STRUCTURAL ENGINEERING CALCULATIONS

FOR

ACADEMY BANK
ITM SHELTER
2101 WEST PENWAY
KANSAS CITY, MO

PREPARED BY

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OF

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FOR

DIMENSIONAL INNOVATIONS
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AUGUST 7, 2019

STATE OF MISSOURI
MICHAEL JOHN FALBE
NUMBER
E-24014
REGISTERED PROFESSIONAL ENGINEER

8-7-19

BOB D. CAMPBELL & CO.
Structural Engineers Since 1957
4338 Belleview Ave. 816.531.4144
Kansas City, MO 64111 www.bdc-engrs.com

Project:	Academy Bank ITM Shelter
Project No.:	DIMIN1916
Location:	Kansas City, MO
By:	MJF / RMH
Date:	8/6/2019

Structural Design Criteria

Building Code:

International Building Code (IBC 2012 - *As adopted by the city of Kansas City, MO)*

Concrete:	ACI 318-11
Steel:	AISC 360-10
Wood:	NDS 2012
Connections:	ASCE 7-10

ANSI as approved in 2011

Basic Load Combinations - Allowable Stress Design (ASCE7-10)

D
D + L
D + (Lr or S or R)
D + 0.75L + 0.75(Lr or S of R)
D + (0.6W or 0.7E)
D + 0.75L + 0.75(0.6W) + 0.75(lR or S or R)
D + 0.75L + 0.75(0.7E) + 0.75S
0.6D + 0.6W
0.6D + 0.7E

Structural Design Loads

Dead Load	15 psf
Live Load	25 psf

Materials

Steel:	Beams & Columns:	ASTM A992, Grade 50
	Miscellaneous steel:	ASTM A36
	Tubes & Pipes:	ASTM A500, Grade B

Concrete: 3500 psi (footings, grade beams)
4000 psi (interior flatwork)
4500 psi w/ 6% +/- 1% air entrainment (exterior flatwork)

Reinf. Steel: ASTM A615 or A706 Grade 60 steel

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MWFRS Wind Pressures

International Building Code 2012 / ASCE7-10

				Roof Angle =	0°			
Kzt=	1.0	Leeward Kh=	**0.85**	Ridge Dirr. =	Flat (<10°)		Pressure	Horiz. Proj.
Kd=	0.85	G=	0.85	Roof Cp+ (Long.)=	0.25		5.2 psf	0.0 psf
V=	115 mph	Windward Cp=	0.8	Roof Cp- (Long.) =	-0.7		-14.6 psf	0.0 psf
I=	1.00	Leeward Cp=	-0.5	Roof Cp+ (Trans.)	0.25		5.2 psf	0.0 psf
Exposure	C	Side Wall Cp=	-0.7	Roof Cp- (Trans.)	-0.6		-12.5 psf	0.0 psf
Mn. Roof Ht.	15	qh=	**24.46**				Parapet GCp+=	1.5
							Parapet GCp-=	-1
							Parapet Pres. =	61.2

Height (ft.)	Kz	qz (psf)	Windward Pressure (psf)	Leeward Pressure (psf)	Total Pressure (psf)
15	0.85	24.46	16.63	-10.40	27.03
20	0.9	25.90	17.61	-10.40	28.01
25	0.94	27.05	18.39	-10.40	28.79
30	0.98	28.20	19.18	-10.40	29.57
40	1.04	29.93	20.35	-10.40	30.75
50	1.09	31.37	21.33	-10.40	31.73
60	1.13	32.52	22.11	-10.40	32.51
70	1.17	33.67	22.90	-10.40	33.29
80	1.21	34.82	23.68	-10.40	34.07
90	1.24	35.68	24.27	-10.40	34.66
100	1.26	36.26	24.66	-10.40	35.05
120	1.31	37.70	25.64	-10.40	36.03
140	1.36	39.14	26.61	-10.40	37.01
160	1.39	40.00	27.20	-10.40	37.60

Side Wall Pressure (psf)
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6
-14.6

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Monoslope Free Roofs - Open Buildings (MWFR) (θ≤45°)

International Building Code 2012 / ASCE7-10

Kzt=	1.0	G=	0.85	**Roof Properties**	
Kd=	0.85	qz=	24.5	Mean Roof Height, h	15.0 ft
V=	115.0 mph			Canopy Width, L	10.0 ft
I=	1.00			Angle, θ	5.0°
Exposure	C			Wind Flow	Clear Wind Flow

Force Coefficients, C_{NW}, C_{NL}

Roof Angle, θ	Load Case	Wind Direction, Υ=0°				Wind Direction, Υ=180°			
		Clear Wind Flow		Obstructed Wind Flow		Clear Wind Flow		Obstructed Wind Flow	
		C_{NW}	C_{NL}	C_{NW}	C_{NL}	C_{NW}	C_{NL}	C_{NW}	C_{NL}
0	A	1.2	0.3	-0.5	-1.2	1.2	0.3	-0.5	-1.2
	B	-1.1	-0.1	-1.1	-0.6	-1.1	-0.1	-1.1	-0.6
7.5	A	-0.6	-1	-1	-1.5	0.9	1.5	-0.2	-1.2
	B	-1.4	0	-1.7	-0.8	1.6	0.3	0.8	-0.3
15	A	-0.9	-1.3	-1.1	-1.5	1.3	1.6	0.4	-1.1
	B	-1.9	0	-2.1	-0.6	1.8	0.6	1.2	-0.3
22.5	A	-1.5	-1.6	-1.5	-1.7	1.7	1.8	0.5	-1
	B	-2.4	-0.3	-2.3	-0.9	2.2	0.7	1.3	0
30	A	-1.8	-1.8	-1.5	-1.8	2.1	2.1	0.6	-1
	B	-2.5	-0.5	-2.3	-1.1	2.6	1	1.6	0.1
37.5	A	-1.8	-1.8	-1.5	-1.8	2.1	2.2	0.7	-0.9
	B	-2.4	-0.6	-2.2	-1.1	2.7	1.1	1.9	0.3
45	A	-1.6	-1.8	-1.3	-1.8	2.2	2.5	0.8	-0.6
	B	-2.3	-0.7	-1.9	-1.2	2.6	1.4	2.1	0.4

Note: For values of θ between 7.5° and 45°, linear interpolation is permitted. For values of θ < 7.5°, use load coefficients fo 0°.

Wind Pressures Coefficients

Load Case	Wind Direction, Υ=0°		Wind Direction, Υ=180°	
	C_{NW}	C_{NL}	C_{NW}	C_{NL}
A	1.20	0.30	1.20	0.30
B	-1.10	-0.10	-1.10	-0.10

Wind Pressures ($p = q_h*G*C_N$)

Load Case	Wind Direction, Υ=0°		Wind Direction, Υ=180°	
	P_{NW}	P_{NL}	P_{NW}	P_{NL}
A	24.95 psf	6.24 psf	24.95 psf	6.24 psf
B	-22.87 psf	-2.08 psf	-22.87 psf	-2.08 psf

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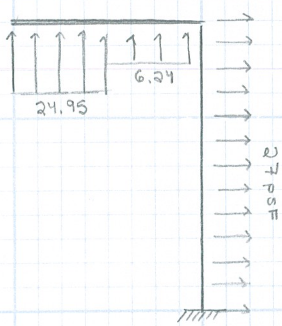
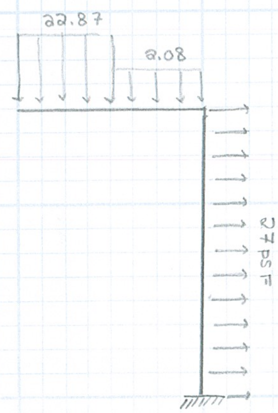
Project DIMIN1916

Date ______ Page ___ of ___

WIND CASES (ULT LOADS)

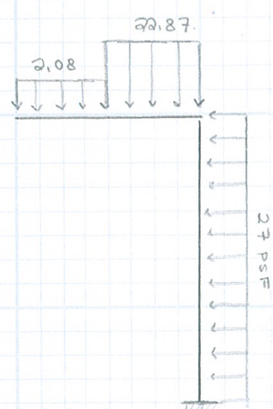


γ = 0 ; LC - A

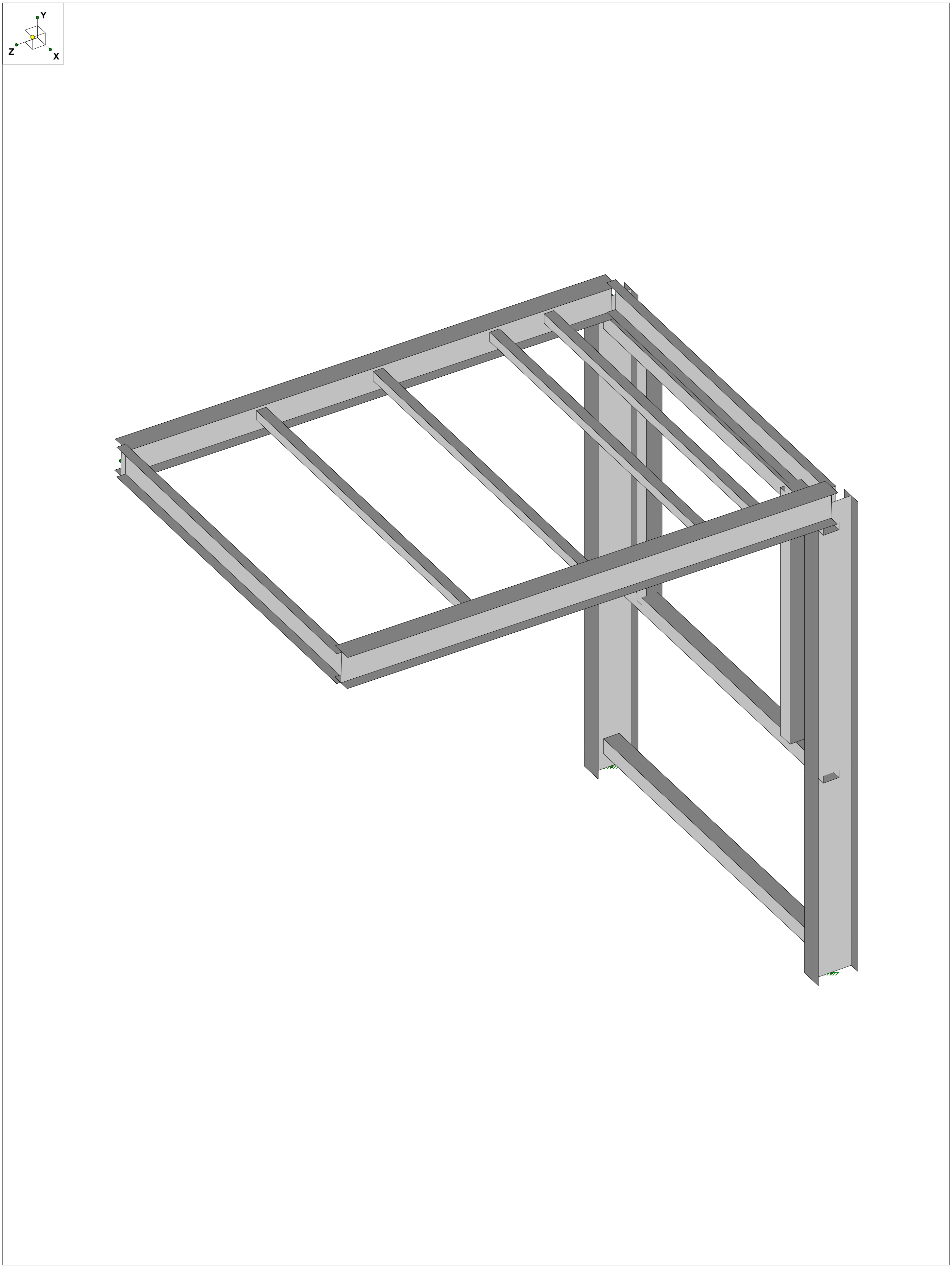


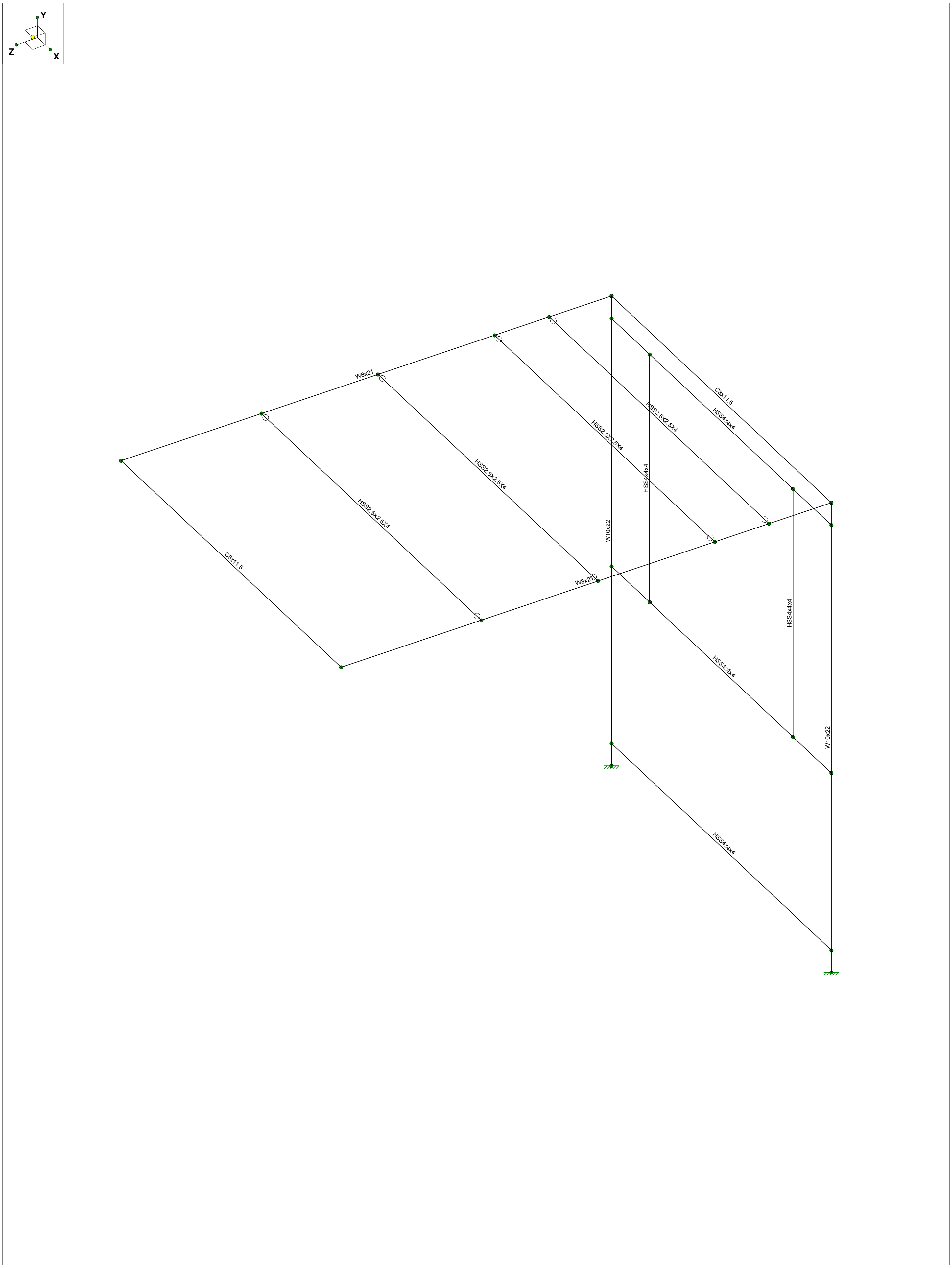
γ = 0 ; LC - B

γ = 180 ; LC - A

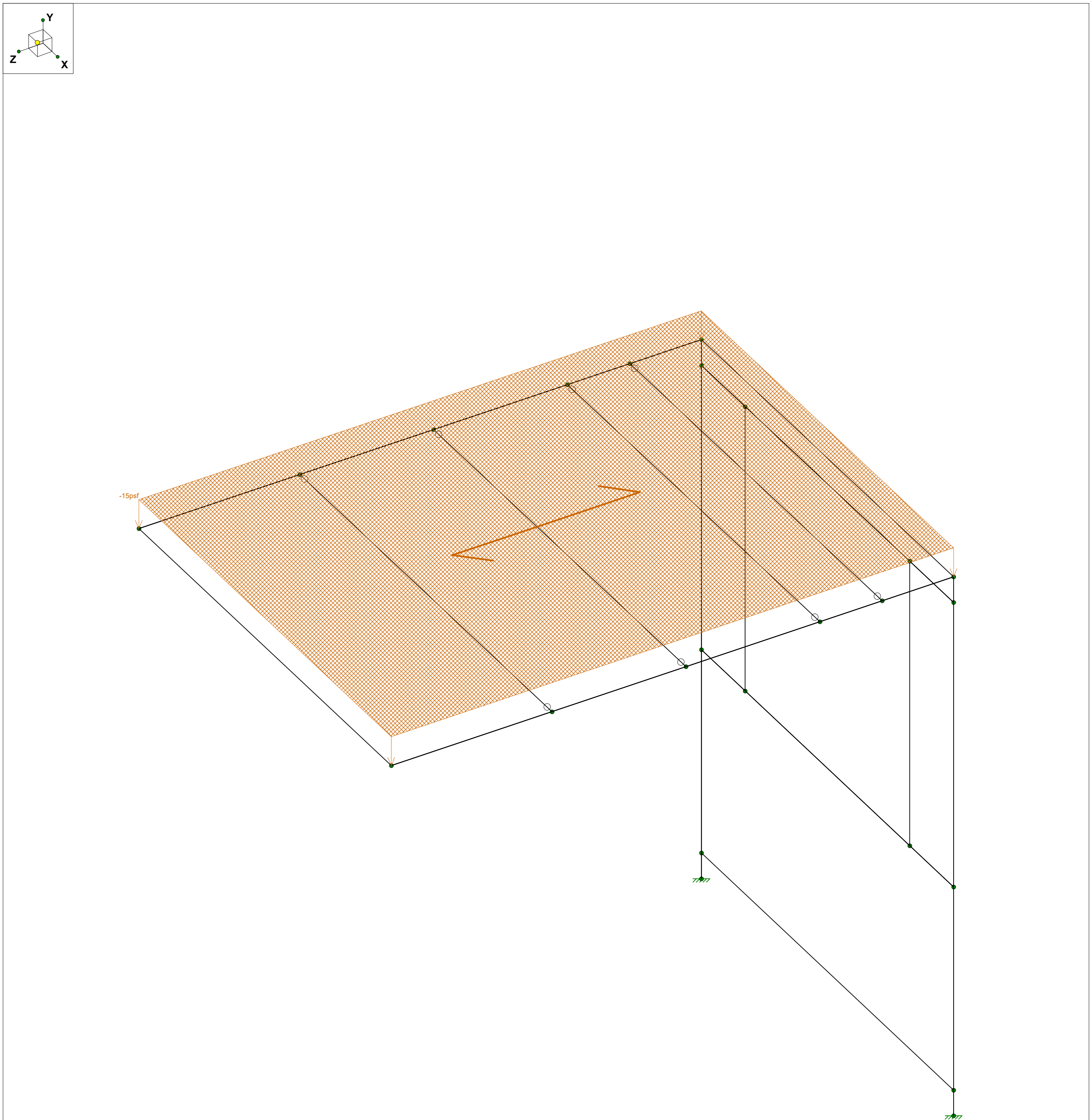


γ = 180 ; LC - B

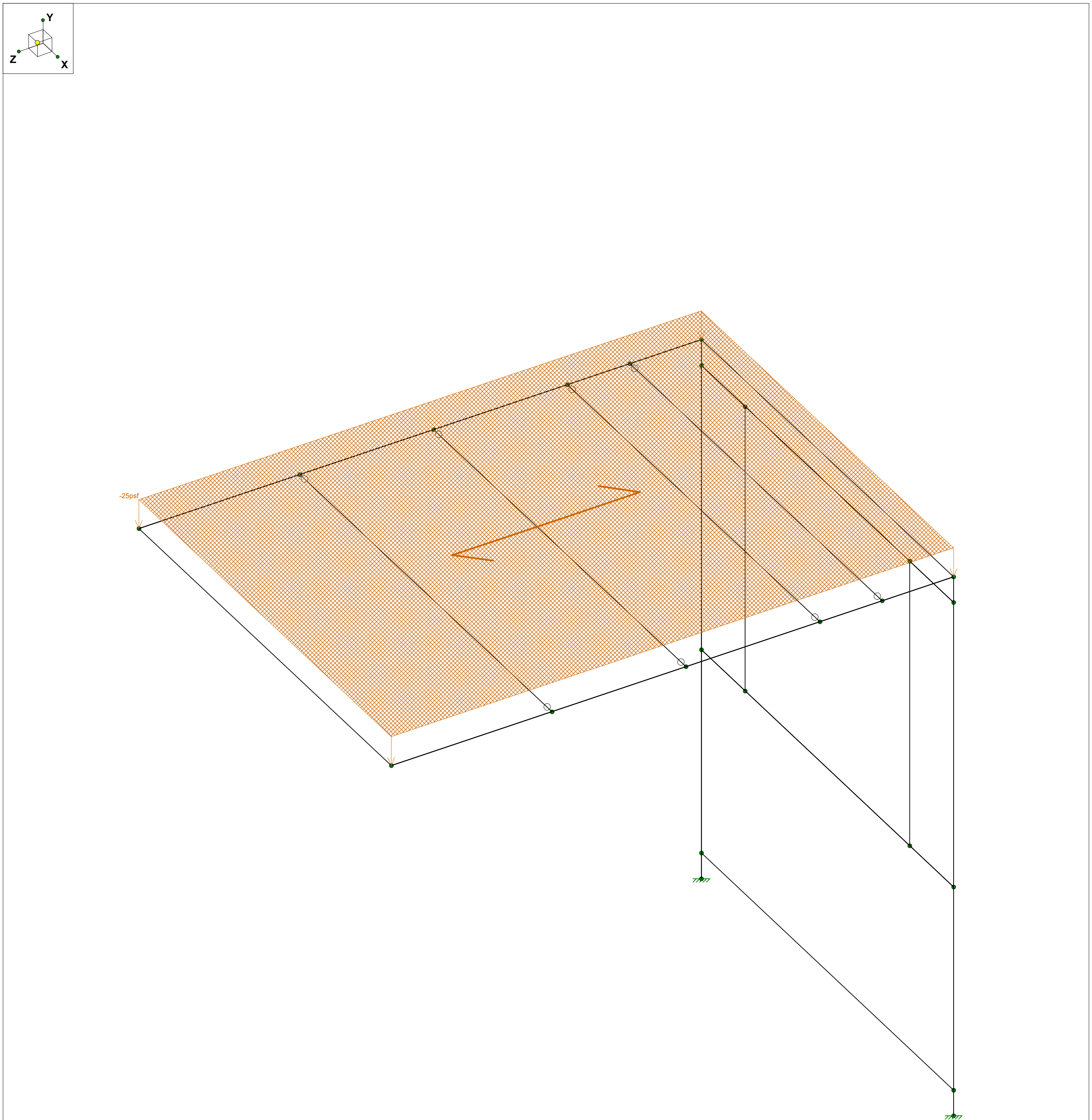

Y
Z
X



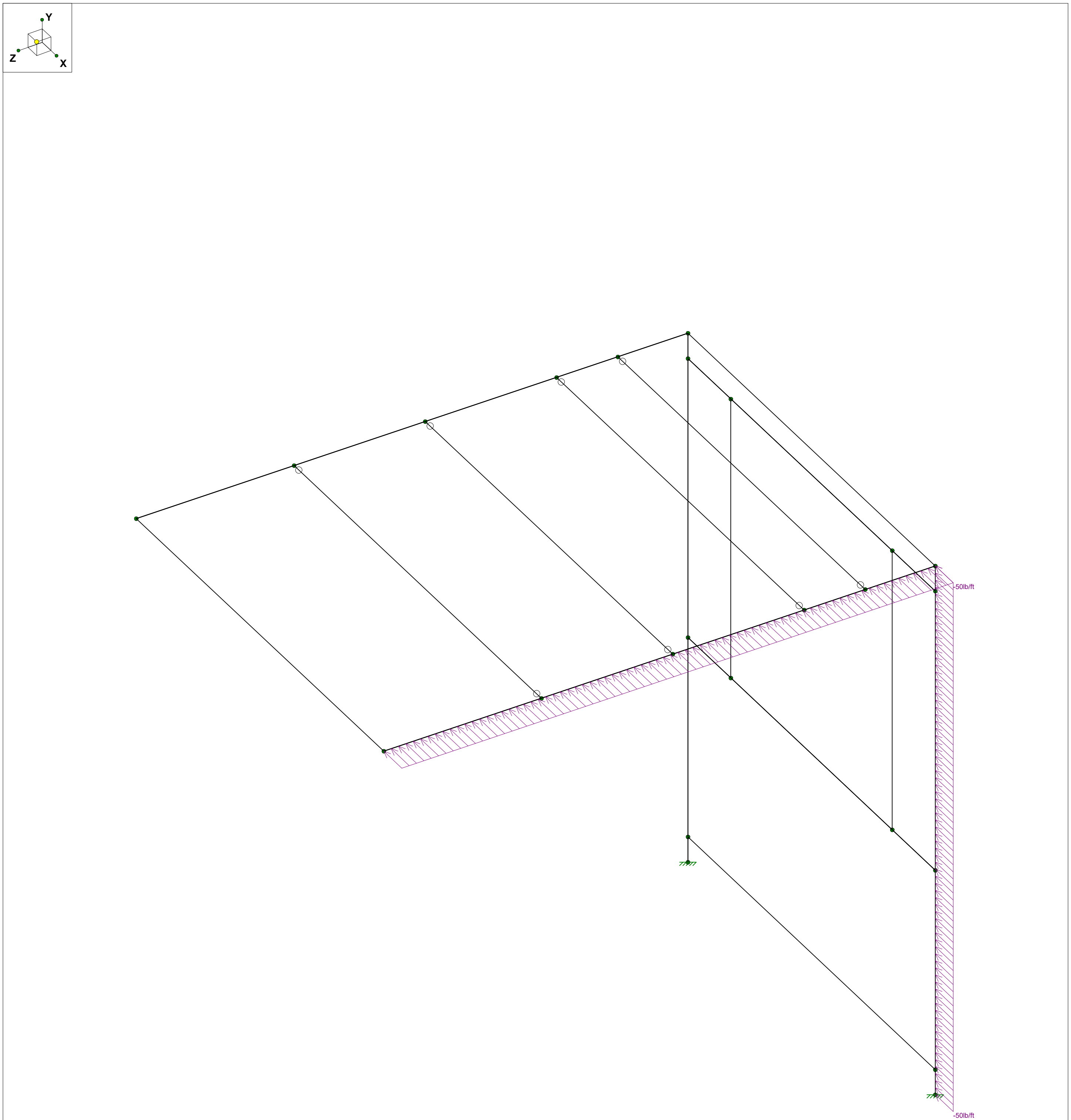
Y
Z
X
W8x21
C8x11.5
HSS4x4x4
HSS2.5X2.5X4
HSS2.5X2.5X4
HSS4x4x4
HSS2.5X2.5X4
W10x22
HSS2.5X2.5X4
C8x11.5
W8x21
HSS4x4x4
HSS4x4x4
W10x22
HSS4x4x4



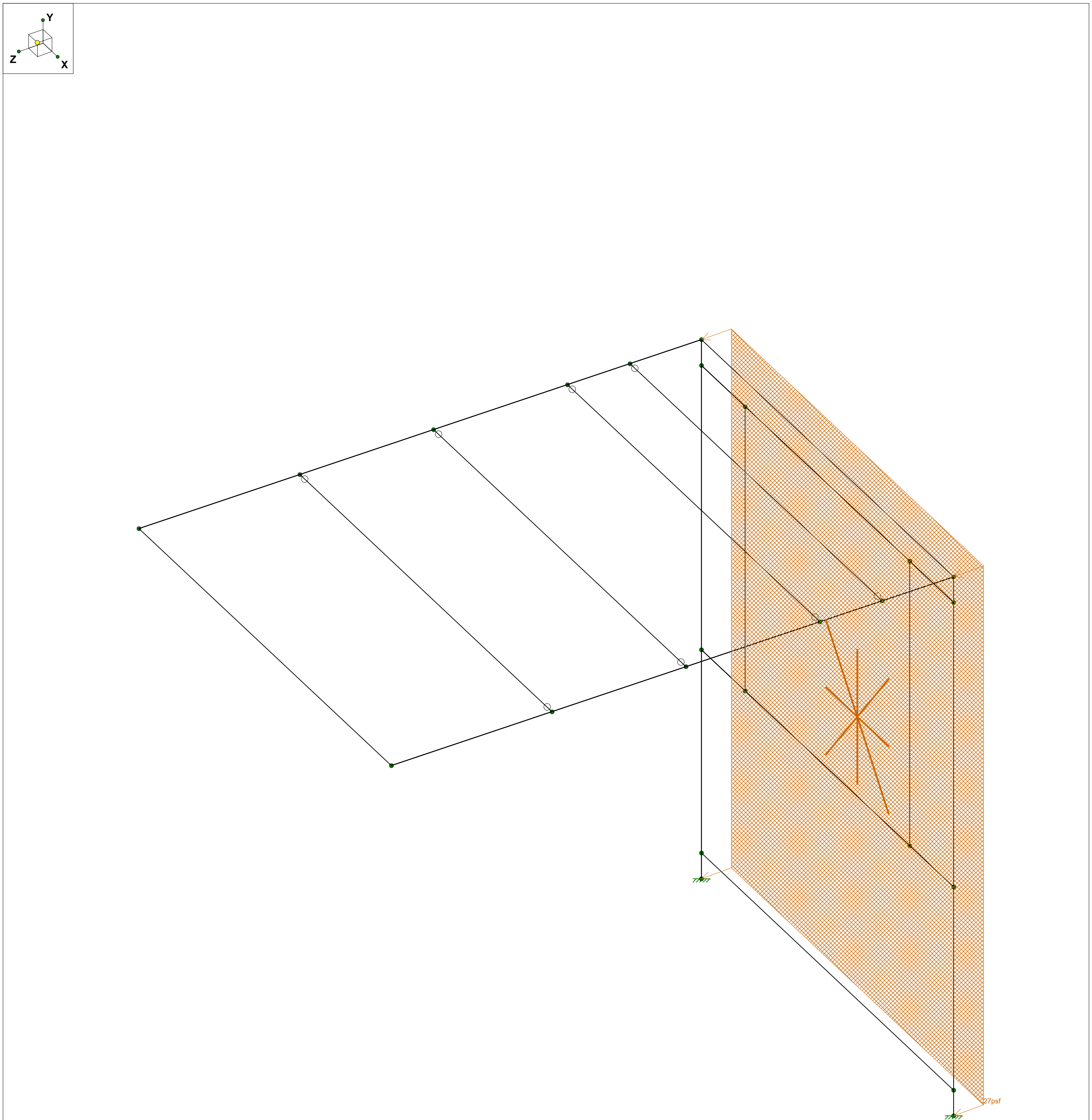
Loads: BLC 1, Dead Load



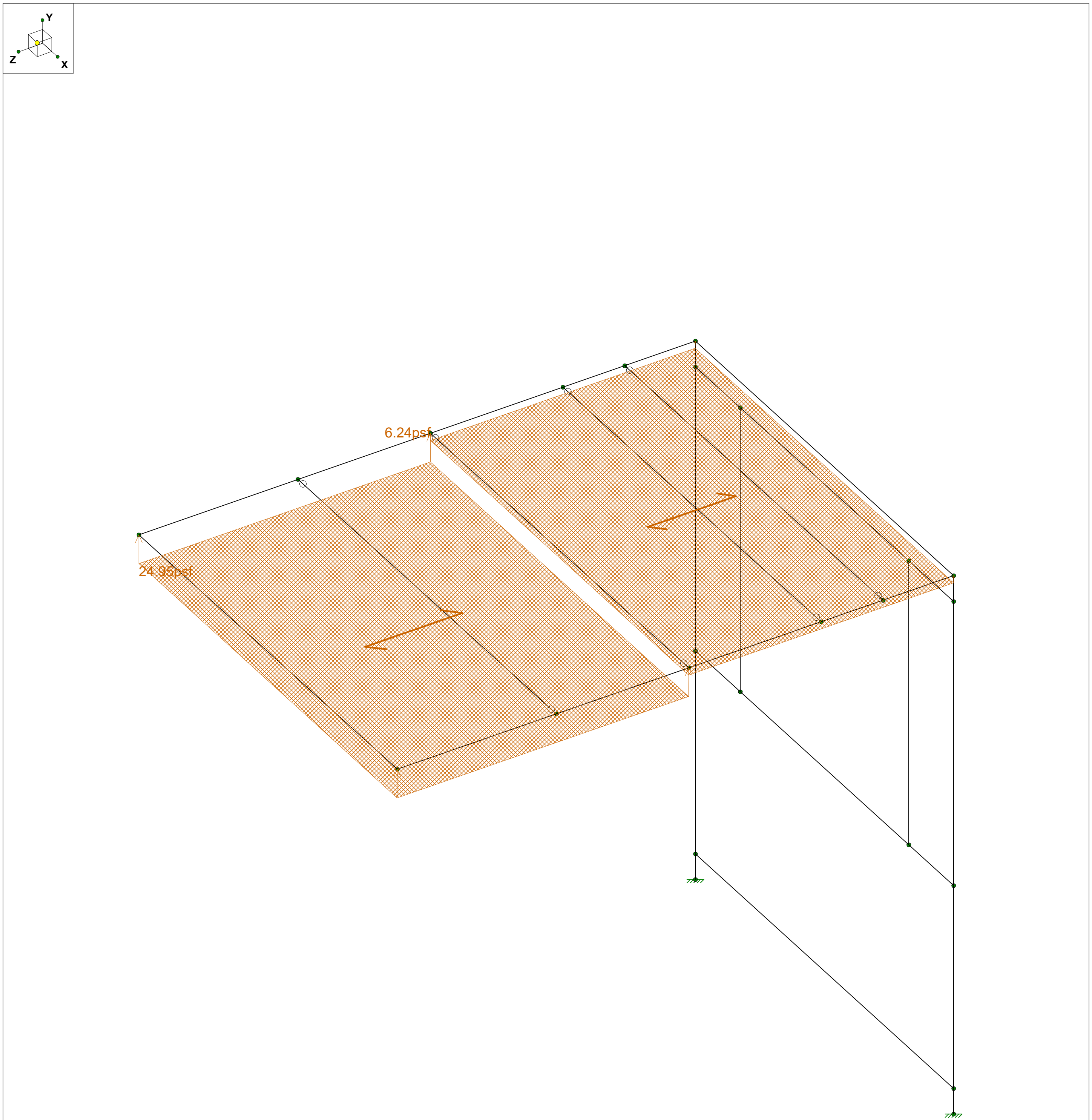
Loads: BLC 2, Live Load



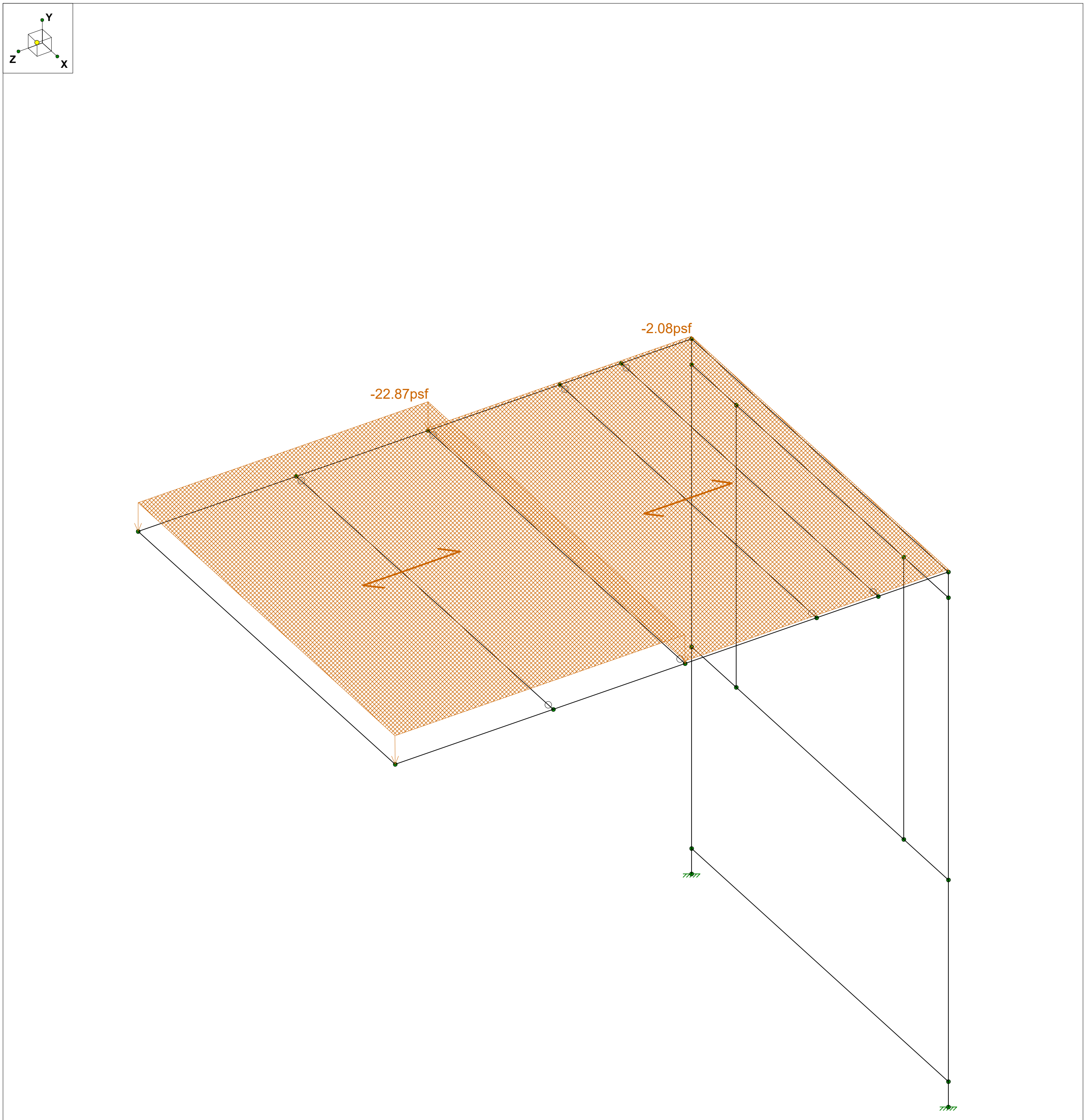
Loads: BLC 3, Wind Load X



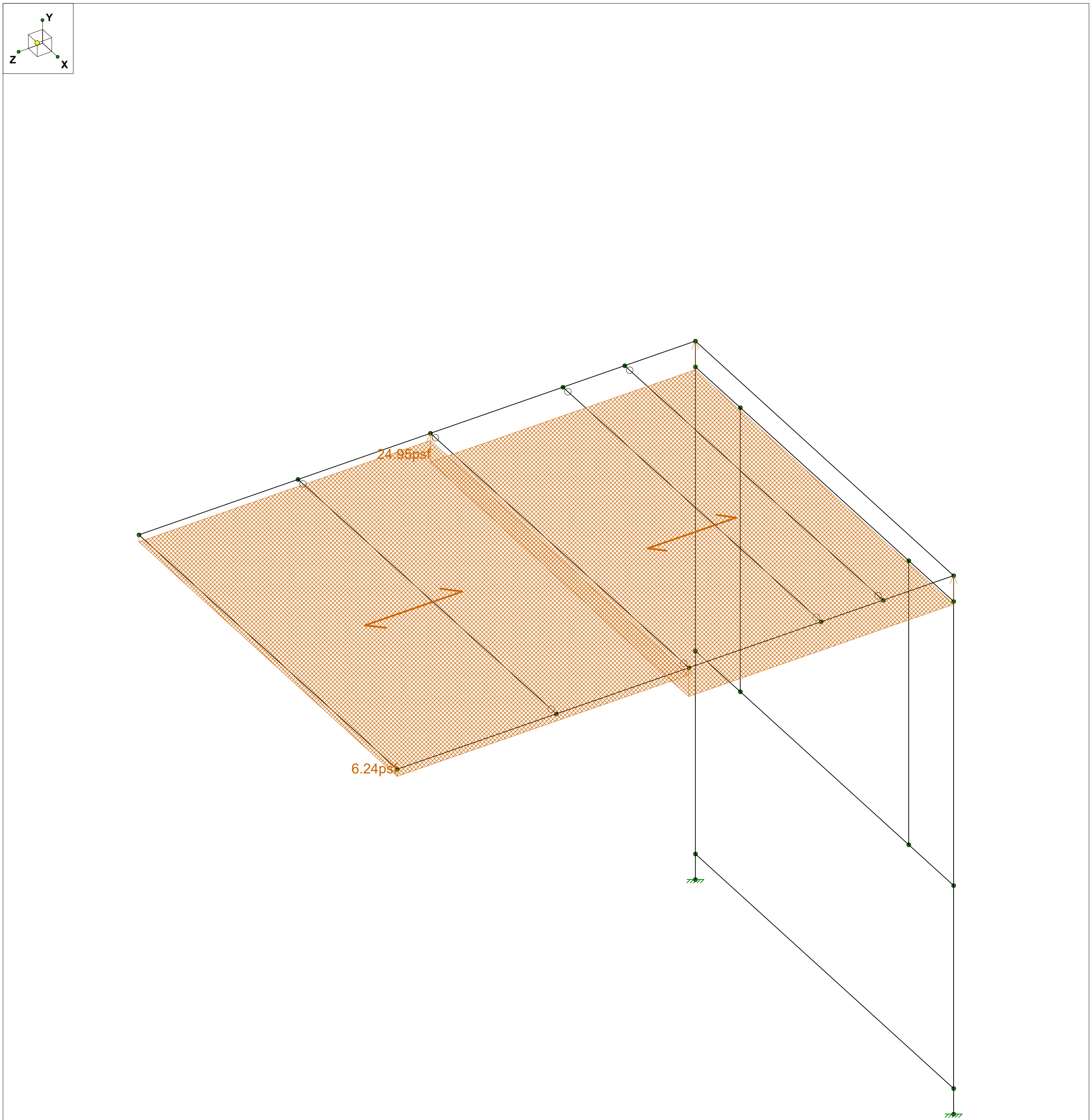
Loads: BLC 4, Wind Load Z



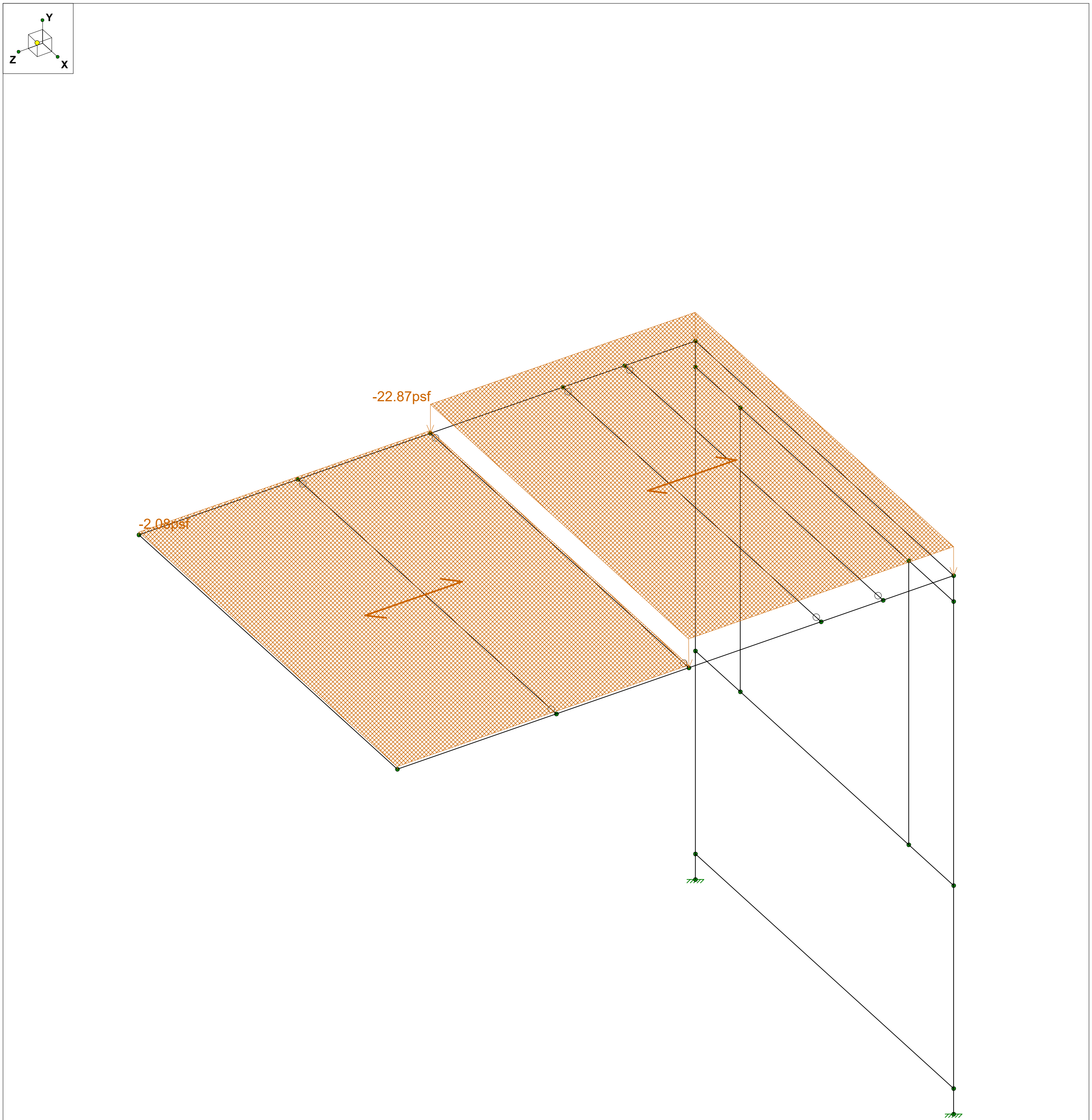
Loads: BLC 7, 0, LC-A



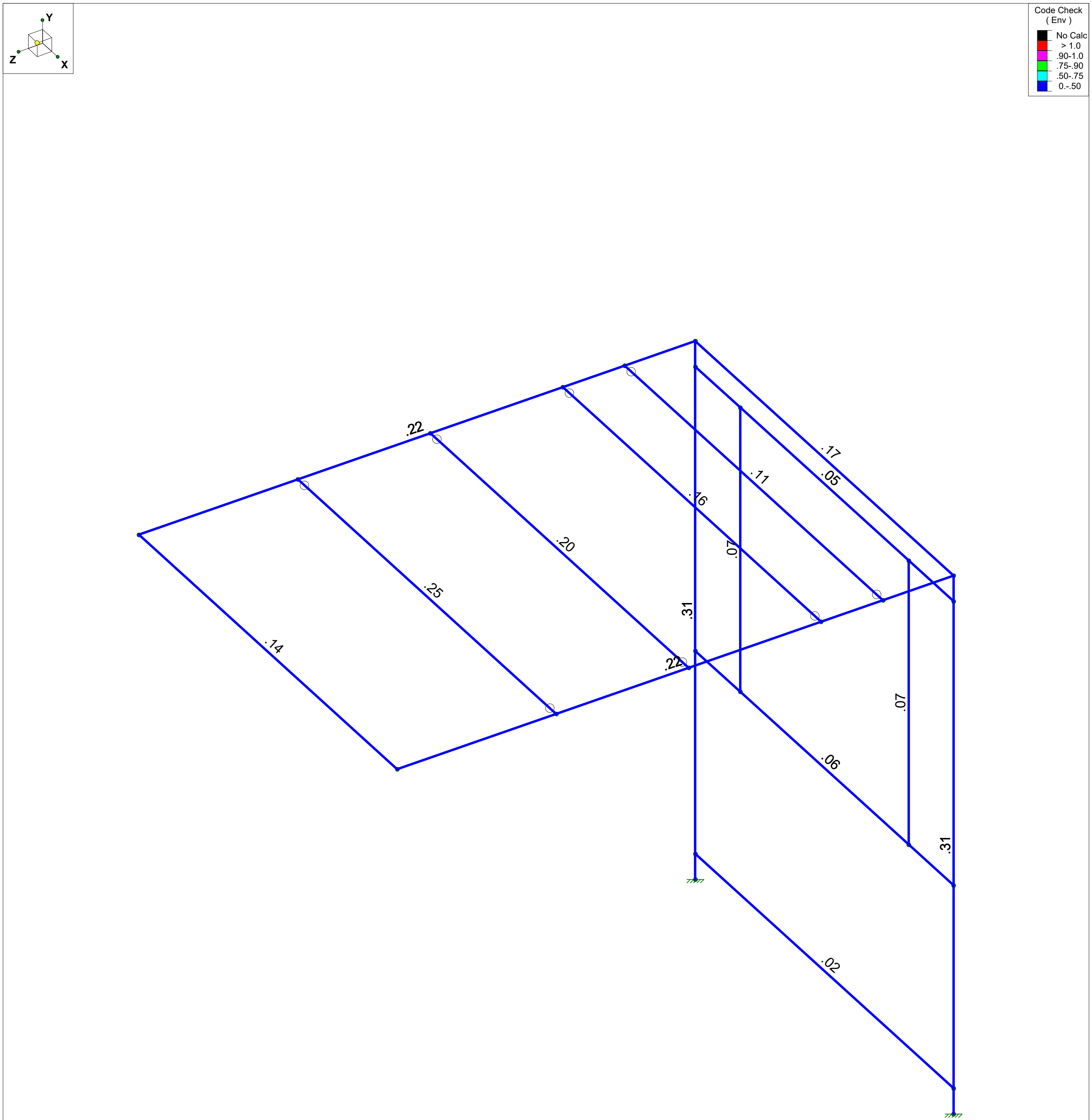
Loads: BLC 8, 0, LC-B



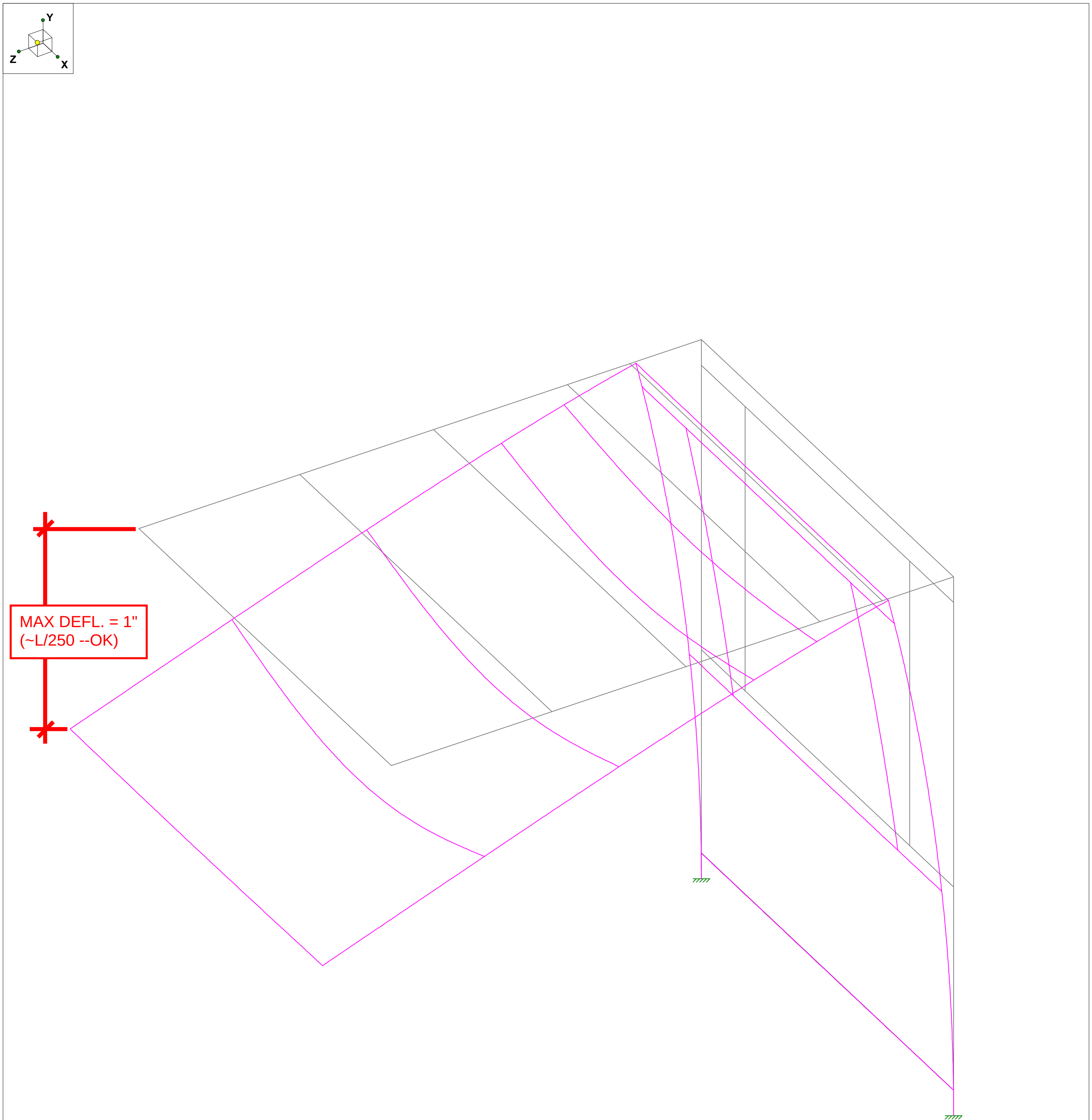
Loads: BLC 9, 180, LC-A



Loads: BLC 10, 180, LC-B



Member Code Checks Displayed (Enveloped)
Results for LC 1, DL



Results for LC 2, DL + LL

Basic Load Cases

	BLC Description	Category	X Gravi...	Y Gravi...	Z Gravity	Joint	Point	Distrib...	Area(M...	Surfac...
1	Dead Load	DL		-1					1	
2	Live Load	LL							1	
3	Wind Load X	WLX						2		
4	Wind Load Z	WLZ							1	
5	Seismic Load X	ELX								
6	Seismic Load Z	ELZ								
7	0, LC-A	None							2	
8	0, LC-B	None							2	
9	180, LC-A	None							2	
10	180, LC-B	None							2	
11	BLC 1 Transient Area Loads	None						22		
12	BLC 2 Transient Area Loads	None						22		
13	BLC 4 Transient Area Loads	None						40		
14	BLC 9 Transient Area Loads	None						23		
15	BLC 10 Transient Area Loads	None						23		
16	BLC 7 Transient Area Loads	None						23		
17	BLC 8 Transient Area Loads	None						23		

Load Combinations

	Description	Solve	PDelta	SRSS	B...	Fa...	BLC	Fa...	BLC	Fa...	BLC	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...
1	DL	Yes	Y		DL	1																		
2	DL + LL	Yes	Y		DL	1	LL	1																
3	DL + 0.6WLX	Yes	Y		DL	1			WLX	.6														
4	DL + 0.6WLZ (180, LC-A)	Yes	Y		DL	1			WLZ	.6	9	.6												
5	DL + 0.6WLZ (180, LC-B)	Yes	Y		DL	1			WLZ	.6	10	.6												
6	DL - 0.6WLX	Yes	Y		DL	1			WLX	-.6														
7	DL - 0.6WLZ (0, LC-A)	Yes	Y		DL	1			WLZ	-.6	7	.6												
8	DL - 0.6WLZ (0, LC-B)	Yes	Y		DL	1			WLZ	-.6	8	.6												
9	DL + 0.75LL + 0.75(0.6...	Yes	Y		DL	1	LL	.75	WLX	.45														
10	DL + 0.75LL + 0.75(0.6...	Yes	Y		DL	1	LL	.75	WLZ	.45	9	.45												
11	DL + 0.75LL + 0.75(0.6...	Yes	Y		DL	1	LL	.75	WLZ	.45	10	.45												
12	DL + 0.75LL - 0.75(0.6...	Yes	Y		DL	1	LL	.75	WLX	-.45														
13	DL + 0.75LL - 0.75(0.6...	Yes	Y		DL	1	LL	.75	WLZ	-.45	7	.45												
14	DL + 0.75LL - 0.75(0.6...	Yes	Y		DL	1	LL	.75	WLZ	-.45	8	.45												
15	0.6DL + 0.6WLX	Yes	Y		DL	.6			WLX	.6														
16	0.6DL + 0.6WLZ (180, L...	Yes	Y		DL	.6			WLZ	.6	9	.6												
17	0.6DL + 0.6WLZ (180, L...	Yes	Y		DL	.6			WLZ	.6	10	.6												
18	0.6DL - 0.6WLX	Yes	Y		DL	.6			WLX	-.6														
19	0.6DL - 0.6WLZ (0, LC-A)	Yes	Y		DL	.6			WLZ	-.6	7	.6												
20	0.6DL - 0.6WLZ (0, LC-B)	Yes	Y		DL	.6			WLZ	-.6	8	.6												
21	1.4DL		Y		DL	1.4																		
22	1.2DL + 1.6LL		Y		DL	1.2	LL	1.6																
23	1.2DL + 0.5WLX		Y		DL	1.2			WLX	.5														
24	1.2DL - 0.5WLX		Y		DL	1.2			WLX	-.5														
25	1.2DL + 0.5WLZ (180, L...		Y		DL	1.2			WLZ	.5	9	.5												
26	1.2DL + 0.5WLZ (180, L...		Y		DL	1.2			WLZ	.5	10	.5												
27	1.2DL - 0.5WLZ (0, LC-A)		Y		DL	1.2			WLZ	-.5	7	.5												
28	1.2DL - 0.5WLZ (0, LC-B)		Y		DL	1.2			WLZ	-.5	8	.5												
29	1.2DL + WLX + LL		Y		DL	1.2	LL	1	WLX	1														

Load Combinations (Continued)

	Description	Solve	PDelta	SRSS	B...	Fa...	BLC	Fa...	BLC	Fa...	BLC	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...
30	1.2DL - WLX + LL		Y		DL	1.2	LL	1	WLX	-1																
31	1.2DL + WLZ + LL (180,...		Y		DL	1.2	LL	1	WLZ	1	9	1														
32	1.2DL + WLZ + LL (180,...		Y		DL	1.2	LL	1	WLZ	1	10	1														
33	1.2DL - WLZ + LL (0, L...		Y		DL	1.2	LL	1	WLZ	-1	7	1														
34	1.2DL - WLZ + LL (0, L...		Y		DL	1.2	LL	1	WLZ	-1	8	1														
35	0.9DL + WLX		Y		DL	.9			WLX	1																
36	0.9DL - WLX		Y		DL	.9			WLX	-1																
37	0.9DL + WLZ (180, LC-A)		Y		DL	.9			WLZ	1	9	1														
38	0.9DL + WLZ (180, LC-B)		Y		DL	.9			WLZ	1	10	1														
39	0.9DL - WLZ (0, LC-A)		Y		DL	.9			WLZ	-1	7	1														
40	0.9DL - WLZ (0, LC-B)		Y		DL	.9			WLZ	-1	8	1														

Hot Rolled Steel Design Parameters

	Label	Shape	Length[in]	Lbyy[in]	Lbzz[in]	Lcomp top[i...	Lcomp bot[i...	L-torq...	Kyy	Kzz	Cb	Function
1	M1	W10x22	126									Lateral
2	M2	W10x22	126									Lateral
3	M3	W8x21	126.025			Lbyy						Lateral
4	M4	W8x21	126.025			Lbyy						Lateral
5	M5	C8x11.5	92			Lbyy						Lateral
6	M6	C8x11.5	92			Lbyy						Lateral
7	M7	HSS2.5X2....	92			Lbyy						Lateral
8	M8	HSS2.5X2....	92			Lbyy						Lateral
9	M9	HSS2.5X2....	92			Lbyy						Lateral
10	M10	HSS2.5X2....	92			Lbyy						Lateral
11	M11	HSS4x4x4	92			Lbyy						Lateral
12	M12	HSS4x4x4	92			Lbyy						Lateral
13	M13	HSS4x4x4	92			Lbyy						Lateral
14	M14	HSS4x4x4	66.5									Lateral
15	M15	HSS4x4x4	66.5									Lateral

Member Area Loads (BLC 1 : Dead Load)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N3	N2	N5	N6	Y	A-B	-15

Member Area Loads (BLC 2 : Live Load)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N3	N2	N5	N6	Y	A-B	-25

Member Area Loads (BLC 4 : Wind Load Z)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N4	N5	N2	N1	Z	Two Way	27

Member Area Loads (BLC 7 : 0, LC-A)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N3	N6	N12	N11	Y	B-C	24.95
2	N11	N12	N5	N2	Y	B-C	6.24

Member Area Loads (BLC 8 : 0, LC-B)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N11	N12	N6	N3	Y	B-C	-22.87
2	N2	N5	N12	N11	Y	B-C	-2.08

Member Area Loads (BLC 9 : 180, LC-A)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N6	N12	N11	N3	Y	C-D	6.24
2	N11	N12	N5	N2	Y	B-C	24.95

Member Area Loads (BLC 10 : 180, LC-B)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N3	N6	N12	N11	Y	B-C	-2.08
2	N11	N12	N5	N2	Y	B-C	-22.87

Member Distributed Loads (BLC 3 : Wind Load X)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M4	X	-50	-50	0	0
2	M1	X	-50	-50	0	0

Member Distributed Loads (BLC 11 : BLC 1 Transient Area Loads)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M5	Y	-22.515	-22.515	2.665e-15	92
2	M6	Y	-6.323	-10.71	0	18.4
3	M6	Y	-10.71	-12.498	18.4	36.8
4	M6	Y	-12.498	-12.287	36.8	55.2
5	M6	Y	-12.287	-10.499	55.2	73.6
6	M6	Y	-10.499	-6.536	73.6	92
7	M7	Y	-41.265	-41.265	7.105e-15	92
8	M8	Y	-62.994	-36.58	0	18.4
9	M8	Y	-36.58	-34.901	18.4	36.8
10	M8	Y	-34.901	-33.732	36.8	55.2
11	M8	Y	-33.732	-34.75	55.2	73.6
12	M8	Y	-34.75	-62.177	73.6	92
13	M9	Y	-21.849	-24.839	0	18.4
14	M9	Y	-24.839	-24.678	18.4	36.8
15	M9	Y	-24.678	-25.71	36.8	55.2
16	M9	Y	-25.71	-25.879	55.2	73.6
17	M9	Y	-25.879	-20.842	73.6	92
18	M10	Y	-21.228	-19.124	0	18.4
19	M10	Y	-19.124	-16.507	18.4	36.8
20	M10	Y	-16.507	-15.729	36.8	55.2
21	M10	Y	-15.729	-18.348	55.2	73.6
22	M10	Y	-18.348	-22.013	73.6	92

Member Distributed Loads (BLC 12 : BLC 2 Transient Area Loads)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M5	Y	-37.526	-37.526	2.665e-15	92
2	M6	Y	-10.538	-17.849	0	18.4
3	M6	Y	-17.849	-20.829	18.4	36.8

Member Distributed Loads (BLC 12 : BLC 2 Transient Area Loads) (Continued)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
4	M6	Y	-20.829	-20.478	36.8	55.2
5	M6	Y	-20.478	-17.499	55.2	73.6
6	M6	Y	-17.499	-10.894	73.6	92
7	M7	Y	-68.776	-68.776	7.105e-15	92
8	M8	Y	-104.99	-60.966	0	18.4
9	M8	Y	-60.966	-58.168	18.4	36.8
10	M8	Y	-58.168	-56.22	36.8	55.2
11	M8	Y	-56.22	-57.916	55.2	73.6
12	M8	Y	-57.916	-103.628	73.6	92
13	M9	Y	-36.414	-41.399	0	18.4
14	M9	Y	-41.399	-41.131	18.4	36.8
15	M9	Y	-41.131	-42.85	36.8	55.2
16	M9	Y	-42.85	-43.132	55.2	73.6
17	M9	Y	-43.132	-34.737	73.6	92
18	M10	Y	-35.38	-31.873	0	18.4
19	M10	Y	-31.873	-27.512	18.4	36.8
20	M10	Y	-27.512	-26.215	36.8	55.2
21	M10	Y	-26.215	-30.58	55.2	73.6
22	M10	Y	-30.58	-36.688	73.6	92

Member Distributed Loads (BLC 13 : BLC 4 Transient Area Loads)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M1	Z	1.255	25.865	0	25.2
2	M1	Z	25.865	29.672	25.2	50.4
3	M1	Z	29.672	18.738	50.4	75.6
4	M1	Z	18.738	16.06	75.6	100.8
5	M1	Z	16.06	11.544	100.8	126
6	M2	Z	1.348	24.468	0	25.2
7	M2	Z	24.468	28.279	25.2	50.4
8	M2	Z	28.279	18.865	50.4	75.6
9	M2	Z	18.865	15.275	75.6	100.8
10	M2	Z	15.275	8.868	100.8	126
11	M6	Z	5.752	6.358	0	18.4
12	M6	Z	6.358	6.662	18.4	36.8
13	M6	Z	6.662	6.662	36.8	55.2
14	M6	Z	6.662	6.358	55.2	73.6
15	M6	Z	6.358	5.752	73.6	92
16	M11	Z	3.317	53.95	0	18.4
17	M11	Z	53.95	109.916	18.4	36.8
18	M11	Z	109.916	108.385	36.8	55.2
19	M11	Z	108.385	52.119	55.2	73.6
20	M11	Z	52.119	3.317	73.6	92
21	M12	Z	8.191	21.494	0	18.4
22	M12	Z	21.494	51.479	18.4	36.8
23	M12	Z	51.479	51.519	36.8	55.2
24	M12	Z	51.519	21.534	55.2	73.6
25	M12	Z	21.534	8.154	73.6	92
26	M13	Z	22.449	53.157	0	18.4
27	M13	Z	53.157	69.623	18.4	36.8
28	M13	Z	69.623	69.312	36.8	55.2
29	M13	Z	69.312	53.436	55.2	73.6

Member Distributed Loads (BLC 13 : BLC 4 Transient Area Loads) (Continued)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
30	M13	Z	53.436	24.526	73.6	92
31	M14	Z	36.158	39.284	0	13.3
32	M14	Z	39.284	72.493	13.3	26.6
33	M14	Z	72.493	79.626	26.6	39.9
34	M14	Z	79.626	42.923	39.9	53.2
35	M14	Z	42.923	18.542	53.2	66.5
36	M15	Z	36.424	39.55	0	13.3
37	M15	Z	39.55	72.933	13.3	26.6
38	M15	Z	72.933	80.357	26.6	39.9
39	M15	Z	80.357	41.548	39.9	53.2
40	M15	Z	41.548	12.719	53.2	66.5

Member Distributed Loads (BLC 14 : BLC 9 Transient Area Loads)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M5	Y	9.366	9.366	6.217e-15	92
2	M7	Y	17.166	17.166	8.882e-15	92
3	M8	Y	7.8	7.8	2.665e-15	92
4	M6	Y	10.872	17.464	0	18.4
5	M6	Y	17.464	20.437	18.4	36.8
6	M6	Y	20.437	20.788	36.8	55.2
7	M6	Y	20.788	17.813	55.2	73.6
8	M6	Y	17.813	10.517	73.6	92
9	M8	Y	56.639	30.511	0	18.4
10	M8	Y	30.511	28.819	18.4	36.8
11	M8	Y	28.819	30.762	36.8	55.2
12	M8	Y	30.762	33.555	55.2	73.6
13	M8	Y	33.555	57.998	73.6	92
14	M9	Y	34.668	43.046	0	18.4
15	M9	Y	43.046	42.765	18.4	36.8
16	M9	Y	42.765	41.049	36.8	55.2
17	M9	Y	41.049	41.316	55.2	73.6
18	M9	Y	41.316	36.341	73.6	92
19	M10	Y	36.615	30.519	0	18.4
20	M10	Y	30.519	26.162	18.4	36.8
21	M10	Y	26.162	27.456	36.8	55.2
22	M10	Y	27.456	31.809	55.2	73.6
23	M10	Y	31.809	35.309	73.6	92

Member Distributed Loads (BLC 15 : BLC 10 Transient Area Loads)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M5	Y	-3.122	-3.122	6.217e-15	92
2	M7	Y	-5.722	-5.722	3.553e-15	92
3	M8	Y	-2.6	-2.6	2.665e-15	92
4	M6	Y	-9.965	-16.008	0	18.4
5	M6	Y	-16.008	-18.733	18.4	36.8
6	M6	Y	-18.733	-19.055	36.8	55.2
7	M6	Y	-19.055	-16.328	55.2	73.6
8	M6	Y	-16.328	-9.64	73.6	92
9	M8	Y	-51.917	-27.967	0	18.4
10	M8	Y	-27.967	-26.416	18.4	36.8
11	M8	Y	-26.416	-28.198	36.8	55.2

Member Distributed Loads (BLC 15 : BLC 10 Transient Area Loads) (Continued)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
12	M8	Y	-28.198	-30.758	55.2	73.6
13	M8	Y	-30.758	-53.163	73.6	92
14	M9	Y	-31.777	-39.457	0	18.4
15	M9	Y	-39.457	-39.2	18.4	36.8
16	M9	Y	-39.2	-37.626	36.8	55.2
17	M9	Y	-37.626	-37.871	55.2	73.6
18	M9	Y	-37.871	-33.312	73.6	92
19	M10	Y	-33.563	-27.974	0	18.4
20	M10	Y	-27.974	-23.981	18.4	36.8
21	M10	Y	-23.981	-25.168	36.8	55.2
22	M10	Y	-25.168	-29.157	55.2	73.6
23	M10	Y	-29.157	-32.366	73.6	92

Member Distributed Loads (BLC 16 : BLC 7 Transient Area Loads)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M5	Y	37.451	37.451	6.217e-15	92
2	M7	Y	68.638	68.638	3.553e-15	92
3	M8	Y	31.188	31.188	2.665e-15	92
4	M6	Y	2.719	4.368	0	18.4
5	M6	Y	4.368	5.111	18.4	36.8
6	M6	Y	5.111	5.199	36.8	55.2
7	M6	Y	5.199	4.455	55.2	73.6
8	M6	Y	4.455	2.63	73.6	92
9	M8	Y	14.166	7.631	0	18.4
10	M8	Y	7.631	7.208	18.4	36.8
11	M8	Y	7.208	7.694	36.8	55.2
12	M8	Y	7.694	8.392	55.2	73.6
13	M8	Y	8.392	14.505	73.6	92
14	M9	Y	8.67	10.766	0	18.4
15	M9	Y	10.766	10.695	18.4	36.8
16	M9	Y	10.695	10.266	36.8	55.2
17	M9	Y	10.266	10.333	55.2	73.6
18	M9	Y	10.333	9.089	73.6	92
19	M10	Y	9.157	7.633	0	18.4
20	M10	Y	7.633	6.543	18.4	36.8
21	M10	Y	6.543	6.867	36.8	55.2
22	M10	Y	6.867	7.955	55.2	73.6
23	M10	Y	7.955	8.831	73.6	92

Member Distributed Loads (BLC 17 : BLC 8 Transient Area Loads)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
1	M5	Y	-34.329	-34.329	3.553e-15	92
2	M7	Y	-62.916	-62.916	7.105e-15	92
3	M8	Y	-28.588	-28.588	8.882e-16	92
4	M6	Y	-.906	-1.456	0	18.4
5	M6	Y	-1.456	-1.703	18.4	36.8
6	M6	Y	-1.703	-1.733	36.8	55.2
7	M6	Y	-1.733	-1.486	55.2	73.6
8	M6	Y	-1.486	-.877	73.6	92
9	M8	Y	-4.728	-2.546	0	18.4
10	M8	Y	-2.546	-2.403	18.4	36.8

Member Distributed Loads (BLC 17 : BLC 8 Transient Area Loads) (Continued)

	Member Label	Direction	Start Magnitude[lb/ft,F,psf]	End Magnitude[lb/...	Start Location[in,%]	End Location[in,%]
11	M8	Y	-2.403	-2.564	36.8	55.2
12	M8	Y	-2.564	-2.795	55.2	73.6
13	M8	Y	-2.795	-4.828	73.6	92
14	M9	Y	-2.891	-3.59	0	18.4
15	M9	Y	-3.59	-3.566	18.4	36.8
16	M9	Y	-3.566	-3.421	36.8	55.2
17	M9	Y	-3.421	-3.443	55.2	73.6
18	M9	Y	-3.443	-3.029	73.6	92
19	M10	Y	-3.052	-2.544	0	18.4
20	M10	Y	-2.544	-2.181	18.4	36.8
21	M10	Y	-2.181	-2.289	36.8	55.2
22	M10	Y	-2.289	-2.651	55.2	73.6
23	M10	Y	-2.651	-2.943	73.6	92

Envelope AISC 14th(360-10): ASD Steel Code Checks

	Member	Shape	Code C...	Loc[in]	LC	Shear ...	Loc[in]	Dir	LC	Pnc/om [k]	Pnt/om [k]	Mnyy/om...	Mnzz/om...	Cb	Eqn
1	M1	W10x22	.312	126	12	.031	120.75	z	6	100.345	194.311	15.22	53.149	1.078	H1-1b
2	M2	W10x22	.313	126	9	.030	120.75	z	3	100.345	194.311	15.22	53.167	1.078	H1-1b
3	M3	W8x21	.221	0	14	.045	0	y	2	88.685	184.431	14.197	50.898	2.248	H1-1b
4	M4	W8x21	.221	0	14	.045	0	y	2	88.685	184.431	14.197	50.898	2.246	H1-1b
5	M5	C8x11.5	.136	0	3	.013	92	y	14	23.264	72.647	2.231	14.464	1.137	H1-1b
6	M6	C8x11.5	.173	0	3	.010	71.875	y	6	23.264	72.647	2.231	17.299	2.171	H1-1b
7	M7	HSS2.5X2.5...	.251	46	14	.035	0	y	14	27.269	54.263	3.742	3.742	1.136	H1-1b
8	M8	HSS2.5X2.5...	.203	46	2	.032	0	y	12	27.269	54.263	3.742	3.742	1.129	H1-1b
9	M9	HSS2.5X2.5...	.158	46	11	.022	92	y	12	27.269	54.263	3.742	3.742	1.137	H1-1b
10	M10	HSS2.5X2.5...	.113	46	11	.018	0	y	12	27.269	54.263	3.742	3.742	1.129	H1-1b
11	M11	HSS4x4x4	.063	92	6	.064	92	y	12	72.584	92.826	10.765	10.765	2.36	H1-1b
12	M12	HSS4x4x4	.049	75.708	6	.056	0	z	11	72.584	92.826	10.765	10.765	1.741	H1-1b
13	M13	HSS4x4x4	.024	46	7	.005	92	z	7	72.584	92.826	10.765	10.765	2.218	H1-1b
14	M14	HSS4x4x4	.066	0	9	.016	0	y	3	81.631	92.826	10.765	10.765	2.251	H1-1b
15	M15	HSS4x4x4	.066	0	12	.016	0	y	6	81.631	92.826	10.765	10.765	2.251	H1-1b

Bentley

Current Date: 8/6/2019 3:56 PM
Units system: English
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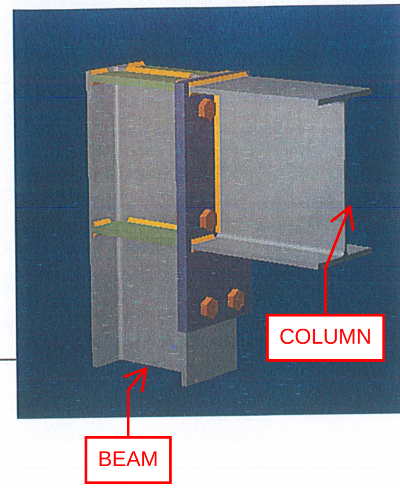


Steel connections

Results

Connection name : **MEP_BCF_DG16_ED_3/8_PL_1B_2B5/8**
Connection ID : **2**

Family: Beam - Column flange (BCF)
Type: Moment end plate
Design code: AISC 360-10 ASD

* APPROXIMATION OF BEAM / COLUMN CONNECTION SEE ADDITIONAL CALCULATIONS FOR BOLT AND PLATE DESIGN *

DEMANDS

Description	Beam Ru [Kip]	Beam Pu [Kip]	Beam Mu [Kip*ft]	Right beam PufTop [Kip]	Right beam PufBot [Kip]	Left beam PufTop [Kip]	Left beam PufBot [Kip]	Column Pu [Kip]	Panel Vu [Kip]	Load type
DL	0.00	0.00	15.00	-18.29	18.29	0.00	0.00	0.00	18.29	Design

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
Extended end plate						
Vertical edge distance	[in]	2.00	1.00	6.00	✔	Sec. J3.5
Horizontal edge distance	[in]	1.63	1.00	6.00	✔	Sec. J3.5
Vertical bolt spacing (internal flange)	[in]	6.11	2.00	--	✔	Sec. J3.3
Horizontal center-to-center spacing (gage)	[in]	2.75	2.63	5.75	✔	Sec. J3.3, DG4 Sec. 2.4, DG4 Sec. 2.1, 2.4, DG16 Sec. 2.5
Inner bolt distance (external flange)	[in]	1.75	1.25	--	✔	DG4 Sec. 2.1
Outer bolt distance (internal flange)	[in]	4.00	1.25	--	✔	DG4 Sec. 2.1
Inner bolt distance (internal flange)	[in]	1.75	1.25	--	✔	DG4 Sec. 2.1
Bolt diameter	[in]	0.75	--	1.50	✔	DG4 Sec. 1.1
Beam						
Weld size (external flange)	[1/16in]	4	3	--	✔	table J2.4
Weld size (internal flange)	[1/16in]	4	3	--	✔	table J2.4
Web	[1/16in]	4	2	--	✔	table J2.4
Support						
Horizontal edge distance	[in]	1.26	1.00	4.80	✔	Sec. J3.5
Support						
Web thickness	[in]	0.25	0.19	--	✔	p. 9-5
Transverse stiffeners						
Length	[in]	7.48	3.74	--	✔	Sec. J10.8
Width	[in]	2.50	1.88	--	✔	Sec. J10.8
Thickness	[in]	0.50	0.38	--	✔	Sec. J10.8
Weld size	[1/16in]	4	4	--	✔	DG 13 Eq. 4.3-6

PLATE / COLUMN BEHAVIOR

End plate behaviour (external flange)
Thick plate behavior controlled by no prying bolt rupture
End plate behaviour (internal flange)
Thin plate behavior controlled by plate yielding
Column flange behavior (external flange)
Thin plate behavior controlled by plate yielding
Column flange behavior (internal flange)
Thin plate behavior controlled by bolt rupture with prying action

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Moment end plate (external flange)						
Flexural yielding	[Kip*ft]	38.85	0.00	DL	0.00	DG16 Sec 2.5
No prying bolt moment strength	[Kip*ft]	26.22	0.00	DL	0.00	DG16 Sec 2.5
Bolts shear	[Kip]	23.87	0.00	DL	0.00	Tables (7-1..14)
Bolt bearing under shear load	[Kip]	78.30	0.00	DL	0.00	Eq. J3-6
Shear yielding	[Kip]	58.20	9.15	DL	0.16	DG4 Eq. 3.12
Moment end plate (internal flange)						
Flexural yielding	[Kip*ft]	57.81	15.00	DL	0.26	DG16 Sec 2.5
No prying bolt moment strength	[Kip*ft]	72.70	15.00	DL	0.21	DG16 Sec 2.5
Bolt rupture with prying moment strength	[Kip*ft]	64.51	15.00	DL	0.23	DG16 Sec 2.5
Bolts shear	[Kip]	47.74	0.00	DL	0.00	Tables (7-1..14)
Bolt bearing under shear load	[Kip]	156.60	0.00	DL	0.00	Eq. J3-6
Shear yielding	[Kip]	58.20	9.15	DL	0.16	DG4 Eq. 3.12
Shear rupture	[Kip]	55.46	9.15	DL	0.16	DG4 Eq 3.14, AISC 358-05 Eq. 6.9-12, DG4 Eq. 3.13
Beam						
Web weld shear strength	[Kip]	32.97	0.00	DL	0.00	Eq. J2-4
Web weld strength to reach yield stress	[Kip/ft]	133.64	86.23	DL	0.65	Eq. J2-4, Eq. J4-1
Shear yielding	[Kip]	48.96	0.00	DL	0.00	Eq. J4-3
Flange weld capacity (external flange)	[Kip]	66.71	18.29	DL	0.27	Eq. J2-4
Flange weld capacity (internal flange)	[Kip]	66.71	18.29	DL	0.27	Eq. J2-4
Support						
Flexural yielding (external flange)	[Kip*ft]	17.95	0.00	DL	0.00	DG4 Eq. 3.20, Sec. 2.2.3, DG4 Eq. 3.21
Bolt rupture with prying moment strength	[Kip*ft]	24.39	0.00	DL	0.00	DG16 Sec 2.5
Support bolt bearing (external flange)	[Kip]	46.80	0.00	DL	0.00	Eq. J3-6
Flexural yielding (internal flange)	[Kip*ft]	53.65	15.00	DL	0.28	DG4 Eq. 3.20, Sec. 2.2.3, DG4 Eq. 3.21
Bolt rupture with prying moment strength	[Kip*ft]	21.39	15.00	DL	0.70	DG16 Sec 2.5
Support bolt bearing (internal flange)	[Kip]	93.60	0.00	DL	0.00	Eq. J3-6
Panel web shear	[Kip]	37.19	18.29	DL	0.49	Sec. J10-6, Eq. J10-9
Support - right side						
Local web yielding	[Kip]	63.25	18.29	DL	0.29	DG4 eq. 3.24, DG13 Eq. 4.3-1, Sec. J10
Transverse stiffeners - top						
Yielding strength due to axial load	[Kip]	32.34	0.00	DL	0.00	Eq. J4-1
Compression	[Kip]	30.46	0.00	DL	0.00	Sec. J4.4
Flange weld capacity	[Kip]	27.84	0.00	DL	0.00	Eq. J2-4
Web weld capacity	[Kip]	92.51	0.00	DL	0.00	Eq. J2-4
Transverse stiffeners - bottom						
Yielding strength due to axial load	[Kip]	32.34	0.00	DL	0.00	Eq. J4-1
Compression	[Kip]	30.46	0.00	DL	0.00	Sec. J4.4
Flange weld capacity	[Kip]	27.84	0.00	DL	0.00	Eq. J2-4
Web weld capacity	[Kip]	92.51	0.00	DL	0.00	Eq. J2-4

Global critical strength ratio **0.70**

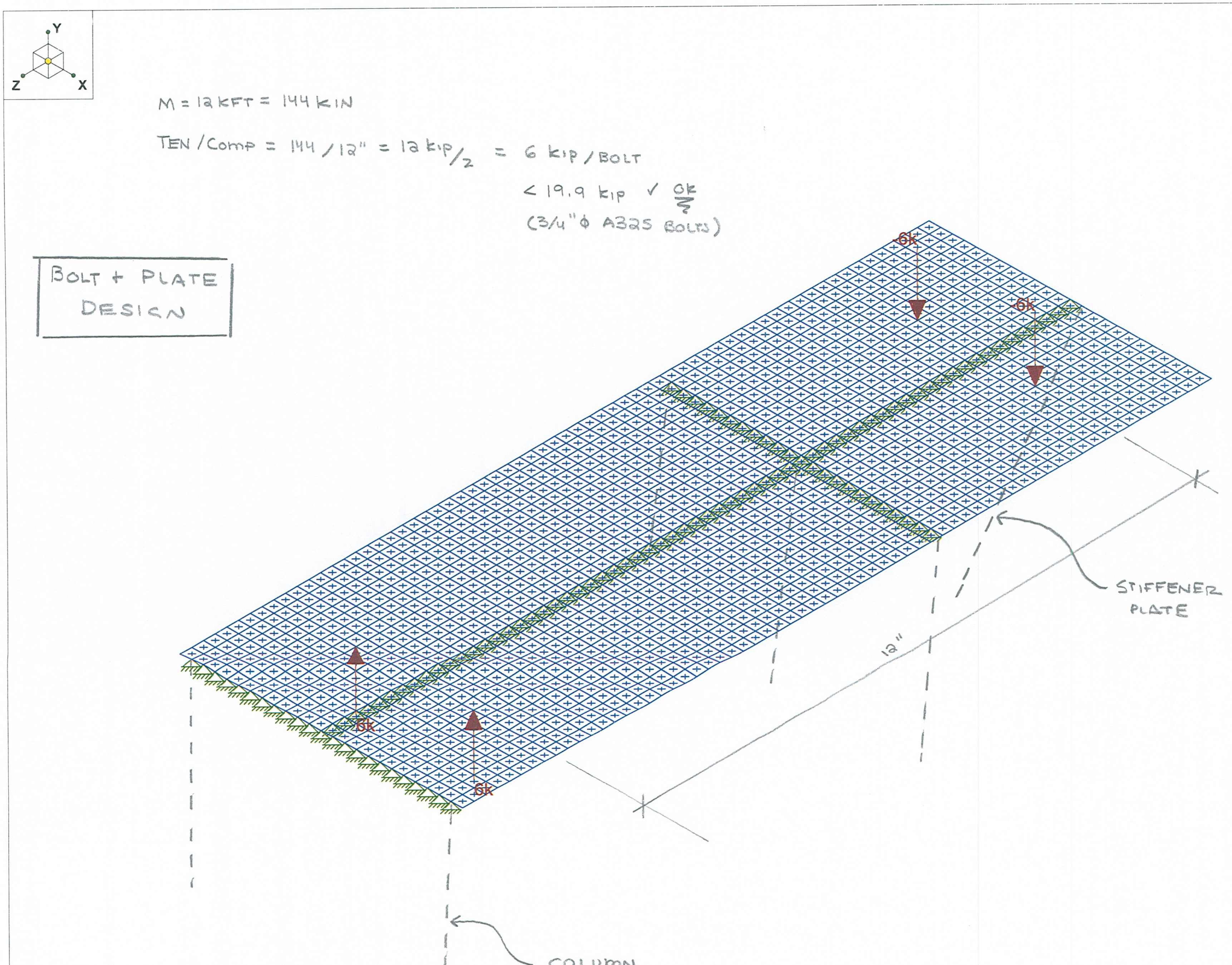
$M = 12\ \text{kFT} = 144\ \text{kIN}$

$\text{TEN}/\text{Comp} = 144 / 12'' = 12\ \text{kip}/2 = 6\ \text{kip}/\text{BOLT}$

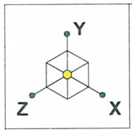
$< 19.9\ \text{kip}$ ✓ $\underline{\underline{\text{OK}}}$

(3/4"ϕ A325 BOLTS)

$\boxed{\text{BOLT + PLATE DESIGN}}$



Loads: BLC 1,

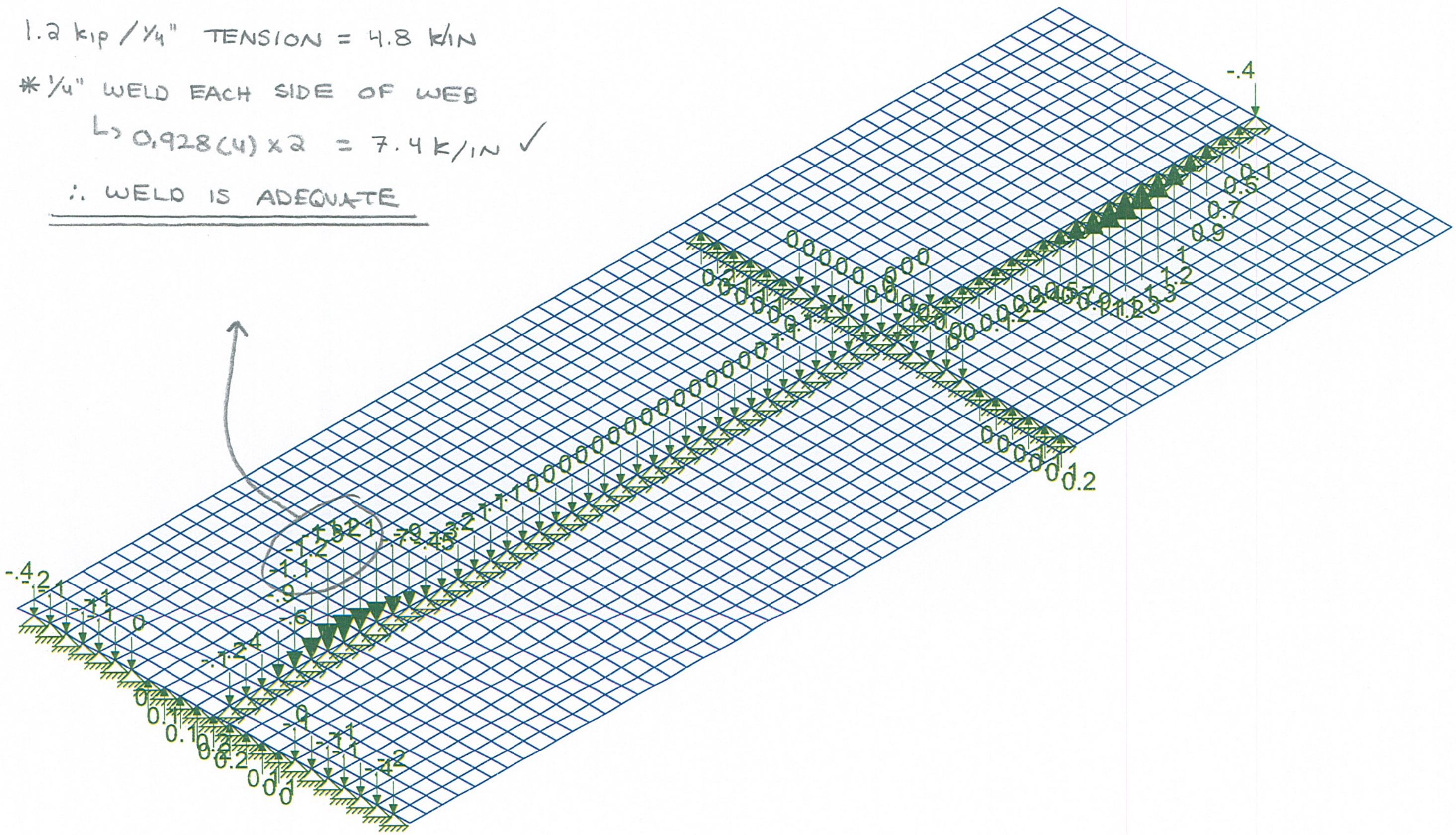


1.2 kip / ¼" TENSION = 4.8 k/IN

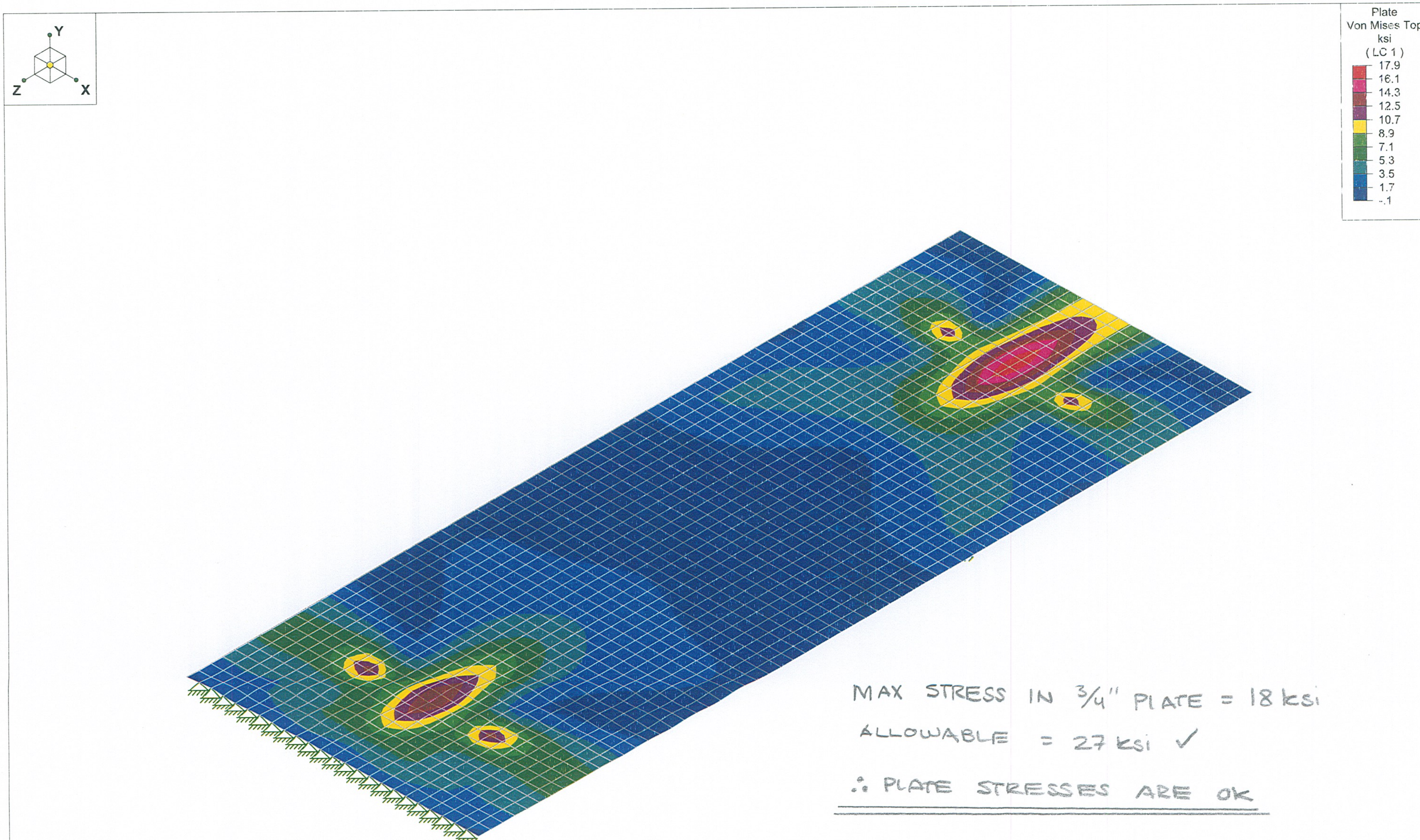
* ¼" WELD EACH SIDE OF WEB

↳ 0.928(4) x 2 = 7.4 k/IN ✓

∴ WELD IS ADEQUATE



Results for LC 1,
Y-direction Reaction Units are k and k-ft



MAX STRESS IN 3/4" PLATE = 18 ksi

ALLOWABLE = 27 ksi ✓

∴ PLATE STRESSES ARE OK

Results for LC 1,

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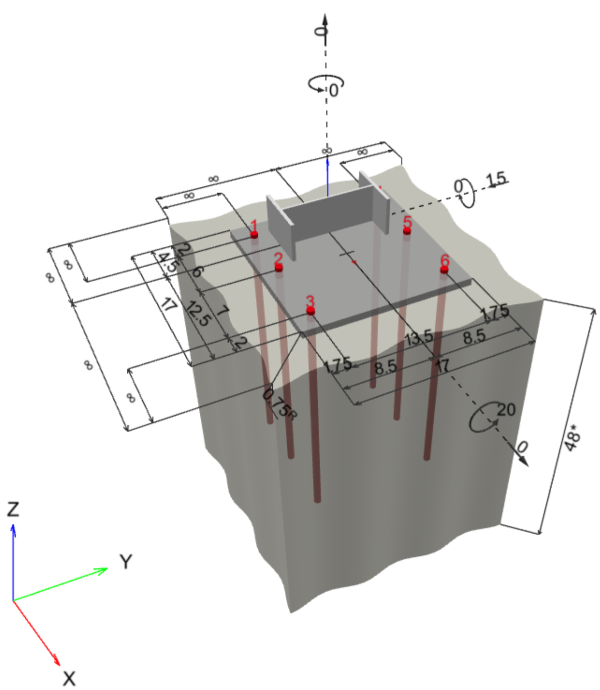
Specifier's comments:

1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 3/4**
Item number:	not available
Effective embedment depth:	h_{ef} = 25.000 in.
Material:	ASTM F 1554
Proof:	Design Method ACI 318-11 / CIP
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.750 in.
Anchor plate[R] :	l_x x l_y x t = 17.000 in. x 17.000 in. x 0.750 in.; (Recommended plate thickness: not calculated)
Profile:	W shape (AISC), W10X22; (L x W x T x FT) = 10.200 in. x 5.750 in. x 0.240 in. x 0.360 in.
Base material:	cracked concrete, 4000, f_c' = 4,000 psi; h = 48.000 in.
Reinforcement:	tension: condition B, shear: condition B;
	edge reinforcement: none or < No. 4 bar

[R] - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [kip, ft.kip]



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1.1 Design results

Case	Description	Forces [kip] / Moments [ft.kip]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0.000; V_x = 0.000; V_y = -1.500; M_x = 20.00000; M_y = 0.00000; M_z = 0.00000;	no	39

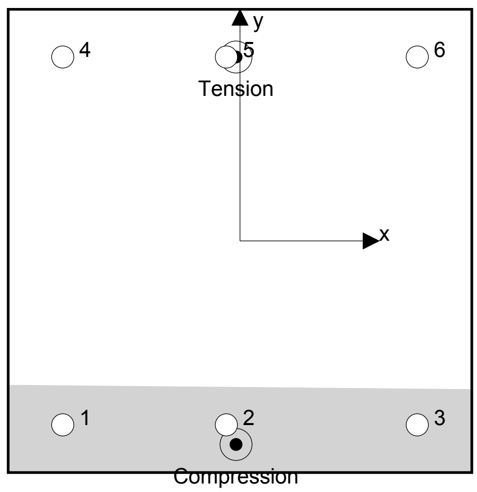
2 Load case/Resulting anchor forces

Load case: Design loads

Anchor reactions [kip]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0.000	0.344	0.088	-0.332
2	0.000	0.269	0.088	-0.254
3	0.000	0.185	0.088	-0.163
4	5.599	0.344	-0.088	-0.332
5	5.625	0.269	-0.088	-0.254
6	5.655	0.185	-0.088	-0.163



max. concrete compressive strain: 0.15 [‰]
max. concrete compressive stress: 659 [psi]
resulting tension force in (x/y)=(-0.145/6.750): 16.878 [kip]
resulting compression force in (x/y)=(-0.145/-7.469): 16.878 [kip]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N_{ua} [kip]	Capacity ϕ N_n [kip]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	5.655	14.529	39	OK
Pullout Strength*	5.655	14.650	39	OK
Concrete Breakout Failure**	16.878	177.549	10	OK
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

3.1 Steel Strength

$N_{sa} = A_{se,N}\, f_{uta}$ ACI 318-11 Eq. (D-2)

$\phi\ N_{sa} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.33	58,000

Calculations

N_{sa} [kip]
19.372

Results

N_{sa} [kip]	ϕ_{steel}	$\phi\ N_{sa}$ [kip]	N_{ua} [kip]
19.372	0.750	14.529	5.655

3.2 Pullout Strength

$N_{pN} = \psi_{c,p}\, N_p$ ACI 318-11 Eq. (D-13)

$N_p = 8\, A_{brg}\, f'_c$ ACI 318-11 Eq. (D-14)

$\phi\ N_{pN} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

Variables

$\psi_{c,p}$	A_{brg} [in.^{2}]	λ_a	f'_c [psi]
1.000	0.65	1.000	4,000

Calculations

N_p [kip]
20.928

Results

N_{pn} [kip]	$\phi_{concrete}$	$\phi\ N_{pn}$ [kip]	N_{ua} [kip]
20.928	0.700	14.650	5.655

3.3 Concrete Breakout Failure

$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b$ ACI 318-11 Eq. (D-4)

$\phi\ N_{cbg} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

A_{Nc} see ACI 318-11, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-11 Eq. (D-5)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e_N'}{3\ h_{ef}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-8)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-11 Eq. (D-10)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-11 Eq. (D-12)

$N_b = 16\ \lambda_a\ \sqrt{f_c'}\ h_{ef}^{5/3}$ ACI 318-11 Eq. (D-7)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
25.000	0.022	0.000	∞	1.000

c_{ac} [in.]	k_c	λ_a	f_c' [psi]
-	16	1.000	4,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [kip]
6,600.00	5,625.00	0.999	1.000	1.000	1.000	216.297

Results

N_{cbg} [kip]	$\phi_{concrete}$	$\phi\ N_{cbg}$ [kip]	N_{ua} [kip]
253.642	0.700	177.549	16.878

4 Shear load

	Load V_{ua} [kip]	Capacity ϕ V_n [kip]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	0.344	7.555	5	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	1.500	380.375	1	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa} = 0.6\, A_{se,V}\, f_{uta}$ ACI 318-11 Eq. (D-29)

$\phi\ V_{steel} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.33	58,000

Calculations

V_{sa} [kip]
11.623

Results

V_{sa} [kip]	ϕ_{steel}	ϕ V_{sa} [kip]	V_{ua} [kip]
11.623	0.650	7.555	0.344

4.2 Pryout Strength

$V_{cpg} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b \right]$ ACI 318-11 Eq. (D-41)

$\phi\ V_{cpg} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

A_{Nc} see ACI 318-11, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-11 Eq. (D-5)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e_N'}{3\ h_{ef}}} \right) \leq 1.0$ ACI 318-11 Eq. (D-8)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0$ ACI 318-11 Eq. (D-10)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0$ ACI 318-11 Eq. (D-12)

$N_b = 16\ \lambda_a\ \sqrt{f_c'}\ h_{ef}^{5/3}$ ACI 318-11 Eq. (D-7)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	25.000	3.833	0.000	∞

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f_c' [psi]
1.000	-	16	1.000	4,000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [kip]
7,788.00	5,625.00	0.907	1.000	1.000	1.000	216.297

Results

V_{cpg} [kip]	$\phi_{concrete}$	$\phi\ V_{cpg}$ [kip]	V_{ua} [kip]
543.393	0.700	380.375	1.500

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.389	0.045	5/3	22	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2018, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/

Fastening meets the design criteria!

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7 Installation data

Profile: W shape (AISC), W10X22; (L x W x T x FT) = 10.200 in. x 5.750 in. x 0.240 in. x 0.360 in.

Hole diameter in the fixture: d_f = 0.813 in.

Plate thickness (input): 0.750 in.

Recommended plate thickness: not calculated

Anchor type and diameter: Hex Head ASTM F 1554 GR. 36 3/4

Item number: not available

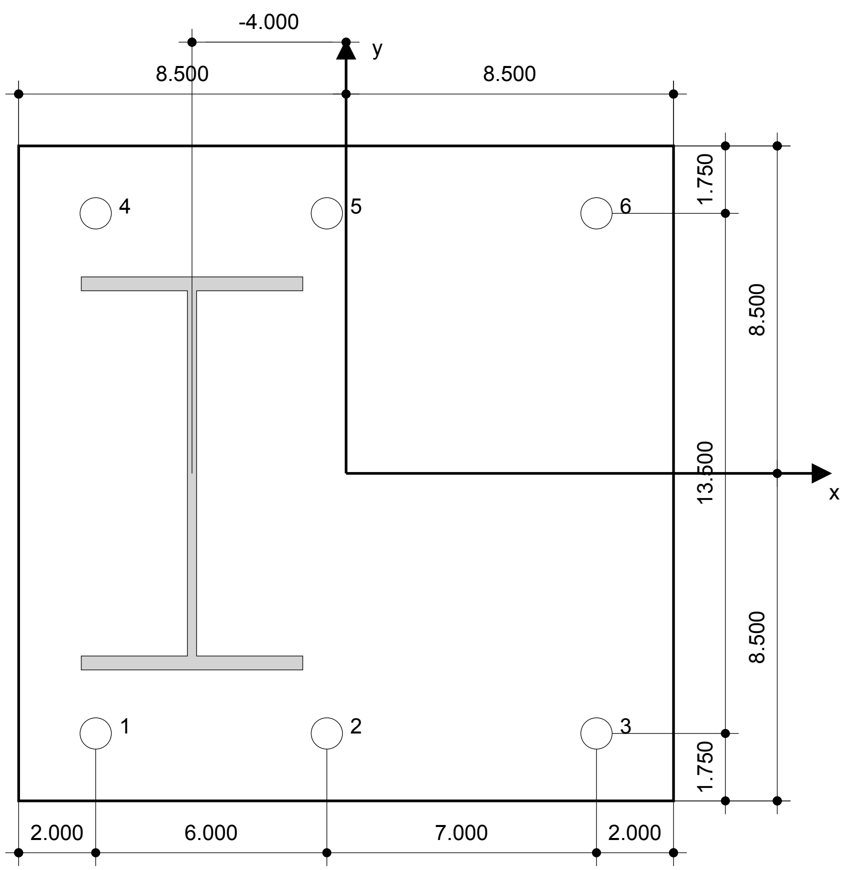
Installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 25.000 in.

Minimum thickness of the base material: 26.000 in.

Hilti Hex Head headed stud anchor with 25 in embedment, 3/4, Steel galvanized, installation per instruction for use



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-6.500	-6.750	-	-	-	-
2	-0.500	-6.750	-	-	-	-
3	6.500	-6.750	-	-	-	-

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
4	-6.500	6.750	-	-	-	-
5	-0.500	6.750	-	-	-	-
6	6.500	6.750	-	-	-	-

8 Remarks; Your Cooperation Duties

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