STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051

Phone: (860) 827-2935 Fax: (860) 827-2950

E-Mail: siting.council@ct.gov

www.ct.gov/csc

VIA ELECTRONIC MAIL

February 14, 2019

Rodney Joujoute
Smartlink, LLC
85 Rangeway Road, Building 3, Suite 102
Billerica, MA 01862

RE: **EM-AT&T-166-181203** – AT&T Mobility, LLC notice of intent to modify an existing telecommunications facility located at 1233 Wolcott Road, Wolcott, Connecticut.

Dear Mr. Joujoute:

The Connecticut Siting Council (Council) is in receipt of your correspondence of February 7, 2019 submitted in response to the Council's December 13, 2018 notification of an incomplete request for exempt modification with regard to the above-referenced matter.

The submission renders the request for exempt modification complete and the Council will process the request in accordance with the Federal Communications Commission 60-day timeframe.

Thank you for your attention and cooperation.

Sincerely,

Melanie A. Bachman
Executive Director

MAB/emr

Robidoux, Evan

From: Rodney Joujoute <rodney.joujoute@smartlinkllc.com>
Sent: Thursday, February 07, 2019 3:51 PM
To: Robidoux, Evan
Cc: CSC-DL Siting Council; Sharon Keefe; April Grasso
Subject: RE: Council 2nd Incomplete Letter for EM-AT&T-166-181203-WolcottRd-Wolcott
Attachments: CSC Exempt Modification Supplement Package CTL01111 2-7-19.pdf

Good Morning,

Please see the attached AT&T Exempt Modification Supplement Filings for the following telecommunications facility:

- CTL01111 – 1233 Wolcott Rd, Wolcott, CT06716

The hard copies will be delivered as soon as possible.

Thank You,

smartlink

Rodney Joujoute | Real Estate Specialist
Smartlink

85 Rangeway Road
Bldg. #3 Suite 102
North Billerica, MA 01862

(o) 781-309-2301

smartlinkllc.com

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From: Robidoux, Evan <Evan.Robidoux@ct.gov>
Sent: Friday, December 14, 2018 8:12 AM
To: Rodney Joujoute <rodney.joujoute@smartlinkllc.com>

Cc: CSC-DL Siting Council <Siting.Council@ct.gov>
Subject: Council 2nd Incomplete Letter for EM-AT&T-166-181203-WolcottRd-Wolcott

Please see the attached correspondence.

Evan Robidoux
Clerk Typist
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

February 7, 2019

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

Re:	**Notice of Exempt Modification – Antenna Swap and RRU Add**
Property Address:	**1233 Wolcott Rd, Wolcott, CT 06716**
Applicant:	**AT&T Mobility, LLC**

Dear Ms. Bachman:

I am submitting an updated Structural Analysis performed by Structure Owners, subcontractors, that incorporate proposed mount modifications. I have also included a copy of the mount modifications report for reference. These documents are being submitted as supplements in response to the letter written by the Connecticut Siting Council from December 13th, 2018. This submission includes all the exhibits as requested by the Connecticut Siting Council's letter dated December 13th, 2018. Please feel free to reach out if you have any questions.

Sincerely,

Rodney Joujoute

CC w/enclosures:
Mayor of Wolcott – Thomas G Dunn
Structure Owner – SBA Communications
Zoning Enforcement Office/Building Inspector – Peter Parks
Property Owner – Edward Cleary

STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
www.ct.gov/csc

December 13, 2018

Rodney Joujoute
Smartlink, LLC
85 Rangeway Road, Building 3, Suite 102
Billerica, MA 01862

RE: **EM-AT&T-166-181203 –** AT&T Mobility, LLC notice of intent to modify an existing telecommunications facility located at 1233 Wolcott Road, Wolcott, Connecticut.

Dear Mr. Joujoute:

The Connecticut Siting Council (Council) received a notice of intent to modify the above-referenced facility on December 3, 2018. On December 4, 2018 the Council issued a letter stating the request was incomplete because there was no proof that notice of the entire request had been mailed to the underlying property owner. On December 7, 2018 the Council received mailing receipts and issued an acknowledgement letter dated December 12, 2018.

Subsequently staff has reviewed this exempt modification request for completeness and has identified a deficiency in the request. The Construction Drawings by Maser Consulting last revised October 22, 2018 shows proposed mount modifications as part of this exempt modification request in sheets C-3 and S-1. However the Structural Analysis report dated November 2, 2018 and provided with the request does not incorporate the above-referenced mount modifications.

Therefore, the exempt modification request is incomplete at this time. The Council recommends that Smartlink provide an updated Structural Analysis Report and a mount analysis that incorporates the proposed mount modifications on or before January 31, 2019. If additional time is needed to gather the requested information, please submit a written request for an extension of time prior to January 31, 2019.

This notice of incompletion shall have the effect of tolling the Federal Communications Commission (FCC) 60-day timeframe in accordance with Paragraph 217 of the FCC Wireless Infrastructure Report and Order issued on October 21, 2014 (FCC 14-153).

Thank you for your attention to this matter. Should you have any questions, please feel free to contact me at 860-827-2951.

Sincerely,

Melanie Bachman
Executive Director

MAB/FOC/in

c: The Honorable Thomas G. Dunn, Mayor, Town of Wolcott
David Kalinowski, Zoning Inspector, Town of Wolcott

MASER CONSULTING
CONNECTICUT

Engineers Planners Surveyors Landscape Architects Environmental Scientists

Antenna Mount Modification Analysis

FOR

CTL01111

FA # 10041812
1233 Wolcott Road
Wolcott CT 06716
New Haven County

Scope: 3C-MRCTB018352
4C-MRCTB032155
5C-MRCTB032159

Modified Mount Utilization Alpha Sector: 83.5%
Modified Mount Utilization Beta & Gamma Sector: 72.4%

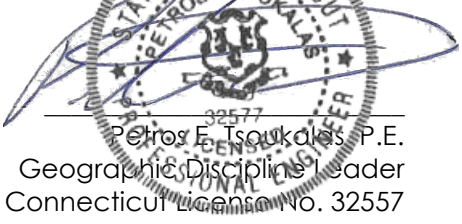
October 4, 2018

Prepared For

AT&T
550 Cochituate Road
Framingham, MA 01701

Prepared By

Maser Consulting Connecticut
331 Newman Springs Road, Suite 203
Red Bank, NJ 07701
T: 732.383.1950



Petros E. Tsoukalas, P.E.
Geographic Discipline Leader
Connecticut License No. 32557

MC Project No. 18946025A

Objective:

The objective of this report is to determine the capacity of the existing antenna support mount with the proposed modifications at the subject facility for the final wireless telecommunications configuration, per the applicable codes and standards.

Introduction:

Maser Consulting Connecticut has performed limited field observations on May 21, 2018 to verify the existing condition of the structure and to locate and quantify the existing wireless appurtenances where possible, from ground level. Maser Consulting Connecticut has reviewed the following documents in completing this report:

- Mount Mapping prepared by Tower Engineering Professionals, Inc., dated August 13, 2018.
- RFDS 2283357 Version 1.00 provided by Smartlink, dated May 9, 2018.
- Previous mount analysis prepared by Maser Consulting Connecticut (18946025A), dated September 25, 2018

The proposed **AT&T** equipment is to be supported on an existing antenna support mount constructed of structural steel antenna support pipes supported by pipes at a centerline of approximately 185'-0" above ground level. This report is based only upon this information.

Codes, Standards and Loading:

Maser Consulting Connecticut utilized the following codes and standards:

- 2016 Connecticut State Building Code, Incorporating the 2012 IBC
- Structural Standards for Antenna Supporting Structures and Antennas ANSI/TIA-222-G
    - Ultimate Wind Speed – 125 mph (3 Second Gust)
    - Basic Wind Speed – 97 mph (3 Second Gust)
    - Exposure Category – B
    - Structural Class – II
    - Topographic Category – 1
    - Ice Wind – 40 mph
    - Ice Thickness – ¾"
    - Maintenance Wind Speed – 30 mph
        - Maintenance Live Load – 250 lbs. (Man live load applied individually at midpoint & cantilevered ends of horizontal members)
        - Maintenance Live Load – 500 lbs. (Man live load applied individually at mount pipe locations)
- Specification for Structural Steel Buildings ANSI/AISC 360-10, American Institute of Steel Construction (AISC)

Loading used in this analysis is found in Appendix A of this report.

Analysis Approach & Assumptions:

The analysis approach used in this structural analysis is based on the premise that if the modified antenna support mount is structurally adequate to support the proposed equipment per the aforementioned codes and standards, or if the increase in the forces in the structure is deemed to be negligible or acceptable, then the proposed equipment can be installed as intended.

The modified antenna mounts in Alpha, Beta, and Gamma sector have been modeled in RISA-3D, a comprehensive structural analysis program. The program performs design checks of structures under user specified loads. The user specified loads have been calculated separately based on the requirements of the above referenced codes. The program performs an analysis based on the steel code to determine the adequacy of the members, and produces the reactions at the connection points of the mounts to the existing structure. Additional calculations were then prepared to analyze the mount connection points with the proposed loading conditions.

General Site Design Assumption:

- All engineering services are performed on the basis that the information used is current and correct.
- It is assumed that the telecommunication equipment supports, antenna supports, and existing structure have been designed by a registered licensed professional engineer for the existing loads acting on the structure, as required by all applicable codes, prior to the proposed modifications listed within this report, if any.
- It is assumed that information provided by the client regarding the structure itself, the antenna models, feed lines, and other relevant information is current and correct.
- It is the responsibility of the client to ensure that the information provided to Maser Consulting Connecticut and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that the original design, material production, fabrication, and erection of the existing structure was performed in accordance with accepted industry design standards and in accordance with all applicable codes. Further, it is assumed that the existing structure and appurtenances have been properly maintained in accordance with all applicable codes and manufacturer's specifications and no structural defects and/or deterioration to the structural members has occurred.
- It is assumed all other existing appurtenances, antennas, cables, etc. belonging to others have been installed and supported per code and per specifications so as not to damage any existing structural support members, and that any contributing loads from adjacent equipment has been taken into consideration for their design.
- All services are performed, results obtained, and recommendations made in accordance with generally accepted engineering principles and practices. Maser Consulting Connecticut is not responsible for the conclusion, opinions, and recommendations made by others based on the information we supply.

Modification Description:

The following modifications have been utilized in this report:

- Two (2) Site Pro 1 heavy duty sector frame stiff arm kits P/N SPTB shall be installed on the top horizontal pipe in each sector
    - The proposed kits shall connect to the top existing horizontal pipe at a distance of 4'-6" from the center of the existing pipe.
    - One (1) proposed kit shall be mounted to the tower leg at a height of 1'-6" from the top of the standoff arms in each sector.
    - One proposed kit shall be connected to the tower leg at a height of 2'-6" from the top of the standoff arms in each sector.

Site Specific Design Parameters and Assumptions:

The following design parameters have been utilized in this report:

- *Structural Steel Angles are assumed to be constructed of A36 Steel*
- *Structural Steel Pipes are assumed to be constructed of A53 Grade B Steel*
- *The proposed KMW EPBQ-654L8H8-L2 shall be mounted on a proposed 10'-0" long 2.0 pipe, which will replace the existing pipe in position 3 in all sectors*
- *The proposed HPA-65R-BUU-H6 shall be mounted in position 4 in all sectors*
- *The proposed RRUS-4478 B5 and RRUS4425 B66 shall be mounted in position 3 in all sectors on the proposed dual mounting bracket*
- *The proposed RRUS-32 shall be mounted in position 4 in all sectors on the existing pipe mast*

Calculations:

The calculations are found in Appendix A of this report.

Conclusion:

Maser Consulting Connecticut has determined the modified antenna support mount in Alpha sector has **ADEQUATE** structural capacity to support the proposed loading. The modified antenna support mount has been determined to be stressed to a maximum of **83.5%** of its structural capacity with the maximum usage occurring at the horizontal support pipe. The existing connections are stressed to a maximum of **22.7%** of its structural capacity. Therefore, the proposed **AT&T** installation **CAN** be installed as intended **once the proposed modifications have been implemented**.

The modified antenna support mounts in Beta and Gamma sector have **ADEQUATE** structural capacity to support the proposed loading. The modified antenna support mounts have been determined to be stressed to a maximum of **72.4%** of their structural capacity with the maximum usage occurring at the horizontal main support pipe. The existing connections are stressed to a maximum of **25.1%** of its structural capacity. Therefore, the proposed **AT&T** installation **CAN** be installed as intended **once the proposed modifications have been implemented.**

The conclusions reached by Maser Consulting Connecticut in this evaluation are only applicable for the existing structural members supporting the proposed **AT&T** telecommunications installation described herein. Further, no structural qualifications are made or implied by this document for the existing structure. The modified mount was checked up to, and including, the bolts that attach to the mount collar/attachment. However, no structural qualifications are made or implied by this document for the existing mount collar/attachment.

Maser Consulting Connecticut reserves the right to amend this report if additional information about the existing members is provided. Any change to the installation will require a revision to this structural analysis.

We appreciate the opportunity to be of service on this project. If you should have any questions or require any additional information, please do not hesitate to call our office.
Sincerely,

Maser Consulting Connecticut

Petros E. Tsoukalas, P.E.
Geographic Discipline Leader

Anthony Bassett
Engineer

\\ujfas01\Projects\2018\18946000A\18946025A\Structural\Mount Modification\Rev 0\Word\ Antenna Mount Modification Analysis - Maser Consulting Connecticut.docx

APPENDIX A

Client:	ATT	Computed By:	AB
Site Name:	CTL01111	Date:	10/2/2018
Project No.	18946025A	Verified By:	PET
Title:	Antenna Mount Modification Analysis	Page:	1

Version 4.0

LOADING SUMMARY

Quantity	Manufacturer	Antenna/ Appurtenance	Status	Sector	
1	KMW	AM-X-CD-16-65-00T-RET	Existing	Alpha	
3	**KMW**	**EPBQ-654L8H8-L2**	**Proposed**	**Alpha, Beta, & Gamma**	
3	**CCI**	**HPA-65R-BUU-H6**	**Proposed**	**Alpha, Beta, & Gamma**	
2	KATHREIN	80010121	Existing	Beta & Gamma	
3	**ERICSSON**	**RRUS 4478 B5**	**Proposed**	**Alpha, Beta, & Gamma**	
3	**ERICSSON**	**RRUS 4426 B66**	**Proposed**	**Alpha, Beta, & Gamma**	
3	ERICSSON	RRUS 32 B2	Existing	Alpha, Beta, & Gamma	
3	ERICSSON	RRUS 11	Existing	Alpha, Beta, & Gamma	
3	**ERICSSON**	**RRUS 32**	**Proposed**	**Alpha, Beta, & Gamma**	
3	CCI	DTMABP7819VG12A	Existing	Alpha, Beta, & Gamma	(TMA)
3	**RAYCAP**	**DC6-48-60-18-8F**	**Existing/Proposed**	**Alpha, Beta, & Gamma**	

The worst case loading occurs in the Alpha Sector

Quantity	Manufacturer	Antenna/ Appurtenance	Status	
1	KMW	AM-X-CD-16-65-00T-RET	Existing	
1	**KMW**	**EPBQ-654L8H8-L2**	**Proposed**	
1	**CCI**	**HPA-65R-BUU-H6**	**Proposed**	
1	**ERICSSON**	**RRUS 4478 B5**	**Proposed**	
1	**ERICSSON**	**RRUS 4426 B66**	**Proposed**	
1	ERICSSON	RRUS 32 B2	Existing	
1	ERICSSON	RRUS 11	Existing	
1	**ERICSSON**	**RRUS 32**	**Proposed**	
1	CCI	DTMABP7819VG12A	Existing	
1	**RAYCAP**	**DC6-48-60-18-8F**	**Existing/Proposed**	
1	KATHREIN	80010121	Existing	(Beta and Gamma sector Only)

Client:	ATT	Computed By:	AB
Site Name:	CTL01111	Date:	10/2/2018
Project No.	18946025A	Verified By:	PET
Title:	Antenna Mount Modification Analysis	Page:	2

I. DESIGN INPUTS

Calculations for gravity and lateral loading on equipment and support mounts are determined as per the ANSI/TIA-222-G Code, Addendum 2

				Reference	Equation
Wind Load Inputs Parameters					
Antenna Centerline	z	185	ft		
Ultimate Wind Speed	V_U	125	mph		
Nominal Wind Speed (3 sec. Gust):	V	97	mph	Ref. 1, Eqn. 16-33	
Nominal Wind Speed with Ice (3 sec. gust):	V_i	40.0	mph	(Figure a5-2a, p. 233)	
Maintenance Wind Speed:	V_m	30.0	mph		
Service Wind Speed:	V_s	60.0	mph	(Figure a5-2a, p. 233)	
Design Ice Thickness:	t_i	0.75	in	(Figure A1-2a, p. 233)	
Exposure Category:		B		Ref. 3, Section 2.6.5.1	
Structure Class:		II		Ref. 3, Table 2-1	
Gust Effect Factor:	G_h	0.85		Ref. 3, Section 2.6.7	
Wind Directionality Factor:	K_d	0.85		Ref. 3, Table 2-2	
Topographic Category:		1		Ref. 3, Section 2.6.6.2	
Wind Load Coefficients					
Importance Factors:					
Non-Iced:	I	1		Ref. 3, Table 2-3	
Iced:	I_{ice}	1		(Table 2-3, P. 39)	
Exposure Category Coefficients:					
3-s Gust-Speed Power Law Exponent:	α	7.0		Ref. 3, Table 2-4	
Nominal Height of the Atmospheric Boundary Layer:	Z_g	1200	ft	Ref. 3, Table 2-4	
Min. Value for k_z:	Kz_{min}	0.70		Ref. 3, Table 2-4	
Terrain Constant:	K_e	0.90		Ref. 3, Table 2-4	
Velocity Pressure Exposure Coefficient:	K_z	1.178		Ref. 3, Section 2.6.5.2	$=2.01\cdot(z/z_g)^{2/\alpha}$
Topographic Category Coefficients:					
Topographic Constant:	K_t	N/A		Ref. 3, Table 2-5	
Height Attenuation Factor:	f	N/A		Ref. 3, Table 2-5	
Height Reduction Factor:	K_h	N/A		Ref. 3, Section 2.6.6.4	$=e^{(f\cdot z/H)}$
Topographic Factor:	K_{zt}	1.00		Ref.3, Section 2.6.6.4	$=[1+(K_e\cdot K_t/K_h)]^2$
Ice Accumulation:					
Ice Velocity Pressure Exposure Coefficient:	K_{iz}	1.19			$=(z/33)^{0.10}$
Factored Ice Thickness:	t_{iz}	1.78	in	(Section 2.6.8, p. 16)	$=2.0\cdot t_i\cdot I\cdot K_{iz}\cdot K_{zt}$
Ice Density:	ρ_i	56.00	pcf		
Design Wind Pressures:					
Velocity Pressure:	q_z	24.03	psf	Ref. 3, Section 2.6.9.6	$=0.00256\cdot K_z\cdot K_{zt}\cdot K_d\cdot V^2\cdot I$
Velocity Pressure (With Ice):	q_{zi}	4.10	psf	(Section 2.6.9.6, P. 25)	$=.00256\cdot K_z\cdot K_{zt}\cdot K_d\cdot V_i^2\cdot I$
Velocity Pressure (Maintenance):	q_{zm}	2.31	psf	(Section 2.6.9.6, P. 25)	$=.00256\cdot K_z\cdot K_{zt}\cdot K_d\cdot V_m^2\cdot I$
Velocity Pressure (Service):	q_{zs}	9.23	psf	(Section 2.6.9.6, P. 25)	$=.00256\cdot K_z\cdot K_{zt}\cdot K_d\cdot V_i^2\cdot I$

II. CALCULATIONS

- ***Wind Load on Appurtenances***

Dimensions and Force Coefficients

Antenna/ Appurtenance	Non-Iced Condition								Iced Condition							
	Mounting Pipe			Equipment					Mounting Pipe			Equipment				
	Length (in)	Diameter (in)	Force Coefficient C_a	Height (in)	Width (in)	Depth (in)	Force Coefficient $C_{a\ Front}$	Force Coefficient $C_{a\ Side}$	Length (in)	Diameter (in)	Force Coefficient C_a	Height (in)	Width (in)	Depth (in)	Force Coefficient $C_{a\ Front}$	Force Coefficient $C_{a\ Side}$
AM-X-CD-16-65-00T-RET	96.0	2.375	1.200	72.00	11.80	5.90	1.36	1.57	99.6	5.9	1.017	75.56	15.36	9.46	1.31	1.43
EPBQ-654L8H8-L2	120.0	2.375	1.200	96.00	21.00	6.30	1.29	1.67	123.6	5.9	1.107	99.56	24.56	9.86	1.27	1.50
HPA-65R-BUU-H6	96.0	2.375	1.200	72.30	14.40	7.30	1.31	1.50	99.6	5.9	1.017	75.86	17.96	10.86	1.28	1.40
RRUS 4478 B5	0.0	0.000	0.000	16.50	13.40	7.70	1.20	1.20	0.0	0.0	0.000	20.06	16.96	11.26	1.20	1.20
RRUS 4426 B66	0.0	0.000	0.000	14.96	13.19	5.80	1.20	1.20	0.0	0.0	0.000	18.52	16.75	9.36	1.20	1.20
RRUS 32 B2	0.0	0.000	0.000	27.20	12.00	7.00	1.20	1.26	0.0	0.0	0.000	30.76	15.56	10.56	1.20	1.22
RRUS 11	0.0	0.000	0.000	19.70	17.00	7.20	1.20	1.21	0.0	0.0	0.000	23.26	20.56	10.76	1.20	1.20
RRUS 32	0.0	0.000	0.000	27.20	12.00	7.00	1.20	1.26	0.0	0.0	0.000	30.76	15.56	10.56	1.20	1.22
DTMABP7819VG12A	0.0	0.000	0.000	14.25	11.46	4.17	1.20	1.24	0.0	0.0	0.000	17.81	15.02	7.73	1.20	1.20
DC6-48-60-18-8F	0.0	0.000	0.000	31.40	10.20	10.20	0.71	0.71	0.0	0.0	0.000	34.96	13.76	13.76	0.70	0.70
80010121	72.0	2.375	1.200	54.90	10.30	5.90	1.33	1.48	75.6	5.9	0.927	58.46	13.86	9.46	1.28	1.36

Antenna/ Appurtenance	# of Brackets	Non-Iced Condition			Iced Condition			Maintenance Condition	
		Wind Force (lbs.)		Gravity (lbs.)	Wind Force (lbs.)		Gravity (lbs.)	Wind Force (lbs.)	
		F_N	F_T		F_N	F_T		F_N	F_T
AM-X-CD-16-65-00T-RET	2	86.8	66.8	**31.8**	20.4	19.7	**102.7**	8.3	6.4
EPBQ-654L8H8-L2	2	189.6	96.1	**47.7**	39.6	27.7	**214.1**	18.2	9.2
HPA-65R-BUU-H6	2	101.7	75.4	**27.8**	23.1	21.2	**123.4**	9.8	7.2
RRUS 4478 B5	1	37.6	21.6	**59.9**	9.9	6.6	**62.8**	3.6	2.1
RRUS 4426 B66	1	33.6	14.8	**48.5**	9.0	5.0	**54.4**	3.2	1.4
RRUS 32 B2	1	55.6	34.1	**52.9**	13.9	9.6	**87.5**	5.3	3.3
RRUS 11	1	57.0	24.4	**55.7**	13.9	7.3	**85.5**	5.5	2.3
RRUS 32	1	55.6	34.1	**52.9**	13.9	9.6	**87.5**	5.3	3.3
DTMABP7819VG12A	1	27.8	10.5	**19.2**	7.8	4.0	**45.2**	2.7	1.0
DC6-48-60-18-8F	1	32.4	32.4	**26.2**	8.2	8.2	**76.0**	3.1	3.1
80010121	2	56.6	48.5	**25.6**	14.0	14.2	**72.4**	5.4	4.7

**** ALL CALCULATED LOADS ARE PER MOUNTING BRACKET. TO GET THE TOTAL EQUIPMENT LOAD, MULTIPLY THE INDIVIDUAL LOADS BY THE NUMBER OF BRACKETS***

- ***Wind Load on Framing Members***

Member Category	Member Shape	Length (in)	Member Surface	Non-Iced Condition			Iced Condition						Maintenance Condition
				Exposed Wind Height (in)	Force Coefficient C_a	Wind Load (plf)	Exposed Wind Height (in)	Depth (in)	Length (in)	Force Coefficient C_a	Wind Load (plf)	Ice Weight (plf)	Wind Load (plf)
Pipe	Pipe 2.5	174	Round	2.88	1.20	5.87	6.44	6.44	177.56	1.20	2.25	10.14	0.56
Pipe	Pipe 2.0	96	Round	2.38	1.20	4.85	5.94	5.94	99.56	1.02	1.75	9.05	0.47
Pipe	Pipe 2.0	72	Round	2.38	1.20	4.85	5.94	5.94	75.56	0.93	1.60	9.05	0.47
Pipe	Pipe 2.0	60	Round	2.38	1.20	4.85	5.94	5.94	63.56	0.88	1.52	9.05	0.47
Pipe	Pipe 2.0	48	Round	2.38	1.09	4.42	5.94	5.94	51.56	0.84	1.44	9.05	0.42
Pipe	Pipe 1.5	52	Round	1.90	1.20	3.88	5.46	5.46	55.56	0.87	1.38	8.02	0.37
Solid Flat Bar	6x0.375	25	Square	6.00	1.27	13.01	9.56	3.94	28.56	1.22	3.39	16.97	1.25
Pipe	Pipe 4.0	63	Round	4.50	0.96	7.32	8.06	8.06	66.56	0.83	1.94	13.68	0.70
Pipe	Pipe 1.25	126	Round	1.66	1.20	3.39	5.22	5.22	129.56	1.20	1.81	7.49	0.33
Solid Round Bar	0.625	33	Round	0.63	1.20	1.28	4.19	4.19	36.56	0.84	1.02	5.24	0.12
Equal Angle	L2.5x2.5	50	Square	2.50	1.83	7.80	6.06	6.06	53.56	1.46	2.57	11.58	0.75

BASIC EQUATIONS

ANSI/TIA-222-G Reference

Importance Factor: Table 2-3, Pg. 39

$$I := \begin{cases} 1.0 & \text{if Class} = \text{"II"} \\ 1.15 & \text{if Class} = \text{"III"} \end{cases}$$

Force Coefficient: (Square) Table 2-8, P. 42

$$C_{f\_square}(h, w) := \begin{cases} 1.2 & \text{if } \frac{h}{w} \le 2.5 \\ \left[1.2 + \frac{0.2}{4.5} \cdot \left(\frac{h}{w} - 2.5\right)\right] & \text{if } \frac{h}{w} > 2.5 \wedge \frac{h}{w} \le 7 \\ \left[1.4 + \frac{0.6}{18} \cdot \left(\frac{h}{w} - 7\right)\right] & \text{if } \frac{h}{w} > 7 \wedge \frac{h}{w} \le 25 \\ 2.0 & \text{otherwise} \end{cases}$$

Force Coefficient: (Round) Table 2-8, P. 42

$$C_{f\_round}(h, w) := \begin{cases} 0.7 & \text{if } \frac{h}{w} \le 2.5 \\ \left[0.7 + \frac{0.1}{4.5} \cdot \left(\frac{h}{w} - 2.5\right)\right] & \text{if } \frac{h}{w} > 2.5 \wedge \frac{h}{w} \le 7 \\ \left[0.8 + \frac{0.4}{18} \cdot \left(\frac{h}{w} - 7\right)\right] & \text{if } \frac{h}{w} > 7 \wedge \frac{h}{w} \le 25 \\ 1.2 & \text{otherwise} \end{cases}$$

Terrain Exposure Constants: Table 2-4, P. 40

$$\alpha := \begin{cases} 7.0 & \text{if Exp} = \text{"B"} \\ 9.5 & \text{if Exp} = \text{"C"} \\ 11.5 & \text{if Exp} = \text{"D"} \end{cases} \quad Z_g := \begin{cases} 1200\text{ft} & \text{if Exp} = \text{"B"} \\ 900\text{ft} & \text{if Exp} = \text{"C"} \\ 700\text{ft} & \text{if Exp} = \text{"D"} \end{cases} \quad K_{zmin} := \begin{cases} 0.70 & \text{if Exp} = \text{"B"} \\ 0.85 & \text{if Exp} = \text{"C"} \\ 1.03 & \text{if Exp} = \text{"D"} \end{cases}$$

BASIC EQUATIONS

ANSI/TIA-222-G Reference

Velocity Pressure Coefficient:

$$Kz(z) := \left| \begin{array}{l} K_z \leftarrow \max\left[2.01 \cdot \left(\frac{z}{Z_g} \right)^{\frac{2}{\alpha}}, K_{zmin} \right] \\ K_z \leftarrow \min\left(K_z, 2.01 \right) \end{array} \right.$$

$K_z := Kz(z)$ Section 2.6.5, P. 13

$$Kzt(z) := K_{zt} \leftarrow \left| \begin{array}{l} 1.0 \text{ if } Topo = "1" \\ \text{otherwise} \\ \quad K_e \leftarrow \left| \begin{array}{l} 0.90 \text{ if } Exp = "B" \\ 1.00 \text{ if } Exp = "C" \\ 1.10 \text{ if } Exp = "D" \end{array} \right. \quad \text{Table 2-4 p. 40} \\ \quad K_t \leftarrow \left| \begin{array}{l} 0.43 \text{ if } Topo = "2" \\ 0.53 \text{ if } Topo = "3" \\ 0.72 \text{ if } Topo = "4" \end{array} \right. \quad \text{Table 2-5 p. 40} \\ \quad f \leftarrow \left| \begin{array}{l} 1.25 \text{ if } Topo = "2" \\ 2.00 \text{ if } Topo = "3" \\ 1.50 \text{ if } Topo = "4" \end{array} \right. \quad \text{Table 2-5 p. 40} \\ \quad K_h \leftarrow e^{\left(\frac{f \cdot z}{CH} \right)} \quad \text{Section 2.6.6.4, P. 14} \\ \left(1 + \frac{K_e \cdot K_t}{K_h} \right)^2 \quad \text{Section 2.6.6.4, P. 14} \end{array} \right.$$

$K_{zt} := Kzt(z)$

Velocity Pressure: Section 2.6.9.6, P. 25

$$q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2 \cdot I \cdot psf$$

LOAD EQUATIONS

WIND LOAD

Area (Normal): $AN_{area} = H_{ant} \cdot Want$

Area (Side): $AT_{area} = H_{ant} \cdot Dant$

Force Coefficient (Normal): $C_{fn} = C_{fsquare}(H_{ant}, Want)$

Force Coefficient (Side): $C_{fs} = C_{fsquare}(H_{ant}, Dant)$

Pipe Area (Normal): $AN_p = \max[(L_p - H_{ant}) * Dp, 0]$

Pipe Area (Side): $AT_p = L_p \cdot Dp$

Force Coefficient (Normal): $C_{fp} = C_{fround}(Lp, Dp)$

Normal Effective Projected Area: $E_{pan} = (C_{fn} \cdot ANarea) + (Cfp \cdot ANp)$

Side Effective Projected Area: $E_{pat} = (C_{fs} \cdot ATarea) + (Cfp \cdot ATp)$

Effective Projected Area: $EPA = max(E_{pan}, Epat)$

Wind Force: $F_{ant} = q_z \cdot Gh \cdot EPA$

ICE DEAD LOAD

Largest Out-to-Out Dimension: $D_{ant} = \sqrt{{D_{ant}}^2 + {W_{ant}}^2}$

Cross Sectional Area of Ice: $A_{ice\_ant} = \pi \cdot tiz \cdot (Dant + tiz)$

Total Ice Dead Load: $DL_{ice\_ant} = \boldsymbol{\rho_i} \cdot (Aice_{\_ant} \cdot Hant)$

ICE WIND LOAD

Dimensions: $H_{i_{ant}} = H_{ant} + 2tiz$

$W_{i_{ant}} = W_{ant} + 2tiz$

$D_{i_{ant}} = D_{ant} + 2tiz$

Area (Normal): $AIN_{area} = H_{i\_ant} \cdot W_{i\_ant}$

Area (Side): $AIT_{area} = H_{i\_ant} \cdot D_{i\_ant}$

Force Coefficient (Normal): $Ci_{fn} = C_{fsquare}(H_{i\_ant}, W_{i\_ant})$

Force Coefficient (Side): $Ci_{fs} = C_{fsquare}(H_{i\_ant}, D_{i\_ant})$

Pipe Area (Normal): $AN_p = \max[(L_{ip} - H_{i\_ant}) * D_{ip}, 0]$

Pipe Area (Side): $AT_p = L_{ip} \cdot Dip$

Force Coefficient (Normal): $C_{fp} = C_{fround}(L_{ip}, D_{ip})$

Normal Effective Projected Area: $E_{pain} = (Ci_{fn} \cdot ANarea) + (Cfp \cdot ANp)$

Side Effective Projected Area: $E_{pait} = (Ci_{fs} \cdot ATarea) + (Cfp \cdot ATp)$

Effective Projected Area: $EPA_i = max(E_{pain}, Epait)$

Wind Force: $F_{i\_ant} = q_z \cdot Gh \cdot EPAi$

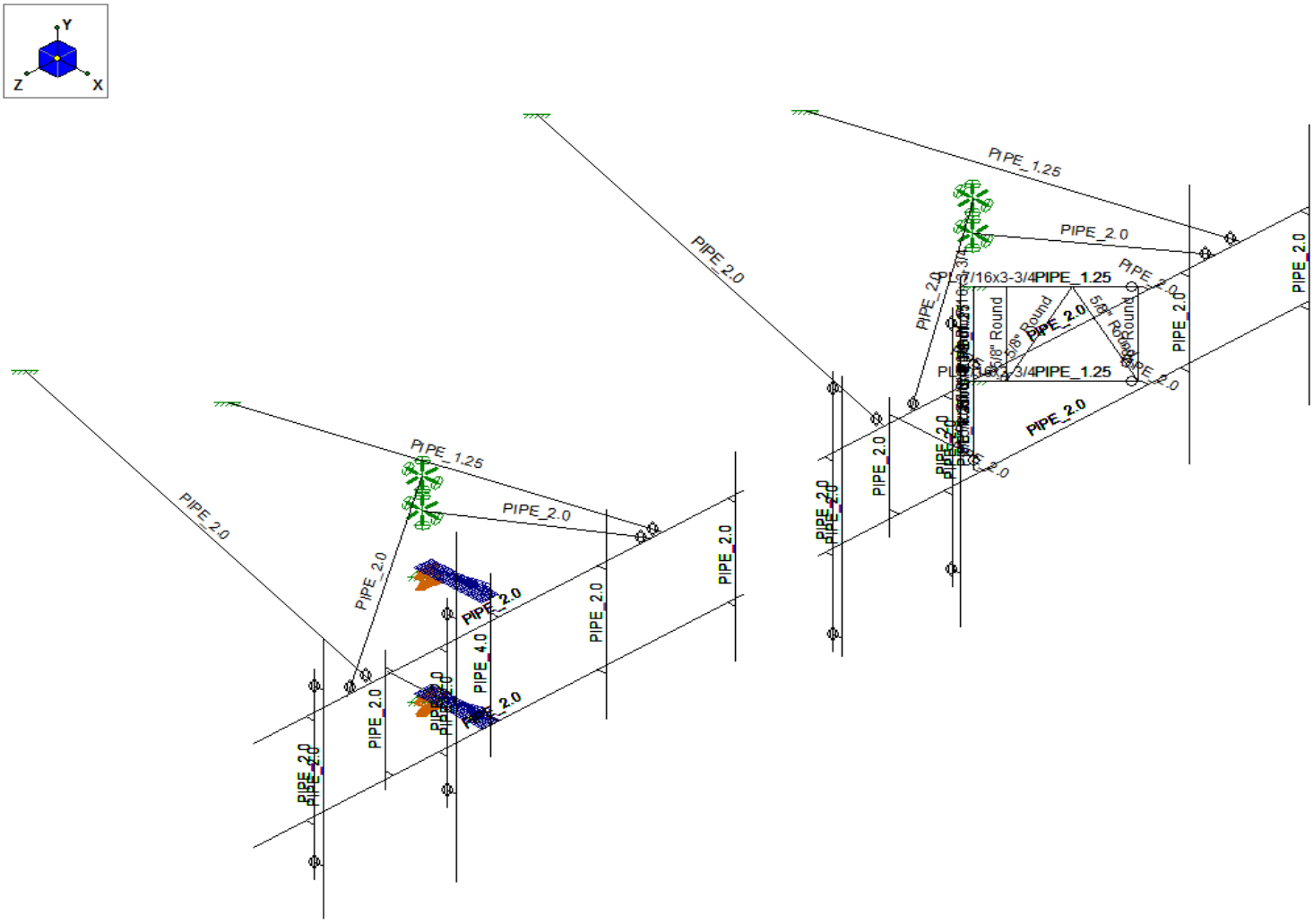
III. ATTACHMENTS

Client:	ATT	Computed By:	AB
Site Name:	CTL01111	Date:	10/2/2018
Project No.	18946025A	Verified By:	PET
Title:	Antenna Mount Modification Analysis	Page:	8

RISA MODELS

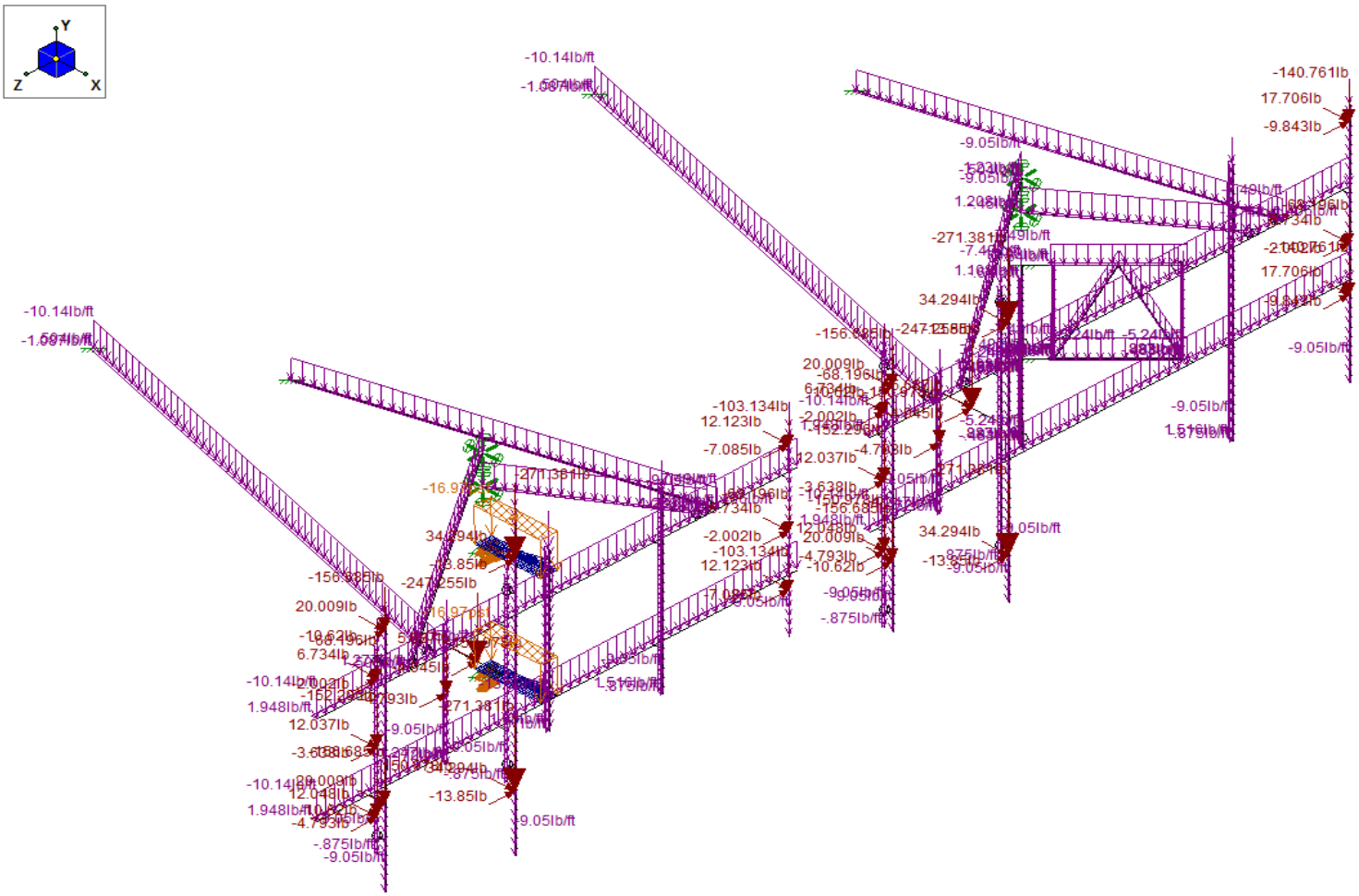
Gamma and Beta Sector

Alpha Sector



Client:	ATT	Computed By:	AB
Site Name:	CTL01111	Date:	10/2/2018
Project No.	18946025A	Verified By:	PET
Title:	Antenna Mount Modification Analysis	Page:	9

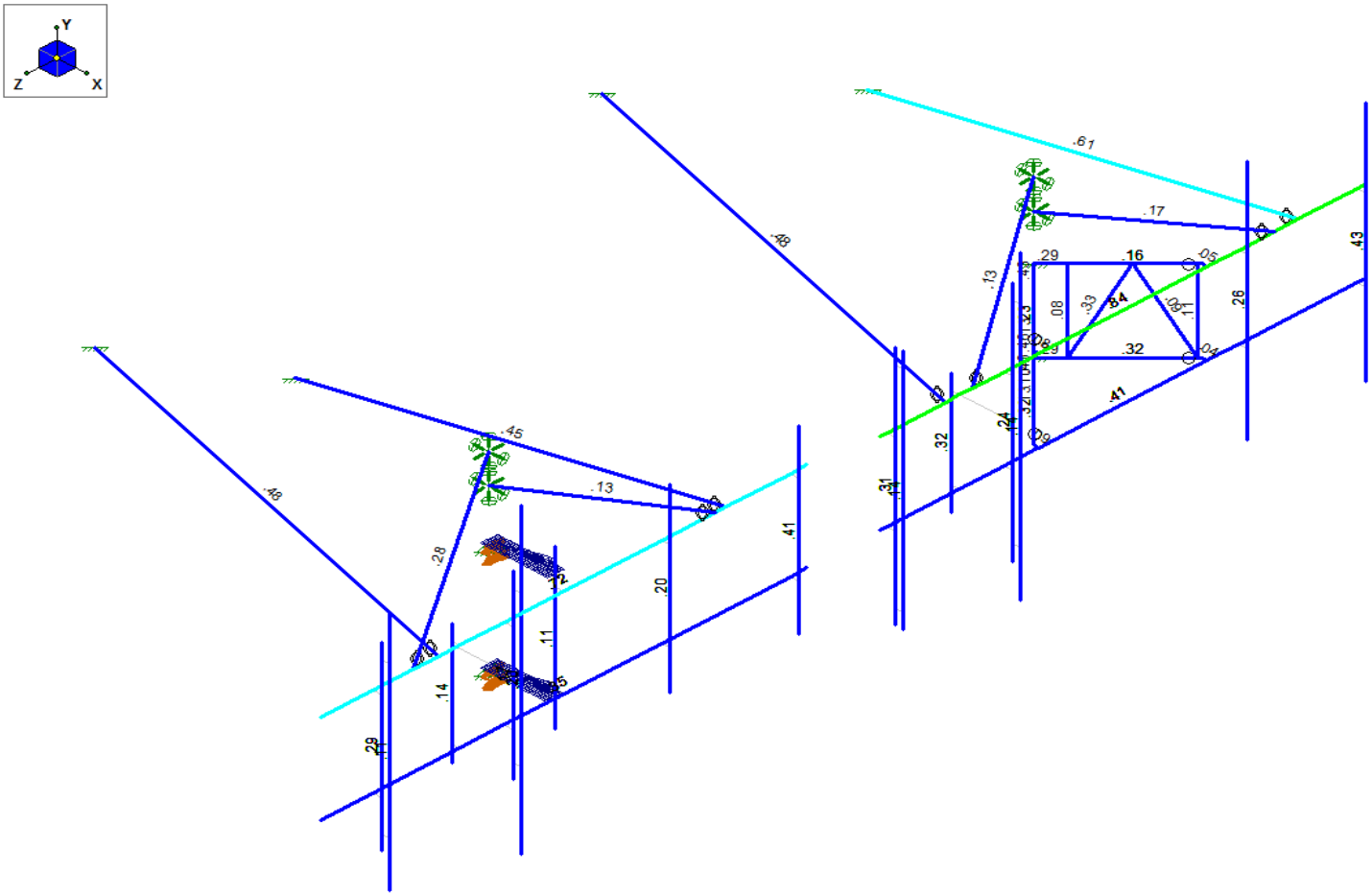
RISA WORST CASE LOADING



Loads: LC 21, 1.2D+1.0ICE+1.0W6ICE
Envelope Only Solution

Client:	ATT	Computed By:	AB
Site Name:	CTL01111	Date:	10/2/2018
Project No.	18946025A	Verified By:	PET
Title:	Antenna Mount Modification Analysis	Page:	10

RISA CODE CHECK



Mount to Tower Connection Check Alpha Sector:

Applied Forces:
From Risa 3D LRFD Loading

$F_x := 1179.618 \cdot lbf$

$F_y := 606.465 lbf$

$F_z := 1228.008 \cdot lbf$

Applied Moments:
From Risa 3D LRFD Loading

$M_x := 117.946 \cdot lbf \cdot ft$

$M_y := 395.469 lbf \cdot ft$

$M_z := 152.73 \cdot lbf \cdot ft$

Bolt Spacing from Edge:

$x_1 := 3.5in$

Bolt Spacing from Edge:

$x_2 := 2 \cdot in$

Number of Bolts:

$n := 1$

Applied Tension at Bolt:

$$P_{a.t} := \frac{M_z}{x_2 \cdot n} + \frac{F_y \cdot (1)}{n} + \frac{M_x}{x_1} = 1927.2\,lbf$$

Applied Shear at Bolt:

$$P_{a.v} := \sqrt{\left(\frac{F_x}{n} + \frac{M_y}{x_1}\right)^2 + \left(\frac{F_z}{n}\right)^2} = 2817.2\,lbf$$

Bolt Type Used: **A325N**

Nominal Tensile Stress, Fnt: $F_{n.t} := 90ksi$ AISC, Table J3-2, P. 16.1-104

Nominal Shear Stress, Fnv: $F_{n.v} := 54ksi$ AISC, Table J3-2, P. 16.1-104

Nominal Bolt Diameter: $d_b := \frac{5}{8}in$

Gross Area of the Bolt: $A_{b.g} := 0.307in^2$ AISC, Table 7-18, P. 7-83

Net Area of the Bolt: $A_{b.n} := 0.226in^2$ AISC, Table 7-18, P. 7-83

Strength Reduction Factor, ϕ: $\phi := 0.75$

Combined Tension And Shear Check

Nominal Tensile Reduced Fntr

$$F_{n.t.r} := 1.3 \cdot F_{n.t} - \frac{F_{n.t}}{\phi \cdot F_{n.v}} \cdot \frac{P_{a.v}}{A_{b.g}} = 96.6 \cdot ksi$$

AISC Eq. J3-3a, P. 16.1-109

Nominal Shear Reduced Fntv

$$F_{n.v.r} := 1.3 \cdot F_{n.v} - \frac{F_{n.v}}{\phi \cdot F_{n.t}} \cdot \frac{P_{a.t}}{A_{b.g}} = 65.2 \cdot ksi$$

AISC Eq. J3-3a, P. 16.1-109

Bolt Nominal Tensive Strength

$$R_{n.t} := F_{n.t} \cdot A_{b.g} = 27.6 \cdot kip$$

Tension Check

$$Check := \begin{cases} \text{"OK"} & \text{if } \phi \cdot R_{n.t} \geq P_{a.t} \\ \text{"NOT GOOD"} & \text{otherwise} \end{cases}$$

$$Check = \text{"OK"}$$

Tension Ratio

$$Ratio_t := \frac{P_{a.t}}{\phi \cdot R_{n.t}} \qquad Ratio_t = 9.3 \cdot \%$$

Bolt Nominal Shear Strength

$$R_{n.v} := F_{n.v} \cdot A_{b.g} = 16.6 \cdot kip$$

Shear Check

$$Check := \begin{cases} \text{"OK"} & \text{if } \phi \cdot R_{n.v} \geq P_{a.v} \\ \text{"NOT GOOD"} & \text{otherwise} \end{cases}$$

$$Check = \text{"OK"}$$

Shear Ratio

$$Ratio_v := \frac{P_{a.v}}{\phi \cdot R_{n.v}} \qquad Ratio_v = 22.7 \cdot \%$$

Mount to Tower Connection Check Beta and Gamma Sector:

Applied Forces:

From Risa 3D LRFD Loading

$F_x := 6219.074 \cdot lbf$

$F_y := 107.982 lbf$

$F_z := 411.308 \cdot lbf$

Applied Moments:

From Risa 3D LRFD Loading

$M_x := 0 \cdot lbf \cdot ft$

$M_y := 0 lbf \cdot ft$

$M_z := 0 \cdot lbf \cdot ft$

Bolts Horizontal Spacing: $x_1 := 4in$

Bolt Spacing from Edge: $x_2 := 2 \cdot in$

Number of Bolts: $n := 2$

Applied Tension at Bolt:

$$P_{a.t} := \frac{M_z}{x_2 \cdot n} + \frac{F_y \cdot (0)}{n} + \frac{M_x}{x_1} = 0$$

Applied Shear at Bolt:

$$P_{a.v} := \sqrt{\left(\frac{F_x}{n} + \frac{M_y}{x_1}\right)^2 + \left(\frac{F_z}{n}\right)^2} = 3116.3\,lbf$$

Bolt Type Used: **A325N**

Nominal Tensile Stress, Fnt: $F_{n.t} := 90ksi$ AISC, Table J3-2, P. 16.1-104

Nominal Shear Stress, Fnv: $F_{n.v} := 54ksi$ AISC, Table J3-2, P. 16.1-104

Nominal Bolt Diameter: $d_b := \frac{5}{8}in$

Gross Area of the Bolt: $A_{b.g} := 0.307in^2$ AISC, Table 7-18, P. 7-83

Net Area of the Bolt: $A_{b.n} := 0.226in^2$ AISC, Table 7-18, P. 7-83

Strength Reduction Factor, ϕ: $\phi := 0.75$

Combined Tension And Shear Check

Nominal Tensile Reduced Fntr

$$F_{n.t.r} := 1.3 \cdot F_{n.t} - \frac{F_{n.t}}{\phi \cdot F_{n.v}} \cdot \frac{P_{a.v}}{A_{b.g}} = 94.4 \cdot ksi$$

AISC Eq. J3-3a, P. 16.1-109

Nominal Shear Reduced Fntv

$$F_{n.v.r} := 1.3 \cdot F_{n.v} - \frac{F_{n.v}}{\phi \cdot F_{n.t}} \cdot \frac{P_{a.t}}{A_{b.g}} = 70.2 \cdot ksi$$

AISC Eq. J3-3a, P. 16.1-109

Bolt Nominal Tensive Strength

$$R_{n.t} := F_{n.t} \cdot A_{b.g} = 27.6 \cdot kip$$

Tension Check

$$Check := \begin{cases} \text{"OK"} & \text{if } \phi \cdot R_{n.t} \geq P_{a.t} \\ \text{"NOT GOOD"} & \text{otherwise} \end{cases}$$

$Check = \text{"OK"}$

Tension Ratio

$$Ratio_t := \frac{P_{a.t}}{\phi \cdot R_{n.t}} \qquad Ratio_t = 0 \cdot \%$$

Bolt Nominal Shear Strength

$$R_{n.v} := F_{n.v} \cdot A_{b.g} = 16.6 \cdot kip$$

Shear Check

$$Check := \begin{cases} \text{"OK"} & \text{if } \phi \cdot R_{n.v} \geq P_{a.v} \\ \text{"NOT GOOD"} & \text{otherwise} \end{cases}$$

$Check = \text{"OK"}$

Shear Ratio

$$Ratio_v := \frac{P_{a.v}}{\phi \cdot R_{n.v}} \qquad Ratio_v = 25.1 \cdot \%$$

ALLPRO
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Tower Structural Analysis Report for
SBA Network Services, Inc.

Existing 350' Self Support Tower

SBA Site Name: Cleary Tower (Edward)
SBA Site ID: CT20021-A-08
Carrier Name: AT&T
Carrier Site ID/Name: CTL01111 / Walcott
App # 92366, v3

Site Location: 1233 Wolcott Road (Rt-69)
Wolcott, CT 06716
New Haven County
Latitude: 41.621581°
Longitude: -72.973633°

ACGI Job # 19-0642
(Refer to Previous ACGI Job # 19-0197, dated 01/15/2019

ANALYSIS RESULTS		
Tower Components	**99.9 %**	**Pass**
Tower Foundation	**42.3 %**	**Pass**
Net change in tower stress	**+1.8 %**	**From previous SA by Allpro Consulting Group, Inc. ACGI # 19-0197 dated 01/15/2019.**
Change in stress due to Mount Modification	**0.6 %**	**Change due to addition of P/N SPTB Stiff Arm tie Backs Mount Reinforcements**

Prepared By:
Bob Akech
Staff Engineer

02/04/2019
Approved By:
Joji M. George, P.E.
CT PE # 24444

TABLE OF CONTENTS

1. ANALYSIS SUMMARY

The existing 350' Self-Supported Tower located in Wolcott, Connecticut was analyzed by Allpro Consulting Group, Inc. (ACGI) for the existing loads and the proposed AT&T antennas, dishes and coaxes per application # 92366, v3 as authorized by SBA Communication Corp. Based on the results of the analysis, the existing tower with below mentioned proposed and existing loading is found **in compliance** with *TIA-222-G, Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and International Building Code 2015*.

2. SCOPE & SOURCE OF INFORMATION

The purpose of this structural analysis is to determine whether the existing structure is capable of supporting additional proposed loads.

SOURCE OF INFORMATION		
Tower Data:	Paul J. Ford & Co.	Structural analysis by Paul J. Ford & Co., Job No. A03-T143 dated 12/22/2003.
	FDH Engineering	Previous structural analysis by FDH Engineering, project #1462GQ1400, dated 04/09/2014.
	Allpro Consulting Group, Inc.	Previous structural analysis by Allpro Consulting Group, Inc., ACGI Job #16-4376, dated 12/14/2016.
		Previous modification design by Allpro Consulting Group, Inc., ACGI#17-0832 Rev.2 dated 07/14/2017.
		Previous structural analysis by Allpro Consulting Group, Inc., ACGI Job #18-5441, dated 08/22/2018
		Previous structural analysis by Allpro Consulting Group, Inc., ACGI Job # 19-0197, dated 01/15/2019
Foundation Data:	Paul J. Ford & Co.	Structural analysis by Paul J. Ford & Co., Job No. A03-T143 dated 12/22/2003.
Geotechnical Report:	Osman Pekin	Soil report by Osman Pekin, Ph.D., P.E. dated 12/12/1991.

Loading Data:	Allpro Consulting Group, Inc. SBA Communication Corp.	Previous modification design SA by Allpro Consulting Group, Inc., ACGI Job # 19-0197, dated 01/15/2019 Proposed final loading for AT&T as per sbasite.com, Application ID 92366, v3 downloaded from the SBA portal.
Authorization:	SBA Communication Corp.	

3. ANALYSIS METHODS & DATA

The analysis was performed in accordance with Telecommunication Industry Association specification TIA-222-G-Addendum 2. The tower was modeled using TNX Tower, a 3-D finite element program. TNX Tower is a general-purpose modeling, analysis, and design program created specifically for communication towers using the EIA-222-C, EIA-222-D, TIA/EIA-222-F or TIA-222-G standards. The 3-D model included the tower, with existing appurtenances and all proposed loads.

SITE DATA	
SBA Site Name:	Cleary Tower (Edward)
SBA Site Number:	CT20021-A-08
Carrier Site Name:	AT&T: CTL01111 / Walcott
City, State:	Wolcott, CT
County:	New Haven
Code Wind Load Requirement:	TIA-222-G & 2015 International Building Code (Ultimate wind speed of 125 mph 3 sec gust equivalent to Nominal design wind speed of 97 mph)
Wind Load Used:	TIA-222-G Code: • Nominal wind speed of 97 mph (3 second gust wind speed) • Structure Class II*. • Exposure Category B. • Topographic Category 1. • A wind speed of 50 mph is used in combination with 0.75 in ice thickness.
Seismic Check:	Spectral Response Acceleration at Short Period (Ss) is 0.186 g which less than 1.000 g. Therefore, no seismic check is required as per TIA-222-G section 2.7.3

*This structural analysis is based upon the tower being classified as a class II; however, if a different classification is required subsequent to the date hereof, the tower classification will be changed to meet such requirement and a new structural analysis will be run.

TOWER DATA	
Tower Type:	Self-Supported Tower
Height:	350'
Cross Section:	Triangular
Steel Strength:	Legs – 50 ksi, Braces – 36ksi
Type of Foundation:	Pad and Pier Foundation

TOWER HISTORY	
Tower Manufacturer / Model:	FWT, Inc.
Date of Original Design:	1992
Previous Modifications:	Previous modification design by Allpro Consulting Group, Inc., ACGI#17-0832 Rev.2 dated 07/14/2017.
Original Design Code Reqts:	EIA/TIA 222-E, 85mph basic wind speed without ice and 74 mph basic wind speed with 0.5" thick ice

4. CONCLUSIONS

RESULT SUMMARY		
MEMBER	*% Capacity*	*Pass/Fail*
Leg	**45.9 %**	**Pass**
Diagonal	**52.7 %**	**Pass**
Horizontal	**51.0 %**	**Pass**
Top Girt	**3.1 %**	**Pass**
Redundant Horizontal Bracing	**99.9 %**	**Pass**
Redundant Diagonal Bracing	**70.1 %**	**Pass**
Inner Bracing	**0.9 %**	**Pass**
Bolts	**49.3 %**	**Pass**
Anchor Bolts	**47.3 %**	**Pass**
OVERALL TOWER RATING = 99.9 % (Pass)		

Foundation Type	*Reaction Direction*	*Current Analysis Reaction (TIA-222-G)*	*Original Design Reaction (EIA/TIA-222-E)*	*Original Design Reaction equivalent to TIA-222-G (multiply by 1.35)*	*% Capacity*
Individual Foundation	**Uplift**	**313 k**	**631 k**	**851.8 k**	**36.7 %**
	Compression	**429 k**	**751 k**	**1013.8 k**	**42.3 %**

**Note: Soil data available as per Soil report by Osman Pekin, Ph.D., P.E. dated 12/12/1991 is not sufficient for the detail analysis of the foundation. Therefore, reactions are compared based upon the original tower design. Foundation is estimated to be acceptable based on the tower member loads and stresses. However, it is recommended to provide detailed geotechnical investigation report for rigorous analysis of the tower foundation.*

MAXIMUM DISH ROTATION AT SERVICE WIND SPEED Twist and Sway (deg), 10 dB degradation limit*				
Elev. (ft)	*MW Dish*	*Tilt (deg)*	*Twist (deg)*	*Allowable (deg)*
165±	**SPD3-2.4**	**0.0678**	**0.0035**	**Carrier to verify**

As per the results of the analysis, the existing tower **is in code compliance** for the proposed and existing antenna loads.

Maximum tower member stress **is less than allowable,** making it **in code compliance** under the TIA-222-G code and **2015 International Building Code (IBC 2015)** requirements.

Overall tower stress ratio increased by 1.8 % compared to previous SA by Allpro Consulting Group, Inc. ACGI # 19-0197 dated 01/15/2019 due to addition of AT&T loadings.

5. ASSUMPTIONS

This analysis was completed based on the following assumptions:

- Tower has been properly maintained
- Tower erection was in accordance to manufacturer drawings
- Leg flanges have been properly designed by manufacturer to not be a limiting reaction
- Welds have been properly designed and installed by manufacturer to not be a limiting reaction
- Foundation was constructed in accordance to manufacturer drawings
- Foundation does not have structural damage
- Bolts have been properly tightened according to manufacturer specifications
- Appurtenance, mount and transmission line sizes and weights are best estimates using the tnxTower database and manufacturer information

6. DISCLAIMER

Installation procedures and related loading are not within the scope of this analysis. A contractor experienced in similar work should perform all installation work. The engineering services provided by Allpro Consulting Group, Inc. (ACGI) are limited to the computer analysis and calculations of the structure with the proposed and existing loads. This analysis is considered void if the loading mentioned in this report is changed or is different as installed. It is assumed that the existing structure is properly maintained and is in good condition free of any defects. Scope of this analysis does not include existing connections, except as noted in this report.

ACGI does not make any warranties, expressed or implied in connection with this engineering analysis report and disclaims any liability arising from deficiencies or any existing conditions of the original structure. ACGI will not be responsible for consequential or incidental damages sustained by any parties as a result of any data or conclusions included in this Report. The maximum liability of ACGI pursuant to this report shall be limited to the consulting fee received for the preparation of the report.

7. APPURTENANCE LISTING

EXISTING LOAD DESCRIPTION					
ELEV (ft.)	***Qty.***	***Antenna Description***	***Mount Type & Qty.***	***TX. LINE (in)***	***TENANT***
350±	1	Celwave PD200 Omni	(1) Star Mount w/ (9) Standoffs	(1) 7/8"	LoJack
350±	1	101 Omni		(1) 1 1/4"	Marcus
341±	3	Comba ODI2-065R18K-GQ Antenna	(3) Commscope SF-SU7-2-96 Sector Frame	(1) 1-1/4" Hybrid	Dish Network
	2	Ericsson 4415 Radio			
	3	Ericsson 0208 Radio			
320±	2	101 Omni	(2) 6' Standoffs	(2) 1 1/4"	Marcus
186±	3	Powerwave 7770 Antenna	(3) Sector Frames	(12) 1-5/8" (1) 1/2" Fiber (2) 3/4" DC Power [DC Power & Fiber inside 2" interduct]	AT&T
	4	KMW AM-X-CD-16-65-00T-RET Antenna			
	2	Kathrein 800 10121 Antenna			
	3	CCI HPA-65R-BUU-H6 Antenna			
	6	CCI DTMABP7819VG12A TMA			
	6	Powerwave LGP 13519 Diplexer			
	4	Kathrein 860 10125 RET			
	3	Ericsson RRUS 11 Remote Radio			
	3	Ericsson RRUS 32 Remote Radio			
	1	Raycap DC6-48-60-18-8F Surge			
165±	3	SPD3-2.4 Radiowaves Dish	Pipe Mount	(6) 1/2"	Marcus
	3	SPD2-5.8 Radiowaves Dish	Pipe Mount		
158±	1	Decibel DB408 Omni	(1) 17" Standoff	(1) 7/8"	Wolcott
134±	3	APXVTM14-C-I20	(3) 15' T-Frames	(4) 1-1/4"	Sprint
	3	RFS APXVSPP18			
	3	RRH 1900 MHz			
	3	RRH 800 MHz			
	3	RRH TD-8x20-25			
	3	RRH 800 MHz Filter			
	4	RFS ACU-A20-N			

FINAL DISH AT&T LOAD DESCRIPTION					
ELEV (ft.)	***Qty.***	***Antenna Description***	***Mount Type & Qty.***	***TX. LINE (in)***	***TENANT***
186±	3	Powerwave 7770 Antenna	(3) sector Frame T-Frames **(2) P/N SPTB Stiff Arm**	(12) 1-5/8" **(2)** 1/2" Fiber **(6)** 3/4" DC Power	**AT&T**
	1	KMW AM-X-CD-16-65-00T-RET Antenna			
	2	Kathrein 800 10121 Antenna			
	3	CCI HPA-65R-BUU-H6 Antenna			
	3	**KMW EPBQ-654L8H8-L2 Antenna**			
	6	CCI DTMABP7819VG12A TMA			
	6	Powerwave LGP 13519 Diplexer			
	4	Kathrein 860 10025 RET			
	3	Ericsson RRUS 11 Remote Radio			
	3	Ericsson RRUS 32 Remote Radio			
	3	**Ericsson RRUS 4478 B5 RRU**			
	3	**Ericsson RRUS 4426 B66 RRU**			
	3	**Ericsson RRUS 32 B66 RRU**			
	1	Raycap DC6-48-60-18-8F Surge			
	2	**Raycap DC6-48-60-18-8F Surge**			

Notes:

1. ACGI should be notified of any discrepancies found in the data listed in this report.
2. Notify ACGI if any potential physical and other interference with existing antennas for a redesign.

8. SUMMARY OF WORKING PERCENTAGE OF STRUCTURAL COMPONENTS

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	350 - 340	Leg	2	3	-6.340	49.286	12.9	Pass
		Diagonal	L2x1 1/2x3/16	9	-2.140	10.346	20.7	Pass
							31.2 (b)	
		Top Girt	L3x3x1/4	4	-0.319	28.598	1.1	Pass
							3.1 (b)	
T2	340 - 320	Leg	2	21	-31.885	72.063	44.2	Pass
		Diagonal	L2x1 1/2x3/16	24	-3.279	11.584	28.3	Pass
							45.2 (b)	
T3	320 - 300	Leg	2 1/2	54	-50.381	112.346	44.8	Pass
		Diagonal	L2x2x3/16	75	-2.735	13.174	20.8	Pass
							36.5 (b)	
T4	300 - 280	Leg	3 1/4	81	-64.889	183.313	35.4	Pass
		Diagonal	L2-1/2x2-1/2x3/16	84	-2.301	13.474	17.1	Pass
							28.0 (b)	
T5	280 - 260	Leg	3 1/4	102	-80.154	183.313	43.7	Pass
		Diagonal	L2-1/2x2-1/2x3/16	108	-2.480	10.341	24.0	Pass
							31.1 (b)	
T6	260 - 240	Leg	3 1/2	123	-96.322	234.484	41.1	Pass
		Diagonal	L3x3x3/16	128	-2.926	13.820	21.2	Pass
							37.3 (b)	
T7	240 - 220	Leg	3 1/2	144	-112.140	306.641	36.6	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x3/8	152	-3.829	25.202	15.2	Pass
							24.1 (b)	
		Horizontal	L2 1/2x2 1/2x3/16	148	-2.132	8.246	25.9	Pass
							27.2 (b)	
		Inner Bracing	L2 1/2x2 1/2x3/16	156	-0.011	7.609	0.6	Pass
T8	220 - 200	Leg	3 3/4	183	-130.154	368.015	35.4	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x3/8	191	-4.328	21.196	20.4	Pass
							23.7 (b)	
		Horizontal	L2 1/2x2 1/2x3/16	187	-2.360	6.207	38.0	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	194	-0.012	5.772	0.7	Pass
T9	200 - 180	Leg	4	222	-150.834	434.236	34.7	Pass
		Diagonal	2L3x3x3/16x3/8	230	-6.826	30.555	22.3	Pass
							34.8 (b)	
		Horizontal	L3x3x3/16	226	-2.619	8.488	30.9	Pass
							33.4 (b)	
		Inner Bracing	L3x3x3/16	232	-0.015	7.941	0.7	Pass
T10	180 - 160	Leg	4 1/4	261	-177.552	505.220	35.1	Pass
		Diagonal	2L3x3x3/16x3/8	269	-7.702	26.278	29.3	Pass
							39.4 (b)	
		Horizontal	L3x3x3/16	265	-3.079	6.804	45.3	Pass
		Inner Bracing	L3x3x3/16	272	-0.016	6.396	0.8	Pass
T11	160 - 140	Leg	4 1/4	300	-205.915	505.220	40.8	Pass
		Diagonal	2L3x3x3/16x3/8	308	-8.517	22.339	38.1	Pass
							44.9 (b)	
		Horizontal	L3 1/2x3 1/2x1/4	304	-3.571	11.687	30.6	Pass
							34.2 (b)	
		Inner Bracing	L3 1/2x3 1/2x1/4	312	-0.019	11.050	0.7	Pass
T12	140 - 120	Leg	4 1/2	339	-227.812	580.902	39.2	Pass
		Diagonal	2L3x3x1/4x3/8	358	-12.582	31.416	40.1	Pass
							45.2 (b)	
		Horizontal	2L2 1/2x2 1/2x3/16x3/8	347	-3.951	13.682	28.9	Pass
		Redund Horz 1 Bracing	L2x2x3/16	374	-3.952	5.620	70.3	Pass
		Redund Diag 1 Bracing	L2-1/2x2-1/2x3/16	375	-2.684	6.069	44.2	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	361	-0.028	9.656	0.7	Pass
T13	120 - 100	Leg	4 3/4	384	-260.000	661.231	39.3	Pass
		Diagonal	2L3x3x1/4x3/8	400	-12.502	28.916	43.2	Pass
							48.7 (b)	
		Horizontal	2L2 1/2x2 1/2x3/16x3/8	399	-4.509	11.547	39.0	Pass
		Redund Horz 1 Bracing	L2x2x3/16	397	-4.510	4.748	95.0	Pass
		Redund Diag 1	L2-1/2x2-1/2x3/16	423	-2.959	5.494	53.9	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
		Bracing						
		Inner Bracing	L4x4x1/4	406	-0.030	12.311	0.8	Pass
T14	100 - 80	Leg	4 3/4	429	-289.764	661.231	43.8	Pass
		Diagonal	2L3x3x1/4x3/8	448	-13.614	26.593	51.2	Pass
		Horizontal	2L2 1/2x2 1/2x3/16x3/8	437	-5.025	9.860	51.0	Pass
		Redund Horz 1 Bracing	L2x2x3/8	442	-5.026	7.521	66.8	Pass
		Redund Diag 1 Bracing	L2-1/2x2-1/2x3/16	465	-3.203	4.968	64.5	Pass
		Inner Bracing	L4x4x1/4	451	-0.031	10.555	0.8	Pass
T15	80 - 60	Leg	5	474	-321.573	746.168	43.1	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	490	-13.639	38.008	35.9 44.6 (b)	Pass
		Horizontal	2L3x3x3/16x3/8	482	-5.577	15.048	37.1	Pass
		Redund Horz 1 Bracing	L2-1/2x2-1/2x3/16	487	-5.578	6.992	79.8	Pass
		Redund Diag 1 Bracing	L3x3x3/16	513	-3.468	7.925	43.8	Pass
		Inner Bracing	2L3x3x3/16x3/8	496	-0.037	14.343	0.8	Pass
T16	60 - 40	Leg	5 1/4	519	-351.970	835.679	42.1	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	538	-14.908	35.047	42.5 45.7 (b)	Pass
		Horizontal	2L3x3x3/16x3/8	527	-6.104	13.146	46.4	Pass
		Redund Horz 1 Bracing	L2-1/2x2-1/2x3/16	536	-6.105	6.113	99.9	Pass
		Redund Diag 1 Bracing	L3x3x3/16	555	-3.716	7.227	51.4	Pass
		Inner Bracing	2L3x3x3/16x3/8	542	-0.038	12.552	0.9	Pass
T17	40 - 20	Leg	5 1/4	564	-383.955	835.679	45.9	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	580	-14.831	32.326	45.9 47.9 (b)	Pass
		Horizontal	2L3 1/2x3 1/2x1/4x3/8	572	-6.659	24.167	27.6	Pass
		Redund Horz 1 Bracing	L2.5x2.5x3/16 + L2.5x2.5x1/4 (C-Shape) - Cleary Tower	577	-6.660	14.963	44.5	Pass
		Redund Diag 1 Bracing	L3x3x3/16	600	-3.981	6.591	60.4	Pass
		Inner Bracing	2L3 1/2x3 1/2x1/4x3/8	586	-0.043	23.141	0.7	Pass
T18	20 - 0	Leg	5 1/2	609	-414.861	929.740	44.6	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	628	-15.748	29.896	52.7	Pass
		Horizontal	2L3 1/2x3 1/2x1/4x3/8	617	-7.195	21.456	33.5	Pass
		Redund Horz 1 Bracing	L3x3x3/16	622	-7.195	8.374	85.9	Pass
		Redund Diag 1 Bracing	L3x3x3/16	645	-4.233	6.043	70.1	Pass
		Inner Bracing	2L3 1/2x3 1/2x1/4x3/8	631	-0.042	20.572	0.7	Pass
							Summary	
						Leg (T17)	45.9	Pass
						Diagonal (T18)	52.7	Pass
						Horizontal (T14)	51.0	Pass
						Top Girt (T1)	3.1	Pass
						Redund Horz 1 Bracing (T16)	99.9	Pass
						Redund Diag 1 Bracing (T18)	70.1	Pass
						Inner Bracing (T16)	0.9	Pass
						Bolt Checks	49.3	Pass
						RATING =	**99.9**	**Pass**

APPENDIX

TOWER DATA

⚠ This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

Hazards by Location

Search Information

Coordinates: 41.621581, -72.973633

Timestamp: 2019-01-30T21:04:21.151Z

Hazard Type: Wind

Map Results

Text Results

ASCE 7-16

MRI 10-Year	75 mph
MRI 25-Year	83 mph
MRI 50-Year	90 mph
MRI 100-Year	97 mph
Risk Category I	107 mph
Risk Category II	117 mph
Risk Category III	126 mph
Risk Category IV	⚠ 131 mph

You are in a wind-borne debris region if you are also within 1 mile of the coastal mean high water line.

ASCE 7-10

MRI 10-Year	76 mph
MRI 25-Year	86 mph
MRI 50-Year	92 mph
MRI 100-Year	99 mph
Risk Category I	110 mph
Risk Category II	121 mph
Risk Category III-IV	⚠ 130 mph

If the structure under consideration is a healthcare facility, you are in a wind-borne debris region. If other occupancy, use the Risk Category II basic wind speed contours to determine if you are in a wind-borne debris region.

ASCE 7-05

ASCE 7-05 Wind Speed ..... 100 mph

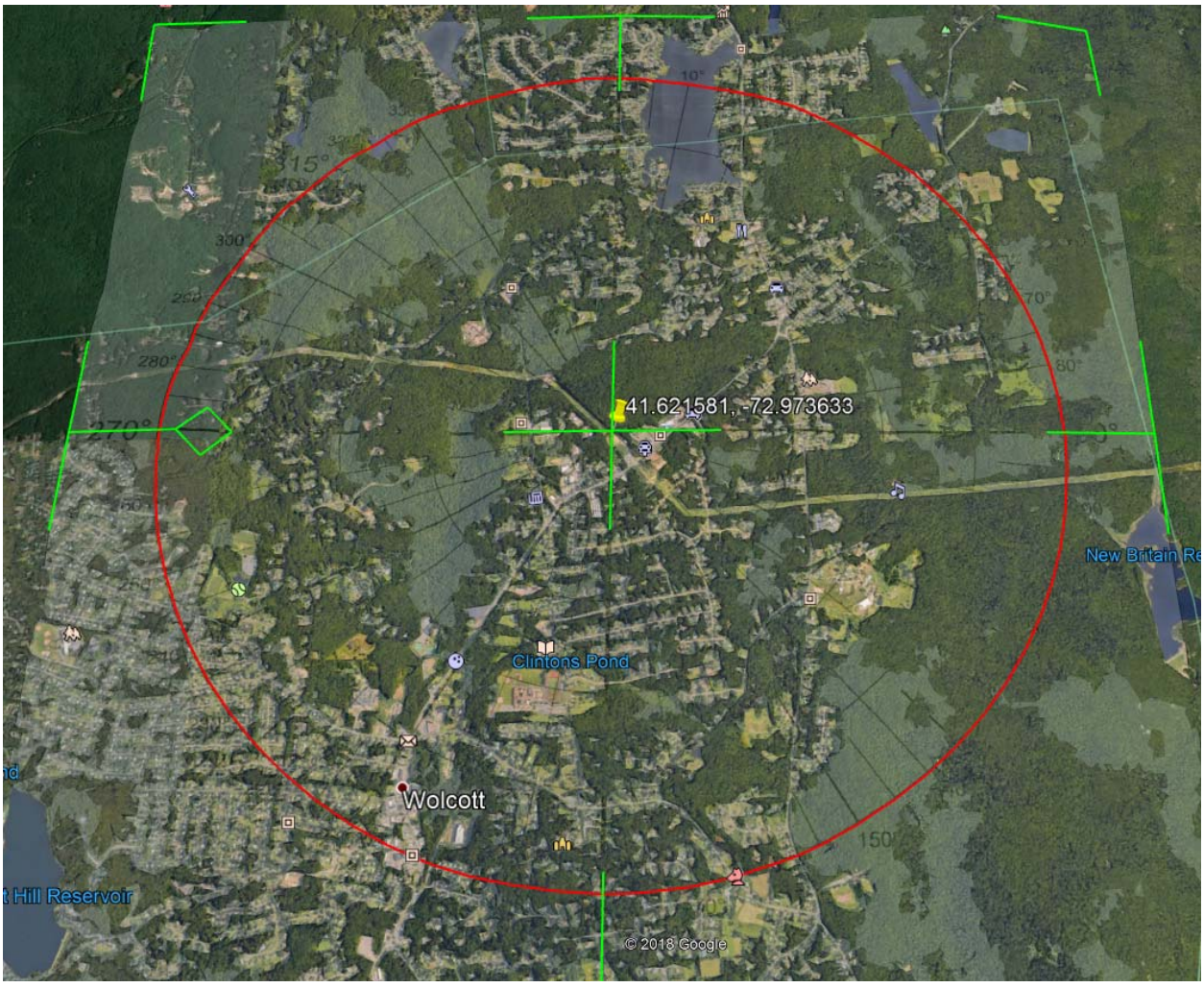
The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

CT20021-A-11 Cleary Tower (Edward)



Structure Class II*.
Exposure Category B.
Topographic Category 1.

⚠ This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

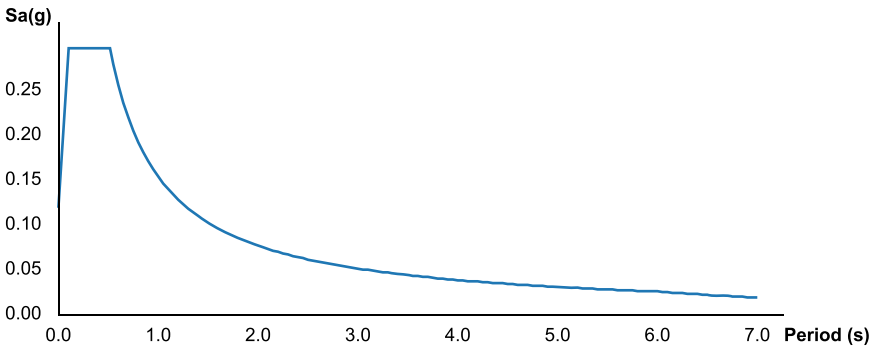
Hazards by Location

Search Information

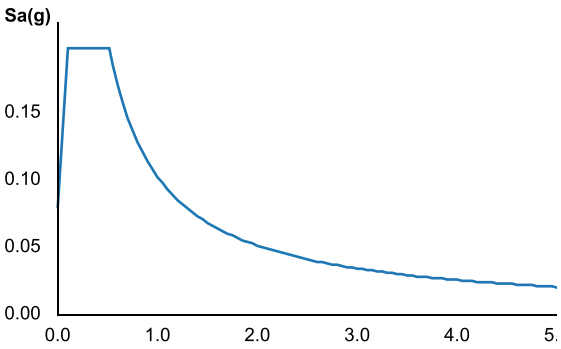
Coordinates:	41.621581, -72.973633
Timestamp:	2019-02-01T23:29:50.518Z
Hazard Type:	Seismic
Reference Document:	ASCE7-10
Risk Category:	II
Site Class:	D
Report Title:	CT20021-A-08 Cleary Tower (Edward)

Map Results

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Text Results

Basic Parameters

Name	Value	Description
S_S	0.186	MCE_R ground motion (period=0.2s)
S_1	0.064	MCE_R ground motion (period=1.0s)
S_{MS}	0.297	Site-modified spectral acceleration value
S_{M1}	0.154	Site-modified spectral acceleration value
S_{DS}	0.198	Numeric seismic design value at 0.2s SA
S_{D1}	0.102	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category

F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
PGA	0.095	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.153	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	0.186	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.208	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.064	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.071	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the United States Geological Survey Seismic Design Web Services.

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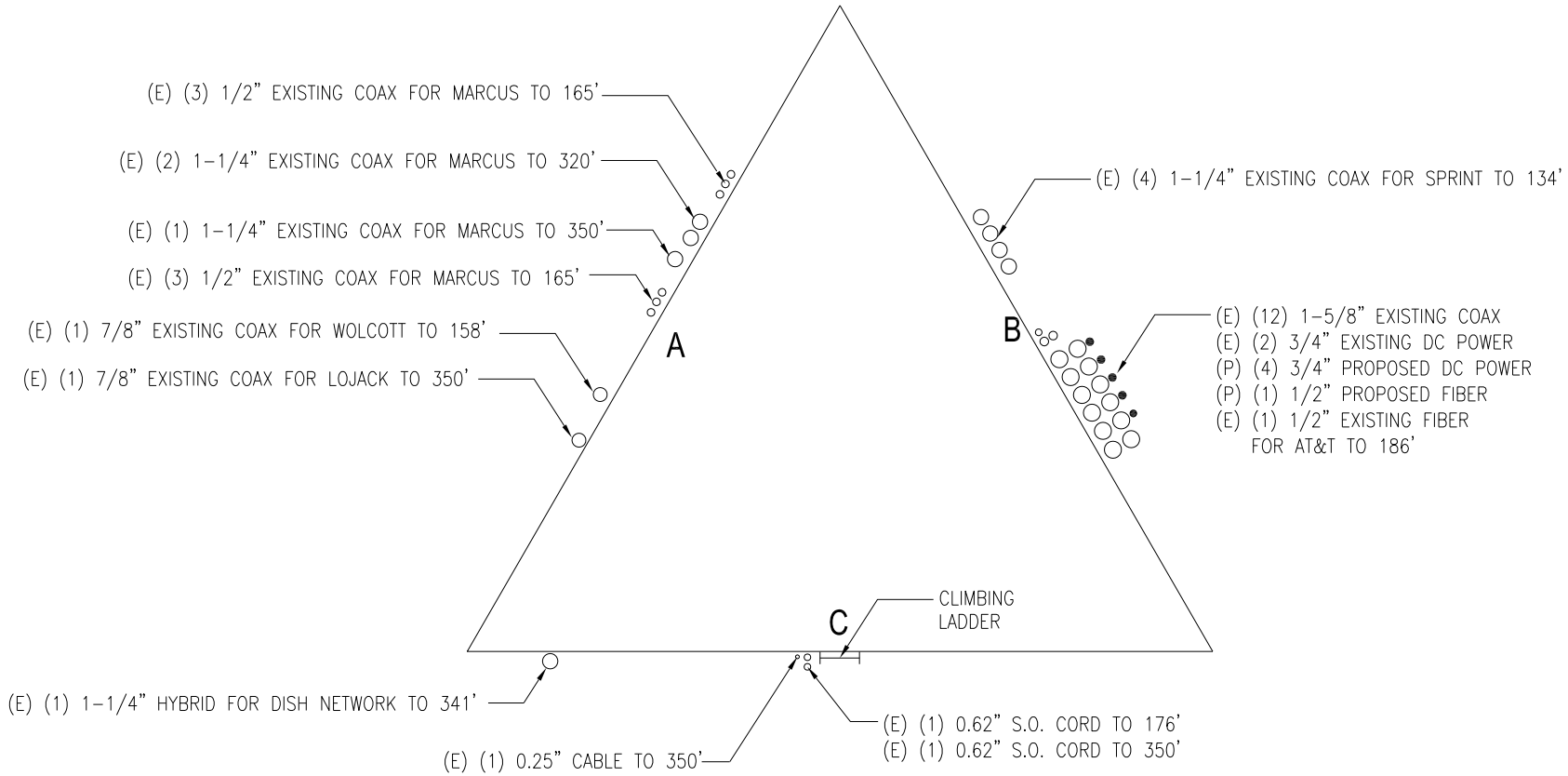
COAX LAYOUT

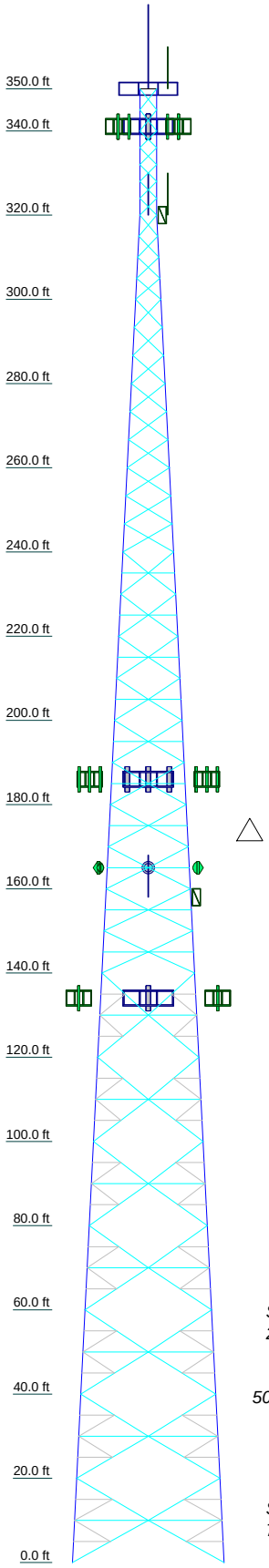


COAX LAYOUT

N.T.S

TOWER ELEVATION DRAWING

Section	T18	T17	T16	T15	T14	T13	T12	T11	T10	T9	T8	T7	T6	T5	T4	T3	T2	T1
Legs	SR 5 1/2	SR 5 1/4		SR 5	SR 4 3/4		SR 4 1/2	B	SR 4 1/4	SR 4	SR 3 3/4	SR 3 1/2			SR 3 1/4	SR 2 1/2	SR 2	
Leg Grade									A572-50									
Diagonals	2L3 1/2x3 1/2x1/4x3/8			2L3x3x1/4x3/8			2L2 1/2x2 1/2x3/16x3/8		2L3x3x16x3/8		2L2 1/2x2 1/2x3/16x3/8		L3x3x3/16		L2-1/2x2-1/2x3/16	L2x2x3/16	L2x1 1/2x3/16	
Diagonal Grade									A36									
Top Girts									N.A.									A
Horizontals	2L3 1/2x3 1/2x1/4x3/8		2L3x3x3/16x3/8			2L2 1/2x2 1/2x3/16x3/8			L3x3x3/16		L2 1/2x2 1/2x3/16					N.A.		
Red. Horizontals	L3x3x3/16	C	L2-1/2x2-1/2x3/16		L2x2x3/8		L2x2x3/16					N.A.						
Red. Diagonals		L3x3x3/16				L2-1/2x2-1/2x3/16						N.A.						
Inner Bracing	2L3 1/2x3 1/2x1/4x3/8		2L3x3x3/16x3/8			L4x4x1/4		L3 1/2x3 1/2x1/4		L3x3x3/16		L2 1/2x2 1/2x3/16						
Face Width (ft)	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	
# Panels @ (ft)				14 @ 10					20 @ 5				9 @ 6.66667			4 @ 5	5 @ 4	2 @ 5
Weight (K)	95.3	10.8	10.1	9.1	8.5	7.4	7.0	6.4	6.4	5.7	5.1	4.2	3.7	3.0	2.4	2.3	1.5	1.1	0.6



SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	L3x3x1/4	C	L2.5x2.5x3/16 + L2.5x2.5x1/4 (C-Shape) - Cleary Tower
B	L3 1/2x3 1/2x1/4		

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 B to the TIA-222-G Standard.
2. Tower designed for a 97 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 II.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 99.9%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 429 K
SHEAR: 48 K

UPLIFT: -313 K
SHEAR: 36 K

AXIAL 298 K
SHEAR 24 K *MOMENT 4017 kip-ft*
TORQUE 8 kip-ft
50 mph WIND - 0.7500 in ICE

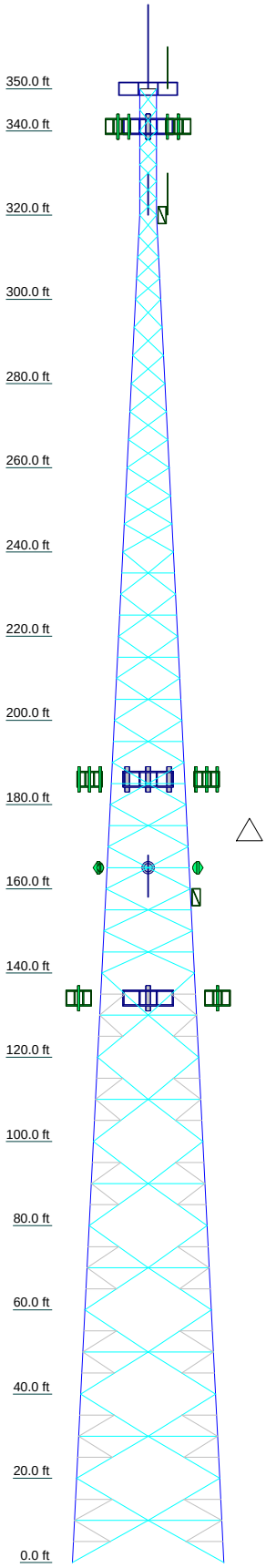
AXIAL 136 K
SHEAR 76 K *MOMENT 11964 kip-ft*
TORQUE 32 kip-ft
REACTIONS - 97 mph WIND

Allpro Consultants group inc
9221 lyndon B johson Freeway. Suite 204
Dallas Tx. 75243
Phone: 972 231 8893
FAX: 866 364 8375

Job: **19-0642**		
Project: ***CT20021-A-08 Cleary Tower (Edward)***		
Client: SBA	Drawn by: bakech	App'd:
Code: TIA-222-G	Date: 02/04/19	Scale: NTS
Path:		Dwg No. E-1

Section	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18
Legs	SR 2	SR 2 1/2	SR 3 1/4	SR 3 1/2	SR 3 3/4	SR 4	SR 4 1/4	SR 4 1/2	SR 4 3/4	SR 5	SR 5 1/4	SR 5 1/2
Leg Grade	A572-50											
Diagonals	L2x1 1/2x3/16	L2x2x3/16	L2-1/2x2-1/2x3/16	L3x3x3/16	L2 1/2x2 1/2x3/16	2L3x3x1/4x3/8	2L3 1/2x3 1/2x1/4x3/8											
Diagonal Grade	A36											
Top Girts	A											
Horizontals	N.A.						2L2 1/2x2 1/2x3/16	B	L3x3x3/16			2L3x3x3/16x3/8						2L3 1/2x3 1/2x1/4x3/8
Red. Horizontals	N.A.							L2x2x3/8	L2x2x3/16								C	L3x3x3/16
Red. Diagonals	N.A.							L2-1/2x2-1/2x3/16				L3x3x3/16						
Inner Bracing	N.A.						L2 1/2x2 1/2x3/16	L4x4x1/4		L3x3x3/16	L3 1/2x3 1/2x1/4							2L3 1/2x3 1/2x1/4x3/8
Face Width (ft)	4	2 @ 5	4 @ 5	5 @ 4	4 @ 5	9 @ 6.66667		16	20 @ 5	18	20	22	24	26	28	30	32	34
# Panels @ (ft)	6				8		14									14 @ 10		
Weight (K)	0.6	1.1	1.5	2.3	2.4	3.0	3.7	4.2	5.1	5.7	6.4	6.4	7.0	7.4	8.5	9.1	10.1	10.8

95.3



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Celwave PD200 Omni (LoJack)	350	(2) CCI DTMA-BP7819VG12A (ATI)	186
101 Omni (Marcus)	350	(2) LGP13519 Diplexer (ATI)	186
Star Mount w/ (9) Standoffs (Marcus/LoJack)	350	(2) LGP13519 Diplexer (ATI)	186
		(2) LGP13519 Diplexer (ATI)	186
ODI2-065R18K-GQ (Dish Network)	341	AM-X-CD-16-65-00T-RET (ATI)	186
ODI2-065R18K-GQ (Dish Network)	341	800-10121 (ATI)	186
ODI2-065R18K-GQ (Dish Network)	341	800-10121 (ATI)	186
4415 (Dish Network)	341	HPA-65R-BUU-H6 (ATI)	186
4415 (Dish Network)	341	HPA-65R-BUU-H6 (ATI)	186
0208 (Dish Network)	341	HPA-65R-BUU-H6 (ATI)	186
0208 (Dish Network)	341	EPBQ-654L8-H8-L2 (ATI)	186
0208 (Dish Network)	341	EPBQ-654L8-H8-L2 (ATI)	186
Commscope SF-SU7-2-96 Sector Frame (Dish Network)	341	EPBQ-654L8-H8-L2 (ATI)	186
		(2) CCI DTMA-BP7819VG12A (ATI)	186
Commscope SF-SU7-2-96 Sector Frame (Dish Network)	341	(2) CCI DTMA-BP7819VG12A (ATI)	186
		(2) Pipe Mounts (5.25' x 4.5") (Marcus)	165
Commscope SF-SU7-2-96 Sector Frame (Dish Network)	341	(2) Pipe Mounts (5.25' x 4.5") (Marcus)	165
		(2) Pipe Mounts (5.25' x 4.5") (Marcus)	165
101 Omni (Marcus)	320	Radiowaves SPD3-2.4 Dish (Marcus)	165
101 Omni (Marcus)	320	Radiowaves SPD3-2.4 Dish (Marcus)	165
6' Standoff (Marcus)	320	Radiowaves SPD3-2.4 Dish (Marcus)	165
6' Standoff (Marcus)	320	Radiowaves SPD2-5.8 Dish (Marcus)	165
860 10025 RET (ATI)	186	Radiowaves SPD2-5.8 Dish (Marcus)	165
(2) 860 10025 RET (ATI)	186	Radiowaves SPD2-5.8 Dish (Marcus)	165
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RRUS 11 (ATI)	186	ACU-A20-N (Sprint)	134
RRUS 32 (ATI)	186	15' T-Frames (Sprint)	134
RRUS 32 (ATI)	186	15' T-Frames (Sprint)	134
RRUS 32 (ATI)	186	15' T-Frames (Sprint)	134
RRUS 4478 B5 (ATI)	186	RRH 800 MHz (Sprint)	134
RRUS 4478 B5 (ATI)	186	RRH 800 MHz (Sprint)	134
RRUS 4478 B5 (ATI)	186	RRH 800 MHz (Sprint)	134
4426 B66 (ATI)	186	(2) ACU-A20-N (Sprint)	134
4426 B66 (ATI)	186	ACU-A20-N (Sprint)	134
4426 B66 (ATI)	186	APXVTM14-C-I20 (Sprint)	134
RRUS 32 B66 (ATI)	186	APXVTM14-C-I20 (Sprint)	134
RRUS 32 B66 (ATI)	186	APXVTM14-C-I20 (Sprint)	134
RRUS 32 B66 (ATI)	186	RFS APXVSPP18 (Sprint)	134
DC6-48-60-18-8F (ATI)	186	RFS APXVSPP18 (Sprint)	134
DC6-48-60-18-8F (ATI)	186	RFS APXVSPP18 (Sprint)	134
DC6-48-60-18-8F (ATI)	186	RRH 1900 MHz (Sprint)	134
13.5' T-Frames (ATI)	186	RRH 1900 MHz (Sprint)	134
13.5' T-Frames (ATI)	186	RRH 1900 MHz (Sprint)	134
13.5' T-Frames (ATI)	186	TD-RRH8x20-25 (Sprint)	134
(2) Site Pro SPTB Tie Back (ATI)	186	TD-RRH8x20-25 (Sprint)	134
(2) Site Pro SPTB Tie Back (ATI)	186	TD-RRH8x20-25 (Sprint)	134
(2) Site Pro SPTB Tie Back (ATI)	186	RRH 800 MHz Filter (Sprint)	134
7770 (ATI)	186	RRH 800 MHz Filter (Sprint)	134
7770 (ATI)	186	RRH 800 MHz Filter (Sprint)	134
7770 (ATI)	186		

SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	L3x3x1/4	C	L2.5x2.5x3/16 + L2.5x2.5x1/4 (C-Shape) - Cleary Tower
B	L3 1/2x3 1/2x1/4		

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 B to the TIA-222-G Standard.
2. Tower designed for a 97 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 II.
6. Topographic Category 1 with Crest Height of 0.00 ft

Allpro Consultants group inc
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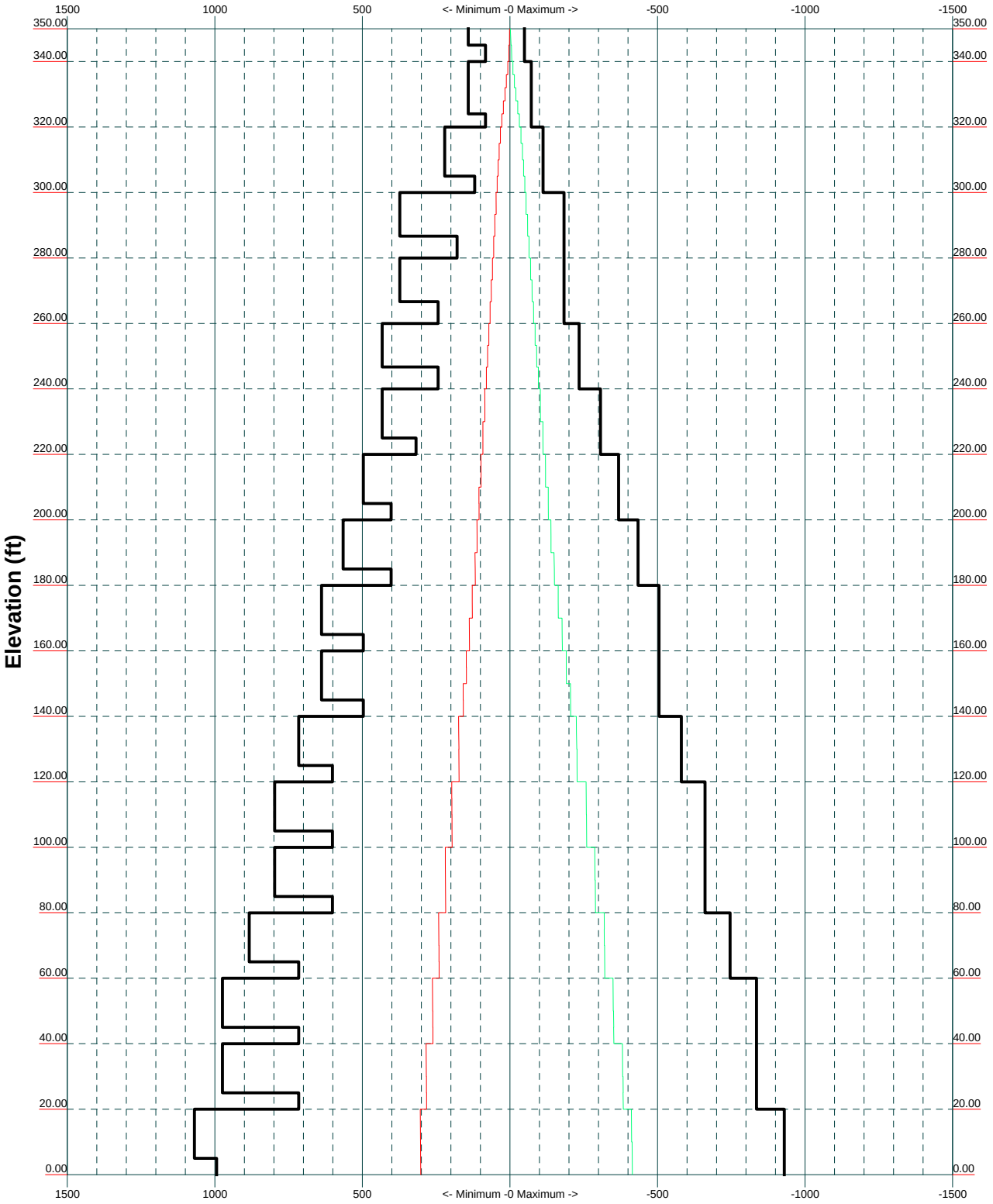
Dallas Tx. 75243
Phone: 972 231 8893
FAX: 866 364 8375

Job: ***19-0642***		
Project: ***CT20021-A-08 Cleary Tower (Edward)***		
Client: SBA	Drawn by: bakech	App'd:
Code: TIA-222-G	Date: 02/04/19	Scale: NTS
Path:		Dwg No. E-1

MISCELLANEOUS PLOTS

TIA-222-G - 97 mph/50 mph 0.7500 in Ice Exposure B

Leg Capacity ——— Leg Compression (K)



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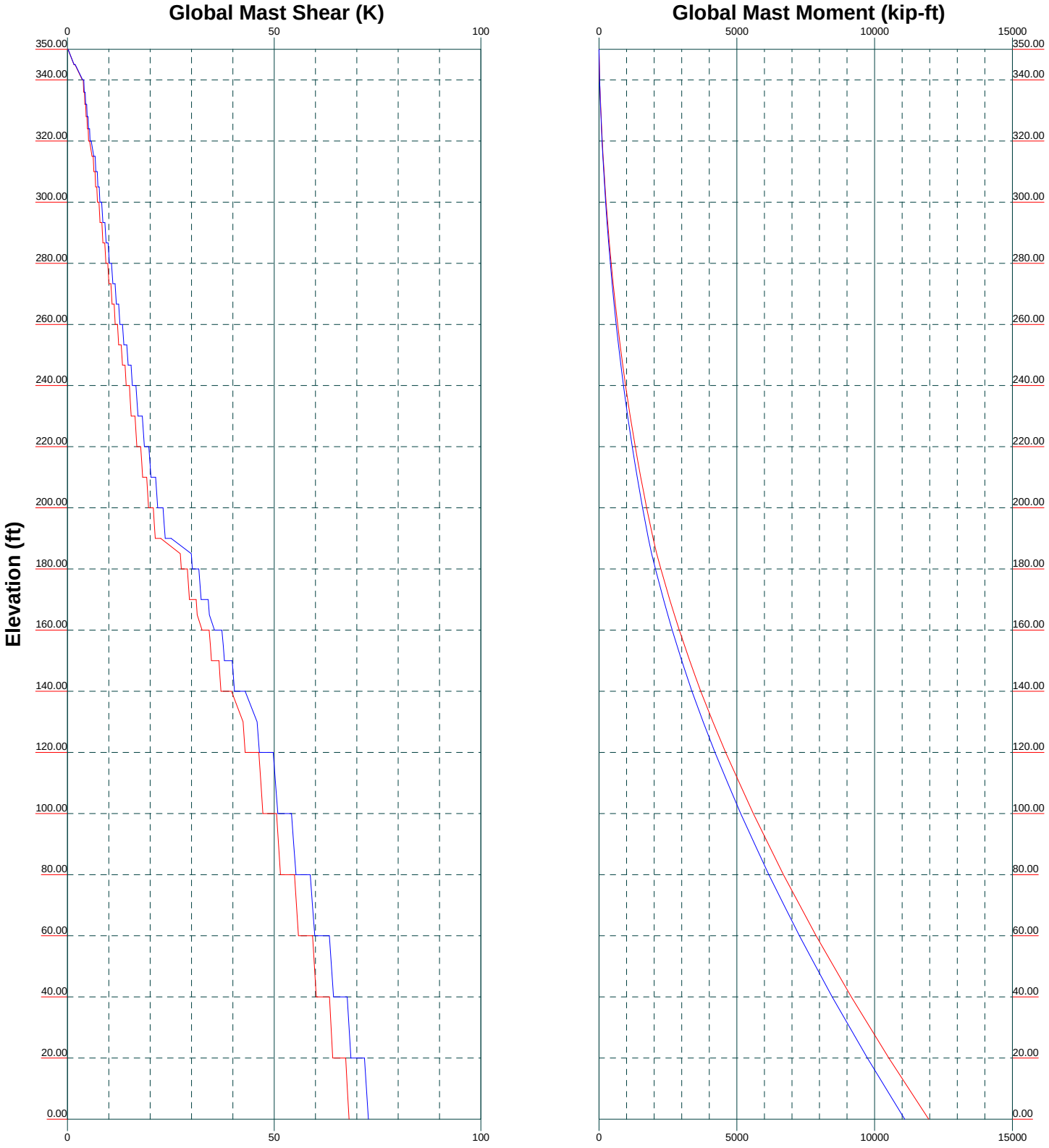
Job: ***19-0642***		
Project: ***CT20021-A-08 Cleary Tower (Edward)***		
Client: SBA	Drawn by: bakech	App'd:
Code: TIA-222-G	Date: 02/04/19	Scale: NTS
Path:		Dwg No. E-3

TIA-222-G - 97 mph/50 mph 0.7500 in Ice Exposure B

Maximum Values

Vx Vz Mx Mz



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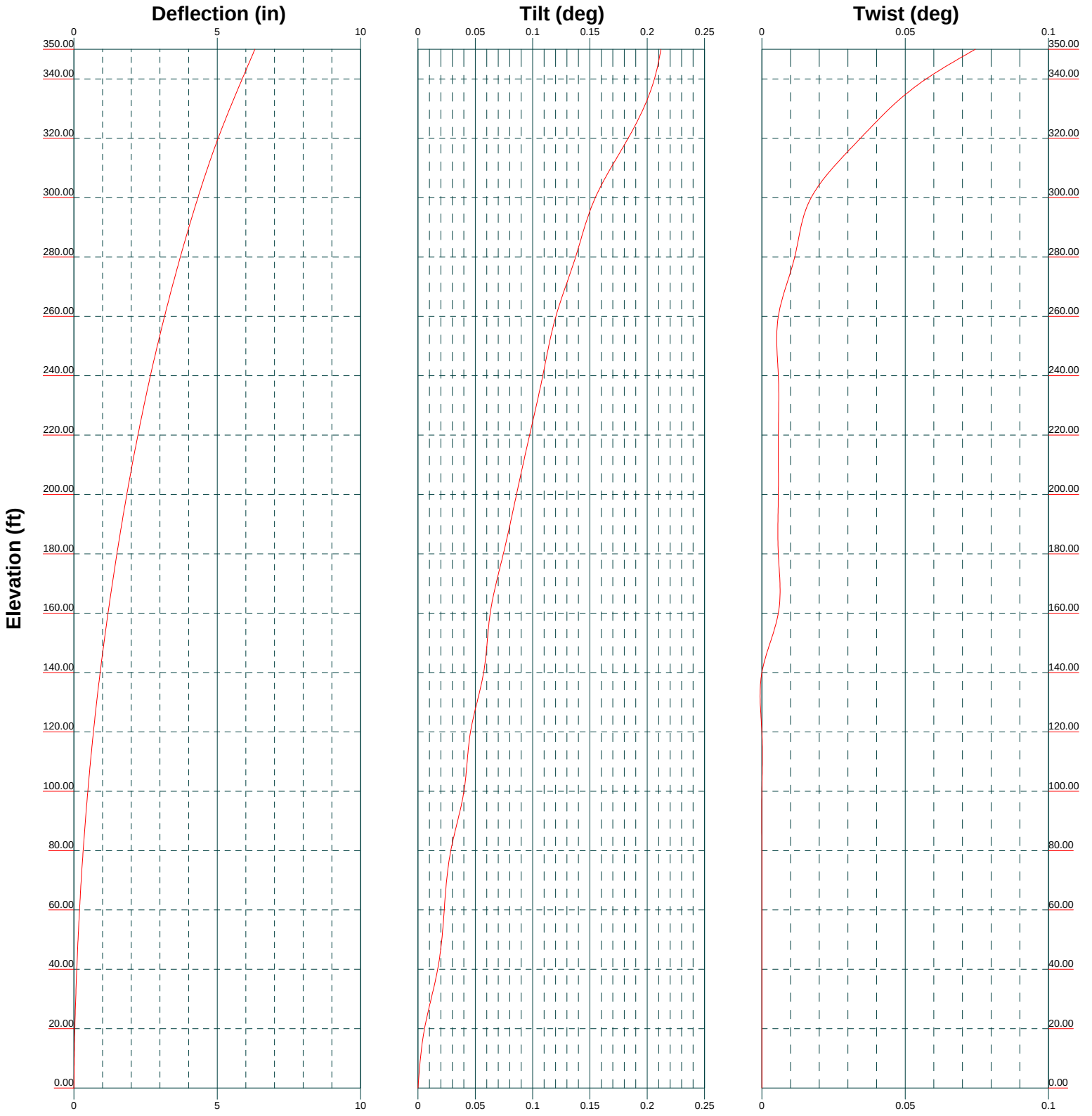
Job: ***19-0642***		
Project: ***CT20021-A-08 Cleary Tower (Edward)***		
Client: SBA	Drawn by: bakech	App'd:
Code: TIA-222-G	Date: 02/04/19	Scale: NTS
Path:		Dwg No. E-4

TIA-222-G - Service - 60 mph

Maximum Values



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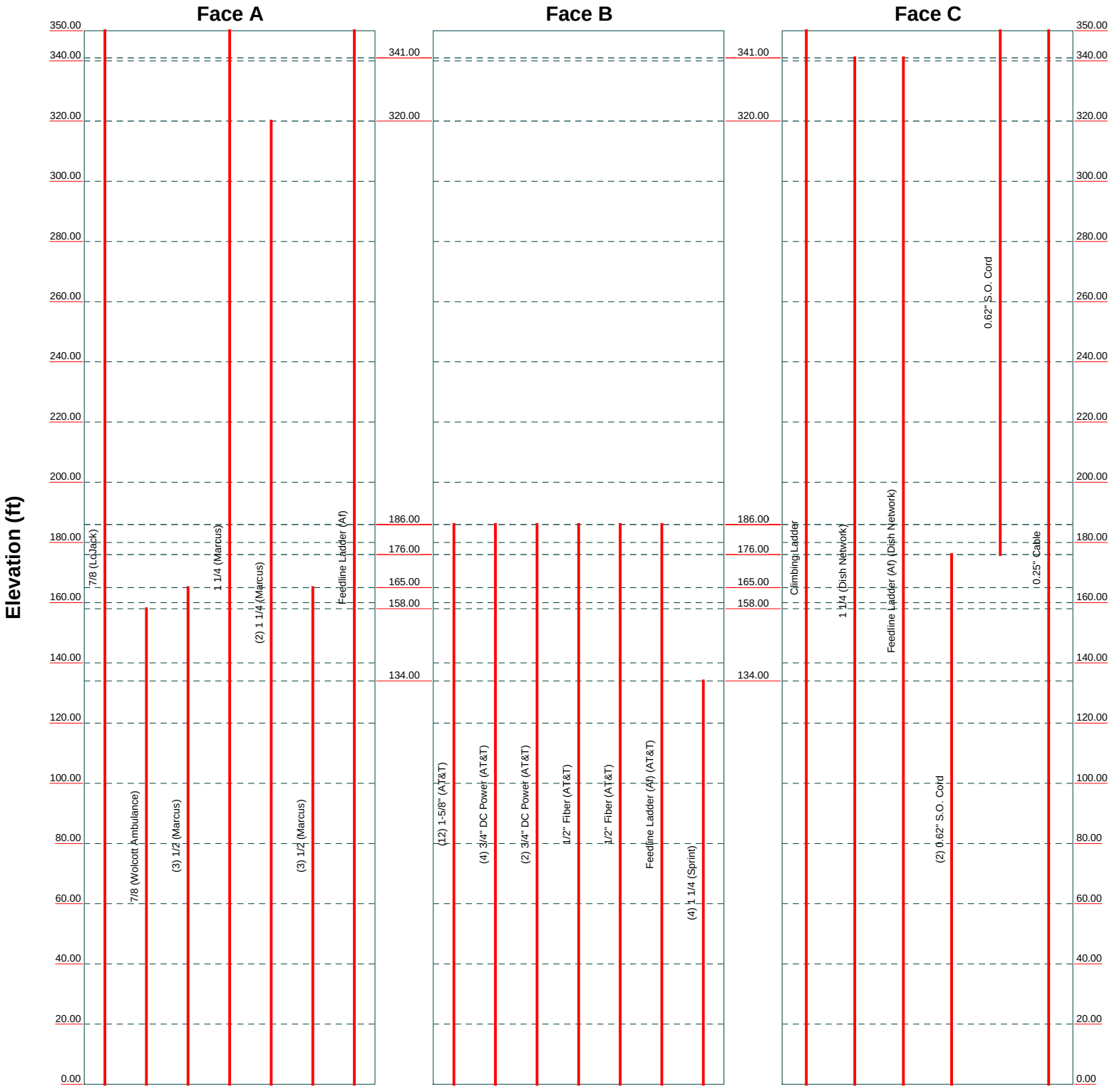
Job: ***19-0642***		
Project: ***CT20021-A-08 Cleary Tower (Edward)***		
Client: SBA	Drawn by: bakech	App'd:
Code: TIA-222-G	Date: 02/04/19	Scale: NTS
Path:		Dwg No. E-5

Feed Line Distribution Chart
0' - 350'

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



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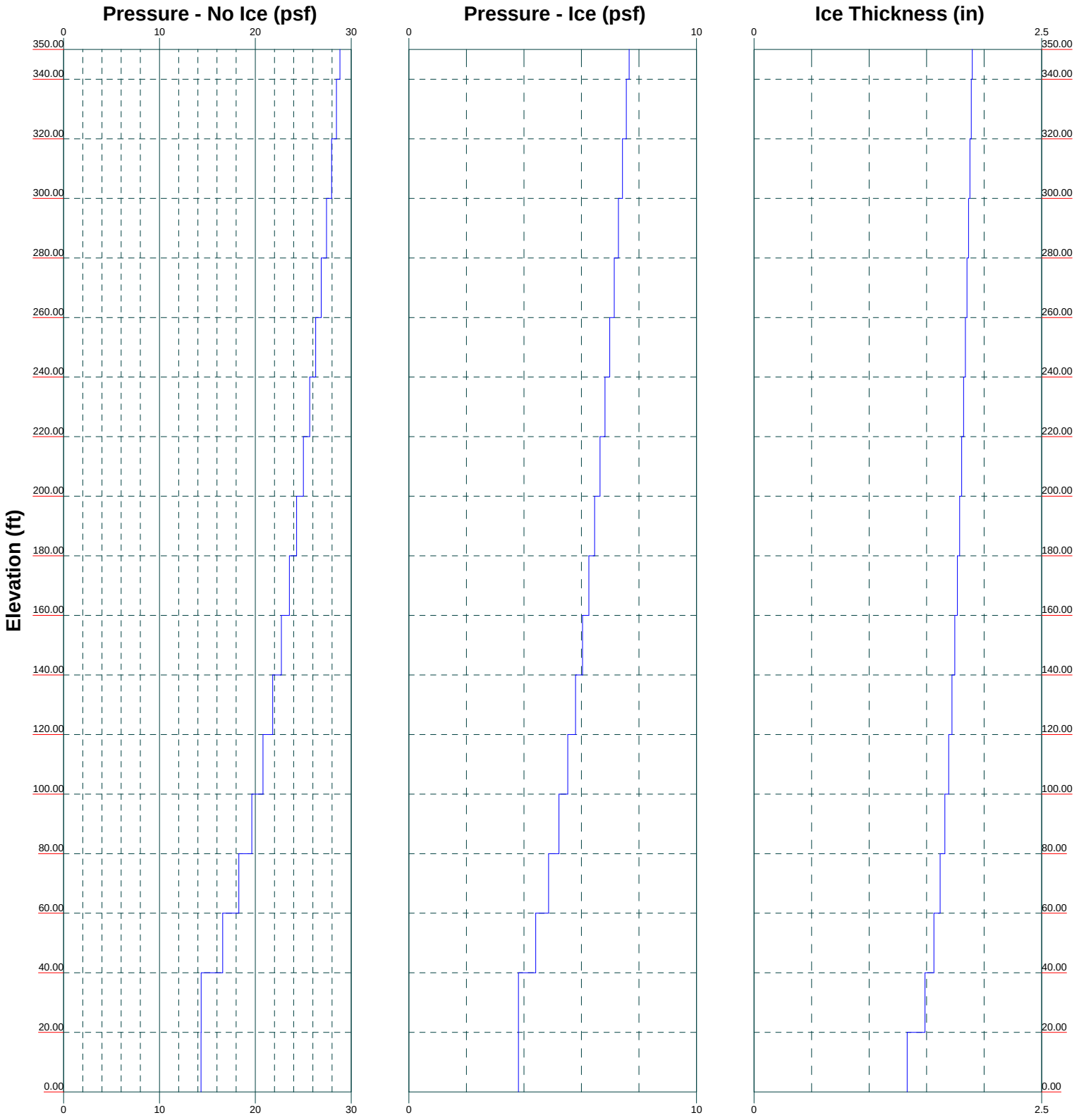
Job: 19-0642		
Project: CT20021-A-08 Cleary Tower (Edward)		
Client: SBA	Drawn by: bakech	App'd:
Code: TIA-222-G	Date: 02/04/19	Scale: NTS
Path:		Dwg No. E-7

Wind Pressures and Ice Thickness

TIA-222-G - 97 mph/50 mph 0.7500 in Ice Exposure B



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Phone: 972 231 8893
FAX: 866 364 8375

Job: ***19-0642***		
Project: ***CT20021-A-08 Cleary Tower (Edward)***		
Client: SBA	Drawn by: bakech	App'd:
Code: TIA-222-G	Date: 02/04/19	Scale: NTS
Path:		Dwg No. E-9

CALCULATION PRINTOUT

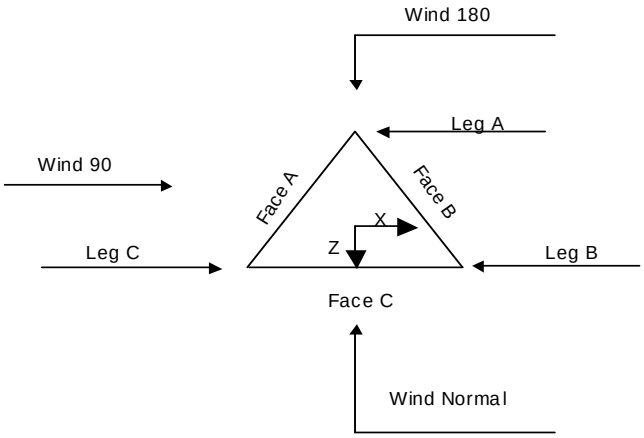
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 350.00 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 4.00 ft at the top and 36.00 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).
Basic wind speed of 97 mph.
Structure Class II.
Exposure Category B.
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.
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		Ignore KL/ry For 60 Deg. Angle Legs		Pole Without Linear Attachments
					Pole With Shroud Or No Appurtenances
					Outside and Inside Corner Radii Are Known



Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation*	*Assembly Database*	*Description*	*Section Width*	*Number of Sections*	*Section Length*
	ft			*ft*		*ft*
T1	350.00-340.00			4.00	1	10.00
T2	340.00-320.00			4.00	1	20.00
T3	320.00-300.00			4.00	1	20.00
T4	300.00-280.00			6.00	1	20.00
T5	280.00-260.00			8.00	1	20.00
T6	260.00-240.00			10.00	1	20.00
T7	240.00-220.00			12.00	1	20.00
T8	220.00-200.00			14.00	1	20.00
T9	200.00-180.00			16.00	1	20.00
T10	180.00-160.00			18.00	1	20.00
T11	160.00-140.00			20.00	1	20.00
T12	140.00-120.00			22.00	1	20.00
T13	120.00-100.00			24.00	1	20.00
T14	100.00-80.00			26.00	1	20.00
T15	80.00-60.00			28.00	1	20.00
T16	60.00-40.00			30.00	1	20.00
T17	40.00-20.00			32.00	1	20.00
T18	20.00-0.00			34.00	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	350.00-340.00	5.00	X Brace	No	No	0.0000	0.0000
T2	340.00-320.00	4.00	X Brace	No	No	0.0000	0.0000
T3	320.00-300.00	5.00	X Brace	No	No	0.0000	0.0000
T4	300.00-280.00	6.67	X Brace	No	No	0.0000	0.0000
T5	280.00-260.00	6.67	X Brace	No	No	0.0000	0.0000
T6	260.00-240.00	6.67	X Brace	No	No	0.0000	0.0000
T7	240.00-220.00	5.00	Double K	No	Yes	0.0000	0.0000
T8	220.00-200.00	5.00	Double K	No	Yes	0.0000	0.0000
T9	200.00-180.00	5.00	Double K	No	Yes	0.0000	0.0000
T10	180.00-160.00	5.00	Double K	No	Yes	0.0000	0.0000
T11	160.00-140.00	5.00	Double K	No	Yes	0.0000	0.0000
T12	140.00-120.00	10.00	Double K1	No	Yes	0.0000	0.0000
T13	120.00-100.00	10.00	Double K1	No	Yes	0.0000	0.0000
T14	100.00-80.00	10.00	Double K1	No	Yes	0.0000	0.0000
T15	80.00-60.00	10.00	Double K1	No	Yes	0.0000	0.0000
T16	60.00-40.00	10.00	Double K1	No	Yes	0.0000	0.0000
T17	40.00-20.00	10.00	Double K1	No	Yes	0.0000	0.0000
T18	20.00-0.00	10.00	Double K1	No	Yes	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 350.00-340.00	Solid Round	2	A572-50 (50 ksi)	Single Angle	L2x1 1/2x3/16	A36 (36 ksi)
T2 340.00-320.00	Solid Round	2	A572-50 (50 ksi)	Single Angle	L2x1 1/2x3/16	A36 (36 ksi)
T3 320.00-300.00	Solid Round	2 1/2	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 300.00-280.00	Solid Round	3 1/4	A572-50 (50 ksi)	Equal Angle	L2-1/2x2-1/2x3/16	A36 (36 ksi)
T5 280.00-260.00	Solid Round	3 1/4	A572-50 (50 ksi)	Equal Angle	L2-1/2x2-1/2x3/16	A36 (36 ksi)
T6 260.00-240.00	Solid Round	3 1/2	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T7 240.00-220.00	Solid Round	3 1/2	A572-50 (50 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x3/8	A36 (36 ksi)
T8 220.00-200.00	Solid Round	3 3/4	A572-50 (50 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x3/8	A36 (36 ksi)
T9 200.00-180.00	Solid Round	4	A572-50 (50 ksi)	Double Equal Angle	2L3x3x3/16x3/8	A36 (36 ksi)
T10 180.00-160.00	Solid Round	4 1/4	A572-50 (50 ksi)	Double Equal Angle	2L3x3x3/16x3/8	A36 (36 ksi)
T11 160.00-140.00	Solid Round	4 1/4	A572-50 (50 ksi)	Double Equal Angle	2L3x3x3/16x3/8	A36 (36 ksi)
T12 140.00-120.00	Solid Round	4 1/2	A572-50 (50 ksi)	Double Equal Angle	2L3x3x1/4x3/8	A36 (36 ksi)
T13 120.00-100.00	Solid Round	4 3/4	A572-50 (50 ksi)	Double Equal Angle	2L3x3x1/4x3/8	A36 (36 ksi)
T14 100.00-80.00	Solid Round	4 3/4	A572-50 (50 ksi)	Double Equal Angle	2L3x3x1/4x3/8	A36 (36 ksi)
T15 80.00-60.00	Solid Round	5	A572-50 (50 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4x3/8	A36 (36 ksi)
T16 60.00-40.00	Solid Round	5 1/4	A572-50 (50 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4x3/8	A36 (36 ksi)
T17 40.00-20.00	Solid Round	5 1/4	A572-50	Double Equal	2L3 1/2x3 1/2x1/4x3/8	A36

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T18 20.00-0.00	Solid Round	5 1/2	(50 ksi) A572-50 (50 ksi)	Angle Double Equal Angle	2L3 1/2x3 1/2x1/4x3/8	(36 ksi) A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T7 240.00-220.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T8 220.00-200.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T9 200.00-180.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T10 180.00-160.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T11 160.00-140.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)
T12 140.00-120.00	None	Flat Bar		A36 (36 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x3/8	A36 (36 ksi)
T13 120.00-100.00	None	Flat Bar		A36 (36 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x3/8	A36 (36 ksi)
T14 100.00-80.00	None	Flat Bar		A36 (36 ksi)	Double Equal Angle	2L2 1/2x2 1/2x3/16x3/8	A36 (36 ksi)
T15 80.00-60.00	None	Flat Bar		A36 (36 ksi)	Double Equal Angle	2L3x3x3/16x3/8	A36 (36 ksi)
T16 60.00-40.00	None	Flat Bar		A36 (36 ksi)	Double Equal Angle	2L3x3x3/16x3/8	A36 (36 ksi)
T17 40.00-20.00	None	Flat Bar		A36 (36 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4x3/8	A36 (36 ksi)
T18 20.00-0.00	None	Flat Bar		A36 (36 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4x3/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Secondary Horizontal Type	Secondary Horizontal Size	Secondary Horizontal Grade	Inner Bracing Type	Inner Bracing Size	Inner Bracing Grade
T7 240.00-220.00	Equal Angle		A36 (36 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T8 220.00-200.00	Equal Angle		A36 (36 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T9 200.00-180.00	Equal Angle		A36 (36 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T10 180.00-160.00	Equal Angle		A36 (36 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T11 160.00-140.00	Equal Angle		A36 (36 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)

Tower Elevation ft	Secondary Horizontal Type	Secondary Horizontal Size	Secondary Horizontal Grade	Inner Bracing Type	Inner Bracing Size	Inner Bracing Grade
T12 140.00-120.00	Equal Angle		A36 (36 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)
T13 120.00-100.00	Equal Angle		A36 (36 ksi)	Equal Angle	L4x4x1/4	A36 (36 ksi)
T14 100.00-80.00	Equal Angle		A36 (36 ksi)	Equal Angle	L4x4x1/4	A36 (36 ksi)
T15 80.00-60.00	Equal Angle		A36 (36 ksi)	Double Equal Angle	2L3x3x3/16x3/8	A36 (36 ksi)
T16 60.00-40.00	Equal Angle		A36 (36 ksi)	Double Equal Angle	2L3x3x3/16x3/8	A36 (36 ksi)
T17 40.00-20.00	Equal Angle		A36 (36 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4x3/8	A36 (36 ksi)
T18 20.00-0.00	Equal Angle		A36 (36 ksi)	Double Equal Angle	2L3 1/2x3 1/2x1/4x3/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Redundant Bracing Grade		Redundant Type	Redundant Size	K Factor
T12 140.00-120.00	A36 (36 ksi)	Horizontal (1) Diagonal (1)	Equal Angle Equal Angle	L2x2x3/16 L2-1/2x2-1/2x3/16	1 1
T13 120.00-100.00	A36 (36 ksi)	Horizontal (1) Diagonal (1)	Equal Angle Equal Angle	L2x2x3/16 L2-1/2x2-1/2x3/16	1 1
T14 100.00-80.00	A36 (36 ksi)	Horizontal (1) Diagonal (1)	Equal Angle Equal Angle	L2x2x3/8 L2-1/2x2-1/2x3/16	1 1
T15 80.00-60.00	A36 (36 ksi)	Horizontal (1) Diagonal (1)	Equal Angle Equal Angle	L2-1/2x2-1/2x3/16 L3x3x3/16	1 1
T16 60.00-40.00	A36 (36 ksi)	Horizontal (1) Diagonal (1)	Equal Angle Equal Angle	L2-1/2x2-1/2x3/16 L3x3x3/16	1 1
T17 40.00-20.00	A36 (36 ksi)	Horizontal (1) Diagonal (1)	Arbitrary Shape Equal Angle	L2.5x2.5x3/16 + L2.5x2.5x1/4 (C-Shape) - Cleary Tower L3x3x3/16	1 1
T18 20.00-0.00	A36 (36 ksi)	Horizontal (1) Diagonal (1)	Equal Angle Equal Angle	L3x3x3/16 L3x3x3/16	1 1

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 350.00-340.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T2 340.00-320.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T3 320.00-300.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T4	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000

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
300.00-280.00			(36 ksi)						
T5	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
280.00-260.00			(36 ksi)						
T6	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
260.00-240.00			(36 ksi)						
T7	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
240.00-220.00			(36 ksi)						
T8	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
220.00-200.00			(36 ksi)						
T9	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
200.00-180.00			(36 ksi)						
T10	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
180.00-160.00			(36 ksi)						
T11	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
160.00-140.00			(36 ksi)						
T12	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
140.00-120.00			(36 ksi)						
T13	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
120.00-100.00			(36 ksi)						
T14	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
100.00-80.00			(36 ksi)						
T15	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
80.00-60.00			(36 ksi)						
T16	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
60.00-40.00			(36 ksi)						
T17	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
40.00-20.00			(36 ksi)						
T18 20.00-0.00	0.00	0.0000	A36	1	1	1.05	36.0000	36.0000	36.0000
			(36 ksi)						

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	Yes	Yes	1	1	1	1	1	1	1	1
350.00-340.00				1	1	1	1	1	1	1
T2	Yes	Yes	1	1	1	1	1	1	1	1
340.00-320.00				1	1	1	1	1	1	1
T3	Yes	Yes	1	1	1	1	1	1	1	1
320.00-300.00				1	1	1	1	1	1	1
T4	Yes	Yes	1	1	1	1	1	1	1	1
300.00-280.00				1	1	1	1	1	1	1
T5	Yes	Yes	1	1	1	1	1	1	1	1
280.00-260.00				1	1	1	1	1	1	1
T6	Yes	Yes	1	1	1	1	1	1	1	1
260.00-240.00				1	1	1	1	1	1	1
T7	Yes	Yes	1	1	1	1	1	1	1	1
240.00-220.00				1	1	1	1	1	1	1
T8	Yes	Yes	1	1	1	1	1	1	1	1
220.00-200.00				1	1	1	1	1	1	1
T9	Yes	Yes	1	1	1	1	1	1	1	1

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
200.00-180.00				1	1	1	1	1	1	1
T10	Yes	Yes	1	1	1	1	1	1	1	1
180.00-160.00				1	1	1	1	1	1	1
T11	Yes	Yes	1	1	1	1	1	1	1	1
160.00-140.00				1	1	1	1	1	1	1
T12	Yes	Yes	1	1	1	1	1	1	1	1
140.00-120.00				1	1	1	1	1	1	1
T13	Yes	Yes	1	1	1	1	1	1	1	1
120.00-100.00				1	1	1	1	1	1	1
T14	Yes	Yes	1	1	1	1	1	1	1	1
100.00-80.00				1	1	1	1	1	1	1
T15	Yes	Yes	1	1	1	1	1	1	1	1
80.00-60.00				1	1	1	1	1	1	1
T16	Yes	Yes	1	1	1	1	1	1	1	1
60.00-40.00				1	1	1	1	1	1	1
T17	Yes	Yes	1	1	1	1	1	1	1	1
40.00-20.00				1	1	1	1	1	1	1
T18	Yes	Yes	1	1	1	1	1	1	1	1
20.00-0.00				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	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
350.00-340.00														
T2	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
340.00-320.00														
T3	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
320.00-300.00														
T4	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
300.00-280.00														
T5	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
280.00-260.00														
T6	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
260.00-240.00														
T7	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
240.00-220.00														
T8	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
220.00-200.00														
T9	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
200.00-180.00														
T10	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
180.00-160.00														
T11	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
160.00-140.00														

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
T12 140.00-120.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T13 120.00-100.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T14 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T15 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T16 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T17 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T18 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 350.00-340.00	Flange	0.6250 A325N	4	0.6250 A325N	1	0.6250 A325N	1	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 340.00-320.00	Flange	0.6250 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 320.00-300.00	Flange	0.7500 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 300.00-280.00	Flange	0.7500 A325N	6	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 280.00-260.00	Flange	0.8750 A325N	6	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 260.00-240.00	Flange	0.8750 A325N	6	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T7 240.00-220.00	Flange	1.0000 A325N	6	0.6250 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	1	0.6250 A325N	0
T8 220.00-200.00	Flange	1.1250 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	1	0.6250 A325N	1
T9 200.00-180.00	Flange	1.1250 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	1	0.6250 A325N	1
T10 180.00-160.00	Flange	1.2500 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	1	0.6250 A325N	1
T11 160.00-140.00	Flange	1.2500 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	1	0.6250 A325N	1
T12 140.00-120.00	Flange	1.3750 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.7500 A325N	1	0.6250 A325N	1
T13 120.00-100.00	Flange	1.3750 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.7500 A325N	1	0.6250 A325N	1
T14 100.00-80.00	Flange	1.3750 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.7500 A325N	1	0.6250 A325N	1
T15 80.00-60.00	Flange	1.5000 A325N	6	0.8750 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.7500 A325N	1	0.6250 A325N	1

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T16 60.00-40.00	Flange	1.5000 A325N	6	0.8750 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.7500 A325N	1	0.6250 A325N	1
T17 40.00-20.00	Flange	1.5000 A325N	6	0.8750 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.7500 A325N	1	0.6250 A325N	1
T18 20.00-0.00	Flange	2.5000 A307	6	0.8750 A325N	1	0.6250 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.7500 A325N	1	0.6250 A325N	1

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
7/8 (LoJack)	A	No	No	Ar (CaAa)	350.00 - 0.00	0.0000	-0.15	1	1	0.5000	1.1100		0.54
7/8 (Wolcott Ambulance)	A	No	No	Ar (CaAa)	158.00 - 0.00	0.0000	-0.1	1	1	0.5000	1.1100		0.54
1/2 (Marcus)	A	No	No	Ar (CaAa)	165.00 - 0.00	0.0000	0.05	3	3	0.5000	0.5800		0.25
1 1/4 (Marcus)	A	No	No	Ar (CaAa)	350.00 - 0.00	0.0000	0.1	1	1	0.5000	1.5500		0.66
1 1/4 (Marcus)	A	No	No	Ar (CaAa)	320.00 - 0.00	0.0000	0.12	2	2	0.5000	1.5500		0.66
1/2 (Marcus)	A	No	No	Ar (CaAa)	165.00 - 0.00	0.0000	0.15	3	3	0.5000	0.5800		0.25
Feedline Ladder (Af) ****	A	No	No	Af (CaAa)	350.00 - 0.00	0.0000	0	1	1	1.5000	1.5000		4.20
1-5/8" (AT&T)	B	No	No	Ar (CaAa)	186.00 - 0.00	0.0000	0.15	12	6	0.5000	1.9800		0.82
3/4" DC Power (AT&T)	B	No	No	Ar (CaAa)	186.00 - 0.00	4.5000	0.15	4	4	0.5000	0.8650		0.15
3/4" DC Power (AT&T)	B	No	No	Ar (CaAa)	186.00 - 0.00	0.0000	0.05	2	1	0.5000	0.8650		0.15
1/2" Fiber (AT&T)	B	No	No	Ar (CaAa)	186.00 - 0.00	0.0000	0.05	1	1	0.5000	0.6400		0.11
1/2" Fiber (AT&T)	B	No	No	Ar (CaAa)	186.00 - 0.00	4.5000	0.17	1	1	0.5000	0.6400		0.11
Feedline Ladder (Af) (AT&T) ****	B	No	No	Af (CaAa)	186.00 - 0.00	0.0000	0	1	1	1.5000	1.5000		4.20
1 1/4 (Sprint) ****	B	No	No	Ar (CaAa)	134.00 - 0.00	0.0000	-0.15	4	4	0.5000	1.5500		0.66
Climbing Ladder ****	C	No	No	Af (CaAa)	350.00 - 0.00	0.0000	0	1	1	0.5000	1.5000		7.90
1 1/4 (Dish Network)	C	No	No	Ar (CaAa)	341.00 - 0.00	0.0000	0.4	1	1	0.5000	1.5500		0.66

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
Feedline Ladder (Af) (Dish Network) ****	C	No	No	Af (CaAa)	341.00 - 0.00	0.0000	0.4	1	1	1.5000	1.5000		4.20
0.62" S.O. Cord	C	No	No	Ar (CaAa)	176.00 - 0.00	0.0000	0	2	2	0.0000	0.6200		0.31
0.62" S.O. Cord	C	No	No	Ar (CaAa)	350.00 - 176.00	0.0000	0	1	1	0.0000	0.6200		0.31
0.25" Cable	C	No	No	Ar (CaAa)	350.00 - 0.00	0.0000	0	1	1	0.2500	0.2500		0.13

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	350.00-340.00	A	0.000	0.000	5.160	0.000	0.054
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	3.775	0.000	0.088
T2	340.00-320.00	A	0.000	0.000	10.320	0.000	0.108
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	14.840	0.000	0.264
T3	320.00-300.00	A	0.000	0.000	16.520	0.000	0.134
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	14.840	0.000	0.264
T4	300.00-280.00	A	0.000	0.000	16.520	0.000	0.134
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	14.840	0.000	0.264
T5	280.00-260.00	A	0.000	0.000	16.520	0.000	0.134
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	14.840	0.000	0.264
T6	260.00-240.00	A	0.000	0.000	16.520	0.000	0.134
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	14.840	0.000	0.264
T7	240.00-220.00	A	0.000	0.000	16.520	0.000	0.134
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	14.840	0.000	0.264
T8	220.00-200.00	A	0.000	0.000	16.520	0.000	0.134
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	14.840	0.000	0.264
T9	200.00-180.00	A	0.000	0.000	16.520	0.000	0.134
		B	0.000	0.000	19.638	0.000	0.091
		C	0.000	0.000	14.840	0.000	0.264
T10	180.00-160.00	A	0.000	0.000	18.260	0.000	0.142
		B	0.000	0.000	65.460	0.000	0.303
		C	0.000	0.000	15.832	0.000	0.269
T11	160.00-140.00	A	0.000	0.000	25.478	0.000	0.174
		B	0.000	0.000	65.460	0.000	0.303
		C	0.000	0.000	16.080	0.000	0.270
T12	140.00-120.00	A	0.000	0.000	25.700	0.000	0.175
		B	0.000	0.000	74.140	0.000	0.340
		C	0.000	0.000	16.080	0.000	0.270
T13	120.00-100.00	A	0.000	0.000	25.700	0.000	0.175
		B	0.000	0.000	77.860	0.000	0.356
		C	0.000	0.000	16.080	0.000	0.270

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
T14	100.00-80.00	A	0.000	0.000	25.700	0.000	0.175
		B	0.000	0.000	77.860	0.000	0.356
		C	0.000	0.000	16.080	0.000	0.270
T15	80.00-60.00	A	0.000	0.000	25.700	0.000	0.175
		B	0.000	0.000	77.860	0.000	0.356
		C	0.000	0.000	16.080	0.000	0.270
T16	60.00-40.00	A	0.000	0.000	25.700	0.000	0.175
		B	0.000	0.000	77.860	0.000	0.356
		C	0.000	0.000	16.080	0.000	0.270
T17	40.00-20.00	A	0.000	0.000	25.700	0.000	0.175
		B	0.000	0.000	77.860	0.000	0.356
		C	0.000	0.000	16.080	0.000	0.270
T18	20.00-0.00	A	0.000	0.000	25.700	0.000	0.175
		B	0.000	0.000	77.860	0.000	0.356
		C	0.000	0.000	16.080	0.000	0.270

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	350.00-340.00	A	1.897	0.000	0.000	16.541	0.000	0.282
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	15.915	0.000	0.291
T2	340.00-320.00	A	1.888	0.000	0.000	32.981	0.000	0.561
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	52.608	0.000	0.950
T3	320.00-300.00	A	1.877	0.000	0.000	55.505	0.000	0.810
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	52.372	0.000	0.943
T4	300.00-280.00	A	1.864	0.000	0.000	55.268	0.000	0.803
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	52.123	0.000	0.935
T5	280.00-260.00	A	1.851	0.000	0.000	55.016	0.000	0.796
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	51.857	0.000	0.927
T6	260.00-240.00	A	1.837	0.000	0.000	54.747	0.000	0.789
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	51.574	0.000	0.919
T7	240.00-220.00	A	1.821	0.000	0.000	54.457	0.000	0.780
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	51.269	0.000	0.909
T8	220.00-200.00	A	1.805	0.000	0.000	54.144	0.000	0.772
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	50.939	0.000	0.900
T9	200.00-180.00	A	1.787	0.000	0.000	53.803	0.000	0.762
		B		0.000	0.000	36.148	0.000	0.575
		C		0.000	0.000	50.579	0.000	0.889
T10	180.00-160.00	A	1.767	0.000	0.000	62.807	0.000	0.842
		B		0.000	0.000	119.853	0.000	1.894
		C		0.000	0.000	56.195	0.000	0.897
T11	160.00-140.00	A	1.745	0.000	0.000	98.503	0.000	1.216
		B		0.000	0.000	119.142	0.000	1.870
		C		0.000	0.000	57.190	0.000	0.889
T12	140.00-120.00	A	1.720	0.000	0.000	98.510	0.000	1.207
		B		0.000	0.000	139.704	0.000	2.113
		C		0.000	0.000	56.619	0.000	0.874
T13	120.00-100.00	A	1.692	0.000	0.000	97.461	0.000	1.182

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
		B		0.000	0.000	147.750	0.000	2.192
		C		0.000	0.000	55.962	0.000	0.858
T14	100.00-80.00	A	1.658	0.000	0.000	96.225	0.000	1.153
		B		0.000	0.000	146.442	0.000	2.149
		C		0.000	0.000	55.187	0.000	0.839
T15	80.00-60.00	A	1.617	0.000	0.000	94.711	0.000	1.117
		B		0.000	0.000	144.841	0.000	2.098
		C		0.000	0.000	54.238	0.000	0.816
T16	60.00-40.00	A	1.564	0.000	0.000	92.744	0.000	1.072
		B		0.000	0.000	142.762	0.000	2.032
		C		0.000	0.000	53.005	0.000	0.787
T17	40.00-20.00	A	1.486	0.000	0.000	89.883	0.000	1.008
		B		0.000	0.000	139.739	0.000	1.937
		C		0.000	0.000	51.210	0.000	0.746
T18	20.00-0.00	A	1.331	0.000	0.000	84.211	0.000	0.887
		B		0.000	0.000	133.752	0.000	1.757
		C		0.000	0.000	47.647	0.000	0.669

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	350.00-340.00	-1.3372	-0.3057	-2.1515	0.9539
T2	340.00-320.00	-2.8616	0.4458	-3.9371	2.2178
T3	320.00-300.00	-3.8281	-0.7662	-5.6618	1.4449
T4	300.00-280.00	-4.3542	-0.8678	-7.3378	1.8853
T5	280.00-260.00	-5.0290	-1.0051	-8.6858	2.2377
T6	260.00-240.00	-5.0100	-1.0061	-9.4059	2.4364
T7	240.00-220.00	-5.8037	-1.1649	-10.5384	2.7177
T8	220.00-200.00	-6.1329	-1.2319	-11.3049	2.9100
T9	200.00-180.00	-3.1752	-1.6058	-7.8020	1.9344
T10	180.00-160.00	1.6763	-2.8341	-1.6159	-0.5761
T11	160.00-140.00	0.2599	-4.1019	-4.6489	-3.3251
T12	140.00-120.00	1.2944	-7.4063	-4.0207	-6.2592
T13	120.00-100.00	1.7775	-8.7758	-3.6372	-7.6297
T14	100.00-80.00	1.8345	-9.1324	-3.7500	-8.0213
T15	80.00-60.00	1.7024	-8.6312	-3.6480	-8.0585
T16	60.00-40.00	1.7358	-8.8561	-3.6658	-8.3800
T17	40.00-20.00	1.7376	-8.9340	-3.5564	-8.6409
T18	20.00-0.00	1.7374	-8.9955	-3.2980	-8.9766

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	7/8	340.00 - 350.00	0.6000	0.4718
T1	4	1 1/4	340.00 - 350.00	0.6000	0.4718
T1	7	Feedline Ladder (Af)	340.00 -	0.6000	0.4718

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	19	Climbing Ladder	340.00 - 350.00	0.6000	0.4718
T1	21	1 1/4	340.00 - 350.00	0.6000	0.4718
T1	22	Feedline Ladder (Af)	340.00 - 341.00	0.6000	0.4718
T1	25	0.62" S.O. Cord	340.00 - 341.00	0.6000	0.4718
T1	26	0.25" Cable	340.00 - 350.00	0.6000	0.4718
T2	1	7/8	320.00 - 340.00	0.6000	0.4940
T2	4	1 1/4	320.00 - 340.00	0.6000	0.4940
T2	7	Feedline Ladder (Af)	320.00 - 340.00	0.6000	0.4940
T2	19	Climbing Ladder	320.00 - 340.00	0.6000	0.4940
T2	21	1 1/4	320.00 - 340.00	0.6000	0.4940
T2	22	Feedline Ladder (Af)	320.00 - 340.00	0.6000	0.4940
T2	25	0.62" S.O. Cord	320.00 - 340.00	0.6000	0.4940
T2	26	0.25" Cable	320.00 - 340.00	0.6000	0.4940
T3	1	7/8	300.00 - 320.00	0.6000	0.5750
T3	4	1 1/4	300.00 - 320.00	0.6000	0.5750
T3	5	1 1/4	300.00 - 320.00	0.6000	0.5750
T3	7	Feedline Ladder (Af)	300.00 - 320.00	0.6000	0.5750
T3	19	Climbing Ladder	300.00 - 320.00	0.6000	0.5750
T3	21	1 1/4	300.00 - 320.00	0.6000	0.5750
T3	22	Feedline Ladder (Af)	300.00 - 320.00	0.6000	0.5750
T3	25	0.62" S.O. Cord	300.00 - 320.00	0.6000	0.5750
T3	26	0.25" Cable	300.00 - 320.00	0.6000	0.5750
T4	1	7/8	280.00 - 300.00	0.6000	0.6000
T4	4	1 1/4	280.00 - 300.00	0.6000	0.6000
T4	5	1 1/4	280.00 - 300.00	0.6000	0.6000
T4	7	Feedline Ladder (Af)	280.00 - 300.00	0.6000	0.6000
T4	19	Climbing Ladder	280.00 - 300.00	0.6000	0.6000
T4	21	1 1/4	280.00 - 300.00	0.6000	0.6000
T4	22	Feedline Ladder (Af)	280.00 - 300.00	0.6000	0.6000
T4	25	0.62" S.O. Cord	280.00 - 300.00	0.6000	0.6000
T4	26	0.25" Cable	280.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T5	1	7/8	260.00 - 300.00	0.6000	0.6000
T5	4	1 1/4	260.00 - 280.00	0.6000	0.6000
T5	5	1 1/4	260.00 - 280.00	0.6000	0.6000
T5	7	Feedline Ladder (Af)	260.00 - 280.00	0.6000	0.6000
T5	19	Climbing Ladder	260.00 - 280.00	0.6000	0.6000
T5	21	1 1/4	260.00 - 280.00	0.6000	0.6000
T5	22	Feedline Ladder (Af)	260.00 - 280.00	0.6000	0.6000
T5	25	0.62" S.O. Cord	260.00 - 280.00	0.6000	0.6000
T5	26	0.25" Cable	260.00 - 280.00	0.6000	0.6000
T6	1	7/8	240.00 - 260.00	0.6000	0.6000
T6	4	1 1/4	240.00 - 260.00	0.6000	0.6000
T6	5	1 1/4	240.00 - 260.00	0.6000	0.6000
T6	7	Feedline Ladder (Af)	240.00 - 260.00	0.6000	0.6000
T6	19	Climbing Ladder	240.00 - 260.00	0.6000	0.6000
T6	21	1 1/4	240.00 - 260.00	0.6000	0.6000
T6	22	Feedline Ladder (Af)	240.00 - 260.00	0.6000	0.6000
T6	25	0.62" S.O. Cord	240.00 - 260.00	0.6000	0.6000
T6	26	0.25" Cable	240.00 - 260.00	0.6000	0.6000
T7	1	7/8	220.00 - 240.00	0.6000	0.6000
T7	4	1 1/4	220.00 - 240.00	0.6000	0.6000
T7	5	1 1/4	220.00 - 240.00	0.6000	0.6000
T7	7	Feedline Ladder (Af)	220.00 - 240.00	0.6000	0.6000
T7	19	Climbing Ladder	220.00 - 240.00	0.6000	0.6000
T7	21	1 1/4	220.00 - 240.00	0.6000	0.6000
T7	22	Feedline Ladder (Af)	220.00 - 240.00	0.6000	0.6000
T7	25	0.62" S.O. Cord	220.00 - 240.00	0.6000	0.6000
T7	26	0.25" Cable	220.00 - 240.00	0.6000	0.6000
T8	1	7/8	200.00 - 220.00	0.6000	0.6000
T8	4	1 1/4	200.00 - 220.00	0.6000	0.6000
T8	5	1 1/4	200.00 - 220.00	0.6000	0.6000
T8	7	Feedline Ladder (Af)	200.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
			220.00		
T8	19	Climbing Ladder	200.00 - 220.00	0.6000	0.6000
T8	21	1 1/4	200.00 - 220.00	0.6000	0.6000
T8	22	Feedline Ladder (Af)	200.00 - 220.00	0.6000	0.6000
T8	25	0.62" S.O. Cord	200.00 - 220.00	0.6000	0.6000
T8	26	0.25" Cable	200.00 - 220.00	0.6000	0.6000
T9	1	7/8	180.00 - 200.00	0.6000	0.6000
T9	4	1 1/4	180.00 - 200.00	0.6000	0.6000
T9	5	1 1/4	180.00 - 200.00	0.6000	0.6000
T9	7	Feedline Ladder (Af)	180.00 - 200.00	0.6000	0.6000
T9	9	1-5/8"	180.00 - 186.00	0.6000	0.6000
T9	10	3/4" DC Power	180.00 - 186.00	0.0001	0.0001
T9	11	3/4" DC Power	180.00 - 186.00	0.6000	0.6000
T9	12	1/2" Fiber	180.00 - 186.00	0.6000	0.6000
T9	13	1/2" Fiber	180.00 - 186.00	0.0001	0.0001
T9	15	Feedline Ladder (Af)	180.00 - 186.00	0.6000	0.6000
T9	19	Climbing Ladder	180.00 - 200.00	0.6000	0.6000
T9	21	1 1/4	180.00 - 200.00	0.6000	0.6000
T9	22	Feedline Ladder (Af)	180.00 - 200.00	0.6000	0.6000
T9	25	0.62" S.O. Cord	180.00 - 200.00	0.6000	0.6000
T9	26	0.25" Cable	180.00 - 200.00	0.6000	0.6000
T10	1	7/8	160.00 - 180.00	0.6000	0.6000
T10	3	1/2	160.00 - 165.00	0.6000	0.6000
T10	4	1 1/4	160.00 - 180.00	0.6000	0.6000
T10	5	1 1/4	160.00 - 180.00	0.6000	0.6000
T10	6	1/2	160.00 - 165.00	0.6000	0.6000
T10	7	Feedline Ladder (Af)	160.00 - 180.00	0.6000	0.6000
T10	9	1-5/8"	160.00 - 180.00	0.6000	0.6000
T10	10	3/4" DC Power	160.00 - 180.00	0.0001	0.0001
T10	11	3/4" DC Power	160.00 - 180.00	0.6000	0.6000
T10	12	1/2" Fiber	160.00 - 180.00	0.6000	0.6000
T10	13	1/2" Fiber	160.00 -	0.0001	0.0001

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
			180.00		
T10	15	Feedline Ladder (Af)	160.00 - 180.00	0.6000	0.6000
T10	19	Climbing Ladder	160.00 - 180.00	0.6000	0.6000
T10	21	1 1/4	160.00 - 180.00	0.6000	0.6000
T10	22	Feedline Ladder (Af)	160.00 - 180.00	0.6000	0.6000
T10	24	0.62" S.O. Cord	160.00 - 176.00	0.6000	0.6000
T10	25	0.62" S.O. Cord	176.00 - 180.00	0.6000	0.6000
T10	26	0.25" Cable	160.00 - 180.00	0.6000	0.6000
T11	1	7/8	140.00 - 160.00	0.6000	0.6000
T11	2	7/8	140.00 - 158.00	0.6000	0.6000
T11	3	1/2	140.00 - 160.00	0.6000	0.6000
T11	4	1 1/4	140.00 - 160.00	0.6000	0.6000
T11	5	1 1/4	140.00 - 160.00	0.6000	0.6000
T11	6	1/2	140.00 - 160.00	0.6000	0.6000
T11	7	Feedline Ladder (Af)	140.00 - 160.00	0.6000	0.6000
T11	9	1-5/8"	140.00 - 160.00	0.6000	0.6000
T11	10	3/4" DC Power	140.00 - 160.00	0.0001	0.0001
T11	11	3/4" DC Power	140.00 - 160.00	0.6000	0.6000
T11	12	1/2" Fiber	140.00 - 160.00	0.6000	0.6000
T11	13	1/2" Fiber	140.00 - 160.00	0.0001	0.0001
T11	15	Feedline Ladder (Af)	140.00 - 160.00	0.6000	0.6000
T11	19	Climbing Ladder	140.00 - 160.00	0.6000	0.6000
T11	21	1 1/4	140.00 - 160.00	0.6000	0.6000
T11	22	Feedline Ladder (Af)	140.00 - 160.00	0.6000	0.6000
T11	24	0.62" S.O. Cord	140.00 - 160.00	0.6000	0.6000
T11	26	0.25" Cable	140.00 - 160.00	0.6000	0.6000
T12	1	7/8	120.00 - 140.00	0.6000	0.6000
T12	2	7/8	120.00 - 140.00	0.6000	0.6000
T12	3	1/2	120.00 - 140.00	0.6000	0.6000
T12	4	1 1/4	120.00 - 140.00	0.6000	0.6000
T12	5	1 1/4	120.00 - 140.00	0.6000	0.6000
T12	6	1/2	120.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
			140.00		
T12	7	Feedline Ladder (Af)	120.00 - 140.00	0.6000	0.6000
T12	9	1-5/8"	120.00 - 140.00	0.6000	0.6000
T12	10	3/4" DC Power	120.00 - 140.00	0.0001	0.0001
T12	11	3/4" DC Power	120.00 - 140.00	0.6000	0.6000
T12	12	1/2" Fiber	120.00 - 140.00	0.6000	0.6000
T12	13	1/2" Fiber	120.00 - 140.00	0.0001	0.0001
T12	15	Feedline Ladder (Af)	120.00 - 140.00	0.6000	0.6000
T12	17	1 1/4	120.00 - 134.00	0.6000	0.6000
T12	19	Climbing Ladder	120.00 - 140.00	0.6000	0.6000
T12	21	1 1/4	120.00 - 140.00	0.6000	0.6000
T12	22	Feedline Ladder (Af)	120.00 - 140.00	0.6000	0.6000
T12	24	0.62" S.O. Cord	120.00 - 140.00	0.6000	0.6000
T12	26	0.25" Cable	120.00 - 140.00	0.6000	0.6000
T13	1	7/8	100.00 - 120.00	0.6000	0.6000
T13	2	7/8	100.00 - 120.00	0.6000	0.6000
T13	3	1/2	100.00 - 120.00	0.6000	0.6000
T13	4	1 1/4	100.00 - 120.00	0.6000	0.6000
T13	5	1 1/4	100.00 - 120.00	0.6000	0.6000
T13	6	1/2	100.00 - 120.00	0.6000	0.6000
T13	7	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T13	9	1-5/8"	100.00 - 120.00	0.6000	0.6000
T13	10	3/4" DC Power	100.00 - 120.00	0.0001	0.0001
T13	11	3/4" DC Power	100.00 - 120.00	0.6000	0.6000
T13	12	1/2" Fiber	100.00 - 120.00	0.6000	0.6000
T13	13	1/2" Fiber	100.00 - 120.00	0.0001	0.0001
T13	15	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T13	17	1 1/4	100.00 - 120.00	0.6000	0.6000
T13	19	Climbing Ladder	100.00 - 120.00	0.6000	0.6000
T13	21	1 1/4	100.00 - 120.00	0.6000	0.6000
T13	22	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T13	24	0.62" S.O. Cord	100.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
			120.00		
T13	26	0.25" Cable	100.00 - 120.00	0.6000	0.6000
T14	1	7/8	80.00 - 100.00	0.6000	0.6000
T14	2	7/8	80.00 - 100.00	0.6000	0.6000
T14	3	1/2	80.00 - 100.00	0.6000	0.6000
T14	4	1 1/4	80.00 - 100.00	0.6000	0.6000
T14	5	1 1/4	80.00 - 100.00	0.6000	0.6000
T14	6	1/2	80.00 - 100.00	0.6000	0.6000
T14	7	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T14	9	1-5/8"	80.00 - 100.00	0.6000	0.6000
T14	10	3/4" DC Power	80.00 - 100.00	0.0001	0.0001
T14	11	3/4" DC Power	80.00 - 100.00	0.6000	0.6000
T14	12	1/2" Fiber	80.00 - 100.00	0.6000	0.6000
T14	13	1/2" Fiber	80.00 - 100.00	0.0001	0.0001
T14	15	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T14	17	1 1/4	80.00 - 100.00	0.6000	0.6000
T14	19	Climbing Ladder	80.00 - 100.00	0.6000	0.6000
T14	21	1 1/4	80.00 - 100.00	0.6000	0.6000
T14	22	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T14	24	0.62" S.O. Cord	80.00 - 100.00	0.6000	0.6000
T14	26	0.25" Cable	80.00 - 100.00	0.6000	0.6000
T15	1	7/8	60.00 - 80.00	0.6000	0.6000
T15	2	7/8	60.00 - 80.00	0.6000	0.6000
T15	3	1/2	60.00 - 80.00	0.6000	0.6000
T15	4	1 1/4	60.00 - 80.00	0.6000	0.6000
T15	5	1 1/4	60.00 - 80.00	0.6000	0.6000
T15	6	1/2	60.00 - 80.00	0.6000	0.6000
T15	7	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T15	9	1-5/8"	60.00 - 80.00	0.6000	0.6000
T15	10	3/4" DC Power	60.00 - 80.00	0.0001	0.0001
T15	11	3/4" DC Power	60.00 - 80.00	0.6000	0.6000
T15	12	1/2" Fiber	60.00 - 80.00	0.6000	0.6000
T15	13	1/2" Fiber	60.00 - 80.00	0.0001	0.0001
T15	15	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T15	17	1 1/4	60.00 - 80.00	0.6000	0.6000
T15	19	Climbing Ladder	60.00 - 80.00	0.6000	0.6000
T15	21	1 1/4	60.00 - 80.00	0.6000	0.6000
T15	22	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T15	24	0.62" S.O. Cord	60.00 - 80.00	0.6000	0.6000
T15	26	0.25" Cable	60.00 - 80.00	0.6000	0.6000
T16	1	7/8	40.00 - 60.00	0.6000	0.6000
T16	2	7/8	40.00 - 60.00	0.6000	0.6000
T16	3	1/2	40.00 - 60.00	0.6000	0.6000
T16	4	1 1/4	40.00 - 60.00	0.6000	0.6000
T16	5	1 1/4	40.00 - 60.00	0.6000	0.6000
T16	6	1/2	40.00 - 60.00	0.6000	0.6000
T16	7	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T16	9	1-5/8"	40.00 - 60.00	0.6000	0.6000
T16	10	3/4" DC Power	40.00 - 60.00	0.0001	0.0001
T16	11	3/4" DC Power	40.00 - 60.00	0.6000	0.6000
T16	12	1/2" Fiber	40.00 - 60.00	0.6000	0.6000
T16	13	1/2" Fiber	40.00 - 60.00	0.0001	0.0001
T16	15	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T16	17	1 1/4	40.00 - 60.00	0.6000	0.6000
T16	19	Climbing Ladder	40.00 - 60.00	0.6000	0.6000
T16	21	1 1/4	40.00 - 60.00	0.6000	0.6000
T16	22	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T16	24	0.62" S.O. Cord	40.00 - 60.00	0.6000	0.6000
T16	26	0.25" Cable	40.00 - 60.00	0.6000	0.6000
T17	1	7/8	20.00 - 40.00	0.6000	0.6000
T17	2	7/8	20.00 - 40.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T17	3	1/2	20.00 - 40.00	0.6000	0.6000
T17	4	1 1/4	20.00 - 40.00	0.6000	0.6000
T17	5	1 1/4	20.00 - 40.00	0.6000	0.6000
T17	6	1/2	20.00 - 40.00	0.6000	0.6000
T17	7	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T17	9	1-5/8"	20.00 - 40.00	0.6000	0.6000
T17	10	3/4" DC Power	20.00 - 40.00	0.0001	0.0001
T17	11	3/4" DC Power	20.00 - 40.00	0.6000	0.6000
T17	12	1/2" Fiber	20.00 - 40.00	0.6000	0.6000
T17	13	1/2" Fiber	20.00 - 40.00	0.0001	0.0001
T17	15	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T17	17	1 1/4	20.00 - 40.00	0.6000	0.6000
T17	19	Climbing Ladder	20.00 - 40.00	0.6000	0.6000
T17	21	1 1/4	20.00 - 40.00	0.6000	0.6000
T17	22	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T17	24	0.62" S.O. Cord	20.00 - 40.00	0.6000	0.6000
T17	26	0.25" Cable	20.00 - 40.00	0.6000	0.6000
T18	1	7/8	0.00 - 20.00	0.6000	0.6000
T18	2	7/8	0.00 - 20.00	0.6000	0.6000
T18	3	1/2	0.00 - 20.00	0.6000	0.6000
T18	4	1 1/4	0.00 - 20.00	0.6000	0.6000
T18	5	1 1/4	0.00 - 20.00	0.6000	0.6000
T18	6	1/2	0.00 - 20.00	0.6000	0.6000
T18	7	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T18	9	1-5/8"	0.00 - 20.00	0.6000	0.6000
T18	10	3/4" DC Power	0.00 - 20.00	0.0001	0.0001
T18	11	3/4" DC Power	0.00 - 20.00	0.6000	0.6000
T18	12	1/2" Fiber	0.00 - 20.00	0.6000	0.6000
T18	13	1/2" Fiber	0.00 - 20.00	0.0001	0.0001
T18	15	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T18	17	1 1/4	0.00 - 20.00	0.6000	0.6000
T18	19	Climbing Ladder	0.00 - 20.00	0.6000	0.6000
T18	21	1 1/4	0.00 - 20.00	0.6000	0.6000
T18	22	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T18	24	0.62" S.O. Cord	0.00 - 20.00	0.6000	0.6000
T18	26	0.25" Cable	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

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
7770 (AT&T)	A	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	5.51 5.87 6.23	2.93 3.27 3.63	0.035 0.068 0.105
7770 (AT&T)	B	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	5.51 5.87 6.23	2.93 3.27 3.63	0.035 0.068 0.105
7770 (AT&T)	C	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	5.51 5.87 6.23	2.93 3.27 3.63	0.035 0.068 0.105

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
AM-X-CD-16-65-00T-RET	A	From Leg	3.00			0.0000	186.00	No Ice	6.04	4.11	0.033
(AT&T)			0.00					1/2" Ice	6.41	4.45	0.074
			0.00					1" Ice	6.77	4.80	0.121
800-10121	A	From Leg	3.00			0.0000	186.00	No Ice	5.16	3.29	0.046
(AT&T)			0.00					1/2" Ice	5.51	3.64	0.079
			0.00					1" Ice	5.87	3.99	0.117
800-10121	B	From Leg	3.00			0.0000	186.00	No Ice	5.16	3.29	0.046
(AT&T)			0.00					1/2" Ice	5.51	3.64	0.079
			0.00					1" Ice	5.87	3.99	0.117
HPA-65R-BUU-H6	A	From Leg	3.00			0.0000	186.00	No Ice	9.49	5.49	0.043
(AT&T)			0.00					1/2" Ice	9.96	5.94	0.100
			0.00					1" Ice	10.43	6.41	0.164
HPA-65R-BUU-H6	B	From Leg	3.00			0.0000	186.00	No Ice	9.49	5.49	0.043
(AT&T)			0.00					1/2" Ice	9.96	5.94	0.100
			0.00					1" Ice	10.43	6.41	0.164
HPA-65R-BUU-H6	C	From Leg	3.00			0.0000	186.00	No Ice	9.49	5.49	0.043
(AT&T)			0.00					1/2" Ice	9.96	5.94	0.100
			0.00					1" Ice	10.43	6.41	0.164
EPBQ-654L8-H8-L2	A	From Leg	3.00			0.0000	186.00	No Ice	18.09	7.03	0.086
(AT&T)			0.00					1/2" Ice	18.72	7.62	0.179
			0.00					1" Ice	19.36	8.21	0.281
EPBQ-654L8-H8-L2	B	From Leg	3.00			0.0000	186.00	No Ice	18.09	7.03	0.086
(AT&T)			0.00					1/2" Ice	18.72	7.62	0.179
			0.00					1" Ice	19.36	8.21	0.281
EPBQ-654L8-H8-L2	C	From Leg	3.00			0.0000	186.00	No Ice	18.09	7.03	0.086
(AT&T)			0.00					1/2" Ice	18.72	7.62	0.179
			0.00					1" Ice	19.36	8.21	0.281
(2) CCI	A	From Leg	3.00			0.0000	186.00	No Ice	0.56	0.34	0.020
DTMA-BP7819VG12A			0.00					1/2" Ice	0.66	0.43	0.025
(AT&T)			0.00					1" Ice	0.77	0.52	0.030
(2) CCI	B	From Leg	3.00			0.0000	186.00	No Ice	0.56	0.34	0.020
DTMA-BP7819VG12A			0.00					1/2" Ice	0.66	0.43	0.025
(AT&T)			0.00					1" Ice	0.77	0.52	0.030
(2) CCI	C	From Leg	3.00			0.0000	186.00	No Ice	0.56	0.34	0.020
DTMA-BP7819VG12A			0.00					1/2" Ice	0.66	0.43	0.025
(AT&T)			0.00					1" Ice	0.77	0.52	0.030
(2) LGP13519 Diplexer	A	From Leg	3.00			0.0000	186.00	No Ice	0.29	0.18	0.005
(AT&T)			0.00					1/2" Ice	0.36	0.24	0.008
			0.00					1" Ice	0.44	0.31	0.012
(2) LGP13519 Diplexer	B	From Leg	3.00			0.0000	186.00	No Ice	0.29	0.18	0.005
(AT&T)			0.00					1/2" Ice	0.36	0.24	0.008
			0.00					1" Ice	0.44	0.31	0.012
(2) LGP13519 Diplexer	C	From Leg	3.00			0.0000	186.00	No Ice	0.29	0.18	0.005
(AT&T)			0.00					1/2" Ice	0.36	0.24	0.008
			0.00					1" Ice	0.44	0.31	0.012
860 10025 RET	A	From Leg	3.00			0.0000	186.00	No Ice	0.14	0.12	0.001
(AT&T)			0.00					1/2" Ice	0.20	0.17	0.003
			0.00					1" Ice	0.26	0.23	0.005
(2) 860 10025 RET	A	From Leg	3.00			0.0000	186.00	No Ice	0.14	0.12	0.001
(AT&T)			0.00					1/2" Ice	0.20	0.17	0.003
			0.00					1" Ice	0.26	0.23	0.005
860 10025 RET	A	From Leg	3.00			0.0000	186.00	No Ice	0.14	0.12	0.001
(AT&T)			0.00					1/2" Ice	0.20	0.17	0.003
			0.00					1" Ice	0.26	0.23	0.005
RRUS 11	A	From Leg	3.00			0.0000	186.00	No Ice	1.26	1.02	0.055
(AT&T)			0.00					1/2" Ice	1.36	1.16	0.074
			0.00					1" Ice	1.46	1.30	0.097

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
RRUS 11 (AT&T)	B	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.26 1.36 1.46	1.02 1.16 1.30	0.055 0.074 0.097
RRUS 11 (AT&T)	C	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.26 1.36 1.46	1.02 1.16 1.30	0.055 0.074 0.097
RRUS 32 (AT&T)	A	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.16 1.26 1.35	1.65 1.83 2.01	0.077 0.098 0.122
RRUS 32 (AT&T)	B	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.16 1.26 1.35	1.65 1.83 2.01	0.077 0.098 0.122
RRUS 32 (AT&T)	C	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.16 1.26 1.35	1.65 1.83 2.01	0.077 0.098 0.122
RRUS 4478 B5 (AT&T)	A	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.84 2.01 2.19	1.06 1.20 1.34	0.060 0.076 0.094
RRUS 4478 B5 (AT&T)	B	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.84 2.01 2.19	1.06 1.20 1.34	0.060 0.076 0.094
RRUS 4478 B5 (AT&T)	C	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.84 2.01 2.19	1.06 1.20 1.34	0.060 0.076 0.094
4426 B66 (AT&T)	A	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.65 1.81 1.98	0.73 0.84 0.97	0.048 0.061 0.077
4426 B66 (AT&T)	B	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.65 1.81 1.98	0.73 0.84 0.97	0.048 0.061 0.077
4426 B66 (AT&T)	C	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.65 1.81 1.98	0.73 0.84 0.97	0.048 0.061 0.077
RRUS 32 B66 (AT&T)	A	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	2.32 2.51 2.71	1.65 1.83 2.01	0.077 0.098 0.122
RRUS 32 B66 (AT&T)	B	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	2.32 2.51 2.71	1.65 1.83 2.01	0.077 0.098 0.122
RRUS 32 B66 (AT&T)	C	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	2.32 2.51 2.71	1.65 1.83 2.01	0.077 0.098 0.122
DC6-48-60-18-8F (AT&T)	A	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.56 1.72 1.89	4.78 5.06 5.35	0.026 0.063 0.104
DC6-48-60-18-8F (AT&T)	B	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.56 1.72 1.89	4.78 5.06 5.35	0.026 0.063 0.104
DC6-48-60-18-8F (AT&T)	C	From Leg	3.00 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	1.56 1.72 1.89	4.78 5.06 5.35	0.026 0.063 0.104
13.5' T-Frames (AT&T)	A	From Leg	1.50 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	10.12 14.43 18.74	9.05 11.89 14.73	0.240 0.340 0.440
13.5' T-Frames (AT&T)	B	From Leg	1.50 0.00 0.00	0.0000	186.00	No Ice 1/2" Ice 1" Ice	10.12 14.43 18.74	9.05 11.89 14.73	0.240 0.340 0.440

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
13.5' T-Frames	C	From Leg	1.50	0.0000	186.00	No Ice	10.12	9.05	0.240
(AT&T)			0.00			1/2" Ice	14.43	11.89	0.340
			0.00			1" Ice	18.74	14.73	0.440
(2) Site Pro SPTB Tie Back	A	From Leg	1.50	0.0000	186.00	No Ice	1.45	2.49	0.088
(AT&T)			0.00			1/2" Ice	1.96	3.57	0.124
			0.00			1" Ice	2.48	4.65	0.159
(2) Site Pro SPTB Tie Back	B	From Leg	1.50	0.0000	186.00	No Ice	1.45	2.49	0.088
(AT&T)			0.00			1/2" Ice	1.96	3.57	0.124
			0.00			1" Ice	2.48	4.65	0.159
(2) Site Pro SPTB Tie Back	C	From Leg	1.50	0.0000	186.00	No Ice	1.45	2.49	0.088
(AT&T)			0.00			1/2" Ice	1.96	3.57	0.124
			0.00			1" Ice	2.48	4.65	0.159
*****									
Celwave PD200 Omni	A	From Leg	3.00	0.0000	350.00	No Ice	2.73	2.73	0.020
(LoJack)			0.00			1/2" Ice	3.91	3.91	0.040
			10.00			1" Ice	5.09	5.10	0.068
101 Omni	B	From Leg	3.00	0.0000	350.00	No Ice	2.14	2.14	0.020
(Marcus)			0.00			1/2" Ice	3.06	3.06	0.040
			5.00			1" Ice	5.10	3.99	0.068
Star Mount w/ (9) Standoffs	A	From Leg	1.50	0.0000	350.00	No Ice	28.57	28.57	0.568
(Marcus/LoJack)			0.00			1/2" Ice	35.34	35.34	0.863
			0.00			1" Ice	42.11	42.11	1.158
****									
101 Omni	A	From Leg	3.00	0.0000	320.00	No Ice	2.14	2.14	0.020
(Marcus)			0.00			1/2" Ice	3.06	3.06	0.040
			5.00			1" Ice	5.10	3.99	0.068
101 Omni	B	From Leg	3.00	0.0000	320.00	No Ice	2.14	2.14	0.020
(Marcus)			0.00			1/2" Ice	3.06	3.06	0.040
			5.00			1" Ice	5.10	3.99	0.068
6' Standoff	A	From Leg	1.50	0.0000	320.00	No Ice	4.97	3.20	0.070
(Marcus)			0.00			1/2" Ice	6.12	5.12	0.130
			0.00			1" Ice	7.27	7.04	0.190
6' Standoff	B	From Leg	1.50	0.0000	320.00	No Ice	4.97	3.20	0.070
(Marcus)			0.00			1/2" Ice	6.12	5.12	0.130
			0.00			1" Ice	7.27	7.04	0.190
*****									
Decibel DB408 Omni	A	From Leg	3.00	0.0000	158.00	No Ice	1.60	1.60	0.020
(Wolcott Ambulance)			0.00			1/2" Ice	2.42	2.42	0.032
			5.00			1" Ice	3.24	3.24	0.050
17" Standoff Mount	B	From Leg	1.50	0.0000	158.00	No Ice	0.73	0.73	0.027
(Wolcott)			0.00			1/2" Ice	0.91	0.91	0.035
			0.00			1" Ice	1.09	1.09	0.046
****									
APXVTM14-C-I20	A	From Leg	3.00	0.0000	134.00	No Ice	6.34	3.61	0.056
(Sprint)			0.00			1/2" Ice	6.72	3.97	0.096
			0.00			1" Ice	7.10	4.33	0.140
APXVTM14-C-I20	B	From Leg	3.00	0.0000	134.00	No Ice	6.34	3.61	0.056
(Sprint)			0.00			1/2" Ice	6.72	3.97	0.096
			0.00			1" Ice	7.10	4.33	0.140
APXVTM14-C-I20	C	From Leg	3.00	0.0000	134.00	No Ice	6.34	3.61	0.056
(Sprint)			0.00			1/2" Ice	6.72	3.97	0.096
			0.00			1" Ice	7.10	4.33	0.140
RFS APXVSPP18	A	From Leg	3.00	0.0000	134.00	No Ice	8.02	5.28	0.057
(Sprint)			0.00			1/2" Ice	8.48	5.74	0.107
			0.00			1" Ice	8.94	6.20	0.162
RFS APXVSPP18	B	From Leg	3.00	0.0000	134.00	No Ice	8.02	5.28	0.057
(Sprint)			0.00			1/2" Ice	8.48	5.74	0.107

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	8.94	6.20	0.162
RFS APXVSPP18	C	From Leg	3.00	0.0000	134.00	No Ice	8.02	5.28	0.057
(Sprint)			0.00			1/2" Ice	8.48	5.74	0.107
			0.00			1" Ice	8.94	6.20	0.162
RRH 1900 MHz	A	From Leg	3.00	0.0000	134.00	No Ice	1.22	1.87	0.043
(Sprint)			0.00			1/2" Ice	1.37	2.05	0.059
			0.00			1" Ice	1.52	2.24	0.077
RRH 1900 MHz	B	From Leg	3.00	0.0000	134.00	No Ice	1.22	1.87	0.043
(Sprint)			0.00			1/2" Ice	1.37	2.05	0.059
			0.00			1" Ice	1.52	2.24	0.077
RRH 1900 MHz	C	From Leg	3.00	0.0000	134.00	No Ice	1.22	1.87	0.043
(Sprint)			0.00			1/2" Ice	1.37	2.05	0.059
			0.00			1" Ice	1.52	2.24	0.077
RRH 800 MHz	A	From Leg	3.00	0.0000	134.00	No Ice	1.73	1.37	0.048
(Sprint)			0.00			1/2" Ice	1.90	1.52	0.065
			0.00			1" Ice	2.07	1.68	0.084
RRH 800 MHz	B	From Leg	3.00	0.0000	134.00	No Ice	1.73	1.37	0.048
(Sprint)			0.00			1/2" Ice	1.90	1.52	0.065
			0.00			1" Ice	2.07	1.68	0.084
RRH 800 MHz	C	From Leg	3.00	0.0000	134.00	No Ice	1.73	1.37	0.048
(Sprint)			0.00			1/2" Ice	1.90	1.52	0.065
			0.00			1" Ice	2.07	1.68	0.084
TD-RRH8x20-25	A	From Leg	3.00	0.0000	134.00	No Ice	3.70	1.29	0.066
(Sprint)			0.00			1/2" Ice	3.95	1.46	0.090
			0.00			1" Ice	4.20	1.64	0.117
TD-RRH8x20-25	B	From Leg	3.00	0.0000	134.00	No Ice	3.70	1.29	0.066
(Sprint)			0.00			1/2" Ice	3.95	1.46	0.090
			0.00			1" Ice	4.20	1.64	0.117
TD-RRH8x20-25	C	From Leg	3.00	0.0000	134.00	No Ice	3.70	1.29	0.066
(Sprint)			0.00			1/2" Ice	3.95	1.46	0.090
			0.00			1" Ice	4.20	1.64	0.117
RRH 800 MHz Filter	A	From Leg	3.00	0.0000	134.00	No Ice	1.73	1.37	0.048
(Sprint)			0.00			1/2" Ice	1.90	1.52	0.065
			0.00			1" Ice	2.07	1.68	0.084
RRH 800 MHz Filter	B	From Leg	3.00	0.0000	134.00	No Ice	1.73	1.37	0.048
(Sprint)			0.00			1/2" Ice	1.90	1.52	0.065
			0.00			1" Ice	2.07	1.68	0.084
RRH 800 MHz Filter	C	From Leg	3.00	0.0000	134.00	No Ice	1.73	1.37	0.048
(Sprint)			0.00			1/2" Ice	1.90	1.52	0.065
			0.00			1" Ice	2.07	1.68	0.084
(2) ACU-A20-N	A	From Leg	3.00	0.0000	134.00	No Ice	0.07	0.12	0.001
(Sprint)			0.00			1/2" Ice	0.10	0.16	0.002
			0.00			1" Ice	0.15	0.21	0.004
ACU-A20-N	B	From Leg	3.00	0.0000	134.00	No Ice	0.07	0.12	0.001
(Sprint)			0.00			1/2" Ice	0.10	0.16	0.002
			0.00			1" Ice	0.15	0.21	0.004
ACU-A20-N	C	From Leg	3.00	0.0000	134.00	No Ice	0.07	0.12	0.001
(Sprint)			0.00			1/2" Ice	0.10	0.16	0.002
			0.00			1" Ice	0.15	0.21	0.004
15' T-Frames	A	From Leg	1.50	0.0000	134.00	No Ice	11.22	10.08	0.370
(Sprint)			0.00			1/2" Ice	15.70	14.58	0.530
			0.00			1" Ice	20.18	19.08	0.690
15' T-Frames	B	From Leg	1.50	0.0000	134.00	No Ice	11.22	10.08	0.370
(Sprint)			0.00			1/2" Ice	15.70	14.58	0.530
			0.00			1" Ice	20.18	19.08	0.690
15' T-Frames	C	From Leg	1.50	0.0000	134.00	No Ice	11.22	10.08	0.370
(Sprint)			0.00			1/2" Ice	15.70	14.58	0.530

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00			1" Ice	20.18	19.08	0.690
*****									
(2) Pipe Mounts (5.25' x 4.5")	A	From Leg	0.50	0.0000	165.00	No Ice	1.69	1.69	0.057
(Marcus)			0.00			1/2" Ice	2.21	2.21	0.074
			0.00			1" Ice	2.54	2.54	0.094
(2) Pipe Mounts (5.25' x 4.5")	B	From Leg	0.50	0.0000	165.00	No Ice	1.69	1.69	0.057
(Marcus)			0.00			1/2" Ice	2.21	2.21	0.074
			0.00			1" Ice	2.54	2.54	0.094
(2) Pipe Mounts (5.25' x 4.5")	C	From Leg	0.50	0.0000	165.00	No Ice	1.69	1.69	0.057
(Marcus)			0.00			1/2" Ice	2.21	2.21	0.074
			0.00			1" Ice	2.54	2.54	0.094
****									
ODI2-065R18K-GQ	A	From Leg	3.00	0.0000	341.00	No Ice	4.85	1.70	0.025
(Dish Network)			0.00			1/2" Ice	5.19	2.02	0.049
			0.00			1" Ice	5.54	2.35	0.078
ODI2-065R18K-GQ	B	From Leg	3.00	0.0000	341.00	No Ice	4.85	1.70	0.025
(Dish Network)			0.00			1/2" Ice	5.19	2.02	0.049
			0.00			1" Ice	5.54	2.35	0.078
ODI2-065R18K-GQ	C	From Leg	3.00	0.0000	341.00	No Ice	4.85	1.70	0.025
(Dish Network)			0.00			1/2" Ice	5.19	2.02	0.049
			0.00			1" Ice	5.54	2.35	0.078
4415	A	From Leg	3.00	0.0000	341.00	No Ice	1.86	0.83	0.046
(Dish Network)			0.00			1/2" Ice	2.03	0.96	0.061
			0.00			1" Ice	2.20	1.09	0.077
4415	B	From Leg	3.00	0.0000	341.00	No Ice	1.86	0.83	0.046
(Dish Network)			0.00			1/2" Ice	2.03	0.96	0.061
			0.00			1" Ice	2.20	1.09	0.077
0208	A	From Leg	3.00	0.0000	341.00	No Ice	1.36	0.48	0.020
(Dish Network)			0.00			1/2" Ice	1.50	0.58	0.029
			0.00			1" Ice	1.66	0.68	0.041
0208	B	From Leg	3.00	0.0000	341.00	No Ice	1.36	0.48	0.020
(Dish Network)			0.00			1/2" Ice	1.50	0.58	0.029
			0.00			1" Ice	1.66	0.68	0.041
0208	C	From Leg	3.00	0.0000	341.00	No Ice	1.36	0.48	0.020
(Dish Network)			0.00			1/2" Ice	1.50	0.58	0.029
			0.00			1" Ice	1.66	0.68	0.041
Commscope SF-SU7-2-96	A	From Leg	1.50	0.0000	341.00	No Ice	11.06	8.76	0.395
Sector Frame			0.00			1/2" Ice	17.63	14.51	0.553
(Dish Network)			0.00			1" Ice	24.20	20.26	0.711
Commscope SF-SU7-2-96	B	From Leg	1.50	0.0000	341.00	No Ice	11.06	8.76	0.395
Sector Frame			0.00			1/2" Ice	17.63	14.51	0.553
(Dish Network)			0.00			1" Ice	24.20	20.26	0.711
Commscope SF-SU7-2-96	C	From Leg	1.50	0.0000	341.00	No Ice	11.06	8.76	0.395
Sector Frame			0.00			1/2" Ice	17.63	14.51	0.553
(Dish Network)			0.00			1" Ice	24.20	20.26	0.711

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
Radiowaves SPD3-2.4 Dish (Marcus)	A	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		165.00	3.00	No Ice 1/2" Ice 1" Ice	7.10 7.46 7.83	0.035 0.073 0.112
Radiowaves SPD3-2.4 Dish (Marcus)	B	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		165.00	3.00	No Ice 1/2" Ice 1" Ice	7.10 7.46 7.83	0.035 0.073 0.112
Radiowaves SPD3-2.4 Dish (Marcus)	C	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		165.00	3.00	No Ice 1/2" Ice 1" Ice	7.10 7.46 7.83	0.035 0.073 0.112
Radiowaves SPD2-5.8 Dish (Marcus)	A	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		165.00	2.00	No Ice 1/2" Ice 1" Ice	3.14 3.41 3.67	0.022 0.039 0.057
Radiowaves SPD2-5.8 Dish (Marcus)	B	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		165.00	2.00	No Ice 1/2" Ice 1" Ice	3.14 3.41 3.67	0.022 0.039 0.057
Radiowaves SPD2-5.8 Dish (Marcus)	C	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	0.0000		165.00	2.00	No Ice 1/2" Ice 1" Ice	3.14 3.41 3.67	0.022 0.039 0.057

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 60 deg - No Ice
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice
15	0.9 Dead+1.6 Wind 180 deg - No Ice
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp

Comb. No.	Description
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	350 - 340	6.316	39	0.2118	0.0745
T2	340 - 320	5.872	39	0.2083	0.0600
T3	320 - 300	5.031	39	0.1808	0.0349
T4	300 - 280	4.326	39	0.1523	0.0185
T5	280 - 260	3.713	39	0.1365	0.0121
T6	260 - 240	3.162	39	0.1214	0.0084
T7	240 - 220	2.669	39	0.1086	0.0062
T8	220 - 200	2.233	39	0.0957	0.0052
T9	200 - 180	1.845	39	0.0845	0.0045
T10	180 - 160	1.500	39	0.0745	0.0039
T11	160 - 140	1.190	39	0.0655	0.0033
T12	140 - 120	0.915	39	0.0560	0.0027
T13	120 - 100	0.680	47	0.0470	0.0023
T14	100 - 80	0.485	47	0.0387	0.0019
T15	80 - 60	0.322	47	0.0301	0.0015
T16	60 - 40	0.195	47	0.0220	0.0011
T17	40 - 20	0.100	47	0.0146	0.0007
T18	20 - 0	0.032	47	0.0070	0.0004

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
350.00	Celwave PD200 Omni	39	6.316	0.2118	0.0745	280538
341.00	ODI2-065R18K-GQ	39	5.916	0.2090	0.0614	148516
320.00	101 Omni	39	5.031	0.1808	0.0349	29221
186.00	7770	39	1.599	0.0774	0.0041	133397
165.00	Radiowaves SPD3-2.4 Dish	39	1.264	0.0678	0.0035	143950
158.00	Decibel DB408 Omni	39	1.161	0.0645	0.0033	138228
134.00	APXVTM14-C-I20	39	0.840	0.0532	0.0026	115282

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	350 - 340	26.338	2	0.8652	0.3115
T2	340 - 320	24.522	2	0.8557	0.2510
T3	320 - 300	21.050	3	0.7504	0.1458
T4	300 - 280	18.111	3	0.6357	0.0772
T5	280 - 260	15.549	3	0.5710	0.0504
T6	260 - 240	13.247	3	0.5082	0.0349
T7	240 - 220	11.181	3	0.4549	0.0260
T8	220 - 200	9.351	3	0.4009	0.0219
T9	200 - 180	7.726	3	0.3539	0.0188
T10	180 - 160	6.282	3	0.3123	0.0164
T11	160 - 140	4.983	3	0.2743	0.0139
T12	140 - 120	3.830	3	0.2345	0.0115
T13	120 - 100	2.848	3	0.1971	0.0098
T14	100 - 80	2.026	18	0.1622	0.0080
T15	80 - 60	1.344	18	0.1260	0.0062
T16	60 - 40	0.814	18	0.0923	0.0047
T17	40 - 20	0.420	18	0.0612	0.0031
T18	20 - 0	0.135	19	0.0292	0.0016

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
350.00	Celwave PD200 Omni	2	26.338	0.8652	0.3115	107475
341.00	ODI2-065R18K-GQ	2	24.703	0.8579	0.2569	53649
320.00	101 Omni	3	21.050	0.7504	0.1458	7347
186.00	7770	3	6.699	0.3243	0.0171	31830
165.00	Radiowaves SPD3-2.4 Dish	3	5.295	0.2839	0.0145	34331
158.00	Decibel DB408 Omni	3	4.860	0.2704	0.0136	32966
134.00	APXVTM14-C-I20	3	3.517	0.2229	0.0109	27518

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	350	Leg	A325N	0.6250	4	0.942	20.709	0.046 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.129	6.831	0.312 ✔	1	Member Block Shear
		Top Girt	A325N	0.6250	1	0.323	10.440	0.031 ✔	1	Member Bearing
T2	340	Leg	A325N	0.6250	4	6.867	20.709	0.332 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	3.086	6.831	0.452 ✔	1	Member Block Shear

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load / Allowable	Allowable Ratio	Criteria
T3	320	Leg	A325N	0.7500	4	10.827	29.821	0.363 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.490	6.831	0.365 ✔	1	Member Block Shear
T4	300	Leg	A325N	0.7500	6	9.195	29.821	0.308 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.194	7.830	0.280 ✔	1	Member Bearing
T5	280	Leg	A325N	0.8750	6	11.237	40.589	0.277 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.438	7.830	0.311 ✔	1	Member Bearing
T6	260	Leg	A325N	0.8750	6	13.330	40.589	0.328 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.921	7.830	0.373 ✔	1	Member Bearing
T7	240	Leg	A325N	1.0000	6	15.278	53.014	0.288 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	3.770	15.660	0.241 ✔	1	Member Bearing
		Horizontal	A325N	0.6250	1	2.132	7.830	0.272 ✔	1	Member Bearing
T8	220	Leg	A325N	1.1250	6	17.472	67.096	0.260 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	4.255	17.944	0.237 ✔	1	Member Block Shear
		Horizontal	A325N	0.6250	1	2.360	7.830	0.301 ✔	1	Member Bearing
T9	200	Leg	A325N	1.1250	6	19.592	67.096	0.292 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	6.592	18.922	0.348 ✔	1	Member Bearing
		Horizontal	A325N	0.6250	1	2.619	7.830	0.334 ✔	1	Member Bearing
T10	180	Leg	A325N	1.2500	6	22.890	82.835	0.276 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	7.448	18.922	0.394 ✔	1	Member Bearing
		Horizontal	A325N	0.6250	1	3.079	7.830	0.393 ✔	1	Member Bearing
T11	160	Leg	A325N	1.2500	6	26.363	82.835	0.318 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	8.501	18.922	0.449 ✔	1	Member Bearing
		Horizontal	A325N	0.6250	1	3.571	10.440	0.342 ✔	1	Member Bearing
T12	140	Leg	A325N	1.3750	6	28.781	100.230	0.287 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	11.393	25.230	0.452 ✔	1	Member Bearing
		Horizontal	A325N	0.7500	1	3.951	17.944	0.220 ✔	1	Member Block Shear
T13	120	Leg	A325N	1.3750	6	32.688	100.230	0.326 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	12.287	25.230	0.487 ✔	1	Member Bearing
		Horizontal	A325N	0.7500	1	4.509	17.944	0.251 ✔	1	Member Block Shear
T14	100	Leg	A325N	1.3750	6	36.335	100.230	0.363 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	12.435	25.230	0.493 ✔	1	Member Bearing
		Horizontal	A325N	0.7500	1	5.025	17.944	0.280 ✔	1	Member Block Shear
T15	80	Leg	A325N	1.5000	6	40.037	119.282	0.336 ✔	1	Bolt Tension
		Diagonal	A325N	0.8750	1	13.199	29.580	0.446 ✔	1	Member Bearing
		Horizontal	A325N	0.7500	1	5.577	18.922	0.295 ✔	1	Member Bearing
T16	60	Leg	A325N	1.5000	6	43.536	119.282	0.365 ✔	1	Bolt Tension
		Diagonal	A325N	0.8750	1	13.517	29.580	0.457 ✔	1	Member Bearing
		Horizontal	A325N	0.7500	1	6.104	18.922	0.323 ✔	1	Member Bearing

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load / Allowable	Allowable Ratio	Criteria
T17	40	Leg	A325N	1.5000	6	47.101	119.282	0.395 ✔	1	Bolt Tension
		Diagonal	A325N	0.8750	1	14.174	29.580	0.479 ✔	1	Member Bearing
		Horizontal	A325N	0.7500	1	6.659	25.230	0.264 ✔	1	Member Bearing
T18	20	Leg	A307	2.5000	6	50.423	165.670	0.304 ✔	1	Bolt Tension
		Diagonal	A325N	0.8750	1	14.557	29.580	0.492 ✔	1	Member Bearing
		Horizontal	A325N	0.7500	1	7.195	25.230	0.285 ✔	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	350 - 340	2	10.00	5.00	120.0 K=1.00	3.1416	-6.340	49.286	0.129 [1] ✔
T2	340 - 320	2	20.00	4.00	96.0 K=1.00	3.1416	-31.885	72.063	0.442 [1] ✔
T3	320 - 300	2 1/2	20.03	5.01	96.2 K=1.00	4.9087	-50.381	112.346	0.448 [1] ✔
T4	300 - 280	3 1/4	20.03	6.68	98.6 K=1.00	8.2958	-64.889	183.313	0.354 [1] ✔
T5	280 - 260	3 1/4	20.03	6.68	98.6 K=1.00	8.2958	-80.154	183.313	0.437 [1] ✔
T6	260 - 240	3 1/2	20.03	6.68	91.6 K=1.00	9.6211	-96.322	234.484	0.411 [1] ✔
T7	240 - 220	3 1/2	20.03	5.01	68.7 K=1.00	9.6211	-112.140	306.641	0.366 [1] ✔
T8	220 - 200	3 3/4	20.03	5.01	64.1 K=1.00	11.0447	-130.154	368.015	0.354 [1] ✔
T9	200 - 180	4	20.03	5.01	60.1 K=1.00	12.5664	-150.834	434.236	0.347 [1] ✔
T10	180 - 160	4 1/4	20.03	5.01	56.6 K=1.00	14.1863	-177.552	505.220	0.351 [1] ✔
T11	160 - 140	4 1/4	20.03	5.01	56.6 K=1.00	14.1863	-205.915	505.220	0.408 [1] ✔
T12	140 - 120	4 1/2	20.03	5.01	53.4 K=1.00	15.9043	-227.812	580.902	0.392 [1] ✔
T13	120 - 100	4 3/4	20.03	5.01	50.6 K=1.00	17.7205	-260.000	661.231	0.393 [1] ✔
T14	100 - 80	4 3/4	20.03	5.01	50.6 K=1.00	17.7205	-289.764	661.231	0.438 [1] ✔
T15	80 - 60	5	20.03	5.01	48.1 K=1.00	19.6350	-321.573	746.168	0.431 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T16	60 - 40	5 1/4	20.03	5.01	45.8 K=1.00	21.6475	-351.970	835.679	0.421 [1] ✔
T17	40 - 20	5 1/4	20.03	5.01	45.8 K=1.00	21.6475	-383.955	835.679	0.459 [1] ✔
T18	20 - 0	5 1/2	20.03	5.01	43.7 K=1.00	23.7583	-414.861	929.740	0.446 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	350 - 340	L2x1 1/2x3/16	6.40	2.95	112.4 K=1.02	0.6211	-2.140	10.346	0.207 [1] ✔
T2	340 - 320	L2x1 1/2x3/16	5.66	2.59	102.4 K=1.06	0.6211	-3.279	11.584	0.283 [1] ✔
T3	320 - 300	L2x2x3/16	6.56	3.22	103.5 K=1.06	0.7148	-2.735	13.174	0.208 [1] ✔
T4	300 - 280	L2-1/2x2-1/2x3/16	10.16	5.00	121.3 K=1.00	0.9023	-2.301	13.474	0.171 [1] ✔
T5	280 - 260	L2-1/2x2-1/2x3/16	11.74	5.79	140.4 K=1.00	0.9023	-2.480	10.341	0.240 [1] ✔
T6	260 - 240	L3x3x3/16	13.44	6.62	133.3 K=1.00	1.0898	-2.926	13.820	0.212 [1] ✔
T7	240 - 220	2L2 1/2x2 1/2x3/16x3/8	8.60	8.18	126.2 K=1.00	1.8000	-3.829	25.202	0.152 [1] ✔
T8	220 - 200	2L2 1/2x2 1/2x3/16x3/8	9.44	8.98	138.5 K=1.00	1.8000	-4.328	21.196	0.204 [1] ✔
T9	200 - 180	2L3x3x3/16x3/8	10.30	9.84	125.7 K=1.00	2.1800	-6.826	30.555	0.223 [1] ✔
T10	180 - 160	2L3x3x3/16x3/8	11.18	10.71	136.9 K=1.00	2.1800	-7.702	26.278	0.293 [1] ✔
T11	160 - 140	2L3x3x3/16x3/8	12.08	11.62	148.5 K=1.00	2.1800	-8.517	22.339	0.381 [1] ✔
T12	140 - 120	2L3x3x1/4x3/8	15.62	15.11	143.9 K=1.00	2.8800	-12.582	31.416	0.401 [1] ✔
T13	120 - 100	2L3x3x1/4x3/8	16.40	15.88	150.0 K=1.00	2.8800	-12.502	28.916	0.432 [1] ✔
T14	100 - 80	2L3x3x1/4x3/8	17.21	16.69	156.4 K=1.00	2.8800	-13.614	26.593	0.512 [1] ✔
T15	80 - 60	2L3 1/2x3 1/2x1/4x3/8	18.03	17.48	141.7 K=1.00	3.3800	-13.639	38.008	0.359 [1] ✔
T16	60 - 40	2L3 1/2x3 1/2x1/4x3/8	18.87	18.31	147.6 K=1.00	3.3800	-14.908	35.047	0.425 [1] ✔
T17	40 - 20	2L3 1/2x3 1/2x1/4x3/8	19.73	19.17	153.7 K=1.00	3.3800	-14.831	32.326	0.459 [1] ✔
T18	20 - 0	2L3 1/2x3 1/2x1/4x3/8	20.59	20.03	159.8 K=1.00	3.3800	-15.748	29.896	0.527 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
									✔

[1] P_u / ϕP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T7	240 - 220	L2 1/2x2 1/2x3/16	13.50	6.48	157.2 K=1.00	0.9023	-2.132	8.246	0.259 [1] ✔
T8	220 - 200	L2 1/2x2 1/2x3/16	15.50	7.47	181.2 K=1.00	0.9023	-2.360	6.207	0.380 [1] ✔
T9	200 - 180	L3x3x3/16	17.50	8.46	170.3 K=1.00	1.0898	-2.619	8.488	0.309 [1] ✔
T10	180 - 160	L3x3x3/16	19.50	9.45	190.2 K=1.00	1.0898	-3.079	6.804	0.453 [1] ✔
T11	160 - 140	L3 1/2x3 1/2x1/4	21.50	10.45	180.7 K=1.00	1.6900	-3.571	11.687	0.306 [1] ✔
T12	140 - 120	2L2 1/2x2 1/2x3/16x3/8	23.00	11.18	172.4 K=1.00	1.8000	-3.951	13.682	0.289 [1] ✔
T13	120 - 100	2L2 1/2x2 1/2x3/16x3/8	25.00	12.17	187.7 K=1.00	1.8000	-4.509	11.547	0.390 [1] ✔
T14	100 - 80	2L2 1/2x2 1/2x3/16x3/8	27.00	13.17	203.1 K=1.00	1.8000	-5.025	9.860	0.510 [1] ✔
T15	80 - 60	2L3x3x3/16x3/8	29.00	14.16	180.9 K=1.00	2.1800	-5.577	15.048	0.371 [1] ✔
T16	60 - 40	2L3x3x3/16x3/8	31.00	15.15	193.6 K=1.00	2.1800	-6.104	13.146	0.464 [1] ✔
T17	40 - 20	2L3 1/2x3 1/2x1/4x3/8	33.00	16.15	177.8 K=1.00	3.3800	-6.659	24.167	0.276 [1] ✔
T18	20 - 0	2L3 1/2x3 1/2x1/4x3/8	35.00	17.14	188.6 K=1.00	3.3800	-7.195	21.456	0.335 [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	350 - 340	L3x3x1/4	4.00	3.59	96.4 K=1.32	1.4400	-0.319	28.598	0.011 [1] ✔

[1] P_u / ϕP_n controls

Redundant Horizontal (1) 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 $\frac{P_u}{\phi P_n}$
T12	140 - 120	L2x2x3/16	5.75	5.56	169.5 K=1.00	0.7148	-3.952	5.620	0.703 [1] ✔
T13	120 - 100	L2x2x3/16	6.25	6.05	184.4 K=1.00	0.7148	-4.510	4.748	0.950 [1] ✔
T14	100 - 80	L2x2x3/8	6.75	6.55	202.1 K=1.00	1.3600	-5.026	7.521	0.668 [1] ✔
T15	80 - 60	L2-1/2x2-1/2x3/16	7.25	7.04	170.7 K=1.00	0.9023	-5.578	6.992	0.798 [1] ✔
T16	60 - 40	L2-1/2x2-1/2x3/16	7.75	7.53	182.6 K=1.00	0.9023	-6.105	6.113	0.999 [1] ✔
T17	40 - 20	L2.5x2.5x3/16 + L2.5x2.5x1/4 (C-Shape) - Cleary Tower	8.25	8.03	125.4 K=1.00	1.0565	-6.660	14.963	0.445 [1] ✔
T18	20 - 0	L3x3x3/16	8.75	8.52	171.5 K=1.00	1.0898	-7.195	8.374	0.859 [1] ✔

[1] $P_u / \phi P_n$ controls

Redundant Diagonal (1) 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 $\frac{P_u}{\phi P_n}$
T12	140 - 120	L2-1/2x2-1/2x3/16	7.81	7.56	183.3 K=1.00	0.9023	-2.684	6.069	0.442 [1] ✔
T13	120 - 100	L2-1/2x2-1/2x3/16	8.20	7.94	192.6 K=1.00	0.9023	-2.959	5.494	0.539 [1] ✔
T14	100 - 80	L2-1/2x2-1/2x3/16	8.60	8.35	202.6 K=1.00	0.9023	-3.203	4.968	0.645 [1] ✔
T15	80 - 60	L3x3x3/16	9.02	8.76	176.3 K=1.00	1.0898	-3.468	7.925	0.438 [1] ✔
T16	60 - 40	L3x3x3/16	9.44	9.17	184.6 K=1.00	1.0898	-3.716	7.227	0.514 [1] ✔
T17	40 - 20	L3x3x3/16	9.86	9.60	193.3 K=1.00	1.0898	-3.981	6.591	0.604 [1] ✔
T18	20 - 0	L3x3x3/16	10.30	10.03	201.9 K=1.00	1.0898	-4.233	6.043	0.701 [1] ✔

[1] $P_u / \phi P_n$ controls

Inner Bracing 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 $\frac{P_u}{\phi P_n}$
T7	240 - 220	L2 1/2x2 1/2x3/16	6.75	6.75	163.7 K=1.00	0.9023	-0.011	7.609	0.001 [1] ✔
T8	220 - 200	L2 1/2x2 1/2x3/16	7.75	7.75	187.9 K=1.00	0.9023	-0.012	5.772	0.002 [1] ✔
T9	200 - 180	L3x3x3/16	8.75	8.75	176.1 K=1.00	1.0898	-0.015	7.941	0.002 [1] ✔
T10	180 - 160	L3x3x3/16	9.75	9.75	196.2 K=1.00	1.0898	-0.016	6.396	0.003 [1] ✔
T11	160 - 140	L3 1/2x3 1/2x1/4	10.75	10.75	185.9 K=1.00	1.6900	-0.019	11.050	0.002 [1] ✔
T12	140 - 120	L3 1/2x3 1/2x1/4	11.50	11.50	198.8 K=1.00	1.6900	-0.028	9.656	0.003 [1] ✔
T13	120 - 100	L4x4x1/4	12.50	12.50	188.7 K=1.00	1.9400	-0.030	12.311	0.002 [1] ✔
T14	100 - 80	L4x4x1/4	13.50	13.50	203.8 K=1.00	1.9400	-0.031	10.555	0.003 [1] ✔
T15	80 - 60	2L3x3x3/16x3/8	14.50	14.50	185.3 K=1.00	2.1800	-0.037	14.343	0.003 [1] ✔
T16	60 - 40	2L3x3x3/16x3/8	15.50	15.50	198.1 K=1.00	2.1800	-0.038	12.552	0.003 [1] ✔
T17	40 - 20	2L3 1/2x3 1/2x1/4x3/8	16.50	16.50	181.7 K=1.00	3.3800	-0.043	23.141	0.002 [1] ✔
T18	20 - 0	2L3 1/2x3 1/2x1/4x3/8	17.50	17.50	192.7 K=1.00	3.3800	-0.042	20.572	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	350 - 340	2	10.00	5.00	120.0	3.1416	3.769	141.372	0.027 [1] ✔
T2	340 - 320	2	20.00	4.00	96.0	3.1416	27.469	141.372	0.194 [1] ✔
T3	320 - 300	2 1/2	20.03	5.01	96.2	4.9087	43.309	220.893	0.196 [1] ✔
T4	300 - 280	3 1/4	20.03	6.68	98.6	8.2958	55.169	373.310	0.148 [1] ✔
T5	280 - 260	3 1/4	20.03	6.68	98.6	8.2958	67.424	373.310	0.181 [1] ✔
T6	260 - 240	3 1/2	20.03	6.68	91.6	9.6211	79.980	432.951	0.185 [1] ✔
T7	240 - 220	3 1/2	20.03	5.01	68.7	9.6211	91.838	432.951	0.212 [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	220 - 200	3 3/4	20.03	5.01	64.1	11.0447	105.028	497.010	0.211 [1] ✔
T9	200 - 180	4	20.03	5.01	60.1	12.5664	118.732	565.487	0.210 [1] ✔
T10	180 - 160	4 1/4	20.03	5.01	56.6	14.1863	137.755	638.381	0.216 [1] ✔
T11	160 - 140	4 1/4	20.03	5.01	56.6	14.1863	158.474	638.381	0.248 [1] ✔
T12	140 - 120	4 1/2	20.03	5.01	53.4	15.9043	174.064	715.694	0.243 [1] ✔
T13	120 - 100	4 3/4	20.03	5.01	50.6	17.7205	197.236	797.425	0.247 [1] ✔
T14	100 - 80	4 3/4	20.03	5.01	50.6	17.7205	219.197	797.425	0.275 [1] ✔
T15	80 - 60	5	20.03	5.01	48.1	19.6350	241.565	883.573	0.273 [1] ✔
T16	60 - 40	5 1/4	20.03	5.01	45.8	21.6475	262.646	974.139	0.270 [1] ✔
T17	40 - 20	5 1/4	20.03	5.01	45.8	21.6475	284.142	974.139	0.292 [1] ✔
T18	20 - 0	5 1/2	20.03	5.01	43.7	23.7583	303.928	1069.120	0.284 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	350 - 340	L2x1 1/2x3/16	6.40	2.95	83.8	0.3604	2.129	15.675	0.136 [1] ✔
T2	340 - 320	L2x1 1/2x3/16	5.66	2.59	74.0	0.3604	3.086	15.675	0.197 [1] ✔
T3	320 - 300	L2x2x3/16	6.56	3.22	64.9	0.4307	2.490	18.734	0.133 [1] ✔
T4	300 - 280	L2-1/2x2-1/2x3/16	9.67	4.77	75.3	0.5713	2.194	24.851	0.088 [1] ✔
T5	280 - 260	L2-1/2x2-1/2x3/16	11.74	5.79	91.1	0.5713	2.438	24.851	0.098 [1] ✔
T6	260 - 240	L3x3x3/16	13.44	6.62	86.1	0.7119	2.921	30.968	0.094 [1] ✔
T7	240 - 220	2L2 1/2x2 1/2x3/16x3/8	8.20	7.78	123.7	1.1391	3.770	49.549	0.076 [1] ✔
T8	220 - 200	2L2 1/2x2 1/2x3/16x3/8	9.02	8.56	136.2	1.1039	4.255	48.020	0.089 [1] ✔
T9	200 - 180	2L3x3x3/16x3/8	10.30	9.84	129.1	1.3889	6.592	60.417	0.109 [1] ✔
T10	180 - 160	2L3x3x3/16x3/8	11.18	10.71	140.4	1.3889	7.448	60.417	0.123 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T11	160 - 140	2L3x3x3/16x3/8	11.63	11.17	146.1	1.3889	8.501	60.417	0.141 [1]
T12	140 - 120	2L3x3x1/4x3/8	15.62	15.11	132.8	1.8319	11.393	79.687	0.143 [1]
T13	120 - 100	2L3x3x1/4x3/8	15.62	15.10	132.7	1.8319	12.287	79.687	0.154 [1]
T14	100 - 80	2L3x3x1/4x3/8	16.40	15.89	139.5	1.8319	12.435	79.687	0.156 [1]
T15	80 - 60	2L3 1/2x3 1/2x1/4x3/8	17.21	16.65	128.0	2.1600	13.199	93.960	0.140 [1]
T16	60 - 40	2L3 1/2x3 1/2x1/4x3/8	18.03	17.47	134.1	2.1600	13.517	93.960	0.144 [1]
T17	40 - 20	2L3 1/2x3 1/2x1/4x3/8	18.87	18.31	140.5	2.1600	14.174	93.960	0.151 [1]
T18	20 - 0	2L3 1/2x3 1/2x1/4x3/8	19.73	19.16	146.9	2.1600	14.557	93.960	0.155 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T7	240 - 220	L2 1/2x2 1/2x3/16	13.50	6.48	101.8	0.5713	2.132	24.851	0.086 [1]
T8	220 - 200	L2 1/2x2 1/2x3/16	15.50	7.47	117.1	0.5713	2.360	24.851	0.095 [1]
T9	200 - 180	L3x3x3/16	17.50	8.46	109.7	0.7119	2.619	30.968	0.085 [1]
T10	180 - 160	L3x3x3/16	19.50	9.45	122.3	0.7119	3.079	30.968	0.099 [1]
T11	160 - 140	L3 1/2x3 1/2x1/4	21.50	10.45	116.4	1.1269	3.571	49.019	0.073 [1]
T12	140 - 120	2L2 1/2x2 1/2x3/16x3/8	23.00	11.18	174.5	1.1039	3.951	48.020	0.082 [1]
T13	120 - 100	2L2 1/2x2 1/2x3/16x3/8	25.00	12.17	189.7	1.1039	4.509	48.020	0.094 [1]
T14	100 - 80	2L2 1/2x2 1/2x3/16x3/8	27.00	13.17	205.2	1.1039	5.025	48.020	0.105 [1]
T15	80 - 60	2L3x3x3/16x3/8	29.00	14.16	182.6	1.3889	5.577	60.417	0.092 [1]
T16	60 - 40	2L3x3x3/16x3/8	31.00	15.15	195.3	1.3889	6.104	60.417	0.101 [1]
T17	40 - 20	2L3 1/2x3 1/2x1/4x3/8	33.00	16.15	179.2	2.2069	6.659	95.999	0.069 [1]
T18	20 - 0	2L3 1/2x3 1/2x1/4x3/8	35.00	17.14	190.1	2.2069	7.195	95.999	0.075 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$

[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	350 - 340	L3x3x1/4	4.00	3.59	49.5	0.9394	0.323	40.863	0.008 [1] ✔

[1] P_u / ϕP_n controls

Redundant Horizontal (1) 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 $\frac{P_u}{\phi P_n}$
T12	140 - 120	L2x2x3/16	5.75	5.56	108.1	0.7148	3.952	23.161	0.171 [1] ✔
T13	120 - 100	L2x2x3/16	6.25	6.05	117.6	0.7148	4.510	23.161	0.195 [1] ✔
T14	100 - 80	L2x2x3/8	6.75	6.55	132.4	1.3600	5.026	44.064	0.114 [1] ✔
T15	80 - 60	L2-1/2x2-1/2x3/16	7.25	7.04	108.6	0.9023	5.578	29.236	0.191 [1] ✔
T16	60 - 40	L2-1/2x2-1/2x3/16	7.75	7.53	116.1	0.9023	6.105	29.236	0.209 [1] ✔
T17	40 - 20	L2.5x2.5x3/16 + L2.5x2.5x1/4 (C-Shape) - Cleary Tower	8.25	8.03	125.4	1.0565	6.660	34.229	0.195 [1] ✔
T18	20 - 0	L3x3x3/16	8.75	8.52	108.9	1.0898	7.195	35.311	0.204 [1] ✔

[1] P_u / ϕP_n controls

Redundant Diagonal (1) 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 $\frac{P_u}{\phi P_n}$
T12	140 - 120	L2-1/2x2-1/2x3/16	7.81	7.56	116.5	0.9023	2.684	29.236	0.092 [1] ✔
T13	120 - 100	L2-1/2x2-1/2x3/16	8.20	7.94	122.5	0.9023	2.959	29.236	0.101 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T14	100 - 80	L2-1/2x2-1/2x3/16	8.60	8.35	128.8	0.9023	3.203	29.236	0.110 [1]
T15	80 - 60	L3x3x3/16	9.02	8.76	111.9	1.0898	3.468	35.311	0.098 [1]
T16	60 - 40	L3x3x3/16	9.44	9.17	117.2	1.0898	3.716	35.311	0.105 [1]
T17	40 - 20	L3x3x3/16	9.86	9.60	122.7	1.0898	3.981	35.311	0.113 [1]
T18	20 - 0	L3x3x3/16	10.30	10.03	128.1	1.0898	4.233	35.311	0.120 [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	350 - 340	Leg	2	3	-6.340	49.286	12.9	Pass
		Diagonal	L2x1 1/2x3/16	9	-2.140	10.346	20.7	Pass
							31.2 (b)	
		Top Girt	L3x3x1/4	4	-0.319	28.598	1.1	Pass
							3.1 (b)	
T2	340 - 320	Leg	2	21	-31.885	72.063	44.2	Pass
		Diagonal	L2x1 1/2x3/16	24	-3.279	11.584	28.3	Pass
							45.2 (b)	
T3	320 - 300	Leg	2 1/2	54	-50.381	112.346	44.8	Pass
		Diagonal	L2x2x3/16	75	-2.735	13.174	20.8	Pass
							36.5 (b)	
T4	300 - 280	Leg	3 1/4	81	-64.889	183.313	35.4	Pass
		Diagonal	L2-1/2x2-1/2x3/16	84	-2.301	13.474	17.1	Pass
							28.0 (b)	
T5	280 - 260	Leg	3 1/4	102	-80.154	183.313	43.7	Pass
		Diagonal	L2-1/2x2-1/2x3/16	108	-2.480	10.341	24.0	Pass
							31.1 (b)	
T6	260 - 240	Leg	3 1/2	123	-96.322	234.484	41.1	Pass
		Diagonal	L3x3x3/16	128	-2.926	13.820	21.2	Pass
							37.3 (b)	
T7	240 - 220	Leg	3 1/2	144	-112.140	306.641	36.6	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x3/8	152	-3.829	25.202	15.2	Pass
							24.1 (b)	
		Horizontal	L2 1/2x2 1/2x3/16	148	-2.132	8.246	25.9	Pass
							27.2 (b)	
		Inner Bracing	L2 1/2x2 1/2x3/16	156	-0.011	7.609	0.6	Pass
T8	220 - 200	Leg	3 3/4	183	-130.154	368.015	35.4	Pass
		Diagonal	2L2 1/2x2 1/2x3/16x3/8	191	-4.328	21.196	20.4	Pass
							23.7 (b)	
		Horizontal	L2 1/2x2 1/2x3/16	187	-2.360	6.207	38.0	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	194	-0.012	5.772	0.7	Pass
T9	200 - 180	Leg	4	222	-150.834	434.236	34.7	Pass
		Diagonal	2L3x3x3/16x3/8	230	-6.826	30.555	22.3	Pass
							34.8 (b)	
		Horizontal	L3x3x3/16	226	-2.619	8.488	30.9	Pass
							33.4 (b)	

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
		Inner Bracing	L3x3x3/16	232	-0.015	7.941	0.7	Pass
T10	180 - 160	Leg	4 1/4	261	-177.552	505.220	35.1	Pass
		Diagonal	2L3x3x3/16x3/8	269	-7.702	26.278	29.3	Pass
							39.4 (b)	
		Horizontal	L3x3x3/16	265	-3.079	6.804	45.3	Pass
		Inner Bracing	L3x3x3/16	272	-0.016	6.396	0.8	Pass
T11	160 - 140	Leg	4 1/4	300	-205.915	505.220	40.8	Pass
		Diagonal	2L3x3x3/16x3/8	308	-8.517	22.339	38.1	Pass
							44.9 (b)	
		Horizontal	L3 1/2x3 1/2x1/4	304	-3.571	11.687	30.6	Pass
							34.2 (b)	
		Inner Bracing	L3 1/2x3 1/2x1/4	312	-0.019	11.050	0.7	Pass
T12	140 - 120	Leg	4 1/2	339	-227.812	580.902	39.2	Pass
		Diagonal	2L3x3x1/4x3/8	358	-12.582	31.416	40.1	Pass
							45.2 (b)	
		Horizontal	2L2 1/2x2 1/2x3/16x3/8	347	-3.951	13.682	28.9	Pass
		Redund Horz 1 Bracing	L2x2x3/16	374	-3.952	5.620	70.3	Pass
		Redund Diag 1 Bracing	L2-1/2x2-1/2x3/16	375	-2.684	6.069	44.2	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	361	-0.028	9.656	0.7	Pass
T13	120 - 100	Leg	4 3/4	384	-260.000	661.231	39.3	Pass
		Diagonal	2L3x3x1/4x3/8	400	-12.502	28.916	43.2	Pass
							48.7 (b)	
		Horizontal	2L2 1/2x2 1/2x3/16x3/8	399	-4.509	11.547	39.0	Pass
		Redund Horz 1 Bracing	L2x2x3/16	397	-4.510	4.748	95.0	Pass
		Redund Diag 1 Bracing	L2-1/2x2-1/2x3/16	423	-2.959	5.494	53.9	Pass
		Inner Bracing	L4x4x1/4	406	-0.030	12.311	0.8	Pass
T14	100 - 80	Leg	4 3/4	429	-289.764	661.231	43.8	Pass
		Diagonal	2L3x3x1/4x3/8	448	-13.614	26.593	51.2	Pass
		Horizontal	2L2 1/2x2 1/2x3/16x3/8	437	-5.025	9.860	51.0	Pass
		Redund Horz 1 Bracing	L2x2x3/8	442	-5.026	7.521	66.8	Pass
		Redund Diag 1 Bracing	L2-1/2x2-1/2x3/16	465	-3.203	4.968	64.5	Pass
		Inner Bracing	L4x4x1/4	451	-0.031	10.555	0.8	Pass
T15	80 - 60	Leg	5	474	-321.573	746.168	43.1	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	490	-13.639	38.008	35.9	Pass
							44.6 (b)	
		Horizontal	2L3x3x3/16x3/8	482	-5.577	15.048	37.1	Pass
		Redund Horz 1 Bracing	L2-1/2x2-1/2x3/16	487	-5.578	6.992	79.8	Pass
		Redund Diag 1 Bracing	L3x3x3/16	513	-3.468	7.925	43.8	Pass
		Inner Bracing	2L3x3x3/16x3/8	496	-0.037	14.343	0.8	Pass
T16	60 - 40	Leg	5 1/4	519	-351.970	835.679	42.1	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	538	-14.908	35.047	42.5	Pass
							45.7 (b)	
		Horizontal	2L3x3x3/16x3/8	527	-6.104	13.146	46.4	Pass
		Redund Horz 1 Bracing	L2-1/2x2-1/2x3/16	536	-6.105	6.113	99.9	Pass
		Redund Diag 1 Bracing	L3x3x3/16	555	-3.716	7.227	51.4	Pass
		Inner Bracing	2L3x3x3/16x3/8	542	-0.038	12.552	0.9	Pass
T17	40 - 20	Leg	5 1/4	564	-383.955	835.679	45.9	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	580	-14.831	32.326	45.9	Pass
							47.9 (b)	
		Horizontal	2L3 1/2x3 1/2x1/4x3/8	572	-6.659	24.167	27.6	Pass
		Redund Horz 1	L2.5x2.5x3/16 + L2.5x2.5x1/4	577	-6.660	14.963	44.5	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
		Bracing	(C-Shape) - Cleary Tower					
		Redund Diag 1 Bracing	L3x3x3/16	600	-3.981	6.591	60.4	Pass
		Inner Bracing	2L3 1/2x3 1/2x1/4x3/8	586	-0.043	23.141	0.7	Pass
T18	20 - 0	Leg	5 1/2	609	-414.861	929.740	44.6	Pass
		Diagonal	2L3 1/2x3 1/2x1/4x3/8	628	-15.748	29.896	52.7	Pass
		Horizontal	2L3 1/2x3 1/2x1/4x3/8	617	-7.195	21.456	33.5	Pass
		Redund Horz 1 Bracing	L3x3x3/16	622	-7.195	8.374	85.9	Pass
		Redund Diag 1 Bracing	L3x3x3/16	645	-4.233	6.043	70.1	Pass
		Inner Bracing	2L3 1/2x3 1/2x1/4x3/8	631	-0.042	20.572	0.7	Pass
							Summary	
						Leg (T17)	45.9	Pass
						Diagonal (T18)	52.7	Pass
						Horizontal (T14)	51.0	Pass
						Top Girt (T1)	3.1	Pass
						Redund Horz 1 Bracing (T16)	99.9	Pass
						Redund Diag 1 Bracing (T18)	70.1	Pass
						Inner Bracing (T16)	0.9	Pass
						Bolt Checks	49.3	Pass
						RATING =	**99.9**	**Pass**

MATHCAD CALCULATION PRINTOUT

EXISTING 350' SELF SUPPORT TOWER ANCHOR BOLT CHECK

REACTIONS ON THE FOUNDATION

As per Tnx output (see attached)

Down load; $Pv := 429 \cdot kips$ Shear; $V_u := 49 \cdot kips$

Uplift load; $P_{up} := 313 \cdot kips$ Moment; $M := 0 \cdot kips \cdot ft$

Anchor Rod Data is as per Structural Analysis by Paul J. Ford & Co., Job No. A03-T143 dated 12/22/2003.

Number of Anchor Rods: $N_{anchors} := 6$

Diameter of Anchors: $D_{anchors} := 2.5in$ $n := 4in^{-1}$

Area of anchor bolts $A_b := \frac{\pi \cdot \left(D_{anchors}^{2}\right)}{4} = 4.909 \cdot in^2$

Net Tensile Area of Anchors: $A_{net} := \frac{\pi}{4} \cdot \left(D_{anchors} - \frac{0.9743}{n}\right)^2 = 3.999 \cdot in^2$

Minimum Yield Stress $F_{Yanchors} := 36ksi$ (Grade A36)

Ultimate Tensile Stress: $F_{Uanchors} := 58ksi$

Saftey Factor for Anchor: $\phi_t := 0.8$ (Section 4.9.9, TIA-222-G Addendum 2)

Allowable Axial Load per Anchor: $T_{cap} := \phi_t \cdot F_{Uanchors} \cdot A_{net}$

$T_{cap} = 185.545 \cdot kips$

Interaction Equation for Anchor Rods as per Section 4.9.9, TIA-222-G Addendum 1 and Figure 4.4

For detail type (D) as per Figure 4.4 $\eta := 0.50$

$P_u := if\left(\eta > 0.5, P_{up}, Pv\right) = 429 \cdot kips$

Maximum Load on Anchor: $T_{max} := \frac{P_u + \frac{V_u}{\eta}}{N_{anchors}}$

$T_{max} = 87.833 \cdot kips$

Anchor Rod Capacity: $\frac{T_{max}}{T_{cap}} = 47.338 \cdot \%$ OK!

$Anchor\_Rod\_Check := if\left(T_{max} < T_{cap}, "OK", "Not\ OK"\right)$

Anchor_Rod_Check = "OK"

For detail type (d), when the clear distance from top of concrete to the bottom of leveling nut exceeds 1.0 times the diameter of the anchor rod, the interaction equation as per section 4.9.9.,TIA-222-G Addendum 1 shall also be satisfied.

Clear distance: $I_{ar} := 2.0in$ (estimated from photo)

Clear distance: $I_{ar} = 2 \cdot in$ < Diameter of Anchors: $D_{anchors} = 2.5 \cdot in$ OK!

Summary

-Foundation Reactions from Tower Base-

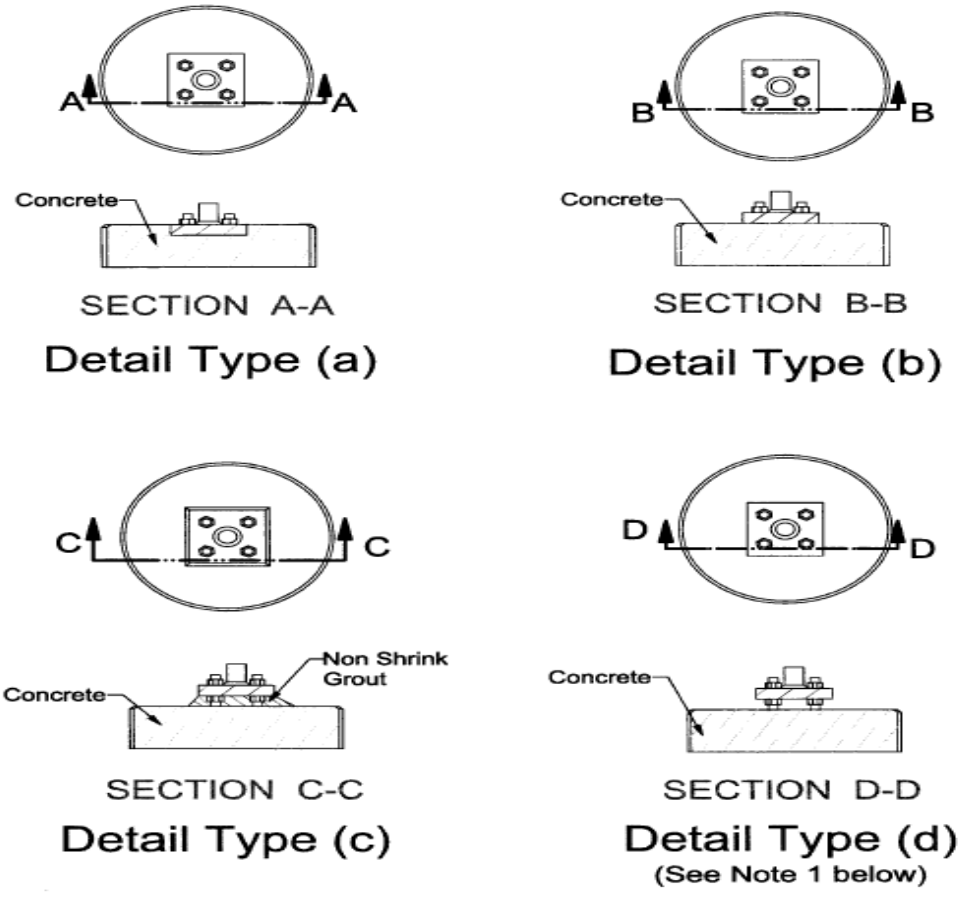
Shear	$V_u = 49 \cdot kips$
Down load	$Pv = 429 \cdot kips$
Uplift load	$P_{up} = 313 \cdot kips$
Moment	$M = 0 \cdot ft \cdot kip$

Anchor Rod Check $T_{max} = 87.833 \cdot kips$ < $T_{cap} = 185.545 \cdot kips$

Anchor_Rod_Check := if$\left(T_{max} < T_{cap}, \text{"OK"}, \text{"Not OK"}\right)$

Anchor_Rod_Check = "OK"

ANSI/TIA-222-G



Note:

1. When clear distance from top of concrete to the bottom face of the leveling nut exceeds 1.5 times the diameter of the anchor rod, bending of the anchor rod shall be considered (refer to 4.9.9).

Figure 4-4: Anchor Rod Detail Types

4.9.9 Anchor Rods

For anchor rods, the following interaction equation shall be satisfied:

$$\left(\frac{P_u + \frac{V_u}{\eta}}{\phi R_{nt}} \right) \leq 1$$

where:

$\phi = 0.80$

P_u = tension force for detail types (a), (b) & (c) and larger of compression or tension force for type (d) as depicted in Figure 4-4.

V_u = shear force (direct shear and torsion components) corresponding to P_u

R_{nt} = nominal tensile strength of anchor rod as per 4.9.6.1

η = 0.90 for detail type (a)
= 0.70 for detail type (b)
= 0.55 for detail type (c)
= 0.50 for detail type (d)

For detail type (d), when the clear distance from the top of concrete to the bottom leveling nut exceeds 1.0 times the diameter of the anchor rod, the following interaction equation shall also be satisfied:

$$\left(\frac{V_u}{\phi R_{nv}} \right)^2 + \left(\left| \frac{P_u}{\phi R_{nt}} \right| + \left| \frac{M_u}{\phi R_{nm}} \right| \right)^2 \leq 1$$

where:

M_u = bending moment corresponding to V_u
= 0.65 $l_{ar} V_u$

l_{ar} = length from top of concrete to bottom of anchor rod leveling nut

Addendum 1

ϕR_{nv} = design shear strength of anchor rod as per 4.9.6.3

ϕR_{nm} = design flexural strength of anchor rod in accordance with 4.7.1 using the tensile root diameter for the determination of z

d_{rt} = tensile root diameter of rod, in [mm]
= d – 0.9743/n inches
= d – 0.9382(p) mm

d = nominal rod diameter, in [mm]

n = number of threads per inch

p = pitch of threads, mm

4.9.6.3 Design Shear Strength

The design shear strength of a bolt, ϕR_{nv}, shall be taken as:

$\phi = 0.75$

(a) When threads are excluded from the shear plane:
$R_{nv} = 0.55\ F_{ub}\ A_b$

(b) When threads are included in the shear plane:
$R_{nv} = 0.45\ F_{ub}\ A_b$

where:

F_{ub} = Specified minimum tensile strength of bolt

A_b = nominal unthreaded area of bolt

4.7.1 Solid Round Members

For solid round members, M_n shall be determined as follows:

$M_n = F_y'Z$

where:

F_y' = effective yield stress as determined from 4.5.4.1

Z = plastic section modulus

4.5.4.1 Effective Yield Stress

For 60^O and 90^O angle members, the effective yield stress for axial compression, F'_y, shall be determined as follows:

$$w/t \le 0.47\sqrt{\frac{E}{F_y}} \qquad F'_y = F_y$$

$$0.47\sqrt{\frac{E}{F_y}} < w/t \le 0.85\sqrt{\frac{E}{F_y}} \qquad F'_y = \left[1.677-0.677\left(\frac{w/t}{0.47\sqrt{E/F_y}}\right)\right] F_y$$

$$0.85\sqrt{\frac{E}{F_y}} < w/t \le 25 \qquad F'_y = [0.0332\ \pi^2\ E/(w/t)^2]$$

The width to thickness ratio (w/t) shall not exceed 25 for angle members (refer to Figure 4-3).

For solid round members, the effective yield stress, F'_y, shall be equal to F_y.

For tubular round members, the diameter to thickness ratio (D/t) shall not exceed 400. The effective yield stress, F'_y, shall be determined as follows:

$$D/t \le 0.114\ E/F_y \qquad F'_y = F_y$$

$$0.114\ E/F_y < D/t \le 0.448\ E/F_y \qquad F'_y = \left(\frac{0.0379E}{(D/t)F_y}+\frac{2}{3}\right)F_y$$

$$0.448\ E/F_y < D/t \le 400 \qquad F'_y = \frac{0.337E}{(D/t)}$$