EVERSOURCE ENERGY

56 Prospect Street,
P.O. Box 270
Hartford, CT 06103

Kathleen M. Shanley
Manager – Transmission Siting
Tel: (860) 728-4527

January 8, 2021

Melanie A. Bachman
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

RE: **Notice of Exempt Modification**
Eversource Site Hartford AWC
410 Sheldon Street, Hartford, CT 06106
Latitude: 41-45-32.71 N / Longitude: 72-39-57.22 W

Dear Ms. Bachman:

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource") currently maintains multiple antennas mounted at various elevations on an existing 41-foot 9-inch tall tower[1] located on the rooftop of the Eversource Hartford Area Work Center located at 410 Sheldon Street in Hartford, CT. See Attachment A, Parcel Map and Property Card. The building and property are owned by Eversource. Eversource plans to install one 18-foot 6-inch tall omni-directional antenna on the existing tower mounted at 94-feet above ground level ("AGL"); the top of the antenna will extend to approximately 112-feet 6-inches. Two 7/8-inch diameter coaxial cables will be routed from the antenna into the existing building where it will terminate in an existing communications room. Two existing antennas will be relocated from 94-foot and 72-foot mounting heights to two new mounts at 72-feet AGL and 60.5-feet AGL. All three antennas will be mounted to the existing tower on new 4-foot stand-off mounts. See Attachment B, Mount Analysis. There will be no ground disturbance and no changes to the building, tower or the existing antennas and equipment. The existing and proposed antennas on the tower are depicted on Attachment C, Construction Drawings, dated November 4, 2020. The tower, a replacement for a previously existing rooftop tower, was approved by the Connecticut Siting Council on Petition No. 1026 in March 2012.

The proposed installation is part of Eversource's program to update the current obsolete analog voice radio communications system to a modern digital voice communications system. The new system will enable the highest level of voice communications under all operating conditions, including during critical emergency and storm restoration activities. The new radio system will also provide for remote control of distribution safety equipment.

[1] The top of the tower is 97-feet 3-inches AGL.

Please accept this letter as notification pursuant to Regulations of Connecticut State Agencies ("R.C.S.A.") §16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this notice is being delivered to Luke A. Bronin, Mayor for the City of Hartford, and Aimee Chambers, AICP, Director of Planning for the City of Hartford via private carrier. Proof of delivery is attached. See Attachment D, Proof of Delivery of Notice.

The planned modifications to the facility fall squarely within those activities explicitly provided for in R.C.S.A. § 16-50j-72(b)(2):

1. There will be no change to the height of the existing tower.
2. The proposed modifications will not require the extension of the site boundary.
3. The proposed modification will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.
4. The operation of the new antenna will not increase radio frequency emissions at the facility to a level at or above the Federal Communications Commission safety standard as shown in the attached Radio Frequency Emissions Report, dated November 23, 2020 (Attachment E – Power Density Report).
5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.
6. The existing tower and building can support the proposed loading as shown in the attached Structural Analyses. (Attachment F – Structural Analysis of Existing Building and Attachment G – Structural Analysis of Existing Tower).

For the foregoing reasons, Eversource respectfully submits that the proposed modifications to the above referenced telecommunications facility constitute an exempt modification under R.C.S.A. § 16-50j-72(b)(2). Two copies of this notice and a check in the amount of $625 are enclosed.

Communications regarding this Notice of Exempt Modification should be directed to Kathleen Shanley at (860) 728-4527.

By: ______________________________
Kathleen M. Shanley
Manager – Transmission Siting

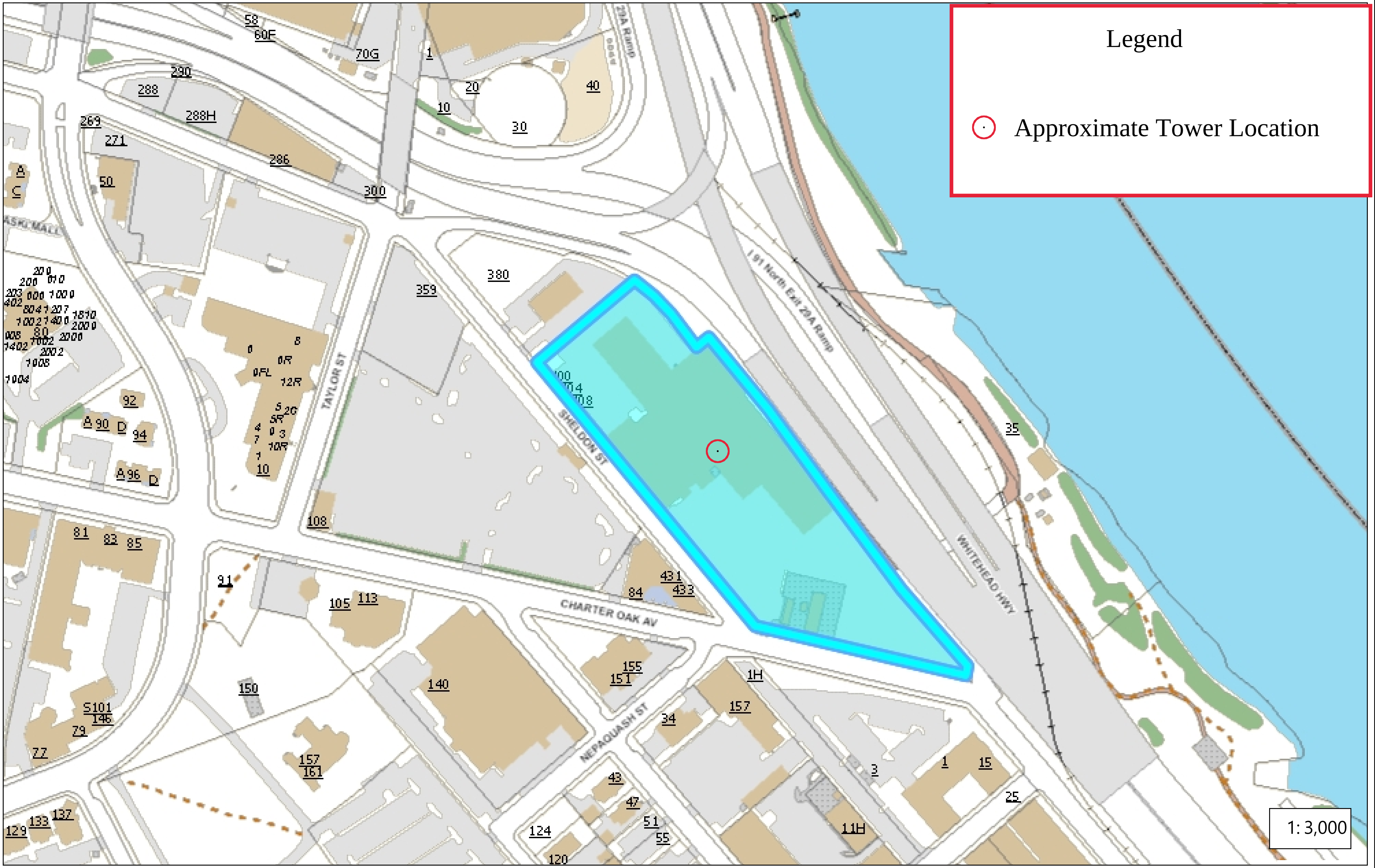
cc: Honorable Luke A. Bronin, Mayor, City of Hartford
Aimee Chambers, AICP, Director of Planning, City of Hartford

Attachments

A. Parcel Map and Property Card
B. Mount Analysis
C. Construction Drawings
D. Proof of Delivery of Notice
E. Power Density Report
F. Structural Analysis of Existing Building
G. Structural Analysis of Existing Tower

ATTACHMENT A – PARCEL MAP AND PROPERTY CARD

City of Hartford - Property Map



500 0 250 500 Feet

City of Hartford GIS Services - HartfordGIS

Date Printed: 4/24/2020

Unofficial Property Record Card - Hartford, CT

General Property Data

Parcel ID	294-077-085	Account Number	
Prior Parcel ID			
Property Owner	CONN LIGHT & POWER CO	Property Location	400-410 SHELDON ST
		Property Use	OTHER UTILTY
Mailing Address	PO BOX 270	Most Recent Sale Date	7/2/1982
		Legal Reference	01977 0129
City	HARTFORD	Grantor	
Mailing State	CT Zip 06141-0270	Sale Price	0
ParcelZoning	CT R	Land Area	263,538.000 acres

Current Property Assessment

Card 1 Value	Building Value 0	Xtra Features Value 0	Land Value 0	Total Value 0
Total Parcel Value	Building Value 0	Xtra Features Value 0	Land Value 0	Total Value 0

Building Description

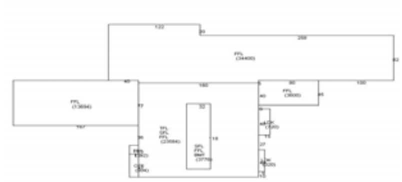
Building Style	OFFICE/WHS	Foundation Type	Concrete	Flooring Type	COMBINATION
# of Living Units	0	Frame Type	Fireproof	Basement Floor	CONCRETE
Year Built	1930	Roof Structure	FLAT	Heating Type	Warm Air
Building Grade	Average +	Roof Cover	Tar & Gravel	Heating Fuel	Gas
Building Condition	N/A	Siding	Brick	Air Conditioning	47%
Finished Area (SF)	N/A	Interior Walls	DRYWALL	# of Bsmt Garages	0
Number Rooms	0	# of Bedrooms	0	# of Full Baths	0
# of 3/4 Baths	0	# of 1/2 Baths	0	# of Other Fixtures	0

Legal Description

Narrative Description of Property

This property contains 263,538.000 acres of land mainly classified as OTHER UTILTY with a(n) OFFICE/WHS style building, built about 1930 , having Brick exterior and Tar & Gravel roof cover, with 0 commercial unit(s) and 0 residential unit(s), 0 room(s), 0 bedroom(s), 0 bath(s), 0 half bath(s).

Property Images



ATTACHMENT B – MOUNT ANALYSIS

BLACK & VEATCH
Building a world of difference.
BLACK & VEATCH CORPORATION
6800 W 115TH ST, SUITE 2292, OVERLAND PARK, KS 66211
+1 913-458-2522 | RILEYJJ@BV.COM

November 30, 2020

MOUNT EVALUATION LETTER

Site Number: ES-090
Site Name: HARTFORD AWC
Site Data: 410 Sheldon St.
Hartford, CT 06106
Latitude: 41° 45’ 32.71”
Longitude: -72° 39’ 57.22”

Black & Veatch Corporation is pleased to submit this “Mount Evaluation Letter” to determine the structural integrity of antenna mounting system on the above-mentioned site. The purpose of this evaluation is to determine the capacity of the system in supporting the final loading in the attached “Loading Summary”.

Proposed Mounting System
Custom Omni Stand-off Frame

Based on our evaluation we have determined the proposed antenna mounting system to be: **SUFFICIENT**

Structure Rating (max from all components) =	80.4%

Black & Veatch recommends installing the omni mount in accordance with the attached Black & Veatch Drawing “ANTENNA EQUIPMENT (C-4)”. If the mount is not installed as specified, this evaluation should be considered invalid. This analysis analyzes the worst-case scenario for the proposed custom omni stand-off frame. All levels are deemed sufficient. The proposed mounting system will be capable of supporting the proposed equipment, under the assumptions described in Section 4 of the report and the following conditions:

- Contractor shall be responsible for the means and methods of construction.
- Contractor shall inspect the condition of all existing and proposed structural members, all relevant members and connections and report any deficiencies to the engineer prior to installation of any new antennas and other equipment.

The scope of this evaluation pertains only to the proposed antenna mounting system and does not include examination of the loads imparted by the antenna mounting system to the existing tower and its structural components. This document was prepared based on information provided to Black & Veatch. If existing conditions do not reflect those represented, this analysis is no longer valid.

Please contact Josh Riley in our Overland Park Office
at 913-458-2522 if you have any questions or comments.

Sincerely,
Black & Veatch Corporation

Prepared By: Joohwan Jung
Submitted By: Josh Riley, P.E.

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED
PROFESSIONAL ENGINEER
11/30/2020

TABLE OF CONTENTS

1. LOADING SUMMARY

Appurtenance								
Carrier	Position	Sector	Antenna RAD Center (ft)	Mount Centerline (ft)	Qty	Type	Manufacturer	Model
Eversource	1	-	103.3	94	1	Omni	dbSpectra	DS2C03P36D-D
Eversource	1	-	78	72	1	Omni	Kreco	CO-41A
Eversource	1	-	66.5	60.5	1	Omni	Kreco	CO-41A

This analysis analyzes the worst-case scenario for the proposed custom omni stand-off frame. All levels are deemed sufficient.

2. ANALYSIS CRITERIA SUMMARY

ANALYSIS CRITERIA	
STANDARD	TIA-222-H
WIND SPEED	Ultimate of 135 mph
WIND SPEED WITH ICE	50 mph with 2" radial ice thickness
EXPOSURE CATEGORY	C
RISK CATEGORY	III
TOPO CATEGORY	Flat
CREST HEIGHT	N/A
SPECTRAL RESPONSE FACTORS, Ss & S1	0.18 g & 0.064 g

3. REFERENCES

- American Institute of Steel Construction, AISC 15th Edition
- Telecommunications Industry Association Standard, TIA-222-H & 2018 Connecticut State Building Code

4. ASSUMPTIONS

This analysis may be affected if any assumptions are not valid or have been made in error. Black & Veatch should be notified to determine the effect on the structural integrity of the antenna mounting system.

- The antenna mounting system was properly fabricated, installed and maintained in good condition in accordance with its original design and manufacturer's specifications.
- The configuration of antennas, mounts, and other appurtenances are as specified in the Loading Summary and the referenced drawings.
- All member connections are assumed to have been designed to meet or exceed the load carrying capacity of the connected member unless otherwise specified in this report.
- Sector frame center line: located equidistant between top & bottom boom; Platform center line: located at the base perimeter of platform, unless otherwise specified.
- Steel grades have been assumed as follows, unless noted otherwise:

Channel, Solid Round, Angle, Plate	ASTM A36 (GR 36)
HSS (Rectangular)	ASTM 500 (GR B-46)
Pipe	ASTM A53 (GR B-35)
Connection Bolts	ASTM A325

5. RESULTS SUMMARY

Name	Bending Stress Ratio		Shear Stress Ratio	
Mount Pipe: Pipe 2.0 Std	72.3%	Pass	78.1%	Pass
Horizontal Member: HSS2.375X0.154	80.4%	Pass	11.7%	Pass

*Von Mises SR = (Max Von Mises Value From RISA-3D)/(0.9*Fy)

**Capacity rating per TIA-222-H Section 15.5.

APPENDIX 1:
MOUNT ANALYSIS REPORT

Dead and Live Loads

Maintenance Live Load: L_V = 250 lb

Installation Live Load: L_M = 500 lb

Appurtenance Dead Loads	
Name	Weight (lb)
DS2C03P36D-D	75

BLACK & VEATCH	Client: Eversource	Computed By: Joohwan Jung	
	Site Name: HARTFORD AWC (ES-090)	Date: 11/24/2020	
		Verified By: JW	
	Title: MOUNT ANALYSIS REPORT	Date: 11/24/2020	

Appurtenance Wind Loading

Parameter	Value	Unit	Equations	TIA-222-H
Exposure Category =	C		$K_z = 2.01 (z / z_g)^{2/\alpha}$	2.6.5.2
Risk Category =	III			
Topographic Category =	1		$K_h = e^{(f \cdot z / H)}$	2.6.6.2.1
Basic Wind Speed, V =	135	mph		
Height Above Ground, z =	103.3	ft	$K_{zt} = [1 + K_c K_t / K_h]^2$	2.6.6.2.1
Crest Height, H =	N/A	ft		
Velocity Pressure Coefficient, K_z =	1.27		$K_e = e^{-0.0000362 \cdot zs}$	2.6.8
Topographic Factor, K_{zt} =	1.00			
Wind Directionality Factor, K_d =	0.95		$q_z = 0.00256\, K_z K_{zt} K_e K_d V^2$	2.6.11.6
Shielding Factor, K_a =	0.90			
Ground Elevation Factor, K_e =	0.997		$F_A = q_z G_h(EPA)$	2.6.11.2
Wind Velocity Pressure, q_z =	56.31	psf		
Gust Effect Factor, G_h =	1.00		$F_M = q_z G_h C_f D_p$	2.6.11.2

Appurtenance Wind Loads

Name	Height (ft)	Width (ft)	Depth (ft)	Normal			Tangential		
				C_a	EPA FT2	F_A (lb)	C_a	EPA FT2	F_A (lb)
DS2C03P36D-D	18.50	0.25	0.25	2.00	8.33	468.81	2.00	8.33	468.81

Client: Eversource	Computed By: Joohwan Jung
Site Name: HARTFORD AWC (ES-090)	Date: 11/24/2020
	Verified By: JW
Title: MOUNT ANALYSIS REPORT	Date: 11/24/2020

BLACK & VEATCH

Member Wind Loading

Parameter	Value	Unit	*Equations*	TIA-222-H
Exposure Category =	C		$K_z = 2.01 (z / z_g)^{2/\alpha}$	2.6.5.2
Risk Category =	III			
Topographic Category =	1		$K_h = e^{(f \cdot z / H)}$	2.6.6.2.1
Basic Wind Speed, V =	135	mph		
Height Above Ground, z =	103.3	ft	$K_{zt} = [1 + K_c K_t / K_h]^2$	2.6.6.2.1
Crest Height, H =	N/A	ft		
Velocity Pressure Coefficient, K_z =	1.27		$K_e = e^{-0.000032 \cdot zs}$	2.6.8
Topographic Factor, K_{zt} =	1.00			
Wind Directionality Factor, K_d =	0.95		$q_z = 0.00256 K_z K_{zt} K_e K_d V^2$	2.6.11.6
Shielding Factor, K_a =	0.90			
Ground Elevation Factor, K_e =	0.997		$F_A = q_z G_h (EPA)$	2.6.11.2
Wind Velocity Pressure, q_z =	56.31	psf		
Gust Effect Factor, G_h =	1.00		$F_M = q_z G_h C_f D_p$	2.6.11.2

Member Wind Loads

Name	Depth (ft)	Width (ft)	C_f	D_p (ft)	F_M (lb)
Mount Pipe: Pipe 2.0 Std	0.20		1.2	0.20	13.37
Horizontal Member: HSS2.375X0.154	0.20		1.2	0.20	13.40

Appurtenance Ice Dead Loading

			Equations	TIA-222-H
Exposure Category =	C			
Risk Category =	III		$K_h = e^{(f \cdot z / H)}$	2.6.6.2.1
Topographic Category =	1			
Height Above Ground, z =	103.3	ft	$K_{zt} = [1 + K_c K_t / K_h]^2$	2.6.6.2.1
Crest Height, H =	N/A	ft		
Design Ice Thickness, T_i =	2.00	in	$K_{iz} = (z/33)^{0.10}$	2.6.10
Importance Factor, I =	1.15			
Topographic Factor, K_{zt} =	1.00		$T_{iz} = T_i I K_{iz} (K_{zt})^{0.35}$	2.6.10
Height Escalation Factor, K_{iz} =	1.12			
Factored Ice Thickness, T_{iz} =	2.58	in	$DL_{ice}=[(H_{ice}*D_{ice}*W_{ice}) - (H*W*D)]*56pcf$	
Grating Ice Dead Load, D_{Gice} =	12.03	psf		

Appurtenance Ice Dead Loads

Name	Height w/ ice (ft)	Width w/ice (ft)	Depth w/ ice (ft)	V_{ice} (ft^3)	DL_{ice} (lb)
DS2C03P36D-D	18.93	0.68	0.68	7.59	424.95

Member Ice Dead Loading

Exposure Category =	C	
Risk Category =	III	
Topographic Category =	1	
Height Above Ground, z =	103.3	ft
Crest Height, H =	N/A	ft
Design Ice Thickness, T_i =	2.00	in
Importance Factor, I =	1.15	
Topographic Factor, K_{zt} =	1.00	
Height Escalation Factor, K_{iz} =	1.12	
Factored Ice Thickness, T_{iz} =	2.58	in
Grating Ice Dead Load, D_{Gice} =	12.03	psf

Equations

Equation	TIA-222-H
$K_h = e^{(f \cdot z / H)}$	2.6.6.2.1
$K_{zt} = [1 + K_c K_t / K_h]^2$	2.6.6.2.1
$K_{iz} = (z/33)^{0.10}$	2.6.10
$T_{iz} = T_i I K_{iz}(K_{zt})^{0.35}$	2.6.10
Aiz = pi*Tiz*(Dc+Tiz)	2.6.10
DL_{ice}=Aiz*56pcf	

Member Ice Dead Loads

Name	Depth w/ ice (ft)	Width w/ ice (ft)	Dc (ft)	Aiz (ft^2)	DL_{ice} (lb/ft)
Mount Pipe: Pipe 2.0 Std	0.63		0.20	0.28	15.60
Horizontal Member: HSS2.375X0.154	0.63		0.20	0.28	15.62

BLACK & VEATCH	Client: Eversource	Computed By: Joohwan Jung	
	Site Name: HARTFORD AWC (ES-090)	Date: 11/24/2020	
		Verified By: JW	
	Title: MOUNT ANALYSIS REPORT	Date: 11/24/2020	

Appurtenance Ice Wind Loading

			Equations	TIA-222-H
Exposure Category =	C		$K_z = 2.01\ (z / z_g)^{2/\alpha}$	2.6.5.2
Risk Category =	III			
Topographic Category =	1		$K_h = e^{(f \cdot z / H)}$	2.6.6.2.1
Ice Wind Speed, V_{ice} =	50	mph		
Height Above Ground, z =	103.3	ft	$K_{zt} = [1 + K_c K_t / K_h]^2$	2.6.6.2.1
Crest Height, H =	N/A	ft		
Velocity Pressure Coefficient, K_z =	1.27	psf	$K_e = e^{-0.0000362 \cdot zs}$	2.6.8
Topographic Factor, K_{zt} =	1.00			
Wind Directionality Factor, K_d =	0.95		$q_z = 0.00256\ K_z K_{zt} K_e K_d V^2$	2.6.11.6
Shielding Factor, K_a =	0.90			
Ground Elevation Factory, K_e =	0.997		$F_{A(ice)} = q_{z(ice)} G_h (EPA)_{A(ice)}$	2.6.11.2
Ice Wind Velocity Pressure, $q_{z(ice)}$ =	7.725			
Factored Ice Thickness, T_{iz} =	2.58	in	$F_{M(ice)} = q_{z(ice)} G_h C_f D_{p(ice)}$	2.6.11.2
Gust Effect Factor, G_h =	1			

Appurtenance Ice Wind Loads

Name	Height w/ Ice (ft)	Width w/ Ice (ft)	Depth w/ Ice (ft)	Normal			Tangential		
				C_a	EPA FT2	F_A (lb)	C_a	EPA FT2	F_A (lb)
DS2C03P36D-D	18.93	0.68	0.68	-	17.23	133.06	-	17.23	133.06

Member Ice Wind Loading

			Equations	TIA-222-H
Exposure Category =	C		$K_z = 2.01\ (z / z_g)^{2/\alpha}$	2.6.5.2
Risk Category =	III			
Topographic Category =	1		$K_h = e^{(f \cdot z / H)}$	2.6.6.2.1
Ice Wind Speed, V_{ice} =	50	mph		
Height Above Ground, z =	103.3	ft	$K_{zt} = [1 + K_c K_t / K_h]^2$	2.6.6.2.1
Crest Height, H =	N/A	ft		
Velocity Pressure Coefficient, K_z =	1.27	psf	$K_e = e^{-0.0000362 \cdot zs}$	2.6.8
Topographic Factor, K_{zt} =	1.00			
Wind Directionality Factor, K_d =	0.95		$q_z = 0.00256\ K_z K_{zt} K_e K_d V^2$	2.6.11.6
Shielding Factor, K_a =	0.90			
Ground Elevation Factory, K_e =	0.997		$F_{A(ice)} = q_{z(ice)} G_h (EPA)_{A(ice)}$	2.6.11.2
Ice Wind Velocity Pressure, $q_{z(ice)}$ =	7.725			
Factored Ice Thickness, T_{iz} =	2.58	in	$F_{M(ice)} = q_{z(ice)} G_h C_f D_{p(ice)}$	2.6.11.2
Gust Effect Factor, G_h =	1			

Member Ice Wind Loads

Name	Depth w/ Ice (ft)	Width w/ Ice (ft)	C_f	$D_{p(ice)}$ (ft)	$F_{M(ice)}$ (lb/ft)
Mount Pipe: Pipe 2.0 Std	0.63		1.2	0.63	5.82
Horizontal Member: HSS2.375X0.154	0.63		1.2	0.63	5.82

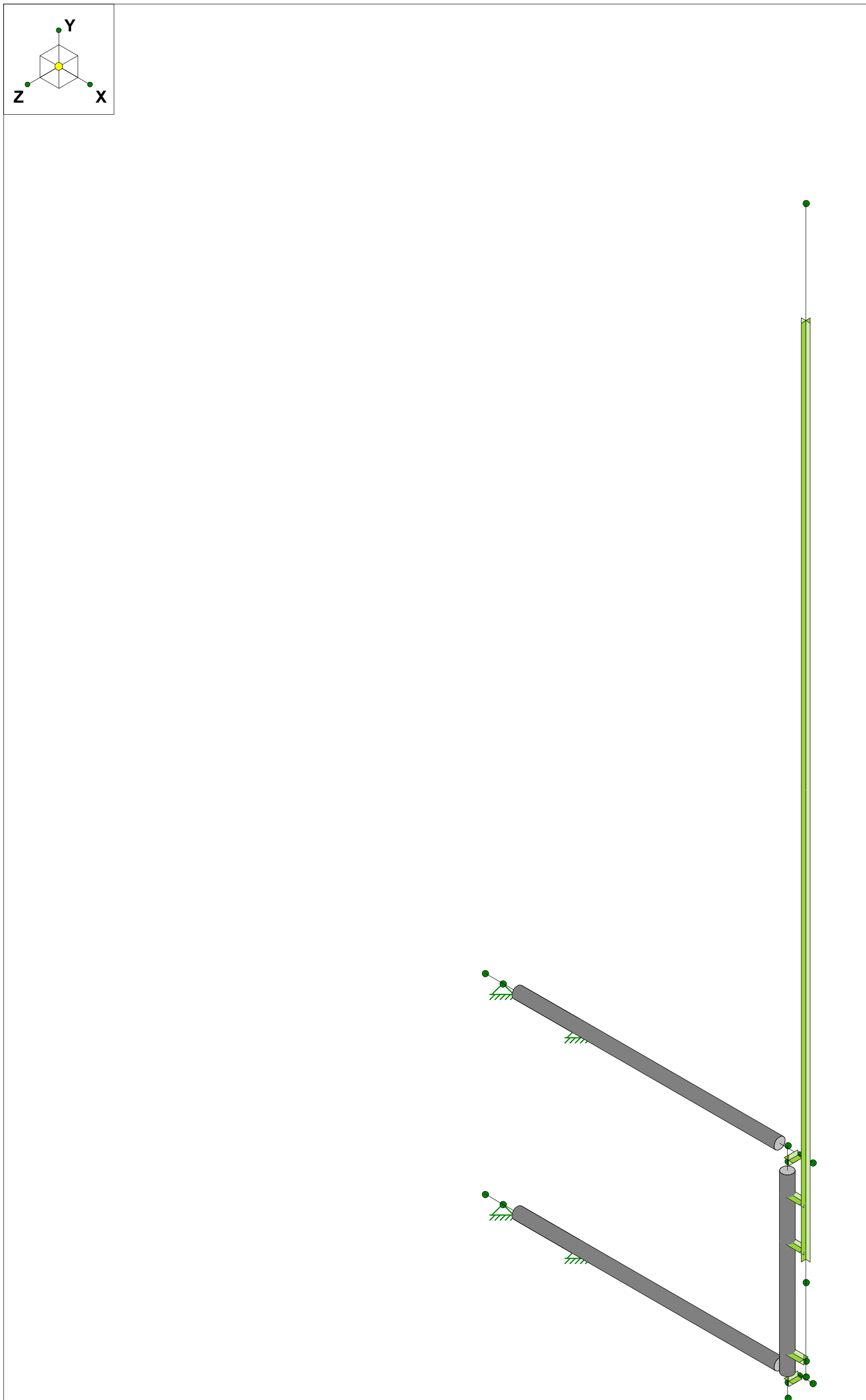
Seismic Loading

			Equations	TIA-222-H
Site Class =	D		$S_{D1} = 2/3\ F_v S_1$	2.7.5
Spectral Response, S_s =	0.180	g		
Max Spectral Response, S_1 =	0.064	g	$S_{DS} = 2/3\ F_a S_s \geq S_{D1}$	2.7.5
Accel. Site Coefficient, F_a =	1.60			
Vel. Site Coefficient, F_v =	2.40		$C_s = 1/2\ S_{DS}\, I \geq 0.03$	2.7.7.1.1
Design Spec. Response (1 sec), S_{D1} =	0.102			
Design Spec. Response, S_{DS} =	0.192		$E_H = A_s\ C_s\ W$	2.7.7
Importantance Factor, I =	1.25			
Seismic Response Coefficient, C_s =	0.120		$E_V = A_s\ 0.2\ S_{DS}\ W$	2.7.6
Amplification Factor, A_s =	3			

Appurtenance Seismic Loads

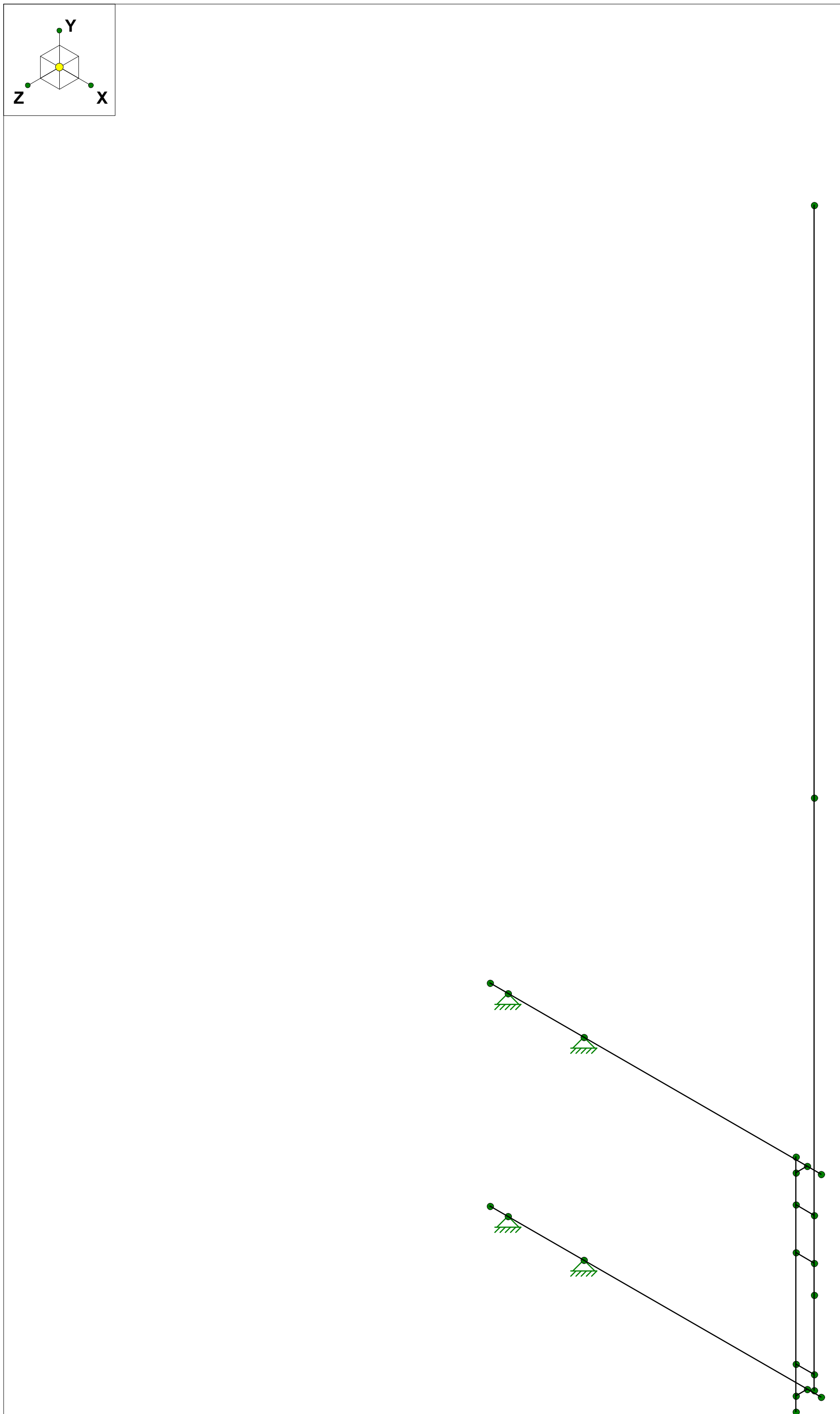
Name	Weight (lb)	E_H (lb)	E_V (lb)
DS2C03P36D-D	75	27.00	8.64

APPENDIX 2:
RISA PRINTOUTS



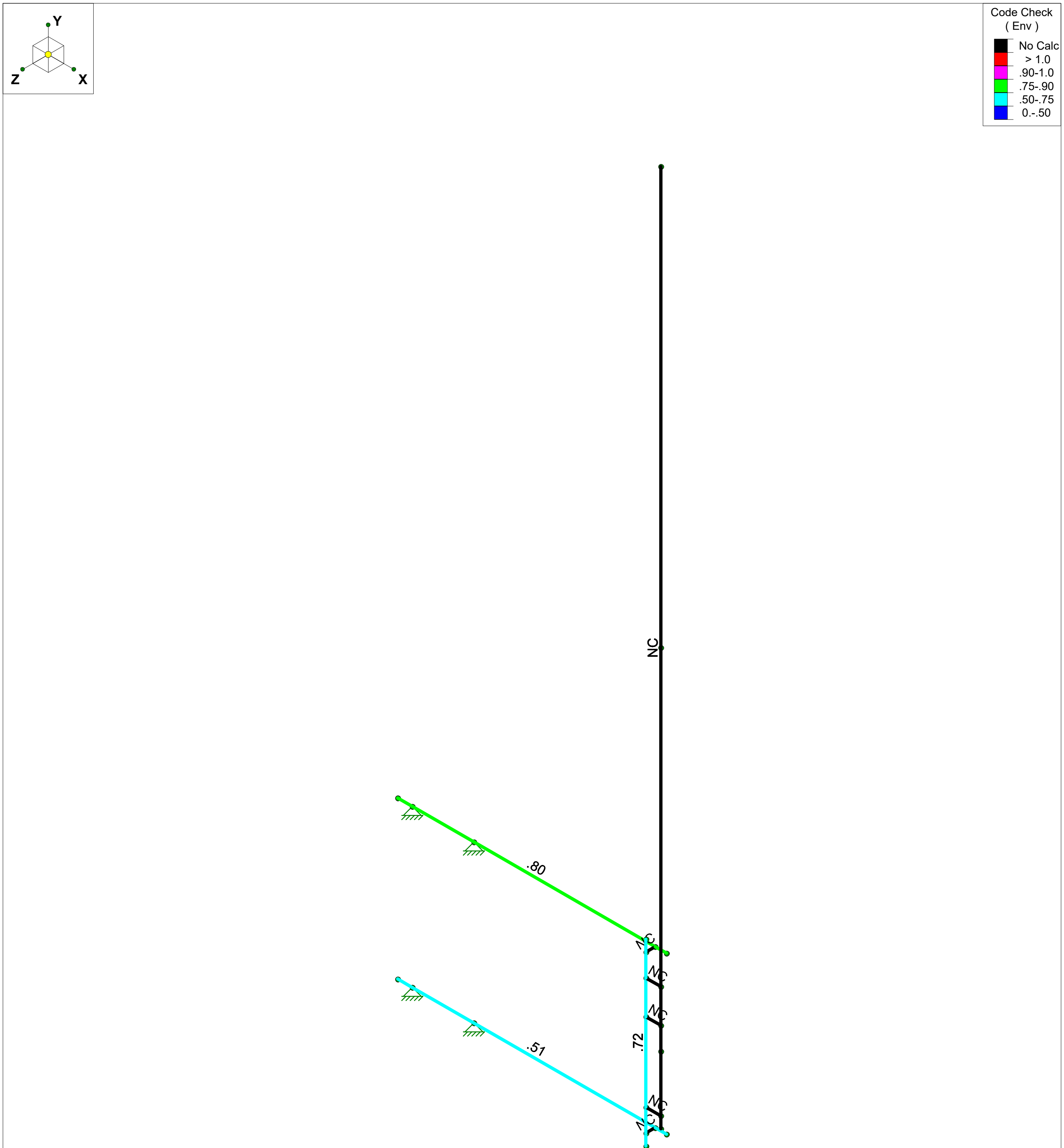
Envelope Only Solution

Black & Veatch	HartfordAWC	SK - 1
Joohwan Jung		Nov 24, 2020 at 9:00 AM
405025		HartfordAWC Antenna Mount Anal...



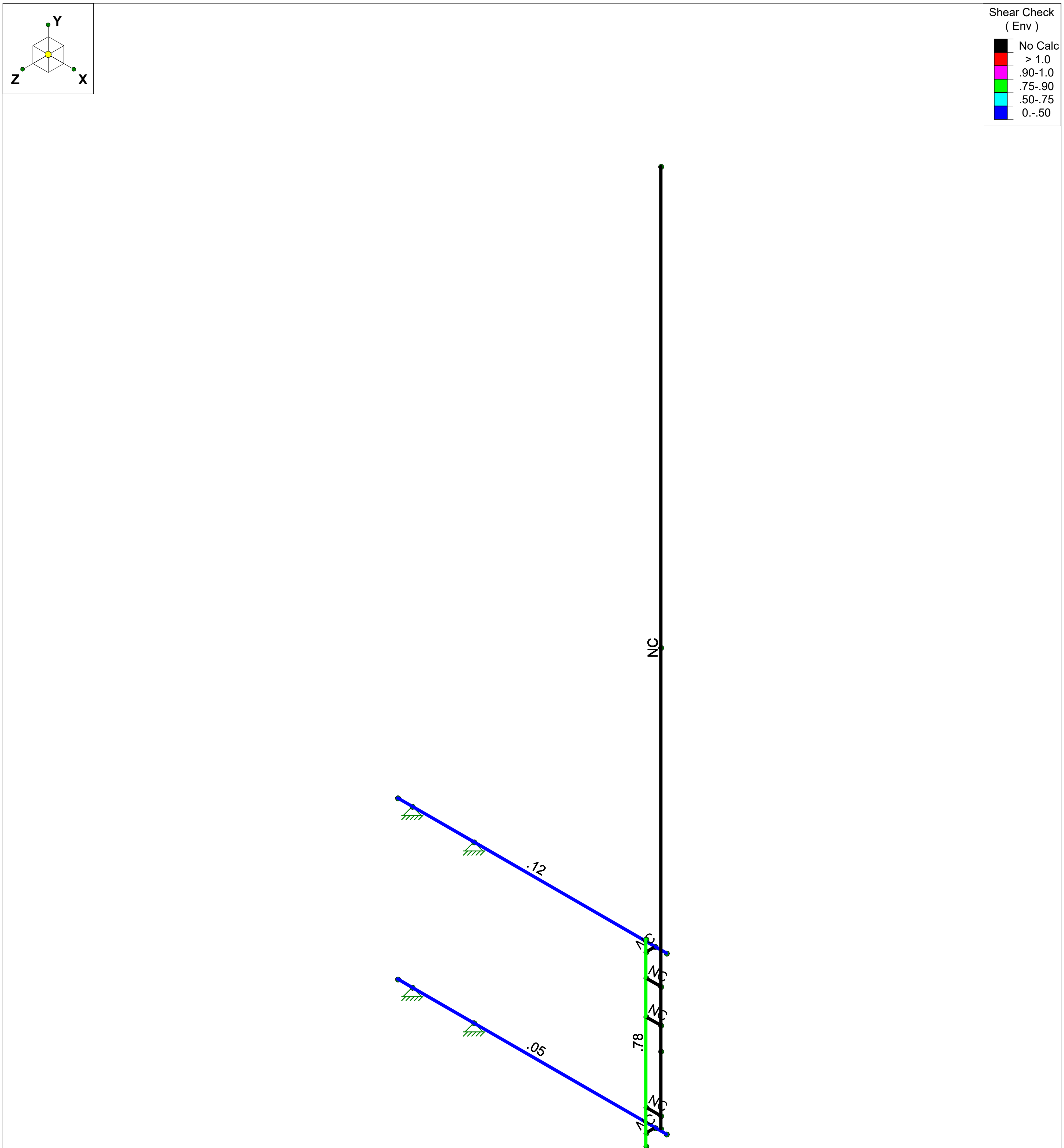
Envelope Only Solution

Black & Veatch	HartfordAWC	SK - 2
Joohwan Jung		Nov 24, 2020 at 9:00 AM
405025		HartfordAWC Antenna Mount Anal...



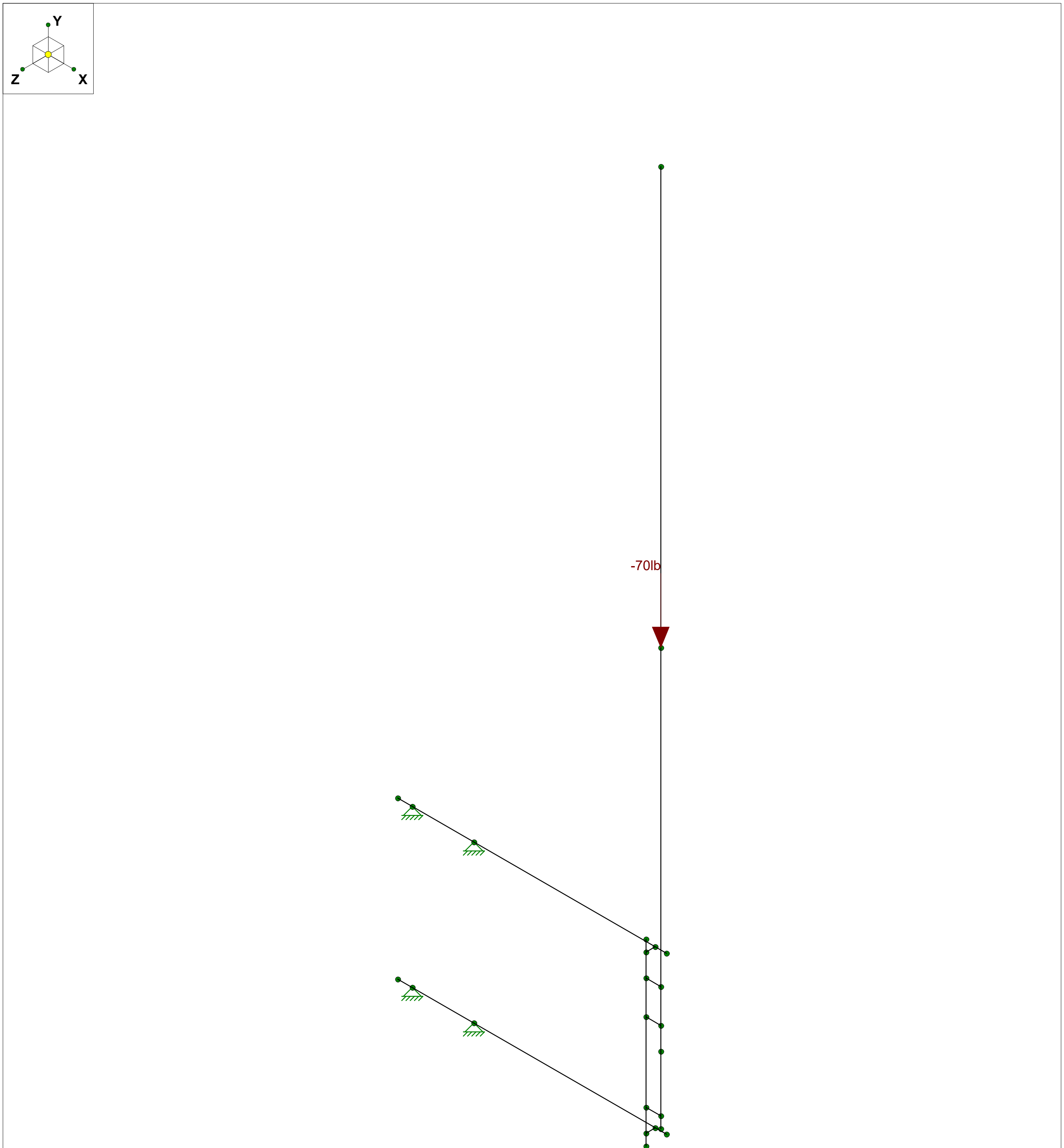
Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Black & Veatch	HartfordAWC	SK - 3
Joohwan Jung		Nov 24, 2020 at 9:00 AM
405025		HartfordAWC Antenna Mount Anal...



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

Black & Veatch	HartfordAWC	SK - 4
Joohwan Jung		Nov 24, 2020 at 9:00 AM
405025		HartfordAWC Antenna Mount Anal...



Loads: BLC 1, DL
Envelope Only Solution

Black & Veatch	HartfordAWC	SK - 5
Joohwan Jung		Nov 24, 2020 at 9:00 AM
405025		HartfordAWC Antenna Mount Anal...

(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (in/sec^2)	386.4
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 15th(360-16): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building
Stainless Steel Code	None

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	ASCE 7-10
Seismic Base Elevation (in)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	1
Om X	1
Cd Z	4
Cd X	4
Rho Z	1
Rho X	1

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1...	Density[k/ft^3]	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A36 Gr.36	29000	11154	.3	.65	.49	36	1.5	58	1.2
2	A53 Gr.B	29000	11154	.3	.65	.49	35	1.6	60	1.2
3	A500 Gr.B RND	29000	11154	.3	.65	.527	42	1.4	58	1.3
4	A500 Gr.B Rect	29000	11154	.3	.65	.527	46	1.4	58	1.3
5	A500 Gr.C RND	29000	11154	.3	.65	.527	46	1.4	62	1.3
6	A500 Gr.C Rect	29000	11154	.3	.65	.527	50	1.4	62	1.3
7	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.1
8	A529 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.1

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design ...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Mount Pipe	PIPE_2.0	Column	Wide Flange	A53 Gr.B	Typical	1.02	.627	.627	1.25
2	Horizontal Member	HSS2.375X0.154	Beam	Wide Flange	A500 Gr.C R...	Typical	1	.627	.627	1.25

General Material Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]
1	gen_Conc3NW	3155	1372	.15	.6	.145
2	gen_Conc4NW	3644	1584	.15	.6	.145
3	gen_Conc3LW	2085	906	.15	.6	.11
4	gen_Conc4LW	2408	1047	.15	.6	.11
5	gen_Alum	10600	4077	.3	1.29	.173
6	gen_Steel	29000	11154	.3	.65	.49
7	RIGID	1e+6		.3	0	0

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N1						
2	N2						
3	N3						
4	N4						
5	N5						
6	N6						
7	N7						
8	N8						
9	N9						
10	N10						
11	N11						
12	N12						
13	N13						
14	N14						
15	N15						
16	N16						
17	N17	Reaction	Reaction	Reaction			
18	N18	Reaction	Reaction	Reaction			
19	N19	Reaction	Reaction	Reaction			
20	N20	Reaction	Reaction	Reaction			
21	N21						
22	N22						
23	N23						

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N2	N4			Horizontal Me...	Beam	Wide Flange	A500 Gr.C...	Typical
2	M2	N1	N3			Horizontal Me...	Beam	Wide Flange	A500 Gr.C...	Typical
3	M3	N6	N5			Mount Pipe	Column	Wide Flange	A53 Gr.B	Typical
4	M4	N9	N7			RIGID	None	None	RIGID	Typical
5	M5	N10	N8			RIGID	None	None	RIGID	Typical
6	M6	N11	N12			RIGID	None	None	RIGID	Typical
7	M7	N14	N13			RIGID	None	None	RIGID	Typical
8	M8	N22	N16			RIGID	None	None	RIGID	Typical
9	M9	N21	N15			RIGID	None	None	RIGID	Typical

Member Advanced Data

	Label	I Release	J Release	I Offset[in]	J Offset[in]	T/C Only	Physical	Defl Rat...	Analysis ...	Inactive	Seismic...
1	M1						Yes	Default			None
2	M2						Yes				None
3	M3						Yes	** NA **			None
4	M4						Yes	** NA **			None
5	M5						Yes	** NA **			None
6	M6						Yes	** NA **			None
7	M7						Yes	** NA **			None
8	M8						Yes	** NA **			None
9	M9						Yes	** NA **			None

Hot Rolled Steel Design Parameters

	Label	Shape	Length[in]	Lbyy[in]	Lbzz[in]	Lcomp top[in]	Lcomp bot[in]	L-torqu...	Kyy	Kzz	Cb	Function
1	M1	Horizontal ...	72									Lateral
2	M2	Horizontal ...	72									Lateral
3	M3	Mount Pipe	48									Lateral

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Me...	Surface(...
1	DL	DL		-1		1				
2	Maintenance LL - LV	LL				1				
3	Installation LL - LM	LL				1				
4	Wind - 0 Deg (X)	WL				1		3		
5	Wind - 30 Deg (X)	WL				1		3		
6	Wind - 60 Deg (X)	WL				1		3		
7	Wind - 90 Deg (X)	WL				1		3		
8	Wind - 120 Deg (X)	WL				1		3		
9	Wind - 150 Deg (X)	WL				1		3		
10	Wind - 180 Deg (X)	WL				1		3		
11	Wind - 210 Deg (X)	WL				1		3		
12	Wind - 240 Deg (X)	WL				1		3		
13	Wind - 270 Deg (X)	WL				1		3		
14	Wind - 300 Deg (X)	WL				1		3		
15	Wind - 330 Deg (X)	WL				1		3		
16	Wind - 0 Deg (Z)	WL				1		3		
17	Wind - 30 Deg (Z)	WL				1		3		
18	Wind - 60 Deg (Z)	WL				1		3		
19	Wind - 90 Deg (Z)	WL				1		3		
20	Wind - 120 Deg (Z)	WL				1		3		
21	Wind - 150 Deg (Z)	WL				1		3		
22	Wind - 180 Deg (Z)	WL				1		3		
23	Wind - 210 Deg (Z)	WL				1		3		
24	Wind - 240 Deg (Z)	WL				1		3		
25	Wind - 270 Deg (Z)	WL				1		3		
26	Wind - 300 Deg (Z)	WL				1		3		
27	Wind - 330 Deg (Z)	WL				1		3		
28	Ice DL	DL				1		3		
29	Ice Wind - 0 Deg (X)	WL				1		3		
30	Ice Wind - 30 Deg (X)	WL				1		3		
31	Ice Wind - 60 Deg (X)	WL				1		3		
32	Ice Wind - 90 Deg (X)	WL				1		3		
33	Ice Wind - 120 Deg (X)	WL				1		3		
34	Ice Wind - 150 Deg (X)	WL				1		3		
35	Ice Wind - 180 Deg (X)	WL				1		3		
36	Ice Wind - 210 Deg (X)	WL				1		3		
37	Ice Wind - 240 Deg (X)	WL				1		3		
38	Ice Wind - 270 Deg (X)	WL				1		3		
39	Ice Wind - 300 Deg (X)	WL				1		3		
40	Ice Wind - 330 Deg (X)	WL				1		3		
41	Ice Wind - 0 Deg (Z)	WL				1		3		
42	Ice Wind - 30 Deg (Z)	WL				1		3		
43	Ice Wind - 60 Deg (Z)	WL				1		3		
44	Ice Wind - 90 Deg (Z)	WL				1		3		
45	Ice Wind - 120 Deg (Z)	WL				1		3		
46	Ice Wind - 150 Deg (Z)	WL				1		3		
47	Ice Wind - 180 Deg (Z)	WL				1		3		
48	Ice Wind - 210 Deg (Z)	WL				1		3		
49	Ice Wind - 240 Deg (Z)	WL				1		3		

Basic Load Cases (Continued)

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Me...	Surface(...
50	Ice Wind - 270 Deg (Z)	WL				1		3		
51	Ice Wind - 300 Deg (Z)	WL				1		3		
52	Ice Wind - 330 Deg (Z)	WL				1		3		

Load Combinations

	Description	S...	PDe...	SRSS	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...
1	WIND LOAD COMBOS (135 MPH)																							
2	1.2DL + WL (0 DEG)	Y...	Y		1	1.2	4	1	16	1														
3	1.2DL + WL (30 DEG)	Y...	Y		1	1.2	5	1	17	1														
4	1.2DL + WL (60 DEG)	Y...	Y		1	1.2	6	1	18	1														
5	1.2DL + WL (90 DEG)	Y...	Y		1	1.2	7	1	19	1														
6	1.2DL + WL (120 DEG)	Y...	Y		1	1.2	8	1	20	1														
7	1.2DL + WL (150 DEG)	Y...	Y		1	1.2	9	1	21	1														
8	1.2DL + WL (180 DEG)	Y...	Y		1	1.2	10	1	22	1														
9	1.2DL + WL (210 DEG)	Y...	Y		1	1.2	11	1	23	1														
10	1.2DL + WL (240 DEG)	Y...	Y		1	1.2	12	1	24	1														
11	1.2DL + WL (270 DEG)	Y...	Y		1	1.2	13	1	25	1														
12	1.2DL + WL (300 DEG)	Y...	Y		1	1.2	14	1	26	1														
13	1.2DL + WL (330 DEG)	Y...	Y		1	1.2	15	1	27	1														
14																								
15	MOUNT LOAD COMBOS (30 MPH)																							
16	1.4DL	Y...	Y		1	1.4																		
17	1.2DL + 1.5LV	Y...	Y		1	1.2	2	1.5																
18	1.2DL + 1.5LM + WL (0 DEG)	Y...	Y		1	1.2	3	1.5	4	.049	16	.049												
19	1.2DL + 1.5LM + WL (30 DEG)	Y...	Y		1	1.2	3	1.5	5	.049	17	.049												
20	1.2DL + 1.5LM + WL (60 DEG)	Y...	Y		1	1.2	3	1.5	6	.049	18	.049												
21	1.2DL + 1.5LM + WL (90 DEG)	Y...	Y		1	1.2	3	1.5	7	.049	19	.049												
22	1.2DL + 1.5LM + WL (120 DEG)	Y...	Y		1	1.2	3	1.5	8	.049	20	.049												
23	1.2DL + 1.5LM + WL (150 DEG)	Y...	Y		1	1.2	3	1.5	9	.049	21	.049												
24	1.2DL + 1.5LM + WL (180 DEG)	Y...	Y		1	1.2	3	1.5	10	.049	22	.049												
25	1.2DL + 1.5LM + WL (210 DEG)	Y...	Y		1	1.2	3	1.5	11	.049	23	.049												
26	1.2DL + 1.5LM + WL (240 DEG)	Y...	Y		1	1.2	3	1.5	12	.049	24	.049												
27	1.2DL + 1.5LM + WL (270 DEG)	Y...	Y		1	1.2	3	1.5	13	.049	25	.049												
28	1.2DL + 1.5LM + WL (300 DEG)	Y...	Y		1	1.2	3	1.5	14	.049	26	.049												
29	1.2DL + 1.5LM + WL (330 DEG)	Y...	Y		1	1.2	3	1.5	15	.049	27	.049												
30																								
31	ICE LOAD COMBOS (2", 50 MPH)																							
32	1.2DL + Ice DL + Ice WL (0 DEG)	Y...	Y		1	1.2	28	1	29	1	41	1												
33	1.2DL + Ice DL + Ice WL (30 DEG)	Y...	Y		1	1.2	28	1	30	1	42	1												
34	1.2DL + Ice DL + Ice WL (60 DEG)	Y...	Y		1	1.2	28	1	31	1	43	1												
35	1.2DL + Ice DL + Ice WL (90 DEG)	Y...	Y		1	1.2	28	1	32	1	44	1												
36	1.2DL + Ice DL + Ice WL (120 DEG)	Y...	Y		1	1.2	28	1	33	1	45	1												
37	1.2DL + Ice DL + Ice WL (150 DEG)	Y...	Y		1	1.2	28	1	34	1	46	1												
38	1.2DL + Ice DL + Ice WL (180 DEG)	Y...	Y		1	1.2	28	1	35	1	47	1												
39	1.2DL + Ice DL + Ice WL (210 DEG)	Y...	Y		1	1.2	28	1	36	1	48	1												
40	1.2DL + Ice DL + Ice WL (240 DEG)	Y...	Y		1	1.2	28	1	37	1	49	1												
41	1.2DL + Ice DL + Ice WL (270 DEG)	Y...	Y		1	1.2	28	1	38	1	50	1												
42	1.2DL + Ice DL + Ice WL (300 DEG)	Y...	Y		1	1.2	28	1	39	1	51	1												
43	1.2DL + Ice DL + Ice WL (330 DEG)	Y...	Y		1	1.2	28	1	40	1	52	1												
44																								
45	SEISMIC LOAD COMBOS																							
46	1.2DL + Ev (Y) + Eh (X)	Y...	Y		1	1.2	55	1	53	1														
47	1.2DL - Ev (Y) + Eh (X)	Y...	Y		1	1.2	55	-1	53	1														
48	1.2DL + Ev (Y) - Eh (X)	Y...	Y		1	1.2	55	1	53	-1														
49	1.2DL - Ev (Y) - Eh (X)	Y...	Y		1	1.2	55	-1	53	-1														

Load Combinations (Continued)

	Description	S...	PDe...	SRSS	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...
50	1.2DL + Ev (Y) + Eh (Z)	Y...	Y		1	1.2	55	1	54	1														
51	1.2DL - Ev (Y) + Eh (Z)	Y...	Y		1	1.2	55	-1	54	1														
52	1.2DL + Ev (Y) - Eh (Z)	Y...	Y		1	1.2	55	1	54	-1														
53	1.2DL - Ev (Y) - Eh (Z)	Y...	Y		1	1.2	55	-1	54	-1														
54																								

Envelope Joint Reactions

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [k-in]	LC	MY [k-in]	LC	MZ [k-in]	LC
1	N17	max	12.489	2	-71.522	10	308.918	5	0	53	0	53	0	53
2		min	-12.489	8	-629.356	19	-324.715	11	0	2	0	2	0	2
3	N18	max	12.489	2	-75.723	10	1433.357	11	0	53	0	53	0	53
4		min	-12.489	8	-628.801	20	-1422.994	5	0	2	0	2	0	2
5	N19	max	591.49	38	1076.56	19	688.307	11	0	53	0	53	0	53
6		min	-292.993	2	144.667	9	-661.624	5	0	2	0	2	0	2
7	N20	max	726.574	2	1085.292	22	2234.138	5	0	53	0	53	0	53
8		min	-879.438	8	153.318	11	-2255.388	11	0	2	0	2	0	2
9	Totals:	max	458.559	2	903.364	27	458.439	5						
10		min	-458.559	8	153.36	5	-458.438	11						

Envelope AISC 15th(360-16): LRFD Steel Code Checks

	Member	Shape	Code Check	Loc[in]	LC	Shear...	Loc[...	Dir	LC	phi*Pn...	phi*Pnt...	phi*Mn...	phi*Mn...	Cb	Eqn
1	M1	HSS2.375X0.154	.804	20.25	11	.117	20.25		11	23738....	41400	29.518	29.518	1...	H1-1b
2	M2	HSS2.375X0.154	.505	69	11	.052	20.25		28	23738....	41400	29.518	29.518	1...	H1-1b
3	M3	PIPE_2.0	.723	39	5	.781	9		5	26521....	32130	22.459	22.459	5	H3-6

APPENDIX 3:
ATTACHMENTS

220 MHz Antenna – Omnidirectional, Low-PIM/Hi-PIP, 2.9 dBd
Model DS2C03P36D-D

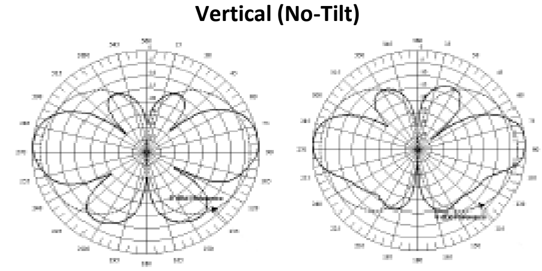
Specifications	
Design Type	True Corporate Feed
Frequency Range	216-222 MHz
Passive Intermodulation – PIM (2 x 20W sources)	-150 dBc, 3rd Order
Bandwidth	6 MHz
Gain - dBd (average over BW)	2.9 dBd
Isolation, min.	34 dB
Configuration	Dual antenna
Beam Tilt (electrical down-tilt)	None (0°)
Vertical Beamwidth (E-Plane)	30°
Impedance -- Ohms	50
VSWR / Return Loss -- dB	1.5 : 1 / 14 dB (min.)
Average Power Rating	500 W (each antenna)
Peak Instantaneous Power	25 kW (each antenna)
Polarization	Vertical
Lightning Protection	Direct Ground
Connector	7/16 DIN female
Equivalent Flat-Plate Area	3.1 sq. ft.
Lateral Wind-load Thrust @100mph	129 lbf.
Wind Speed rating	160 mph (without ice)
Total Length	18.5 feet
Mounting Mast Length	35 inches
Mounting Hardware (Included)	DSH3V4N
Top Sway Brace (Recommended if side mounting antennas on top)	DSH2H3S (order separately)
Mast O.D.	3.5 inches
Radome color	Horizon Blue
Radome O.D.	3.0 inches
Weight, antenna, and hardware	75 lbs. (approx.)
Shipping Weight	105 lbs. (approx.)
Invertibility	Antennas are physically invertible, but the patterns are optimized for upright mount.

Features and Benefits

Antennas from dbSpectra provide long term, trouble-free service in severe environments!
Design is tested to stringent Peak Instantaneous Power (PIP) levels of 25 KW using dbSpectra's 12-channel P25 PIP test bed. High PIP level is demanded by today's digital systems.
True Corporate Feed Array – provides for excellent gain and pattern consistency across a wider frequency range.
PIM Rated Design – better than -150 dBc.
Sturdy Construction – Heavy-wall fiberglass radome minimizes tip deflection.
Excellent Lightning Protection – heavy internal conductor DC ground.

Radiation Pattern

Vertical (No-Tilt)

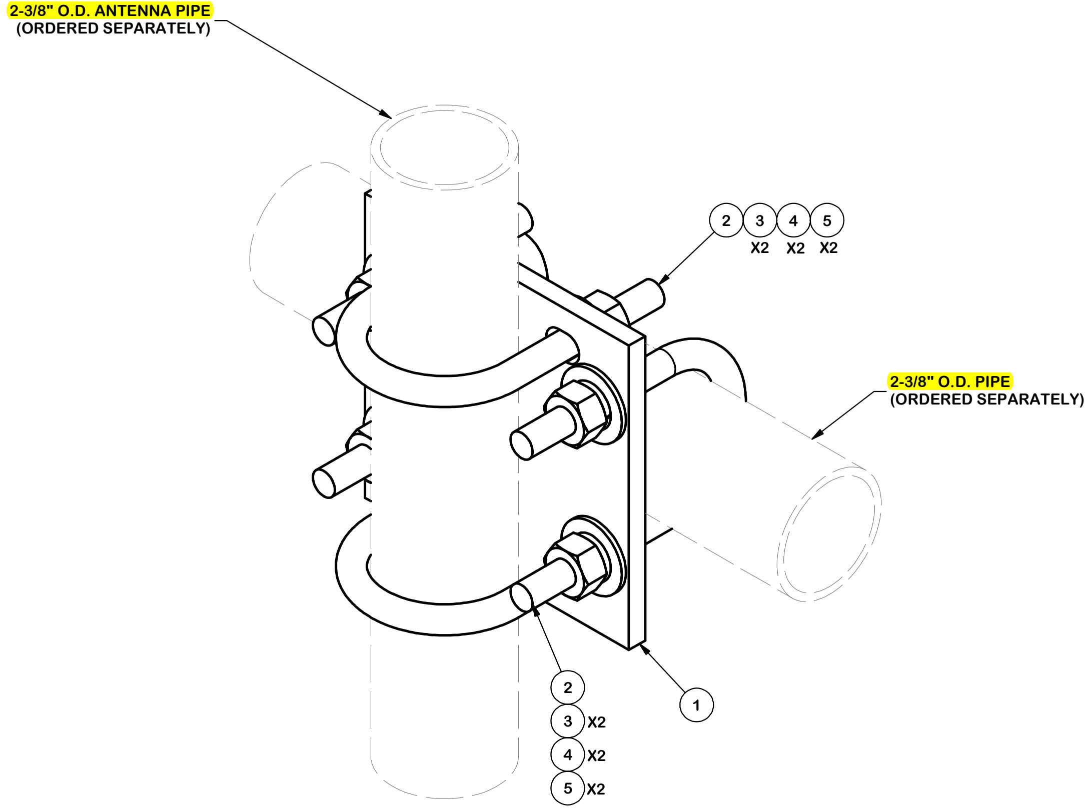


Top **Bottom**

(2) CROSSOVER PLATE KITS REQUIRED

PARTS LIST

ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	1	SCX1	CROSSOVER PLATE 2-3/8" X 2-3/8"		3.71	3.71
2	4	X-UB1212	1/2" X 2-1/2" X 4-1/2" X 2" U-BOLT (HDG.)		0.63	2.50
3	8	G12FW	1/2" HDG USS FLATWASHER		0.03	0.27
4	8	G12LW	1/2" HDG LOCKWASHER		0.01	0.11
5	8	G12NUT	1/2" HDG HEAVY 2H HEX NUT		0.07	0.57
					TOTAL WT. #	7.16



TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES *(± 0.030")*
DRILLED AND GAS CUT HOLES *(± 0.030")* - NO CONING OF HOLES
LASER CUT EDGES AND HOLES *(± 0.010")* - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING *(± 0.030")*
ALL OTHER ASSEMBLY *(± 0.060")*

DESCRIPTION: CROSSOVER PLATE

SITE PRO 1 — A valmont COMPANY

Engineering Support Team:
1-888-753-7446

Locations:
New York, NY
Atlanta, GA
Los Angeles, CA
Plymouth, IN
Salem, OR
Dallas, TX

CPD NO.	DRAWN BY	ENG. APPROVAL	PART NO.
	CEK 6/30/2011		SCX1-K

CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.
81	01	CUSTOMER	CEK 8/23/2012	SCX1-K

PAGE 1 OF 1

REV	DESCRIPTION OF REVISIONS	CPD	BY	DATE
A	ADDED MISSING U-BOLT AND HRDWE		KC8	7/5/2012

REVISION HISTORY

(2) CLAMP KITS REQUIRED (TOTAL OF 4 TOWER CONNECTIONS)

Products (http://www.sitepro1.com/store/cart.php) > OVERSTOCK & CLEARANCE 2020 SALE (http://www.sitepro1.com/store/cart.php?m=product_list&c=940) > Miscellaneous 2020 Sale (http://www.sitepro1.com/store/cart.php?m=product_list&c=958)

Adjustable Clamp Plate Tie-Back Assembly

SKU: PUCK3
Size: See Description

Description Specs/Instructions

- **PUCK3 • Adjustable Clamp Plate**
- Adjustable Clamp Plate Tie-Back Assembly
- Application 7/8" to 2-3/8" OD
- Weight 11.4 lb
- Hot-dip galvanized
- Kit includes two clamp plates and all hardware
- Angle adjusts from 40° to 140°
- Use where applicable

- **VIEW ALL MISCELLANEOUS 2020 SALE (https://www.sitepro1.com/store/cart.php?m=product_list&c=958)**
- **VIEW ALL OVERSTOCK & CLEARANCE 2020 SALE (https://www.sitepro1.com/store/cart.php?m=product_list&c=940)**
- **VIEW COMPLETE PRODUCT CATALOG (https://www.sitepro1.com/store/cart.php?m=product_list)**

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ATTACHMENT C – CONSTRUCTION DRAWINGS

EVERSOURCE ENERGY

HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

PROJECT SUMMARY

THE GENERAL SCOPE OF WORK CONSISTS OF THE FOLLOWING:

1. RELOCATE EXISTING OMNI ANTENNA AND COAX FROM 106'–0"± AGL TO 78'–0"± AGL AND REMOVE OMNI ANTENNA'S EXISTING STANDOFF MOUNT
2. RELOCATE EXISTING OMNI ANTENNA AND COAX FROM 78'–0"± AGL TO 66'–6"± AGL AND REMOVE OMNI ANTENNA'S EXISTING STANDOFF MOUNT
3. INSTALL (1) NEW OMNI/WHIP ANTENNA AT ELEVATION 112'–6"± AGL
4. INSTALL (1) NEW RACK WITH DMR EQUIPMENT IN EXISTING TELECOM ROOM
5. INSTALL NEW 448AH BATTERIES IN MAIN COMMUNICATION ROOM
6. REMOVE EXISTING BATTERIES AND MOVE TO CANTON5R

GOVERNING CODES

2018 CONNECTICUT STATE BUILDING CODE (2015 IBC BASIS)
2017 NATIONAL ELECTRIC CODE
TIA–222–H

GENERAL NOTES

A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OR EFFECT ON DRAINAGE; NO SANITARY SEWER SERVICE, POTABLE WATER, OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS PROPOSED.

SITE INFORMATION

SITE NAME:	HARTFORD AWC
SITE ID NUMBER:	#294077085
SITE ADDRESS:	410 SHELDON ST HARTFORD, CT 06106
MAP:	294
BLOCK:	077
LOT:	085
ZONE:	CT R
LATITUDE:	41° 45' 32.71" N
LONGITUDE:	72° 39' 57.22" W
ELEVATION:	32'± AMSL
FEMA/FIRM DESIGNATION:	X
ACREAGE:	6.05± AC (BOOK: 01977, PAGE: 0129)

CONTACT INFORMATION

APPLICANTS:
EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037

PROPERTY OWNER:
EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037

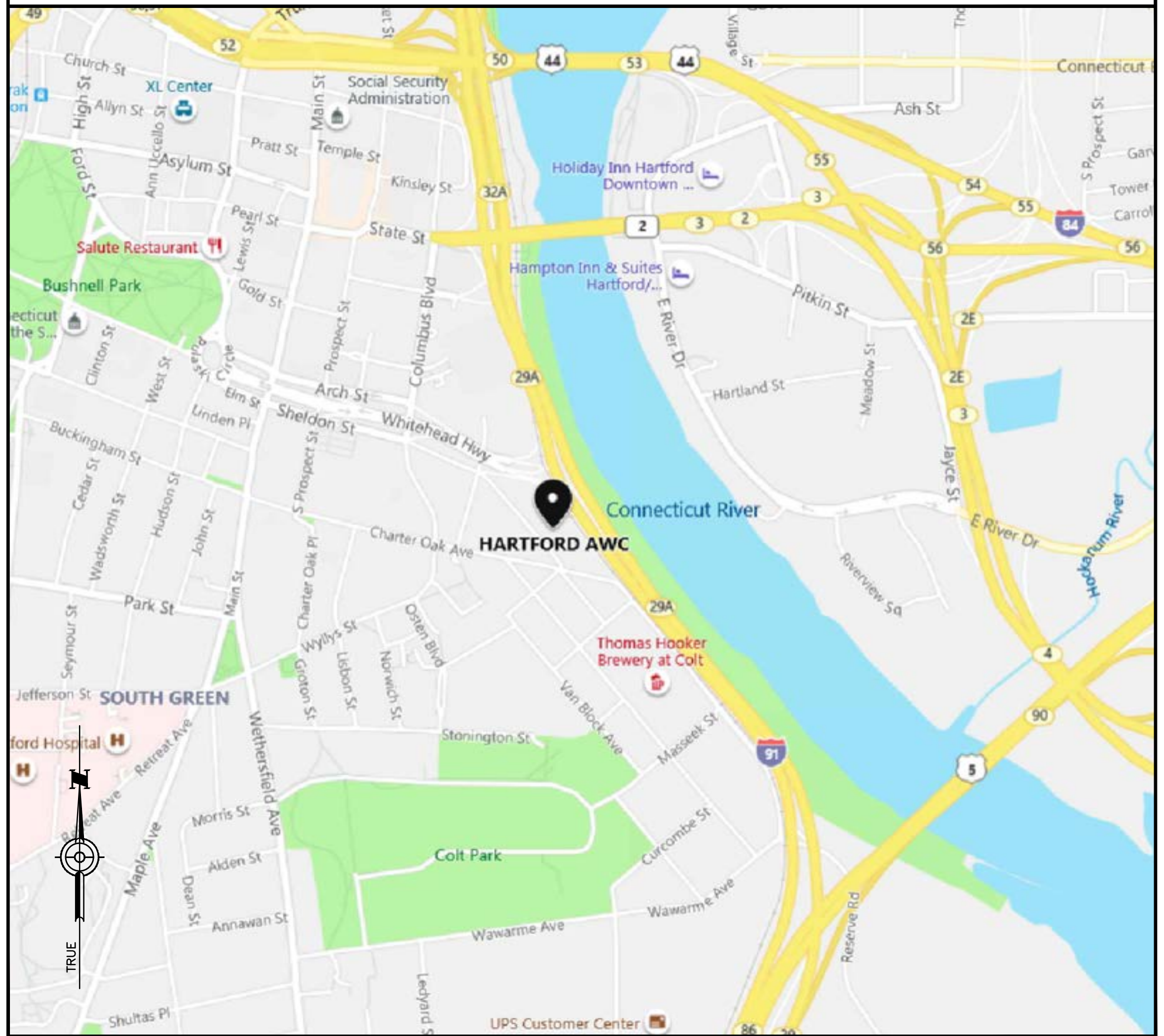
EVERSOURCE ENERGY PROJECT MANAGER:
NIKOLL PRECI
(860) 655–3079

POWER PROVIDER:
EVERSOURCE ENERGY
(800) 286–2000

TELCO PROVIDER:
FRONTIER
(800) 921–8102

CALL BEFORE YOU DIG:
(800) 922–4455

LOCATION MAP



NO SCALE

DESIGN TYPE

SITE UPGRADE
GUYED TOWER

DRAWING INDEX

SHEET NO:	SHEET TITLE
T–1	TITLE SHEET
C–1	SITE PLAN
C–2	ROOFTOP PLAN
C–3	TOWER ELEVATION
C–4	ANTENNA EQUIPMENT
G–1	GROUNDING PLAN
G–2	GROUNDING DETAILS
G–3	GROUNDING DETAILS
N–1	NOTES & SPECIFICATIONS
N–2	NOTES & SPECIFICATIONS
N–3	NOTES & SPECIFICATIONS

DO NOT SCALE DRAWINGS

SUBCONTRACTOR SHALL VERIFY ALL PLANS & EXISTING DIMENSIONS & CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME

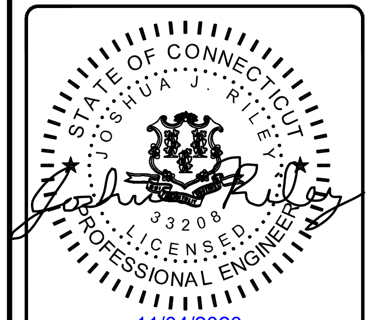
UNDERGROUND SERVICE ALERT
UTILITIES PROTECTION CENTER, INC.
811
48 HOURS BEFORE YOU DIG

EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037
PHONE: (800) 286–2000

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458–2522

PROJECT NO:	405025
DRAWN BY:	TYW
CHECKED BY:	TH

REV	DATE	DESCRIPTION
0	11/04/20	ISSUED FOR FILING



11/04/2020

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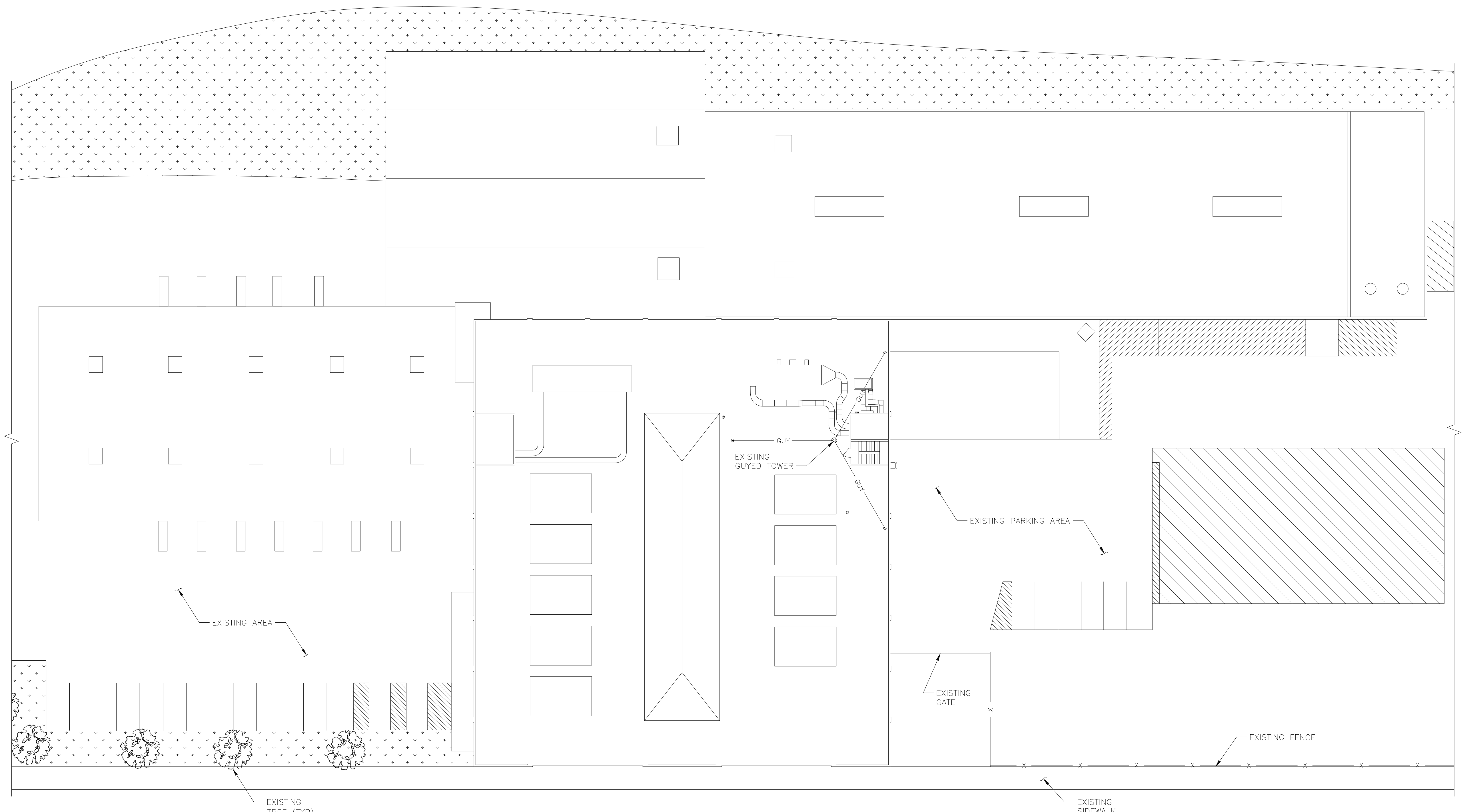
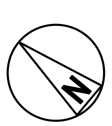
HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1



SITE PLAN
NO SCALE



EVERSOURCE ENERGY

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BERLIN, CT 06037
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BLACK & VEATCH

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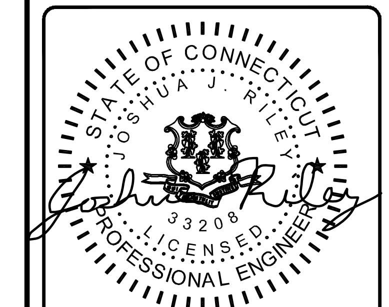

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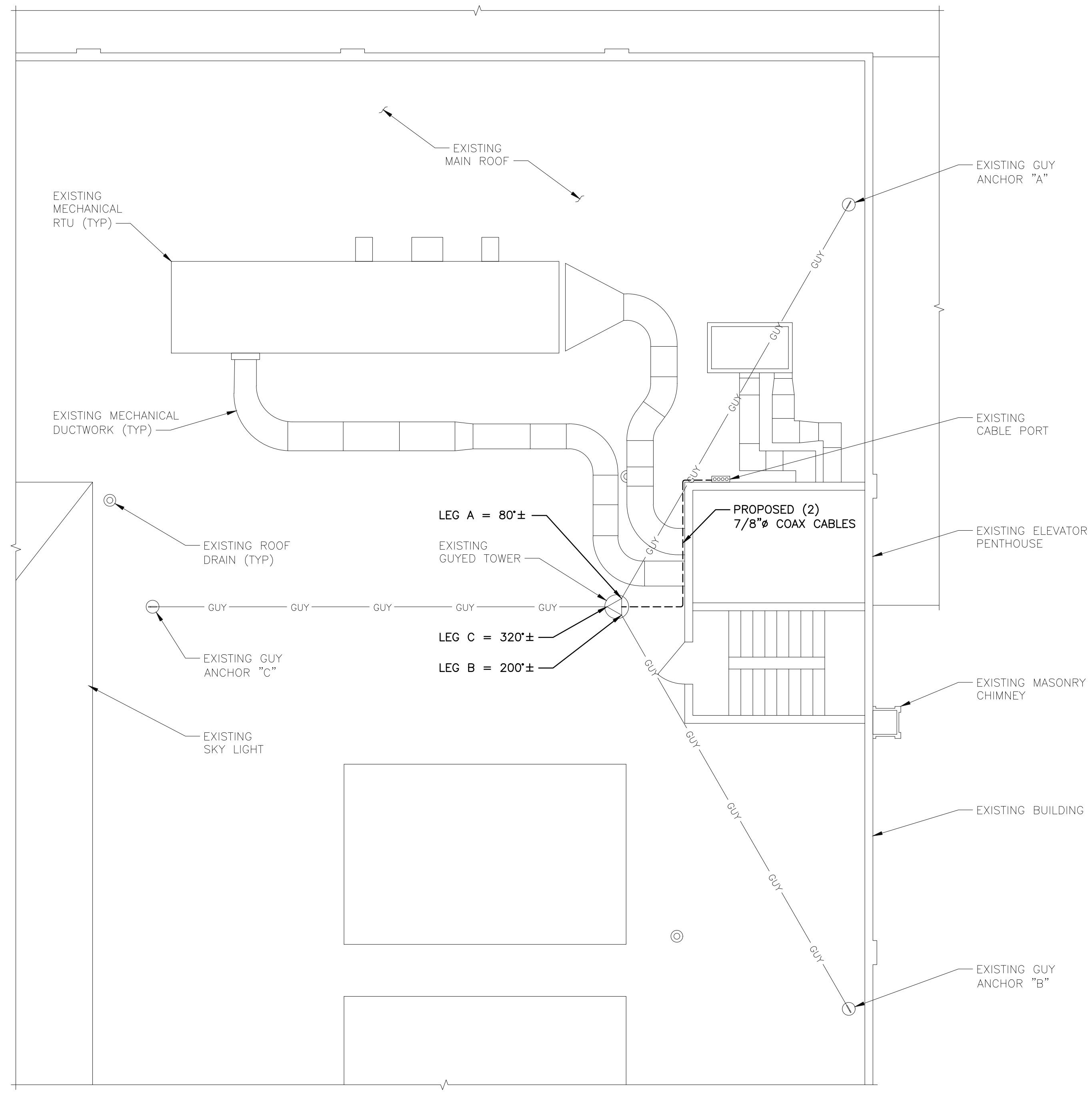
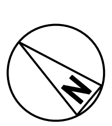
HARTFORD, CT 06106

SHEET TITLE
SITE PLAN

SHEET NUMBER
C-1



ROOFTOP PLAN
NO SCALE



EVERSOURCE
ENERGY
107 SELDEN STREET
BERLIN, CT 06037
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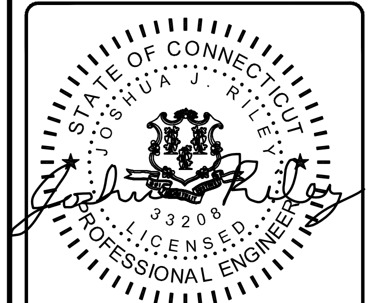


11/04/2020

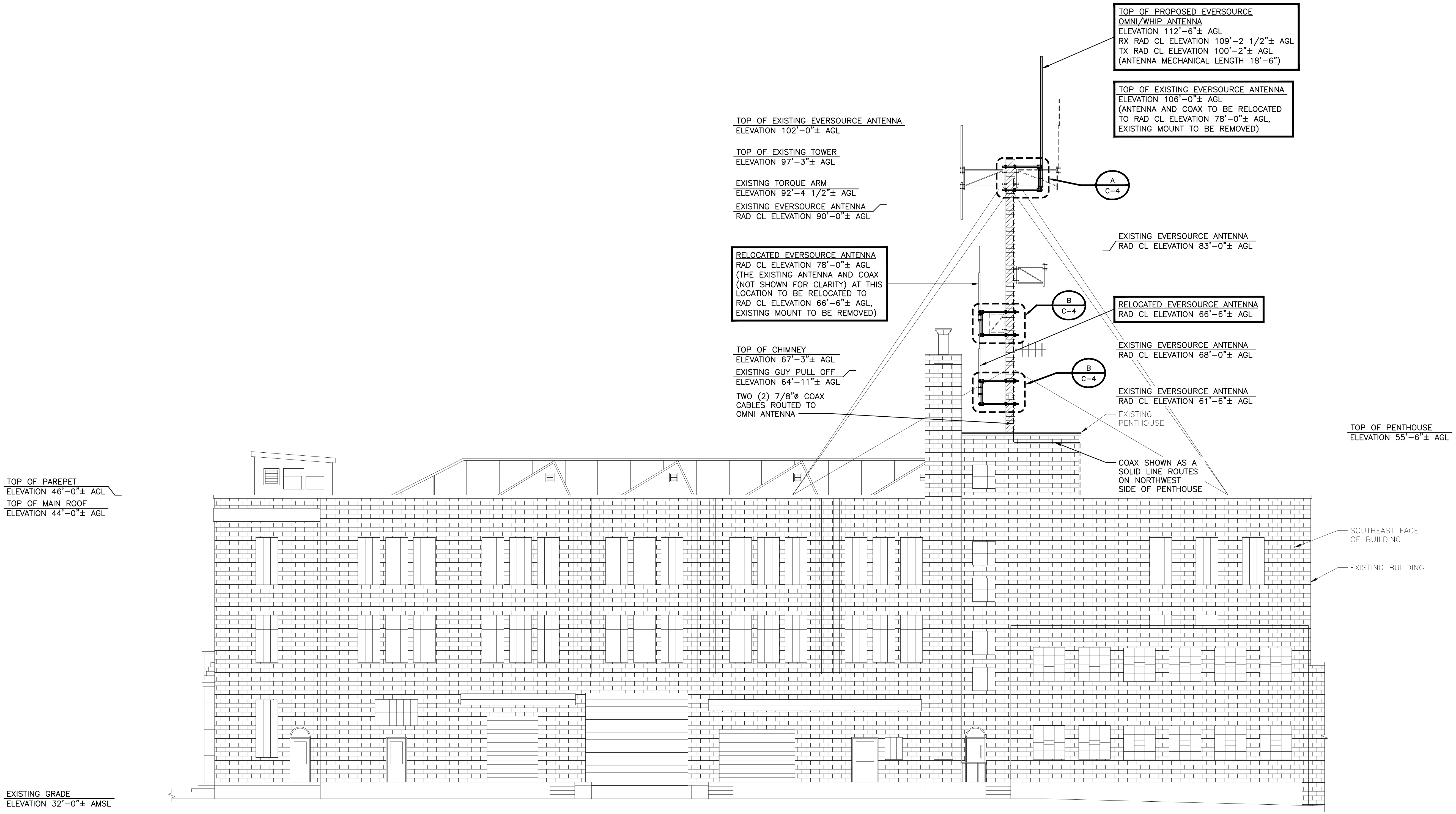
HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE
ROOFTOP PLAN

SHEET NUMBER
C-2

NOTES

1. EXISTING ANTENNA BEING RELOCATED AT RAD CL 78'-0" MAY NEED TO BE RELOCATED BEFORE ANY OTHER ANTENNA WORK IS PERFORMED.



TOWER ELEVATION
NO SCALE

EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037
PHONE: (800) 286-2000

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
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STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED
PROFESSIONAL ENGINEER
11/04/2020

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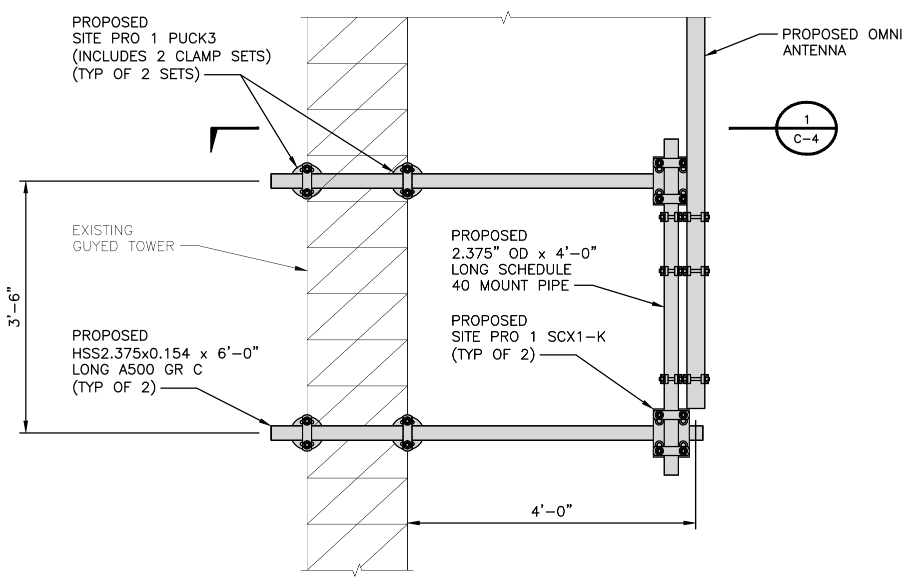
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE
TOWER ELEVATION

SHEET NUMBER
C-3

NOTES

1. EXISTING ANTENNA CLAMPS SHALL NOT BE REUSED.

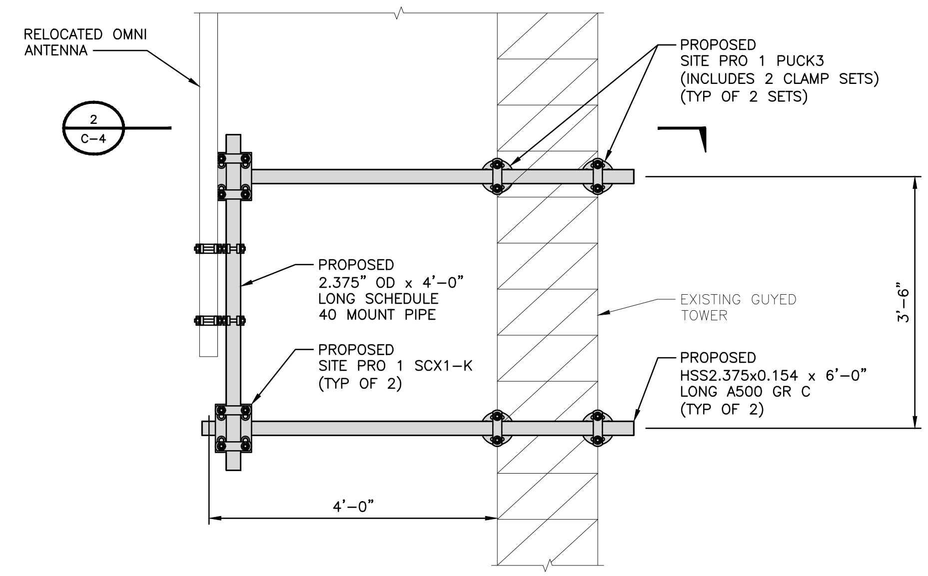


NOTE

1. TRIM PIPE MEMBERS AS REQUIRED TO MAINTAIN A MINIMUM 3" DISTANCE BETWEEN END OF PIPE AND END OF CLAMP.

DETAIL A

NO SCALE

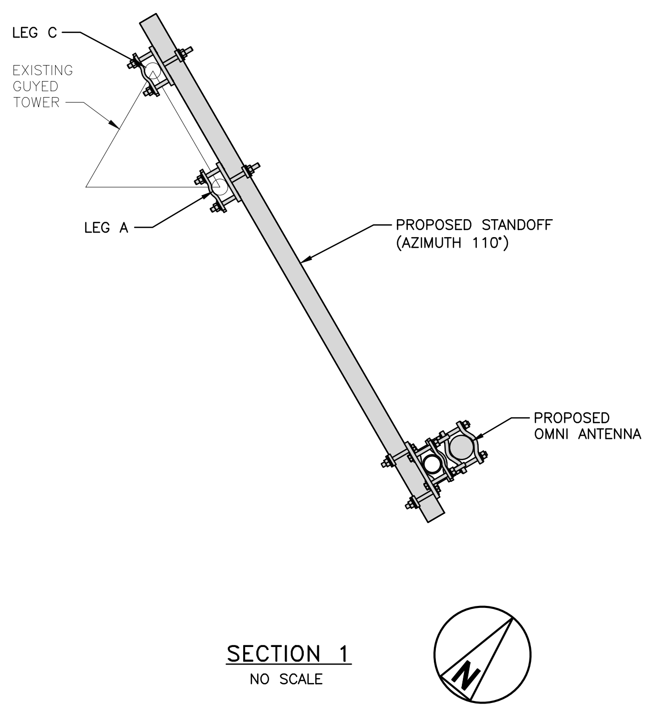


NOTE

1. TRIM PIPE MEMBERS AS REQUIRED TO MAINTAIN A MINIMUM 3" DISTANCE BETWEEN END OF PIPE AND END OF CLAMP.

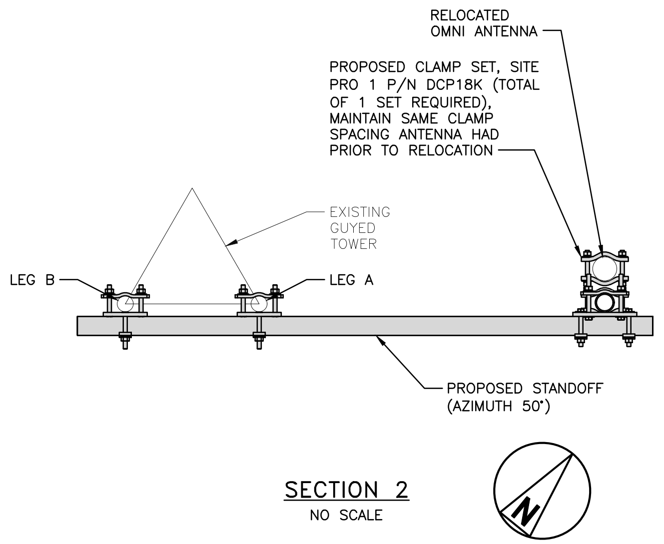
DETAIL B

NO SCALE



SECTION 1

NO SCALE



SECTION 2

NO SCALE

EVERSOURCE ENERGY
107 SELDEN STREET
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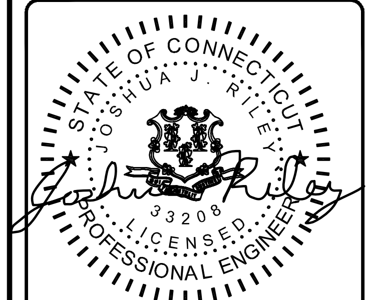

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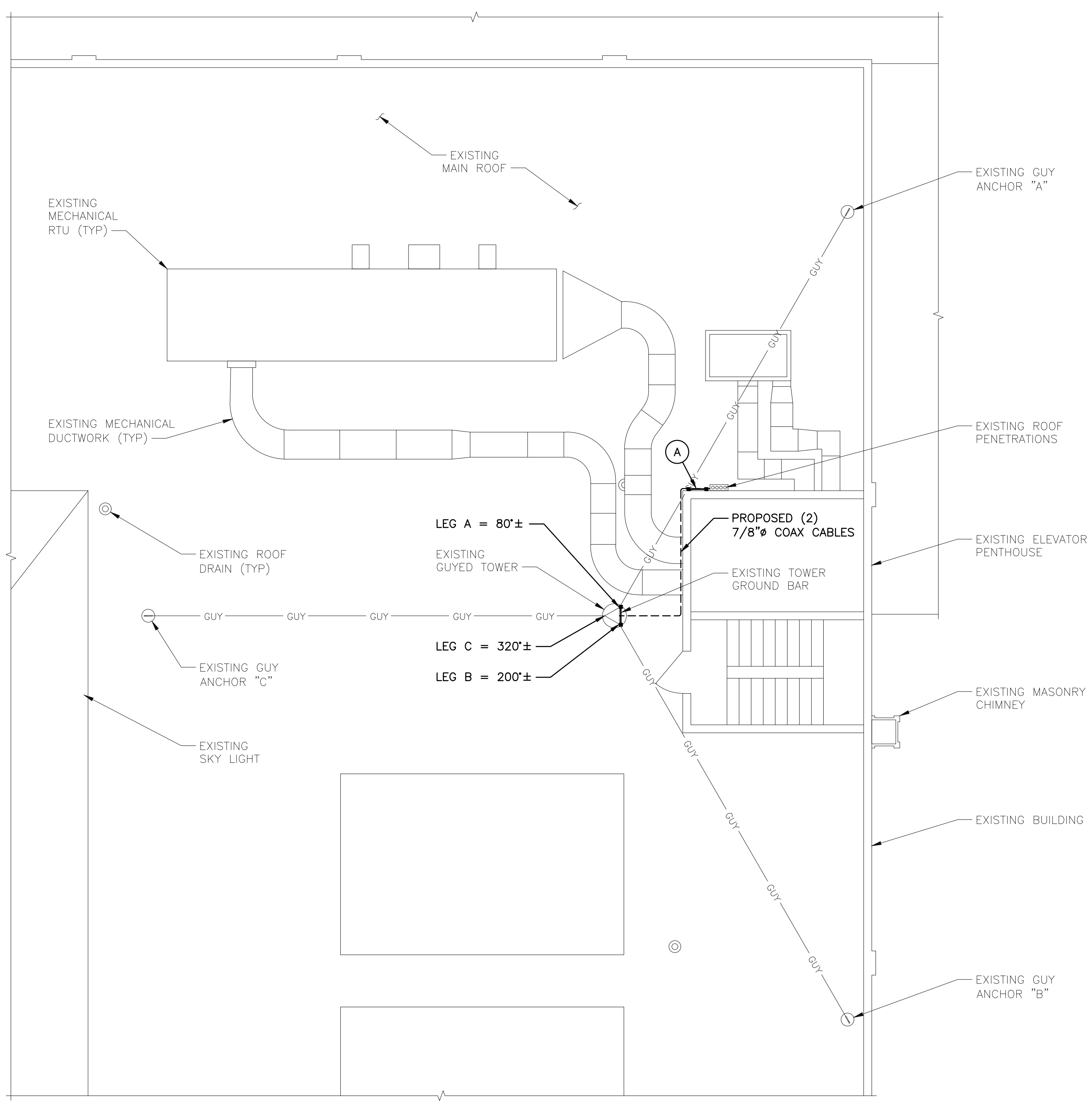
HARTFORD, CT 06106

SHEET TITLE
ANTENNA EQUIPMENT

SHEET NUMBER
C-4

LEGEND

– – – – GROUND WIRE.



GROUNDING PLAN

NO SCALE

KEY NOTES

(A) EXTERIOR GROUND BAR: EXTEND #2 TINNED CU WIRE FROM EXISTING GROUND BAR AND EXOTHERMICALLY WELD. SEE DETAIL G-2.

NOTE

1. ALL GROUNDING SYSTEM CONDUCTORS AND CONNECTIONS SHALL BE THERMAL WELDED.
2. ALL INSTALLATIONS SHALL BE FIELD VERIFIED.
3. ALL GROUND WIRE SHALL BE #2 AWG BARE COPPER TINNED UNLESS NOTED OTHERWISE.
4. ALL GROUND WIRES SHALL PROVIDE A STRAIGHT DOWNWARD PATH TO GROUND WITH GRADUAL BEND AS REQUIRED. GROUND WIRES SHALL NOT BE LOOPED OR SHARPLY BENT.
5. ALL EXOTHERMIC CONNECTIONS SHALL BE INSTALLED UTILIZING THE PROPER CONNECTION/MOLD AND MATERIALS FOR THE PARTICULAR APPLICATION.
6. ALL BOLTED GROUNDING CONNECTIONS SHALL BE INSTALLED WITH AN EXTERNAL TOOTHED LOCK WASHER. GROUNDING BUS BARS MAY HAVE PRE PUNCHED HOLES OR TAPPED HOLES. ALL HARDWARE SHALL BE 3/8" STAINLESS STEEL.
7. EXTERNAL GROUNDING CONDUCTOR SHALL NOT BE INSTALLED OR ROUTED THROUGH HOLES IN ANY METAL OBJECTS, CONDUITS, OR SUPPORTS TO PRECLUDE ESTABLISHING A MAGNETIC CHOKE POINT.
8. PLASTIC CLIPS SHALL BE USED TO FASTEN AND SUPPORT GROUNDING CONDUCTORS. FERROUS METAL CLIPS WHICH COMPLETELY SURROUND THE GROUNDING CONDUCTOR SHALL NOT BE USED.
9. STANDARD BUS BARS MGB, GWB, IGB, TELCO GB, FIBER GB, AND POWER GB SHALL BE FURNISHED AND INSTALLED BY THE SUBCONTRACTOR. THEY SHALL NOT BE FABRICATED OR MODIFIED IN THE FIELD. ALL GROUNDING BUSES SHALL BE IDENTIFIED WITH MINIMUM 3/4" LETTERS BY WAY OF STENCILING OR DESIGNATION PLATE.
10. CONTRACTOR SHALL REPAIR/PLACE EXISTING GROUNDING SYSTEM COMPONENTS DAMAGED DURING CONSTRUCTION AT THE CONTRACTORS EXPENSE.

EVERSOURCE ENERGY

107 SELDEN STREET
BERLIN, CT 06037
PHONE: (800) 286-2000

BLACK & VEATCH

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OVERLAND PARK, KS 66211
PHONE: (913) 458-2522

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11/04/2020

HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE

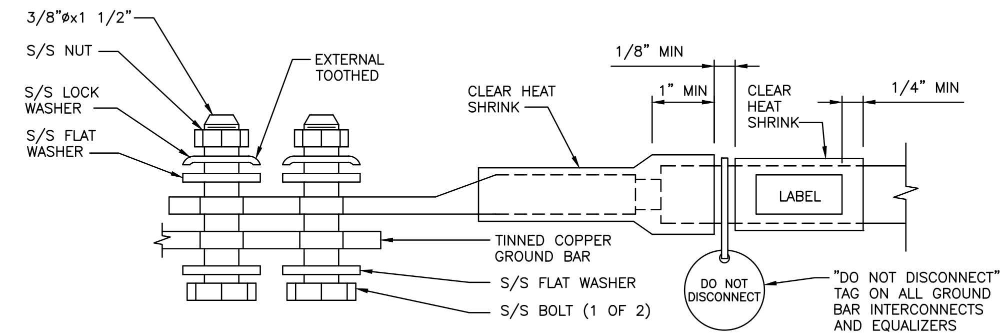
GROUNDING PLAN

SHEET NUMBER

G-1

NOTES

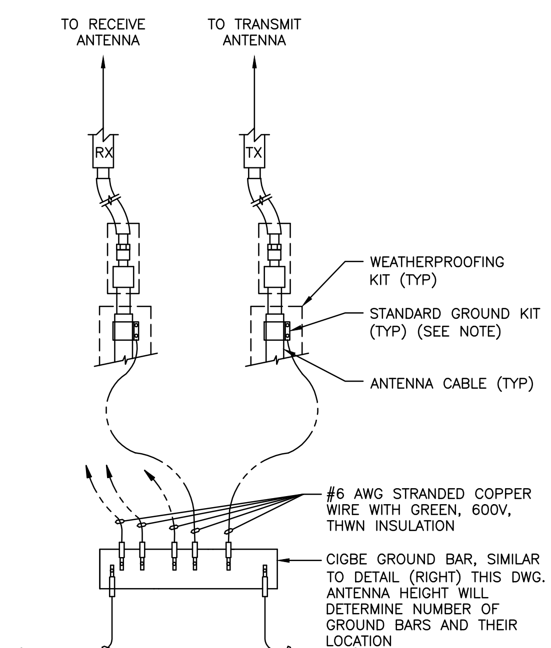
1. ALL LUGS SHALL BE 2-HOLE, LONG BARREL, TINNED SOLID COPPER UNLESS OTHERWISE SPECIFIED, USING THE PROPER U.L. TOOL AND CIRCUMFERENTIAL HEXAGON DIE. LUGS SHALL BE THOMAS AND BETTS SERIES 548##BE, BURNDY, ERICO OR EQUIVALENT. BOLT HOLE DIAMETER AND SPACING ON ALL GROUND LUGS SHALL MATCH HOLE DIAMETER AND SPACING OF THE GROUND BAR. ANGLE LUGS MAY BE USED IF CONSTRUCTION CONDITIONS DICTATE. REFER TO DETAIL "G".
2. AN ANTI-OXIDATION COMPOUND SHALL BE APPLIED BETWEEN THE LUG AND GROUND BAR ONLY. DO NOT COVER THE LUG. THE ANTI-OXIDATION COMPOUND SHALL BE THOMAS AND BETTS "KOPR-SHIELD" OR BURNDY PENETROX-E.
3. GROUND BARS SHALL BE ATTACHED TO THE ANTENNA SUPPORT STRUCTURES WITH U.L. APPROVED MOUNTING DEVICES. GROUND CLAMPS MAY BE USED TO MOUNT THE GROUND BAR TO AVAILABLE FLANGES, COAX PORT RIMS, ETC. STEEL STRAPS MAY BE USED TO ATTACH GROUND BAR TO A MONOPOLE IF NO CONVENIENT CLAMPING SURFACES ARE PRESENT. ALL CONNECTING SURFACES SHALL BE CLEAN AND FREE OF DIRT, OIL AND CORROSION. GALVANIZED SURFACES SHALL BE POLISHED WITH A STEEL BRUSH. DO NOT DRILL HOLES OR USE EXOTHERMIC WELDS TO CONNECT GROUND LEADS TO A STEEL TOWER EXCEPT ON STEEL TABS OR FLANGES SPECIFICALLY DESIGNED FOR THAT PURPOSE.



NOTES

1. ALL HARDWARE 18-8 STAINLESS STEEL INCLUDING LOCK WASHERS, COAT ALL SURFACES WITH AN ANTI-OXIDANT COMPOUND BEFORE MATING.
2. ALL HARDWARE SHALL BE S/S 3/8 INCH DIAMETER OR LARGER.
3. FOR GROUND BOND TO STEEL ONLY: INSERT A CADMIUM FLAT WASHER BETWEEN LUG AND STEEL, COAT ALL SURFACES WITH AN ANTI-OXIDANT COMPOUND BEFORE MATING.

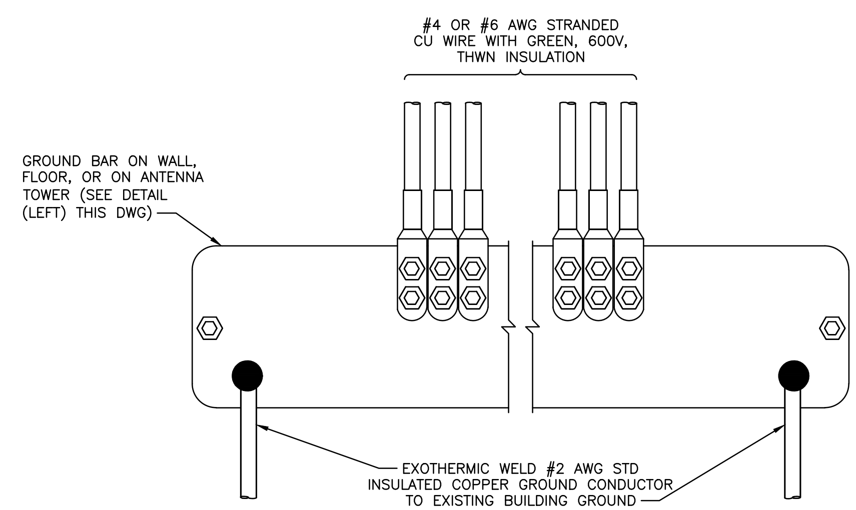
TWO HOLE LUG
NO SCALE



NOTE

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO CIGBE.

CONNECTION OF GROUND WIRE TO EXTERIOR GROUNDING BAR
NO SCALE



NOTE

1. NUT & WASHER SHALL BE PLACED ON THE FRONT SIDE OF THE GROUND BAR AND BOLTED ON THE BACK SIDE.

INSTALLATION OF GROUND WIRE TO EXTERIOR GROUNDING BAR
NO SCALE

EVERSOURCE ENERGY
107 SELDEN STREET
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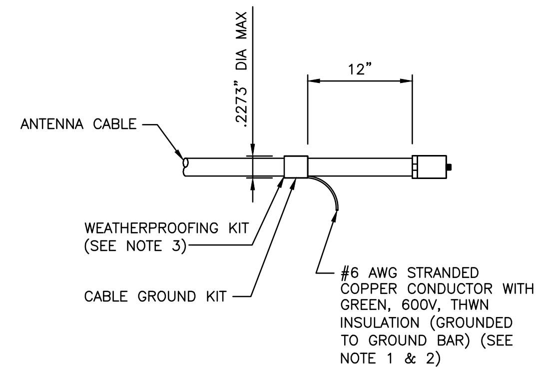
HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE
GROUNDING DETAILS

SHEET NUMBER
G-2

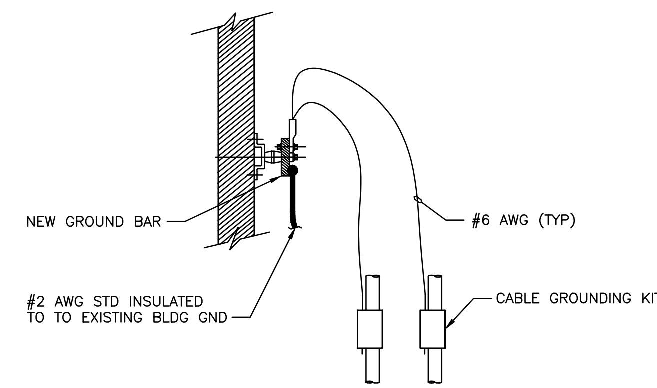


NOTES

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO GROUND BAR.
2. GROUNDING KIT SHALL BE TYPE AND PART NUMBER AS SUPPLIED OR RECOMMENDED BY CABLE MANUFACTURER.
3. WEATHER PROOFING SHALL BE TYPE AND PART NUMBER AS SUPPLIED OR RECOMMENDED BY CABLE MANUFACTURER.

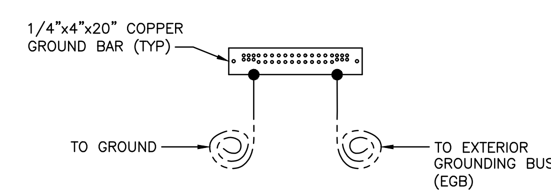
CONNECTION OF CABLE GROUND KIT TO ANTENNA CABLE

NO SCALE



CABLE INSTALLATION

NO SCALE



GROUND BAR AT CABLE EXIT

NO SCALE

EVERSOURCE ENERGY

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BERLIN, CT 06037
PHONE: (800) 286-2000

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
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11/04/2020

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HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE

GROUNDING DETAILS

SHEET NUMBER

G-3

DESIGN BASIS

1. GOVERNING CODE: 2018 CONNECTICUT STATE BUILDING CODE (2015 IBC BASIS).

GENERAL CONDITIONS

1. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL BUILDING CODES, PERMIT CONDITIONS AND SAFETY CODES DURING CONSTRUCTION.
2. THE ENGINEER IS NOT: A GUARANTOR OF THE INSTALLING CONTRACTOR'S WORK; RESPONSIBLE FOR SAFETY IN, ON OR ABOUT THE WORK SITE; IN CONTROL OF THE SAFETY OR ADEQUACY OF ANY BUILDING COMPONENT, SCAFFOLDING OR SUPERINTENDING THE WORK.
3. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL PERMITS, INSPECTIONS, TESTING AND CERTIFICATES NEEDED FOR LEGAL OCCUPANCY OF THE FINISHED PROJECT.
4. THE CONTRACTOR IS RESPONSIBLE TO REVIEW THIS COMPLETE PLAN SET AND VERIFY THE EXISTING CONDITIONS SHOWN IN THESE PLANS AS THEY RELATE TO THE WORK PRIOR TO SUBMITTING PRICE. SIGNIFICANT DEVIATIONS FROM WHAT IS SHOWN AFFECTING THE WORK SHALL BE REPORTED IMMEDIATELY TO THE CONSTRUCTION MANAGER.
5. DETAILS INCLUDED IN THIS PLAN SET ARE TYPICAL AND APPLY TO SIMILAR CONDITIONS.
6. EXISTING ELECTRICAL AND MECHANICAL FIXTURES, PIPING, WIRING, AND EQUIPMENT OBSTRUCTING THE WORK SHALL BE REMOVED AND/OR RELOCATED AS DIRECTED BY THE CONSTRUCTION MANAGER. TEMPORARY SERVICE INTERRUPTIONS MUST BE COORDINATED WITH OWNER.
7. THE CONTRACTOR SHALL DILIGENTLY PROTECT THE EXISTING BUILDING/SITE CONDITIONS AND THOSE OF ANY ADJOINING BUILDING/SITES AND RESTORE ANY DAMAGE CAUSED BY HIS ACTIVITIES TO THE PRE–CONSTRUCTION CONDITION.
8. THE CONTRACTOR SHALL SAFEGUARD AGAINST: CREATING A FIRE HAZARD, AFFECTING TENANT EGRESS OR COMPROMISING BUILDING SITE SECURITY MEASURES.
9. THE CONTRACTOR SHALL REMOVE ALL DEBRIS AND CONSTRUCTION WASTE FROM THE SITE EACH DAY. WORK AREAS SHALL BE SWEPT AND MADE CLEAN AT THE END OF EACH WORK DAY.
10. THE CONTRACTOR'S HOURS OF WORK SHALL BE IN ACCORDANCE WITH LOCAL CODES AND ORDINANCES AND BE APPROVED BY OWNER.
11. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE CONSTRUCTION MANAGER IF ASBESTOS IS ENCOUNTERED DURING THE EXECUTION OF HIS WORK. THE CONTRACTOR SHALL CEASE ALL ACTIVITIES WHERE THE ASBESTOS MATERIAL IS FOUND UNTIL NOTIFIED BY THE CONSTRUCTION MANAGER TO RESUME OPERATIONS.

THERMAL & MOISTURE PROTECTION

1. FIRE–STOP ALL PENETRATIONS FOR ELECTRICAL CONDUITS OR WAVEGUIDE CABLING THROUGH BUILDING WALLS, FLOORS, AND CEILINGS SHALL BE FIRESTOPPED WITH ACCEPTED MATERIALS TO MAINTAIN THE FIRE RATING OF THE EXISTING ASSEMBLY. ALL FILL MATERIAL SHALL BE SHAPED, FITTED, AND PERMANENTLY SECURED IN PLACE. FIRESTOPPING SHALL BE INSTALLED IN ACCORDANCE WITH ASTM E814.
2. HILTI CP620 FIRE FOAM OR 3M FIRE BARRIER FILL, VOID OR CAVITY MATERIAL OR ACCEPTED EQUAL SHALL BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND ASSOCIATED UNDERWRITERS LABORATORIES (UL) SYSTEM NUMBER.
3. FIRESTOPPING SHALL BE APPLIED AS SOON AS PRACTICABLE AFTER PENETRATIONS ARE MADE AND EQUIPMENT INSTALLED.
4. FIRESTOPPED PENETRATIONS SHALL BE LEFT EXPOSED AND MADE AVAILABLE FOR INSPECTION BEFORE CONCEALING SUCH PENETRATIONS. FIRESTOPPING MATERIAL CERTIFICATES SHALL BE MADE AVAILABLE AT THE TIME OF INSPECTION.
5. ANY BUILDING ROOF PENETRATION AND/OR RESTORATION SHALL BE PERFORMED SO THAT THE ROOF WARRANTY IN PLACE IS NOT COMPROMISED. CONTRACTOR SHALL ARRANGE FOR OWNER'S ROOFING CONTRACTOR TO PERFORM ANY AND ALL ROOFING WORK IF SO REQUIRED BY EXISTING ROOF WARRANTY. OTHERWISE, ROOF SHALL BE MADE WATERTIGHT WITH LIKE CONSTRUCTION AS SOON AS PRACTICABLE AND AT COMPLETION OF CONSTRUCTION.
6. ALL PENETRATIONS INTO AND/OR THROUGH BUILDING EXTERIOR WALLS SHALL BE SEALED WITH SILICONE SEALER.
7. WHERE CONDUIT AND CABLES PENETRATES FIRE RATED WALLS AND FLOORS, FIRE GROUT ALL PENETRATIONS IN ORDER TO MAINTAIN THE FIRE RATING USING A LISTED FIRE SEALING DEVICE OR GROUT.
8. CONTRACTOR TO REMOVE AND RE–INSTALL ALL FIRE PROOFING AS REQUIRED DURING CONSTRUCTION.

SUBMITTALS

1. CONTRACTOR TO SUBMIT SHOP DRAWINGS TO ENGINEER FOR REVIEW PRIOR TO FABRICATION.
2. CONTRACTOR TO NOTIFY ENGINEER FOR INSPECTION PRIOR TO CLOSING PENETRATIONS.
3. CONTRACTORS SHALL VERIFY ALL DIMENSIONS AND CONDITIONS IN THE FIELD PRIOR TO FABRICATION AND ERECTION OF ANY MATERIAL. THE ENGINEER SHALL BE NOTIFIED OF ANY CONDITIONS WHICH PRECLUDE COMPLETION OF THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
4. ALL STEEL MATERIAL EXPOSED TO WEATHER SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 " ZINC (HOT–DIPPED GALVANIZED) COATINGS" ON IRON AND STEEL PRODUCTS.
5. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NONCONFORMING MATERIALS OR CONDITIONS FOR REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.

STEEL

1. MATERIAL:

WIDE FLANGE:	ASTM A572, GR 50
TUBING:	ASTM A500, GR C
PIPE:	ASTM A53, GR B
BOLTS:	ASTM A325
GRATING:	TYPE GW–2 (1"x3/16" BARS)
MISC. MATERIAL:	ASTM A36

   ALL STEEL SHAPES SHALL BE HOT–DIPPED GALVANIZED IN ACCORDANCE WITH ASTM A123 WITH A COATING WEIGHT OF 2 OZ/SF.

2. DAMAGED GALVANIZED SURFACES SHALL BE CLEANED WITH A WIRE BRUSH AND PAINTED WITH TWO COATS OF COLD ZINC, "GALVANOX", "DRY GALV", "ZINC IT", OR APPROVED EQUIVALENT, IN ACCORDANCE WITH MANUFACTURER'S GUIDELINES. TOUCH UP DAMAGED NON GALVANIZED STEEL WITH SAME PAINT IN SHOP OR FIELD.
3. DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO THE AISC "MANUAL OF STEEL CONSTRUCTION" 13TH EDITION.
4. THE STEEL STRUCTURE IS DESIGNED TO BE SELF–SUPPORTING AND STABLE AFTER COMPLETION. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE AND TO INSURE THE SAFETY OF THE BUILDING AND ITS COMPONENT PARTS DURING ERECTION.
5. ALL STEEL ELEMENTS SHALL BE INSTALLED PLUMB AND LEVEL.
6. TOWER MANUFACTURER'S DESIGNS SHALL PREVAIL FOR TOWER.

SITE GENERAL

1. CONTRACTOR SHALL FOLLOW CONDITIONS OF ALL APPLICABLE PERMITS AND WORK IN ACCORDANCE WITH OSHA REGULATIONS.
2. THESE PLANS DEPICT KNOWN UNDERGROUND STRUCTURES, CONDUITS, AND/OR PIPELINES. THE LOCATIONS FOR THESE ELEMENTS ARE BASED UPON THE VARIOUS RECORD DRAWINGS AVAILABLE. THE CONTRACTOR IS HEREBY ADVISED THAT THESE DRAWINGS MAY NOT ACCURATELY DEPICT AS–BUILT LOCATIONS AND OTHER UNKNOWN STRUCTURES. THE CONTRACTOR SHALL THEREFORE DETERMINE THE EXACT LOCATION OF EXISTING UNDERGROUND ELEMENTS AND EXCAVATE WITH CARE AFTER CALLING MARKOUT SERVICE AT 1–800–272–4480 48 HOURS BEFORE DIGGING, DRILLING OR BLASTING.
3. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC, FIBER OPTIC, AND OTHER UTILITIES WHERE ENCOUNTERED, SHALL BE PROTECTED AT ALL TIMES, AND WHERE REQUIRED FOR THE PROPER EXECUTION, SHALL BE RELOCATED AS DIRECTED BY ENGINEER. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR PIER DRILLING AROUND OR NEAR UTILITIES. CONTRACTOR SHALL HAND DIG UTILITIES AS NEEDED. CONTRACTOR SHALL PROVIDE, BUT IS NOT LIMITED TO, APPROPRIATE A) FALL PROTECTION, B) CONFINED SPACE ENTRY, C) ELECTRICAL SAFETY, AND D) TRENCHING AND EXCAVATION.
4. IF NECESSARY, RUBBISH, STUMPS, DEBRIS, STICKS, STONES, AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF LEGALLY.
5. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC, FIBER OPTIC, OR OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED, AND/OR CAPPED, PLUGGED OR OTHERWISE DISCONTINUED AT THE POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, SUBJECT TO THE APPROVAL OF THE CONSTRUCTION MANAGER.
6. CONTRACTOR IS RESPONSIBLE FOR REPAIRING OR REPLACING STRUCTURES OR UTILITIES DAMAGED DURING CONSTRUCTION.
7. CONTRACTOR SHALL PROTECT EXISTING PAVED AND GRAVEL SURFACES, CURBS, LANDSCAPE AND STRUCTURES AND RESTORE SITE OR PRE–CONSTRUCTION CONDITION WITH AS GOOD, OR BETTER, MATERIALS. NEW MATERIALS SHALL MATCH EXISTING THICKNESS AND TYPE.
8. THE CONTRACTOR SHALL SHORE ALL TRENCH EXCAVATIONS GREATER THAN 5 FEET IN DEPTH OR LESS WHERE SOIL CONDITIONS ARE DEEMED UNSTABLE. ALL SHEETING AND/OR SHORING METHODS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.
9. THE CONTRACTOR IS RESPONSIBLE FOR MANAGING GROUNDWATER LEVELS IN THE VICINITY OF EXCAVATIONS TO PROTECT ADJACENT PROPERTIES AND NEW WORK. GROUNDWATER SHALL BE DRAINED IN ACCORDANCE WITH LOCAL SEDIMENTATION AND EROSION CONTROL GUIDELINES.

EVERSOURCE ENERGY

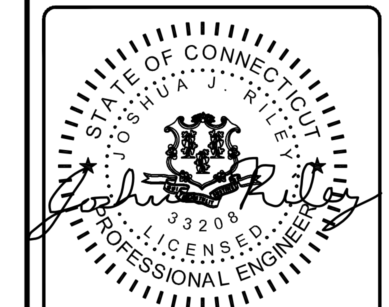
107 SELDEN STREET
BERLIN, CT 06037
PHONE: (800) 286–2000

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458–2522

PROJECT NO:	405025
DRAWN BY:	TYW
CHECKED BY:	TH

REV	DATE	DESCRIPTION
0	11/04/20	ISSUED FOR FILING



11/04/2020

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT.

HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE
NOTES & SPECIFICATIONS

SHEET NUMBER
N-1

ELECTRICAL

1. CONTRACTOR SHALL VERIFY EXISTING ELECTRIC SERVICE TYPE AND CAPACITY AND ORDER NEW ELECTRIC SERVICE FROM LOCAL ELECTRIC UTILITY, WHERE APPLICABLE.
2. ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH ALL APPLICABLE CODES, AND SHALL BE ACCEPTABLE TO ALL AUTHORITIES HAVING JURISDICTION. WHERE A CONFLICT EXISTS BETWEEN CODES, PLAN AND SPECIFICATIONS, OR AUTHORITIES HAVING JURISDICTION, THE MORE STRINGENT AUTHORITIES SHALL APPLY.
3. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, INSURANCE, EQUIPMENT, INSTALLATION, CONSTRUCTION TOOLS, TRANSPORTATION, ETC, FOR A COMPLETE AND PROPERLY OPERATIVE SYSTEM ENERGIZED THROUGHOUT AND AS INDICATED ON THE DRAWINGS AND AS SPECIFIED HEREIN AND/OR OTHERWISE REQUIRED.
4. ALL ELECTRICAL CONDUCTORS SHALL BE 100% COPPER AND SHALL HAVE TYPE THHN INSULATION UNLESS INDICATED OTHERWISE.
5. CONDUIT SHALL BE THREADED RIGID GALVANIZED STEEL OR EMT WITH ONLY COMPRESSION TYPE COUPLINGS AND CONNECTORS, ALL MADE UP WRENCH TIGHT.
6. ALL BURIED CONDUIT SHALL BE MINIMUM SCH 40 PVC UNLESS NOTED OTHERWISE, OR AS PER LOCAL CODE REQUIREMENTS.
7. PROVIDE FLEXIBLE STEEL CONDUIT OR LIQUID TIGHT FLEXIBLE STEEL CONDUIT TO ALL VIBRATING EQUIPMENT, INCLUDING HVAC UNITS, TRANSFORMERS, MOTORS, ETC, OR WHERE EQUIPMENT IS PLACED UPON A SLAB ON GRADE.
8. ALL BRANCH CIRCUITS AND FEEDERS SHALL HAVE A SEPARATE GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR BONDED TO ALL ENCLOSURES, PULLBOXES, ETC.
9. CONDUIT AND CABLE WITHIN CORRIDORS SHALL BE CONCEALED AND EXPOSED ELSEWHERE, UNLESS NOTED OTHERWISE.
10. ELECTRICAL MATERIALS INSTALLED ON ROOFTOP SHALL BE LISTED FOR NEMA 3R USE. –AND ALL WIRING WITHIN A VENTILATION DUCT SHALL BE LISTED FOR SUCH USE. IN GENERAL WIRING METHODS WITHIN A DUCT SHALL BE AN MC CABLE WITH SMOOTH OR CORRUGATED METAL JACKET AND HAVE NO OUTER COVERING OVER THE METAL JACKET. INTERLOCKED ARMOR TYPE OF MC CABLE IS NOT ACCEPTABLE FOR THIS APPLICATION. CONTRACTOR CAN ALSO USE TYPE MI CABLE IN THE VENTILATION DUCT PROVIDED IT DOES NOT HAVE ANY OUTER COVERINGS OVER THE METAL EXTERIOR.
11. WIRING DEVICES SHALL BE SPECIFICATION GRADE, AND WIRING DEVICE COVER PLATES SHALL BE PLASTIC WITH ENGRAVING AS SPECIFIED.
12. GROUNDING SYSTEM RESISTANCE SHALL BE MEASURED, RECORDED, AND DATED USING MEGGER DET14 OR SIMILAR INSTRUMENT. GROUND RESISTANCE SHALL NOT EXCEED 5 OHMS. IF THE RESISTANCE VALUE IS EXCEEDED, NOTIFY CONSTRUCTION MANAGER FOR FURTHER INSTRUCTION.
13. COORDINATE WITH BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK INVOLVING EXISTING SYSTEMS OR EQUIPMENT IN ORDER TO DETERMINE THE EFFECT, IF ANY, ON OTHER TENANTS WITHIN THE BUILDING, AND TO DETERMINE THE APPROPRIATE TIME FOR PERFORMING THIS WORK.
14. THE CONTRACTOR SHALL BE REQUIRED TO VISIT THE SITE PRIOR TO SUBMITTING BID IN ORDER TO DETERMINE THE EXTENT OF THE EXISTING CONDITIONS.
15. ALL CONDUCTOR ENDS SHALL BE TAGGED AND ELECTRICAL EQUIPMENT LABELED WITH ENGRAVED IDENTIFICATION PLATES.
16. CONTRACTOR IS RESPONSIBLE FOR ALL CONTROL WIRING AND ALARM TIE–INS.

GROUNDING

1. #6 THWN SHALL BE STRANDED #6 COPPER WITH GREEN THWN INSULATION SUITABLE FOR WET INSTALLATIONS.
2. #2 THWN SHALL BE STRANDED #2 COPPER WITH THWN INSULATION SUITABLE FOR WET INSTALLATIONS.
3. #2 BARE TINNED SHALL BE SOLID COPPER TINNED. ALL BURIED WIRE SHALL MEET THIS CRITERIA.
4. ALL LUGS SHALL BE 2–HOLE, LONG BARREL, TINNED SOLID COPPER UNLESS OTHERWISE SPECIFIED, LUGS SHALL BE THOMAS AND BETTS SERIES 548##BE OR EQUIVALENT (IE #2 THWN – 54856BE, #2 SOLID – 54856BE, AND #6 THWN – 54852BE).
5. ALL HARDWARE, BOLTS, NUTS, AND WASHERS SHALL BE 18–8 STAINLESS STEEL. EVERY CONNECTION SHALL BE BOLT–FLAT WASHER–BUSS–LUG–FLAT WASHER–BELLEVILLE WASHER–NUT IN THAT EXACT ORDER. BACK–TO–BACK LUGGING, BOLT–FLAT WASHER–LUG–BUSS–LUG–FLAT WASHER–BELLEVILLE WASHER–NUT, IN THAT EXACT ORDER, IS ACCEPTED WHERE NECESSARY TO CONNECT MANY LUGS TO A BUSS BAR. STACKING OF LUGS, BUSS–LUG–LUG, IS NOT ACCEPTABLE.
6. WHERE CONNECTIONS ARE MADE TO STEEL OR DISSIMILAR METALS, A THOMAS AND BETTS DRAGON TOOTH WASHER MODEL DTWXXX SHALL BE USED BETWEEN THE LUG AND THE STEEL, BOLT–FLAT WASHER–STEEL–DRAGON TOOTH WASHER–LUG–FLAT WASHER–BELEVILE WASHER–NUT.
7. ALL CONNECTIONS, INTERIOR AND EXTERIOR, SHALL BE MADE WITH THOMAS AND BETTS KPOR–SHIELD. COAT ALL WIRES BEFORE LUGGING AND COAT ALL SURFACES BEFORE CONNECTING.
8. THE MINIMUM BEND RADIUS SHALL BE 8 INCHES FOR #6 WIRE AND SMALLER AND 12 INCHES FOR WIRE LARGER THAN #6.
9. ALL CONNECTIONS TO THE GROUND RING SHALL BE EXOTHERMIC WELD.
10. BOND THE FENCE TO THE GROUND RING AT EACH CORNER, AND AT EACH GATE POST WITH #2 SOLID TINNED WIRE. EXOTHERMIC WELD BOTH ENDS.
11. GROUND KITS SHALL BE SOLID COPPER STRAP WITH #6 WIRE 2–HOLE COMPRESSION CRIMPED LUGS AND SHALL BE SEALED ACCORDING TO MANUFACTURER INSTRUCTIONS.
12. FERROUS METAL CLIPS WHICH COMPLETELY SURROUND THE GROUNDING CONDUCTOR SHALL BE USED.
13. GROUND BARS SHALL BE FURNISHED AND INSTALLED WITH PRE–DRILLED HOLE DIAMETERS AND SPACINGS. GROUND BARS SHALL NEITHER BE FIELD FABRICATED NOR NEW HOLES DRILLED. GROUND LUGS SHALL MATCH THE SPACING ON THE BAR. HARDWARE DIAMETER SHALL BE MINIMUM 3.8 INCH.
14. MGB GROUND CONNECTION SHALL BE EXOTHERMIC WELDED TO THE GROUND SYSTEM.
15. ALL CABLE TRAY AND/OR PLATFORM STEEL SHALL BE BONDED TOGETHER WITH JUMPERS (#6 IN EQUIPMENT ROOM, #2 ELSEWHERE AND HOMERUN).

CABLE TRAY

1. CABLE TRAY SHALL BE MADE OF EITHER CORROSION RESISTANT METAL OR WITH A CORROSION RESISTANT FINISH.
2. CABLE TRAY SHALL BE OF LADDER TRAY TYPE WITH FLAT COVER CLAMPED TO SIDE RAILS.
3. CABLE LADDER SHALL BE SIZED TO FIT ALL CABLES IN ACCORD WITH NEC AND NEMA 11–15–84.
4. CABLE LADDER TRAYS SHALL BE NEMA CLASS 12A BY PW INDUSTRIES, INC OR EQUAL.
5. CABLE LADDER TRAY SHALL BE SUPPORTED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
6. ALL WORKMANSHIP SHALL CONFORM TO THESE REQUIREMENTS AND ALL LOCAL CODES AND STANDARDS TO ENSURE SAFE AND ADEQUATE GROUNDING SYSTEM.

ANTENNA & CABLE NOTES

1. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL TRANSMISSION CABLES, JUMPERS, CONNECTORS, GROUNDING STRAPS, ANTENNAS, MOUNTS AND HARDWARE. ALL MATERIALS SHALL BE INSPECTED BY THE CONTRACTOR FOR DAMAGE UPON DELIVERY. JUMPERS SHALL BE SUPPLIED AT ANTENNAS AND EQUIPMENT INSIDE SHELTER COORDINATE LENGTH OF JUMP CABLES WITH EVERSOURCE. COORDINATE AND VERIFY ALL OF THE MATERIALS TO BE PROVIDED WITH EVERSOURCE PRIOR TO SUBMITTING BID AND ORDERING MATERIALS.
2. AFTER INSTALLATION, THE TRANSMISSION LINE SYSTEM SHALL BE PIM/SWEEP TESTED FOR PROPER INSTALLATION AND DAMAGE WITH ANTENNAS CONNECTED. CONTRACTOR TO OBTAIN LATEST TESTING PROCEDURES FROM EVERSOURCE PRIOR TO BIDDING.
3. ANTENNA CABLES SHALL BE COLOR CODED AT THE FOLLOWING LOCATIONS:
   - AT THE ANTENNAS.
   - AT THE WAVEGUIDE ENTRY PLATE ON BOTH SIDES OF THE EQUIPMENT SHELTER WALL.
   - JUMPER CABLES AT THE EQUIPMENT ENTER.
4. SYSTEM INSTALLATION:
   THE CONTRACTOR SHALL INSTALL ALL CABLES AND ANTENNAS TO THE MANUFACTURER'S SPECIFICATIONS. THE CONTRACTOR IS RESPONSIBLE FOR THE PROCUREMENT AND INSTALLATION OF THE FOLLOWING:
   - ALL CONNECTORS, ASSOCIATED CABLE MOUNTING, AND GROUNDING HARDWARE.
   - WALL MOUNTS, STANDOFFS, AND ASSOCIATED HARDWARE.
   - 1/2 INCH HELIAX ANTENNA JUMPERS OF APPROPRIATE LENGTHS.
5. MINIMUM BENDING RADIUS FOR COAXIAL CABLES:
   - 7/8 INCH, RMIN = 15 INCHES
   - 1 5/8 INCH, RMIN = 25 INCHES
6. CABLE SHALL BE INSTALLED WITH A MINIMUM NUMBER OF BENDS WHERE POSSIBLE. CABLE SHALL NOT BE LEFT UNTERMINATED AND SHALL BE SEALED IMMEDIATELY AFTER BEING INSTALLED.
7. ALL CABLE CONNECTIONS OUTSIDE SHALL BE COVERED WITH WATERPROOF SPLICING KIT.
8. CONTRACTOR SHALL VERIFY EXACT LENGTH AND DIRECTION OF TRAVEL IN FIELD PRIOR TO CONSTRUCTION.
9. CABLE SHALL BE FURNISHED WITHOUT SPLICES AND WITH CONNECTORS AT EACH END.

EVERSOURCE ENERGY

107 SELDEN STREET
BERLIN, CT 06037
PHONE: (800) 286–2000

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458–2522

PROJECT NO:	405025
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STATE OF CONNECTICUT
MARK P. STILES
34358
LICENSED PROFESSIONAL ENGINEER
11/04/2020

HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE

NOTES
& SPECIFICATIONS

SHEET NUMBER

N-2

SYMBOLS

●	EXOTHERMIC CONNECTION
■	COMPRESSION CONNECTION
	5/8"ø x10-'0" COPPER CLAD STEEL GROUND ROD.
	TEST GROUND ROD WITH INSPECTION SLEEVE
----	GROUNDING CONDUCTOR
(A)	KEY NOTES
CHAINLINK FENCE	—x—x—x—x—x—
WOOD FENCE	
LEASE AREA	— — — —
ICE BRIDGE	
CABLE TRAY	
GAS LINE	—G—G—G—G—G—
UNDERGROUND ELECTRICAL/TELCO	—E/T—E/T—E/T—E/T—
UNDERGROUND ELECTRICAL/CONTROL	—E/C—E/C—E/C—E/C—
UNDERGROUND ELECTRICAL	—E—E—E—E—E—
UNDERGROUND TELCO	—T—T—T—T—T—
PROPERTY LINE (PL)	

ABBREVIATIONS

AC	ALTERNATING CURRENT	MGB	MASTER GROUNDING BAR
AIC	AMPERAGE INTERRUPTION CAPACITY	MIN	MINIMUM
ANI	AUXILIARY NETWORK INTERFACE	MW	MICROWAVE
ATM	ASYNCHRONOUS TRANSFER MODE	MTS	MANUAL TRANSFER SWITCH
ATS	AUTOMATIC TRANSFER SWITCH	NEC	NATIONAL ELECTRICAL CODE
AWG	AMERICAN WIRE GAUGE	OC	ON CENTER
AWS	ADVANCED WIRELESS SERVICES	PP	POLARIZING PRESERVING
BATT	BATTERY	PCU	PRIMARY CONTROL UNIT
BBU	BASEBAND UNIT	PDU	PROTOCOL DATA UNIT
BTC	BARE TINNED COPPER CONDUCTOR	PWR	POWER
BTS	BASE TRANSCEIVER STATION	RECT	RECTIFIER
CCU	CLIMATE CONTROL UNIT	RET	REMOTE ELECTRICAL TILT
CDMA	CODE DIVISION MULTIPLE ACCESS	RMC	RIGID METALLIC CONDUIT
CHG	CHARGING	RF	RADIO FREQUENCY
CLU	CLIMATE UNIT	RUC	RACK USER COMMISSIONING
COMM	COMMON	RRH	REMOTE RADIO HEAD
DC	DIRECT CURRENT	RRU	REMOTE RADIO UNIT
DIA	DIAMETER	RWY	RACEWAY
DWG	DRAWING	SFP	SMALL FORM-FACTOR PLUGGABLE
EC	ELECTRICAL CONDUCTOR	SIAD	SMART INTEGRATED ACCESS DEVICE
EMT	ELECTRICAL METALLIC TUBING	SSC	SITE SOLUTIONS CABINET
FIF	FACILITY INTERFACE FRAME	T1	1544KBPS DIGITAL LINE
GEN	GENERATOR	TDMA	TIME-DIVISION MULTIPLE ACCESS
GPS	GLOBAL POSITIONING SYSTEM	TMA	TOWER MOUNT AMPLIFIER
GSM	GLOBAL SYSTEM FOR MOBILE	TVSS	TRANSIENT VOLTAGE SUPPRESSION SYSTEM
HVAC	HEAT/VENTILATION/AIR CONDITIONING	TYP	TYPICAL
ICF	INTERCONNECTION FRAME	UMTS	UNIVERSAL MOBILE TELECOMMUNICATION SYSTEM
IGR	INTERIOR GROUNDING RING (HALO)	UPS	UNINTERRUPTIBLE POWER SUPPLY (DC POWER PLANT)
LTE	LONG TERM EVOLUTION		

EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037
PHONE: (800) 286-2000

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458-2522

PROJECT NO:	405025
DRAWN BY:	TYW
CHECKED BY:	TH

REV	DATE	DESCRIPTION
0	11/04/20	ISSUED FOR FILING

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
11/04/2020

HARTFORD AWC
410 SHELDON ST
HARTFORD, CT 06106

SHEET TITLE
NOTES & SPECIFICATIONS

SHEET NUMBER

REFERENCE CUTSHEETS

220 MHz Antenna – Omnidirectional, Low-PIM/Hi-PIP, 2.9 dBd
Model DS2C03P36D-D

Specifications	
Design Type	True Corporate Feed
Frequency Range	216-222 MHz
Passive Intermodulation – PIM (2 x 20W sources)	-150 dBc, 3rd Order
Bandwidth	6 MHz
Gain - dBd (average over BW)	2.9 dBd
Isolation, min.	34 dB
Configuration	Dual antenna
Beam Tilt (electrical down-tilt)	None (0°)
Vertical Beamwidth (E-Plane)	30°
Impedance -- Ohms	50
VSWR / Return Loss -- dB	1.5 : 1 / 14 dB (min.)
Average Power Rating	500 W (each antenna)
Peak Instantaneous Power	25 kW (each antenna)
Polarization	Vertical
Lightning Protection	Direct Ground
Connector	7/16 DIN female
Equivalent Flat-Plate Area	3.1 sq. ft.
Lateral Wind-load Thrust @100mph	129 lbf.
Wind Speed rating	160 mph (without ice)
Total Length	18.5 feet
Mounting Mast Length	35 inches
Mounting Hardware (Included)	DSH3V4N
Top Sway Brace (Recommended if side mounting antennas on top)	DSH2H3S (order separately)
Mast O.D.	3.5 inches
Radome color	Horizon Blue
Radome O.D.	3.0 inches
Weight, antenna, and hardware	75 lbs. (approx.)
Shipping Weight	105 lbs. (approx.)
Invertibility	Antennas are physically invertible, but the patterns are optimized for upright mount.

Features and Benefits

Antennas from dbSpectra provide long term, trouble-free service in severe environments!

Design is tested to stringent Peak Instantaneous Power (PIP) levels of 25 KW using dbSpectra's 12-channel P25 PIP test bed. High PIP level is demanded by today's digital systems.

True Corporate Feed Array – provides for excellent gain and pattern consistency across a wider frequency range.

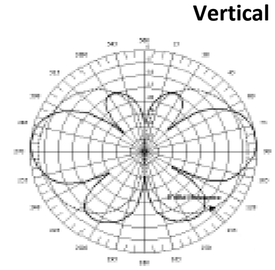
PIM Rated Design – better than -150 dBc.

Sturdy Construction – Heavy-wall fiberglass radome minimizes tip deflection.

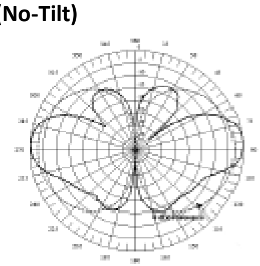
Excellent Lightning Protection – heavy internal conductor DC ground.

Radiation Pattern

Vertical (No-Tilt)

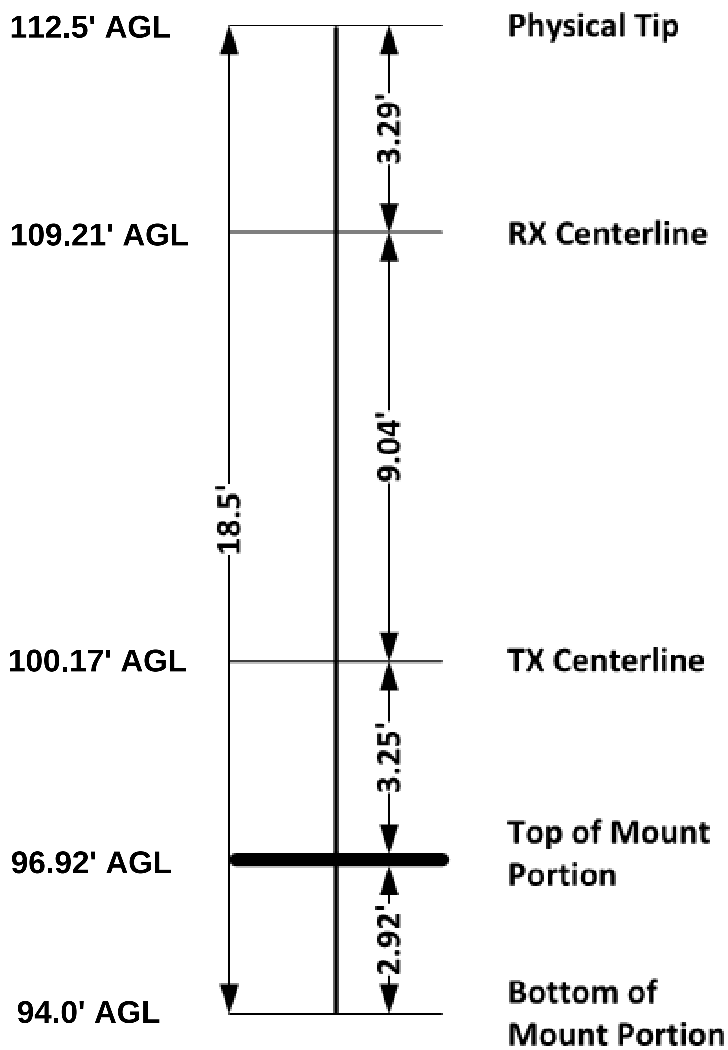


Top



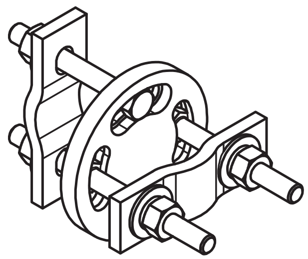
Bottom

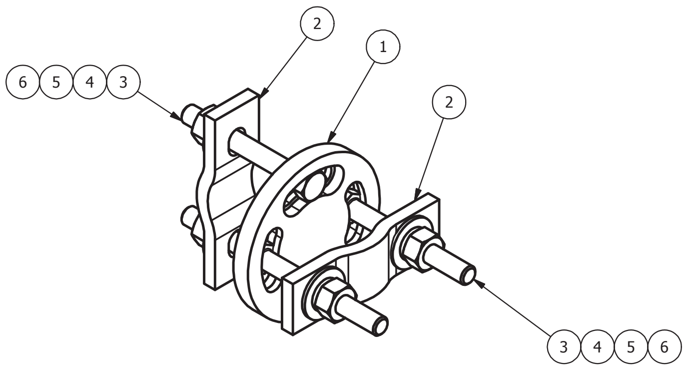
dBSpectra DS2C03P36 (18.5' Total)



TOWER/MAST SIZE AT PROPOSED ANTENNA ATTACHMENT = 1.25"± DIAMETER
A TOTAL OF (4) CLAMP PLATE TIE-BACK ASSEMBLIES REQUIRED
A TOTAL OF (2) PIPE 2 STD (2.375" OD) x 4'-0" LONG ASTM A53, GR. B PIPES REQUIRED
A TOTAL OF (4) HSS2.375X0.154 x 6'-0" LONG ASTM A500, GR. C HSS REQUIRED

PARTS LIST						
ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	2	X-123614	FLAT DISK CLAMP PLATE 3" CENTERS		1.52	3.03
2	4	X-116165	3" V-CLAMP		1.03	4.12
3	8	G1204	1/2" x 4" HDG HEX BOLT GR5 FULL THREAD	4 in	0.27	2.16
4	8	G12FW	1/2" HDG USS FLATWASHER		0.03	0.27
5	8	G12LW	1/2" HDG LOCKWASHER		0.01	0.11
6	8	G12NUT	1/2" HDG HEAVY 2H HEX NUT		0.07	0.57
					TOTAL WT. #	11.41





PROPRIETARY NOTE:
THE DATA AND TECHNIQUES CONTAINED IN THIS DRAWING ARE PROPRIETARY INFORMATION OF VALMONT INDUSTRIES AND CONSIDERED A TRADE SECRET. ANY USE OR DISCLOSURE WITHOUT THE CONSENT OF VALMONT INDUSTRIES IS STRICTLY PROHIBITED.

TOLERANCE NOTE:
TOLERANCES ON DIMENSIONS UNLESS OTHERWISE NOTED ARE (PLUS OR MINUS) MACHINING 0.030" AND STRUCTURAL 0.060". BENDS ARE (+ OR -) 1/2 DEGREE.

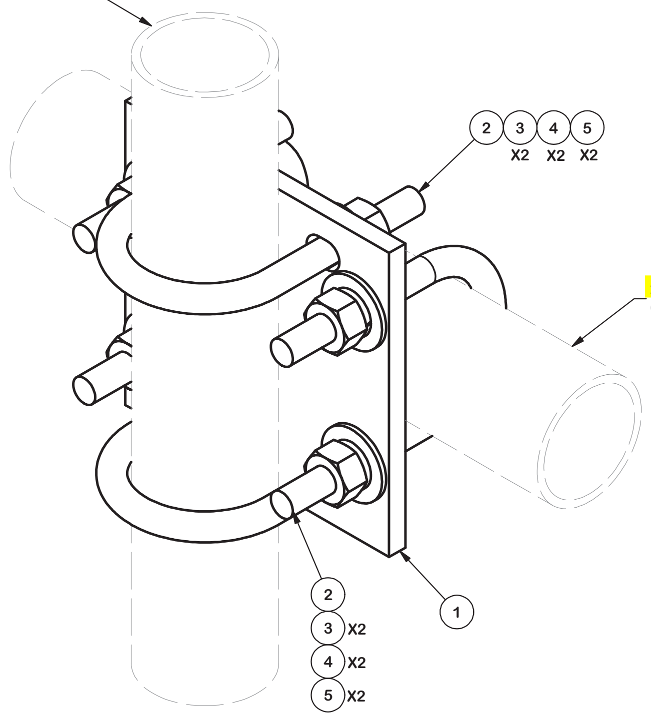
DESCRIPTION
ADJUSTABLE CLAMP PLATE
TIE-BACK ASSEMBLY

valmont STRUCTURES
1-877-467-4763 Plymouth, IN
1-888-880-9191 Salem, OR

DRAWN BY	CPD NO.	DRAWING USAGE	PART NO.
CEK 5/11/2011		CUSTOMER	PUCK3
ENG. APPROVAL	CHECKED BY BMC 5/11/2011		DWG. NO. PUCK3

A TOTAL OF (4) CROSSOVER PLATE KITS REQUIRED

PARTS LIST						
ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	1	SCX1	CROSSOVER PLATE 2-3/8" X 2-3/8"		3.71	3.71
2	4	X-UB1212	1/2" X 2-1/2" X 4-1/2" X 2" U-BOLT (HDG.)		0.63	2.50
3	8	G12FW	1/2" HDG USS FLATWASHER		0.03	0.27
4	8	G12LW	1/2" HDG LOCKWASHER		0.01	0.11
5	8	G12NUT	1/2" HDG HEAVY 2H HEX NUT		0.07	0.57
					TOTAL WT. #	7.16



REV	DESCRIPTION OF REVISIONS	CPD	BY	DATE
A	ADDED MISSING U-BOLT AND HRDWE		KC8	7/5/2012

REVISION HISTORY

TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES *(± 0.030")*
DRILLED AND GAS CUT HOLES *(± 0.030")* - NO CONING OF HOLES
LASER CUT EDGES AND HOLES *(± 0.010")* - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING *(± 0.030")*
ALL OTHER ASSEMBLY *(± 0.060")*

DESCRIPTION
CROSSOVER PLATE

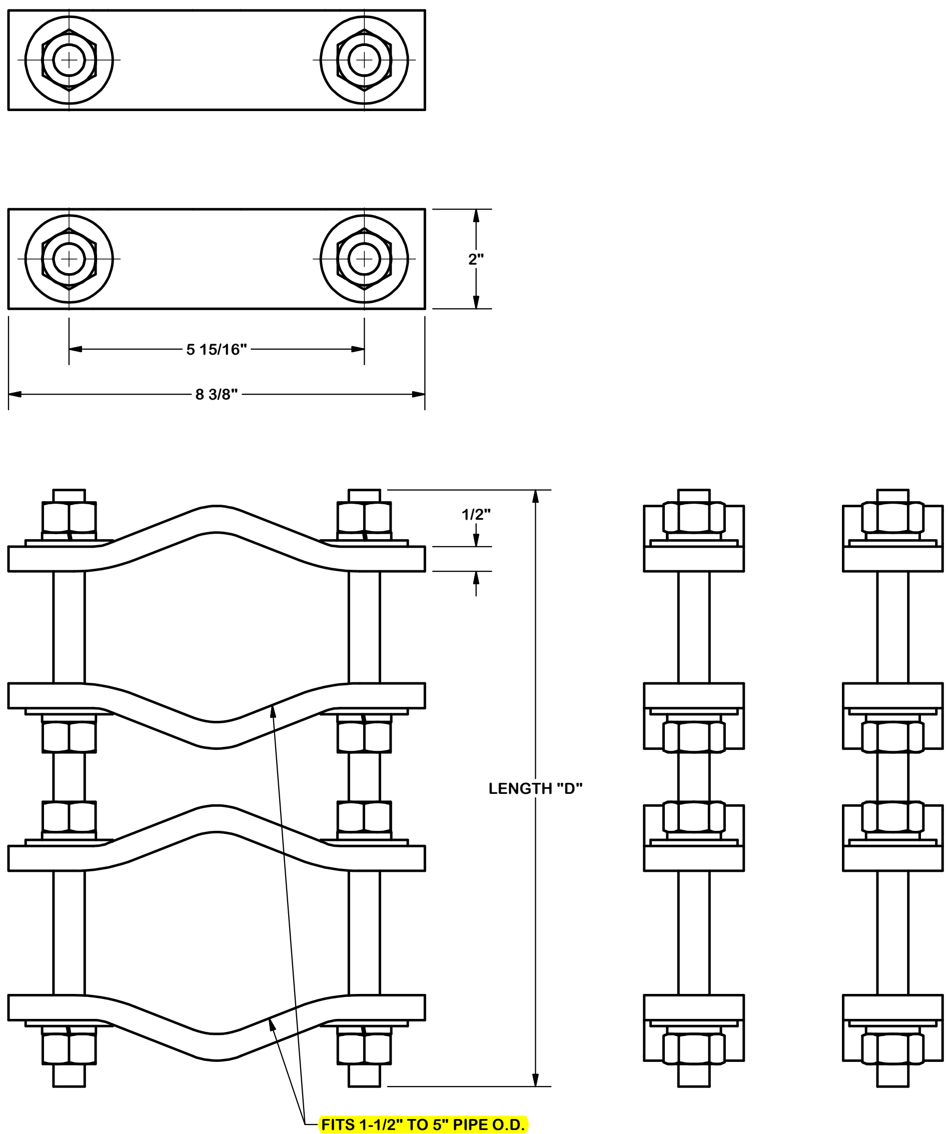
SITE PRO 1
A valmont COMPANY

Engineering Support Team:
1-888-753-7446

Locations:
New York, NY
Atlanta, GA
Los Angeles, CA
Plymouth, IN
Salem, OR
Dallas, TX

CPD NO.		DRAWN BY	ENG. APPROVAL	PART NO.
		CEK 6/30/2011		SCX1-K
CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.
81	01	CUSTOMER	CEK 8/23/2012	SCX1-K

A TOTAL OF (2) CLAMP SETS REQUIRED, ONE SET PER RELOCATED OMNI ANTENNA

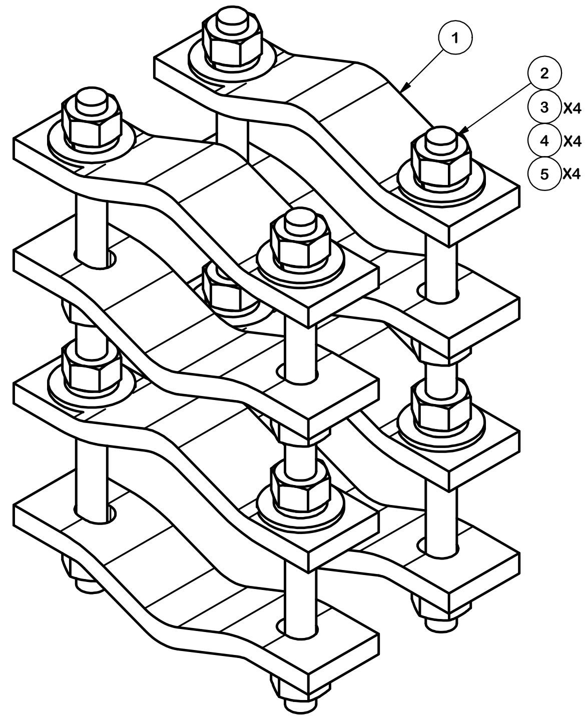


PARTS LIST

ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	8	DCP	CLAMP HALF, 1/2" THICK, 8-3/8"		2.40	19.20
2	B	C	5/8" THREADED ROD	D	E	F
3	16	G58NUT	5/8" HDG HEAVY 2H HEX NUT		0.13	2.08
4	16	G58LW	5/8" HDG LOCKWASHER		0.03	0.42
5	16	G58FW	5/8" HDG USS FLATWASHER		0.07	1.13

VARIABLE PARTS TABLE

ASSEMBLY "A"	QTY "B"	PART "C"	LENGTH "D"	UNIT WT. "E"	NET WT. "F"	TOTAL WEIGHT
DCP12K	4	G58R-12	12"	1.05	4.18	27.01
DCP18K	4	G58R-18	18"	1.57	6.27	29.10



TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES *(± 0.030")*
DRILLED AND GAS CUT HOLES *(± 0.030")* - NO CONING OF HOLES
LASER CUT EDGES AND HOLES *(± 0.010")* - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING *(± 0.030")*
ALL OTHER ASSEMBLY *(± 0.060")*

DESCRIPTION
PIPE TO PIPE CLAMP SET
1-1/2" TO 5" PIPE
1/2" THICK CLAMP

SITE PRO 1
A valmont COMPANY
Engineering Support Team: 1-888-753-7446
Locations:
New York, NY
Atlanta, GA
Los Angeles, CA
Plymouth, IN
Salem, OR
Dallas, TX

CPD NO.	DRAWN BY	ENG. APPROVAL	PART NO.
	KC8 8/21/2012		SEE ASSEMBLY "A"

CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.
81	01	CUSTOMER	CEK 1/22/2013	DCPxxK

ATTACHMENT D – PROOF OF DELIVERY OF NOTICE

Ref: ES-090 HARTFORD Date: 07Jan21 SHIPPING: 0.00
Dep: BL GRAPHICS Wgt: 2.65 LBS SPECIAL: 0.00
HANDLING: 0.00
DV: 0.00 TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT
TRCK: 9151 3346 9900

ORIGIN ID:RSPA (800) 301-3077
BL COMPANIES
355 RESEARCH PARKWAY
MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 07JAN21
ACTWGT: 2.65 LB
CAD: 0765627/CAFE3407
BILL THIRD PARTY

TO **HONORABLE LUKE BRONIN MAYOR**
CITY OF HARTFORD
550 MAIN STREET, ROOM 200

HARTFORD CT 06103

REF: ES-090 HARTFORD
DEPT: BL GRAPHICS

56DC1/1136/05A2

FedEx Express

E

J201019110601uv

FRI - 08 JAN 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **9151 3346 9900**

00 KXAA

06103
CT-US **BDL**

Part # 156148-434 RIT EXP 09/21

Ref: ES-090 HARTFORD Date: 07Jan21 SHIPPING: 0.00
Dep: BL GRAPHICS Wgt: 2.65 LBS SPECIAL: 0.00
HANDLING: 0.00
DV: 0.00 TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT
TRCK: 9151 3346 9911

ORIGIN ID:RSPA (800) 301-3077

BL COMPANIES
355 RESEARCH PARKWAY

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 07JAN21
ACTWGT: 2.65 LB MAN
CAD: 0765627/CAFE3407

BILL THIRD PARTY

56DC1/1136/05A2

TO **AIMEE CHAMBERS, AICP DIRECTOR OF PL**
CITY OF HARTFORD
260 CONSTITUTION PLAZA, 1ST FLOOR

HARTFORD CT 06103
REF: ES-090 HARTFORD
DEPT: BL GRAPHICS

FedEx
Express

E

J201019110601uv

FRI - 08 JAN 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **9151 3346 9911**

00 KXAA

06103
CT-US **BDL**

Part # 156148-434 RIT EXP 08/21

Ref: ES-090 HARTFORD Date: 07Jan21 SHIPPING: 0.00
Dep: BL GRAPHICS Wgt: 2.65 LBS SPECIAL: 0.00
HANDLING: 0.00
DV: 0.00 TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT
TRCK: 9151 3346 9922

ORIGIN ID:RSPA (800) 301-3077
BL COMPANIES
355 RESEARCH PARKWAY
MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 07JAN21
ACTWGT: 2.65 LB MAN
CAD: 0765627/CAFE3407

BILL THIRD PARTY

56DC1/1136/05A2

TO

CONNECTICUT SITING COUNCIL
10 FRANKLIN SQUARE

NEW BRITAIN CT 06051
REF: ES-090 HARTFORD
DEPT: BL GRAPHICS

FedEx
Express
E
J201019110601uv

FRI - 08 JAN 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **9151 3346 9922**

00 BDLA

06051
CT-US **BDL**

Part # 156148-434 RIT EXP 09/21

ATTACHMENT E – POWER DENSITY REPORT

C Squared Systems, LLC
65 Dartmouth Drive
Auburn, NH 03032
603-644-2800
support@csquaredsystems.com

Calculated Radio Frequency Emissions Report

ES-090 – Hartford AWC

410 Sheldon Street

Hartford, CT 06106

November 23, 2020

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed Eversource installation on the roof-mounted tower at 410 Sheldon Street in Hartford, CT. Eversource is proposing to install one omnidirectional antenna as part of its 220 MHz communications system. The proposed antenna contains two internally stacked antennas, the upper antenna will be receive-only while the lower antenna will be transmit-only.

This report considers the proposed antenna configuration as detailed by Eversource along with % MPE (Maximum Permissible Exposure) measurements around the existing tower to determine FCC compliance of the facility.

Figure 1: View of ES-090 Hartford AWC

Site Address	410 Sheldon Street
Latitude	41° 45' 32.7" N
Longitude	72° 39' 57.2" W
Site Elevation AMSL	32’
Survey Engineer	Marc Salas
Survey Date/Time	6/17/2020; 7:00 AM – 7:30 AM

Table 1: Survey Information

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include Maximum Permissible Exposure (MPE) limits for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based upon those recommended by the National Council on Radiation Protection and Measurements (NCRP), developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

The FCC general population/uncontrolled limits set the maximum exposure to which most people may be subjected. General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

Higher exposure limits are permitted under the occupational/controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure, and they must be able to exercise control over their exposure. General population/uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals. Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population/uncontrolled exposure and for occupational/controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

3. Power Density Calculation Methods

The power density calculation results were generated using the following formula as outlined in FCC bulletin OET 65, and Connecticut Siting Council recommendations:

$$\text{Power Density} = \left(\frac{1.6^2 \times 1.64 \times \text{ERP}}{4\pi \times R^2}\right) \text{X Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power = 1.64 x ERP

R = Radial Distance = $\sqrt{(H^2 + V^2)}$

H = Horizontal Distance from antenna

V = Vertical Distance from radiation center of antenna

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and full power, and that all antenna channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not consider actual terrain elevations which could attenuate the signal. As a result, the calculated power density and corresponding % MPE levels reported below are much higher than the actual levels will be from the final installation.

4. Proposed Antenna Configuration

Table 2 below lists the technical details of the proposed Eversource installation. These parameters are applied to the above calculation methods in order to calculate the % MPE values of the proposed equipment. Any proposed receive-only antennas have not been included in the table as they are irrelevant in terms of the % MPE calculations.

Operator	Antenna Model	TX Freq. (MHz)	Ant Gain (dBd)	Power ERP (Watts)	Number of Channels	Vertical Beamwidth	Length (ft)	Antenna Centerline Height (ft)
Eversource	dbSpectra DS2C03P36D-D	217	2.9	124	4	30	18.5	100.2

Table 2: Eversource Antenna Configuration (Proposed)[2] [3]

[2] Transmit power assumes 0 dB of cable loss.

[3] Transmit antenna height listed for the proposed installation is based on the Black & Veatch Structural Analysis Report dated October 14, 2020 and the overall length of the antenna. The proposed antenna consists of two internally stacked antennas – upper is for receive, lower is for transmit. Due to the unavailability of the digital pattern for this specific antenna, the pattern of a similar antenna was substituted in the calculations.

5. Measurement Procedure

Frequencies from 300 KHz to 50 GHz were measured using the Narda Probe EA 5091, E-Field, shaped, FCC probe in conjunction with the NBM550 survey meter. The EA 5091 probe is "shaped" such that in a mixed signal environment (i.e.: more than one frequency band is used in a particular location), it accurately measures the percent of MPE.

From FCC OET Bulletin No. 65 - Edition 97-01 – "A useful characteristic of broadband probes used in multiple-frequency RF environments is a frequency-dependent response that corresponds to the variation in MPE limits with frequency. Broadband probes having such a "shaped" response permit direct assessment of compliance at sites where RF fields result from antennas transmitting over a wide range of frequencies. Such probes can express the composite RF field as a percentage of the applicable MPEs".

Probe Description - As suggested in FCC OET Bulletin No. 65 - Edition 97-01, the response of the measurement instrument should be essentially isotropic, (i.e., independent of orientation or rotation angle of the probe). For this reason, the Narda EA 5091 probe was used for these measurements.

Sampling Description - At each measurement location, a spatially averaged measurement is collected over the height of an average human body. The NBM550 survey meter performs a time average measurement while the user slowly moves the probe over a distance range of 20 cm to 200 cm (about 6 feet) above ground level. The results recorded at each measurement location include average values over the spatial distance.

Instrumentation Information - A summary of specifications for the equipment used is provided in the table below.

Manufacturer	Narda Microwave			
Probe	EA 5091, Serial# 01116			
Calibration Date	May 2020			
Calibration Interval	24 Months			
Meter	NBM550, Serial# E-1069			
Calibration Date	May 2020			
Calibration Interval	24 Months			
Probe Specifications	**Frequency Range**	**Field Measured**	**Standard**	**Measurement Range**
	300 KHz-50 GHz	Electric Field	U.S. FCC 1997 Occupational/Controlled	0.2 – 600 % of Standard

Table 3: Instrumentation Information

Instrument Measurement Uncertainty - The total measurement uncertainty of the NARDA measurement probe and meter is no greater than ±3 dB (0.5% to 6%), ±1 dB (6% to 100%), ±2 dB (100% to 600%). The factors which contribute to this include the probe's frequency response deviation, calibration uncertainty, ellipse ratio, and isotropic response[4]. Every effort is taken to reduce the overall uncertainty during measurement collection including pointing the probe directly at the likely highest source of emissions.

[4] For further details, please refer to Narda Safety Test Solutions NBM550 Probe Specifications, pg. 64 http://www.narda-sts.us/pdf_files/DataSheets/NBM-Probes_DataSheet.pdf

6. Surveyed and Calculated % MPE Results

Measured and calculated results and a description of each survey location are detailed in the table below. Measurements were recorded on June 17, 2020 between 7:00 AM and 7:30 AM. The calculated % MPE contribution from the proposed equipment modifications was then added to the measured % MPE values in the “Composite % MPE” column. These calculated values incorporate the antenna pattern of the antenna model specified by Eversource to determine the “Off Beam Loss” factor shown in the power density formula from Section 3. All % MPE values are in reference to the FCC Uncontrolled/General Population exposure limit.

Table 4 below lists 17 measurements recorded in the vicinity of the tower. The highest spatially averaged measurement was 4.57% (Average Uncontrolled / General Population MPE) and was recorded at Location 9, below the existing tower. The highest composite (measured + calculated) % MPE value is calculated to be 5.37% (Average Uncontrolled / General Population) and is calculated to occur at location 6, within the northwestern parking area.

Meas. Location	Location Description	Latitude	Longitude	Dist. From Site (feet)	Measured % MPE (Uncontrolled / General)	Calculated % MPE (Eversource Proposed)	Composite % MPE (Uncontrolled / General)
1	Northwest Parking Area	41.7593	-72.6666	202	< 1.00%	0.82%	< 1.82%
2	Northwest Parking Area	41.7594	-72.6667	255	< 1.00%	0.76%	< 1.76%
3	Northwest Parking Area	41.7596	-72.6668	313	2.77%	0.63%	3.41%
4	Northwest Parking Area	41.7598	-72.6667	343	3.02%	0.57%	3.58%
5	Northwest Parking Area	41.7598	-72.6664	306	3.57%	0.67%	4.24%
6	**Northwest Parking Area**	**41.7597**	**-72.6662**	**225**	**4.49%**	**0.88%**	**5.37%**
7	Southeast Vehicle Gate	41.7588	-72.6660	104	2.71%	0.20%	2.91%
8	Below Tower	41.7589	-72.6659	78	3.81%	0.04%	3.85%
9	**Below Tower**	**41.7589**	**-72.6658**	**58**	**4.57%**	**0.09%**	**4.67%**
10	Southeast Paved Area	41.7587	-72.6657	135	2.11%	0.56%	2.67%
11	Southeast Paved Area	41.7588	-72.6654	170	2.78%	0.84%	3.62%
12	Southeast Paved Area	41.7584	-72.6655	258	< 1.00%	0.78%	< 1.78%
13	Southeast Paved Area	41.7584	-72.6649	362	3.66%	0.55%	4.22%
14	Southeast Paved Area	41.7582	-72.6647	460	3.38%	0.38%	3.76%
15	Intersection of Sheldon St and Van Dyke Ave	41.7582	-72.6656	345	3.42%	0.57%	3.99%
16	The Open Hearth Northeast Entrance	41.7585	-72.6662	217	3.08%	0.78%	3.85%
17	Sheldon St Access to Lower Parking Lot	41.7591	-72.6668	240	3.38%	0.76%	4.14%

Table 4: Measured and Calculated % MPE Results [5]

[5] Due to measurement uncertainty at low levels (See Table 3), any readings outside the measurement range of the probe (< 1.00 % FCC General Population/Uncontrolled MPE) are noted as such.

Figure 2 below is an aerial view[6] of the tower location and the surrounding area, along with the measurement locations listed in Table 4.

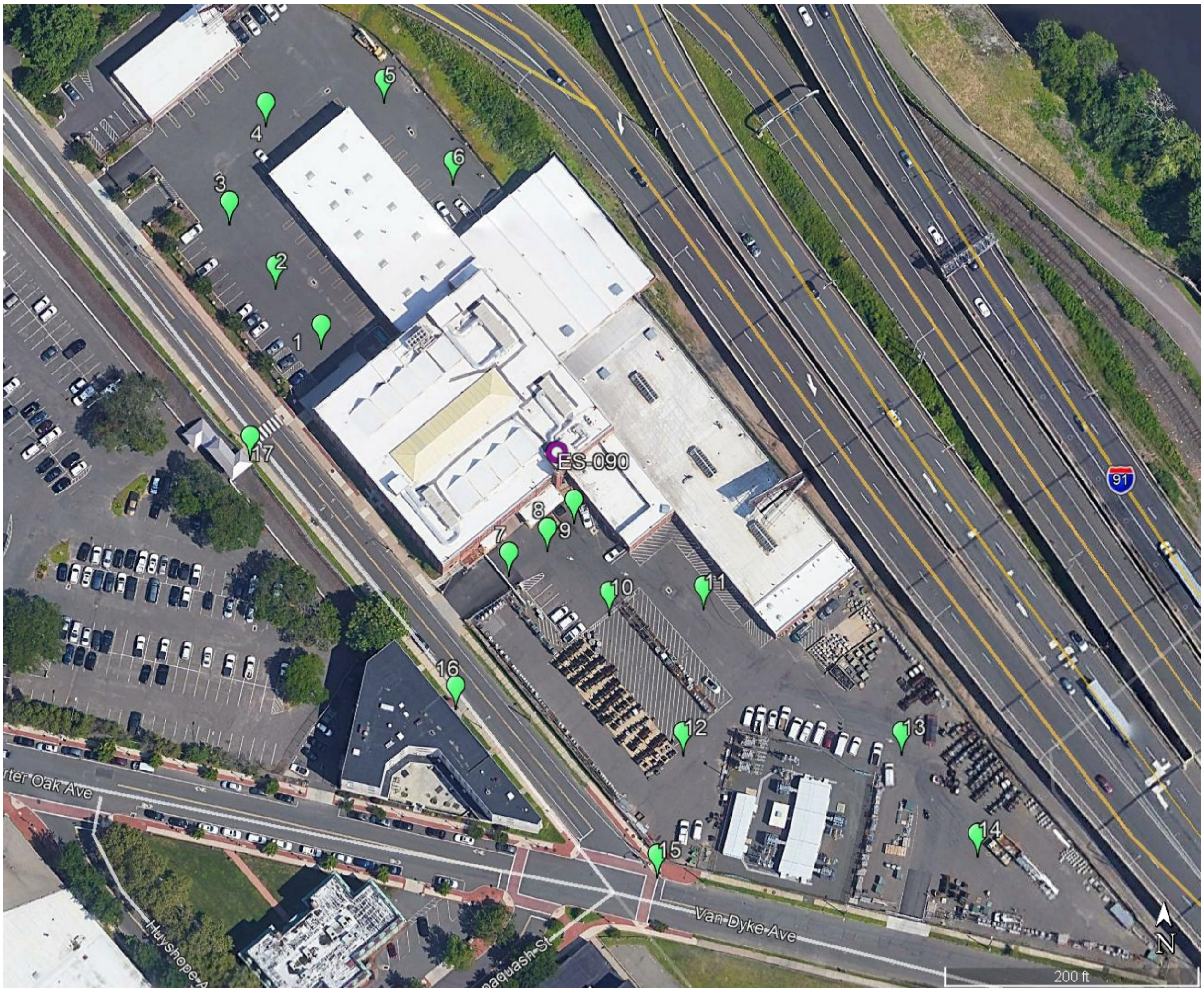


Figure 2: Measurement Points

[6] Map showing location of telecommunications facility and the surrounding area. *Google Earth*, https://earth.google.com/web/.

7. Conclusion

A number of accessible areas around the tower at 410 Sheldon Street in Hartford, CT were surveyed and found to be well within the mandated General Population/Uncontrolled limits for Maximum Permissible Exposure, as delineated in the Federal Communications Commission's Radio Frequency exposure rules published in 47 CFR 1.1307(b)(1)-(b)(3).

The highest spatially averaged % MPE measurement of all surveyed points based on the 1997 FCC standard for exposure to the general population is 4.57% MPE. This measurement was recorded at Location 9 below the proposed antenna.

The highest composite (measured + calculated) power density is **5.37% of the FCC General Population MPE limit** with the proposed Eversource equipment is calculated to occur at Location 6 in the northwestern parking area.

The above analysis concludes that RF exposure at ground level around the tower, both currently and with the proposed antenna installation, will be below the maximum power density limits as outlined by the FCC in the OET Bulletin 65 Ed. 97-01.

As noted previously, the calculated % MPE levels are more conservative (higher) than the actual levels will be from the finished installation.

8. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in FCC OET Bulletin 65 Edition 97-01, IEEE Std. C95.1, and IEEE Std. C95.3.

Report Prepared By:	Marc Salas RF Engineer C Squared Systems, LLC	November 23, 2020 Date
Reviewed/Approved By:	Keith Vellante Director of RF Services C Squared Systems, LLC	November 23, 2020 Date

Attachment A: References

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

IEEE C95.1-2005, IEEE Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz IEEE-SA Standards Board

IEEE C95.3-2002 (R2008), IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz-300 GHz IEEE-SA Standards Board

Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure[7]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population/Uncontrolled Exposure[8]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f = frequency in MHz * Plane-wave equivalent power density

Table 5: FCC Limits for Maximum Permissible Exposure (MPE)

[7] Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure

[8] General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure

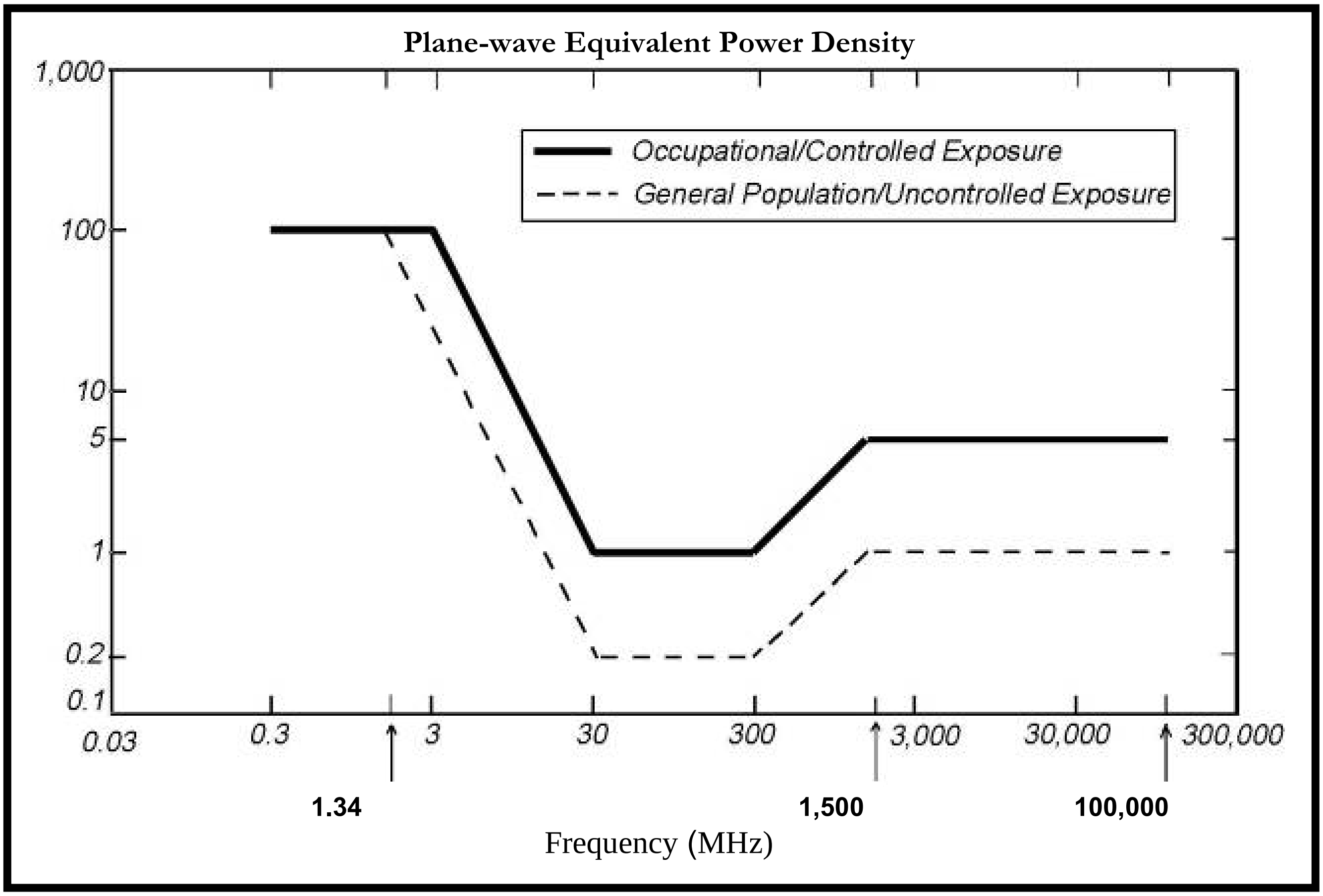
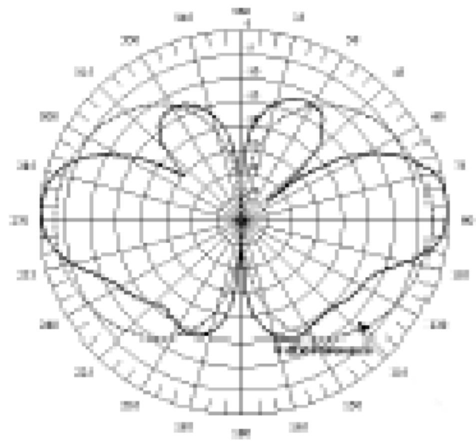


Figure 3: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Eversource Antenna Data Sheet and Electrical Patterns

217 MHz Manufacturer: dbSpectra Model #: DS2C03P36D-D Frequency Band: 216 - 222 MHz Gain: 2.9 dBd Vertical Beamwidth: 30° Horizontal Beamwidth: 360° Polarization: Vertical-Polarization Length: 18.5’	

ATTACHMENT F – STRUCTURAL ANALYSIS OF EXISTING BUILDING

BLACK & VEATCH
Building a world of difference.
BLACK & VEATCH CORPORATION
6800 W 115TH ST, SUITE 2292, OVERLAND PARK, KS 66211
+1 913-458-2522 | RILEYJJ@BV.COM

October 26, 2020

STRUCTURAL ANALYSIS EVALUATION LETTER

Site Number: 25225 (OH0016)
Site Name: HARTFORD AWC
Site Address: 410 Sheldon Street; Hartford, CT 06106

Project Number: 403093.200.2200
Project Name: LMR EPC Phase 2.1

Black & Veatch Corporation is pleased to submit this "Structural Analysis Evaluation Letter" to determine the impact to the structural integrity as stated in the Previous Rooftop Structural Analysis, dated October 26, 2020, of the above-mentioned site. The change in loading for this equipment installation is described in the Final Tower Structural Analysis, dated October 14, 2020, and the Rev. B Construction Drawings, dated October 26, 2020.

The reactions of the mast of the tower have increased slightly. However, by a calculation comparison, the change in stress ratios of the roof structural supports under the tower mast increased slightly. The Previous Rooftop Structural Analysis had an overall mast stress ratio of 78.6%, the current overall stress ratio of those same structural supports after the change in loading is around 80%.

The reactions of the guy anchors of the tower have fluctuated slightly. Any increase in the guy anchor reactions was considered insignificant when compared to the reactions utilized in the Previous Rooftop Structural Analysis.

By engineering judgment, the proposed loading will have minimal effect on the structural capacity as stated in the Previous Rooftop Structural Analysis.

This Structural Letter is based on the following conditions:

- All existing structural members are in good condition.
- Contractor shall be responsible for the means and methods of construction.
- Contractor shall inspect the condition of all relevant members and connections and report any deficiencies to the engineer prior to installation of any new antennas and other equipment.

This document was prepared based on information provided to Black & Veatch. If existing conditions do not reflect those represented, this document is no longer valid.

Please contact Joshua J. Riley in our Overland Park Office at 913-458-2522 if you have any questions or comments.

Sincerely,
Black & Veatch Corporation

Prepared By: Logan M. Meyer, P.E.
Submitted By: Joshua J. Riley, P.E.

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED
PROFESSIONAL ENGINEER

11/17/2020

STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE

HARTFORD AWC
410 SHELDON STREET
HARTFORD, CT 06106

B&V PROJECT NO. 403093.2000.2200
PROJECT NAME: LMR EPC PHASE 2.1

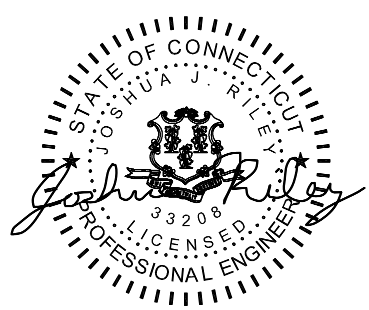
PREPARED FOR

EVERSOURCE ENERGY

107 SELDEN STREET
BERLIN, CT 06037

BLACK & VEATCH CORPORATION
6800 WEST 115TH ST, SUITE 2292
OVERLAND PARK, KANSAS 66211

October 26, 2020



11/17/2020

Joshua J. Riley, P.E.
Professional Engineer

TABLE OF CONTENTS

1. PURPOSE

The purpose of this calculation is to evaluate the existing building rooftop structure under existing and proposed loading configuration.

2. REFERENCES

A. 2018 Connecticut State Building Code

B. International Building Code, IBC 2015

C. Structural Standard for Antenna Supporting Structures and Antennas, TIA-222-H

D. American Society of Civil Engineers, ASCE 7-10

E. American Institute of Steel Construction, 14th Edition

F. American Concrete Institute, ACI 318-11

G. Steel Designer's Manual - 6th Edition (2003)

H. Original Building Drawings were design in August 1928

I. Structural Analysis Completed by Centek Engineering, dated 10/18/2011

J. Construction Drawings (Rev. 2) Completed by Centek Engineering, dated 10/18/2011

K. Site Survey Report Completed by Black & Veatch Corp., dated 9/28/2018

L. Preliminary Structural Analysis Completed by Black & Veatch Corporation, dated 5/27/2020 (See Results Attached)

M. Construction Drawings (Rev. A) Completed by Black & Veatch Corporation, dated 2/14/2020

N. Site Photos

3. ASSUMPTIONS

- The material grade of steel WF is assumed to be A9 (Building) (fy =33 ksi, fu = 60 ksi) for original drawings based on historical ASTM Specifications for Structural Shapes before year 1928.

- Compressive strength of concrete for encased concrete beam is assumed to be 3000 psi for original building.

- The existing steel beam with encased concrete beam is assumed to be located at center of concrete beam.

- The existing column and foundation of building are adequate to support the final loading configuration. Therefore, the proposed equipment on the Guyed Tower will not have significant adverse effect on the existing column and foundation of building.

- All other Assumptions listed within this report.

4. CONCLUSION

Design Criteria based on: **2018 Connecticut State Building Code**

Wind			**Ice**		
Wind Speed:	135	mph	Ice Thickness:	1.00	inch
Exposure Category:	C		Ice Wind:	50	mph
Topographic Factor K_{zt}:	1.00				
Risk Category:	III		**Seismic**	(Neglect)	
Snow			Seismic Importance Factor, I_p:	1.00	
Ground Snow Load:	30	psf	Seismic S_{DS}:	0.192g	
Importance Factor, I_s:	1.10		Seismic Design Category:	B	

4.1 Structural Analysis of Existing Building Rooftop Structure

Governing Load Combination:	1.2DL + 1.0IDL + 1.0IWL (30 DEG) + 0.5SLN
Max. Bending Stress Ratio on W16x36 (Tower Mast) with Encased Concrete Beam	78.6%
Governing Load Combination:	1.2DL + 1.0IDL + 1.0IWL (60 DEG) + 0.5SLN
Max. Shear Stress Ratio on W16x36 (Tower Mast)	24.8%
Governing Load Combination:	1.2DL + 1.6SLN + 0.5WL
Max. Bending Stress Ratio on W12x26 (Anchor A)	77.7%
Governing Load Combination:	1.2DL + 1.6SLN + 0.5WL
Max. Shear Stress Ratio on W12x26 (Anchor A)	24.8%
Governing Load Combination:	1.2DL + 1.6SLN + 0.5WL
Max. Bending Stress Ratio on W12x22 (Anchor B) with Encased Concrete Beam	76.5%
Governing Load Combination:	1.2DL + 1.6SLN + 0.5WL
Max. Shear Stress Ratio on W12x22 (Anchor B)	19.8%
Governing Load Combination:	1.2DL + 1.0IDL + 1.0IWL + 0.5SLN
Max. Stress Ratio on W10x12 Strut Beam (Anchor B)	6.6%
Governing Load Combination:	1.2DL + 1.6SLN + 0.5WL
Max. Bending Stress Ratio on W12x22 (Anchor C) with Encased Concrete Beam	88.8%
Governing Load Combination:	1.2DL + 1.6SLN + 0.5WL
Max. Shear Stress Ratio on W12x22 (Anchor C)	20.8%
Governing Load Combination:	1.2DL + 1.0IDL + 1.0IWL + 0.5SLN
Max. Stress Ratio on W10x12 Strut Beam (Anchor C)	5.6%
The Existing Building Rooftop Result:	**SUFFICIENT**

4. CONCLUSION (CONTINUED)

4.2 Disclaimers

This calculation is based on the loading and equipment position provided by client. If the installed loading and/or equipment position are different from the calculation, the calculation is considered invalid.

This certification assumes that all structural members are in good condition. Contractor shall inspect the condition of all relevant members and connectors and report any perceived deficiencies to the engineer prior to installation of any new equipment.

The contractor shall be responsible for the means and methods of construction. It is contractor's responsibility to provide necessary intermediate or temporary support during construction.

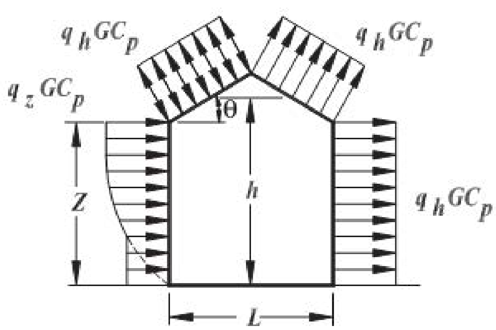
This analysis is based on the previously stated assumptions. Contractor should verify the validity of the assumptions prior to construction. If those assumptions are incorrect this analysis is invalid, and the contractor shall cease work and contact the EOR immediately.

- WIND LOADS ON BUILDINGS - MWFRS (DIRECTIONAL PROCEDURE)

Basic Wind Speed, V		=	135	mph
Exposure Category		=	C	
Velocity Pressure Exposure Coefficient, Kz = 2.01 $(z/z_g)^{2/\alpha}$		=	1.06	
Topographic Factor, Kzt		=	1.00	
Wind Directionality Factor, Kd		=	0.85	
qz = qh = 0.00256 Kz Kzt Kd V^2		=	42.14	psf
Gust Effect Factor, G		=	0.85	
Angle of Roof		=	0	degree
Height of building, z or h		=	43.6	ft
Width of Building, B		=	158.0	ft
Length of Building, L		=	169.7	ft

- ENCLOSED AND PARTIALLY ENCLOSED RIGID BUILDING : WALL & ROOFS

h/L		=	0.26	< 0.50
External Pressure Coefficient, Cp (Windward Wall)		=	0.80	All values
External Pressure Coefficient, Cp (Leeward Wall)		=	-0.50	L/B
Roof Pressure Coefficient for θ < 10				
External Pressure Coefficient, Cp	(Fig. 27.4.1)	=	-0.90	
		=	-0.18	
Internal Pressure Coefficient, GCpi	(Table 26.11-1)	=	0.18	Internal (+)
		=	-0.18	Internal (-)



ELEVATION

BLACK & VEATCH

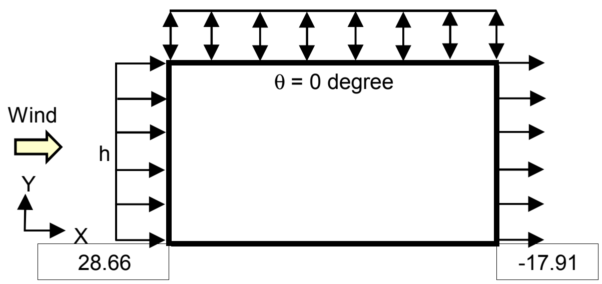
Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Project:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

Case I) Wind Apply to Risa

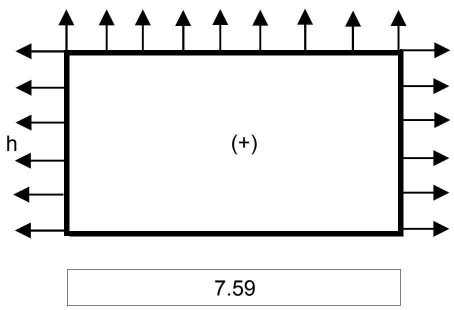
p = q*G*Cp - qi*(GCpi)

p1	= 42.14*0.85*0.8 - 42.14*0.18	=	21.07	psf
p2	= 42.14*0.85*-0.5 - 42.14*0.18	=	-25.49	psf
p uplift	= 42.14*0.85*-0.9 - 42.14*0.18	=	-39.82	psf
p uplift	= 42.14*0.85*-0.18 - 42.14*0.18	=	-14.03	psf

q*G*Cp =	-32.24	Cp = -0.90
q*G*Cp =	-6.45	Cp = -0.18



External Wind



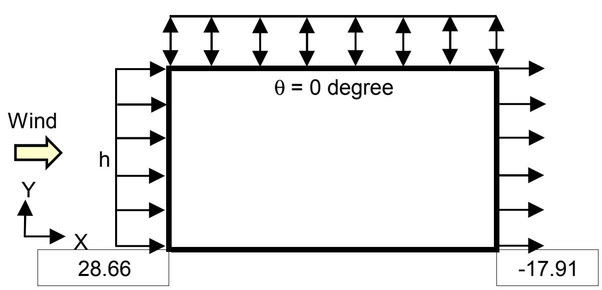
Internal Wind - Positive

Case II) Wind Apply to Risa

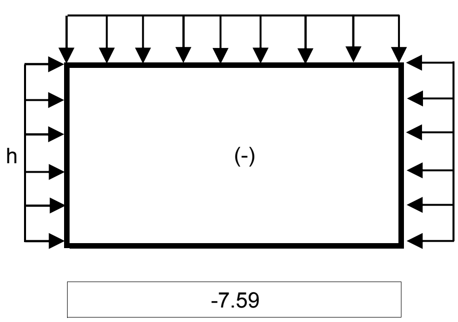
p = q*G*Cp - qi*(GCpi)

p1	= 42.14*0.85*0.8 - 42.14*-0.18	=	36.24	psf
p2	= 42.14*0.85*-0.5 - 42.14*-0.18	=	-10.32	psf
p uplift	= 42.14*0.85*-0.9 - 42.14*-0.18	=	-24.65	psf
p uplift	= 42.14*0.85*-0.18 - 42.14*-0.18	=	1.14	psf

q*G*Cp =	-32.24	Cp = -0.90
q*G*Cp =	-6.45	Cp = -0.18



External Wind



Internal Wind - Positive

The Wind Pressure for Acting to Rooftop

Max. Positive Wind Pressure =	=	**1.14**	psf
Min. Negative Wind Uplift Pressure =	=	**-39.82**	psf

ANALYSIS OF EXISTING STEEL FOR TOWER MAST

"W16x36"

BLACK & VEATCH

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Project:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	6/10/2020

Load Combination	Vertical Load	Shear X	Shear Z	Moment X	Moment Z	Torque
	lbs	lbs	lbs	lb-ft	lb-ft	lb-ft
User Input						
Dead Tower	1128.70					
Dead Only (without equipment and feedline)	9694.10	-1.90	-1.80	0.00	0.00	-118.00
Dead Only (with equipment and feedline)	10410.0	-15.3	-13.1	0.0	0.0	120.0
1.2 Dead + 1.0 Wind (Env.) - No Ice + 1.0 Guy	11860.0	440.0	-560.0	0.0	0.0	-980.0
1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Guy	31560.0	-40.0	-90.0	0.0	0.0	-310.0
1.2 Dead + 1.0 Wind Ice (Env.) + 1.0 Ice + 1.0 Temp + 1.0 Guy	32080.0	-350.0	-430.0	0.0	0.0	-630.0
Unfactored Load						
Dead Tower	1128.7	0.0	0.0	0.0	0.0	0.0
Dead Guy	8565.4	-1.9	-1.8	0.0	0.0	-118.0
Dead Equipment and Feedline	715.9	-13.4	-11.3	0.0	0.0	238.0
Total Dead without guy	1844.6	-13.4	-11.3	0.0	0.0	238.0
Un - FactorLoad for Apply to Risa						
Dead Load Only	10410.0	-15.3	-13.1	0.0	0.0	120.0
Wind Env. Degree (+X, +Z)	1081.1	458.0	-544.6	0.0	0.0	-1147.6
1.0 Ice + 1.0 Temp	20781.1	-22.0	-74.6	0.0	0.0	-477.6
Wind Ice Env. Degree (+X, +Z)	520.0	-310.0	-340.0	0.0	0.0	-320.0

Load Combination	Vertical Load	Shear X		Shear Z		Moment X	Moment Z	Torque	
	kip	kip		kip		kip-ft	kip-ft	kip-ft	
1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy	11.65	-0.04	0.04	-0.56	0.56	0.00	0.00	0.02	0.02
1.2 Dead+1.0 Wind 30 deg - No Ice+1.0 Guy	11.69	0.18	0.18	-0.44	0.44	0.00	0.00	0.45	0.45
1.2 Dead+1.0 Wind 60 deg - No Ice+1.0 Guy	11.75	0.34	0.34	-0.20	0.20	0.00	0.00	0.71	0.71
1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy	11.76	0.41	0.41	0.04	0.04	0.00	0.00	0.70	0.70
1.2 Dead+1.0 Wind 120 deg - No Ice+1.0 Guy	11.78	0.44	0.44	0.27	0.27	0.00	0.00	0.53	0.53
1.2 Dead+1.0 Wind 150 deg - No Ice+1.0 Guy	11.86	0.29	0.29	0.42	0.42	0.00	0.00	0.19	0.19
1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy	11.81	0.03	0.03	0.45	0.45	0.00	0.00	-0.29	0.29
1.2 Dead+1.0 Wind 210 deg - No Ice+1.0 Guy	11.70	-0.24	0.24	0.38	0.38	0.00	0.00	-0.72	0.72
1.2 Dead+1.0 Wind 240 deg - No Ice+1.0 Guy	11.60	-0.42	0.42	0.20	0.20	0.00	0.00	-0.98	0.98
1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy	11.63	-0.43	0.43	-0.03	0.03	0.00	0.00	-0.98	0.98
1.2 Dead+1.0 Wind 300 deg - No Ice+1.0 Guy	11.70	-0.40	0.40	-0.27	0.27	0.00	0.00	-0.81	0.81
1.2 Dead+1.0 Wind 330 deg - No Ice+1.0 Guy	11.69	-0.26	0.26	-0.49	0.49	0.00	0.00	-0.46	0.46
1.2 Dead+1.0 Wind (Env.) - No Ice+1.0 Guy	11.86		0.44		-0.56	0.00	0.00		-0.98

Load Combination	Vertical Load	Shear X		Shear Z		Moment X	Moment Z	Torque	
	kip	kip		kip		kip-ft	kip-ft	kip-ft	
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.96	-0.05	0.05	-0.43	0.43	0.00	0.00	-0.30	0.30
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.94	0.10	0.10	-0.36	0.36	0.00	0.00	-0.12	0.12
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.91	0.22	0.22	-0.22	0.22	0.00	0.00	-0.02	0.02
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.98	0.28	0.28	-0.06	0.06	0.00	0.00	0.01	0.01
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.08	0.27	0.27	0.10	0.10	0.00	0.00	-0.03	0.03
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.02	0.15	0.15	0.19	0.19	0.00	0.00	-0.14	0.14
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.95	-0.02	0.02	0.22	0.22	0.00	0.00	-0.32	0.32
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.96	-0.19	0.19	0.17	0.17	0.00	0.00	-0.50	0.50
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.95	-0.32	0.32	0.06	0.06	0.00	0.00	-0.60	0.60
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.83	-0.35	0.35	-0.10	0.10	0.00	0.00	-0.63	0.63
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.77	-0.31	0.31	-0.26	0.26	0.00	0.00	-0.59	0.59
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.85	-0.20	0.20	-0.38	0.38	0.00	0.00	-0.48	0.48
1.2 Dead+1.0 Wind (Env.) Ice+1.0 Guy	32.08		-0.35		-0.43	0.00	0.00		-0.63

BLACK & VEATCH	Owner:	EVERSOURCE	Computed By:	T. Eakkalak
	Plant:	HARTFORD AWC	Date:	6/8/2020
	Project No.	403093.2000.2200	Verified By:	L. Meyer
	Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

Snow Load for Rooftop Capacity Check (ASCE 7-10) - Windward Drift

Ground snow load	p_g =	30.0	psf	
Terrain Category		C		Sec. 26.7
Exposure of Roof		Fully Exposed		Table 7-2
Thermal Condition		All structures		
Snow exposure factor	C_e =	0.9		Table 7.2
Thermal factor	C_t =	1.0		Table 7.3
Structure Risk category		III		
Snow load importance factor	I_s =	1.1		Sec. 7.3.3
Snow load on "flat" roof	p_f =	20.8	psf	Eq. 7.3-1
Snow density	γ =	17.9	pcf	
Min. Snow load on "flat" roof: P_m =	P_m =	**22.0**	psf	Sec. 7.3.4

Geometry

Parapet and Roof Projections		Yes	
Height of balanced snow load	h_b =	1.16	ft
Clear height from top of balanced snow	h_c =	10.8	ft
Length of roof windward of drift (lower)	$l_{u,wind}$ =	50.0	ft
Height of snow drift (windward)	$h_{d,wind}$ =	1.86	ft
Height of snow drift	h_d =	1.86	ft

Results

Min. snow load on low-slope roofs	p_m =	20.0	psf
Width of snow drift	w =	**7.45**	ft
Max. intensity of drift surcharge load	p_d =	**33.3**	psf

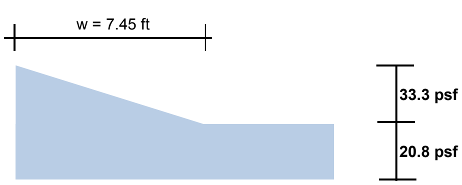
hc/hb > 0.2, NEED TO CAL SNOW DRIFT! (Sec. 7.7.1)

where,

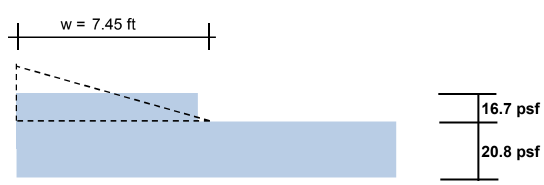
p_m = if(p_g <= 20, I_s x p_g, 20 x I_s)	Sec. 7.3.4
γ = 0.13 x p_g + 14 ≤ 30 pcf	Eq. 7.7-1
$h_b = p_f / \gamma$	
h_d = (0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9
$h_{d\_parapet}$ = 0.75(0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9 and Sec. 7.8
p_f = 0.7 x C_e x C_t x I_s x p_g	Eq. 7.3-1
w = IF(h_d<=h_c,4*h_d, 4*h_d^2/h_c)	
p_d = h_d x γ	

Notes:

1) For parapet walls, l_u shall be taken equal to the length of the roof upwind (windward) of the wall
2) For roof projections, l_u shall be taken equal to the length of the roof upwind (windward)/downwind (leeward) of the projection
3) If the side of roof projection is less than 15ft long, a drift load is not required to be applied on that side
4) This template is not applicable for Hip and Gable Roofs, and/or highly sloped roofs



Actual Snow Drift Diagram



Equivalent Snow Drift Diagram for RISA Analysis

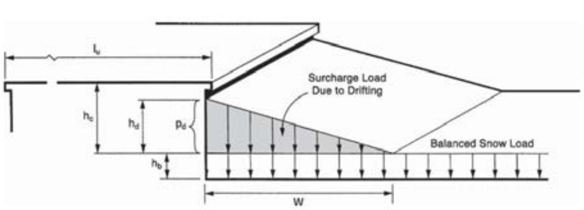


FIGURE 7-8 Configuration of Snow Drifts on Lower Roofs.

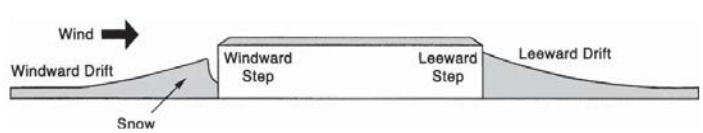


FIGURE 7-7 Drifts Formed at Windward and Leeward Steps.

5. ANALYSIS & DESIGN

5.1 Structural Analysis of Existing Building Rooftop Structure

Existing Loading Conditions

Exist roof construction consists of EPDM rubber roofing over insulation (3" assumed), over 3-1/4" thickness concrete deck (Normal Weight), over concrete encased W beams.

5.1.1) Existing Roof Beam W16x35 (Grid-13, Grid-G&Grid-H)

Dead Load of Roof Floor Slab

Tributary Width	=	3.00	ft
0.060 EPDM	=	1.0	psf
3" Rigid	=	4.5	psf
3 -1/4" Concrete Deck = 145 pcf x 3.25" / 12	=	39.3	psf
M/E/P	=	4.0	psf
Finishing	=	1.0	psf
Total	=	49.8	psf
	USE =	**50.0**	psf

Dead Load of Concrete Beam + W16x36	=	215.6	psf
Roof Live Load	=	20.0	psf
Snow - Pm (Uniform Min. Roof)	=	22.0	psf
Snow Load on "Flat" Roof, Pf with drift (when w > 7.45ft)	=	37.5	psf
Wind Uplift Load on Building Roof	=	-39.82	psf
Wind Down Load on Building Roof	=	1.14	psf

Load Apply For RISA 3D:

- Existing Load on Roof Floor Slab

Concrete Beam Self Weight, DL =	=	215.6	plf
Dead Load from Roof Floor Slab, DL = 50psf x 3ft	=	150.0	plf
Roof Live Load, Lr = 20psf x 3ft	=	60.0	plf
Snow Load, SL = 22psf x 3ft	=	66.0	plf
Snow Load, SLN = 37.5psf x 3ft	=	112.5	plf
Wind Uplift Load, WL-Y = -39.82psf x 3ft	=	-119.5	plf
Wind Down Load, WL+Y = 1.14psf x 3ft	=	3.4	plf

- Load from TNX. (Un - Factor)

Height of Pipe 10 STD., h	=	2.50	ft
Dead Load of Tower without Guy			
Vertical Load, Y	=	1844.6	lbs.
Horizontal Load, X	=	-11.3	lbs.
Horizontal Load, Z	=	-13.4	lbs.
Torque, My	=	238.0	lbs. - ft
Moment from Horizontal X, Mz	=	-28.3	lbs. - ft
Moment from Horizontal Z, Mx	=	-33.5	lbs. - ft
Dead Load of Guy only			
Vertical Load, Y	=	8565.4	lbs.
Horizontal Load, X	=	-1.9	lbs.
Horizontal Load, Z	=	-1.8	lbs.
Torque, My	=	-118.0	lbs. - ft
Moment from Horizontal X, Mz	=	-4.8	lbs. - ft
Moment from Horizontal Z, Mx	=	-4.5	lbs. - ft

Wind Load (Env.) +X, +Z

Horizontal Load, X	=	-544.6	lbs.
Horizontal Load, Z	=	458.0	lbs.
Moment from Horizontal X, Mz	=	-1361.5	lbs. - ft
Moment from Horizontal Z, Mx	=	1145.0	lbs. - ft

Wind Load (Env.) +Y

Vertical Load, Y	=	1081.1	lbs.
Torque, My	=	-1147.6	lbs. - ft

Ice Dead Load + Temp

Vertical Load, Y	=	20781	lbs.
Horizontal Load, X	=	-74.6	lbs.
Horizontal Load, Z	=	-22.0	lbs.
Torque, My	=	-447.6	lbs. - ft
Moment from Horizontal X, Mz	=	-186.5	lbs. - ft
Moment from Horizontal Z, Mx	=	-55.0	lbs. - ft

Ice Wind Load (Env.) +X, +Z

Horizontal Load, X	=	-340.0	lbs.
Horizontal Load, Z	=	-310.0	lbs.
Moment from Horizontal X, Mz	=	-850.0	lbs. - ft
Moment from Horizontal Z, Mx	=	-775.0	lbs. - ft

Ice Wind Load (Env.) +Y

Vertical Load, Y	=	520	lbs.
Torque, My	=	-320.0	lbs. - ft

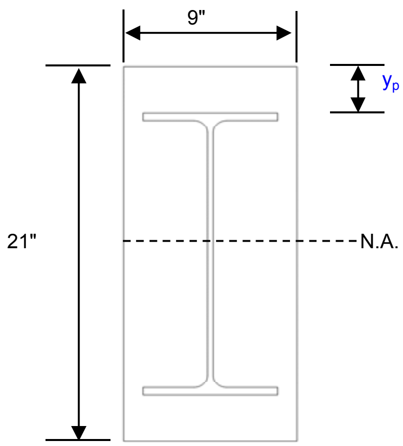
- Determined Section Properties of Encased Concrete Steel Beam

- Steel Section : W16x36

Yield Strength, F_y	=	33.00	ksi
Tensile Strength, F_u	=	65.00	ksi
Depth, d	=	15.90	in
Flange Width, b_f	=	6.99	in
Flange Thickness, t_f	=	0.43	in
Web Thickness, t_w	=	0.295	in
Section Area, A_s	=	10.60	in^2
Weight of Steel, W	=	36.00	plf
Modulus of Elastic of Steel, E_s	=	29000	ksi

- RC. Section : Assumed to be 9"x21" from previous SA

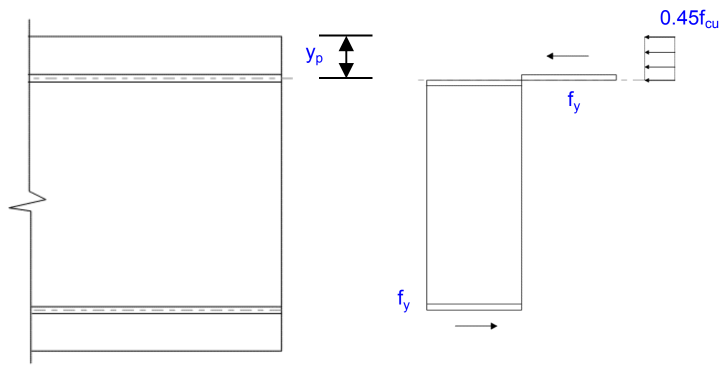
Compressive Stength of Concrete, f'_c	=	3000	psi
β_1	=	0.85	
Height of Beam, h	=	21.00	in
Width of Beam, b	=	9.00	in
Section Area, A_g = b x h	=	189.00	in^2
Modulus of Elasticity of Concrete, $E_c = 57000 f'_c{}^{1/2}$	=	3122	ksi ACI318-14 (19.2.2)



Neutral axis without rebars

$A_1 = A_{steel}$	=	10.6	in^2	
$A_2 = A_{concrete}$	=	178.4	in^2	
A_{total}	=	189.0	in^2	
y_1	=	10.5	in	C.G. Steel
$y_2 = h/2$	=	10.5	in	C.G. Concrete Beam
Neutral axis without rebars, y'	=	10.50	in	
Assumed covering top and bottom	=	2.55	in	
y_p	=	2.765	in	Sec. 22.2.2

- Nominal Flexural Strength of Composited Beam, ϕM_n



The moment resistance of the composite section is then given by

Davidson's "Steel Designer's 6th Edition" in Sec. 22.2.2

$M_p = 0.5A_sf_y\,(h - y_p)$; Eq. 22.4

= 0.5*10.6*33000 * (21 - 2.765)	=	265,775	lbs - ft
ϕM_p = 0.9 * 265,775	=	239,198	lbs - ft

- Nominal Shear Strength of Beam, ϕV_n (Assume Shear is Taken Fully by Steel Section)

The resistance factor for Shear, ϕ_v		=	1.00	
Ratio of Section, h / t_w		=	48.10	< 2.24 (E / Fy) ^0.5
Limit Ratio = $2.24 \times (E / F_y)^{0.5}$ =	2.24 x (29000 / 33) ^0.5	=	66.4	
C_v		=	1.00	Eq. G2-2
Area of Web, $A_w = (h - 2t_f) \times t_w$ =	(15.9 - 2 x 0.43) x 0.295	=	4.44	in^2

The shear resistance of the composite section is then given by

AISC Steel Construction Manual (14th Ed.) Section G2.1a

$V_n = 0.6F_yA_wC_v$; Eq. G2-1

0.6 x 33000 x 4.44 x 1.00	=	87,912	lbs
$\phi_v V_n$ = 0.9 * 87,912	=	87,912	lbs

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Site Name:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

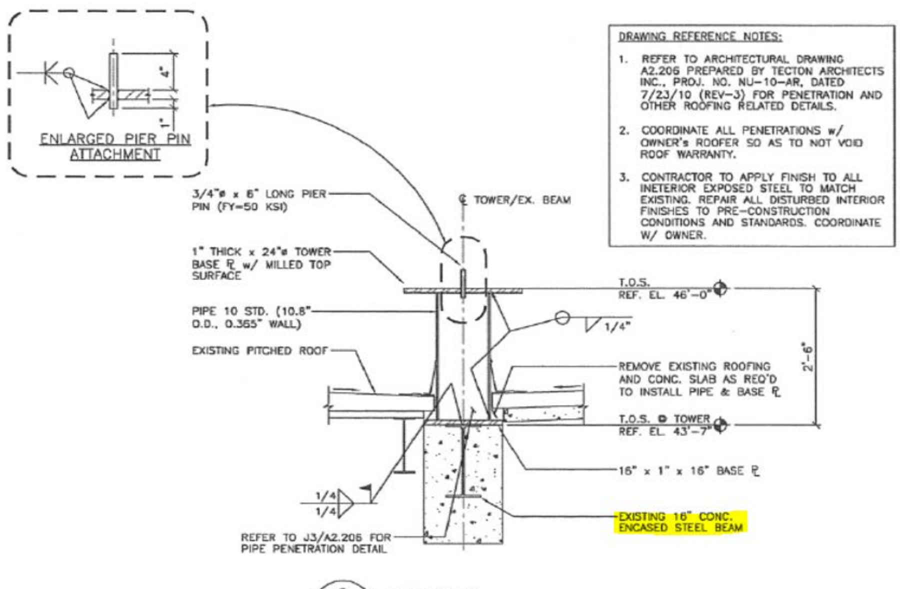
BLACK & VEATCH

- The Result from Risa 3D

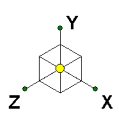
Max. Shear Force, V_u	=	21,767	lbs
Max. Bending Moment, M_u	=	187,996	lbs. - ft

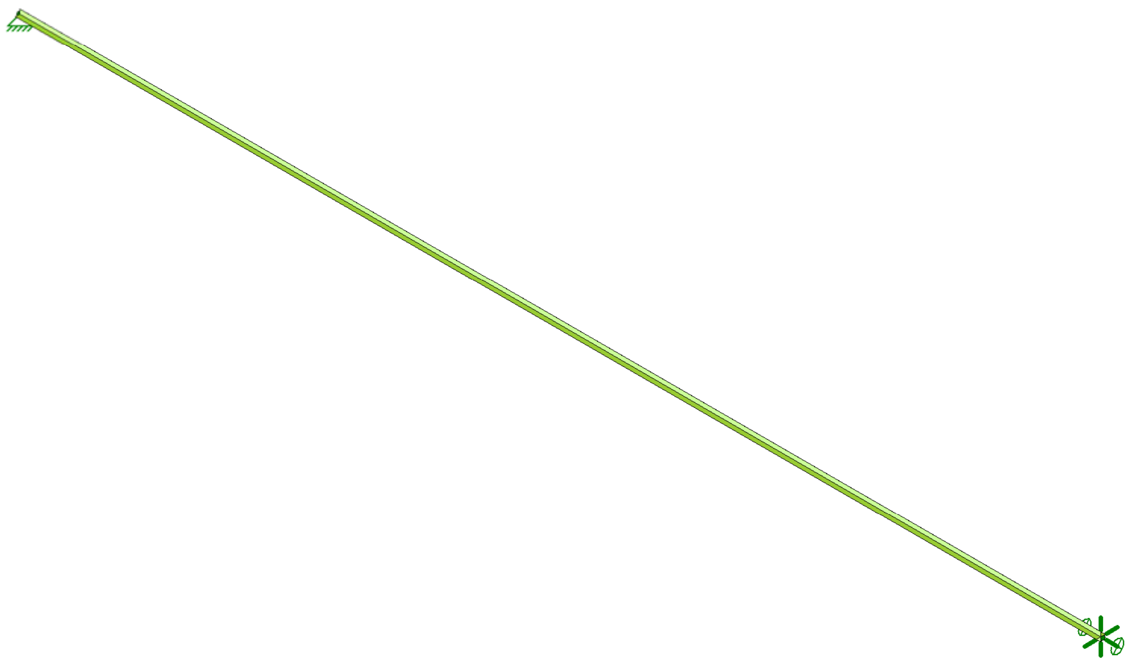
- The Stress Ratio

The Shear Stress Ratio, V_u / ϕV_n = 21767 / 87,912	=	0.248	OK
		24.8%	
The Flexural Stress Ratio, M_u / ϕM_n 187996 / 239,198	=	0.786	OK
		78.6%	

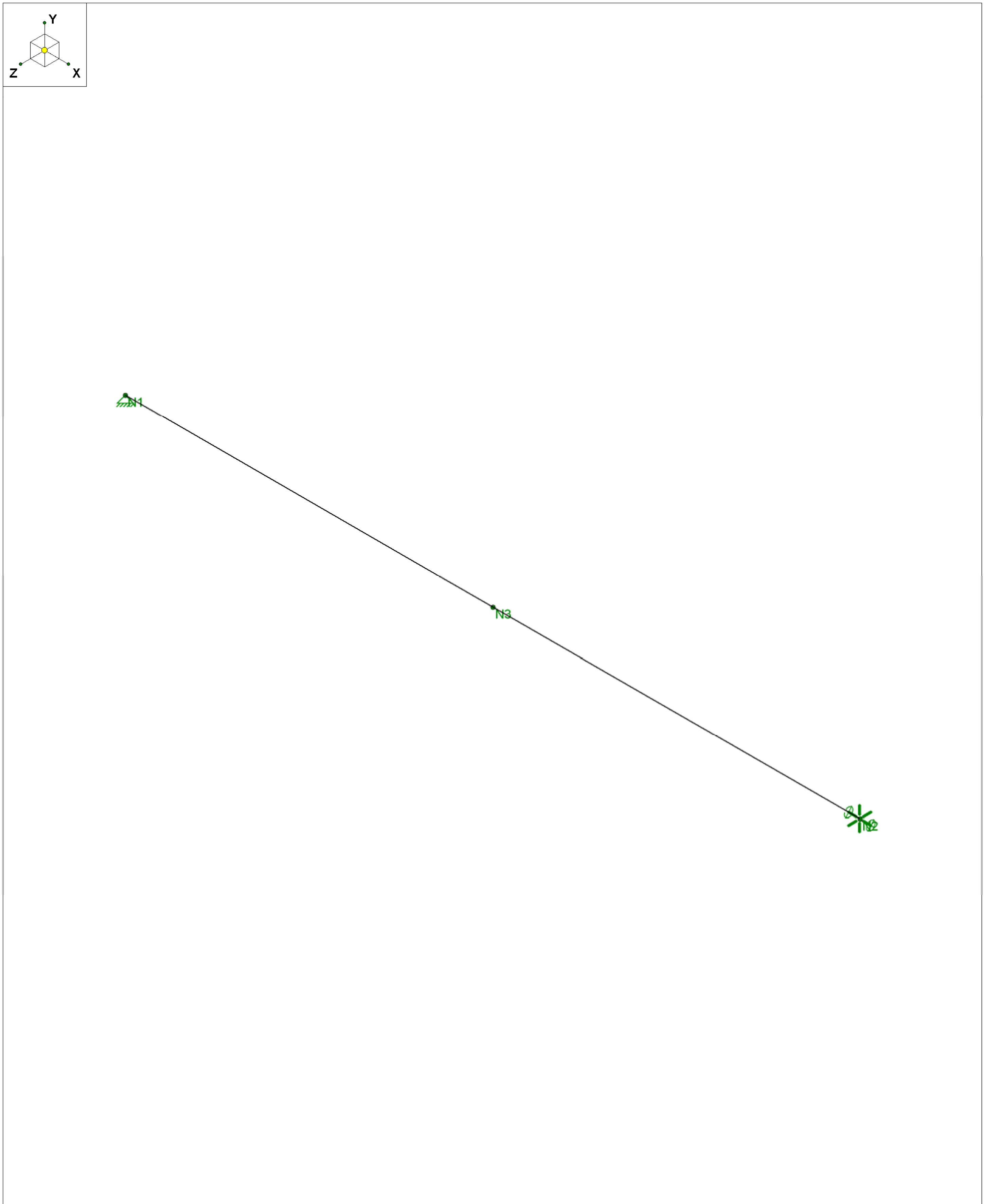


2 S-2 **SECTION**
SCALE: 3/4" = 1'-0"

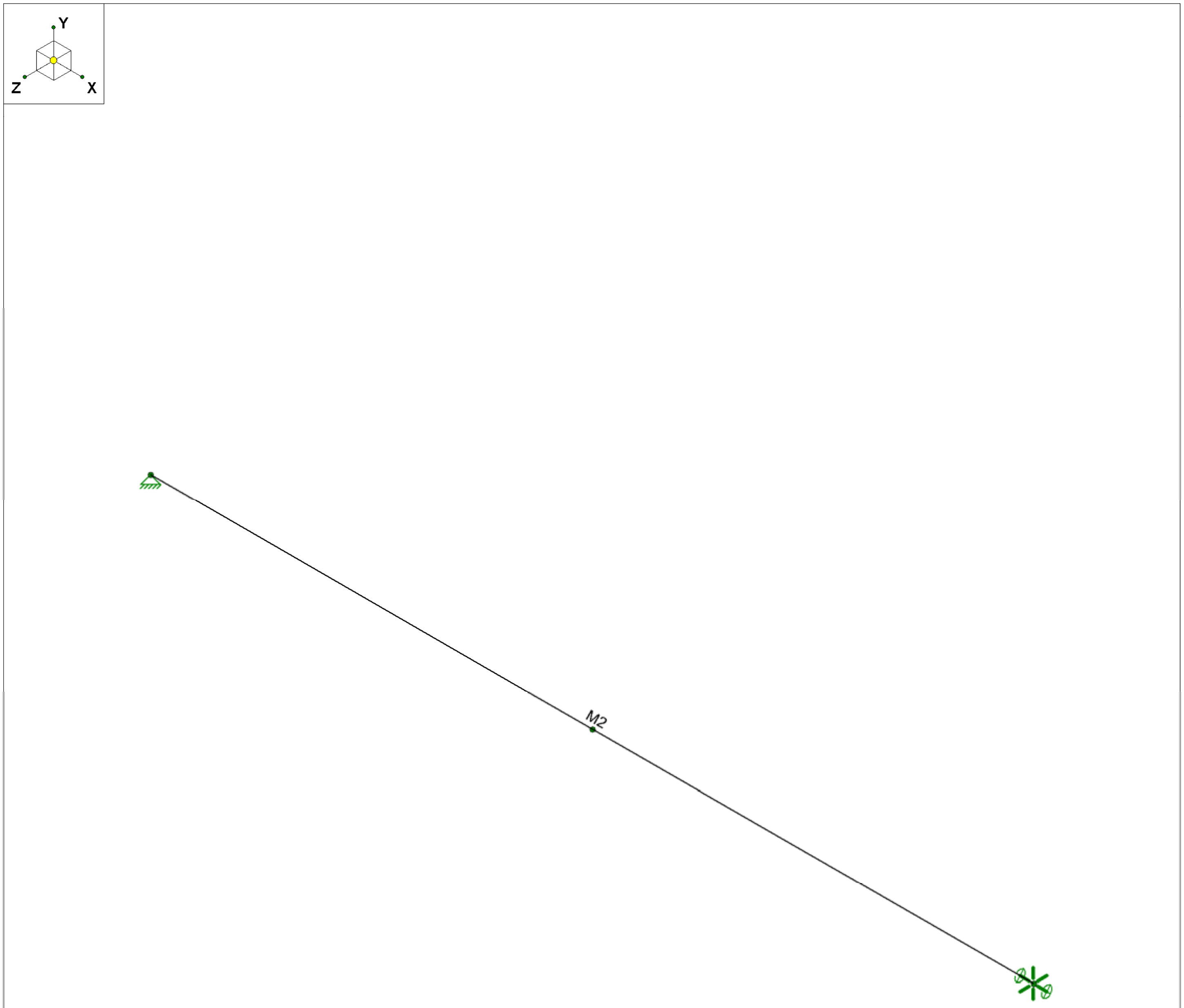




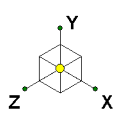
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 1
T. Eakkalak		July 23, 2020 at 8:52 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

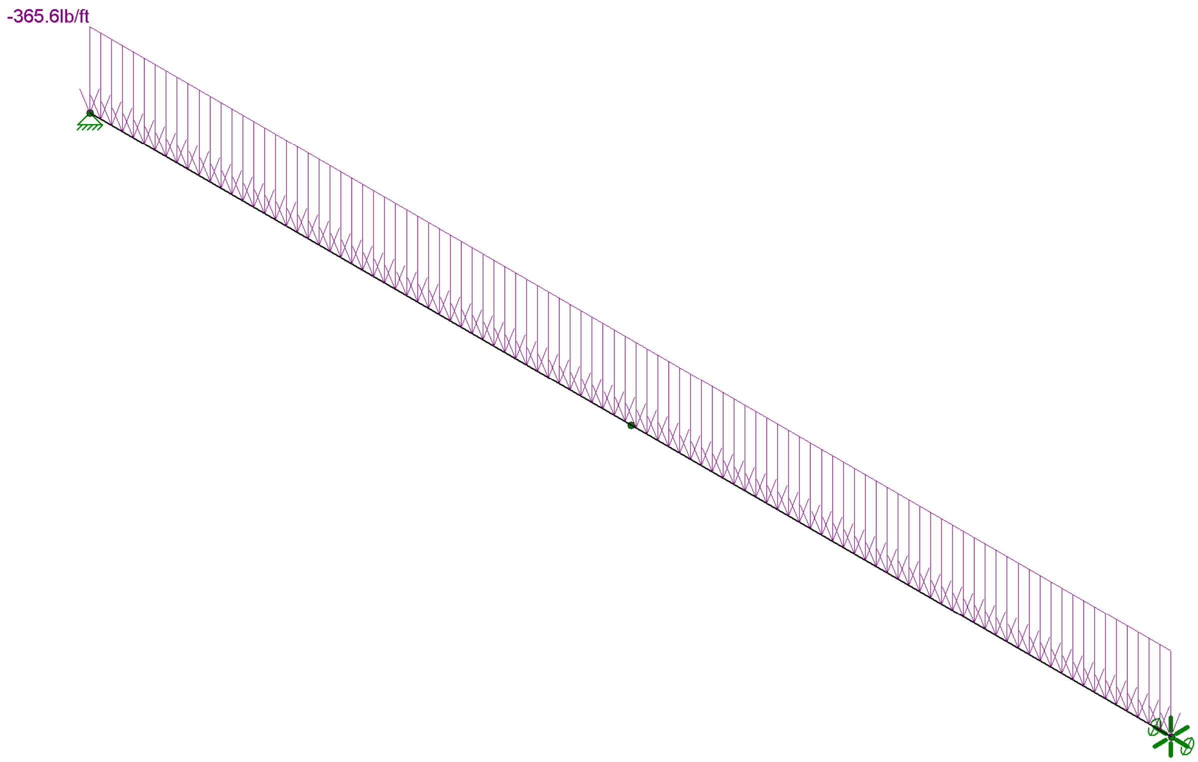


Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 2
T. Eakkalak		July 23, 2020 at 8:52 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 3
T. Eakkalak		July 23, 2020 at 8:52 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...





Load Apply For RISA 3D:				
	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	215.6	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 3ft	=	150.0	plf
	Roof Live Load, Lr = 20psf x 3ft	=	60.0	plf
	Snow Load, SL = 22psf x 3ft	=	66.0	plf
	Snow Load, SLN = 37.5psf x 3ft	=	112.5	plf
	Wind Uplift Load, WL-Y = -39.82psf x 3ft	=	-119.5	plf
	Wind Down Load, WL+Y = 1.14psf x 3ft	=	3.4	plf

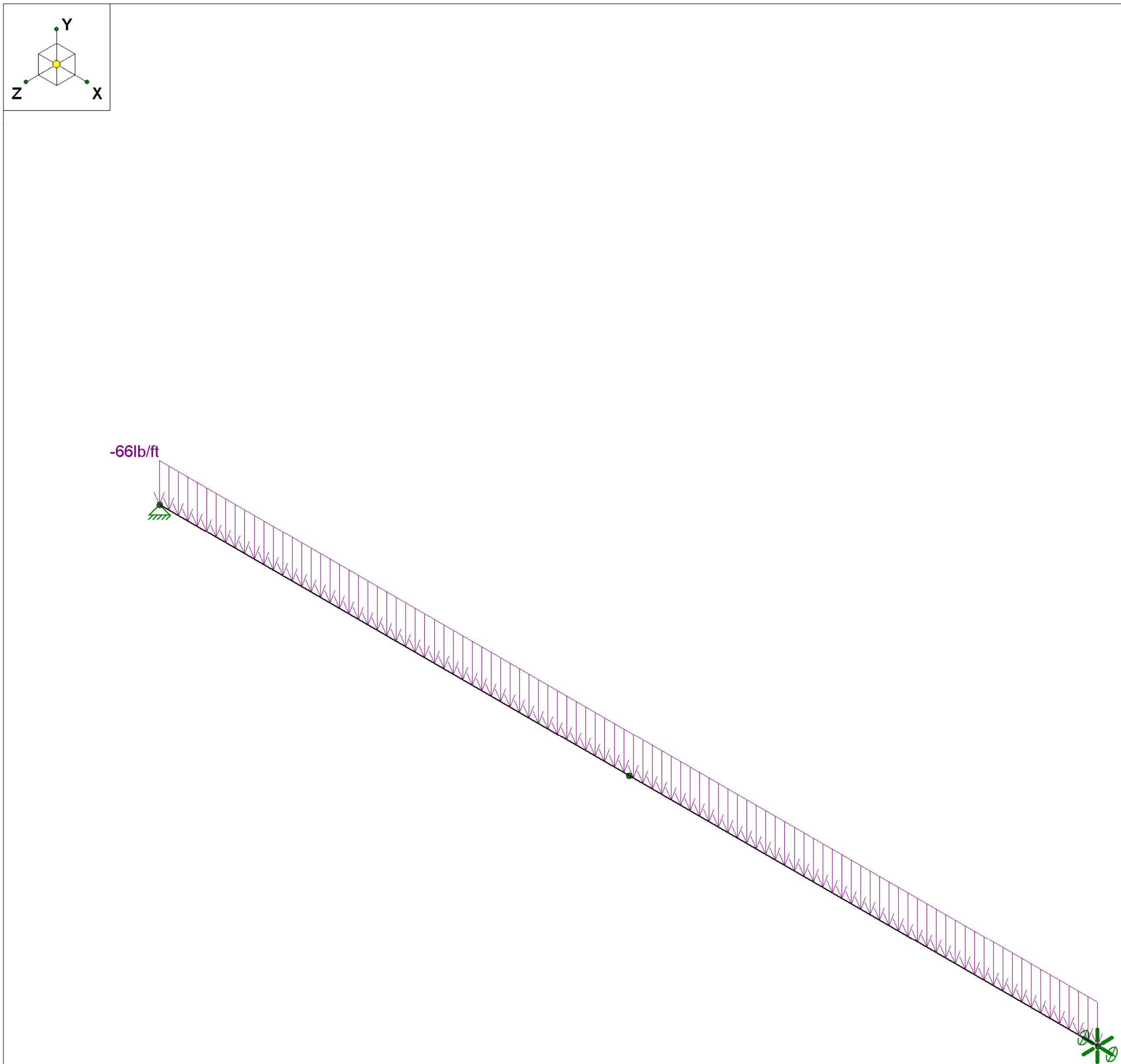
Loads: BLC 1, Beam and Roof

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 4
T. Eakkalak		July 23, 2020 at 8:53 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

Load Apply For RISA 3D:					
	- **Existing Load on Roof Floor Slab**				
	Concrete Beam Self Weight, DL =		=	215.6	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 3ft		=	150.0	plf
	Roof Live Load, Lr = 20psf x 3ft		=	60.0	plf
	Snow Load, SL = 22psf x 3ft		=	66.0	plf
	Snow Load, SLN = 37.5psf x 3ft		=	112.5	plf
	Wind Uplift Load, WL-Y = -39.82psf x 3ft		=	-119.5	plf
	Wind Down Load, WL+Y = 1.14psf x 3ft		=	3.4	plf

Loads: BLC 2, Roof Live Load

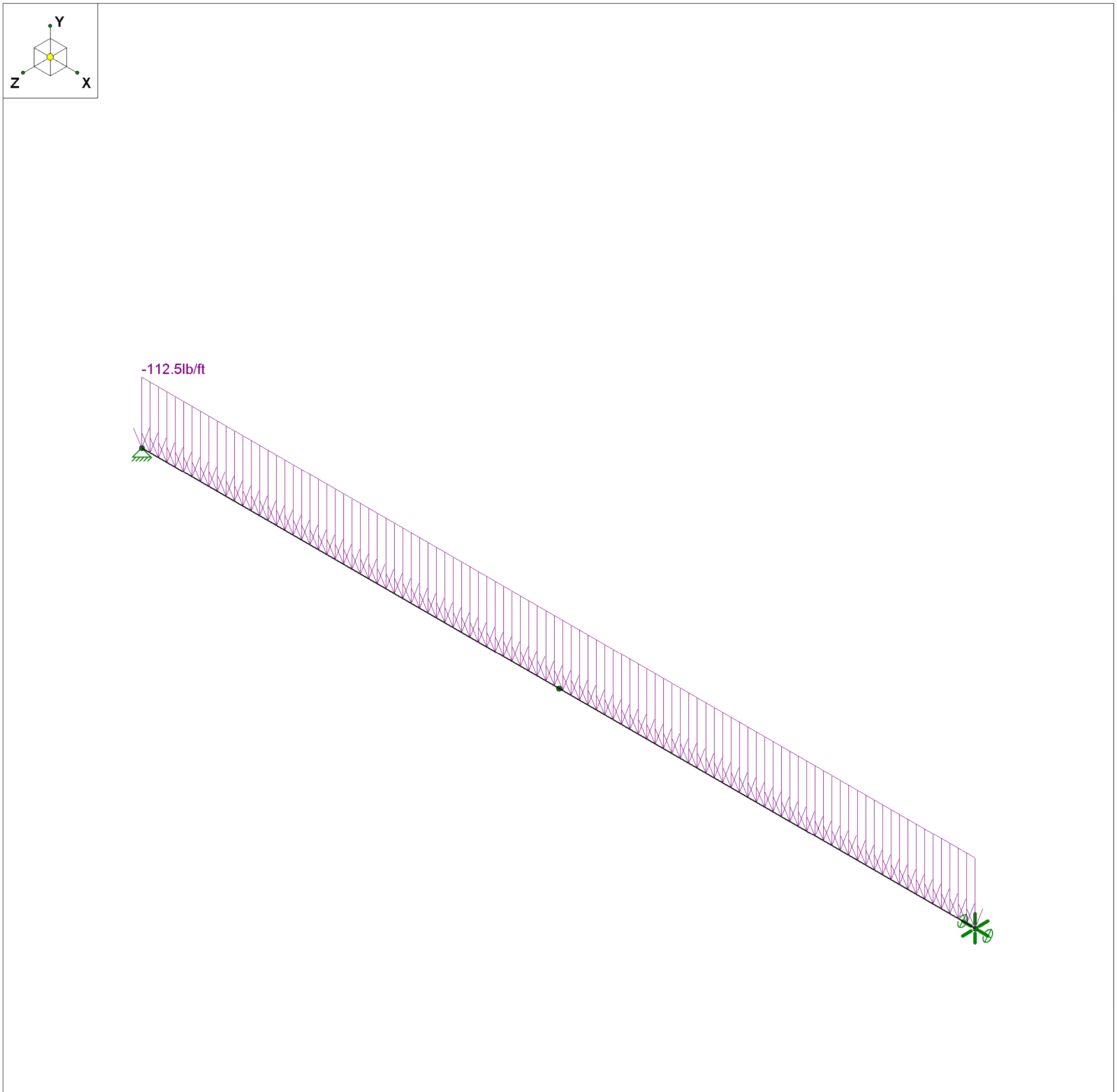
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 5
T. Eakkalak		July 23, 2020 at 8:53 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:			
- **Existing Load on Roof Floor Slab**			
Concrete Beam Self Weight, DL =	=	215.6	plf
Dead Load from Roof Floor Slab, DL = 50psf x 3ft	=	150.0	plf
Roof Live Load, Lr = 20psf x 3ft	=	60.0	plf
Snow Load, SL = 22psf x 3ft	=	66.0	plf
Snow Load, SLN = 37.5psf x 3ft	=	112.5	plf
Wind Uplift Load, WL-Y = -39.82psf x 3ft	=	-119.5	plf
Wind Down Load, WL+Y = 1.14psf x 3ft	=	3.4	plf

Loads: BLC 3, Snow (Pm)

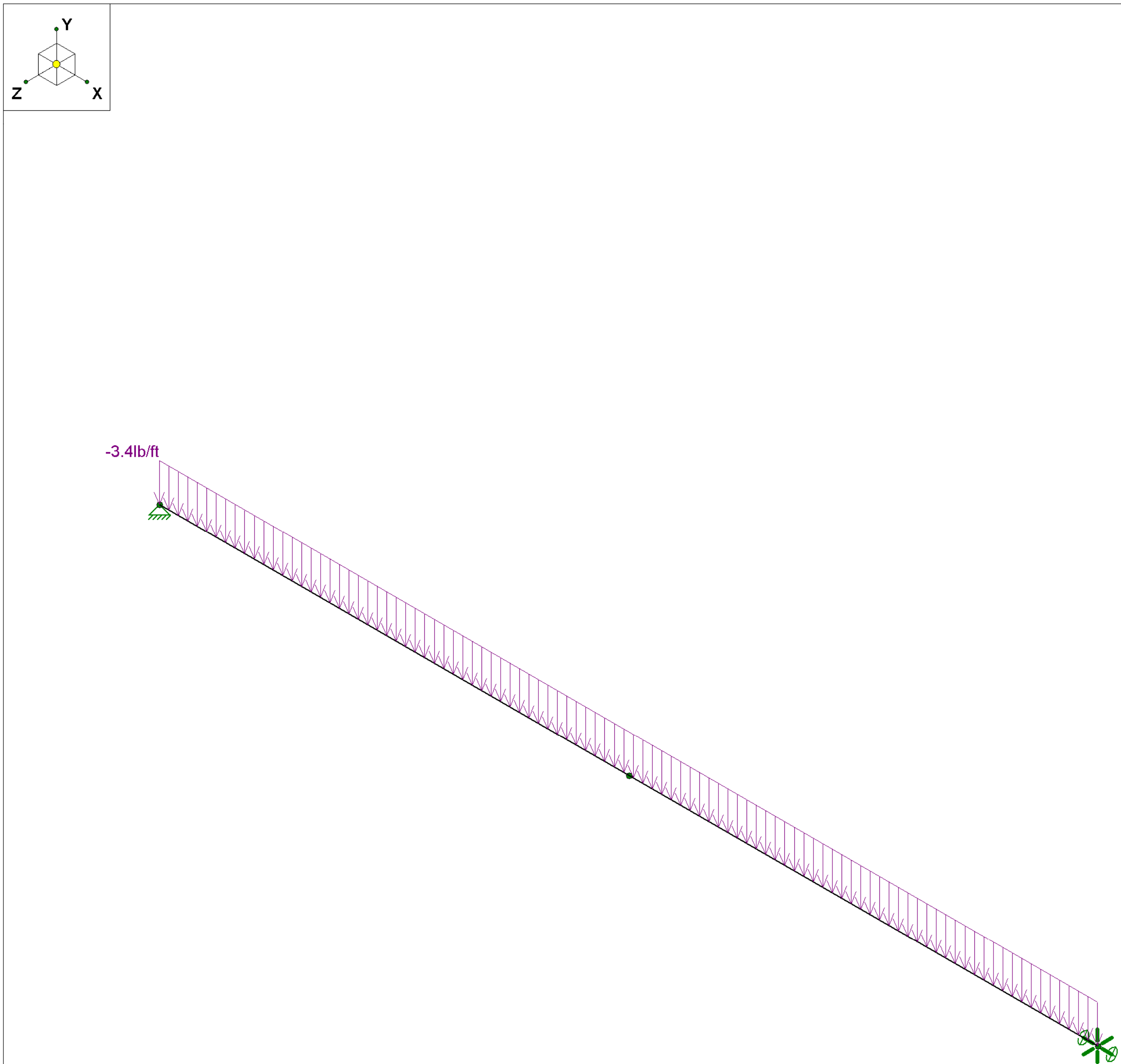
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 6
T. Eakkalak		July 23, 2020 at 8:53 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:						
	- **Existing Load on Roof Floor Slab**					
	Concrete Beam Self Weight, DL =			=	215.6	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 3ft			=	150.0	plf
	Roof Live Load, Lr = 20psf x 3ft			=	60.0	plf
	Snow Load, SL = 22psf x 3ft			=	66.0	plf
	Snow Load, SLN = 37.5psf x 3ft			=	112.5	plf
	Wind Uplift Load, WL-Y = -39.82psf x 3ft			=	-119.5	plf
	Wind Down Load, WL+Y = 1.14psf x 3ft			=	3.4	plf

Loads: BLC 4, Snow (Pf + Drift)

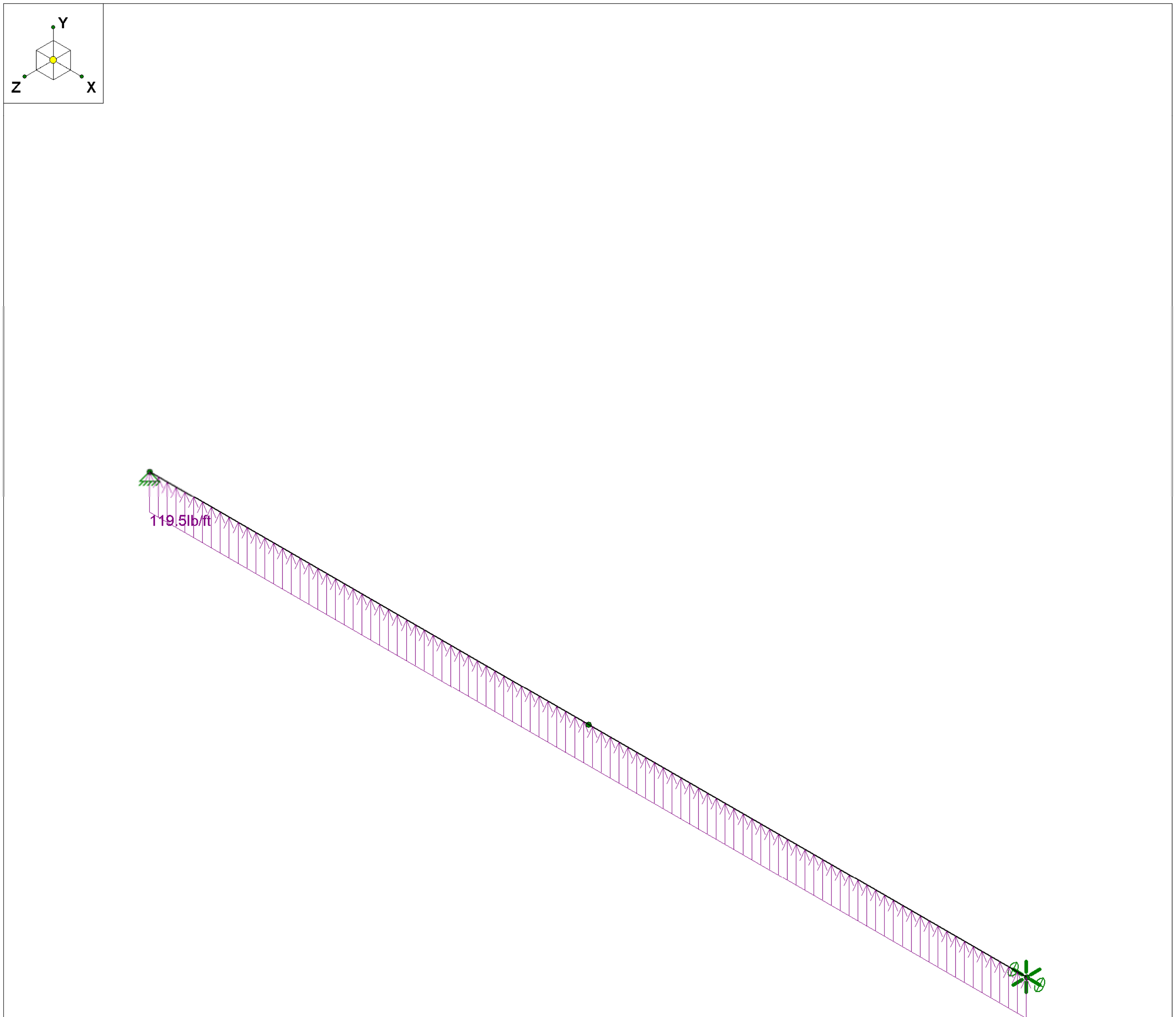
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 7
T. Eakkalak		July 23, 2020 at 8:53 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:					
	- **Existing Load on Roof Floor Slab**				
	Concrete Beam Self Weight, DL =		=	215.6	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 3ft		=	150.0	plf
	Roof Live Load, Lr = 20psf x 3ft		=	60.0	plf
	Snow Load, SL = 22psf x 3ft		=	66.0	plf
	Snow Load, SLN = 37.5psf x 3ft		=	112.5	plf
	Wind Uplift Load, WL-Y = -39.82psf x 3ft		=	-119.5	plf
	Wind Down Load, WL+Y = 1.14psf x 3ft		=	3.4	plf

Loads: BLC 5, Wind Roof Pressure (Positive)

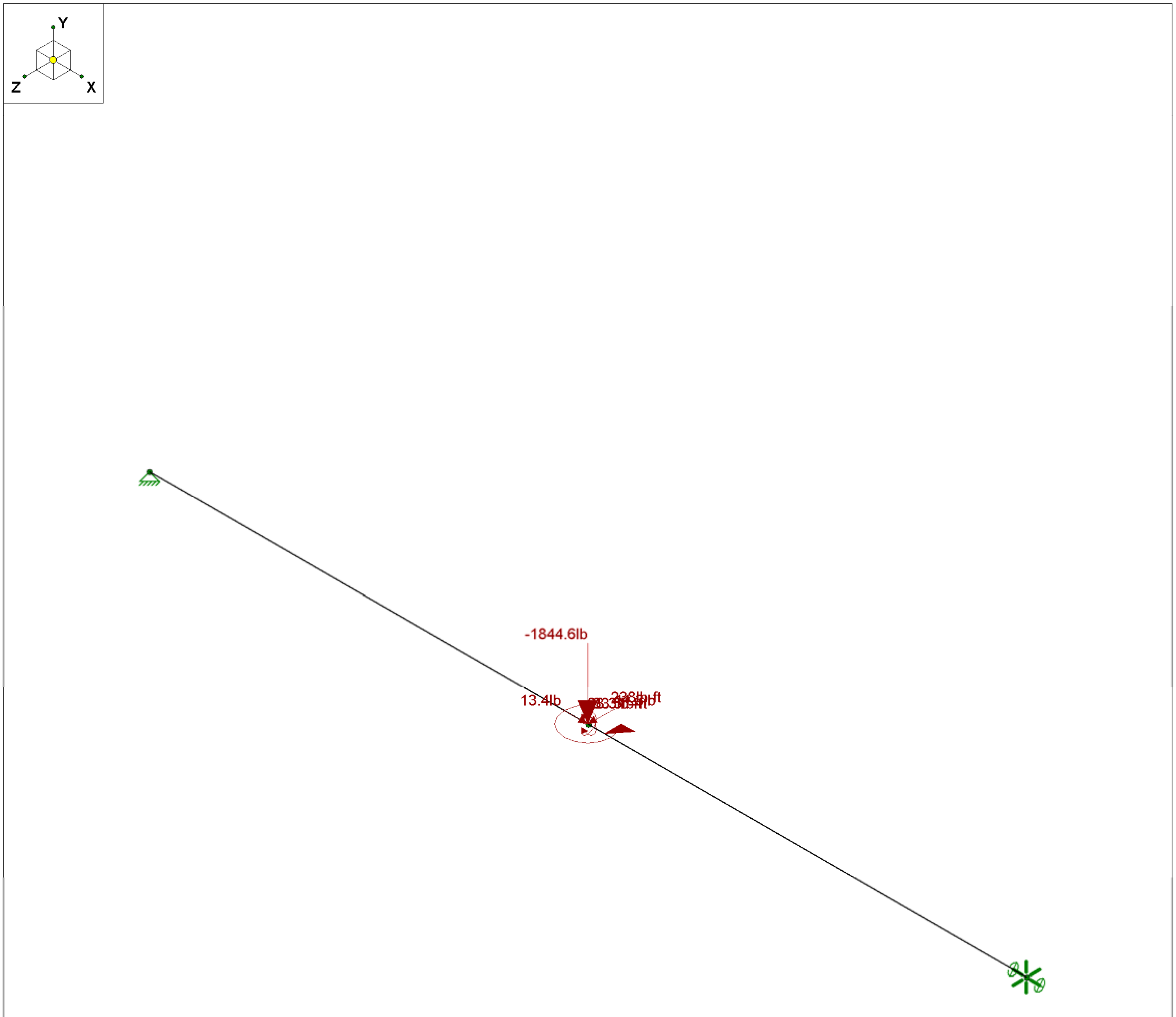
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 8
T. Eakkalak		July 23, 2020 at 8:53 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:				
	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	215.6	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 3ft	=	150.0	plf
	Roof Live Load, Lr = 20psf x 3ft	=	60.0	plf
	Snow Load, SL = 22psf x 3ft	=	66.0	plf
	Snow Load, SLN = 37.5psf x 3ft	=	112.5	plf
	Wind Uplift Load, WL-Y = -39.82psf x 3ft	=	-119.5	plf
	Wind Down Load, WL+Y = 1.14psf x 3ft	=	3.4	plf

Loads: BLC 6, Wind Roof Pressure (Negative)

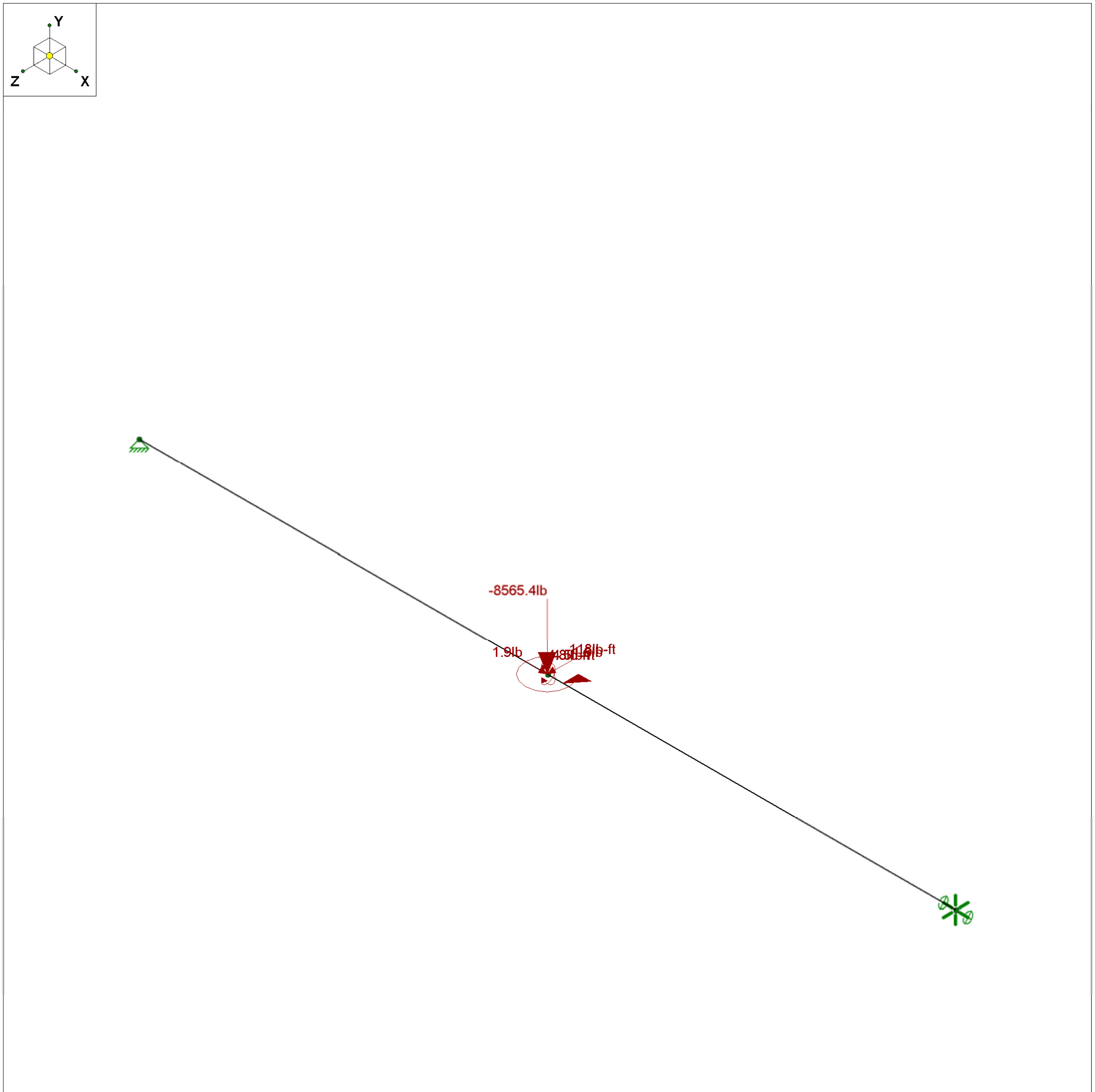
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 9
T. Eakkalak		July 23, 2020 at 8:53 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Dead Load of Tower without Guy						
	Vertical Load, Y			=	1844.6	lbs.
	Horizontal Load, X			=	-11.3	lbs.
	Horizontal Load, Z			=	-13.4	lbs.
	Torque, My			=	238.0	lbs. - ft
	Moment from Horizontal X, Mz			=	-28.3	lbs. - ft
	Moment from Horizontal Z, Mx			=	-33.5	lbs. - ft

Loads: BLC 8, Tower Dead
Envelope Only Solution

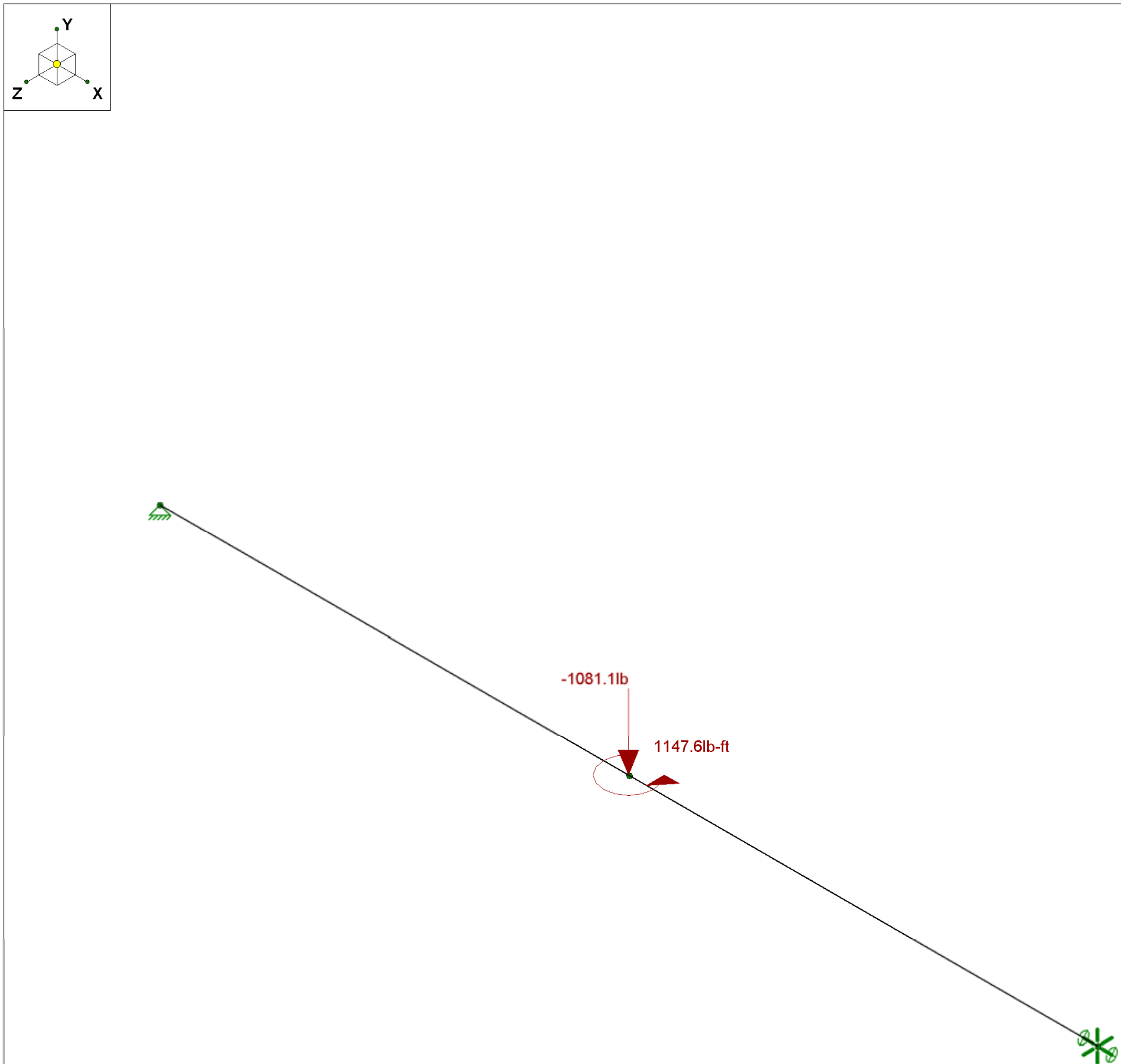
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 10
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Dead Load of Guy only						
	Vertical Load, Y			=	8565.4	lbs.
	Horizontal Load, X			=	-1.9	lbs.
	Horizontal Load, Z			=	-1.8	lbs.
	Torque, My			=	-118.0	lbs. - ft
	Moment from Horizontal X, Mz			=	-4.8	lbs. - ft
	Moment from Horizontal Z, Mx			=	-4.5	lbs. - ft

Loads: BLC 9, Guy Self Weight
Envelope Only Solution

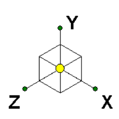
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 11
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

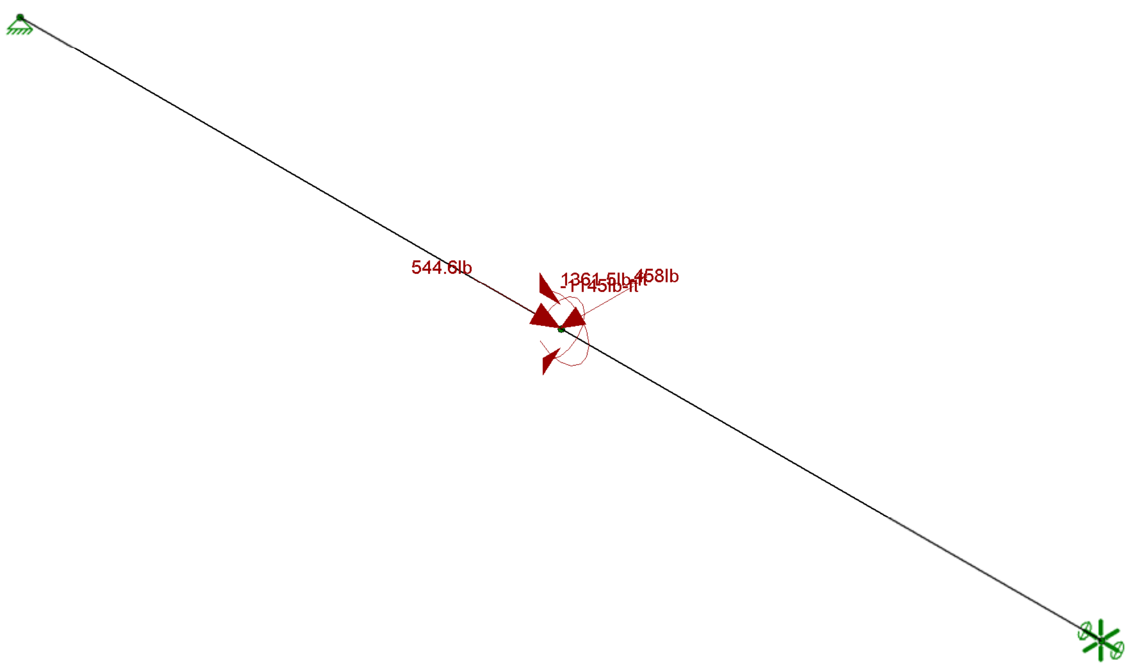


Wind Load (Env.) +Y						
	Vertical Load, Y			=	1081.1	lbs.
	Torque, My			=	-1147.6	lbs. - ft

Loads: BLC 10, Wind Load Y
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 12
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

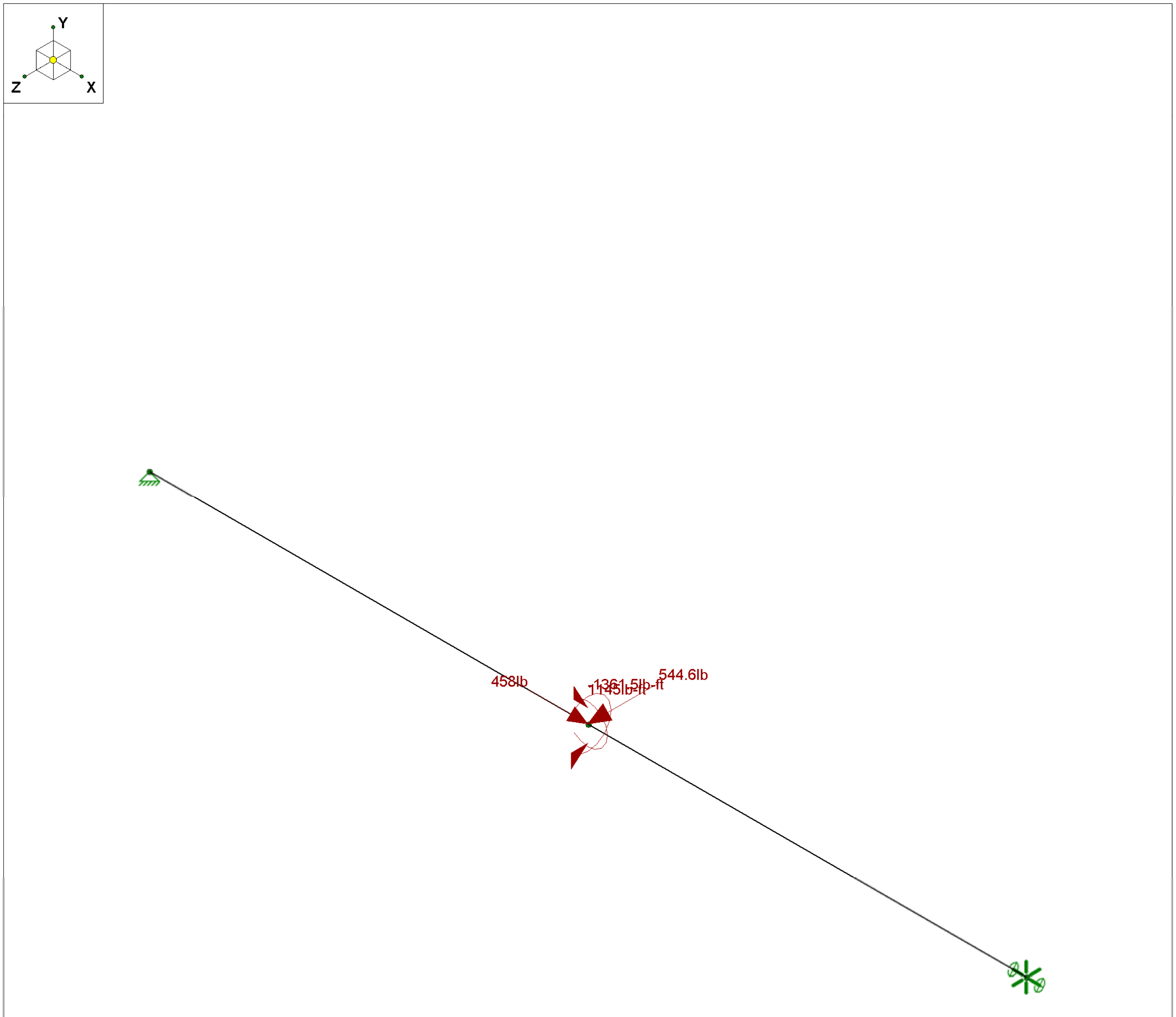




Wind Load (Env.) +X, +Z					
	Horizontal Load, X		=	-544.6	lbs.
	Horizontal Load, Z		=	458.0	lbs.
	Moment from Horizontal X, Mz		=	-1361.5	lbs. - ft
	Moment from Horizontal Z, Mx		=	1145.0	lbs. - ft

Loads: BLC 11, Wind Load X
Envelope Only Solution

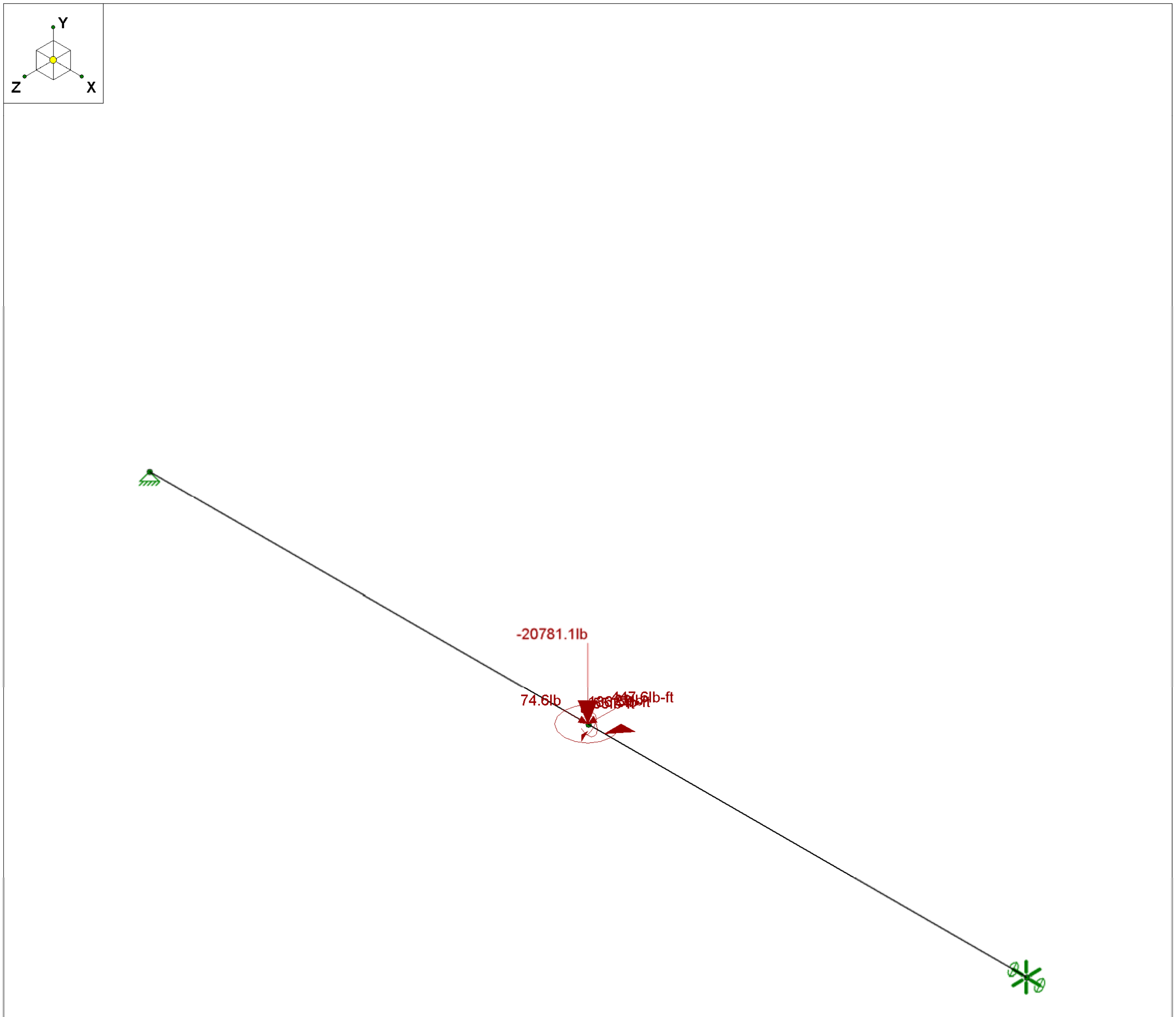
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 13
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Wind Load (Env.) +X, +Z					
	Horizontal Load, X		=	-544.6	lbs.
	Horizontal Load, Z		=	458.0	lbs.
	Moment from Horizontal X, Mz		=	-1361.5	lbs. - ft
	Moment from Horizontal Z, Mx		=	1145.0	lbs. - ft

Loads: BLC 12, Wind Load Z
Envelope Only Solution

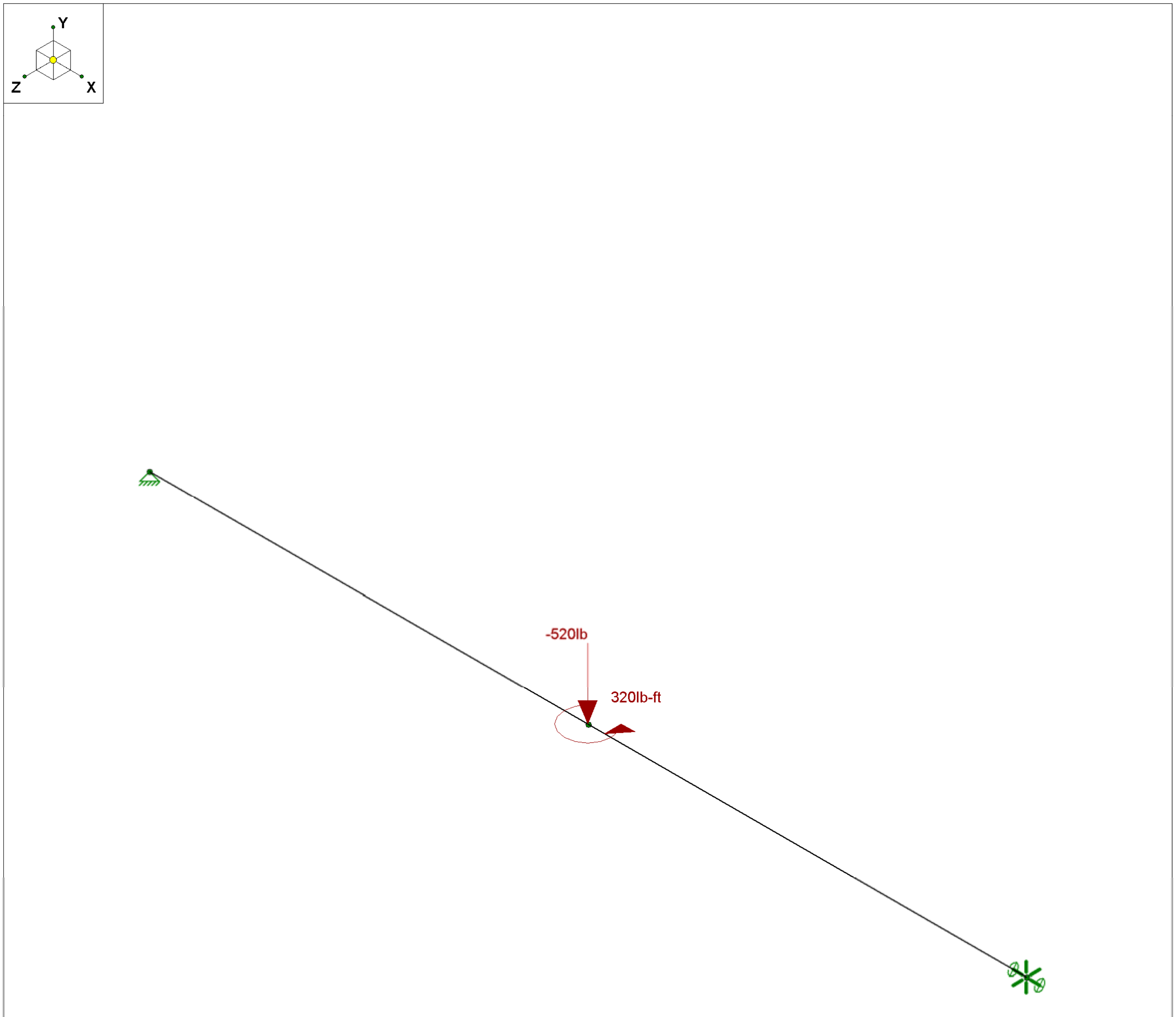
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 14
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice Dead Load + Temp			
Vertical Load, Y	=	20781	lbs.
Horizontal Load, X	=	-74.6	lbs.
Horizontal Load, Z	=	-22.0	lbs.
Torque, My	=	-447.6	lbs. - ft
Moment from Horizontal X, Mz	=	-186.5	lbs. - ft
Moment from Horizontal Z, Mx	=	-55.0	lbs. - ft

Loads: BLC 13, Ice Dead Load
Envelope Only Solution

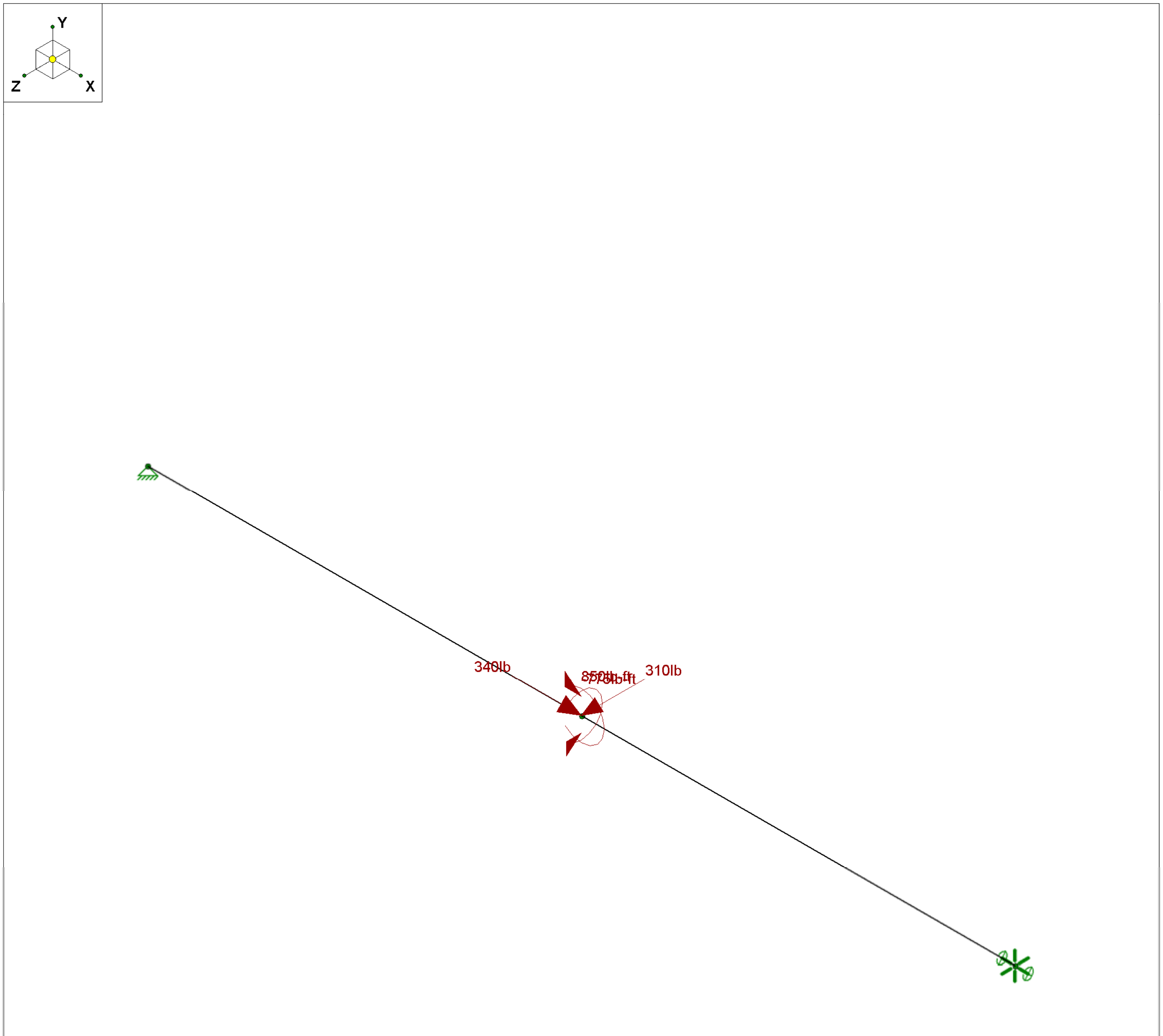
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 15
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice Wind Load (Env.) +Y						
	Vertical Load, Y			=	520	lbs.
	Torque, My			=	-320.0	lbs. - ft

Loads: BLC 14, Ice Wind Load Y
Envelope Only Solution

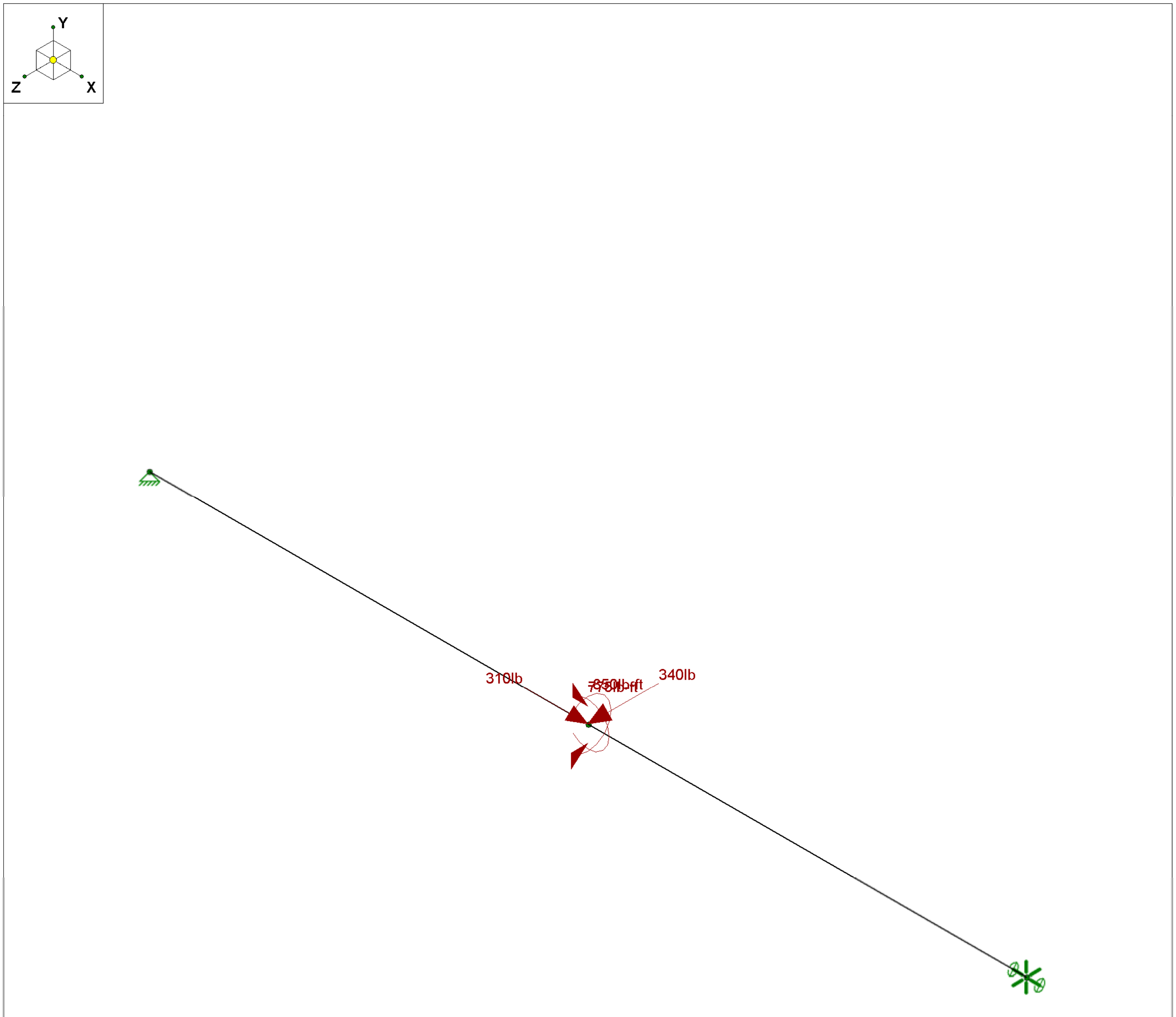
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 16
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice Wind Load (Env.) +X, +Z					
	Horizontal Load, X		=	-340.0	lbs.
	Horizontal Load, Z		=	-310.0	lbs.
	Moment from Horizontal X, Mz		=	-850.0	lbs. - ft
	Moment from Horizontal Z, Mx		=	-775.0	lbs. - ft

Loads: BLC 15, Ice Wind Load X
Envelope Only Solution

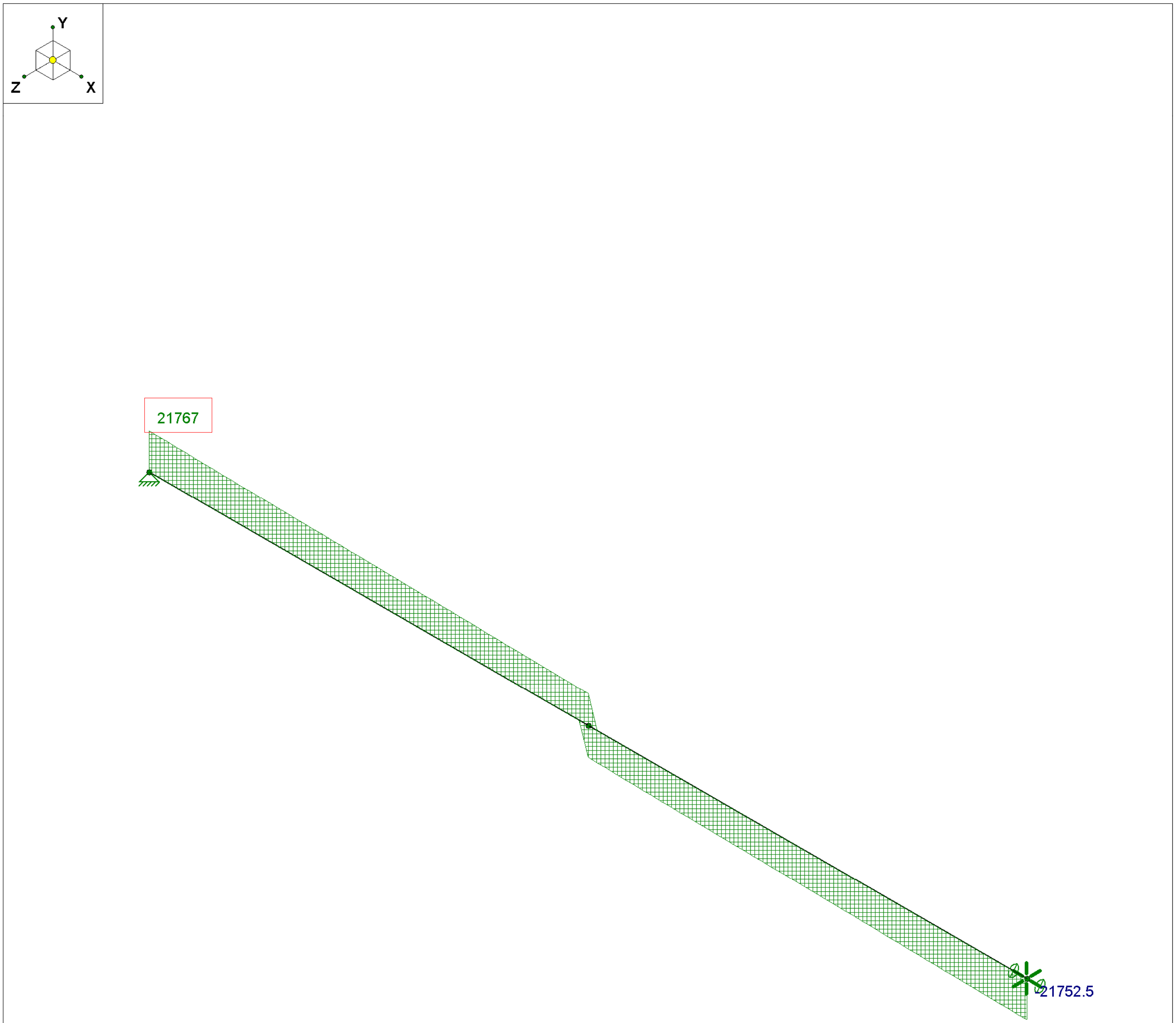
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 17
T. Eakkalak		July 23, 2020 at 9:09 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

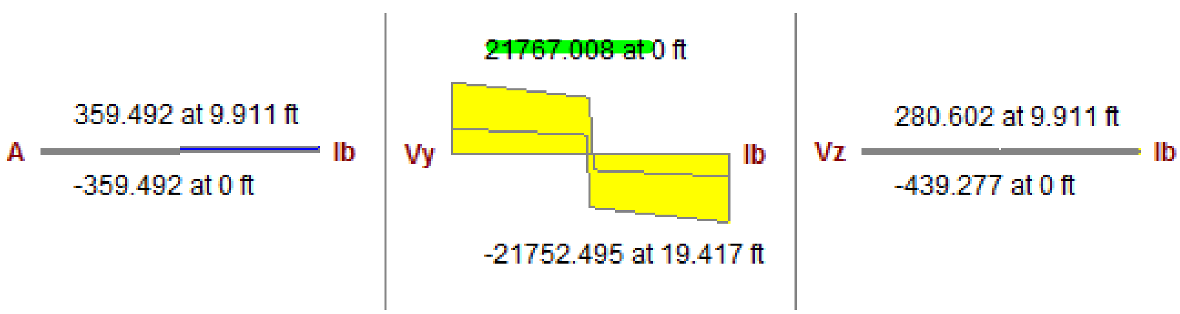


Ice Wind Load (Env.) +X, +Z						
	Horizontal Load, X			=	-340.0	lbs.
	Horizontal Load, Z			=	-310.0	lbs.
	Moment from Horizontal X, Mz			=	-850.0	lbs. - ft
	Moment from Horizontal Z, Mx			=	-775.0	lbs. - ft

Loads: BLC 16, Ice Wind Load Z
Envelope Only Solution

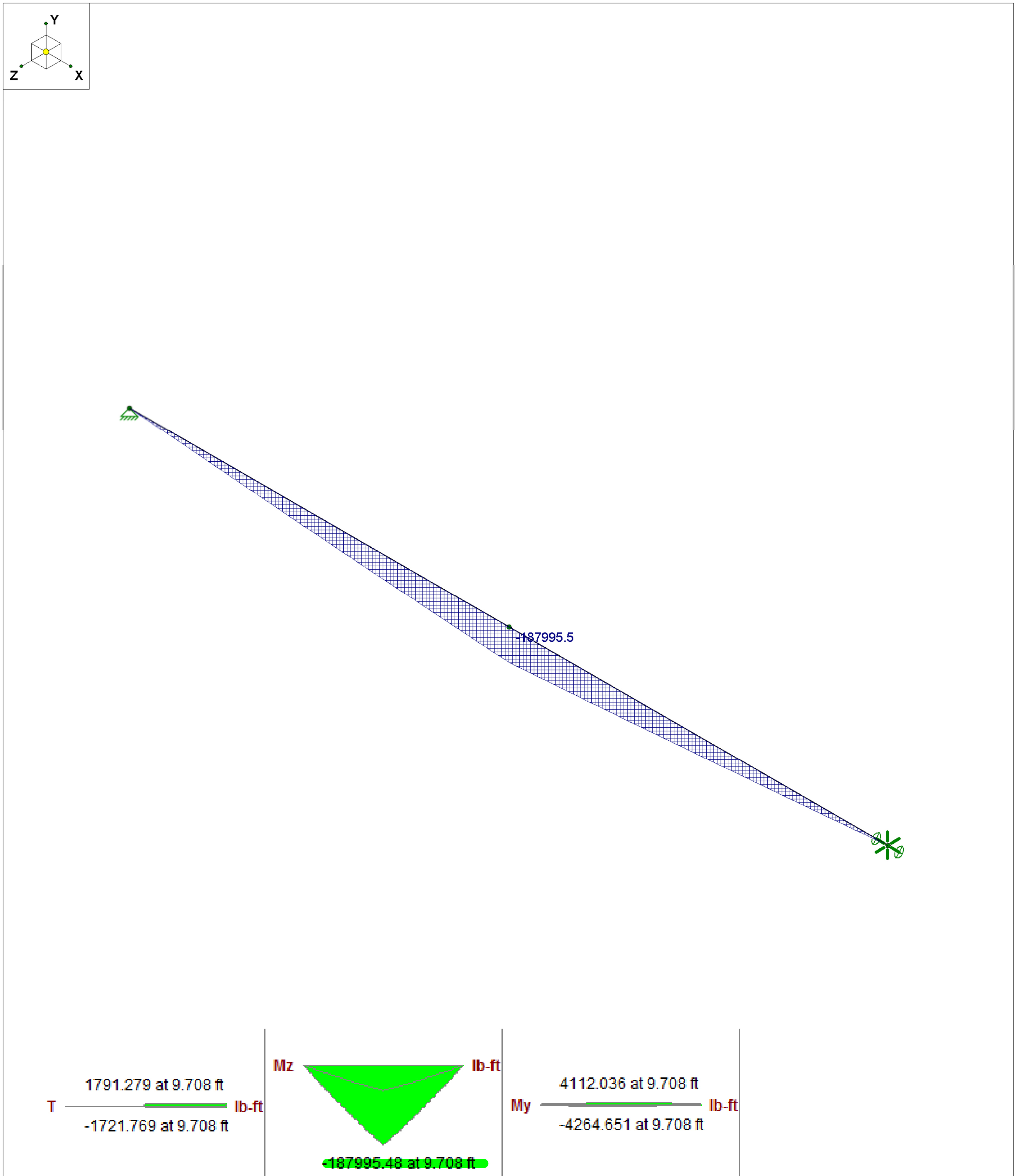
Black & Veatch Corp.		SK - 18
T. Eakkalak	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	July 23, 2020 at 9:10 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...





Envelope Only Solution
Member y Shear Forces (lb) (Enveloped)

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 19
T. Eakkalak		July 23, 2020 at 9:10 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Envelope Only Solution
Member z Bending Moments (lb-ft) (Enveloped)

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W16x36 - Tower Mast	SK - 20
T. Eakkalak		July 23, 2020 at 9:10 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	None
RISAConnection Code	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building
Stainless Steel Code	None

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

Seismic Code	None
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3

General Material Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]
1	RIGID	1e+6		.3	0	0

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	RIGID		None	RIGID	1e+6	1e+6	1e+6	1e+6

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	N1	0	0	-5	0	
2	N2	19.416667	0	-5	0	
3	N3	9.708333	0	-5	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N1	Reaction	Reaction	Reaction			
2	N2	Reaction	Reaction	Reaction	Reaction		

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design Rul...
1	M2	N1	N2			RIGID	None	None	RIGID	Typical

Joint Loads and Enforced Displacements (BLC 8 : Tower Dead)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	-1844.6
2	N3	L	X	13.4
3	N3	L	Z	11.3
4	N3	L	Mx	28.3
5	N3	L	Mz	-33.5
6	N3	L	My	238

Joint Loads and Enforced Displacements (BLC 9 : Guy Self Weight)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	-8565.4
2	N3	L	X	1.9
3	N3	L	Z	1.8
4	N3	L	My	118
5	N3	L	Mx	4.8
6	N3	L	Mz	-4.5

Joint Loads and Enforced Displacements (BLC 10 : Wind Load Y)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	-1081.1
2	N3	L	My	1147.6

Joint Loads and Enforced Displacements (BLC 11 : Wind Load X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	X	544.6
2	N3	L	Z	458
3	N3	L	Mx	-1145
4	N3	L	Mz	1361.5

Joint Loads and Enforced Displacements (BLC 12 : Wind Load Z)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	X	458
2	N3	L	Z	544.6
3	N3	L	Mx	-1361.5
4	N3	L	Mz	1145

Joint Loads and Enforced Displacements (BLC 13 : Ice Dead Load)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	-20781.1
2	N3	L	X	74.6
3	N3	L	Z	22
4	N3	L	My	447.6
5	N3	L	Mx	-55
6	N3	L	Mz	186.5

Joint Loads and Enforced Displacements (BLC 14 : Ice Wind Load Y)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	-520
2	N3	L	My	320

Joint Loads and Enforced Displacements (BLC 15 : Ice Wind Load X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	X	340
2	N3	L	Z	310
3	N3	L	Mx	-775
4	N3	L	Mz	850

Joint Loads and Enforced Displacements (BLC 16 : Ice Wind Load Z)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	X	310
2	N3	L	Z	340
3	N3	L	Mx	-850
4	N3	L	Mz	775

Member Distributed Loads (BLC 1 : Beam and Roof)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	-150	-150	0	0
2	M2	Y	-215.6	-215.6	0	0

Member Distributed Loads (BLC 2 : Roof Live Load)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	-60	-60	0	0

Member Distributed Loads (BLC 3 : Snow (Pm))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	-66	-66	0	0

Member Distributed Loads (BLC 4 : Snow (Pf + Drift))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	-62.4	-62.4	0	0
2	M2	Y	-50.1	-50.1	0	0

Member Distributed Loads (BLC 5 : Wind Roof Pressure (Positive))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	-3.4	-3.4	0	0

Member Distributed Loads (BLC 6 : Wind Roof Pressure (Negative))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	119.5	119.5	0	0

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu...	Area(M...	Surface...
1	Beam and Roof	DL						2		
2	Roof Live Load	RLL						1		
3	Snow (Pm)	SL						1		
4	Snow (Pf + Drift)	SLN						2		
5	Wind Roof Pressure (Positive)	WL+Y						1		
6	Wind Roof Pressure (Negative)	WL-Y						1		
8	Tower Dead	DL				6				
9	Guy Self Weight	DL				6				
10	Wind Load Y	WLY				2				
11	Wind Load X	WLX				4				
12	Wind Load Z	WLZ				4				
13	Ice Dead Load	NL				6				
14	Ice Wind Load Y	NLY				2				
15	Ice Wind Load X	NLX				4				
16	Ice Wind Load Z	NLZ				4				

Load Combinations

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	...	F...
1	1.4DL	Yes	Y		DL	1.4																		
2	1.2DL + 0.5RLL	Yes	Y		DL	1.2	RLL	.5																
3	1.2DL + 0.5SL	Yes	Y		DL	1.2	SL	.5																
4	1.2DL + 0.5SLN	Yes	Y		DL	1.2	SLN	.5																
5	1.2DL + 0.2IDL + 0.5SL	Yes	Y		DL	1.2	NL	.2	SL	.5														
6	1.2DL + 0.2IDL + 0.5SLN	Yes	Y		DL	1.2	NL	.2	SLN	.5														
7	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.5	WLZ		WLY	.5	WL...	.5								
8	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.433	WLZ	.25	WLY	.5	WL...	.5								
9	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.25	WLZ	.433	WLY	.5	WL...	.5								
10	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX		WLZ	.5	WLY	.5	WL...	.5								
11	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.25	WLZ	.433	WLY	.5	WL...	.5								
12	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.433	WLZ	.25	WLY	.5	WL...	.5								
13	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.5	WLZ		WLY	.5	WL...	.5								
14	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.433	WLZ	-.25	WLY	.5	WL...	.5								
15	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.25	WLZ	-.433	WLY	.5	WL...	.5								
16	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX		WLZ	-.5	WLY	.5	WL...	.5								
17	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.25	WLZ	-.433	WLY	.5	WL...	.5								
18	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.433	WLZ	-.25	WLY	.5	WL...	.5								
19	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.5	WLZ		WLY	.5	WL...	.5								
20	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.433	WLZ	.25	WLY	.5	WL...	.5								
21	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.25	WLZ	.433	WLY	.5	WL...	.5								
22	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX		WLZ	.5	WLY	.5	WL...	.5								
23	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.25	WLZ	.433	WLY	.5	WL...	.5								
24	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.433	WLZ	.25	WLY	.5	WL...	.5								
25	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.5	WLZ		WLY	.5	WL...	.5								
26	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.433	WLZ	-.25	WLY	.5	WL...	.5								
27	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	-.25	WLZ	-.433	WLY	.5	WL...	.5								
28	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX		WLZ	-.5	WLY	.5	WL...	.5								
29	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.25	WLZ	-.433	WLY	.5	WL...	.5								
30	1.2DL + 1.6RLL + 0.5WL (...	Yes	Y		DL	1.2	RLL	1.6	WLX	.433	WLZ	-.25	WLY	.5	WL...	.5								
31	1.2DL + 1.6SL + 0.5WL (0...	Yes	Y		DL	1.2	SL	1.6	WLX	.5	WLZ		WLY	.5	WL...	.5								
32	1.2DL + 1.6SL + 0.5WL (3...	Yes	Y		DL	1.2	SL	1.6	WLX	.433	WLZ	.25	WLY	.5	WL...	.5								
33	1.2DL + 1.6SL + 0.5WL (6...	Yes	Y		DL	1.2	SL	1.6	WLX	.25	WLZ	.433	WLY	.5	WL...	.5								
34	1.2DL + 1.6SL + 0.5WL (9...	Yes	Y		DL	1.2	SL	1.6	WLX		WLZ	.5	WLY	.5	WL...	.5								
35	1.2DL + 1.6SL + 0.5WL (1...	Yes	Y		DL	1.2	SL	1.6	WLX	-.25	WLZ	.433	WLY	.5	WL...	.5								
36	1.2DL + 1.6SL + 0.5WL (1...	Yes	Y		DL	1.2	SL	1.6	WLX	-.433	WLZ	.25	WLY	.5	WL...	.5								
37	1.2DL + 1.6SL + 0.5WL (1...	Yes	Y		DL	1.2	SL	1.6	WLX	-.5	WLZ		WLY	.5	WL...	.5								
38	1.2DL + 1.6SL + 0.5WL (2...	Yes	Y		DL	1.2	SL	1.6	WLX	-.433	WLZ	-.25	WLY	.5	WL...	.5								
39	1.2DL + 1.6SL + 0.5WL (2...	Yes	Y		DL	1.2	SL	1.6	WLX	-.25	WLZ	-.433	WLY	.5	WL...	.5								
40	1.2DL + 1.6SL + 0.5WL (2...	Yes	Y		DL	1.2	SL	1.6	WLX		WLZ	-.5	WLY	.5	WL...	.5								
41	1.2DL + 1.6SL + 0.5WL (3...	Yes	Y		DL	1.2	SL	1.6	WLX	.25	WLZ	-.433	WLY	.5	WL...	.5								
42	1.2DL + 1.6SL + 0.5WL (3...	Yes	Y		DL	1.2	SL	1.6	WLX	.433	WLZ	-.25	WLY	.5	WL...	.5								
43	1.2DL + 1.6SL + 0.5WL (0...	Yes	Y		DL	1.2	SL	1.6	WLX	.5	WLZ		WLY	.5	WL...	.5								
44	1.2DL + 1.6SL + 0.5WL (3...	Yes	Y		DL	1.2	SL	1.6	WLX	.433	WLZ	.25	WLY	.5	WL...	.5								
45	1.2DL + 1.6SL + 0.5WL (6...	Yes	Y		DL	1.2	SL	1.6	WLX	.25	WLZ	.433	WLY	.5	WL...	.5								
46	1.2DL + 1.6SL + 0.5WL (9...	Yes	Y		DL	1.2	SL	1.6	WLX		WLZ	.5	WLY	.5	WL...	.5								
47	1.2DL + 1.6SL + 0.5WL (1...	Yes	Y		DL	1.2	SL	1.6	WLX	-.25	WLZ	.433	WLY	.5	WL...	.5								
48	1.2DL + 1.6SL + 0.5WL (1...	Yes	Y		DL	1.2	SL	1.6	WLX	-.433	WLZ	.25	WLY	.5	WL...	.5								
49	1.2DL + 1.6SL + 0.5WL (1...	Yes	Y		DL	1.2	SL	1.6	WLX	-.5	WLZ		WLY	.5	WL...	.5								
50	1.2DL + 1.6SL + 0.5WL (2...	Yes	Y		DL	1.2	SL	1.6	WLX	-.433	WLZ	-.25	WLY	.5	WL...	.5								
51	1.2DL + 1.6SL + 0.5WL (2...	Yes	Y		DL	1.2	SL	1.6	WLX	-.25	WLZ	-.433	WLY	.5	WL...	.5								
52	1.2DL + 1.6SL + 0.5WL (2...	Yes	Y		DL	1.2	SL	1.6	WLX		WLZ	-.5	WLY	.5	WL...	.5								
53	1.2DL + 1.6SL + 0.5WL (3...	Yes	Y		DL	1.2	SL	1.6	WLX	.25	WLZ	-.433	WLY	.5	WL...	.5								
54	1.2DL + 1.6SL + 0.5WL (3...	Yes	Y		DL	1.2	SL	1.6	WLX	.433	WLZ	-.25	WLY	.5	WL...	.5								
55	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.5	WLZ		WLY	.5	WL...	.5								
56	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.433	WLZ	.25	WLY	.5	WL...	.5								
57	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.25	WLZ	.433	WLY	.5	WL...	.5								
58	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX		WLZ	.5	WLY	.5	WL...	.5								
59	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.25	WLZ	.433	WLY	.5	WL...	.5								
60	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.433	WLZ	.25	WLY	.5	WL...	.5								
61	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.5	WLZ		WLY	.5	WL...	.5								
62	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.433	WLZ	-.25	WLY	.5	WL...	.5								
63	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.25	WLZ	-.433	WLY	.5	WL...	.5								
64	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX		WLZ	-.5	WLY	.5	WL...	.5								
65	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.25	WLZ	-.433	WLY	.5	WL...	.5								
66	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.433	WLZ	-.25	WLY	.5	WL...	.5								
67	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.5	WLZ		WLY	.5	WL...	.5								

Load Combinations (Continued)

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	...	F...
68	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.433	WLZ	.25	WLY	.5	WL...	.5								
69	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.25	WLZ	.433	WLY	.5	WL...	.5								
70	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX		WLZ	.5	WLY	.5	WL...	.5								
71	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.25	WLZ	.433	WLY	.5	WL...	.5								
72	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.433	WLZ	.25	WLY	.5	WL...	.5								
73	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.5	WLZ		WLY	.5	WL...	.5								
74	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.433	WLZ	-.25	WLY	.5	WL...	.5								
75	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	-.25	WLZ	-.433	WLY	.5	WL...	.5								
76	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX		WLZ	-.5	WLY	.5	WL...	.5								
77	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.25	WLZ	-.433	WLY	.5	WL...	.5								
78	1.2DL + 1.6SLN + 0.5WL ...	Yes	Y		DL	1.2	SLN	1.6	WLX	.433	WLZ	-.25	WLY	.5	WL...	.5								
79	1.2DL + 1.0WL (0 DEG) +...	Yes	Y		DL	1.2	WLX	1	WLZ		RLL	.5	WLY	1	WL...	1								
80	1.2DL + 1.0WL (30 DEG) ...	Yes	Y		DL	1.2	WLX	.866	WLZ	.5	RLL	.5	WLY	1	WL...	1								
81	1.2DL + 1.0WL (60 DEG) ...	Yes	Y		DL	1.2	WLX	.5	WLZ	.866	RLL	.5	WLY	1	WL...	1								
82	1.2DL + 1.0WL (90 DEG) ...	Yes	Y		DL	1.2	WLX		WLZ	1	RLL	.5	WLY	1	WL...	1								
83	1.2DL + 1.0WL (120 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	.866	RLL	.5	WLY	1	WL...	1								
84	1.2DL + 1.0WL (150 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	.5	RLL	.5	WLY	1	WL...	1								
85	1.2DL + 1.0WL (180 DEG...	Yes	Y		DL	1.2	WLX	-1	WLZ		RLL	.5	WLY	1	WL...	1								
86	1.2DL + 1.0WL (210 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	-.5	RLL	.5	WLY	1	WL...	1								
87	1.2DL + 1.0WL (240 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	-.866	RLL	.5	WLY	1	WL...	1								
88	1.2DL + 1.0WL (270 DEG...	Yes	Y		DL	1.2	WLX		WLZ	-1	RLL	.5	WLY	1	WL...	1								
89	1.2DL + 1.0WL (300 DEG...	Yes	Y		DL	1.2	WLX	.5	WLZ	-.866	RLL	.5	WLY	1	WL...	1								
90	1.2DL + 1.0WL (330 DEG...	Yes	Y		DL	1.2	WLX	.866	WLZ	-.5	RLL	.5	WLY	1	WL...	1								
91	1.2DL + 1.0WL (0 DEG) +...	Yes	Y		DL	1.2	WLX	1	WLZ		RLL	.5	WLY	1	WL...	1								
92	1.2DL + 1.0WL (30 DEG) ...	Yes	Y		DL	1.2	WLX	.866	WLZ	.5	RLL	.5	WLY	1	WL...	1								
93	1.2DL + 1.0WL (60 DEG) ...	Yes	Y		DL	1.2	WLX	.5	WLZ	.866	RLL	.5	WLY	1	WL...	1								
94	1.2DL + 1.0WL (90 DEG) ...	Yes	Y		DL	1.2	WLX		WLZ	1	RLL	.5	WLY	1	WL...	1								
95	1.2DL + 1.0WL (120 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	.866	RLL	.5	WLY	1	WL...	1								
96	1.2DL + 1.0WL (150 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	.5	RLL	.5	WLY	1	WL...	1								
97	1.2DL + 1.0WL (180 DEG...	Yes	Y		DL	1.2	WLX	-1	WLZ		RLL	.5	WLY	1	WL...	1								
98	1.2DL + 1.0WL (210 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	-.5	RLL	.5	WLY	1	WL...	1								
99	1.2DL + 1.0WL (240 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	-.866	RLL	.5	WLY	1	WL...	1								
100	1.2DL + 1.0WL (270 DEG...	Yes	Y		DL	1.2	WLX		WLZ	-1	RLL	.5	WLY	1	WL...	1								
101	1.2DL + 1.0WL (300 DEG...	Yes	Y		DL	1.2	WLX	.5	WLZ	-.866	RLL	.5	WLY	1	WL...	1								
102	1.2DL + 1.0WL (330 DEG...	Yes	Y		DL	1.2	WLX	.866	WLZ	-.5	RLL	.5	WLY	1	WL...	1								
103	1.2DL + 1.0WL (0 DEG) +...	Yes	Y		DL	1.2	WLX	1	WLZ		SL	.5	WLY	1	WL...	1								
104	1.2DL + 1.0WL (30 DEG) ...	Yes	Y		DL	1.2	WLX	.866	WLZ	.5	SL	.5	WLY	1	WL...	1								
105	1.2DL + 1.0WL (60 DEG) ...	Yes	Y		DL	1.2	WLX	.5	WLZ	.866	SL	.5	WLY	1	WL...	1								
106	1.2DL + 1.0WL (90 DEG) ...	Yes	Y		DL	1.2	WLX		WLZ	1	SL	.5	WLY	1	WL...	1								
107	1.2DL + 1.0WL (120 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	.866	SL	.5	WLY	1	WL...	1								
108	1.2DL + 1.0WL (150 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	.5	SL	.5	WLY	1	WL...	1								
109	1.2DL + 1.0WL (180 DEG...	Yes	Y		DL	1.2	WLX	-1	WLZ		SL	.5	WLY	1	WL...	1								
110	1.2DL + 1.0WL (210 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	-.5	SL	.5	WLY	1	WL...	1								
111	1.2DL + 1.0WL (240 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	-.866	SL	.5	WLY	1	WL...	1								
112	1.2DL + 1.0WL (270 DEG...	Yes	Y		DL	1.2	WLX		WLZ	-1	SL	.5	WLY	1	WL...	1								
113	1.2DL + 1.0WL (300 DEG...	Yes	Y		DL	1.2	WLX	.5	WLZ	-.866	SL	.5	WLY	1	WL...	1								
114	1.2DL + 1.0WL (330 DEG...	Yes	Y		DL	1.2	WLX	.866	WLZ	-.5	SL	.5	WLY	1	WL...	1								
115	1.2DL + 1.0WL (0 DEG) +...	Yes	Y		DL	1.2	WLX	1	WLZ		SL	.5	WLY	1	WL...	1								
116	1.2DL + 1.0WL (30 DEG) ...	Yes	Y		DL	1.2	WLX	.866	WLZ	.5	SL	.5	WLY	1	WL...	1								
117	1.2DL + 1.0WL (60 DEG) ...	Yes	Y		DL	1.2	WLX	.5	WLZ	.866	SL	.5	WLY	1	WL...	1								
118	1.2DL + 1.0WL (90 DEG) ...	Yes	Y		DL	1.2	WLX		WLZ	1	SL	.5	WLY	1	WL...	1								
119	1.2DL + 1.0WL (120 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	.866	SL	.5	WLY	1	WL...	1								
120	1.2DL + 1.0WL (150 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	.5	SL	.5	WLY	1	WL...	1								
121	1.2DL + 1.0WL (180 DEG...	Yes	Y		DL	1.2	WLX	-1	WLZ		SL	.5	WLY	1	WL...	1								
122	1.2DL + 1.0WL (210 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	-.5	SL	.5	WLY	1	WL...	1								
123	1.2DL + 1.0WL (240 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	-.866	SL	.5	WLY	1	WL...	1								
124	1.2DL + 1.0WL (270 DEG...	Yes	Y		DL	1.2	WLX		WLZ	-1	SL	.5	WLY	1	WL...	1								
125	1.2DL + 1.0WL (300 DEG...	Yes	Y		DL	1.2	WLX	.5	WLZ	-.866	SL	.5	WLY	1	WL...	1								
126	1.2DL + 1.0WL (330 DEG...	Yes	Y		DL	1.2	WLX	.866	WLZ	-.5	SL	.5	WLY	1	WL...	1								
127	1.2DL + 1.0WL (0 DEG) +...	Yes	Y		DL	1.2	WLX	1	WLZ		SLN	.5	WLY	1	WL...	1								
128	1.2DL + 1.0WL (30 DEG) ...	Yes	Y		DL	1.2	WLX	.866	WLZ	.5	SLN	.5	WLY	1	WL...	1								
129	1.2DL + 1.0WL (60 DEG) ...	Yes	Y		DL	1.2	WLX	.5	WLZ	.866	SLN	.5	WLY	1	WL...	1								
130	1.2DL + 1.0WL (90 DEG) ...	Yes	Y		DL	1.2	WLX		WLZ	1	SLN	.5	WLY	1	WL...	1								
131	1.2DL + 1.0WL (120 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	.866	SLN	.5	WLY	1	WL...	1								
132	1.2DL + 1.0WL (150 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	.5	SLN	.5	WLY	1	WL...	1								
133	1.2DL + 1.0WL (180 DEG...	Yes	Y		DL	1.2	WLX	-1	WLZ		SLN	.5	WLY	1	WL...	1								
134	1.2DL + 1.0WL (210 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	-.5	SLN	.5	WLY	1	WL...	1								
135	1.2DL + 1.0WL (240 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	-.866	SLN	.5	WLY	1	WL...	1								

Load Combinations (Continued)

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	...	F...
136	1.2DL + 1.0WL (270 DEG...	Yes	Y		DL	1.2	WLX		WLZ	-1	SLN	.5	WLY	1	WL...	1								
137	1.2DL + 1.0WL (300 DEG...	Yes	Y		DL	1.2	WLX	.5	WLZ	-.866	SLN	.5	WLY	1	WL...	1								
138	1.2DL + 1.0WL (330 DEG...	Yes	Y		DL	1.2	WLX	.866	WLZ	-.5	SLN	.5	WLY	1	WL...	1								
139	1.2DL + 1.0WL (0 DEG) +...	Yes	Y		DL	1.2	WLX	1	WLZ		SLN	.5	WLY	1	WL...	1								
140	1.2DL + 1.0WL (30 DEG) ...	Yes	Y		DL	1.2	WLX	.866	WLZ	.5	SLN	.5	WLY	1	WL...	1								
141	1.2DL + 1.0WL (60 DEG) ...	Yes	Y		DL	1.2	WLX	.5	WLZ	.866	SLN	.5	WLY	1	WL...	1								
142	1.2DL + 1.0WL (90 DEG) ...	Yes	Y		DL	1.2	WLX		WLZ	1	SLN	.5	WLY	1	WL...	1								
143	1.2DL + 1.0WL (120 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	.866	SLN	.5	WLY	1	WL...	1								
144	1.2DL + 1.0WL (150 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	.5	SLN	.5	WLY	1	WL...	1								
145	1.2DL + 1.0WL (180 DEG...	Yes	Y		DL	1.2	WLX	-1	WLZ		SLN	.5	WLY	1	WL...	1								
146	1.2DL + 1.0WL (210 DEG...	Yes	Y		DL	1.2	WLX	-.866	WLZ	-.5	SLN	.5	WLY	1	WL...	1								
147	1.2DL + 1.0WL (240 DEG...	Yes	Y		DL	1.2	WLX	-.5	WLZ	-.866	SLN	.5	WLY	1	WL...	1								
148	1.2DL + 1.0WL (270 DEG...	Yes	Y		DL	1.2	WLX		WLZ	-1	SLN	.5	WLY	1	WL...	1								
149	1.2DL + 1.0WL (300 DEG...	Yes	Y		DL	1.2	WLX	.5	WLZ	-.866	SLN	.5	WLY	1	WL...	1								
150	1.2DL + 1.0WL (330 DEG...	Yes	Y		DL	1.2	WLX	.866	WLZ	-.5	SLN	.5	WLY	1	WL...	1								
151	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	1	NLZ		SL	.5	NLY	1								
152	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.866	NLZ	.5	SL	.5	NLY	1								
153	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.5	NLZ	.866	SL	.5	NLY	1								
154	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX		NLZ	1	SL	.5	NLY	1								
155	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.5	NLZ	.866	SL	.5	NLY	1								
156	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.866	NLZ	.5	SL	.5	NLY	1								
157	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-1	NLZ		SL	.5	NLY	1								
158	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.866	NLZ	-.5	SL	.5	NLY	1								
159	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.5	NLZ	-.866	SL	.5	NLY	1								
160	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX		NLZ	-1	SL	.5	NLY	1								
161	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.5	NLZ	-.866	SL	.5	NLY	1								
162	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.866	NLZ	-.5	SL	.5	NLY	1								
163	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	1	NLZ		SLN	.5	NLY	1								
164	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.866	NLZ	.5	SLN	.5	NLY	1								
165	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.5	NLZ	.866	SLN	.5	NLY	1								
166	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX		NLZ	1	SLN	.5	NLY	1								
167	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.5	NLZ	.866	SLN	.5	NLY	1								
168	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.866	NLZ	.5	SLN	.5	NLY	1								
169	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-1	NLZ		SLN	.5	NLY	1								
170	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.866	NLZ	-.5	SLN	.5	NLY	1								
171	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	-.5	NLZ	-.866	SLN	.5	NLY	1								
172	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX		NLZ	-1	SLN	.5	NLY	1								
173	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.5	NLZ	-.866	SLN	.5	NLY	1								
174	1.2DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	1.2	NL	1	NLX	.866	NLZ	-.5	SLN	.5	NLY	1								
175	0.9DL + 1.0WL (0 DEG)	Yes	Y		DL	.9	WLX	1	WLZ		WLY	1	WL...	1										
176	0.9DL + 1.0WL (30 DEG)	Yes	Y		DL	.9	WLX	.866	WLZ	.5	WLY	1	WL...	1										
177	0.9DL + 1.0WL (60 DEG)	Yes	Y		DL	.9	WLX	.5	WLZ	.866	WLY	1	WL...	1										
178	0.9DL + 1.0WL (90 DEG)	Yes	Y		DL	.9	WLX		WLZ	1	WLY	1	WL...	1										
179	0.9DL + 1.0WL (120 DEG)	Yes	Y		DL	.9	WLX	-.5	WLZ	.866	WLY	1	WL...	1										
180	0.9DL + 1.0WL (150 DEG)	Yes	Y		DL	.9	WLX	-.866	WLZ	.5	WLY	1	WL...	1										
181	0.9DL + 1.0WL (180 DEG)	Yes	Y		DL	.9	WLX	-1	WLZ		WLY	1	WL...	1										
182	0.9DL + 1.0WL (210 DEG)	Yes	Y		DL	.9	WLX	-.866	WLZ	-.5	WLY	1	WL...	1										
183	0.9DL + 1.0WL (240 DEG)	Yes	Y		DL	.9	WLX	-.5	WLZ	-.866	WLY	1	WL...	1										
184	0.9DL + 1.0WL (270 DEG)	Yes	Y		DL	.9	WLX		WLZ	-1	WLY	1	WL...	1										
185	0.9DL + 1.0WL (300 DEG)	Yes	Y		DL	.9	WLX	.5	WLZ	-.866	WLY	1	WL...	1										
186	0.9DL + 1.0WL (330 DEG)	Yes	Y		DL	.9	WLX	.866	WLZ	-.5	WLY	1	WL...	1										
187	0.9DL + 1.0WL (0 DEG)	Yes	Y		DL	.9	WLX	1	WLZ		WLY	1	WL-Y	1										
188	0.9DL + 1.0WL (30 DEG)	Yes	Y		DL	.9	WLX	.866	WLZ	.5	WLY	1	WL-Y	1										
189	0.9DL + 1.0WL (60 DEG)	Yes	Y		DL	.9	WLX	.5	WLZ	.866	WLY	1	WL-Y	1										
190	0.9DL + 1.0WL (90 DEG)	Yes	Y		DL	.9	WLX		WLZ	1	WLY	1	WL-Y	1										
191	0.9DL + 1.0WL (120 DEG)	Yes	Y		DL	.9	WLX	-.5	WLZ	.866	WLY	1	WL-Y	1										
192	0.9DL + 1.0WL (150 DEG)	Yes	Y		DL	.9	WLX	-.866	WLZ	.5	WLY	1	WL-Y	1										
193	0.9DL + 1.0WL (180 DEG)	Yes	Y		DL	.9	WLX	-1	WLZ		WLY	1	WL-Y	1										
194	0.9DL + 1.0WL (210 DEG)	Yes	Y		DL	.9	WLX	-.866	WLZ	-.5	WLY	1	WL-Y	1										
195	0.9DL + 1.0WL (240 DEG)	Yes	Y		DL	.9	WLX	-.5	WLZ	-.866	WLY	1	WL-Y	1										
196	0.9DL + 1.0WL (270 DEG)	Yes	Y		DL	.9	WLX		WLZ	-1	WLY	1	WL-Y	1										
197	0.9DL + 1.0WL (300 DEG)	Yes	Y		DL	.9	WLX	.5	WLZ	-.866	WLY	1	WL-Y	1										
198	0.9DL + 1.0WL (330 DEG)	Yes	Y		DL	.9	WLX	.866	WLZ	-.5	WLY	1	WL-Y	1										
199	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	1	NLZ		NLY	1										
200	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.866	NLZ	.5	NLY	1										
201	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.5	NLZ	.866	NLY	1										
202	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX		NLZ	1	NLY	1										
203	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.5	NLZ	.866	NLY	1										

Load Combinations (Continued)

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	F...
204	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.866	NLZ	.5	NLY	1									
205	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-1	NLZ		NLY	1									
206	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.866	NLZ	-.5	NLY	1									
207	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.5	NLZ	-.866	NLY	1									
208	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX		NLZ	-1	NLY	1									
209	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.5	NLZ	-.866	NLY	1									
210	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.866	NLZ	-.5	NLY	1									
211	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	1	NLZ		NLY	1									
212	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.866	NLZ	.5	NLY	1									
213	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.5	NLZ	.866	NLY	1									
214	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX		NLZ	1	NLY	1									
215	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.5	NLZ	.866	NLY	1									
216	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.866	NLZ	.5	NLY	1									
217	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-1	NLZ		NLY	1									
218	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.866	NLZ	-.5	NLY	1									
219	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	-.5	NLZ	-.866	NLY	1									
220	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX		NLZ	-1	NLY	1									
221	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.5	NLZ	-.866	NLY	1									
222	0.9DL + 1.0IDL + 1.0IWL (...	Yes	Y		DL	.9	NL	1	NLX	.866	NLZ	-.5	NLY	1									

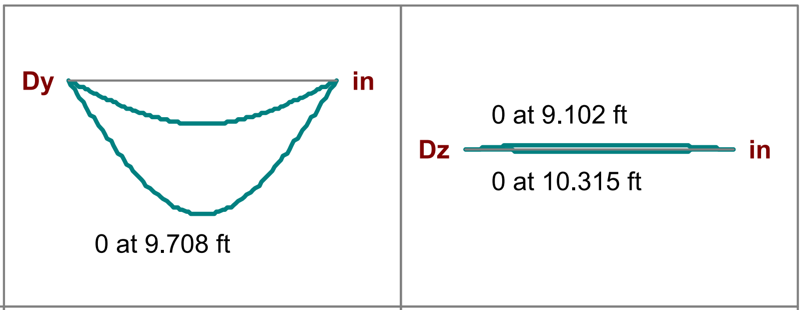
Envelope Maximum Member Section Forces

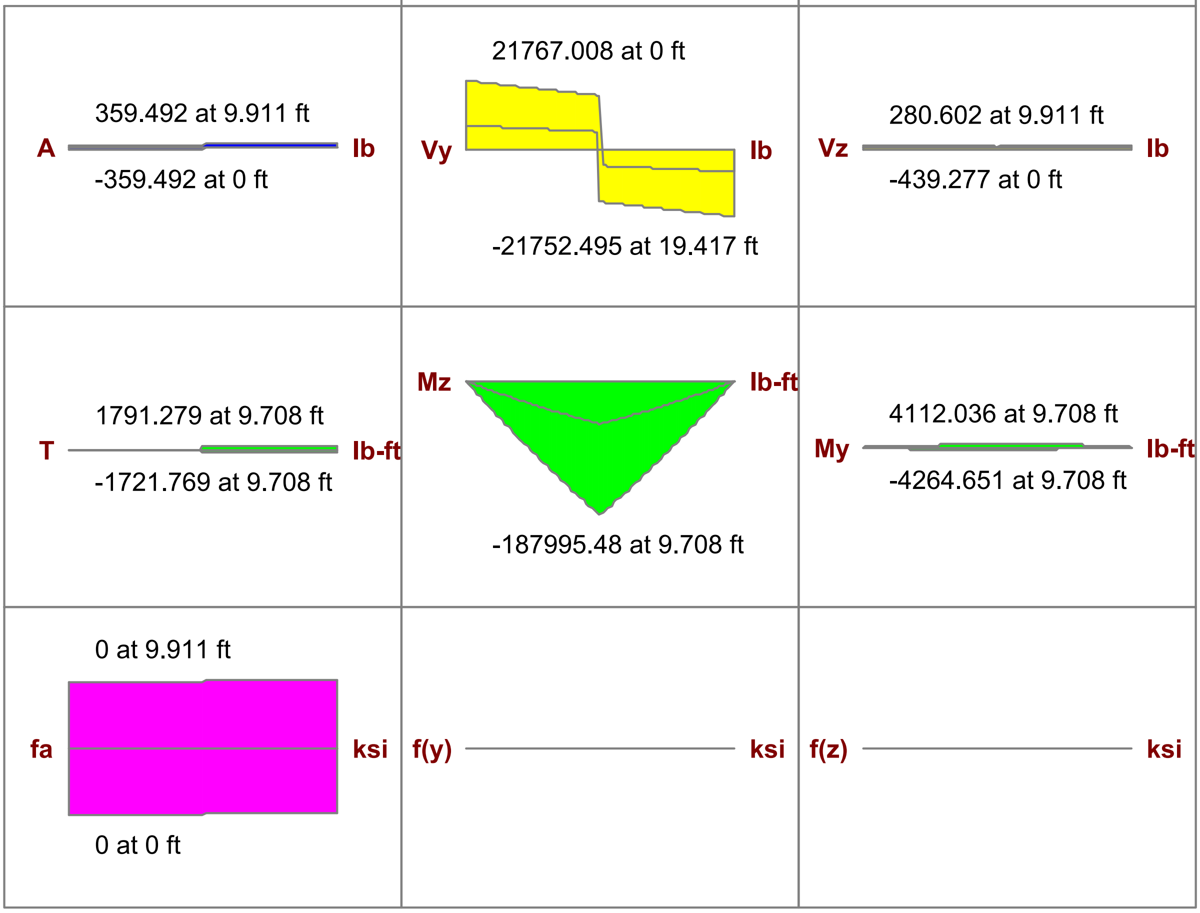
	Mem...		Axial[lb]	Loc...	LC	y Shear[lb]	Lo...	LC	z Shear[lb]	Lo...	LC	Torque[l...	Lo...	LC	y-y Mome...	Lo...	LC	z-z Mome...	Lo...	LC
1	M2	max	359.492	9.9...	140	21767.008	0	164	280.602	9....	189	1791.279	9....	147	4112.036	9....	147	0	0	222
2		min	-359.492	0	80	-21752.495	19...	170	-439.277	0	81	-1721.769	9....	177	-4264.651	9....	81	-187995.48	9....	164

Member: ***M2***

Shape:
Material: **RIGID**
Length: **19.417 ft**
I Joint: **N1**
J Joint: **N2**

Code Check: **No Calc**
Report Based On 97 Sections





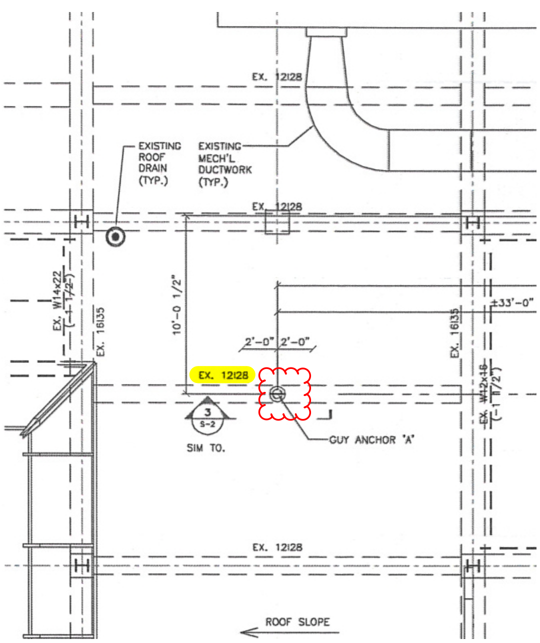
ANALYSIS OF EXISTING STEEL FOR GUY ANCHOR A

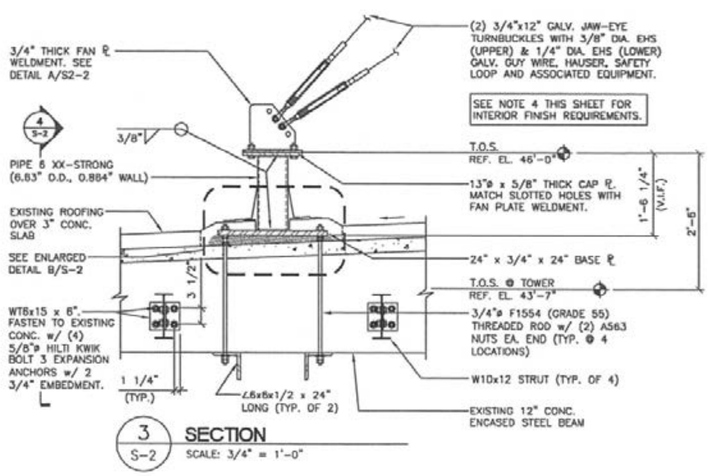
"W12x26"

BLACK & VEATCH

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Project:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	6/10/2020

No.	Load Combination	Tension lbs	Vertical	Axial	Shear
	User Input				
1	Dead Only w/o equipment and feedline	3771.00			
2	Dead Only with equipment and feedline	3787.00			
3	1.2 Dead + 1.0 Wind 0 degree + 1.0 Guy	1857.00			
5	1.2 Dead + 1.0 Wind 180 degree + 1.0 Guy	6659.00			
7	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Guy	6463.00			
8	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Wind 0 degree + 1.0 Guy	4947.00			
10	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Wind 180 degree + 1.0 Guy	8366.00			
	Unfactored Load				
12	Guy	3771.00	2729.94	2601.51	0.00
13	Dead (Equipment and feedline)	16.00	11.58	11.04	0.00
14	Wind 0 degree	-1933.20	-1399.50	-1333.66	0.00
16	Wind 180 degree	2868.80	2076.81	1979.11	0.00
18	Ice + Temp	2672.80	1934.92	1843.89	0.00
19	Wind Ice 0 degree	-1516	-1097.48	-1045.85	0.00
21	Wind Ice 180 degree	1903	1377.64	1312.83	0.00





BLACK & VEATCH	Owner:	EVERSOURCE		Computed By:	T. Eakkalak
	Plant:	HARTFORD AWC		Date:	6/8/2020
	Project No.	403093.2000.2200		Verified By:	L. Meyer
	Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE		Date:	7/23/2020

Snow Load for Rooftop Capacity Check (ASCE 7-10) - Windward Drift

Ground snow load	p_g =	30.0	psf	
Terrain Category		C		Sec. 26.7
Exposure of Roof		Fully Exposed		Table 7-2
Thermal Condition		All structures		
Snow exposure factor	C_e =	0.9		Table 7.2
Thermal factor	C_t =	1.0		Table 7.3
Structure Risk category		III		
Snow load importance factor	I_s =	1.1		Sec. 7.3.3
Snow load on "flat" roof	p_f =	20.8	psf	Eq. 7.3-1
Snow density	γ =	17.9	pcf	
Min. Snow load on "flat" roof: P_m =	P_m =	22.0	psf	Sec. 7.3.4

Geometry

Parapet and Roof Projections		Yes	
Height of balanced snow load	h_b =	1.16	ft
Clear height from top of balanced snow	h_c =	9.8	ft
Length of roof windward of drift (lower)	$l_{u,wind}$ =	50.0	ft
Height of snow drift (windward)	$h_{d,wind}$ =	1.86	ft
Height of snow drift	h_d =	1.86	ft

Results

Min. snow load on low-slope roofs	p_m =	20.0	psf
Width of snow drift	w =	7.45	ft
Max. intensity of drift surcharge load	p_d =	33.3	psf

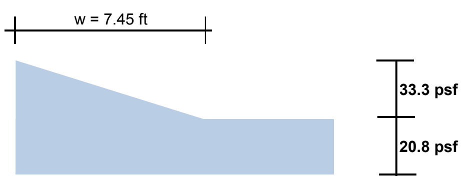
hc/hb > 0.2, NEED TO CAL SNOW DRIFT! (Sec. 7.7.1)

where,

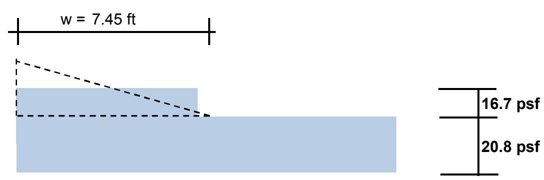
p_m = if(p_g <= 20, I_s x p_g, 20 x I_s)	Sec. 7.3.4
$\gamma = 0.13 \times p_g + 14 \leq 30$ pcf	Eq. 7.7-1
$h_b = p_f / \gamma$	
h_d = (0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9
$h_{d\_parapet}$ = 0.75(0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9 and Sec. 7.8
$p_f = 0.7 \times C_e \times C_t \times I_s \times p_g$	Eq. 7.3-1
w = IF(h_d<=h_c,4*h_d, 4*h_d^2/h_c)	
$p_d = h_d \times \gamma$	

Notes:

1) For parapet walls, l_u shall be taken equal to the length of the roof upwind (windward) of the wall
2) For roof projections, l_u shall be taken equal to the length of the roof upwind (windward)/downwind (leeward) of the projection
3) If the side of roof projection is less than 15ft long, a drift load is not required to be applied on that side
4) This template is not applicable for Hip and Gable Roofs, and/or highly sloped roofs



Actual Snow Drift Diagram



Equivalent Snow Drift Diagram for RISA Analysis

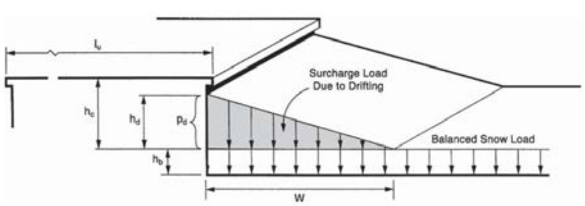


FIGURE 7-8 Configuration of Snow Drifts on Lower Roofs.

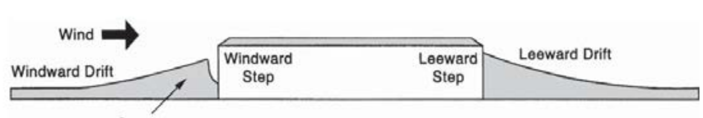


FIGURE 7-7 Drifts Formed at Windward and Leeward Steps.

5. ANALYSIS & DESIGN

5.1 Structural Analysis of Existing Building Rooftop Structure

Existing Loading Conditions

Exist roof construction consists of EPDM rubber roofing over insulation (3" assumed), over 3-1/4" thickness concrete deck (Normal Weight), over concrete encased W beams.

5.1.2) Existing Roof Beam W12x26 (Grid-9&Grid-11, Grid-G&Grid-H)

Dead Load of Roof Floor Slab

Width of Slab at considering span, B	=	9.71	ft	
Length of Slab at considering span, L	=	22.00	ft	
Ratio B / L = 9.71ft / 22ft	=	0.44	< 0.5 One Way Load	
Tributary Width	=	9.71	ft	
0.060 EPDM	=	1.0	psf	
3" Rigid	=	4.5	psf	
3 -1/4" Concrete Deck = 145 pcf x 3.25" / 12	=	39.3	psf	
M/E/P	=	4.0	psf	
Finishing	=	1.0	psf	
Total	=	49.8	psf	
	USE =	**50.0**	psf	
Dead Load of Concrete Beam + W12x26	=	144.0	psf	
Roof Live Load	=	20.0	psf	
Snow - Pm (Uniform Min. Roof)	=	22.0	psf	
Snow Load on "Flat" Roof, Pf with drift (when w > 7.45ft)	=	37.5	psf	
Wind Uplift Load on Building Roof	=	-39.82	psf	
Wind Down Load on Building Roof	=	1.14	psf	

Load Apply For RISA 3D:

- Existing Load on Roof Floor Slab

Concrete Beam Self Weight, DL =	=	144.0	plf
Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft	=	485.5	plf
Roof Live Load, Lr = 20psf x 9.71ft	=	194.2	plf
Snow Load, SL = 22psf x 9.71ft	=	213.6	plf
Snow Load, SLN = 37.5psf x 9.71ft	=	364.1	plf
Wind Uplift Load, WL-Y = -39.82psf x 9.71ft	=	-386.7	plf
Wind Down Load, WL+Y = 1.14psf x 9.71ft	=	11.1	plf

- Load from TNX. (Un - Factor)

Guy Geometry : Guy Anchor A (+ = Tension, - = Compression)

Guy Height - Level 1	@	Corner	=	18.94	ft	
Guy Radius - Level 1	@	Corner	=	33.00	ft	
Guy Height - Level 2	@	Torque Arm	=	46.38	ft	
Guy Radius - Level 2	@	Torque Arm	=	33.00	ft	
The Effective Angle of Tension in Guy, θ_R			=	46.38	degree	From E1 tnx.
Height of Pipe 6 XXS, h			=	2.50	ft	

BLACK & VEATCH			
Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Site Name:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

Dead Load of Equipment & Feedline without Guy

Tension in Guy, T		=	16	lbs.
Horizontal Load, Z	= 16lbs.x cos46.38	=	11	lbs.
Tension Load, Y	= 16lbs.x sin46.38	=	12	lbs.
Moment from Horizontal Z, Mx	= 11lbs. x 2.5ft	=	27.5	lbs. - ft

Dead Load of Guy only

Tension in Guy, T		=	3771	lbs.
Horizontal Load, Z	= 3771lbs.x cos46.38	=	2,602	lbs.
Tension Load, Y	= 3771lbs.x sin46.38	=	2730	lbs.
Moment from Horizontal Z, Mx	= 2,602lbs. x 2.5ft	=	6505	lbs. - ft

Wind Load 0 Deg (+Z)

Tension in Guy, T		=	-1933	lbs.
Horizontal Load, Z	= -1933lbs.x cos46.38	=	-1,334	lbs.
Compression Load, Y	= -1933lbs.x sin46.38	=	-1399	lbs.
Moment from Horizontal Z, Mx	= -1,334lbs. x 2.5ft	=	-3335	lbs. - ft

Wind Load 180 Deg (-Z)

Tension in Guy, T		=	2869	lbs.
Horizontal Load, Z	= 2869lbs.x cos46.38	=	1,979	lbs.
Tension Load, Y	= 2869lbs.x sin46.38	=	2077	lbs.
Moment from Horizontal Z, Mx	= 1,979lbs. x 2.5ft	=	4948	lbs. - ft

Ice DL + Temp

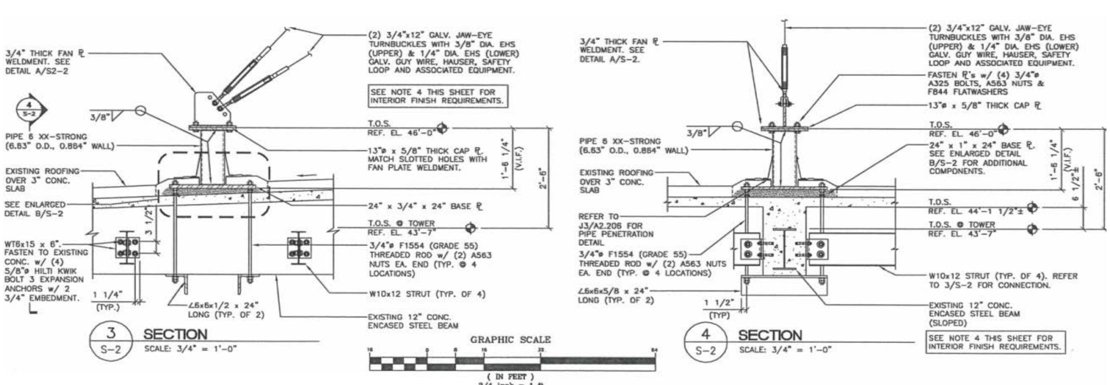
Tension in Guy, T		=	2673	lbs.
Horizontal Load, Z	= 2673lbs.x cos46.38	=	1,844	lbs.
Tension Load, Y	= 2673lbs.x sin46.38	=	1935	lbs.
Moment from Horizontal Z, Mx	= 1,844lbs. x 2.5ft	=	4610	lbs. - ft

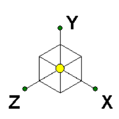
Ice Wind Load 0 Deg (+Z)

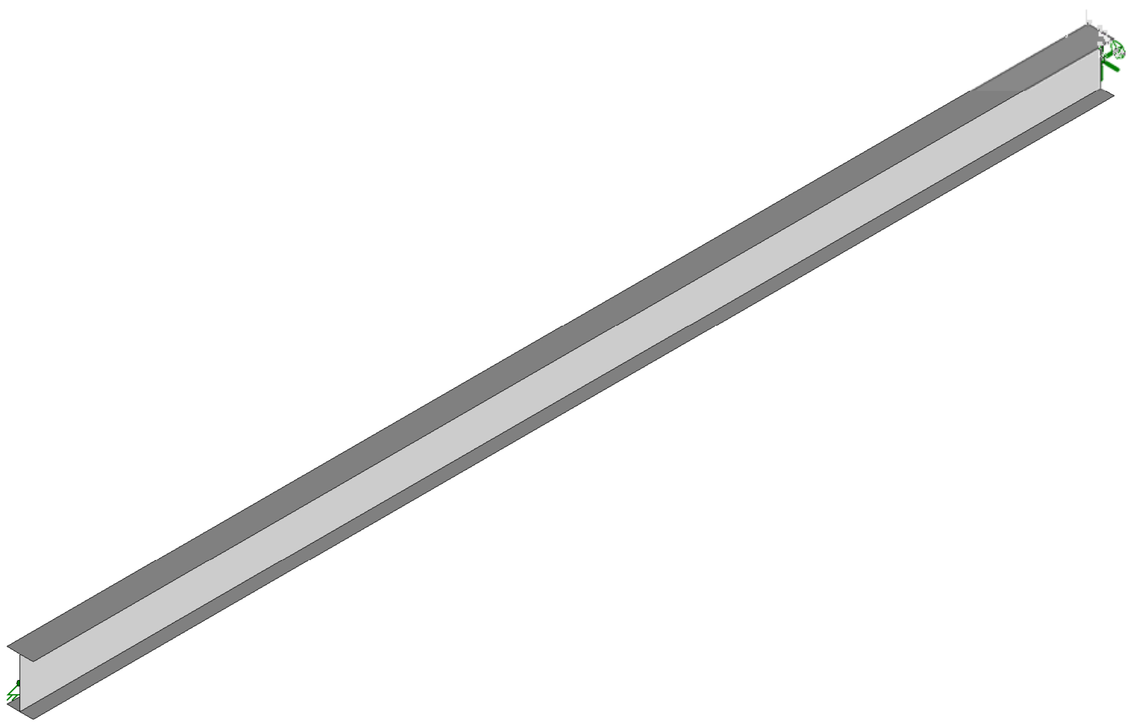
Tension in Guy, T		=	-1516	lbs.
Horizontal Load, Z	= -1516lbs.x cos46.38	=	-1,046	lbs.
Compression Load, Y	= -1516lbs.x sin46.38	=	-1097	lbs.
Moment from Horizontal Z, Mx	= -1,046lbs. x 2.5ft	=	-2615	lbs. - ft

Ice Wind Load 180 Deg (-Z)

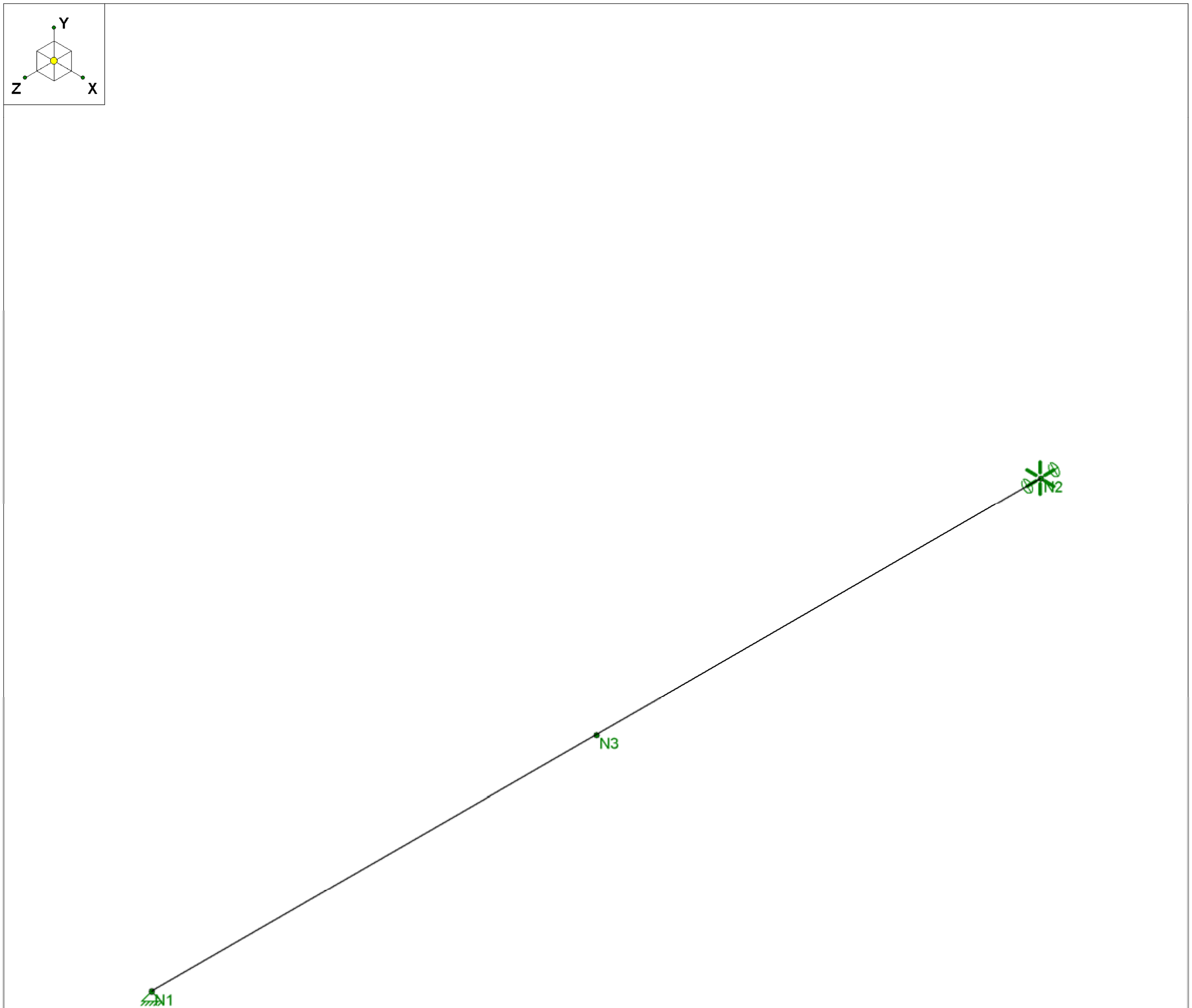
Tension in Guy, T		=	1903	lbs.
Horizontal Load, Z	= 1903lbs.x cos46.38	=	1,313	lbs.
Tension Load, Y	= 1903lbs.x sin46.38	=	1378	lbs.
Moment from Horizontal Z, Mx	= 1,313lbs. x 2.5ft	=	3283	lbs. - ft



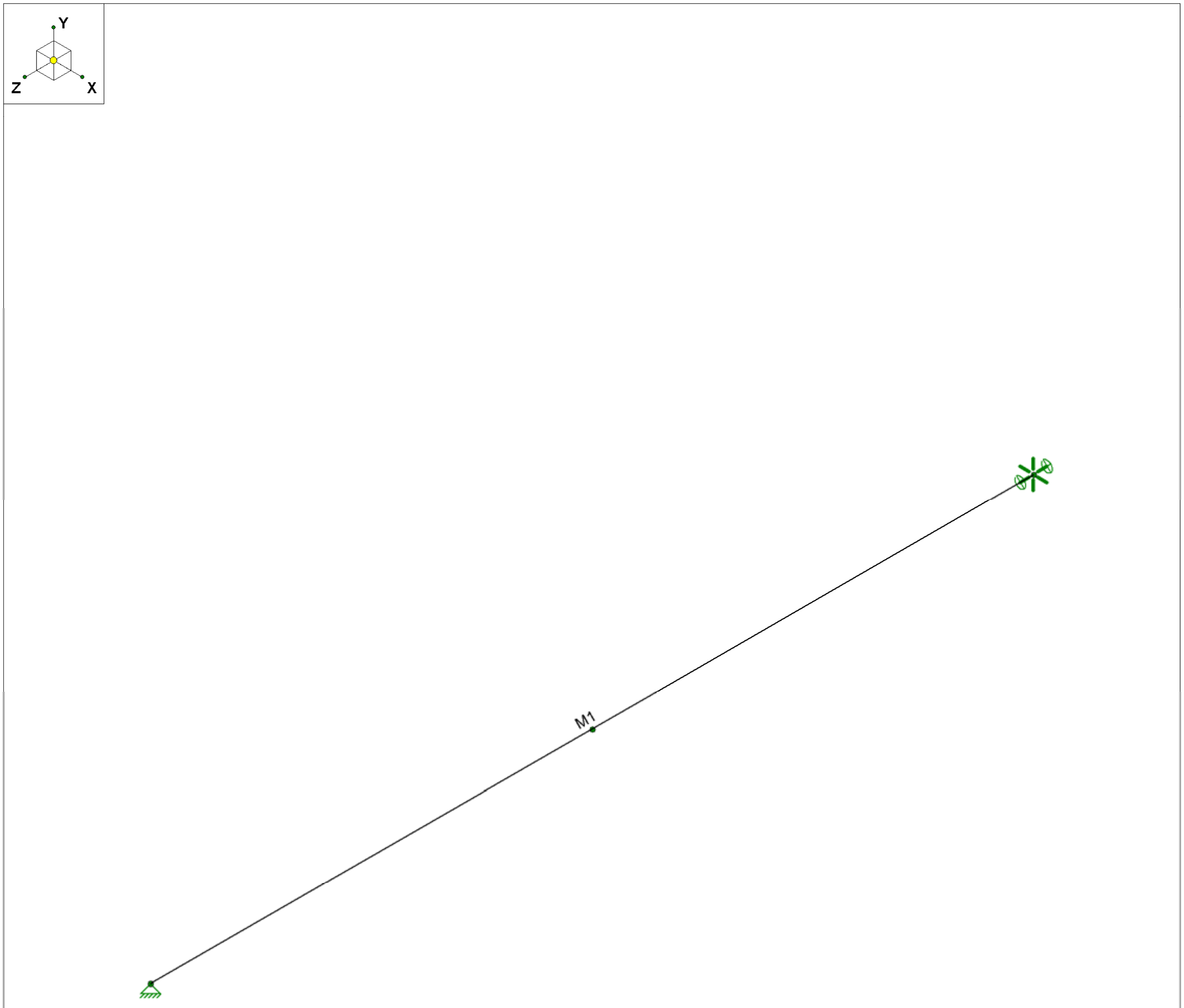




Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 1
T. Eakkalak		July 23, 2020 at 9:33 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 2
T. Eakkalak		July 23, 2020 at 9:33 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 3
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

Load Apply For RISA 3D:					
	- Existing Load on Roof Floor Slab				
	Concrete Beam Self Weight, DL =		=	144.0	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft		=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft		=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft		=	213.6	plf
	Snow Load, SLN = 37.5psf x 9.71ft		=	364.1	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft		=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft		=	11.1	plf

Loads: BLC 1, Beam and Roof

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 4
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

Load Apply For RISA 3D:						
	- **Existing Load on Roof Floor Slab**					
	Concrete Beam Self Weight, DL =			=	144.0	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft			=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft			=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft			=	213.6	plf
	Snow Load, SLN = 37.5psf x 9.71ft			=	364.1	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft			=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft			=	11.1	plf

Loads: BLC 2, Roof Live Load

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 5
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

Load Apply For RISA 3D:				
	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	144.0	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft	=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft	=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft	=	213.6	plf
	Snow Load, SLN = 37.5psf x 9.71ft	=	364.1	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft	=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft	=	11.1	plf

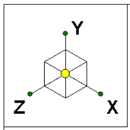
Loads: BLC 3, Snow (Pm)

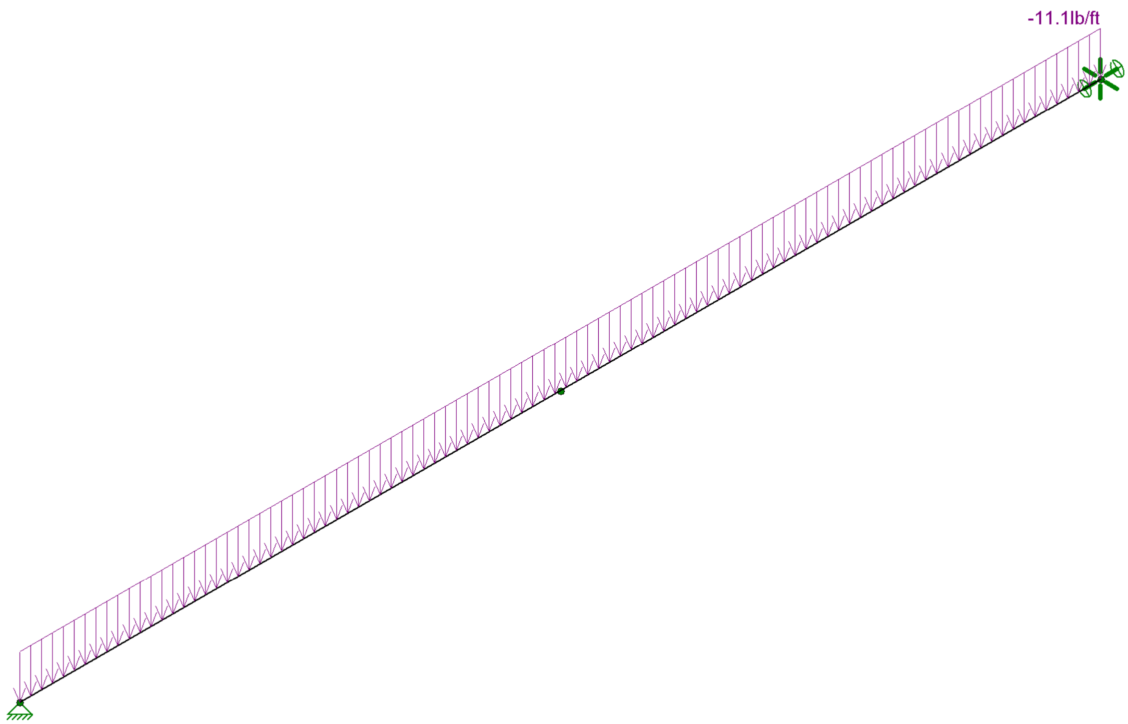
Black & Veatch Corp.		SK - 6
T. Eakkalak	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

Load Apply For RISA 3D:				
	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	144.0	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft	=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft	=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft	=	213.6	plf
	Snow Load, SLN = 37.5psf x 9.71ft	=	364.1	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft	=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft	=	11.1	plf

Loads: BLC 4, Snow (Pf + Drift)

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 7
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...





Load Apply For RISA 3D:				
	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	144.0	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft	=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft	=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft	=	213.6	plf
	Snow Load, SLN = 37.5psf x 9.71ft	=	364.1	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft	=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft	=	11.1	plf

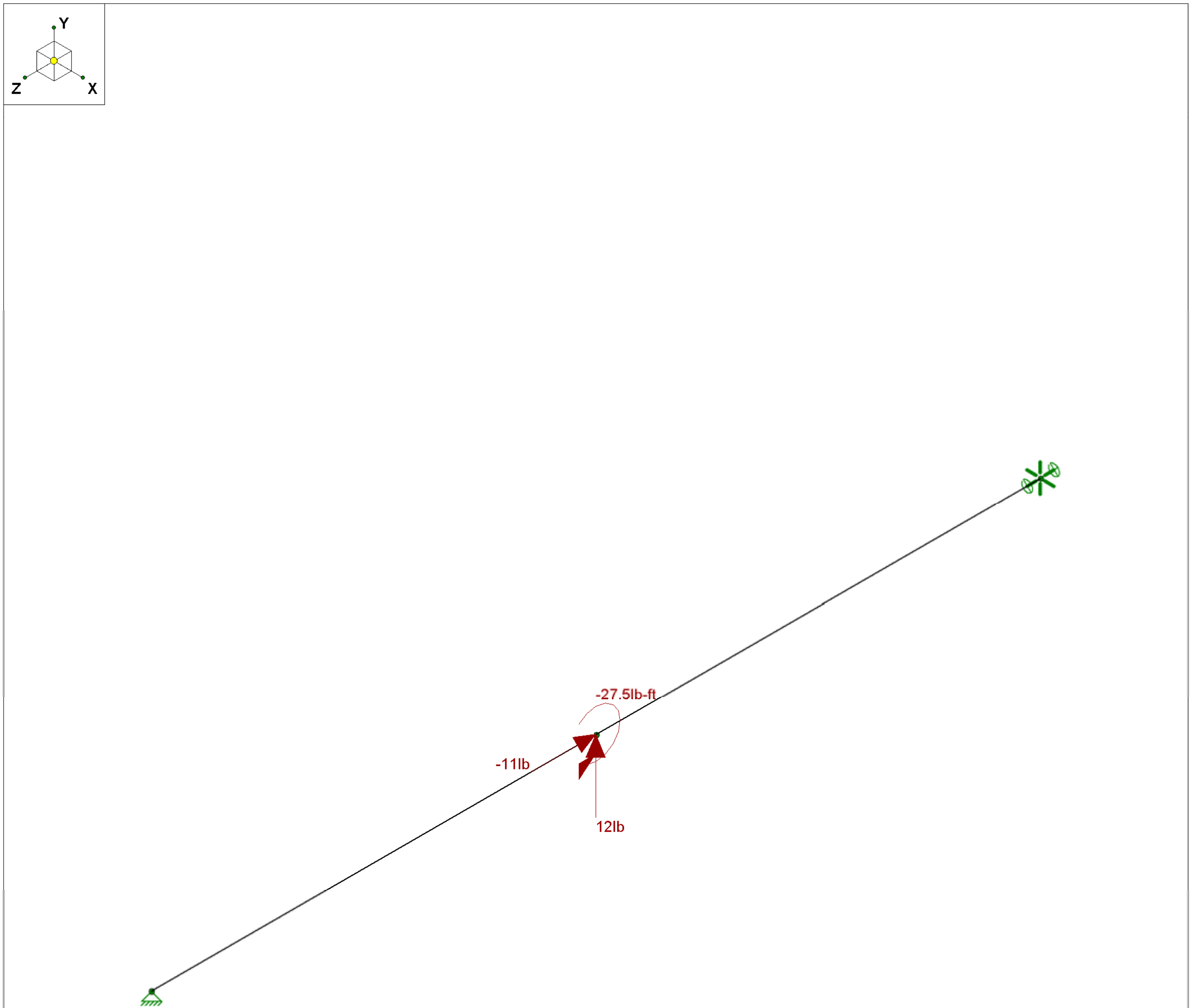
Loads: BLC 5, Wind Roof Pressure (Positive)

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 8
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

Load Apply For RISA 3D:				
- **Existing Load on Roof Floor Slab**				
Concrete Beam Self Weight, DL =	=	144.0	plf
Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft	=	485.5	plf
Roof Live Load, Lr = 20psf x 9.71ft	=	194.2	plf
Snow Load, SL = 22psf x 9.71ft	=	213.6	plf
Snow Load, SLN = 37.5psf x 9.71ft	=	364.1	plf
Wind Uplift Load, WL-Y = -39.82psf x 9.71ft	=	-386.7	plf
Wind Down Load, WL+Y = 1.14psf x 9.71ft	=	11.1	plf

Loads: BLC 6, Wind Roof Pressure (Negative)

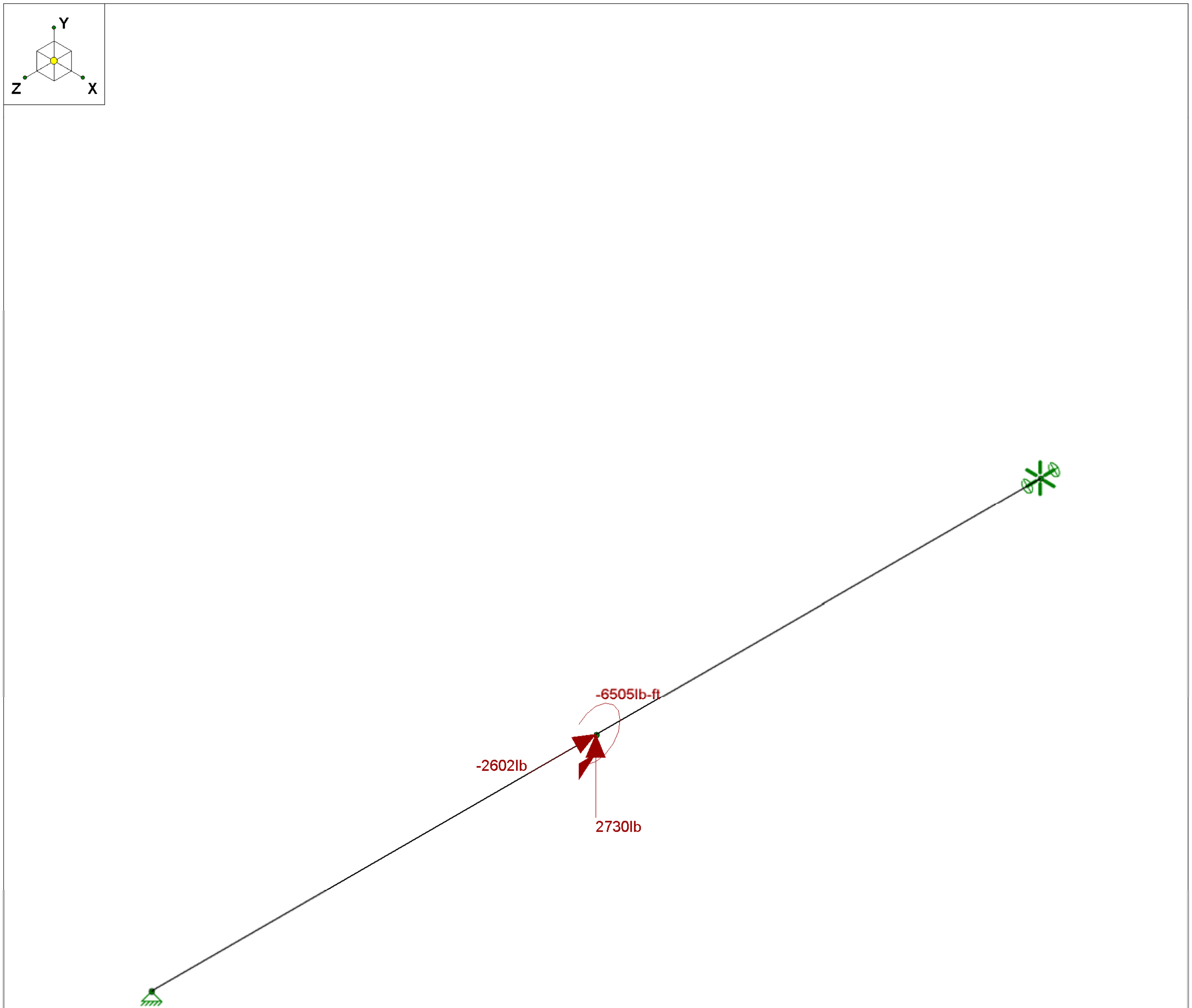
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 9
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Dead Load of Equipment & Feedline without Guy						
	Tension in Guy, T			=	16	lbs.
	Horizontal Load, Z		= 16lbs.x cos46.38	=	11	lbs.
	Tension Load, Y		= 16lbs.x sin46.38	=	12	lbs.
	Moment from Horizontal Z, Mx		= 11lbs. x 2.5ft	=	27.5	lbs. - ft

Loads: BLC 8, Tower Dead

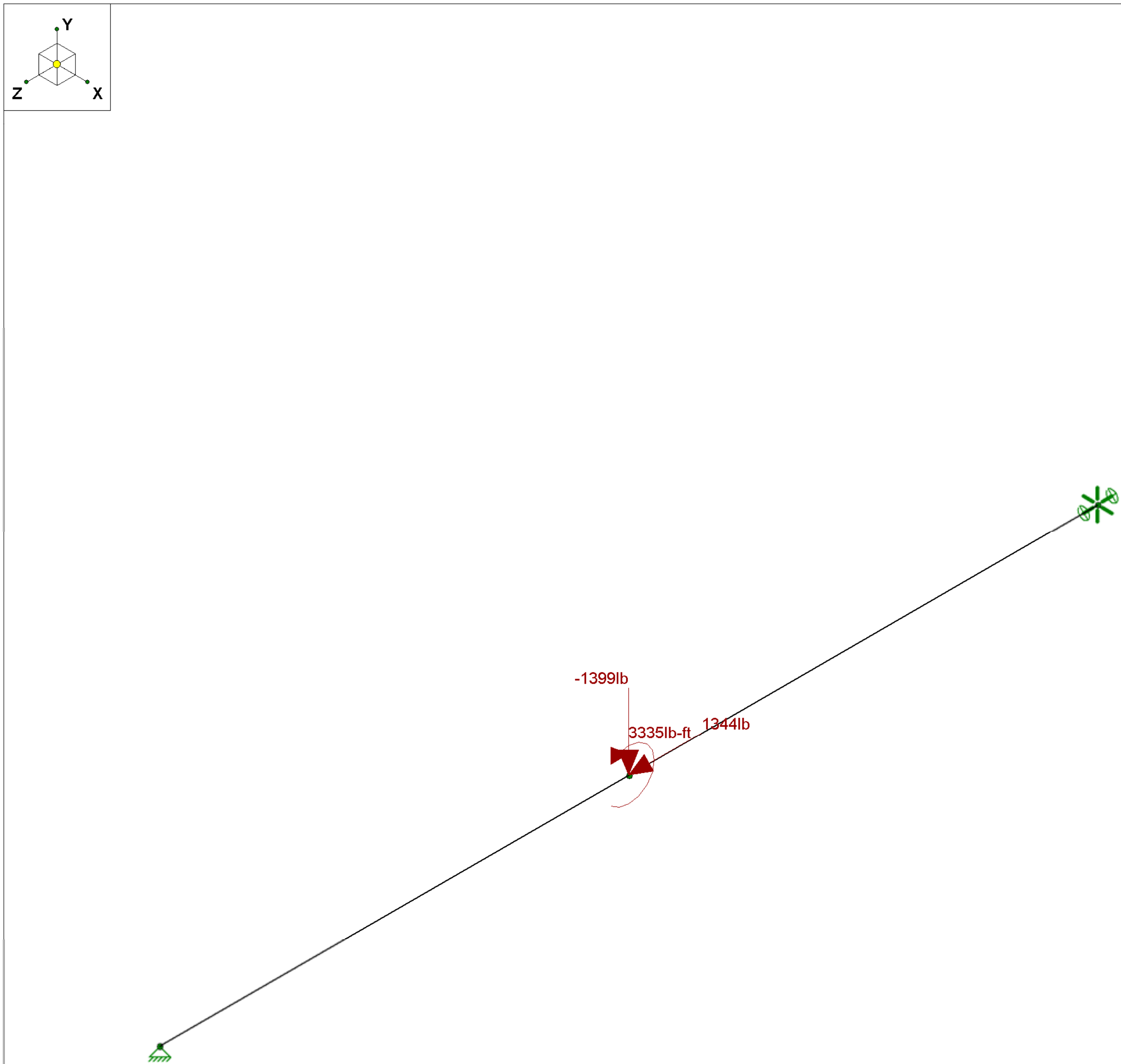
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 10
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Dead Load of Guy only						
	Tension in Guy, T			=	3771	lbs.
	Horizontal Load, Z		= 3771lbs.x cos46.38	=	2,602	lbs.
	Tension Load, Y		= 3771lbs.x sin46.38	=	2730	lbs.
	Moment from Horizontal Z, Mx		= 2,602lbs. x 2.5ft	=	6505	lbs. - ft

Loads: BLC 9, Guy Self Weight

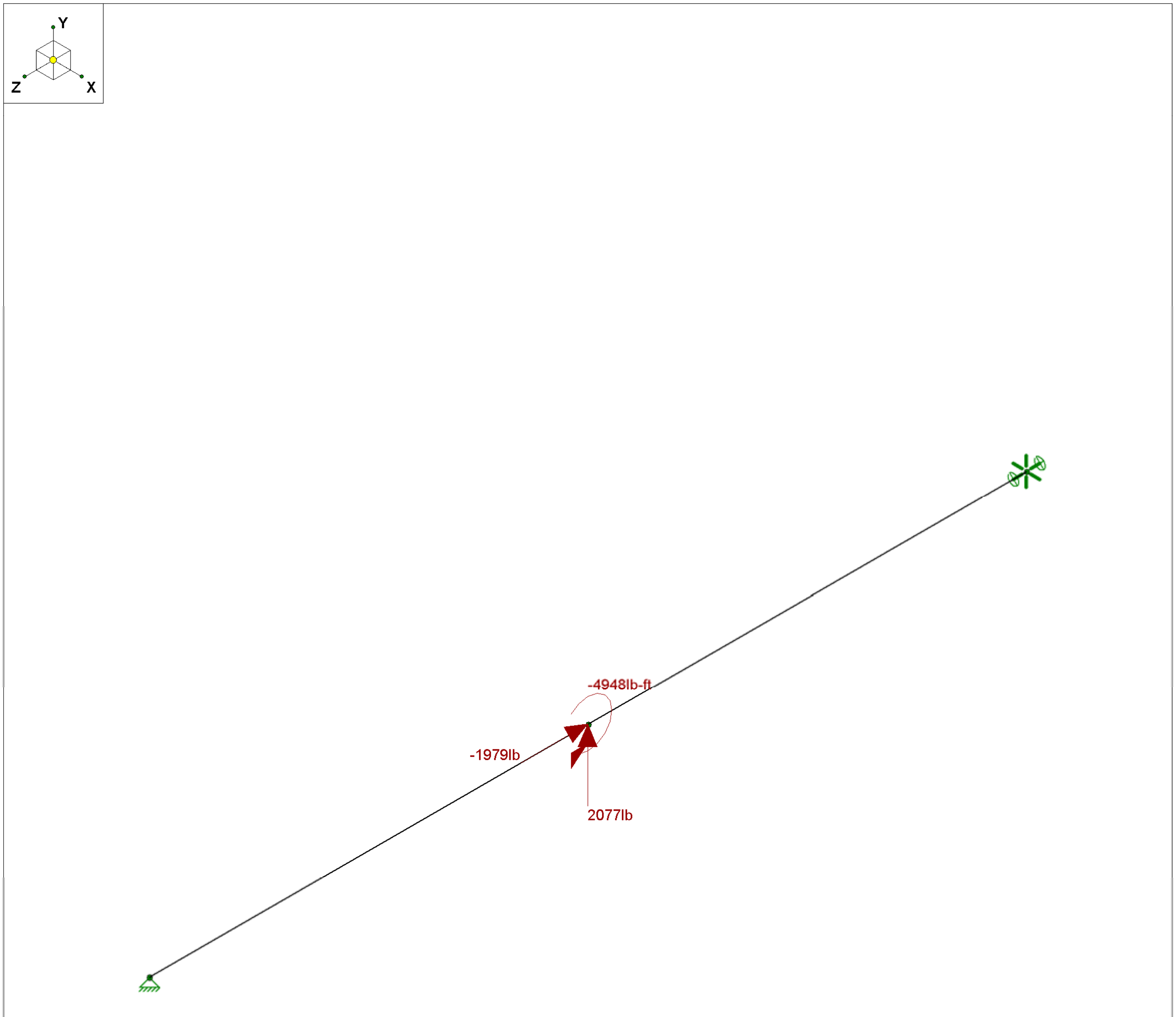
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 11
T. Eakkalak		July 23, 2020 at 9:34 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Wind Load 0 Deg (+Z)					
Tension in Guy, T		=	-1933	lbs.
Horizontal Load, Z	= -1933lbs.x cos46.38	=	-1,334	lbs.
Compression Load, Y	= -1933lbs.x sin46.38	=	-1399	lbs.
Moment from Horizontal Z, Mx	= -1,334lbs. x 2.5ft	=	-3335	lbs. - ft

Loads: BLC 10, Wind Load +Z

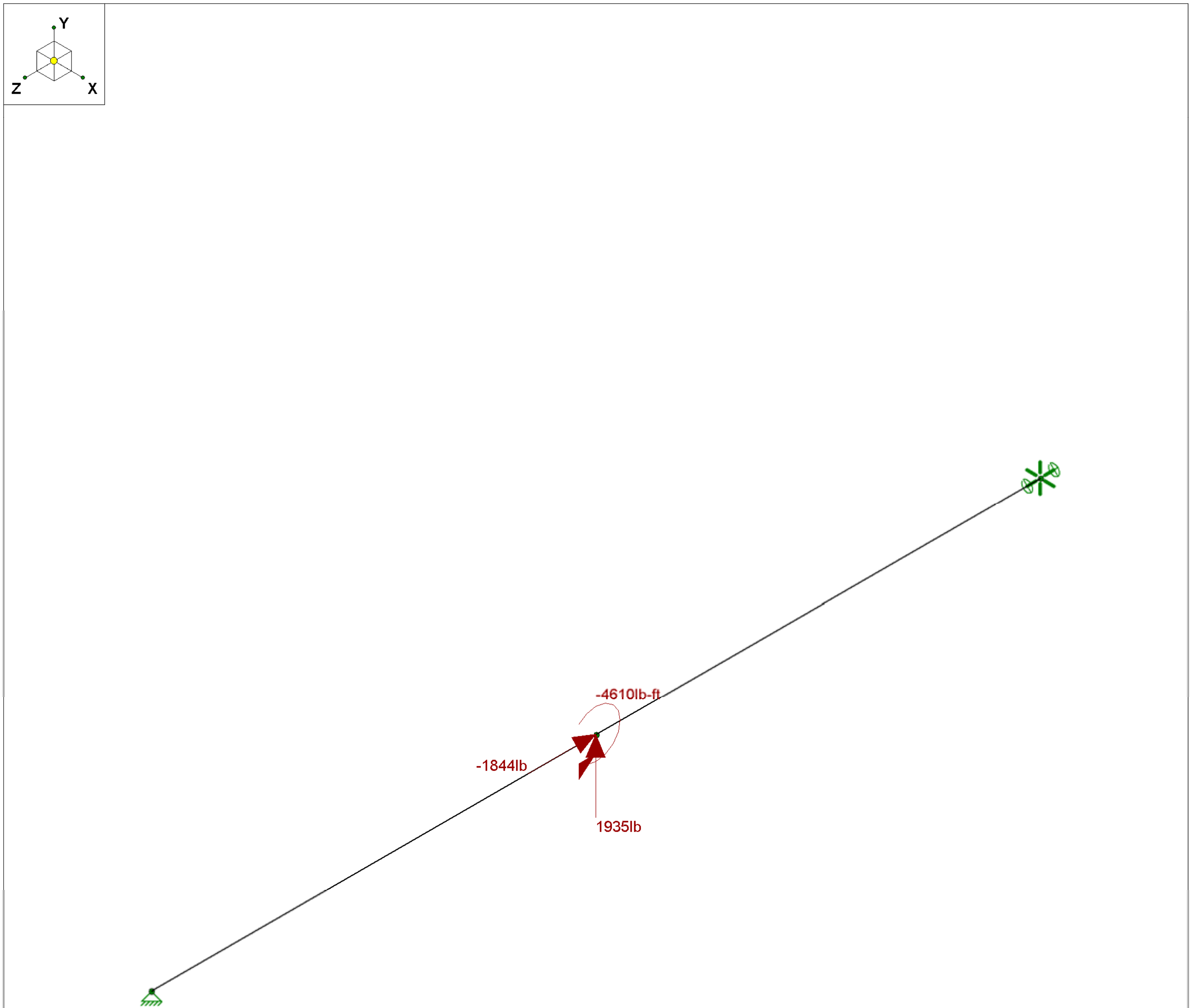
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 12
T. Eakkalak		July 23, 2020 at 9:35 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Wind Load 180 Deg (-Z)						
	Tension in Guy, T			=	2869	lbs.
	Horizontal Load, Z		= 2869lbs.x cos46.38	=	1,979	lbs.
	Tension Load, Y		= 2869lbs.x sin46.38	=	2077	lbs.
	Moment from Horizontal Z, Mx		= 1,979lbs. x 2.5ft	=	4948	lbs. - ft

Loads: BLC 11, Wind Load -Z

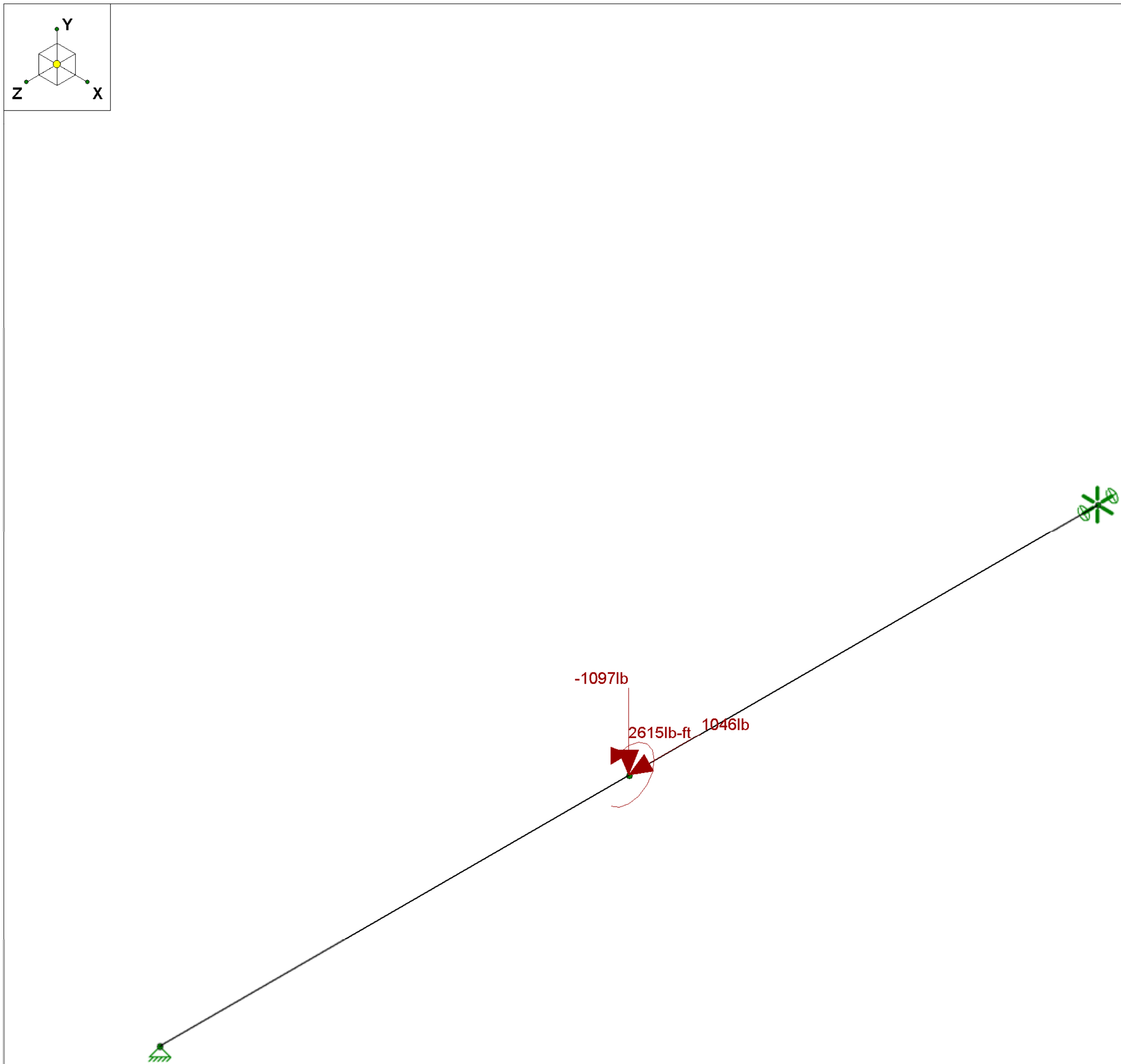
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 13
T. Eakkalak		July 23, 2020 at 9:35 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice DL + Temp					
Tension in Guy, T			=	2673	lbs.
Horizontal Load, Z		= 2673lbs.x cos46.38	=	1,844	lbs.
Tension Load, Y		= 2673lbs.x sin46.38	=	1935	lbs.
Moment from Horizontal Z, Mx		= 1,844lbs. x 2.5ft	=	4610	lbs. - ft

Loads: BLC 12, Ice Dead Load

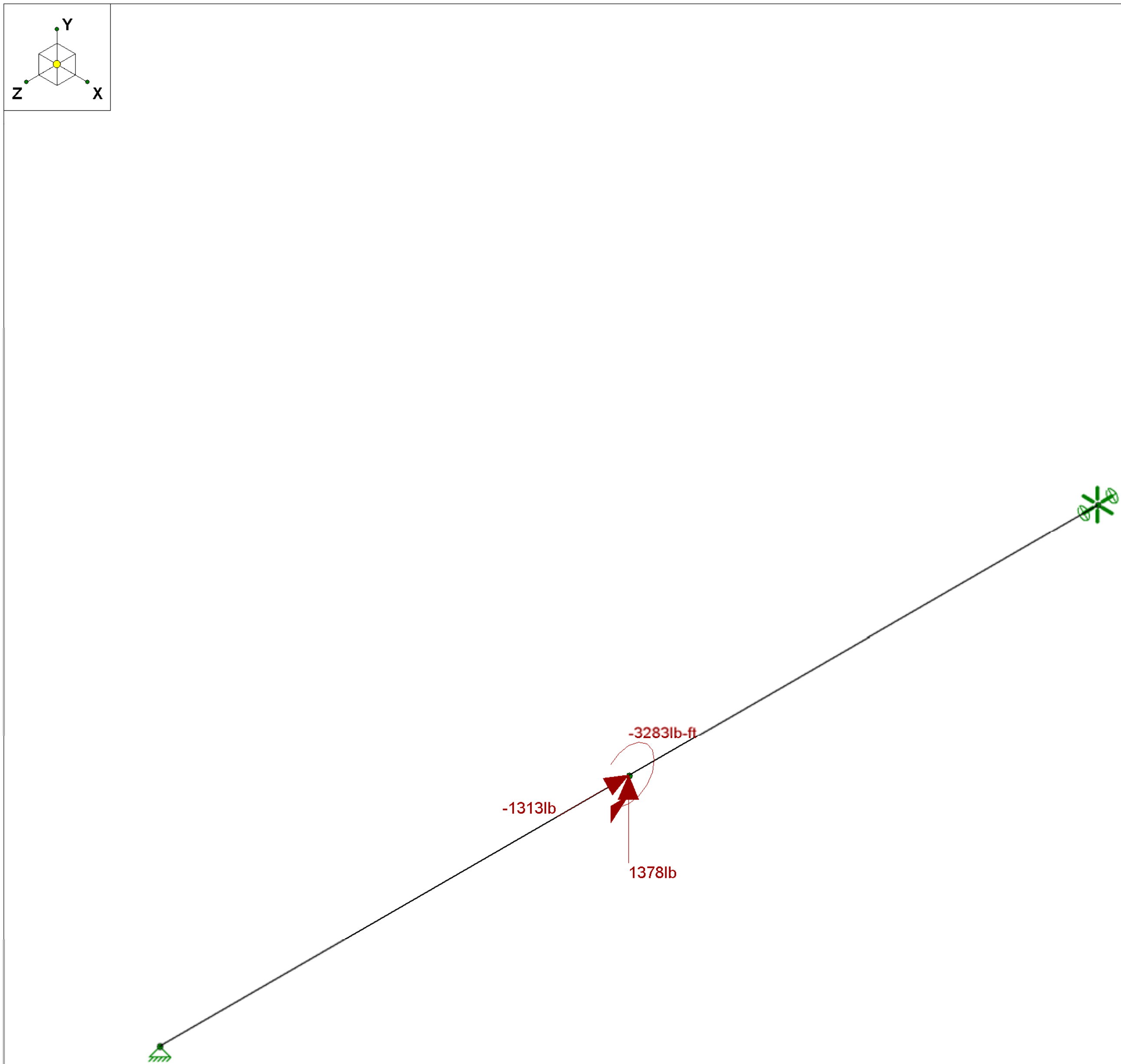
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 14
T. Eakkalak		July 23, 2020 at 9:35 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice Wind Load 0 Deg (+Z)						
	Tension in Guy, T			=	-1516	lbs.
	Horizontal Load, Z		= -1516lbs.x cos46.38	=	-1,046	lbs.
	Compression Load, Y		= -1516lbs.x sin46.38	=	-1097	lbs.
	Moment from Horizontal Z, Mx		= -1,046lbs. x 2.5ft	=	-2615	lbs. - ft

Loads: BLC 13, Ice Wind Load +Z

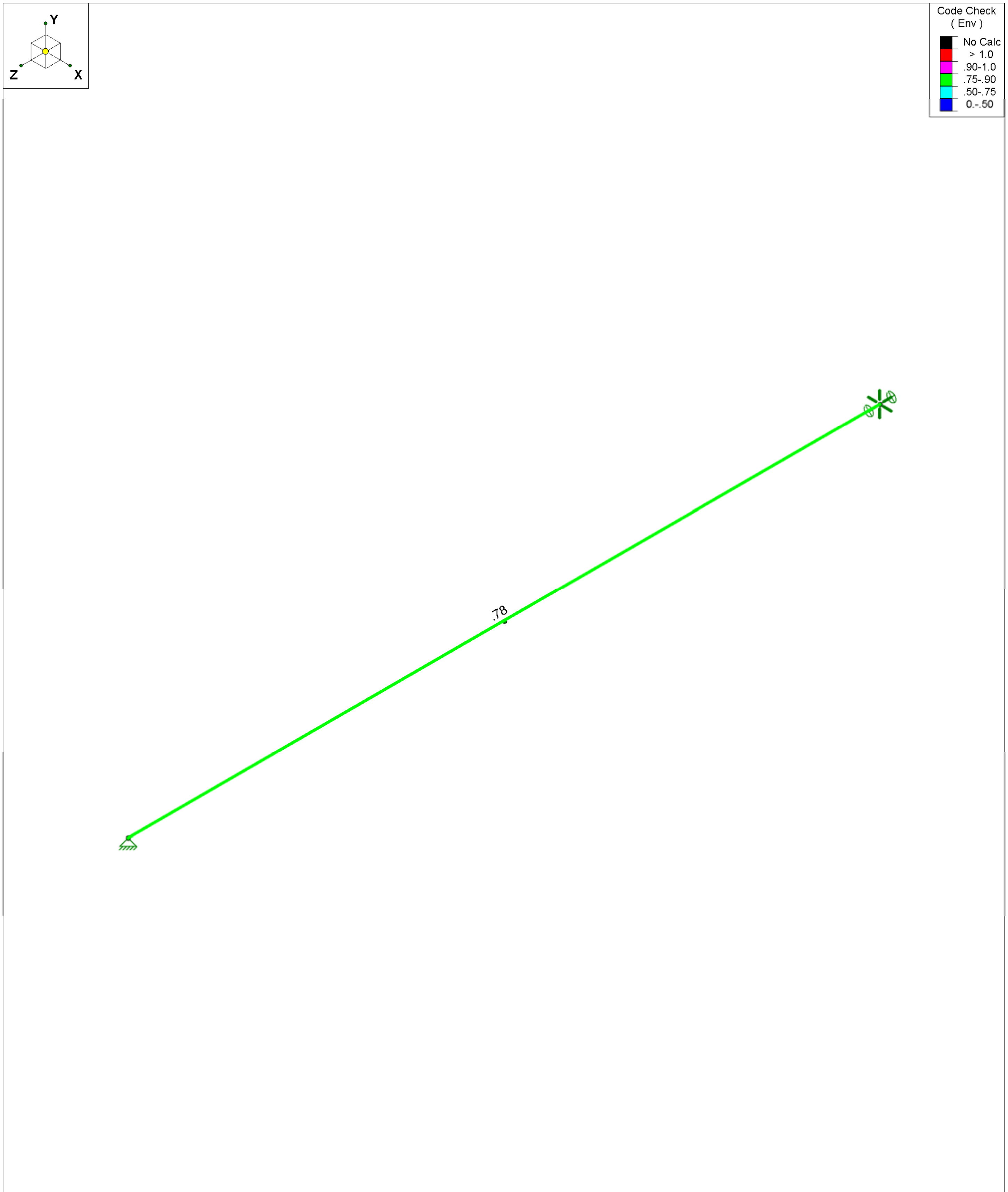
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 15
T. Eakkalak		July 23, 2020 at 9:35 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice Wind Load 180 Deg (-Z)					
Tension in Guy, T		=	1903	lbs.
Horizontal Load, Z	= 1903lbs.x cos46.38	=	1,313	lbs.
Tension Load, Y	= 1903lbs.x sin46.38	=	1378	lbs.
Moment from Horizontal Z, Mx	= 1,313lbs. x 2.5ft	=	3283	lbs. - ft

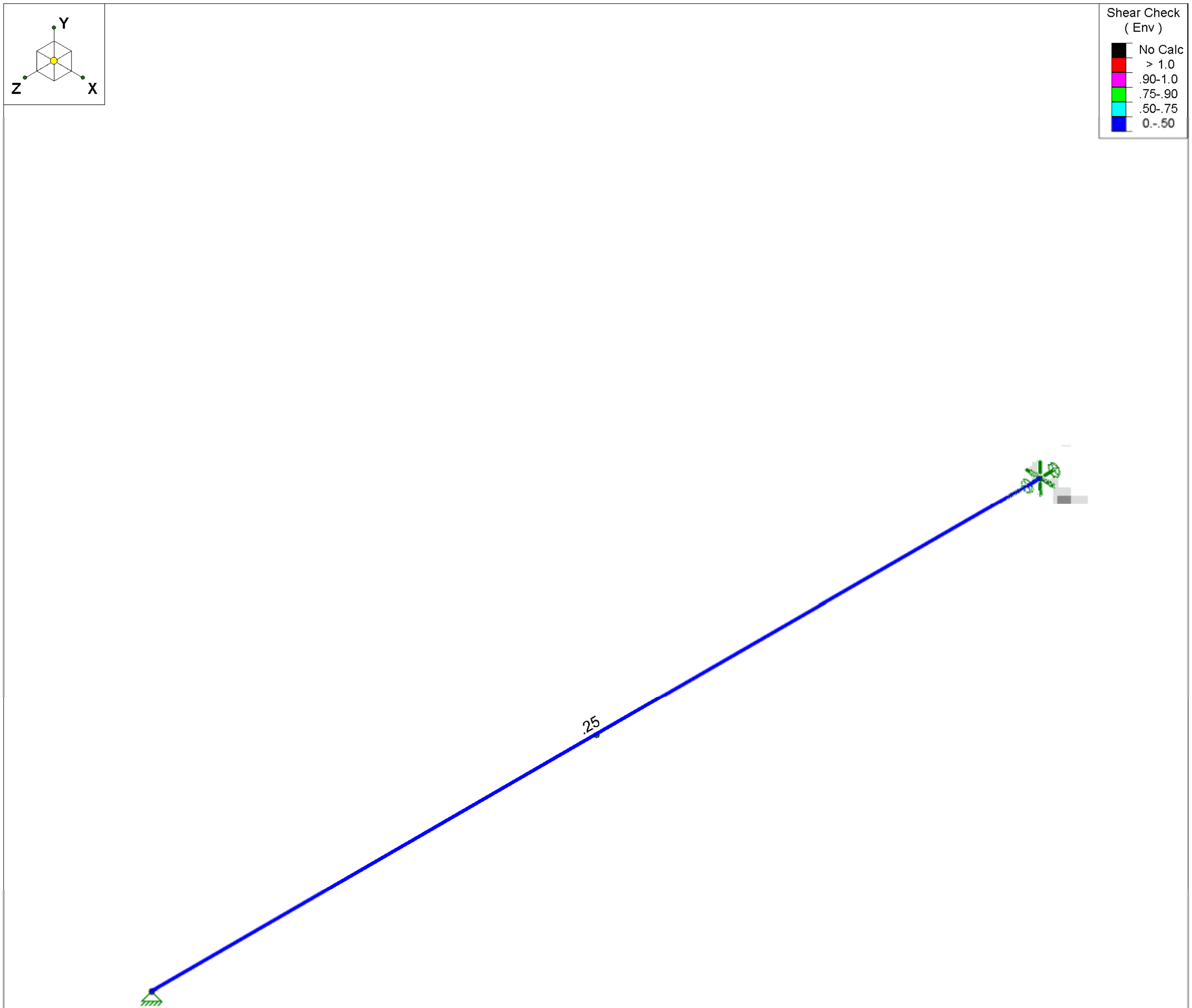
Loads: BLC 14, Ice Wind Load -Z

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 16
T. Eakkalak		July 23, 2020 at 9:35 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 17
T. Eakkalak		July 23, 2020 at 9:35 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x26 (Anchor A)	SK - 18
T. Eakkalak		July 23, 2020 at 9:35 AM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

(Global) Model Settings

Display Sections for Member Calcs	12
Max Internal Sections for Member Calcs	100
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building
Stainless Steel Code	None

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	None
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A9 (Building)	29000	11154	.3	.65	.49	33	1.5	65	1.2

General Material Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]
1	RIGID	1e+6		.3	0	0

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Beam	W12X26	Beam	Wide Flange	A9 (Building)	Typical	7.65	17.3	204	.3

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	RIGID		None	RIGID	1e+6	1e+6	1e+6	1e+6

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	N1	20.705	0	22	0	
2	N2	20.705	0	0	0	
3	N3	20.705	0	11	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N1	Reaction	Reaction	Reaction			
2	N2	Reaction	Reaction	Reaction			Reaction

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design Rul...
1	M1	N2	N1			Beam	Beam	Wide Flange	A9 (Buildi...	Typical

Member Advanced Data

	Label	I Release	J Release	I Offset[in]	J Offset[in]	T/C Only	Physical	Defl Rat...	Analysis ...	Inactive	Seismic...
1	M1						Yes	Default			None

Hot Rolled Steel Design Parameters

	Label	Shape	Length[ft]	Lbyy[ft]	Lbzz[ft]	Lcomp to...	Lcomp b...	L-torque[ft]	Kyy	Kzz	Cb	Function
1	M1	Beam	22	22		0		0				Lateral

Joint Loads and Enforced Displacements (BLC 8 : Tower Dead)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	12
2	N3	L	Z	-11
3	N3	L	Mx	-27.5

Joint Loads and Enforced Displacements (BLC 9 : Guy Self Weight)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	2730
2	N3	L	Z	-2602
3	N3	L	Mx	-6505

Joint Loads and Enforced Displacements (BLC 10 : Wind Load +Z)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	-1399
2	N3	L	Z	1344
3	N3	L	Mx	3335

Joint Loads and Enforced Displacements (BLC 11 : Wind Load -Z)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	2077
2	N3	L	Z	-1979
3	N3	L	Mx	-4948

Joint Loads and Enforced Displacements (BLC 12 : Ice Dead Load)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	1935
2	N3	L	Z	-1844
3	N3	L	Mx	-4610

Joint Loads and Enforced Displacements (BLC 13 : Ice Wind Load +Z)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	-1097
2	N3	L	Z	1046
3	N3	L	Mx	2615

Joint Loads and Enforced Displacements (BLC 14 : Ice Wind Load -Z)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Y	1378
2	N3	L	Z	-1313
3	N3	L	Mx	-3283

Member Distributed Loads (BLC 1 : Beam and Roof)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-144	-144	0	0
2	M1	Y	-485.5	-485.5	0	0

Member Distributed Loads (BLC 2 : Roof Live Load)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-194.2	-194.2	0	0

Member Distributed Loads (BLC 3 : Snow (Pm))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-213.6	-213.6	0	0

Member Distributed Loads (BLC 4 : Snow (Pf + Drift))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-202	-202	0	0
2	M1	Y	-162.1	-162.1	0	0

Member Distributed Loads (BLC 5 : Wind Roof Pressure (Positive))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-11.1	-11.1	0	0

Member Distributed Loads (BLC 6 : Wind Roof Pressure (Negative))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	386.7	386.7	0	0

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu...	Area(M...	Surface...
1	Beam and Roof	DL						2		
2	Roof Live Load	RLL						1		
3	Snow (Pm)	SL						1		
4	Snow (Pf + Drift)	SLN						2		
5	Wind Roof Pressure (Positive)	WL+Y						1		
6	Wind Roof Pressure (Negative)	WL-Y						1		
8	Tower Dead	DL				3				
9	Guy Self Weight	DL				3				
10	Wind Load +Z	WL+Z				3				
11	Wind Load -Z	WL-Z				3				
12	Ice Dead Load	NL				3				
13	Ice Wind Load +Z	WLZ+R				3				
14	Ice Wind Load -Z	WLZ-R				3				

Load Combinations

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	...	F...
1	1.4DL	Yes	Y		DL	1.4																		
2	1.2DL + 0.5RLL	Yes	Y		DL	1.2	RLL	.5																
3	1.2DL + 0.5SL	Yes	Y		DL	1.2	SL	.5																
4	1.2DL + 0.5SLN	Yes	Y		DL	1.2	SLN	.5																
5	1.2DL + 0.2IDL + 0.5SL	Yes	Y		DL	1.2	NL	.2	SL	.5														
6	1.2DL + 0.2IDL + 0.5SLN	Yes	Y		DL	1.2	NL	.2	SLN	.5														
7	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL...	.5	WL...	.5												
8	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL-Z	.5	WL...	.5												
9	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL...	.5	WL-Y	.5												
10	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL-Z	.5	WL-Y	.5												
11	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL...	.5	WL...	.5												
12	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL-Z	.5	WL...	.5												
13	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL...	.5	WL-Y	.5												
14	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL-Z	.5	WL-Y	.5												
15	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL...	.5	WL...	.5												
16	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL-Z	.5	WL...	.5												
17	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL...	.5	WL-Y	.5												
18	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL-Z	.5	WL-Y	.5												
19	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL...	1	RLL	.5												
20	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL...	1	RLL	.5												
21	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	RLL	.5												
22	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	RLL	.5												
23	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL...	1	SL	.5												
24	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL...	1	SL	.5												

Load Combinations (Continued)

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	...	F...
25	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SL	.5												
26	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SL	.5												
27	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL...	1	SLN	.5												
28	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL...	1	SLN	.5												
29	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SLN	.5												
30	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SLN	.5												
31	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SL	.5												
32	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SL	.5												
33	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SLN	.5												
34	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SLN	.5												
35	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL...	1														
36	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL...	1														
37	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL-Y	1														
38	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL-Y	1														
39	0.9DL + 1.0IDL + 1.0IWL	Yes	Y		DL	.9	NL	1	WL...	1														
40	0.9DL + 1.0IDL + 1.0IWL	Yes	Y		DL	.9	NL	1	WL...	1														

Envelope Joint Reactions

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N1	max	0	40	13214.898	15	3146.3	34	0	40	0	40	0	40
2		min	0	1	-789.045	38	503.85	35	0	1	0	1	0	1
3	N2	max	0	40	13751.422	15	3146.3	34	0	40	0	40	0	40
4		min	0	1	200.945	38	503.85	35	0	1	0	1	0	1
5	Totals:	max	0	40	26966.32	15	6292.6	34						
6		min	0	1	-588.1	38	1007.7	35						

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

	Member	Shape	Code C...	Loc[ft]	LC	Shear C...	Loc[ft]	Dir	LC	phi*Pnc...	phi*Pnt [...	phi*Mn y-...	phi*Mn z...	Cb	Eqn
1	M1	W12X26	.777	10.222	15	.248	0	y	15	56076....	227205	20220.75	92070	1.133	H1-1b

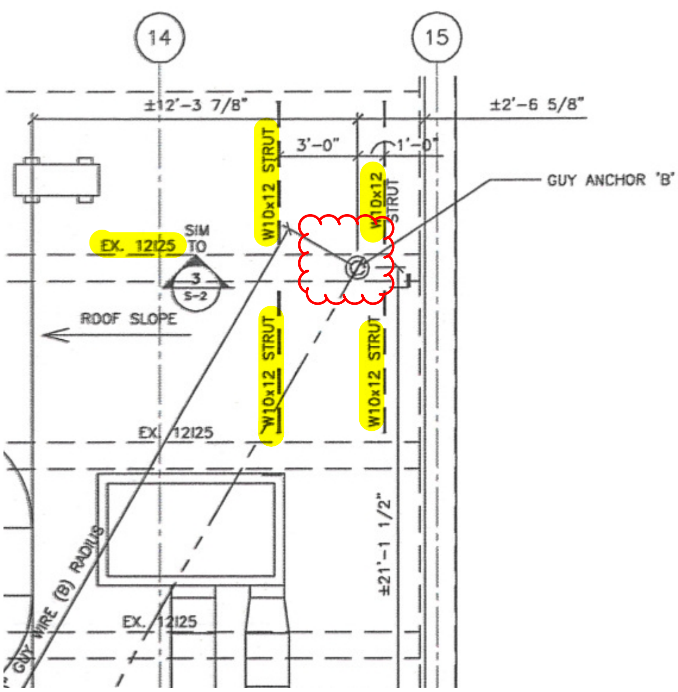
ANALYSIS OF EXISTING STEEL FOR GUY ANCHOR B

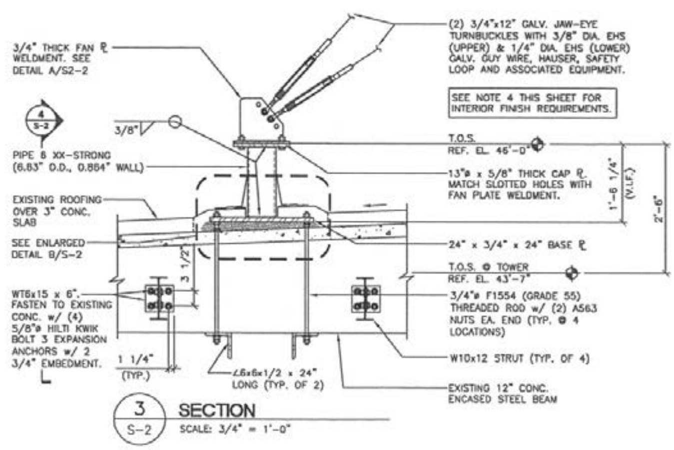
"W12x22"

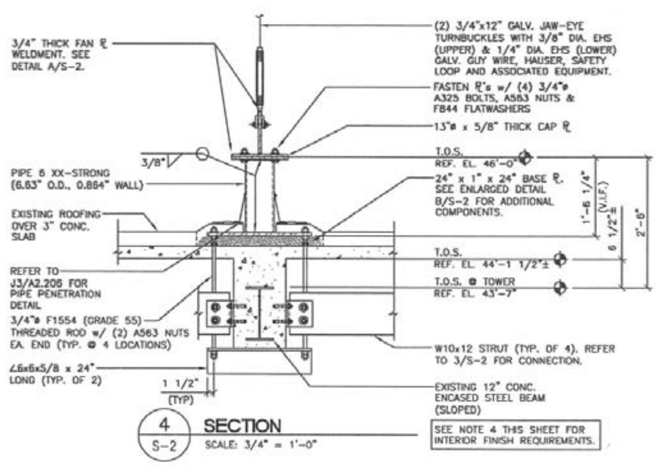
BLACK & VEATCH

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Project:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	6/10/2020

No.	Load Combination	Tension lbs	Vertical	Axial	Shear
User Input					
1	Dead Only w/o equipment and feedline	3582.00			
2	Dead Only with equipment and feedline	3567.00			
3	1.2 Dead + 1.0 Wind 120 degree + 1.0 Guy	1626.00			
5	1.2 Dead + 1.0 Wind 300 degree + 1.0 Guy	6407.00			
7	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Guy	5973.00			
8	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Wind 120 degree + 1.0 Guy	4504.00			
10	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Wind 300 degree + 1.0 Guy	7783.00			
Unfactored Load					
12	Guy	3582.00	2425.95	1317.71	2282.35
13	Dead (Equipment and feedline)	-15.00	-10.16	-5.52	-9.56
14	Wind 120 degree	-1938.00	-1312.53	-712.93	-1234.84
16	Wind 300 degree	2843.00	1925.45	1045.86	1811.48
18	Ice + Temp	2409.00	1631.52	886.20	1534.95
19	Wind Ice 120 degree	-1469	-994.90	-540.40	-936.01
21	Wind Ice 300 degree	1810	1225.84	665.85	1153.28







BLACK & VEATCH

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Plant:	HARTFORD AWC	Date:	6/8/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

Snow Load for Rooftop Capacity Check (ASCE 7-10) - Windward Drift

Ground snow load	p_g =	30.0	psf	
Terrain Category		C		Sec. 26.7
Exposure of Roof		Fully Exposed		Table 7-2
Thermal Condition		All structures		
Snow exposure factor	C_e =	0.9		Table 7.2
Thermal factor	C_t =	1.0		Table 7.3
Structure Risk category		III		
Snow load importance factor	I_s =	1.1		Sec. 7.3.3
Snow load on "flat" roof	p_f =	20.8	psf	Eq. 7.3-1
Snow density	γ =	17.9	pcf	
Min. Snow load on "flat" roof: P_m =	P_m =	22.0	psf	Sec. 7.3.4

Geometry

Parapet and Roof Projections		Yes	
Height of balanced snow load	h_b =	1.16	ft
Clear height from top of balanced snow	h_c =	0.8	ft
Length of roof windward of drift (lower)	$l_{u,wind}$ =	158.0	ft
Height of snow drift (windward)	$h_{d,wind}$ =	0.84	ft
Height of snow drift	h_d =	0.84	ft

Results

Min. snow load on low-slope roofs	p_m =	20.0	psf
Width of snow drift	w =	3.35	ft
Max. intensity of drift surcharge load	p_d =	15.0	psf

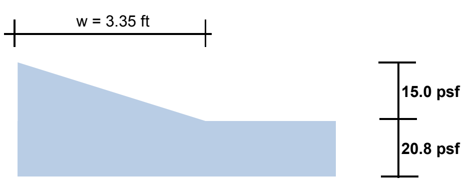
hc/hb > 0.2, NEED TO CAL SNOW DRIFT! (Sec. 7.7.1)

where,

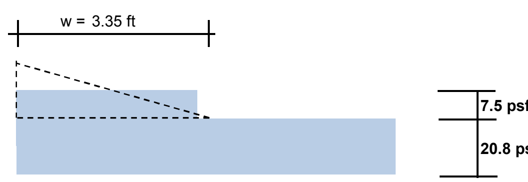
p_m = if(p_g <= 20, I_s x p_g, 20 x I_s)	Sec. 7.3.4
γ = 0.13 x p_g + 14 ≤ 30 pcf	Eq. 7.7-1
$h_b = p_f / \gamma$	
h_d = (0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9
$h_{d\_parapet}$ = 0.75(0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9 and Sec. 7.8
p_f = 0.7 x C_e x C_t x I_s x p_g	Eq. 7.3-1
w = IF(h_d<=h_c,4*h_d, 4*h_d^2/h_c)	
p_d = h_d x γ	

Notes:

1) For parapet walls, l_u shall be taken equal to the length of the roof upwind (windward) of the wall
2) For roof projections, l_u shall be taken equal to the length of the roof upwind (windward)/downwind (leeward) of the projection
3) If the side of roof projection is less than 15ft long, a drift load is not required to be applied on that side
4) This template is not applicable for Hip and Gable Roofs, and/or highly sloped roofs



Actual Snow Drift Diagram



Equivalent Snow Drift Diagram for RISA Analysis

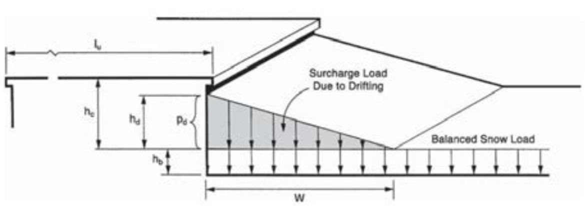


FIGURE 7-8 Configuration of Snow Drifts on Lower Roofs.

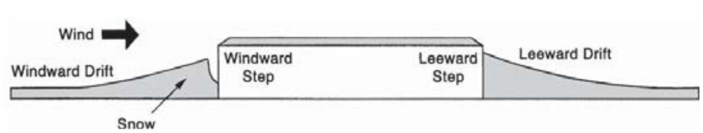


FIGURE 7-7 Drifts Formed at Windward and Leeward Steps.

5. ANALYSIS & DESIGN

5.1 Structural Analysis of Existing Building Rooftop Structure

Existing Loading Conditions

Exist roof construction consists of EPDM rubber roofing over insulation (3" assumed), over 3-1/4" thickness concrete deck (Normal Weight), over concrete encased W beams.

5.1.3) Existing Roof Beam W12x22 (Grid-13&Grid-15, Grid-I)

Dead Load of Roof Floor Slab

Width of Slab at considering span, B	=	9.00	ft	
Length of Slab at considering span, L	=	21.00	ft	
Ratio B / L = 9ft / 21ft	=	0.43	< 0.5 One Way Load	
Tributary Width	=	8.94	ft	
0.060 EPDM	=	1.0	psf	
3" Rigid	=	4.5	psf	
3 -1/4" Concrete Deck = 145 pcf x 3.25" / 12	=	39.3	psf	
M/E/P	=	4.0	psf	
Finishing	=	1.0	psf	
Total	=	49.8	psf	
	USE =	**50.0**	psf	

Dead Load of Concrete Beam + W12x22	=	141.2	psf
Roof Live Load	=	20.0	psf
Snow - Pm (Uniform Min. Roof)	=	22.0	psf
Snow Load on "Flat" Roof, Pf with drift (when w > 3.35ft)	=	28.3	psf
Wind Uplift Load on Building Roof	=	-39.8	psf
Wind Down Load on Building Roof	=	1.1	psf

Load Apply For RISA 3D:

- Existing Load on Roof Floor Slab

Concrete Beam Self Weight, DL =	=	141.2	plf
Dead Load from Roof Floor Slab, DL = 50psf x 8.94ft	=	447.0	plf
Roof Live Load, Lr = 20psf x 8.94ft	=	178.8	plf
Snow Load, SL = 22psf x 8.94ft	=	196.7	plf
Snow Load, SLN = 28.3psf x 8.94ft	=	254.7	plf
Wind Uplift Load, WL-Y = -39.82psf x 9ft	=	-356.0	plf
Wind Down Load, WL+Y = 1.14psf x 9ft	=	10.2	plf

- Load from TNX. (Un - Factor)

Guy Geometry : Guy Anchor B (+ = Tension, - = Compression)

Guy Height - Level 1	@ Corner	=	18.94	ft	
Guy Radius - Level 1	@ Corner	=	36.00	ft	
Guy Height - Level 2	@ Torque Arm	=	46.38	ft	
Guy Radius - Level 2	@ Torque Arm	=	36.00	ft	
The Effective Angle of Tension in Guy, θ_R		=	42.63	degree	From E1 tnx.
The Angle of plane XZ in Guy, θ_1		=	60.0	degree	
Height of Pipe 6 XXS, h		=	2.50	ft	

Dead Load of Equipment & Feedline without Guy

Compression Guy, T		=	-15	lbs.
Horizontal Load, Z (along beam)	= -15lbs.x cos42.63 x cos60	=	-5.5	lbs.
Compression Load, Y	= -15lbs.x sin42.63	=	-10	lbs.
Horizontal Load, X	= -15lbs.x cos42.63 x sin60	=	-10	lbs.
Moment from Horizontal Z, Mx	= -5.5lbs. x 2.5ft	=	-14	lbs. - ft
Moment from Horizontal X, Mz	= -9.56lbs. x 2.5ft	=	-24	lbs. - ft

Dead Load of Guy only

Tension in Guy, T		=	3582	lbs.
Horizontal Load, Z (along beam)	= 3582lbs.x cos42.63 x cos60	=	1,318	lbs.
Tension Load, Y	= 3582lbs.x sin42.63	=	2426	lbs.
Horizontal Load, X	= 3582lbs.x cos42.63 x sin60	=	2,282	lbs.
Moment from Horizontal Z, Mx	= 1,318lbs. x 2.5ft	=	3295	lbs. - ft
Moment from Horizontal X, Mz	= 2,282lbs. x 2.5ft	=	5705	lbs. - ft

Wind Load 120 Deg (+X)

Compression Guy, T		=	-1938	lbs.
Horizontal Load, Z (along beam)	= -1938lbs.x cos42.63 x cos60	=	-713	lbs.
Compression Load, Y	= -1938lbs.x sin42.63	=	-1313	lbs.
Horizontal Load, X	= -1938lbs.x cos42.63 x sin60	=	-1235	lbs.
Moment from Horizontal Z, Mx	= -712.93lbs. x 2.5ft	=	-1782	lbs. - ft
Moment from Horizontal X, Mz	= -1234.84lbs. x 2.5ft	=	-3087	lbs. - ft

Wind Load 300 Deg (-X)

Tension in Guy, T		=	2843	lbs.
Horizontal Load, Z (along beam)	= 2843lbs.x cos42.63 x cos60	=	1,046	lbs.
Tension Load, Y	= 2843lbs.x sin42.63	=	1925	lbs.
Horizontal Load, X	= 2843lbs.x cos42.63 x sin60	=	1,811	lbs.
Moment from Horizontal Z, Mx	= 1,046lbs. x 2.5ft	=	2615	lbs. - ft
Moment from Horizontal X, Mz	= 1,811lbs. x 2.5ft	=	4528	lbs. - ft

Ice DL + Temp

Tension in Guy, T		=	2409	lbs.
Horizontal Load, Z (along beam)	= 2409lbs.x cos42.63 x cos60	=	886	lbs.
Tension Load, Y	= 2409lbs.x sin42.63	=	1632	lbs.
Horizontal Load, X	= 2409lbs.x cos42.63 x sin60	=	1,535	lbs.
Moment from Horizontal Z, Mx	= 886lbs. x 2.5ft	=	2215	lbs. - ft
Moment from Horizontal X, Mz	= 1,535lbs. x 2.5ft	=	3838	lbs. - ft

Ice Wind Load 120 Deg (+X)

Compression Guy, T		=	-1469	lbs.
Horizontal Load, Z (along beam)	= -1469lbs.x cos42.63 x cos60	=	-540	lbs.
Compression Load, Y	= -1469lbs.x sin42.63	=	-995	lbs.
Horizontal Load, X	= -1469lbs.x cos42.63 x sin60	=	-936	lbs.
Moment from Horizontal Z, Mx	= -540lbs. x 2.5ft	=	-1350	lbs. - ft
Moment from Horizontal X, Mz	= -936lbs. x 2.5ft	=	-2340	lbs. - ft

Ice Wind Load 300 Deg (-X)

Tension in Guy, T		=	1810	lbs.
Horizontal Load, Z (along beam)	= 1810lbs.x cos42.63 x cos60	=	666	lbs.
Tension Load, Y	= 1810lbs.x sin42.63	=	1226	lbs.
Horizontal Load, X	= 1810lbs.x cos42.63 x sin60	=	1,153	lbs.
Moment from Horizontal Z, Mx	= 666lbs. x 2.5ft	=	1665	lbs. - ft
Moment from Horizontal X, Mz	= 1,153lbs. x 2.5ft	=	2883	lbs. - ft

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Site Name:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

BLACK & VEATCH

- Determined Section Properties of Encased Concrete Steel Beam

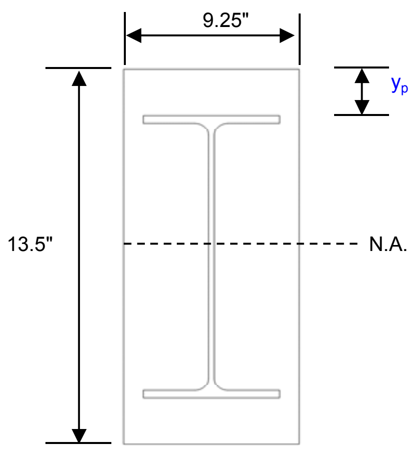
- Steel Section : W12x22

Yield Strength, F_y	=	33.00	ksi
Tensile Strength, F_u	=	65.00	ksi
Depth, d	=	12.30	in
Flange Width, b_f	=	4.03	in
Flange Thickness, t_f	=	0.43	in
Web Thickness, t_w	=	0.260	in
Section Area, A_s	=	6.48	in^2
Weight of Steel, W	=	22.00	plf
Modulus of Elastic of Steel, E_s	=	29000	ksi

- RC. Section : Assumed to be 9.25"x13.5" from previous SA

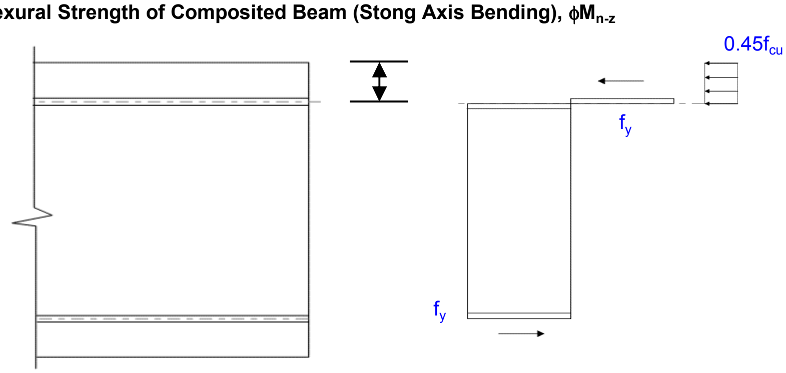
Compressive Stength of Concrete, f'_c	=	3000	psi
β_1	=	0.85	
Height of Beam, h	=	13.50	in
Width of Beam, b	=	9.25	in
Section Area, A_g = b x h	=	124.88	in^2
Modulus of Elasticity of Concrete, E_c = 57000 $f'_c{}^{1/2}$	=	3122	ksi ACI318-14 (19.2.2)

Neutral axis without rebars



$A_1 = A_{steel}$	=	6.5	in^2	
$A_2 = A_{concrete}$	=	118.4	in^2	
A_{total}	=	124.9	in^2	
y_1	=	6.8	in	C.G. Steel
y_2 = h/2	=	6.8	in	C.G. Concrete Beam
Neutral axis without rebars, y'	=	6.75	in	
Assumed covering top and bottom	=	0.60	in	
y_p	=	0.815	in	Sec. 22.2.2

- Nominal Flexural Strength of Composited Beam (Stong Axis Bending), ϕM_{n-z}



Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Site Name:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

BLACK & VEATCH

The moment resistance of the composite section is then given by
Davidson's "Steel Designer's 6th Edition" in Sec. 22.2.2

$M_p = 0.5A_s f_y (h - y_p)$; Eq. 22.4

= 0.5*6.48*33000 * (13.5 - 0.815) = 113,023 lbs - ft

ϕM_p = 0.9 * 113,023 = 101,721 lbs - ft

- Nominal Shear Strength of Beam, ϕV_n (Assume Shear is Taken Fully by Steel Section)

The resistance factor for Shear, ϕ_v	=	1.00	
Ratio of Section, h / t_w	=	46.60	< 2.24 (E / Fy) ^0.5
Limit Ratio = $2.24 \times (E / F_y)^{0.5}$ = 2.24 x (3000 / 4.03) ^0.5	=	66.4	
C_v	=	1.00	Eq. G2-2
Area of Web, $A_w = (h - 2t_f) \times t_w$ = (0.26 - 2 x 22) x 29000	=	2.97	in^2

The shear resistance of the composite section is then given by
AISC Steel Construction Manual (14th Ed.) Section G2.1a

$V_n = 0.6F_y A_w C_v$; Eq. G2-1

0.6 x 4030 x 2.97 x 1.00 = 58,806 lbs

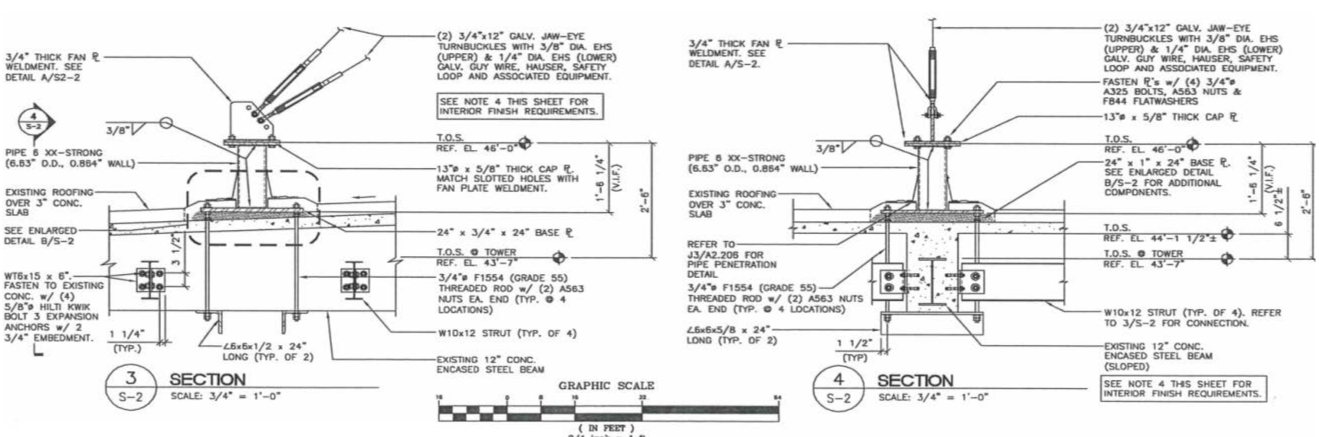
$\phi_v V_n$ = 0.9 * 58,806 = 58,806 lbs

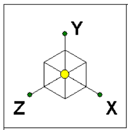
- The Result from Risa 3D

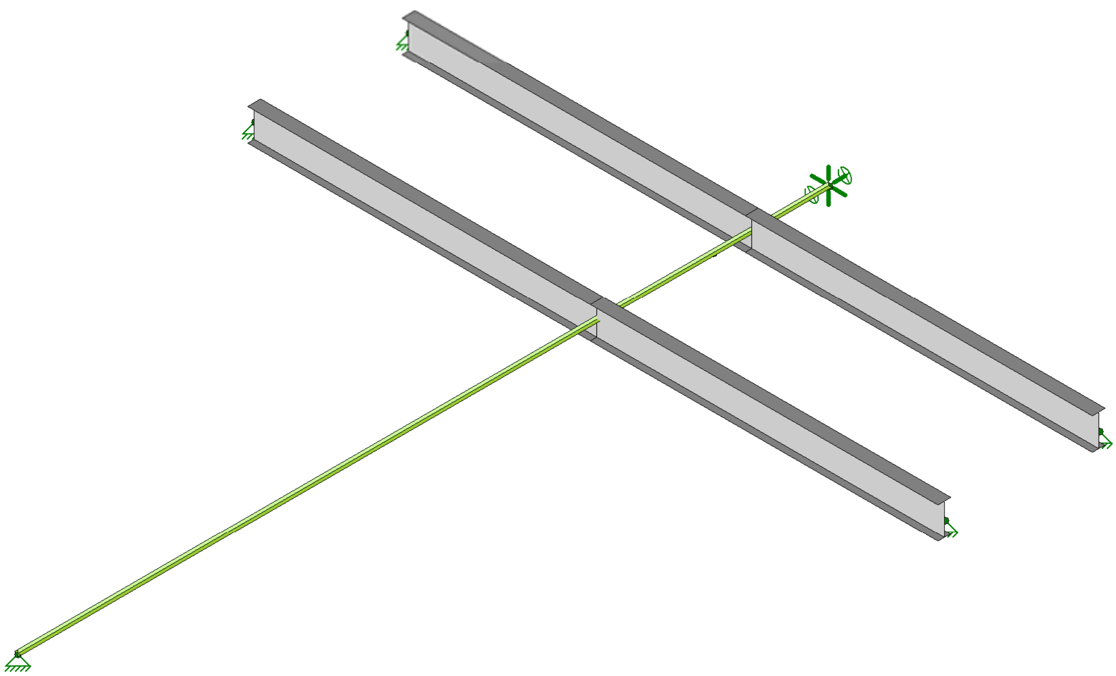
Max. Shear Force, V_u	=	11,616	lbs
Max. Bending Moment, M_u-z	=	60,313	lbs. - ft
Max. Bending Moment, M_u-y	=	2,365	lbs. - ft

- The Stress Ratio

The Shear Stress Ratio, $V_u / \phi V_n$ = 11616 / 58806	=	0.198 19.8%	OK
The Flexural Stress Ratio, $M_u / \phi M_r$ 60313 / 101,721	=	0.593 59.3%	OK
The Flexural Stress Ratio, $M_u / \phi M_r$ 2365.402 / 13725	=	0.172 17.2%	OK
Combined Flexural Stress Ratio	=	76.5%	OK

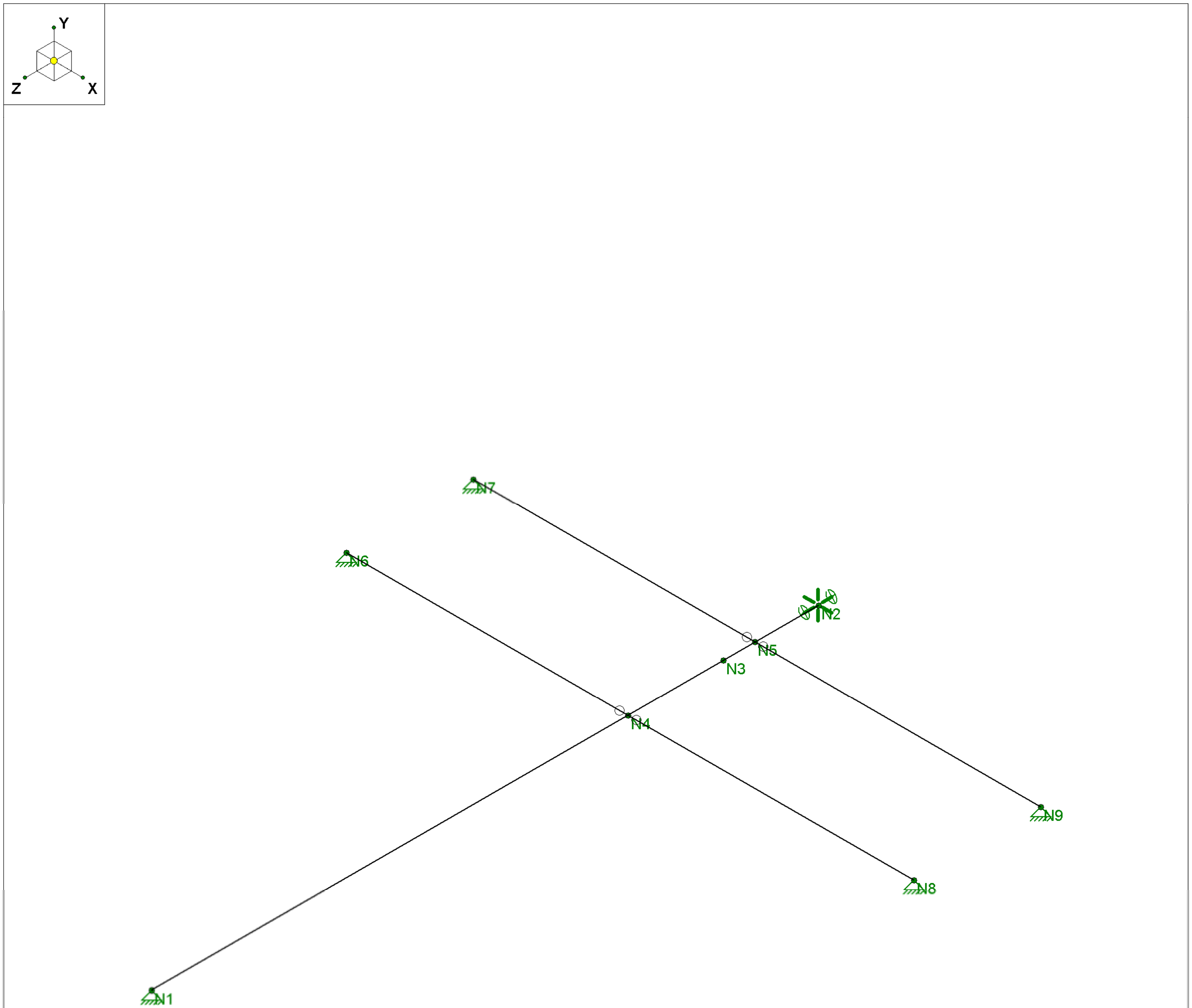






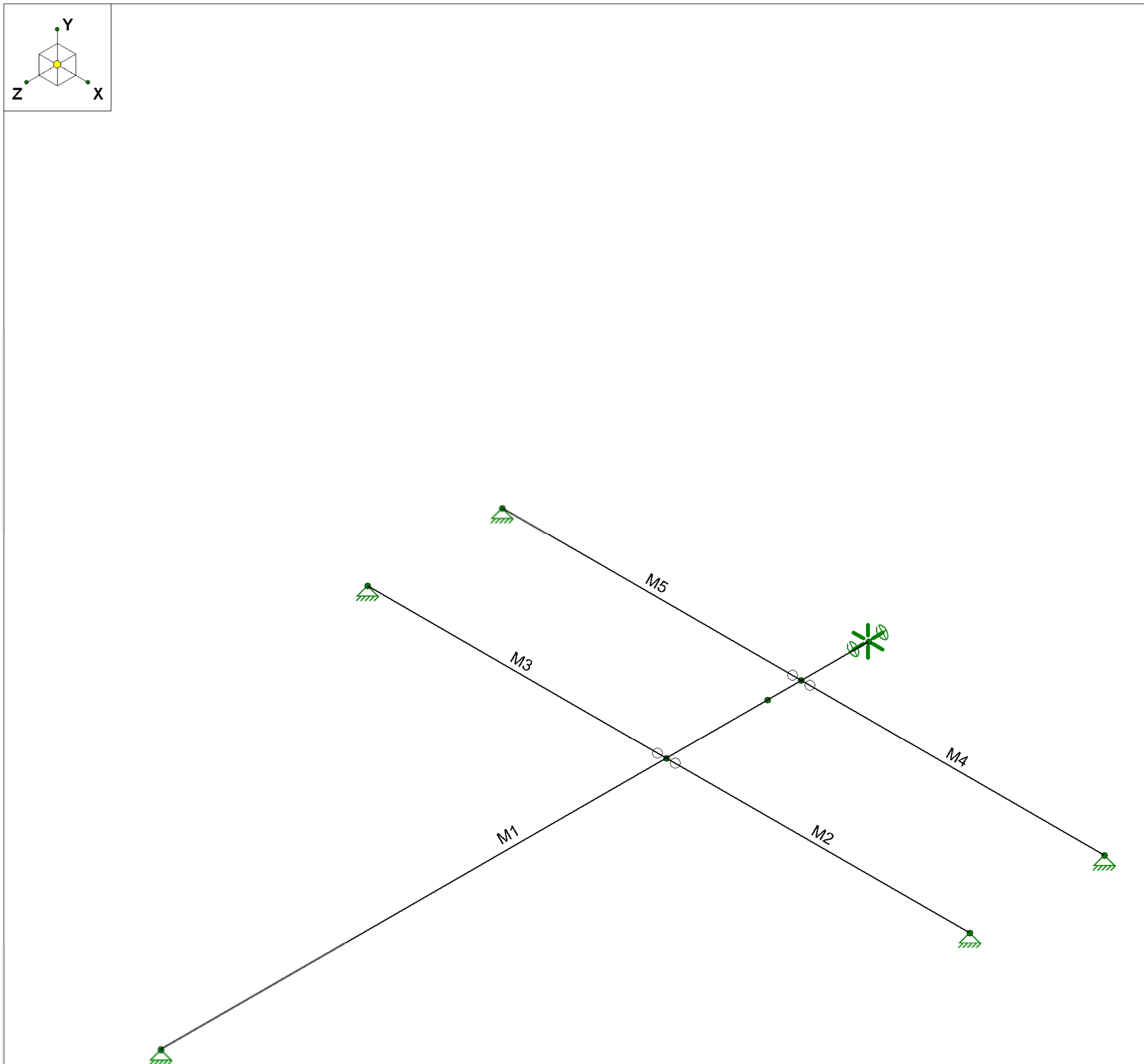
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 1
T. Eakkalak		July 23, 2020 at 12:27 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



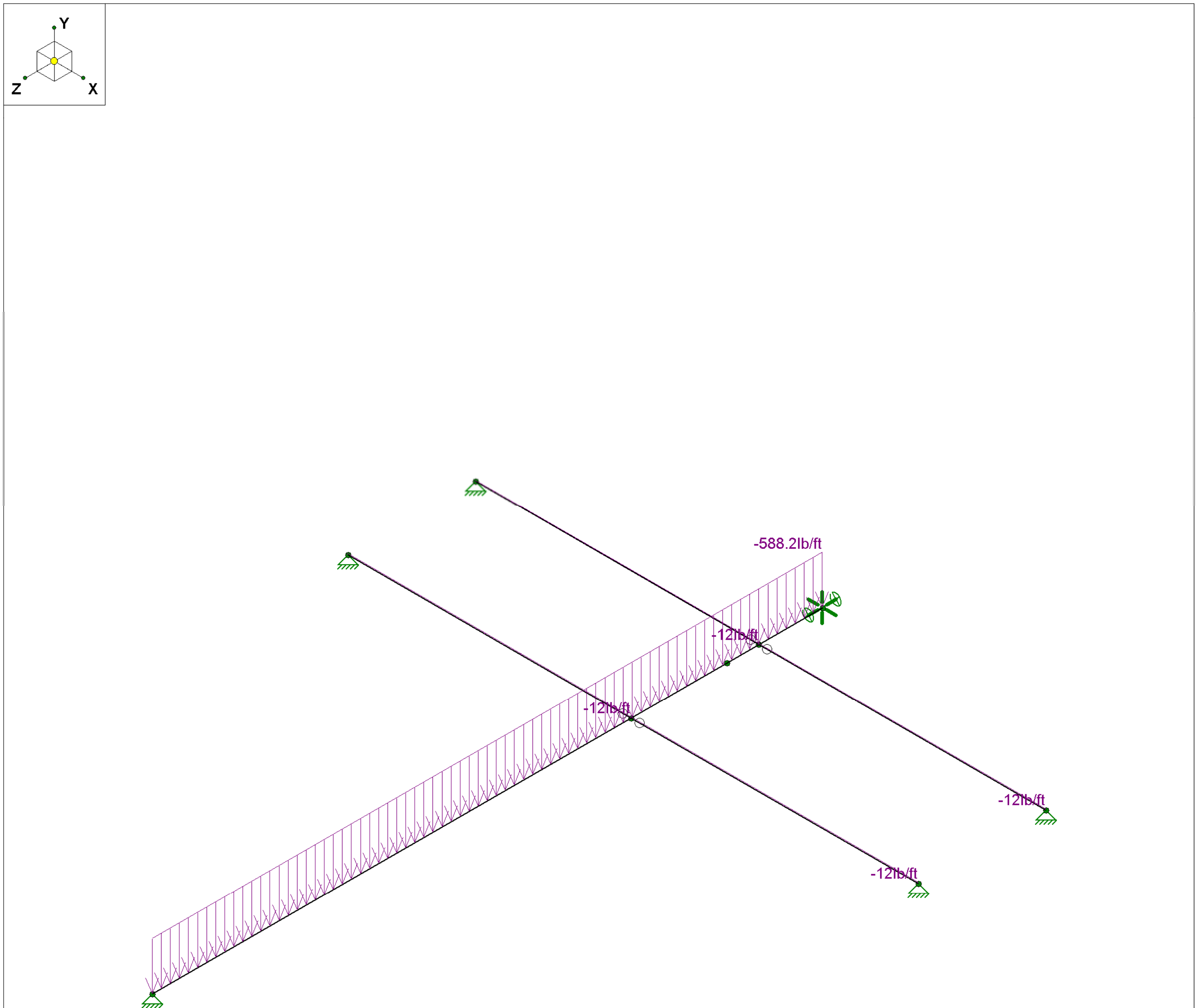
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 2
T. Eakkalak		July 23, 2020 at 12:28 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 3
T. Eakkalak		July 23, 2020 at 12:28 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

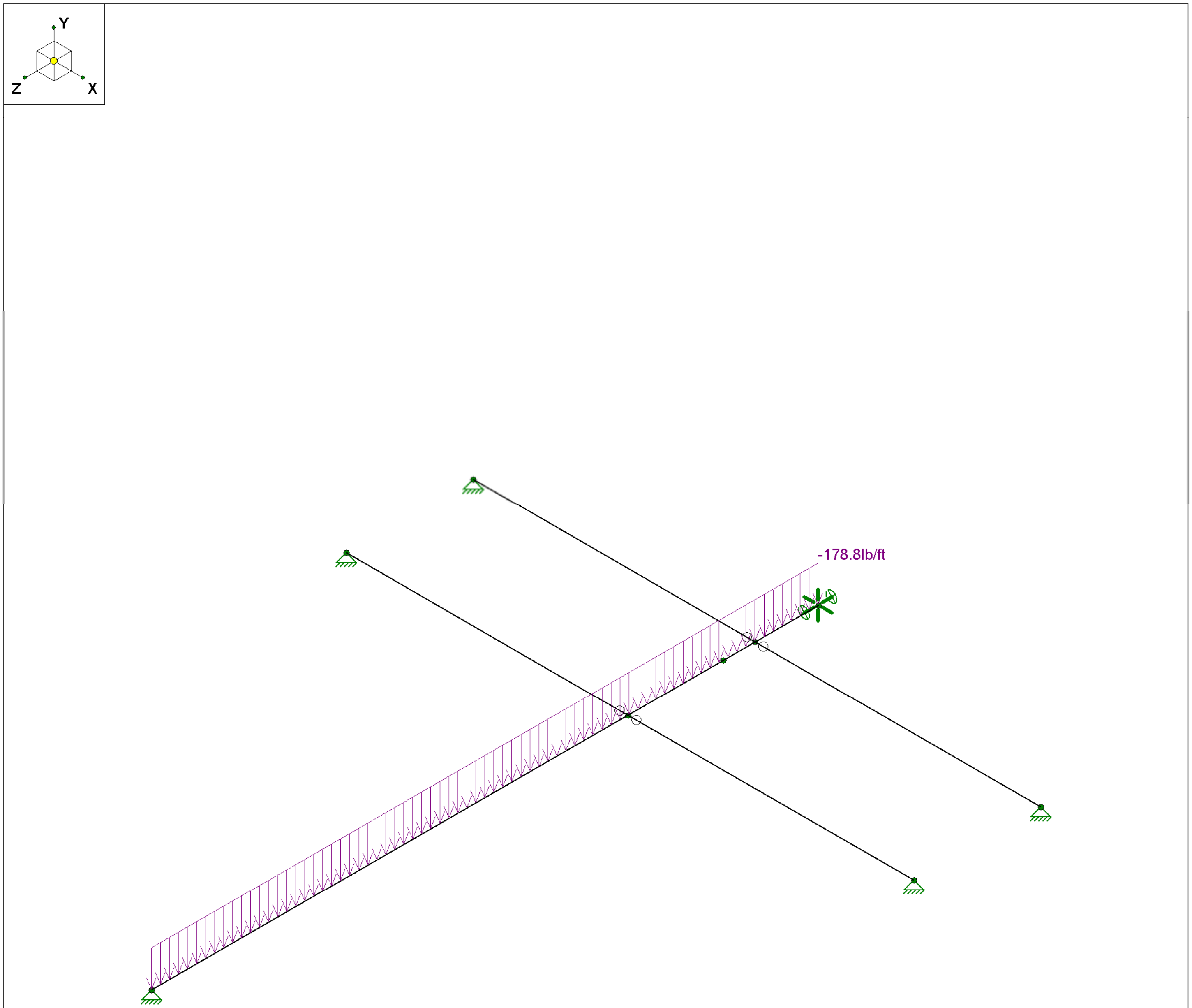


DL of WF12x22 = 12 plf

Load Apply For RISA 3D:				
	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 8.94ft	=	447.0	plf
	Roof Live Load, Lr = 20psf x 8.94ft	=	178.8	plf
	Snow Load, SL = 22psf x 8.94ft	=	196.7	plf
	Snow Load, SLN = 28.3psf x 8.94ft	=	254.7	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9ft	=	-356.0	plf
	Wind Down Load, WL+Y = 1.14psf x 9ft	=	10.2	plf

Loads: BLC 1, Beam and Roof
Envelope Only Solution

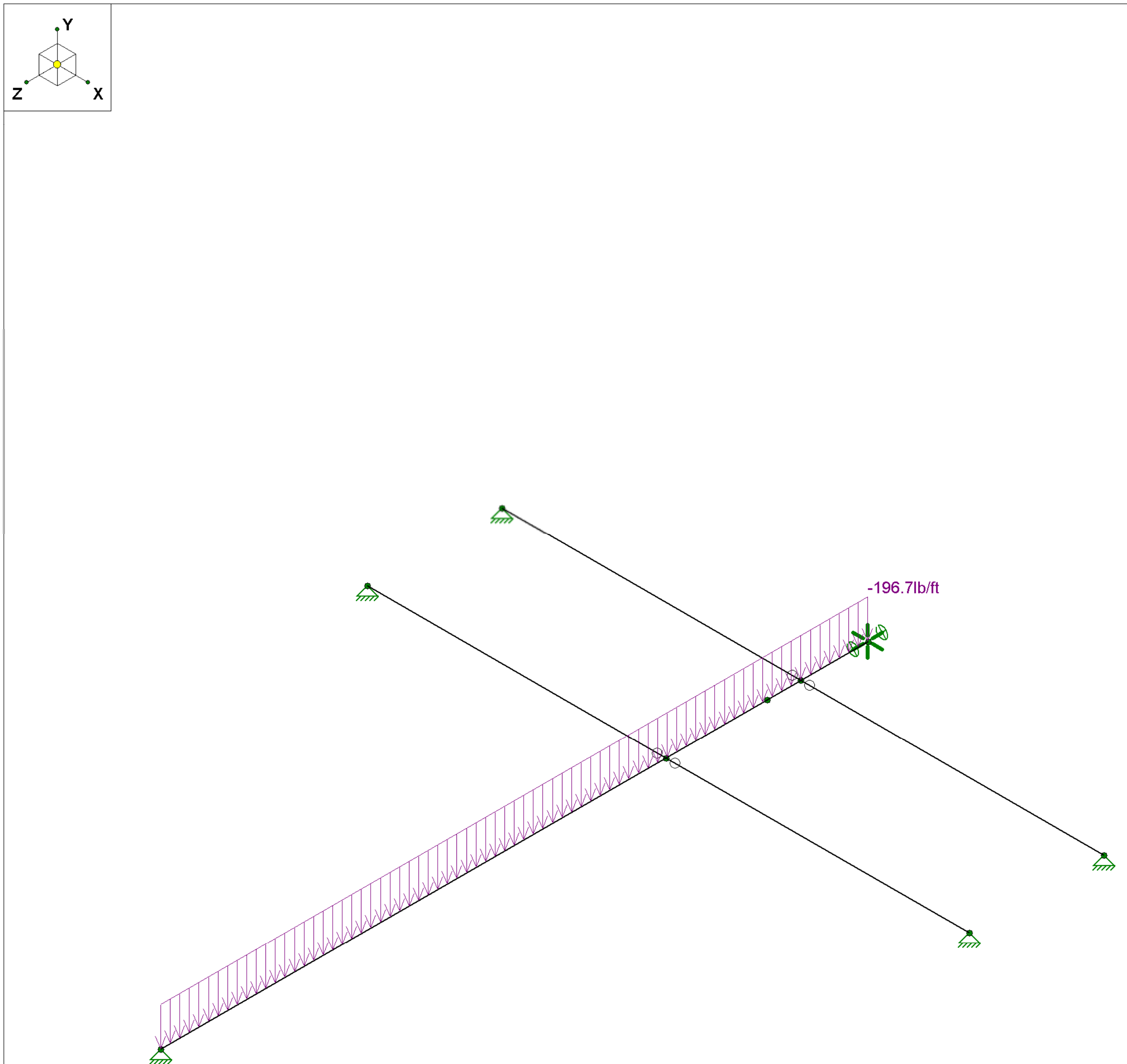
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 4
T. Eakkalak		July 23, 2020 at 12:28 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:					
	- Existing Load on Roof Floor Slab				
	Concrete Beam Self Weight, DL =	=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 8.94ft	=	447.0	plf
	Roof Live Load, Lr = 20psf x 8.94ft	=	178.8	plf
	Snow Load, SL = 22psf x 8.94ft	=	196.7	plf
	Snow Load, SLN = 28.3psf x 8.94ft	=	254.7	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9ft	=	-356.0	plf
	Wind Down Load, WL+Y = 1.14psf x 9ft	=	10.2	plf

Loads: BLC 2, Roof Live Load
Envelope Only Solution

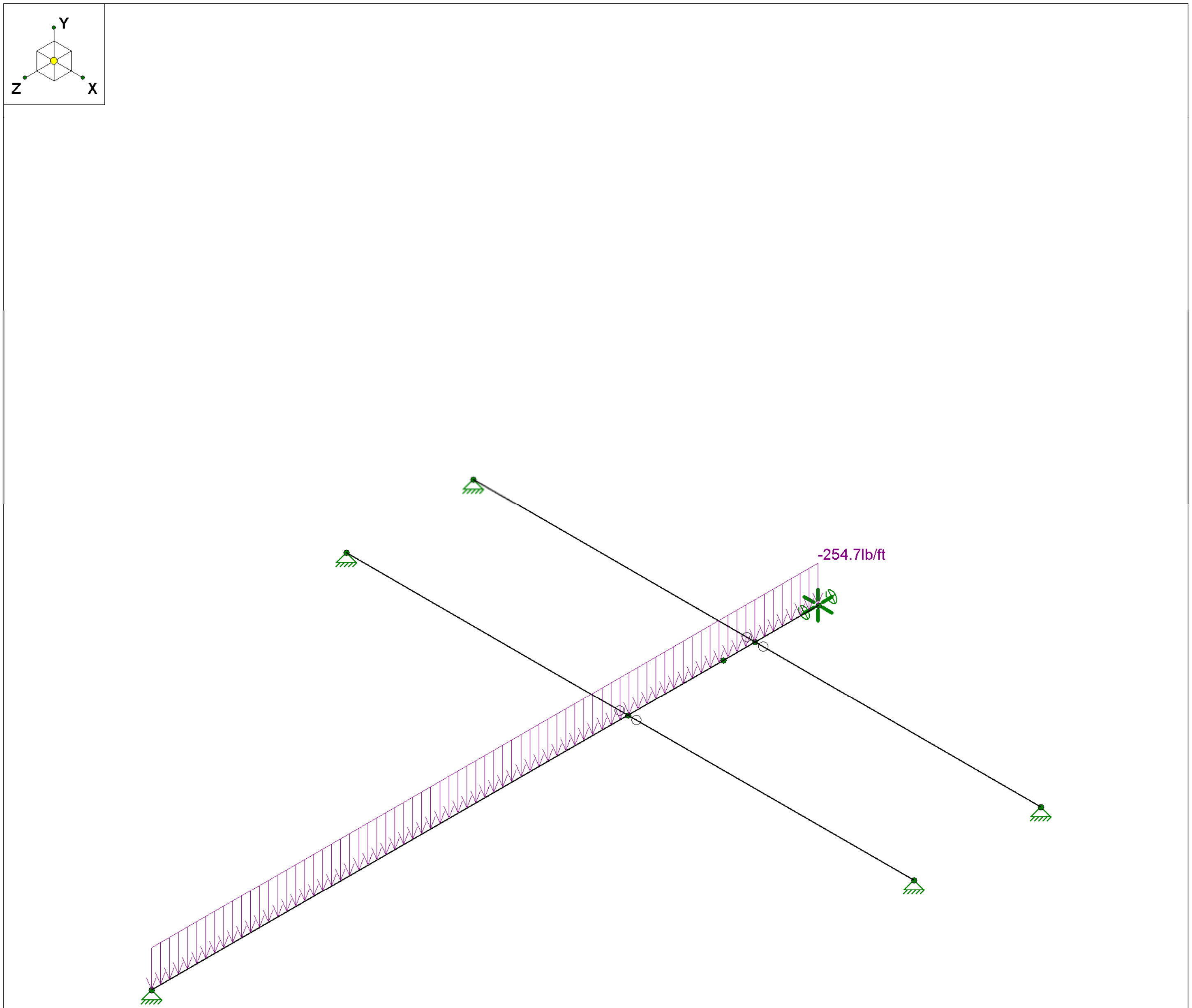
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 5
T. Eakkalak		July 23, 2020 at 12:28 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:				
	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 8.94ft	=	447.0	plf
	Roof Live Load, Lr = 20psf x 8.94ft	=	178.8	plf
	Snow Load, SL = 22psf x 8.94ft	=	196.7	plf
	Snow Load, SLN = 28.3psf x 8.94ft	=	254.7	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9ft	=	-356.0	plf
	Wind Down Load, WL+Y = 1.14psf x 9ft	=	10.2	plf

Loads: BLC 3, Snow (Pm)
Envelope Only Solution

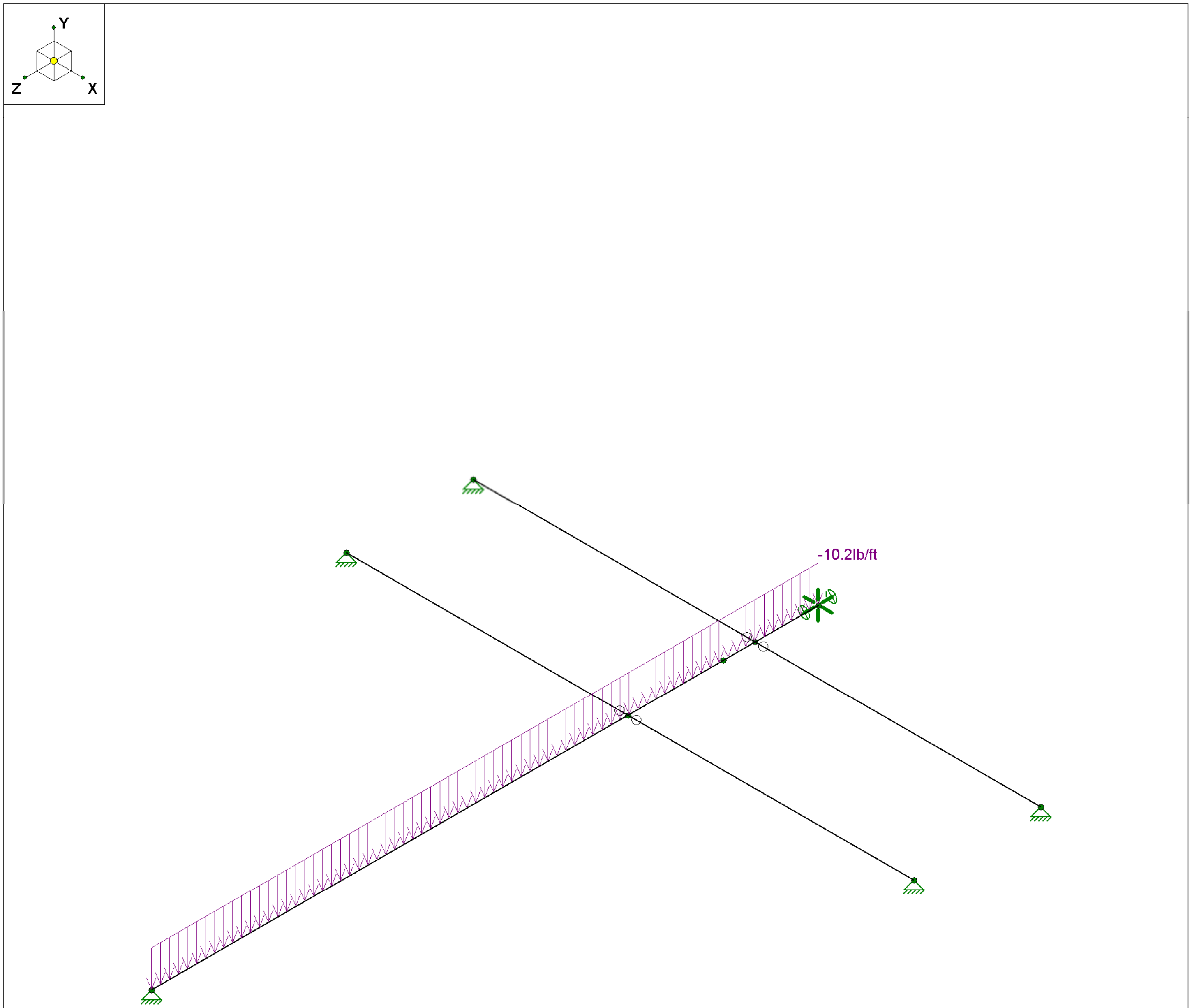
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 6
T. Eakkalak		July 23, 2020 at 12:28 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:		
- Existing Load on Roof Floor Slab		
Concrete Beam Self Weight, DL =	=	141.2 plf
Dead Load from Roof Floor Slab, DL = 50psf x 8.94ft	=	447.0 plf
Roof Live Load, Lr = 20psf x 8.94ft	=	178.8 plf
Snow Load, SL = 22psf x 8.94ft	=	196.7 plf
Snow Load, SLN = 28.3psf x 8.94ft	=	254.7 plf
Wind Uplift Load, WL-Y = -39.82psf x 9ft	=	-356.0 plf
Wind Down Load, WL+Y = 1.14psf x 9ft	=	10.2 plf

Loads: BLC 4, Snow (Pf + Drift)
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 7
T. Eakkalak		July 23, 2020 at 12:28 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

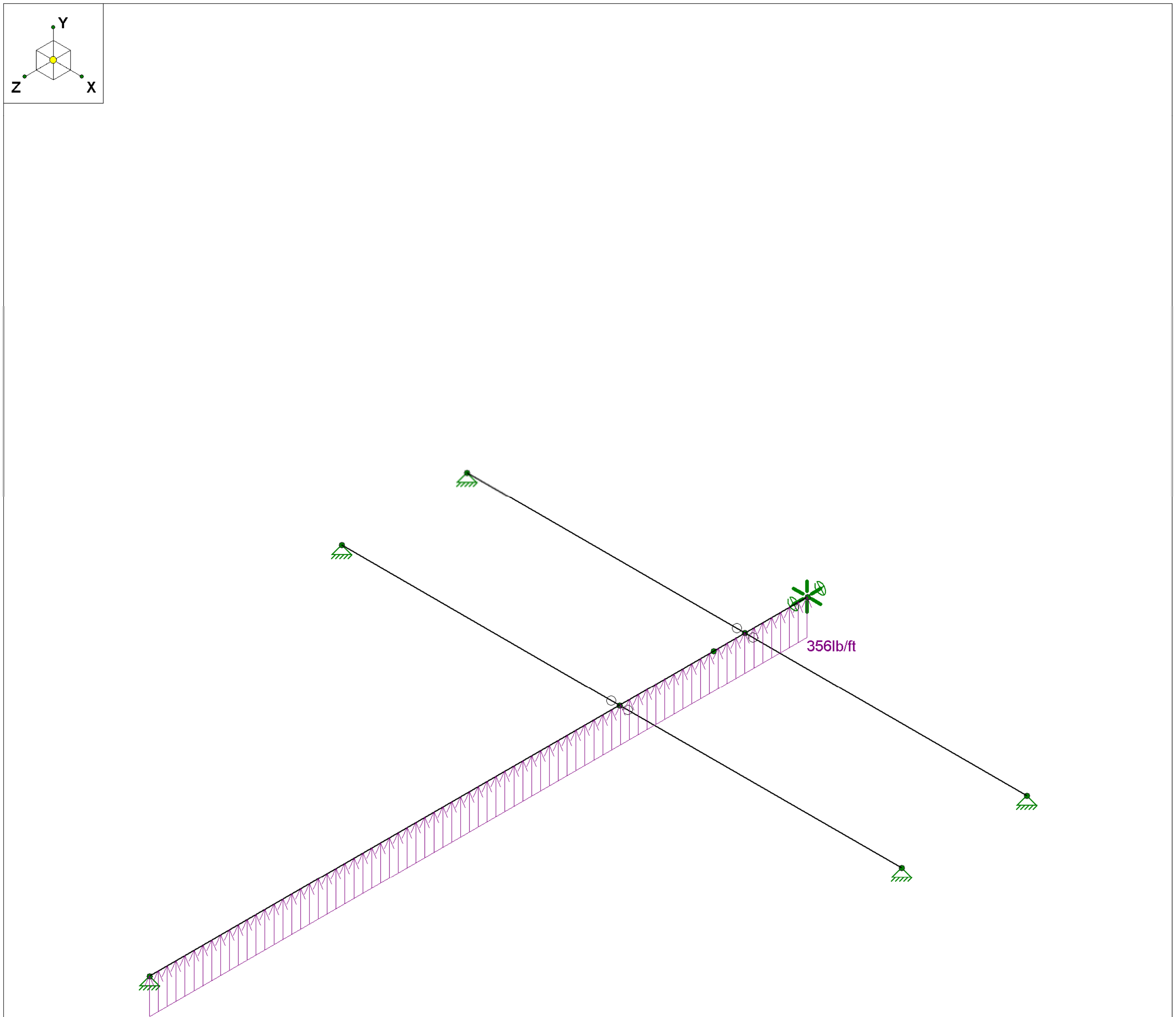


Load Apply For RISA 3D:

	- Existing Load on Roof Floor Slab			
	Concrete Beam Self Weight, DL =	=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 8.94ft	=	447.0	plf
	Roof Live Load, Lr = 20psf x 8.94ft	=	178.8	plf
	Snow Load, SL = 22psf x 8.94ft	=	196.7	plf
	Snow Load, SLN = 28.3psf x 8.94ft	=	254.7	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9ft	=	-356.0	plf
	Wind Down Load, WL+Y = 1.14psf x 9ft	=	10.2	plf

Loads: BLC 5, Wind Roof Pressure (Positive)
Envelope Only Solution

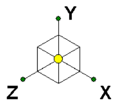
Black & Veatch Corp.		SK - 8
T. Eakkalak	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

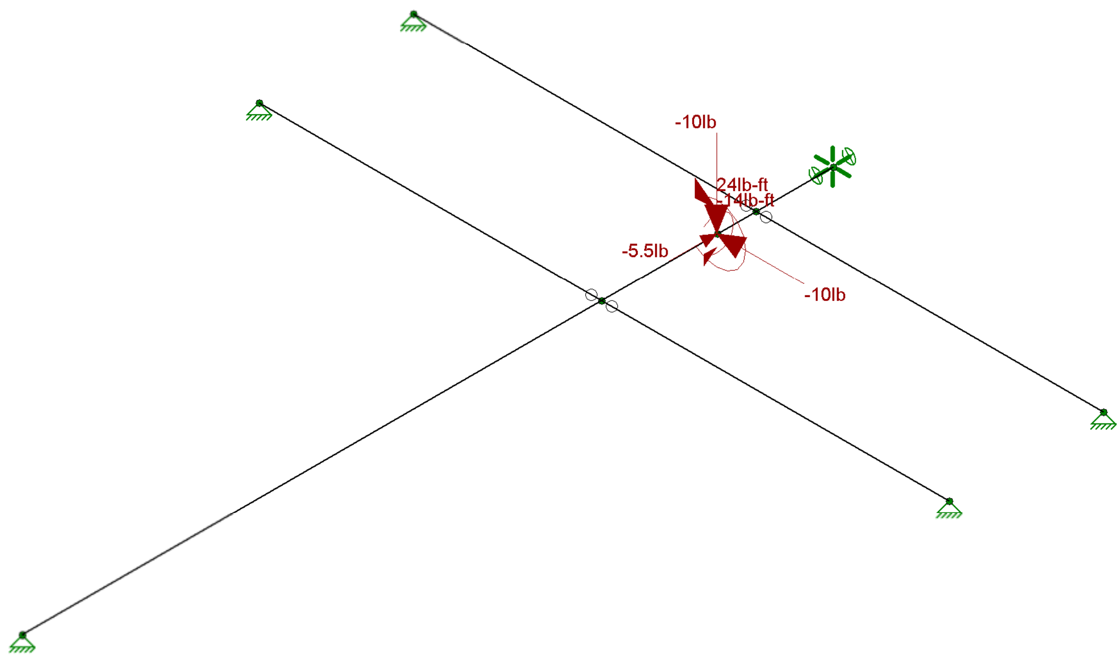


Load Apply For RISA 3D:			
- Existing Load on Roof Floor Slab			
Concrete Beam Self Weight, DL =	=	141.2	plf
Dead Load from Roof Floor Slab, DL = 50psf x 8.94ft	=	447.0	plf
Roof Live Load, Lr = 20psf x 8.94ft	=	178.8	plf
Snow Load, SL = 22psf x 8.94ft	=	196.7	plf
Snow Load, SLN = 28.3psf x 8.94ft	=	254.7	plf
Wind Uplift Load, WL-Y = -39.82psf x 9ft	=	-356.0	plf
Wind Down Load, WL+Y = 1.14psf x 9ft	=	10.2	plf

Loads: BLC 6, Wind Roof Pressure (Negative)
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 9
T. Eakkalak		July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

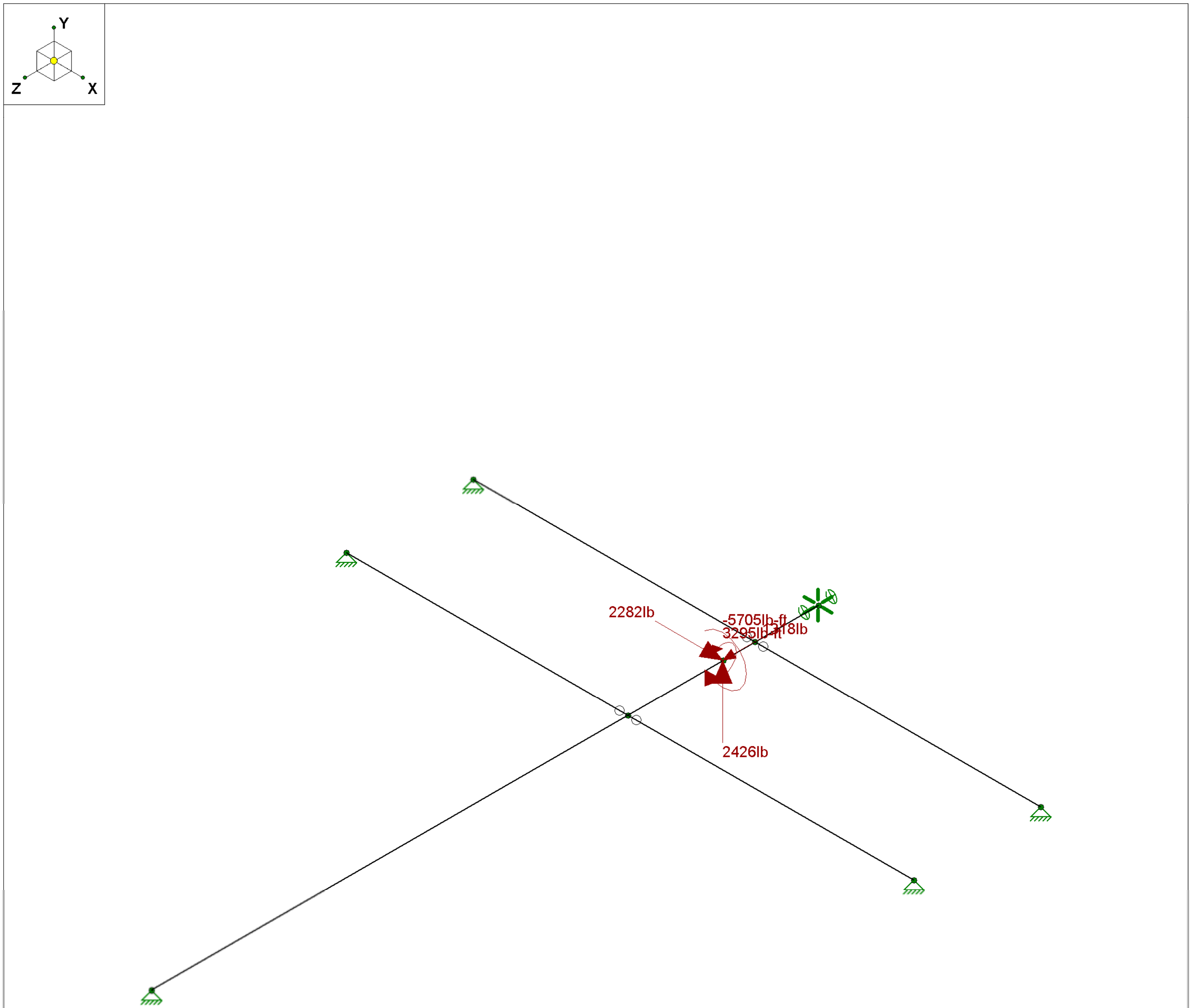




Dead Load of Equipment & Feedline without Guy					
Compression Guy, T		=	-15	lbs.
Horizontal Load, Z (along beam)	= -15lbs.x cos42.63 x cos60	=	-5.5	lbs.
Compression Load, Y	= -15lbs.x sin42.63	=	-10	lbs.
Horizontal Load, X	= -15lbs.x cos42.63 x sin60	=	-10	lbs.
Moment from Horizontal Z, Mx	= -5.5lbs. x 2.5ft	=	-14	lbs. - ft
Moment from Horizontal X, Mz	= -9.56lbs. x 2.5ft	=	-24	lbs. - ft

Loads: BLC 8, Tower Dead
Envelope Only Solution

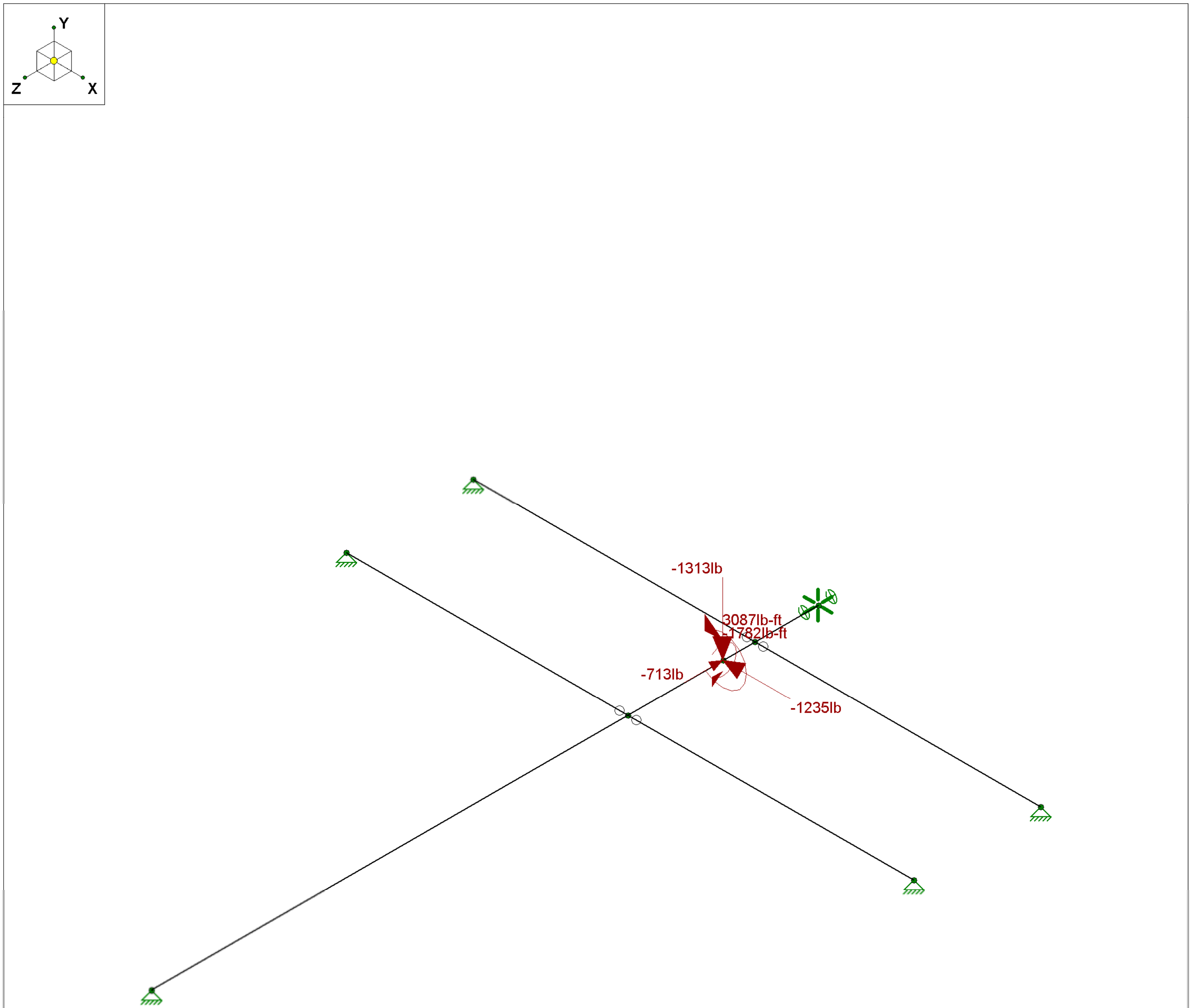
Black & Veatch Corp.		SK - 10
T. Eakkalak	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Dead Load of Guy only					
Tension in Guy, T			=	3582	lbs.
Horizontal Load, Z (along beam)	= 3582lbs.x cos42.63 x cos60		=	1,318	lbs.
Tension Load, Y	= 3582lbs.x sin42.63		=	2426	lbs.
Horizontal Load, X	= 3582lbs.x cos42.63 x sin60		=	2,282	lbs.
Moment from Horizontal Z, Mx	= 1,318lbs. x 2.5ft		=	3295	lbs. - ft
Moment from Horizontal X, Mz	= 2,282lbs. x 2.5ft		=	5705	lbs. - ft

Loads: BLC 9, Guy Self Weight
Envelope Only Solution

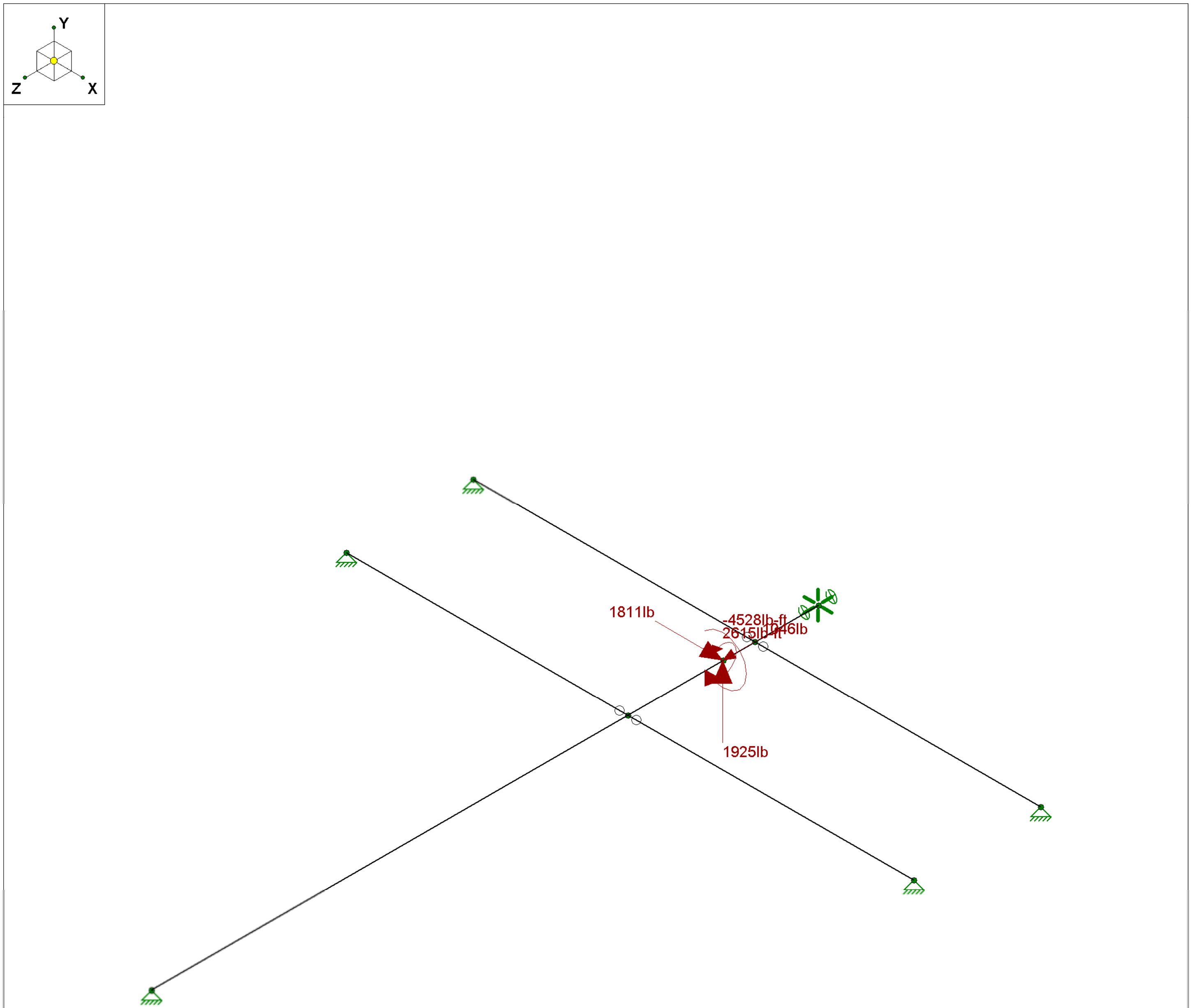
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 11
T. Eakkalak		July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Wind Load 120 Deg (+X)						
	Compression Guy, T			=	-1938	lbs.
	Horizontal Load, Z (along beam)	= -1938lbs.x cos42.63 x cos60		=	-713	lbs.
	Compression Load, Y	= -1938lbs.x sin42.63		=	-1313	lbs.
	Horizontal Load, X	= -1938lbs.x cos42.63 x sin60		=	-1235	lbs.
	Moment from Horizontal Z, Mx	= -712.93lbs. x 2.5ft		=	-1782	lbs. - ft
	Moment from Horizontal X, Mz	= -1234.84lbs. x 2.5ft		=	-3087	lbs. - ft

Loads: BLC 10, Wind Load (120 Deg.) +X
Envelope Only Solution

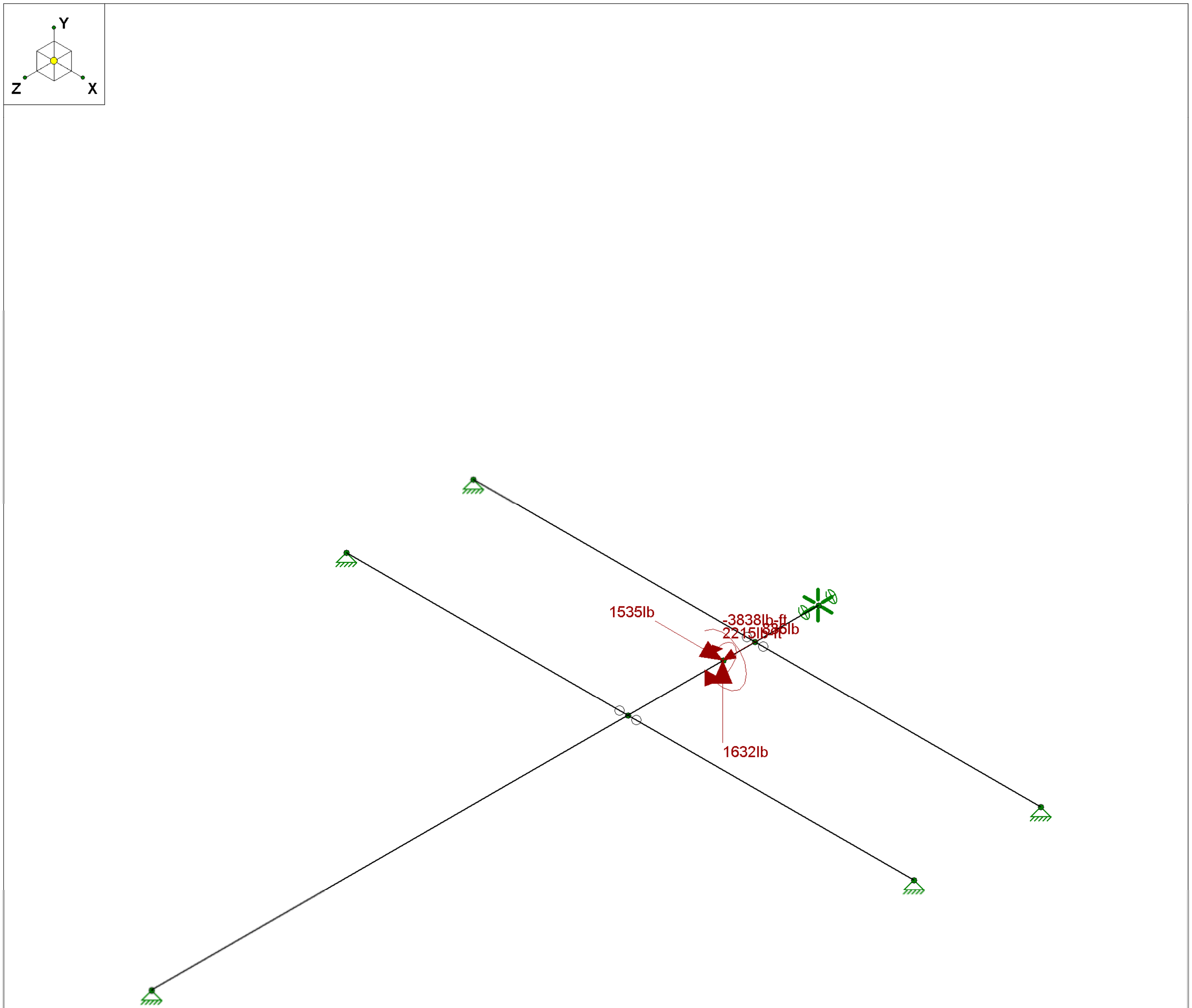
Black & Veatch Corp.		SK - 12
T. Eakkalak	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Wind Load 300 Deg (-X)					
	Tension in Guy, T		=	2843	lbs.
	Horizontal Load, Z (along beam)	= 2843lbs.x cos42.63 x cos60	=	1,046	lbs.
	Tension Load, Y	= 2843lbs.x sin42.63	=	1925	lbs.
	Horizontal Load, X	= 2843lbs.x cos42.63 x sin60	=	1,811	lbs.
	Moment from Horizontal Z, Mx	= 1,046lbs. x 2.5ft	=	2615	lbs. - ft
	Moment from Horizontal X, Mz	= 1,811lbs. x 2.5ft	=	4528	lbs. - ft

Loads: BLC 11, Wind Load (300 Deg.) -X
Envelope Only Solution

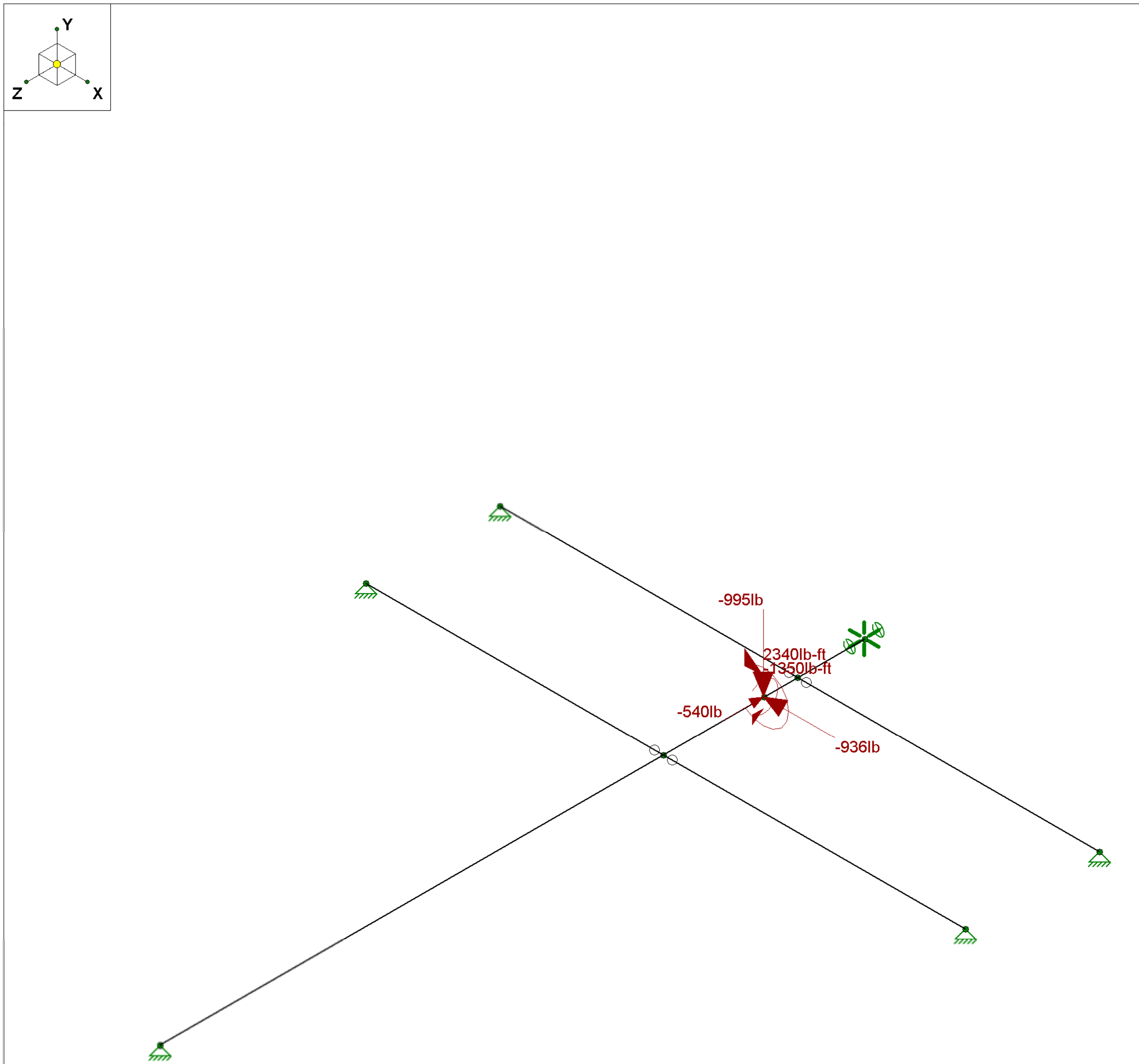
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 13
T. Eakkalak		July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Loads: BLC 12, Ice Dead Load
Envelope Only Solution

Ice DL + Temp					
Tension in Guy, T			=	2409	lbs.
Horizontal Load, Z (along beam)	= 2409lbs.x cos42.63 x cos60		=	886	lbs.
Tension Load, Y	= 2409lbs.x sin42.63		=	1632	lbs.
Horizontal Load, X	= 2409lbs.x cos42.63 x sin60		=	1,535	lbs.
Moment from Horizontal Z, Mx	= 886lbs. x 2.5ft		=	2215	lbs. - ft
Moment from Horizontal X, Mz	= 1,535lbs. x 2.5ft		=	3838	lbs. - ft

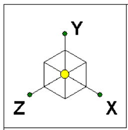
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 14
T. Eakkalak		July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

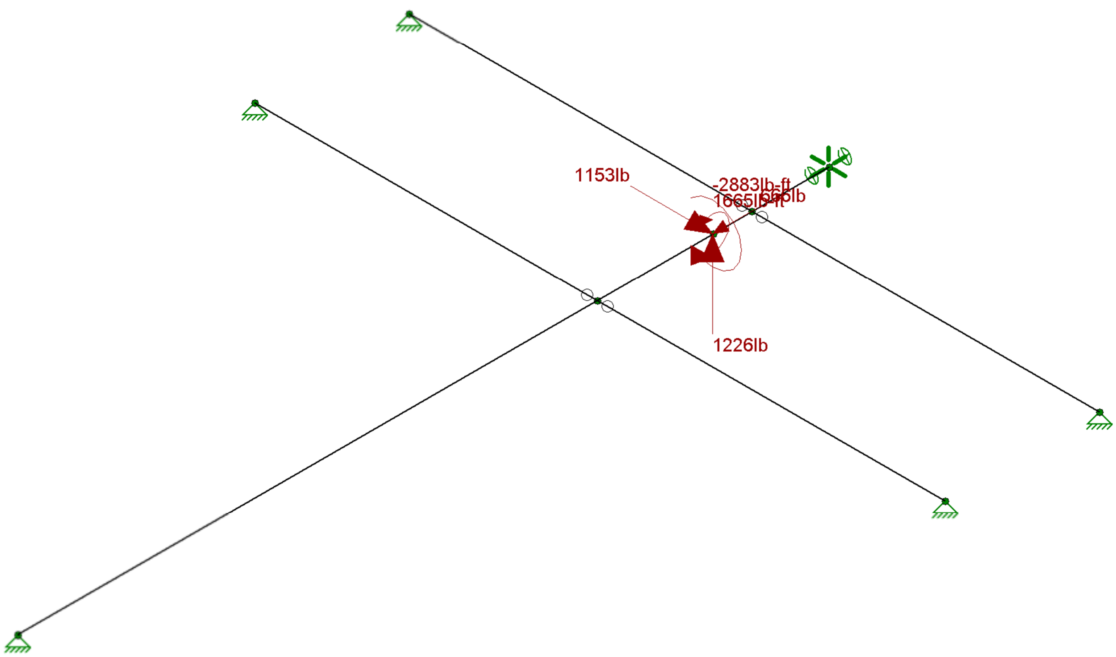


Ice Wind Load 120 Deg (+X)					
Compression Guy, T			=	-1469	lbs.
Horizontal Load, Z (along beam)	= -1469lbs.x cos42.63 x cos60		=	-540	lbs.
Compression Load, Y	= -1469lbs.x sin42.63		=	-995	lbs.
Horizontal Load, X	= -1469lbs.x cos42.63 x sin60		=	-936	lbs.
Moment from Horizontal Z, Mx	= -540lbs. x 2.5ft		=	-1350	lbs. - ft
Moment from Horizontal X, Mz	= -936lbs. x 2.5ft		=	-2340	lbs. - ft

Loads: BLC 13, Ice Wind Load (120 Deg.) +X
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 15
T. Eakkalak		July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

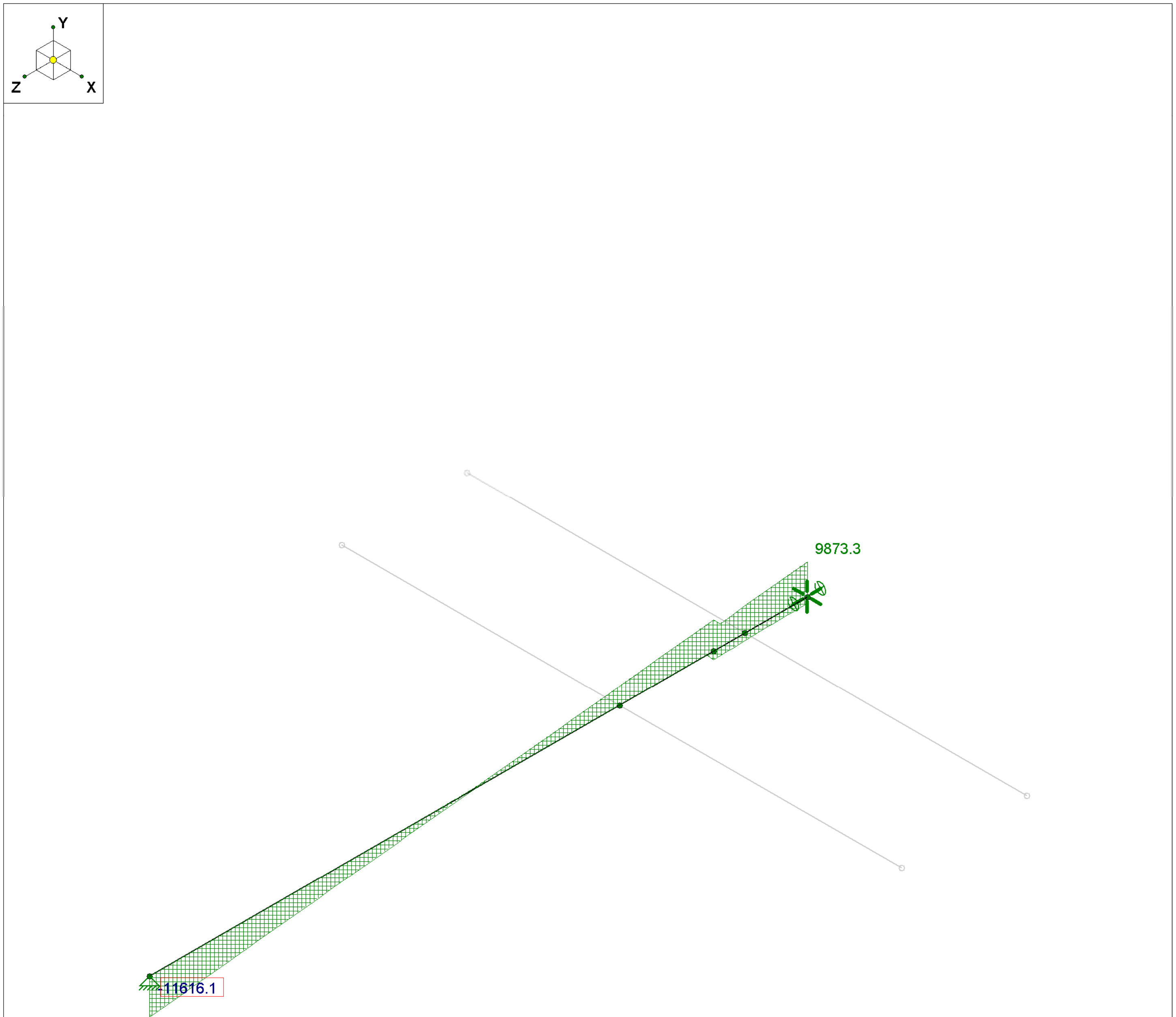


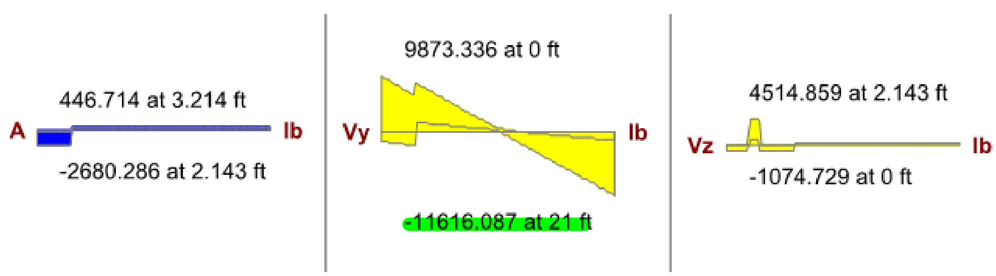


Ice Wind Load 300 Deg (-X)					
Tension in Guy, T		=	1810	lbs.
Horizontal Load, Z (along beam)	= 1810lbs.x cos42.63 x cos60	=	666	lbs.
Tension Load, Y	= 1810lbs.x sin42.63	=	1226	lbs.
Horizontal Load, X	= 1810lbs.x cos42.63 x sin60	=	1,153	lbs.
Moment from Horizontal Z, Mx	= 666lbs. x 2.5ft	=	1665	lbs. - ft
Moment from Horizontal X, Mz	= 1,153lbs. x 2.5ft	=	2883	lbs. - ft

Loads: BLC 14, Ice Wind Load (300 Deg.) -X
Envelope Only Solution

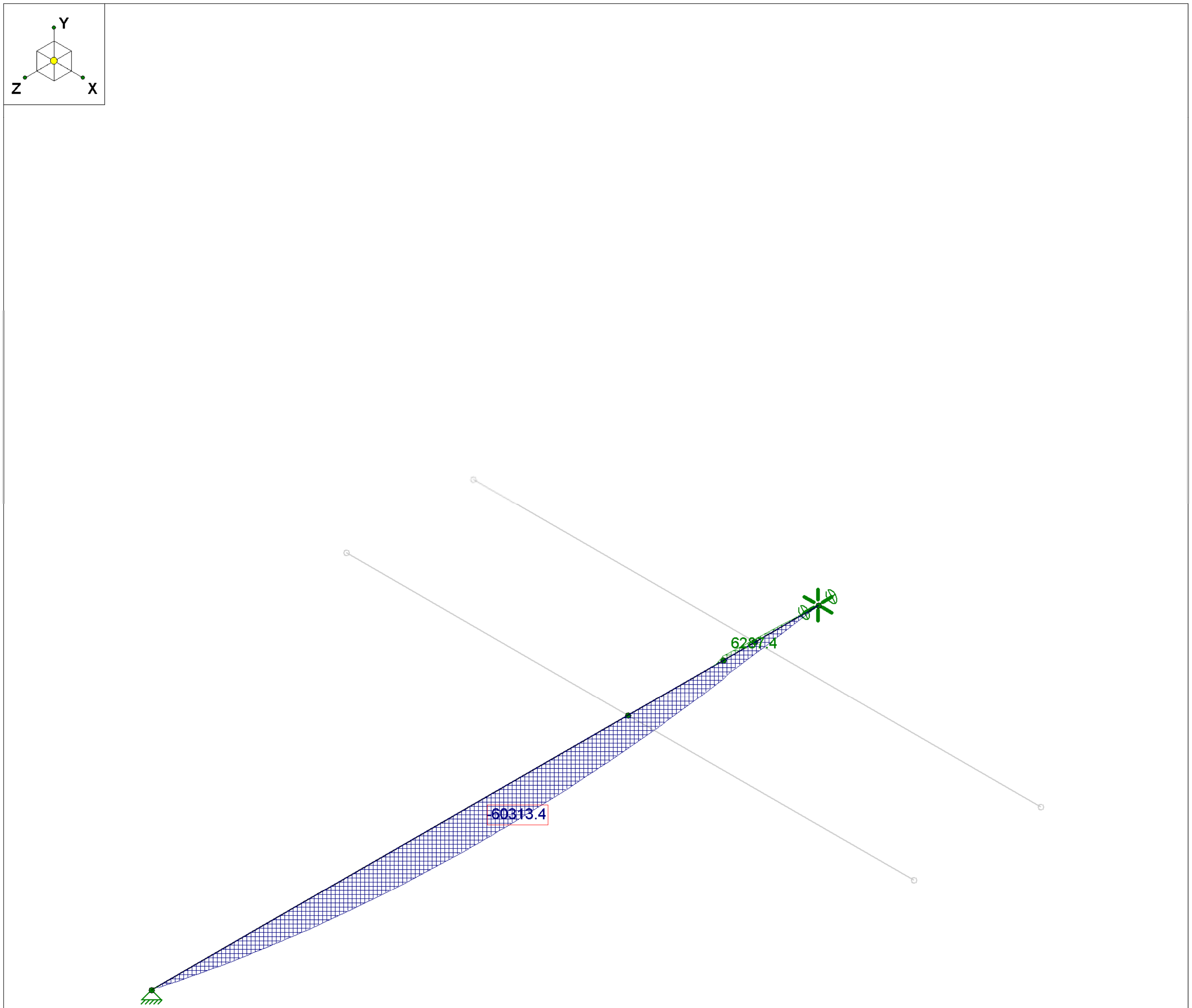
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 16
T. Eakkalak		July 23, 2020 at 12:29 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

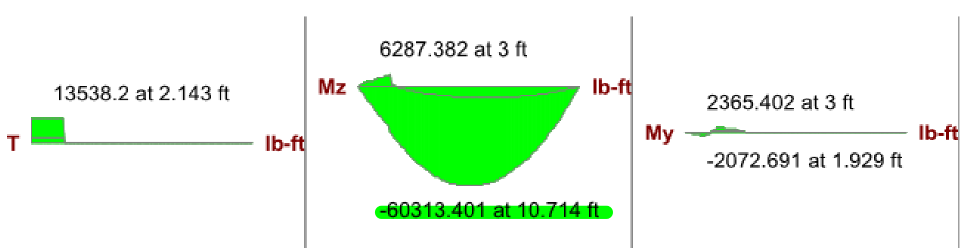




Envelope Only Solution
Member y Shear Forces (lb) (Enveloped)

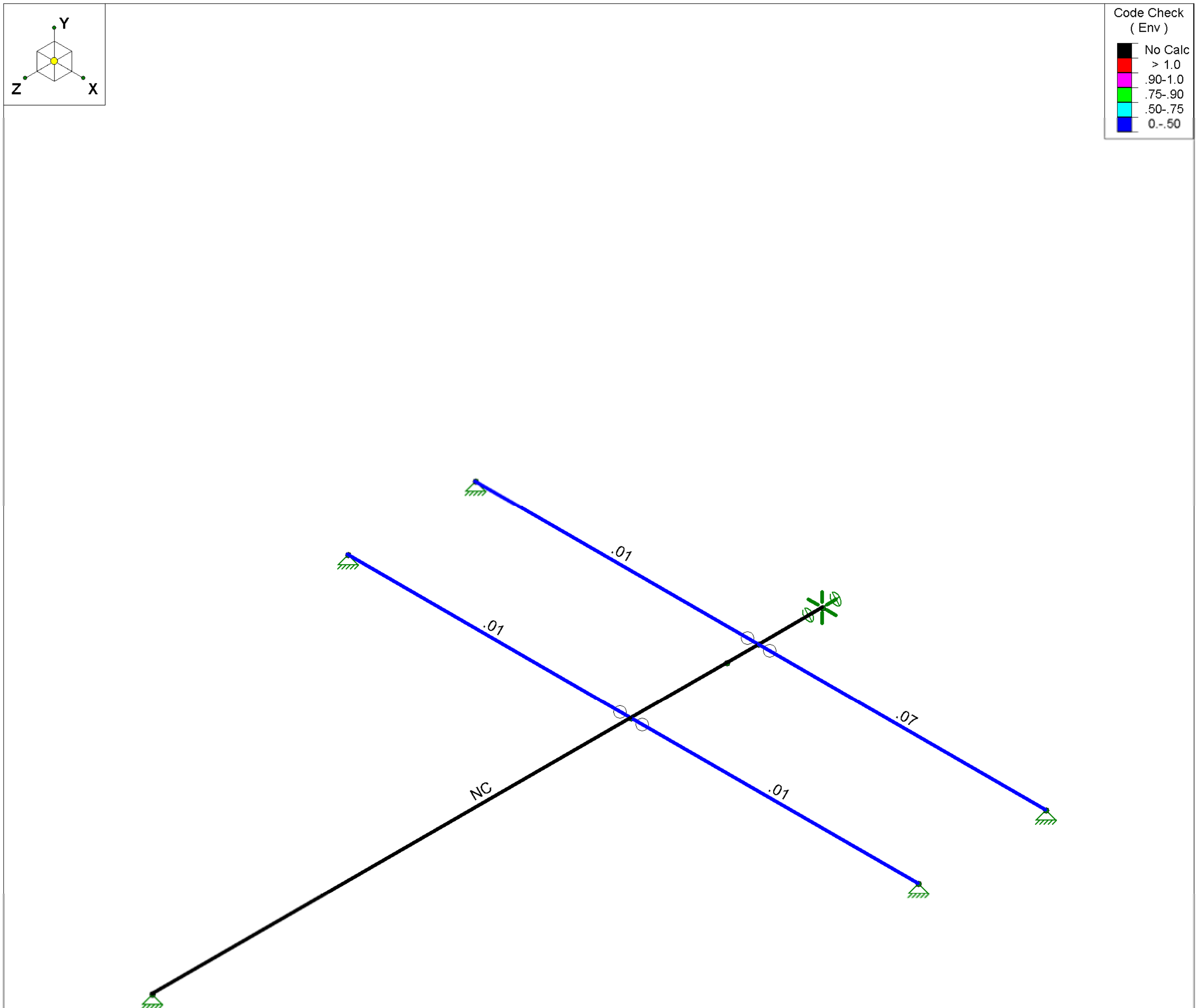
Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 17
T. Eakkalak		July 23, 2020 at 12:31 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...





Envelope Only Solution
Member z Bending Moments (lb-ft) (Enveloped)

Black & Veatch Corp.	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	SK - 18
T. Eakkalak		July 23, 2020 at 12:31 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Black & Veatch Corp.		SK - 19
T. Eakkalak	HartfordAWC - Existing Roof Beam W12x22 (Anchor B)	July 23, 2020 at 12:31 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

(Global) Model Settings

Display Sections for Member Calcs	3
Max Internal Sections for Member Calcs	99
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building
Stainless Steel Code	None

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	None
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A992 Gr. 50	29000	11154	.3	.65	.49	50	1.5	65	1.2

General Material Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]
1	RIGID	29000	11154	.3	.65	0

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Strut Beam	W10X12	Beam	Wide Flange	A992 Gr. 50	Typical	3.54	2.18	53.8	.055

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	RIGID		None	RIGID	6.48	4.66	156	.293

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	N1	-.295	0	0	0	
2	N2	-.295	0	-21	0	
3	N3	-.295	0	-18	0	
4	N4	-.295	0	-15	0	
5	N5	-.295	0	-19	0	
6	N6	-9.17	0	-15	0	
7	N7	-9.17	0	-19	0	
8	N8	8.705	0	-15	0	
9	N9	8.705	0	-19	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N1	Reaction	Reaction	Reaction			
2	N2	Reaction	Reaction	Reaction			Reaction
3	N4						
4	N5						
5	N6	Reaction	Reaction	Reaction			
6	N7	Reaction	Reaction	Reaction			
7	N8	Reaction	Reaction	Reaction			
8	N9	Reaction	Reaction	Reaction			

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design Rul...
1	M1	N2	N1			RIGID	None	None	RIGID	DR1
2	M2	N8	N4			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical
3	M3	N4	N6			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical
4	M4	N9	N5			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical
5	M5	N5	N7			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical

Member Advanced Data

	Label	I Release	J Release	I Offset[in]	J Offset[in]	T/C Only	Physical	Defl Rat...	Analysis ...	Inactive	Seismic...
1	M1						Yes	** NA **			None
2	M2		BenPIN				Yes	Default			None
3	M3	BenPIN					Yes	Default			None
4	M4		BenPIN				Yes	Default			None
5	M5	BenPIN					Yes	Default			None

Hot Rolled Steel Design Parameters

	Label	Shape	Length[ft]	Lbyy[ft]	Lbzz[ft]	Lcomp to...	Lcomp b...	L-torque[ft]	Kyy	Kzz	Cb	Function
1	M2	Strut Beam	9									Lateral
2	M3	Strut Beam	8.875									Lateral
3	M4	Strut Beam	9									Lateral
4	M5	Strut Beam	8.875									Lateral

Joint Loads and Enforced Displacements (BLC 8 : Tower Dead)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	-5.5
2	N3	L	Mx	-14
3	N3	L	Y	-10
4	N3	L	X	-10
5	N3	L	Mz	24

Joint Loads and Enforced Displacements (BLC 9 : Guy Self Weight)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	1318
2	N3	L	Mx	3295
3	N3	L	Y	2426
4	N3	L	X	2282
5	N3	L	Mz	-5705

Joint Loads and Enforced Displacements (BLC 10 : Wind Load (120 Deg.) +X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	-713
2	N3	L	Mx	-1782
3	N3	L	Y	-1313
4	N3	L	X	-1235
5	N3	L	Mz	3087

Joint Loads and Enforced Displacements (BLC 11 : Wind Load (300 Deg.) -X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	1046
2	N3	L	Mx	2615
3	N3	L	Y	1925
4	N3	L	X	1811
5	N3	L	Mz	-4528

Joint Loads and Enforced Displacements (BLC 12 : Ice Dead Load)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	886
2	N3	L	Mx	2215
3	N3	L	Y	1632
4	N3	L	X	1535
5	N3	L	Mz	-3838

Joint Loads and Enforced Displacements (BLC 13 : Ice Wind Load (120 Deg.) +X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	-540
2	N3	L	Mx	-1350
3	N3	L	Y	-995
4	N3	L	X	-936
5	N3	L	Mz	2340

Joint Loads and Enforced Displacements (BLC 14 : Ice Wind Load (300 Deg.) -X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	666
2	N3	L	Mx	1665
3	N3	L	Y	1226
4	N3	L	X	1153
5	N3	L	Mz	-2883

Member Distributed Loads (BLC 1 : Beam and Roof)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-141.2	-141.2	0	0
2	M1	Y	-447	-447	0	0
3	M2	Y	-12	-12	0	0
4	M3	Y	-12	-12	0	0
5	M4	Y	-12	-12	0	0
6	M5	Y	-12	-12	0	0

Member Distributed Loads (BLC 2 : Roof Live Load)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-178.8	-178.8	0	0

Member Distributed Loads (BLC 3 : Snow (Pm))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-196.7	-196.7	0	0

Member Distributed Loads (BLC 4 : Snow (Pf + Drift))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-254.7	-254.7	0	0

Member Distributed Loads (BLC 5 : Wind Roof Pressure (Positive))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-10.2	-10.2	0	0

Member Distributed Loads (BLC 6 : Wind Roof Pressure (Negative))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	356	356	0	0

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu...	Area(M...	Surface...
1	Beam and Roof	DL						6		
2	Roof Live Load	RLL						1		
3	Snow (Pm)	SL						1		
4	Snow (Pf + Drift)	SLN						1		
5	Wind Roof Pressure (Positive)	WL+Y						1		
6	Wind Roof Pressure (Negative)	WL-Y						1		
8	Tower Dead	DL				5				
9	Guy Self Weight	DL				5				
10	Wind Load (120 Deg.) +X	WL+X				5				
11	Wind Load (300 Deg.) -X	WL-X				5				
12	Ice Dead Load	NL				5				
13	Ice Wind Load (120 Deg.) +X	WLX+R				5				
14	Ice Wind Load (300 Deg.) -X	WLX-R				5				

Load Combinations

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	...	F...
1	1.4DL	Yes	Y		DL	1.4																		
2	1.2DL + 0.5RLL	Yes	Y		DL	1.2	RLL	.5																
3	1.2DL + 0.5SL	Yes	Y		DL	1.2	SL	.5																
4	1.2DL + 0.5SLN	Yes	Y		DL	1.2	SLN	.5																
5	1.2DL + 0.2IDL + 0.5SL	Yes	Y		DL	1.2	NL	.2	SL	.5														
6	1.2DL + 0.2IDL + 0.5SLN	Yes	Y		DL	1.2	NL	.2	SLN	.5														
7	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL...	.5	WL...	.5												
8	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL-X	.5	WL...	.5												
9	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL...	.5	WL-Y	.5												
10	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL-X	.5	WL-Y	.5												
11	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL...	.5	WL...	.5												
12	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL-X	.5	WL...	.5												
13	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL...	.5	WL-Y	.5												
14	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL-X	.5	WL-Y	.5												
15	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL...	.5	WL...	.5												
16	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL-X	.5	WL...	.5												
17	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL...	.5	WL-Y	.5												
18	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL-X	.5	WL-Y	.5												
19	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL...	1	RLL	.5												
20	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL...	1	RLL	.5												
21	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	RLL	.5												
22	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	RLL	.5												
23	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL...	1	SL	.5												
24	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL...	1	SL	.5												
25	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SL	.5												
26	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SL	.5												
27	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL...	1	SLN	.5												
28	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL...	1	SLN	.5												
29	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SLN	.5												
30	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SLN	.5												
31	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SL	.5												
32	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SL	.5												
33	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SLN	.5												
34	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SLN	.5												
35	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL...	1														
36	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL...	1														
37	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL-Y	1														
38	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL-Y	1														
39	0.9DL + 1.0IDL + 1.0IWL	Yes	Y		DL	.9	NL	1	WL...	1														
40	0.9DL + 1.0IDL + 1.0IWL	Yes	Y		DL	.9	NL	1	WL...	1														

Envelope Joint Reactions

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N1	max	21.16	34	11615.284	15	-66.893	37	0	40	0	40	0	40
2		min	3.167	35	1536.489	38	-446.714	32	0	1	0	1	0	1
3	N2	max	1074.321	34	9886.949	15	-401.357	37	0	40	0	40	13538.2	34
4		min	160.872	35	-1801.875	38	-2680.285	32	0	1	0	1	2025.9	35
5	N6	max	-68.987	37	76.04	1	0	37	0	40	0	40	0	40
6		min	-460.733	32	48.006	37	-.002	32	0	1	0	1	0	1
7	N7	max	-421.338	37	77.932	1	0	37	0	40	0	40	0	40
8		min	-2816.969	32	48.109	37	-.009	32	0	1	0	1	0	1
9	N8	max	-68.028	37	74.151	1	.002	34	0	40	0	40	0	40
10		min	-454.334	32	47.392	40	0	35	0	1	0	1	0	1
11	N9	max	-415.486	37	72.311	1	.009	34	0	40	0	40	0	40
12		min	-2777.845	32	45.982	40	0	35	0	1	0	1	0	1
13	Totals:	max	-809.8	37	21759.76	15	-468.25	37						
14		min	-5414.4	32	-72.32	38	-3127	32						

Envelope Maximum Member Section Forces

	Mem...		Axial[lb]	Loc...	LC	y Shear[lb]	Lo...	LC	z Shear[lb]	Lo...	LC	Torque[l...	Lo...	LC	y-y Mome...	Lo...	LC	z-z Mome...	Lo...	LC
1	M1	max	446.714	3.2...	34	9873.336	0	15	4514.859	2....	34	13538.2	0	34	2365.402	3	34	6287.382	3	38
2		min	-2680.286	2.1...	32	-11616.087	21	15	-1074.729	0	32	0	3....	1	-2072.691	1....	32	-60313.401	10...	15
3	M2	max	454.334	0	34	75.6	0	1	0	0	40	0	0	40	0	0	40	0	0	40
4		min	68.028	0	35	-75.6	9	1	0	0	1	0	0	1	0	0	1	-170.1	4.5	1
5	M3	max	-68.987	0	37	74.55	0	1	0	0	40	0	0	40	0	0	40	0	0	40
6		min	-460.733	0	32	-74.55	8....	1	0	0	1	0	0	1	0	0	1	-165.408	4....	1
7	M4	max	2777.845	0	34	75.6	0	1	0	0	40	0	0	40	0	0	40	0	0	40
8		min	415.486	0	35	-75.6	9	1	0	0	1	0	0	1	0	0	1	-170.1	4.5	1
9	M5	max	-421.338	0	37	74.55	0	1	0	0	40	0	0	40	0	0	40	0	0	40
10		min	-2816.969	0	32	-74.55	8....	1	0	0	1	0	0	1	0	0	1	-165.408	4....	1

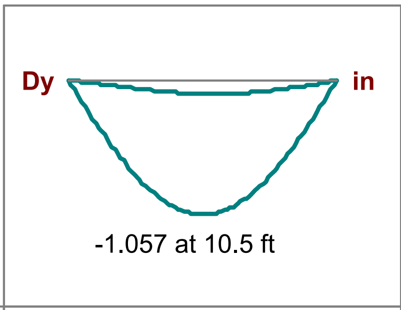
Envelope AISC 14th(360-10): LRFD Steel Code Checks

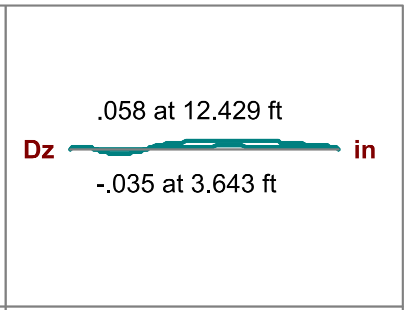
	Member	Shape	Code C...	Loc[ft]	LC	Shear C...	Loc[ft]	Dir	LC	phi*Pnc...	phi*Pnt [...	phi*Mn y-...	phi*Mn z...	Cb	Eqn
1	M2	W10X12	.011	4.5	34	.001	9	y	1	42222....	159300	6457.579	26884.207	1.136	H1-1b
2	M3	W10X12	.007	4.438	1	.001	0	y	1	43420.73	159300	6457.579	27521.318	1.136	H1-1b
3	M4	W10X12	.066	0	34	.001	9	y	1	42222....	159300	6457.579	26884.207	1.136	H1-1b*
4	M5	W10X12	.014	4.438	34	.001	0	y	1	43420.73	159300	6457.579	27521.318	1.136	H1-1b

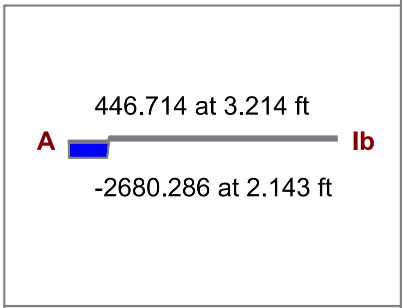
Member: ***M1***

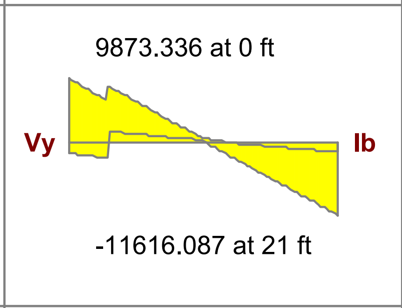
Shape:
Material: **RIGID**
Length: **21 ft**
I Joint: **N2**
J Joint: **N1**

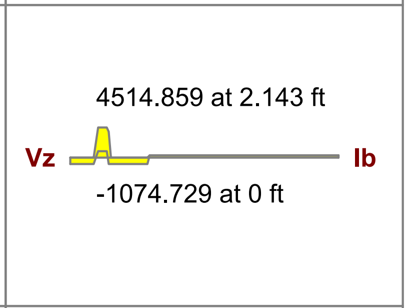
Code Check: **No Calc**
Report Based On 99 Sections

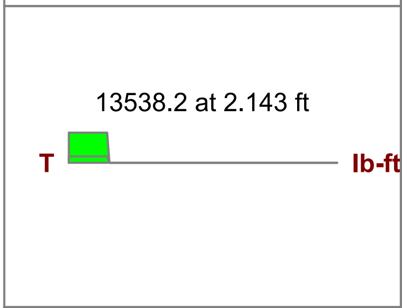


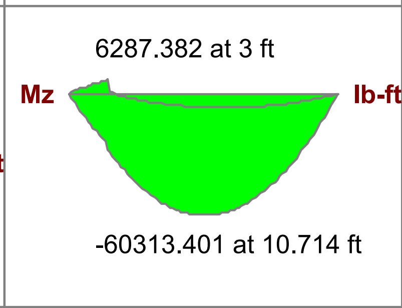


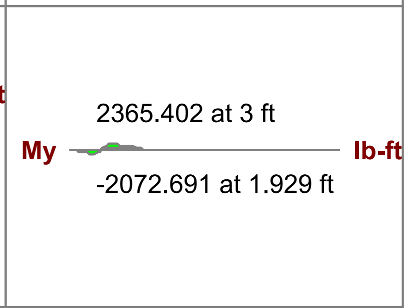


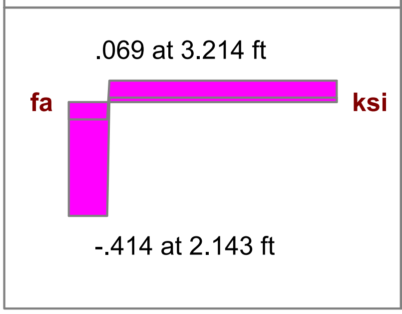


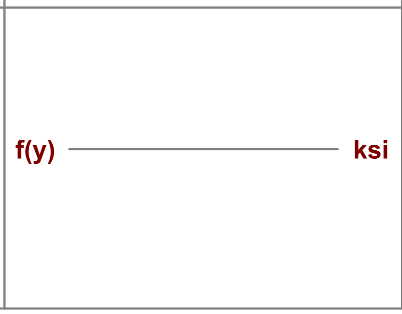


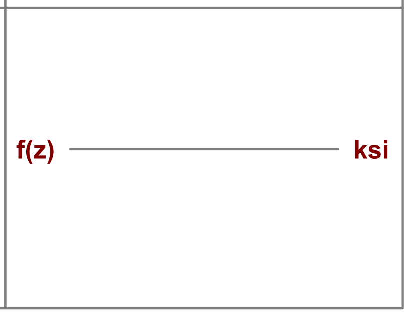












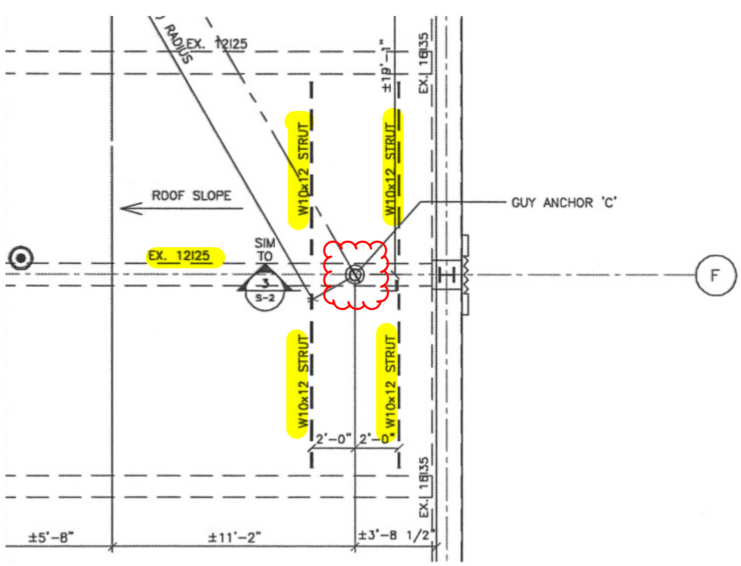
ANALYSIS OF EXISTING STEEL FOR GUY ANCHOR C

"W12x22"

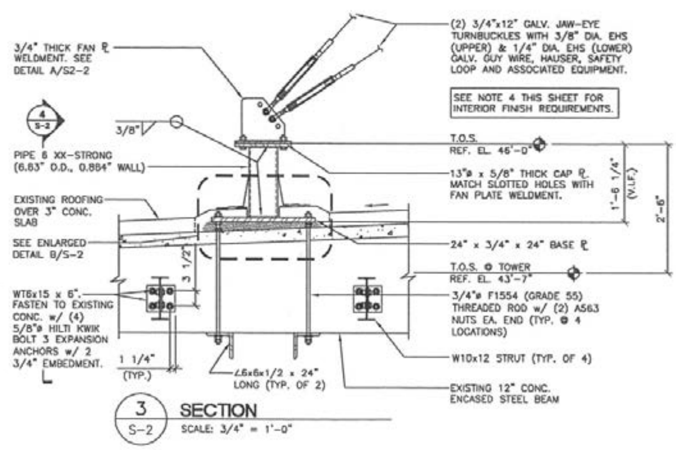
BLACK & VEATCH

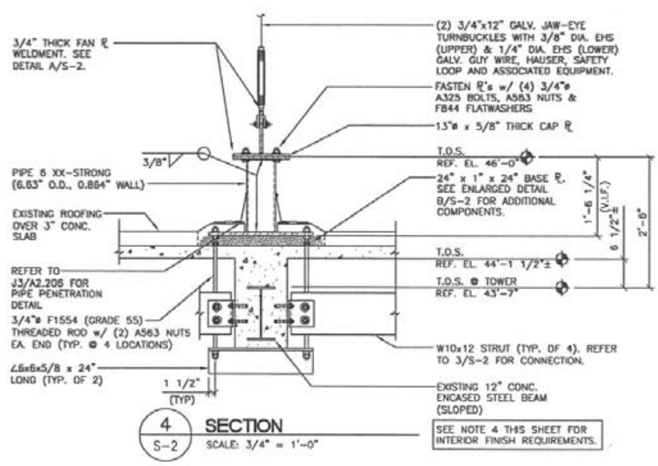
Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Project:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	6/10/2020

No.	Load Combination	Tension lbs	Vertical	Axial	Shear
	User Input				
1	Dead Only w/o equipment and feedline	3725.00			
2	Dead Only with equipment and feedline	3725.00			
3	1.2 Dead + 1.0 Wind 240 degree + 1.0 Guy	2969.00			
5	1.2 Dead + 1.0 Wind 60 degree + 1.0 Guy	6508.00			
7	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Guy	6236.00			
10	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Wind 240 degree + 1.0 Guy	5517.00			
8	1.2 Dead + 1.0 Ice + 1.0 Temp + 1.0 Wind 60 degree + 1.0 Guy	8088.00			
	Unfactored Load				
12	Guy	3725.00	2637.65	1315.15	2277.90
13	Dead (Equipment and feedline)	0.00	0.00	0.00	0.00
16	Wind 240 degree	-756.00	-535.32	-266.91	-462.31
14	Wind 60 degree	2783.00	1970.62	982.56	1701.85
18	Ice + Temp	2511.00	1778.02	886.53	1535.52
21	Wind Ice 240 degree	-719	-509.12	-253.85	-439.68
19	Wind Ice 60 degree	1852	1311.39	653.87	1132.53



SCALE





BLACK & VEATCH

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Plant:	HARTFORD AWC	Date:	6/8/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

Snow Load for Rooftop Capacity Check (ASCE 7-10) - Windward Drift

Ground snow load	p_g =	30.0	psf	
Terrain Category		C		Sec. 26.7
Exposure of Roof		Fully Exposed		Table 7-2
Thermal Condition		All structures		
Snow exposure factor	C_e =	0.9		Table 7.2
Thermal factor	C_t =	1.0		Table 7.3
Structure Risk category		III		
Snow load importance factor	I_s =	1.1		Sec. 7.3.3
Snow load on "flat" roof	p_f =	20.8	psf	Eq. 7.3-1
Snow density	γ =	17.9	pcf	
Min. Snow load on "flat" roof: P_m =	P_m =	**22.0**	psf	Sec. 7.3.4

Geometry

Parapet and Roof Projections		Yes	
Height of balanced snow load	h_b =	1.16	ft
Clear height from top of balanced snow	h_c =	0.8	ft
Length of roof windward of drift (lower)	$l_{u,wind}$ =	65.0	ft
Height of snow drift (windward)	$h_{d,wind}$ =	0.84	ft
Height of snow drift	h_d =	0.84	ft

Results

Min. snow load on low-slope roofs	p_m =	20.0	psf
Width of snow drift	w =	**3.35**	ft
Max. intensity of drift surcharge load	p_d =	**15.0**	psf

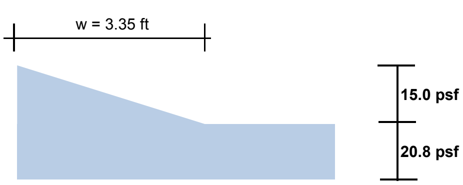
hc/hb > 0.2, NEED TO CAL SNOW DRIFT! (Sec. 7.7.1)

where,

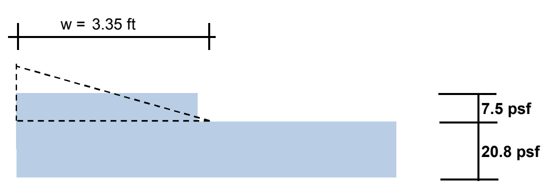
p_m = if(p_g <= 20, I_s x p_g, 20 x I_s)	Sec. 7.3.4
γ = 0.13 x p_g + 14 ≤ 30 pcf	Eq. 7.7-1
$h_b = p_f / \gamma$	
h_d = (0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9
$h_{d\_parapet}$ = 0.75(0.43(l_u)^(1/3) x (p_g+10)^(1/4) - 1.5), h_c max	Fig. 7.9 and Sec. 7.8
p_f = 0.7 x C_e x C_t x I_s x p_g	Eq. 7.3-1
w = IF(h_d<=h_c,4*h_d, 4*h_d^2/h_c)	
p_d = h_d x γ	

Notes:

1) For parapet walls, l_u shall be taken equal to the length of the roof upwind (windward) of the wall
2) For roof projections, l_u shall be taken equal to the length of the roof upwind (windward)/downwind (leeward) of the projection
3) If the side of roof projection is less than 15ft long, a drift load is not required to be applied on that side
4) This template is not applicable for Hip and Gable Roofs, and/or highly sloped roofs



Actual Snow Drift Diagram



Equivalent Snow Drift Diagram for RISA Analysis

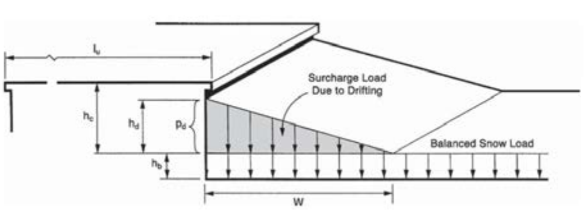


FIGURE 7-8 Configuration of Snow Drifts on Lower Roofs.

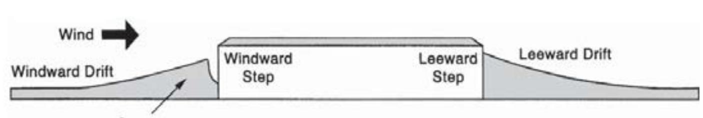


FIGURE 7-7 Drifts Formed at Windward and Leeward Steps.

5. ANALYSIS & DESIGN

5.1 Structural Analysis of Existing Building Rooftop Structure

Existing Loading Conditions

Exist roof construction consists of EPDM rubber roofing over insulation (3" assumed), over 3-1/4" thickness concrete deck (Normal Weight), over concrete encased W beams.

5.1.4) Existing Roof Beam W12x22 (Grid-13&Grid-15, Grid-F)

Dead Load of Roof Floor Slab

Width of Slab at considering span, B	=	9.71	ft	
Length of Slab at considering span, L	=	21.00	ft	
Ratio B / L = 9.71ft / 21ft	=	0.46	< 0.5 One Way Load	
Tributary Width	=	9.71	ft	
0.060 EPDM	=	1.0	psf	
3" Rigid	=	4.5	psf	
3 -1/4" Concrete Deck = 145 pcf x 3.25" / 12	=	39.3	psf	
M/E/P	=	4.0	psf	
Finishing	=	1.0	psf	
Total	=	49.8	psf	
	USE =	**50.0**	psf	
Dead Load of Concrete Beam + W12x22	=	141.2	psf	
Roof Live Load	=	20.0	psf	
Snow - Pm (Uniform Min. Roof)	=	22.0	psf	
Snow Load on "Flat" Roof, Pf with drift (when w > 3.35ft)	=	28.3	psf	
Wind Uplift Load on Building Roof	=	-39.8	psf	
Wind Down Load on Building Roof	=	1.1	psf	

Load Apply For RISA 3D:

- Existing Load on Roof Floor Slab

Concrete Beam Self Weight, DL =	=	141.2	plf
Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft	=	485.5	plf
Roof Live Load, Lr = 20psf x 9.71ft	=	194.2	plf
Snow Load, SL = 22psf x 9.71ft	=	213.6	plf
Snow Load, SLN = 28.3psf x 9.71ft	=	274.8	plf
Wind Uplift Load, WL-Y = -39.82psf x 9.71ft	=	-386.7	plf
Wind Down Load, WL+Y = 1.14psf x 9.71ft	=	11.1	plf

- Load from TNX. (Un - Factor)

Guy Geometry : Guy Anchor C (+ = Tension, - = Compression)

Guy Height - Level 1	@	Corner	=	18.94	ft	
Guy Radius - Level 1	@	Corner	=	33.67	ft	
Guy Height - Level 2	@	Torque Arm	=	46.38	ft	
Guy Radius - Level 2	@	Torque Arm	=	33.67	ft	
The Effective Angle of Tension in Guy, θ_R			=	45.08	degree	From E1 tnx.
The Angle of plane XZ in Guy, θ_1			=	60.0	degree	
Height of Pipe 6 XXS, h			=	2.50	ft	

Dead Load of Guy only

Tension in Guy, T		=	3725	lbs.
Horizontal Load, Z (along beam)	= 3725lbs.x cos45.08 x cos60	=	1,315	lbs.
Tension Load, Y	= 3725lbs.x sin45.08	=	2638	lbs.
Horizontal Load, X	= 3725lbs.x cos45.08 x sin60	=	2,278	lbs.
Moment from Horizontal Z, Mx	= 1,315lbs. x 2.5ft	=	3288	lbs. - ft
Moment from Horizontal X, Mz	= 2,278lbs. x 2.5ft	=	5695	lbs. - ft

Wind Load 240 Deg (+X)

Compression Guy, T		=	-756	lbs.
Horizontal Load, Z (along beam)	= -756lbs.x cos45.08 x cos60	=	-267	lbs.
Compression Load, Y	= -756lbs.x sin45.08	=	-535	lbs.
Horizontal Load, X	= -756lbs.x cos45.08 x sin60	=	-462	lbs.
Moment from Horizontal Z, Mx	= -267lbs. x 2.5ft	=	-668	lbs. - ft
Moment from Horizontal X, Mz	= -462lbs. x 2.5ft	=	-1155	lbs. - ft

Wind Load 60 Deg (-X)

Tension in Guy, T		=	2783	lbs.
Horizontal Load, Z (along beam)	= 2783lbs.x cos45.08 x cos60	=	983	lbs.
Tension Load, Y	= 2783lbs.x sin45.08	=	1971	lbs.
Horizontal Load, X	= 2783lbs.x cos45.08 x sin60	=	1,702	lbs.
Moment from Horizontal Z, Mx	= 983lbs. x 2.5ft	=	2458	lbs. - ft
Moment from Horizontal X, Mz	= 1,702lbs. x 2.5ft	=	4255	lbs. - ft

Ice DL + Temp

Tension in Guy, T		=	2511	lbs.
Horizontal Load, Z (along beam)	= 2511lbs.x cos45.08 x cos60	=	887	lbs.
Tension Load, Y	= 2511lbs.x sin45.08	=	1778	lbs.
Horizontal Load, X	= 2511lbs.x cos45.08 x sin60	=	1,536	lbs.
Moment from Horizontal Z, Mx	= 887lbs. x 2.5ft	=	2218	lbs. - ft
Moment from Horizontal X, Mz	= 1,536lbs. x 2.5ft	=	3840	lbs. - ft

Ice Wind Load 240 Deg (+X)

Compression Guy, T		=	-719	lbs.
Horizontal Load, Z (along beam)	= -719lbs.x cos45.08 x cos60	=	-254	lbs.
Compression Load, Y	= -719lbs.x sin45.08	=	-509	lbs.
Horizontal Load, X	= -719lbs.x cos45.08 x sin60	=	-440	lbs.
Moment from Horizontal Z, Mx	= -254lbs. x 2.5ft	=	-635	lbs. - ft
Moment from Horizontal X, Mz	= -440lbs. x 2.5ft	=	-1100	lbs. - ft

Ice Wind Load 60 Deg (-X)

Tension in Guy, T		=	1852	lbs.
Horizontal Load, Z (along beam)	= 1852lbs.x cos45.08 x cos60	=	654	lbs.
Tension Load, Y	= 1852lbs.x sin45.08	=	1311	lbs.
Horizontal Load, X	= 1852lbs.x cos45.08 x sin60	=	1,133	lbs.
Moment from Horizontal Z, Mx	= 654lbs. x 2.5ft	=	1635	lbs. - ft
Moment from Horizontal X, Mz	= 1,133lbs. x 2.5ft	=	2833	lbs. - ft

Owner:	EVERSOURCE	Computed By:	T. Eakkalak
Site Name:	HARTFORD AWC	Date:	5/28/2020
Project No.	403093.2000.2200	Verified By:	L. Meyer
Title:	STRUCTURAL ANALYSIS OF EXISTING BUILDING ROOFTOP STRUCTURE	Date:	7/23/2020

BLACK & VEATCH

- Determined Section Properties of Encased Concrete Steel Beam

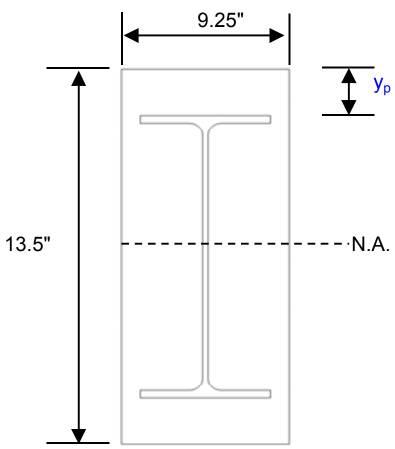
- Steel Section : W12x22

Yield Strength, F_y	=	33.00	ksi
Tensile Strength, F_u	=	65.00	ksi
Depth, d	=	12.30	in
Flange Width, b_f	=	4.03	in
Flange Thickness, t_f	=	0.43	in
Web Thickness, t_w	=	0.260	in
Section Area, A_s	=	6.48	in^2
Weight of Steel, W	=	22.00	plf
Modulus of Elastic of Steel, E_s	=	29000	ksi

- RC. Section : Assumed to be 9.25"x13.5" from previous SA

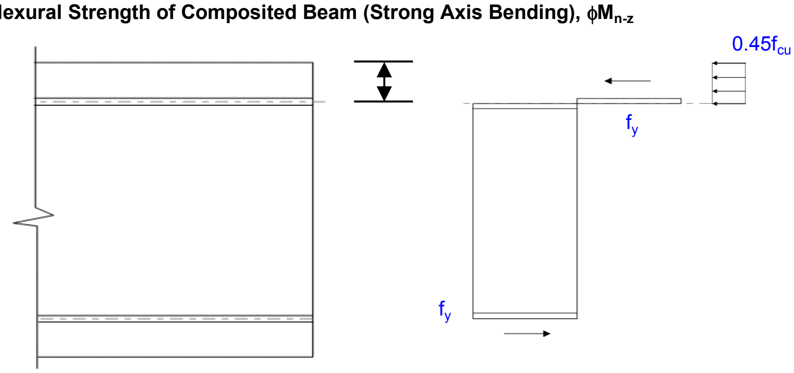
Compressive Stength of Concrete, f'_c	=	3000	psi
β_1	=	0.85	
Height of Beam, h	=	13.50	in
Width of Beam, b	=	9.25	in
Section Area, A_g = b x h	=	124.88	in^2
Modulus of Elasticity of Concrete, $E_c = 57000\ f'_c{}^{1/2}$	=	3122	ksi ACI318-14 (19.2.2)

Neutral axis without rebars



$A_1 = A_{steel}$	=	6.5	in^2	
$A_2 = A_{concrete}$	=	118.4	in^2	
A_{total}	=	124.9	in^2	
y_1	=	6.8	in	C.G. Steel
$y_2 = h/2$	=	6.8	in	C.G. Concrete Beam
Neutral axis without rebars, y'	=	6.75	in	
Assumed covering top and bottom	=	0.60	in	
y_p	=	0.815	in	Sec. 22.2.2

- Nominal Flexural Strength of Composited Beam (Strong Axis Bending), ϕM_{n-z}



The moment resistance of the composite section is then given by
Davidson's "Steel Designer's 6th Edition" in Sec. 22.2.2

$M_p = 0.5A_s f_y (h - y_p)$; Eq. 22.4

= 0.5*6.48*33000 * (13.5 - 0.815) = 113,023 lbs - ft

ϕM_p = 0.9 * 113,023 = 101,721 lbs - ft

- Nominal Shear Strength of Beam, ϕV_n (Assume Shear is Taken Fully by Steel Section)

The resistance factor for Shear, ϕ_v	=	1.00	
Ratio of Section, h / t_w	=	46.60	< 2.24 (E / Fy) ^0.5
Limit Ratio = $2.24 \times (E / F_y)^{0.5}$ = 2.24 x (3000 / 4.03) ^0.5	=	66.4	
C_v	=	1.00	Eq. G2-2
Area of Web, $A_w = (h - 2t_f) \times t_w$ = (0.26 - 2 x 22) x 29000	=	2.97	in^2

The shear resistance of the composite section is then given by
AISC Steel Construction Manual (14th Ed.) Section G2.1a

$V_n = 0.6F_y A_w C_v$; Eq. G2-1

0.6 x 4030 x 2.97 x 1.00 = 58,806 lbs

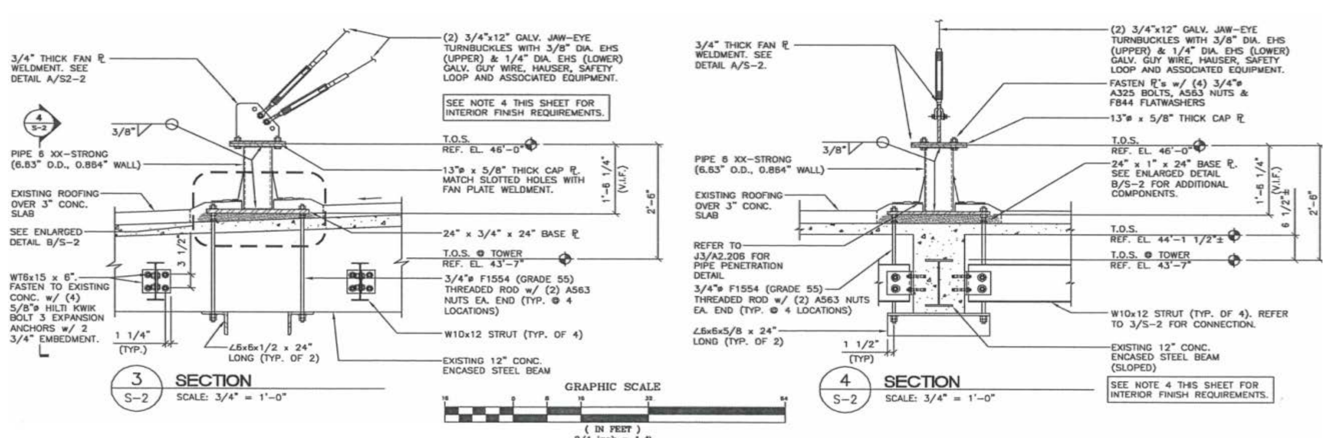
$\phi_v V_n$ = 0.9 * 58,806 = 58,806 lbs

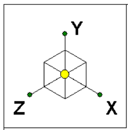
- The Result from Risa 3D

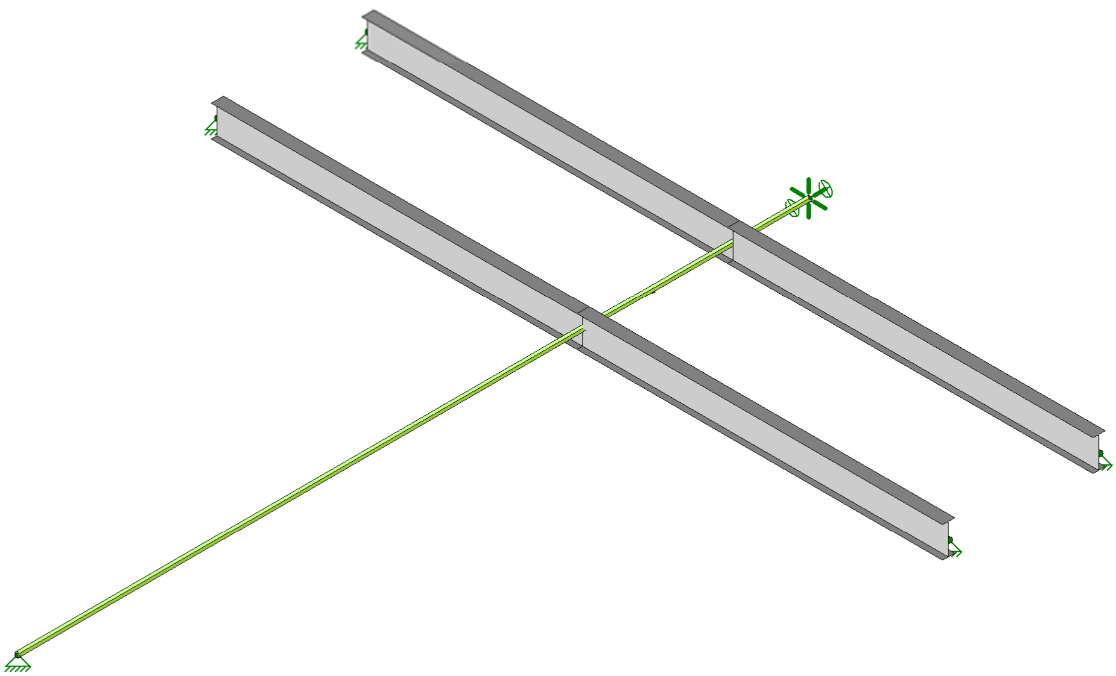
Max. Shear Force, V_u	=	12,219	lbs
Max. Bending Moment, M_{u-z}	=	62,352	lbs. - ft
Max. Bending Moment, M_{u-y}	=	3,768	lbs. - ft

- The Stress Ratio

The Shear Stress Ratio, $V_u / \phi V_n$: 12219 / 58806	=	0.208	OK
		20.8%	
The Flexural Stress Ratio, M_u / ϕN 62352 / 101,721	=	0.613	OK
		61.3%	
The Flexural Stress Ratio, M_u / ϕN 3768.411 / 13725	=	0.275	OK
		27.5%	
Combined Flexural Stress Ratio	=	88.8%	OK

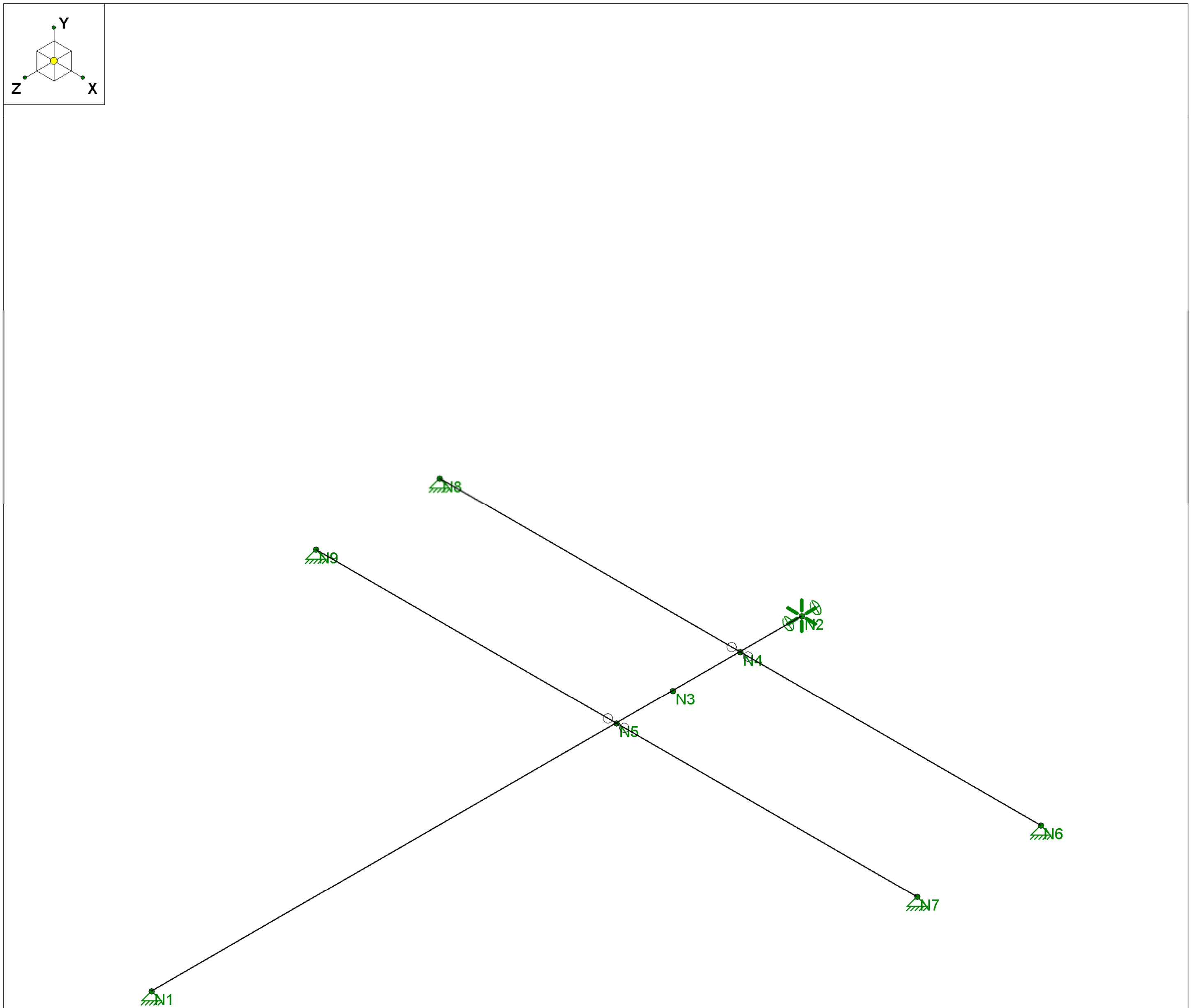






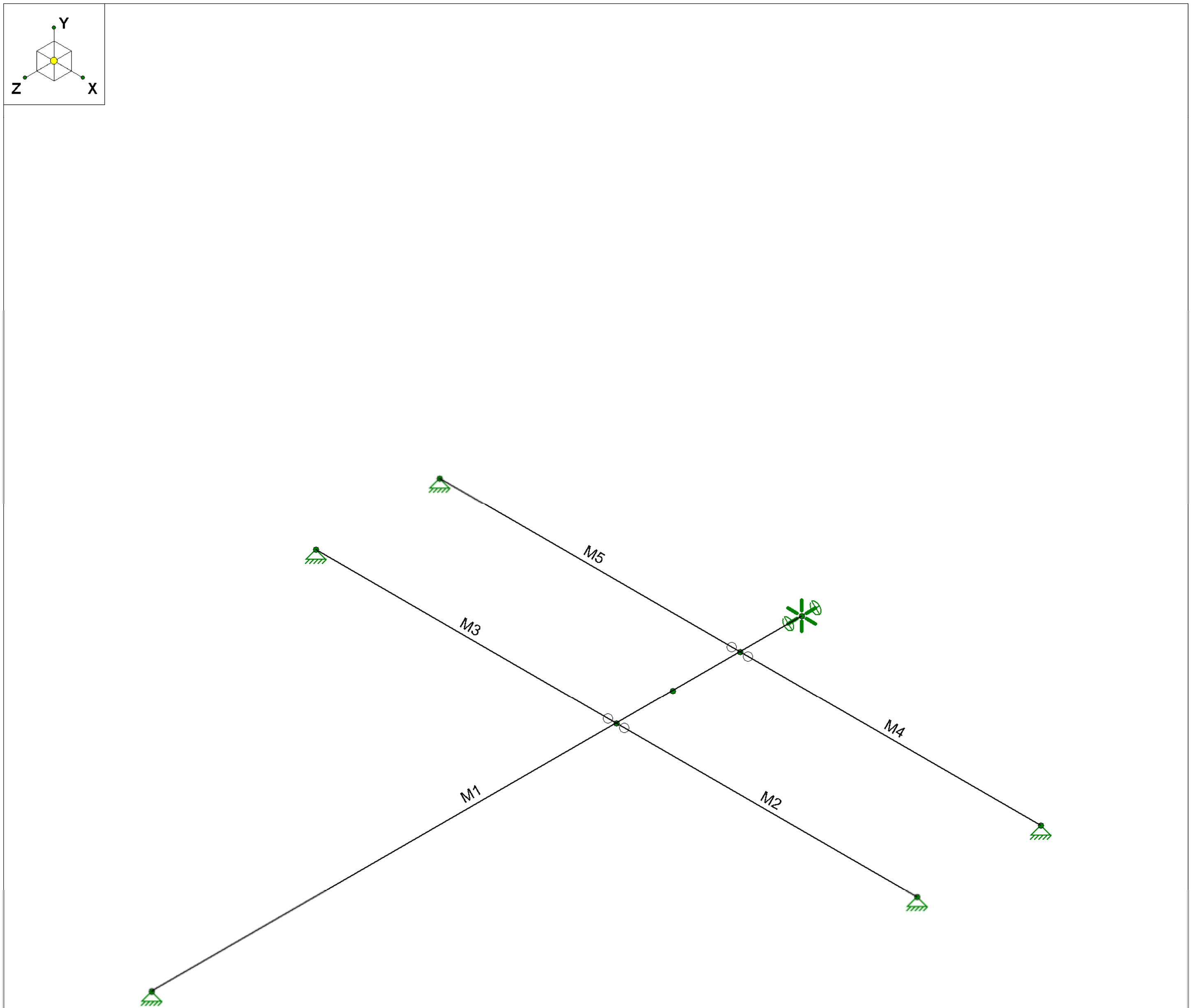
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 1
T. Eakkalak		July 23, 2020 at 1:34 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



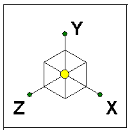
Envelope Only Solution

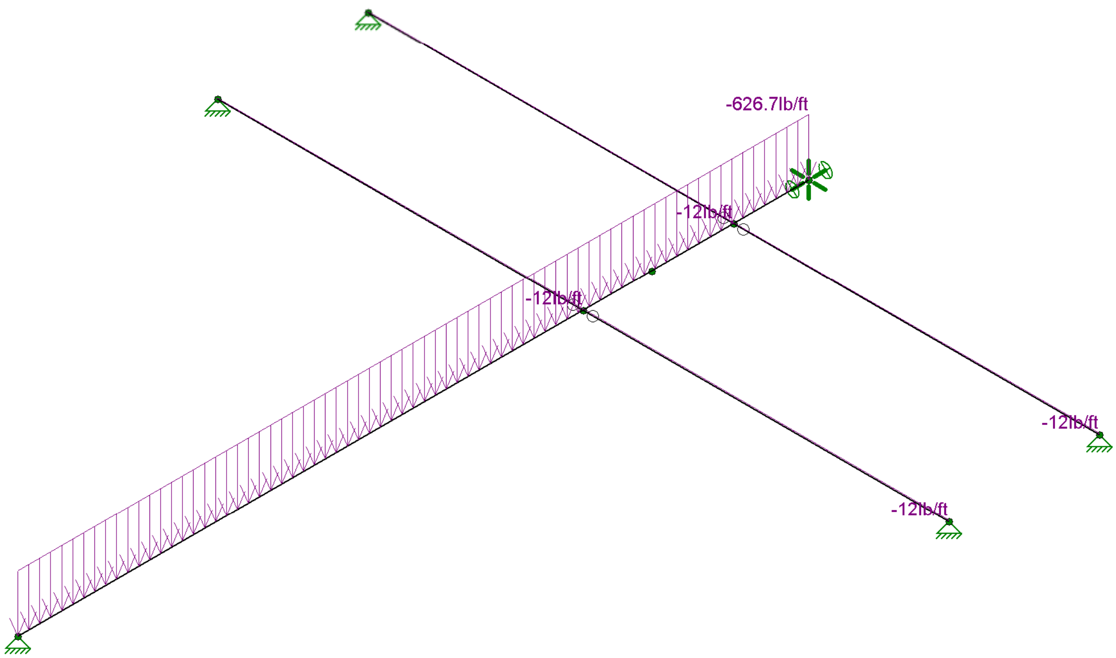
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 2
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Envelope Only Solution

Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 3
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

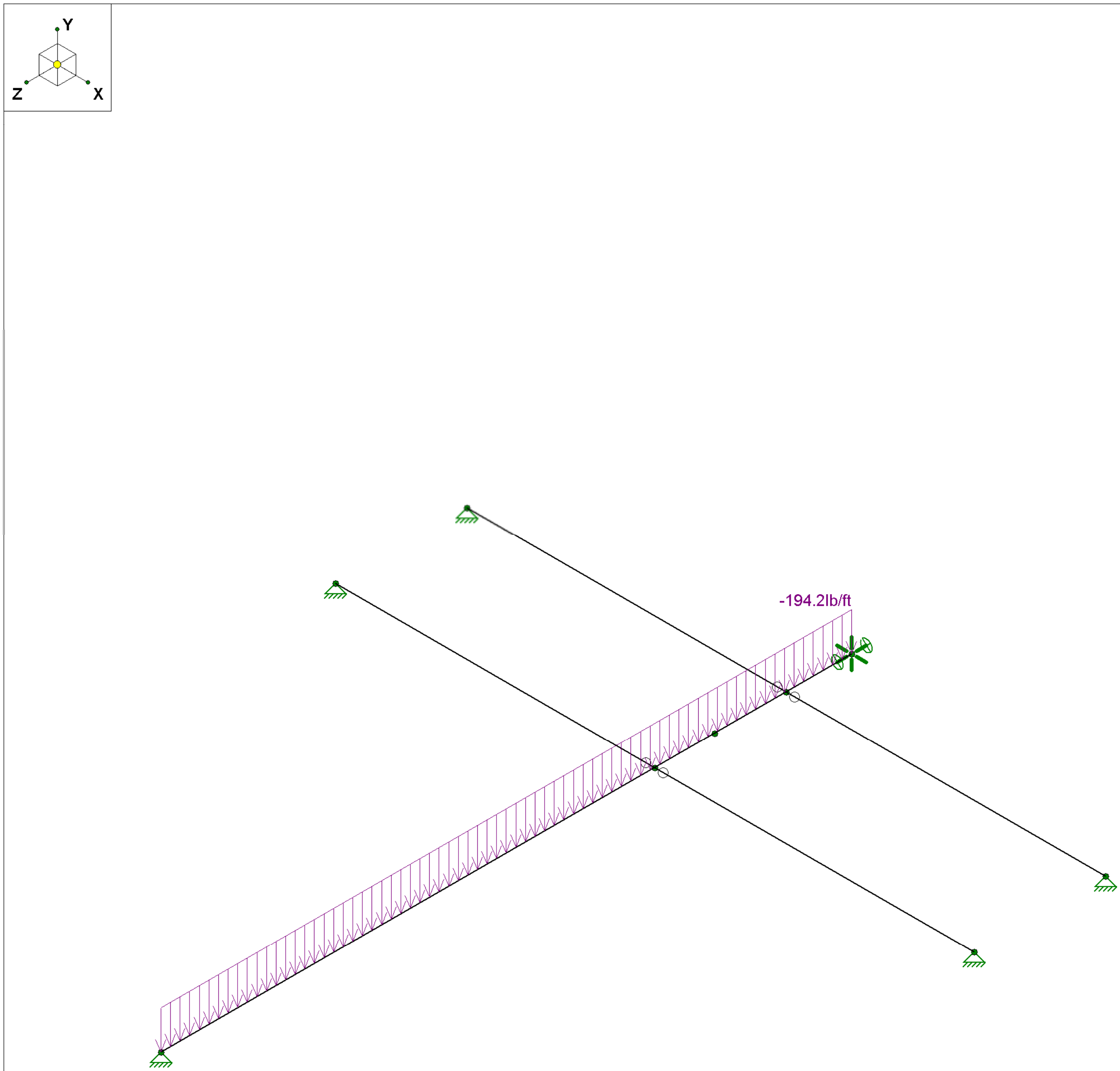




Load Apply For RISA 3D:					
	- **Existing Load on Roof Floor Slab**				
	Concrete Beam Self Weight, DL =		=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft		=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft		=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft		=	213.6	plf
	Snow Load, SLN = 28.3psf x 9.71ft		=	274.8	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft		=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft		=	11.1	plf

Loads: BLC 1, Beam and Roof
Envelope Only Solution

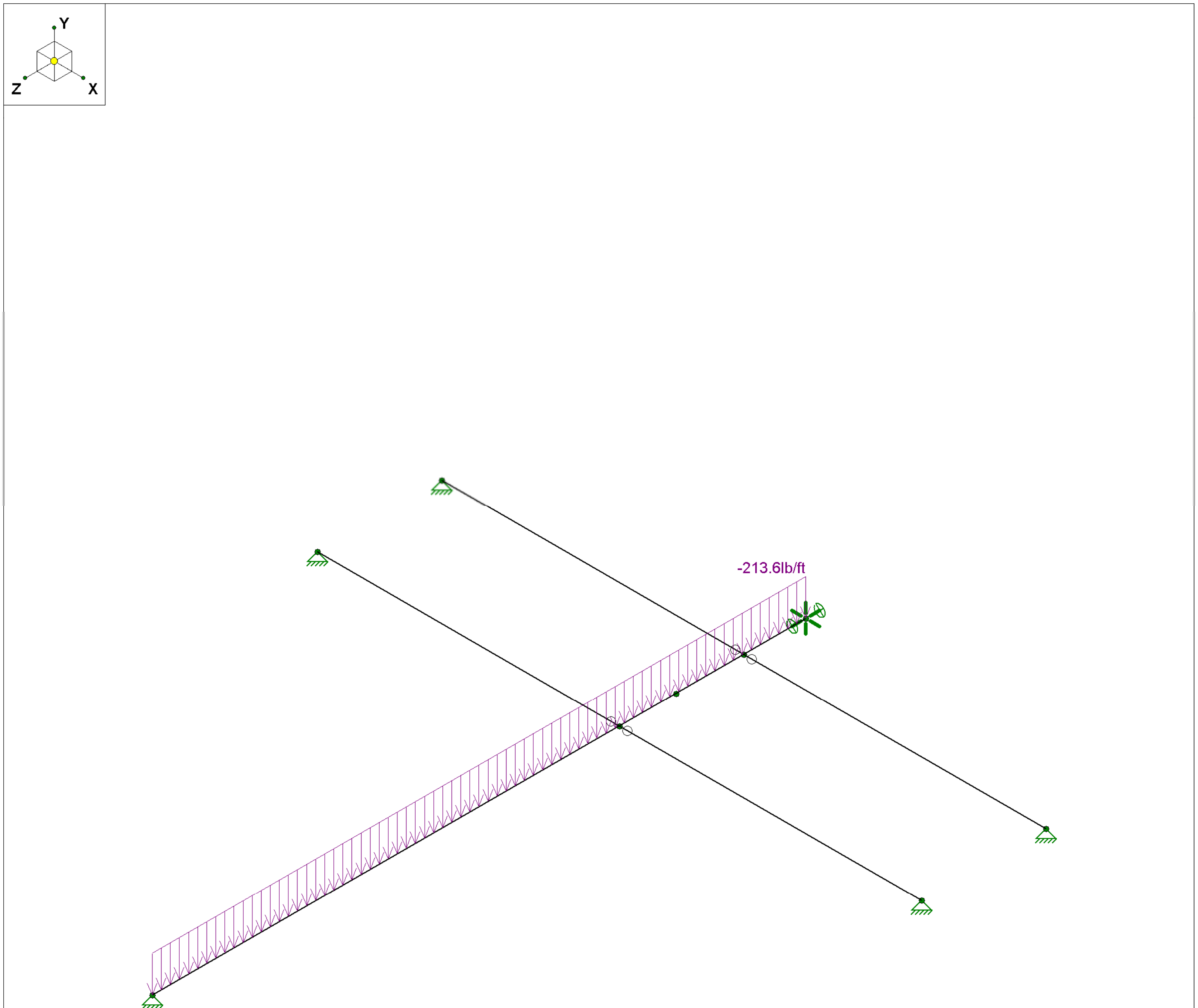
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 4
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:					
	- **Existing Load on Roof Floor Slab**				
	Concrete Beam Self Weight, DL =		=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft		=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft		=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft		=	213.6	plf
	Snow Load, SLN = 28.3psf x 9.71ft		=	274.8	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft		=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft		=	11.1	plf

Loads: BLC 2, Roof Live Load
Envelope Only Solution

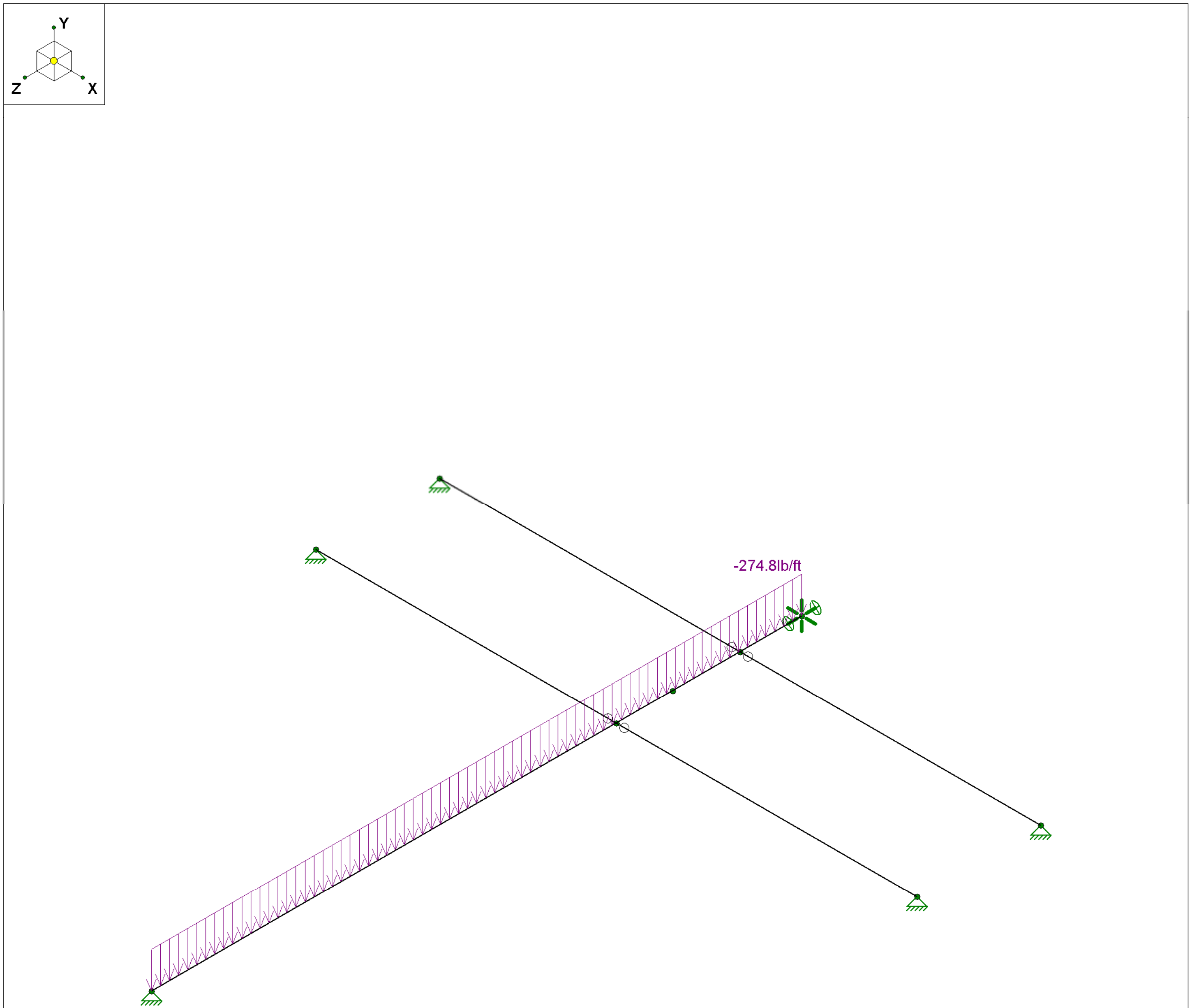
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 5
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:					
	- **Existing Load on Roof Floor Slab**				
	Concrete Beam Self Weight, DL =		=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft		=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft		=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft		=	213.6	plf
	Snow Load, SLN = 28.3psf x 9.71ft		=	274.8	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft		=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft		=	11.1	plf

Loads: BLC 3, Snow (Pm)
Envelope Only Solution

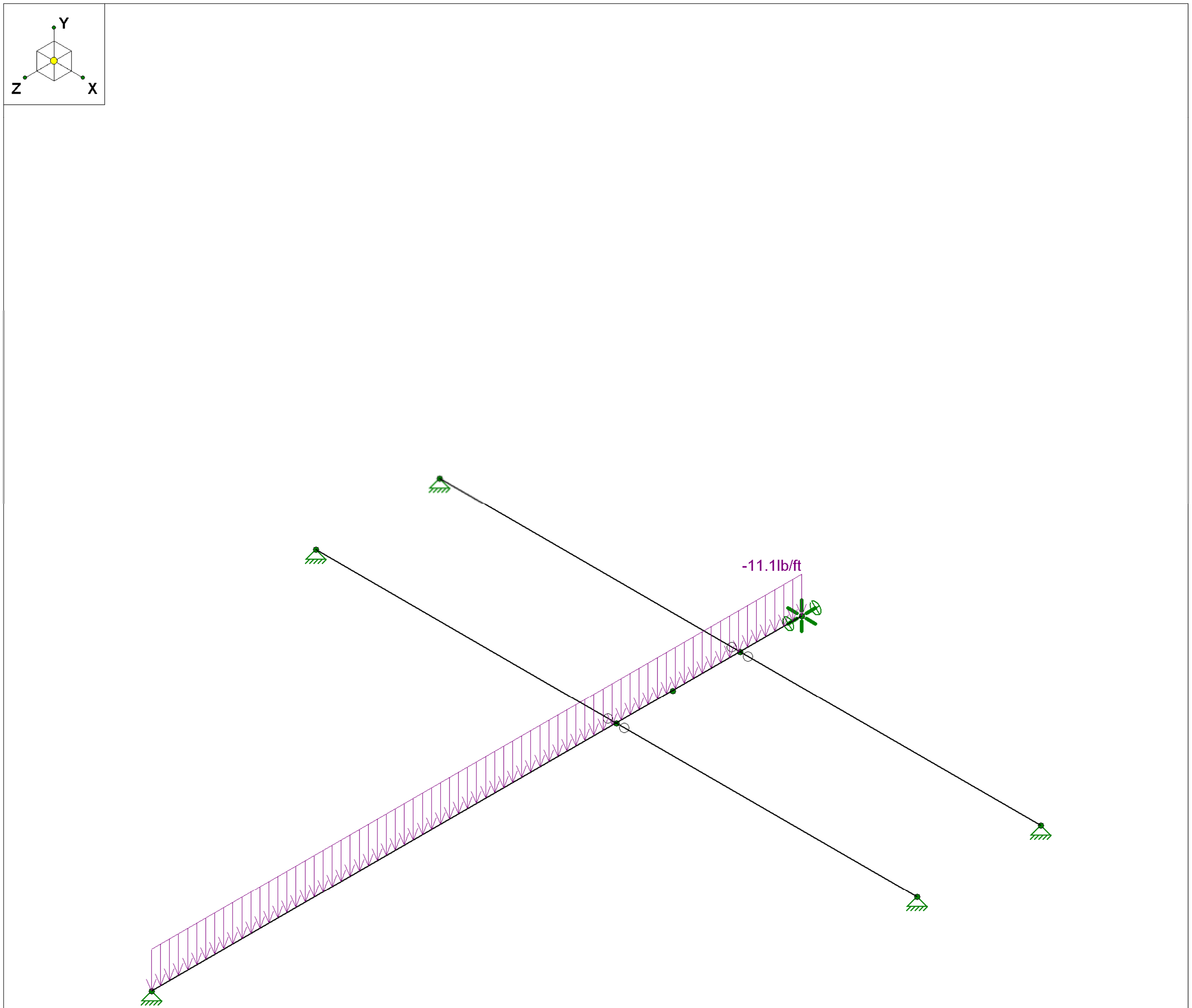
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 6
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:				
	- **Existing Load on Roof Floor Slab**			
	Concrete Beam Self Weight, DL =	=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft	=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft	=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft	=	213.6	plf
	Snow Load, SLN = 28.3psf x 9.71ft	=	274.8	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft	=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft	=	11.1	plf

Loads: BLC 4, Snow (Pf + Drift)
Envelope Only Solution

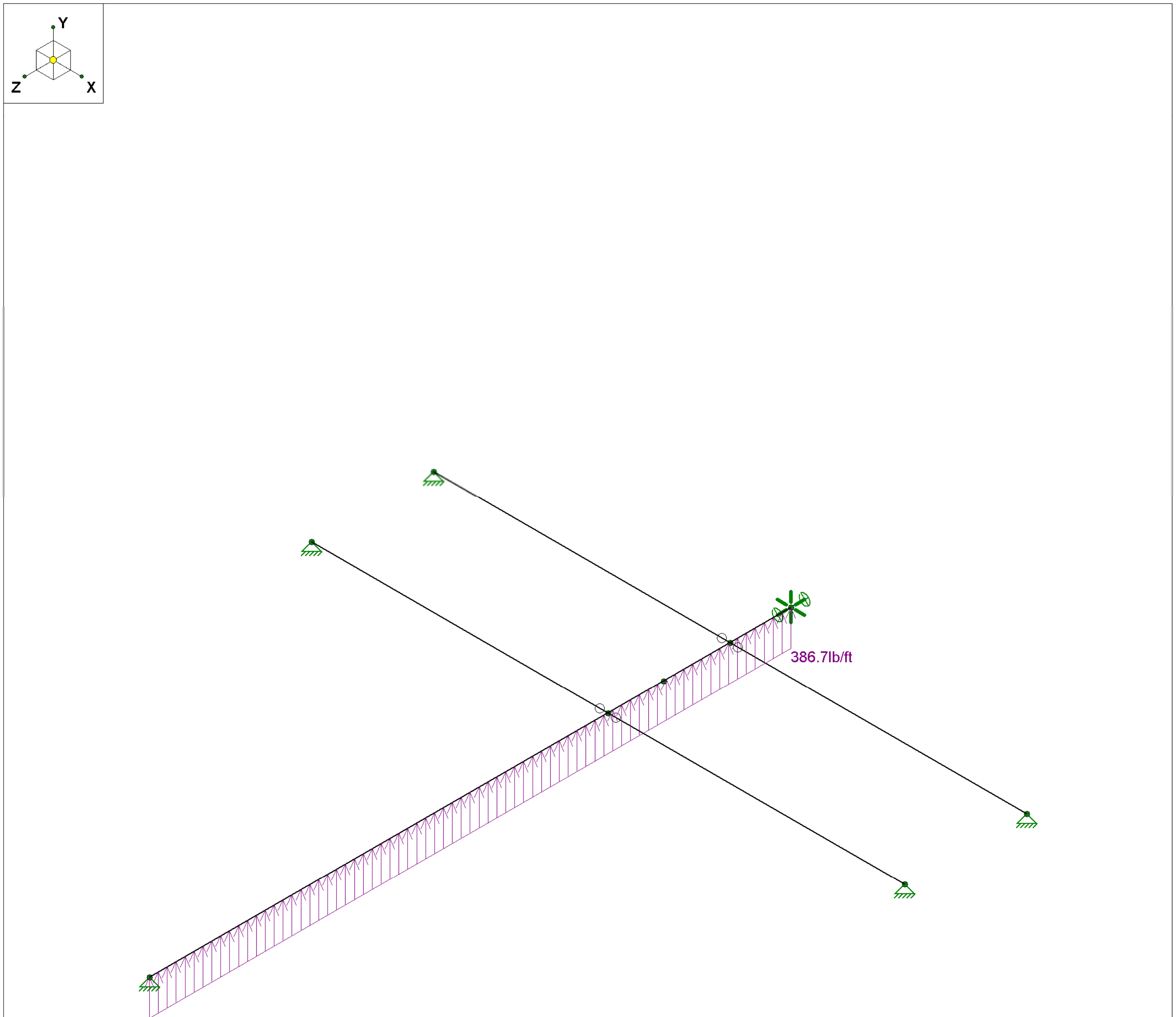
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 7
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:					
	- **Existing Load on Roof Floor Slab**				
	Concrete Beam Self Weight, DL =		=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft		=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft		=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft		=	213.6	plf
	Snow Load, SLN = 28.3psf x 9.71ft		=	274.8	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft		=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft		=	11.1	plf

Loads: BLC 5, Wind Roof Pressure (Positive)
Envelope Only Solution

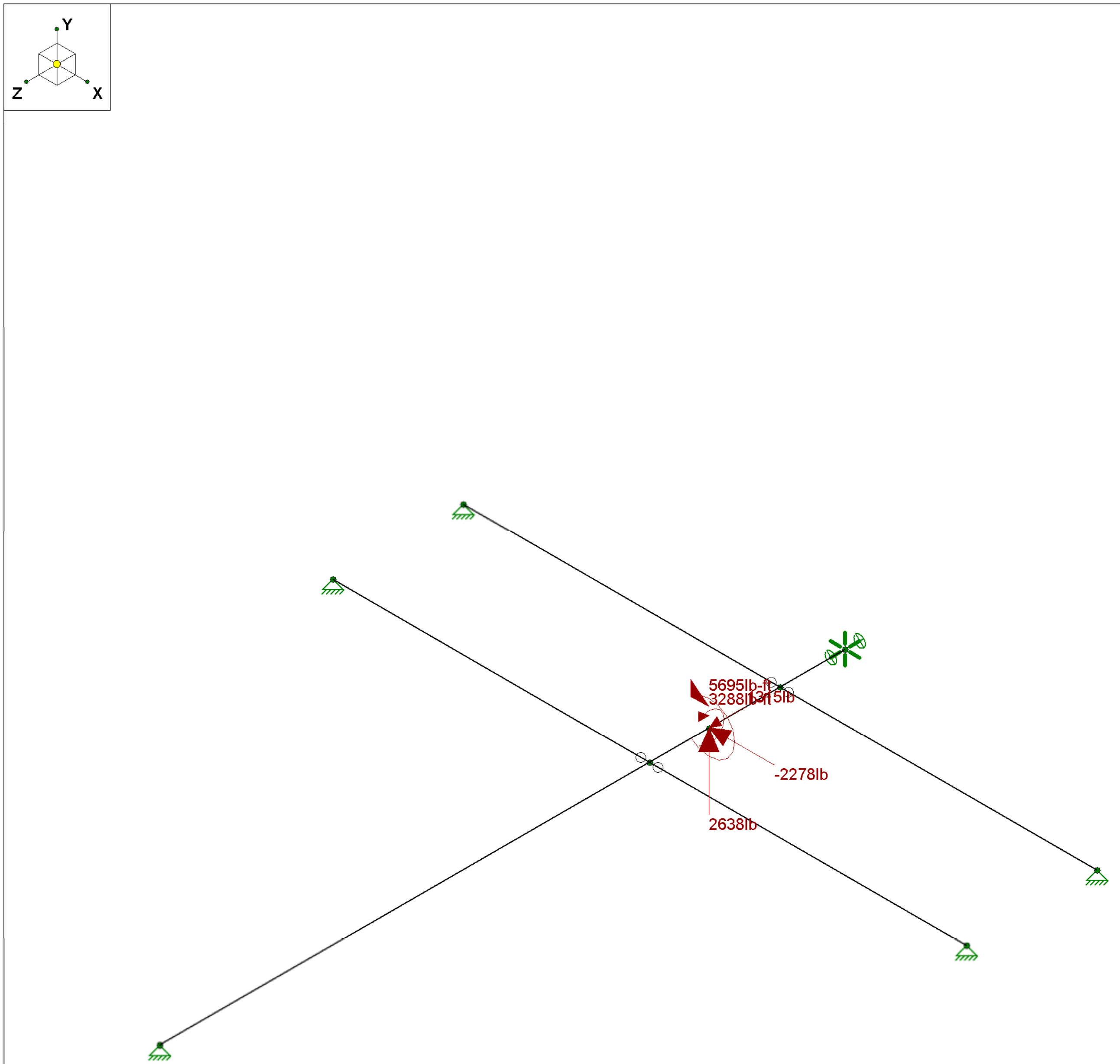
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 8
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Load Apply For RISA 3D:					
	- **Existing Load on Roof Floor Slab**				
	Concrete Beam Self Weight, DL =		=	141.2	plf
	Dead Load from Roof Floor Slab, DL = 50psf x 9.71ft		=	485.5	plf
	Roof Live Load, Lr = 20psf x 9.71ft		=	194.2	plf
	Snow Load, SL = 22psf x 9.71ft		=	213.6	plf
	Snow Load, SLN = 28.3psf x 9.71ft		=	274.8	plf
	Wind Uplift Load, WL-Y = -39.82psf x 9.71ft		=	-386.7	plf
	Wind Down Load, WL+Y = 1.14psf x 9.71ft		=	11.1	plf

Loads: BLC 6, Wind Roof Pressure (Negative)
Envelope Only Solution

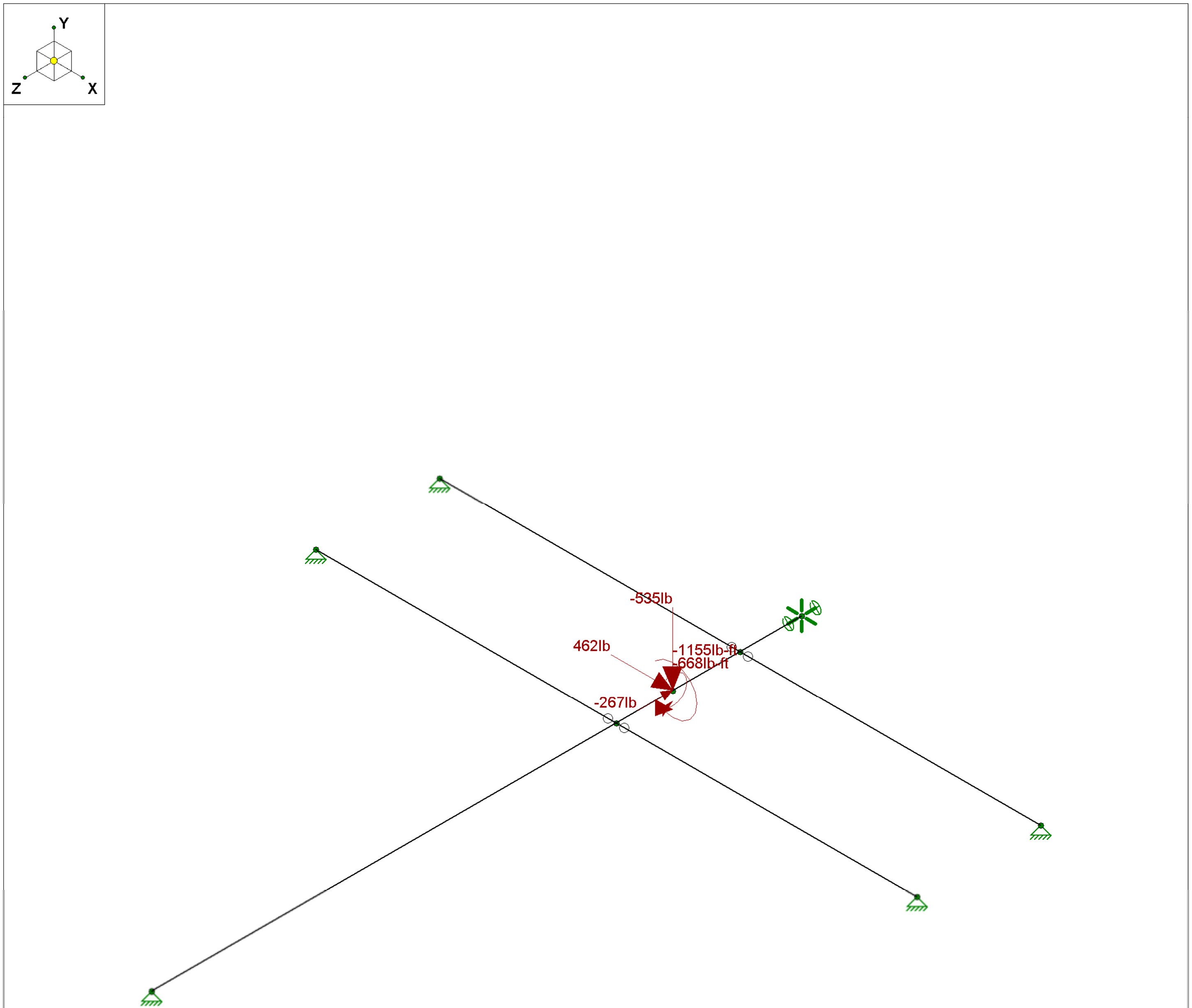
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 9
T. Eakkalak		July 23, 2020 at 1:35 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Dead Load of Guy only						
	Tension in Guy, T		=	3725	lbs.
	Horizontal Load, Z (along beam)	= 3725lbs. x cos45.08 x cos60	=	1,315	lbs.
	Tension Load, Y	= 3725lbs. x sin45.08	=	2638	lbs.
	Horizontal Load, X	= 3725lbs. x cos45.08 x sin60	=	2,278	lbs.
	Moment from Horizontal Z, Mx	= 1,315lbs. x 2.5ft	=	3288	lbs. - ft
	Moment from Horizontal X, Mz	= 2,278lbs. x 2.5ft	=	5695	lbs. - ft

Loads: BLC 9, Guy Self Weight
Envelope Only Solution

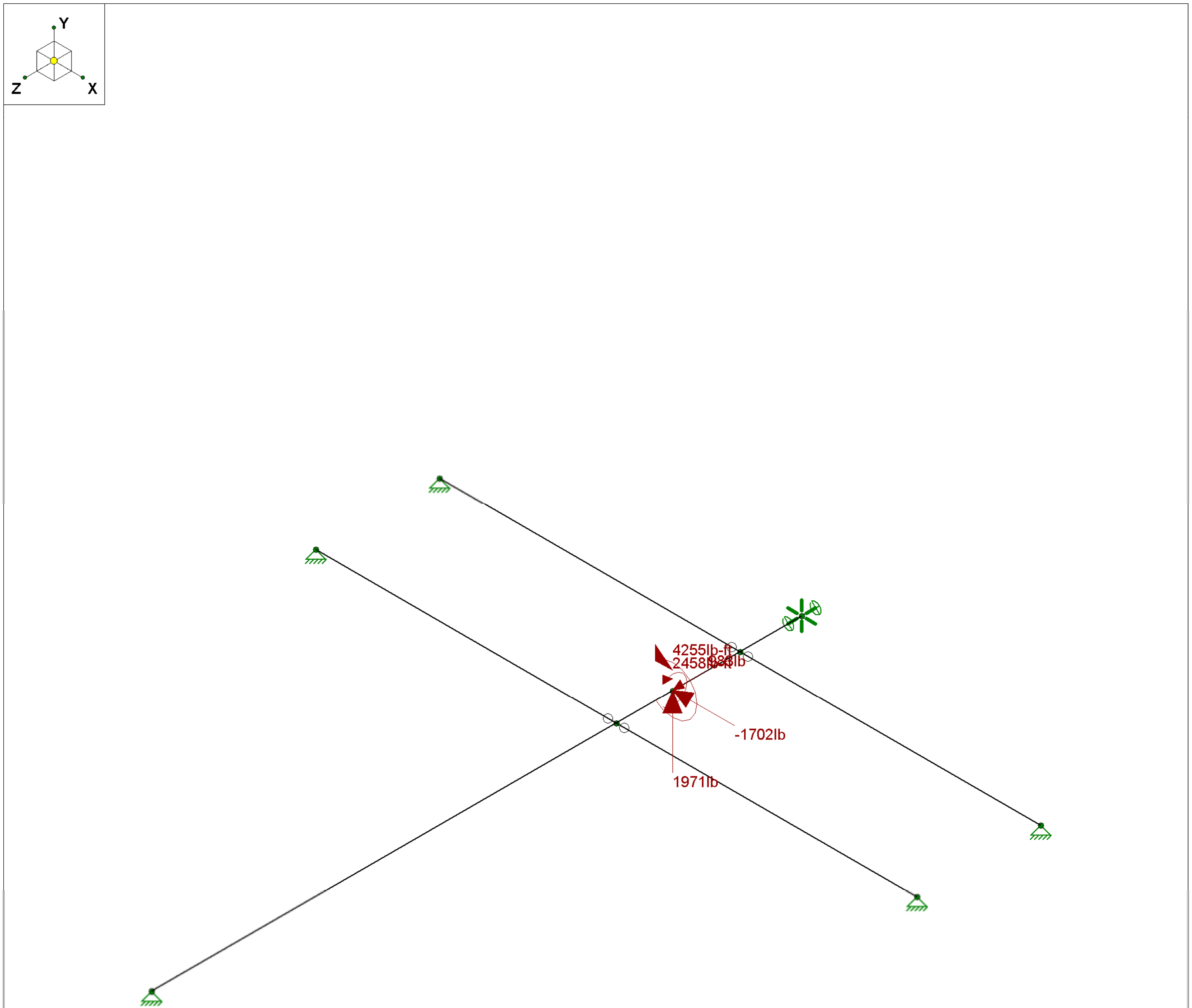
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 10
T. Eakkalak		July 23, 2020 at 1:36 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Wind Load 240 Deg (+X)						
	Compression Guy, T		=	-756	lbs.	
	Horizontal Load, Z (along beam)	= -756lbs.x cos45.08 x cos60	=	-267	lbs.	
	Compression Load, Y	= -756lbs.x sin45.08	=	-535	lbs.	
	Horizontal Load, X	= -756lbs.x cos45.08 x sin60	=	-462	lbs.	
	Moment from Horizontal Z, Mx	= -267lbs. x 2.5ft	=	-668	lbs. - ft	
	Moment from Horizontal X, Mz	= -462lbs. x 2.5ft	=	-1155	lbs. - ft	

Loads: BLC 10, Wind Load (240 Deg.) +X
Envelope Only Solution

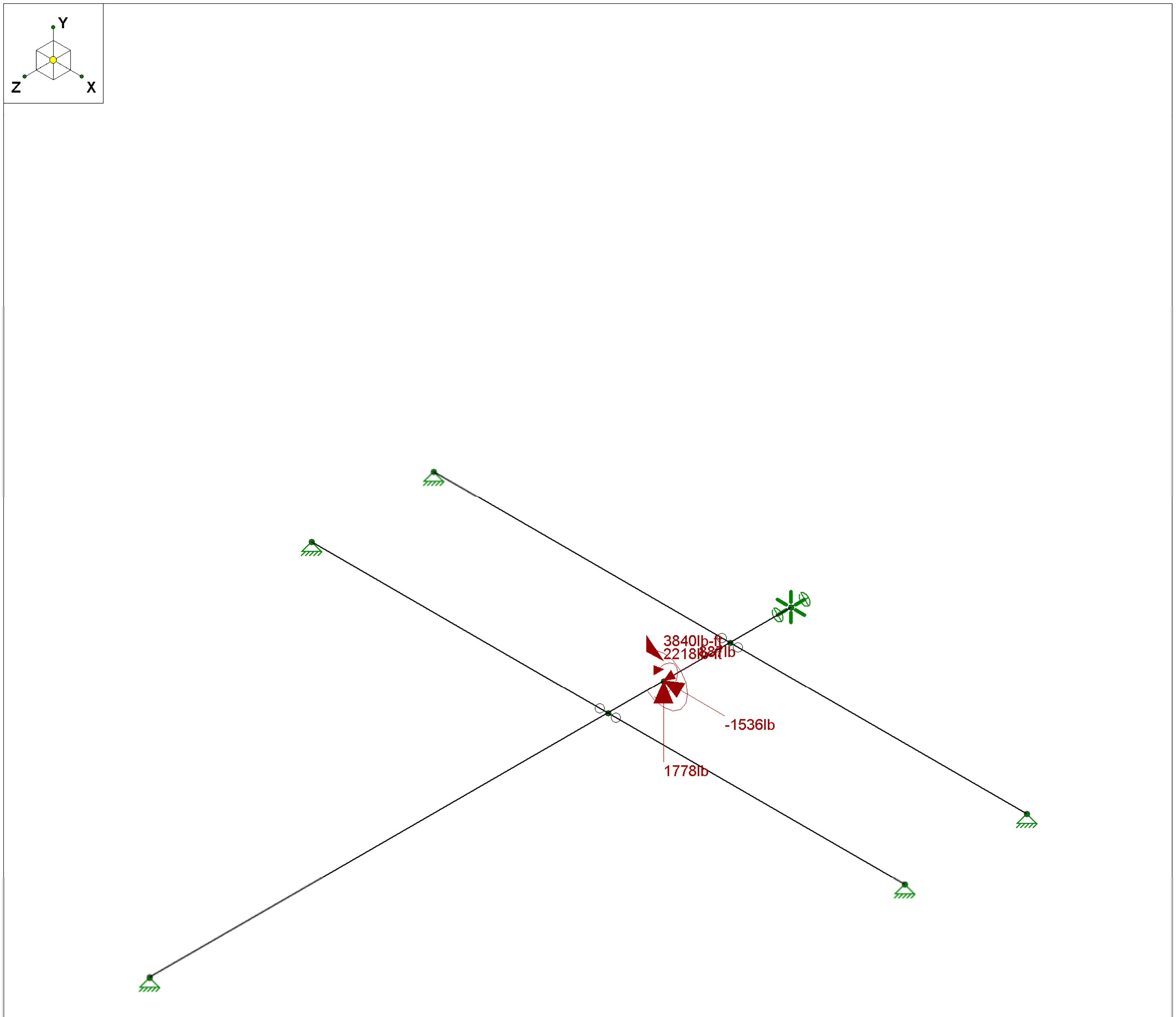
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 11
T. Eakkalak		July 23, 2020 at 1:36 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Wind Load 60 Deg (-X)					
Tension in Guy, T			=	2783	lbs.
Horizontal Load, Z (along beam)	= 2783lbs.x cos45.08 x cos60		=	983	lbs.
Tension Load, Y	= 2783lbs.x sin45.08		=	1971	lbs.
Horizontal Load, X	= 2783lbs.x cos45.08 x sin60		=	1,702	lbs.
Moment from Horizontal Z, Mx	= 983lbs. x 2.5ft		=	2458	lbs. - ft
Moment from Horizontal X, Mz	= 1,702lbs. x 2.5ft		=	4255	lbs. - ft

Loads: BLC 11, Wind Load (60 Deg.) -X
Envelope Only Solution

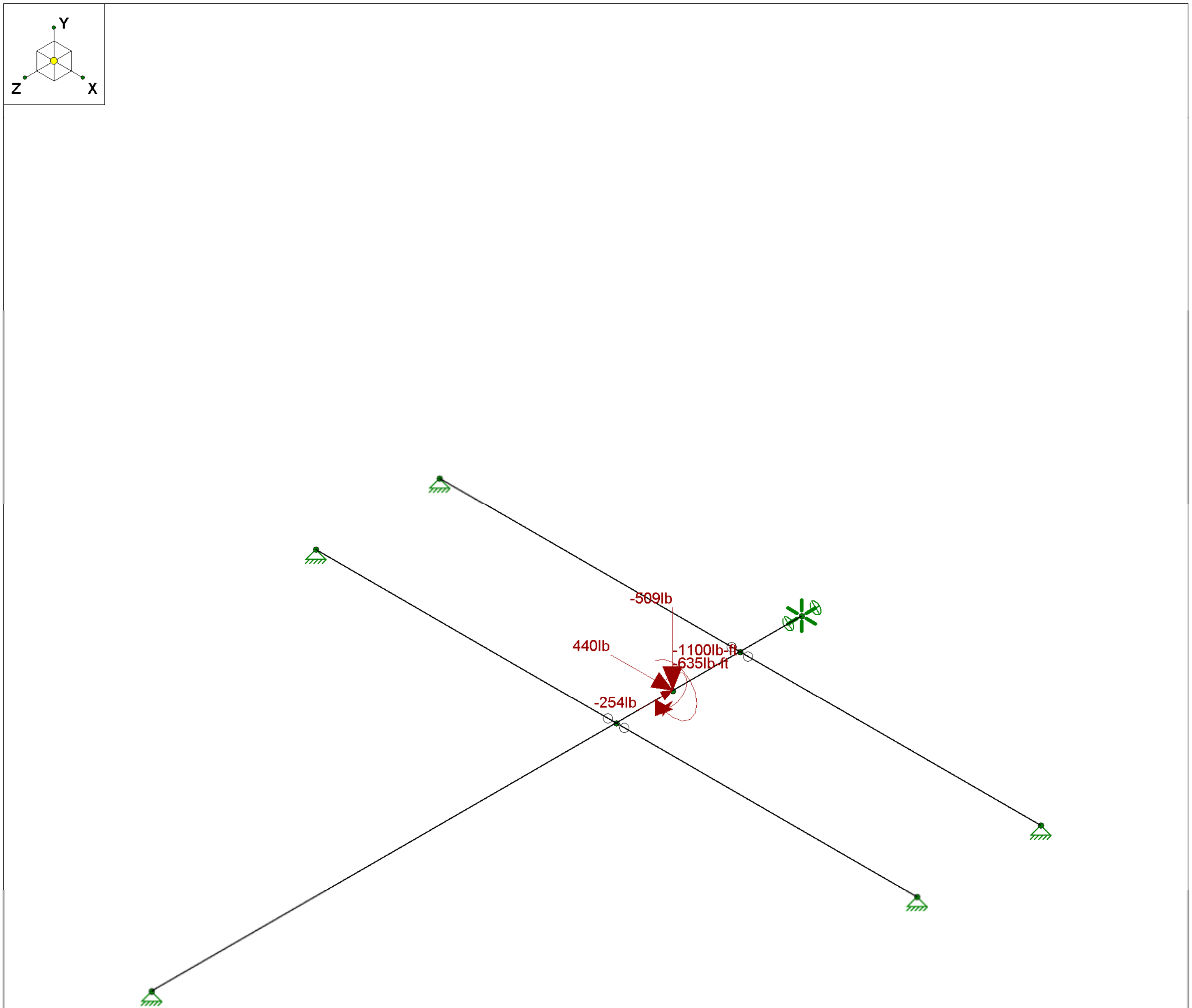
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 12
T. Eakkalak		July 23, 2020 at 1:36 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice DL + Temp					
Tension in Guy, T			=	2511	lbs.
Horizontal Load, Z (along beam)	= 2511lbs.x cos45.08 x cos60		=	887	lbs.
Tension Load, Y	= 2511lbs.x sin45.08		=	1778	lbs.
Horizontal Load, X	= 2511lbs.x cos45.08 x sin60		=	1,536	lbs.
Moment from Horizontal Z, Mx	= 887lbs. x 2.5ft		=	2218	lbs. - ft
Moment from Horizontal X, Mz	= 1,536lbs. x 2.5ft		=	3840	lbs. - ft

Loads: BLC 12, Ice Dead Load
Envelope Only Solution

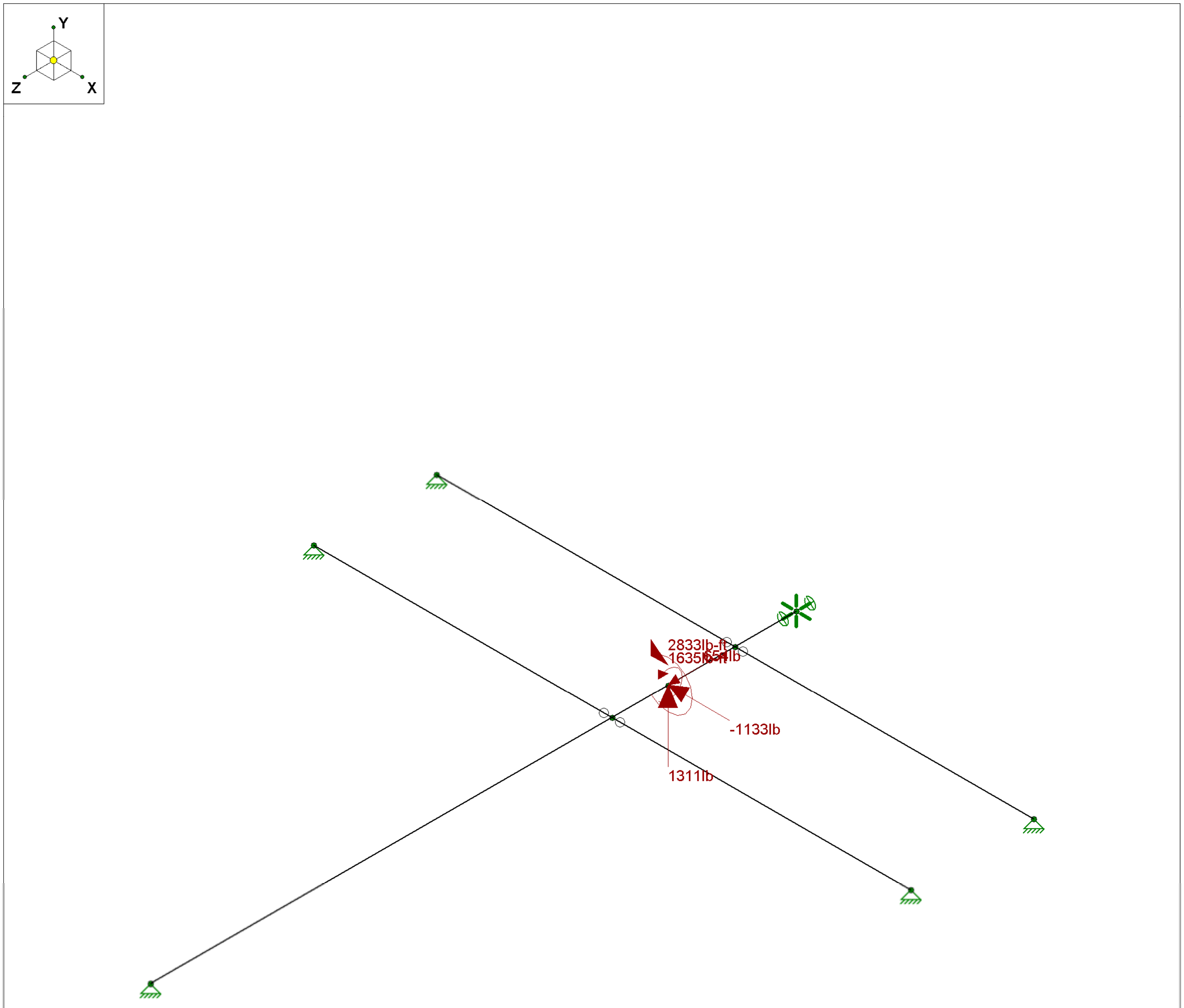
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 13
T. Eakkalak		July 23, 2020 at 1:36 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Ice Wind Load 240 Deg (+X)					
Compression Guy, T		=	-719	lbs.
Horizontal Load, Z (along beam)	= -719lbs.x cos45.08 x cos60	=	-254	lbs.
Compression Load, Y	= -719lbs.x sin45.08	=	-509	lbs.
Horizontal Load, X	= -719lbs.x cos45.08 x sin60	=	-440	lbs.
Moment from Horizontal Z, Mx	= -254lbs. x 2.5ft	=	-635	lbs. - ft
Moment from Horizontal X, Mz	= -440lbs. x 2.5ft	=	-1100	lbs. - ft

Loads: BLC 13, Ice Wind Load (240 Deg.) +X
Envelope Only Solution

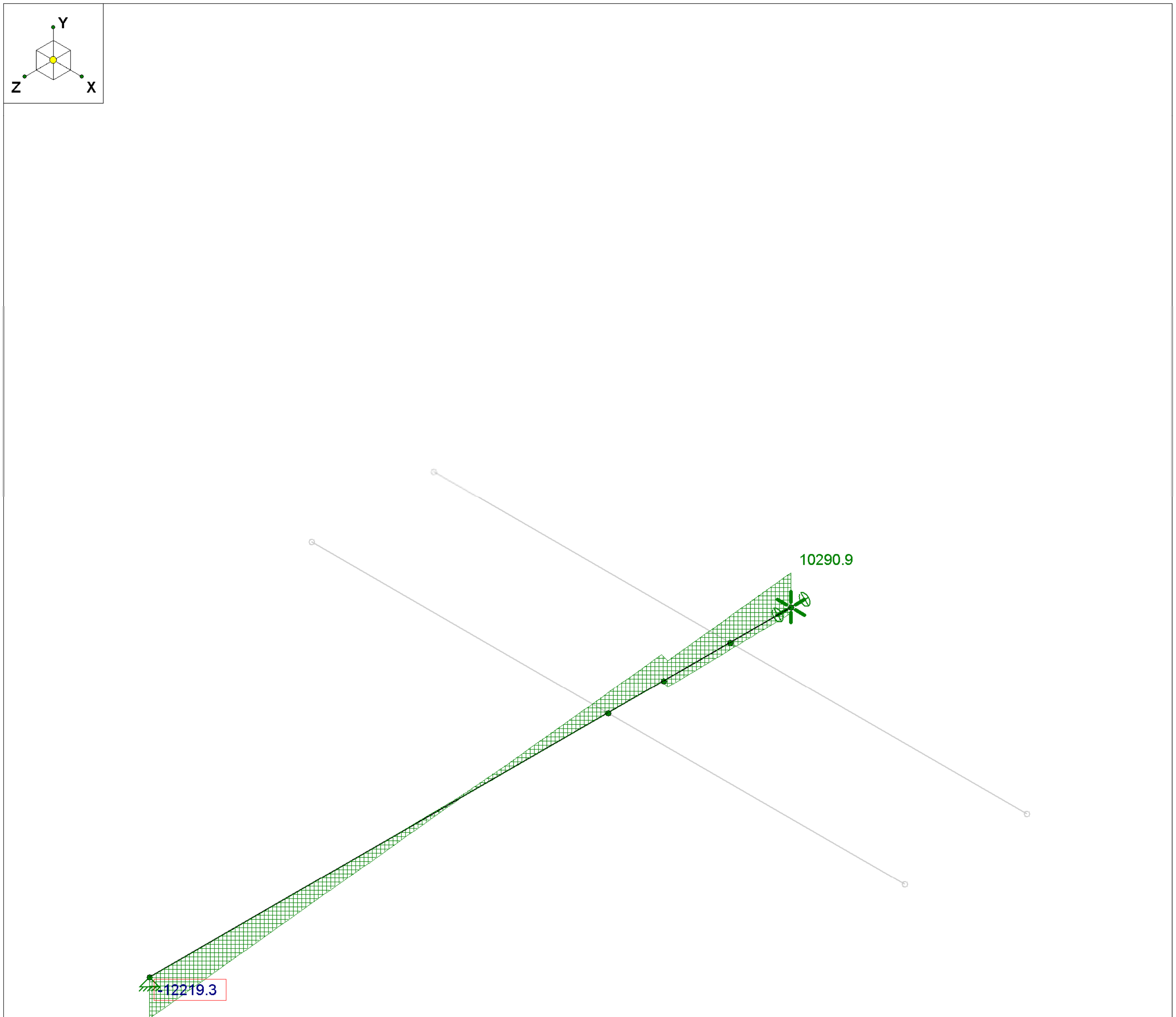
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 14
T. Eakkalak		July 23, 2020 at 1:36 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

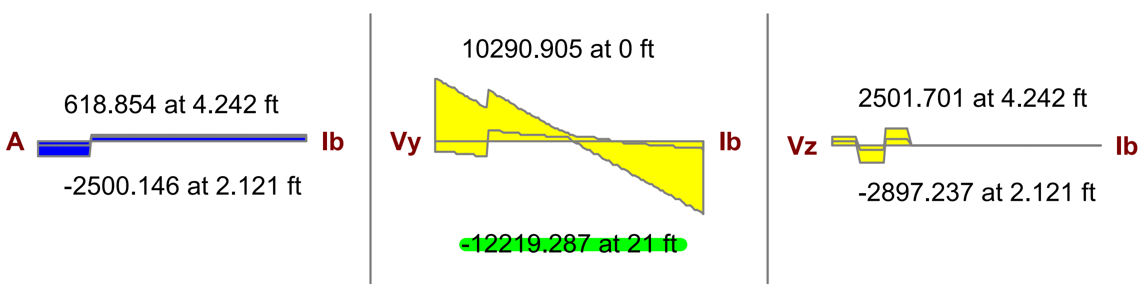


Ice Wind Load 60 Deg (-X)					
	Tension in Guy, T		=	1852	lbs.
	Horizontal Load, Z (along beam)	= 1852lbs.x cos45.08 x cos60	=	654	lbs.
	Tension Load, Y	= 1852lbs.x sin45.08	=	1311	lbs.
	Horizontal Load, X	= 1852lbs.x cos45.08 x sin60	=	1,133	lbs.
	Moment from Horizontal Z, Mx	= 654lbs. x 2.5ft	=	1635	lbs. - ft
	Moment from Horizontal X, Mz	= 1,133lbs. x 2.5ft	=	2833	lbs. - ft

Loads: BLC 14, Ice Wind Load (60 Deg.) -X
Envelope Only Solution

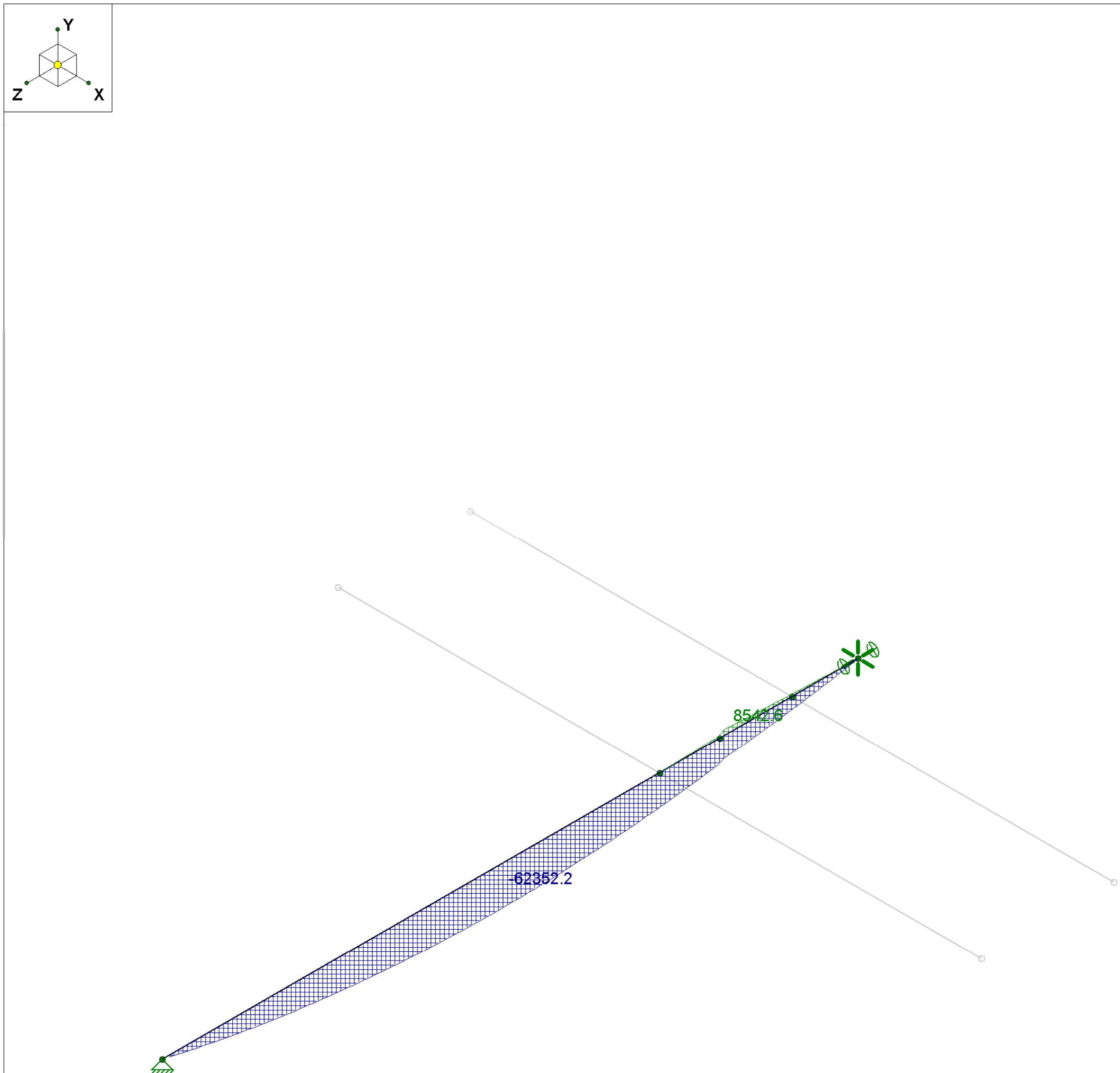
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 15
T. Eakkalak		July 23, 2020 at 1:36 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

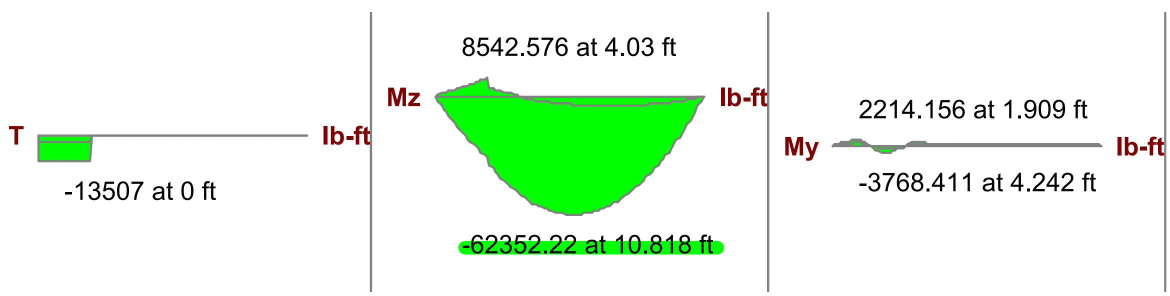




Envelope Only Solution
Member y Shear Forces (lb) (Enveloped)

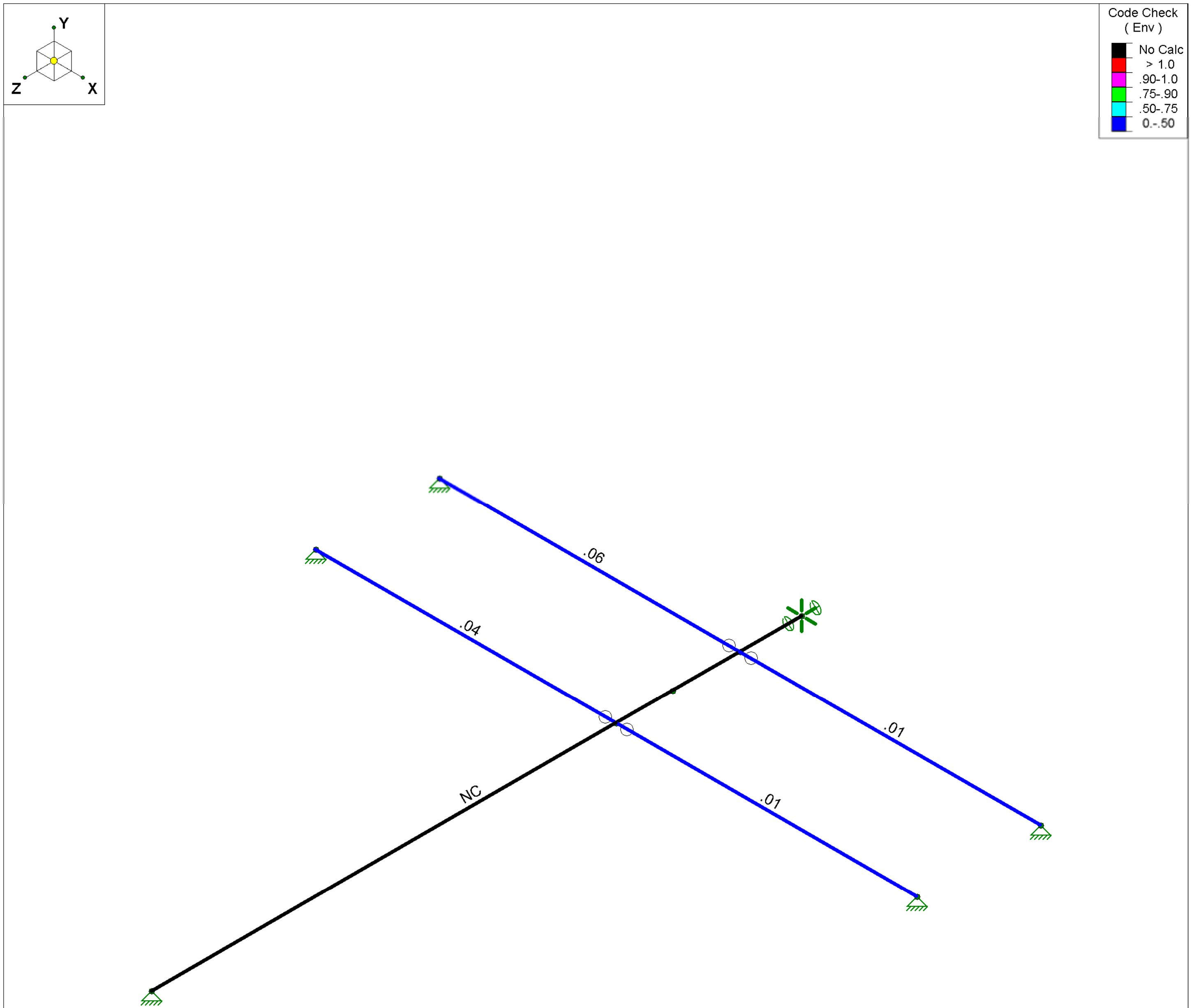
Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 16
T. Eakkalak		July 23, 2020 at 1:36 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...





Envelope Only Solution
Member z Bending Moments (lb-ft) (Enveloped)

Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 17
T. Eakkalak		July 23, 2020 at 1:37 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Black & Veatch Corp.	HartfordAWC-Existing Roof Beam W12x22 (Anchor C)	SK - 18
T. Eakkalak		July 23, 2020 at 1:37 PM
403093.2000.2200		HartfordAWC - Existing Roof Beam ...

(Global) Model Settings

Display Sections for Member Calcs	12
Max Internal Sections for Member Calcs	100
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building
Stainless Steel Code	None

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	None
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A992 Gr. 50	29000	11154	.3	.65	.49	50	1.5	65	1.2

General Material Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]
1	RIGID	29000	11154	.3	.65	0

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Strut Beam	W10X12	Beam	Wide Flange	A992 Gr. 50	Typical	3.54	2.18	53.8	.055

General Section Sets

	Label	Shape	Type	Material	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	RIGID		None	RIGID	6.48	4.66	156	.293

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	N1	20.705	0	21	0	
2	N2	20.705	0	0	0	
3	N3	20.705	0	4.1667	0	
4	N4	20.705	0	2	0	
5	N5	20.705	0	6	0	
6	N6	30.413	0	2	0	
7	N7	30.413	0	6	0	
8	N8	10.997	0	2	0	
9	N9	10.997	0	6	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N1	Reaction	Reaction	Reaction			
2	N2	Reaction	Reaction	Reaction			Reaction
3	N4						
4	N5						
5	N6	Reaction	Reaction	Reaction			
6	N7	Reaction	Reaction	Reaction			
7	N8	Reaction	Reaction	Reaction			
8	N9	Reaction	Reaction	Reaction			

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design Rul...
1	M1	N2	N1			RIGID	None	None	RIGID	Default
2	M2	N7	N5			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical
3	M3	N5	N9			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical
4	M4	N6	N4			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical
5	M5	N4	N8			Strut Beam	Beam	Wide Flange	A992 Gr. ...	Typical

Member Advanced Data

	Label	I Release	J Release	I Offset[in]	J Offset[in]	T/C Only	Physical	Defl Rat...	Analysis ...	Inactive	Seismic...
1	M1						Yes	** NA **			None
2	M2		BenPIN				Yes	Default			None
3	M3	BenPIN					Yes	Default			None
4	M4		BenPIN				Yes	Default			None
5	M5	BenPIN					Yes	Default			None

Hot Rolled Steel Design Parameters

	Label	Shape	Length[ft]	Lbyy[ft]	Lbzz[ft]	Lcomp to...	Lcomp b...	L-torque[ft]	Kyy	Kzz	Cb	Function
1	M2	Strut Beam	9.708									Lateral
2	M3	Strut Beam	9.708									Lateral
3	M4	Strut Beam	9.708									Lateral
4	M5	Strut Beam	9.708									Lateral

Joint Loads and Enforced Displacements (BLC 9 : Guy Self Weight)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	1315
2	N3	L	Mx	3288
3	N3	L	Y	2638
4	N3	L	X	-2278
5	N3	L	Mz	5695

Joint Loads and Enforced Displacements (BLC 10 : Wind Load (240 Deg.) +X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	-267
2	N3	L	Mx	-668
3	N3	L	Y	-535
4	N3	L	X	462
5	N3	L	Mz	-1155

Joint Loads and Enforced Displacements (BLC 11 : Wind Load (60 Deg.) -X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	983
2	N3	L	Mx	2458
3	N3	L	Y	1971
4	N3	L	X	-1702
5	N3	L	Mz	4255

Joint Loads and Enforced Displacements (BLC 12 : Ice Dead Load)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	887
2	N3	L	Mx	2218
3	N3	L	Y	1778
4	N3	L	X	-1536
5	N3	L	Mz	3840

Joint Loads and Enforced Displacements (BLC 13 : Ice Wind Load (240 Deg.) +X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	-254
2	N3	L	Mx	-635
3	N3	L	Y	-509
4	N3	L	X	440
5	N3	L	Mz	-1100

Joint Loads and Enforced Displacements (BLC 14 : Ice Wind Load (60 Deg.) -X)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^...
1	N3	L	Z	654
2	N3	L	Mx	1635
3	N3	L	Y	1311
4	N3	L	X	-1133
5	N3	L	Mz	2833

Member Distributed Loads (BLC 1 : Beam and Roof)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-141.2	-141.2	0	0
2	M1	Y	-485.5	-485.5	0	0
3	M2	Y	-12	-12	0	0
4	M3	Y	-12	-12	0	0
5	M4	Y	-12	-12	0	0
6	M5	Y	-12	-12	0	0

Member Distributed Loads (BLC 2 : Roof Live Load)

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-194.2	-194.2	0	0

Member Distributed Loads (BLC 3 : Snow (Pm))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-213.6	-213.6	0	0

Member Distributed Loads (BLC 4 : Snow (Pf + Drift))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-274.8	-274.8	0	0

Member Distributed Loads (BLC 5 : Wind Roof Pressure (Positive))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-11.1	-11.1	0	0

Member Distributed Loads (BLC 6 : Wind Roof Pressure (Negative))

	Member Label	Direction	Start Magnitude[lb/ft,...	End Magnitude[lb/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	386.7	386.7	0	0

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu...	Area(M...	Surface...
1	Beam and Roof	DL						6		
2	Roof Live Load	RLL						1		
3	Snow (Pm)	SL						1		
4	Snow (Pf + Drift)	SLN						1		
5	Wind Roof Pressure (Positive)	WL+Y						1		
6	Wind Roof Pressure (Negative)	WL-Y						1		
8	Tower Dead	DL								
9	Guy Self Weight	DL				5				
10	Wind Load (240 Deg.) +X	WL+X				5				
11	Wind Load (60 Deg.) -X	WL-X				5				

Basic Load Cases (Continued)

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribu...	Area(M...	Surface...
12	Ice Dead Load	NL				5				
13	Ice Wind Load (240 Deg.) +X	WLX+R				5				
14	Ice Wind Load (60 Deg.) -X	WLX-R				5				

Load Combinations

	Description	Solve	PD...	S...	BLC	Fact...	BLC	Fa...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fa...	B...	F...	...	F...	...	F...	...	F...
1	1.4DL	Yes	Y		DL	1.4																		
2	1.2DL + 0.5RLL	Yes	Y		DL	1.2	RLL	.5																
3	1.2DL + 0.5SL	Yes	Y		DL	1.2	SL	.5																
4	1.2DL + 0.5SLN	Yes	Y		DL	1.2	SLN	.5																
5	1.2DL + 0.2IDL + 0.5SL	Yes	Y		DL	1.2	NL	.2	SL	.5														
6	1.2DL + 0.2IDL + 0.5SLN	Yes	Y		DL	1.2	NL	.2	SLN	.5														
7	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL...	.5	WL...	.5												
8	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL-X	.5	WL...	.5												
9	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL...	.5	WL-Y	.5												
10	1.2DL + 1.6RLL + 0.5WL	Yes	Y		DL	1.2	RLL	1.6	WL-X	.5	WL-Y	.5												
11	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL...	.5	WL...	.5												
12	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL-X	.5	WL...	.5												
13	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL...	.5	WL-Y	.5												
14	1.2DL + 1.6SL + 0.5WL	Yes	Y		DL	1.2	SL	1.6	WL-X	.5	WL-Y	.5												
15	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL...	.5	WL...	.5												
16	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL-X	.5	WL...	.5												
17	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL...	.5	WL-Y	.5												
18	1.2DL + 1.6SLN + 0.5WL	Yes	Y		DL	1.2	SLN	1.6	WL-X	.5	WL-Y	.5												
19	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL...	1	RLL	.5												
20	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL...	1	RLL	.5												
21	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	RLL	.5												
22	1.2DL + 1.0WL + 0.5RLL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	RLL	.5												
23	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL...	1	SL	.5												
24	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL...	1	SL	.5												
25	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SL	.5												
26	1.2DL + 1.0WL + 0.5SL	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SL	.5												
27	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL...	1	SLN	.5												
28	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL...	1	SLN	.5												
29	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SLN	.5												
30	1.2DL + 1.0WL + 0.5SLN	Yes	Y		DL	1.2	WL...	1	WL-Y	1	SLN	.5												
31	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SL	.5												
32	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SL	.5												
33	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SLN	.5												
34	1.2DL + 1.0IDL + 1.0IWL ...	Yes	Y		DL	1.2	NL	1	WL...	1	SLN	.5												
35	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL...	1														
36	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL...	1														
37	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL-Y	1														
38	0.9DL + 1.0WL	Yes	Y		DL	.9	WL...	1	WL-Y	1														
39	0.9DL + 1.0IDL + 1.0IWL	Yes	Y		DL	.9	NL	1	WL...	1														
40	0.9DL + 1.0IDL + 1.0IWL	Yes	Y		DL	.9	NL	1	WL...	1														

Envelope Joint Reactions

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N1	max	-12.324	37	12217.941	15	-181.847	37	0	40	0	40	0	40
2		min	-41.907	32	1297.675	38	-618.854	32	0	1	0	1	0	1
3	N2	max	-341.095	37	10306.219	15	-734.653	37	0	40	0	40	-3970.5	37
4		min	-1159.496	32	-1709.252	38	-2500.146	32	0	1	0	1	-13507	32
5	N6	max	2030.976	34	83.751	1	0	37	0	40	0	40	0	40
6		min	596.83	35	52.414	38	-.006	32	0	1	0	1	0	1
7	N7	max	1271.026	34	85.279	1	0	37	0	40	0	40	0	40
8		min	373.979	35	52.561	38	-.006	32	0	1	0	1	0	1
9	N8	max	2030.976	34	79.344	1	.006	34	0	40	0	40	0	40

Envelope Joint Reactions (Continued)

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
10		min	596.83	35	50.93	40	0	35	0	1	0	1	0	1
11	N9	max	1271.026	34	77.815	1	.006	34	0	40	0	40	0	40
12		min	373.979	35	49.723	40	0	35	0	1	0	1	0	1
13	Totals:	max	5402.6	34	22803.751	15	-916.5	37						
14		min	1588.2	35	-201.884	38	-3119	32						

Envelope Maximum Member Section Forces

	Mem...		Axial[lb]	Loc...	LC	y Shear[lb]	Lo...	LC	z Shear[lb]	Lo...	LC	Torque[l...	Lo...	LC	y-y Mome...	Lo...	LC	z-z Mome...	Lo...	LC
1	M1	max	618.854	4.2...	34	10290.905	0	15	2501.701	4....	34	0	4....	40	2214.156	1....	34	8542.576	4....	38
2		min	-2500.146	0	32	-12219.287	21	15	-2897.237	2....	32	-13507	0	32	-3768.411	4....	32	-62352.22	10...	15
3	M2	max	-373.979	0	37	81.547	0	1	0	0	40	0	0	40	0	0	40	0	0	40
4		min	-1271.026	0	32	-81.547	9....	1	0	0	1	0	0	1	0	0	1	-197.895	4....	1
5	M3	max	1271.026	0	34	81.547	0	1	0	0	40	0	0	40	0	0	40	0	0	40
6		min	373.979	0	35	-81.547	9....	1	0	0	1	0	0	1	0	0	1	-197.895	4....	1
7	M4	max	-596.83	0	37	81.547	0	1	0	0	40	0	0	40	0	0	40	0	0	40
8		min	-2030.976	0	32	-81.547	9....	1	0	0	1	0	0	1	0	0	1	-197.895	4....	1
9	M5	max	2030.976	0	34	81.547	0	1	0	0	40	0	0	40	0	0	40	0	0	40
10		min	596.83	0	35	-81.547	9....	1	0	0	1	0	0	1	0	0	1	-197.895	4....	1

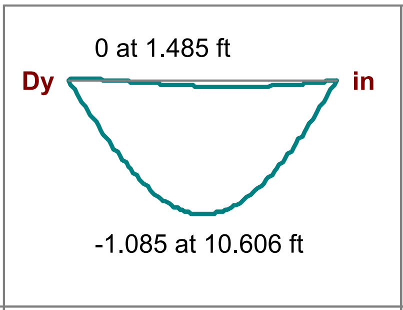
Envelope AISC 14th(360-10): LRFD Steel Code Checks

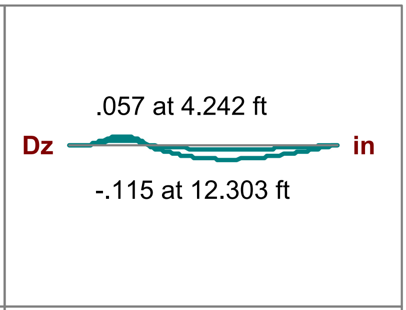
	Member	Shape	Code C...	Loc[ft]	LC	Shear C...	Loc[ft]	Dir	LC	phi*Pnc...	phi*Pnt [...	phi*Mn y-...	phi*Mn z...	Cb	Eqn
1	M2	W10X12	.011	4.805	34	.001	9.708	y	1	36288....	159300	6457.579	23783.085	1.14	H1-1b
2	M3	W10X12	.035	0	34	.001	9.708	y	1	36288....	159300	6457.579	23783.085	1.14	H1-1b*
3	M4	W10X12	.014	4.805	34	.001	9.708	y	1	36288....	159300	6457.579	23783.085	1.14	H1-1b
4	M5	W10X12	.056	0	34	.001	9.708	y	1	36288....	159300	6457.579	23783.085	1.14	H1-1b*

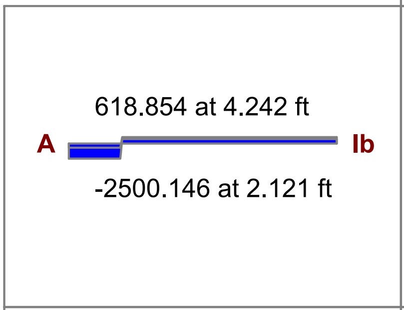
Member: ***M1***

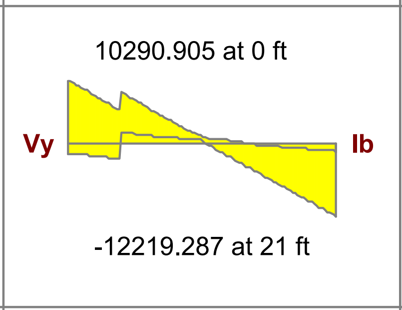
Shape:
Material: **RIGID**
Length: **21 ft**
I Joint: **N2**
J Joint: **N1**

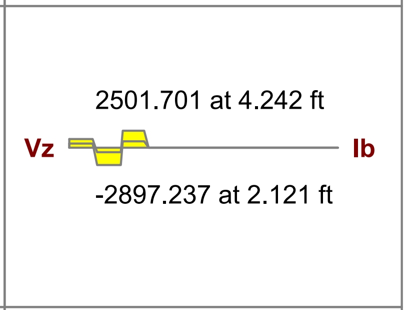
Code Check: **No Calc**
Report Based On 100 Sections

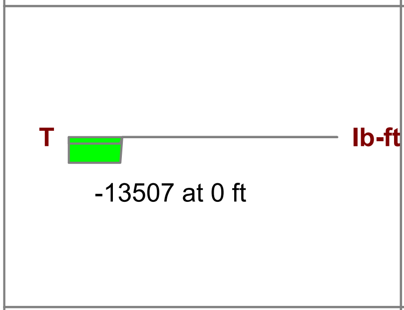


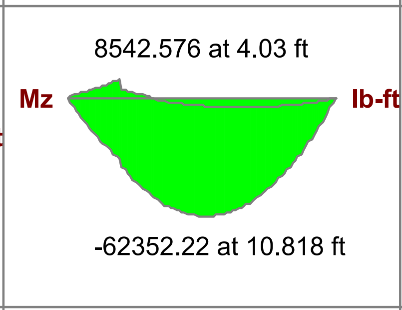


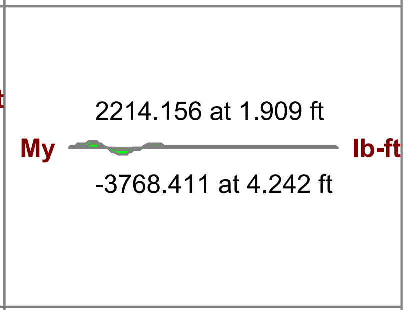


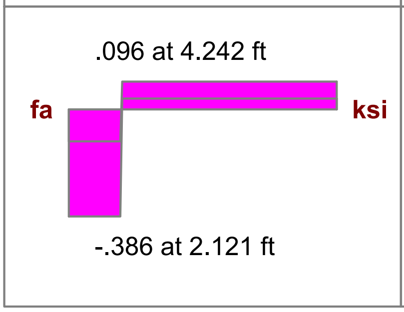


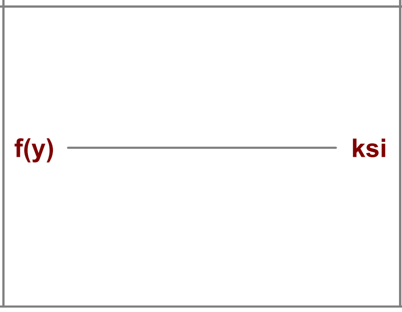


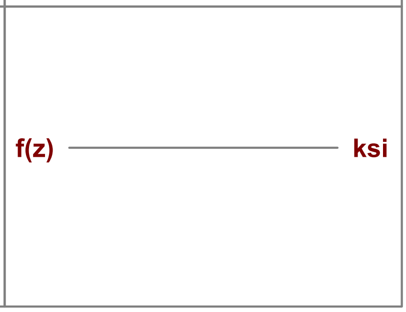






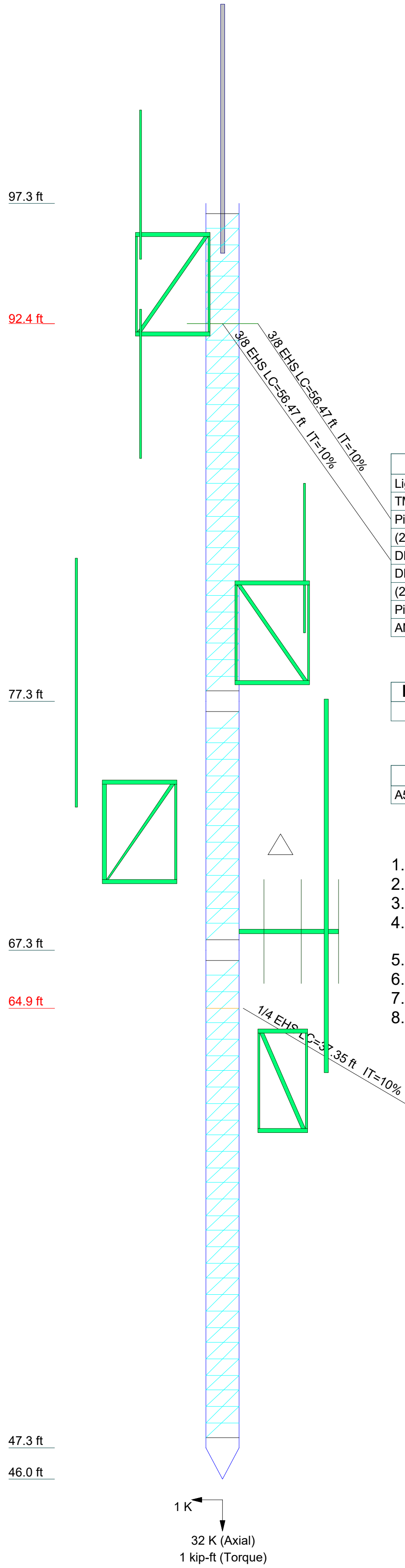


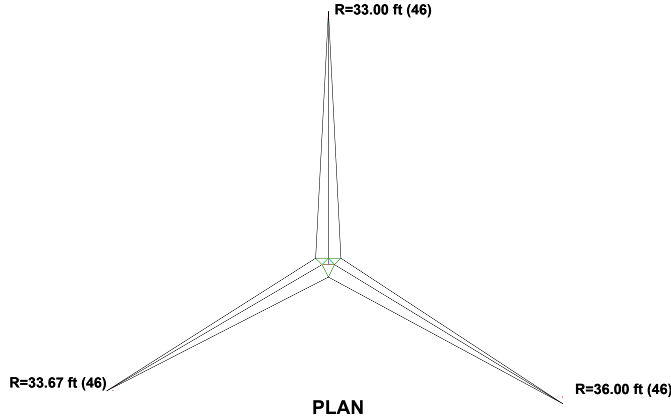




6. ATTACHMENTS

Section	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Bottom Girts	Horizontals	Top Guy Pull-Offs	Face Width (ft)	# Panels @ (ft)	Weight (K)
T1	SR 1 1/4	A572-50	SR 7/16	A572-50	SR 7/16	SR 7/16	SR 7/16	SR 7/16	1.39583	16 @ 1.28194	0.5
T2								N.A.		8 @ 1.31845	0.2
T3								4x3/8		16 @ 1.28194	0.4
T4	A		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		B	0.0
											1.1





PLAN

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lighting Rod 5/8" x 8'	97.25	Side Arm Mount [SO 308-1]	72
TMA	94	(2) 4' Horiz x L2x2x1/4	72
Pipe Mount [PM 601-1]	94	CO-41A	72
(2) 5' Hor x 3.5" Square Tube	94	2' Yagi	68
DB586-Y	94	DS2C03F36D-D	62
DB586-Y	94	4' Standoff	62
(2) 6' Hor L3.5x3.5x4	80	1'x2" Mount Pipe	61
Pipe Mount [PM 601-1]	80	3.5' Hor 2.5x2.5 Angle	61
ANT150F2	80	Samll Antenna	61

SYMBOL LIST

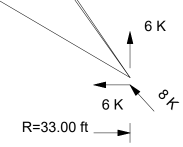
MARK	SIZE	MARK	SIZE
A	W6x9	B	1 @ 1.25

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi			

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 135 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 2.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Risk Category III.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 92.1%



ALL REACTIONS ARE FACTORED

BLACK & VEATCH Building a world of difference.
Black & Veatch Corp.
6800 W 115th St. Suite 2292
Overland Park, KS 66211
Phone: (913) 458-2522
FAX: (913) 458-8136

Job: ES-090 HartfordAWC		
Project: 405025		
Client: Eversource	Drawn by: zan92313	App'd:
Code: TIA-222-H	Date: 05/27/20	Scale: NTS
Path:		Dwg No. E-1

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
						2" Ice	1.06	0.81	0.04
1'x2" Mount Pipe	A	From Leg	1.50 0.00 0.50	0.00	61.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.15 0.22 0.30 0.50	0.15 0.22 0.30 0.50	0.00 0.01 0.01 0.02
*** ***Proposed*** DS2C03F36D-D	B	From Leg	4.00 0.00 7.80	0.00	62.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.58 7.47 9.38 13.25	5.58 7.47 9.38 13.25	0.07 0.11 0.16 0.30
4' Standoff	B	From Leg	2.00 0.00 0.00	0.00	62.00	No Ice 1/2" Ice 1" Ice 2" Ice	3.72 4.96 5.95 8.02	0.88 1.19 1.51 2.17	0.09 0.14 0.19 0.32

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.0 Wind 30 deg - No Ice+1.0 Guy
4	1.2 Dead+1.0 Wind 60 deg - No Ice+1.0 Guy
5	1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy
6	1.2 Dead+1.0 Wind 120 deg - No Ice+1.0 Guy
7	1.2 Dead+1.0 Wind 150 deg - No Ice+1.0 Guy
8	1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy
9	1.2 Dead+1.0 Wind 210 deg - No Ice+1.0 Guy
10	1.2 Dead+1.0 Wind 240 deg - No Ice+1.0 Guy
11	1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy
12	1.2 Dead+1.0 Wind 300 deg - No Ice+1.0 Guy
13	1.2 Dead+1.0 Wind 330 deg - No Ice+1.0 Guy
14	1.2 Dead+1.0 Ice+1.0 Temp+Guy
15	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy
16	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy
17	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy
18	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy
19	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy
20	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy
21	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy
22	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy
23	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy
24	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy
25	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy
26	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy
27	Dead+Wind 0 deg - Service+Guy
28	Dead+Wind 30 deg - Service+Guy
29	Dead+Wind 60 deg - Service+Guy
30	Dead+Wind 90 deg - Service+Guy
31	Dead+Wind 120 deg - Service+Guy
32	Dead+Wind 150 deg - Service+Guy
33	Dead+Wind 180 deg - Service+Guy
34	Dead+Wind 210 deg - Service+Guy
35	Dead+Wind 240 deg - Service+Guy
36	Dead+Wind 270 deg - Service+Guy
37	Dead+Wind 300 deg - Service+Guy
38	Dead+Wind 330 deg - Service+Guy

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Top Cable Norm	25	1.81		
			Top Cable Tan	25	0.00		
			Bot Cable Vert	25	-0.81		
			Bot Cable Norm	25	1.82		
			Bot Cable Tan	25	0.00		
		Guy C	Bottom Tension	17	2.12		
			Top Tension	17	2.27		
			Top Cable Vert	17	1.26		
			Top Cable Norm	17	1.89		
			Top Cable Tan	17	0.00		
			Bot Cable Vert	17	-0.93		
			Bot Cable Norm	17	1.90		
			Bot Cable Tan	17	0.00		
		Top Guy Pull-Off	Max Tension	15	1.21	0.00	0.00
			Max. Compression	8	-0.19	0.00	0.00
			Max. Mx	25	0.86	0.01	0.00
			Max. My	18	0.82	0.00	0.00
			Max. Vy	25	0.02	0.00	0.00
			Max. Vx	18	-0.00	0.00	0.00
T4	47.25 - 46	Leg	Max Tension	1	0.00	0.00	0.00
			Max. Compression	25	-10.62	5.50	0.37
			Max. Mx	23	-10.39	5.53	0.41
			Max. My	11	-3.11	2.07	0.67
			Max. Vy	24	-4.17	5.51	0.41
			Max. Vx	10	-0.44	2.12	0.66

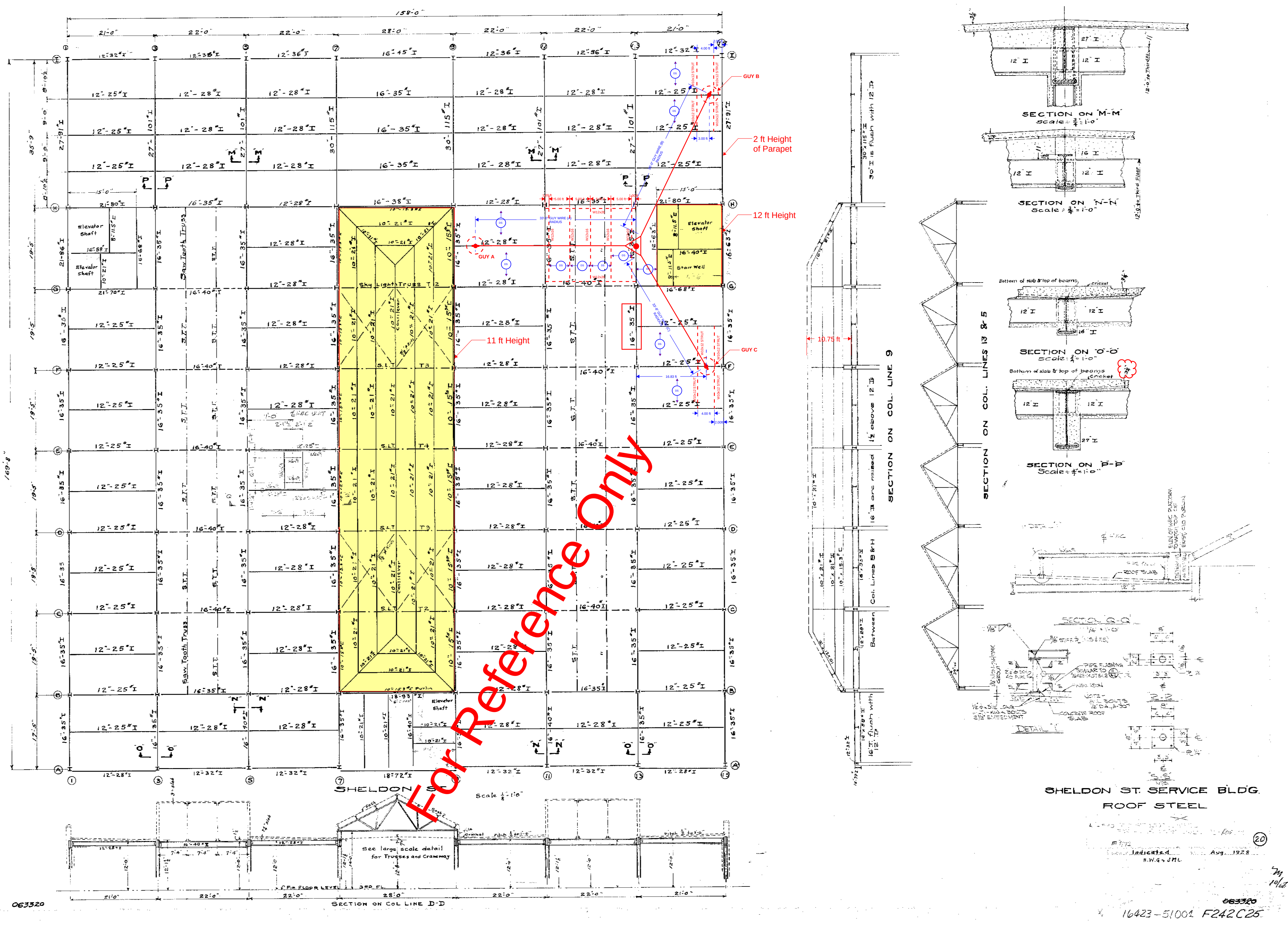
Maximum Reactions

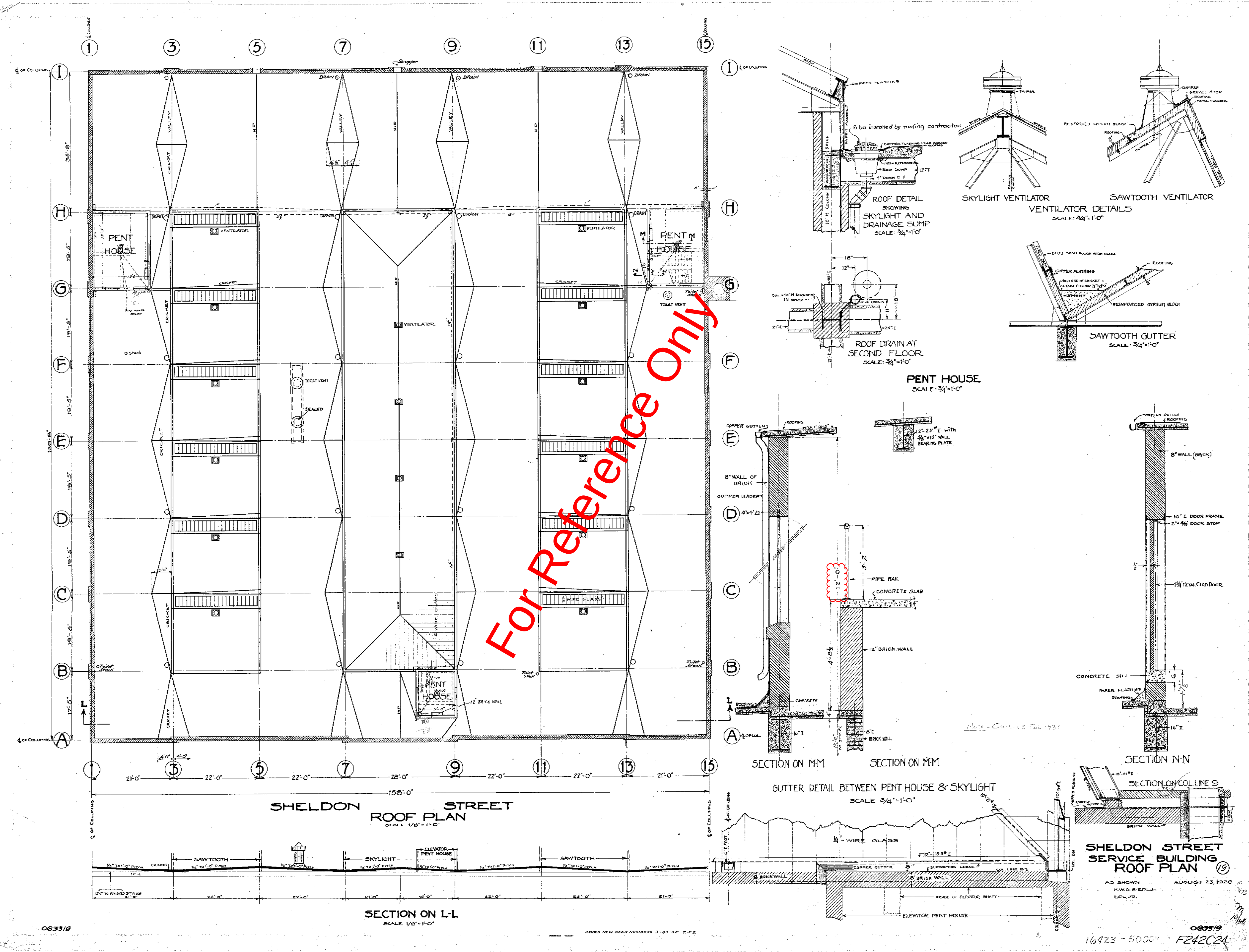
Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Mast	Max. Vert	19	32.08	-0.27	-0.10
	Max. H_x	11	11.63	0.43	0.03
	Max. H_z	2	11.65	0.04	0.56
	Max. M_x	1	0.00	0.02	0.01
	Max. M_z	1	0.00	0.02	0.01
	Max. Torsion	10	0.98	0.42	-0.20
	Min. Vert	1	10.41	0.02	0.01
	Min. H_x	6	11.78	-0.44	-0.27
	Min. H_z	8	11.81	-0.03	-0.45
	Min. M_x	1	0.00	0.02	0.01
	Min. M_z	1	0.00	0.02	0.01
	Min. Torsion	4	-0.71	-0.34	0.20
Guy C @ 33.67 ft Elev 46 ft Azimuth 240 deg	Max. Vert	10	-1.47	-0.87	0.51
	Max. H_x	10	-1.47	-0.87	0.51
	Max. H_z	16	-5.53	-4.82	2.88
	Min. Vert	17	-5.68	-4.99	2.87
	Min. H_x	17	-5.68	-4.99	2.87
	Min. H_z	10	-1.47	-0.87	0.51
Guy B @ 36 ft Elev 46 ft Azimuth 120 deg	Max. Vert	6	-1.32	0.82	0.48
	Max. H_x	25	-5.27	4.96	2.86
	Max. H_z	26	-5.14	4.80	2.87
	Min. Vert	25	-5.27	4.96	2.86
	Min. H_x	6	-1.32	0.82	0.48
	Min. H_z	6	-1.32	0.82	0.48
Guy A @ 33 ft Elev 46 ft Azimuth 0 deg	Max. Vert	2	-1.54	-0.00	-1.03
	Max. H_x	24	-4.74	0.21	-4.57
	Max. H_z	2	-1.54	-0.00	-1.03
	Min. Vert	21	-5.98	0.00	-5.85

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Min. H_x	18	-4.78	-0.21	-4.63
	Min. H_z	21	-5.98	0.00	-5.85

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	10.41	-0.02	-0.01	0.00	0.00	-0.12
1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy	11.65	-0.04	-0.56	0.00	0.00	0.02
1.2 Dead+1.0 Wind 30 deg - No Ice+1.0 Guy	11.69	0.18	-0.44	0.00	0.00	0.45
1.2 Dead+1.0 Wind 60 deg - No Ice+1.0 Guy	11.75	0.34	-0.20	0.00	0.00	0.71
1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy	11.76	0.41	0.04	0.00	0.00	0.70
1.2 Dead+1.0 Wind 120 deg - No Ice+1.0 Guy	11.78	0.44	0.27	0.00	0.00	0.53
1.2 Dead+1.0 Wind 150 deg - No Ice+1.0 Guy	11.86	0.29	0.42	0.00	0.00	0.19
1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy	11.81	0.03	0.45	0.00	0.00	-0.29
1.2 Dead+1.0 Wind 210 deg - No Ice+1.0 Guy	11.70	-0.24	0.38	0.00	0.00	-0.72
1.2 Dead+1.0 Wind 240 deg - No Ice+1.0 Guy	11.60	-0.42	0.20	0.00	0.00	-0.98
1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy	11.63	-0.43	-0.03	0.00	0.00	-0.98
1.2 Dead+1.0 Wind 300 deg - No Ice+1.0 Guy	11.70	-0.40	-0.27	0.00	0.00	-0.81
1.2 Dead+1.0 Wind 330 deg - No Ice+1.0 Guy	11.69	-0.26	-0.49	0.00	0.00	-0.46
1.2 Dead+1.0 Ice+1.0 Temp+Guy	31.56	-0.04	-0.09	0.00	0.00	-0.31
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.96	-0.05	-0.43	0.00	0.00	-0.30
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.94	0.10	-0.36	0.00	0.00	-0.12
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.91	0.22	-0.22	0.00	0.00	-0.02
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.98	0.28	-0.06	0.00	0.00	0.01
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.08	0.27	0.10	0.00	0.00	-0.03
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.02	0.15	0.19	0.00	0.00	-0.14
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.95	-0.02	0.22	0.00	0.00	-0.32
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.96	-0.19	0.17	0.00	0.00	-0.50
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.95	-0.32	0.06	0.00	0.00	-0.60
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.83	-0.35	-0.10	0.00	0.00	-0.63
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.77	-0.31	-0.26	0.00	0.00	-0.59
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy	31.85	-0.20	-0.38	0.00	0.00	-0.48
Dead+Wind 0 deg - Service+Guy	10.43	-0.02	-0.11	0.00	0.00	-0.09
Dead+Wind 30 deg - Service+Guy	10.43	0.02	-0.09	0.00	0.00	-0.01
Dead+Wind 60 deg - Service+Guy	10.43	0.05	-0.05	0.00	0.00	0.04


158'-0"
GUY B
2 ft Height of Parapet
12 ft Height
GUY A
GUY C
11 ft Height
10.75 ft
Elevator Shaft
Stair Well
Sky Light Truss
Saw Tooth Truss
SECTION ON 'M-M' Scale: 3/4" = 1'-0"
SECTION ON 'N-N' Scale: 3/4" = 1'-0"
SECTION ON 'O-O' Scale: 3/4" = 1'-0"
SECTION ON 'P-P' Scale: 3/4" = 1'-0"
SECTION ON COL. LINES 13 & 5
SECTION ON COL. LINE 9
SECTION Q-Q
DETAIL 'Z'
SHELDON ST.
Scale 1/8" = 1'-0"
SECTION ON COL. LINE D-D
See large scale detail for Trusses and Crane-way
For Reference Only
SHELDON ST. SERVICE BLDG.
ROOF STEEL
Indicated
Aug. 1928
063320
16423-51001 F242C25



SHELDON STREET
ROOF PLAN
SCALE 1/8"=1'-0"
SECTION ON L-L
SCALE 1/8"=1'-0"
PENT HOUSE
VENTILATOR
SKYLIGHT
SAWTOOTH
ELEVATOR PENT HOUSE
ROOF DETAIL SHOWING SKYLIGHT AND DRAINAGE SUMP
SCALE: 3/4"=1'-0"
To be installed by roofing contractor
SKYLIGHT VENTILATOR
SAWTOOTH VENTILATOR
VENTILATOR DETAILS
SCALE: 3/4"=1'-0"
ROOF DRAIN AT SECOND FLOOR
SCALE: 3/4"=1'-0"
SAWTOOTH GUTTER
SCALE: 3/4"=1'-0"
PENT HOUSE
SCALE: 3/4"=1'-0"
SECTION ON M-M
SECTION ON M-M
SECTION N-N
GUTTER DETAIL BETWEEN PENT HOUSE & SKYLIGHT
SCALE 3/4"=1'-0"
SECTION ON COL LINE 9
1/4" WIRE GLASS
SHELDON STREET
SERVICE BUILDING
ROOF PLAN
19
AS SHOWN
AUGUST 23, 1928
063319
063319
F242C24
16423-50007
For Reference Only

DESIGN BASIS:

GOVERNING CODE: 2003 INTERNATIONAL BUILDING CODE (IBC) AS MODIFIED BY THE 2009 CONNECTICUT SUPPLEMENT.

DESIGN CRITERIA

WIND LOAD: PER NU SUB 090 (ANTENNA MOUNTS): 85 MPH (FASTEST MILE), EQUIVALENT TO 100 MPH (3 SECOND GUST).

GENERAL NOTES:

ALL WORK SHALL BE IN ACCORDANCE WITH TIA/EIA-222 REVISION "F" "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND SUPPORTING STRUCTURES".

1. THE CONTRACTOR IS SOLELY RESPONSIBLE TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE, AND TO ENSURE THE SAFETY OF THE EXISTING STRUCTURES AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, BRACING, UNDERPINNING, ETC. THAT MAY BE NECESSARY. MAINTAIN EXISTING SITE OPERATIONS, COORDINATE WORK WITH NORTHEAST UTILITIES.
2. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.
3. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES, AND EXISTING CONDITIONS AT THE SITE, PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA.
4. ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.
5. ALL EXISTING GROUNDING TO REMAIN INTACT. CONTRACTOR SHALL REPAIR GROUNDING WHERE DAMAGED. GROUND ANCHORS TO THE BUILDING STEEL IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF THE NATIONAL ELECTRIC CODE.

TOWER AND GUY ANCHOR REACTIONS

GUY ANCHOR CONNECTION ASSEMBLY DESIGN INCLUDES A SAFETY FACTOR OF 2.0 PER TIA/EIA-222-F SECTION 8.

TOWER BASE AXIAL (kips)	16.9
TOWER BASE HORZ SHEAR (kips)	0.7
GUY ANCHOR (A) VERT. (kips)	7.9
GUY ANCHOR (A) HORZ SHEAR (kips)	6.7
GUY ANCHOR (B) VERT. (kips)	5.8
GUY ANCHOR (B) HORZ SHEAR (kips)	5.4
GUY ANCHOR (C) VERT. (kips)	7.3
GUY ANCHOR (C) HORZ SHEAR (kips)	6.4

NON-SHRINK GROUT FOR BASE PLATES AND BEARING PLATES:

1. GROUT FOR ALL BASE PLATES:

   A NONMETALLIC, SHRINKAGE RESISTANT, PREMIXED, NON-CORROSIVE, NON-STAINING PRODUCT CONTAINING PORTLAND CEMENT, SILICON SANDS, SHRINKAGE COMPENSATING AGENT, AND FLUIDITY IMPROVING COMPOUND.
2. COMPRESSIVE STRENGTH:

   TWENTY-EIGHT DAY COMPRESSIVE STRENGTH AS DETERMINED BY GROUT CUBELESIS 8,000 PSI FOR SUPPORTING CONCRETE GREATER THAN 3,000 PSI AND LESS THAN OR EQUAL TO 4,000 PSI.
3. PLACEMENT:

   PLACE GROUT IN A FLUID FLOWABLE STATE UNDER BASE PLATE WITH A FORM BUILT AROUND THEM FOR GROUT CONFINEMENT. GROUT SHOULD BE CURED ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
4. MINIMUM THICKNESS:

   1" MINIMUM THICKNESS OF GROUT UNDER ALL BASEPLATES AND BEARING PLATES, UNLESS SPECIFIED OTHERWISEON THE DRAWINGS.

STRUCTURAL STEEL NOTES:

1. ALL STRUCTURAL STEEL IS DESIGNED BY ALLOWABLE STRESS DESIGN (ASD)
   - A. STRUCTURAL STEEL (W SHAPES)---ASTM A992, (FY = 50 KSI)
   - B. STRUCTURAL STEEL (OTHER SHAPES)---ASTM A36, (FY = 36 KSI)
   - C. STRUCTURAL HSS (RECTANGULAR SHAPES)---ASTM A500 GRADE B, (FY = 46 KSI)
   - D. STRUCTURAL HSS (ROUND SHAPES)---ASTM A500 GRADE B, (FY = 42 KSI)
   - E. ROUND PIPE SHAPES---ASTM A53 GRADE B, (FY = 35 KSI)
   - E. CONNECTION BOLTS---ASTM A325-N
   - F. ANCHOR RODS---ASTM F 1554 GRADE 55
   - G. WELDING ELECTRODE---ASTM E 70XX
2. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE ENGINEER FOR REVIEW. SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING: SECTION PROFILES, SIZES, CONNECTION ATTACHMENTS, REINFORCING, ANCHORAGE, SIZE AND TYPE OF FASTENERS AND ACCESSORIES. INCLUDE ERECTION DRAWINGS, ELEVATIONS AND DETAILS.
3. STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST PROVISIONS OF AISC MANUAL OF STEEL CONSTRUCTION.
4. PROVIDE ALL PLATES, CLIP ANGLES, CLOSURE PIECES, STRAP ANCHORS, MISCELLANEOUS PIECES AND HOLES REQUIRED TO COMPLETE THE STRUCTURE.
5. FIT AND SHOP ASSEMBLE FABRICATIONS IN THE LARGEST PRACTICAL SECTIONS FOR DELIVERY TO SITE.
6. INSTALL FABRICATIONS PLUMB AND LEVEL, ACCURATELY FITTED, AND FREE FROM DISTORTIONS OR DEFECTS.
7. NOTIFY THE ENGINEER PRIOR TO FIELD CUTTING OR MODIFYING APPROVED FABRICATIONS.
8. AFTER ERECTION OF STRUCTURES, TOUCHUP ALL WELDS, ABRASIONS AND NON-GALVANIZED SURFACES WITH A 95% ORGANIC ZINC RICH PAINT IN ACCORDANCE WITH ASTM 780.
9. ALL STEEL MATERIAL (EXPOSED TO WEATHER) SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT DIPPED GALVANIZED) COATINGS" ON IRONS AND STEEL PRODUCTS.
10. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE".
11. CONTRACTOR SHALL COMPLY WITH AWS CODE FOR PROCEDURES APPEARANCE AND QUALITY OF WELDS, AND WELDING PROCESSES SHALL BE QUALIFIED IN ACCORDANCE WITH AWS "STANDARD QUALIFICATION PROCEDURES". ALL WELDING SHALL BE DONE USING E70XX ELECTRODES AND WELDING SHALL CONFORM TO AISC AND D1.1 WHERE FILLET WELD SIZES ARE NOT SHOWN, PROVIDE THE MINIMUM SIZE PER TABLET J2.4 IN THE AISC "MANUAL OF STEEL CONSTRUCTION" 9TH EDITION. AT THE COMPLETION OF WELDING, ALL DAMAGE TO GALVANIZED COATING SHALL BE REPAIRED.
12. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NON CONFORMING MATERIALS OR CONDITIONS TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.
13. STRUCTURAL CONNECTION BOLTS SHALL CONFORM TO ASTM A325 WITH NUTS AND PAL NUTS. ALL BOLTS TO BE TENSIONED IN ACCORDANCE WITH TABLE 4 OF THE AISC SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS.
14. SHOP CONNECTIONS SHALL BE WELDED OR HIGH STRENGTH BOLTED.
15. MILL BEARING ENDS OF COLUMNS, STIFFENERS, AND OTHER BEARING SURFACES TO TRANSFER LOAD OVER ENTIRE CROSS SECTION.
16. LEVEL AND PLUMB INDIVIDUAL MEMBERS OF THE STRUCTURE TO AN ACCURACY OF 1:500, BUT NOT TO EXCEED 1/4" IN THE FULL HEIGHT OF THE COLUMN.
17. COMMENCEMENT OF STRUCTURAL STEEL WORK WITHOUT NOTIFYING THE ENGINEER OF ANY DISCREPANCIES WILL BE CONSIDERED ACCEPTANCE OF PRECEDING WORK.
18. INSPECTION AND TESTING OF ALL WELDING AND HIGH STRENGTH BOLTING SHALL BE PERFORMED BY AN INDEPENDENT TESTING LABORATORY. THE INSPECTOR SHALL OBSERVE INSTALLATION OF BOLTS AND TEST WITH A CALIBRATED TORQUE WRENCH NOT LESS THAN 20% OF THE BOLTS AND NOT LESS THAN TWO BOLTS, SELECTED AT RANDOM, IN EACH CONNECTION.
19. FOUR COPIES OF ALL INSPECTION TEST REPORTS SHALL BE SUBMITTED TO THE ENGINEER WITHIN TEN (10) WORKING DAYS OF THE DATE OF INSPECTION.

DESIGNED BY: JRM
DRAWN BY: DEB/JRM
CHK'D BY: CFC

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
[illegible]	10/18/11	JRM/DEB	CFC	W BEAMS ELEVATED AT GUY ANCHOR A. FINISH NOTES ADDED
[illegible]	[illegible]	[illegible]	[illegible]	ISSUED FOR CONSTRUCTION
[illegible]	7/29/11	JRM/DEB	CFC	ISSUED FOR CONSTRUCTION
[illegible]	3/17/11	DEB	CFC	ISSUED FOR REVIEW

PROFESSIONAL ENGINEER SEAL

CENTEK engineering
Centered on Solutions
(203) 488-0580
(203) 488-8587 Fax
63-2 North Branford Road
Branford, CT 06405
www.CentekEng.com

NORTHEAST UTILITIES SYSTEM

ROOF TOP GUYED LATTICE TOWER

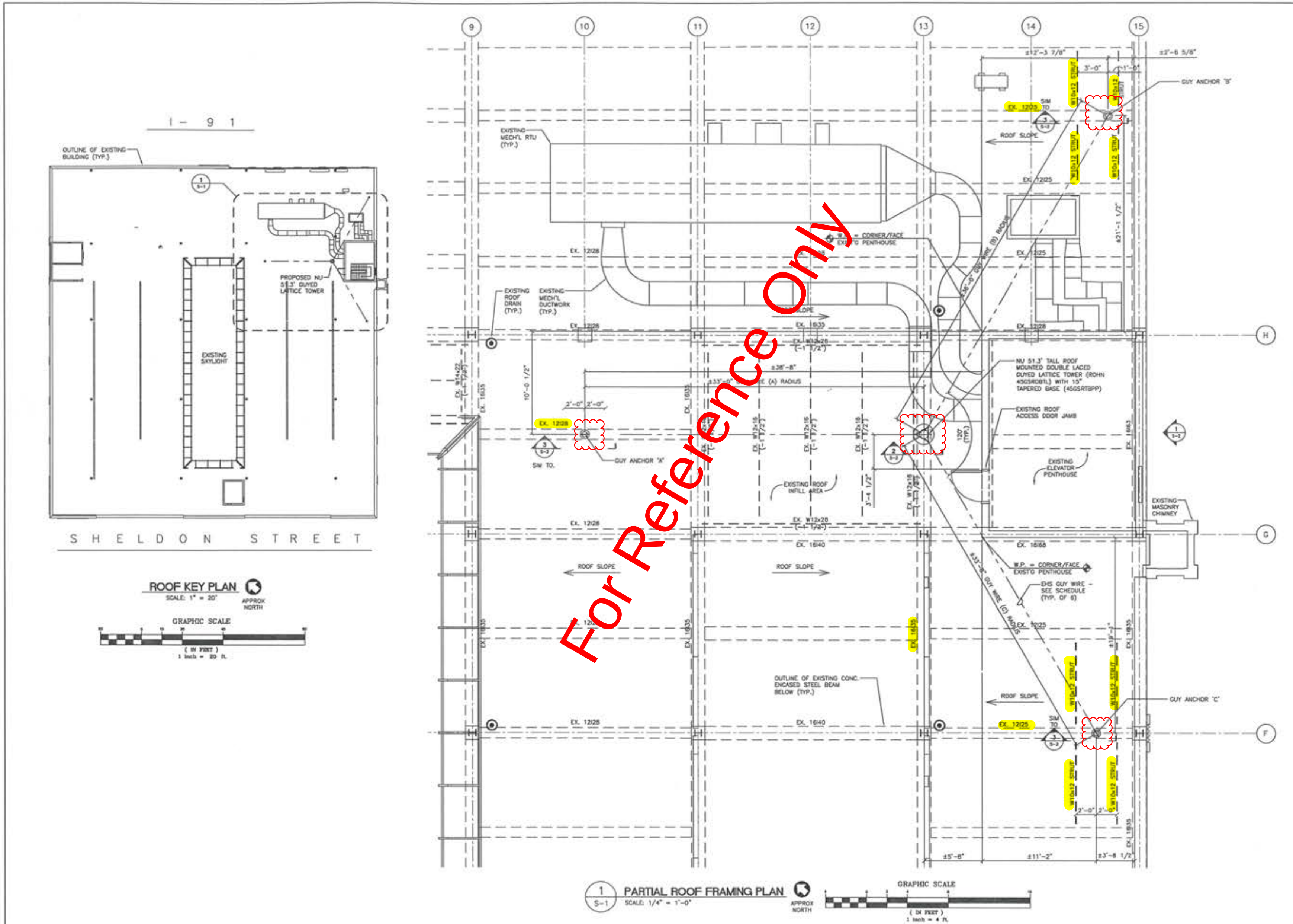
410 SHELDON STREET
HARTFORD, CT

DATE: 8/25/11
SCALE: AS NOTED
JOB NO. 11060

STRUCTURAL NOTES

N-1

Sheet No. 1 of 3



DESIGNED BY: JRM
DRAWN BY: DEB/JRM
CHK'D BY: CFC

NORTHEAST UTILITIES SYSTEM

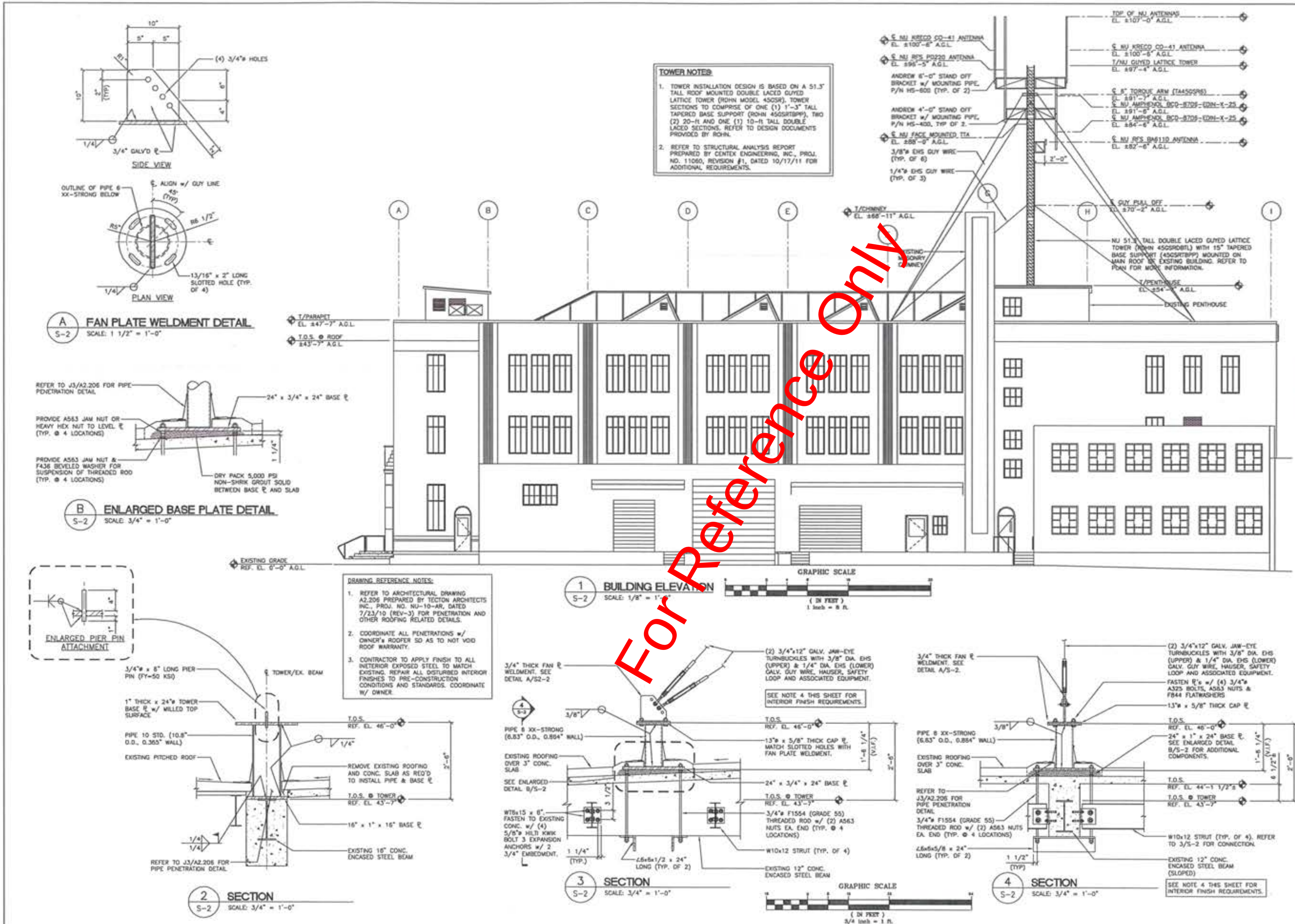
ROOF TOP GUYED LATTICE TOWER

410 SHELDON STREET HARTFORD, CT

DATE: 8/25/11
SCALE: AS NOTED
JOB NO. 11060

STRUCTURAL PLANS

S-1



TOWER NOTES:

1. TOWER INSTALLATION DESIGN IS BASED ON A 51.3' TALL ROOF MOUNTED DOUBLE LACED GUYED LATTICE TOWER (ROHN MODEL 45GSR). TOWER SECTIONS TO COMPRISE OF ONE (1) 1'-3" TALL TAPERED BASE SUPPORT (ROHN 45GSRTBPP), TWO (2) 20-ft AND ONE (1) 10-ft TALL DOUBLE LACED SECTIONS. REFER TO DESIGN DOCUMENTS PROVIDED BY ROHN.
2. REFER TO STRUCTURAL ANALYSIS REPORT PREPARED BY CENTEK ENGINEERING, INC., PROJ. NO. 11060, REVISION #1, DATED 10/17/11 FOR ADDITIONAL REQUIREMENTS.

DRAWING REFERENCE NOTES:

1. REFER TO ARCHITECTURAL DRAWING A2.206 PREPARED BY TECTON ARCHITECTS INC., PROJ. NO. NU-10-AR, DATED 7/23/10 (REV-3) FOR PENETRATION AND OTHER ROOFING RELATED DETAILS.
2. COORDINATE ALL PENETRATIONS w/ OWNER's ROOFER SO AS TO NOT VOID ROOF WARRANTY.
3. CONTRACTOR TO APPLY FINISH TO ALL INETERIOR EXPOSED STEEL TO MATCH EXISTING. REPAIR ALL DISTURBED INTERIOR FINISHES TO PRE-CONSTRUCTION CONDITIONS AND STANDARDS. COORDINATE W/ OWNER.

DESIGNED BY:	JRM
DRAWN BY:	DEB/JRM
CHK'D BY:	CFC

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
02	10/18/11	JRM/DEB	CFC	W BEAMS ELIMINATED AT GUY ANCHOR A. FINISH NOTES ADDED
01	9/14/11	JRM/DEB	CFC	ISSUED FOR CONSTRUCTION
00	9/12/11	DEB	CFC	ISSUED FOR REVIEW

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NORTHEAST UTILITIES SYSTEM

ROOF TOP GUYED LATTICE TOWER

410 SHELDON STREET
HARTFORD, CT

DATE:	8/25/11
SCALE:	AS NOTED
JOB NO.	11060

SECTIONS AND BUILDING ELEVATION

S-2

Sheet No. 3 of 3

CENTEK engineering

Centered on Solutions℠ www.centekeng.com

63-2 North Branford Road P: (203) 488-0580

Branford, CT 06405 F: (203) 488-8587

JOB: NEW - 410 SHELDON ST. HARTFORD, CT.

SHEET NO. 1 OF 1

CALCULATED BY: JRM. DATE: 09.08.11

CHECKED BY: DATE:

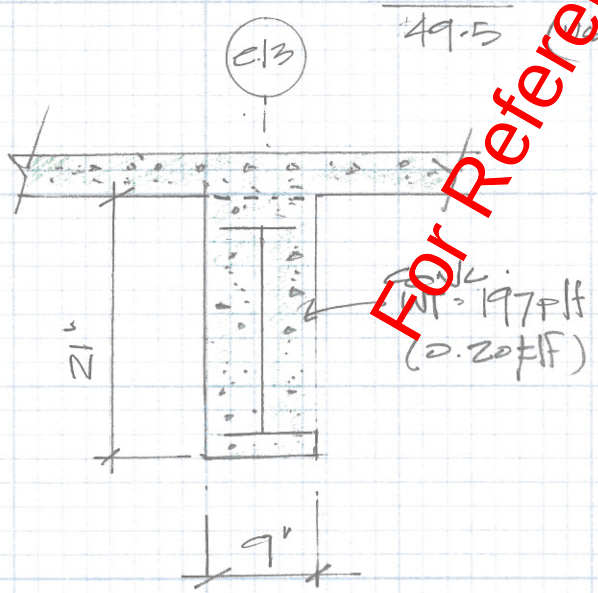
SCALE: EXISTING ROOF LOADS.

EXISTING LOADING CONDITIONS:

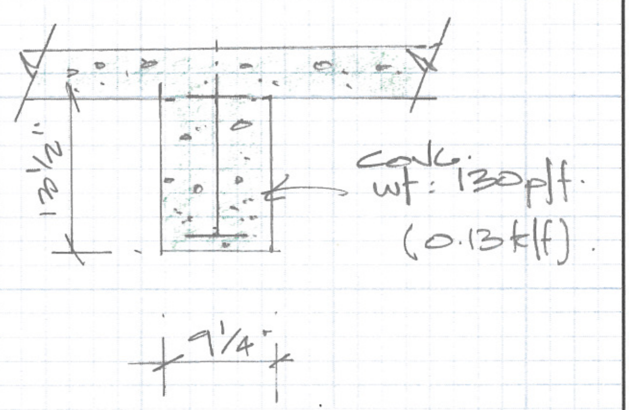
I: Exist roof construction consists of Epdm rubber roofing over insulation (3" assumed) over 3 1/4" thick conc. deck (normal wt.) over conc. encased W Beams.

Dead loads:	(psf)
0.060 EPDM	1.0
3" RIGID	4.5
3 1/4" CONC. DECK	39.0
M/E/P	4.0
FINISHES	1.0
	49.5 (USE 50 psf)

Live loads	(psf)
pf (min)	: 30
	per 2005 CSBC section
Roof (Lr)	= 20



DETAIL @ K0135 BM (W16x36 EQUIV)

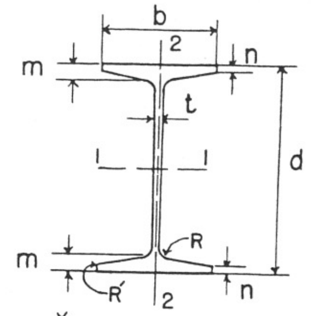


DETAIL @ 12128 BM / 12125 BM (W12x26 EQUIV.) (W12x22 EQUIV).

12" BEAMS

REFERENCES; SEE COLUMN (1) AND PAGE 4

12	14	22	1, 7, 19
S54-1946	C1916	CIL1946	See Page 71
S56-1948	C1917	CIL1948	9,10,17,20
13	C1919	US1950	See Page 72
C1913	C1920	23	3,5,6,8,24
C1915	15	IL1914	See Page 73
	C1921	IL1925	
	C1923		



*Computed

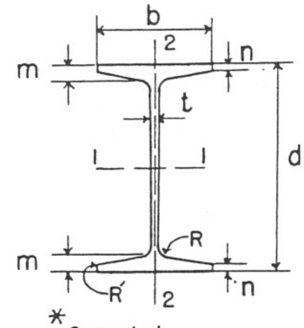
SECT. NO. OR NOM. SIZE	COL. (1)	WEIGHT PER FOOT Lb.	AREA Sq.In.	DEPTH d In.	FLANGE WIDTH b In.	WEB THICK t In.	DIMENSIONS m In.	n In.	R In.	R' In.	SLOPE INSIDE FLANGE %	AXIS 1—1 I In.⁴	S In.³	r In.	AXIS 2—2 I In.⁴	S In.³	r In.
B12	7	31.5	9.36	12.120	6.525	.270	.610	.350	.35	0	8 1/3*	245.7	40.5	5.12	19.4	5.93	1.44
B12	1	31.0	9.13	12.000	6.160	.310	.645	.280	.35	0	12.5*	225.2	37.5	4.97	14.7	4.77*	1.27
12WF B12 12X6 1/2	12	31.0	9.12	12.090	6.525	.265	.465†		.35	0	5.0	238.4	39.4	5.11	19.8	6.1	1.47
12WF CB121 12X6 1/2	22	31.0	9.12	12.090	6.525	.265	.465	.465	.37	0	0	238.4	39.4	5.11	19.8	6.1	1.47
B12	5	31.0	9.02	12.060	6.270	.270	.605	.355	.35	0	8 1/3*	232.3	38.5	5.08	17.3	5.51	1.38
12WF 12X6 1/2	24	29.6	8.70	12.000	6.500	.240	.456†		—	—	10.5	228.0	38.0	5.12	17.1	5.31	1.40
B12	3	28.5	8.42	12.000	6.120	.250	.594	.330	.35	0	9.0*	216.2	36.0	5.07	15.3	5.00*	1.35
B12	1	28.5	8.41	12.000	6.100	.250	.645	.280	.35	0	12.5*	216.6	36.1	5.07	14.2	4.66*	1.30
B12	5	28.5	8.40	12.000	6.250	.250	.575	.325	.35	0	8 1/3*	215.8	36.0	5.07	15.9	5.08	1.38
B12	7	28.0	8.28	12.000	6.500	.245	.550	.290	.35	0	8 1/3*	213.6	35.6	5.08	16.4	5.04	1.41
12WF B12 12X6 1/2	10	28.0	8.23	12.000	6.500	.240	.420†		.35	0	5.0	213.5	35.6	5.09	17.5	5.4	1.46
12WF CB121 12X6 1/2	20	28.0	8.23	12.000	6.500	.240	.420	.420	.37	0	0	213.5	35.6	5.09	17.5	5.4	1.46
CB 122 12X6 1/2	17	28.0	8.22	12.000	6.500	.240	.420	.420	.35	0	0	213.4	35.6	5.10	19.2	5.9	1.53
CB 122N 12X6 1/2	19	28.0	8.22	12.000	6.500	.240	.420	.420	.35	0	0	213.4	35.6	5.10	19.2	5.9	1.53
B66	14	28.0	8.15	12.000	6.000	.284	.540	.280	.26	0	9.0*	199.4	33.2	4.95	12.6	4.2	1.24
B66	15	27.9	8.15	12.000	6.000	.284	.540	.280	.26	0	9.0*	199.4	33.2	4.95	12.6	4.2	1.24
B36	13	27.5	8.04	12.000	5.000	.255	.710	.315	.40	0	16 2/3*	199.6	33.3	4.98	8.7	3.5	1.04
12WF CB121 12X6 1/2	22	27.0	7.97	11.960	6.500	.240	.400	.400	.37	0	0	204.1	34.1	5.06	16.6	5.1	1.44
12WF B12 12X6 1/2	12	27.0	7.97	11.960	6.500	.240	.400†		.35	0	5.0	204.1	34.1	5.06	16.6	5.1	1.44
B12 12X6 1/2	7	25.0	7.44	11.880	6.495	.240	.490	.230	.35	0	8 1/3*	185.1	31.2	4.99	13.6	4.19	1.35
12WF B12 12X6 1/2	10	25.0	7.39	11.870	6.500	.240	.355†		.35	0	5.0	183.4	30.9	4.98	14.5	4.5	1.40
12WF CB121 12X6 1/2	20	25.0	7.39	11.870	6.500	.240	.355	.355	.37	0	0	183.4	30.9	4.98	14.5	4.5	1.40
B12 12X6 1/2	9	25.0	7.38	11.870	6.495	.240	.485	.225	.35	0	8 1/3*	182.8	30.8	4.98	13.4	4.12	1.35
B12	6	25.0	7.37	11.840	6.240	.240	.495	.245	.35	0	8 1/3*	181.4	30.6	4.96	12.6	4.03	1.31
CB122N 12X6 1/2	19	25.0	7.36	11.868	6.500	.240	.354	.354	.35	0	0	182.9	30.8	4.98	16.2	5.0	1.48
B25	23	25.0	7.35	12.000	5.000	.270	.570	.270	.27	0	12.5*	175.5	29.2	4.89	7.3	2.92	1.00
CB121	17	25.0	7.34	11.924	6.000	.240	.382	.382	.35	0	0	183.0	30.7	4.99	13.8	4.6	1.37

†Average thickness

16" BEAMS

REFERENCES; SEE COLUMN (1) AND PAGE 4

11	2,3,4,7,8,10
K1950	See Page 61
K1952	1, 6
	See Page 62



*Computed

SECT. NO. OR NOM. SIZE	COL (1)	WEIGHT PER FOOT Lb.	AREA Sq.In.	DEPTH d In.	FLANGE WIDTH b In.	WEB THICK t In.	DIMENSIONS m In.	n In.	R In.	R′ In.	SLOPE INSIDE FLANGE %	AXIS 1—1 I In.⁴	S In.³	r In.	AXIS 2—2 I In.⁴	S In.³	r In.
16WF 16X7	11	45.1	13.26	15.875	7.110	.417	.487†		–	–	10.5	530.1	66.8	6.32	24.2	6.8	1.35
B16 16X7 1/4	3	45.0	13.26	16.120	7.285	.330	.708	.418	.40	0	8 1/3	594.5	73.8	6.69	31.9	8.75	1.55
16WF B16 16X7	6	45.0	13.24	16.120	7.039	.346	.563†		.40	0	5.0	583.3	72.4	6.64	30.5	8.70	1.52
16WF CB161 16X7	10	45.0	13.24	16.120	7.039	.346	.563	.563	.43	0	0	583.3	72.4	6.64	30.5	8.70	1.52
CB162N 16X7 1/4	8	45.0	13.23	16.120	7.286	.328	.563	.563	.40	0	0	594.6	73.8	6.70	36.3	10.0	1.66
CB162 16X7	7	45.0	13.23	16.128	7.036	.326	.584	.584	.45	0	0	595.0	73.8	6.71	34.0	9.7	1.60
B16	1	45.0	13.20	16.000	7.250	.320	.720	.430	.40	0	8 1/3*	588.6	73.6	6.68	32.2	8.88	1.56
CB162 16X7	7	43.0	12.65	15.934	7.085	.375	.487	.487	.45	0	0	523.8	65.7	6.44	28.9	8.2	1.51
B16 16X7 1/4	3	40.0	11.83	16.000	7.250	.295	.648	.358	.40	0	8 1/3*	526.2	65.8	6.67	27.6	7.61	1.53
CB162N 16X7 1/4	8	40.0	11.78	16.000	7.250	.292	.503	.503	.40	0	0	525.9	65.7	6.88	32.0	8.8	1.65
B16	1	40.0	11.78	15.880	7.215	.285	.660	[illegible]	.40	0	8 1/3*	521.7	65.7	6.66	27.9	7.74	1.54
16WF B16 16X7	6	40.0	11.77	16.000	7.000	.307	.503†		.40	0	5.0	515.5	64.4	6.62	26.5	7.6	1.50
16WF CB161 16X7	10	40.0	11.77	16.000	7.000	.307	.503	.503	.43	0	0	515.5	64.4	6.62	26.5	7.6	1.50
CB162 16X7	7	40.0	11.75	16.000	7.000	.290	.520	.520	.45	0	0	524.6	65.6	6.68	29.8	8.5	1.59
16WF 16X7	11	38.7	11.39	15.875	6.992	.299	.487†		–	–	10.5	490.8	61.9	6.56	22.9	6.5	1.42
CB161 16X6	7	38.0	11.17	16.012	6.024	.314	.526	.526	.45	0	0	475.1	59.3	6.52	19.2	6.4	1.31
CB162N 16X7 1/4	8	37.0	10.88	15.880	7.248	.290	.443	.443	.40	0	0	470.0	59.2	6.57	28.1	7.8	1.61
B16 16X7 1/4	4	37.0	10.88	15.880	7.245	.290	.588	.298	.40	0	8 1/3*	469.2	59.1	6.57	23.7	6.55	1.48
16WF B16 16X7	6	36.0	10.59	15.850	6.992	.299	.428†		.40	0	5.0	446.3	56.3	6.49	22.1	6.3	1.45
16WF CB161 16X7	10	36.0	10.59	15.850	6.992	.299	.428	.428	.43	0	0	446.3	56.3	6.49	22.1	6.3	1.45
B16	2	35.0	10.29	15.810	7.240	.285	.553	.263	.40	0	8 1/3*	435.8	55.1	6.51	21.4	5.92	1.44
CB161 16X6	7	35.0	10.29	15.930	6.000	.290	.485	.485	.45	0	0	435.5	54.7	6.50	17.5	5.8	1.30

†Average thickness

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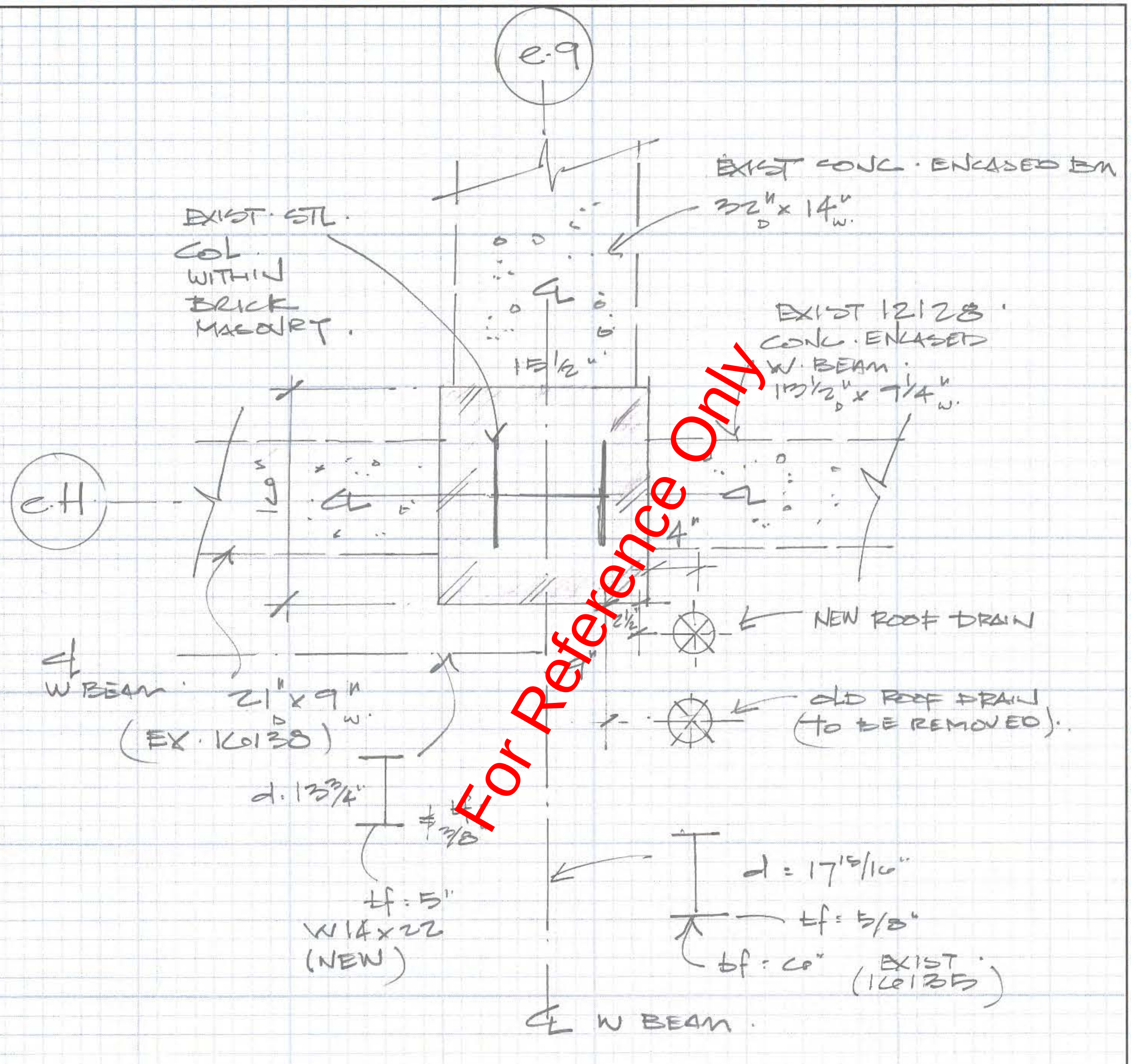
Branford, CT 06405 F: (203) 488-8587

JOB: NU · SHELDON ST. HARTFORD, CT.
SHEET NO. 1 OF 1
CALCULATED BY: JRM DATE: 08.26.11
CHECKED BY: DATE:
SCALE:



COL DETAIL @ GRID LINES e.9/e.H.

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Centered on Solutions℠
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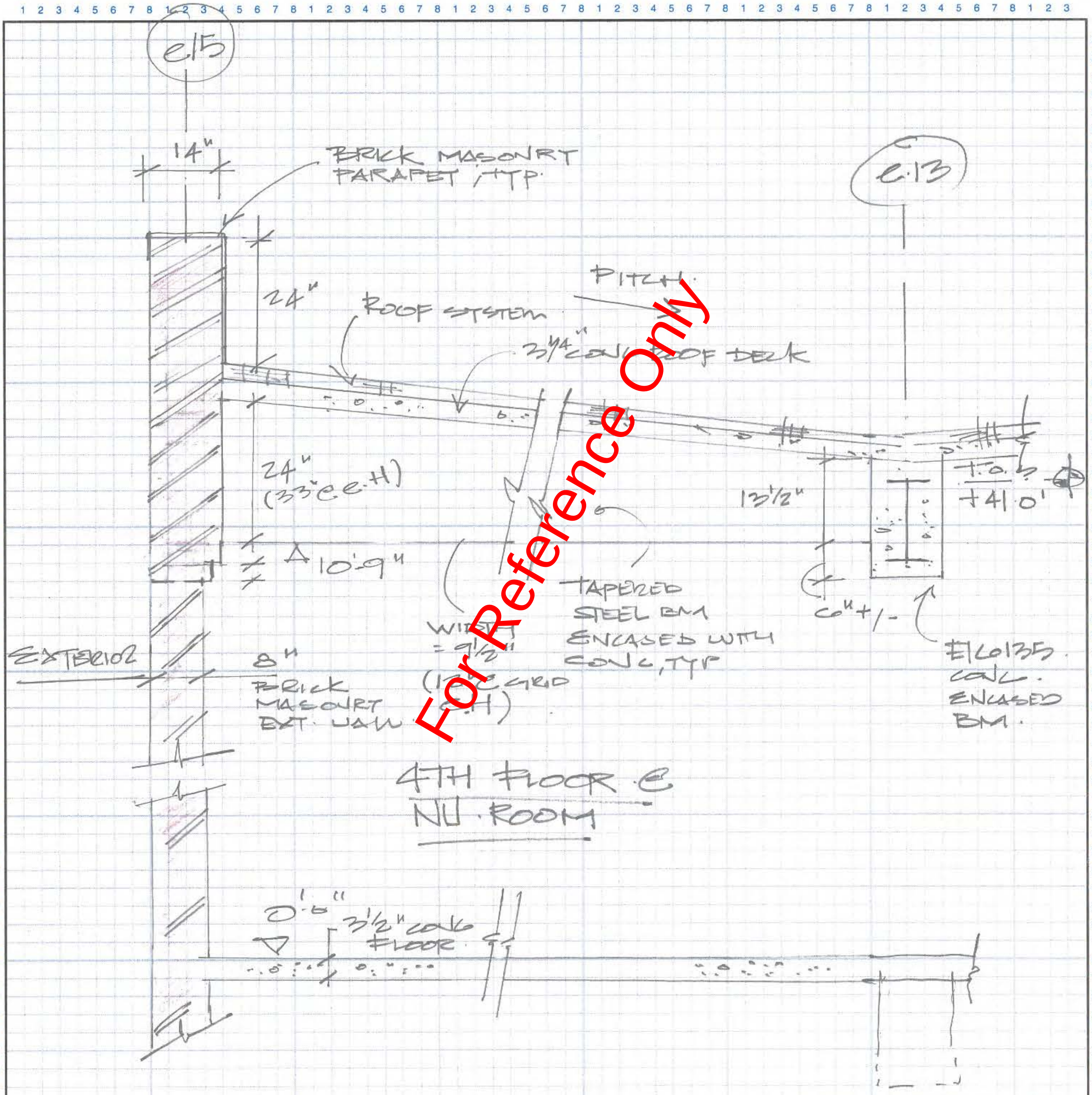
Branford, CT 06405
www.centekeng.com
P: (203) 488-0580
F: (203) 488-8587

JOB NU - SHELDON ST. HARTFORD
SHEET NO. 1 OF 1
CALCULATED BY JRM DATE 08.26.11
CHECKED BY DATE
SCALE



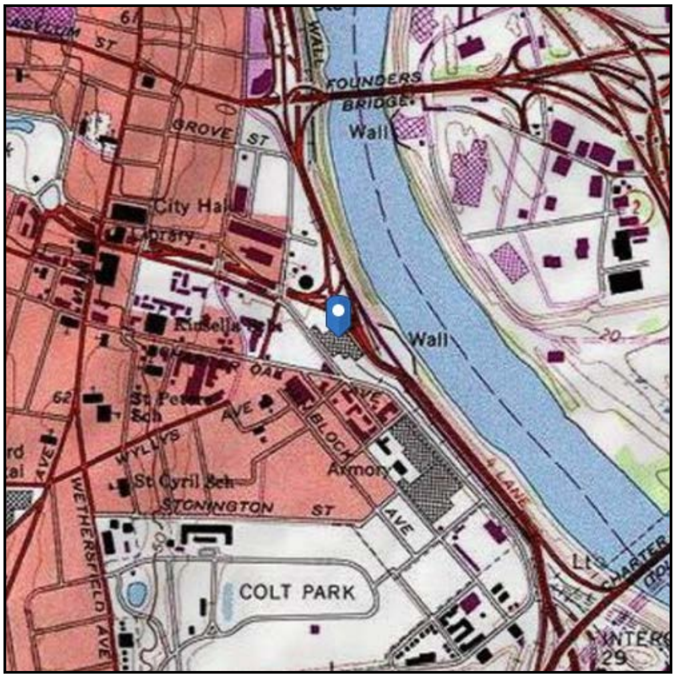
SECTION @ NU ROOM (PROPOSED)
BETWEEN GRID LINES E.13 & E.15
LOOKING TOWARDS E-H.

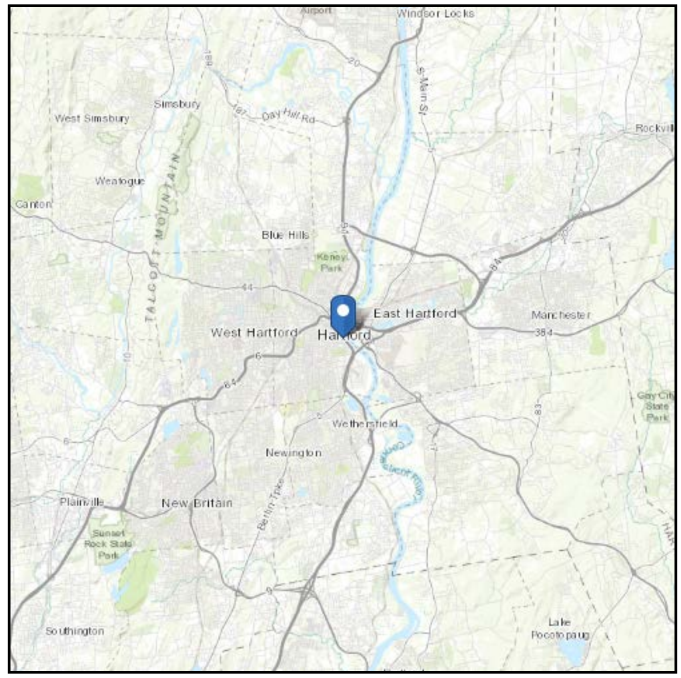
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-10
Risk Category: III
Soil Class: D - Stiff Soil

Elevation: 35.68 ft (NAVD 88)
Latitude: 41.759091
Longitude: -72.665879





Wind

Results:

Wind Speed:	135 Vmph
10-year MRI	77 Vmph
25-year MRI	86 Vmph
50-year MRI	93 Vmph
100-year MRI	100 Vmph

Data Source: ASCE/SEI 7-10, Fig. 26.5-1B and Figs. CC-1–CC-4, incorporating errata of March 12, 2014

Date Accessed: Thu Apr 02 2020

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

Site is in a hurricane-prone region as defined in ASCE/SEI 7-10 Section 26.2. Glazed openings need not be protected against wind-borne debris.

Mountainous terrain, gorges, ocean promontories, and special wind regions should be examined for unusual wind conditions.

ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

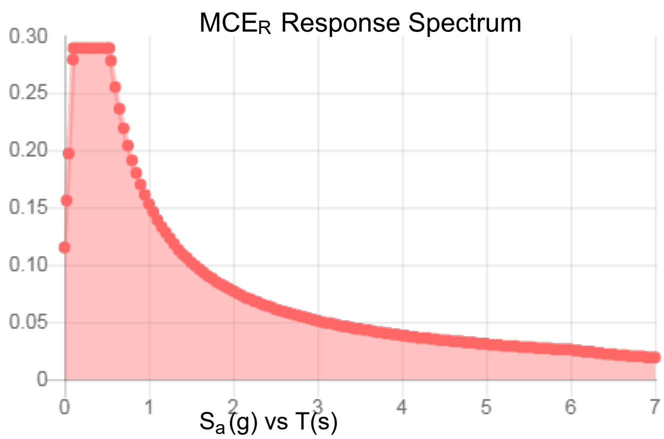
Seismic

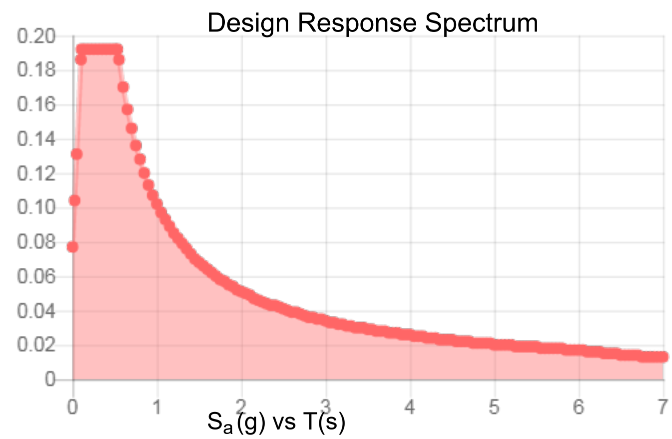
Site Soil Class: D - Stiff Soil

Results:

S_S :	0.18	S_{DS} :	0.192
S_1 :	0.064	S_{D1} :	0.102
F_a :	1.6	T_L :	6
F_v :	2.4	PGA :	0.091
S_{MS} :	0.289	PGA_M :	0.145
S_{M1} :	0.153	F_{PGA} :	1.6
		I_e :	1.25

Seismic Design Category B





Data Accessed: Thu Apr 02 2020

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.

Ice

Results:

Ice Thickness:	1.00 in.
Concurrent Temperature:	5 F
Gust Speed:	50 mph
Data Source:	Standard ASCE/SEI 7-10, Figs. 10-2 through 10-8
Date Accessed:	Thu Apr 02 2020

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Values provided are equivalent radial ice thicknesses due to freezing rain with concurrent 3-second gust speeds, for a 50-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Snow

Results:

Ground Snow Load, p_g :	30 lb/ft^2
Elevation:	35.7 ft
Data Source:	ASCE/SEI 7-10, Fig. 7-1.
Date Accessed:	Thu Apr 02 2020

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

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

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ATTACHMENT G – STRUCTURAL ANALYSIS OF EXISTING TOWER

Date: **October 14, 2020**

Black & Veatch Corp.
6800 W. 115th St., Suite 2292
Overland Park, KS 66211
(913) 458-2522

Subject:	**Structural Analysis Report**	
Eversource Designation:	**Site Number:** **Site Name:**	ES-090 Hartford AWC
Engineering Firm Designation:	**Black & Veatch Corp. Project Number:**	405025
Site Data:	**410 Sheldon Street, Hartford, Hartford Country, CT** **Latitude *41° 45' 32.71"*, Longitude *72° 39' 57.22"*** **51.25 Foot - Guyed Tower on Building**	

Black & Veatch Corp. is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC1: Proposed Equipment Configuration **Sufficient Capacity – 75.8%**

This analysis utilizes an ultimate 3-second gust wind speed of 135 mph as required by the 2018 Connecticut State Building Code. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria

Structural analysis prepared by: Eakkalak Thichan /Changzhi Zang

Respectfully submitted by:

Joshua J. Riley, P.E.
Professional Engineer

STATE OF CONNECTICUT · JOSHUA J. RILEY · 33208 · LICENSED · PROFESSIONAL ENGINEER

11/17/2020

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 51.25 ft Guyed tower designed by Rohn Industries, Inc.

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	III
Wind Speed:	135 mph
Exposure Category:	C
Topographic Factor:	1
Ice Thickness:	2.00 in
Wind Speed with Ice:	50 mph
Seismic Ss:	0.180
Seismic S1:	0.064
Service Wind Speed:	60 mph

Table 1 - Proposed Equipment Configuration

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
94.0	103.3	1	dbspectra	DS2C03P36D-D	2	7/8	-
	94.0	1	mount	4’ Standoff			
72.0	72.0	1	mount	4’ Standoff	-	-	1
60.5	60.5	1	mount	4’ Standoff	-	-	2

Notes:
1) For antenna being relocated to 72.0’ Mount Level, see Table 2.
2) For antenna being relocated to 60.5’ Mount Level, see Table 2.

Table 2 - Other Considered Equipment

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
94.0	100.0	1	kreco	CO-41A	1	7/8	2
	94.0	1	tower mounts	Side Arm Mount [SO 308-1]			
	98.0	1	decibel	DB586-Y	3	7/8	1
	94.0	1	unknown	TMA			
		2	tower mounts	5’ Hor x 3.5” Square Tube			
		1	tower mounts	Pipe Mount [PM 601-1]			
	90.0	1	decibel	DB586-Y			
80.0	83.0	1	telewave	ANT150F2	1	7/8	1
	80.0	2	tower mounts	6' Hor L3.5x3.5x1/4			
		1	tower mounts	Pipe Mount [PM 601-1]			
72.0	78.0	1	kreco	CO-41A	1	7/8	3
	72.0	1	tower mounts	Side Arm Mount [SO 308-1]			
68.0	68.0	1	unknown	2' Yagi	1	3/8	1
61.0	61.0	1	miscl	Small Antenna	1	3/8	1
		1	tower mounts	3.5' Hor 2.5x2.5 Angle			

Notes:
1) Existing Equipment
2) Antenna mount to be removed. Antenna and its coax to be relocated down to Mounting Level 72' (Center Line Elevation = 78') onto proposed standoff arm mount at 72'.
3) Antenna mount to be removed. Antenna and its coax to be relocated down to Mounting Level 60.5' (Center Line Elevation = 66.5') onto proposed standoff arm mount at 60.5'.

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
TOWER STRUCTURAL ANALYSIS REPORTS	Centek Engineering, Inc., dated 10/18/2011	Tower geometry and tower loading	Eversource
TOWER STRUCTURAL ANALYSIS LETTER REPORTS	Centek Engineering, Inc., dated 06/12/2011	Tower loading	Eversource
CONSTRUCTION DRAWINGS	Centek Engineering, Inc., dated 10/18/2011 (Rev.2)	Tower geometry and tower loading	Eversource

3.1) Analysis Method

tnxTower (version 8.0.7.5), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built and maintained in accordance with the manufacturer's specifications.
2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
3) This analysis was performed under the assumption that all information provided to Black & Veatch is current and correct. This is to include site data, appurtenance loading, tower detail, and existing building rooftop data

This analysis may be affected if any assumptions are not valid or have been made in error. Black & Veatch Corp. should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	97.25 - 77.25	Leg	1 1/4	2	-12.88	57.06	22.6	Pass
T2	77.25 - 67.25	Leg	1 1/4	184	-12.97	55.33	23.4	Pass
T3	67.25 - 47.25	Leg	1 1/4	272	-13.15	55.47	23.7	Pass
T4	47.25 - 46	Leg	W6x9	456	-10.74	123.08	15.0	Pass
T1	97.25 - 77.25	Diagonal	7/16	11	-1.44	1.97	73.4	Pass
T2	77.25 - 67.25	Diagonal	7/16	266	-1.45	1.92	75.8	Pass
T3	67.25 - 47.25	Diagonal	7/16	281	-1.29	1.97	65.8	Pass
T1	97.25 - 77.25	Horizontal	7/16	163	-0.59	3.46	17.1	Pass
T2	77.25 - 67.25	Horizontal	7/16	257	-0.55	3.46	15.9	Pass
T3	67.25 - 47.25	Horizontal	7/16	284	-0.49	3.46	14.3	Pass
T1	97.25 - 77.25	Top Girt	7/16	6	-0.02	3.46	0.7	Pass
T2	77.25 - 67.25	Top Girt	7/16	188	-0.40	3.46	11.6	Pass

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T3	67.25 - 47.25	Top Girt	7/16	275	-0.30	3.46	8.7	Pass
T1	97.25 - 77.25	Bottom Girt	7/16	8	-0.42	3.46	12.2	Pass
T2	77.25 - 67.25	Bottom Girt	7/16	190	-0.32	3.46	9.3	Pass
T3	67.25 - 47.25	Bottom Girt	7/16	278	1.75	7.10	24.6	Pass
T1	97.25 - 77.25	Guy A@92.3778	3/8	465	3.75	9.70	38.7	Pass
T3	67.25 - 47.25	Guy A@64.9417	1/4	474	2.08	4.19	49.6	Pass
T1	97.25 - 77.25	Guy B@92.3778	3/8	462	3.38	9.70	34.9	Pass
T3	67.25 - 47.25	Guy B@64.9417	1/4	473	2.21	4.19	52.8	Pass
T1	97.25 - 77.25	Guy C@92.3778	3/8	458	3.78	9.70	39.0	Pass
T3	67.25 - 47.25	Guy C@64.9417	1/4	469	2.25	4.19	53.7	Pass
T1	97.25 - 77.25	Top Guy Pull-Off@92.3778	7/16	153	-0.97	1.78	54.9	Pass
T3	67.25 - 47.25	Top Guy Pull-Off@64.9417	4x3/8	470	1.06	51.03	2.1	Pass
T1	97.25 - 77.25	Torque Arm Top@92.3778	C6x8.2	459	0.36	113.40	21.7	Pass
							Summary	
						Leg (T3)	23.7	Pass
						Diagonal (T2)	75.8	Pass
						Horizontal (T1)	17.1	Pass
						Top Girt (T2)	11.6	Pass
						Bottom Girt (T3)	24.6	Pass
						Guy A (T3)	49.6	Pass
						Guy B (T3)	52.8	Pass
						Guy C (T3)	53.7	Pass
						Top Guy Pull-Off (T1)	54.9	Pass
						Torque Arm Top (T1)	21.7	Pass
						Bolt Checks	8.0	Pass
						RATING =	**75.8**	**Pass**

Structure Rating (max from all components) =	**75.8%**

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity. Rating per TIA-222-H Section 15.5.

4.1) Recommendations

The tower has sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °	*Check**
T1	97.25 - 77.25	0.9378	8	0.23	1.31	OK
T2	77.25 - 67.25	0.9985	3	0.08	1.2	OK
T3	67.25 - 47.25	0.8297	10	0.12	0.9	OK
T4	47.25 - 46	0.0591	10	0.22	0.07	OK

*Limit State Deformation (TIA-222-H Section 2.8.2)

1) Maximum Rotation = 4 Degrees

2) Maximum Deflection = 0.03 * Tower Height = 18 in.

Maximum Tower Deflections - Design Wind

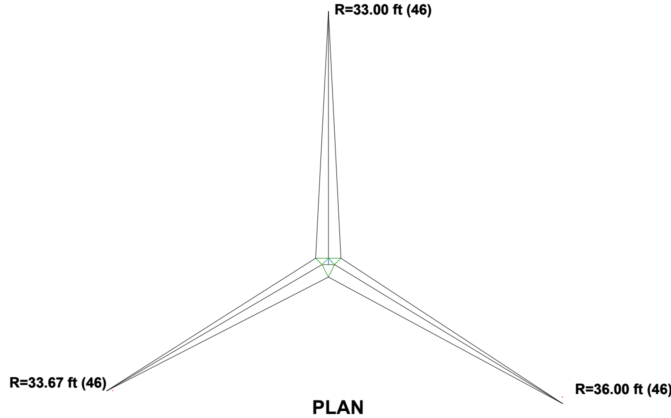
Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °	*Combined Max*	*Check**
T1	97.25 - 77.25	0.5381	33	0.04	0.71	0.711	OK**
T2	77.25 - 67.25	0.5466	29	0.03	0.68	0.681	OK**
T3	67.25 - 47.25	0.4408	29	0.07	0.54	0.545	OK**
T4	47.25 - 46	0.0306	29	0.12	0.04	0.126	OK

*Up to 0.5 degree is considered acceptable per SUB090 Section 7

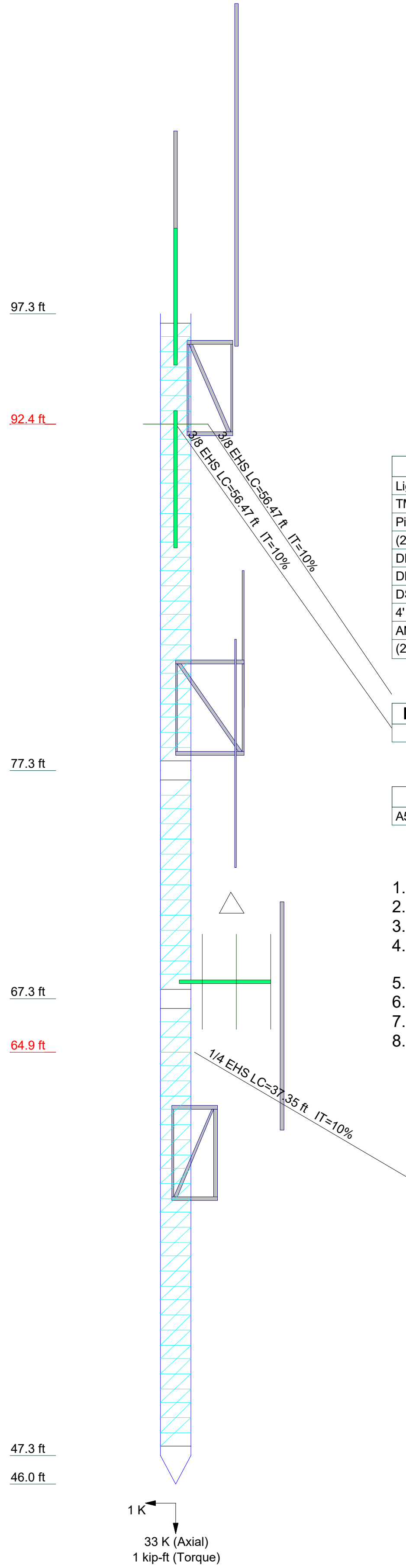
** Deflection approved by Eversource Energy

APPENDIX A

TNXTOWER OUTPUT



Section	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Bottom Girts	Horizontals	Top Guy Pull-Offs	Face Width (ft)	# Panels @ (ft)	Weight (K)
T1								SR 7/16	1.39583	16 @ 1.28194	0.5
T2	SR 1 1/4	A572-50	SR 7/16	A572-50	SR 7/16	SR 7/16	SR 7/16	N.A.		8 @ 1.31845	0.2
T3								4x3/8		16 @ 1.28194	0.4
T4	A		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		B	0.0
											1.1



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lighting Rod 5/8" x 8'	97.25	Pipe Mount [PM 601-1]	80
TMA	94	4' Standoff	72
Pipe Mount [PM 601-1]	94	CO-41A	72
(2) 5' Hor x 3.5" Square Tube	94	2' Yagi	68
DB586-Y	94	1'x2" Mount Pipe	61
DB586-Y	94	Small Antenna	61
DS2C03P36D-D	94	3.5' Hor 2.5x2.5 Angle	61
4' Standoff	94	CO-41A	60.5
ANT150F2	80	4' Standoff	60.5
(2) 6' Hor L3.5x3.5x4	80		

SYMBOL LIST

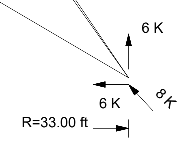
MARK	SIZE	MARK	SIZE
A	W6x9	B	1 @ 1.25

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi			

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 135 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 2.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Risk Category III.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 75.8%



ALL REACTIONS ARE FACTORED

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FAX: (913) 458-8136

Job: ***ES-090 HartfordAWC***		
Project: ***405025***		
Client: Eversource	Drawn by: zan92313	App'd:
Code: TIA-222-H	Date: 10/29/20	Scale: NTS
Path:		Dwg No. E-1

Tower Input Data

The main tower is a 3x guyed tower with an overall height of 97.25 ft above the ground line.
The base of the tower is set at an elevation of 46.00 ft above the ground line.
The face width of the tower is 1.40 ft at the top and tapered at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

1) Tower is located in Hartford County, Connecticut.
2) Tower base elevation above sea level: 82.00 ft.
3) Basic wind speed of 135 mph.
4) Risk Category III.
5) Exposure Category C.
6) Simplified Topographic Factor Procedure for wind speed-up calculations is used.
7) Topographic Category: 1.
8) Crest Height: 0.00 ft.
9) Nominal ice thickness of 2.0000 in.
10) Ice thickness is considered to increase with height.
11) Ice density of 56 pcf.
12) A wind speed of 50 mph is used in combination with ice.
13) Temperature drop of 50 °F.
14) Deflections calculated using a wind speed of 60 mph.
15) Pressures are calculated at each section.
16) Safety factor used in guy design is 0.9524.
17) Stress ratio used in tower member design is 1.05.
18) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

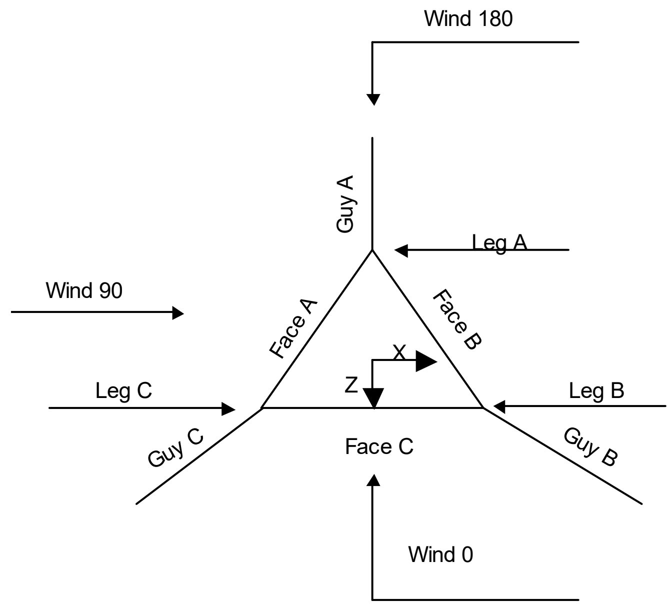
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
Use Code Stress Ratios
Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
√ Leg Bolts Are At Top Of Section
√ Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
SR Members Have Cut Ends
SR Members Are Concentric

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
√ Retension Guys To Initial Tension
√ Bypass Mast Stability Checks
√ Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
√ Autocalc Torque Arm Areas
Add IBC .6D+W Combination
√ Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing
Treat Feed Line Bundles As Cylinder
Ignore KL/ry For 60 Deg. Angle Legs

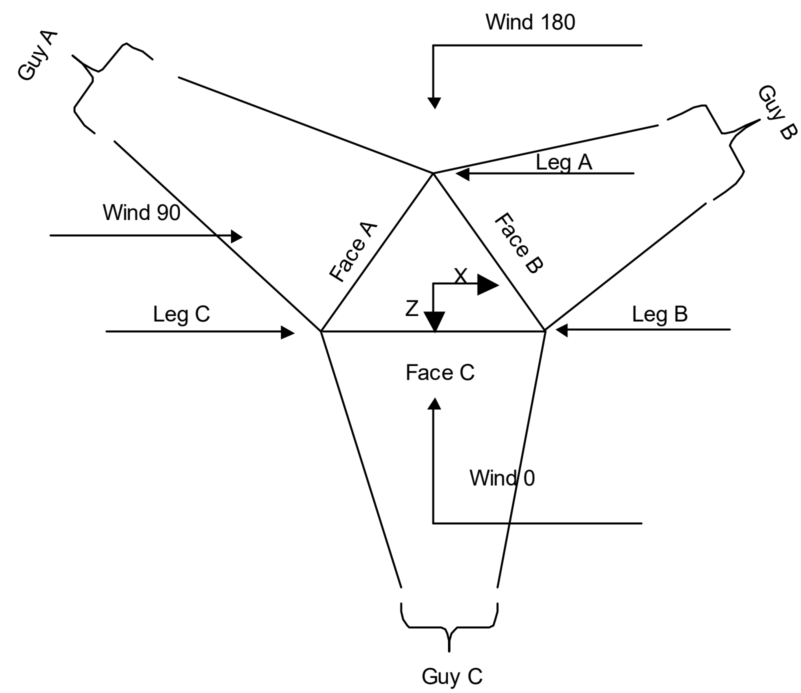
Use ASCE 10 X-Brace Ly Rules
√ Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
√ SR Leg Bolts Resist Compression
All Leg Panels Have Same Allowable
Offset Girt At Foundation
√ Consider Feed Line Torque
√ Include Angle Block Shear Check
Use TIA-222-H Bracing Resist. Exemption
Use TIA-222-H Tension Splice Exemption

Poles

Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets
Pole Without Linear Attachments
Pole With Shroud Or No Appurtenances
Outside and Inside Corner Radii Are Known



Corner & Starmount Guyed Tower



Face Guyed

Tower Section Geometry

Tower Section	*Tower Elevation* *ft*	*Assembly Database*	*Description*	*Section Width* *ft*	*Number of Sections*	*Section Length* *ft*
T1	97.25-77.25			1.40	1	20.00
T2	77.25-67.25			1.40	1	10.00
T3	67.25-47.25			1.40	1	20.00
T4	47.25-46.00			1.40	1	1.25

Tower Section Geometry *(cont'd)*

Tower Section	*Tower Elevation* *ft*	*Diagonal Spacing* *ft*	*Bracing Type*	*Has K Brace End Panels*	*Has Horizontals*	*Top Girt Offset* *in*	*Bottom Girt Offset* *in*
T1	97.25-77.25	1.28	Z Rohn 65	No	Yes	4.6250	4.6250
T2	77.25-67.25	1.32	Z Rohn 65	No	Yes	4.6250	4.6250
T3	67.25-47.25	1.28	Z Rohn 65	No	Yes	4.6250	4.6250
T4	47.25-46.00	1.25	X Brace	No	Yes	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 97.25-77.25	Solid Round	1 1/4	A572-50 (50 ksi)	Solid Round	7/16	A572-50 (50 ksi)
T2 77.25-67.25	Solid Round	1 1/4	A572-50 (50 ksi)	Solid Round	7/16	A572-50 (50 ksi)
T3 67.25-47.25	Solid Round	1 1/4	A572-50 (50 ksi)	Solid Round	7/16	A572-50 (50 ksi)
T4 47.25-46.00	Wide Flange	W6x9	A572-50 (50 ksi)	Solid Round		A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 97.25-77.25	Solid Round	7/16	A572-50 (50 ksi)	Solid Round	7/16	A572-50 (50 ksi)
T2 77.25-67.25	Solid Round	7/16	A572-50 (50 ksi)	Solid Round	7/16	A572-50 (50 ksi)
T3 67.25-47.25	Solid Round	7/16	A572-50 (50 ksi)	Solid Round	7/16	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T1 97.25-77.25	None	Flat Bar		A36 (36 ksi)	Solid Round	7/16	A572-50 (50 ksi)
T2 77.25-67.25	None	Flat Bar		A36 (36 ksi)	Solid Round	7/16	A572-50 (50 ksi)
T3 67.25-47.25	None	Flat Bar		A36 (36 ksi)	Solid Round	7/16	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 97.25-77.25	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T2 77.25-67.25	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T3 67.25-47.25	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T4 47.25-46.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 97.25-77.25	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	0.5 0.5	1 1
T2 77.25-67.25	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	0.5 0.5	1 1
T3 67.25-47.25	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	0.5 0.5	1 1
T4 47.25-46.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	0.5 0.5	1 1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 97.25-77.25	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	0.75	0.0000	1	0.0000	0.75
T2 77.25-67.25	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	0.75	0.0000	1	0.0000	0.75
T3 67.25-47.25	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	0.75	0.0000	1	0.0000	0.75
T4 47.25-46.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	0.75	0.0000	1	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 97.25-77.25	Flange	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 77.25-67.25	Flange	0.5000 A325N	4	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 67.25-47.25	Flange	0.5000 A325N	4	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 47.25-46.00	Flange	0.5000 A325N	4	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Guy Data

Guy Elevation ft	Guy Grade		Guy Size	Initial Tension K	%	Guy Modulus ksi	Guy Weight plf	L_u ft	Anchor Radius ft	Anchor Azimuth Adj. °	Anchor Elevation ft	End Fitting Efficiency %
92.3778	EHS	A	3/8	1.54	10%	23000	0.27	56.43	33.00	0.00	46.00	100%
		B	3/8	1.54	10%	23000	0.27	58.19	36.00	0.00	46.00	100%
		C	3/8	1.54	10%	23000	0.27	56.81	33.67	0.00	46.00	100%
64.9417	EHS	A	1/4	0.67	10%	21000	0.12	37.32	33.00	0.00	46.00	100%
		B	1/4	0.67	10%	21000	0.12	39.93	36.00	0.00	46.00	100%
		C	1/4	0.67	10%	21000	0.12	37.90	33.67	0.00	46.00	100%

Guy Data(cont'd)

Guy Elevation ft	Mount Type	Torque-Arm Spread ft	Torque-Arm Leg Angle °	Torque-Arm Style	Torque-Arm Grade	Torque-Arm Type	Torque-Arm Size
92.3778	Torque Arm	2.79	0.00	Channel	A572-50 (50 ksi)	Channel	C6x8.2
64.9417	Corner						

Guy Data (cont'd)

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
92.38	A572-50 (50 ksi)	Solid Round			No	A36 (36 ksi)	Solid Round	7/16
64.94	A572-50 (50 ksi)	Solid Round			Yes	A36 (36 ksi)	Flat Bar	4x3/8

Guy Data (cont'd)

Guy Elevation ft	Cable Weight A K	Cable Weight B K	Cable Weight C K	Cable Weight D K	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
92.3778	0.02	0.02	0.02		0.28 0.9 sec/pulse	0.30 0.9 sec/pulse	0.29 0.9 sec/pulse	
64.9417	0.00	0.00	0.00		0.13 0.6 sec/pulse	0.14 0.7 sec/pulse	0.13 0.6 sec/pulse	

Guy Data (cont'd)

			Torque Arm		Pull Off		Diagonal	
Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K_x	K_y	K_x	K_y	K_x	K_y
92.3778	No	No	1	1	1	1	1	1
64.9417	No	No			1	1	1	1

Guy Data (cont'd)

	Torque-Arm				Pull Off				Diagonal			
Guy Elevation ft	Bolt Size in	Number	Net Width Deduct in	U	Bolt Size in	Number	Net Width Deduct in	U	Bolt Size in	Number	Net Width Deduct in	U
92.3778	0.5000 A325N	4	0.0000	1	0.0000 A325N	0	0.0000	1	0.6250 A325N	0	0.0000	0.75
64.9417	0.6250 A325N	0	0.0000	0.75	0.0000 A325N	0	0.0000	1	0.6250 A325N	0	0.0000	0.75

Guy Pressures

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
92.3778	A	69.19	46	6	2.4767
	B	69.19	46	6	2.4767
	C	69.19	46	6	2.4767
64.9417	A	55.47	44	6	2.4226
	B	55.47	44	6	2.4226
	C	55.47	44	6	2.4226

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
***													
LDF2-50A(3/8)	C	No	No	Ar (CaAa)	68.00 - 61.00	1.0000	0.45	1	1	0.4400	0.4400		0.08
LDF2-50A(3/8)	C	No	No	Ar (CaAa)	61.00 - 54.00	1.0000	0.45	2	2	0.4400	0.4400		0.08
***													
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	94.00 - 80.00	0.0000	0.35	5	3	0.5000	1.0300		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	80.00 - 72.00	0.0000	0.35	6	3	0.5000	1.0300		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	72.00 - 60.50	0.0000	0.35	7	3	0.5000	1.0300		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	60.50 - 54.00	0.0000	0.35	8	3	0.5000	1.0300		0.33
Proposed													

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
T1	97.25-77.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	8.909	0.000	0.03
T2	77.25-67.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	6.702	0.000	0.02
T3	67.25-47.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	11.114	0.000	0.03
T4	47.25-46.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	*Tower Elevation ft*	*Face or Leg*	*Ice Thickness in*	A_R ft^2	A_F ft^2	C_AA_A *In Face* ft^2	C_AA_A *Out Face* ft^2	*Weight K*
T1	97.25-77.25	A	2.535	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	24.960	0.000	0.38
T2	77.25-67.25	A	2.487	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	15.689	0.000	0.26
T3	67.25-47.25	A	2.430	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	30.897	0.000	0.47
T4	47.25-46.00	A	2.381	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00

Feed Line Center of Pressure

Section	*Elevation ft*	CP_X *in*	CP_Z *in*	CP_X *Ice in*	CP_Z *Ice in*
T1	97.25-77.25	-1.9052	1.4160	0.0000	0.0000
T2	77.25-67.25	-2.1847	2.1188	0.0000	0.0000
T3	67.25-47.25	-1.7213	1.9108	0.0000	0.0000
T4	47.25-46.00	0.0000	0.0000	0.0000	0.0000

Shielding Factor Ka

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	K_a *No Ice*	K_a *Ice*
T1	8	LDF5-50A(7/8)	80.00 - 94.00	0.6000	0.0000
T1	9	LDF5-50A(7/8)	77.25 - 80.00	0.6000	0.0000
T2	5	LDF2-50A(3/8)	67.25 - 68.00	0.6000	0.0000
T2	9	LDF5-50A(7/8)	72.00 - 77.25	0.6000	0.0000
T2	10	LDF5-50A(7/8)	67.25 - 72.00	0.6000	0.0000
T3	5	LDF2-50A(3/8)	61.00 - 67.25	0.6000	0.0000
T3	6	LDF2-50A(3/8)	54.00 - 61.00	0.6000	0.0000
T3	10	LDF5-50A(7/8)	60.50 - 67.25	0.6000	0.0000
T3	11	LDF5-50A(7/8)	54.00 - 60.50	0.6000	0.0000

Discrete Tower Loads

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert ft ft ft*	*Azimuth Adjustment °*	*Placement ft*		C_AA_A *Front* ft^2	C_AA_A *Side* ft^2	*Weight K*
Lighting Rod 5/8" x 8'	A	From Leg	0.00	0.00	97.25	No Ice	0.50	0.50	0.03
			0.00			1/2" Ice	1.31	1.31	0.04
			3.00			1" Ice	2.14	2.14	0.05
						2" Ice	3.61	3.61	0.08
***									
TMA	C	From Face	0.00	0.00	94.00	No Ice	0.92	0.92	0.02
			0.00			1/2" Ice	1.05	1.05	0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00			1" Ice	1.19	1.19	0.04
						2" Ice	1.49	1.49	0.07
***									
Pipe Mount [PM 601-1]	C	From Face	4.30	0.00	94.00	No Ice	1.32	1.32	0.07
			0.00			1/2" Ice	1.58	1.58	0.08
			0.00			1" Ice	1.84	1.84	0.09
						2" Ice	2.40	2.40	0.13
(2) 5' Hor x 3.5" Square Tube	C	From Face	0.00	0.00	94.00	No Ice	1.75	0.10	0.04
			1.80			1/2" Ice	2.11	0.14	0.06
			0.00			1" Ice	2.47	0.19	0.08
						2" Ice	3.22	0.32	0.14
DB586-Y	C	From Face	4.30	0.00	94.00	No Ice	1.01	1.01	0.01
			0.00			1/2" Ice	1.28	1.28	0.02
			4.00			1" Ice	1.56	1.56	0.03
						2" Ice	2.14	2.14	0.06
DB586-Y	C	From Face	4.30	0.00	94.00	No Ice	1.01	1.01	0.01
			0.00			1/2" Ice	1.28	1.28	0.02
			-4.00			1" Ice	1.56	1.56	0.03
						2" Ice	2.14	2.14	0.06
***									
(2) 6' Hor L3.5x3.5x4	B	From Face	0.00	0.00	80.00	No Ice	2.45	0.12	0.03
			2.30			1/2" Ice	2.94	0.17	0.05
			0.00			1" Ice	3.45	0.23	0.08
						2" Ice	4.48	0.37	0.14
Pipe Mount [PM 601-1]	B	From Face	0.00	0.00	80.00	No Ice	1.32	1.32	0.07
			5.30			1/2" Ice	1.58	1.58	0.08
			0.00			1" Ice	1.84	1.84	0.09
						2" Ice	2.40	2.40	0.13
ANT150F2	B	From Face	0.00	0.00	80.00	No Ice	1.23	1.23	0.01
			5.30			1/2" Ice	1.53	1.53	0.02
			3.00			1" Ice	1.84	1.84	0.04
						2" Ice	2.49	2.49	0.07
***									
4' Standoff	A	From Leg	0.00	0.00	72.00	No Ice	0.88	3.72	0.09
			2.30			1/2" Ice	1.19	4.96	0.14
			0.00			1" Ice	1.51	5.95	0.19
						2" Ice	2.17	8.02	0.32
CO-41A	A	From Face	0.00	0.00	72.00	No Ice	3.15	3.15	0.01
			6.00			1/2" Ice	4.38	4.38	0.04
			6.00			1" Ice	5.63	5.63	0.07
						2" Ice	7.77	7.77	0.15
***									
2' Yagi	B	From Leg	0.00	0.00	68.00	No Ice	1.29	1.29	0.03
			1.00			1/2" Ice	1.68	1.68	0.03
			0.00			1" Ice	2.06	2.06	0.04
						2" Ice	2.84	2.84	0.06
***									
3.5' Hor 2.5x2.5 Angle	B	From Face	0.00	0.00	61.00	No Ice	0.88	0.05	0.04
			-1.00			1/2" Ice	1.13	0.08	0.05
			0.00			1" Ice	1.38	0.12	0.06
						2" Ice	1.92	0.22	0.10
Small Antenna	A	From Leg	0.50	0.00	61.00	No Ice	0.60	0.41	0.01
			-2.00			1/2" Ice	0.70	0.50	0.02
			0.50			1" Ice	0.81	0.59	0.02
						2" Ice	1.06	0.81	0.04
1'x2" Mount Pipe	A	From Leg	0.50	0.00	61.00	No Ice	0.15	0.15	0.00
			-2.00			1/2" Ice	0.22	0.22	0.01
			0.50			1" Ice	0.30	0.30	0.01
						2" Ice	0.50	0.50	0.02
***									
Proposed									
DS2C03P36D-D	B	From Face	0.00	0.00	94.00	No Ice	5.82	5.82	0.08
			4.70			1/2" Ice	7.80	7.80	0.12
			9.30			1" Ice	9.79	9.79	0.17
						2" Ice	13.82	13.82	0.32

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
4' Standoff	B	From Face	0.00	0.00	94.00	No Ice	0.88	3.72	0.09
			2.30			1/2" Ice	1.19	4.96	0.14
			0.00			1" Ice	1.51	5.95	0.19
						2" Ice	2.17	8.02	0.32
***Relocated 49.2MHz Kreco at 72'**									
CO-41A	A	From Leg	0.00	0.00	60.50	No Ice	3.15	3.15	0.01
			4.70			1/2" Ice	4.38	4.38	0.04
			6.00			1" Ice	5.63	5.63	0.07
						2" Ice	7.77	7.77	0.15
4' Standoff	A	From Face	0.00	0.00	60.50	No Ice	0.88	3.72	0.09
			2.30			1/2" Ice	1.19	4.96	0.14
			0.00			1" Ice	1.51	5.95	0.19
						2" Ice	2.17	8.02	0.32
***									

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.0 Wind 30 deg - No Ice+1.0 Guy
4	1.2 Dead+1.0 Wind 60 deg - No Ice+1.0 Guy
5	1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy
6	1.2 Dead+1.0 Wind 120 deg - No Ice+1.0 Guy
7	1.2 Dead+1.0 Wind 150 deg - No Ice+1.0 Guy
8	1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy
9	1.2 Dead+1.0 Wind 210 deg - No Ice+1.0 Guy
10	1.2 Dead+1.0 Wind 240 deg - No Ice+1.0 Guy
11	1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy
12	1.2 Dead+1.0 Wind 300 deg - No Ice+1.0 Guy
13	1.2 Dead+1.0 Wind 330 deg - No Ice+1.0 Guy
14	1.2 Dead+1.0 Ice+1.0 Temp+Guy
15	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy
16	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy
17	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy
18	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy
19	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy
20	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy
21	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy
22	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy
23	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy
24	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy
25	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy
26	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy
27	Dead+Wind 0 deg - Service+Guy
28	Dead+Wind 30 deg - Service+Guy
29	Dead+Wind 60 deg - Service+Guy
30	Dead+Wind 90 deg - Service+Guy
31	Dead+Wind 120 deg - Service+Guy
32	Dead+Wind 150 deg - Service+Guy
33	Dead+Wind 180 deg - Service+Guy
34	Dead+Wind 210 deg - Service+Guy
35	Dead+Wind 240 deg - Service+Guy
36	Dead+Wind 270 deg - Service+Guy
37	Dead+Wind 300 deg - Service+Guy
38	Dead+Wind 330 deg - Service+Guy

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	97.25 - 77.25	Leg	Max Tension	21	4.09	-0.00	-0.01
			Max. Compression	25	-12.88	0.00	-0.00
			Max. Mx	11	-3.12	0.17	-0.00
			Max. My	4	-3.06	-0.12	0.18
			Max. Vy	11	0.46	0.17	-0.00
			Max. Vx	11	0.38	0.00	0.00
		Diagonal	Max Tension	5	1.46	0.00	0.00
			Max. Compression	11	-1.44	0.00	0.00
			Max. Mx	15	-0.02	0.00	0.00
			Max. My	17	0.00	0.00	-0.00
			Max. Vy	15	-0.01	0.00	0.00
			Max. Vx	17	0.00	0.00	0.00
		Horizontal	Max Tension	11	0.68	0.00	0.00
			Max. Compression	5	-0.59	0.00	0.00
			Max. Mx	22	0.24	0.00	0.00
			Max. My	16	-0.13	0.00	-0.00
			Max. Vy	22	0.01	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Top Girt	Max Tension	17	0.02	0.00	0.00
			Max. Compression	23	-0.02	0.00	0.00
			Max. Mx	20	-0.01	0.00	0.00
			Max. My	16	-0.01	0.00	-0.00
			Max. Vy	20	0.01	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Bottom Girt	Max Tension	11	0.53	0.00	0.00
			Max. Compression	5	-0.42	0.00	0.00
			Max. Mx	24	0.36	0.00	0.00
			Max. My	16	0.01	0.00	-0.00
			Max. Vy	24	0.01	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Guy A	Bottom Tension	21	3.34		
			Top Tension	21	3.75		
			Top Cable Vert	21	3.19		
			Top Cable Norm	21	1.97		
			Top Cable Tan	21	0.00		
			Bot Cable Vert	21	-2.62		
			Bot Cable Norm	21	2.07		
			Bot Cable Tan	21	0.00		
		Guy B	Bottom Tension	25	2.97		
			Top Tension	25	3.38		
			Top Cable Vert	25	2.82		
			Top Cable Norm	25	1.87		
			Top Cable Tan	25	0.00		
			Bot Cable Vert	25	-2.24		
			Bot Cable Norm	25	1.96		
			Bot Cable Tan	25	0.00		
		Guy C	Bottom Tension	17	3.37		
			Top Tension	17	3.78		
			Top Cable Vert	17	3.20		
			Top Cable Norm	17	2.02		
			Top Cable Tan	17	0.00		
			Bot Cable Vert	17	-2.63		
			Bot Cable Norm	17	2.11		
			Bot Cable Tan	17	0.00		
		Top Guy Pull-Off	Max Tension	12	1.01	0.00	0.00
			Max. Compression	6	-0.97	0.00	0.00
			Max. Mx	16	-0.21	0.00	0.00
			Max. My	16	0.30	0.00	-0.00
			Max. Vy	16	0.01	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Torque Arm Top	Max Tension	4	1.88	-1.69	0.00
			Max. Compression	5	-0.72	0.00	0.00
			Max. Mx	21	0.25	-4.36	0.00
			Max. My	16	0.32	-4.09	0.00
			Max. Vy	21	3.15	-4.36	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vx	16	0.00	-4.09	0.00
T2	77.25 - 67.25	Leg	Max Tension	10	3.19	0.05	0.08
			Max. Compression	17	-12.97	0.00	-0.01
			Max. Mx	11	-3.12	-0.18	-0.01
			Max. My	11	2.28	0.06	0.15
			Max. Vy	11	0.46	-0.00	-0.01
			Max. Vx	11	0.38	0.07	-0.14
		Diagonal	Max Tension	5	1.17	0.00	0.00
			Max. Compression	11	-1.45	0.00	0.00
			Max. Mx	17	-0.11	0.00	0.00
			Max. My	16	-0.22	0.00	-0.00
			Max. Vy	17	-0.01	0.00	0.00
			Max. Vx	16	0.00	0.00	0.00
		Horizontal	Max Tension	11	0.68	0.00	0.00
			Max. Compression	5	-0.55	0.00	0.00
			Max. Mx	24	0.13	0.00	0.00
			Max. My	15	0.04	0.00	-0.00
			Max. Vy	24	-0.01	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Top Girt	Max Tension	11	0.51	0.00	0.00
			Max. Compression	5	-0.40	0.00	0.00
			Max. Mx	24	0.33	0.00	0.00
			Max. My	16	0.05	0.00	-0.00
			Max. Vy	24	-0.01	0.00	0.00
			Max. Vx	16	0.00	0.00	0.00
		Bottom Girt	Max Tension	10	0.43	0.00	0.00
			Max. Compression	4	-0.32	0.00	0.00
			Max. Mx	24	0.23	0.00	0.00
			Max. My	16	0.24	0.00	-0.00
			Max. Vy	24	-0.01	0.00	0.00
			Max. Vx	16	0.00	0.00	0.00
T3	67.25 - 47.25	Leg	Max Tension	10	0.22	0.00	0.00
			Max. Compression	25	-13.15	-0.00	-0.00
			Max. Mx	25	-11.32	0.60	0.34
			Max. My	21	-11.27	-0.02	-0.67
			Max. Vy	24	-2.06	0.59	0.33
			Max. Vx	21	2.26	-0.02	-0.67
		Diagonal	Max Tension	2	1.02	0.00	0.00
			Max. Compression	8	-1.29	0.00	0.00
			Max. Mx	26	0.33	0.00	0.00
			Max. My	15	-0.36	0.00	-0.00
			Max. Vy	26	0.01	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Horizontal	Max Tension	8	0.64	0.00	0.00
			Max. Compression	2	-0.49	0.00	0.00
			Max. Mx	23	0.16	0.00	0.00
			Max. My	16	0.04	0.00	-0.00
			Max. Vy	23	0.01	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Top Girt	Max Tension	8	0.42	0.00	0.00
			Max. Compression	3	-0.30	0.00	0.00
			Max. Mx	24	0.06	0.00	0.00
			Max. My	16	0.20	0.00	-0.00
			Max. Vy	24	0.01	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Bottom Girt	Max Tension	21	1.75	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	15	1.49	0.00	0.00
			Max. Vy	15	0.01	0.00	0.00
			Max. Vx	22	-0.00	0.00	0.00
		Guy A	Bottom Tension	21	1.93		
			Top Tension	21	2.08		
			Top Cable Vert	21	1.17		
			Top Cable Norm	21	1.72		
			Top Cable Tan	21	0.00		
			Bot Cable Vert	21	-0.85		
			Bot Cable Norm	21	1.73		
			Bot Cable Tan	21	0.00		
		Guy B	Bottom Tension	25	2.06		

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Top Tension	25	2.21		
			Top Cable Vert	25	1.18		
			Top Cable Norm	25	1.87		
			Top Cable Tan	25	0.00		
			Bot Cable Vert	25	-0.84		
			Bot Cable Norm	25	1.88		
			Bot Cable Tan	25	0.00		
		Guy C	Bottom Tension	17	2.10		
			Top Tension	17	2.25		
			Top Cable Vert	17	1.24		
			Top Cable Norm	17	1.87		
			Top Cable Tan	17	0.00		
			Bot Cable Vert	17	-0.92		
			Bot Cable Norm	17	1.88		
			Bot Cable Tan	17	0.00		
		Top Guy Pull-Off	Max Tension	15	1.06	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	14	0.82	0.01	0.00
			Max. My	16	0.82	0.00	-0.00
			Max. Vy	14	0.02	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
T4	47.25 - 46	Leg	Max Tension	1	0.00	0.00	0.00
			Max. Compression	25	-10.83	5.56	0.08
			Max. Mx	20	-10.68	5.66	0.39
			Max. My	8	-3.56	2.17	0.58
			Max. Vy	21	-4.26	5.65	0.40
			Max. Vx	8	-0.39	2.17	0.58

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Mast	Max. Vert	19	32.79	-0.18	-0.14
	Max. H_x	11	12.06	0.47	-0.04
	Max. H_z	2	12.10	-0.01	0.48
	Max. M_x	1	0.00	0.01	0.00
	Max. M_z	1	0.00	0.01	0.00
	Max. Torsion	8	0.83	0.05	-0.41
	Min. Vert	1	10.56	0.01	0.00
	Min. H_x	5	12.19	-0.42	0.02
	Min. H_z	8	12.18	0.05	-0.41
	Min. M_x	1	0.00	0.01	0.00
	Min. M_z	1	0.00	0.01	0.00
	Min. Torsion	2	-0.54	-0.01	0.48
Guy C @ 33.67 ft Elev 46 ft Azimuth 240 deg	Max. Vert	10	-1.20	-0.70	0.41
	Max. H_x	10	-1.20	-0.70	0.41
	Max. H_z	16	-5.75	-4.95	2.95
	Min. Vert	17	-5.91	-5.12	2.94
	Min. H_x	17	-5.91	-5.12	2.94
	Min. H_z	10	-1.20	-0.70	0.41
Guy B @ 36 ft Elev 46 ft Azimuth 120 deg	Max. Vert	6	-1.03	0.65	0.38
	Max. H_x	25	-5.26	4.98	2.88
	Max. H_z	26	-5.11	4.81	2.88
	Min. Vert	25	-5.26	4.98	2.88
	Min. H_x	6	-1.03	0.65	0.38
	Min. H_z	6	-1.03	0.65	0.38
Guy A @ 33 ft Elev 46 ft Azimuth 0 deg	Max. Vert	2	-1.13	0.01	-0.74
	Max. H_x	24	-4.75	0.21	-4.55

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Max. H_z	2	-1.13	0.01	-0.74
	Min. Vert	21	-6.08	-0.00	-5.84
	Min. H_x	18	-4.74	-0.21	-4.53
	Min. H_z	21	-6.08	-0.00	-5.84

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	10.56	-0.01	-0.00	0.00	0.00	-0.13
1.2 Dead+1.0 Wind 0 deg - No Ice+1.0 Guy	12.10	0.01	-0.48	0.00	0.00	0.54
1.2 Dead+1.0 Wind 30 deg - No Ice+1.0 Guy	12.21	0.22	-0.41	0.00	0.00	0.47
1.2 Dead+1.0 Wind 60 deg - No Ice+1.0 Guy	12.24	0.36	-0.24	0.00	0.00	0.23
1.2 Dead+1.0 Wind 90 deg - No Ice+1.0 Guy	12.19	0.42	-0.02	0.00	0.00	-0.12
1.2 Dead+1.0 Wind 120 deg - No Ice+1.0 Guy	12.09	0.37	0.20	0.00	0.00	-0.46
1.2 Dead+1.0 Wind 150 deg - No Ice+1.0 Guy	12.11	0.19	0.35	0.00	0.00	-0.71
1.2 Dead+1.0 Wind 180 deg - No Ice+1.0 Guy	12.18	-0.05	0.41	0.00	0.00	-0.83
1.2 Dead+1.0 Wind 210 deg - No Ice+1.0 Guy	12.27	-0.29	0.38	0.00	0.00	-0.76
1.2 Dead+1.0 Wind 240 deg - No Ice+1.0 Guy	12.21	-0.46	0.26	0.00	0.00	-0.51
1.2 Dead+1.0 Wind 270 deg - No Ice+1.0 Guy	12.06	-0.47	0.04	0.00	0.00	-0.15
1.2 Dead+1.0 Wind 300 deg - No Ice+1.0 Guy	11.94	-0.38	-0.19	0.00	0.00	0.19
1.2 Dead+1.0 Wind 330 deg - No Ice+1.0 Guy	11.96	-0.21	-0.38	0.00	0.00	0.43
1.2 Dead+1.0 Ice+1.0 Temp+Guy	32.29	-0.09	-0.00	0.00	0.00	-0.32
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.70	-0.08	-0.31	0.00	0.00	-0.02
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.72	0.05	-0.27	0.00	0.00	-0.07
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.70	0.16	-0.15	0.00	0.00	-0.20
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.73	0.21	-0.00	0.00	0.00	-0.37
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.79	0.18	0.14	0.00	0.00	-0.51
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.73	0.06	0.24	0.00	0.00	-0.59
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.70	-0.10	0.28	0.00	0.00	-0.63
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.72	-0.25	0.25	0.00	0.00	-0.58
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.70	-0.36	0.16	0.00	0.00	-0.44
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.57	-0.38	0.02	0.00	0.00	-0.27
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.49	-0.33	-0.14	0.00	0.00	-0.13
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy	32.57	-0.22	-0.26	0.00	0.00	-0.05
Dead+Wind 0 deg - Service+Guy	10.59	-0.01	-0.09	0.00	0.00	0.00
Dead+Wind 30 deg - Service+Guy	10.59	0.04	-0.07	0.00	0.00	-0.01

Load Combination	*Vertical* K	*Shear$_x$* K	*Shear$_z$* K	*Overturning Moment, M$_x$* kip-ft	*Overturning Moment, M$_z$* kip-ft	*Torque* kip-ft
Dead+Wind 60 deg - Service+Guy	10.59	0.06	-0.04	0.00	0.00	-0.06
Dead+Wind 90 deg - Service+Guy	10.59	0.07	-0.00	0.00	0.00	-0.13
Dead+Wind 120 deg - Service+Guy	10.60	0.06	0.04	0.00	0.00	-0.20
Dead+Wind 150 deg - Service+Guy	10.60	0.03	0.07	0.00	0.00	-0.24
Dead+Wind 180 deg - Service+Guy	10.60	-0.02	0.08	0.00	0.00	-0.26
Dead+Wind 210 deg - Service+Guy	10.60	-0.06	0.07	0.00	0.00	-0.24
Dead+Wind 240 deg - Service+Guy	10.59	-0.09	0.05	0.00	0.00	-0.19
Dead+Wind 270 deg - Service+Guy	10.59	-0.10	0.00	0.00	0.00	-0.12
Dead+Wind 300 deg - Service+Guy	10.58	-0.08	-0.04	0.00	0.00	-0.06
Dead+Wind 330 deg - Service+Guy	10.58	-0.05	-0.07	0.00	0.00	-0.01

Solution Summary

	Sum of Applied Forces			*Sum of Reactions*			
Load Comb.	*PX* K	*PY* K	*PZ* K	*PX* K	*PY* K	*PZ* K	*% Error*
1	0.00	-2.11	0.00	0.00	2.11	0.00	0.010%
2	0.09	-2.53	-3.67	-0.09	2.53	3.67	0.003%
3	1.87	-2.51	-3.18	-1.87	2.51	3.18	0.002%
4	3.09	-2.49	-1.86	-3.09	2.49	1.86	0.002%
5	3.49	-2.51	-0.09	-3.49	2.51	0.09	0.001%
6	3.02	-2.52	1.71	-3.02	2.52	-1.71	0.002%
7	1.71	-2.50	3.09	-1.71	2.50	-3.09	0.001%
8	-0.09	-2.49	3.64	0.09	2.49	-3.64	0.001%
9	-1.87	-2.51	3.18	1.87	2.51	-3.18	0.002%
10	-3.12	-2.53	1.88	3.12	2.53	-1.88	0.003%
11	-3.49	-2.51	0.09	3.49	2.51	-0.09	0.002%
12	-3.00	-2.49	-1.70	3.00	2.49	1.70	0.003%
13	-1.71	-2.51	-3.09	1.71	2.51	3.09	0.001%
14	0.00	-19.24	-0.00	0.00	19.24	0.00	0.002%
15	0.03	-19.28	-2.55	-0.03	19.28	2.55	0.001%
16	1.29	-19.24	-2.23	-1.29	19.24	2.23	0.001%
17	2.20	-19.19	-1.30	-2.20	19.19	1.30	0.001%
18	2.52	-19.23	-0.03	-2.52	19.23	0.03	0.001%
19	2.17	-19.27	1.25	-2.17	19.27	-1.25	0.002%
20	1.24	-19.23	2.19	-1.24	19.23	-2.19	0.001%
21	-0.03	-19.19	2.55	0.03	19.19	-2.55	0.001%
22	-1.29	-19.24	2.23	1.29	19.24	-2.22	0.001%
23	-2.20	-19.28	1.30	2.20	19.28	-1.30	0.001%
24	-2.52	-19.24	0.03	2.52	19.24	-0.03	0.001%
25	-2.17	-19.20	-1.25	2.17	19.20	1.25	0.001%
26	-1.24	-19.24	-2.19	1.24	19.24	2.19	0.001%
27	0.02	-2.11	-0.72	-0.02	2.11	0.72	0.003%
28	0.37	-2.11	-0.63	-0.37	2.11	0.63	0.003%
29	0.61	-2.10	-0.37	-0.61	2.10	0.37	0.003%
30	0.69	-2.11	-0.02	-0.69	2.11	0.02	0.002%
31	0.60	-2.11	0.34	-0.60	2.11	-0.34	0.006%
32	0.34	-2.11	0.61	-0.34	2.11	-0.61	0.004%
33	-0.02	-2.10	0.72	0.02	2.10	-0.72	0.005%
34	-0.37	-2.11	0.63	0.37	2.11	-0.63	0.006%
35	-0.62	-2.11	0.37	0.62	2.11	-0.37	0.002%
36	-0.69	-2.11	0.02	0.69	2.11	-0.02	0.003%
37	-0.59	-2.10	-0.34	0.59	2.10	0.34	0.003%
38	-0.34	-2.11	-0.61	0.34	2.11	0.61	0.003%

Non-Linear Convergence Results

Load Combination	*Converged?*	*Number of Cycles*	*Displacement Tolerance*	*Force Tolerance*
1	Yes	8	0.00000001	0.00007249
2	Yes	15	0.00000001	0.00009305
3	Yes	15	0.00000001	0.00006110
4	Yes	13	0.00000001	0.00004354
5	Yes	15	0.00000001	0.00004625
6	Yes	15	0.00000001	0.00007197
7	Yes	15	0.00000001	0.00003999
8	Yes	13	0.00000001	0.00003347
9	Yes	15	0.00000001	0.00006595
10	Yes	15	0.00000001	0.00010000
11	Yes	15	0.00000001	0.00005420
12	Yes	12	0.00000001	0.00008884
13	Yes	15	0.00000001	0.00004440
14	Yes	12	0.00000001	0.00009627
15	Yes	14	0.00000001	0.00006436
16	Yes	14	0.00000001	0.00004604
17	Yes	14	0.00000001	0.00004580
18	Yes	14	0.00000001	0.00007691
19	Yes	14	0.00000001	0.00009796
20	Yes	14	0.00000001	0.00008122
21	Yes	14	0.00000001	0.00005059
22	Yes	13	0.00000001	0.00008976
23	Yes	14	0.00000001	0.00004842
24	Yes	13	0.00000001	0.00009112
25	Yes	13	0.00000001	0.00007323
26	Yes	14	0.00000001	0.00005204
27	Yes	10	0.00000001	0.00005108
28	Yes	10	0.00000001	0.00005168
29	Yes	10	0.00000001	0.00005101
30	Yes	10	0.00000001	0.00004224
31	Yes	9	0.00000001	0.00008587
32	Yes	9	0.00000001	0.00006627
33	Yes	9	0.00000001	0.00007425
34	Yes	9	0.00000001	0.00009223
35	Yes	10	0.00000001	0.00004300
36	Yes	10	0.00000001	0.00004637
37	Yes	10	0.00000001	0.00004957
38	Yes	10	0.00000001	0.00004931

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	97.25 - 77.25	0.2077	33	0.03	0.25
T2	77.25 - 67.25	0.1801	29	0.02	0.23
T3	67.25 - 47.25	0.1454	28	0.02	0.20
T4	47.25 - 46	0.0100	28	0.04	0.02

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
97.25	Lighting Rod 5/8" x 8'	33	0.2077	0.03	0.25	74974
94.00	TMA	33	0.1981	0.02	0.25	74974

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
92.38	Guy	33	0.1933	0.02	0.25	74974
80.00	(2) 6' Hor L3.5x3.5x4	29	0.1825	0.02	0.24	21952
72.00	4' Standoff	28	0.1664	0.02	0.22	27978
68.00	2' Yagi	28	0.1491	0.02	0.20	38179
64.94	Guy	28	0.1331	0.03	0.18	42879
61.00	3.5' Hor 2.5x2.5 Angle	28	0.1097	0.03	0.14	51543
60.50	CO-41A	28	0.1065	0.03	0.13	52926

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	97.25 - 77.25	0.9378	8	0.23	1.31
T2	77.25 - 67.25	0.9985	3	0.08	1.20
T3	67.25 - 47.25	0.8297	10	0.12	0.90
T4	47.25 - 46	0.0591	10	0.22	0.07

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
97.25	Lighting Rod 5/8" x 8'	8	0.9378	0.23	1.31	18656
94.00	TMA	8	0.9447	0.21	1.32	18656
92.38	Guy	8	0.9473	0.20	1.32	18656
80.00	(2) 6' Hor L3.5x3.5x4	3	1.0106	0.10	1.25	5455
72.00	4' Standoff	10	0.9334	0.05	1.05	6102
68.00	2' Yagi	10	0.8487	0.10	0.92	6091
64.94	Guy	10	0.7654	0.22	0.83	6456
61.00	3.5' Hor 2.5x2.5 Angle	10	0.6374	0.43	0.67	7918
60.50	CO-41A	10	0.6197	0.46	0.65	8165

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	97.25	Torque Arm Top@92.3778	A325N	0.5000	4	0.47	8.84	0.053	1.05	Bolt Shear
T2	77.25	Leg	A325N	0.5000	4	1.07	12.77	0.084	1.05	Bolt Tension
T3	67.25	Leg	A325N	0.5000	4	1.01	12.77	0.079	1.05	Bolt Tension
T4	47.25	Leg	A325N	0.5000	4	0.90	12.77	0.071	1.05	Bolt Tension

Guy Design Data

Section No.	Elevation ft	Size	Initial Tension K	Breaking Load K	Actual T_u K	Allowable ϕT_n K	Required S.F.	Actual S.F.
T1	92.38 (A) (465)	3/8 EHS	1.54	15.40	3.75	9.70	0.952	2.463
	92.38 (A) (466)	3/8 EHS	1.54	15.40	3.73	9.70	0.952	2.479
	92.38 (B) (461)	3/8 EHS	1.54	15.40	3.31	9.70	0.952	2.789
	92.38 (B) (462)	3/8 EHS	1.54	15.40	3.38	9.70	0.952	2.730
	92.38 (C) (457)	3/8 EHS	1.54	15.40	3.45	9.70	0.952	2.676
	92.38 (C) (458)	3/8 EHS	1.54	15.40	3.78	9.70	0.952	2.443
T3	64.94 (A) (474)	1/4 EHS	0.67	6.65	2.08	4.19	0.952	1.919
	64.94 (B) (473)	1/4 EHS	0.67	6.65	2.21	4.19	0.952	1.804
	64.94 (C) (469)	1/4 EHS	0.67	6.65	2.25	4.19	0.952	1.775

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	1 1/4	20.00	0.39	14.8 K=1.00	1.2272	-12.88	54.35	0.237 [1]
T2	77.25 - 67.25	1 1/4	10.00	0.66	25.3 K=1.00	1.2272	-12.97	52.70	0.246 [1]
T3	67.25 - 47.25	1 1/4	20.00	0.64	24.6 K=1.00	1.2272	-13.15	52.83	0.249 [1]
T4	47.25 - 46	W6x9	1.49	1.49	19.7 K=1.00	2.6800	-10.83	117.22	0.092 [1]

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	7/16	1.90	1.75	134.7 K=0.70	0.1503	-1.44	1.87	0.771 [1]
T2	77.25 - 67.25	7/16	1.92	1.78	136.5 K=0.70	0.1503	-1.45	1.82	0.796 [1]
T3	67.25 - 47.25	7/16	1.90	1.75	134.7 K=0.70	0.1503	-1.29	1.87	0.691 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.59	3.29	0.179 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	77.25 - 67.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.55	3.29	0.167 [1]
T3	67.25 - 47.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.49	3.29	0.150 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.02	3.29	0.007 [1]
T2	77.25 - 67.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.40	3.29	0.122 [1]
T3	67.25 - 47.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.30	3.29	0.091 [1]

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.42	3.29	0.128 [1]
T2	77.25 - 67.25	7/16	1.40	1.29	99.2 K=0.70	0.1503	-0.32	3.29	0.097 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	7/16	1.40	1.29	141.7 K=1.00	0.1503	-0.97	1.69	0.576 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	97.25 - 77.25	7/16	0.00	0.04	0.000	0.00	0.04	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	97.25 - 77.25	7/16	0.576	0.000	0.000	0.576 [1]	1.050	4.8.1

[1] P_u / ϕP_n controls

Torque-Arm Top Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25 (459)	C6x8.2	1.39	1.34	30.0 K=1.00	2.4000	-0.07	101.12	0.001
T1	97.25 - 77.25 (460)	C6x8.2	1.39	1.34	30.0 K=1.00	2.4000	-0.06	101.12	0.001
T1	97.25 - 77.25 (463)	C6x8.2	1.39	1.34	30.0 K=1.00	2.4000	-0.35	101.12	0.003
T1	97.25 - 77.25 (464)	C6x8.2	1.39	1.34	30.0 K=1.00	2.4000	-0.65	101.12	0.006
T1	97.25 - 77.25 (467)	C6x8.2	1.39	1.34	30.0 K=1.00	2.4000	-0.00	101.12	0.000
T1	97.25 - 77.25 (468)	C6x8.2	1.39	1.34	30.0 K=1.00	2.4000	-0.45	101.12	0.004

Torque-Arm Top Bending Design Data

Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	97.25 - 77.25 (459)	C6x8.2	-3.23	19.24	0.168	0.00	2.77	0.000
T1	97.25 - 77.25 (460)	C6x8.2	-2.82	19.24	0.147	0.00	2.77	0.000
T1	97.25 - 77.25 (463)	C6x8.2	-2.82	19.24	0.146	0.00	2.77	0.000
T1	97.25 - 77.25 (464)	C6x8.2	-3.05	19.24	0.159	0.00	2.77	0.000
T1	97.25 - 77.25 (467)	C6x8.2	-2.87	19.24	0.149	0.00	2.77	0.000
T1	97.25 - 77.25 (468)	C6x8.2	-3.26	19.24	0.169	-0.00	2.77	0.000

Torque-Arm Top Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	97.25 - 77.25 (459)	C6x8.2	0.001	0.168	0.000	0.168	1.050	4.8.1
T1	97.25 - 77.25 (460)	C6x8.2	0.001	0.147	0.000	0.147	1.050	4.8.1

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	97.25 - 77.25 (463)	C6x8.2	0.003	0.146	0.000	0.148	1.050	4.8.1
T1	97.25 - 77.25 (464)	C6x8.2	0.006	0.159	0.000	0.162	1.050	4.8.1
T1	97.25 - 77.25 (467)	C6x8.2	0.000	0.149	0.000	0.149	1.050	4.8.1
T1	97.25 - 77.25 (468)	C6x8.2	0.004	0.169	0.000	0.171	1.050	4.8.1

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	1 1/4	20.00	0.64	24.6	1.2272	4.09	55.22	0.074 [1]
T2	77.25 - 67.25	1 1/4	10.00	0.66	25.3	1.2272	3.19	55.22	0.058 [1]
T3	67.25 - 47.25	1 1/4	20.00	0.64	24.6	1.2272	0.22	55.22	0.004 [1]

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	7/16	1.90	1.75	192.4	0.1503	1.46	6.76	0.215 [1]
T2	77.25 - 67.25	7/16	1.92	1.78	194.9	0.1503	1.17	6.76	0.173 [1]
T3	67.25 - 47.25	7/16	1.90	1.75	192.4	0.1503	1.02	6.76	0.151 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25	7/16	1.40	1.29	141.7	0.1503	0.68	6.76	0.100 [1]
T2	77.25 - 67.25	7/16	1.40	1.29	141.7	0.1503	0.68	6.76	0.100 [1]
T3	67.25 - 47.25	7/16	1.40	1.29	141.7	0.1503	0.64	6.76	0.095 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio P_u / ϕP_n
T1	97.25 - 77.25	7/16	1.40	1.29	141.7	0.1503	0.02	6.76	0.003 [1]
T2	77.25 - 67.25	7/16	1.40	1.29	141.7	0.1503	0.51	6.76	0.076 [1]
T3	67.25 - 47.25	7/16	1.40	1.29	141.7	0.1503	0.42	6.76	0.062 [1]

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio P_u / ϕP_n
T1	97.25 - 77.25	7/16	1.40	1.29	141.7	0.1503	0.53	6.76	0.078 [1]
T2	77.25 - 67.25	7/16	1.40	1.29	141.7	0.1503	0.43	6.76	0.064 [1]
T3	67.25 - 47.25	7/16	1.40	1.29	141.7	0.1503	1.75	6.76	0.258 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio P_u / ϕP_n
T1	97.25 - 77.25	7/16	1.40	1.29	141.7	0.1503	1.01	4.87	0.207 [1]
T3	67.25 - 47.25	4x3/8	1.40	1.29	143.2	1.5000	1.06	48.60	0.022 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio M_{ux} / ϕM_{nx}	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio M_{uy} / ϕM_{ny}
T1	97.25 - 77.25	7/16	0.00	0.04	0.000	0.00	0.04	0.000
T3	67.25 - 47.25	4x3/8	0.00	4.05	0.000	0.00	0.38	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio P_u / ϕP_n	Ratio M_{ux} / ϕM_{nx}	Ratio M_{uy} / ϕM_{ny}	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	97.25 - 77.25	7/16	0.207	0.000	0.000	0.207 [1]	1.050	4.8.1
T3	67.25 - 47.25	4x3/8	0.022	0.000	0.000	0.022 [1]	1.050	4.8.1

[1] P_u / ϕP_n controls

Torque-Arm Top Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	97.25 - 77.25 (459)	C6x8.2	1.39	1.34	30.0	2.4000	0.36	108.00	0.003
T1	97.25 - 77.25 (460)	C6x8.2	1.39	1.34	30.0	2.4000	0.59	108.00	0.006
T1	97.25 - 77.25 (463)	C6x8.2	1.39	1.34	30.0	2.4000	0.42	108.00	0.004
T1	97.25 - 77.25 (464)	C6x8.2	1.39	1.34	30.0	2.4000	0.10	108.00	0.001
T1	97.25 - 77.25 (467)	C6x8.2	1.39	1.34	30.0	2.4000	0.41	108.00	0.004
T1	97.25 - 77.25 (468)	C6x8.2	1.39	1.34	30.0	2.4000	0.25	108.00	0.002

Torque-Arm Top Bending Design Data

Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	97.25 - 77.25 (459)	C6x8.2	-4.36	19.24	0.227	0.00	2.77	0.000
T1	97.25 - 77.25 (460)	C6x8.2	-4.20	19.24	0.218	-0.00	2.77	0.000
T1	97.25 - 77.25 (463)	C6x8.2	-3.72	19.24	0.193	0.00	2.77	0.000
T1	97.25 - 77.25 (464)	C6x8.2	-4.13	19.24	0.215	0.00	2.77	0.000
T1	97.25 - 77.25 (467)	C6x8.2	-3.73	19.24	0.194	0.00	2.77	0.000
T1	97.25 - 77.25 (468)	C6x8.2	-4.36	19.24	0.227	0.00	2.77	0.000

Torque-Arm Top Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	97.25 - 77.25 (459)	C6x8.2	0.003	0.227	0.000	0.228	1.050	4.8.1
T1	97.25 - 77.25 (460)	C6x8.2	0.006	0.218	0.000	0.221	1.050	4.8.1
T1	97.25 - 77.25 (463)	C6x8.2	0.004	0.193	0.000	0.195	1.050	4.8.1
T1	97.25 - 77.25 (464)	C6x8.2	0.001	0.215	0.000	0.215	1.050	4.8.1
T1	97.25 - 77.25 (467)	C6x8.2	0.004	0.194	0.000	0.196	1.050	4.8.1
T1	97.25 - 77.25 (468)	C6x8.2	0.002	0.227	0.000	0.228	1.050	4.8.1

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T1	97.25 - 77.25	Leg	1 1/4	2	-12.88	57.06	22.6	Pass
T2	77.25 - 67.25	Leg	1 1/4	184	-12.97	55.33	23.4	Pass
T3	67.25 - 47.25	Leg	1 1/4	272	-13.15	55.47	23.7	Pass

Section No.	*Elevation ft*	*Component Type*	*Size*	*Critical Element*	*P K*	*øP$_{allow}$ K*	*% Capacity*	*Pass Fail*
T4	47.25 - 46	Leg	W6x9	456	-10.74	123.08	15.0	Pass
T1	97.25 - 77.25	Diagonal	7/16	11	-1.44	1.97	73.4	Pass
T2	77.25 - 67.25	Diagonal	7/16	266	-1.45	1.92	75.8	Pass
T3	67.25 - 47.25	Diagonal	7/16	281	-1.29	1.97	65.8	Pass
T1	97.25 - 77.25	Horizontal	7/16	163	-0.59	3.46	17.1	Pass
T2	77.25 - 67.25	Horizontal	7/16	257	-0.55	3.46	15.9	Pass
T3	67.25 - 47.25	Horizontal	7/16	284	-0.49	3.46	14.3	Pass
T1	97.25 - 77.25	Top Girt	7/16	6	-0.02	3.46	0.7	Pass
T2	77.25 - 67.25	Top Girt	7/16	188	-0.40	3.46	11.6	Pass
T3	67.25 - 47.25	Top Girt	7/16	275	-0.30	3.46	8.7	Pass
T1	97.25 - 77.25	Bottom Girt	7/16	8	-0.42	3.46	12.2	Pass
T2	77.25 - 67.25	Bottom Girt	7/16	190	-0.32	3.46	9.3	Pass
T3	67.25 - 47.25	Bottom Girt	7/16	278	1.75	7.10	24.6	Pass
T1	97.25 - 77.25	Guy A@92.3778	3/8	465	3.75	9.70	38.7	Pass
T3	67.25 - 47.25	Guy A@64.9417	1/4	474	2.08	4.19	49.6	Pass
T1	97.25 - 77.25	Guy B@92.3778	3/8	462	3.38	9.70	34.9	Pass
T3	67.25 - 47.25	Guy B@64.9417	1/4	473	2.21	4.19	52.8	Pass
T1	97.25 - 77.25	Guy C@92.3778	3/8	458	3.78	9.70	39.0	Pass
T3	67.25 - 47.25	Guy C@64.9417	1/4	469	2.25	4.19	53.7	Pass
T1	97.25 - 77.25	Top Guy Pull-Off@92.3778	7/16	153	-0.97	1.78	54.9	Pass
T3	67.25 - 47.25	Top Guy Pull-Off@64.9417	4x3/8	470	1.06	51.03	2.1	Pass
T1	97.25 - 77.25	Torque Arm Top@92.3778	C6x8.2	459	0.36	113.40	21.7	Pass
							Summary	
						Leg (T3)	23.7	Pass
						Diagonal (T2)	75.8	Pass
						Horizontal (T1)	17.1	Pass
						Top Girt (T2)	11.6	Pass
						Bottom Girt (T3)	24.6	Pass
						Guy A (T3)	49.6	Pass
						Guy B (T3)	52.8	Pass
						Guy C (T3)	53.7	Pass
						Top Guy Pull-Off (T1)	54.9	Pass
						Torque Arm Top (T1)	21.7	Pass
						Bolt Checks	8.0	Pass
						RATING =	**75.8**	**Pass**

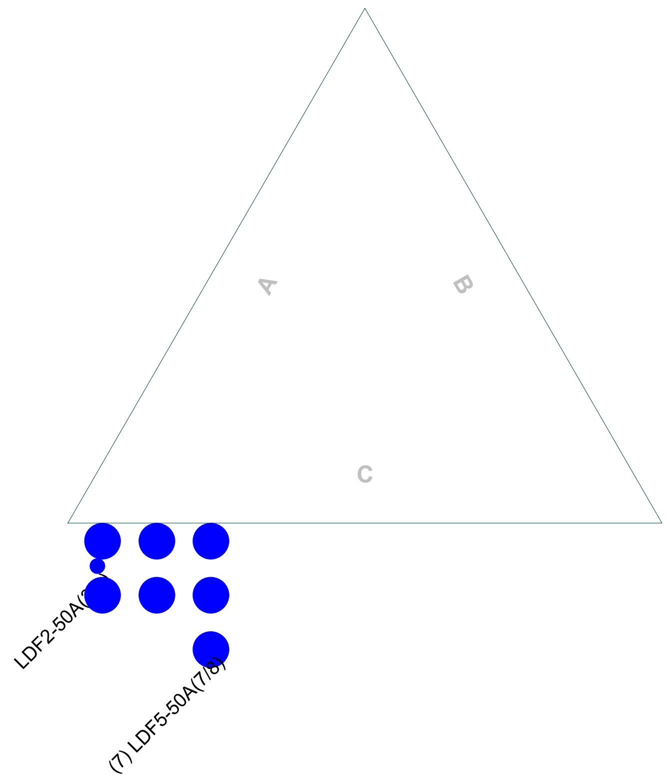
APPENDIX B

BASE LEVEL DRAWING

Feed Line Plan
67'3"

Round Flat App In Face App Out Face

Section @ 67'3"



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Project: ***405025***		
Client: Eversource	Drawn by: zan92313	App'd:
Code: TIA-222-H	Date: 10/29/20	Scale: NTS
Path:		Dwg No. E-7