(REVISED)
STRUCTURAL ANALYSIS REPORT

For

Site Number: VTL06469 (C-Band)

TEP Project Number: 248445.1079989

Site Name: RCC - DT ST ALBANS

79 Walnut Street
Saint Albans, VT 05478
44.817497° N, 73.095556° W

Antennas Mounted to Building and Handrail System

Prepared for:

12 Industrial Way
Salem NH, 03079

Dated: March 21, 2025 (Rev.4)
January 29, 2025 (Rev.3)
July 3, 2024 (Rev.2)
September 29, 2022 (Rev.1)

Prepared by:

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STATE OF VERMONT
DANIEL P. HAMM
LICENSED
PROFESSIONAL ENGINEER

SCOPE OF WORK:

TEP has been authorized by AT&T to conduct a structural evaluation of the structure supporting the proposed equipment located in the areas depicted in the latest TEP construction drawings.

This report represents this office's findings, conclusions and recommendations pertaining to the support of AT&T's proposed antennas listed below.

TEP conducted an on-site visual survey of the above site on March 22, 2022.

The following documents were used for our reference:

- Mount Mapping Report prepared by ProVertic LLC dated March 13, 2019.
- Previous Structural Analysis prepared by Hudson Design Group LLC dated March 12, 2019.

CONCLUSION SUMMARY:

Based on our evaluation, we have determined that the existing mounts **ARE CAPABLE** of supporting the proposed equipment loading.

	Member	Controlling Component	Stress Ratio	Pass/Fail
Existing Antenna Mount (Alpha & Beta Sector)	Handrail Angle	L-2x2x3/16 Angle	86%	**PASS**
Existing Antenna Mount (Gamma Sector)	Handrail Angle	L-2x2x3/16 Angle	80%	**PASS**

Based on our evaluation, we have determined that the existing connections **ARE CAPABLE** of supporting the proposed equipment loading.

	Anchor Description	Stress Ratio	Pass/Fail
Existing Connection (Alpha & Beta Sector)	1/2" Bolt	35%	**PASS**
Existing Connection (Gamma Sector)	1/2" Bolt	29%	**PASS**

DESIGN CRITERIA:

International Building Code (IBC) 2015 with Vermont Fire and Building Safety Code, and ASCE 7-10 (Minimum Design Loads for Buildings and Other Structures).		
Wind		
Reference Wind Speed:	115 mph	(ASCE 7-10 Figure 26.5-1A)
Exposure Category:	C	(ASCE 7-10 Chapter 26)
Risk Category:	II	(ASCE 7-10 Table 1.5-1)
Snow		
Ground Snow, P_g:	40 psf	(VFBSC Annex VII)
Importance Factor (I_s):	1.0	(ASCE 7-10 Table 1.5-2)
Exposure Factor (C_e):	0.9	(Fully Exposed, Table 7-2)
Thermal Factor (C_t):	1.0	(ASCE 7-10 Table 7-3)
Flat Roof Snow Load:	25.2 psf	(ASCE 7-10 Equation 7.3-1)
Min. Flat Roof Snow Load:	30 psf	
Seismic		
Seismic Design Category:	B	(ASCE 7-10 Table 11.6-1/2)
Site Class:	C	(ASCE 7-10 Sec.11.4.2)
Importance Factor (I_e):	1.0	(ASCE 7-10 Table 1.5-2)
Ground Motion Parameter (S_s):	0.375	(ASCE 7-10 Figure 22-1)
Ground Motion Parameter (S_1):	0.111	(ASCE 7-10 Figure 22-2)
EIA/TIA-222-H Structural Standards for Steel Antenna Towers and Antenna Supporting Structures		
Wind		
City/Town:	Saint Albans	
County:	Franklin	
Risk Category:	II	(TIA-222-H Table 2-1)
Wind Load:	115 mph	(TIA-222-H Figure B-2)
Ice		
Design Ice Thickness (t_i):	2.0 in	(TIA-222-H Figure B-9)
Importance Factor (I_i):	1.0	(TIA-222-H Table 2-3)
Factored Thickness of Radial Ice (t_{iz}):	2.19 in	(TIA-222-H Sec. 2.6.10)

APPURTENANCE CONFIGURATION:

Appurtenances	Dimensions	Weight	**Elevation	Mount
(3) 4478 B14 RRH's	18.1"x13.4"x8.3"	60 lbs	-	Steel Frame
(3) RRUS-32 B66A RRH's	27.2"x12.1"x7.0"	60 lbs	-	Steel Frame
(3) RRUS-32 B30 RRH's	27.2"x12.1"x7.0"	60 lbs	-	Steel Frame
(3) DC6-48-60-18-8F Surge Arrestors	31.4"x10.2"Ø	29 lbs	-	Steel Frame
(3) DC6-48-60-0-8C Surge Arrestors	31.4"x10.2"Ø	29 lbs	-	Steel Frame
(3) TPA65R-BU6DA-K Antennas	71.2"x20.7"x7.7"	78 lbs	81'-6"	Steel Frame
(2) AIR6419 B77D Antennas* **	28.2"x16.1"x7.3"	66 lbs	81'-6"	Steel Frame
(2) OPA65R-BU6DA Antennas	71.2"x20.7"x7.7"	73 lbs	81'-6"	Steel Frame
(1) NNH4-65B-R3-UPM w/ AIR6419 B77D Antenna* **	72.0"x19.6"x14.8"	197 lbs	81'-6"	Steel Frame
(3) 4415 B25 RRH's	16.5"x13.4"x5.9"	46 lbs	-	Steel Frame
(3) 4490 B5/B12A RRH's	17.5"x15.1"x6.8"	68 lbs	-	Steel Frame

** Proposed equipment shown in bold.*
*** Elevation to antenna centerline.*
**** CFD dimensions are implemented.*

Note:
This analysis has been prepared in association with antenna aerodynamic efficiency data, procured via computational fluid dynamic (CFD) analysis, at the direction of AT&T. TEP is under the assumption that the aforementioned data has been produced in accordance with all pertinent rules and regulations of the design codes referenced herein.

ANTENNA/RRH's SUPPORT RECOMMENDATIONS:

The proposed antennas and RRH's will be mounted on proposed pipe masts installed on existing pipes secured to the existing handrail system with U-bolts and to the building roof top with bolts.

Limitations and Assumptions:

1. Reference the latest TEP construction drawings for all the equipment locations and details.
2. All detail requirements will be designed and furnished in the construction drawings.
3. All structural members and their connections are assumed to be in good condition and are free from defects with no deterioration to its member capacities.
4. TEP is not responsible for any modifications completed prior to and hereafter which TEP was not directly involved.
5. All antennas, coax cables and waveguide cables are assumed to be properly installed and supported as per the manufacturer requirements.
6. If field conditions differ from what is assumed in this report, then the engineer of record is to be notified as soon as possible.

FIELD PHOTOS:

Photo 1: Sample photo illustrating the existing Alpha sector antennas and RRH's.

Photo 2: Sample photo illustrating the existing Beta sector antennas and RRH's.

FIELD PHOTOS (CONT.):

Photo 3: Sample photo illustrating the existing Gamma sector antennas and RRH's.

Photo 4: Sample photo illustrating the existing steel frames.

FIELD PHOTOS (CONT.):

Photo 5: Sample photo illustrating the existing steel frames.

Photo 6: Sample photo illustrating the existing steel frames.

Wind and Ice Calculations

Date: 3/21/2025

Project Name: RCC - DT ST ALBANS

Project No.: VTL06469

Designed By: KSBM **Checked By:** MSC

2.6.5.2 Velocity Pressure Coeff:

$K_z = 2.01\ (z/z_g)^{2/\alpha}$

z=	81.5	(ft)
z_g=	900	(ft)
α=	9.5	

K_z= 1.212

Kzmin ≤ Kz ≤ 2.01

Table 2-4

Exposure	Z_g	α	K_{zmin}	K_c
B	1200 ft	7.0	0.70	0.9
C	900 ft	9.5	0.85	1.0
D	700 ft	11.5	1.03	1.1

2.6.6.2 Topographic Factor:

Table 2-5

Topo. Category	K_t	f
2	0.43	1.25
3	0.53	2.0
4	0.72	1.5

$K_{zt} = [1+(K_c\ K_t/K_h)]^2$

$K_h = e^{(f*z/H)}$

K_{zt}= 1

(If Category 1 then K_{zt} =1.0)

Category= 1

K_h=	1	
K_c=	1.0	(from Table 2-4)
K_t=	0	(from Table 2-5)
f=	0	(from Table 2-5)
z=	81.5	
z_s=	375	(Mean elevation of base of structure above sea level)
H=	0	(Ht. of the crest above surrounding terrain)
K_{zt}=	1.00	(from 2.6.6.2.1)
K_e=	0.99	(from 2.6.8)

2.6.10 Design Ice Thickness

Max Ice Thickness =	t_i = 2.00	in
Importance Factor =	I= 1.00	(from Table 2-3)
	K_{iz} = 1.09	(from Sec. 2.6.10)

$t_{iz} = t_i * I * K_{iz} * (K_{zt})^{0.35}$

t_{iz} = 2.19 in

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2.6.9 Gust Effect Factor

2.6.9.1 Self Supporting Lattice Structures

G_h = 1.0 Latticed Structures > 600 ft

G_h = 0.85 Latticed Structures 450 ft or less

G_h = 0.85 + 0.15 [h/150 - 3.0] h= ht. of structure

h=	78.5	G_h=	0.85

2.6.9.2 Guyed Masts G_h= 0.85

2.6.9.3 Pole Structures G_h= 1.1

2.6.9 Appurtenances G_h= 1.0

2.6.9.4 Structures Supported on Other Structures

(Cantilivered tubular or latticed spines, pole, structures on buildings (ht. : width ratio > 5)

G_h=	1.35	**Gh=**	**1.00**

2.6.11.2 Design Wind Force on Appurtenances

F= q_z*G_h*$(EPA)_A$

q_z= $0.00256*K_z*K_{zt}*K_s*K_e*K_d*V_{max}^2$

		K_z=	1.212	(from 2.6.5.2)
		K_{zt}=	1.0	(from 2.6.6.2.1)
		K_s=	1.0	(from 2.6.7)
q_z=	**38.46**	K_e=	0.99	(from 2.6.8)
$q_{z\ (ice)}$=	**4.65**	K_d=	0.95	(from Table 2-2)
		V_{max}=	115	mph (Ultimate Wind Speed)
		$V_{max\ (ice)}$=	40	mph

Table 2-2

Structure Type	Wind Direction Probability Factor, Kd
Latticed structures with triangular, square or rectangular cross sections	0.85
Tubular pole structures, latticed structures with other cross sections, appurtenances	0.95
Tubular pole structures supporting antennas enclosed within a cylindrical shroud	1.00

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Determine Ca:

Table 2-9

Force Coefficients (Ca) for Appurtenances				
Member Type		Aspect Ratio ≤ 2.5	Aspect Ratio = 7	Aspect Ratio ≥ 25
		Ca	Ca	Ca
Flat		1.2	1.4	2.0
Square/Rectangular HSS		1.2 - 2.8(r_s) ≥ 0.85	1.4 - 4.0(r_s) ≥ 0.90	2.0 - 6.0(r_s) ≥ 1.25
Round	**C < 39** (Subcritical)	0.7	0.8	1.2
	39 ≤ C ≤ 78 (Transitional)	$4.14/(C^{0.485})$	$3.66/(C^{0.415})$	$46.8/(C^{-1.0})$
	C > 78 (Supercritical)	0.5	0.6	0.6

Aspect Ratio is the overall length/width ratio in the plane normal to the wind direction.
(Aspect ratio is independent of the spacing between support points of a linear appurtenance,

Note: Linear interpolation may be used for aspect ratios other than those shown.

Ice Thickness = **2.19** **in** **Angle =** **0 (deg)** **Equivalent Angle =** **180 (deg)**

Appurtenances	Height	Width	Depth	Flat Area	Aspect Ratio	Ca	Force (lbs)	Force (lbs) (w/ Ice)
TPA65R-BU6DA-K Antenna	71.2	20.7	7.7	10.24	3.44	1.24	**489**	**76**
TPA65R-BU6DA-K Antenna (Side)	71.2	7.7	20.7	3.81	9.25	1.47	**216**	**44**
AIR6419 B77D Antenna	28.2	16.1	7.3	3.23	1.75	1.20	**149**	**26**
AIR6419 B77D Antenna (Side)	28.2	7.3	16.1	1.10	3.86	1.26	**53**	**15**
OPA65R-BU6DA Antenna	71.2	20.7	7.7	10.24	3.44	1.24	**489**	**76**
OPA65R-BU6DA Antenna (Side)	71.2	7.7	20.7	3.81	9.25	1.47	**216**	**44**
NNH4-65B-R3-UPM w/ AIR6419 B77D Antenna	72.0	19.6	14.8	6.80	3.67	1.25	**328**	**74**
NNH4-65B-R3-UPM w/ AIR6419 B77D Antenna (Side)	72.0	14.8	19.6	3.50	4.86	1.31	**176**	**62**
4415 B25 RRH	16.5	13.4	5.9	1.54	1.23	1.20	**71**	**14**
4415 B25 RRH (Side)	16.5	5.9	13.4	0.68	2.80	1.21	**32**	**8**
4415 B25 RRH (Shielded)	16.5	3.0	13.4	0.34	5.59	1.34	**17**	**7**
4490 B5/B12A RRH	17.5	15.1	6.8	1.84	1.16	1.20	**85**	**17**
4490 B5/B12A RRH (Side)	17.5	6.8	15.1	0.83	2.57	1.20	**38**	**10**
4490 B5/B12A RRH (Shielded)	17.5	3.4	15.1	0.41	5.15	1.32	**21**	**7**
RRUS-32 RRH	27.2	12.1	7.0	2.29	2.25	1.20	**105**	**20**
RRUS-32 RRH (Side)	27.2	7.0	12.1	1.32	3.89	1.26	**64**	**15**
RRUS-32 RRH (Shielded)	27.2	3.5	12.1	0.66	7.77	1.43	**36**	**11**
4478 B14 RRH	18.1	13.4	8.3	1.68	1.35	1.20	**78**	**15**
4478 B14 RRH (Side)	18.1	8.3	13.4	1.04	2.18	1.20	**48**	**11**
4478 B14 RRH (Shielded)	18.1	4.2	13.4	0.52	4.36	1.28	**26**	**8**
Squid Surge Arrestor	31.4	10.2	10.2	2.22	3.08	0.70	**60**	**12**
2x2 Angle	2.0	12.0		0.17	0.17	2.00	**13**	
2-1/2" Pipe	2.9	12.0		0.24	0.24	1.20	**11**	
3" Pipe	3.5	12.0		0.29	0.29	1.20	**13**	

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ICE WEIGHT CALCULATIONS

Thickness of ice: 2.19 in.
Density of ice: 56 pcf

TPA65R-BU6DA-K Antenna

Weight of ice based on total radial SF area:

Height (in):	71.2	
Width (in):	20.7	
Depth (in):	7.7	
Total weight of ice on object:		385 lbs
Weight of object:	78.0 lbs	
Combined weight of ice and object:		463 lbs

AIR6419 B77D Antenna

Weight of ice based on total radial SF area:

Height (in):	28.2	
Width (in):	16.1	
Depth (in):	7.3	
Total weight of ice on object:		125 lbs
Weight of object:	66.0 lbs	
Combined weight of ice and object:		191 lbs

OPA65R-BU6DA Antenna

Weight of ice based on total radial SF area:

Height (in):	71.2	
Width (in):	20.7	
Depth (in):	7.7	
Total weight of ice on object:		385 lbs
Weight of object:	73.0 lbs	
Combined weight of ice and object:		458 lbs

NNH4-65B-R3-UPM w/ AIR6419 B77D Antenna

Weight of ice based on total radial SF area:

Height (in):	72.0	
Width (in):	19.6	
Depth (in):	14.8	
Total weight of ice on object:		429 lbs
Weight of object:	197.0 lbs	
Combined weight of ice and object:		626 lbs

4478 B14 RRH

Weight of ice based on total radial SF area:

Height (in):	18.1	
Width (in):	13.4	
Depth (in):	8.3	
Total weight of ice on object:		72 lbs
Weight of object:	60.0 lbs	
Combined weight of ice and object:		132 lbs

4415 B25 RRH

Weight of ice based on total radial SF area:

Height (in):	16.5	
Width (in):	13.4	
Depth (in):	5.9	
Total weight of ice on object:		62 lbs
Weight of object:	46.0 lbs	
Combined weight of ice and object:		108 lbs

RRUS-32 RRH

Weight of ice based on total radial SF area:

Height (in):	27.2	
Width (in):	12.1	
Depth (in):	7.0	
Total weight of ice on object:		98 lbs
Weight of object:	60.0 lbs	
Combined weight of ice and object:		158 lbs

4490 B5/B12A RRH

Weight of ice based on total radial SF area:

Height (in):	17.5	
Width (in):	15.1	
Depth (in):	6.8	
Total weight of ice on object:		73 lbs
Weight of object:	68.0 lbs	
Combined weight of ice and object:		141 lbs

Squid Surge Arrestor

Weight of ice based on total radial SF area:

Depth (in):	31.4	
Diameter(in):	10.2	
Total weight of ice on object:		87 lbs
Weight of object:	29 lbs	
Combined weight of ice and object:		116 lbs

L 2x2 Angles

Weight of ice based on total radial SF area:

Height (in):	2	
Width (in):	2	
Per foot weight of ice on object:		13 plf

2-1/2" Pipe

Per foot weight of ice:

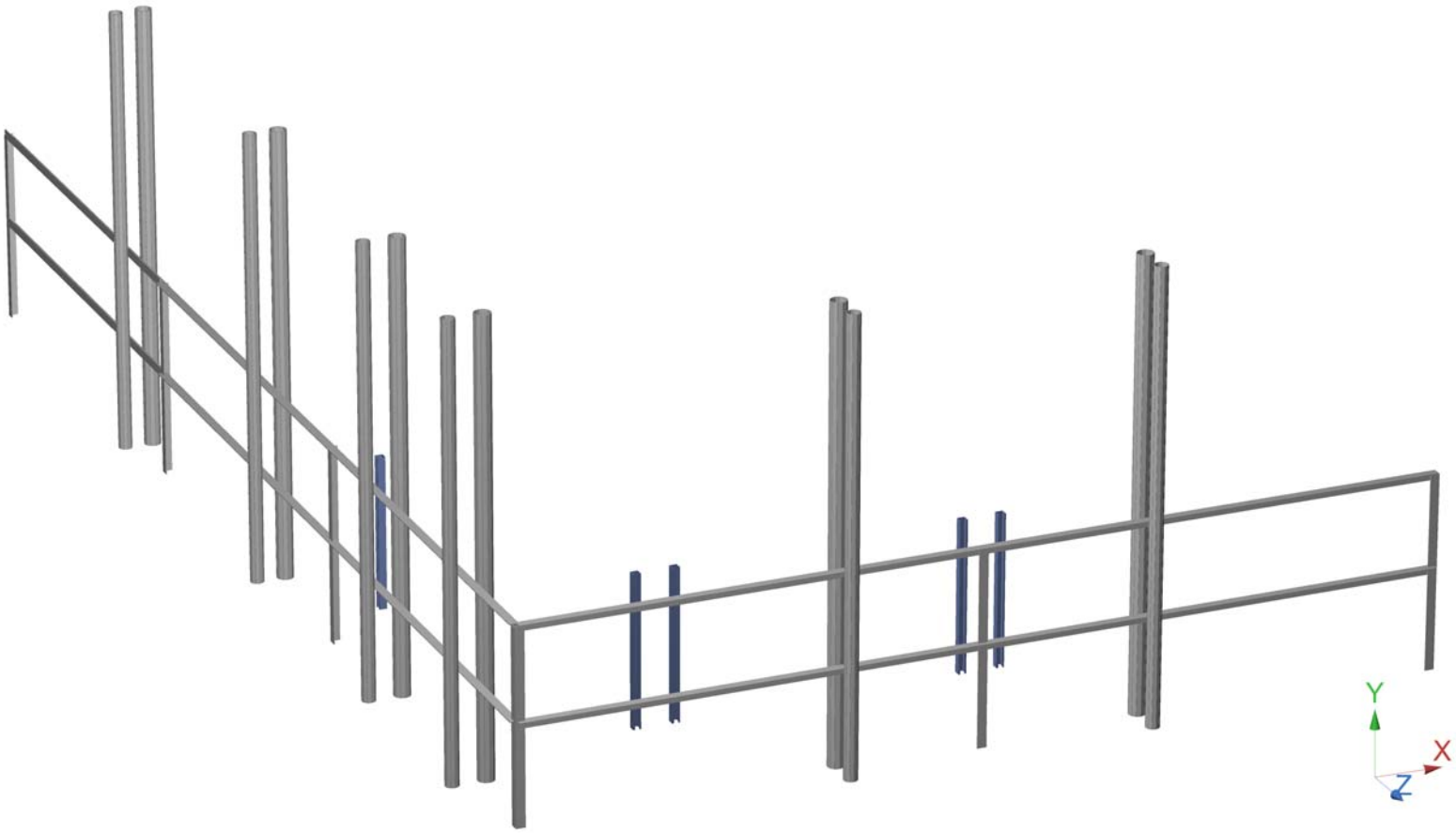
diameter (in):	2.88	
Per foot weight of ice on object:		14 plf

3" Pipe

Per foot weight of ice:

diameter (in):	3.5	
Per foot weight of ice on object:		15 plf

Alpha and Beta Sector
Antenna Mount
Calculations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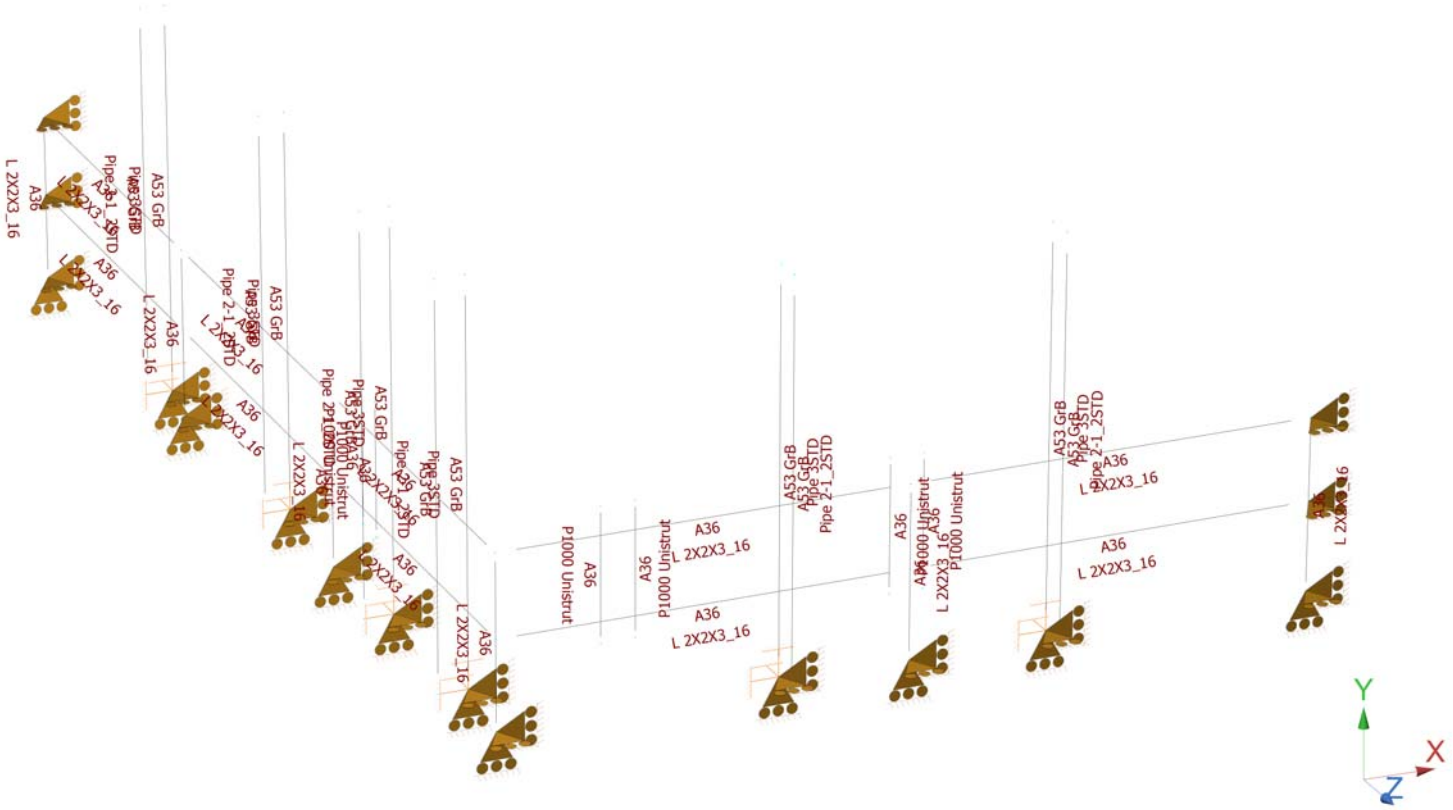
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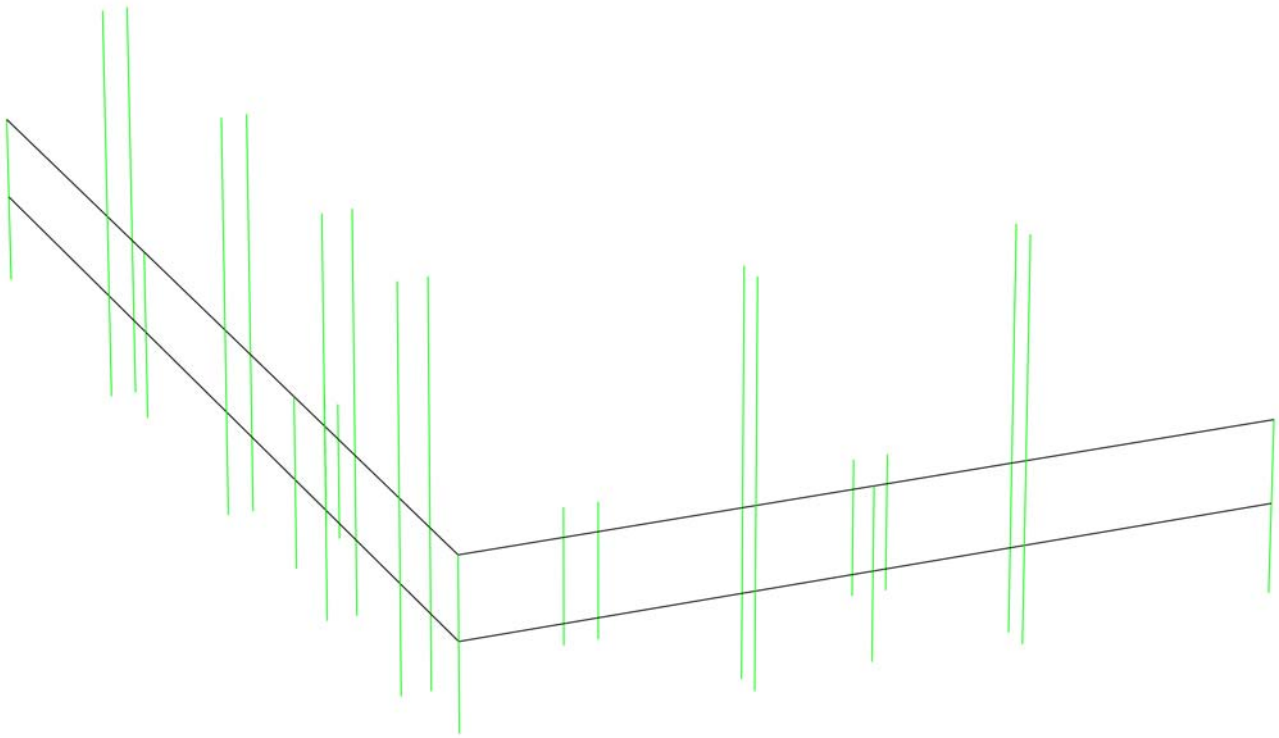
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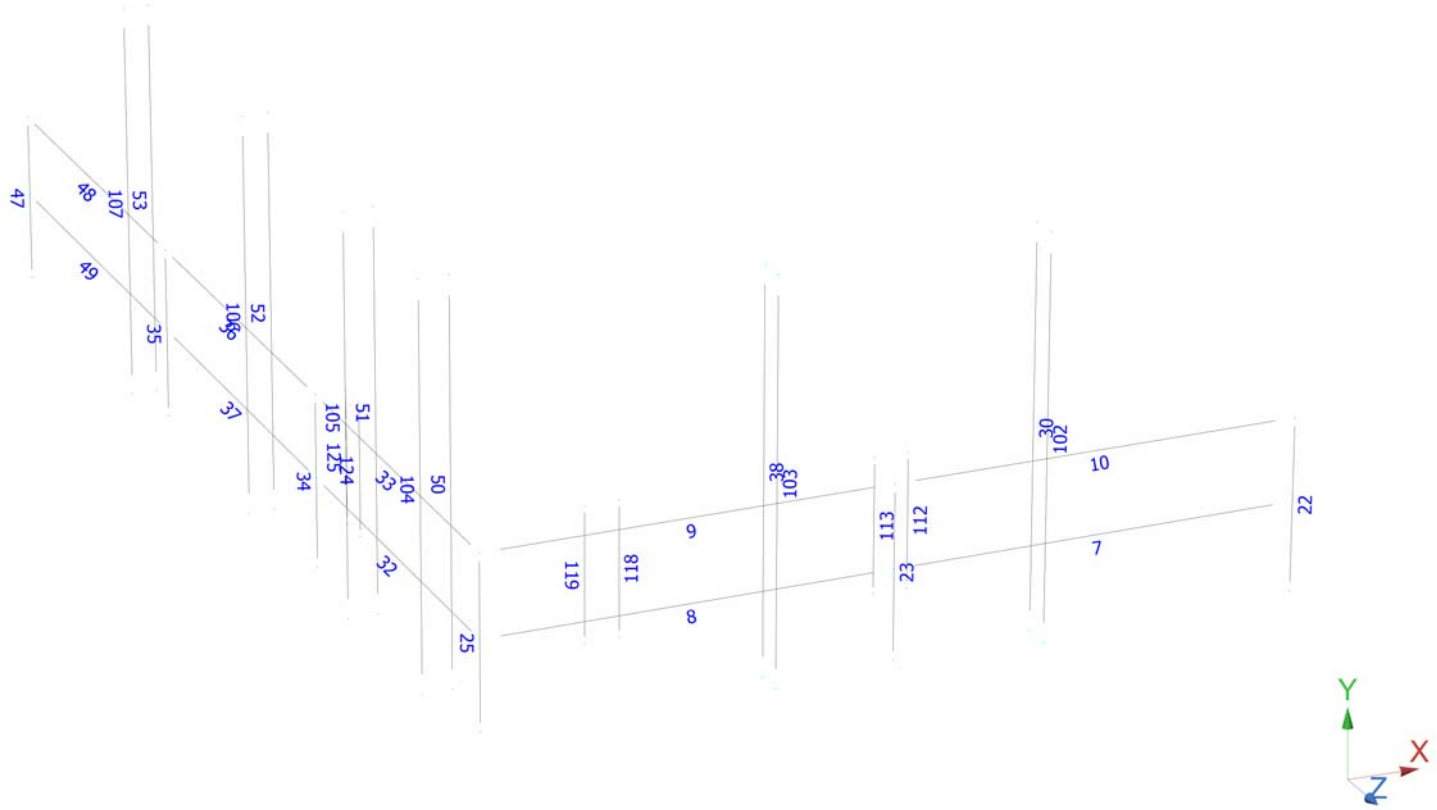
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103
113
112
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102
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7
22
Y
X
Z

RAM Elements

Current Date: 1/24/2025 2:37 PM
Units system: English

Load data

Load Conditions

Condition	Description	Comb.	Category
DL	Dead Load	No	DL
W1	Wind Load Side 1	No	WIND
W2	Wind Load Side 2	No	WIND
W3	Wind Load Side 3	No	WIND
W4	Wind Load Side 4	No	WIND
Di	Ice Load	No	LL
W1ice	Wind with Ice Side 1	No	WIND
W2ice	Wind with Ice Side 2	No	WIND
W3ice	Wind with Ice Side 3	No	WIND
W4ice	Wind with Ice Side 4	No	WIND

Distributed force on members

Condition	Member	Dir1	Val1 [Kip/ft]	Val2 [Kip/ft]	Dist1 [ft]	%	Dist2 [ft]	%
W1	7	z	-0.013	0.00	0.00	No	0.00	No
	8	z	-0.013	0.00	0.00	No	0.00	No
	9	z	-0.013	0.00	0.00	No	0.00	No
	10	z	-0.013	0.00	0.00	No	0.00	No
	22	z	-0.013	0.00	0.00	No	0.00	No
	23	z	-0.013	0.00	0.00	No	0.00	No
	25	z	-0.013	0.00	0.00	No	0.00	No
	30	z	-0.013	-0.013	0.00	No	2.00	No
	34	z	-0.013	0.00	0.00	No	0.00	No
	35	z	-0.013	0.00	0.00	No	0.00	No
	38	z	-0.013	-0.013	0.00	No	2.00	No
	47	z	-0.013	0.00	0.00	No	0.00	No
	50	z	-0.013	0.00	0.00	No	0.00	No
	51	z	-0.013	0.00	0.00	No	0.00	No
	52	z	-0.013	0.00	0.00	No	0.00	No
	53	z	-0.013	0.00	0.00	No	0.00	No
	102	z	-0.011	-0.011	0.00	No	2.00	No
	103	z	-0.011	-0.011	0.00	No	2.00	No
	104	z	-0.011	-0.011	0.00	No	3.50	No
		z	-0.011	-0.011	6.50	No	100.00	Yes
	105	z	-0.011	0.00	0.00	No	0.00	No
	106	z	-0.011	0.00	0.00	No	0.00	No
	107	z	-0.011	0.00	0.00	No	0.00	No
W2	22	x	-0.013	0.00	0.00	No	0.00	No
	23	x	-0.013	0.00	0.00	No	0.00	No
	25	x	-0.013	0.00	0.00	No	0.00	No
	30	x	-0.013	0.00	0.00	No	0.00	No
	32	x	-0.013	0.00	0.00	No	0.00	No
	33	x	-0.013	0.00	0.00	No	0.00	No
	34	x	-0.013	0.00	0.00	No	0.00	No
	35	x	-0.013	0.00	0.00	No	0.00	No
	36	x	-0.013	0.00	0.00	No	0.00	No

	37	x	-0.013	0.00	0.00	No	0.00	No
	38	x	-0.013	0.00	0.00	No	0.00	No
	47	x	-0.013	0.00	0.00	No	0.00	No
	48	x	-0.013	0.00	0.00	No	0.00	No
	49	x	-0.013	0.00	0.00	No	0.00	No
	50	x	-0.013	0.00	0.00	No	0.00	No
	51	x	-0.013	0.00	0.00	No	0.00	No
	52	x	-0.013	0.00	0.00	No	0.00	No
	53	x	-0.013	0.00	0.00	No	0.00	No
	102	x	-0.011	0.00	0.00	No	0.00	No
	103	x	-0.011	0.00	0.00	No	0.00	No
	104	x	-0.011	0.00	0.00	No	0.00	No
	105	x	-0.011	0.00	0.00	No	0.00	No
	106	x	-0.011	0.00	0.00	No	0.00	No
	107	x	-0.011	0.00	0.00	No	0.00	No
W3	7	z	0.013	0.00	0.00	No	0.00	No
	8	z	0.013	0.00	0.00	No	0.00	No
	9	z	0.013	0.00	0.00	No	0.00	No
	10	z	0.013	0.00	0.00	No	0.00	No
	22	z	0.013	0.00	0.00	No	0.00	No
	23	z	0.013	0.00	0.00	No	0.00	No
	25	z	0.013	0.00	0.00	No	0.00	No
	30	z	0.013	0.00	0.00	No	0.00	No
	34	z	0.013	0.00	0.00	No	0.00	No
	35	z	0.013	0.00	0.00	No	0.00	No
	38	z	0.013	0.00	0.00	No	0.00	No
	47	z	0.013	0.00	0.00	No	0.00	No
	50	z	0.013	0.00	0.00	No	0.00	No
	51	z	0.013	0.00	0.00	No	0.00	No
	52	z	0.013	0.00	0.00	No	0.00	No
	53	z	0.013	0.00	0.00	No	0.00	No
	102	z	0.011	0.00	0.00	No	0.00	No
	103	z	0.011	0.00	0.00	No	0.00	No
	104	z	0.011	0.00	0.00	No	0.00	No
	105	z	0.011	0.00	0.00	No	0.00	No
	106	z	0.011	0.00	0.00	No	0.00	No
	107	z	0.011	0.00	0.00	No	0.00	No
W4	22	x	0.013	0.00	0.00	No	0.00	No
	23	x	0.013	0.00	0.00	No	0.00	No
	25	x	0.013	0.00	0.00	No	0.00	No
	30	x	0.013	0.00	0.00	No	0.00	No
	32	x	0.013	0.00	0.00	No	0.00	No
	33	x	0.013	0.00	0.00	No	0.00	No
	34	x	0.013	0.00	0.00	No	0.00	No
	35	x	0.013	0.00	0.00	No	0.00	No
	36	x	0.013	0.00	0.00	No	0.00	No
	37	x	0.013	0.00	0.00	No	0.00	No
	38	x	0.013	0.00	0.00	No	0.00	No
	47	x	0.013	0.00	0.00	No	0.00	No
	48	x	0.013	0.00	0.00	No	0.00	No
	49	x	0.013	0.00	0.00	No	0.00	No
	50	x	0.013	0.00	0.00	No	0.00	No
	51	x	0.013	0.013	0.00	No	2.00	No
	52	x	0.013	0.013	0.00	No	3.50	No
		x	0.013	0.013	6.50	No	100.00	Yes
	53	x	0.013	0.013	0.00	No	2.00	No
	102	x	0.011	0.00	0.00	No	0.00	No
	103	x	0.011	0.00	0.00	No	0.00	No
	104	x	0.011	0.00	0.00	No	0.00	No
	105	x	0.011	0.011	0.00	No	2.00	No
	106	x	0.011	0.011	0.00	No	3.50	No
		x	0.011	0.011	6.50	No	100.00	Yes

	107	x	0.011	0.011	0.00	No	2.00	No
Di	7	y	-0.013	0.00	0.00	No	0.00	No
	8	y	-0.013	0.00	0.00	No	0.00	No
	9	y	-0.013	0.00	0.00	No	0.00	No
	10	y	-0.013	0.00	0.00	No	0.00	No
	22	y	-0.013	0.00	0.00	No	0.00	No
	23	y	-0.013	0.00	0.00	No	0.00	No
	25	y	-0.013	0.00	0.00	No	0.00	No
	30	y	-0.015	0.00	0.00	No	0.00	No
	32	y	-0.013	0.00	0.00	No	0.00	No
	33	y	-0.013	0.00	0.00	No	0.00	No
	34	y	-0.013	0.00	0.00	No	0.00	No
	35	y	-0.013	0.00	0.00	No	0.00	No
	36	y	-0.013	0.00	0.00	No	0.00	No
	37	y	-0.013	0.00	0.00	No	0.00	No
	38	y	-0.015	0.00	0.00	No	0.00	No
	47	y	-0.013	0.00	0.00	No	0.00	No
	48	y	-0.013	0.00	0.00	No	0.00	No
	49	y	-0.013	0.00	0.00	No	0.00	No
	50	y	-0.015	0.00	0.00	No	0.00	No
	51	y	-0.015	0.00	0.00	No	0.00	No
	52	y	-0.015	0.00	0.00	No	0.00	No
	53	y	-0.015	0.00	0.00	No	0.00	No
	102	y	-0.014	0.00	0.00	No	0.00	No
	103	y	-0.014	0.00	0.00	No	0.00	No
	104	y	-0.014	0.00	0.00	No	0.00	No
	105	y	-0.014	0.00	0.00	No	0.00	No
	106	y	-0.014	0.00	0.00	No	0.00	No
	107	y	-0.014	0.00	0.00	No	0.00	No

Concentrated forces on members

Condition	Member	Dir1	Value1 [Kip]	Dist1 [ft]	%
DL	30	y	-0.06	1.00	No
		y	-0.046	3.50	No
		y	-0.068	3.50	No
	38	y	-0.06	3.50	No
		y	-0.029	1.00	No
	51	y	-0.029	3.50	No
	52	y	-0.06	3.50	No
		y	-0.06	3.50	No
	53	y	-0.06	1.00	No
		y	-0.046	3.50	No
		y	-0.068	3.50	No
	102	y	-0.037	2.50	No
		y	-0.037	7.50	No
	103	y	-0.039	2.50	No
		y	-0.039	7.50	No
	104	y	-0.033	4.00	No
		y	-0.033	6.00	No
	105	y	-0.039	2.50	No
		y	-0.039	7.50	No
	106	y	-0.033	4.00	No
		y	-0.033	6.00	No
	107	y	-0.037	2.50	No
		y	-0.037	7.50	No
	112	y	-0.03	0.00	Yes

	113	y	-0.03	0.00	Yes
	118	y	-0.015	0.00	Yes
	119	y	-0.015	0.00	Yes
	124	y	-0.015	0.00	Yes
	125	y	-0.015	0.00	Yes
W1	30	z	-0.105	1.00	No
		z	-0.017	3.50	No
		z	-0.021	3.50	No
	38	z	-0.06	1.00	No
	51	z	-0.06	3.50	No
	52	z	-0.105	3.50	No
	53	z	-0.064	1.00	No
		z	-0.085	3.50	No
	102	z	-0.245	2.50	No
		z	-0.245	7.50	No
	103	z	-0.245	2.50	No
		z	-0.245	7.50	No
	104	z	-0.075	4.00	No
		z	-0.075	6.00	No
	105	z	-0.108	2.50	No
		z	-0.108	7.50	No
	106	z	-0.027	4.00	No
		z	-0.027	6.00	No
	107	z	-0.108	2.50	No
		z	-0.108	7.50	No
	112	z	-0.053	0.00	No
	113	z	-0.053	0.00	No
	118	z	-0.03	0.00	No
	119	z	-0.03	0.00	No
	124	z	-0.03	0.00	No
	125	z	-0.03	0.00	No
W2	30	x	-0.064	1.00	No
		x	-0.085	3.50	No
	38	x	-0.048	3.50	No
		x	-0.06	1.00	No
	51	x	-0.06	3.50	No
	52	x	-0.048	3.50	No
		x	-0.064	3.50	No
	53	x	-0.105	1.00	No
		x	-0.032	3.50	No
		x	-0.038	3.50	No
	102	x	-0.108	2.50	No
		x	-0.108	7.50	No
	103	x	-0.108	2.50	No
		x	-0.108	7.50	No
	104	x	-0.027	4.00	No
		x	-0.027	6.00	No
	105	x	-0.245	2.50	No
		x	-0.245	7.50	No
	106	x	-0.075	4.00	No
		x	-0.075	6.00	No
	107	x	-0.245	2.50	No
		x	-0.245	7.50	No
	112	x	-0.032	0.00	No
	113	x	-0.032	0.00	No
	118	x	-0.03	0.00	No
	119	x	-0.03	0.00	No
	124	x	-0.03	0.00	No
	125	x	-0.03	0.00	No
W3	30	z	0.105	1.00	No
		z	0.032	3.50	No
		z	0.038	3.50	No

	38	z	0.06	1.00	No
		z	0.078	3.50	No
	51	z	0.06	3.50	No
	52	z	0.105	3.50	No
	53	z	0.064	1.00	No
		z	0.085	3.50	No
	102	z	0.245	2.50	No
		z	0.245	7.50	No
	103	z	0.245	2.50	No
		z	0.245	7.50	No
	104	z	0.075	4.00	No
		z	0.075	6.00	No
	105	z	0.108	2.50	No
		z	0.108	7.50	No
	106	z	0.027	4.00	No
		z	0.027	6.00	No
	107	z	0.108	2.50	No
		z	0.108	7.50	No
	112	z	0.053	0.00	No
	113	z	0.053	0.00	No
	118	z	0.03	0.00	No
	119	z	0.03	0.00	No
	124	z	0.03	0.00	No
	125	z	0.03	0.00	No
W4	30	x	0.064	1.00	No
		x	0.085	3.50	No
	38	x	0.048	3.50	No
		x	0.06	1.00	No
	52	x	0.048	3.50	No
		x	0.064	3.50	No
	53	x	0.105	1.00	No
		x	0.017	3.50	No
		x	0.021	3.50	No
	102	x	0.108	2.50	No
		x	0.108	7.50	No
	103	x	0.108	2.50	No
		x	0.108	7.50	No
	104	x	0.027	4.00	No
		x	0.027	6.00	No
	105	x	0.245	2.50	No
		x	0.245	7.50	No
	106	x	0.075	4.00	No
		x	0.075	6.00	No
	107	x	0.245	2.50	No
		x	0.245	7.50	No
	112	x	0.032	0.00	No
	113	x	0.032	0.00	No
	118	x	0.03	0.00	No
	119	x	0.03	0.00	No
	124	x	0.03	0.00	No
	125	x	0.03	0.00	No
Di	30	y	-0.098	1.00	No
		y	-0.062	3.50	No
		y	-0.073	3.50	No
	38	y	-0.072	3.50	No
		y	-0.087	1.00	No
	51	y	-0.029	3.50	No
	52	y	-0.072	3.50	No
		y	-0.098	3.50	No
	53	y	-0.098	1.00	No
		y	-0.062	3.50	No
		y	-0.073	3.50	No

	102	y	-0.193	2.50	No
		y	-0.193	7.50	No
	103	y	-0.193	2.50	No
		y	-0.193	7.50	No
	104	y	-0.063	4.00	No
		y	-0.063	6.00	No
	105	y	-0.193	2.50	No
		y	-0.193	7.50	No
	106	y	-0.063	4.00	No
		y	-0.063	6.00	No
	107	y	-0.193	2.50	No
		y	-0.193	7.50	No
	112	y	-0.049	0.00	Yes
	113	y	-0.049	0.00	Yes
	118	y	-0.044	0.00	Yes
	119	y	-0.044	0.00	Yes
	124	y	-0.044	0.00	Yes
	125	y	-0.044	0.00	Yes
W1ice	30	z	-0.02	1.00	No
		z	-0.007	3.50	No
		z	-0.007	3.50	No
	38	z	-0.012	1.00	No
	51	z	-0.012	3.50	No
	52	z	-0.02	3.50	No
	53	z	-0.015	1.00	No
		z	-0.017	3.50	No
	102	z	-0.039	2.50	No
		z	-0.039	7.50	No
	103	z	-0.039	2.50	No
		z	-0.039	7.50	No
	104	z	-0.013	4.00	No
		z	-0.013	6.00	No
	105	z	-0.022	2.50	No
		z	-0.022	7.50	No
	106	z	-0.008	4.00	No
		z	-0.008	6.00	No
	107	z	-0.022	2.50	No
		z	-0.022	7.50	No
	112	z	-0.01	1.00	No
	113	z	-0.01	1.00	No
	118	z	-0.006	0.00	No
	119	z	-0.006	0.00	No
	124	z	-0.006	0.00	No
	125	z	-0.006	0.00	No
W2ice	30	x	-0.015	1.00	No
		x	-0.017	3.50	No
	38	x	-0.011	3.50	No
	51	x	-0.012	3.50	No
	52	x	-0.015	3.50	No
		x	-0.011	3.50	No
	53	x	-0.02	1.00	No
		x	-0.008	3.50	No
		x	-0.01	3.50	No
	102	x	-0.022	2.50	No
		x	-0.022	7.50	No
	103	x	-0.022	2.50	No
		x	-0.022	7.50	No
	104	x	-0.008	4.00	No
		x	-0.008	6.00	No
	105	x	-0.039	2.50	No
		x	-0.039	7.50	No
	106	x	-0.013	4.00	No

		x	-0.013	6.00	No
	107	x	-0.039	2.50	No
		x	-0.039	7.50	No
	112	x	-0.008	1.00	No
	113	x	-0.008	1.00	No
	118	x	-0.006	0.00	No
	119	x	-0.006	0.00	No
	124	x	-0.006	0.00	No
	125	x	-0.006	0.00	No
W3ice	30	z	0.02	1.00	No
		z	0.008	3.50	No
		z	0.01	3.50	No
	38	z	0.012	1.00	No
		z	0.015	3.50	No
	51	z	0.012	3.50	No
	52	z	0.02	3.50	No
	53	z	0.015	1.00	No
		z	0.017	3.50	No
	102	z	0.039	2.50	No
		z	0.039	7.50	No
	103	z	0.039	2.50	No
		z	0.039	7.50	No
	104	z	0.013	4.00	No
		z	0.013	6.00	No
	105	z	0.022	2.50	No
		z	0.022	7.50	No
	106	z	0.008	4.00	No
		z	0.008	6.00	No
	107	z	0.022	2.50	No
		z	0.022	7.50	No
	112	z	0.01	1.00	No
	113	z	0.01	1.00	No
	118	z	0.006	0.00	No
	119	z	0.006	0.00	No
	124	z	0.006	0.00	No
	125	z	0.006	0.00	No
W4ice	30	x	0.015	1.00	No
		x	0.017	3.50	No
	38	x	0.011	3.50	No
	52	x	0.015	3.50	No
		x	0.011	3.50	No
	53	x	0.02	1.00	No
		x	0.007	3.50	No
		x	0.07	3.50	No
	102	x	0.022	2.50	No
		x	0.022	7.50	No
	103	x	0.022	2.50	No
		x	0.022	7.50	No
	104	x	0.008	4.00	No
		x	0.008	6.00	No
	105	x	0.039	2.50	No
		x	0.039	7.50	No
	106	x	0.013	4.00	No
		x	0.013	6.00	No
	107	x	0.039	2.50	No
		x	0.039	7.50	No
	112	x	0.008	1.00	No
	113	x	0.008	1.00	No
	118	x	0.006	0.00	No
	119	x	0.006	0.00	No
	124	x	0.006	0.00	No
	125	x	0.006	0.00	No

Self weight multipliers for load conditions

Condition	Description	Self weight multiplier			
		Comb.	**MultX**	**MultY**	**MultZ**
DL	Dead Load	No	0.00	-1.00	0.00
W1	Wind Load Side 1	No	0.00	0.00	0.00
W2	Wind Load Side 2	No	0.00	0.00	0.00
W3	Wind Load Side 3	No	0.00	0.00	0.00
W4	Wind Load Side 4	No	0.00	0.00	0.00
Di	Ice Load	No	0.00	0.00	0.00
W1ice	Wind with Ice Side 1	No	0.00	0.00	0.00
W2ice	Wind with Ice Side 2	No	0.00	0.00	0.00
W3ice	Wind with Ice Side 3	No	0.00	0.00	0.00
W4ice	Wind with Ice Side 4	No	0.00	0.00	0.00

Glossary

Comb : Indicates if load condition is a load combination

RAM Elements

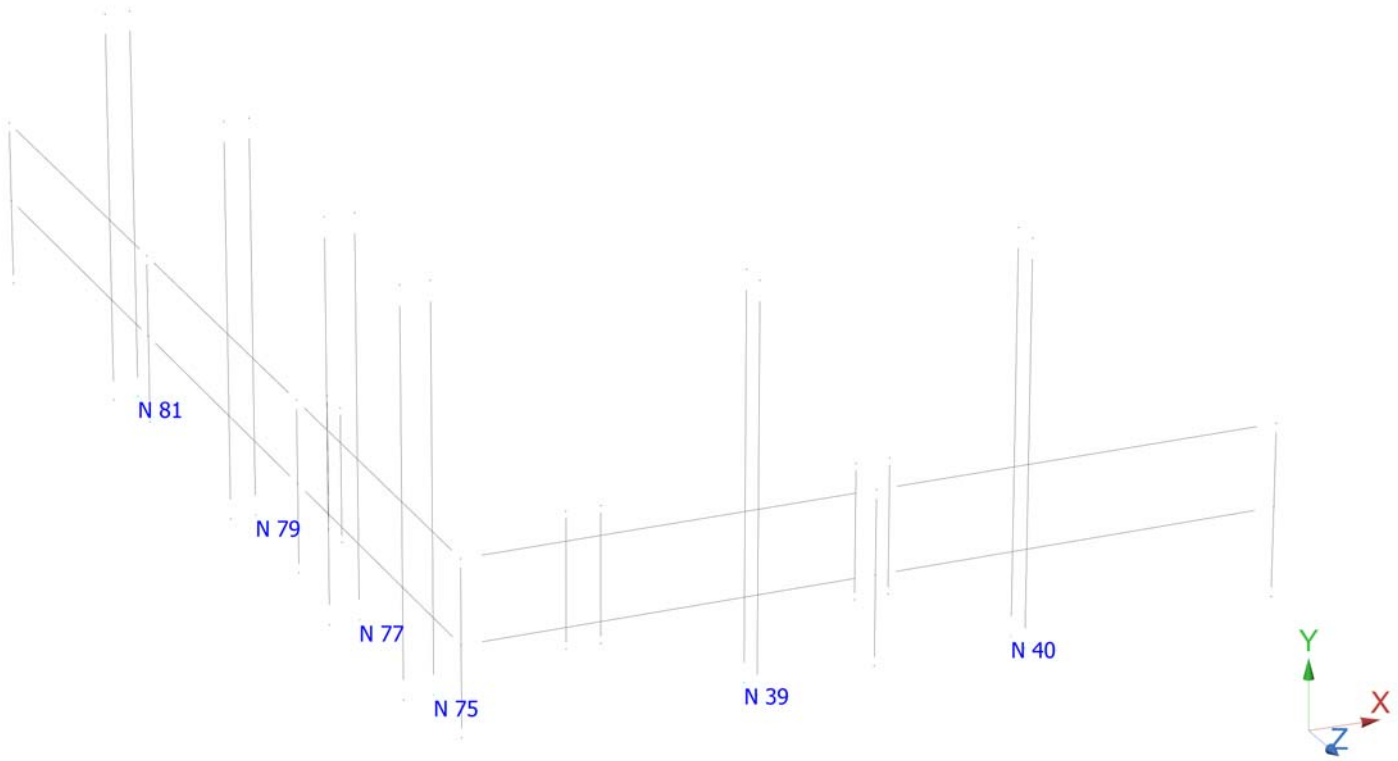
Current Date: 1/24/2025 2:37 PM
Units system: English

Steel Code Check
Summary - Group by member

Load conditions to be included in design :

LC1=1.2DL+W1
LC2=1.2DL+W2
LC3=1.2DL-W1
LC4=1.2DL-W2
LC5=0.9DL+W1
LC6=0.9DL+W2
LC7=0.9DL-W1
LC8=0.9DL-W2
LC9=1.2DL+Di+W1ice
LC10=1.2DL+Di+W2ice
LC11=1.2DL+Di-W1ice
LC12=1.2DL+Di-W2ice
LC13=1.4DL
LC14=0.9DL
LC15=1.4DL
LC16=1.2DL+1.6Di
LC17=1.2DL+0.5W1
LC18=1.2DL+0.5W2
LC19=1.2DL+0.5W3
LC20=1.2DL+0.5W4
LC21=1.2DL+0.5W1ice
LC22=1.2DL+0.5W2ice
LC23=1.2DL+0.5W3ice
LC24=1.2DL+0.5W4ice
LC25=1.2DL+W3
LC26=1.2DL+W2
LC28=1.2DL+W4
LC29=1.2DL+W1ice
LC30=1.2DL+W2ice
LC31=1.2DL+W3ice
LC32=1.2DL+W4ice
LC33=1.2DL+W1+Di
LC34=1.2DL+W2+Di
LC35=1.2DL+W3+Di
LC36=1.2DL+W4+Di
LC37=1.2DL+Di+W1ice
LC38=1.2DL+Di+W2ice
LC39=1.2DL+Di+W3ice
LC40=1.2DL+Di+W4ice
LC41=0.9DL+W1
LC42=0.9DL+W2
LC43=0.9DL+W3
LC44=0.9DL+W4
LC45=0.9DL+W1ice
LC46=0.9DL+W2ice
LC47=0.9DL+W3ice
LC48=0.9DL+W4ice

Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
	L 2X2X3_16	**7**	LC35 at 100.00%	0.27	With warnings	
		8	LC35 at 0.00%	0.27	With warnings	
		9	LC35 at 0.00%	0.38	With warnings	
		10	LC36 at 63.66%	0.72	With warnings	
		22	LC35 at 0.00%	0.12	OK	
		23	LC35 at 48.19%	0.20	OK	
		25	LC16 at 0.00%	0.16	OK	
		32	LC34 at 100.00%	0.25	With warnings	
		33	LC41 at 69.25%	0.38	With warnings	
		34	LC34 at 48.19%	0.12	OK	
		35	LC4 at 48.19%	0.20	OK	
		36	LC33 at 63.95%	0.49	With warnings	
		37	LC34 at 35.92%	0.21	With warnings	
		47	LC34 at 0.00%	0.18	OK	
		48	LC33 at 100.00%	**0.86**	**With warnings**	
		49	LC8 at 0.00%	0.32	With warnings	
	P1000 Unistrut	**112**	LC33 at 18.75%	0.09	OK	Eq. H1.2-1
		113	LC33 at 18.75%	0.11	OK	Eq. H1.2-1
		118	LC33 at 18.75%	0.09	OK	Eq. H1.2-1
		119	LC35 at 18.75%	**0.13**	**OK**	Eq. H1.2-1
		124	LC4 at 18.75%	0.12	OK	Eq. H1.1-1
		125	LC34 at 18.75%	0.10	OK	Eq. H1.2-1
	Pipe 2-1_2STD	**102**	LC35 at 50.00%	**0.13**	**OK**	
		103	LC35 at 50.00%	0.13	OK	
		104	LC35 at 67.19%	0.04	OK	
		105	LC34 at 50.00%	0.13	OK	
		106	LC33 at 67.19%	0.03	OK	
		107	LC34 at 50.00%	0.13	OK	
	Pipe 3STD	**30**	LC35 at 100.00%	**0.76**	**OK**	
		38	LC35 at 100.00%	0.71	OK	
		50	LC34 at 100.00%	0.20	OK	
		51	LC34 at 100.00%	0.56	OK	
		52	LC34 at 100.00%	0.45	OK	
		53	LC34 at 100.00%	0.71	OK	


N 81
N 79
N 77
N 75
N 39
N 40
Y
X
Z

RAM Elements

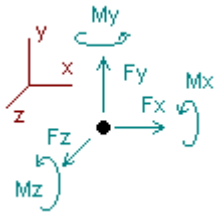
Current Date: 1/24/2025 2:39 PM
Units system: English

Analysis result

Nodes

Envelope for nodal reactions

Note.- **Ic** is the controlling load condition



Direction of positive forces and moments

Envelope of nodal reactions for :

LC1=1.2DL+W1
LC2=1.2DL+W2
LC3=1.2DL-W1
LC4=1.2DL-W2
LC5=0.9DL+W1
LC6=0.9DL+W2
LC7=0.9DL-W1
LC8=0.9DL-W2
LC9=1.2DL+Di+W1ice
LC10=1.2DL+Di+W2ice
LC11=1.2DL+Di-W1ice
LC12=1.2DL+Di-W2ice
LC13=1.4DL
LC14=0.9DL
LC15=1.4DL
LC16=1.2DL+1.6Di
LC17=1.2DL+0.5W1
LC18=1.2DL+0.5W2
LC19=1.2DL+0.5W3
LC20=1.2DL+0.5W4
LC21=1.2DL+0.5W1ice
LC22=1.2DL+0.5W2ice
LC23=1.2DL+0.5W3ice
LC24=1.2DL+0.5W4ice
LC25=1.2DL+W3
LC26=1.2DL+W2
LC28=1.2DL+W4
LC29=1.2DL+W1ice
LC30=1.2DL+W2ice
LC31=1.2DL+W3ice
LC32=1.2DL+W4ice
LC33=1.2DL+W1+Di
LC34=1.2DL+W2+Di
LC35=1.2DL+W3+Di
LC36=1.2DL+W4+Di
LC37=1.2DL+Di+W1ice
LC38=1.2DL+Di+W2ice
LC39=1.2DL+Di+W3ice

LC40=1.2DL+Di+W4ice
LC41=0.9DL+W1
LC42=0.9DL+W2
LC43=0.9DL+W3
LC44=0.9DL+W4
LC45=0.9DL+W1ice
LC46=0.9DL+W2ice
LC47=0.9DL+W3ice
LC48=0.9DL+W4ice

		Forces						Moments					
Node		**Fx** [Kip]	**lc**	**Fy** [Kip]	**lc**	**Fz** [Kip]	**lc**	**Mx** [Kip*ft]	**lc**	**My** [Kip*ft]	**lc**	**Mz** [Kip*ft]	**lc**
39	Max	0.080	LC33	1.474	LC16	0.879	LC33	2.84888	LC5	0.16302	LC35	0.09978	LC25
	Min	-0.096	LC35	0.082	LC43	-1.069	LC43	-3.93177	LC35	-0.12679	LC5	-0.08754	LC33
40	Max	0.134	LC35	1.611	LC16	0.897	LC33	3.16233	LC5	0.10410	LC5	0.09287	LC5
	Min	-0.085	LC5	0.190	LC43	-1.080	LC35	-4.15344	LC35	-0.13265	LC35	-0.13770	LC35
75	Max	0.248	LC6	0.589	LC16	0.055	LC34	0.10298	LC33	0.19800	LC8	0.92425	LC8
	Min	-0.280	LC4	0.163	LC6	-0.049	LC8	-0.08905	LC43	-0.24406	LC34	-1.01809	LC34
77	Max	0.866	LC2	1.182	LC16	0.069	LC34	0.09113	LC33	0.11265	LC8	2.70011	LC8
	Min	-0.863	LC8	0.064	LC6	-0.065	LC8	-0.09203	LC43	-0.12367	LC34	-3.07573	LC34
79	Max	0.730	LC34	1.003	LC16	0.023	LC8	0.05698	LC5	0.02257	LC44	2.27708	LC8
	Min	-0.716	LC8	0.116	LC6	-0.037	LC34	-0.07030	LC35	-0.02173	LC33	-2.52238	LC34
81	Max	1.097	LC34	1.576	LC16	0.106	LC8	0.07352	LC8	0.02455	LC5	3.59848	LC8
	Min	-1.091	LC8	-0.107	LC6	-0.133	LC34	-0.09000	LC34	-0.03580	LC35	-3.95221	LC34

Date: 1/27/2025
Project Name: RCC - DT ST ALBANS
Project Number: VTL06469
Designed By: KSBM **Checked By:** MSC

CHECK THRU BOLT CONNECTION CAPACITY → EXISTING ANCHORS AT ALPHA SECTOR

Reference: AISC Steel Construction Manual 14th Edition (ASD)

Bolt Type = A325 1/2" Bolt

Allowable Tensile Load =
F_{Tall} = 8836 lbs.

Allowable Shear Load =
F_{vall} = 5301 lbs.

CONNECTION PLATE CONFIGURATION (4-BOLTS)

$N_{BOLT\ ROWS}$	=	2	rows	d_Y	=	10	in (Min.)
N_{BOLTS}	=	2	bolts/row	d_X	=	22	in (Min.)

TENSILE FORCES

Moment in X axis:	4153	lb-ft.	(See Bentley Output)
Couple Reaction from M_X:	4984	lbs.	
Moment in Z axis:	138	lb-ft.	(See Bentley Output)
Couple Reaction from M_Z:	76	lbs.	
Reaction in Y direction:	0	lbs.	(Gravity Load Supported by Roof Structure)
Resultant per bolt:	2530	lbs.	

SHEAR FORCES

Moment in Y axis:	133	lb-ft.	(See Bentley Output)
Couple Reaction from M_Y:	73	lbs.	
Reaction in X direction:	134	lbs.	(See Bentley Output)
Reaction in Z direction:	1080	lbs.	(See Bentley Output)
Resultant per bolt:	309	lbs.	

Tension Design Load /Bolts =

f_t= 2530.00 lbs. < 8835.7 lbs. **Therefore, OK !**

Shear Design Load / Bolts=

f_v= 308.57 lbs. < 5301.4 lbs. **Therefore, OK !**

CHECK COMBINED TENSION AND SHEAR

f_t / F_T	+	f_v / F_V	≤	1.0			
0.286	+	0.058	=	0.345	<	1.0	**Therefore, OK !**

Date: 1/27/2025
Project Name: RCC - DT ST ALBANS
Project Number: VTL06469
Designed By: KSBM **Checked By:** MSC

CHECK THRU BOLT CONNECTION CAPACITY → EXISTING ANCHORS AT BETA SECTOR

Reference: AISC Steel Construction Manual 14th Edition (ASD)

Bolt Type = A325 1/2" Bolt

Allowable Tensile Load =
F_{Tall} = 8836 lbs.

Allowable Shear Load =
F_{vall} = 5301 lbs.

CONNECTION PLATE CONFIGURATION (4-BOLTS)

$N_{BOLT\ ROWS}$	=	2	rows	d_Y	=	22	in (Min.)
N_{BOLTS}	=	2	bolts/row	d_X	=	10	in (Min.)

TENSILE FORCES

Moment in X axis:	90	lb-ft.	(See Bentley Output)
Couple Reaction from M_X:	50	lbs.	
Moment in Z axis:	3952	lb-ft.	(See Bentley Output)
Couple Reaction from M_Z:	4743	lbs.	
Reaction in Y direction:	107	lbs.	(See Bentley Output)
Resultant per bolt:	2423	lbs.	

SHEAR FORCES

Moment in Y axis:	36	lb-ft.	(See Bentley Output)
Couple Reaction from M_Y:	20	lbs.	
Reaction in X direction:	1097	lbs.	(See Bentley Output)
Reaction in Z direction:	133	lbs.	(See Bentley Output)
Resultant per bolt:	286	lbs.	

Tension Design Load /Bolts =

f_t= 2423.25 lbs. < 8835.7 lbs. **Therefore, OK !**

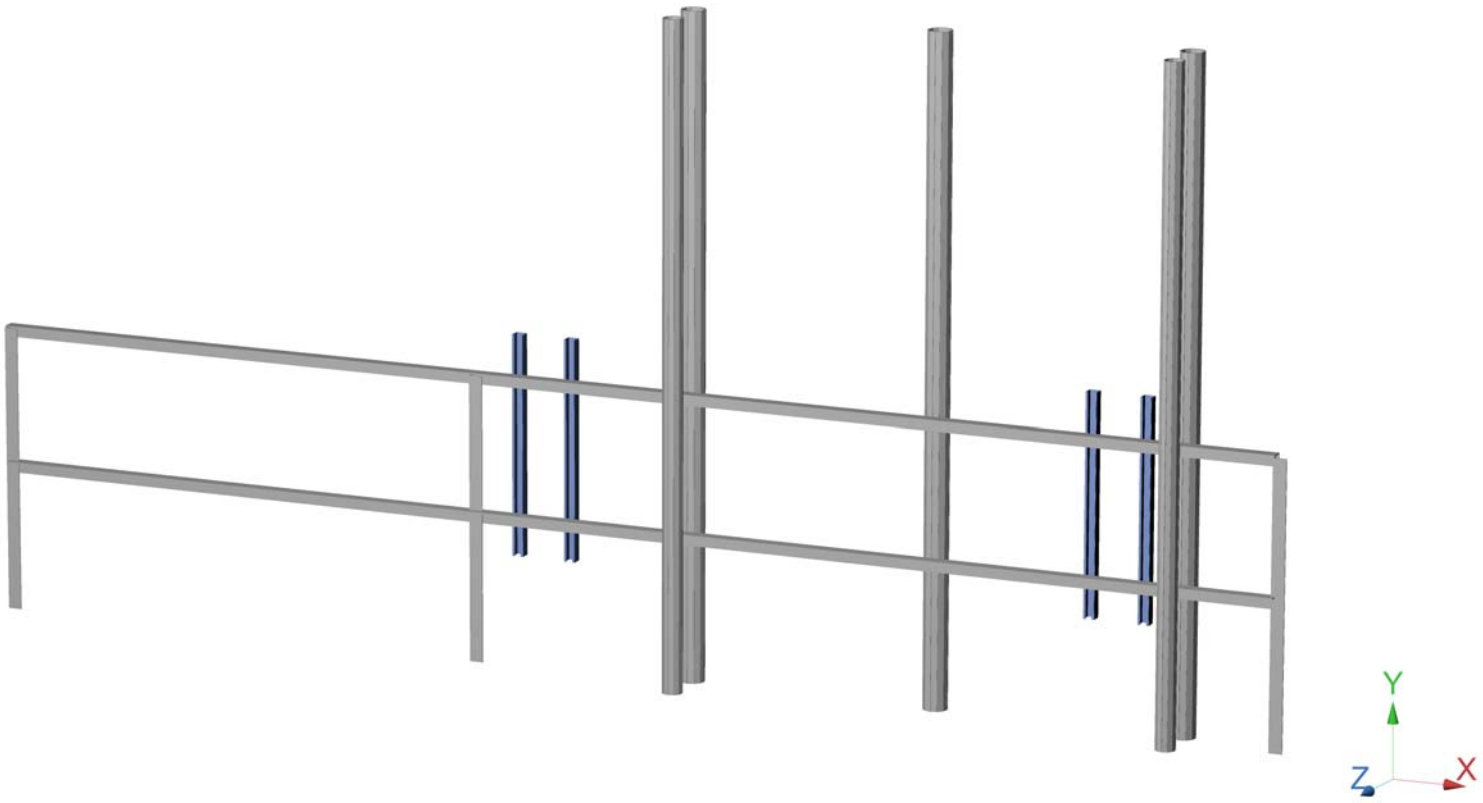
Shear Design Load / Bolts=

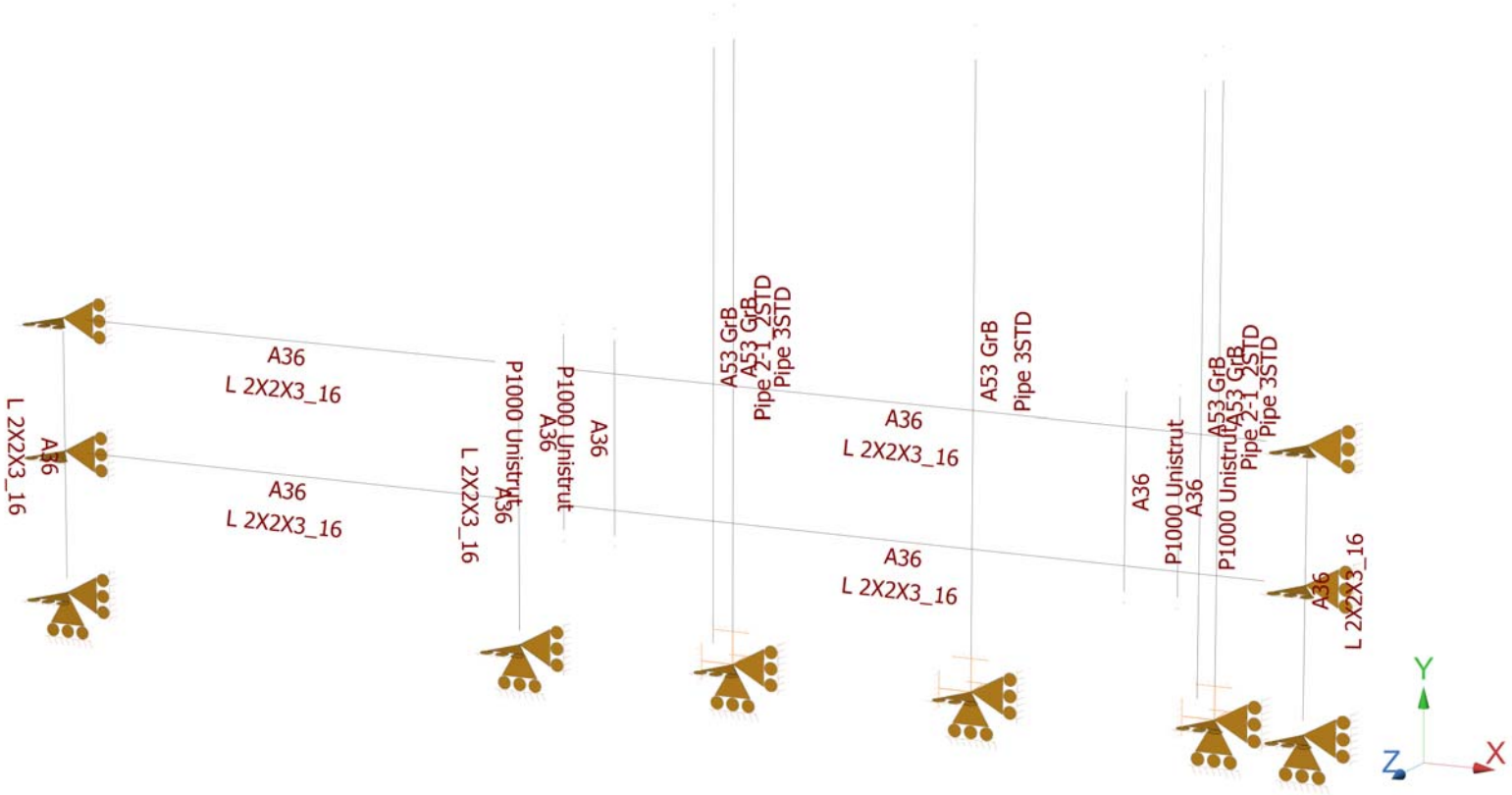
f_v= 286.26 lbs. < 5301.4 lbs. **Therefore, OK !**

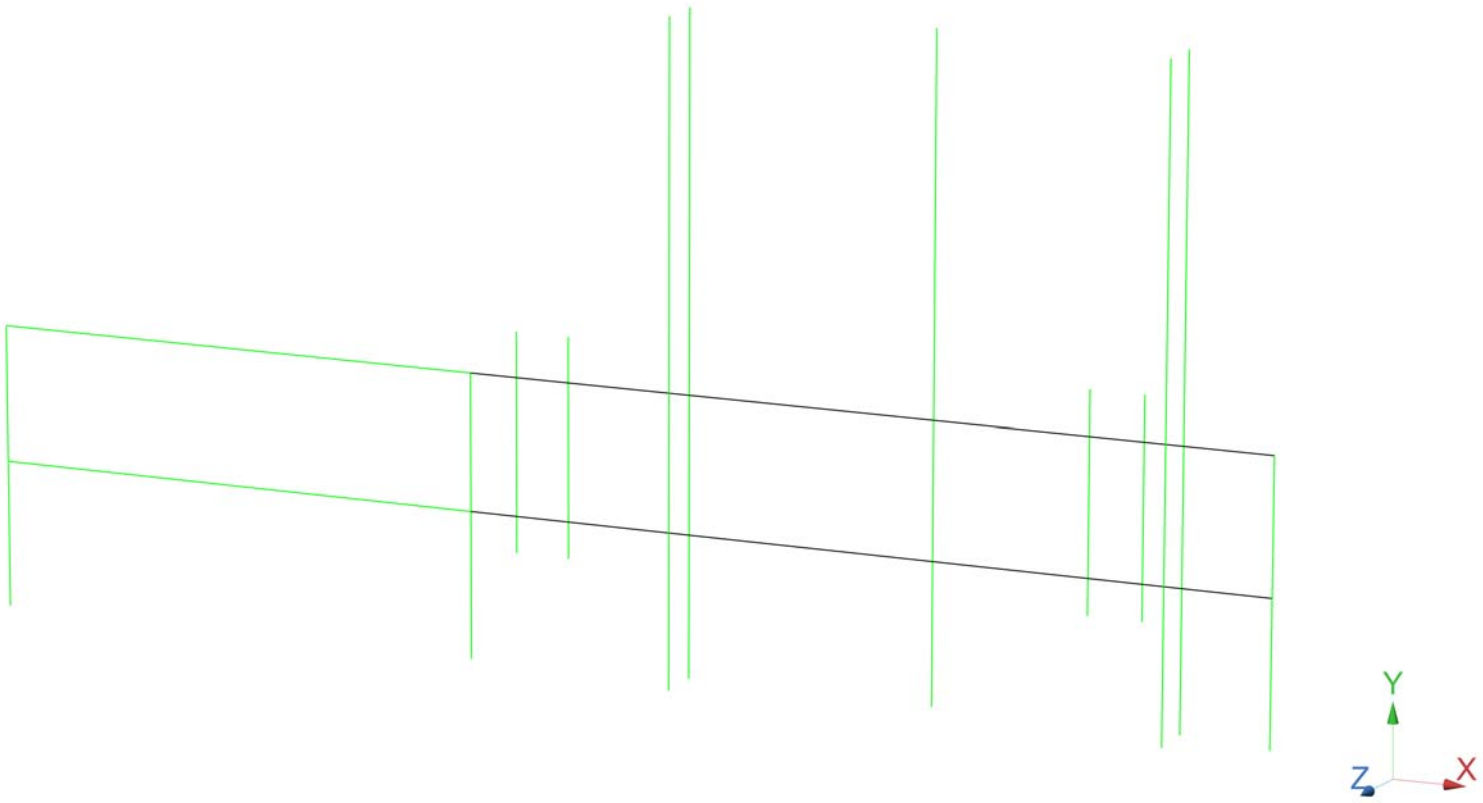
CHECK COMBINED TENSION AND SHEAR

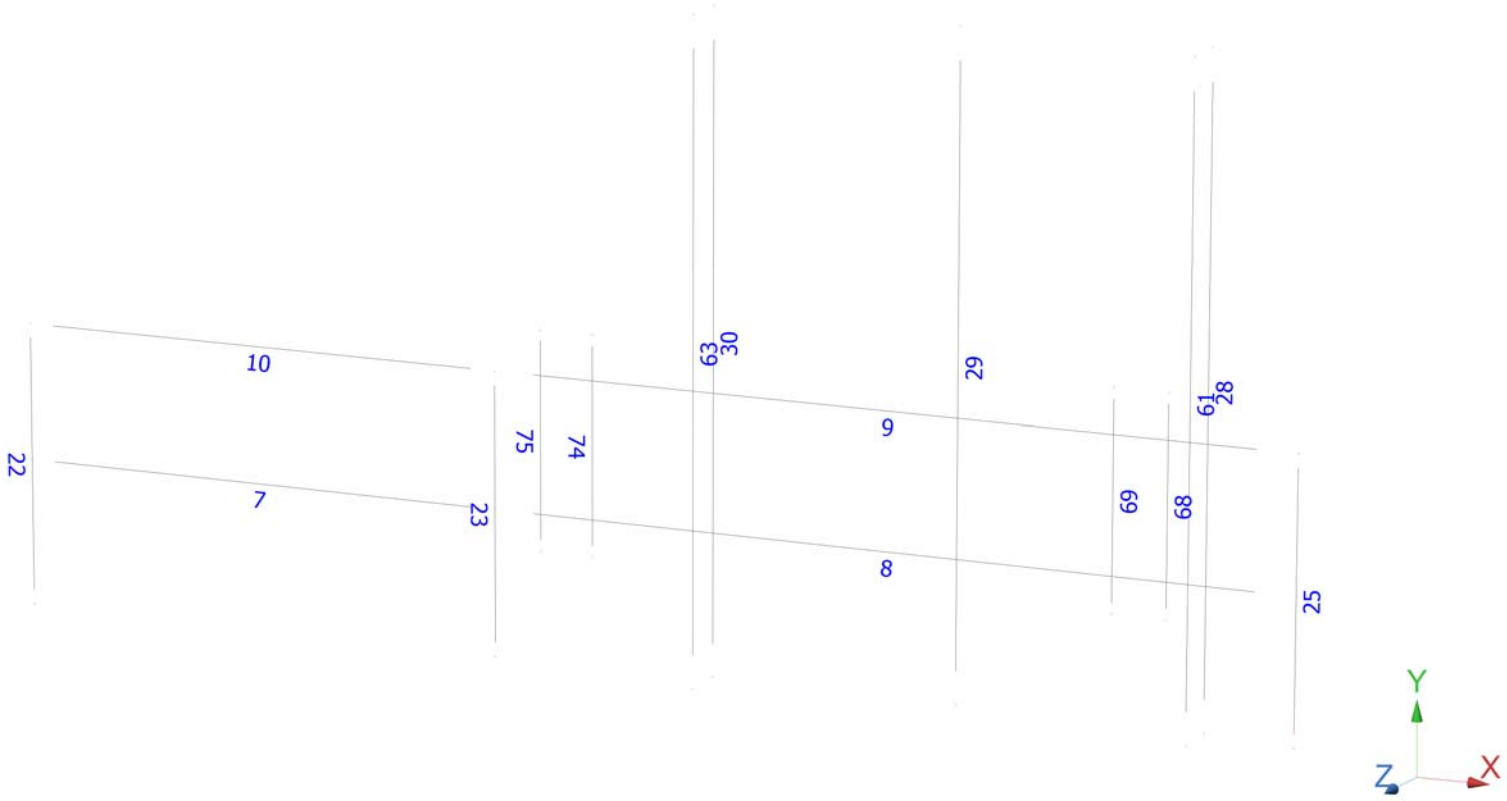
f_t / F_T	+	f_v / F_V	≤	1.0			
0.274	+	0.054	=	0.328	<	1.0	**Therefore, OK !**

Gamma Sector
Antenna Mount
Calculations


Y
Z
X


A36
L 2X2X3_16
A36
L 2X2X3_16
A36
L 2X2X3_16
A36
L 2X2X3_16
A36
L 2X2X3_16
A36
L 2X2X3_16
P1000 Unistrut
A36
P1000 Unistrut
A36
A53 GrB
Pipe 2-1 2STD
Pipe 3STD
A53 GrB
Pipe 3STD
A53 GrB
Pipe 2-1 2STD
Pipe 3STD
A36
P1000 Unistrut
A36
P1000 Unistrut
A36
A53 GrB
Pipe 2-1 2STD
Pipe 3STD
Y
Z
X


Y
Z
X


10
22
7
23
75
74
63
30
29
6
61
28
69
68
8
25
Y
Z
X

RAM Elements

Current Date: 3/21/2025 1:56 PM
Units system: English

Load data

Load Conditions

Condition	Description	Comb.	Category
DL	Dead Load	No	DL
W1	Wind Load Side 1	No	WIND
W2	Wind Load Side 2	No	WIND
W3	Wind Load Side 3	No	WIND
W4	Wind Load Side 4	No	WIND
Di	Ice Load	No	LL
W1ice	Wind with Ice Side 1	No	WIND
W2ice	Wind with Ice Side 2	No	WIND
W3ice	Wind with Ice Side 3	No	WIND
W4ice	Wind with Ice Side 4	No	WIND

Distributed force on members

Condition	Member	Dir1	Val1 [Kip/ft]	Val2 [Kip/ft]	Dist1 [ft]	%	Dist2 [ft]	%
W1	7	z	-0.013	0.00	0.00	No	0.00	No
	8	z	-0.013	0.00	0.00	No	0.00	No
	9	z	-0.013	0.00	0.00	No	0.00	No
	10	z	-0.013	0.00	0.00	No	0.00	No
	22	z	-0.013	0.00	0.00	No	0.00	No
	23	z	-0.013	0.00	0.00	No	0.00	No
	25	z	-0.013	0.00	0.00	No	0.00	No
	28	z	-0.013	-0.013	0.00	No	2.00	No
	30	z	-0.013	-0.013	0.00	No	2.00	No
	61	z	-0.013	-0.013	0.00	No	2.00	No
	63	z	-0.013	-0.013	0.00	No	2.00	No
W2	22	x	-0.013	0.00	0.00	No	0.00	No
	23	x	-0.013	0.00	0.00	No	0.00	No
	25	x	-0.013	0.00	0.00	No	0.00	No
	28	x	-0.013	0.00	0.00	No	0.00	No
	29	x	-0.013	0.00	0.00	No	0.00	No
	30	x	-0.013	0.00	0.00	No	0.00	No
	61	x	-0.011	0.00	0.00	No	0.00	No
	63	x	-0.011	0.00	0.00	No	0.00	No
W3	7	z	0.013	0.00	0.00	No	0.00	No
	8	z	0.013	0.00	0.00	No	0.00	No
	9	z	0.013	0.00	0.00	No	0.00	No
	10	z	0.013	0.00	0.00	No	0.00	No
	22	z	0.013	0.00	0.00	No	0.00	No
	23	z	0.013	0.00	0.00	No	0.00	No
	25	z	0.013	0.00	0.00	No	0.00	No
	28	z	0.013	0.00	0.00	No	0.00	No
	29	z	0.013	0.00	0.00	No	0.00	No
	30	z	0.013	0.00	0.00	No	0.00	No
	61	z	0.011	0.00	0.00	No	0.00	No
	63	z	0.011	0.00	0.00	No	0.00	No
W4	22	x	0.013	0.00	0.00	No	0.00	No

	23	x	0.013	0.00	0.00	No	0.00	No
	25	x	0.013	0.00	0.00	No	0.00	No
	28	x	0.013	0.00	0.00	No	0.00	No
	29	x	0.013	0.00	0.00	No	0.00	No
	30	x	0.013	0.00	0.00	No	0.00	No
	61	x	0.011	0.00	0.00	No	0.00	No
	63	x	0.011	0.00	0.00	No	0.00	No
Di	7	y	-0.014	0.00	0.00	No	0.00	No
	8	y	-0.014	0.00	0.00	No	0.00	No
	9	y	-0.014	0.00	0.00	No	0.00	No
	10	y	-0.014	0.00	0.00	No	0.00	No
	22	y	-0.014	0.00	0.00	No	0.00	No
	23	y	-0.014	0.00	0.00	No	0.00	No
	25	y	-0.014	0.00	0.00	No	0.00	No
	28	y	-0.015	0.00	0.00	No	0.00	No
	29	y	-0.015	0.00	0.00	No	0.00	No
	30	y	-0.015	0.00	0.00	No	0.00	No
	61	y	-0.014	0.00	0.00	No	0.00	No
	63	y	-0.014	0.00	0.00	No	0.00	No

Concentrated forces on members

Condition	Member	Dir1	Value1 [Kip]	Dist1 [ft]	%
DL	28	y	-0.046	3.50	No
		y	-0.068	3.50	No
	29	y	-0.06	3.50	No
	30	y	-0.06	3.50	No
		y	-0.06	3.50	No
	61	y	-0.039	2.50	No
		y	-0.039	7.50	No
	63	y	-0.099	2.50	No
		y	-0.099	7.50	No
	68	y	-0.015	0.00	No
	69	y	-0.015	0.00	No
	74	y	-0.015	0.00	No
	75	y	-0.015	0.00	No
W1	28	z	-0.017	3.50	No
		z	-0.021	3.50	No
	29	z	-0.105	3.50	No
	30	z	-0.026	3.50	No
		z	-0.036	3.50	No
	61	z	-0.245	2.50	No
		z	-0.245	7.50	No
	63	z	-0.164	2.50	No
		z	-0.164	7.50	No
	68	z	-0.03	0.00	No
	69	z	-0.03	0.00	No
	74	z	-0.03	0.00	No
	75	z	-0.03	0.00	No
W2	28	x	-0.085	3.50	No
	29	x	-0.048	3.50	No
	30	x	-0.105	3.50	No
	61	x	-0.108	2.50	No
		x	-0.108	7.50	No
	63	x	-0.088	2.50	No
		x	-0.088	7.50	No
	68	x	-0.03	0.00	No

	69	x	-0.03	0.00	No
	74	x	-0.03	0.00	No
	75	x	-0.03	0.00	No
W3	28	z	0.032	3.50	No
		z	0.038	3.50	No
	29	z	0.105	3.50	No
	30	z	0.064	3.50	No
		z	0.048	3.50	No
	61	z	0.245	2.50	No
		z	0.245	7.50	No
	63	z	0.164	2.50	No
		z	0.164	7.50	No
	68	z	0.03	0.00	No
	69	z	0.03	0.00	No
	74	z	0.03	0.00	No
	75	z	0.03	0.00	No
W4	28	x	0.085	3.50	No
	29	x	0.048	3.50	No
	30	x	0.105	3.50	No
	61	x	0.108	2.50	No
		x	0.108	7.50	No
	63	x	0.088	2.50	No
		x	0.088	7.50	No
	68	x	0.03	0.00	No
	69	x	0.03	0.00	No
	74	x	0.03	0.00	No
	75	x	0.03	0.00	No
Di	28	y	-0.062	3.50	No
		y	-0.073	3.50	No
	29	y	-0.098	3.50	No
	30	y	-0.072	3.50	No
		y	-0.098	3.50	No
	61	y	-0.193	2.50	No
		y	-0.193	7.50	No
	63	y	-0.215	2.50	No
		y	-0.215	7.50	No
	68	y	-0.044	0.00	No
	69	y	-0.044	0.00	No
	74	y	-0.044	0.00	No
	75	y	-0.044	0.00	No
W1ice	28	z	-0.007	3.50	No
		z	-0.007	3.50	No
	29	z	-0.02	3.50	No
	30	z	-0.008	3.50	No
		z	-0.011	3.50	No
	61	z	-0.039	2.50	No
		z	-0.039	7.50	No
	63	z	-0.038	2.50	No
		z	-0.038	7.50	No
	68	z	-0.006	0.00	No
	69	z	-0.006	0.00	No
	74	z	-0.006	0.00	No
	75	z	-0.006	0.00	No
W2ice	28	x	-0.017	3.50	No
	29	x	-0.015	3.50	No
	30	x	-0.02	3.50	No
	61	x	-0.022	2.50	No
		x	-0.022	7.50	No
	63	x	-0.031	2.50	No
		x	-0.031	7.50	No
	68	x	-0.006	0.00	No
	69	x	-0.006	0.00	No

	74	x	-0.006	0.00	No
	75	x	-0.006	0.00	No
W3ice	28	z	0.008	3.50	No
		z	0.01	3.50	No
	29	z	0.02	3.50	No
	30	z	0.011	3.50	No
		z	0.015	3.50	No
	61	z	0.039	2.50	No
		z	0.039	7.50	No
	63	z	0.038	2.50	No
		z	0.038	7.50	No
	68	z	0.006	0.00	No
	69	z	0.006	0.00	No
	74	z	0.006	0.00	No
	75	z	0.006	0.00	No
W4ice	28	x	0.017	3.50	No
	29	x	0.015	3.50	No
	30	x	0.02	3.50	No
	61	x	0.022	2.50	No
		x	0.022	7.50	No
	63	x	0.031	2.50	No
		x	0.031	7.50	No
	68	x	0.006	0.00	No
	69	x	0.006	0.00	No
	74	x	0.006	0.00	No
	75	x	0.006	0.00	No

Self weight multipliers for load conditions

		Self weight multiplier			
Condition	**Description**	**Comb.**	**MultX**	**MultY**	**MultZ**
DL	Dead Load	No	0.00	-1.00	0.00
W1	Wind Load Side 1	No	0.00	0.00	0.00
W2	Wind Load Side 2	No	0.00	0.00	0.00
W3	Wind Load Side 3	No	0.00	0.00	0.00
W4	Wind Load Side 4	No	0.00	0.00	0.00
Di	Ice Load	No	0.00	0.00	0.00
W1ice	Wind with Ice Side 1	No	0.00	0.00	0.00
W2ice	Wind with Ice Side 2	No	0.00	0.00	0.00
W3ice	Wind with Ice Side 3	No	0.00	0.00	0.00
W4ice	Wind with Ice Side 4	No	0.00	0.00	0.00

Glossary

Comb : Indicates if load condition is a load combination

RAM Elements

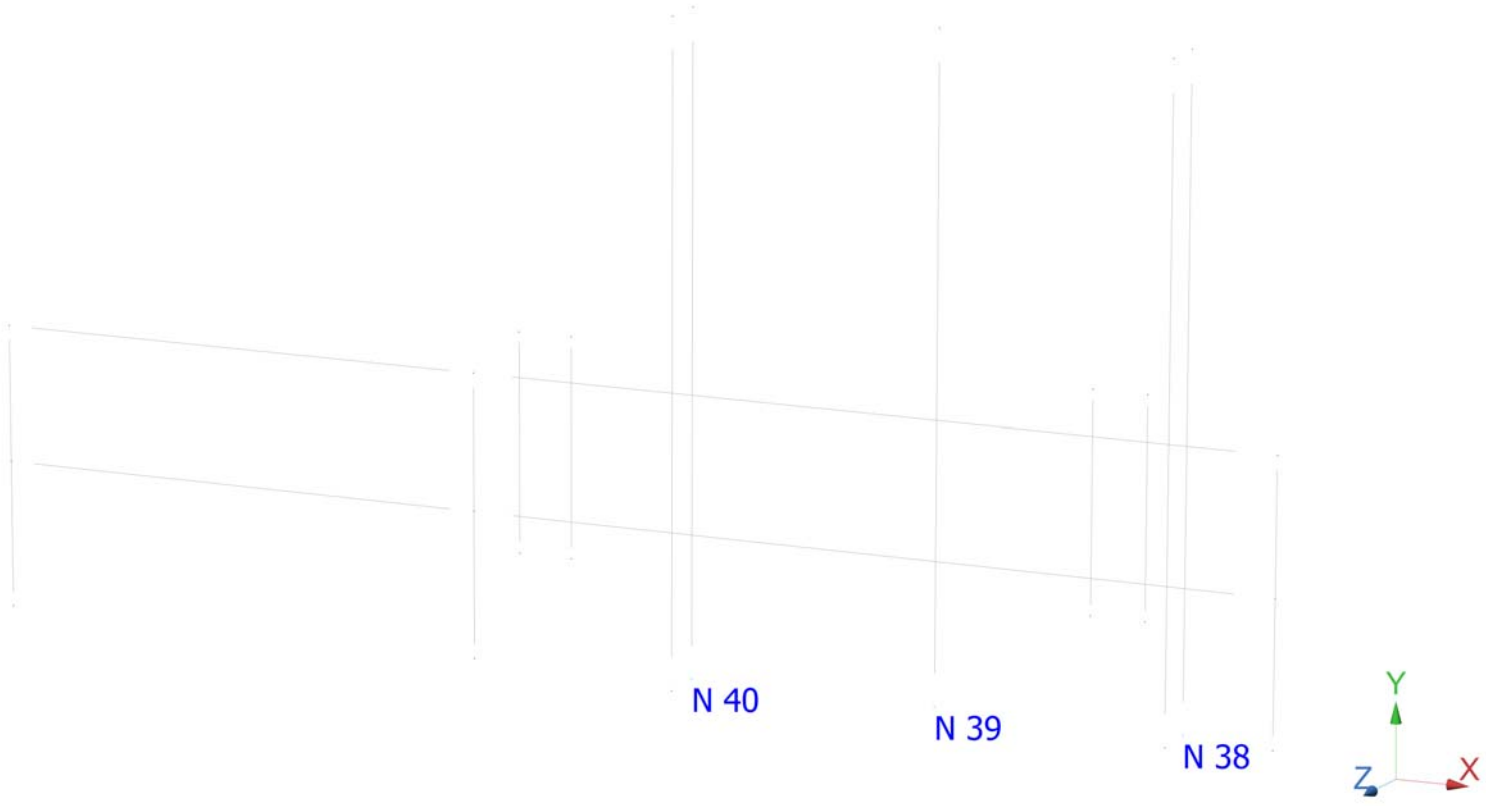
Current Date: 3/21/2025 1:56 PM
Units system: English

Steel Code Check
Summary - Group by member

Load conditions to be included in design :

LC1=1.2DL+W1
LC2=1.2DL+W2
LC3=1.2DL-W1
LC4=1.2DL-W2
LC5=0.9DL+W1
LC6=0.9DL+W2
LC7=0.9DL-W1
LC8=0.9DL-W2
LC9=1.2DL+Di+W1ice
LC10=1.2DL+Di+W2ice
LC11=1.2DL+Di-W1ice
LC12=1.2DL+Di-W2ice
LC13=1.4DL
LC14=0.9DL
LC15=1.4DL
LC16=1.2DL+1.6Di
LC17=1.2DL+0.5W1
LC18=1.2DL+0.5W2
LC19=1.2DL+0.5W3
LC20=1.2DL+0.5W4
LC21=1.2DL+0.5W1ice
LC22=1.2DL+0.5W2ice
LC23=1.2DL+0.5W3ice
LC24=1.2DL+0.5W4ice
LC25=1.2DL+W3
LC26=1.2DL+W2
LC28=1.2DL+W4
LC29=1.2DL+W1ice
LC30=1.2DL+W2ice
LC31=1.2DL+W3ice
LC32=1.2DL+W4ice
LC33=1.2DL+W1+Di
LC34=1.2DL+W2+Di
LC35=1.2DL+W3+Di
LC36=1.2DL+W4+Di
LC37=1.2DL+Di+W1ice
LC38=1.2DL+Di+W2ice
LC39=1.2DL+Di+W3ice
LC40=1.2DL+Di+W4ice
LC41=0.9DL+W1
LC42=0.9DL+W2
LC43=0.9DL+W3
LC44=0.9DL+W4
LC45=0.9DL+W1ice
LC46=0.9DL+W2ice
LC47=0.9DL+W3ice
LC48=0.9DL+W4ice

Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
	L 2X2X3_16	**7**	LC35 at 100.00%	0.22	OK	
		8	LC35 at 27.08%	0.23	With warnings	
		9	LC35 at 11.67%	**0.80**	**With warnings**	
		10	LC35 at 0.00%	0.24	OK	
		22	LC16 at 0.00%	0.13	OK	
		23	LC35 at 80.57%	0.05	OK	
		25	LC35 at 0.00%	0.13	OK	
	P1000 Unistrut	**68**	LC33 at 18.75%	0.08	OK	Eq. H1.2-1
		69	LC33 at 18.75%	0.06	OK	Eq. H1.2-1
		74	LC35 at 18.75%	**0.10**	**OK**	Eq. H1.2-1
		75	LC35 at 18.75%	0.07	OK	Eq. H1.2-1
	Pipe 2-1_2STD	**61**	LC35 at 84.38%	**0.06**	**OK**	
		63	LC36 at 84.37%	0.05	OK	
	Pipe 3STD	**28**	LC35 at 100.00%	0.26	OK	
		29	LC35 at 100.00%	0.31	OK	
		30	LC35 at 100.00%	**0.59**	**OK**	


N 40
N 39
N 38
Y
Z
X

RAM Elements

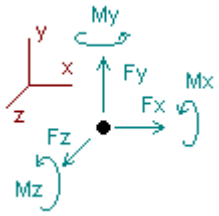
Current Date: 3/21/2025 1:57 PM
Units system: English

Analysis result

Nodes

Envelope for nodal reactions

Note.- **Ic** is the controlling load condition



Direction of positive forces and moments

Envelope of nodal reactions for :

LC1=1.2DL+W1
LC2=1.2DL+W2
LC3=1.2DL-W1
LC4=1.2DL-W2
LC5=0.9DL+W1
LC6=0.9DL+W2
LC7=0.9DL-W1
LC8=0.9DL-W2
LC9=1.2DL+Di+W1ice
LC10=1.2DL+Di+W2ice
LC11=1.2DL+Di-W1ice
LC12=1.2DL+Di-W2ice
LC13=1.4DL
LC14=0.9DL
LC15=1.4DL
LC16=1.2DL+1.6Di
LC17=1.2DL+0.5W1
LC18=1.2DL+0.5W2
LC19=1.2DL+0.5W3
LC20=1.2DL+0.5W4
LC21=1.2DL+0.5W1ice
LC22=1.2DL+0.5W2ice
LC23=1.2DL+0.5W3ice
LC24=1.2DL+0.5W4ice
LC25=1.2DL+W3
LC26=1.2DL+W2
LC28=1.2DL+W4
LC29=1.2DL+W1ice
LC30=1.2DL+W2ice
LC31=1.2DL+W3ice
LC32=1.2DL+W4ice
LC33=1.2DL+W1+Di
LC34=1.2DL+W2+Di
LC35=1.2DL+W3+Di
LC36=1.2DL+W4+Di
LC37=1.2DL+Di+W1ice
LC38=1.2DL+Di+W2ice
LC39=1.2DL+Di+W3ice

LC40=1.2DL+Di+W4ice
LC41=0.9DL+W1
LC42=0.9DL+W2
LC43=0.9DL+W3
LC44=0.9DL+W4
LC45=0.9DL+W1ice
LC46=0.9DL+W2ice
LC47=0.9DL+W3ice
LC48=0.9DL+W4ice

		Forces						Moments					
Node		**Fx** [Kip]	**lc**	**Fy** [Kip]	**lc**	**Fz** [Kip]	**lc**	**Mx** [Kip*ft]	**lc**	**My** [Kip*ft]	**lc**	**Mz** [Kip*ft]	**lc**
38	Max	0.086	LC35	1.520	LC16	0.297	LC33	0.90006	LC5	0.24648	LC5	0.10467	LC5
	Min	-0.067	LC8	0.207	LC5	-0.279	LC43	-1.26063	LC35	-0.37302	LC35	-0.15508	LC35
39	Max	0.011	LC36	0.449	LC16	0.319	LC5	1.10554	LC5	0.01893	LC5	0.00810	LC6
	Min	-0.007	LC6	0.057	LC43	-0.493	LC35	-1.75645	LC35	-0.05560	LC35	-0.01848	LC35
40	Max	0.137	LC35	1.639	LC16	0.692	LC33	2.09704	LC5	0.22857	LC5	0.13242	LC5
	Min	-0.111	LC5	0.216	LC43	-0.837	LC43	-3.15117	LC35	-0.26127	LC35	-0.15843	LC35

Date: 3/21/2025
Project Name: RCC - DT ST ALBANS
Project Number: VTL06469
Designed By: KSBM **Checked By:** MSC

CHECK THRU BOLT CONNECTION CAPACITY → EXISTING ANCHORS AT GAMMA SECTOR

Reference: AISC Steel Construction Manual 14th Edition (ASD)

Bolt Type = A325 1/2" Bolt

Allowable Tensile Load =
F_{Tall} = 8836 lbs.

Allowable Shear Load =
F_{vall} = 5301 lbs.

CONNECTION PLATE CONFIGURATION (4-BOLTS)

$N_{BOLT\ ROWS}$	=	2	rows	d_Y	=	10	in (Min.)
N_{BOLTS}	=	2	bolts/row	d_X	=	22	in (Min.)

TENSILE FORCES

Moment in X axis:	3151	lb-ft.	(See Bentley Output)
Couple Reaction from M_X:	3782	lbs.	
Moment in Z axis:	158	lb-ft.	(See Bentley Output)
Couple Reaction from M_Z:	87	lbs.	
Reaction in Y direction:	0	lbs.	(Gravity Load Supported by Roof Structure)
Resultant per bolt:	1935	lbs.	

SHEAR FORCES

Moment in Y axis:	261	lb-ft.	(See Bentley Output)
Couple Reaction from M_Y:	314	lbs.	
Reaction in X direction:	137	lbs.	(See Bentley Output)
Reaction in Z direction:	837	lbs.	(See Bentley Output)
Resultant per bolt:	369	lbs.	

Tension Design Load /Bolts =

f_t= 1934.50 lbs. < 8835.7 lbs. **Therefore, OK !**

Shear Design Load / Bolts=

f_v= 369.03 lbs. < 5301.4 lbs. **Therefore, OK !**

CHECK COMBINED TENSION AND SHEAR

f_t / F_T	+	f_v / F_V	≤	1.0			
0.219	+	0.070	=	0.289	<	1.0	**Therefore, OK !**