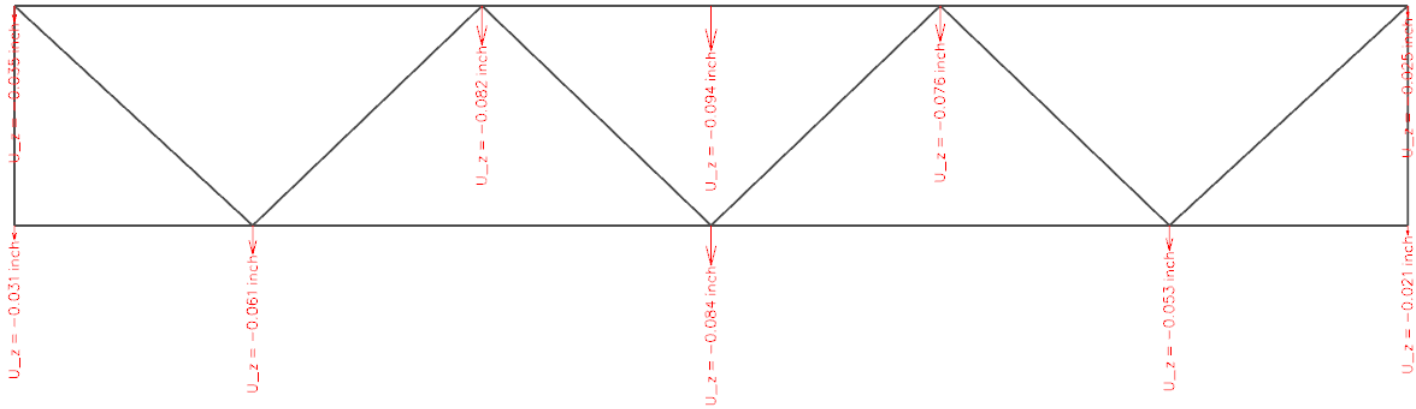


Displacement of nodes

Vertical displacement
LRFD-Ult (auto)7 (1.2*D1+1.2*D2+1.2*D3+1.2*D4+1.2*D5+1.2*D6+1.6*Lr), inch:



Vertical displacement
LRFD-Ult (auto)15 (1.2*D1+1.2*D2+1.2*D3+1.2*D4+1.2*D5+1.2*D6+1.6*Lr+Wy+), inch:



The maximum deflection is 0.094" according to table 1604.3 the code IBC 2019 - the deflection limits L/360. L = 12’ 8”=12’*12”+8”=152”.

152”/360 = 0.423”. 0.094"< 0.423”. Deflection is OK!

Steel check elements LRFD
Check Top chord: AISI S100-16 LRFD Check

AISI S100-16 LRFD Check

Member B5492	S362S162-54	A913 grade 50	LRFD-Ult (auto)	0.81

Material data		
Yield stress Fy	50.00	ksi
Tensile stress Fu	65.00	ksi
fabrication	cold formed	

The critical check is on position 8.42 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-1095.59	lbf
Vux	317.19	lbf
Vuy	-42.18	lbf
Mut	-0.00	lbfft
Mux	179.27	lbfft
Muy	263.31	lbfft

...::Flexural Strength about X-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.359	-35.544 -45.447	-	-	-	-	-	- -	- -	-	- -	-
3	1.342	-48.574 -48.574	-	-	-	-	-	- -	- -	-	- -	-
5	3.342	46.873 -45.447	0.97	23.220	174.612	0.518	1.000	- 3.342	0.842 1.671	-	- -	-
7	1.342	50.000 50.000	1.00	2.882	134.415	0.610	1.000	1.342 -	0.415 0.927	30.83	0.000 0.000	0.222
9	0.359	46.873 36.970	0.79	0.512	334.645	0.374	1.000	0.222 -	- -	-	- -	-

Table of values		
Sxe	0.467	inch^3
Mnxo	1944.30	lbfft
Resistance factor	0.90	
Unity check	0.10	-

Lateral-Torsional Buckling Strength

According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.359	-32.418 -41.346	-	-	-	-	-	- -	- -	-	- -	-
3	1.342	-44.165 -44.165	-	-	-	-	-	- -	- -	-	- -	-
5	3.342	41.883 -41.346	0.99	23.669	177.986	0.485	1.000	- 3.342	0.838 1.671	-	- -	-
7	1.342	44.702 44.702	1.00	3.181	148.325	0.549	1.000	1.342 -	0.560 0.782	32.61	0.000 0.000	0.299
9	0.359	41.883 32.955	0.79	0.513	335.206	0.353	1.000	0.299 -	- -	-	- -	-

Table of values		
Lltb	4' 2.000"	ft
Sigma,ey	41.585	ksi
Kt	1.00	
Lt	4' 2.000"	ft
Sigma,t	32.994	ksi
Cb	1.09	
Sfx	0.487	inch^3
Fcre	71.090	ksi
Fc	44.702	ksi
Scx	0.475	inch^3

Table of values		
Mnx	1770.88	lbfft
Resistance factor	0.90	
Unity check	0.11	-

Distortional Buckling Strength

According to article F4 and formula F4.1-2.

Table of values		
Sfy	0.487	inch^3
My	2027.44	lbfft
L	11.725"	ft
Beta	1.00	
k,phi,fe	491.40	lbf
k,phi,we	438.80	lbf
k,phi	0.00	lbf
k,phi,fg	0.010	inch^2
k,phi,wg	0.001	inch^2
Fd	86.811	ksi
Sf	0.487	inch^3
Mcrd	3520.08	lbfft
Lambda,d	0.76	
Mn	1897.05	lbfft
Resistance factor	0.90	
Unity check	0.10	-

Data		
Lm	4' 2.000"	ft
Lcr	11.725"	ft
h0	3.625	inch
Ixf	0.002	$inch^4$
Iyf	0.024	$inch^4$
Ixyf	-0.004	$inch^4$
Cwf	0.000	$inch^6$
Jf	0.000	$inch^4$
x0f	0.550	inch
hxf	-1.004	inch
Af	0.106	$inch^2$
y0f	0.052	inch
Ksi,web	2.00	

Number of compressed flanges: 1
Critical flange contains Initial shape parts: 8, 7, 9
...::Flexural Strength about Y-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.359	50.000 50.000	1.00	0.430	281.003	0.422	1.000	0.359 -	- -	-	- -	-
3	1.342	44.662 -18.616	0.42	12.522	583.964	0.277	1.000	- 1.342	0.393 0.671	-	- -	-
5	3.342	-23.954 -23.954	-	-	-	-	-	- -	- -	-	- -	-
7	1.342	44.662 -18.616	0.42	12.522	583.964	0.277	1.000	- 1.342	0.393 0.671	-	- -	-
9	0.359	50.000 50.000	1.00	0.430	281.003	0.422	1.000	0.359 -	- -	-	- -	-

Table of values		
Sye	0.142	$inch^3$
Mnyo	590.17	lbfft
Resistance factor	0.90	
Unity check	0.50	-

Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.2-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.359	47.389 47.389	1.00	0.430	281.003	0.411	1.000	0.359 -	- -	-	- -	-
3	1.342	42.330 -17.644	0.42	12.522	583.964	0.269	1.000	- 1.342	0.393 0.671	-	- -	-
5	3.342	-22.703 -22.703	-	-	-	-	-	- -	- -	-	- -	-
7	1.342	42.330 -17.644	0.42	12.522	583.964	0.269	1.000	- 1.342	0.393 0.671	-	- -	-
9	0.359	47.389 47.389	1.00	0.430	281.003	0.411	1.000	0.359 -	- -	-	- -	-

Table of values		
Sigma,ex	951.352	ksi
Kt	1.00	
Lt	4' 2.000"	ft
Sigma,t	32.994	ksi
Cs	-1.00	
CTF	1.00	
Sfy	0.142	$inch^3$
j	2.131	inch
Fcre	94.488	ksi
Fc	47.389	ksi
Scy	0.142	$inch^3$
Mny	559.35	lbfft
Resistance factor	0.90	
Unity check	0.52	-

Distortional Buckling Strength

According to article F4 and formula F4.1-2.

Table of values		
Sfy	0.142	$inch^3$
My	590.11	lbfft
L	11.725"	ft
Beta	1.00	
k,phi,fe	491.40	lbf
k,phi,we	438.80	lbf
k,phi	0.00	lbf
k,phi,fg	0.010	$inch^2$
k,phi,wg	0.003	$inch^2$
Fd	68.216	ksi
Sf	0.142	$inch^3$
Mcrd	805.10	lbfft
Lambda,d	0.86	
Mn	512.15	lbfft
Resistance factor	0.90	
Unity check	0.57	-

Data		
Lm	4' 2.000"	ft
Lcr	11.725"	ft
h0	3.625	inch
Ixf	0.002	$inch^4$
Iyf	0.024	$inch^4$
Ixyf	-0.004	$inch^4$
Cwf	0.000	$inch^6$
Jf	0.000	$inch^4$
x0f	0.550	inch
hxf	-1.004	inch
Af	0.106	$inch^2$
y0f	0.052	inch
Ksi,web	0.00	

Number of compressed flanges: 2

Critical flange contains Initial shape parts: 8, 7, 9

...::Shear Strength::...

Shear Strength

According to article G2.1 and formula (G2.1.1)

Shear force Vx

Element ID	Aw [inch^2]	Vn [lbf]
3	0.076	2278.72
5	0.000	0.00
7	0.076	2278.72

Table of values		
Vn,x	4557.43	lbf
Resistance factor	0.95	
Unity check	0.07	-

Shear force Vy

Element ID	Aw [inch^2]	Vn [lbf]
3	0.000	0.00
5	0.189	5350.76
7	0.000	0.00

Table of values		
Vn,y	5350.76	lbf
Resistance factor	0.95	
Unity check	0.01	-

Combined Bending and Shear

According to article H2 and formula (H2-1)

Table of values		
Mnxo	1944.30	lbfft
Vny	5350.76	lbf
Mnyo	590.17	lbfft
Vnx	4557.43	lbf
Resistance factor shear	0.95	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check (Mx, Vy) = sqrt(0.01+0.00) = 0.10
Unity check (My, Vx) = sqrt(0.25+0.01) = 0.50

...::Axial Compression Strength::...

Nominal Axial Strength

According to article E2 and formula (E2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.359	50.000 50.000	1.00	0.430	281.003	0.422	1.000	0.222 -	- -	-	- -	-
3	1.342	50.000 50.000	1.00	2.882	134.415	0.610	1.000	1.342 -	0.415 0.927	30.83	0.000 0.000	0.222
5	3.342	50.000 50.000	1.00	4.000	30.079	1.289	0.643	2.150 -	- -	-	- -	-
7	1.342	50.000 50.000	1.00	2.882	134.415	0.610	1.000	1.342 -	0.415 0.927	30.83	0.000 0.000	0.222
9	0.359	50.000 50.000	1.00	0.430	281.003	0.422	1.000	0.222 -	- -	-	- -	-

Table of values		
Fn	50.000	ksi
Ae	0.339	inch^2
Pno	16945.16	lbf
Resistance factor	0.85	
Unity check	0.08	-

Buckling check
According to article E2 and formula (E2-1)
Flexural Buckling Strength
According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	sway	
Unbraced Length L	2 1/8	4 1/4	ft
Effective Length factor K	1.00	1.00	
Effective Length	2 1/8	4 1/4	ft
Slenderness	17.35	82.97	
Flexural Buckling stress Fcre	951.352	41.585	ksi

Torsional (-Flexural) Buckling Strength
According to article E2.2, E2.3, E2.4

Table of values		
Sigma,ex	951.352	ksi
Sigma,ey	41.585	ksi
Kt	1.00	
Lt	4 1/4	ft
Sigma,t	32.994	ksi
Sigma,TF	32.527	ksi
Torsional (-Flexural) buckling stress Fcre	32.527	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.359	26.275 26.275	1.00	0.430	281.003	0.306	1.000	0.359 -	- -	-	- -	-
3	1.342	26.275 26.275	1.00	3.387	157.959	0.408	1.000	1.342 -	0.671 0.671	42.53	0.000 0.000	0.359
5	3.342	26.275 26.275	1.00	4.000	30.079	0.935	0.818	2.734 -	- -	-	- -	-
7	1.342	26.275 26.275	1.00	3.387	157.959	0.408	1.000	1.342 -	0.671 0.671	42.53	0.000 0.000	0.359
9	0.359	26.275 26.275	1.00	0.430	281.003	0.306	1.000	0.359 -	- -	-	- -	-

Table of values		
Fe	32.527	ksi
lambda, c	1.24	
Fn	26.275	ksi
Ae	0.387	inch^2
Pn	10180.41	lbf
Resistance factor	0.85	
Unity check	0.13	-

Distortional Buckling Strength
According to article E4 and formula (E4.1-2).

Table of values		
Py	21232.26	lbf
L	1' 0.972"	ft
k,phi,fe	341.95	lbf
k,phi,we	265.74	lbf
k,phi	0.00	lbf
k,phi,fg	0.008	inch^2
k,phi,wg	0.003	inch^2
Fd	55.567	ksi
Pcrd	23596.26	lbf
Lambda,d	0.95	
Pn	16595.67	lbf
Resistance factor	0.85	
Unity check	0.08	-

Data		
Lm	4' 2.000"	ft
Lcr	1' 0.972"	ft
h0	3.625	inch
Ixf	0.002	inch^4
Iyf	0.024	inch^4
Ixyf	-0.004	inch^4
Cwf	0.000	inch^6
Jf	0.000	inch^4
x0f	0.550	inch
hxf	-1.004	inch
Af	0.106	inch^2
y0f	0.052	inch

Number of compressed flanges: 2
Critical flange contains Initial shape parts: 8, 7, 9

Combined Compressive Axial Load and Bending
According to article H1.2 and formulas (C5.2.1-3)

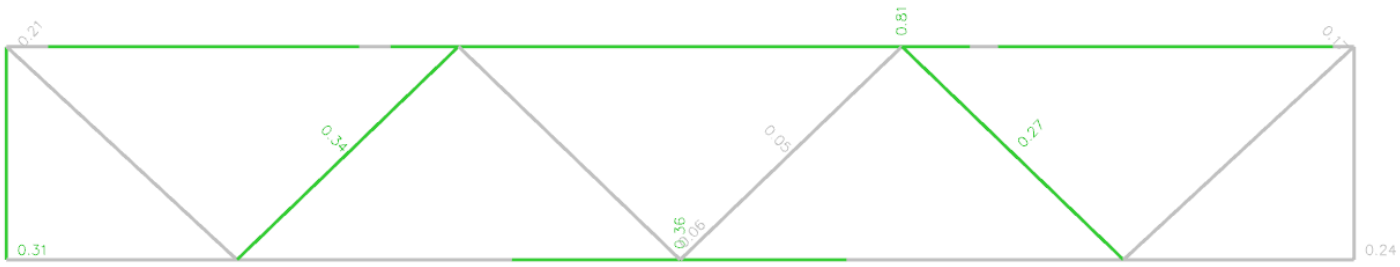
Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.359	2.580 2.580	1.00	0.430	281.003	0.096	1.000	0.359 -	- -	-	- -	-
3	1.342	2.580 2.580	1.00	4.000	186.542	0.118	1.000	1.342 -	0.671 0.671	135.72	- 0.000	0.359
5	3.342	2.580 2.580	1.00	4.000	30.079	0.293	1.000	3.342 -	- -	-	- -	-
7	1.342	2.580 2.580	1.00	4.000	186.542	0.118	1.000	1.342 -	0.671 0.671	135.72	- 0.000	0.359
9	0.359	2.580 2.580	1.00	0.430	281.003	0.096	1.000	0.359 -	- -	-	- -	-

Table of values		
Mnx	1770.88	lbfft
Mny	512.15	lbfft
Pn	10180.41	lbf
Resistance factor compression	0.85	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check = 0.13+0.11+0.57 = 0.81 - (C5.2.1-3)

The member satisfies the check !

Unity check

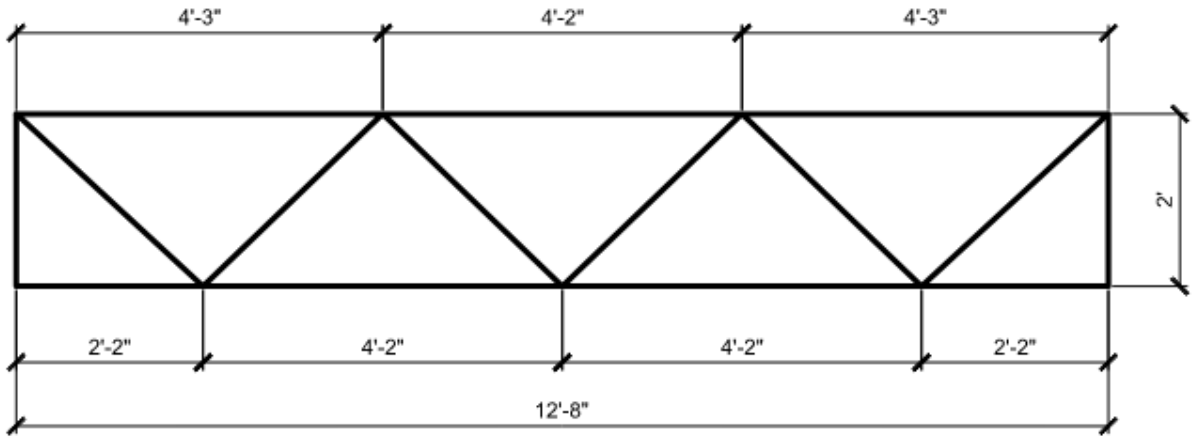


2.4.2 TRUSS 2 CHECK

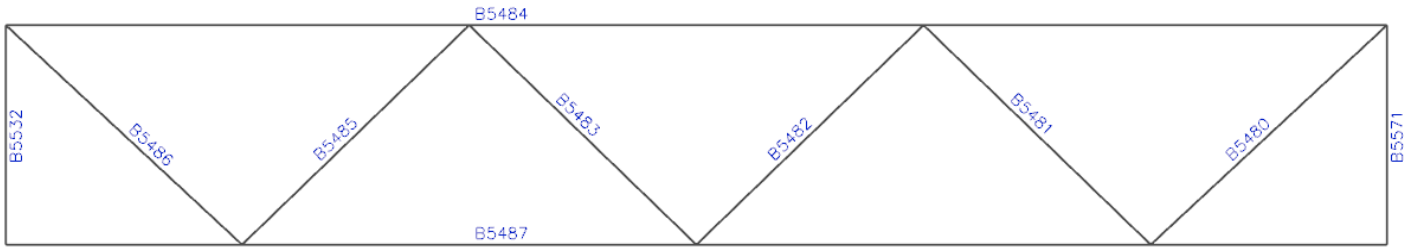
The main supporting structures of the coating we use truss.

Truss spacing 4 ft

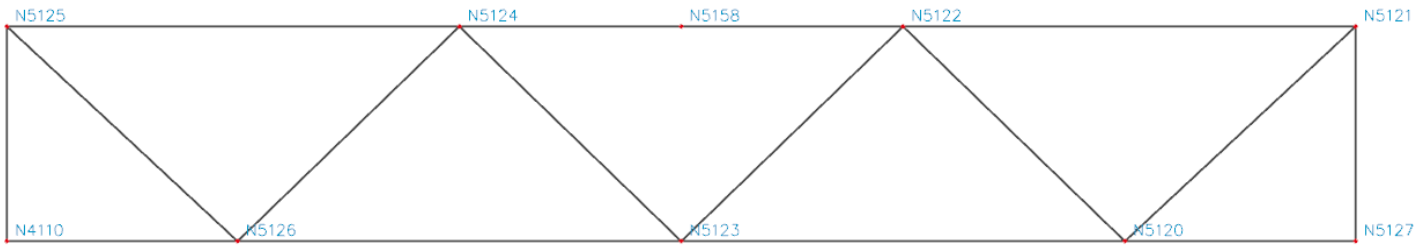
Analytic model



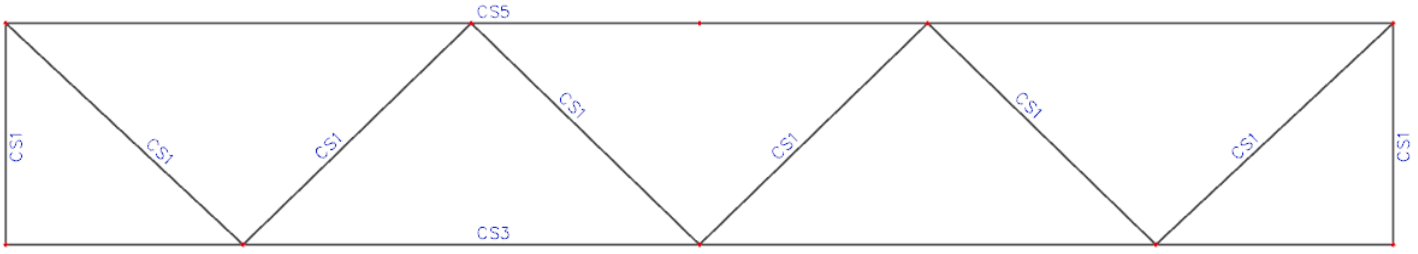
Member numbers



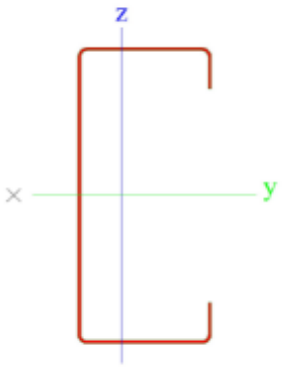
Node numbers



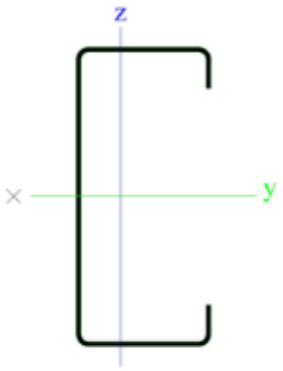
Cross-sections trusses element.



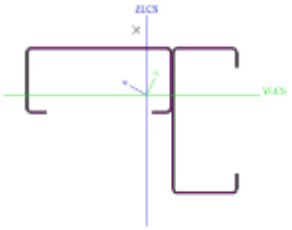
Cross-Section Properties: CS1 - 362S162-33

CS1		
Type	S362S162-33	
Formcode	114 - Cold formed C section	
Shape type	Thin-walled	
Item material	A653 grade 33	
Fabrication	cold formed	
Colour		
A [inch^2]	0.263	
A_y [inch^2], A_z [inch^2]	0.112	0.137
A_L [inch^2/inch], A_D [inch^2/inch]	1.52e+01	1.52e+01
$c_{y.ucs}$ [inch], $c_{z.ucs}$ [inch]	0.537	1.812
α [deg]	0.00	
I_y [inch^4], I_z [inch^4]	0.555	0.099
i_y [inch], i_z [inch]	1.452	0.614
$W_{el.y}$ [inch^3], $W_{el.z}$ [inch^3]	0.304	0.091
$W_{pl.y}$ [inch^3], $W_{pl.z}$ [inch^3]	0.351	0.135
$M_{pl.y.+}$ [lbfinch], $M_{pl.y.-}$ [lbfinch]	1.16e+04	1.16e+04
$M_{pl.z.+}$ [lbfinch], $M_{pl.z.-}$ [lbfinch]	4.45e+03	4.45e+03
d_y [inch], d_z [inch]	-1.314	0.000
I_t [inch^4], I_w [inch^6]	0.000	0.297
β_y [inch], β_z [inch]	0.000	4.162
Picture		

Cross-Section Properties: CS3 - 362S162-54

CS3		
Type	S362S162-54	
Formcode	114 - Cold formed C section	
Shape type	Thin-walled	
Item material	A913 grade 50	
Fabrication	cold formed	
Colour	■	
A [inch^2]	0.425	
A_y [inch^2], A_z [inch^2]	0.184	0.220
A_L [inch^2/inch], A_D [inch^2/inch]	1.50e+01	1.50e+01
$c_{Y,UCS}$ [inch], $c_{Z,UCS}$ [inch]	0.536	1.812
α [deg]	0.00	
I_y [inch^4], I_z [inch^4]	0.882	0.154
i_y [inch], i_z [inch]	1.441	0.603
$W_{el,y}$ [inch^3], $W_{el,z}$ [inch^3]	0.481	0.142
$W_{pl,y}$ [inch^3], $W_{pl,z}$ [inch^3]	0.559	0.212
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	2.80e+04	2.80e+04
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	1.06e+04	1.06e+04
d_y [inch], d_z [inch]	-1.290	0.000
I_t [inch^4], I_w [inch^6]	0.000	0.457
β_y [inch], β_z [inch]	0.000	4.130
Picture		

Cross-Section Properties: CS5 - 2 x 362S162-54

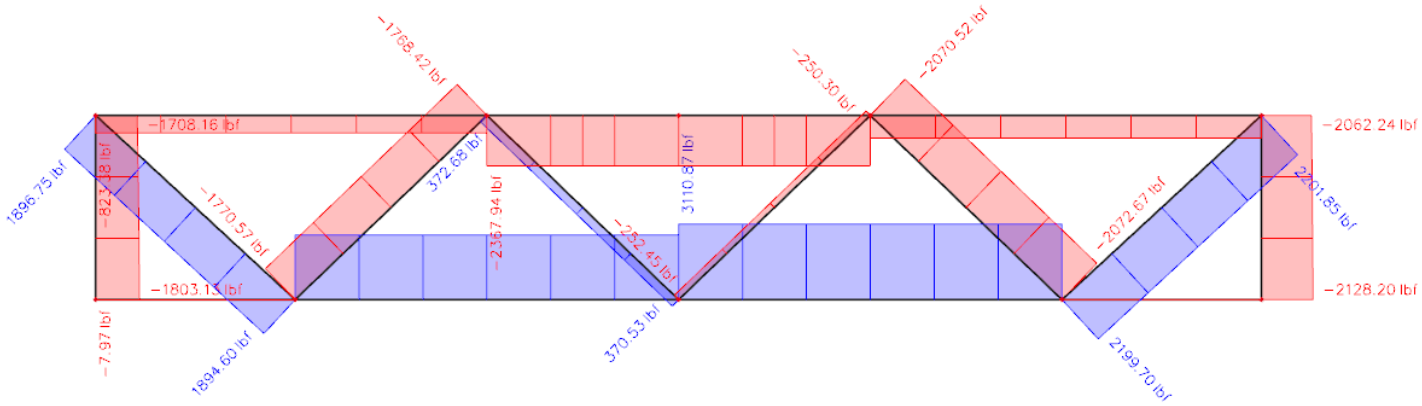
CS5		
Type	2 x 362S162-54	
Shape type	Thin-walled	
Item material	A913 grade 50	
Fabrication	cold formed	
Colour		
A [inch^2]	0.843	
A_y [inch^2], A_z [inch^2]	0.668	0.488
A_L [inch^2/inch], A_D [inch^2/inch]	2.74e+01	2.74e+01
$c_{Y,UCS}$ [inch], $c_{Z,UCS}$ [inch]	-0.776	3.759
$I_{Y,LCS}$ [inch^4], $I_{Z,LCS}$ [inch^4]	1.370	2.190
$I_{YZ,LCS}$ [inch^4]	-0.632	
α [deg]	61.48	
I_y [inch^4], I_z [inch^4]	2.533	1.027
i_y [inch], i_z [inch]	1.733	1.103
$W_{el,y}$ [inch^3], $W_{el,z}$ [inch^3]	0.808	0.498
$W_{pl,y}$ [inch^3], $W_{pl,z}$ [inch^3]	1.168	0.796
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	5.84e+04	5.84e+04
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	3.98e+04	3.98e+04
d_y [inch], d_z [inch]	1.276	0.990
I_t [inch^4], I_w [inch^6]	0.001	1.972
β_y [inch], β_z [inch]	-1.696	-4.215
Picture		

Explanations of symbols	
Formcode	s - Thickness r - Inner radius b - Flange width h - Height c - Lip
A	Area
A_y	Shear Area in principal y-direction
A_z	Shear Area in principal z-direction
A_L	Circumference per unit length
A_D	Drying surface per unit length
$c_{Y.UCS}$	Centroid coordinate in Y-direction of Input axis system
$c_{Z.UCS}$	Centroid coordinate in Z-direction of Input axis system
$I_{Y.LCS}$	Second moment of area about the YLCS axis
$I_{Z.LCS}$	Second moment of area about the ZLCS axis
$I_{YZ.LCS}$	Product moment of area in the LCS system
α	Rotation angle of the principal axis system
I_y	Second moment of area about the principal y-axis
I_z	Second moment of area about the principal z-axis
i_y	Radius of gyration about the principal y-axis

Explanations of symbols	
i_z	Radius of gyration about the principal z-axis
$W_{el.y}$	Elastic section modulus about the principal y-axis
$W_{el.z}$	Elastic section modulus about the principal z-axis
$W_{pl.y}$	Plastic section modulus about the principal y-axis
$W_{pl.z}$	Plastic section modulus about the principal z-axis
$M_{pl.y.+}$	Plastic moment about the principal y-axis for a positive My moment
$M_{pl.y.-}$	Plastic moment about the principal y-axis for a negative My moment
$M_{pl.z.+}$	Plastic moment about the principal z-axis for a positive Mz moment
$M_{pl.z.-}$	Plastic moment about the principal z-axis for a negative Mz moment
d_y	Shear center coordinate in principal y-direction measured from the centroid
d_z	Shear center coordinate in principal z-direction measured from the centroid
I_t	Torsional constant
I_w	Warping constant
β_y	Mono-symmetry constant about the principal y-axis
β_z	Mono-symmetry constant about the principal z-axis

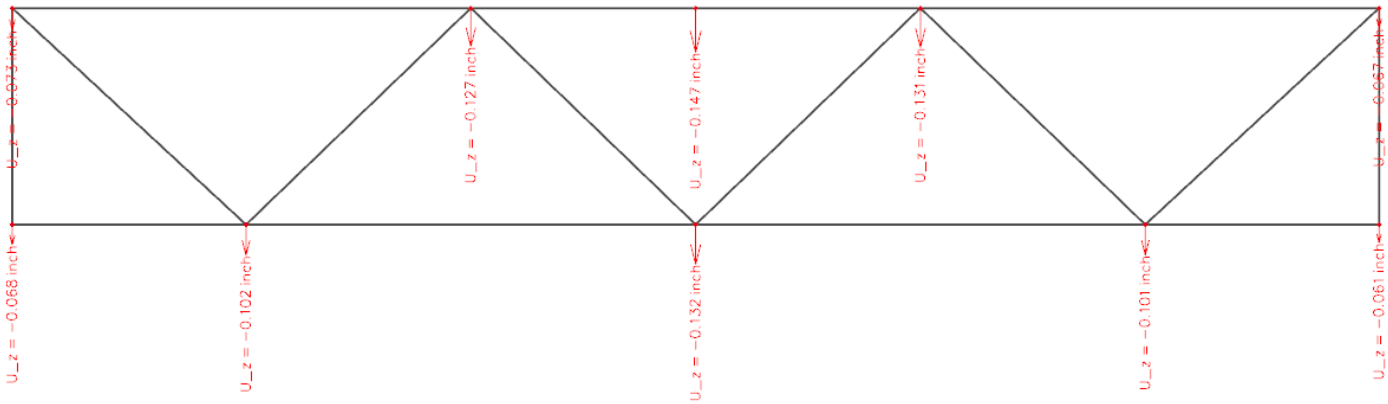
Force diagram

Axial force diagram N, LRFD-Ult (auto)8 (1.2*D1+1.2*D2+1.2*D3+1.2*D4+1.2*D5+1.2*D6+1.6*Lr+0.5*L), lbf.



Displacement of nodes

Vertical displacement
LRFD-Ult (auto)8 (1.2*D1+1.2*D2+1.2*D3+1.2*D4+1.2*D5+1.2*D6+1.6*Lr+0.5*L), inch:



The maximum deflection is 0.147" according to table 1604.3 the code IBC 2019 - the deflection limits L/360. L = 12’ 8”=12’*12”+8”=152”.

152”/360 = 0.423”. 0.147"< 0.423”. Deflection is OK!

Steel check elements LRFD
Check Top chord: AISI S100-16 LRFD Check

Member B5484	2 x 362S162-54	A913 grade 50	LRFD-Ult (auto)	0.65

Material data		
Yield stress Fy	50.00	ksi
Tensile stress Fu	65.00	ksi
fabrication	cold formed	

The critical check is on position 6.33 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-1313.10	lbf
Vux	-167.85	lbf
Vuy	-35.78	lbf
Mut	-0.00	lbfft
Mux	423.82	lbfft
Muy	-1063.08	lbfft

...::Flexural Strength about X-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.472	25.605 15.611	0.61	0.609	229.741	0.334	1.000	0.472 -	- -	-	- -	-
2	1.568	25.605 25.605	1.00	4.000	136.574	0.433	1.000	1.568 -	- -	-	- -	-
3	2.000	-7.625 -50.000	-	-	-	-	-	- -	- -	-	- -	-
4	1.568	-50.000 -50.000	-	-	-	-	-	- -	- -	-	- -	-
5	0.472	-40.006 -50.000	-	-	-	-	-	- -	- -	-	- -	-
6	0.472	-7.625 -7.625	-	-	-	-	-	- -	- -	-	- -	-
7	1.568	25.605 -7.625	0.30	10.967	1497.850	0.131	1.000	- 1.568	0.476 0.784	-	- -	-
8	3.568	25.605 25.605	1.00	4.000	26.384	0.985	0.788	2.813 -	- -	-	- -	-
9	1.568	25.605 -7.625	0.30	10.967	374.462	0.261	1.000	- 1.568	0.476 0.784	-	- -	-
10	0.472	-7.625 -7.625	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Sxe	0.570	$inch^3$
Mnxo	2373.84	lbfft
Resistance factor	0.90	
Unity check	0.20	-

Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Table of values		
Lltb	4' 2.000"	ft
Sigma,ey	139.386	ksi
Kt	1.00	
Lt	4' 2.000"	ft
Sigma,t	42.094	ksi
Cb	1.10	
Sfx	1.167	$inch^3$
Fcre	159.031	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.
...::Flexural Strength about Y-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.472	-37.654 -37.654	-	-	-	-	-	- -	- -	-	- -	-
2	1.568	-11.182 -37.654	-	-	-	-	-	- -	- -	-	- -	-
3	2.000	-11.182 -11.182	-	-	-	-	-	- -	- -	-	- -	-
4	1.568	-11.182 -37.654	-	-	-	-	-	- -	- -	-	- -	-
5	0.472	-37.654 -37.654	-	-	-	-	-	- -	- -	-	- -	-
6	0.472	-2.266 -10.227	-	-	-	-	-	- -	- -	-	- -	-
7	1.568	-10.705 -10.705	-	-	-	-	-	- -	- -	-	- -	-
8	3.568	50.000 -10.227	0.20	9.904	65.329	0.875	0.856	- 3.053	0.953 2.100	-	- -	-
9	1.568	50.000 50.000	1.00	4.000	136.574	0.605	1.000	- 1.568	0.784 0.784	-	- -	-
10	0.472	50.000 42.039	0.84	0.490	184.778	0.520	1.000	0.472 -	- -	-	- -	-

Table of values		
Sye	0.732	$inch^3$
Mnyo	3050.70	lbfft
Resistance factor	0.90	
Unity check	0.39	-

Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Table of values		
Sigma,ex	1375.812	ksi
Kt	1.00	
Lt	4' 2.000"	ft
Sigma,t	42.094	ksi
Cb	1.00	
Sfy	0.733	$inch^3$
Fcre	723.557	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.

...::Shear Strength::...
Shear Strength
According to article G2.1 and formula (G2.1.1)
Shear force Vx

Element ID	Aw [$inch^2$]	Vn [lbf]
1	0.000	0.00
2	0.089	2663.14
3	0.000	0.00
4	0.089	2663.14
5	0.000	0.00
6	0.027	800.95
7	0.000	0.00
8	0.202	5350.76
9	0.000	0.00
10	0.027	800.95

Table of values		
Vn,x	12278.94	lbf
Resistance factor	0.95	
Unity check	0.01	-

Combined Bending and Shear
According to article H2 and formula (H2-1)

Table of values		
Mnyo	3050.70	lbfft
Vnx	12278.94	lbf
Resistance factor shear	0.95	
Resistance factor bending y	0.90	

Unity check (My, Vx) = sqrt(0.15+0.00) = 0.39

...::Axial Compression Strength::...

Nominal Axial Strength

According to article E2 and formula (E2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.472	50.000 50.000	1.00	0.430	162.315	0.555	1.000	0.472 -	- -	-	- -	-
2	1.568	50.000 50.000	1.00	4.000	136.574	0.605	1.000	1.568 -	- -	-	- -	-
3	2.000	50.000 50.000	1.00	4.000	83.989	0.772	0.927	1.853 -	- -	-	- -	-
4	1.568	50.000 50.000	1.00	4.000	136.574	0.605	1.000	1.568 -	- -	-	- -	-
5	0.472	50.000 50.000	1.00	0.430	162.315	0.555	1.000	0.472 -	- -	-	- -	-
6	0.472	50.000 50.000	1.00	0.430	162.315	0.555	1.000	0.472 -	- -	-	- -	-
7	1.568	50.000 50.000	1.00	4.000	546.295	0.303	1.000	1.568 -	- -	-	- -	-
8	3.568	50.000 50.000	1.00	4.000	26.384	1.377	0.610	2.178 -	- -	-	- -	-
9	1.568	50.000 50.000	1.00	4.000	136.574	0.605	1.000	1.568 -	- -	-	- -	-
10	0.472	50.000 50.000	1.00	0.430	162.315	0.555	1.000	0.472 -	- -	-	- -	-

Table of values		
Fn	50.000	ksi
Ae	0.779	inch^2
Pno	38962.23	lbf
Resistance factor	0.85	
Unity check	0.04	-

Buckling check

According to article E2 and formula (E2-1)

Flexural Buckling Strength

According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	sway	
Unbraced Length L	2 1/8	4 1/4	ft
Effective Length factor K	1.00	1.00	
Effective Length	2 1/8	4 1/4	ft
Slenderness	14.43	45.32	
Flexural Buckling stress Fcre	1375.812	139.386	ksi

Torsional (-Flexural) Buckling Strength
According to article E2.2, E2.3, E2.4

Table of values		
Sigma,ex	1375.812	ksi
Sigma,ey	139.386	ksi
Kt	1.00	
Lt	4 1/4	ft
Sigma,t	42.094	ksi
Sigma,TF	39.564	ksi
Torsional (-Flexural) buckling stress Fcre	39.564	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.472	29.461 29.461	1.00	0.430	162.315	0.426	1.000	0.472 -	- -	-	- -	-
2	1.568	29.461 29.461	1.00	4.000	136.574	0.464	1.000	1.568 -	- -	-	- -	-
3	2.000	29.461 29.461	1.00	4.000	83.989	0.592	1.000	2.000 -	- -	-	- -	-
4	1.568	29.461 29.461	1.00	4.000	136.574	0.464	1.000	1.568 -	- -	-	- -	-
5	0.472	29.461 29.461	1.00	0.430	162.315	0.426	1.000	0.472 -	- -	-	- -	-
6	0.472	29.461 29.461	1.00	0.430	162.315	0.426	1.000	0.472 -	- -	-	- -	-
7	1.568	29.461 29.461	1.00	4.000	546.295	0.232	1.000	1.568 -	- -	-	- -	-
8	3.568	29.461 29.461	1.00	4.000	26.384	1.057	0.749	2.674 -	- -	-	- -	-
9	1.568	29.461 29.461	1.00	4.000	136.574	0.464	1.000	1.568 -	- -	-	- -	-
10	0.472	29.461 29.461	1.00	0.430	162.315	0.426	1.000	0.472 -	- -	-	- -	-

Table of values		
Fe	39.564	ksi
lambda, c	1.12	
Fn	29.461	ksi
Ae	0.816	inch^2
Pn	24029.54	lbf
Resistance factor	0.85	
Unity check	0.06	-

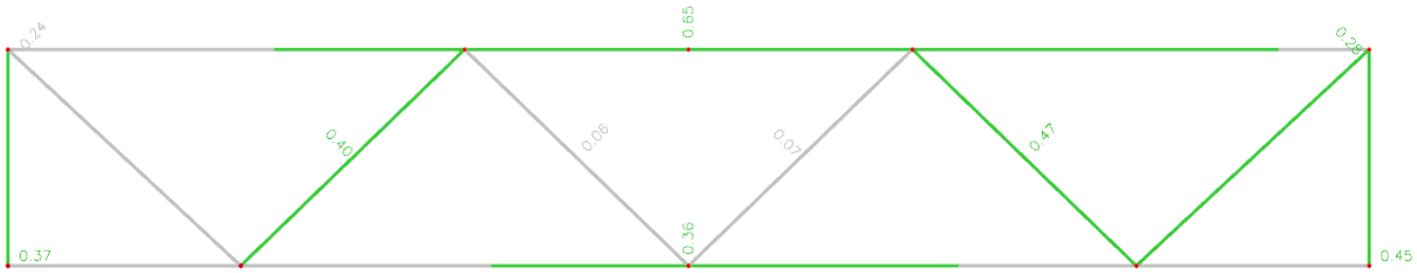
Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch⁴]	ds [inch]
1	0.472	1.557 1.557	1.00	0.430	162.315	0.098	1.000	0.472 -	- -	-	- -	-
2	1.568	1.557 1.557	1.00	4.000	136.574	0.107	1.000	1.568 -	- -	-	- -	-
3	2.000	1.557 1.557	1.00	4.000	83.989	0.136	1.000	2.000 -	- -	-	- -	-
4	1.568	1.557 1.557	1.00	4.000	136.574	0.107	1.000	1.568 -	- -	-	- -	-
5	0.472	1.557 1.557	1.00	0.430	162.315	0.098	1.000	0.472 -	- -	-	- -	-
6	0.472	1.557 1.557	1.00	0.430	162.315	0.098	1.000	0.472 -	- -	-	- -	-
7	1.568	1.557 1.557	1.00	4.000	546.295	0.053	1.000	1.568 -	- -	-	- -	-
8	3.568	1.557 1.557	1.00	4.000	26.384	0.243	1.000	3.568 -	- -	-	- -	-
9	1.568	1.557 1.557	1.00	4.000	136.574	0.107	1.000	1.568 -	- -	-	- -	-
10	0.472	1.557 1.557	1.00	0.430	162.315	0.098	1.000	0.472 -	- -	-	- -	-

Table of values		
Mnx	2373.84	lbfft
Mny	3050.70	lbfft
Pn	24029.54	lbf
Resistance factor compression	0.85	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check = 0.06+0.20+0.39 = 0.65 - (C5.2.1-3)

The member satisfies the check !

Unity check

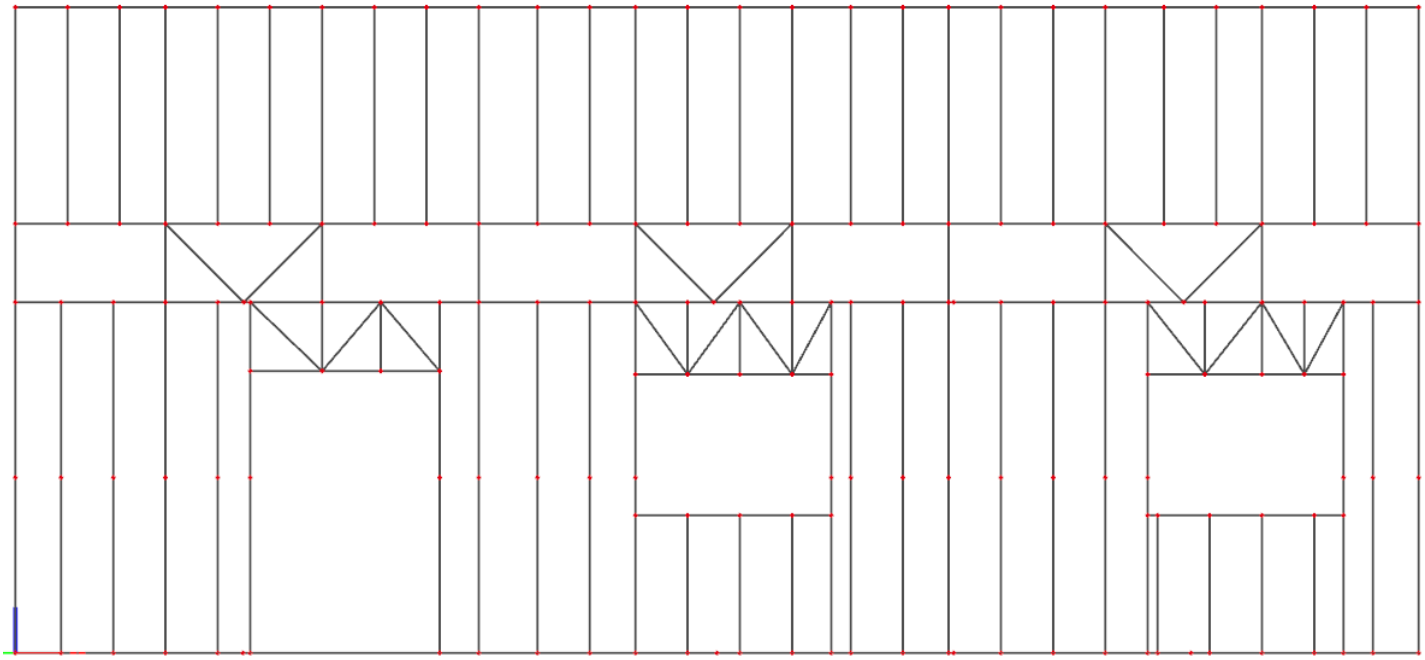


2.4.3 WALL ELEMENTS CHECK

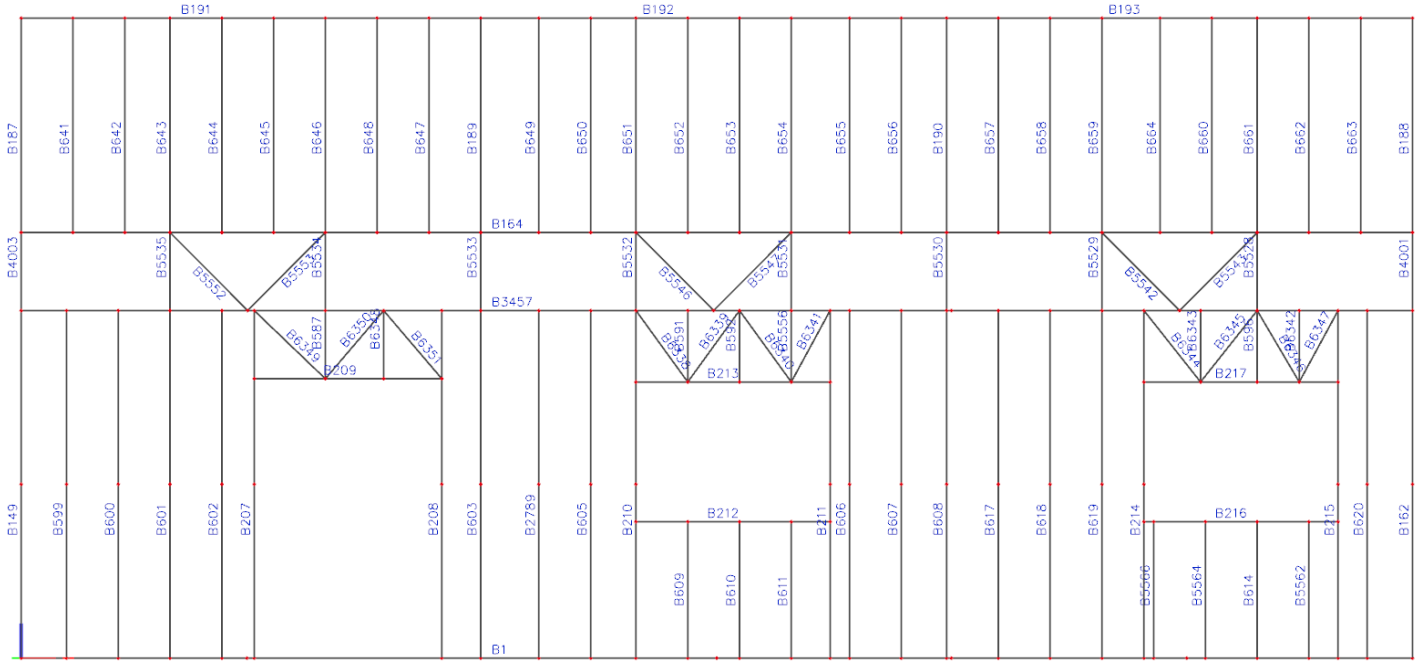
The most loaded studs are analysed:
South wall

Studs spacing 16”. Studs length 8 ft 11 in.

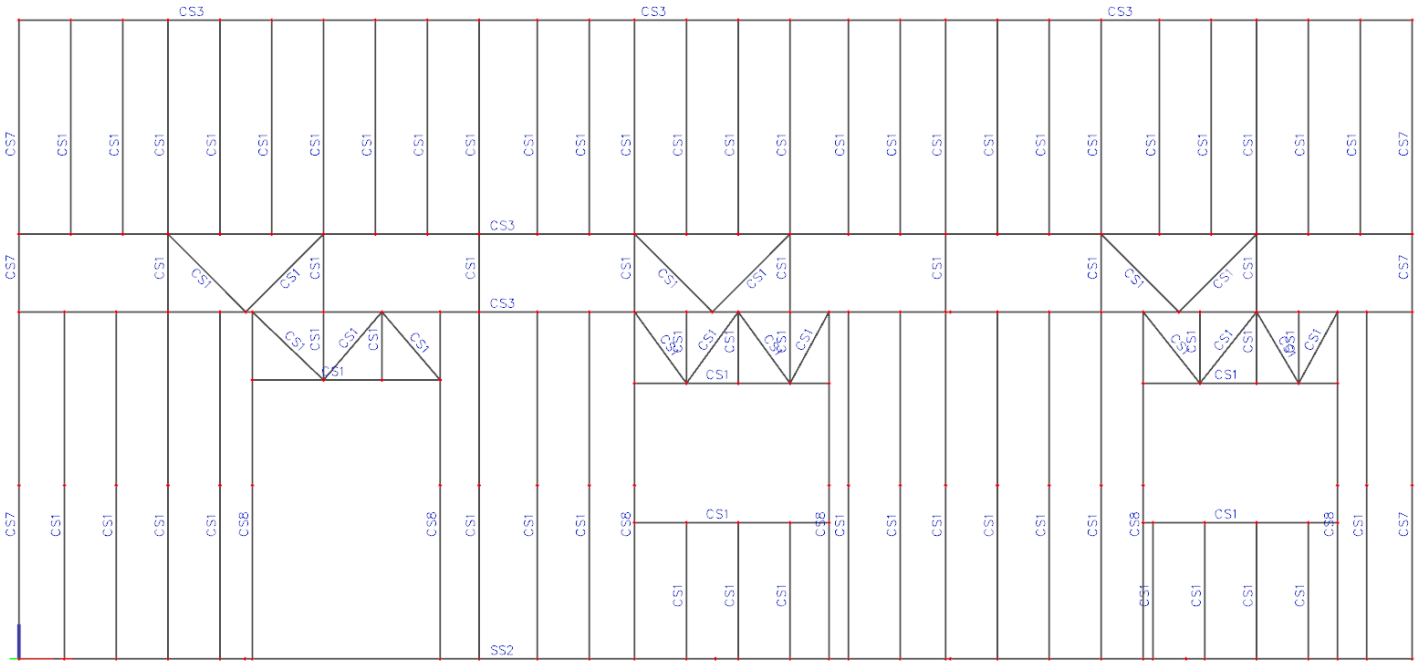
Analytic model



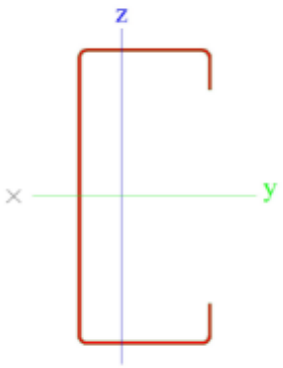
Member numbers



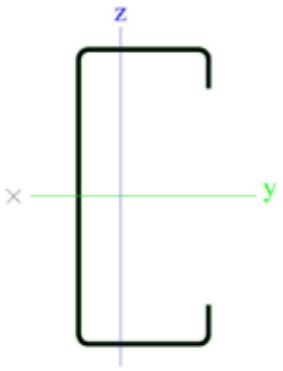
Cross-sections walls element.



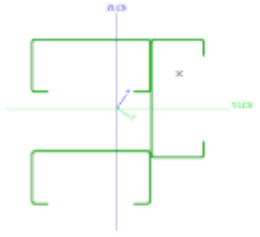
Cross-Section Properties: CS1 - 362S162-33

CS1		
Type	S362S162-33	
Formcode	114 - Cold formed C section	
Shape type	Thin-walled	
Item material	A653 grade 33	
Fabrication	cold formed	
Colour		
A [inch^2]	0.263	
A_y [inch^2], A_z [inch^2]	0.112	0.137
A_L [inch^2/inch], A_D [inch^2/inch]	1.52e+01	1.52e+01
$c_{y.ucs}$ [inch], $c_{z.ucs}$ [inch]	0.537	1.812
α [deg]	0.00	
I_y [inch^4], I_z [inch^4]	0.555	0.099
i_y [inch], i_z [inch]	1.452	0.614
$W_{el.y}$ [inch^3], $W_{el.z}$ [inch^3]	0.304	0.091
$W_{pl.y}$ [inch^3], $W_{pl.z}$ [inch^3]	0.351	0.135
$M_{pl.y.+}$ [lbfinch], $M_{pl.y.-}$ [lbfinch]	1.16e+04	1.16e+04
$M_{pl.z.+}$ [lbfinch], $M_{pl.z.-}$ [lbfinch]	4.45e+03	4.45e+03
d_y [inch], d_z [inch]	-1.314	0.000
I_t [inch^4], I_w [inch^6]	0.000	0.297
β_y [inch], β_z [inch]	0.000	4.162
Picture		

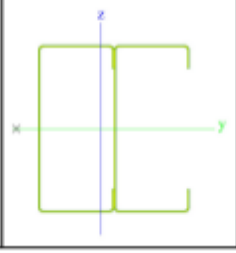
Cross-Section Properties: CS3 - 362S162-54

CS3		
Type	S362S162-54	
Formcode	114 - Cold formed C section	
Shape type	Thin-walled	
Item material	A913 grade 50	
Fabrication	cold formed	
Colour	■	
A [inch^2]	0.425	
A_y [inch^2], A_z [inch^2]	0.184	0.220
A_L [inch^2/inch], A_D [inch^2/inch]	1.50e+01	1.50e+01
$c_{Y,UCS}$ [inch], $c_{Z,UCS}$ [inch]	0.536	1.812
α [deg]	0.00	
I_y [inch^4], I_z [inch^4]	0.882	0.154
i_y [inch], i_z [inch]	1.441	0.603
$W_{el,y}$ [inch^3], $W_{el,z}$ [inch^3]	0.481	0.142
$W_{pl,y}$ [inch^3], $W_{pl,z}$ [inch^3]	0.559	0.212
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	2.80e+04	2.80e+04
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	1.06e+04	1.06e+04
d_y [inch], d_z [inch]	-1.290	0.000
I_t [inch^4], I_w [inch^6]	0.000	0.457
β_y [inch], β_z [inch]	0.000	4.130
Picture		

Cross-Section Properties: CS7 - 3 x 362S162-33

CS7		
Type	3 x 362S162-33	
Shape type	Thin-walled	
Item material	A653 grade 33	
Fabrication	cold formed	
Colour		
A [inch^2]	0.786	
A_y [inch^2], A_z [inch^2]	0.610	0.692
A_L [inch^2/inch], A_D [inch^2/inch]	4.29e+01	4.29e+01
$c_{Y,UCS}$ [inch], $c_{Z,UCS}$ [inch]	-7.014	9.575
$I_{Y,LCS}$ [inch^4], $I_{Z,LCS}$ [inch^4]	2.298	2.165
$I_{YZ,LCS}$ [inch^4]	0.175	
α [deg]	-34.58	
I_y [inch^4], I_z [inch^4]	2.419	2.045
i_y [inch], i_z [inch]	1.754	1.613
$W_{el,y}$ [inch^3], $W_{el,z}$ [inch^3]	0.629	0.623
$W_{pl,y}$ [inch^3], $W_{pl,z}$ [inch^3]	1.145	1.022
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	3.78e+04	3.78e+04
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	3.37e+04	3.37e+04
d_y [inch], d_z [inch]	0.960	1.932
I_t [inch^4], I_w [inch^6]	0.000	8.765
β_y [inch], β_z [inch]	-4.444	-2.440
Picture		

Cross-Section Properties: CS8 - 2 x 362S162-33

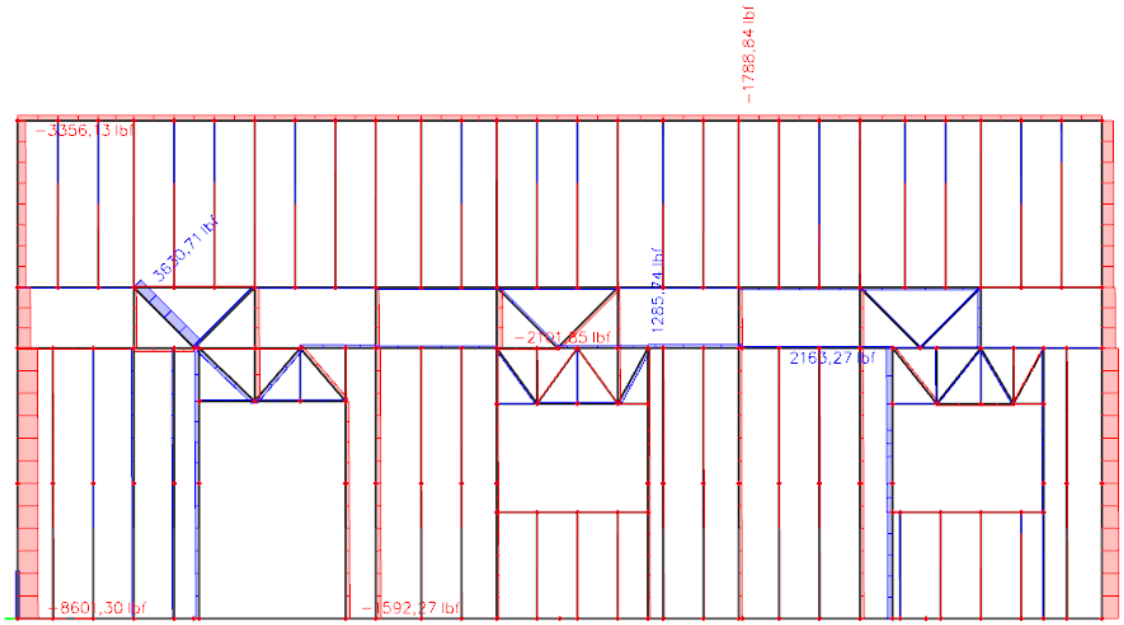
CS8		
Type	2 x 362S162-33	
Shape type	Thin-walled	
Item material	A653 grade 33	
Fabrication	cold formed	
Colour		
A [inch^2]	0.524	
A_y [inch^2], A_z [inch^2]	0.235	0.273
A_L [inch^2/inch], A_D [inch^2/inch]	1.87e+01	2.89e+01
$c_{Y,UCS}$ [inch], $c_{Z,UCS}$ [inch]	6.165	4.112
α [deg]	0.00	
I_y [inch^4], I_z [inch^4]	1.102	0.545
i_y [inch], i_z [inch]	1.450	1.019
$W_{el,y}$ [inch^3], $W_{el,z}$ [inch^3]	0.608	0.286
$W_{pl,y}$ [inch^3], $W_{pl,z}$ [inch^3]	0.701	0.426
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	2.31e+04	2.31e+04
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	1.41e+04	1.41e+04
d_y [inch], d_z [inch]	-1.822	0.000
I_t [inch^4], I_w [inch^6]	0.067	0.696
β_y [inch], β_z [inch]	0.000	4.202
Picture		

Explanations of symbols	
A	Area
A_y	Shear Area in principal y-direction
A_z	Shear Area in principal z-direction
A_L	Circumference per unit length
A_D	Drying surface per unit length
$c_{Y,UCS}$	Centroid coordinate in Y-direction of Input axis system
$c_{Z,UCS}$	Centroid coordinate in Z-direction of Input axis system
$I_{Y,LCS}$	Second moment of area about the YLCS axis
$I_{Z,LCS}$	Second moment of area about the ZLCS axis
$I_{YZ,LCS}$	Product moment of area in the LCS system
α	Rotation angle of the principal axis system
I_y	Second moment of area about the principal y-axis
I_z	Second moment of area about the principal z-axis
i_y	Radius of gyration about the principal y-axis
i_z	Radius of gyration about the principal z-axis

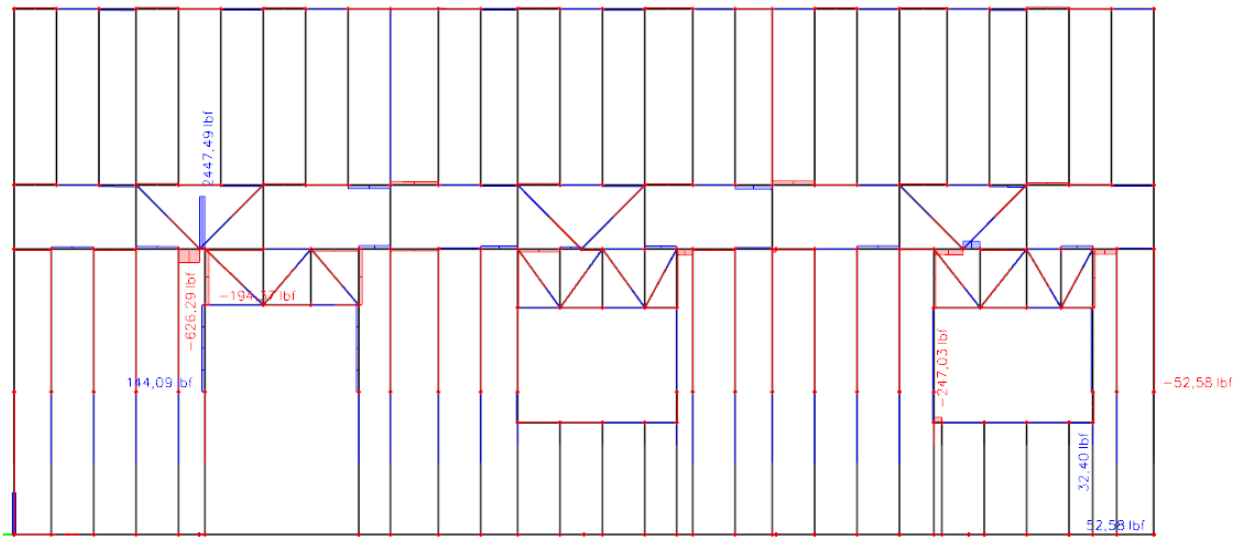
Explanations of symbols	
$W_{el,y}$	Elastic section modulus about the principal y-axis
$W_{el,z}$	Elastic section modulus about the principal z-axis
$W_{pl,y}$	Plastic section modulus about the principal y-axis
$W_{pl,z}$	Plastic section modulus about the principal z-axis
$M_{pl,y,+}$	Plastic moment about the principal y-axis for a positive My moment
$M_{pl,y,-}$	Plastic moment about the principal y-axis for a negative My moment
$M_{pl,z,+}$	Plastic moment about the principal z-axis for a positive Mz moment
$M_{pl,z,-}$	Plastic moment about the principal z-axis for a negative Mz moment
d_y	Shear center coordinate in principal y-direction measured from the centroid
d_z	Shear center coordinate in principal z-direction measured from the centroid
I_t	Torsional constant
I_w	Warping constant
β_y	Mono-symmetry constant about the principal y-axis
β_z	Mono-symmetry constant about the principal z-axis

Force diagram

Axial force diagram N,
LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5*Lr+1.6*L, (lbf).



Shear force diagram Vz,
LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*Lr, (lbf).



Shear force diagram Vz,
LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5*Lr+1.6*L, (lbf).

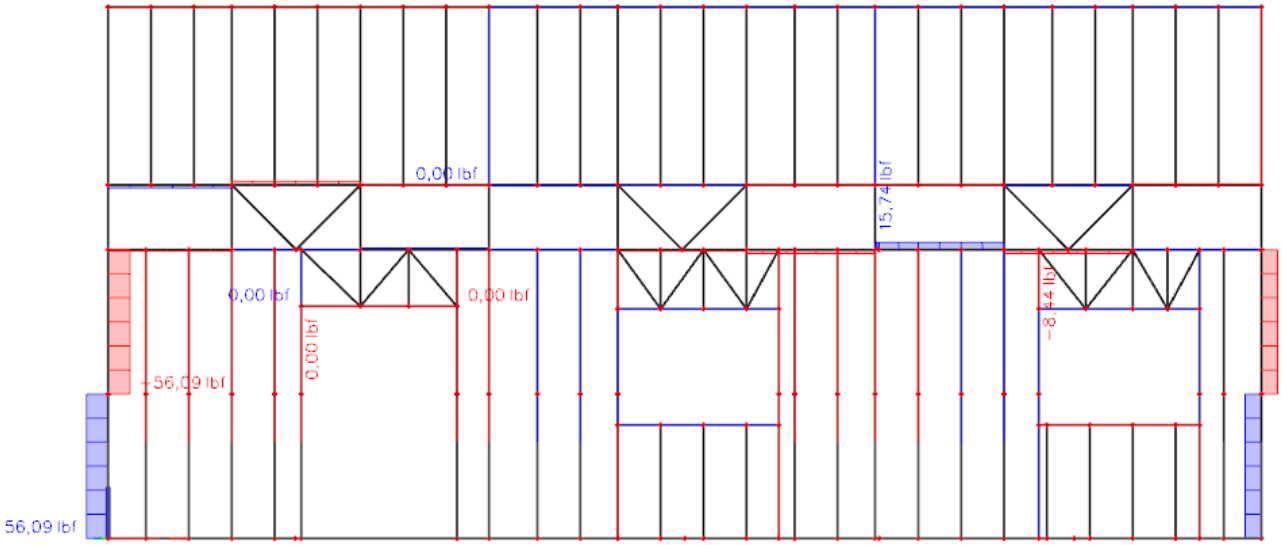


Diagram of bending moments My,
LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5*Lr+1.6*L, (lbf ft).

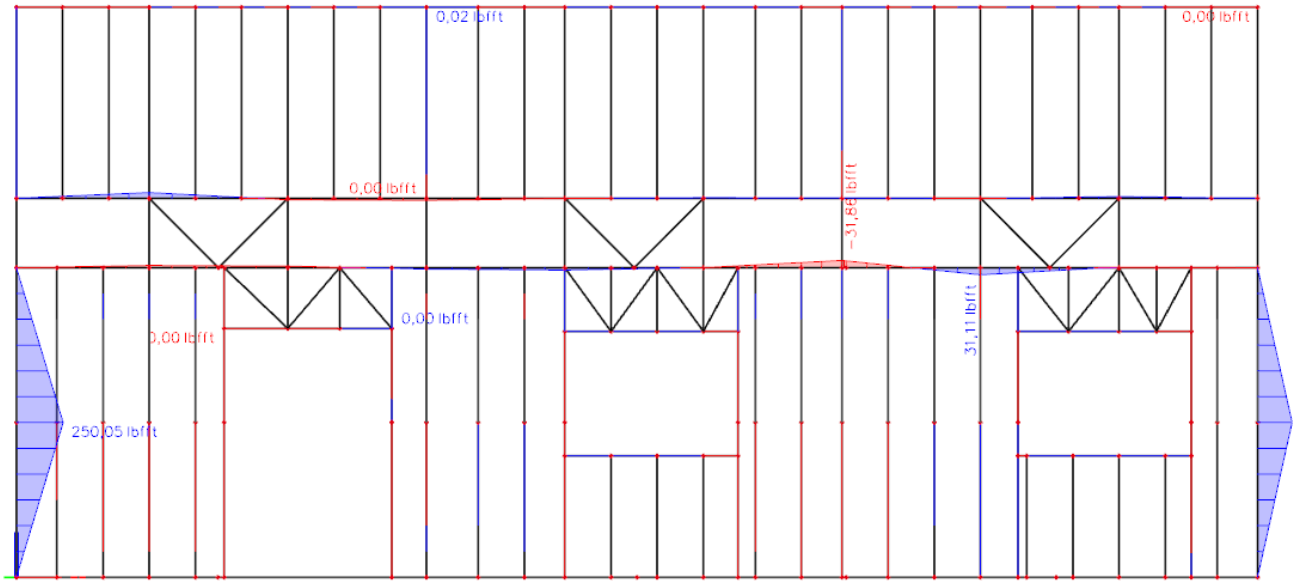
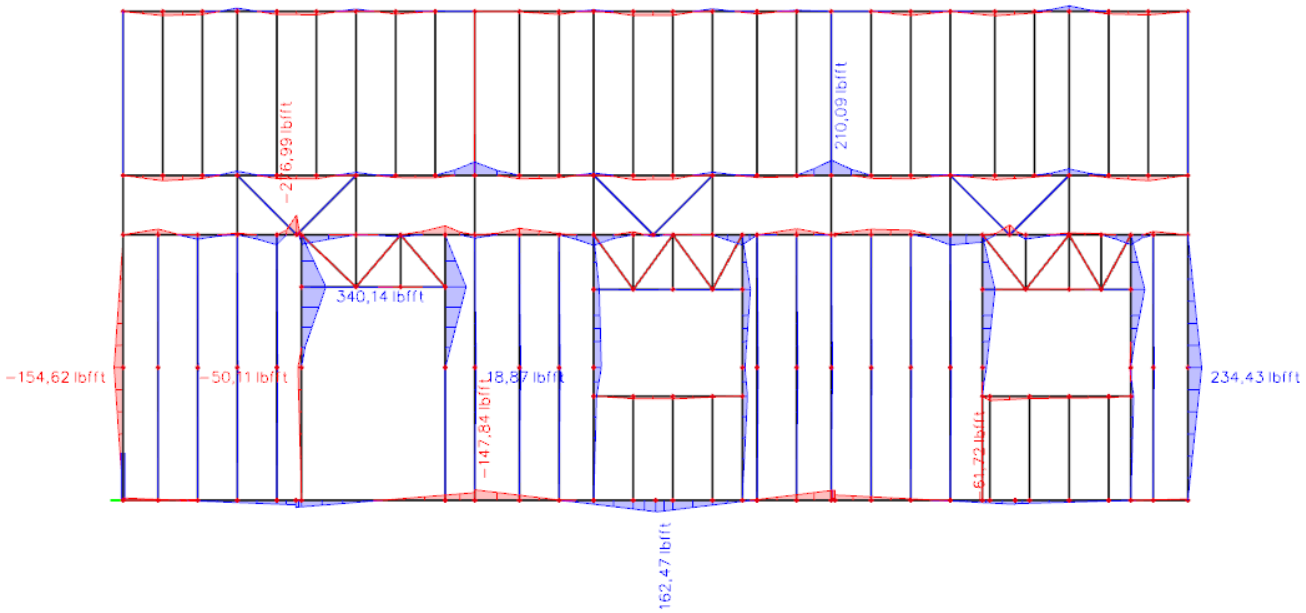
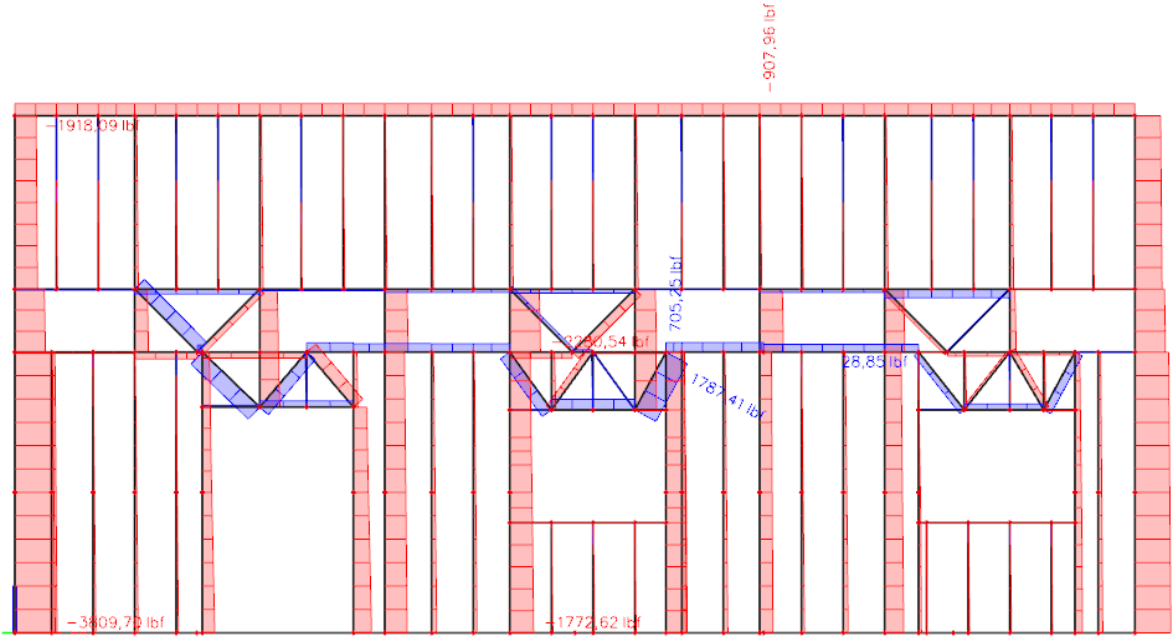


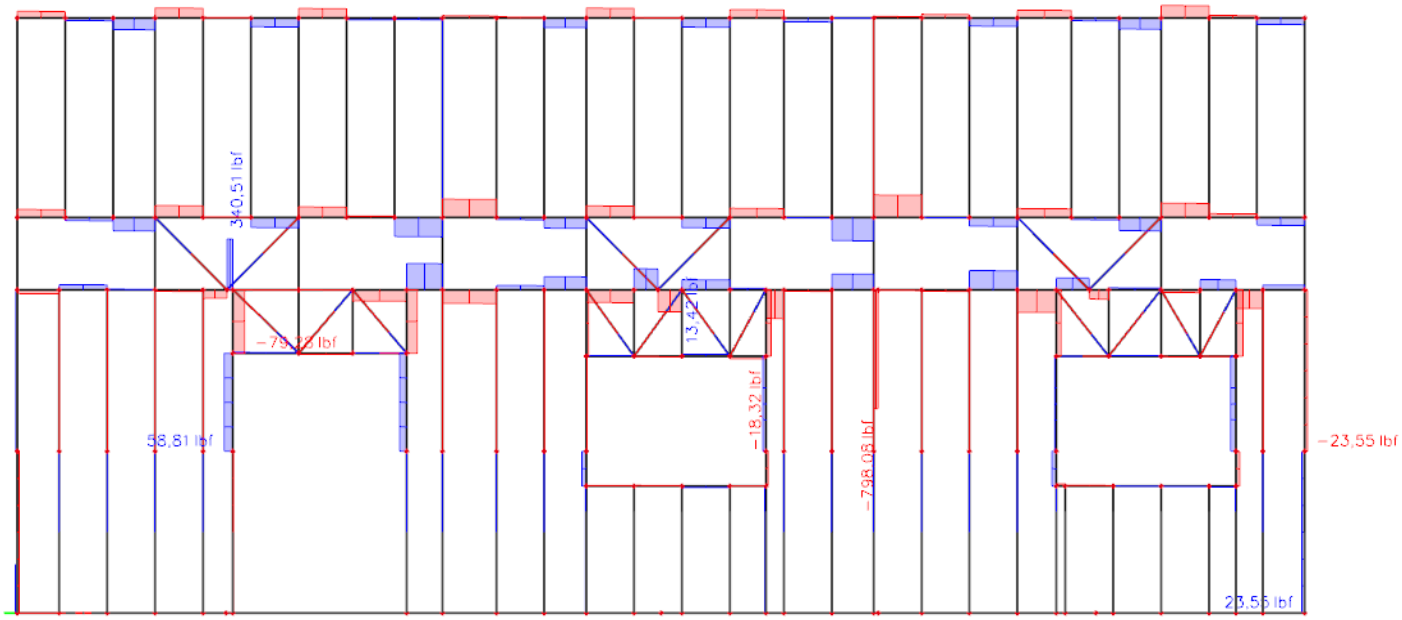
Diagram of bending moments Mz,
LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5*Lr+1.6*L, (lbf ft).



Axial force diagram N,
LRFD-Ult (auto)7 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*Lr, (lbf).



Shear force diagram Vy,
LRFD-Ult (auto)7 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*Lr, (lbf).



Shear force diagram Vz,
LRFD-Ult (auto)7 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*Lr, (lbf).

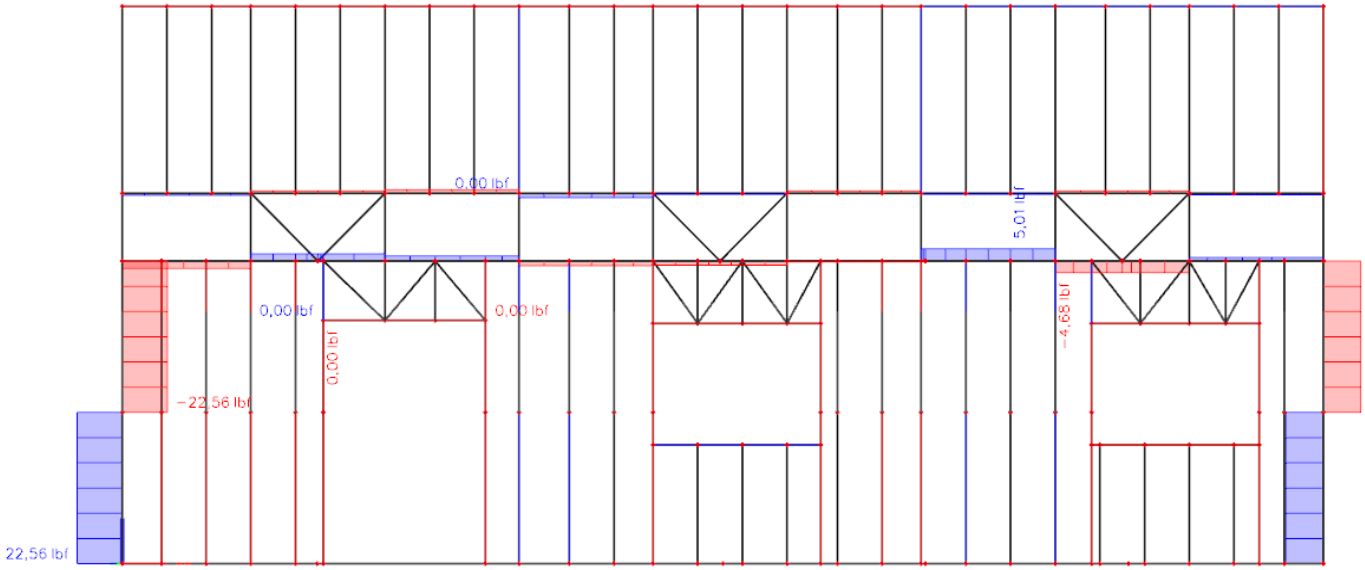


Diagram of bending moments My,
LRFD-Ult (auto)7 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*Lr, (lbf ft).

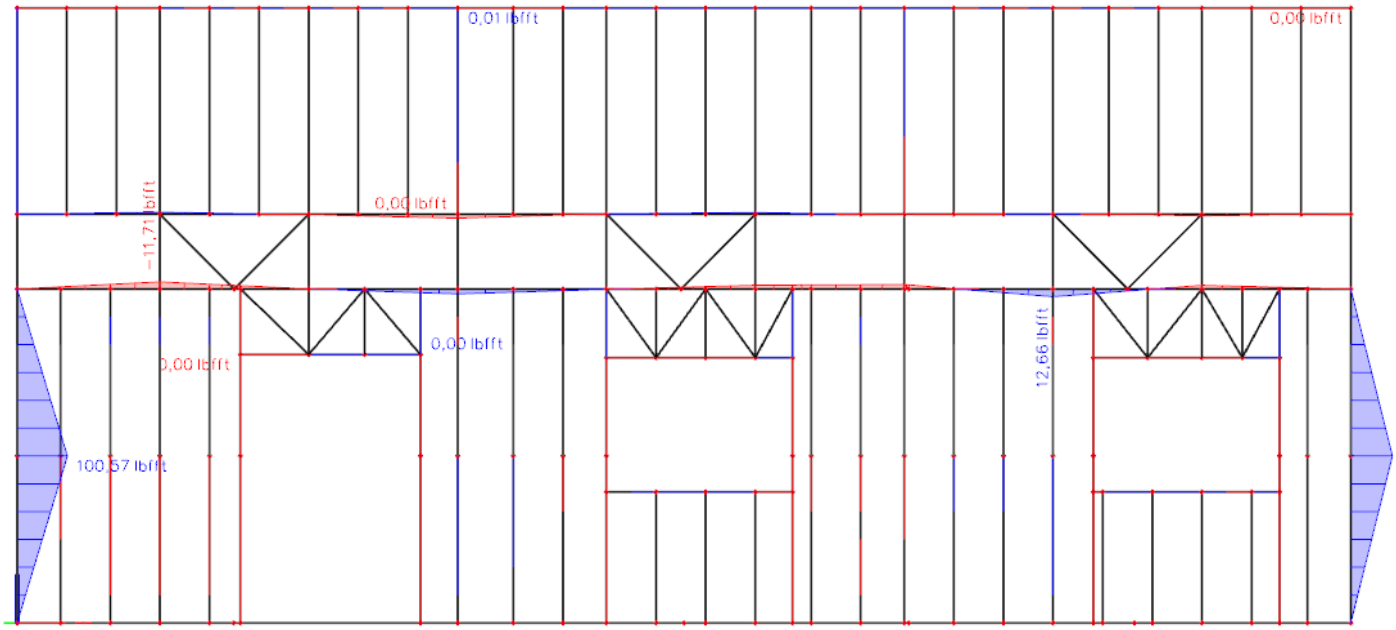
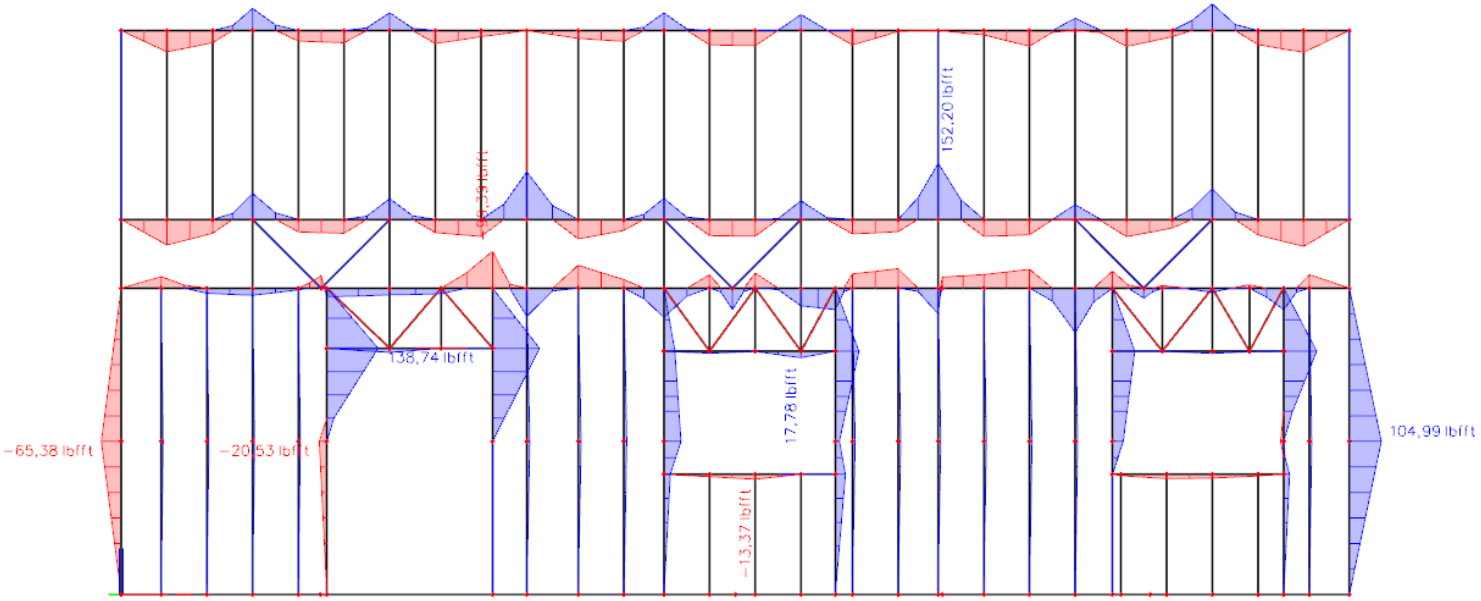
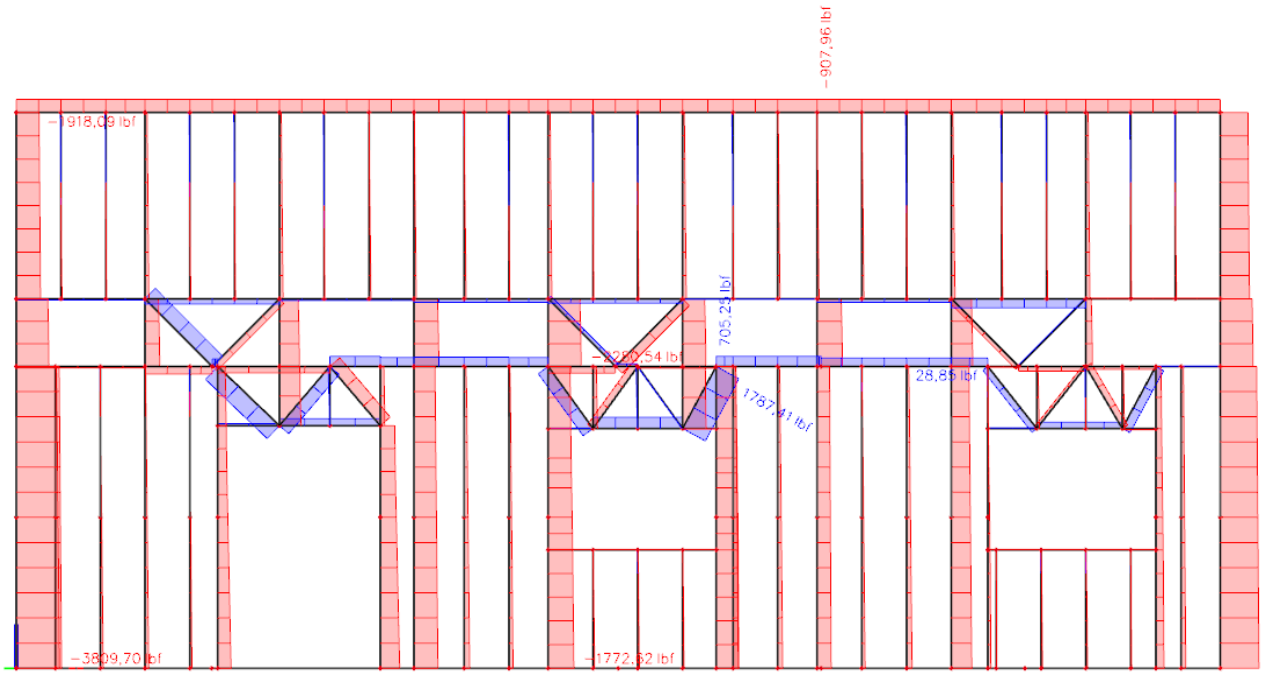


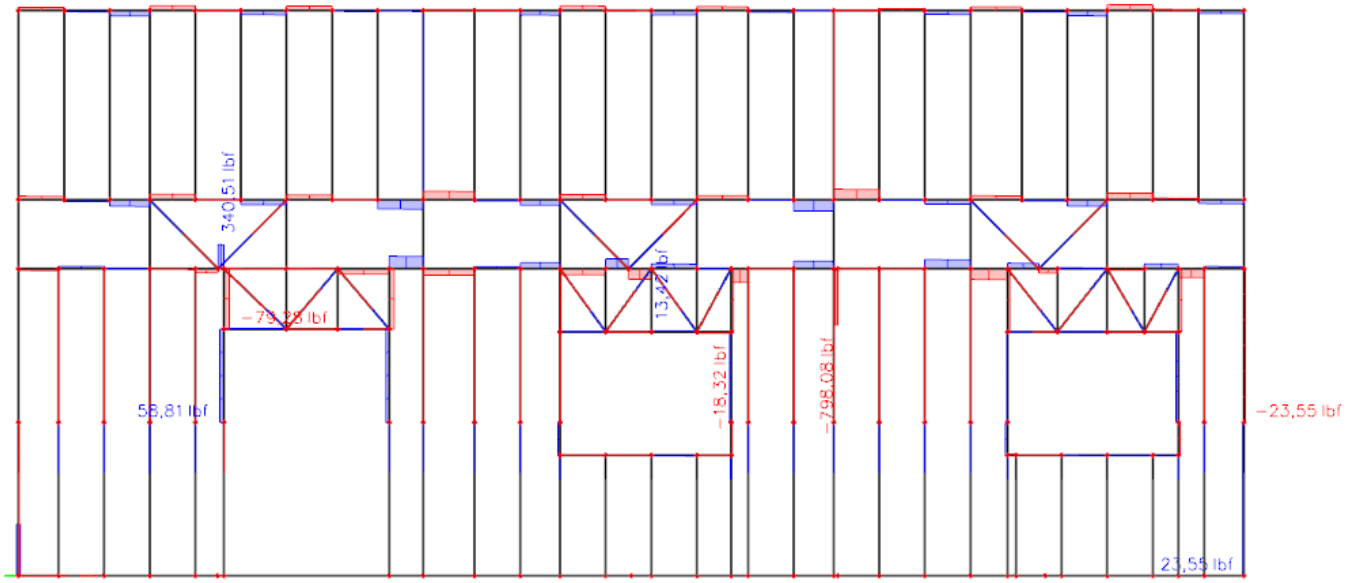
Diagram of bending moments Mz,
LRFD-Ult (auto)7 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*Lr, (lbf ft).



Axial force diagram N,
LRFD-Ult (auto)27 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L+Wy+, (lbf).



Shear force diagram Vy,
LRFD-Ult (auto)27 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L+Wy+, (lbf).



Shear force diagram Vz,
LRFD-Ult (auto)27 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L+Wy+, (lbf).

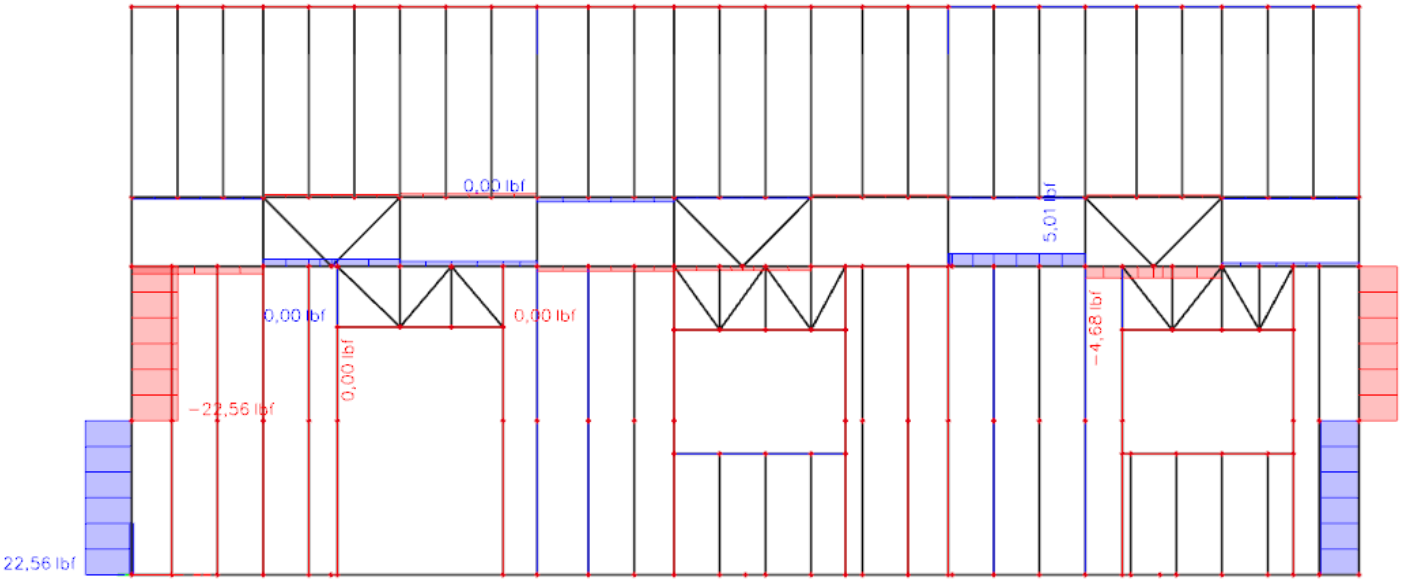


Diagram of bending moments My,
LRFD-Ult (auto)27 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L+Wy+, (lbf ft).

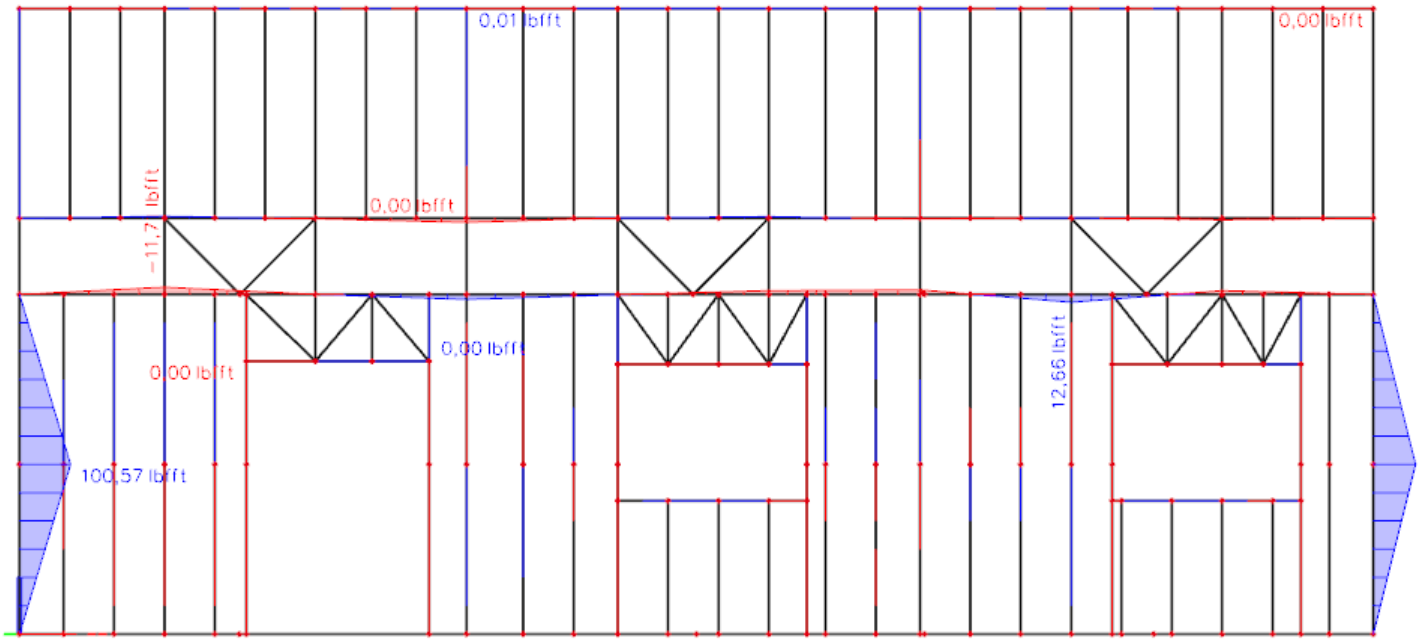
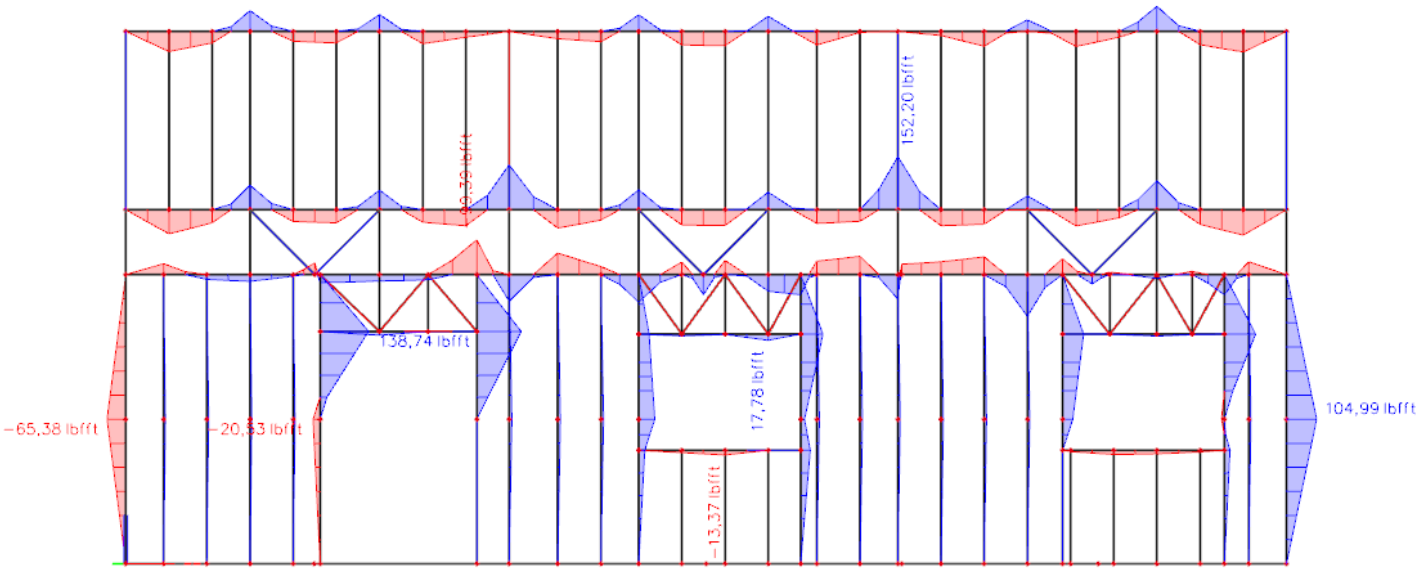


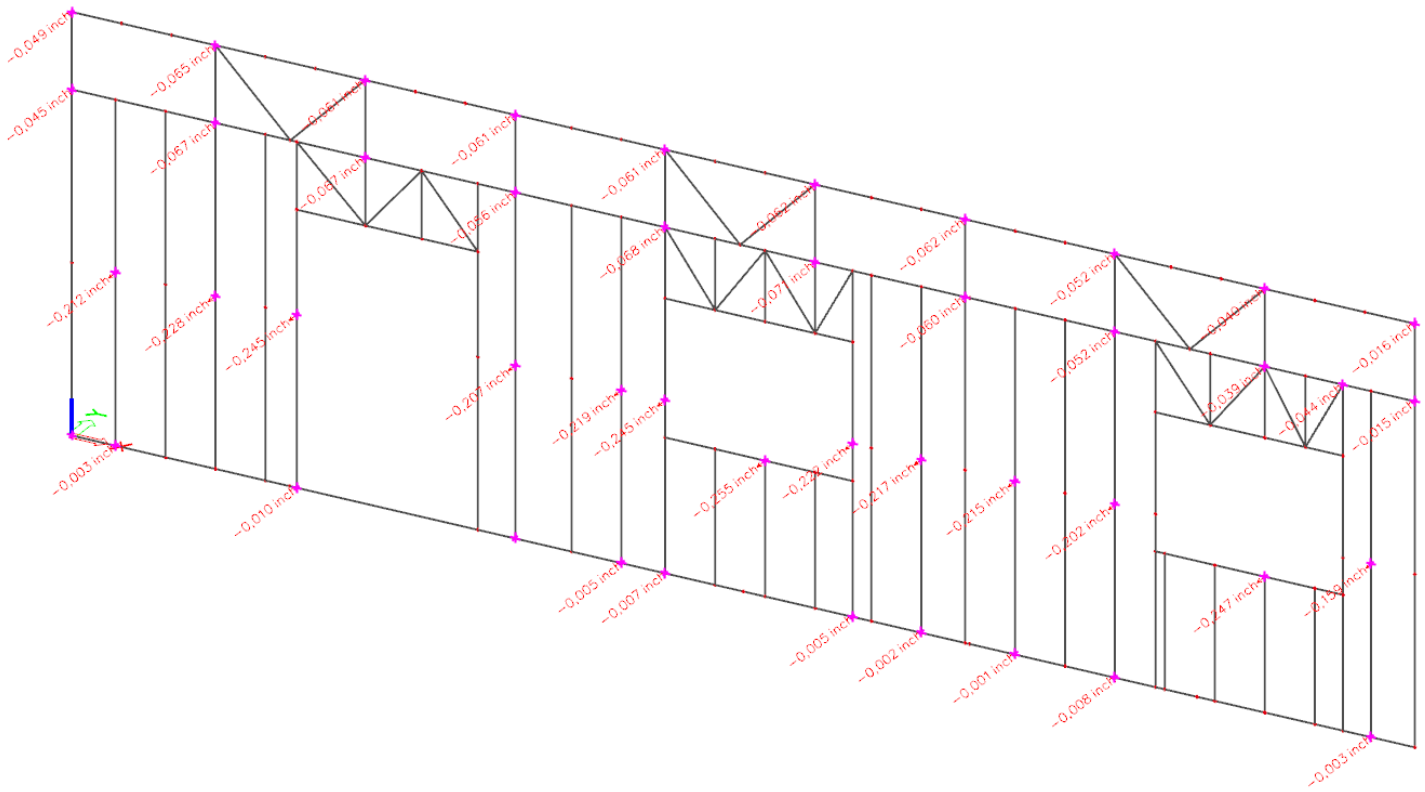
Diagram of bending moments Mz,
LRFD-Ult (auto)27 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L+Wy+, (lbf ft).



Displacement of nodes

Value: Uy

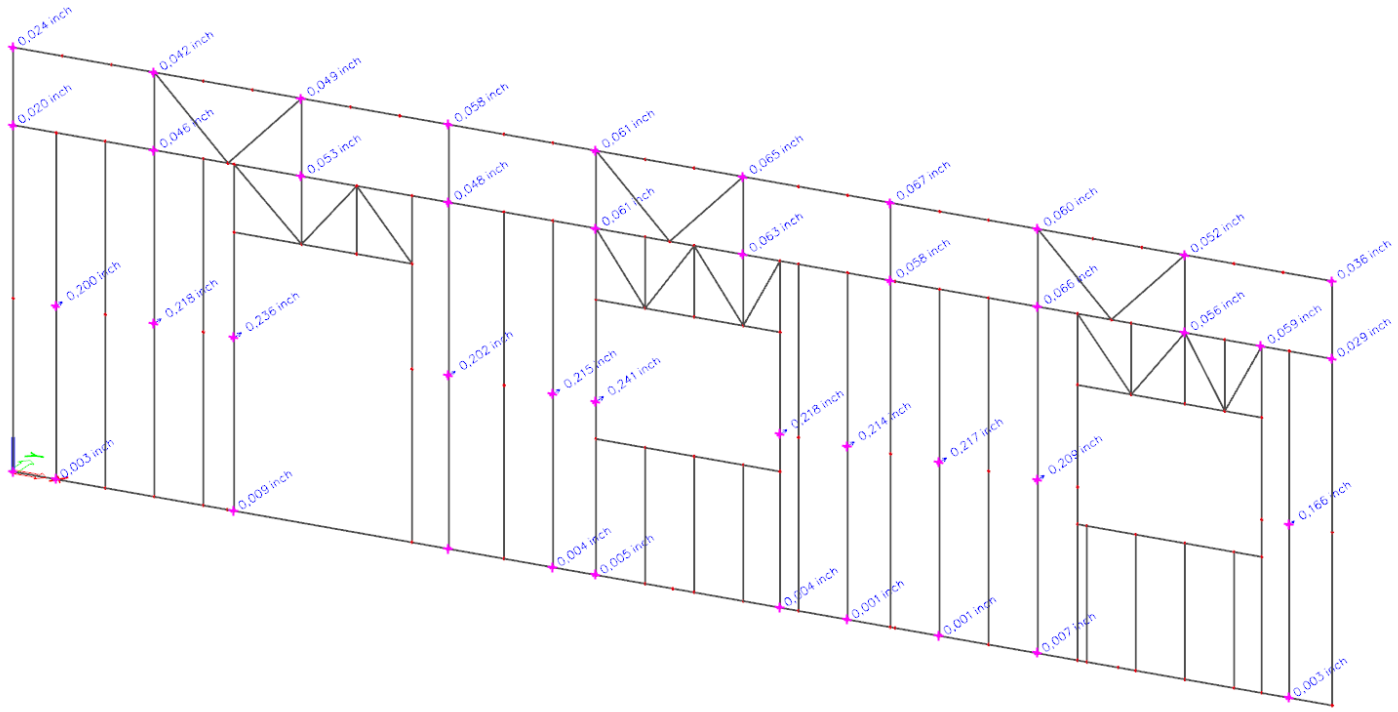
LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-, (inch).



Maximum horizontal displacement of wall studs is 0.245 inches, occur with a load combination LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-.
According to table 1604.3 the code IBC 2019 - the displacement limits L/240.
L = 8’ 11”= 8’x12”+11”=107”/240 =0.445” 0.245" < 0.445”
Deflection is OK!

Value: Uy

LRFD-Ult (auto)45 - 0.9xDL1+0.9xDL2+0.9xDL3+0.9xDL4+0.9xDL5+0.9xDL6+Wy-, (inch).



Steel wall member check LRFD

Steel member check B603

AISI S100-16 LRFD Check

Member B603	S362S162-33	A653 grade 33	LRFD-Ult (auto)	0.69

Material data		
Yield stress Fy	33.00	ksi
Tensile stress Fu	45.00	ksi
fabrication	cold formed	

The critical check is on position 4.46 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-1231.90	lbf
Vux	2.24	lbf
Vuy	0.00	lbf
Mut	0.00	lbfft
Mux	-198.77	lbfft
Muy	9.99	lbfft

...::Flexural Strength about X-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.389	31.308 24.284	0.78	0.518	107.459	0.540	1.000	0.360 -	- -	-	- -	-
3	1.403	33.000 33.000	1.00	3.391	54.075	0.781	0.920	1.290 -	0.597 0.693	37.95	0.000 0.000	0.360
5	3.403	31.308 -30.139	0.96	23.046	62.460	0.708	0.974	- 3.313	0.836 1.656	-	- -	-
7	1.403	-31.831 -31.831	-	-	-	-	-	- -	- -	-	- -	-
9	0.389	-23.115 -30.139	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Sxe	0.291	inch^3
Mnxo	799.81	lbfft
Resistance factor	0.90	
Unity check	0.28	-

Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.389	30.512 23.652	0.78	0.518	107.504	0.533	1.000	0.365 -	- -	-	- -	-
3	1.403	32.164 32.164	1.00	3.404	54.269	0.770	0.928	1.302 -	0.610 0.691	38.44	0.000 0.000	0.365
5	3.403	30.512 -29.498	0.97	23.149	62.741	0.697	0.982	- 3.340	0.842 1.670	-	- -	-
7	1.403	-31.150 -31.150	-	-	-	-	-	- -	- -	-	- -	-
9	0.389	-22.638 -29.498	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Lltb	4' 5.500"	ft
Sigma,ey	37.740	ksi
Kt	1.00	
Lt	4' 5.500"	ft
Sigma,t	27.866	ksi
Cb	1.30	
Sfx	0.306	inch^3
Fcre	74.648	ksi
Fc	32.164	ksi
Scx	0.292	inch^3

Table of values		
Mnx	783.43	lbfft
Resistance factor	0.90	
Unity check	0.28	-

Distortional Buckling Strength
According to article F4 and formula F4.1-2.

Table of values		
Sfy	0.306	inch^3
My	841.57	lbfft
L	1' 3.375"	ft
Beta	1.17	
k,phi,fe	103.75	lbf
k,phi,we	96.37	lbf
k,phi	0.00	lbf
k,phi,fg	0.004	inch^2
k,phi,wg	0.000	inch^2
Fd	58.145	ksi
Sf	0.306	inch^3
Mcrd	1482.82	lbfft
Lambda,d	0.75	
Mn	790.87	lbfft
Resistance factor	0.90	
Unity check	0.28	-

Data		
Lm	4' 5.500"	ft
Lcr	1' 3.375"	ft
h0	3.625	inch
Ixf	0.001	$inch^4$
Iyf	0.016	$inch^4$
Ixyf	0.002	$inch^4$
Cwf	0.000	$inch^6$
Jf	0.000	$inch^4$
x0f	0.566	inch
hxf	-1.012	inch
Af	0.067	$inch^2$
y0f	-0.055	inch
Ksi,web	2.00	

Number of compressed flanges: 1
Critical flange contains Initial shape parts: 2, 3, 1
...::Flexural Strength about Y-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.389	33.000 33.000	1.00	0.430	89.189	0.608	1.000	0.389 -	- -	-	- -	-
3	1.403	30.112 -13.127	0.44	12.793	203.991	0.384	1.000	- 1.403	0.408 0.702	-	- -	-
5	3.403	-16.015 -16.015	-	-	-	-	-	- -	- -	-	- -	-
7	1.403	30.112 -13.127	0.44	12.793	203.991	0.384	1.000	- 1.403	0.408 0.702	-	- -	-
9	0.389	33.000 33.000	1.00	0.430	89.189	0.608	1.000	0.389 -	- -	-	- -	-

Table of values		
Sye	0.091	$inch^3$
Mnyo	250.93	lbfft
Resistance factor	0.90	
Unity check	0.04	-

Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.2-1).

Table of values		
Sigma,ex	52.710	ksi
Kt	1.00	
Lt	4' 5.500"	ft
Sigma,t	27.866	ksi
Cs	-1.00	
CTF	0.60	
Sfy	0.091	$inch^3$
j	2.131	inch
Fcre	119.203	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.
Distortional Buckling Strength
According to article F4 and formula F4.1-2.

Table of values		
Sfy	0.091	$inch^3$
My	250.91	lbfft
L	1' 3.375"	ft
Beta	1.17	
k,phi,fe	103.75	lbf
k,phi,we	96.37	lbf
k,phi	0.00	lbf
k,phi,fg	0.004	$inch^2$
k,phi,wg	0.001	$inch^2$
Fd	45.950	ksi
Sf	0.091	$inch^3$
Mcrd	349.38	lbfft
Lambda,d	0.85	
Mn	219.22	lbfft
Resistance factor	0.90	
Unity check	0.05	-

Data		
Lm	4' 5.500"	ft
Lcr	1' 3.375"	ft
h0	3.625	inch
Ixf	0.001	$inch^4$
Iyf	0.016	$inch^4$
Ixyf	0.002	$inch^4$
Cwf	0.000	$inch^6$
Jf	0.000	$inch^4$
x0f	0.566	inch
hxf	-1.012	inch
Af	0.067	$inch^2$
y0f	-0.055	inch
Ksi,web	0.00	

Number of compressed flanges: 2
Critical flange contains Initial shape parts: 2, 3, 1

...::Axial Compression Strength::...
Nominal Axial Strength
According to article E2 and formula (E2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.389	33.000 33.000	1.00	0.430	89.189	0.608	1.000	0.360 -	- -	-	- -	-
3	1.403	33.000 33.000	1.00	3.391	54.075	0.781	0.920	1.290 -	0.597 0.693	37.95	0.000 0.000	0.360
5	3.403	33.000 33.000	1.00	4.000	10.841	1.745	0.501	1.705 -	- -	-	- -	-
7	1.403	33.000 33.000	1.00	3.391	54.075	0.781	0.920	1.290 -	0.597 0.693	37.95	0.000 0.000	0.360
9	0.389	33.000 33.000	1.00	0.430	89.189	0.608	1.000	0.360 -	- -	-	- -	-

Table of values		
Fn	33.000	ksi
Ae	0.194	$inch^2$
Pno	6386.52	lbf
Resistance factor	0.85	
Unity check	0.23	-

Buckling check
According to article E2 and formula (E2-1)
Flexural Buckling Strength
According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	sway	
Unbraced Length L	9	4 1/2	ft
Effective Length factor K	1.00	1.00	
Effective Length	9	4 1/2	ft
Slenderness	73.70	87.10	
Flexural Buckling stress Fcre	52.710	37.740	ksi

Torsional (-Flexural) Buckling Strength
According to article E2.2, E2.3, E2.4

Table of values		
Sigma,ex	52.710	ksi
Sigma,ey	37.740	ksi
Kt	1.00	
Lt	4 1/2	ft
Sigma,t	27.866	ksi
Sigma,TF	21.666	ksi
Torsional (-Flexural) buckling stress Fcre	21.666	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.389	17.444 17.444	1.00	0.430	89.189	0.442	1.000	0.389 -	- -	-	- -	-
3	1.403	17.444 17.444	1.00	3.468	55.299	0.562	1.000	1.403 -	0.702 0.702	52.20	0.000 0.000	0.389
5	3.403	17.444 17.444	1.00	4.000	10.841	1.268	0.652	2.217 -	- -	-	- -	-
7	1.403	17.444 17.444	1.00	3.468	55.299	0.562	1.000	1.403 -	0.702 0.702	52.20	0.000 0.000	0.389
9	0.389	17.444 17.444	1.00	0.430	89.189	0.442	1.000	0.389 -	- -	-	- -	-

Table of values		
Fe	21.666	ksi
lambda, c	1.23	
Fn	17.444	ksi
Ae	0.221	$inch^2$
Pn	3856.48	lbf
Resistance factor	0.85	
Unity check	0.38	-

Distortional Buckling Strength
According to article E4 and formula (E4.1-2).

Table of values		
Py	8683.60	lbf
L	1' 5.014"	ft
k,phi,fe	71.10	lbf
k,phi,we	60.71	lbf
k,phi	0.00	lbf
k,phi,fg	0.003	$inch^2$
k,phi,wg	0.001	$inch^2$
Fd	32.519	ksi
Pcrd	8556.96	lbf
Lambda,d	1.01	
Pn	6474.43	lbf
Resistance factor	0.85	
Unity check	0.22	-

Data		
Lm	4' 5.500"	ft
Lcr	1' 5.014"	ft
h0	3.625	inch
Ixf	0.001	$inch^4$
Iyf	0.016	$inch^4$
Ixyf	0.002	$inch^4$
Cwf	0.000	$inch^6$
Jf	0.000	$inch^4$
x0f	0.566	inch
hxf	-1.012	inch
Af	0.067	$inch^2$
y0f	-0.055	inch

Number of compressed flanges: 2
Critical flange contains Initial shape parts: 2, 3, 1

Combined Compressive Axial Load and Bending
According to article H1.2 and formulas (H1.2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.389	4.682 4.682	1.00	0.430	89.189	0.229	1.000	0.389 -	- -	-	- -	-
3	1.403	4.682 4.682	1.00	3.468	55.299	0.291	1.000	1.403 -	0.702 0.702	100.76	0.000 0.000	0.389
5	3.403	4.682 4.682	1.00	4.000	10.841	0.657	1.000	3.403 -	- -	-	- -	-
7	1.403	4.682 4.682	1.00	3.468	55.299	0.291	1.000	1.403 -	0.702 0.702	100.76	0.000 0.000	0.389
9	0.389	4.682 4.682	1.00	0.430	89.189	0.229	1.000	0.389 -	- -	-	- -	-

Table of values		
Mnx	783.43	lbfft
Mny	219.22	lbfft
PEx	13870.04	lbf
PEy	9930.78	lbf
Alfa x	0.91	
Alfa y	0.88	
Cmx	0.85	
Cmy	0.85	
Pn	3856.48	lbf
Pno	6386.52	lbf
Resistance factor compression	0.85	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check = 0.38+0.26+0.05 = 0.69 - (H1.2-1)
Unity check = 0.23+0.28+0.05 = 0.56 -

The member satisfies the check !

Steel member check B3457

AISI S100-16 LRFD Check

Member B3457	S362S162-54	A913 grade 50	LRFD-Ult (auto)	0.79

Material data		
Yield stress Fy	50.00	ksi
Tensile stress Fu	65.00	ksi
fabrication	cold formed	

The critical check is on position 5.83 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	734.58	lbf
Vux	2467.00	lbf
Vuy	-0.02	lbf
Mut	-0.00	lbfft
Mux	-7.01	lbfft
Muy	-280.27	lbfft

Nominal Tensile Strength
According to article D2 and formula (D2-1).

Table of values		
Tn	21232.26	lbf
Resistance factor	0.90	
Unity check	0.04	-

...::Flexural Strength about X-axis::...
Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Table of values		
Lltb	2.000"	ft
Sigma,ey	25990.417	ksi
Kt	1.00	
Lt	2.000"	ft
Sigma,t	18773.805	ksi
Cb	1.00	
Sfx	0.487	$inch^3$
Fcre	39053.833	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.

...::Flexural Strength about Y-axis::...

Nominal Flexural Strength

According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.359	-50.000 -50.000	-	-	-	-	-	- -	- -	-	- -	-
3	1.342	21.755 -44.418	2.04	66.371	3095.217	0.084	1.000	- 1.342	0.266 0.671	-	- -	-
5	3.342	27.337 27.337	1.00	4.000	30.079	0.953	0.807	2.697 -	- -	-	- -	-
7	1.342	21.755 -44.418	2.04	66.371	3095.217	0.084	1.000	- 1.342	0.266 0.671	-	- -	-
9	0.359	-50.000 -50.000	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Sye	0.138	inch^3
Mnyo	576.53	lbfft
Resistance factor	0.90	
Unity check	0.54	-

Lateral-Torsional Buckling Strength

According to article F2.1 and formula (F2.1-1),(F2.1.2-1).

Table of values		
Sigma,ex	258.071	ksi
Kt	1.00	
Lt	2.000"	ft
Sigma,t	18773.805	ksi
Cs	1.00	
CTF	0.41	
Sfy	0.288	inch^3
j	2.131	inch
Fcre	18018.549	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.

...::Shear Strength::...

Shear Strength

According to article G2.1 and formula (G2.1.1)

Shear force Vx

Element ID	Aw [inch^2]	Vn [lbf]
3	0.076	2278.72
5	0.000	0.00
7	0.076	2278.72

Table of values		
Vn,x	4557.43	lbf
Resistance factor	0.95	
Unity check	0.57	-

Combined Bending and Shear
According to article H2 and formula (H2-1)

Table of values		
Mnyo	576.53	lbfft
Vnx	4557.43	lbf
Resistance factor shear	0.95	
Resistance factor bending y	0.90	

Unity check (My, Vx) = sqrt(0.29+0.32) = 0.79

Combined Bending and Web Crippling
According to article H3 and formula H3b)

Table of values		
P	1.82	lbf
Pn	1020.92	lbf
M	7.01	lbfft
Mnxo	1944.30	lbfft
Resistance factor	0.90	
Unity check	0.00	-

Combined Tensile Axial Load and Bending
According to article H1.1 and formulas (H1.1-1), (H1.1-2)

Table of values		
Sftx	0.487	$inch^3$
Sfty	0.142	$inch^3$
Mnxt	2027.44	lbfft
Mnyt	590.11	lbfft
Mnx	1944.30	lbfft
Mny	576.53	lbfft
Tn	21232.26	lbf
Resistance factor tension	0.95	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check = 0.00+0.53+0.04 = 0.57 - (H1.1-1)
Unity check = 0.00+0.54-0.04 = 0.51 - (H1.1-2)

The member satisfies the check !

Steel member check B149

AISI S100-16 LRFD Check

Member B149	3 x 362S162-33	A653 grade 33	LRFD-Ult (auto)	0.70

Material data		
Yield stress Fy	33.00	ksi
Tensile stress Fu	45.00	ksi
fabrication	cold formed	

The critical check is on position 4.46 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-8503.52	lbf
Vux	3.28	lbf
Vuy	65.86	lbf
Mut	-0.00	lbfft
Mux	316.20	lbfft
Muy	-31.88	lbfft

Note: Mux and/or Muy include additional moments as defined in art. H1.2

...::Flexural Strength about X-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.483	27.217 21.396	0.79	0.513	69.140	0.627	1.000	0.483 -	- -	-	- -	-
2	1.590	27.217 27.217	1.00	4.000	49.635	0.741	0.949	1.510 -	- -	-	- -	-
3	1.813	8.038 -13.821	1.72	49.660	474.401	0.130	1.000	- 1.813	0.384 0.906	-	- -	-
4	1.590	-16.081 -16.081	-	-	-	-	-	- -	- -	-	- -	-
5	0.483	-10.260 -16.081	-	-	-	-	-	- -	- -	-	- -	-
6	0.483	8.038 8.038	1.00	0.430	57.923	0.373	1.000	0.483 -	- -	-	- -	-
7	1.590	27.217 8.038	0.30	6.109	303.228	0.300	1.000	- 1.590	0.588 1.002	-	- -	-
8	3.590	27.217 27.217	1.00	4.000	9.739	1.672	0.519	1.865 -	- -	-	- -	-
9	1.590	27.217 8.038	0.30	6.109	75.807	0.599	1.000	- 1.590	0.588 1.002	-	- -	-
10	0.483	8.038 8.038	1.00	0.430	57.923	0.373	1.000	0.483 -	- -	-	- -	-

11	0.483	-33.000 -33.000	-	-	-	-	-	- -	- -	-	- -	-
12	1.403	-16.081 -33.000	-	-	-	-	-	- -	- -	-	- -	-
13	3.590	-13.821 -13.821	-	-	-	-	-	- -	- -	-	- -	-
14	1.590	-13.821 -33.000	-	-	-	-	-	- -	- -	-	- -	-
15	0.483	-33.000 -33.000	-	-	-	-	-	- -	- -	-	- -	-
20	0.187	-13.821 -16.081	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Sxe	0.751	$inch^3$
Mnxo	2065.10	lbfft
Resistance factor	0.90	
Unity check	0.17	-

Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Table of values		
Lltb	4' 5.500"	ft
Sigma,ey	260.194	ksi
Kt	1.00	
Lt	4' 5.500"	ft
Sigma,t	108.590	ksi
Cb	1.67	
Sfx	1.096	$inch^3$
Fcre	645.702	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.
...::Flexural Strength about Y-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.483	-30.704 -30.704	-	-	-	-	-	- -	- -	-	- -	-
2	1.590	-11.278 -30.704	-	-	-	-	-	- -	- -	-	- -	-
3	1.813	-11.278 -11.278	-	-	-	-	-	- -	- -	-	- -	-
4	1.590	-11.278 -30.704	-	-	-	-	-	- -	- -	-	- -	-
5	0.483	-30.704 -30.704	-	-	-	-	-	- -	- -	-	- -	-
6	0.483	-4.959 -10.855	-	-	-	-	-	- -	- -	-	- -	-
7	1.590	-11.067 -11.067	-	-	-	-	-	- -	- -	-	- -	-
8	3.590	33.000 -10.855	0.33	11.352	27.639	1.093	0.731	- 2.624	0.788 1.312	-	- -	-

9	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	- 1.424	0.712 0.712	-	- -	-
10	0.483	33.000 27.104	0.82	0.498	67.043	0.702	0.978	0.472 -	- -	-	- -	-
11	0.483	-4.959 -10.855	-	-	-	-	-	- -	- -	-	- -	-
12	1.403	-10.855 -10.855	-	-	-	-	-	- -	- -	-	- -	-
13	3.590	33.000 -10.855	0.33	11.352	27.639	1.093	0.731	- 2.624	0.788 1.312	-	- -	-
14	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	- 1.424	0.712 0.712	-	- -	-
15	0.483	33.000 27.104	0.82	0.498	67.043	0.702	0.978	0.472 -	- -	-	- -	-
20	0.187	-11.067 -11.067	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Sye	0.752	$inch^3$
Mnyo	2068.04	lbfft
Resistance factor	0.90	
Unity check	0.02	-

Lateral-Torsional Buckling Strength

According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Table of values		
Sigma,ex	307.784	ksi
Kt	1.00	
Lt	4' 5.500"	ft
Sigma,t	108.590	ksi
Cb	1.00	
Sfy	0.834	$inch^3$
Fcre	553.745	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.

...::Shear Strength::...

Shear Strength

According to article G2.1 and formula (G2.1.1)

Shear force Vy

Element ID	Aw [$inch^2$]	Vn [lbf]
1	0.017	330.69
2	0.000	0.00
3	0.063	1241.78
4	0.000	0.00
5	0.017	330.69

Element ID	Aw [inch^2]	Vn [lbf]
6	0.000	0.00
7	0.110	2179.10
8	0.000	0.00
9	0.055	1089.55
10	0.000	0.00
11	0.000	0.00
12	0.049	961.17
13	0.000	0.00
14	0.055	1089.55
15	0.000	0.00
20	0.013	256.77

Table of values		
Vn,y	7479.29	lbf
Resistance factor	0.95	
Unity check	0.01	-

Combined Bending and Shear
According to article H2 and formula (H2-1)

Table of values		
Mnxo	2065.10	lbfft
Vny	7479.29	lbf
Resistance factor shear	0.95	
Resistance factor bending x	0.90	

Unity check (Mx, Vy) = sqrt(0.03+0.00) = 0.17

...::Axial Compression Strength::...
Nominal Axial Strength
According to article E2 and formula (E2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-
2	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
3	1.813	33.000 33.000	1.00	4.000	38.212	0.929	0.821	1.489 -	- -	-	- -	-
4	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
5	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-
6	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-
7	1.590	33.000 33.000	1.00	4.000	198.540	0.408	1.000	1.590 -	- -	-	- -	-
8	3.590	33.000 33.000	1.00	4.000	9.739	1.841	0.478	1.717 -	- -	-	- -	-
9	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
10	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-

11	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-
12	1.403	33.000 33.000	1.00	4.000	63.780	0.719	0.965	1.354 -	- -	-	- -	-
13	3.590	33.000 33.000	1.00	4.000	9.739	1.841	0.478	1.717 -	- -	-	- -	-
14	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
15	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-
20	0.187	33.000 33.000	1.00	4.000	14299.506	0.048	1.000	0.187 -	- -	-	- -	-

Table of values		
Fn	33.000	ksi
Ae	0.632	$inch^2$
Pno	20854.23	lbf
Resistance factor	0.85	
Unity check	0.48	-

Buckling check
According to article E2 and formula (E2-1)
Flexural Buckling Strength
According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	sway	
Unbraced Length L	4 1/2	4 1/2	ft
Effective Length factor K	1.00	1.00	
Effective Length	4 1/2	4 1/2	ft
Slenderness	30.50	33.17	
Flexural Buckling stress Fcre	307.784	260.194	ksi

Torsional (-Flexural) Buckling Strength
According to article E2.2, E2.3, E2.4

Table of values		
Sigma,ex	307.784	ksi
Sigma,ey	260.194	ksi
Kt	1.00	
Lt	4 1/2	ft
Sigma,t	108.590	ksi
Sigma,TF	88.774	ksi
Torsional (-Flexural) buckling stress Fcre	88.774	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.483	28.245 28.245	1.00	0.430	57.923	0.698	0.981	0.473 -	- -	-	- -	-
2	1.590	28.245 28.245	1.00	4.000	49.635	0.754	0.939	1.493 -	- -	-	- -	-
3	1.813	28.245 28.245	1.00	4.000	38.212	0.860	0.865	1.569 -	- -	-	- -	-
4	1.590	28.245 28.245	1.00	4.000	49.635	0.754	0.939	1.493 -	- -	-	- -	-
5	0.483	28.245 28.245	1.00	0.430	57.923	0.698	0.981	0.473 -	- -	-	- -	-

6	0.483	28.245 28.245	1.00	0.430	57.923	0.698	0.981	0.473 -	- -	-	- -	-
7	1.590	28.245 28.245	1.00	4.000	198.540	0.377	1.000	1.590 -	- -	-	- -	-
8	3.590	28.245 28.245	1.00	4.000	9.739	1.703	0.511	1.836 -	- -	-	- -	-
9	1.590	28.245 28.245	1.00	4.000	49.635	0.754	0.939	1.493 -	- -	-	- -	-
10	0.483	28.245 28.245	1.00	0.430	57.923	0.698	0.981	0.473 -	- -	-	- -	-
11	0.483	28.245 28.245	1.00	0.430	57.923	0.698	0.981	0.473 -	- -	-	- -	-
12	1.403	28.245 28.245	1.00	4.000	63.780	0.665	1.000	1.403 -	- -	-	- -	-
13	3.590	28.245 28.245	1.00	4.000	9.739	1.703	0.511	1.836 -	- -	-	- -	-
14	1.590	28.245 28.245	1.00	4.000	49.635	0.754	0.939	1.493 -	- -	-	- -	-
15	0.483	28.245 28.245	1.00	0.430	57.923	0.698	0.981	0.473 -	- -	-	- -	-
20	0.187	28.245 28.245	1.00	4.000	14299.506	0.044	1.000	0.187 -	- -	-	- -	-

Table of values		
Fe	88.774	ksi
lambda, c	0.61	
Fn	28.245	ksi
Ae	0.658	$inch^2$
Pn	18597.16	lbf
Resistance factor	0.85	
Unity check	0.54	-

Combined Compressive Axial Load and Bending

According to article H1.2 and formulas (H1.2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.483	10.818 10.818	1.00	0.430	57.923	0.432	1.000	0.483 -	- -	-	- -	-
2	1.590	10.818 10.818	1.00	4.000	49.635	0.467	1.000	1.590 -	- -	-	- -	-
3	1.813	10.818 10.818	1.00	4.000	38.212	0.532	1.000	1.813 -	- -	-	- -	-
4	1.590	10.818 10.818	1.00	4.000	49.635	0.467	1.000	1.590 -	- -	-	- -	-
5	0.483	10.818 10.818	1.00	0.430	57.923	0.432	1.000	0.483 -	- -	-	- -	-

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
6	0.483	10.818 10.818	1.00	0.430	57.923	0.432	1.000	0.483 -	- -	-	- -	-
7	1.590	10.818 10.818	1.00	4.000	198.540	0.233	1.000	1.590 -	- -	-	- -	-
8	3.590	10.818 10.818	1.00	4.000	9.739	1.054	0.751	2.696 -	- -	-	- -	-
9	1.590	10.818 10.818	1.00	4.000	49.635	0.467	1.000	1.590 -	- -	-	- -	-
10	0.483	10.818 10.818	1.00	0.430	57.923	0.432	1.000	0.483 -	- -	-	- -	-
11	0.483	10.818 10.818	1.00	0.430	57.923	0.432	1.000	0.483 -	- -	-	- -	-
12	1.403	10.818 10.818	1.00	4.000	63.780	0.412	1.000	1.403 -	- -	-	- -	-
13	3.590	10.818 10.818	1.00	4.000	9.739	1.054	0.751	2.696 -	- -	-	- -	-
14	1.590	10.818 10.818	1.00	4.000	49.635	0.467	1.000	1.590 -	- -	-	- -	-
15	0.483	10.818 10.818	1.00	0.430	57.923	0.432	1.000	0.483 -	- -	-	- -	-
20	0.187	10.818 10.818	1.00	4.000	14299.506	0.028	1.000	0.187 -	- -	-	- -	-

Table of values		
Centerline shift ex	0.066	inch
Centerline shift ey	-0.032	inch
Additional moment Mx	22.57	lbfft
Additional moment My	-46.49	lbfft
Mnx	2065.10	lbfft
Mny	2068.04	lbfft
PEx	241933.93	lbf
PEy	204525.87	lbf
Alfa x	0.96	
Alfa y	0.96	
Cmx	0.85	
Cmy	0.85	
Pn	18597.16	lbf
Pno	20854.23	lbf
Resistance factor compression	0.85	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check = 0.54+0.15+0.02 = 0.70 - (H1.2-1)
Unity check = 0.48+0.17+0.02 = 0.67 -

The member satisfies the check !

Steel member check B208

AISI S100-16 LRFD Check

Member B208	2 x 362S162-33	A653 grade 33	LRFD-Ult (auto)	0.55

Material data		
Yield stress Fy	33.00	ksi
Tensile stress Fu	45.00	ksi
fabrication	cold formed	

The critical check is on position 7.17 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-1249.11	lbf
Vux	107.28	lbf
Vuy	-0.00	lbf
Mut	-0.14	lbfft
Mux	-0.00	lbfft
Muy	293.43	lbfft

...::Flexural Strength about Y-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.483	4.847 4.847	1.00	4.000	2155.289	0.047	1.000	0.483 -	- -	-	- -	-
2	1.590	4.544 -23.306	5.13	476.649	5914.608	0.028	1.000	- 1.590	0.196 0.795	-	- -	-
3	3.590	-23.306 -23.306	-	-	-	-	-	- -	- -	-	- -	-
4	1.590	4.544 -23.306	5.13	476.649	5914.608	0.028	1.000	- 1.590	0.196 0.795	-	- -	-
5	0.483	4.847 4.847	1.00	4.000	2155.289	0.047	1.000	0.483 -	- -	-	- -	-
6	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-
7	1.590	33.000 5.150	0.16	6.890	85.496	0.621	1.000	- 1.590	0.559 1.031	-	- -	-
8	2.625	5.150 5.150	1.00	4.000	18.220	0.532	1.000	2.625 -	- -	-	- -	-
9	1.590	33.000 5.150	0.16	6.890	85.496	0.621	1.000	- 1.590	0.559 1.031	-	- -	-
10	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-

Table of values		
Sye	0.286	$inch^3$
Mnyo	787.36	lbfft
Resistance factor	0.90	
Unity check	0.41	-

Lateral-Torsional Buckling Strength
According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Table of values		
Sigma,ex	52.577	ksi
Kt	1.00	
Lt	2' 8.500"	ft
Sigma,t	275.063	ksi
Cb	1.00	
Sfy	0.286	$inch^3$
Fcre	559.079	ksi

Note: Lateral-Torsional buckling is not governing since Fe is greater than or equal to 2.78 Fy.

...::Shear Strength::...
Shear Strength
According to article G2.1 and formula (G2.1.1)
Shear force Vx

Element ID	Aw [$inch^2$]	Vn [lbf]
1	0.000	0.00
2	0.055	1089.55
3	0.000	0.00
4	0.055	1089.55
5	0.000	0.00
6	0.000	0.00
7	0.055	1089.55
8	0.000	0.00
9	0.055	1089.55
10	0.000	0.00

Table of values		
Vn,x	4358.21	lbf
Resistance factor	0.95	
Unity check	0.03	-

Combined Bending and Shear
According to article H2 and formula (H2-1)

Table of values		
Mnyo	787.36	lbfft
Vnx	4358.21	lbf
Resistance factor shear	0.95	
Resistance factor bending y	0.90	

Unity check (My, Vx) = sqrt(0.17+0.00) = 0.41

...::Axial Compression Strength::...

Nominal Axial Strength

According to article E2 and formula (E2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.483	33.000 33.000	1.00	4.000	2155.289	0.124	1.000	0.483 -	- -	-	- -	-
2	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
3	3.590	33.000 33.000	1.00	4.000	9.739	1.841	0.478	1.717 -	- -	-	- -	-
4	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
5	0.483	33.000 33.000	1.00	4.000	2155.289	0.124	1.000	0.483 -	- -	-	- -	-
6	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-
7	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
8	2.625	33.000 33.000	1.00	4.000	18.220	1.346	0.622	1.632 -	- -	-	- -	-
9	1.590	33.000 33.000	1.00	4.000	49.635	0.815	0.896	1.424 -	- -	-	- -	-
10	0.483	33.000 33.000	1.00	0.430	57.923	0.755	0.939	0.453 -	- -	-	- -	-

Table of values		
Fn	33.000	ksi
Ae	0.412	inch^2
Pno	13581.43	lbf
Resistance factor	0.85	
Unity check	0.11	-

Buckling check

According to article E2 and formula (E2-1)

Flexural Buckling Strength

According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	non-sway	
Unbraced Length L	9	2 3/4	ft
Effective Length factor K	1.00	0.76	
Effective Length	9	2 1/8	ft
Slenderness	73.79	24.12	
Flexural Buckling stress Fcre	52.577	492.194	ksi

Torsional (-Flexural) Buckling Strength
According to article E2.2, E2.3, E2.4

Table of values		
Sigma,ex	52.577	ksi
Sigma,ey	492.194	ksi
Kt	1.00	
Lt	2 3/4	ft
Sigma,t	275.063	ksi
Sigma,TF	47.487	ksi
Torsional (-Flexural) buckling stress Fcre	47.487	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.483	24.671 24.671	1.00	4.000	2155.289	0.107	1.000	0.483 -	- -	-	- -	-
2	1.590	24.671 24.671	1.00	4.000	49.635	0.705	0.976	1.552 -	- -	-	- -	-
3	3.590	24.671 24.671	1.00	4.000	9.739	1.592	0.541	1.944 -	- -	-	- -	-
4	1.590	24.671 24.671	1.00	4.000	49.635	0.705	0.976	1.552 -	- -	-	- -	-
5	0.483	24.671 24.671	1.00	4.000	2155.289	0.107	1.000	0.483 -	- -	-	- -	-
6	0.483	24.671 24.671	1.00	0.430	57.923	0.653	1.000	0.483 -	- -	-	- -	-
7	1.590	24.671 24.671	1.00	4.000	49.635	0.705	0.976	1.552 -	- -	-	- -	-
8	2.625	24.671 24.671	1.00	4.000	18.220	1.164	0.697	1.829 -	- -	-	- -	-
9	1.590	24.671 24.671	1.00	4.000	49.635	0.705	0.976	1.552 -	- -	-	- -	-
10	0.483	24.671 24.671	1.00	0.430	57.923	0.653	1.000	0.483 -	- -	-	- -	-

Table of values		
Fe	47.487	ksi
lambda, c	0.83	
Fn	24.671	ksi
Ae	0.446	inch^2
Pn	11002.41	lbf
Resistance factor	0.85	
Unity check	0.13	-

Combined Compressive Axial Load and Bending
According to article H1.2 and formulas (C5.2.1-3)

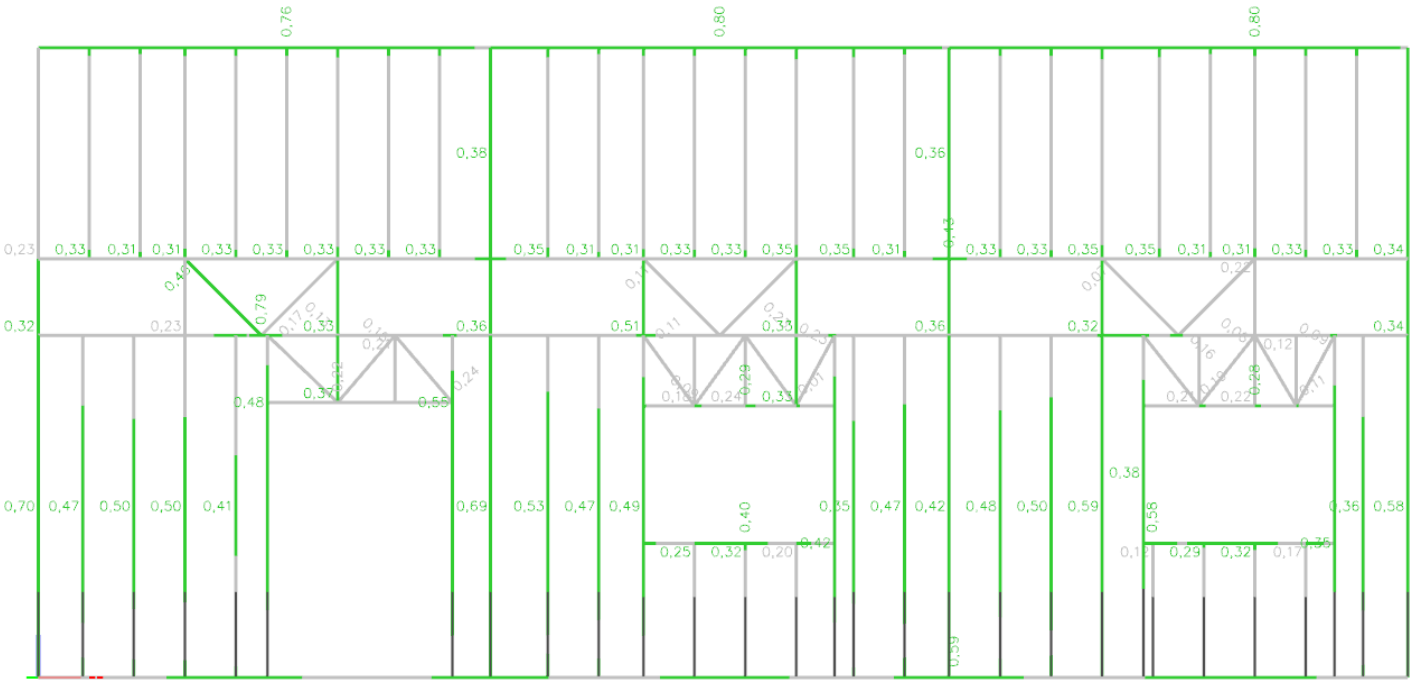
Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch ^{4}]	ds [inch]
1	0.483	2.384 2.384	1.00	4.000	2155.289	0.033	1.000	0.483 -	- -	-	- -	-
2	1.590	2.384 2.384	1.00	4.000	49.635	0.219	1.000	1.590 -	- -	-	- -	-
3	3.590	2.384 2.384	1.00	4.000	9.739	0.495	1.000	3.590 -	- -	-	- -	-
4	1.590	2.384 2.384	1.00	4.000	49.635	0.219	1.000	1.590 -	- -	-	- -	-
5	0.483	2.384 2.384	1.00	4.000	2155.289	0.033	1.000	0.483 -	- -	-	- -	-
6	0.483	2.384 2.384	1.00	0.430	57.923	0.203	1.000	0.483 -	- -	-	- -	-
7	1.590	2.384 2.384	1.00	4.000	49.635	0.219	1.000	1.590 -	- -	-	- -	-
8	2.625	2.384 2.384	1.00	4.000	18.220	0.362	1.000	2.625 -	- -	-	- -	-
9	1.590	2.384 2.384	1.00	4.000	49.635	0.219	1.000	1.590 -	- -	-	- -	-
10	0.483	2.384 2.384	1.00	0.430	57.923	0.203	1.000	0.483 -	- -	-	- -	-

Table of values		
Mny	787.36	lbfft
Pn	11002.41	lbf
Resistance factor compression	0.85	
Resistance factor bending y	0.90	

Unity check = 0.13+0.00+0.41 = 0.55 - (C5.2.1-3)

The member satisfies the check !

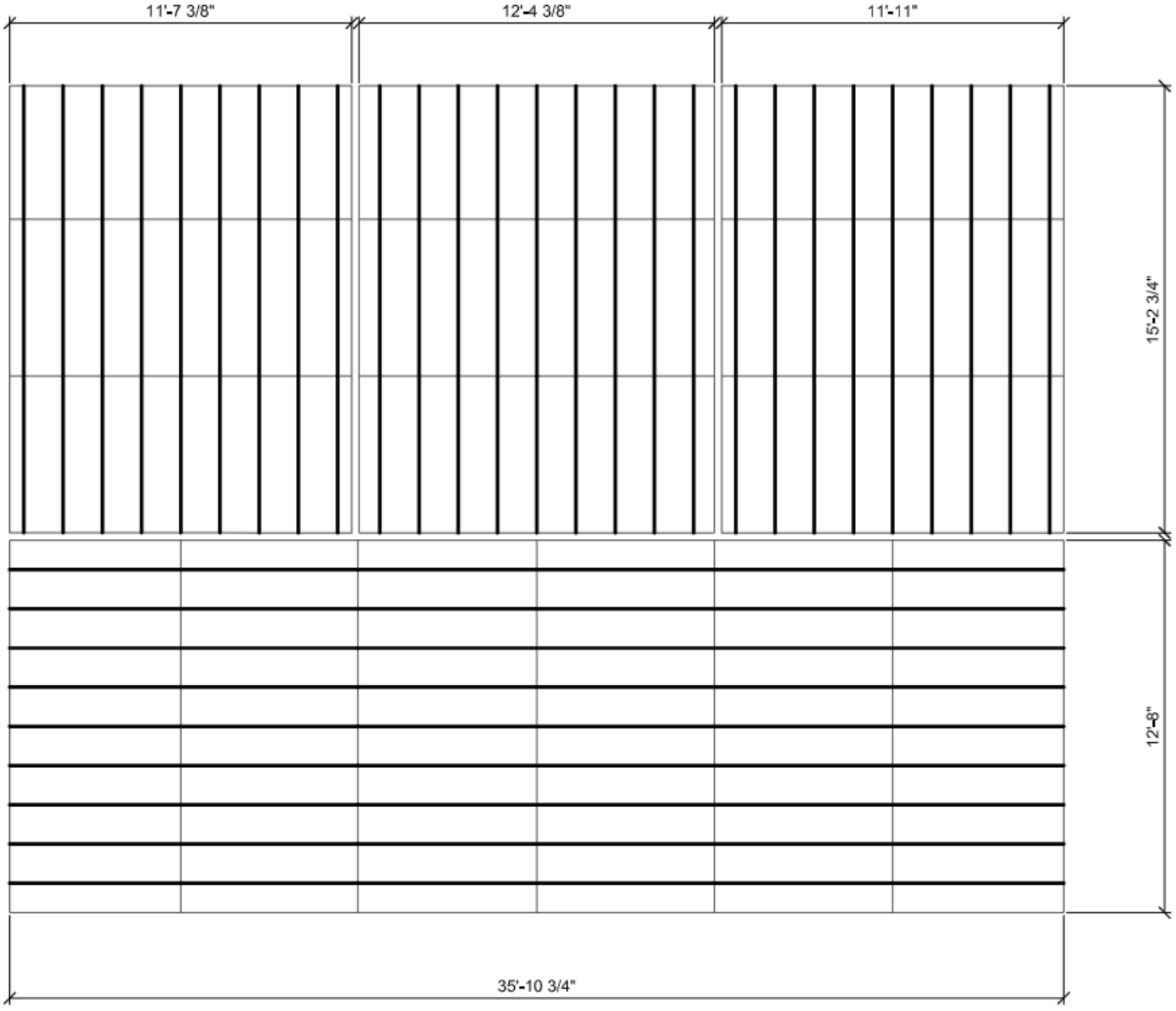
Unity check



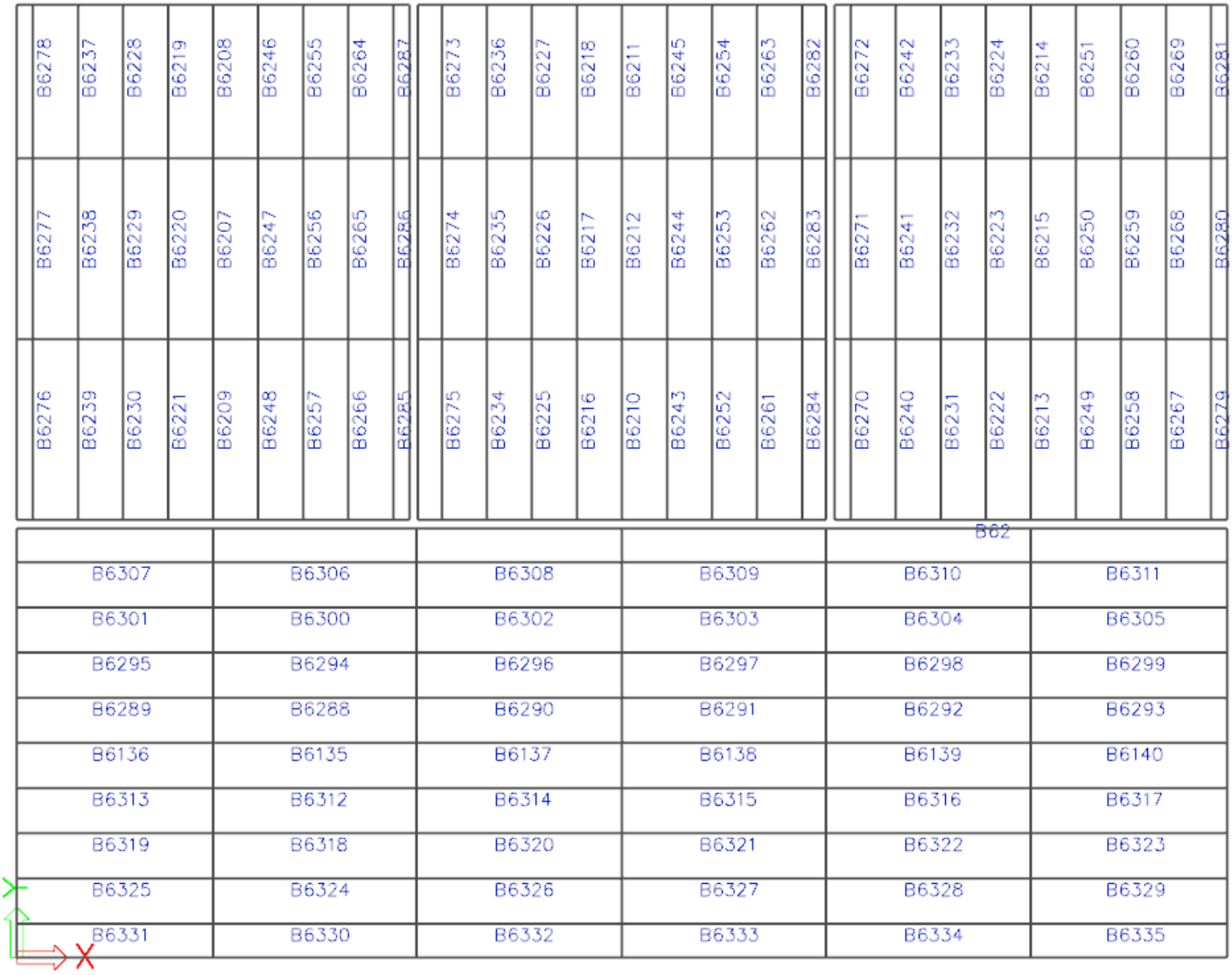
2.4.4 FLOOR JOIST CHECK

Floor joist spacing 16 inch.

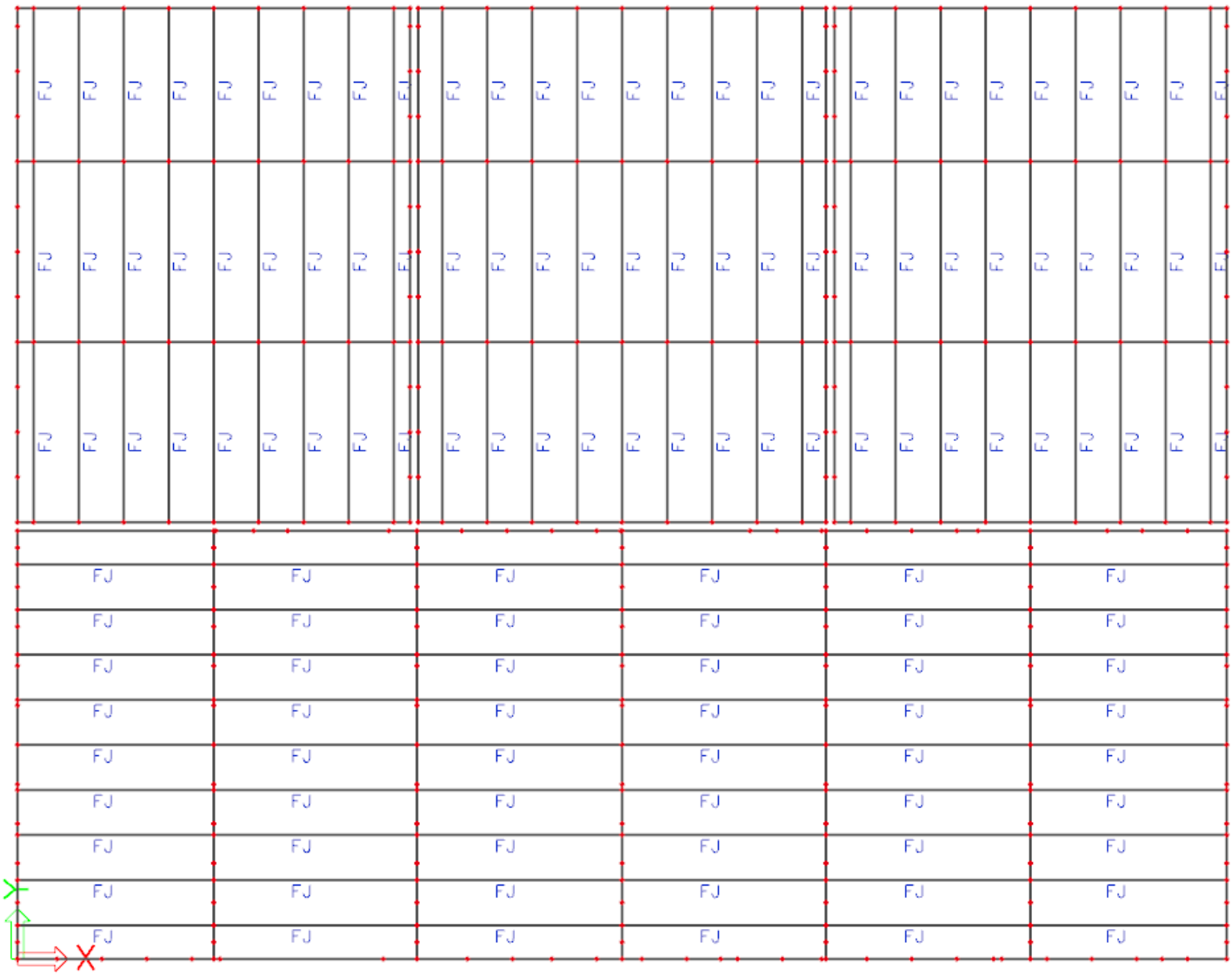
Analytic model



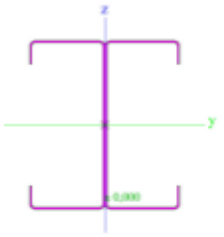
Member numbers



Cross-sections floors joists element.



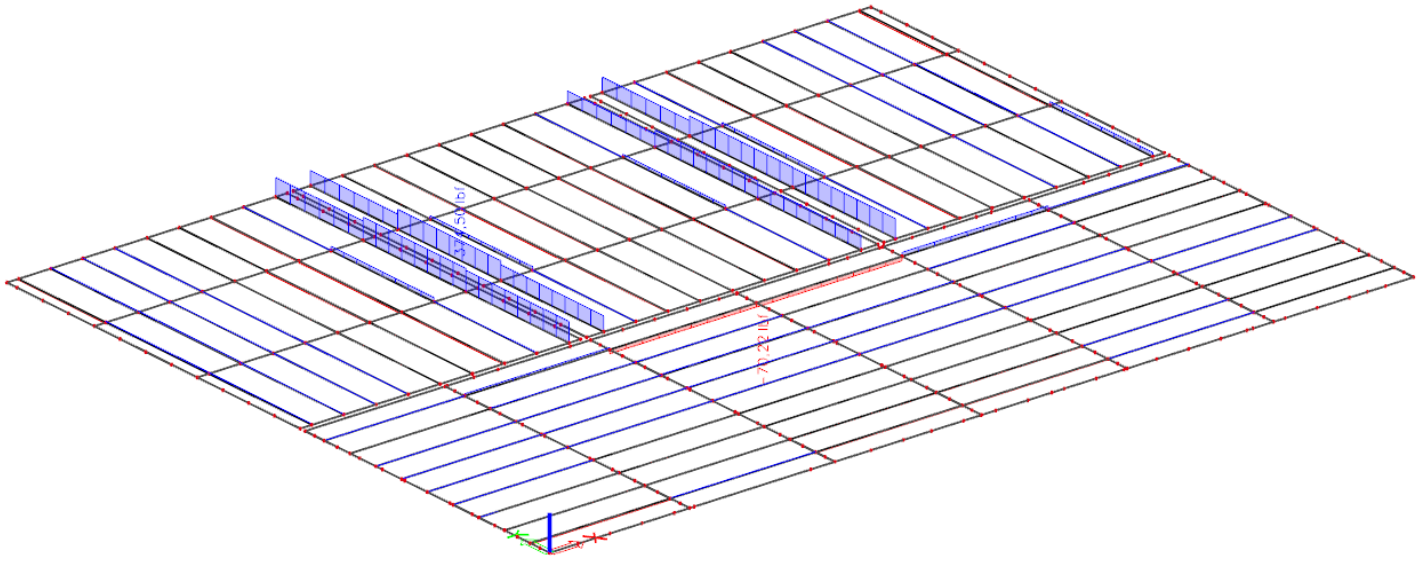
Cross-section Properties: FJ

FJ		
Type	2CFCo	
Detailed	S362S162-43; 0,000	
Shape type	Thin-walled	
Item material	A653 grade 33	
Fabrication	cold formed	
Colour		
A [inch²]	0,679	
A_y [inch²], A_z [inch²]	0,288	0,346
A_L [inch²/inch], A_D [inch²/inch]	2,35e+01	2,35e+01
$c_{y,ucs}$ [inch], $c_{z,ucs}$ [inch]	1,625	1,812
α [deg]	0,00	
I_y [inch⁴], I_z [inch⁴]	1,419	0,450
i_y [inch], i_z [inch]	1,445	0,814
$W_{el,y}$ [inch³], $W_{el,z}$ [inch³]	0,783	0,277
$W_{pl,y}$ [inch³], $W_{pl,z}$ [inch³]	0,906	0,365
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	2,99e+04	2,99e+04
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	1,20e+04	1,20e+04
d_y [inch], d_z [inch]	0,000	0,000
I_t [inch⁴], I_w [inch⁶]	0,001	1,634
β_y [inch], β_z [inch]	0,000	0,000
Picture		

Force diagram

Axial force diagram N,

LRFD-Ult (auto)4 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L, (lbf).



Shear force diagram Vz, (lbf)

LRFD-Ult (auto)4 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L, (lbf).

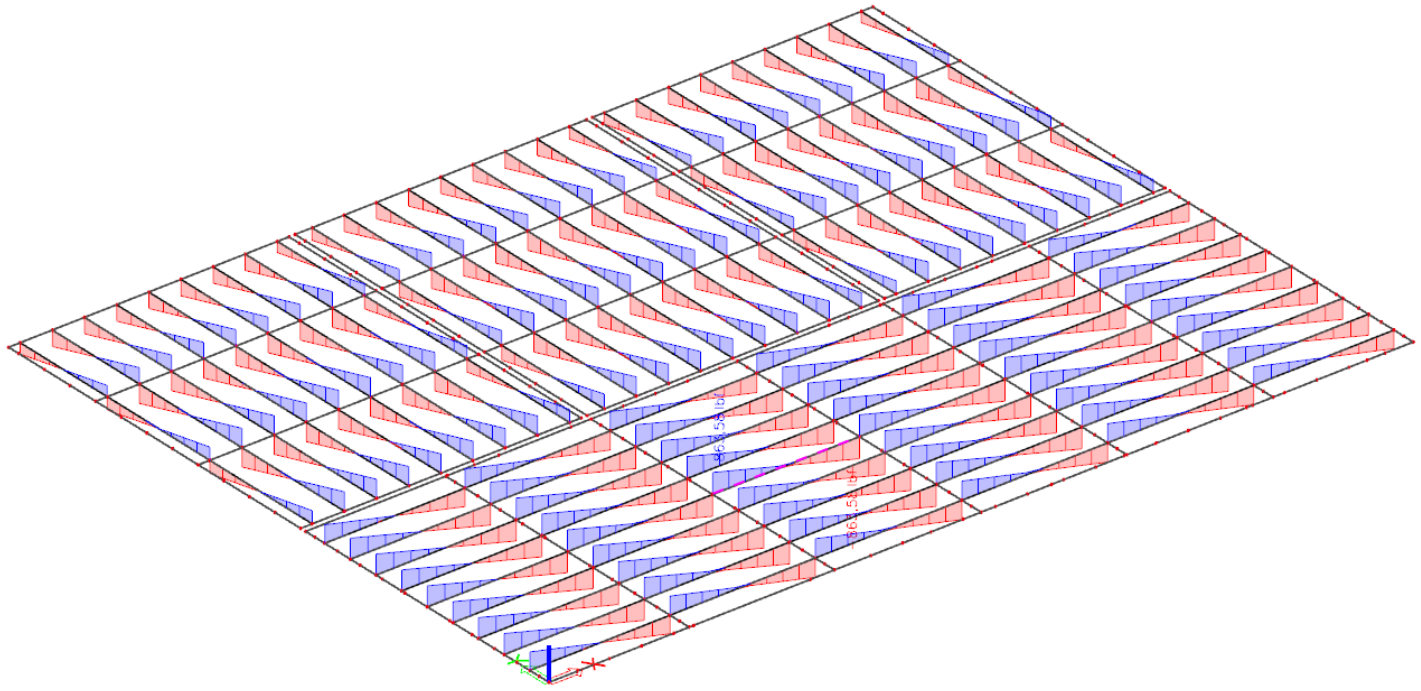
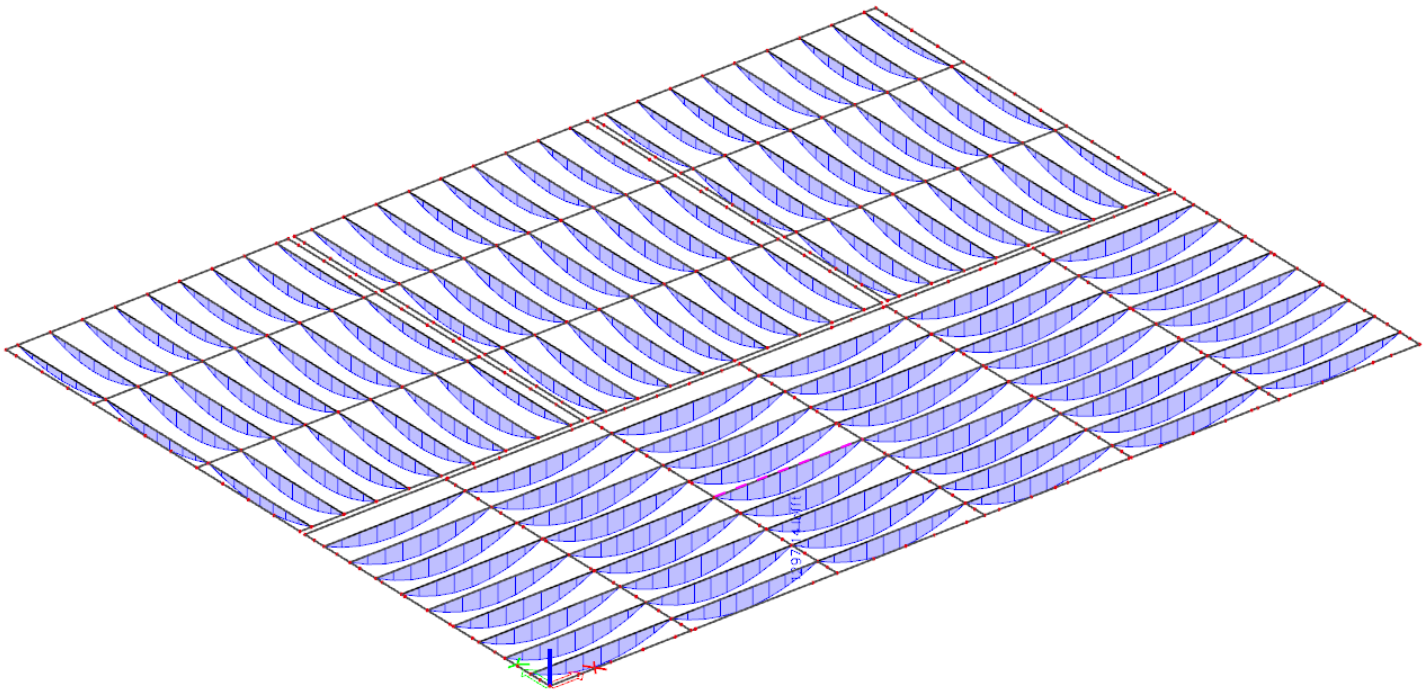


Diagram of bending moments My, (lbf*ft)

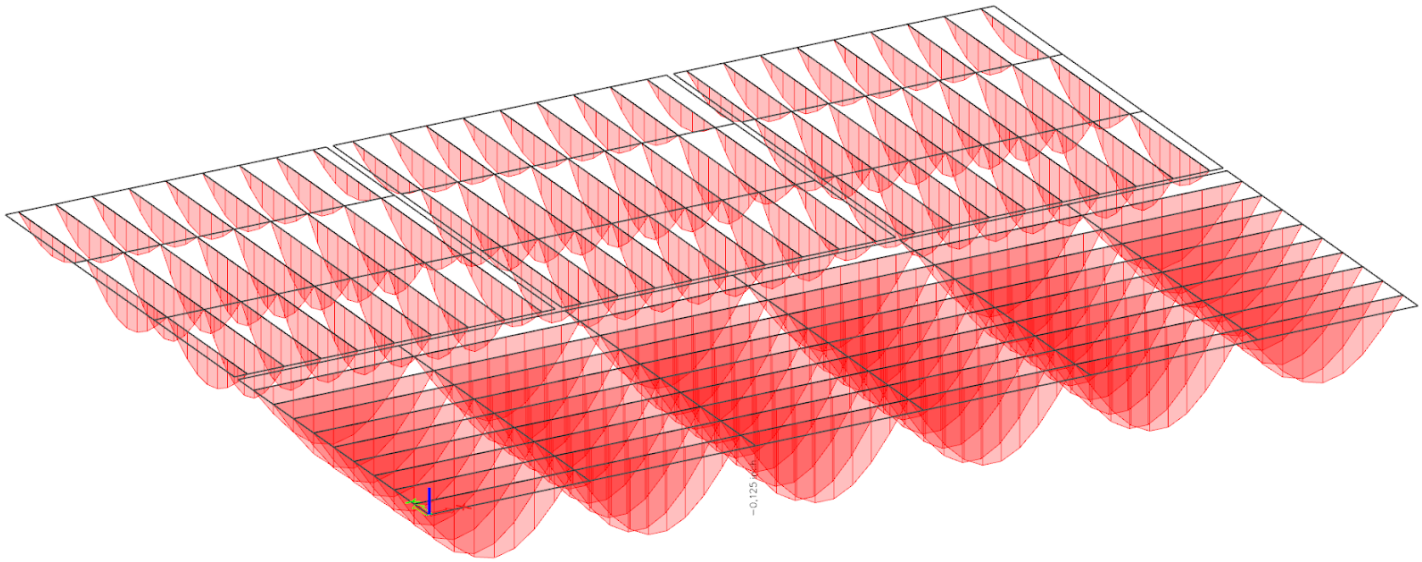
LRFD-Ult (auto)4 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+1.6*L, (lbf ft).



DEFLECTIONS

Diagram vertical deflection in the direction of the Z axis

Combination #4 LRFD-Ult (auto)4 - 1.2*DL1+1.2*DL2+1.2*DL3+1.2*DL4+1.2*DL5+1.6*L



The maximum deflection is 0.125" according to table 1604.3 the code IBC 2019 - the deflection limits L/360. L = 6'-2"= 6'*12"+2"=74". 74"/360 =0.205"
0.125" < 0.205" <u>Deflection is OK!</u>

Steel floor joist check LRFD

Steel member check B6300

AISI S100-16 LRFD Check

Member B6300	2CFCo (S(SSMA)362S162-43; 0,000)	A653 grade 33	LRFD-Ult (auto)	0.71

Material data		
Yield stress Fy	33.00	ksi
Tensile stress Fu	45.00	ksi
fabrication	cold formed	

The critical check is on position 2.68 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-439.99	lbf
Vux	0.00	lbf
Vuy	94.95	lbf
Mut	-0.02	lbfft
Mux	1270.36	lbfft
Muy	-0.00	lbfft

...::Flexural Strength about X-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch⁴]	ds [inch]
1	0.384	-24.198 -31.272	-	-	-	-	-	- -	- -	-	- -	-
3	1.392	-33.000 -33.000	-	-	-	-	-	- -	- -	-	- -	-
5	3.392	31.272 -31.272	1.00	24.000	111.209	0.530	1.000	- 3.392	0.848 1.696	-	- -	-
7	1.392	33.000 33.000	1.00	3.455	95.017	0.589	1.000	1.392 -	0.696 0.696	37.95	0.000 0.000	0.384
9	0.384	31.272 24.198	0.77	0.519	187.967	0.408	1.000	0.384 -	- -	-	- -	-
10	0.384	31.272 24.198	0.77	0.519	187.967	0.408	1.000	0.384 -	- -	-	- -	-
12	1.392	33.000 33.000	1.00	3.455	95.017	0.589	1.000	1.392 -	0.696 0.696	37.95	0.000 0.000	0.384
14	3.392	31.272 -31.272	1.00	24.000	111.209	0.530	1.000	- 3.392	0.848 1.696	-	- -	-
16	1.392	-33.000 -33.000	-	-	-	-	-	- -	- -	-	- -	-
18	0.384	-24.198 -31.272	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Sxe	0.783	$inch^3$
Mnxo	2152.97	lbfft
Resistance factor	0.90	
Unity check	0.66	-

Lateral-Torsional Buckling Strength

According to article F2.1 and formula (F2.1-1),(F2.1.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.384	-23.508 -30.380	-	-	-	-	-	- -	- -	-	- -	-
3	1.392	-32.060 -32.060	-	-	-	-	-	- -	- -	-	- -	-
5	3.392	30.380 -30.380	1.00	24.000	111.209	0.523	1.000	- 3.392	0.848 1.696	-	- -	-
7	1.392	32.060 32.060	1.00	3.455	95.017	0.581	1.000	1.392 -	0.696 0.696	38.50	0.000 0.000	0.384
9	0.384	30.380 23.508	0.77	0.519	187.967	0.402	1.000	0.384 -	- -	-	- -	-

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
10	0.384	30.380 23.508	0.77	0.519	187.967	0.402	1.000	0.384 -	- -	-	- -	-
12	1.392	32.060 32.060	1.00	3.455	95.017	0.581	1.000	1.392 -	0.696 0.696	38.50	0.000 0.000	0.384
14	3.392	30.380 -30.380	1.00	24.000	111.209	0.523	1.000	- 3.392	0.848 1.696	-	- -	-
16	1.392	-32.060 -32.060	-	-	-	-	-	- -	- -	-	- -	-
18	0.384	-23.508 -30.380	-	-	-	-	-	- -	- -	-	- -	-

Table of values		
Lltb	6' 0.250"	ft
Sigma,ey	36.301	ksi
Kt	1.00	
Lt	6' 0.250"	ft
Sigma,t	54.231	ksi
Cb	1.14	
Sfx	0.783	$inch^3$
Fcre	72.955	ksi
Fc	32.060	ksi
Scx	0.783	$inch^3$
Mnx	2091.62	lbfft
Resistance factor	0.90	
Unity check	0.67	-

Distortional Buckling Strength
According to article F4 and formula F4.1-2.

Table of values		
Sfy	0.783	$inch^3$
My	2152.97	lbfft
L	1' 1.117"	ft
Beta	1.00	
k,phi,fe	253.79	lbf
k,phi,we	230.64	lbf
k,phi	0.00	lbf
k,phi,fg	0.007	$inch^2$
k,phi,wg	0.000	$inch^2$
Fd	69.475	ksi
Sf	0.783	$inch^3$
Mcrd	4532.63	lbfft
Lambda,d	0.69	
Mn	2126.70	lbfft
Resistance factor	0.90	
Unity check	0.66	-

Data		
Lm	6' 0.250"	ft
Lcr	1' 1.117"	ft
h0	3.392	inch
Ixf	0.001	$inch^4$
Iyf	0.021	$inch^4$
Ixyf	0.003	$inch^4$
Cwf	0.000	$inch^6$
Jf	0.000	$inch^4$
x0f	-0.563	inch
hxf	1.005	inch
Af	0.087	$inch^2$
y0f	0.054	inch
Ksi,web	2.00	

Number of compressed flanges: 2
Critical flange contains Initial shape parts: 11, 12, 10

...::Shear Strength::...
Shear Strength
According to article G2.1 and formula (G2.1.1)
Shear force Vy

Element ID	Aw [$inch^2$]	Vn [lbf]
3	0.000	0.00
5	0.153	2759.99
7	0.000	0.00
12	0.000	0.00
14	0.153	2759.99
16	0.000	0.00

Table of values		
Vn,y	5519.99	lbf
Resistance factor	0.95	
Unity check	0.02	-

Combined Bending and Shear
According to article H2 and formula (H2-1)

Table of values		
Mnxo	2152.97	lbfft
Vny	5519.99	lbf
Resistance factor shear	0.95	
Resistance factor bending x	0.90	

Unity check (Mx, Vy) = sqrt(0.43+0.00) = 0.66

...::Axial Compression Strength::...
Nominal Axial Strength
According to article E2 and formula (E2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.384	33.000 33.000	1.00	0.430	155.749	0.460	1.000	0.384 -	- -	-	- -	-
3	1.392	33.000 33.000	1.00	3.455	95.017	0.589	1.000	1.392 -	0.696 0.696	37.95	0.000 0.000	0.384
5	3.392	33.000 33.000	1.00	4.000	18.535	1.334	0.626	2.123 -	- -	-	- -	-
7	1.392	33.000 33.000	1.00	3.455	95.017	0.589	1.000	1.392 -	0.696 0.696	37.95	0.000 0.000	0.384
9	0.384	33.000 33.000	1.00	0.430	155.749	0.460	1.000	0.384 -	- -	-	- -	-
10	0.384	33.000 33.000	1.00	0.430	155.749	0.460	1.000	0.384 -	- -	-	- -	-
12	1.392	33.000 33.000	1.00	3.455	95.017	0.589	1.000	1.392 -	0.696 0.696	37.95	0.000 0.000	0.384
14	3.392	33.000 33.000	1.00	4.000	18.535	1.334	0.626	2.123 -	- -	-	- -	-
16	1.392	33.000 33.000	1.00	3.455	95.017	0.589	1.000	1.392 -	0.696 0.696	37.95	0.000 0.000	0.384
18	0.384	33.000 33.000	1.00	0.430	155.749	0.460	1.000	0.384 -	- -	-	- -	-

Table of values		
Fn	33.000	ksi
Ae	0.565	inch^2
Pno	18644.58	lbf
Resistance factor	0.85	
Unity check	0.03	-

Buckling check
According to article E2 and formula (E2-1)
Flexural Buckling Strength
According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	sway	
Unbraced Length L	6 1/8	6 1/8	ft
Effective Length factor K	1.00	1.00	
Effective Length	6 1/8	6 1/8	ft
Slenderness	49.99	88.81	
Flexural Buckling stress Fcre	114.572	36.301	ksi

Torsional (-Flexural) Buckling Strength
According to article E2.2, E2.3, E2.4

Table of values		
Sigma,ex	114.572	ksi
Sigma,ey	36.301	ksi
Kt	1.00	
Lt	6 1/8	ft
Sigma,t	54.231	ksi
Sigma,TF	36.301	ksi
Torsional (-Flexural) buckling stress Fcre	36.301	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	0.384	22.556 22.556	1.00	0.430	155.749	0.381	1.000	0.384 -	- -	-	- -	-
3	1.392	22.556 22.556	1.00	3.455	95.017	0.487	1.000	1.392 -	0.696 0.696	45.90	0.000 0.000	0.384
5	3.392	22.556 22.556	1.00	4.000	18.535	1.103	0.726	2.462 -	- -	-	- -	-
7	1.392	22.556 22.556	1.00	3.455	95.017	0.487	1.000	1.392 -	0.696 0.696	45.90	0.000 0.000	0.384
9	0.384	22.556 22.556	1.00	0.430	155.749	0.381	1.000	0.384 -	- -	-	- -	-
10	0.384	22.556 22.556	1.00	0.430	155.749	0.381	1.000	0.384 -	- -	-	- -	-
12	1.392	22.556 22.556	1.00	3.455	95.017	0.487	1.000	1.392 -	0.696 0.696	45.90	0.000 0.000	0.384
14	3.392	22.556 22.556	1.00	4.000	18.535	1.103	0.726	2.462 -	- -	-	- -	-
16	1.392	22.556 22.556	1.00	3.455	95.017	0.487	1.000	1.392 -	0.696 0.696	45.90	0.000 0.000	0.384
18	0.384	22.556 22.556	1.00	0.430	155.749	0.381	1.000	0.384 -	- -	-	- -	-

Table of values		
Fe	36.301	ksi
lambda, c	0.95	
Fn	22.556	ksi
Ae	0.596	inch^2
Pn	13433.17	lbf
Resistance factor	0.85	
Unity check	0.04	-

Distortional Buckling Strength
According to article E4 and formula (E4.1-2).

Table of values		
Py	22415.77	lbf
L	1' 2.514"	ft
k,phi,fe	175.04	lbf
k,phi,we	143.66	lbf
k,phi	0.00	lbf
k,phi,fg	0.005	$inch^2$
k,phi,wg	0.001	$inch^2$
Fd	46.660	ksi
Pcrd	31694.69	lbf
Lambda,d	0.84	
Pn	19101.86	lbf
Resistance factor	0.85	
Unity check	0.03	-

Data		
Lm	6' 0.250"	ft
Lcr	1' 2.514"	ft
h0	3.392	inch
Ixf	0.001	$inch^4$
Iyf	0.021	$inch^4$
Ixyf	0.003	$inch^4$
Cwf	0.000	$inch^6$
Jf	0.000	$inch^4$
x0f	0.563	inch
hxf	-1.005	inch
Af	0.087	$inch^2$
y0f	-0.054	inch

Number of compressed flanges: 4
Critical flange contains Initial shape parts: 2, 3, 1

Combined Compressive Axial Load and Bending
According to article H1.2 and formulas (C5.2.1-3)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [$inch^4$]	ds [inch]
1	0.384	0.648 0.648	1.00	0.430	155.749	0.064	1.000	0.384 -	- -	-	- -	-
3	1.392	0.648 0.648	1.00	4.000	110.020	0.077	1.000	1.392 -	0.696 0.696	270.87	- 0.000	0.384
5	3.392	0.648 0.648	1.00	4.000	18.535	0.187	1.000	3.392 -	- -	-	- -	-
7	1.392	0.648	1.00	4.000	110.020	0.077	1.000	1.392	0.696	270.87	-	0.384

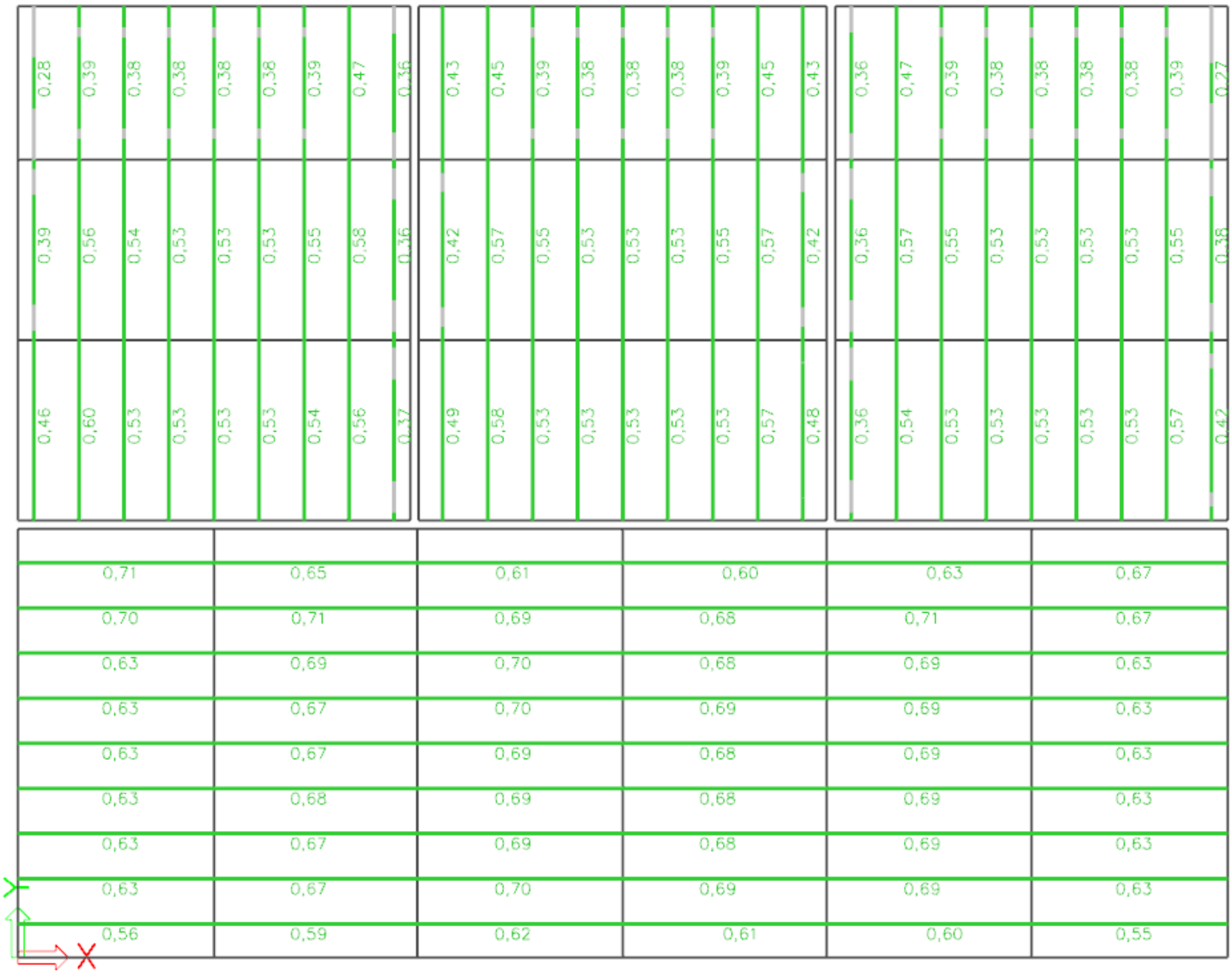
Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch ^{4}]	ds [inch]
		0.648						-	0.696		0.000	
9	0.384	0.648 0.648	1.00	0.430	155.749	0.064	1.000	0.384 -	- -	-	- -	-
10	0.384	0.648 0.648	1.00	0.430	155.749	0.064	1.000	0.384 -	- -	-	- -	-
12	1.392	0.648 0.648	1.00	4.000	110.020	0.077	1.000	1.392 -	0.696 0.696	270.87	- 0.000	0.384
14	3.392	0.648 0.648	1.00	4.000	18.535	0.187	1.000	3.392 -	- -	-	- -	-
16	1.392	0.648 0.648	1.00	4.000	110.020	0.077	1.000	1.392 -	0.696 0.696	270.87	- 0.000	0.384
18	0.384	0.648 0.648	1.00	0.430	155.749	0.064	1.000	0.384 -	- -	-	- -	-

Table of values		
Mnx	2091.62	lbfft
Pn	13433.17	lbf
Resistance factor compression	0.85	
Resistance factor bending x	0.90	

Unity check = 0.04+0.67+0.00 = 0.71 - (C5.2.1-3)

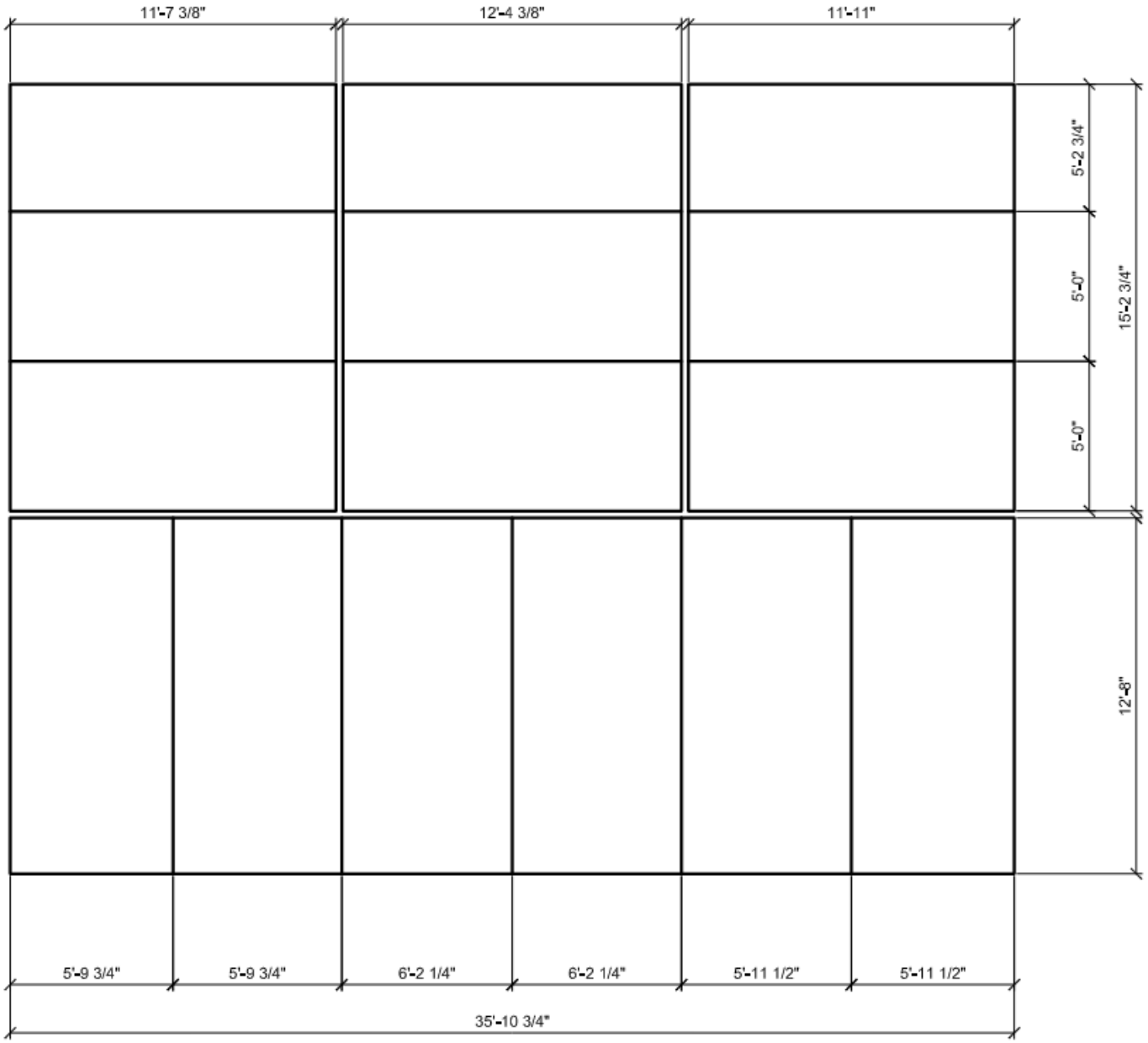
The member satisfies the check !

Unity check


0,28 0,39 0,38 0,38 0,38 0,38 0,39 0,47 0,36
0,39 0,56 0,54 0,53 0,53 0,53 0,55 0,58 0,36
0,46 0,60 0,53 0,53 0,53 0,53 0,54 0,56 0,37
0,43 0,45 0,39 0,38 0,38 0,38 0,39 0,45 0,43
0,42 0,57 0,55 0,53 0,53 0,53 0,55 0,57 0,42
0,49 0,58 0,53 0,53 0,53 0,53 0,53 0,57 0,48
0,36 0,47 0,39 0,38 0,38 0,38 0,38 0,39 0,27
0,36 0,57 0,55 0,53 0,53 0,53 0,53 0,55 0,38
0,36 0,54 0,53 0,53 0,53 0,53 0,53 0,57 0,42
0,71 0,65 0,61 0,60 0,63 0,67
0,70 0,71 0,69 0,68 0,71 0,67
0,63 0,69 0,70 0,68 0,69 0,63
0,63 0,67 0,70 0,69 0,69 0,63
0,63 0,67 0,69 0,68 0,69 0,63
0,63 0,68 0,69 0,68 0,69 0,63
0,63 0,67 0,69 0,68 0,69 0,63
0,63 0,67 0,70 0,69 0,69 0,63
0,56 0,59 0,62 0,61 0,60 0,55
Y
X

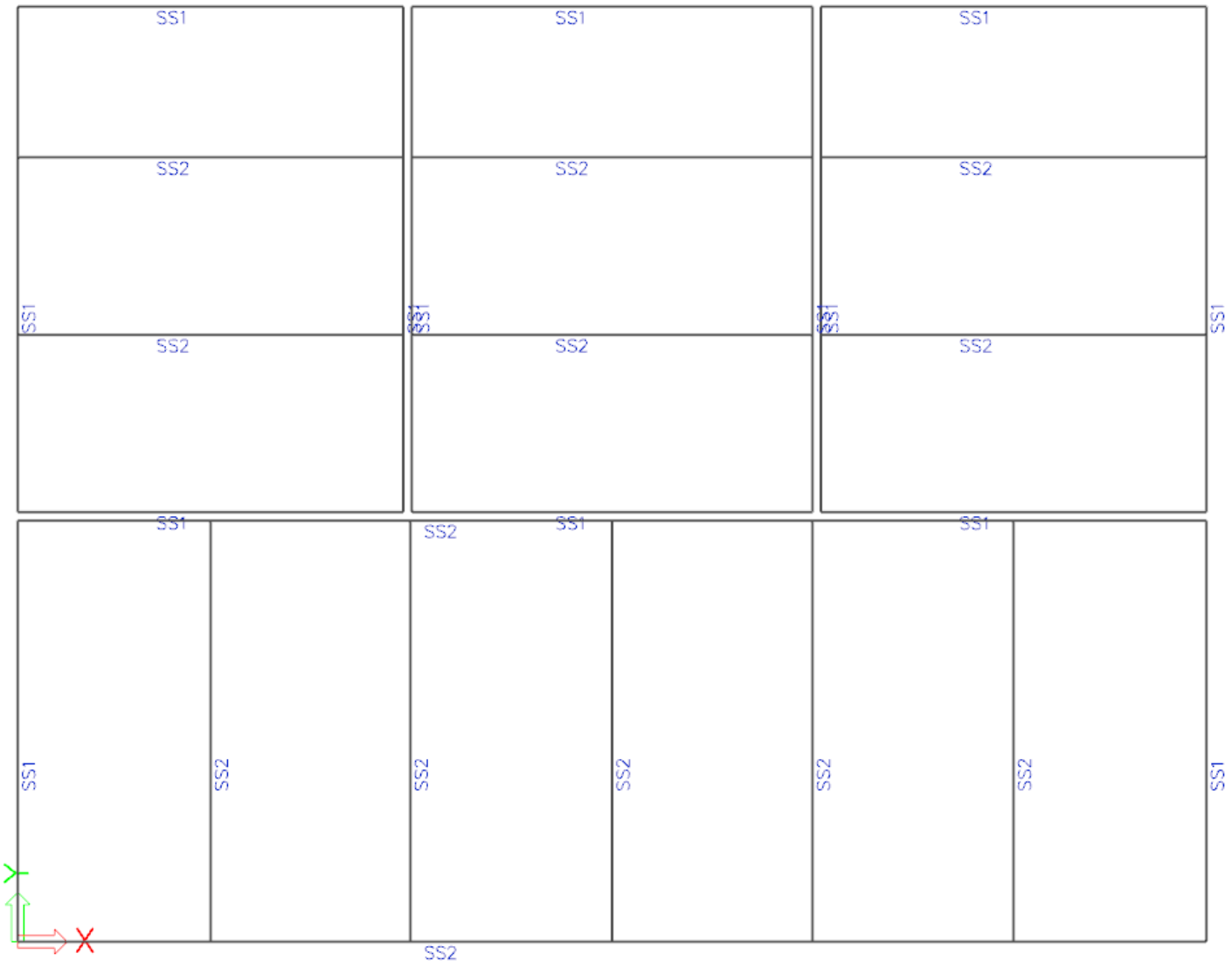
2.4.5 MAIN SUPPORTING BEAMS CHECK

Analytic model

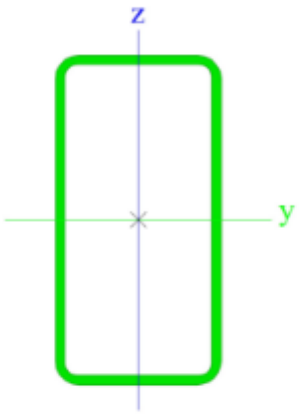


Member numbers

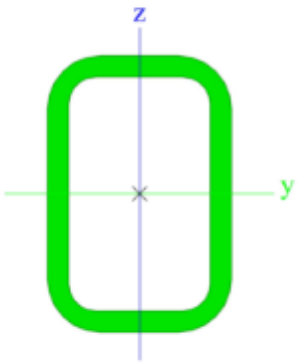
Cross-sections walls element.



Cross-Section Properties: SS1 - HSS6X3X3/16

SS1		
Type	HSS6X3X3/16	
Formcode	2 - Rectangular hollow section	
Shape type	Thin-walled	
Item material	A36	
Fabrication	cold formed	
Colour		
A [inch^2]	2,930	
A_y [inch^2], A_z [inch^2]	0,962	1,925
A_L [inch^2/inch], A_D [inch^2/inch]	1,72e+01	3,35e+01
$c_{Y,UCS}$ [inch], $c_{Z,UCS}$ [inch]	1,500	3,000
α [deg]	0,00	
I_y [inch^4], I_z [inch^4]	13,400	4,550
i_y [inch], i_z [inch]	2,139	1,246
$W_{el,y}$ [inch^3], $W_{el,z}$ [inch^3]	4,470	3,030
$W_{pl,y}$ [inch^3], $W_{pl,z}$ [inch^3]	5,590	3,450
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	1,96e+05	1,96e+05
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	1,22e+05	1,22e+05
d_y [inch], d_z [inch]	0,000	0,000
I_t [inch^4], I_w [inch^6]	11,100	21,141
β_y [inch], β_z [inch]	0,000	0,000
Picture		

Cross-Section Properties: SS2 - HSS6X4X1/2

SS2		
Type	HSS6X4X1/2	
Formcode	2 - Rectangular hollow section	
Shape type	Thin-walled	
Item material	A36	
Fabrication	cold formed	
Colour		
A [inch²]	7,880	
A_y [inch²], A_z [inch²]	3,019	4,529
A_L [inch²/inch], A_D [inch²/inch]	1,80e+01	3,33e+01
$c_{y,UCS}$ [inch], $c_{z,UCS}$ [inch]	2,000	3,000
α [deg]	0,00	
I_y [inch⁴], I_z [inch⁴]	34,000	17,800
i_y [inch], i_z [inch]	2,077	1,503
$W_{el,y}$ [inch³], $W_{el,z}$ [inch³]	11,300	8,890
$W_{pl,y}$ [inch³], $W_{pl,z}$ [inch³]	14,600	11,000
$M_{pl,y,+}$ [lbfinch], $M_{pl,y,-}$ [lbfinch]	4,95e+05	4,95e+05
$M_{pl,z,+}$ [lbfinch], $M_{pl,z,-}$ [lbfinch]	3,75e+05	3,75e+05
d_y [inch], d_z [inch]	0,000	0,000
I_t [inch⁴], I_w [inch⁶]	40,300	111,600
β_y [inch], β_z [inch]	0,000	0,000
Picture		

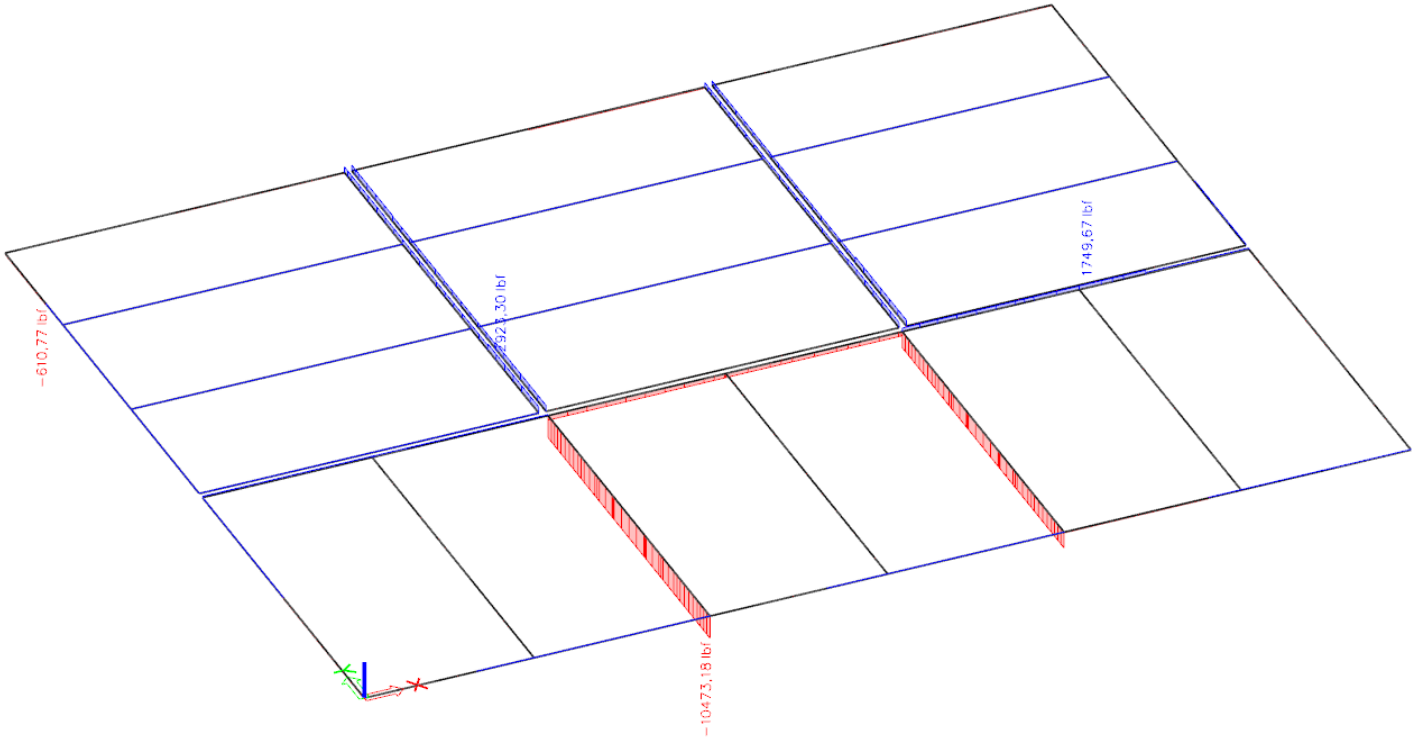
Explanations of symbols	
Formcode	h - Height b - Width s - Thickness r - Outer radius r1 - Inner radius
A	Area
A_y	Shear Area in principal y-direction
A_z	Shear Area in principal z-direction
A_L	Circumference per unit length
A_D	Drying surface per unit length
$c_{Y,UCS}$	Centroid coordinate in Y-direction of Input axis system
$c_{Z,UCS}$	Centroid coordinate in Z-direction of Input axis system
$I_{Y,LCS}$	Second moment of area about the YLCS axis
$I_{Z,LCS}$	Second moment of area about the ZLCS axis
$I_{YZ,LCS}$	Product moment of area in the LCS system
α	Rotation angle of the principal axis system
I_y	Second moment of area about the principal y-axis
I_z	Second moment of area about the principal z-axis
i_y	Radius of gyration about the principal y-axis

Explanations of symbols	
i_z	Radius of gyration about the principal z-axis
$W_{el,y}$	Elastic section modulus about the principal y-axis
$W_{el,z}$	Elastic section modulus about the principal z-axis
$W_{pl,y}$	Plastic section modulus about the principal y-axis
$W_{pl,z}$	Plastic section modulus about the principal z-axis
$M_{pl,y,+}$	Plastic moment about the principal y-axis for a positive My moment
$M_{pl,y,-}$	Plastic moment about the principal y-axis for a negative My moment
$M_{pl,z,+}$	Plastic moment about the principal z-axis for a positive Mz moment
$M_{pl,z,-}$	Plastic moment about the principal z-axis for a negative Mz moment
d_y	Shear center coordinate in principal y-direction measured from the centroid
d_z	Shear center coordinate in principal z-direction measured from the centroid
I_t	Torsional constant
I_w	Warping constant
β_y	Mono-symmetry constant about the principal y-axis
β_z	Mono-symmetry constant about the principal z-axis

Force diagram

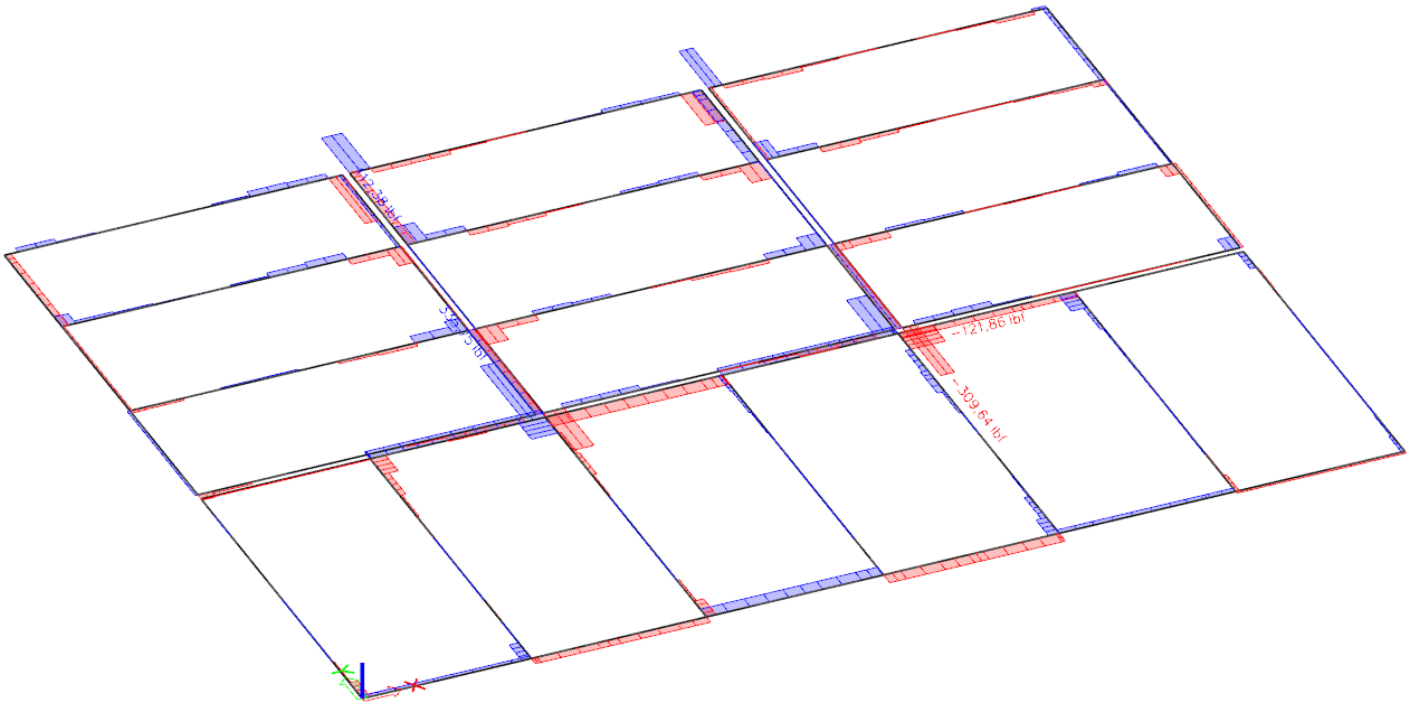
Axial force diagram N,

LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, (lbf).



Shear force diagram Vy, (lbf)

LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, (lbf).



Shear force diagram Vz, (lbf)

LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, (lbf).

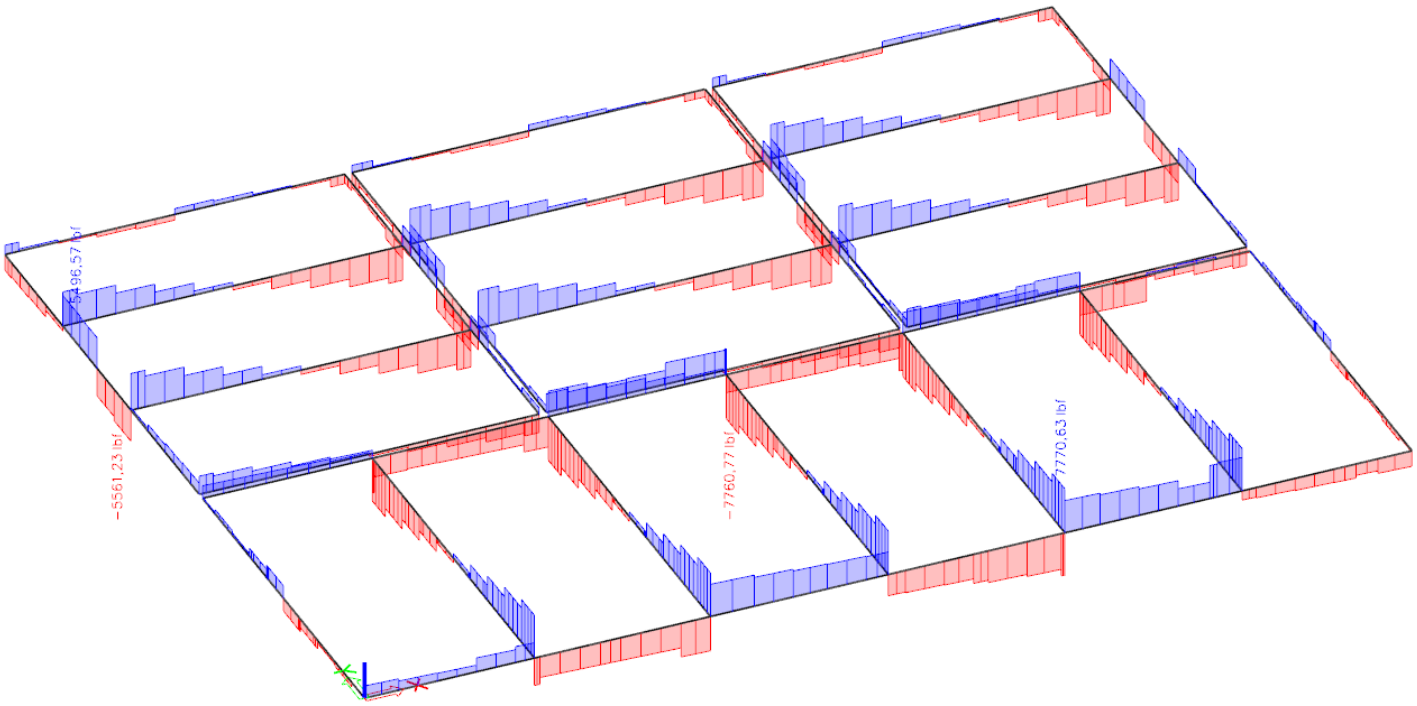


Diagram of torsional moments Mx, (lbf*ft)

LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, (lbf ft).

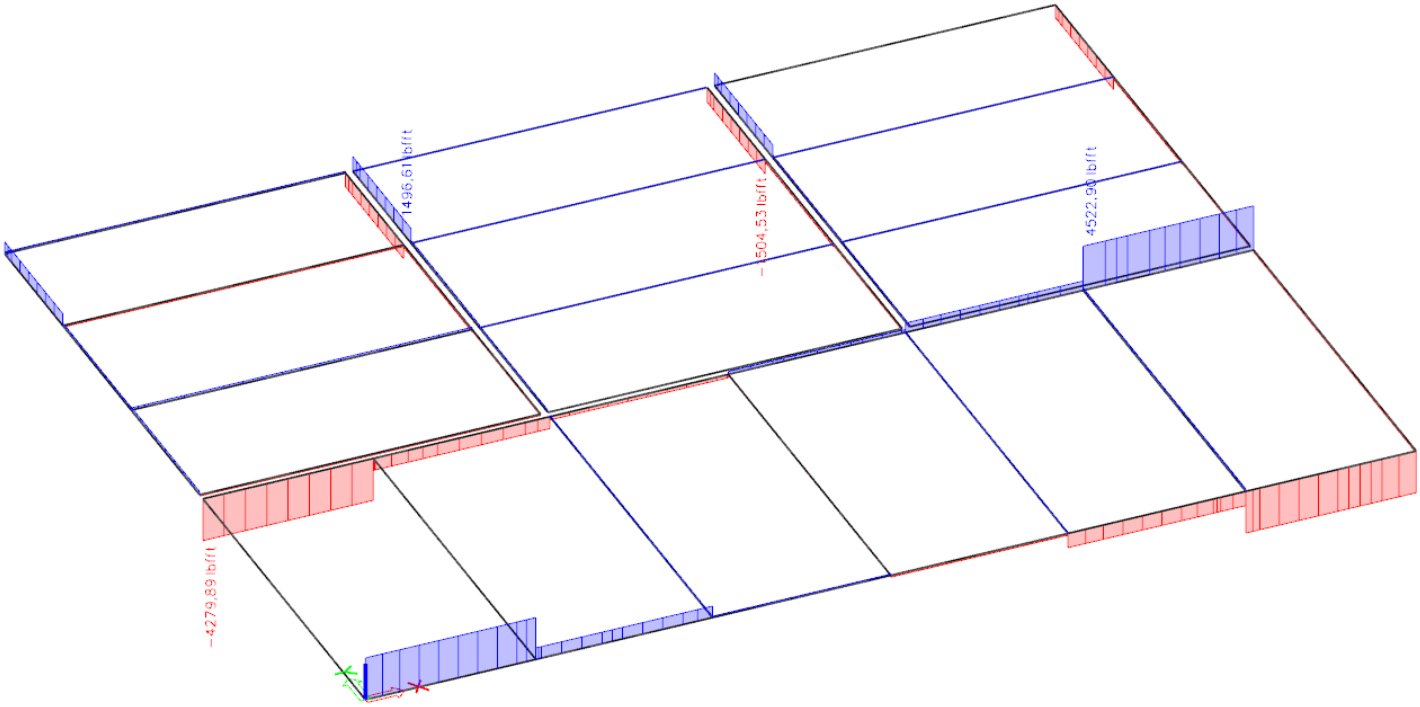


Diagram of bending moments My, (lbf*ft)

LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, (lbf ft).

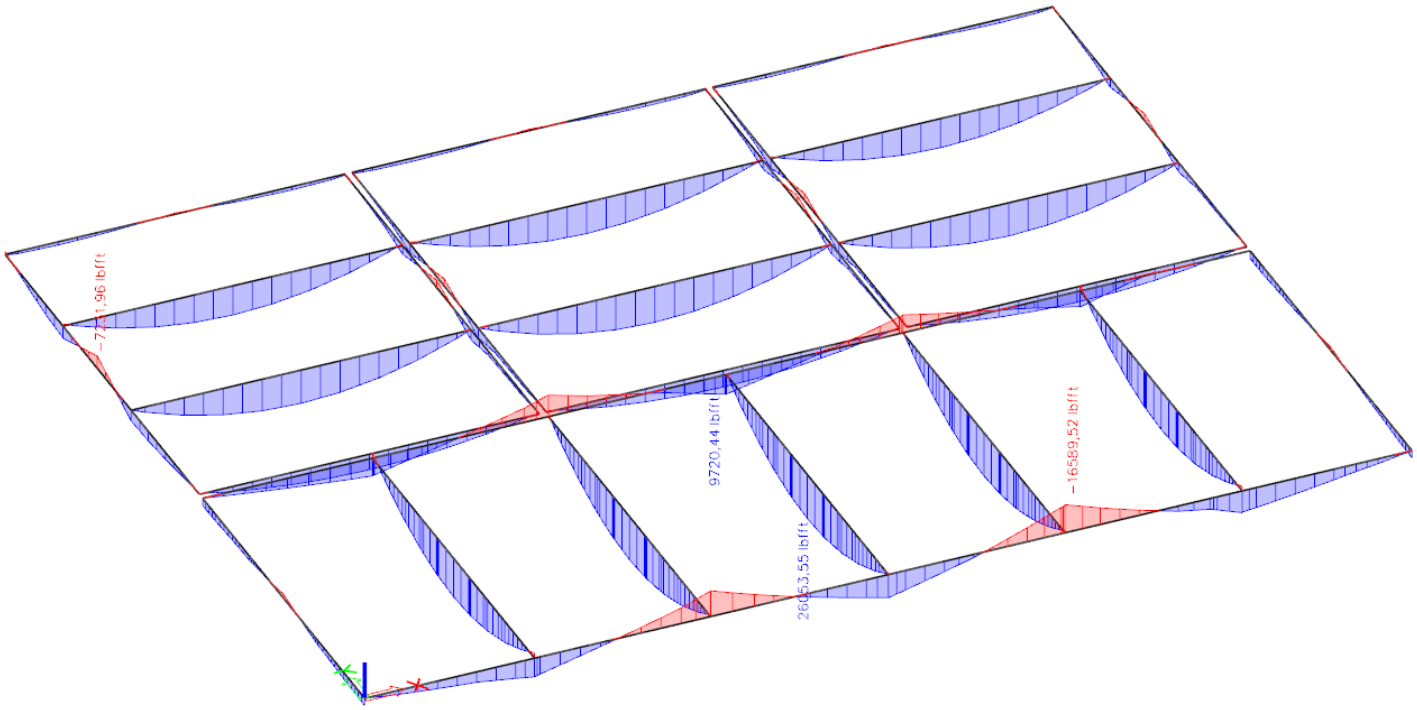
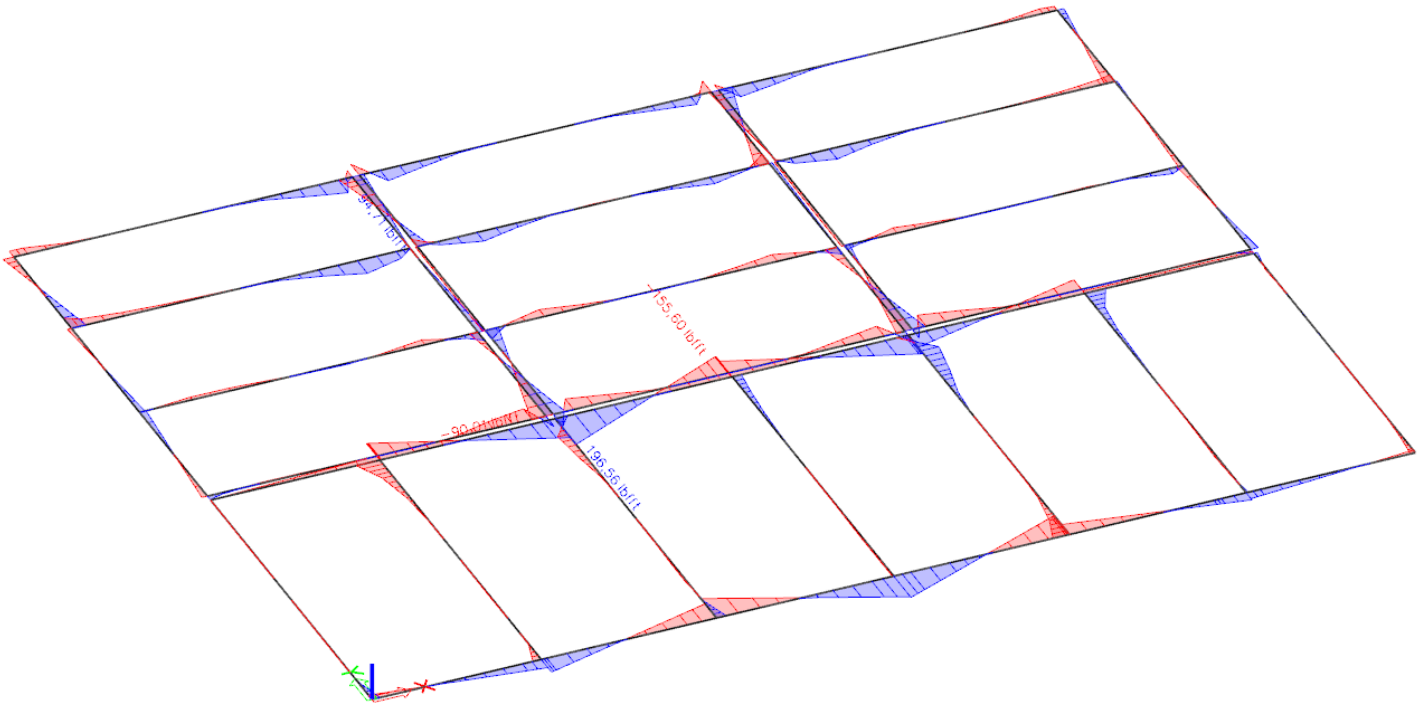


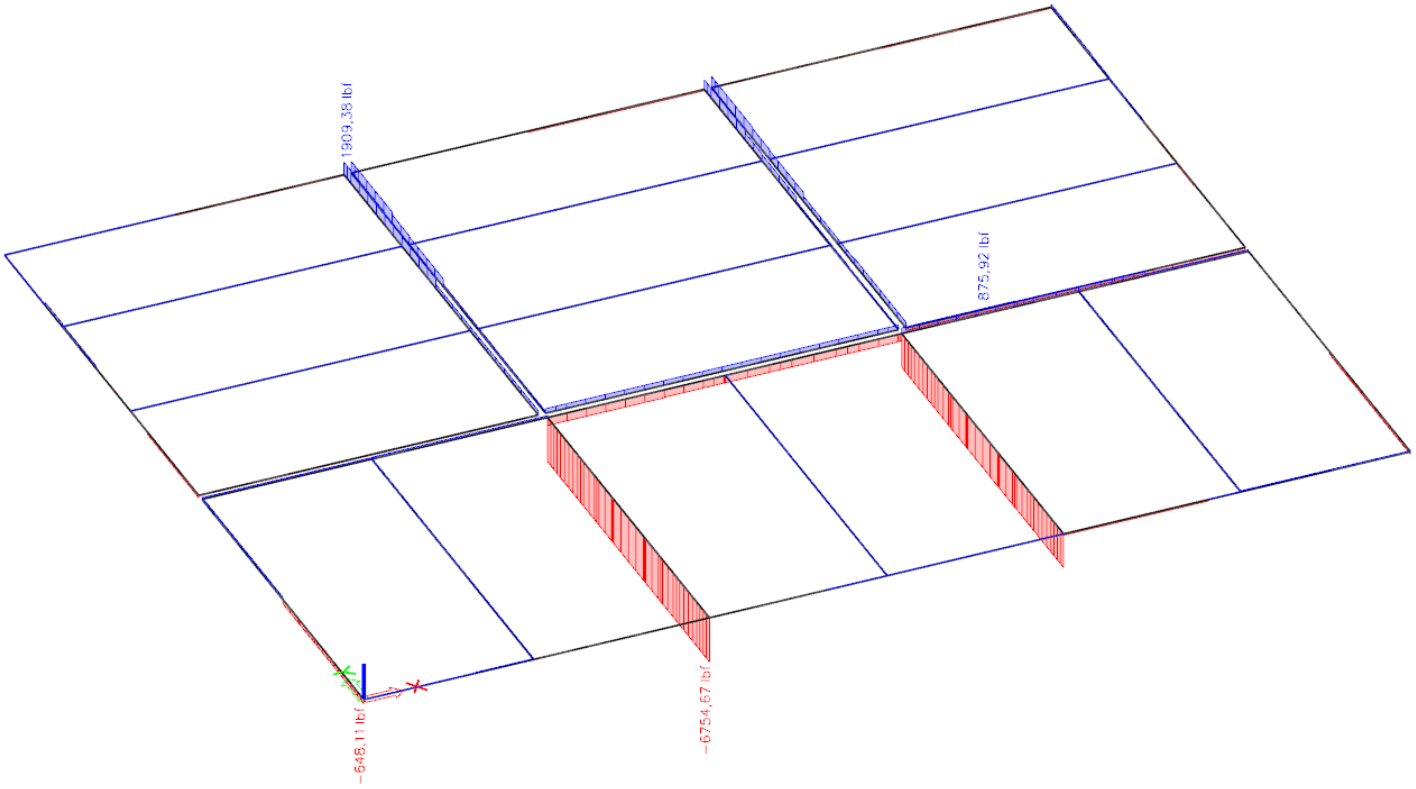
Diagram of bending moments Mz, (lbf*ft)

LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, (lbf ft).



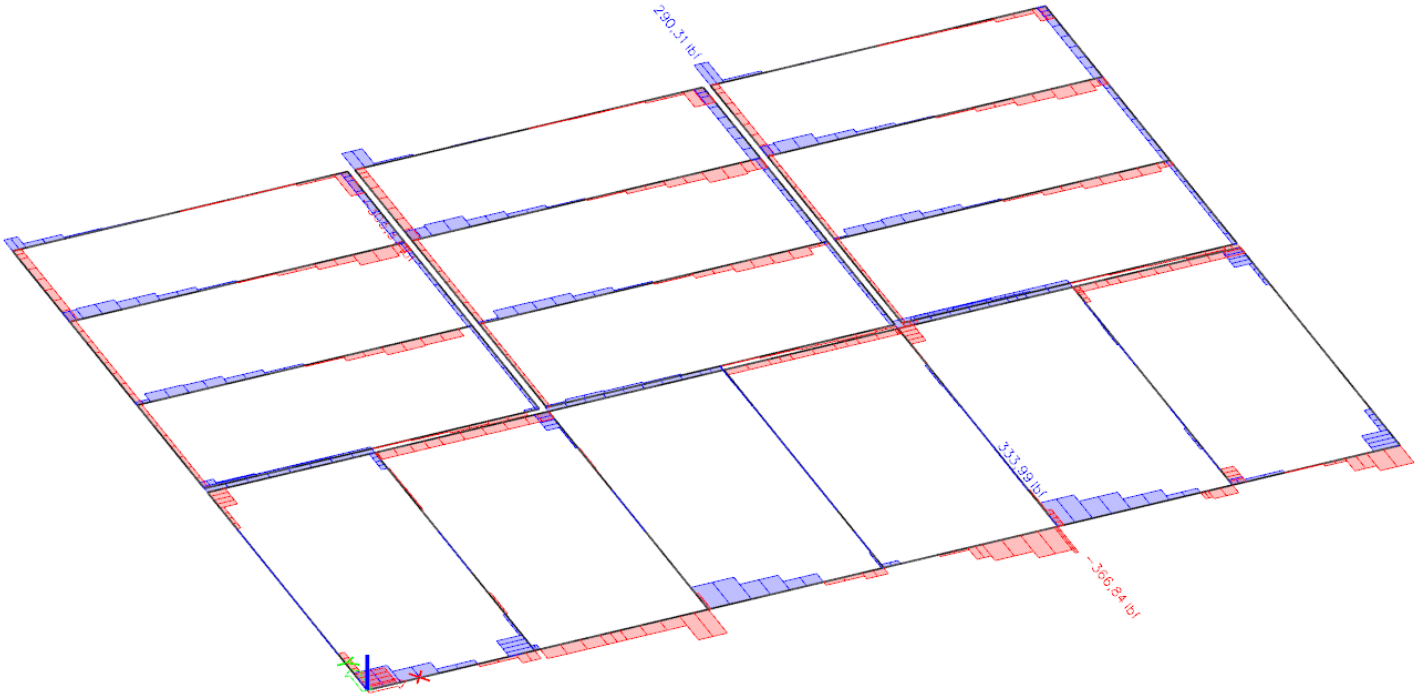
Axial force diagram N,

LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-, (lbf).



Shear force diagram Vy, (lbf)

LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-, (lbf).



Shear force diagram Vz, (lbf)

LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-, (lbf).

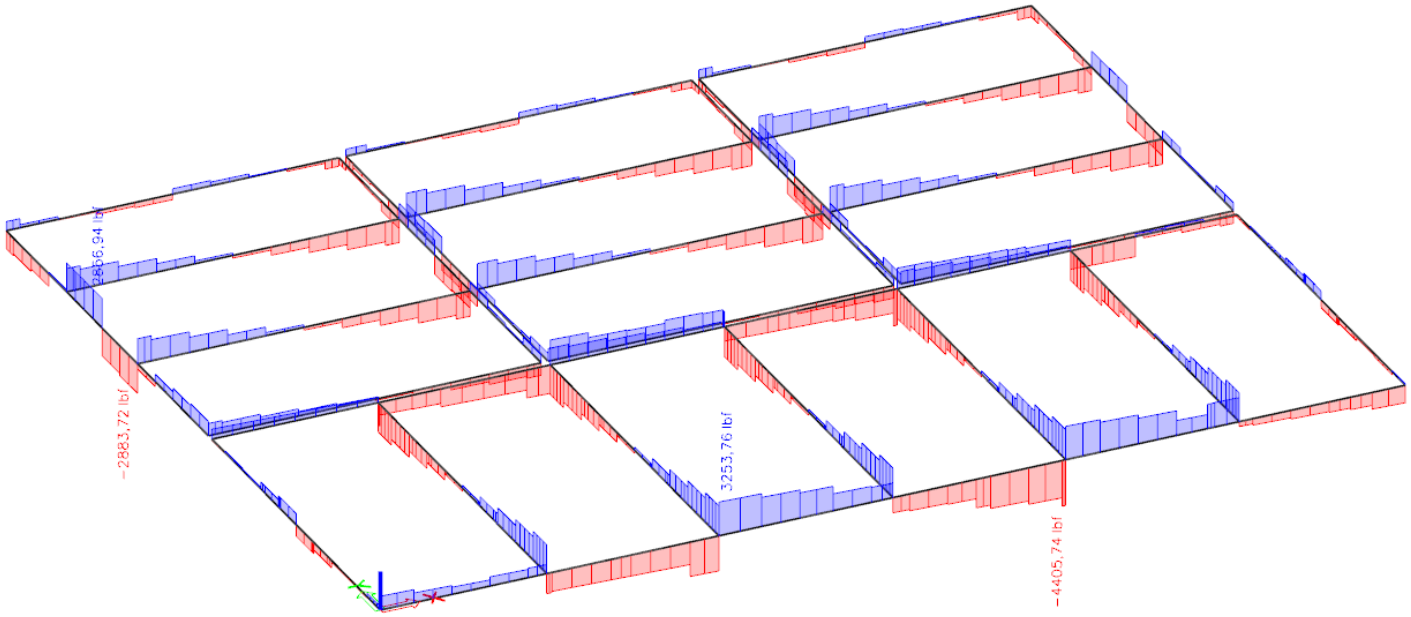


Diagram of torsional moments Mx, (lbf*ft)

LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-, (lbf ft).

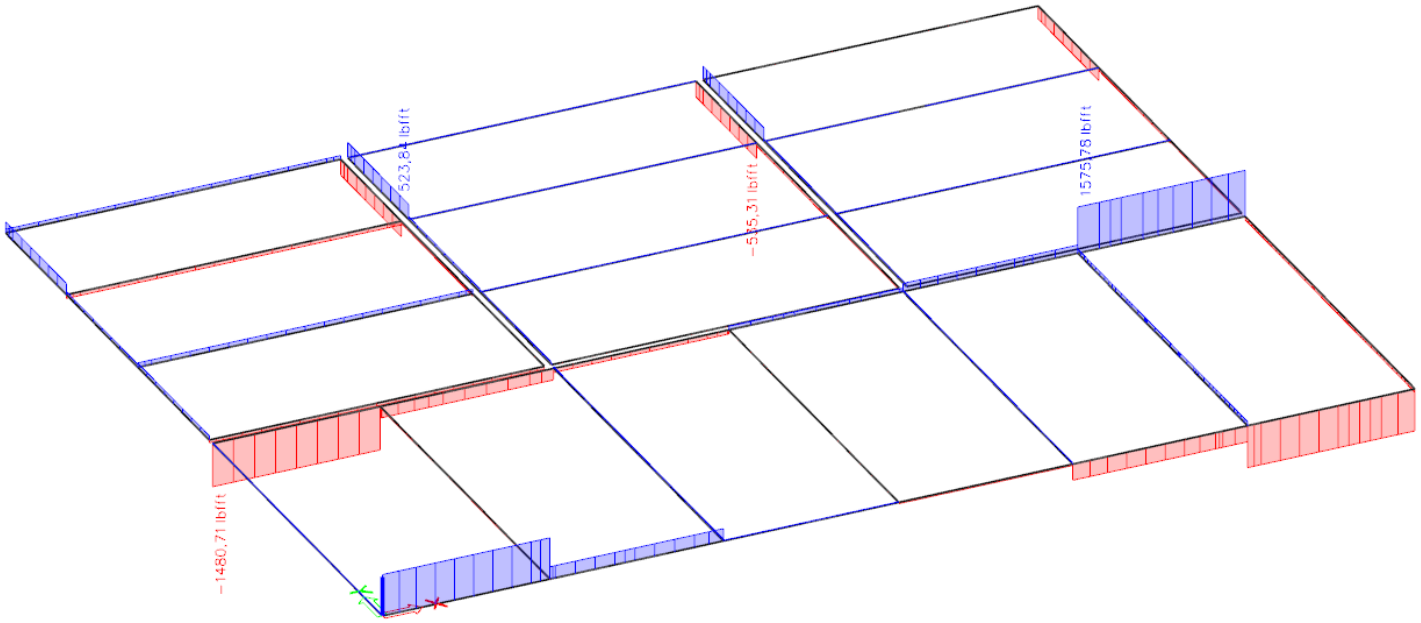


Diagram of bending moments My, (lbf*ft)

LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-, (lbf ft).

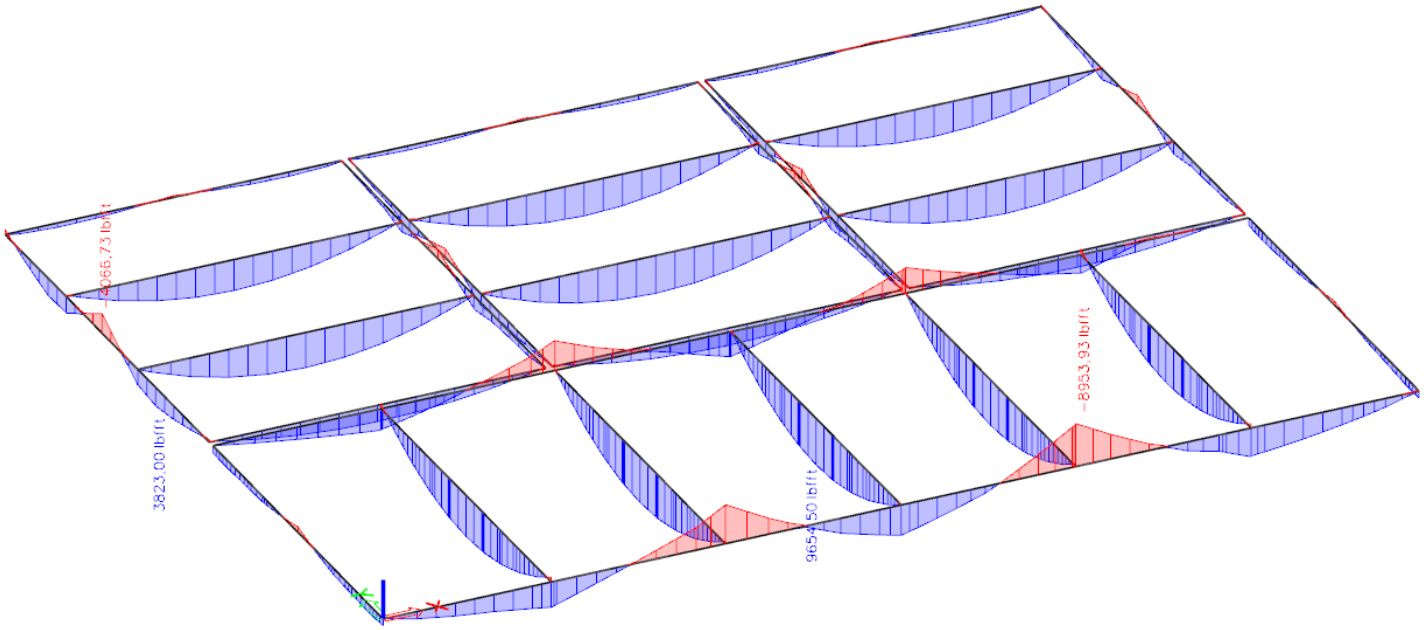
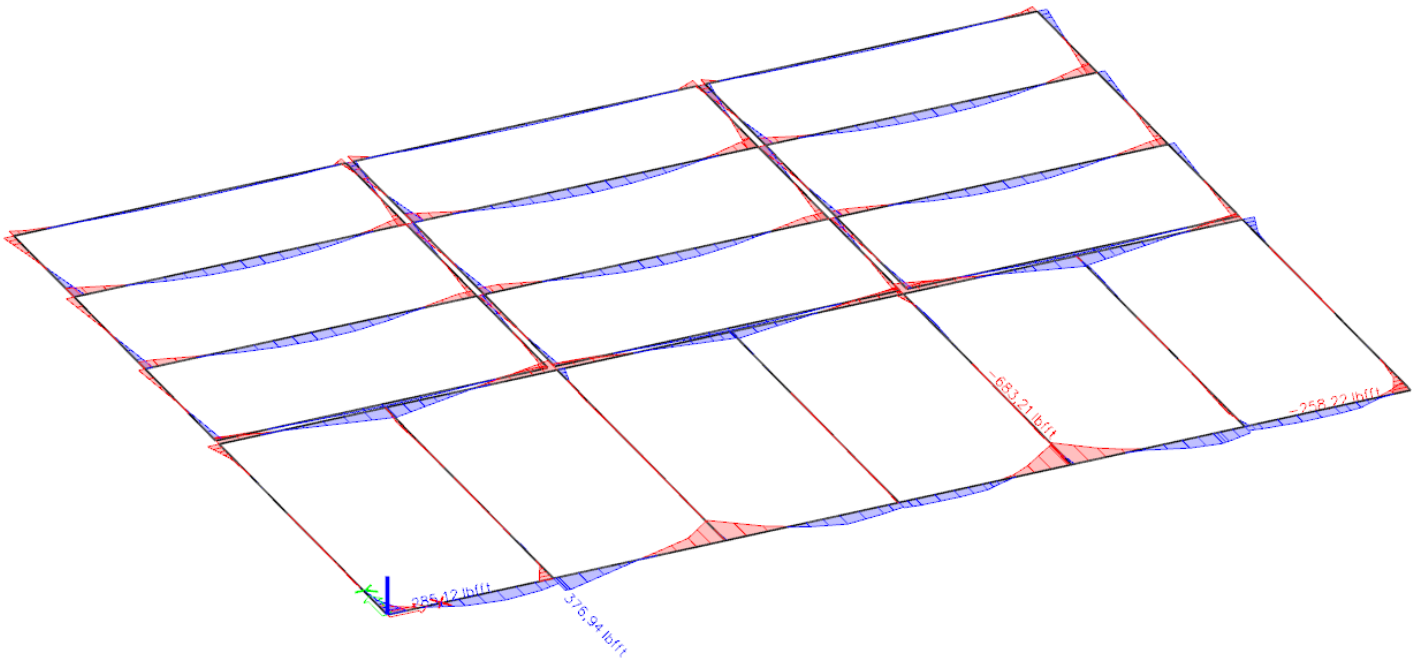


Diagram of bending moments Mz, (lbf*ft)

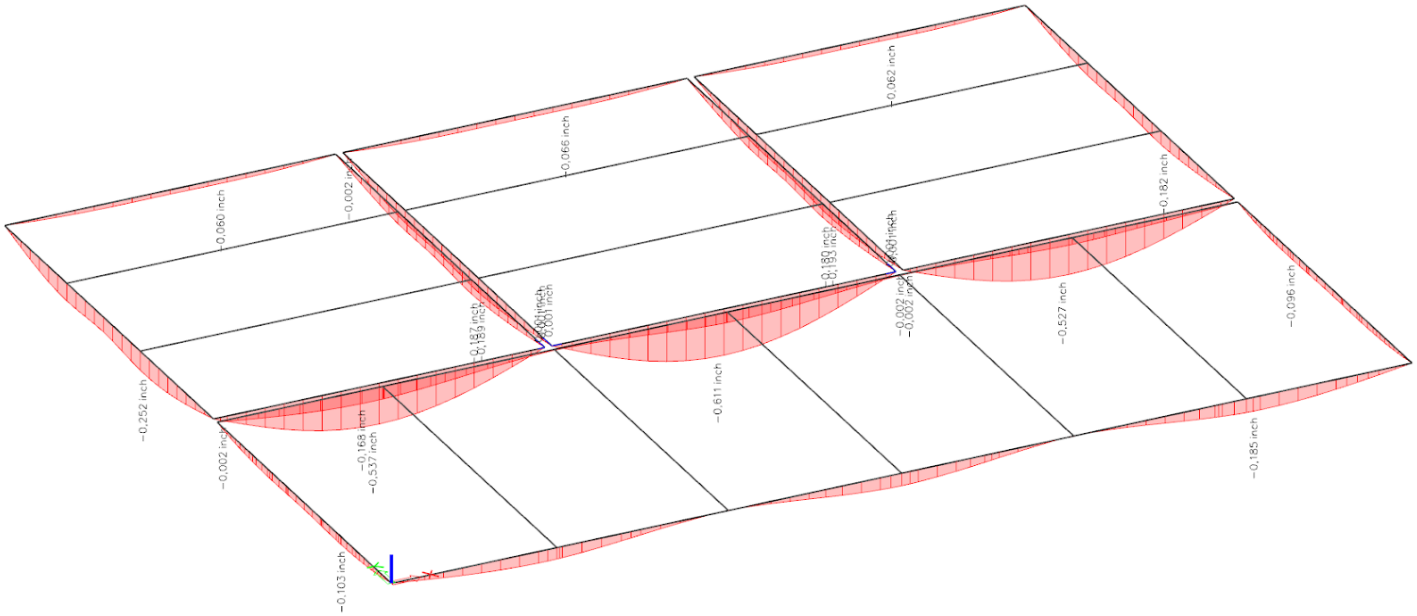
LRFD-Ult (auto)33 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+0.5xL+Wy-, (lbf ft).



DEFLECTIONS

Diagram vertical deflection in the direction of the Z axis

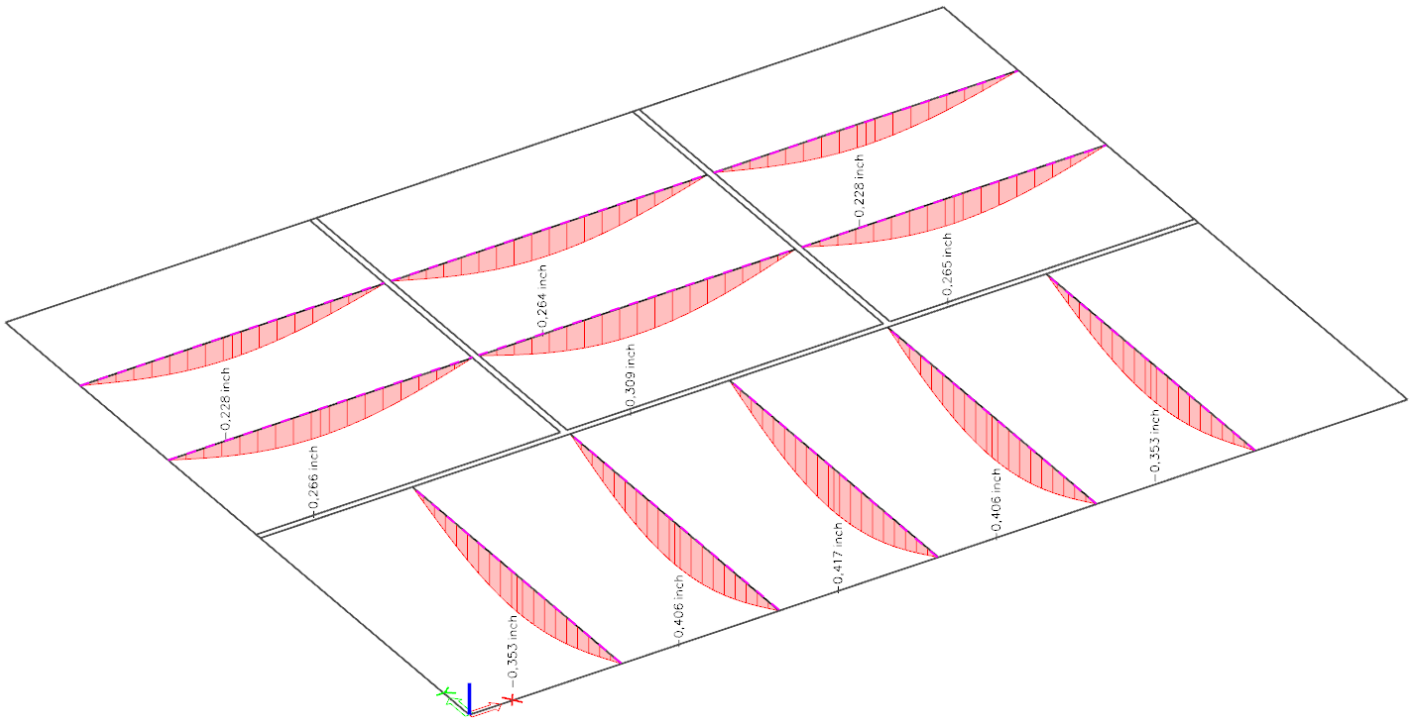
LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, inch.



The maximum deflection is 0.611" according to table 1604.3 the code IBC 2019 - the deflection limits L/240. L = 12'-4"= 12"*12"+4"=148". 148"/240 =0.616"
0.611" < 0.616" <u>Deflection is OK!</u>

Diagram vertical deflection in the direction of the Z axis

LRFD-Ult (auto)5 - 1.2xDL1+1.2xDL2+1.2xDL3+1.2xDL4+1.2xDL5+1.2xDL6+0.5xLr+1.6xL, inch.



The maximum deflection is 0.417" according to table 1604.3 the code IBC 2019 - the deflection limits L/240. L = 12'-8"= 12"*12"+8"=152". 152"/240 =0.633"
0.417" < 0.633" <u>Deflection is OK!</u>

Steel support beam check LRFD

Steel member check B60

AISI S100-16 LRFD Check

Member B60	HSS6X3X3/16	A36	LRFD-Ult (auto)	0.83

Material data		
Yield stress Fy	36.00	ksi
Tensile stress Fu	58.00	ksi
fabrication	cold formed	

The critical check is on position 6.04 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-234.07	lbf
Vux	0.33	lbf
Vuy	373.98	lbf
Mut	-23.30	lbfft
Mux	9720.44	lbfft
Muy	2.77	lbfft

Combined Bending and Torsional Loading
According to article H4 and formula (H4-1)

Table of values		
Critical fibre	9	
Sigma Mx	-26.843	ksi
Sigma My	-0.008	ksi
f bending	-26.851	ksi
Tau t	-0.049	ksi
f torsion	-0.049	ksi
Composed Stress	26.851	ksi
R	1.00	-

...::Flexural Strength about X-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch⁴]	ds [inch]
1	2.130	-36.000 -36.000	-	-	-	-	-	- -	- -	-	- -	-
3	5.130	31.699 -31.699	1.00	24.000	723.874	0.209	1.000	- 5.130	1.282 2.565	-	- -	-
5	2.130	36.000 36.000	1.00	4.000	699.822	0.227	1.000	2.130 -	- -	-	- -	-
7	5.130	31.699 -31.699	1.00	24.000	723.874	0.209	1.000	- 5.130	1.282 2.565	-	- -	-

Table of values		
Sxe	4.345	$inch^3$
Mnxo	13036.39	lbfft
Resistance factor	0.90	
Unity check	0.83	-

Lateral-Torsional Buckling Strength
According to article F2.1.4 and formula (F2.1.4-1).

Table of values		
Lltb	1' 4.000"	ft
Cb	1.02	
Sfx	4.467	$inch^3$
Lu	76' 6.310"	ft

Note: Lateral-Torsional buckling is not governing since the unbraced length is smaller than or equal to Lu.

...::Flexural Strength about Y-axis::...
Lateral-Torsional Buckling Strength
According to article F2.1.4 and formula (F2.1.4-1).

Table of values		
KxLx	12' 1.000"	ft
Cb	1.00	
Sfy	3.033	$inch^3$
Lu	189' 4.315"	ft

Note: Lateral-Torsional buckling is not governing since the unbraced length is smaller than or equal to Lu.

...::Shear Strength::...
Shear Strength
According to article G2.1 and formula (G2.1.1)
Shear force Vy

Element ID	Aw [$inch^2$]	Vn [lbf]
1	0.000	0.00
3	0.893	19280.59
5	0.000	0.00
7	0.893	19280.59

Table of values		
Vn,y	38561.19	lbf
Resistance factor	0.95	
Unity check	0.01	-

Combined Bending and Shear
According to article H2 and formula (H2-1)

Table of values		
Mnxo	13036.39	lbfft
Vny	38561.19	lbf
Resistance factor shear	0.95	
Resistance factor bending x	0.90	

Unity check (Mx, Vy) = sqrt(0.69+0.00) = 0.83

Buckling check
According to article E2 and formula (E2-1)
Flexural Buckling Strength
According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	sway	
Unbraced Length L	8 3/4	1 3/8	ft
Effective Length factor K	1.00	1.00	
Effective Length	8 3/4	1 3/8	ft
Slenderness	48.71	12.84	
Flexural Buckling stress Fcre	48836.433	1736.655	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch⁴]	ds [inch]
1	2.130	35.689 35.689	1.00	4.000	699.822	0.226	1.000	2.130 -	- -	-	- -	-
3	5.130	35.689 35.689	1.00	4.000	120.646	0.544	1.000	5.130 -	- -	-	- -	-
5	2.130	35.689 35.689	1.00	4.000	699.822	0.226	1.000	2.130 -	- -	-	- -	-
7	5.130	35.689 35.689	1.00	4.000	120.646	0.544	1.000	5.130 -	- -	-	- -	-

Table of values		
Fe	1736.655	ksi
lambda, c	0.14	
Fn	35.689	ksi
Ae	2.889	inch²
Pn	103087.92	lbf
Resistance factor	0.85	
Unity check	0.00	-

Combined Compressive Axial Load and Bending
According to article H1.2 and formulas (C5.2.1-3)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch⁴]	ds [inch]
1	2.130	0.080 0.080	1.00	4.000	699.822	0.011	1.000	2.130 -	- -	-	- -	-
3	5.130	0.080 0.080	1.00	4.000	120.646	0.026	1.000	5.130 -	- -	-	- -	-
5	2.130	0.080 0.080	1.00	4.000	699.822	0.011	1.000	2.130 -	- -	-	- -	-
7	5.130	0.080 0.080	1.00	4.000	120.646	0.026	1.000	5.130 -	- -	-	- -	-

Table of values		
Mnx	13036.39	lbfft
Mny	8919.00	lbfft
Pn	103087.92	lbf
Resistance factor compression	0.85	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check = 0.00+0.83+0.00 = 0.83 - (C5.2.1-3)

The member satisfies the check !

Steel member check B23

AISI S100-16 LRFD Check

Member B23	HSS6X4X1/2	A36	LRFD-Ult (auto)	0.94

Material data		
Yield stress Fy	36.00	ksi
Tensile stress Fu	58.00	ksi
fabrication	cold formed	

The critical check is on position 6.33 ft

Axis definition :
- local x- axis in this code check is referring to the local y axis in Scia Engineer
- local y- axis in this code check is referring to the local z axis in Scia Engineer

Internal forces		
Pu	-10473.18	lbf
Vux	2.26	lbf
Vuy	871.45	lbf
Mut	134.99	lbfft
Mux	25533.59	lbfft
Muy	1.00	lbfft

Combined Bending and Torsional Loading
According to article H4 and formula (H4-1)

Table of values		
Critical fibre	9	
Sigma Mx	-29.147	ksi
Sigma My	-0.001	ksi
f bending	-29.147	ksi
Tau t	0.089	ksi
f torsion	0.089	ksi
Composed Stress	29.148	ksi
R	1.00	-

...::Flexural Strength about X-axis::...
Nominal Flexural Strength
According to article F3.1 and formula (F3.1-1).

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	1.674	-36.000 -36.000	-	-	-	-	-	- -	- -	-	- -	-
3	3.674	23.896 -23.896	1.00	24.000	10079.219	0.049	1.000	- 3.674	0.919 1.837	-	- -	-
5	1.674	36.000 36.000	1.00	4.000	8091.760	0.067	1.000	1.674 -	- -	-	- -	-
7	3.674	23.896 -23.896	1.00	24.000	10079.219	0.049	1.000	- 3.674	0.919 1.837	-	- -	-

Table of values		
Sxe	10.512	$inch^3$
Mnxo	31536.96	lbfft
Resistance factor	0.90	
Unity check	0.90	-

Lateral-Torsional Buckling Strength
According to article F2.1.4 and formula (F2.1.4-1).

Table of values		
Lltb	1' 4.000"	ft
Cb	1.02	
Sfx	11.333	$inch^3$
Lu	113' 4.774"	ft

Note: Lateral-Torsional buckling is not governing since the unbraced length is smaller than or equal to Lu.
...::Flexural Strength about Y-axis::...
Lateral-Torsional Buckling Strength
According to article F2.1.4 and formula (F2.1.4-1).

Table of values		
KxLx	12' 8.000"	ft
Cb	1.00	
Sfy	8.900	$inch^3$
Lu	195' 10.586"	ft

Note: Lateral-Torsional buckling is not governing since the unbraced length is smaller than or equal to Lu.

...::Shear Strength::...
Shear Strength
According to article G2.1 and formula (G2.1.1)
Shear force Vy

Element ID	Aw [$inch^2$]	Vn [lbf]
1	0.000	0.00
3	1.708	36901.66
5	0.000	0.00
7	1.708	36901.66

Table of values		
Vn,y	73803.32	lbf
Resistance factor	0.95	
Unity check	0.01	-

Combined Bending and Shear
According to article H2 and formula (H2-1)

Table of values		
Mnxo	31536.96	lbfft
Vny	73803.32	lbf
Resistance factor shear	0.95	
Resistance factor bending x	0.90	

Unity check (Mx, Vy) = sqrt(0.81+0.00) = 0.90

...::Axial Compression Strength::...

Nominal Axial Strength

According to article E2 and formula (E2-1)

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	1.674	36.000 36.000	1.00	4.000	8091.760	0.067	1.000	1.674 -	- -	-	- -	-
3	3.674	36.000 36.000	1.00	4.000	1679.870	0.146	1.000	3.674 -	- -	-	- -	-
5	1.674	36.000 36.000	1.00	4.000	8091.760	0.067	1.000	1.674 -	- -	-	- -	-
7	3.674	36.000 36.000	1.00	4.000	1679.870	0.146	1.000	3.674 -	- -	-	- -	-

Table of values		
Fn	36.000	ksi
Ae	7.560	inch^2
Pno	272160.63	lbf
Resistance factor	0.85	
Unity check	0.05	-

Buckling check

According to article E2 and formula (E2-1)

Flexural Buckling Strength

According to article E2.1 and formula (E2.1-1)

Buckling parameters	xx	yy	
Sway type	sway	sway	
Unbraced Length L	2 3/8	3/4	ft
Effective Length factor K	1.00	1.00	
Effective Length	2 3/8	3/4	ft
Slenderness	13.05	5.95	
Flexural Buckling stress Fcre	3573709.658	8256919.877	ksi

Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	1.674	36.000 36.000	1.00	4.000	8091.760	0.067	1.000	1.674 -	- -	-	- -	-
3	3.674	36.000 36.000	1.00	4.000	1679.870	0.146	1.000	3.674 -	- -	-	- -	-
5	1.674	36.000 36.000	1.00	4.000	8091.760	0.067	1.000	1.674 -	- -	-	- -	-
7	3.674	36.000 36.000	1.00	4.000	1679.870	0.146	1.000	3.674 -	- -	-	- -	-

Table of values		
Fe	3573709.658	ksi
lambda, c	0.00	
Fn	36.000	ksi
Ae	7.560	inch^2
Pn	272159.48	lbf
Resistance factor	0.85	
Unity check	0.05	-

Combined Compressive Axial Load and Bending

According to article H1.2 and formulas (C5.2.1-3)

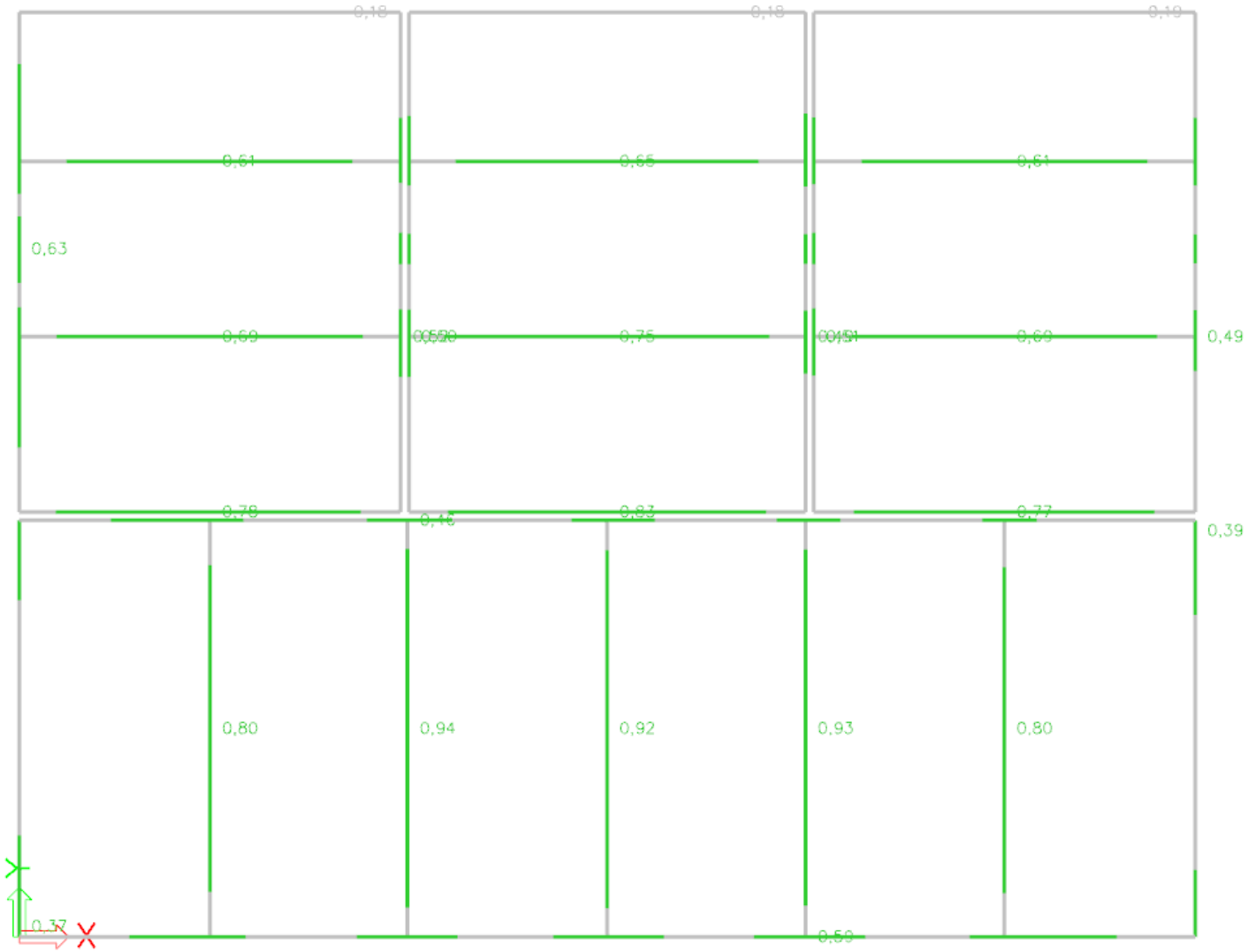
Id	w [inch]	f1 f2 [ksi]	psi [-]	k [-]	Fcr [ksi]	lambda [-]	rho [-]	b be [inch]	b1 b2 [inch]	S [-]	Ia Is [inch^4]	ds [inch]
1	1.674	1.329 1.329	1.00	4.000	8091.760	0.013	1.000	1.674 -	- -	-	- -	-
3	3.674	1.329 1.329	1.00	4.000	1679.870	0.028	1.000	3.674 -	- -	-	- -	-
5	1.674	1.329 1.329	1.00	4.000	8091.760	0.013	1.000	1.674 -	- -	-	- -	-
7	3.674	1.329 1.329	1.00	4.000	1679.870	0.028	1.000	3.674 -	- -	-	- -	-

Table of values		
Mnx	31536.96	lbfft
Mny	25152.03	lbfft
Pn	272159.48	lbf
Resistance factor compression	0.85	
Resistance factor bending x	0.90	
Resistance factor bending y	0.90	

Unity check = 0.05+0.90+0.00 = 0.94 - (C5.2.1-3)

The member satisfies the check !

Unity check


0,18
0,18
0,19
0,61
0,65
0,61
0,63
0,59
0,75
0,69
0,49
0,79
0,83
0,77
0,39
0,80
0,94
0,92
0,93
0,80
0,37
0,59

Wind base shear:	
Transverse direction:	**19.6 kip**
Longitudinal direction:	**15.4 kip**
Analysis procedure:	**Modal response spectrum analysis**
Seismic base shear:	
Transverse direction base shear:	**6.57 kip**
Longitudinal direction base shear:	**6.57 kip**

The seismic base shear is the same in both directions.

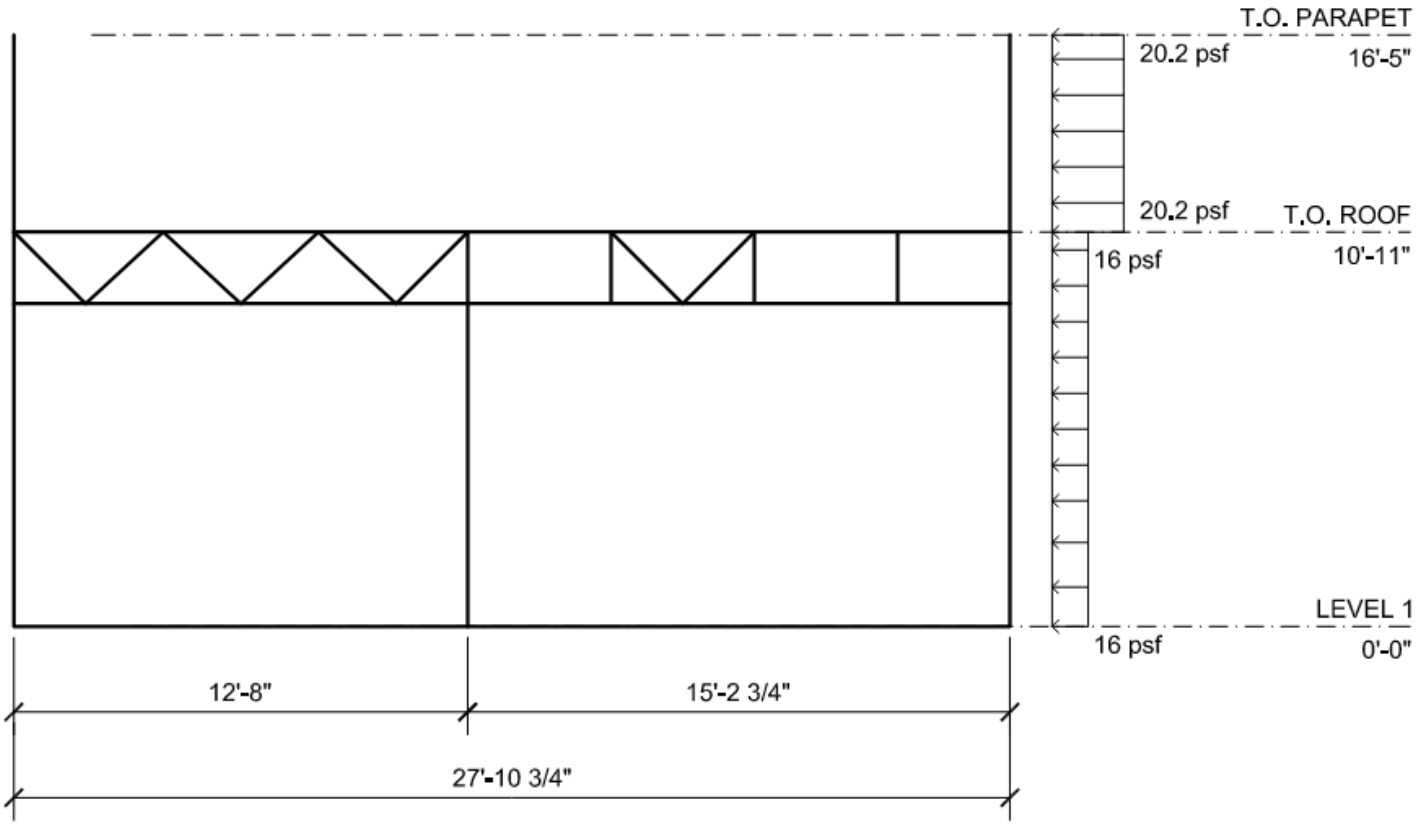
According to the calculation results, wind influences design in transverse and longitudinal direction.

2.4.6 LATERAL ANALYSIS

Building length L- 35’-10 3/4"

Building width W - 27’-10 3/4"

Wind load diagram



Determine the linear total wind load on the building, Qwl.

Qwl=(5’-6”x 20.2 psf)+(10’-11”x16 psf)= 282.8 lbs/ft

Determine the shear force in the longitudinal direction on 1 exterior wall, Sl:

Sl = (Qwl x W)/2 = (282.8 bs/ft x 27’-10 3/4") / 2 = 3944.4 lbs

Shear force of 1 feet wall:

3944.4 lbs / 35’-10 3/4" = 109.88 lbs/ft

Determine the shear force in the transverse direction on 1ft exterior wall, St:

St = (Qwl x L)/2 = (282.8 lbs/ft x 35’-10 3/4") / 2 = 5075.5 lbs

Shear force of 1 feet wall:

5075.5 lbs / 27’-10 3/4" = 181.95 lbs/ft

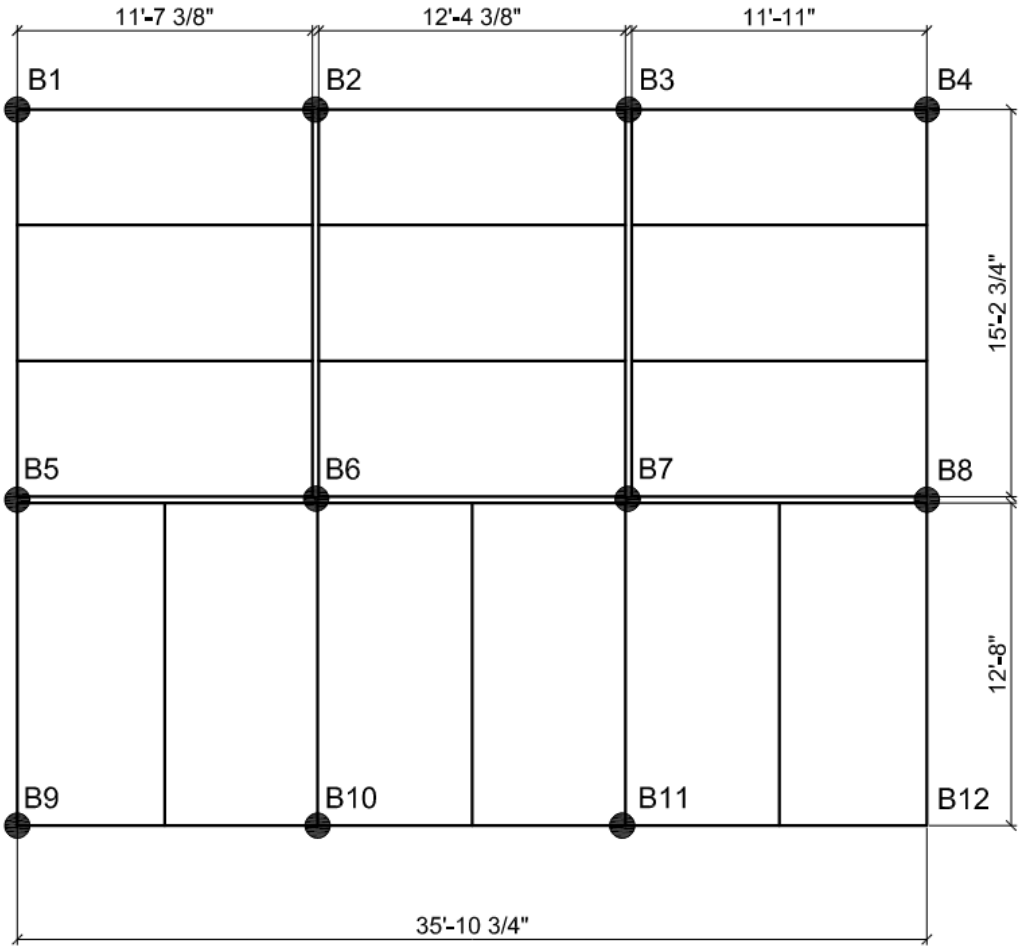
Shear capacity of panels Rok-on structural insulated sheathing is 183 lbs/ft.

181.95 lbs/ft < 183 lbs/ft.

Design OK!

3. SUPPORT DESIGN

3.1. SCREW PILES REACTIONS



BASE PLATE PLAN

Maximum reactions are specified using bold font.

Bace	Case	Rx [lbf]	Ry [lbf]	Rz [lbf]
B1	LRFD-Ult (auto)31	**1809,26**	-2786,42	10560,64
	LRFD-Ult (auto)5	986,27	**-3708,19**	**13288,34**
B2	LRFD-Ult (auto)30	**-2354,89**	452,66	14650,65
	LRFD-Ult (auto)5	-364,79	1400,51	**26848,12**
	LRFD-Ult (auto)33	-207,57	**2963,25**	11164,74
B3	LRFD-Ult (auto)30	**-2547,71**	-52,14	14857,62
	LRFD-Ult (auto)5	-857,29	-73,17	**31269,09**
	LRFD-Ult (auto)20	-50,33	**2214,85**	5519,55
B4	LRFD-Ult (auto)5	-1753,54	**-3148,48**	**15956,78**
	LRFD-Ult (auto)44	817,23	250	1952,48
	LRFD-Ult (auto)30	**-2244,82**	-2584,62	11928,21
B5	LRFD-Ult (auto)33	-226,33	**3046,07**	10738,98
	LRFD-Ult (auto)5	-710,16	2686,23	**23198,23**
	LRFD-Ult (auto)30	**-2718,46**	1419,46	10270,41
B6	LRFD-Ult (auto)5	**3720,69**	**-10821,18**	**50133,37**
	LRFD-Ult (auto)45	1079,71	-3644,23	4029,18
	LRFD-Ult (auto)46	-62,31	-2,29	10570,68
B7	LRFD-Ult (auto)46	231,48	179,46	9476,07
	LRFD-Ult (auto)45	-1025,3	-2992,58	3589,81
	LRFD-Ult (auto)5	**-3656,31**	**-7850,69**	**47243,84**

Bace	Case	Rx [lbf]	Ry [lbf]	Rz [lbf]
B8	LRFD-Ult (auto)27	-184,14	**-2057,29**	12257,51
	LRFD-Ult (auto)5	-877,48	-364,2	**24652,95**
	LRFD-Ult (auto)30	**-3324,01**	-597,96	14868,49
B9	LRFD-Ult (auto)31	**1312,7**	1177,75	9101,34
	LRFD-Ult (auto)5	1029,49	**2453,25**	**14294,99**
B10	LRFD-Ult (auto)31	**1725,75**	5749,2	11899,23
	LRFD-Ult (auto)5	1123	**10557,3**	**24190,53**
B11	LRFD-Ult (auto)31	**1895,29**	3982,48	12548,23
	LRFD-Ult (auto)5	1151,55	**7633,22**	**24701,93**
B12	LRFD-Ult (auto)/1	**534,7**	602,29	5473,11
	LRFD-Ult (auto)33	-72,41	**1660,49**	7712,19
	LRFD-Ult (auto)5	208,58	1235,39	**9994,9**

Proposed Krinner Screw Piles

Mark	Pile Diameter x Thickn, mm x mm	Foundation Nodes #
1	(1) KSF M 114x1300-4xM16	B1
2	(2) KSF M 114x1300-4xM16	B2
3	(2) KSF M 114x1300-4xM16	B3
4	(1) KSF M 114x1300-4xM16	B4
5	(2) KSF M 114x1300-4xM16	B5
6	(4) KSF M 114x1300-4xM16	B6
7	(4) KSF M 114x1300-4xM16	B7
8	(2) KSF M 114x1300-4xM16	B8
9	(1) KSF M 114x1300-4xM16	B9
10	(2) KSF M 114x1300-4xM16	B10
11	(2) KSF M 114x1300-4xM16	B11
12	(1) KSF M 114x1300-4xM16	B12

Item	KRINNER screw foundation Type desig. New version	Type desig. Old version	Tube diameter ø	Wall thickness	Steel tube MRd, el kNm	Steel tube MRd, pl kNm	Flange plate MRd, el kNm	Load values (tension in N/compression/horizontal) Compression (kN)	Tension (kN)	Horizontal (kN)
M-Series										
27		(KSF M24 140x2000)	139.70	3.60	11.140	15.980	3.97	72.50 16,29 kip	40.00 8,99 kip	19.50 4,38 kip
	KSF M 140x2100-M24		139.70	3.60	△	△	△	△	△	△
28		(KSF M24 114x2000)	114.30	3.60	7.329	10.610	2.66	66.00	37.50	17.00
	KSF M 114x2100-M24		114.30	3.60	△	△	△	△	△	△
29		(KSF M24 114x1600)	114.30	3.60	7.329	10.610	2.66	47.50	27.50	13.50
	KSF M 114x1600-M24		114.30	3.60	△	△	△	△	△	△
30		(KSF M24 114x1200)	114.30	3.60	7.329	10.610	2.66	35.00	20.50	9.50
	KSF M 114x1300-M24		114.30	3.60	△	△	△	△	△	△
31		(KSF M24 90x2000)	88.90	3.60	4.314	6.220		55.00	35.00	14.00
	KSF M 89x2100-M24		88.90	3.60	△	△		△	△	△
32		(KSF M24 90x1600)	88.90	3.60	4.314	6.220		41.00	24.50	11.00
	KSF M 89x1600-M24		88.90	3.60	△	△		△	△	△
33		(KSF M24 90x1200)	88.90	3.60	4.314	6.220		30.00	16.50	7.50
	KSF M 89x1300-M24		88.90	3.60	△	△		△	△	△