EVERSOURCE ENERGY

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

November 10, 2016

Robert Stein, Chairman
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

RE: **TS-EVER-086-160823** – Eversource Energy request for an order to approve tower sharing at an existing telecommunications facility located at 911 Route 32 (Norwich New London Turnpike), Montville, Connecticut

Dear Chairman Stein:

On September 19, 2016, Eversource Energy ("Eversource") receiving a ruling from the Connecticut Siting Council ("Council") that the shared use of the existing tower site is technically, legally, environmentally, and economically feasible and meets public safety concerns, and therefore, in compliance with General Statutes Section 16-50aa.

In its decision, the Council required that Eversource shall, prior to commencement of the installation, provide one copy of the Structural Analysis Report to the Council referencing Revision G of the Structural Standards for Steel Towers and Antenna Supporting Structures ("Standards") as adopted by the Connecticut State Building Code effective October 1, 2016.

Eversource hereby submits to the Council the enclosed Structural Analysis Report – 145' Valmont Lattice Tower, revised October 21, 2016 based on Revision G of the Standards, prepared by Centek Engineering.

If you have any questions concerning this submittal, please contact me at your convenience.

Sincerely,

Kathleen M. Shanley
Manager – Transmission Siting

Attachment: Centek Engineering Structural Analysis Report

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

145' Valmont Lattice Tower

Proposed Eversource
Antenna Installation

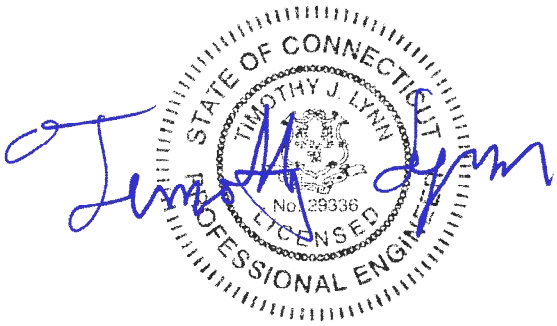
911 Route 32
Uncasville, CT

CENTEK Project No. 15122.000

~~Date: May 21, 2015~~

~~Rev 1: December 7, 2015~~

Rev 2: October 21, 2016



Prepared for:

Eversource
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Hartford, CT 06103

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Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation proposed by Eversource on the existing lattice tower located in Uncasville, Connecticut.

The host tower is a 145-ft, three legged, lattice tower designed and manufactured by Valmont eng. file no. A-158420 dated November 11, 2011. The tower geometry, structure member sizes and foundation information were taken from the original design documents.

Antenna and appurtenance inventory were taken from an antenna schedule provided by Montville PD, visual verification from grade conducted by Centek personnel on May 8, 2015, a previous structural analysis prepared by Centek for Verizon Wireless job no. 15115.000 dated May 19, 2015 and information provided by Eversource.

The tower consists of eight (8) vertical sections consisting of solid round legs and truss legs conforming to ASTM A572 Gr. 50 and solid round lateral bracing conforming to ASTM A572 Gr. 50 and angle lateral bracing conforming to ASTM A36. The vertical tower sections are connected by bolted flange plates with the diagonal and horizontal bracing to pipe legs consisting of bolted connections. The width of the tower face is 5.0-ft at the top and 18.0-ft at the bottom.

Eversource proposes the installation of one (1) Omni-directional whip antenna mounted on 3-ft sidearm. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing and proposed loads considered in the analysis consist of the following:

- Unknown (Existing):
  Antenna: Two (2) Telewave ANT150F2 Omni-directional whips, one (1) Kreco CO41A Omni-directional whip and one (1) Telewave ANT450F2 Omni-directional whip mounted on three (3) 3-ft side arms with an elevation of ±145-ft above grade level.
  Coax Cable: Four (4) 1/2" ∅ coax cables running on a leg of the existing tower as specified in Section 3 of this report.
- Unknown (Existing):
  Antenna: Two (2) Telewave ANT150F2 Omni-directional whips and one (1) Kreco CO156AN Omni-directional whip mounted on three (3) 3-ft side arms with an elevation of ±125-ft above grade level.
  Coax Cable: Two (2) 1/2" ∅ and one (1) 7/8" ∅ coax cables running on a leg of the existing tower as specified in Section 3 of this report.
- Unknown (Existing):
  Antenna: Two (2) Telewave ANT150D dipoles mounted on two (2) 3-ft standoffs with an elevation of ±115-ft above grade level.
  Coax Cable: Two (2) 1/2" ∅ coax cables running on a leg of the existing tower as specified in Section 3 of this report.
- Unknown (Existing):
  Antenna: One (1) Telewave ANT150F2 Omni-directional whip mounted on one (1) 3-ft side arm with an elevation of ±110-ft above grade level.

Coax Cable: One (1) 1/2" ∅ coax cable running on a leg of the existing tower as specified in Section 3 of this report.

- Unknown (Existing):
  Antenna: One (1) Telewave ANT150D dipole and one (1) 10-ft Omni-directional whip mounted on one (1) 3-ft side arm and one (1) 3-ft standoff with an elevation of ±105-ft above grade level.
  Coax Cable: Two (2) 1/2" ∅ coax cables running on a leg of the existing tower as specified in Section 3 of this report.
- Unknown (Existing):
  Antenna: One (1) Telewave ANT150D dipole mounted on one (1) 3-ft standoff with an elevation of ±102-ft above grade level.
  Coax Cable: One (1) 1/2" ∅ coax cable running on a leg of the existing tower as specified in Section 3 of this report.
- Unknown (Existing):
  Antenna: One (1) Radiowaves SPD2-4.7 microwave dish pipe mounted with an elevation of ±95-ft above grade level.
  Coax Cable: Two (2) 1/2" ∅ coax cables running on a leg of the existing tower as specified in Section 3 of this report.
- VERIZON (Reserved):
  Antennas: One (1) Andrew NH65PS-DG-F0M antenna and one (1) Alcatel-Lucent RRH2x60-AWS remote radio head leg mounted with a RAD center elevation of ±70-ft above grade level.
  Coax Cables: One (1) 1-5/8" ∅ fiber cable running on a leg of the tower as specified in Section 3 of this report.
- **Eversource (Proposed):**
  Antenna: One (1) Andrew DB589-Y Omni-directional whip mounted on one (1) 3-ft side arm with an elevation of ±133-ft above grade level.
  Coax Cable: One (1) 1-1/4" ∅ coax cable running on a leg of the existing tower as specified in Section 3 of this report.

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All coax cables should be routed as specified in section 3 of this report.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower, and the model assumes that the tower members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for the controlling basic wind speed (3-second gust) with no ice and the applicable wind and ice combination to determine stresses in members as per guidelines of TIA-222-G-2005 entitled "Structural Standard for Antenna Support Structures and Antennas", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Load and Resistance Factor Design (LRFD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix N of the CSBC[1] and the wind speed data available in the TIA-222-G-2005 Standard.

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA-222-G-2005, gravity loads of the tower structure and its components, and the application of 0.75" radial ice on the tower structure and its components.

Basic Wind Speed:	New London; v = 105-120 mph (3-second gust)	*[Annex B of TIA-222-G-2005]*
	Montville; v = 105 mph (3 second gust)	*[Appendix N of the 2016 CT Building Code]*
Load Cases:	Load Case 1; 105 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Appendix N of the 2016 CT Building Code]*
	Load Case 2; 50 mph wind speed w/ 0.75" radial ice plus gravity load – used in calculation of tower stresses.	*[Annex B of TIA-222-G-2005]*

[1] The 2012 International Building Code as amended by the 2016 Connecticut State Building Code (CSBC).

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. Allowable stresses were determined based on Table 4-8 of the TIA code.

- Calculated stresses were found to be within allowable limits. In Load Case 2, per tnxTower "Section Capacity Table", this tower was found to be at **88.5%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Leg (T8)	0'-0"-20'-0"	75.7%	**PASS**
Diagonal (T8)	0'-0"-20'-0"	88.5%	**PASS**

Foundation and Anchors

The existing foundation consists of three (3) 3.0-ft square x 4.5-ft long reinforced concrete piers on a 26.5-ft square x 1.5-ft thick reinforced concrete pad bearing directly on existing sub grade. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned design documents. Tower legs are connected to the foundation by means of (6) 1.0"∅, ASTM F1554 GR. 105 anchor bolts per leg, embedded 5-ft into the concrete foundation structure.

- The tower reactions developed from the governing Load Case 2 were used in the verification of the foundation:

Reactions	Vector	Proposed Base Reactions
Base	Shear	**23 kips**
	Compression	**15 kips**
	Moment	**1693 kip-ft**
Leg	Shear	**14 kips**
	Uplift	**97 kips**
	Compression	**114 kips**

- The anchor bolts were found to be within allowable limits.

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Tension	28.1%	**PASS**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	TIA-222-G Section 9.4 FS[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Mat	OM[2]	1.0	2.88	**PASS**

Note 1: FS denotes Factor of Safety
Note 2: OM denotes Overturning Moment.

Conclusion and Recommendations

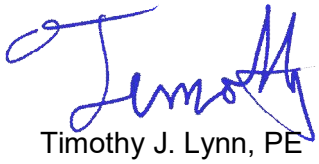
This analysis shows that the subject tower **is adequate** to support the proposed antenna configuration with the below recommendations.

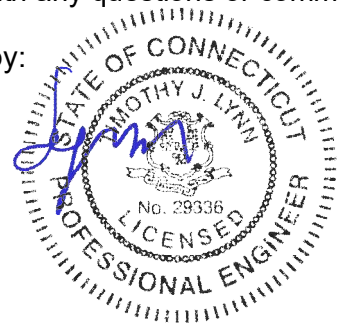
- **All coax cables routed as specified in Section 3 of this report**

The analysis is based, in part, on the information provided to this office by Eversource. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:





Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

All engineering services are performed on the basis that the information used is current and correct. This information may consist of, but is not necessarily limited to:

- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provided to Centek Engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the “as new” condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. Centek Engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

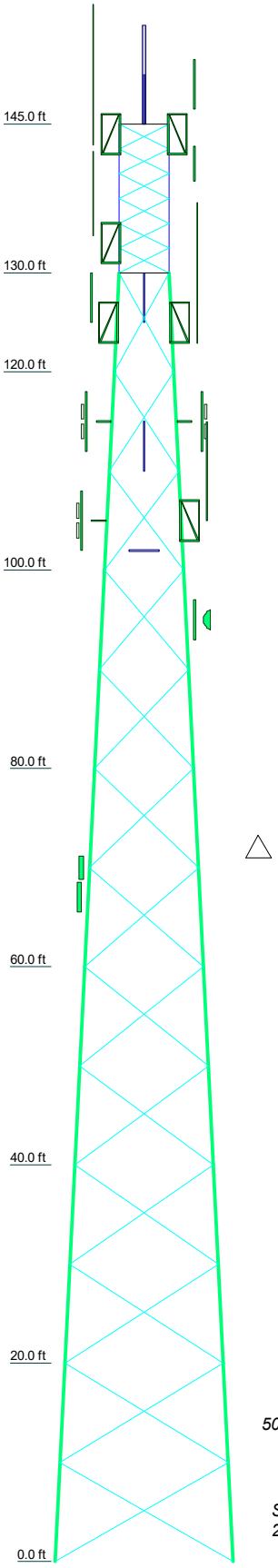
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

TnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, TnxTower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

TnxTower Features:

- TnxTower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- TnxTower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

Section	T8	T7	T6	T5	T4	T3	T2	T1
Legs				Pirod 207628				SR 1 3/4
Leg Grade				A572-50				
Diagonals	L3x3x3/16				L2 1/2x2 1/2x3/16			SR 7/8
Diagonal Grade				A36				A572-50
Top Girts				N.A.			A	SR 7/8
Face Width (ft)	16	14	12	10	8	6	5	
# Panels @ (ft)	13 @ 10							6 @ 2.5
Weight (K)	10.8	1.8	1.7	1.5	1.5	1.4	1.4	0.7	0.8



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
10-ft Lightning Rod	145	ANT150D	115
ANT150F2	145	3' Pipe Mount Side Arm	115
ANT150F2	145	ANT150D	115
ANT450F2	145	3' Pipe Mount Side Arm	115
CO-41A	145	3' Side Mount Standoff	110
3' Side Mount Standoff	144	ANT150F2	110
3' Side Mount Standoff	144	3' Side Mount Standoff	105
3' Side Mount Standoff	144	ANT150D	105
DB589-Y (Eversource Proposed)	138	3' Pipe Mount Side Arm	105
3' Side Mount Standoff (Eversource Proposed)	133	10' x 3" Dia Omni	105
		ANT150D	102
ANT150F2	125	3' Pipe Mount Side Arm	102
CO156AN	125	4'x4" Pipe Mount	95
3' Side Mount Standoff	125	SPD2-4.7	95
3' Side Mount Standoff	125	NH65PS-DG-F0M (Verizon Reserved)	70
ANT150F2	125	RRH2x60-AWS (Verizon Reserved)	67
3' Side Mount Standoff	125		

SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	L2 1/2x2 1/2x3/16		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-G Standard.
2. Tower designed for a 105 mph basic wind in accordance with the TIA-222-G Standard.
3. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Structure Class III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. Weld together tower sections have flange connections.
8. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
9. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
10. Welds are fabricated with ER-70S-6 electrodes.
11. TOWER RATING: 88.5%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 114 K
SHEAR: 14 K

UPLIFT: -97 K
SHEAR: 13 K

AXIAL 84 K
SHEAR 7 K
MOMENT 574 kip-ft
TORQUE 2 kip-ft
50 mph WIND - 0.7500 in ICE

AXIAL 15 K
SHEAR 23 K
MOMENT 1693 kip-ft
TORQUE 9 kip-ft
REACTIONS - 105 mph WIND

Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job: *15122.000 - Montville PD*			
Project: *145' Valmont Lattice Tower - 911 Route 32 Uncasville, CT*			
Client: Eversource	Drawn by: TJL	App'd:	
Code: TIA-222-G	Date: 10/21/16	Scale: NTS	
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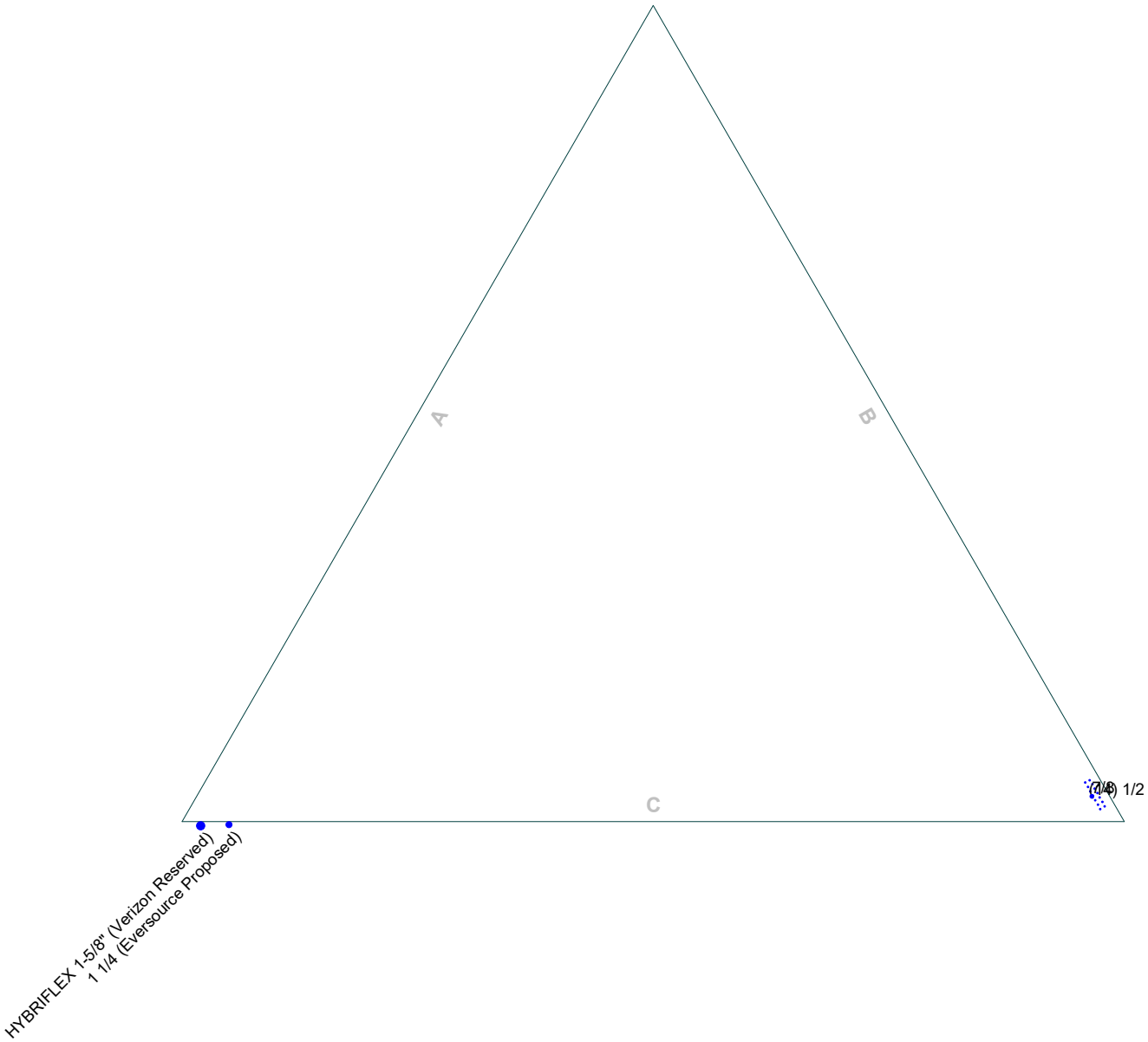
Feed Line Plan

Round Flat App In Face App Out Face Truss-Leg



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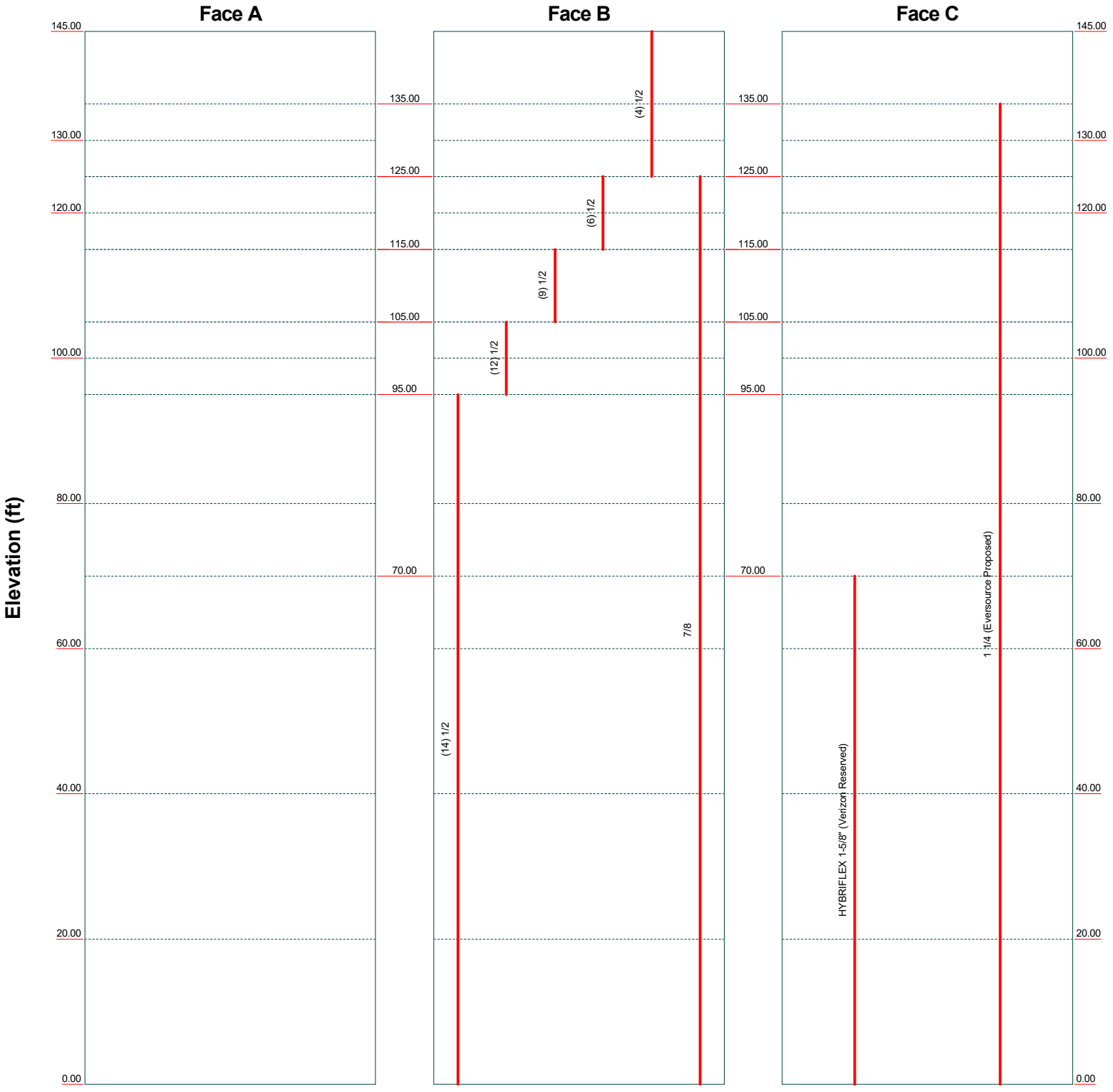
Feed Line Distribution Chart
0' - 145'

Round | Flat | App In Face | App Out Face | Truss Leg



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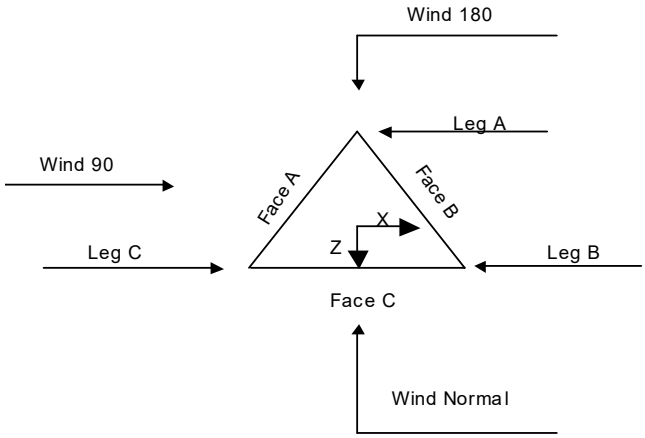
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 145.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 5.00 ft at the top and 18.00 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Basic wind speed of 105 mph.
Structure Class III.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 0.7500 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Horizontals		Assume Legs Pinned		Calculate Redundant Bracing Forces
	Consider Moments - Diagonals	√	Assume Rigid Index Plate		Ignore Redundant Members in FEA
	Use Moment Magnification	√	Use Clear Spans For Wind Area	√	SR Leg Bolts Resist Compression
√	Use Code Stress Ratios	√	Use Clear Spans For KL/r	√	All Leg Panels Have Same Allowable
√	Use Code Safety Factors - Guys		Retension Guys To Initial Tension		Offset Girt At Foundation
	Escalate Ice		Bypass Mast Stability Checks	√	Consider Feed Line Torque
	Always Use Max Kz	√	Use Azimuth Dish Coefficients		Include Angle Block Shear Check
	Use Special Wind Profile	√	Project Wind Area of Appurt.		Use TIA-222-G Bracing Resist. Exemption
√	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Use TIA-222-G Tension Splice Exemption
	Leg Bolts Are At Top Of Section		Add IBC .6D+W Combination		Poles
√	Secondary Horizontal Braces Leg	√	Sort Capacity Reports By Component		Include Shear-Torsion Interaction
	Use Diamond Inner Bracing (4 Sided)		Triangulate Diamond Inner Bracing		Always Use Sub-Critical Flow
	SR Members Have Cut Ends		Treat Feed Line Bundles As Cylinder		Use Top Mounted Sockets
	SR Members Are Concentric				



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	145.00-130.00			5.00	1	15.00
T2	130.00-120.00			5.00	1	10.00
T3	120.00-100.00			6.00	1	20.00
T4	100.00-80.00			8.00	1	20.00
T5	80.00-60.00			10.00	1	20.00
T6	60.00-40.00			12.00	1	20.00
T7	40.00-20.00			14.00	1	20.00
T8	20.00-0.00			16.00	1	20.00

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	145.00-130.00	2.50	X Brace	No	No	0.0000	0.0000
T2	130.00-120.00	10.00	X Brace	No	No	0.0000	0.0000
T3	120.00-100.00	10.00	X Brace	No	No	0.0000	0.0000
T4	100.00-80.00	10.00	X Brace	No	No	0.0000	0.0000
T5	80.00-60.00	10.00	X Brace	No	No	0.0000	0.0000
T6	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T7	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000

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
T8	20.00-0.00	10.00	X Brace	No	No	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 145.00-130.00	Solid Round	1 3/4	A572-50 (50 ksi)	Solid Round	7/8	A572-50 (50 ksi)
T2 130.00-120.00	Truss Leg	Pirod 207628	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T3 120.00-100.00	Truss Leg	Pirod 207628	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T4 100.00-80.00	Truss Leg	Pirod 207628	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 80.00-60.00	Truss Leg	Pirod 207628	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T6 60.00-40.00	Truss Leg	Pirod 207628	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T7 40.00-20.00	Truss Leg	Pirod 207628	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T8 20.00-0.00	Truss Leg	Pirod 207628	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A36 (36 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 145.00-130.00	Solid Round	7/8	A572-50 (50 ksi)	Equal Angle		A36 (36 ksi)
T2 130.00-120.00	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)	Equal Angle		A36 (36 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 145.00-130.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T2 130.00-120.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T3 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000

Tower Elevation ft	Gusset Area (per face) ft²	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
T4 100.00-80.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T5 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T6 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T7 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T8 20.00-0.00	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 145.00-130.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 130.00-120.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 120.00-100.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 100.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 40.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 20.00-0.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	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	Truss-Leg K Factors: Truss-Legs Used As Leg Members — Leg Panels	X Brace Diagonals	Z Brace Diagonals	Truss-Legs Used As Inner Members — Leg Panels	X Brace Diagonals	Z Brace Diagonals
T2 130.00-120.00	1	0.5	0.85	1	0.5	0.85
T3 120.00-100.00	1	0.5	0.85	1	0.5	0.85
T4 100.00-80.00	1	0.5	0.85	1	0.5	0.85

T5 80.00-60.00	1	0.5	0.85	1	0.5	0.85
T6 60.00-40.00	1	0.5	0.85	1	0.5	0.85
T7 40.00-20.00	1	0.5	0.85	1	0.5	0.85
T8 20.00-0.00	1	0.5	0.85	1	0.5	0.85

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 145.00-130.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T2 130.00-120.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T3 120.00-100.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T4 100.00-80.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T5 80.00-60.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T6 60.00-40.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T7 40.00-20.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
T8 20.00-0.00	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1

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 145.00-130.00	Flange	1.0000 A325N	6	1.0000 A325N	0	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 130.00-120.00	Flange	1.0000 A325N	6	1.0000 A325N	1	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 120.00-100.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 100.00-80.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 80.00-60.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 60.00-40.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T7 40.00-20.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	1
T8 20.00-0.00	Flange	1.0000 F1554-105	6	1.0000 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
1/2	B	No	Ar (CaAa)	95.00 - 0.00	-3.0000	0.46	14	7	0.5800	0.5800		0.25
1/2	B	No	Ar (CaAa)	105.00 - 95.00	-3.0000	0.46	12	6	0.5800	0.5800		0.25
1/2	B	No	Ar (CaAa)	115.00 - 105.00	-3.0000	0.46	9	5	0.5800	0.5800		0.25
1/2	B	No	Ar (CaAa)	125.00 - 115.00	-3.0000	0.46	6	3	0.5800	0.5800		0.25
1/2	B	No	Ar (CaAa)	145.00 - 125.00	-3.0000	0.46	4	2	0.5800	0.5800		0.25
7/8	B	No	Ar (CaAa)	125.00 - 0.00	-3.0000	0.46	1	1	1.1100	1.1100		0.54
HYBRIFLEX 1-5/8" (Verizon Reserved)	C	No	Ar (CaAa)	70.00 - 0.00	0.0000	0.48	1	1	1.9800	1.9800		1.90
1 1/4 (Eversource Proposed)	C	No	Ar (CaAa)	135.00 - 0.00	0.0000	0.45	1	1	1.5500	1.5500		0.66

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	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	145.00-130.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	3.480	0.000	0.01
		C	0.000	0.000	0.775	0.000	0.00
T2	130.00-120.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	3.455	0.000	0.02
		C	0.000	0.000	1.550	0.000	0.01
T3	120.00-100.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	12.660	0.000	0.06
		C	0.000	0.000	3.100	0.000	0.01
T4	100.00-80.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	17.880	0.000	0.08
		C	0.000	0.000	3.100	0.000	0.01
T5	80.00-60.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	18.460	0.000	0.08
		C	0.000	0.000	5.080	0.000	0.03
T6	60.00-40.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	18.460	0.000	0.08
		C	0.000	0.000	7.060	0.000	0.05
T7	40.00-20.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	18.460	0.000	0.08
		C	0.000	0.000	7.060	0.000	0.05
T8	20.00-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	18.460	0.000	0.08
		C	0.000	0.000	7.060	0.000	0.05

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

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	145.00-130.00	A	2.163	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	16.083	0.000	0.19
		C		0.000	0.000	2.938	0.000	0.05
T2	130.00-120.00	A	2.142	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	13.882	0.000	0.19
		C		0.000	0.000	5.834	0.000	0.10
T3	120.00-100.00	A	2.115	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	38.072	0.000	0.58
		C		0.000	0.000	11.560	0.000	0.20
T4	100.00-80.00	A	2.073	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	42.582	0.000	0.70
		C		0.000	0.000	11.392	0.000	0.20
T5	80.00-60.00	A	2.021	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	42.671	0.000	0.69
		C		0.000	0.000	17.209	0.000	0.31
T6	60.00-40.00	A	1.955	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	41.956	0.000	0.67
		C		0.000	0.000	22.696	0.000	0.41
T7	40.00-20.00	A	1.857	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	40.915	0.000	0.63
		C		0.000	0.000	21.918	0.000	0.38
T8	20.00-0.00	A	1.664	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	38.855	0.000	0.57
		C		0.000	0.000	20.372	0.000	0.33

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	145.00-130.00	1.1044	1.1145	0.0056	0.2855
T2	130.00-120.00	0.7164	1.1967	-0.0279	0.4376
T3	120.00-100.00	2.1516	2.1536	0.5439	1.0876
T4	100.00-80.00	3.6974	3.0986	1.1692	1.6958
T5	80.00-60.00	3.7549	3.9263	0.9138	2.3922
T6	60.00-40.00	3.5753	4.6984	0.4849	3.0055
T7	40.00-20.00	3.8074	4.9474	0.6060	3.2967
T8	20.00-0.00	4.1940	5.4032	0.8116	3.6039

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	5	1/2	130.00 - 145.00	0.6000	0.4489
T1	8	1 1/4	130.00 - 135.00	0.6000	0.4489
T2	4	1/2	120.00 - 125.00	0.6000	0.3296
T2	5	1/2	125.00 - 130.00	0.6000	0.3296

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T2	6	7/8	120.00 - 125.00	0.6000	0.3296
T2	8	1 1/4	120.00 - 130.00	0.6000	0.3296
T3	2	1/2	100.00 - 105.00	0.6000	0.4796
T3	3	1/2	105.00 - 115.00	0.6000	0.4796
T3	4	1/2	115.00 - 120.00	0.6000	0.4796
T3	6	7/8	100.00 - 120.00	0.6000	0.4796
T3	8	1 1/4	100.00 - 120.00	0.6000	0.4796
T4	1	1/2	80.00 - 95.00	0.6000	0.5657
T4	2	1/2	95.00 - 100.00	0.6000	0.5657
T4	6	7/8	80.00 - 100.00	0.6000	0.5657
T4	8	1 1/4	80.00 - 100.00	0.6000	0.5657
T5	1	1/2	60.00 - 80.00	0.6000	0.6000
T5	6	7/8	60.00 - 80.00	0.6000	0.6000
T5	7	HYBRIFLEX 1-5/8"	60.00 - 70.00	0.6000	0.6000
T5	8	1 1/4	60.00 - 80.00	0.6000	0.6000
T6	1	1/2	40.00 - 60.00	0.6000	0.6000
T6	6	7/8	40.00 - 60.00	0.6000	0.6000
T6	7	HYBRIFLEX 1-5/8"	40.00 - 60.00	0.6000	0.6000
T6	8	1 1/4	40.00 - 60.00	0.6000	0.6000
T7	1	1/2	20.00 - 40.00	0.6000	0.6000
T7	6	7/8	20.00 - 40.00	0.6000	0.6000
T7	7	HYBRIFLEX 1-5/8"	20.00 - 40.00	0.6000	0.6000
T7	8	1 1/4	20.00 - 40.00	0.6000	0.6000
T8	1	1/2	0.00 - 20.00	0.6000	0.6000
T8	6	7/8	0.00 - 20.00	0.6000	0.6000
T8	7	HYBRIFLEX 1-5/8"	0.00 - 20.00	0.6000	0.6000
T8	8	1 1/4	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
10-ft Lightning Rod	A	From Leg	0.00	0.0000	145.00	No Ice	2.92	2.92	0.05
			0.00			1/2" Ice	4.03	4.03	0.07
			5.00			1" Ice	5.03	5.03	0.10
ANT150F2	A	From Leg	3.00	0.0000	145.00	No Ice	1.29	1.29	0.02
			0.00			1/2" Ice	1.60	1.60	0.03
			2.50			1" Ice	1.91	1.91	0.04
3' Side Mount Standoff	A	From Leg	1.00	0.0000	144.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06
ANT150F2	A	From Leg	3.00	0.0000	125.00	No Ice	1.29	1.29	0.02
			0.00			1/2" Ice	1.60	1.60	0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			2.50			1" Ice	1.91	1.91	0.04
3' Side Mount Standoff	A	From Leg	1.00	0.0000	125.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06
ANT150F2	A	From Leg	3.00	0.0000	110.00	No Ice	1.29	1.29	0.02
			0.00			1/2" Ice	1.60	1.60	0.03
			2.50			1" Ice	1.91	1.91	0.04
3' Side Mount Standoff	A	From Leg	1.00	0.0000	110.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06
ANT150D	A	From Leg	3.00	0.0000	102.00	No Ice	0.80	0.80	0.01
			0.00			1/2" Ice	1.44	1.44	0.01
			0.00			1" Ice	2.08	2.08	0.01
3' Pipe Mount Side Arm	A	From Leg	1.00	0.0000	102.00	No Ice	0.30	0.30	0.01
			0.00			1/2" Ice	0.61	0.61	0.05
			0.00			1" Ice	0.81	0.81	0.09
ANT150F2	B	From Leg	3.00	0.0000	145.00	No Ice	1.29	1.29	0.02
			0.00			1/2" Ice	1.60	1.60	0.03
			4.00			1" Ice	1.91	1.91	0.04
ANT450F2	B	From Leg	3.00	0.0000	145.00	No Ice	0.79	0.79	0.01
			0.00			1/2" Ice	1.01	1.01	0.02
			-4.00			1" Ice	1.23	1.23	0.03
3' Side Mount Standoff	B	From Leg	1.00	0.0000	144.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06
CO156AN	B	From Leg	3.00	0.0000	125.00	No Ice	2.27	2.27	0.01
			0.00			1/2" Ice	3.71	3.71	0.03
			5.00			1" Ice	5.16	5.16	0.06
3' Side Mount Standoff	B	From Leg	1.00	0.0000	125.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06
ANT150D	B	From Leg	3.00	0.0000	115.00	No Ice	0.80	0.80	0.01
			0.00			1/2" Ice	1.44	1.44	0.01
			0.00			1" Ice	2.08	2.08	0.01
3' Pipe Mount Side Arm	B	From Leg	1.00	0.0000	115.00	No Ice	0.30	0.30	0.01
			0.00			1/2" Ice	0.61	0.61	0.05
			0.00			1" Ice	0.81	0.81	0.09
10' x 3" Dia Omni	B	From Leg	3.00	0.0000	105.00	No Ice	3.00	3.00	0.03
			0.00			1/2" Ice	4.03	4.03	0.05
			5.00			1" Ice	5.03	5.03	0.08
3' Side Mount Standoff	B	From Leg	1.00	0.0000	105.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06
4'x4" Pipe Mount	B	From Leg	1.00	0.0000	95.00	No Ice	1.06	1.06	0.04
			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
CO-41A	C	From Leg	3.00	0.0000	145.00	No Ice	2.27	2.27	0.01
			0.00			1/2" Ice	3.71	3.71	0.03
			5.00			1" Ice	5.16	5.16	0.06
3' Side Mount Standoff	C	From Leg	1.00	0.0000	144.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06
ANT150F2	C	From Leg	3.00	0.0000	125.00	No Ice	1.29	1.29	0.02
			0.00			1/2" Ice	1.60	1.60	0.03
			2.50			1" Ice	1.91	1.91	0.04
3' Side Mount Standoff	C	From Leg	1.00	0.0000	125.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00			1" Ice	4.74	4.74	0.06
ANT150D	C	From Leg	3.00	0.0000	115.00	No Ice	0.80	0.80	0.01
			0.00			1/2" Ice	1.44	1.44	0.01
			0.00			1" Ice	2.08	2.08	0.01
3' Pipe Mount Side Arm	C	From Leg	1.00	0.0000	115.00	No Ice	0.30	0.30	0.01
			0.00			1/2" Ice	0.61	0.61	0.05
			0.00			1" Ice	0.81	0.81	0.09
ANT150D	C	From Leg	3.00	0.0000	105.00	No Ice	0.80	0.80	0.01
			0.00			1/2" Ice	1.44	1.44	0.01
			0.00			1" Ice	2.08	2.08	0.01
3' Pipe Mount Side Arm	C	From Leg	1.00	0.0000	105.00	No Ice	0.30	0.30	0.01
			0.00			1/2" Ice	0.61	0.61	0.05
			0.00			1" Ice	0.81	0.81	0.09
NH65PS-DG-F0M (Verizon Reserved)	C	From Leg	1.00	0.0000	70.00	No Ice	1.20	1.20	0.03
			0.00			1/2" Ice	1.88	1.88	0.05
			0.00			1" Ice	2.09	2.09	0.08
RRH2x60-AWS (Verizon Reserved)	C	From Leg	1.00	0.0000	67.00	No Ice	3.36	2.03	0.06
			0.00			1/2" Ice	3.61	2.26	0.08
			0.00			1" Ice	3.88	2.50	0.11
DB589-Y (Eversource Proposed)	C	From Leg	3.00	0.0000	138.00	No Ice	2.13	2.13	0.01
			0.00			1/2" Ice	3.00	3.00	0.03
			0.00			1" Ice	3.76	3.76	0.05
3' Side Mount Standoff (Eversource Proposed)	C	From Leg	1.00	0.0000	133.00	No Ice	2.64	2.64	0.04
			0.00			1/2" Ice	3.69	3.69	0.05
			0.00			1" Ice	4.74	4.74	0.06

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
SPD2-4.7	B	Paraboloid w/o Radome	From Leg	2.00	0.0000		95.00	2.00	No Ice	3.14	0.03
				0.00					1/2" Ice	3.41	0.04
				0.00					1" Ice	3.68	0.06

Truss-Leg Properties

Section Designation	Area in^2	Area Ice in^2	Self Weight K	Ice Weight K	Equiv. Diameter in	Equiv. Diameter Ice in	Leg Area in^2
Pirod 207628	1122.3795	5584.4979	0.30	2.27	3.8972	19.3906	3.6816
Pirod 207628	1122.3795	5568.8255	0.30	2.26	3.8972	19.3362	3.6816
Pirod 207628	1122.3795	5544.6239	0.30	2.24	3.8972	19.2522	3.6816
Pirod 207628	1122.3795	5514.9914	0.30	2.21	3.8972	19.1493	3.6816
Pirod 207628	1122.3795	5476.4661	0.30	2.18	3.8972	19.0155	3.6816

Section Designation	Area	Area Ice	Self Weight	Ice Weight	Equiv. Diameter	Equiv. Diameter Ice	Leg Area
	in^2	in^2	K	K	in	in	in^2
Pirod 207628	1122.3795	5420.4005	0.30	2.14	3.8972	18.8208	3.6816
Pirod 207628	1122.3795	5309.1015	0.30	2.05	3.8972	18.4344	3.6816

Tower Pressures - No Ice

$G_H = 0.850$

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
T1	137.50	1.353	37	77.188	A	0.000	9.478	4.375	46.16	0.000	0.000
145.00-130.00					B	0.000	9.478		46.16	3.480	0.000
					C	0.000	9.478		46.16	0.775	0.000
T2	125.00	1.326	37	66.055	A	5.273	6.506	6.506	55.23	0.000	0.000
130.00-120.00					B	5.273	6.506		55.23	3.455	0.000
					C	5.273	6.506		55.23	1.550	0.000
T3	110.00	1.291	36	162.111	A	8.723	13.012	13.012	59.87	0.000	0.000
120.00-100.00					B	8.723	13.012		59.87	12.660	0.000
					C	8.723	13.012		59.87	3.100	0.000
T4	90.00	1.238	34	202.111	A	9.970	13.012	13.012	56.62	0.000	0.000
100.00-80.00					B	9.970	13.012		56.62	17.880	0.000
					C	9.970	13.012		56.62	3.100	0.000
T5 80.00-60.00	70.00	1.174	32	242.111	A	11.267	13.012	13.012	53.59	0.000	0.000
					B	11.267	13.012		53.59	18.460	0.000
					C	11.267	13.012		53.59	5.080	0.000
T6 60.00-40.00	50.00	1.094	30	282.111	A	12.620	13.012	13.012	50.76	0.000	0.000
					B	12.620	13.012		50.76	18.460	0.000
					C	12.620	13.012		50.76	7.060	0.000
T7 40.00-20.00	30.00	0.982	27	322.111	A	16.830	13.012	13.012	43.60	0.000	0.000
					B	16.830	13.012		43.60	18.460	0.000
					C	16.830	13.012		43.60	7.060	0.000
T8 20.00-0.00	10.00	0.85	23	362.111	A	18.566	13.012	13.012	41.21	0.000	0.000
					B	18.566	13.012		41.21	18.460	0.000
					C	18.566	13.012		41.21	7.060	0.000

Tower Pressure - With Ice

$G_H = 0.850$

Section Elevation	z	K_Z	q_z	t_Z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	in	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
T1	137.50	1.353	7	2.1626	82.594	A	0.000	45.514	15.188	33.37	0.000	0.000
145.00-130.00						B	0.000	45.514		33.37	16.083	0.000
						C	0.000	45.514		33.37	2.938	0.000
T2	125.00	1.326	7	2.1421	69.630	A	5.273	41.408	32.372	69.35	0.000	0.000
130.00-120.00						B	5.273	41.408		69.35	13.882	0.000
						C	5.273	41.408		69.35	5.834	0.000
T3	110.00	1.291	7	2.1149	169.169	A	8.723	79.319	64.561	73.33	0.000	0.000
120.00-100.00						B	8.723	79.319		73.33	38.072	0.000
						C	8.723	79.319		73.33	11.560	0.000

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T4 100.00-80.00	90.00	1.238	7	2.0729	209.029	A	9.970	80.814	64.281	70.81	0.000	0.000
						B	9.970	80.814		70.81	42.582	0.000
						C	9.970	80.814		70.81	11.392	0.000
T5 80.00-60.00	70.00	1.174	6	2.0214	248.857	A	11.267	82.157	63.937	68.44	0.000	0.000
						B	11.267	82.157		68.44	42.671	0.000
						C	11.267	82.157		68.44	17.209	0.000
T6 60.00-40.00	50.00	1.094	6	1.9546	288.634	A	12.620	83.224	63.491	66.24	0.000	0.000
						B	12.620	83.224		66.24	41.956	0.000
						C	12.620	83.224		66.24	22.696	0.000
T7 40.00-20.00	30.00	0.982	5	1.8572	328.309	A	16.830	83.678	62.841	62.52	0.000	0.000
						B	16.830	83.678		62.52	40.915	0.000
						C	16.830	83.678		62.52	21.918	0.000
T8 20.00-0.00	10.00	0.85	5	1.6640	367.664	A	18.566	82.146	61.550	61.11	0.000	0.000
						B	18.566	82.146		61.11	38.855	0.000
						C	18.566	82.146		61.11	20.372	0.000

Tower Pressure - Service

$G_H = 0.850$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T1 145.00-130.00	137.50	1.353	11	77.188	A	0.000	9.478	4.375	46.16	0.000	0.000
					B	0.000	9.478		46.16	3.480	0.000
					C	0.000	9.478		46.16	0.775	0.000
T2 130.00-120.00	125.00	1.326	10	66.055	A	5.273	6.506	6.506	55.23	0.000	0.000
					B	5.273	6.506		55.23	3.455	0.000
					C	5.273	6.506		55.23	1.550	0.000
T3 120.00-100.00	110.00	1.291	10	162.111	A	8.723	13.012	13.012	59.87	0.000	0.000
					B	8.723	13.012		59.87	12.660	0.000
					C	8.723	13.012		59.87	3.100	0.000
T4 100.00-80.00	90.00	1.238	10	202.111	A	9.970	13.012	13.012	56.62	0.000	0.000
					B	9.970	13.012		56.62	17.880	0.000
					C	9.970	13.012		56.62	3.100	0.000
T5 80.00-60.00	70.00	1.174	9	242.111	A	11.267	13.012	13.012	53.59	0.000	0.000
					B	11.267	13.012		53.59	18.460	0.000
					C	11.267	13.012		53.59	5.080	0.000
T6 60.00-40.00	50.00	1.094	9	282.111	A	12.620	13.012	13.012	50.76	0.000	0.000
					B	12.620	13.012		50.76	18.460	0.000
					C	12.620	13.012		50.76	7.060	0.000
T7 40.00-20.00	30.00	0.982	8	322.111	A	16.830	13.012	13.012	43.60	0.000	0.000
					B	16.830	13.012		43.60	18.460	0.000
					C	16.830	13.012		43.60	7.060	0.000
T8 20.00-0.00	10.00	0.85	7	362.111	A	18.566	13.012	13.012	41.21	0.000	0.000
					B	18.566	13.012		41.21	18.460	0.000
					C	18.566	13.012		41.21	7.060	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	37	1	1	5.358	0.57	37.99	C
145.00-130.00			B	0.123	2.874		1	1	5.358			
			C	0.123	2.874		1	1	5.358			
T2	0.02	0.71	A	0.178	2.67	37	1	1	8.988	0.84	84.00	C
130.00-120.00			B	0.178	2.67		1	1	8.988			
			C	0.178	2.67		1	1	8.988			
T3	0.07	1.36	A	0.134	2.831	36	1	1	16.089	1.67	83.28	C
120.00-100.00			B	0.134	2.831		1	1	16.089			
			C	0.134	2.831		1	1	16.089			
T4	0.09	1.41	A	0.114	2.91	34	1	1	17.320	1.83	91.41	C
100.00-80.00			B	0.114	2.91		1	1	17.320			
			C	0.114	2.91		1	1	17.320			
T5	0.11	1.46	A	0.1	2.963	32	1	1	18.610	1.91	95.35	C
80.00-60.00			B	0.1	2.963		1	1	18.610			
			C	0.1	2.963		1	1	18.610			
T6	0.13	1.52	A	0.091	3.001	30	1	1	19.962	1.93	96.47	C
60.00-40.00			B	0.091	3.001		1	1	19.962			
			C	0.091	3.001		1	1	19.962			
T7	0.13	1.71	A	0.093	2.994	27	1	1	24.172	2.02	100.98	C
40.00-20.00			B	0.093	2.994		1	1	24.172			
			C	0.093	2.994		1	1	24.172			
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	23	1	1	25.907	1.86	93.14	C
			B	0.087	3.016		1	1	25.907			
			C	0.087	3.016		1	1	25.907			
Sum Weight:	0.71	10.77						OTM	840.26 kip-ft	12.62		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	37	0.825	1	5.358	0.57	37.99	C
145.00-130.00			B	0.123	2.874		0.825	1	5.358			
			C	0.123	2.874		0.825	1	5.358			
T2	0.02	0.71	A	0.178	2.67	37	0.825	1	8.066	0.76	76.33	C
130.00-120.00			B	0.178	2.67		0.825	1	8.066			
			C	0.178	2.67		0.825	1	8.066			
T3	0.07	1.36	A	0.134	2.831	36	0.825	1	14.562	1.53	76.74	C
120.00-100.00			B	0.134	2.831		0.825	1	14.562			
			C	0.134	2.831		0.825	1	14.562			
T4	0.09	1.41	A	0.114	2.91	34	0.825	1	15.575	1.68	84.04	C
100.00-80.00			B	0.114	2.91		0.825	1	15.575			
			C	0.114	2.91		0.825	1	15.575			
T5	0.11	1.46	A	0.1	2.963	32	0.825	1	16.638	1.75	87.31	C
80.00-60.00			B	0.1	2.963		0.825	1	16.638			
			C	0.1	2.963		0.825	1	16.638			
T6	0.13	1.52	A	0.091	3.001	30	0.825	1	17.753	1.76	87.96	C
60.00-40.00			B	0.091	3.001		0.825	1	17.753			
			C	0.091	3.001		0.825	1	17.753			
T7	0.13	1.71	A	0.093	2.994	27	0.825	1	21.226	1.82	90.82	C
40.00-20.00			B	0.093	2.994		0.825	1	21.226			
			C	0.093	2.994		0.825	1	21.226			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	23	0.825	1	22.658	1.67	83.37	C
			B	0.087	3.016		0.825	1	22.658			
			C	0.087	3.016		0.825	1	22.658			
Sum Weight:	0.71	10.77						OTM	775.22 kip-ft	11.54		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	37	0.8	1	5.358	0.57	37.99	C
145.00-130.00			B	0.123	2.874		0.8	1	5.358			
			C	0.123	2.874		0.8	1	5.358			
T2	0.02	0.71	A	0.178	2.67	37	0.8	1	7.934	0.75	75.24	C
130.00-120.00			B	0.178	2.67		0.8	1	7.934			
			C	0.178	2.67		0.8	1	7.934			
T3	0.07	1.36	A	0.134	2.831	36	0.8	1	14.344	1.52	75.80	C
120.00-100.00			B	0.134	2.831		0.8	1	14.344			
			C	0.134	2.831		0.8	1	14.344			
T4	0.09	1.41	A	0.114	2.91	34	0.8	1	15.326	1.66	82.99	C
100.00-80.00			B	0.114	2.91		0.8	1	15.326			
			C	0.114	2.91		0.8	1	15.326			
T5	0.11	1.46	A	0.1	2.963	32	0.8	1	16.357	1.72	86.16	C
80.00-60.00			B	0.1	2.963		0.8	1	16.357			
			C	0.1	2.963		0.8	1	16.357			
T6	0.13	1.52	A	0.091	3.001	30	0.8	1	17.438	1.74	86.75	C
60.00-40.00			B	0.091	3.001		0.8	1	17.438			
			C	0.091	3.001		0.8	1	17.438			
T7	0.13	1.71	A	0.093	2.994	27	0.8	1	20.806	1.79	89.37	C
40.00-20.00			B	0.093	2.994		0.8	1	20.806			
			C	0.093	2.994		0.8	1	20.806			
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	23	0.8	1	22.194	1.64	81.97	C
			B	0.087	3.016		0.8	1	22.194			
			C	0.087	3.016		0.8	1	22.194			
Sum Weight:	0.71	10.77						OTM	765.93 kip-ft	11.38		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	37	0.85	1	5.358	0.57	37.99	C
145.00-130.00			B	0.123	2.874		0.85	1	5.358			
			C	0.123	2.874		0.85	1	5.358			
T2	0.02	0.71	A	0.178	2.67	37	0.85	1	8.197	0.77	77.43	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
130.00-120.00			B	0.178	2.67		0.85	1	8.197			
			C	0.178	2.67		0.85	1	8.197			
T3	0.07	1.36	A	0.134	2.831	36	0.85	1	14.780	1.55	77.67	C
120.00-100.00			B	0.134	2.831		0.85	1	14.780			
			C	0.134	2.831		0.85	1	14.780			
T4	0.09	1.41	A	0.114	2.91	34	0.85	1	15.825	1.70	85.10	C
100.00-80.00			B	0.114	2.91		0.85	1	15.825			
			C	0.114	2.91		0.85	1	15.825			
T5	0.11	1.46	A	0.1	2.963	32	0.85	1	16.920	1.77	88.46	C
80.00-60.00			B	0.1	2.963		0.85	1	16.920			
			C	0.1	2.963		0.85	1	16.920			
T6	0.13	1.52	A	0.091	3.001	30	0.85	1	18.069	1.78	89.18	C
60.00-40.00			B	0.091	3.001		0.85	1	18.069			
			C	0.091	3.001		0.85	1	18.069			
T7	0.13	1.71	A	0.093	2.994	27	0.85	1	21.647	1.85	92.27	C
40.00-20.00			B	0.093	2.994		0.85	1	21.647			
			C	0.093	2.994		0.85	1	21.647			
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	23	0.85	1	23.122	1.70	84.76	C
			B	0.087	3.016		0.85	1	23.122			
			C	0.087	3.016		0.85	1	23.122			
Sum Weight:	0.71	10.77						OTM	784.51 kip-ft	11.69		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.25	3.01	A	0.551	1.842	7	1	1	32.490	0.43	28.54	C
145.00-130.00			B	0.551	1.842		1	1	32.490			
			C	0.551	1.842		1	1	32.490			
T2	0.29	5.36	A	0.67	1.777	7	1	1	38.001	0.45	45.41	C
130.00-120.00			B	0.67	1.777		1	1	38.001			
			C	0.67	1.777		1	1	38.001			
T3	0.78	10.28	A	0.52	1.875	7	1	1	63.948	0.86	42.90	C
120.00-100.00			B	0.52	1.875		1	1	63.948			
			C	0.52	1.875		1	1	63.948			
T4	0.89	10.42	A	0.434	2	7	1	1	62.642	0.89	44.59	C
100.00-80.00			B	0.434	2		1	1	62.642			
			C	0.434	2		1	1	62.642			
T5	1.00	10.55	A	0.375	2.115	6	1	1	62.692	0.91	45.74	C
80.00-60.00			B	0.375	2.115		1	1	62.692			
			C	0.375	2.115		1	1	62.692			
T6	1.07	10.65	A	0.332	2.214	6	1	1	63.349	0.91	45.28	C
60.00-40.00			B	0.332	2.214		1	1	63.349			
			C	0.332	2.214		1	1	63.349			
T7	1.01	11.12	A	0.306	2.28	5	1	1	67.108	0.87	43.31	C
40.00-20.00			B	0.306	2.28		1	1	67.108			
			C	0.306	2.28		1	1	67.108			
T8 20.00-0.00	0.90	10.78	A	0.274	2.368	5	1	1	67.135	0.76	38.22	C
			B	0.274	2.368		1	1	67.135			
			C	0.274	2.368		1	1	67.135			
Sum Weight:	6.20	72.18						OTM	433.21	6.08		

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
									kip-ft			

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.25	3.01	A	0.551	1.842	7	0.825	1	32.490	0.43	28.54	C
145.00-130.00			B	0.551	1.842		0.825	1	32.490			
			C	0.551	1.842		0.825	1	32.490			
T2	0.29	5.36	A	0.67	1.777	7	0.825	1	37.078	0.44	44.40	C
130.00-120.00			B	0.67	1.777		0.825	1	37.078			
			C	0.67	1.777		0.825	1	37.078			
T3	0.78	10.28	A	0.52	1.875	7	0.825	1	62.421	0.84	42.04	C
120.00-100.00			B	0.52	1.875		0.825	1	62.421			
			C	0.52	1.875		0.825	1	62.421			
T4	0.89	10.42	A	0.434	2	7	0.825	1	60.897	0.87	43.60	C
100.00-80.00			B	0.434	2		0.825	1	60.897			
			C	0.434	2		0.825	1	60.897			
T5	1.00	10.55	A	0.375	2.115	6	0.825	1	60.721	0.89	44.61	C
80.00-60.00			B	0.375	2.115		0.825	1	60.721			
			C	0.375	2.115		0.825	1	60.721			
T6	1.07	10.65	A	0.332	2.214	6	0.825	1	61.141	0.88	44.04	C
60.00-40.00			B	0.332	2.214		0.825	1	61.141			
			C	0.332	2.214		0.825	1	61.141			
T7	1.01	11.12	A	0.306	2.28	5	0.825	1	64.163	0.84	41.78	C
40.00-20.00			B	0.306	2.28		0.825	1	64.163			
			C	0.306	2.28		0.825	1	64.163			
T8 20.00-0.00	0.90	10.78	A	0.274	2.368	5	0.825	1	63.886	0.73	36.71	C
			B	0.274	2.368		0.825	1	63.886			
			C	0.274	2.368		0.825	1	63.886			
Sum Weight:	6.20	72.18						OTM	424.24 kip-ft	5.93		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.25	3.01	A	0.551	1.842	7	0.8	1	32.490	0.43	28.54	C
145.00-130.00			B	0.551	1.842		0.8	1	32.490			
			C	0.551	1.842		0.8	1	32.490			
T2	0.29	5.36	A	0.67	1.777	7	0.8	1	36.946	0.44	44.26	C
130.00-120.00			B	0.67	1.777		0.8	1	36.946			
			C	0.67	1.777		0.8	1	36.946			
T3	0.78	10.28	A	0.52	1.875	7	0.8	1	62.203	0.84	41.92	C
120.00-100.00			B	0.52	1.875		0.8	1	62.203			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
			C	0.52	1.875		0.8	1	62.203			
T4	0.89	10.42	A	0.434	2	7	0.8	1	60.648	0.87	43.45	C
100.00-80.00			B	0.434	2		0.8	1	60.648			
			C	0.434	2		0.8	1	60.648			
T5	1.00	10.55	A	0.375	2.115	6	0.8	1	60.439	0.89	44.45	C
80.00-60.00			B	0.375	2.115		0.8	1	60.439			
			C	0.375	2.115		0.8	1	60.439			
T6	1.07	10.65	A	0.332	2.214	6	0.8	1	60.825	0.88	43.87	C
60.00-40.00			B	0.332	2.214		0.8	1	60.825			
			C	0.332	2.214		0.8	1	60.825			
T7	1.01	11.12	A	0.306	2.28	5	0.8	1	63.742	0.83	41.56	C
40.00-20.00			B	0.306	2.28		0.8	1	63.742			
			C	0.306	2.28		0.8	1	63.742			
T8 20.00-0.00	0.90	10.78	A	0.274	2.368	5	0.8	1	63.422	0.73	36.49	C
			B	0.274	2.368		0.8	1	63.422			
			C	0.274	2.368		0.8	1	63.422			
Sum Weight:	6.20	72.18						OTM	422.96 kip-ft	5.91		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.25	3.01	A	0.551	1.842	7	0.85	1	32.490	0.43	28.54	C
145.00-130.00			B	0.551	1.842		0.85	1	32.490			
			C	0.551	1.842		0.85	1	32.490			
T2	0.29	5.36	A	0.67	1.777	7	0.85	1	37.210	0.45	44.55	C
130.00-120.00			B	0.67	1.777		0.85	1	37.210			
			C	0.67	1.777		0.85	1	37.210			
T3	0.78	10.28	A	0.52	1.875	7	0.85	1	62.640	0.84	42.17	C
120.00-100.00			B	0.52	1.875		0.85	1	62.640			
			C	0.52	1.875		0.85	1	62.640			
T4	0.89	10.42	A	0.434	2	7	0.85	1	61.146	0.87	43.74	C
100.00-80.00			B	0.434	2		0.85	1	61.146			
			C	0.434	2		0.85	1	61.146			
T5	1.00	10.55	A	0.375	2.115	6	0.85	1	61.002	0.90	44.77	C
80.00-60.00			B	0.375	2.115		0.85	1	61.002			
			C	0.375	2.115		0.85	1	61.002			
T6	1.07	10.65	A	0.332	2.214	6	0.85	1	61.456	0.88	44.22	C
60.00-40.00			B	0.332	2.214		0.85	1	61.456			
			C	0.332	2.214		0.85	1	61.456			
T7	1.01	11.12	A	0.306	2.28	5	0.85	1	64.584	0.84	42.00	C
40.00-20.00			B	0.306	2.28		0.85	1	64.584			
			C	0.306	2.28		0.85	1	64.584			
T8 20.00-0.00	0.90	10.78	A	0.274	2.368	5	0.85	1	64.350	0.74	36.93	C
			B	0.274	2.368		0.85	1	64.350			
			C	0.274	2.368		0.85	1	64.350			
Sum Weight:	6.20	72.18						OTM	425.52 kip-ft	5.95		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	11	1	1	5.358	0.16	10.79	C
145.00-130.00			B	0.123	2.874		1	1	5.358			
			C	0.123	2.874		1	1	5.358			
T2	0.02	0.71	A	0.178	2.67	10	1	1	8.988	0.24	23.85	C
130.00-120.00			B	0.178	2.67		1	1	8.988			
			C	0.178	2.67		1	1	8.988			
T3	0.07	1.36	A	0.134	2.831	10	1	1	16.089	0.47	23.65	C
120.00-100.00			B	0.134	2.831		1	1	16.089			
			C	0.134	2.831		1	1	16.089			
T4	0.09	1.41	A	0.114	2.91	10	1	1	17.320	0.52	25.96	C
100.00-80.00			B	0.114	2.91		1	1	17.320			
			C	0.114	2.91		1	1	17.320			
T5	0.11	1.46	A	0.1	2.963	9	1	1	18.610	0.54	27.07	C
80.00-60.00			B	0.1	2.963		1	1	18.610			
			C	0.1	2.963		1	1	18.610			
T6	0.13	1.52	A	0.091	3.001	9	1	1	19.962	0.55	27.39	C
60.00-40.00			B	0.091	3.001		1	1	19.962			
			C	0.091	3.001		1	1	19.962			
T7	0.13	1.71	A	0.093	2.994	8	1	1	24.172	0.57	28.67	C
40.00-20.00			B	0.093	2.994		1	1	24.172			
			C	0.093	2.994		1	1	24.172			
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	7	1	1	25.907	0.53	26.44	C
			B	0.087	3.016		1	1	25.907			
			C	0.087	3.016		1	1	25.907			
Sum Weight:	0.71	10.77						OTM	238.58 kip-ft	3.58		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	11	0.825	1	5.358	0.16	10.79	C
145.00-130.00			B	0.123	2.874		0.825	1	5.358			
			C	0.123	2.874		0.825	1	5.358			
T2	0.02	0.71	A	0.178	2.67	10	0.825	1	8.066	0.22	21.67	C
130.00-120.00			B	0.178	2.67		0.825	1	8.066			
			C	0.178	2.67		0.825	1	8.066			
T3	0.07	1.36	A	0.134	2.831	10	0.825	1	14.562	0.44	21.79	C
120.00-100.00			B	0.134	2.831		0.825	1	14.562			
			C	0.134	2.831		0.825	1	14.562			
T4	0.09	1.41	A	0.114	2.91	10	0.825	1	15.575	0.48	23.86	C
100.00-80.00			B	0.114	2.91		0.825	1	15.575			
			C	0.114	2.91		0.825	1	15.575			
T5	0.11	1.46	A	0.1	2.963	9	0.825	1	16.638	0.50	24.79	C
80.00-60.00			B	0.1	2.963		0.825	1	16.638			
			C	0.1	2.963		0.825	1	16.638			
T6	0.13	1.52	A	0.091	3.001	9	0.825	1	17.753	0.50	24.98	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
60.00-40.00			B	0.091	3.001		0.825	1	17.753			
			C	0.091	3.001		0.825	1	17.753			
T7	0.13	1.71	A	0.093	2.994	8	0.825	1	21.226	0.52	25.79	C
40.00-20.00			B	0.093	2.994		0.825	1	21.226			
			C	0.093	2.994		0.825	1	21.226			
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	7	0.825	1	22.658	0.47	23.67	C
			B	0.087	3.016		0.825	1	22.658			
			C	0.087	3.016		0.825	1	22.658			
Sum Weight:	0.71	10.77						OTM	220.12 kip-ft	3.28		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	11	0.8	1	5.358	0.16	10.79	C
145.00-130.00			B	0.123	2.874		0.8	1	5.358			
			C	0.123	2.874		0.8	1	5.358			
T2	0.02	0.71	A	0.178	2.67	10	0.8	1	7.934	0.21	21.36	C
130.00-120.00			B	0.178	2.67		0.8	1	7.934			
			C	0.178	2.67		0.8	1	7.934			
T3	0.07	1.36	A	0.134	2.831	10	0.8	1	14.344	0.43	21.52	C
120.00-100.00			B	0.134	2.831		0.8	1	14.344			
			C	0.134	2.831		0.8	1	14.344			
T4	0.09	1.41	A	0.114	2.91	10	0.8	1	15.326	0.47	23.56	C
100.00-80.00			B	0.114	2.91		0.8	1	15.326			
			C	0.114	2.91		0.8	1	15.326			
T5	0.11	1.46	A	0.1	2.963	9	0.8	1	16.357	0.49	24.46	C
80.00-60.00			B	0.1	2.963		0.8	1	16.357			
			C	0.1	2.963		0.8	1	16.357			
T6	0.13	1.52	A	0.091	3.001	9	0.8	1	17.438	0.49	24.63	C
60.00-40.00			B	0.091	3.001		0.8	1	17.438			
			C	0.091	3.001		0.8	1	17.438			
T7	0.13	1.71	A	0.093	2.994	8	0.8	1	20.806	0.51	25.38	C
40.00-20.00			B	0.093	2.994		0.8	1	20.806			
			C	0.093	2.994		0.8	1	20.806			
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	7	0.8	1	22.194	0.47	23.28	C
			B	0.087	3.016		0.8	1	22.194			
			C	0.087	3.016		0.8	1	22.194			
Sum Weight:	0.71	10.77						OTM	217.48 kip-ft	3.23		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.02	0.81	A	0.123	2.874	11	0.85	1	5.358	0.16	10.79	C
145.00-130.00			B	0.123	2.874		0.85	1	5.358			
			C	0.123	2.874		0.85	1	5.358			
T2	0.02	0.71	A	0.178	2.67	10	0.85	1	8.197	0.22	21.98	C
130.00-120.00			B	0.178	2.67		0.85	1	8.197			
			C	0.178	2.67		0.85	1	8.197			
T3	0.07	1.36	A	0.134	2.831	10	0.85	1	14.780	0.44	22.05	C
120.00-100.00			B	0.134	2.831		0.85	1	14.780			
			C	0.134	2.831		0.85	1	14.780			
T4	0.09	1.41	A	0.114	2.91	10	0.85	1	15.825	0.48	24.16	C
100.00-80.00			B	0.114	2.91		0.85	1	15.825			
			C	0.114	2.91		0.85	1	15.825			
T5	0.11	1.46	A	0.1	2.963	9	0.85	1	16.920	0.50	25.12	C
80.00-60.00			B	0.1	2.963		0.85	1	16.920			
			C	0.1	2.963		0.85	1	16.920			
T6	0.13	1.52	A	0.091	3.001	9	0.85	1	18.069	0.51	25.32	C
60.00-40.00			B	0.091	3.001		0.85	1	18.069			
			C	0.091	3.001		0.85	1	18.069			
T7	0.13	1.71	A	0.093	2.994	8	0.85	1	21.647	0.52	26.20	C
40.00-20.00			B	0.093	2.994		0.85	1	21.647			
			C	0.093	2.994		0.85	1	21.647			
T8 20.00-0.00	0.13	1.79	A	0.087	3.016	7	0.85	1	23.122	0.48	24.07	C
			B	0.087	3.016		0.85	1	23.122			
			C	0.087	3.016		0.85	1	23.122			
Sum Weight:	0.71	10.77						OTM	222.75 kip-ft	3.32		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	6.29					
Bracing Weight	4.48					
Total Member Self-Weight	10.77			2.79	-1.26	
Total Weight	12.28			2.79	-1.26	
Wind 0 deg - No Ice		-0.10	-14.35	-1050.45	9.13	3.41
Wind 30 deg - No Ice		6.70	-11.57	-856.30	-498.59	5.04
Wind 45 deg - No Ice		9.39	-9.33	-691.44	-700.24	5.43
Wind 60 deg - No Ice		11.35	-6.54	-484.51	-848.22	5.48
Wind 90 deg - No Ice		13.42	-0.01	2.16	-998.49	4.65
Wind 120 deg - No Ice		12.43	7.16	528.59	-914.08	2.42
Wind 135 deg - No Ice		10.01	9.99	738.14	-737.76	0.84
Wind 150 deg - No Ice		6.70	11.60	864.62	-499.33	-0.69
Wind 180 deg - No Ice		-0.00	13.07	978.11	-1.67	-3.24
Wind 210 deg - No Ice		-6.70	11.57	861.98	495.89	-5.04
Wind 225 deg - No Ice		-9.44	9.31	694.40	702.61	-5.43
Wind 240 deg - No Ice		-12.51	7.08	520.41	918.17	-5.83
Wind 270 deg - No Ice		-13.46	-0.06	-3.20	1000.04	-4.35
Wind 300 deg - No Ice		-11.40	-6.56	-488.01	850.94	-2.24
Wind 315 deg - No Ice		-10.07	-10.00	-733.32	741.24	-1.03
Wind 330 deg - No Ice		-6.78	-11.60	-859.26	504.58	0.39
Member Ice	61.41					

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Total Weight Ice	81.84			22.44	-9.90	
Wind 0 deg - Ice		-0.03	-6.98	-522.42	-7.22	0.26
Wind 30 deg - Ice		3.42	-5.91	-441.53	-278.06	1.03
Wind 45 deg - Ice		4.82	-4.81	-355.31	-388.81	1.32
Wind 60 deg - Ice		5.89	-3.39	-244.28	-472.61	1.52
Wind 90 deg - Ice		6.84	-0.00	22.33	-546.95	1.62
Wind 120 deg - Ice		6.04	3.49	294.70	-481.91	1.26
Wind 135 deg - Ice		4.91	4.91	406.28	-393.98	0.92
Wind 150 deg - Ice		3.42	5.92	487.16	-278.32	0.52
Wind 180 deg - Ice		0.00	6.79	556.14	-10.04	-0.29
Wind 210 deg - Ice		-3.42	5.91	486.44	258.22	-1.03
Wind 225 deg - Ice		-4.84	4.80	399.53	370.26	-1.32
Wind 240 deg - Ice		-6.06	3.46	292.56	463.75	-1.52
Wind 270 deg - Ice		-6.85	-0.02	20.88	528.19	-1.55
Wind 300 deg - Ice		-5.90	-3.40	-245.24	454.19	-1.23
Wind 315 deg - Ice		-4.93	-4.91	-361.58	375.71	-0.97
Wind 330 deg - Ice		-3.44	-5.92	-442.33	260.50	-0.60
Total Weight	12.28			2.79	-1.26	
Wind 0 deg - Service		-0.03	-4.07	-298.66	2.99	0.97
Wind 30 deg - Service		1.90	-3.29	-243.53	-141.17	1.43
Wind 45 deg - Service		2.67	-2.65	-196.72	-198.43	1.54
Wind 60 deg - Service		3.22	-1.86	-137.97	-240.45	1.56
Wind 90 deg - Service		3.81	-0.00	0.22	-283.11	1.32
Wind 120 deg - Service		3.53	2.03	149.69	-259.14	0.69
Wind 135 deg - Service		2.84	2.84	209.19	-209.08	0.24
Wind 150 deg - Service		1.90	3.29	245.11	-141.38	-0.20
Wind 180 deg - Service		-0.00	3.71	277.33	-0.08	-0.92
Wind 210 deg - Service		-1.90	3.29	244.36	141.20	-1.43
Wind 225 deg - Service		-2.68	2.64	196.77	199.90	-1.54
Wind 240 deg - Service		-3.55	2.01	147.37	261.10	-1.66
Wind 270 deg - Service		-3.82	-0.02	-1.30	284.35	-1.23
Wind 300 deg - Service		-3.24	-1.86	-138.96	242.02	-0.64
Wind 315 deg - Service		-2.86	-2.84	-208.61	210.87	-0.29
Wind 330 deg - Service		-1.93	-3.29	-244.37	143.67	0.11

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 45 deg - No Ice
7	0.9 Dead+1.6 Wind 45 deg - No Ice
8	1.2 Dead+1.6 Wind 60 deg - No Ice
9	0.9 Dead+1.6 Wind 60 deg - No Ice
10	1.2 Dead+1.6 Wind 90 deg - No Ice
11	0.9 Dead+1.6 Wind 90 deg - No Ice
12	1.2 Dead+1.6 Wind 120 deg - No Ice
13	0.9 Dead+1.6 Wind 120 deg - No Ice
14	1.2 Dead+1.6 Wind 135 deg - No Ice
15	0.9 Dead+1.6 Wind 135 deg - No Ice
16	1.2 Dead+1.6 Wind 150 deg - No Ice
17	0.9 Dead+1.6 Wind 150 deg - No Ice

Comb. No.	Description
18	1.2 Dead+1.6 Wind 180 deg - No Ice
19	0.9 Dead+1.6 Wind 180 deg - No Ice
20	1.2 Dead+1.6 Wind 210 deg - No Ice
21	0.9 Dead+1.6 Wind 210 deg - No Ice
22	1.2 Dead+1.6 Wind 225 deg - No Ice
23	0.9 Dead+1.6 Wind 225 deg - No Ice
24	1.2 Dead+1.6 Wind 240 deg - No Ice
25	0.9 Dead+1.6 Wind 240 deg - No Ice
26	1.2 Dead+1.6 Wind 270 deg - No Ice
27	0.9 Dead+1.6 Wind 270 deg - No Ice
28	1.2 Dead+1.6 Wind 300 deg - No Ice
29	0.9 Dead+1.6 Wind 300 deg - No Ice
30	1.2 Dead+1.6 Wind 315 deg - No Ice
31	0.9 Dead+1.6 Wind 315 deg - No Ice
32	1.2 Dead+1.6 Wind 330 deg - No Ice
33	0.9 Dead+1.6 Wind 330 deg - No Ice
34	1.2 Dead+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
39	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
40	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
41	1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Temp
42	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
43	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
44	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
45	1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Temp
46	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
47	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
48	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
49	1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Temp
50	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
51	Dead+Wind 0 deg - Service
52	Dead+Wind 30 deg - Service
53	Dead+Wind 45 deg - Service
54	Dead+Wind 60 deg - Service
55	Dead+Wind 90 deg - Service
56	Dead+Wind 120 deg - Service
57	Dead+Wind 135 deg - Service
58	Dead+Wind 150 deg - Service
59	Dead+Wind 180 deg - Service
60	Dead+Wind 210 deg - Service
61	Dead+Wind 225 deg - Service
62	Dead+Wind 240 deg - Service
63	Dead+Wind 270 deg - Service
64	Dead+Wind 300 deg - Service
65	Dead+Wind 315 deg - Service
66	Dead+Wind 330 deg - Service

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	145 - 130	Leg	Max Tension	29	4.23	0.01	-0.00
			Max. Compression	24	-4.95	0.02	-0.01
			Max. Mx	26	-0.57	-0.07	-0.00
			Max. My	18	-0.37	0.00	0.07

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	26	0.24	0.00	0.00
			Max. Vx	18	-0.23	0.00	0.00
		Diagonal	Max Tension	20	0.81	0.00	0.00
			Max. Compression	4	-0.82	0.00	0.00
			Max. Mx	46	0.26	-0.01	0.00
			Max. My	16	-0.47	-0.00	0.00
			Max. Vy	45	0.02	-0.01	0.00
			Max. Vx	43	0.00	0.00	0.00
		Top Girt	Max Tension	25	0.07	0.00	0.00
			Max. Compression	18	-0.09	0.00	0.00
			Max. Mx	34	-0.04	0.03	0.00
			Max. My	10	-0.01	0.00	0.00
			Max. Vy	34	-0.03	0.00	0.00
			Max. Vx	10	-0.00	0.00	0.00
T2	130 - 120	Leg	Max Tension	29	6.61	-0.82	0.02
			Max. Compression	24	-7.86	0.77	0.01
			Max. Mx	28	6.45	-0.83	0.02
			Max. My	20	-0.67	-0.04	0.81
			Max. Vy	8	0.29	-0.82	-0.01
			Max. Vx	20	-0.31	-0.04	0.81
		Diagonal	Max Tension	29	1.63	0.00	0.00
			Max. Compression	12	-1.76	0.00	0.00
			Max. Mx	43	0.31	0.04	-0.01
			Max. My	42	-0.39	0.04	-0.01
			Max. Vy	43	0.03	0.04	-0.01
			Max. Vx	41	0.00	0.00	0.00
		Top Girt	Max Tension	28	0.04	0.00	0.00
			Max. Compression	23	-0.03	0.00	0.00
			Max. Mx	34	0.02	-0.06	0.00
			Max. My	40	0.02	0.00	0.00
			Max. Vy	34	0.05	0.00	0.00
			Max. Vx	40	0.00	0.00	0.00
T3	120 - 100	Leg	Max Tension	19	18.10	-0.77	0.04
			Max. Compression	12	-21.11	1.09	-0.00
			Max. Mx	28	17.67	-1.11	0.00
			Max. My	4	-1.43	-0.02	-1.11
			Max. Vy	28	0.21	-1.11	0.00
			Max. Vx	4	0.25	-0.02	-1.11
		Diagonal	Max Tension	26	2.61	0.00	0.00
			Max. Compression	26	-2.65	0.00	0.00
			Max. Mx	43	0.74	0.06	0.01
			Max. My	40	-0.05	0.06	-0.01
			Max. Vy	43	0.05	0.06	-0.01
			Max. Vx	40	-0.00	0.00	0.00
T4	100 - 80	Leg	Max Tension	9	32.36	-1.09	-0.05
			Max. Compression	12	-37.46	1.24	-0.01
			Max. Mx	12	-37.46	1.24	-0.01
			Max. My	4	-2.17	-0.01	-1.23
			Max. Vy	28	0.16	-1.13	0.00
			Max. Vx	20	-0.16	-0.01	1.15
		Diagonal	Max Tension	26	3.26	0.00	0.00
			Max. Compression	10	-3.30	0.00	0.00
			Max. Mx	43	0.81	0.08	0.01
			Max. My	46	-0.05	0.08	0.01
			Max. Vy	43	0.06	0.08	-0.01
			Max. Vx	46	0.00	0.00	0.00
T5	80 - 60	Leg	Max Tension	29	47.31	-1.32	0.01
			Max. Compression	12	-54.57	1.48	-0.02
			Max. Mx	25	-53.71	1.48	0.03
			Max. My	16	-2.63	-0.01	-1.43
			Max. Vy	8	-0.15	-1.33	-0.02

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	-0.16	-0.01	-1.30
		Diagonal	Max Tension	10	3.73	0.00	0.00
			Max. Compression	26	-3.79	0.00	0.00
			Max. Mx	43	0.90	0.11	-0.02
			Max. My	40	-0.08	0.10	-0.02
			Max. Vy	43	0.07	0.11	-0.02
			Max. Vx	40	-0.00	0.00	0.00
T6	60 - 40	Leg	Max Tension	29	62.64	-1.42	0.00
			Max. Compression	12	-72.31	1.83	-0.02
			Max. Mx	24	-72.24	1.83	0.05
			Max. My	20	-3.44	0.02	1.64
			Max. Vy	48	0.14	-1.05	0.02
			Max. Vx	20	-0.13	0.02	1.64
		Diagonal	Max Tension	10	4.13	0.00	0.00
			Max. Compression	10	-4.22	0.00	0.00
			Max. Mx	43	1.02	0.13	-0.02
			Max. My	46	-0.02	0.13	0.02
			Max. Vy	43	0.07	0.13	-0.02
			Max. Vx	40	-0.00	0.00	0.00
T7	40 - 20	Leg	Max Tension	29	77.97	-1.49	0.01
			Max. Compression	12	-90.33	2.01	-0.01
			Max. Mx	43	5.70	-2.29	0.01
			Max. My	20	-3.80	-0.06	1.82
			Max. Vy	48	0.33	-2.26	0.01
			Max. Vx	20	0.20	-0.06	1.82
		Diagonal	Max Tension	26	4.64	0.00	0.00
			Max. Compression	10	-4.76	0.00	0.00
			Max. Mx	43	1.45	0.17	-0.02
			Max. My	46	-0.09	0.14	0.02
			Max. Vy	43	0.09	0.17	-0.02
			Max. Vx	46	0.00	0.00	0.00
T8	20 - 0	Leg	Max Tension	29	93.01	-1.65	0.01
			Max. Compression	12	-108.24	0.00	0.00
			Max. Mx	40	-57.79	2.57	0.03
			Max. My	20	-4.58	-0.13	3.32
			Max. Vy	48	-0.44	-2.26	0.01
			Max. Vx	20	0.42	-0.13	3.32
		Diagonal	Max Tension	27	5.24	0.00	0.00
			Max. Compression	24	-5.80	0.00	0.00
			Max. Mx	43	0.10	0.19	0.03
			Max. My	44	-1.47	0.16	0.03
			Max. Vy	42	0.09	0.17	-0.02
			Max. Vx	44	0.01	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	24	113.50	12.69	-6.97
	Max. H_x	24	113.50	12.69	-6.97
	Max. H_z	7	-94.25	-10.56	6.13
	Min. Vert	9	-96.78	-10.97	6.01
	Min. H_x	9	-96.78	-10.97	6.01
	Min. H_z	24	113.50	12.69	-6.97
Leg B	Max. Vert	12	113.50	-12.58	-7.12
	Max. H_x	29	-97.31	10.94	6.18

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg A	Max. H_z	31	-94.79	10.50	6.35
	Min. Vert	29	-97.31	10.94	6.18
	Min. H_x	12	113.50	-12.58	-7.12
	Min. H_z	12	113.50	-12.58	-7.12
	Max. Vert	2	113.08	0.18	14.44
	Max. H_x	27	4.14	0.96	0.40
	Max. H_z	2	113.08	0.18	14.44
	Min. Vert	19	-96.78	-0.17	-12.49
	Min. H_x	13	-50.55	-1.00	-6.67
	Min. H_z	19	-96.78	-0.17	-12.49

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	12.28	0.00	0.00	2.79	-1.26	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	14.74	-0.17	-22.95	-1686.10	15.14	5.47
0.9 Dead+1.6 Wind 0 deg - No Ice	11.05	-0.17	-22.95	-1685.86	15.51	5.46
1.2 Dead+1.6 Wind 30 deg - No Ice	14.74	10.72	-18.52	-1374.69	-799.29	8.08
0.9 Dead+1.6 Wind 30 deg - No Ice	11.05	10.72	-18.52	-1374.65	-798.41	8.07
1.2 Dead+1.6 Wind 45 deg - No Ice	14.74	15.02	-14.93	-1110.25	-1122.76	8.71
0.9 Dead+1.6 Wind 45 deg - No Ice	11.05	15.02	-14.93	-1110.37	-1121.66	8.71
1.2 Dead+1.6 Wind 60 deg - No Ice	14.74	18.16	-10.46	-778.31	-1360.14	8.78
0.9 Dead+1.6 Wind 60 deg - No Ice	11.05	18.16	-10.46	-778.65	-1358.88	8.78
1.2 Dead+1.6 Wind 90 deg - No Ice	14.74	21.47	-0.02	2.36	-1601.16	7.44
0.9 Dead+1.6 Wind 90 deg - No Ice	11.05	21.47	-0.02	1.52	-1599.75	7.44
1.2 Dead+1.6 Wind 120 deg - No Ice	14.74	19.89	11.46	846.77	-1465.72	3.88
0.9 Dead+1.6 Wind 120 deg - No Ice	11.05	19.89	11.46	845.39	-1464.41	3.88
1.2 Dead+1.6 Wind 135 deg - No Ice	14.74	15.00	14.97	1121.79	-1121.79	1.35
0.9 Dead+1.6 Wind 135 deg - No Ice	11.05	15.00	14.97	1120.23	-1120.69	1.35
1.2 Dead+1.6 Wind 150 deg - No Ice	14.74	10.72	18.55	1385.81	-800.46	-1.10
0.9 Dead+1.6 Wind 150 deg - No Ice	11.05	10.72	18.55	1384.08	-799.57	-1.10
1.2 Dead+1.6 Wind 180 deg - No Ice	14.74	-0.00	20.91	1567.86	-2.19	-5.19
0.9 Dead+1.6 Wind 180 deg - No Ice	11.05	-0.00	20.91	1566.01	-1.81	-5.19
1.2 Dead+1.6 Wind 210 deg - No Ice	14.74	-10.72	18.52	1381.58	795.94	-8.08
0.9 Dead+1.6 Wind 210 deg - No Ice	11.05	-10.72	18.52	1379.86	795.82	-8.07

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
1.2 Dead+1.6 Wind 225 deg - No Ice	14.74	-15.10	14.89	1112.77	1127.53	-8.70
0.9 Dead+1.6 Wind 225 deg - No Ice	11.05	-15.10	14.89	1111.22	1127.19	-8.70
1.2 Dead+1.6 Wind 240 deg - No Ice	14.74	-20.01	11.33	833.67	1473.30	-9.35
0.9 Dead+1.6 Wind 240 deg - No Ice	11.05	-20.01	11.33	832.30	1472.74	-9.34
1.2 Dead+1.6 Wind 270 deg - No Ice	14.74	-21.54	-0.09	-6.24	1604.66	-6.97
0.9 Dead+1.6 Wind 270 deg - No Ice	11.05	-21.54	-0.09	-7.08	1604.01	-6.97
1.2 Dead+1.6 Wind 300 deg - No Ice	14.74	-18.24	-10.50	-783.93	1365.51	-3.59
0.9 Dead+1.6 Wind 300 deg - No Ice	11.05	-18.24	-10.50	-784.27	1365.01	-3.59
1.2 Dead+1.6 Wind 315 deg - No Ice	14.74	-15.10	-14.99	-1116.30	1128.39	-1.65
0.9 Dead+1.6 Wind 315 deg - No Ice	11.05	-15.10	-14.99	-1116.42	1128.05	-1.65
1.2 Dead+1.6 Wind 330 deg - No Ice	14.74	-10.85	-18.56	-1379.45	809.90	0.62
0.9 Dead+1.6 Wind 330 deg - No Ice	11.05	-10.85	-18.56	-1379.40	809.75	0.62
1.2 Dead+1.0 Ice+1.0 Temp	84.30	-0.00	-0.00	23.23	-10.28	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	84.30	-0.03	-6.98	-529.36	-7.60	0.28
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	84.30	3.42	-5.91	-447.32	-282.35	1.06
1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Temp	84.30	4.82	-4.81	-359.86	-394.70	1.35
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	84.30	5.89	-3.39	-247.22	-479.71	1.56
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	84.30	6.84	-0.00	23.23	-555.12	1.66
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	84.30	6.04	3.49	299.53	-489.12	1.28
1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Temp	84.30	4.82	4.82	407.39	-394.61	0.93
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	84.30	3.42	5.92	494.77	-282.61	0.52
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	84.30	0.00	6.79	564.75	-10.46	-0.31
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	84.30	-3.42	5.91	494.05	261.68	-1.06
1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Temp	84.30	-4.84	4.80	405.88	375.33	-1.35
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	84.30	-6.06	3.46	297.35	470.16	-1.56
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	84.30	-6.85	-0.02	21.76	535.54	-1.58
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	84.30	-5.90	-3.40	-248.20	460.48	-1.25
1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Temp	84.30	-4.84	-4.82	-360.89	375.53	-0.98
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	84.30	-3.44	-5.92	-448.13	263.99	-0.60
Dead+Wind 0 deg - Service	12.28	-0.03	-4.07	-296.90	1.69	0.97
Dead+Wind 30 deg - Service	12.28	1.90	-3.29	-241.65	-142.78	1.43
Dead+Wind 45 deg - Service	12.28	2.67	-2.65	-194.75	-200.16	1.55
Dead+Wind 60 deg - Service	12.28	3.22	-1.86	-135.87	-242.27	1.56

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 90 deg - Service	12.28	3.81	-0.00	2.62	-285.02	1.32
Dead+Wind 120 deg - Service	12.28	3.53	2.03	152.41	-261.00	0.69
Dead+Wind 135 deg - Service	12.28	2.66	2.66	201.19	-199.99	0.24
Dead+Wind 150 deg - Service	12.28	1.90	3.29	248.02	-142.99	-0.19
Dead+Wind 180 deg - Service	12.28	-0.00	3.71	280.32	-1.38	-0.92
Dead+Wind 210 deg - Service	12.28	-1.90	3.29	247.27	140.20	-1.43
Dead+Wind 225 deg - Service	12.28	-2.68	2.64	199.59	199.02	-1.54
Dead+Wind 240 deg - Service	12.28	-3.55	2.01	150.08	260.36	-1.66
Dead+Wind 270 deg - Service	12.28	-3.82	-0.02	1.09	283.65	-1.24
Dead+Wind 300 deg - Service	12.28	-3.24	-1.86	-136.86	241.23	-0.64
Dead+Wind 315 deg - Service	12.28	-2.68	-2.66	-195.82	199.17	-0.29
Dead+Wind 330 deg - Service	12.28	-1.93	-3.29	-242.50	142.67	0.11

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	-12.28	0.00	0.00	12.28	0.00	0.000%
2	-0.17	-14.74	-22.95	0.17	14.74	22.95	0.000%
3	-0.17	-11.05	-22.95	0.17	11.05	22.95	0.000%
4	10.72	-14.74	-18.52	-10.72	14.74	18.52	0.000%
5	10.72	-11.05	-18.52	-10.72	11.05	18.52	0.000%
6	15.02	-14.74	-14.93	-15.02	14.74	14.93	0.000%
7	15.02	-11.05	-14.93	-15.02	11.05	14.93	0.000%
8	18.16	-14.74	-10.46	-18.16	14.74	10.46	0.000%
9	18.16	-11.05	-10.46	-18.16	11.05	10.46	0.000%
10	21.47	-14.74	-0.02	-21.47	14.74	0.02	0.000%
11	21.47	-11.05	-0.02	-21.47	11.05	0.02	0.000%
12	19.89	-14.74	11.46	-19.89	14.74	-11.46	0.000%
13	19.89	-11.05	11.46	-19.89	11.05	-11.46	0.000%
14	15.00	-14.74	14.97	-15.00	14.74	-14.97	0.000%
15	15.00	-11.05	14.97	-15.00	11.05	-14.97	0.000%
16	10.72	-14.74	18.55	-10.72	14.74	-18.55	0.000%
17	10.72	-11.05	18.55	-10.72	11.05	-18.55	0.000%
18	-0.00	-14.74	20.91	0.00	14.74	-20.91	0.000%
19	-0.00	-11.05	20.91	0.00	11.05	-20.91	0.000%
20	-10.72	-14.74	18.52	10.72	14.74	-18.52	0.000%
21	-10.72	-11.05	18.52	10.72	11.05	-18.52	0.000%
22	-15.10	-14.74	14.89	15.10	14.74	-14.89	0.000%
23	-15.10	-11.05	14.89	15.10	11.05	-14.89	0.000%
24	-20.01	-14.74	11.33	20.01	14.74	-11.33	0.000%
25	-20.01	-11.05	11.33	20.01	11.05	-11.33	0.000%
26	-21.54	-14.74	-0.09	21.54	14.74	0.09	0.000%
27	-21.54	-11.05	-0.09	21.54	11.05	0.09	0.000%
28	-18.24	-14.74	-10.50	18.24	14.74	10.50	0.000%
29	-18.24	-11.05	-10.50	18.24	11.05	10.50	0.000%
30	-15.10	-14.74	-14.99	15.10	14.74	14.99	0.000%
31	-15.10	-11.05	-14.99	15.10	11.05	14.99	0.000%
32	-10.85	-14.74	-18.56	10.85	14.74	18.56	0.000%
33	-10.85	-11.05	-18.56	10.85	11.05	18.56	0.000%
34	0.00	-84.30	0.00	0.00	84.30	0.00	0.000%
35	-0.03	-84.30	-6.98	0.03	84.30	6.98	0.000%
36	3.42	-84.30	-5.91	-3.42	84.30	5.91	0.000%
37	4.82	-84.30	-4.81	-4.82	84.30	4.81	0.000%
38	5.89	-84.30	-3.39	-5.89	84.30	3.39	0.000%
39	6.84	-84.30	-0.00	-6.84	84.30	0.00	0.000%
40	6.04	-84.30	3.49	-6.04	84.30	-3.49	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
41	4.82	-84.30	4.82	-4.82	84.30	-4.82	0.000%
42	3.42	-84.30	5.92	-3.42	84.30	-5.92	0.000%
43	0.00	-84.30	6.79	-0.00	84.30	-6.79	0.000%
44	-3.42	-84.30	5.91	3.42	84.30	-5.91	0.000%
45	-4.84	-84.30	4.80	4.84	84.30	-4.80	0.000%
46	-6.06	-84.30	3.46	6.06	84.30	-3.46	0.000%
47	-6.85	-84.30	-0.02	6.85	84.30	0.02	0.000%
48	-5.90	-84.30	-3.40	5.90	84.30	3.40	0.000%
49	-4.84	-84.30	-4.82	4.84	84.30	4.82	0.000%
50	-3.44	-84.30	-5.92	3.44	84.30	5.92	0.000%
51	-0.03	-12.28	-4.07	0.03	12.28	4.07	0.000%
52	1.90	-12.28	-3.29	-1.90	12.28	3.29	0.000%
53	2.67	-12.28	-2.65	-2.67	12.28	2.65	0.000%
54	3.22	-12.28	-1.86	-3.22	12.28	1.86	0.000%
55	3.81	-12.28	-0.00	-3.81	12.28	0.00	0.000%
56	3.53	-12.28	2.03	-3.53	12.28	-2.03	0.000%
57	2.66	-12.28	2.66	-2.66	12.28	-2.66	0.000%
58	1.90	-12.28	3.29	-1.90	12.28	-3.29	0.000%
59	-0.00	-12.28	3.71	0.00	12.28	-3.71	0.000%
60	-1.90	-12.28	3.29	1.90	12.28	-3.29	0.000%
61	-2.68	-12.28	2.64	2.68	12.28	-2.64	0.000%
62	-3.55	-12.28	2.01	3.55	12.28	-2.01	0.000%
63	-3.82	-12.28	-0.02	3.82	12.28	0.02	0.000%
64	-3.24	-12.28	-1.86	3.24	12.28	1.86	0.000%
65	-2.68	-12.28	-2.66	2.68	12.28	2.66	0.000%
66	-1.93	-12.28	-3.29	1.93	12.28	3.29	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00000001
3	Yes	4	0.00000001	0.00000001
4	Yes	4	0.00000001	0.00000001
5	Yes	4	0.00000001	0.00000001
6	Yes	4	0.00000001	0.00000001
7	Yes	4	0.00000001	0.00000001
8	Yes	4	0.00000001	0.00000001
9	Yes	4	0.00000001	0.00000001
10	Yes	4	0.00000001	0.00000001
11	Yes	4	0.00000001	0.00000001
12	Yes	4	0.00000001	0.00000001
13	Yes	4	0.00000001	0.00000001
14	Yes	4	0.00000001	0.00000001
15	Yes	4	0.00000001	0.00000001
16	Yes	4	0.00000001	0.00000001
17	Yes	4	0.00000001	0.00000001
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00000001
20	Yes	4	0.00000001	0.00000001
21	Yes	4	0.00000001	0.00000001
22	Yes	4	0.00000001	0.00000001
23	Yes	4	0.00000001	0.00000001
24	Yes	4	0.00000001	0.00000001
25	Yes	4	0.00000001	0.00000001

26	Yes	4	0.00000001	0.00000001
27	Yes	4	0.00000001	0.00000001
28	Yes	4	0.00000001	0.00000001
29	Yes	4	0.00000001	0.00000001
30	Yes	4	0.00000001	0.00000001
31	Yes	4	0.00000001	0.00000001
32	Yes	4	0.00000001	0.00000001
33	Yes	4	0.00000001	0.00000001
34	Yes	4	0.00000001	0.00000001
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000001
37	Yes	4	0.00000001	0.00000001
38	Yes	4	0.00000001	0.00000001
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000001
41	Yes	4	0.00000001	0.00000001
42	Yes	4	0.00000001	0.00000001
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000001
45	Yes	4	0.00000001	0.00000001
46	Yes	4	0.00000001	0.00000001
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000001
49	Yes	4	0.00000001	0.00000001
50	Yes	4	0.00000001	0.00000001
51	Yes	4	0.00000001	0.00000001
52	Yes	4	0.00000001	0.00000001
53	Yes	4	0.00000001	0.00000001
54	Yes	4	0.00000001	0.00000001
55	Yes	4	0.00000001	0.00000001
56	Yes	4	0.00000001	0.00000001
57	Yes	4	0.00000001	0.00000001
58	Yes	4	0.00000001	0.00000001
59	Yes	4	0.00000001	0.00000001
60	Yes	4	0.00000001	0.00000001
61	Yes	4	0.00000001	0.00000001
62	Yes	4	0.00000001	0.00000001
63	Yes	4	0.00000001	0.00000001
64	Yes	4	0.00000001	0.00000001
65	Yes	4	0.00000001	0.00000001
66	Yes	4	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	145 - 130	1.778	56	0.0889	0.0070
T2	130 - 120	1.498	56	0.0871	0.0070
T3	120 - 100	1.315	56	0.0852	0.0069
T4	100 - 80	0.963	56	0.0781	0.0060
T5	80 - 60	0.648	56	0.0670	0.0046
T6	60 - 40	0.385	56	0.0529	0.0033
T7	40 - 20	0.184	56	0.0368	0.0020
T8	20 - 0	0.054	56	0.0190	0.0010

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
145.00	10-ft Lightning Rod	56	1.778	0.0889	0.0070	Inf
144.00	3' Side Mount Standoff	56	1.759	0.0887	0.0070	Inf
138.00	DB589-Y	56	1.647	0.0881	0.0070	845397
133.00	3' Side Mount Standoff	56	1.554	0.0875	0.0070	494377
125.00	ANT150F2	56	1.406	0.0862	0.0070	336607
115.00	ANT150D	56	1.225	0.0839	0.0067	224164
110.00	ANT150F2	56	1.136	0.0822	0.0065	178537
105.00	10' x 3" Dia Omni	56	1.048	0.0803	0.0063	147598
102.00	ANT150D	56	0.997	0.0790	0.0062	133967
95.00	SPD2-4.7	56	0.880	0.0757	0.0057	114896
70.00	NH65PS-DG-F0M	56	0.510	0.0602	0.0039	83797
67.00	RRH2x60-AWS	56	0.471	0.0581	0.0037	81808

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	145 - 130	9.942	12	0.4967	0.0392
T2	130 - 120	8.379	12	0.4867	0.0396
T3	120 - 100	7.354	12	0.4759	0.0387
T4	100 - 80	5.390	12	0.4362	0.0340
T5	80 - 60	3.631	12	0.3742	0.0260
T6	60 - 40	2.160	24	0.2960	0.0185
T7	40 - 20	1.030	24	0.2060	0.0114
T8	20 - 0	0.302	24	0.1064	0.0057

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
145.00	10-ft Lightning Rod	12	9.942	0.4967	0.0392	215269
144.00	3' Side Mount Standoff	12	9.837	0.4961	0.0393	215269
138.00	DB589-Y	12	9.210	0.4925	0.0394	153764
133.00	3' Side Mount Standoff	12	8.690	0.4891	0.0396	89882
125.00	ANT150F2	12	7.864	0.4820	0.0393	60390
115.00	ANT150D	12	6.850	0.4683	0.0379	39959
110.00	ANT150F2	12	6.353	0.4592	0.0369	31840
105.00	10' x 3" Dia Omni	12	5.866	0.4484	0.0356	26435
102.00	ANT150D	12	5.579	0.4413	0.0347	24039
95.00	SPD2-4.7	12	4.927	0.4226	0.0322	20670
70.00	NH65PS-DG-F0M	12	2.855	0.3368	0.0221	15055
67.00	RRH2x60-AWS	24	2.638	0.3249	0.0210	14680

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	145	Leg	A325N	1.0000	6	0.70	53.01	0.013 ✔	1	Bolt Tension
T2	130	Leg	A325N	1.0000	6	1.10	53.01	0.021 ✔	1	Bolt Tension
		Diagonal	A325N	1.0000	1	1.63	12.72	0.128 ✔	1	Member Bearing
		Top Girt	A325N	1.0000	1	0.04	12.72	0.003 ✔	1	Member Bearing
T3	120	Leg	A325N	1.0000	6	3.02	53.01	0.057 ✔	1	Bolt Tension
		Diagonal	A325N	1.0000	1	2.61	12.72	0.205 ✔	1	Member Bearing
T4	100	Leg	A325N	1.0000	6	5.39	53.01	0.102 ✔	1	Bolt Tension
		Diagonal	A325N	1.0000	1	3.26	12.72	0.256 ✔	1	Member Bearing
T5	80	Leg	A325N	1.0000	6	7.89	53.01	0.149 ✔	1	Bolt Tension
		Diagonal	A325N	1.0000	1	3.73	12.72	0.293 ✔	1	Member Bearing
T6	60	Leg	A325N	1.0000	6	10.44	53.01	0.197 ✔	1	Bolt Tension
		Diagonal	A325N	1.0000	1	4.13	12.72	0.324 ✔	1	Member Bearing
T7	40	Leg	A325N	1.0000	6	12.99	53.01	0.245 ✔	1	Bolt Tension
		Diagonal	A325N	1.0000	1	4.64	12.72	0.364 ✔	1	Member Bearing
T8	20	Leg	F1554-105	1.0000	6	15.50	55.22	0.281 ✔	1	Bolt Tension
		Diagonal	A325N	1.0000	1	5.24	12.72	0.412 ✔	1	Member Bearing

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	145 - 130	1 3/4	15.00	2.50	68.6 K=1.00	2.4053	-4.95	76.75	0.065 [1] ✔
T2	130 - 120	Pirod 207628	10.02	10.02	44.8 K=1.00	3.6816	-7.86	143.06	0.055 [1] ✔
T3	120 - 100	Pirod 207628	20.03	10.02	44.8 K=1.00	3.6816	-21.11	143.06	0.148 [1] ✔
T4	100 - 80	Pirod 207628	20.03	10.02	44.8 K=1.00	3.6816	-37.46	143.06	0.262 [1] ✔
T5	80 - 60	Pirod 207628	20.03	10.02	44.8 K=1.00	3.6816	-54.57	143.06	0.381 [1] ✔
T6	60 - 40	Pirod 207628	20.03	10.02	44.8 K=1.00	3.6816	-72.31	143.06	0.505 [1] ✔
T7	40 - 20	Pirod 207628	20.03	10.02	44.8 K=1.00	3.6816	-90.33	143.06	0.631 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T8	20 - 0	Pirod 207628	20.03	10.02	44.8 K=1.00	3.6816	-108.24	143.06	0.757 [1] ✔

[1] P_u / ϕP_n controls

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n K	A in^2	V_u K	ϕV_n K	Stress Ratio
T2	130 - 120	0.5	1.47	120.0	165.67	0.1963	0.32	3.47	0.092 ✔
T3	120 - 100	0.5	1.47	120.0	165.67	0.1963	0.26	3.47	0.075 ✔
T4	100 - 80	0.5	1.47	120.0	165.67	0.1963	0.18	3.47	0.053 ✔
T5	80 - 60	0.5	1.47	120.0	165.67	0.1963	0.16	3.47	0.045 ✔
T6	60 - 40	0.5	1.47	120.0	165.67	0.1963	0.14	3.47	0.042 ✔
T7	40 - 20	0.5	1.47	120.0	165.67	0.1963	0.33	3.47	0.095 ✔
T8	20 - 0	0.5	1.47	120.0	165.67	0.1963	0.44	3.47	0.126 ✔

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	145 - 130	7/8	5.59	2.71	134.0 K=0.90	0.6013	-0.82	7.57	0.108 [1] ✔
T2	130 - 120	L2 1/2x2 1/2x3/16	11.42	5.02	121.8 K=1.00	0.9020	-1.76	13.38	0.131 [1] ✔
T3	120 - 100	L2 1/2x2 1/2x3/16	12.50	5.67	137.4 K=1.00	0.9020	-2.65	10.79	0.245 [1] ✔
T4	100 - 80	L2 1/2x2 1/2x3/16	13.80	6.37	154.4 K=1.00	0.9020	-3.30	8.55	0.386 [1] ✔
T5	80 - 60	L2 1/2x2 1/2x3/16	15.24	7.12	172.7 K=1.00	0.9020	-3.79	6.83	0.555 [1] ✔
T6	60 - 40	L2 1/2x2 1/2x3/16	16.80	7.92	192.1 K=1.00	0.9020	-4.22	5.52	0.764 [1] ✔
T7	40 - 20	L3x3x3/16	18.45	8.76	176.4 K=1.00	1.0900	-4.76	7.92	0.601 [1] ✔
T8	20 - 0	L3x3x3/16	20.16	9.62	193.8 K=1.00	1.0900	-5.80	6.56	0.885 [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	145 - 130	7/8	5.00	4.85	186.4 K=0.70	0.6013	-0.09	3.91	0.022 [1] ✔
T2	130 - 120	L2 1/2x2 1/2x3/16	5.00	4.52	114.8 K=1.05	0.9020	-0.03	14.60	0.002 [1] ✔

[1] P_u / ϕP_n controls

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	145 - 130	1 3/4	15.00	2.50	68.6	2.4053	4.23	108.24	0.039 [1] ✔
T2	130 - 120	Pirod 207628	10.02	10.02	44.8	3.6816	6.61	165.67	0.040 [1] ✔
T3	120 - 100	Pirod 207628	20.03	10.02	44.8	3.6816	18.10	165.67	0.109 [1] ✔
T4	100 - 80	Pirod 207628	20.03	10.02	44.8	3.6816	32.36	165.67	0.195 [1] ✔
T5	80 - 60	Pirod 207628	20.03	10.02	44.8	3.6816	47.31	165.67	0.286 [1] ✔
T6	60 - 40	Pirod 207628	20.03	10.02	44.8	3.6816	62.64	165.67	0.378 [1] ✔
T7	40 - 20	Pirod 207628	20.03	10.02	44.8	3.6816	77.97	165.67	0.471 [1] ✔
T8	20 - 0	Pirod 207628	20.03	10.02	44.8	3.6816	93.01	165.67	0.561 [1] ✔

[1] P_u / ϕP_n controls

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n K	A in^2	V_u K	ϕV_n K	Stress Ratio
T2	130 - 120	0.5	1.47	120.0	165.67	0.1963	0.32	3.47	0.092 ✔

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n K	A in^2	V_u K	ϕV_n K	Stress Ratio
T3	120 - 100	0.5	1.47	120.0	165.67	0.1963	0.26	3.47	0.075 ✓
T4	100 - 80	0.5	1.47	120.0	165.67	0.1963	0.18	3.47	0.053 ✓
T5	80 - 60	0.5	1.47	120.0	165.67	0.1963	0.16	3.47	0.045 ✓
T6	60 - 40	0.5	1.47	120.0	165.67	0.1963	0.14	3.47	0.042 ✓
T7	40 - 20	0.5	1.47	120.0	165.67	0.1963	0.33	3.47	0.095 ✓
T8	20 - 0	0.5	1.47	120.0	165.67	0.1963	0.44	3.47	0.126 ✓

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	145 - 130	7/8	5.59	2.71	148.9	0.6013	0.81	27.06	0.030 [1] ✓
T2	130 - 120	L2 1/2x2 1/2x3/16	11.42	5.02	80.1	0.9020	1.63	29.22	0.056 [1] ✓
T3	120 - 100	L2 1/2x2 1/2x3/16	12.50	5.67	90.0	0.9020	2.61	29.22	0.089 [1] ✓
T4	100 - 80	L2 1/2x2 1/2x3/16	13.80	6.37	100.8	0.9020	3.26	29.22	0.111 [1] ✓
T5	80 - 60	L2 1/2x2 1/2x3/16	15.24	7.12	112.4	0.9020	3.73	29.22	0.128 [1] ✓
T6	60 - 40	L2 1/2x2 1/2x3/16	16.80	7.92	124.8	0.9020	4.13	29.22	0.141 [1] ✓
T7	40 - 20	L3x3x3/16	18.45	8.76	114.1	1.0900	4.64	35.32	0.131 [1] ✓
T8	20 - 0	L3x3x3/16	20.16	9.62	125.1	1.0900	5.24	35.32	0.148 [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 $\frac{P_u}{\phi P_n}$
T1	145 - 130	7/8	5.00	4.85	266.3	0.6013	0.07	27.06	0.003 [1] ✓
T2	130 - 120	L2 1/2x2 1/2x3/16	5.00	4.52	74.9	0.9020	0.04	29.22	0.001 [1] ✓

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	145 - 130	Leg	1 3/4	1	-4.95	76.75	6.5	Pass
T2	130 - 120	Leg	Pirod 207628	44	-7.83	143.06	9.2	Pass
T3	120 - 100	Leg	Pirod 207628	56	-21.11	143.06	14.8	Pass
T4	100 - 80	Leg	Pirod 207628	71	-37.46	143.06	26.2	Pass
T5	80 - 60	Leg	Pirod 207628	86	-54.57	143.06	38.1	Pass
T6	60 - 40	Leg	Pirod 207628	101	-72.31	143.06	50.5	Pass
T7	40 - 20	Leg	Pirod 207628	116	-90.33	143.06	63.1	Pass
T8	20 - 0	Leg	Pirod 207628	131	-108.24	143.06	75.7	Pass
T1	145 - 130	Diagonal	7/8	11	-0.82	7.57	10.8	Pass
T2	130 - 120	Diagonal	L2 1/2x2 1/2x3/16	50	-1.76	13.38	13.1	Pass
T3	120 - 100	Diagonal	L2 1/2x2 1/2x3/16	58	-2.65	10.79	24.5	Pass
T4	100 - 80	Diagonal	L2 1/2x2 1/2x3/16	74	-3.30	8.55	38.6	Pass
T5	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	88	-3.79	6.83	55.5	Pass
T6	60 - 40	Diagonal	L2 1/2x2 1/2x3/16	104	-4.22	5.52	76.4	Pass
T7	40 - 20	Diagonal	L3x3x3/16	119	-4.76	7.92	60.1	Pass
T8	20 - 0	Diagonal	L3x3x3/16	133	-5.80	6.56	88.5	Pass
T1	145 - 130	Top Girt	7/8	4	-0.09	3.91	2.2	Pass
T2	130 - 120	Top Girt	L2 1/2x2 1/2x3/16	47	-0.03	14.60	0.5	Pass
							Summary	
						Leg (T8)	75.7	Pass
						Diagonal (T8)	88.5	Pass
						Top Girt (T1)	2.2	Pass
						Bolt Checks	41.2	Pass
						RATING =	**88.5**	**Pass**

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Subject:	FOUNDATION ANALYSIS
Location:	Uncasville, CT
Rev. 2: 10/21/16	Prepared by: T.J.L. Checked by: C.F.C. Job No. 15122.000

Mat Foundation Analysis:

Input Data:

Tower Data

Overturning Moment =	$OM := 1693 \cdot ft \cdot kips$	(User Input from tnxTower)	
Shear Force =	$S_t := 23 \cdot kip$	(User Input from tnxTower)	
Axial Force =	$WT_t := 15 \cdot kip$	(User Input from tnxTower)	
Max Compression Force =	$C_t := 114 \cdot kip$	(User Input from tnxTower)	
Max Uplift Force =	$U_t := 97 \cdot kip$	(User Input from tnxTower)	
Tower Height =	$H_t := 145 \cdot ft$	(User Input)	
Tower Width =	$W_t := 18 \cdot ft$	(User Input)	
Tower Position on Foundation (1=offset, 2=centered) =	$Pos_t := 1$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 5.5 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 1.5 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 26.5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 4.5 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 0.5 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 3.0 \cdot ft$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Ultimate Soil Bearing Capacity =	$q_s := 8000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 100 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 6$	(User Input)	
Bar Diameter =	$d_{bpier} := 0.75 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 12$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 3 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 6$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 0.75 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 39$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 6$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 0.75 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 39$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area = $A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.442 \cdot in^2$

Pad Top Reinforcement Bar Area = $A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.442 \cdot in^2$

Pad Bottom Reinforcement Bar Area = $A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.442 \cdot in^2$

Coefficient of Lateral Soil Pressure = $K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$

Load Factor = $LF := 1$

Stability of Footing:

Adjusted Concrete Unit Weight = $\gamma_c := if(Bouyancy = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc}) = 150 \cdot pcf$

Adjusted Soil Unit Weight = $\gamma_s := if(Bouyancy = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}) = 100 \cdot pcf$

Passive Pressure = $P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0 \cdot ksf$

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p} = 1.2 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}] = 1.2 \cdot ksf$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.65 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.425 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)] = 1.5$

$A_p := W_f \cdot T_p = 39.75$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 56.644 \cdot kip$

Weight of Concrete Pad = $WT_{pad} := (W_f^2 \cdot T_f) \cdot \gamma_c = 158.006 \cdot kip$

Weight of Concrete Piers = $WT_{pier} := 3 \cdot [(L_p \cdot d_p^2) \cdot \gamma_c] = 18.225 \cdot kip$

Total Weight of Concrete = $WT_c := WT_{pad} + WT_{pier} = 176 \cdot kip$

Weight of Soil Above Footing = $WT_{s1} := (W_f^2 - 3 \cdot d_p^2) \cdot (L_p - L_{pag}) \cdot \gamma_s = 270 \cdot kip$

Weight of Soil Back Face = $WT_{s2} := \left[\frac{\tan(\Phi_s) \cdot (D_f)^2}{2} \cdot W_f\right] \cdot \gamma_s = 23 \cdot kip$

Tower Offset = $X_{t1} := \left[\frac{W_f}{2} - \frac{(W_t \cdot \cos(30 \cdot deg))}{2}\right]$ $X_{t2} := \frac{W_f}{2} - \frac{(W_t \cdot \cos(30 \cdot deg))}{3}$

$X_t := if(Pos_t, X_{t1}, X_{t2}) = 5.456$

$X_{off} := \frac{W_f}{2} - \left[\frac{(W_t \cdot \cos(30 \cdot deg))}{3} + X_t\right] = 2.598$

Resisting Moment = $M_r := (0.9WT_c + 0.75WT_{s1}) \cdot \frac{W_f}{2} + 0.75S_u \cdot \frac{T_f}{3} + 0.75WT_{s2} \cdot \left[W_f + \frac{\tan(\Phi_s) \cdot (L_p - L_{pag})}{3}\right] = 5280 \cdot kip \cdot ft$

Overturning Moment = $M_{ot} := OM + S_t \cdot (L_p + T_f) = 1831 \cdot kip \cdot ft$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.88$

Factor of Safety Required = $FS_{req} := 1$

$OverTurning\_Moment\_Check := if(FS \geq FS_{req}, "Okay", "No Good")$

OverTurning_Moment_Check = "Okay"

Bearing Pressure Caused by Footing:

Total Load = $Load_{tot} := WT_c + WT_{s1} + WT_t = 461 \cdot kip$

Area of the Mat = $A_{mat} := W_f^{\,2} = 702.25$

Section Modulus of Mat = $S := \frac{W_f^{\,3}}{6} = 3101.6 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{Load_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.247 \cdot ksf$

$Max\_Pressure\_Check := if\left(P_{max} < 0.75 q_s, "Okay", "No\ Good"\right)$

$Max\_Pressure\_Check = "Okay"$

Minimum Pressure in Mat = $P_{min} := \frac{Load_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = 0.067 \cdot ksf$

$Min\_Pressure\_Check := if\left[\left(P_{min} \geq 0\right) \cdot \left(P_{min} < q_s\right), "Okay", "No\ Good"\right]$

$Min\_Pressure\_Check = "Okay"$

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 9.332$

Distance to Kern = $X_k := \frac{W_f}{6} = 4.417$ Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity = $e := \frac{M_{ot}}{Load_{tot}} = 3.969$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot Load_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.25 \cdot ksf$

$q_{adj} := if\left(P_{min} < 0, P_a, P_{max}\right) = 1.247 \cdot ksf$

$Pressure\_Check := if\left(q_{adj} < 0.75 q_s, "Okay", "No\ Good"\right)$

$Pressure\_Check = "Okay"$

Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^{\,2}}{4} = 2.25 \times 10^3 \cdot kips$ (ACI-2008 10.14)

$Bearing\_Check := if\left(P_b > LF \cdot C_t, "Okay", "No\ Good"\right)$

$Bearing\_Check = "Okay"$

Shear Strength of Concrete:

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - \frac{d_{bbot}}{2} = 14.625 \cdot in$

$FL := \frac{C_t}{W_f^2} = 0.1623 \cdot ksf$

$V_{req} := LF \cdot FL \cdot \left(X_t - 0.5 \cdot d_p - d\right) \cdot W_f = 11.774 \cdot kip$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d = 500 \cdot kip$ (ACI-2008 11.2.1.1)

$Beam\_Shear\_Check := if\left(V_{req} < V_{Avail}, "Okay", "No Good"\right)$

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 13.3$

Required Shear Strength = $V_{req} := LF \cdot FL \cdot \left[W_f^2 - \left(d_p + d\right)^2 \cdot \frac{\pi}{4}\right] = 111.7 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 500.2 \cdot kip$ (ACI-2008 11.11.2.1)

$Punching\_Shear\_Check := if\left(V_{req} < V_{Avail}, "Okay", "No Good"\right)$

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

$$M_{nT} := LF\cdot\left[U_t\cdot\left(W_t\cdot\sin(60\cdot deg) - \frac{d_p}{2}\right) + S_t\cdot\left(D_f + L_{pag}\right)\right] - WT_t\cdot X_{off} = 1466\cdot ft\cdot k$$

$$M_{nS} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left[\gamma_s\cdot\left(T_p - T_f\right)\right] + WT_{s2}\cdot\left[\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2} + \left(D_f - n\right)\cdot\tan\left(\Phi_s\right)\right]\right] = -4$$

$$M_{nC} := -1\cdot\left[\frac{1}{2}\cdot\left(\frac{W_f}{2} + \frac{W_t}{3}\cdot\cos(30\cdot deg) - \frac{d_p}{2}\right)^2\cdot W_t\cdot\left(\gamma_c\cdot T_f\right)\right]$$

Design Moment = $M_n := \frac{M_{nT} + M_{nS} + M_{nC}}{\phi_m} = 464.95\cdot kips\cdot ft$

$$\beta := \begin{cases} 0.85 \text{ if } 2500\cdot psi \le f_c \le 4000\cdot psi \\ 0.65 \text{ if } f_c > 8000\cdot psi \\ \left[\left[0.85 - \left[\frac{\left(\frac{f_c}{psi} - 4000\right)}{1000}\right]\cdot 0.5\right]\right] \text{ otherwise} \end{cases} = 0.85$$

(ACI-200810.2.7.3)

$b_{eff} := W_t\cdot\cos(30\cdot deg) + d_p = 223.061\cdot in$

$d := T_f - Cvr_{pad} - d_{bbot} = 14.25\cdot in$

$A_s := \frac{M_n}{\left(f_y\cdot d\right)} = 6.526\cdot in^2$

$a := \frac{A_s\cdot f_y}{\beta\cdot f_c\cdot b_{eff}} = 0.516\cdot in$

$A_s := \frac{M_n}{f_y\cdot\left(d - \frac{a}{2}\right)} = 6.646\cdot in^2$

$\rho := \frac{A_s}{b_{eff}\,d} = 0.00209$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \geq 60000\cdot psi \\ .0020 & \text{otherwise} \end{cases} = 0.0018 \qquad \text{(ACI -2008 7.12.2.1)}$$

Check Bottom Bars:

$$As := \begin{cases} \left(\rho\cdot b_{eff}\, d\right) & \text{if } \left(\rho\cdot b_{eff}\, d\right) > \rho_{sh}\cdot\frac{b_{eff}}{2}\cdot d \\ \rho_{sh}\cdot\frac{b_{eff}}{2}\cdot d & \text{otherwise} \end{cases} = 6.646\cdot in^2$$

$As_{prov} := A_{bbot}\cdot NB_{bot} = 17.2\cdot in^2$

$Pad\_Reinforcement\_Bot := if\left(As_{prov} > As, "Okay", "No\ Good"\right)$

$Pad\_Reinforcement\_Bot = "Okay"$

Check top Bars:

$$As := if\left(\rho \geq \rho_{sh}, A_s, \rho_{sh}\cdot\frac{b_{eff}}{2}\cdot d\right) = 6.6\cdot in^2$$

$As_{prov} := A_{btop}\cdot NB_{top} = 17.2\cdot in^2$

$Pad\_Reinforcement\_Top := if\left(As_{prov} > As, "Okay", "No\ Good"\right)$

$Pad\_Reinforcement\_Top = "Okay"$

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2\cdot Cvr_{pad} - NB_{bot}\cdot d_{bbot}}{NB_{bot} - 1} = 7.44\cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 3\cdot in$$

Transverse Reinforcement Index =

$k_{tr} := 0$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3\cdot f_y\,\alpha_{pad}\cdot\beta_{pad}\cdot\gamma_{pad}\cdot\lambda_{pad}}{40\cdot\sqrt{f_c\cdot psi}\cdot\frac{c + k_{tr}}{d_{bbot}}}\cdot d_{bbot} = 13.3\cdot in$$

Minimum Development Length =

$L_{dbmin} := 12\cdot in$ (ACI-2008 12.2.1)

$L_{dbtCheck} := if\left(L_{dbt} \geq L_{dbmin}, "Use\ L.dbt", "Use\ L.dbmin"\right) = "Use\ L.dbt"$

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{W_t}{2} - Cvr_{pad} = 48\cdot in$$

$Lpad\_Check := if\left(L_{Pad} > L_{dbt}, "Okay", "No\ Good"\right)$

$Lpad\_Check = "Okay"$

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^2}{4} = 1017.88 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.5 \cdot A_p = 5.09 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 5.3 \cdot in^2$

$Steel\_Area\_Check := if(A_{sprov} > A_{smin}, "Okay", "No Good")$

$Steel\_Area\_Check = "Okay"$

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 8.675 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 30 \cdot in$

Maximum Moment in Pier = $M_p := \left[S_t \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF = 1380 \cdot in \cdot kips$

Pier Check evaluated from outside program and results are listed below;

$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) := \left(d_p \cdot 12 \;\; NB_{pier} \;\; BS_{pier} \;\; \frac{C_t \cdot 1.333}{kips} \;\; \frac{M_p}{in \cdot kips}\right)$

$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) = (36 \;\; 12 \;\; 6 \;\; 152 \;\; 1380)$

$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := (0 \;\; 0 \;\; 0 \;\; 0)$

$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := \phi P'_n\left(D, N, n, P_u, M_{xu}\right)^T$

$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = (949.9 \;\; 8626.5 \;\; -60 \;\; 0)$

$Axial\_Load\_Check := if(\phi P_n \geq P_u, "Okay", "No Good")$

$Axial\_Load\_Check = "Okay"$

$Bending\_Check := if(\phi M_{xn} \geq M_{xu}, "Okay", "No Good")$

$Bending\_Check = "Okay"$

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 51 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 15 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 3 \cdot in$

Transverse Reinforcement = $k_{tr} := 0$ (ACI-2008 12.2.3)

$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 13.34 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 9.961 \cdot in$ (ACI 12.2.1)

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right)$

$L_{tension\_Check} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No Good"\right)$

$L_{tension\_Check} = "Okay"$

Compression: (ACI-2008 12.3.2)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 14.23 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 13.5 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 14.23 \cdot in$

$L_{compression\_Check} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No Good"\right)$

$L_{compression\_Check} = "Okay"$

Tie Size and Spacing in Column:

Minimum Tie Size = $Tie_{min} := if(BS_{pier} \le 10, 3, 4) = 3$

Used #3 Ties

Seismic Factor = $z := if(Z \le 2, 1, 0.5) = 1$ (ACI-2008 21.10.5)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 12 \cdot in$

$s_{lim2} := \frac{48 \cdot d_{Tie}}{8} \cdot z = 18 \cdot in$

$s_{lim3} := D_f \cdot z = 66 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing = $s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 12 \cdot in$

Number of Ties Required = $n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 5$

Check Anchor Steel Embedment:

Depth Available = $D_{ab} := L_{st} - A_{BP} = 5 \cdot ft$

Length of Anchor Bolt = $L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot in}{\sqrt{f_c \cdot psi}} = 10.87 \cdot ft$

$Depth\_Check := if(D_{ab} \ge L_{anchor}, "Okay", "No Good")$

Depth_Check = "No Good"

Note: Anchor plate is provided

Product Specifications

COMMSCOPE®

POWERED BY ANDREW®

DB589-Y

Andrew® Omni Antenna, 890–960 MHz, 360° horizontal beamwidth, fixed electrical tilt, fits on 38–51 mm (1-1/2 to 2 in) OD pipe

- Light weight, low profile omnidirectional antenna ideal for low to moderate gain applications
- Integral dual purpose mount allows top or side mounting

Electrical Specifications

Frequency Band, MHz	**890–960**
Gain, dBi	11.1
Beamwidth, Horizontal, degrees	360
Beamwidth, Vertical, degrees	9.0
Beam Tilt, degrees	0
VSWR | Return Loss, dB	1.5 | 14.0
PIM, 5th Order, 2 x 20 W, dBc	-153
Input Power per Port, maximum, watts	400
Polarization	Vertical
Impedance	50 ohm

General Specifications

Antenna Brand	Andrew®
Antenna Type	Omni
Band	Single band
Operating Frequency Band	890 – 960 MHz
Includes	V-bolts
Performance Note	Outdoor usage

Mechanical Specifications

Color	Horizon blue
Lightning Protection	dc Ground
Radiator Material	Brass
Radome Material	Fiberglass, UV resistant
RF Connector Interface	N Female
RF Connector Location	Bottom
RF Connector Quantity, total	1
Wind Loading, maximum	176.1 N @ 100 mph 39.6 lbf @ 100 mph
Wind Speed, maximum	201.2 km/h | 125.0 mph

Dimensions

Length	2794.0 mm | 110.0 in
Outer Diameter	38.1 mm | 1.5 in
Net Weight	5.2 kg | 11.5 lb

Product Specifications

DB589-Y

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance