September 10, 2018

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

Re: **Notice of Exempt Modification – Antenna Swap**
Property Address: **880 POST ROAD EAST WESTPORT, CT 06880**
Applicant: **AT&T Mobility, LLC**

Dear Ms. Bachman:

On behalf of AT&T, please accept this application as notification pursuant to R.C.S.A. §16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. §16-50j-72(b) (2).

AT&T currently maintains a wireless telecommunications facility consisting of nine (9) wireless telecommunication antennas at an antenna center line height of 133-feet on an existing 180 –self-support tower, owned by the STATE OF CONNECTICUT DEPARTMENT OF PUBLIC SAFETY. AT&T now intends to INSTALL (3) NEW ANTENNAS TO REPLACE (3) EXISTING ANTENNAS (3) NEW RRUS-32 B66 UNITS (3) NEW RRUS-32 UNITS (6) NEW LOW BAND COMBINER UNITS (1) NEW RAYCAP UNIT (1) FIBER CABLE AND (2) DC POWER CABLES.

This facility was approved by the Connecticut Siting Council, Docket No. 123 on March 9 ,1990. There were no conditions that could feasibly be violated by this modification, including the total facility height or mounting restrictions. This modification therefore complies with the approval.

The following is a list of subsequent decisions by the Connecticut Siting Council:

EM-AT&T-158-991101 - AT&T Wireless PCS notice of intent to modify an existing telecommunications facility located at 880 Post Road East in **Westport**.

EM-CING-015-018-034-057-097-103-144-158-020913 - Southwestern Bell Mobile Systems, LLC notice of intent to modify existing telecommunications facilities located in Bridgeport, Brookfield, Danbury, Greenwich, Newtown, Norwalk, Trumbull, and **Westport**, Connecticut.

EM-CING-015-034-035-051-057-085-103-117-126-135-138-157-158-161-020917 - Southwestern Bell Mobile Systems, LLC notice of intent to modify existing telecommunications facilities located in Bridgeport, Danbury, Darien, Fairfield, Greenwich, Monroe, Newtown, Norwalk, Redding, Shelton, Stamford, Stratford, Weston, **Westport**, and Wilton, Connecticut.

smartlink

EM-CING-158-021223 - Southwestern Bell Mobile Systems, LLC a/k/a Cingular Wireless notice of intent to modify an existing telecommunications facility located at 880 Post Road, **Westport**, Connecticut.

EM-CING-158-110620 - New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at 880 Post Road East, **Westport**, Connecticut.

EM-CING-158-130326 - New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at 880 Post Road East, **Westport**, Connecticut.

EM-CING-158-140501 – New Cingular Wireless PCS, LLC notice of intent to modify an existing telecommunications facility located at 880 Post Road East, **Westport**, Connecticut. Decision. Completion Letter.

EM-CING-158-170724 – AT&T notice of intent to modify an existing telecommunications facility located at 880 Post Road East, **Westport**, Connecticut. Decision

EM-AT&T-158-171019 – AT&T Wireless notice of intent to modify an existing telecommunications facility located at 880 Post Road East, **Westport**, Connecticut. Decision

Please accept this letter pursuant to Regulation of Connecticut State Agencies §16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-5I0j-72(b) (2). In accordance with R.C.S.A., a copy of this letter is being sent to Mr. James Marpe, First Selectman of the Town of Westport, the Westport Planning and Zoning Director and State of CT Department of Public Safety, tower owner.

The planned modifications to AT&T's facility fall squarely within those activities explicitly provided for in R.C.S.A. §16-50j-72(b) (2).

1. The proposed modifications will not result in an increase in the height of the existing tower. AT&T's replacement antennas will be installed at the 133-foot level of the 180-foot self-support tower.
2. The proposed modifications will not involve any changes to ground-mounted equipment and, therefore, will not require and extension of the site boundary.
3. The proposed modifications will not increase the noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.
4. The operation of the modified facility will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. A cumulative worst-case RF emissions calculation for AT&T's modified facility is provided in the RF Emissions Compliance Report, included in Tab 2.

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.
6. The tower and its foundation can support AT&T's proposed modifications. (See Structural Analysis Report included in Tab 3).

For the foregoing reasons, AT&T respectfully submits that the proposed modifications to the above referenced telecommunications facility constitutes an exempt modification under R.C.S.A. §16-50j-72(b) (2).

Sincerely,

David Barbagallo

CC w/enclosures:

Mr. James Marpe, First Selectman of the Town of Westport
Westport Planning and Zoning Director
Tower Owner, State of CT Department of Public Safety

8618 Westwood Center Drive, Suite 315, Vienna, VA 22182
703.276.1100 • 703.276.1169 fax
info@sitesafe.com • www.sitesafe.com

Smartlink on behalf of AT&T Mobility, LLC
Site FA – 10035298
Site ID – CT2147 (MRCTB025509-MRCTB025517)
USID – 60430
Site Name – WESTPORT SP TOWER

880 POST ROAD EAST
WESTPORT, CT 06880

Latitude: N41-8-14.87
Longitude: W73-20-03.70
Structure Type: Self-Support

Report generated date: June 7, 2018
Report by: Scott Broyles
Customer Contact: David Barbagallo

AT&T Mobility, LLC will be compliant when the remediation recommended in Section 5.2 or other appropriate remediation is implemented.

Table of Contents

1 General Site Summary

1.1 Report Summary

AT&T Mobility, LLC	Summary
Access to Antennas Locked?	Yes
Max Cumulative Simulated RFE Level on the Ground	<1% General Public Limit
FCC & AT&T Compliant?	Will Be Compliant
Optional AT&T Mitigation Items?	No

The following documents were provided by the client and were utilized to create this report:

RFDS: NEW-ENGLAND_CONNECTICUT_CTL02147_2018-LTE-Next-Carrier_LTE_rx855w_PTN_10...

CD's: 10035298_AE201_180307_CTL02147_REV2 (00000002)

RF Powers Used: RFDS Above

1.2 Signage Summary

AT&T Signage Locations	Information 1	Information 2	Notice	Notice 2	Caution	Caution 2	Warning	Warning 2	Barriers
Access Point(s)	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐
Alpha	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐
Beta	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐
Gamma	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐[#]	☐

1.3 Fall Arrest Anchor Point Summary

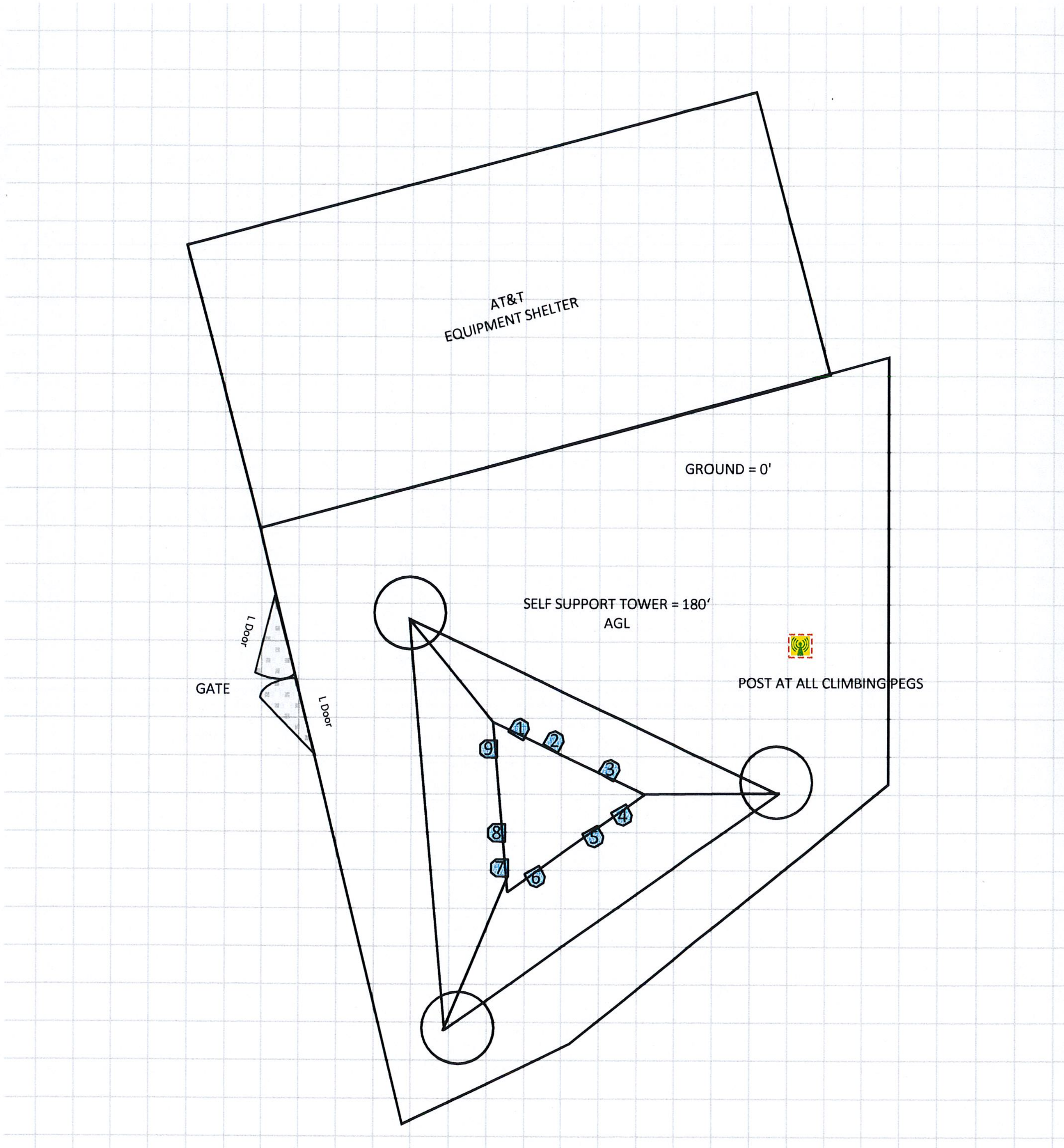
Fall Arrest Anchor & Parapet Info	Parapet Available (Y/N)	Parapet Height (inches)	Fall Arrest Anchor Available (Y/N)
Roof Safety Info	N	N/A	N

2 Scale Maps of Site

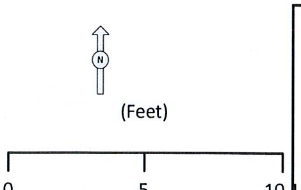
The following diagrams are included:

- Site Scale Map
- RF Exposure Diagram
- RF Exposure Diagram – Elevation View

Site Scale Map For: WESTPORT SP TOWER



% of FCC Public Exposure Limit
Spatial average 0' - 6'



www.sitesafe.com
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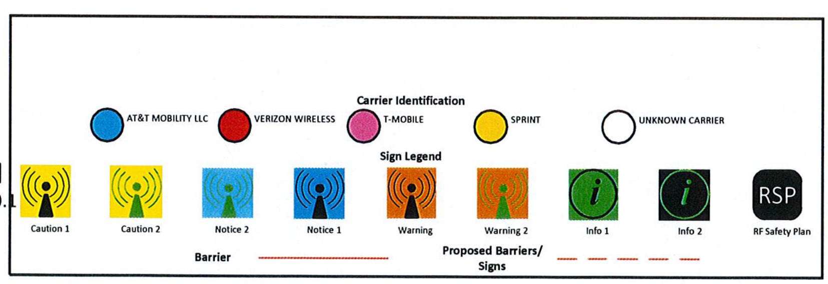
6/7/2018 11:18:46 AM



3 Antenna Inventory

The following antenna inventory was obtained by the customer and was utilized to create the site model diagrams:

Ant ID	Operator	Antenna Make & Model	Type	TX Freq (MHz)	Az (Deg)	Hor BW (Deg)	Ant Len (ft)	Ant Gain (dBd)	3G UMTS Radio(s)	4G Radio(s)	Total ERP (Watts)	X	Y	Z
1	AT&T MOBILITY LLC	Powerwave P65-16-XLH-RR	Panel	850	30	65	6	13.41	1	0	368.1	36.7'	39.7'	130'
2	AT&T MOBILITY LLC	CCI Antennas HPA-65R-BUU-H6	Panel	737	30	66.2	6	11.68	0	1	1475.7	39.1'	38.9'	130'
2	AT&T MOBILITY LLC	CCI Antennas HPA-65R-BUU-H6	Panel	1900	30	61.1	6	14.53	0	1	4842.1	39.1'	38.9'	130'
3	AT&T MOBILITY LLC (Proposed)	Kathrein-Scala 800-10798	Panel	2100	30	62	6.5	14.04	0	1	3837.1	42.8'	37'	129.7'
3	AT&T MOBILITY LLC (Proposed)	Kathrein-Scala 800-10798	Panel	2300	30	64	6.5	13.22	0	1	1285.3	42.8'	37'	129.7'
4	AT&T MOBILITY LLC	Powerwave P65-16-XLH-RR	Panel	850	150	65	6	13.41	1	0	368.1	43.6'	34'	130'
5	AT&T MOBILITY LLC	CCI Antennas HPA-65R-BUU-H6	Panel	737	150	66.2	6	11.68	0	1	1475.7	41.7'	32.5'	130'
5	AT&T MOBILITY LLC	CCI Antennas HPA-65R-BUU-H6	Panel	1900	150	61.1	6	14.53	0	1	4842.1	41.7'	32.5'	130'
6	AT&T MOBILITY LLC (Proposed)	Kathrein-Scala 800-10798	Panel	2100	150	62	6.5	14.04	0	1	3837.1	37.8'	29.9'	129.7'
6	AT&T MOBILITY LLC (Proposed)	Kathrein-Scala 800-10798	Panel	2300	150	64	6.5	13.22	0	1	1285.3	37.8'	29.9'	129.7'
7	AT&T MOBILITY LLC	Powerwave P65-16-XLH-RR	Panel	850	270	65	6	13.41	1	0	368.1	35.4'	30.5'	130'
8	AT&T MOBILITY LLC	CCI Antennas HPA-65R-BUU-H6	Panel	737	270	66.2	6	11.68	0	1	1475.7	35.2'	32.8'	130'
8	AT&T MOBILITY LLC	CCI Antennas HPA-65R-BUU-H6	Panel	1900	270	61.1	6	14.53	0	1	4842.1	35.2'	32.8'	130'
9	AT&T MOBILITY LLC (Proposed)	Kathrein-Scala 800-10798	Panel	2100	270	62	6.5	14.04	0	1	3837.1	34.6'	38.3'	129.7'
9	AT&T MOBILITY LLC (Proposed)	Kathrein-Scala 800-10798	Panel	2300	270	64	6.5	13.22	0	1	1285.3	34.6'	38.3'	129.7'

NOTE: X, Y and Z indicate relative position of the bottom of the antenna to the origin location on the site, displayed in the model results diagram. Specifically, the Z reference indicates the bottom of the antenna height **above ground level (AGL)**. The distance to the bottom of the antenna is calculated by subtracting half of the length of the antenna from the antenna centerline. Effective Radiated Power (ERP) is provided by the operator or based on Sitesafe experience. The values used in the modeling may be greater than are currently deployed.

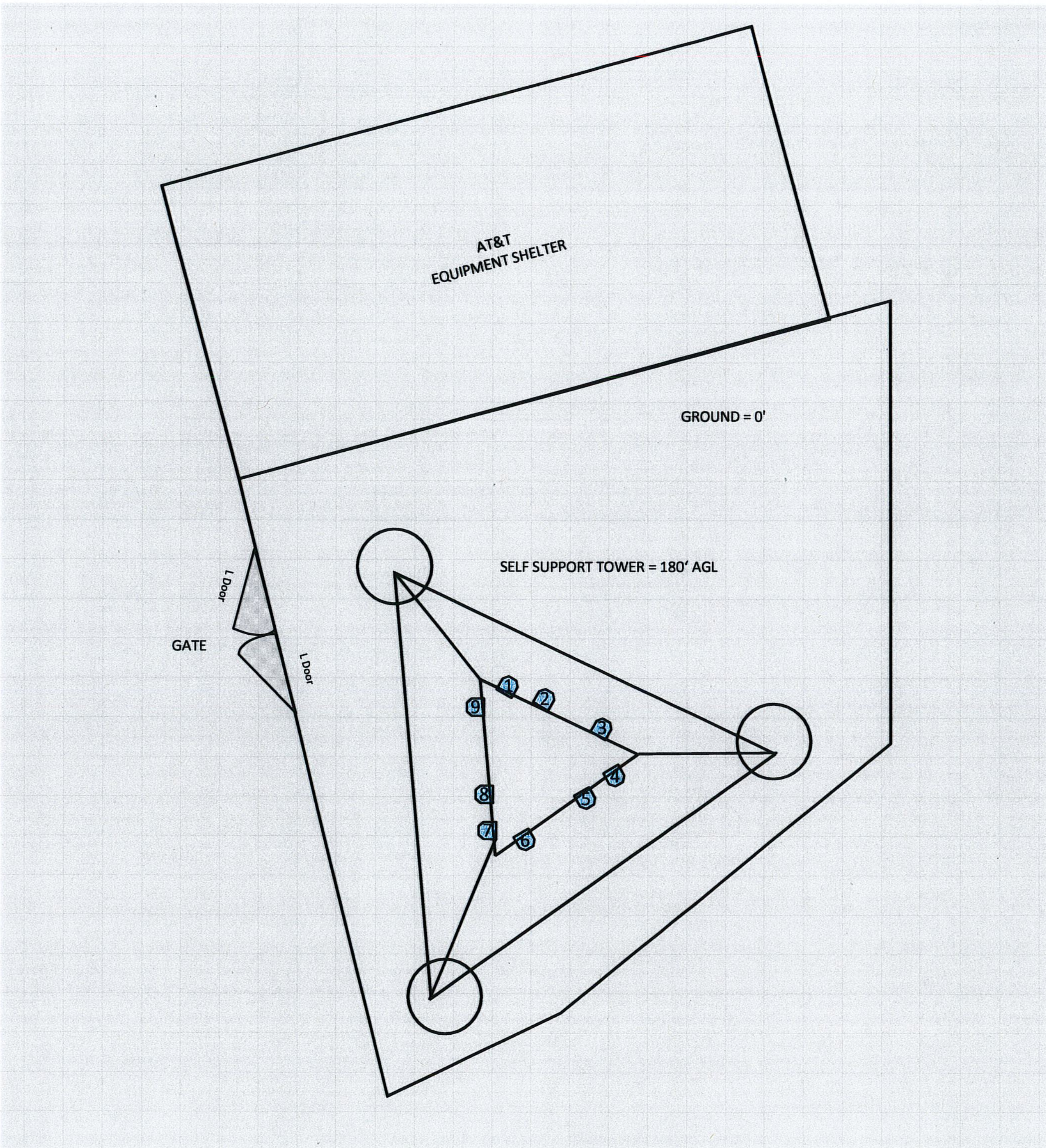
4 Emission Predictions

In the RF Exposure Simulations below all heights are reflected with respect to main site level. In most rooftop cases this is the height of the main rooftop and in other cases this can be ground level. Each different height area, rooftop, or platform level is labeled with its height relative to the main site level. Emissions are calculated appropriately based on the relative height and location of that area to all antennas. The total analyzed elevations in the below RF Exposure Simulations are listed below.

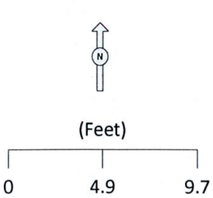
- Ground = 0'

The Antenna Inventory heights are referenced to the same level.

RF Exposure Simulation For: WESTPORT SP TOWER
Composite View



% of FCC Public Exposure Limit
Spatial average 0' - 6'



www.sitesafe.com
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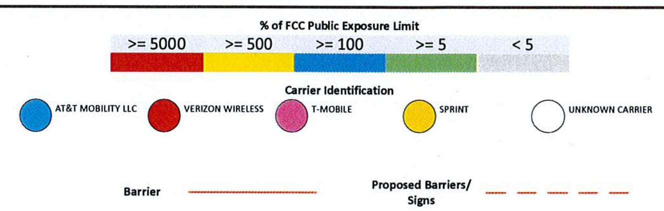
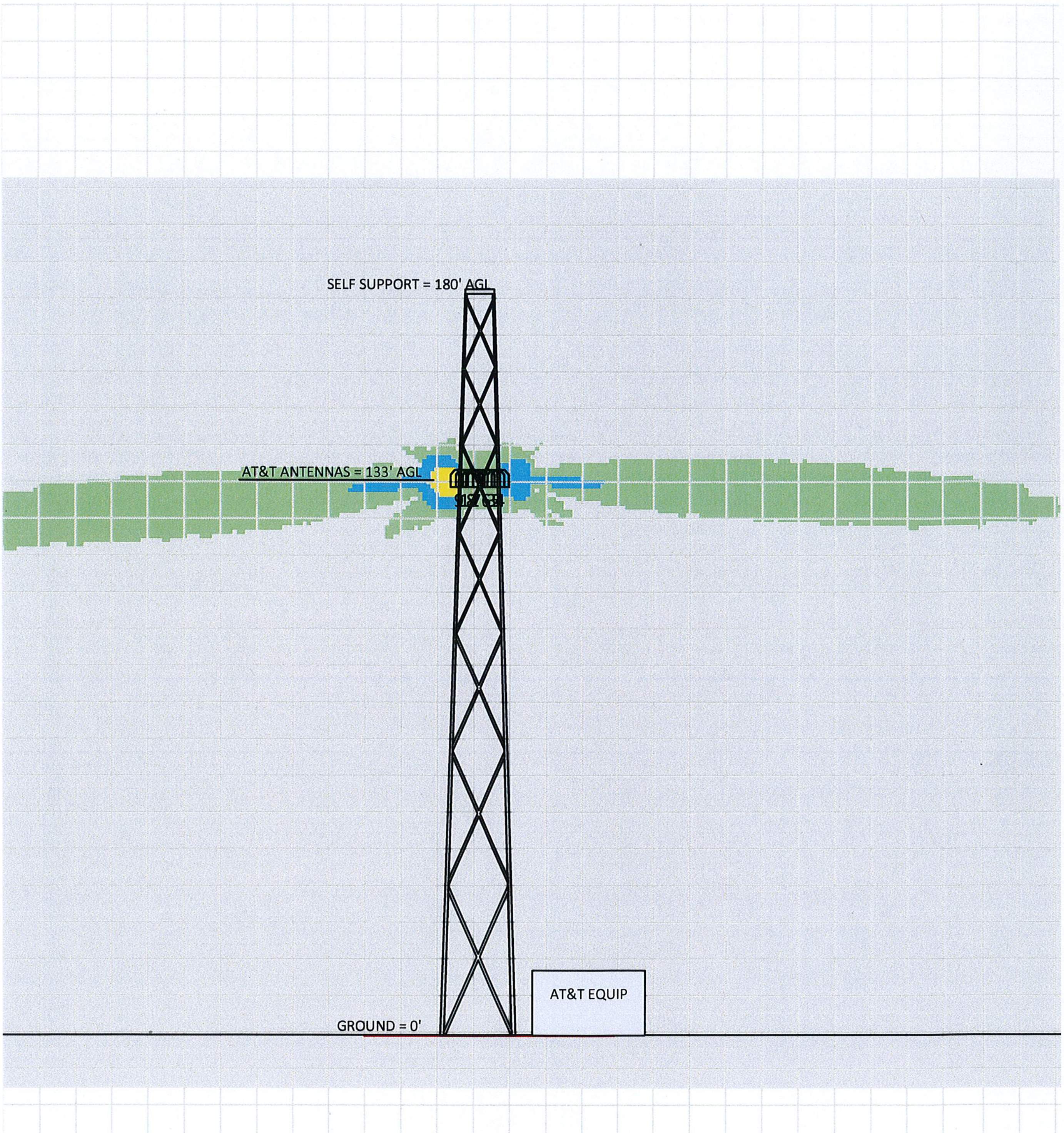
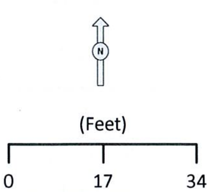


Sitesafe OET-65 Model
Near Field Boundary:
1.5 * Aperture
Reflection Factor: 1
Spatially Averaged

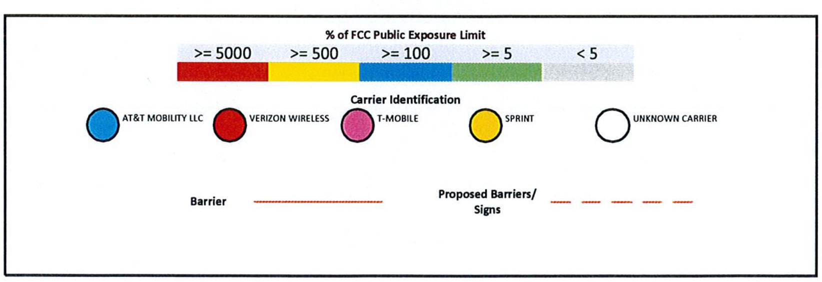
RF Exposure Simulation For: WESTPORT SP TOWER
Elevation View



% of FCC Public Exposure Limit
Spatial average 0' - 6'



www.sitesafe.com
Site Name:WESTPORT SP TOWER
6/7/2018 11:14:53 AM



Sitesafe OET-65 Model
Near Field Boundary:
1.5 * Aperture
Reflection Factor: 1
Single Level (0)

5 Site Compliance

5.1 Site Compliance Statement

Upon evaluation of the cumulative RF emission levels from all operators at this site, RF hazard signage and antenna locations, Sitesafe has determined that:

AT&T Mobility, LLC will be compliant when the remediation recommended in Section 5.2 or other appropriate remediation is implemented.

The compliance determination is based on General Public RFE levels derived from theoretical modeling, RF signage placement, proposed antenna inventory and the level of restricted access to the antennas at the site. Any deviation from the AT&T Mobility, LLC's proposed deployment plan could result in the site being rendered non-compliant.

Modeling is used for determining compliance and the percentage of MPE contribution.

5.2 Actions for Site Compliance

Based on FCC regulations, common industry practice, and our understanding of AT&T Mobility, LLC RF Safety Policy requirements, this section provides a statement of recommendations for site compliance. Recommendations have been proposed based on our understanding of existing access restrictions, signage, and an analysis of predicted RFE levels.

AT&T Mobility, LLC will be made compliant if the following changes are implemented:

Self-Support Tower Access Location

(1) Yellow Caution 2B sign(s) required at all Climbing Pegs

Notes:

- Signage may already be in place. Sitesafe does not have record of any existing signage because there were no previous visits or data supplied regarding them. All remediation is based on a worst-case scenario.
- Data concerning all other carriers on site was unavailable and therefore not included in this report

6 Reviewer Certification

The reviewer whose signature appears below hereby certifies and affirms:

That I am an employee of Sitesafe, LLC., in Vienna, Virginia, at which place the staff and I provide RF compliance services to clients in the wireless communications industry; and

That I am thoroughly familiar with the Rules and Regulations of the Federal Communications Commission (FCC) as well as the regulations of the Occupational Safety and Health Administration (OSHA), both in general and specifically as they apply to the FCC Guidelines for Human Exposure to Radio-frequency Radiation; and

That I have thoroughly reviewed this Site Compliance Report and believe it to be true and accurate to the best of my knowledge as assembled by and attested to by Scott Broyles.

June 7, 2018

Young Min Kim

Appendix A – Statement of Limiting Conditions

Sitesafe has provided computer generated model(s) in this Site Compliance Report to show approximate dimensions of the site, and the model is included to assist the reader of the compliance report to visualize the site area, and to provide supporting documentation for Sitesafe's recommendations.

Sitesafe may note in the Site Compliance Report any adverse physical conditions, such as needed repairs, that Sitesafe became aware of during the normal research involved in creating this report. Sitesafe will not be responsible for any such conditions that do exist or for any engineering or testing that might be required to discover whether such conditions exist. Because Sitesafe is not an expert in the field of mechanical engineering or building maintenance, the Site Compliance Report must not be considered a structural or physical engineering report.

Sitesafe obtained information used in this Site Compliance Report from sources that Sitesafe considers reliable and believes them to be true and correct. Sitesafe does not assume any responsibility for the accuracy of such items that were furnished by other parties. When conflicts in information occur between data collected by Sitesafe provided by a second party and data collected by Sitesafe, the data will be used.

Appendix B – Regulatory Background Information

FCC Rules and Regulations

In 1996, the Federal Communications Commission (FCC) adopted regulations for the evaluating of the effects of RF emissions in 47 CFR § 1.1307 and 1.1310. The guideline from the FCC Office of Engineering and Technology is Bulletin 65 ("OET Bulletin 65"), *Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields*, Edition 97-01, published August 1997. Since 1996 the FCC periodically reviews these rules and regulations as per their congressional mandate.

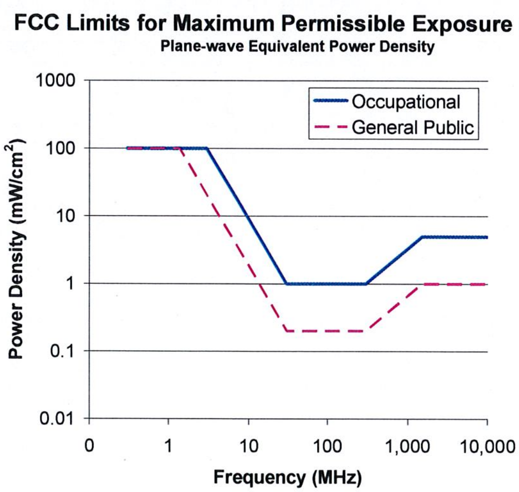
FCC regulations define two separate tiers of exposure limits: Occupational or "Controlled environment" and General Public or "Uncontrolled environment". The General Public limits are generally five times more conservative or restrictive than the Occupational limit. These limits apply to *accessible* areas where workers or the general public may be exposed to Radio Frequency (RF) electromagnetic fields.

Occupational or Controlled limits apply in situations in which persons are exposed as a consequence of their employment and where those persons exposed have been made fully aware of the potential for exposure and can exercise control over their exposure.

An area is considered a Controlled environment when access is limited to these aware personnel. Typical criteria are restricted access (i.e. locked or alarmed doors, barriers, etc.) to the areas where antennas are located coupled with proper RF warning signage. A site with Controlled environments is evaluated with Occupational limits.

All other areas are considered Uncontrolled environments. If a site has no access controls or no RF warning signage it is evaluated with General Public limits.

The theoretical modeling of the RF electromagnetic fields has been performed in accordance with OET Bulletin 65. The Maximum Permissible Exposure (MPE) limits utilized in this analysis are outlined in the following diagram:



Limits for Occupational/Controlled Exposure (MPE)

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

Limits for General Population/Uncontrolled Exposure (MPE)

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

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

OSHA Statement

The General Duty clause of the OSHA Act (Section 5) outlines the occupational safety and health responsibilities of the employer and employee. The General Duty clause in Section 5 states:

(a) Each employer –

(1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;

(2) shall comply with occupational safety and health standards promulgated under this Act.

(b) Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act which are applicable to his own actions and conduct.

OSHA has defined Radiofrequency and Microwave Radiation safety standards for workers who may enter hazardous RF areas. Regulation Standards 29 CFR § 1910.147 identify a generic Lock Out Tag Out procedure aimed to control the unexpected energization or start up of machines when maintenance or service is being performed.

Appendix C – Safety Plan and Procedures

The following items are general safety recommendations that should be administered on a site by site basis as needed by the carrier.

General Maintenance Work: Any maintenance personnel required to work immediately in front of antennas and / or in areas indicated as above 100% of the Occupational MPE limits should coordinate with the wireless operators to disable transmitters during their work activities.

Training and Qualification Verification: All personnel accessing areas indicated as exceeding the General Population MPE limits should have a basic understanding of EME awareness and RF Safety procedures when working around transmitting antennas. Awareness training increases a workers understanding to potential RF exposure scenarios. Awareness can be achieved in a number of ways (e.g. videos, formal classroom lecture or internet based courses).

Physical Access Control: Access restrictions to transmitting antennas locations is the primary element in a site safety plan. Examples of access restrictions are as follows:

- Locked door or gate
- Alarmed door
- Locked ladder access
- Restrictive Barrier at antenna (e.g. Chain link with posted RF Sign)

RF Signage: Everyone should obey all posted signs at all times. RF signs play an important role in properly warning a worker prior to entering into a potential RF Exposure area.

Assume all antennas are active: Due to the nature of telecommunications transmissions, an antenna transmits intermittently. Always assume an antenna is transmitting. Never stop in front of an antenna. If you have to pass by an antenna, move through as quickly and safely as possible thereby reducing any exposure to a minimum.

Maintain a 3 foot clearance from all antennas: There is a direct correlation between the strength of an EME field and the distance from the transmitting antenna. The further away from an antenna, the lower the corresponding EME field is.

Site RF Emissions Diagram: Section 4 of this report contains an RF Diagram that outlines various theoretical Maximum Permissible Exposure (MPE) areas at the site. The modeling is a worst case scenario assuming a duty cycle of 100% for each transmitting antenna at full power. This analysis is based on one of two access control criteria: General Public criteria means the access to the site is uncontrolled and anyone can gain access. Occupational criteria means the access is restricted and only properly trained individuals can gain access to the antenna locations.

Appendix D – RF Emissions

The RF Emissions Simulation(s) in this report display theoretical spatially averaged percentage of the Maximum Permissible Exposure for all systems at the site unless otherwise noted. These diagrams use modeling as prescribed in OET Bulletin 65 and assumptions detailed in Appendix E.

The key at the bottom of each RF Emissions Simulation indicates percentages displayed referenced to FCC General Public Maximum Permissible Exposure (MPE) limits. Color coding on the diagram is as follows:

- Areas indicated as Gray are predicted to be below 5% of the MPE limits. Gray represents areas more than 20 times below the most conservative exposure limit.
- Green represents areas are predicted to be between 5% and 100% of the MPE limits. **Green areas are accessible to anyone**.
- Blue represents areas predicted to exceed the General Public MPE limits but are less than Occupational limits. **Blue areas should be accessible only to RF trained workers**.
- Yellow represents areas predicted to exceed Occupational MPE limits. Yellow areas should be accessible only to RF trained workers able to assess current exposure levels.
- Red represents areas predicted to have exposure more than 10 times the Occupational MPE limits. **Red indicates that the RF levels must be reduced prior to access.** An RF Safety Plan is required which outlines how to reduce the RF energy in these areas prior to access.

Appendix E – Assumptions and Definitions

General Model Assumptions

In this site compliance report, it is assumed that all antennas are operating at **full power at all times**. Software modeling was performed for all transmitting antennas located on the site. Sitesafe has further assumed a 100% duty cycle and maximum radiated power.

The modeling is based on recommendations from the FCC's OET-65 bulletin with the following variances per AT&T guidance. Reflection has not been considered in the modeling, i.e. the reflection factor is 1.0. The near / far field boundary has been set to 1.5 times the aperture height of the antenna and modeling beyond that point is the lesser of the near field cylindrical model and the far field model taking into account the gain of the antenna.

The site has been modeled with these assumptions to show the maximum RF energy density. Areas modeled with exposure greater than 100% of the General Public MPE level may not actually occur, but are shown as a prediction that could be realized. Sitesafe believes these areas to be safe for entry by occupationally trained personnel utilizing appropriate personal protective equipment (in most cases, a personal monitor).

Use of Generic Antennas

For the purposes of this report, the use of "Generic" as an antenna model, or "Unknown" for an operator means the information about a carrier, their FCC license and/or antenna information was not provided and could not be obtained while on site. In the event of unknown information, Sitesafe will use our industry specific knowledge of equipment, antenna models, and transmit power to model the site. If more specific information can be obtained for the unknown measurement criteria, Sitesafe recommends remodeling of the site utilizing the more complete and accurate data. Information about similar facilities is used when the service is identified and associated with a particular antenna. If no information is available regarding the transmitting service associated with an unidentified antenna, using the antenna manufacturer's published data regarding the antenna's physical characteristics makes more conservative assumptions.

Where the frequency is unknown, Sitesafe uses the closest frequency in the antenna's range that corresponds to the highest Maximum Permissible Exposure (MPE), resulting in a conservative analysis.

Definitions

5% Rule – The rules adopted by the FCC specify that, in general, at multiple transmitter sites actions necessary to bring the area into compliance with the guidelines are the shared responsibility of all licensees whose transmitters produce field strengths or power density levels at the area in question in excess of 5% of the exposure limits. In other words, any wireless operator that contributes 5% or greater of the MPE limit in an area that is identified to be greater than 100% of the MPE limit is responsible taking corrective actions to bring the site into compliance.

Compliance – The determination of whether a site is safe or not with regards to Human Exposure to Radio Frequency Radiation from transmitting antennas.

Decibel (dB) – A unit for measuring power or strength of a signal.

Duty Cycle – The percent of pulse duration to the pulse period of a periodic pulse train. Also, may be a measure of the temporal transmission characteristic of an intermittently transmitting RF source such as a paging antenna by dividing average transmission duration by the average period for transmission. A duty cycle of 100% corresponds to continuous operation.

Effective (or Equivalent) Isotropic Radiated Power (EIRP) – The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna.

Effective Radiated Power (ERP) – In a given direction, the relative gain of a transmitting antenna with respect to the maximum directivity of a half wave dipole multiplied by the net power accepted by the antenna from the connecting transmitter.

Gain (of an antenna) – The ratio of the maximum intensity in a given direction to the maximum radiation in the same direction from an isotropic radiator. Gain is a measure of the relative efficiency of a directional antennas as compared to an omni directional antenna.

General Population/Uncontrolled Environment – Defined by the FCC, as an area where exposure to RF energy may occur to persons who are **unaware** of the potential for exposure and who have no control of their exposure. General Population is also referenced as General Public.

Generic Antenna – For the purposes of this report, the use of "Generic" as an antenna model means the antenna information was not provided and could not be obtained while on site. In the event of unknown information, Sitesafe will use our industry specific knowledge of antenna models to select a worst case scenario antenna to model the site.

Isotropic Antenna – An antenna that is completely non-directional. In other words, an antenna that radiates energy equally in all directions.

Maximum Measurement – This measurement represents the single largest measurement recorded when performing a spatial average measurement.

Maximum Permissible Exposure (MPE) – The maximum levels of RF exposure a person may be exposed to without harmful effect and with acceptable safety factor.

Occupational/Controlled Environment – Defined by the FCC, as an area where Radio Frequency Radiation (RFR) exposure may occur to persons who are **aware** of the potential for exposure as a condition of employment or specific activity and can exercise control over their exposure.

OET Bulletin 65 – Technical guideline developed by the FCC's Office of Engineering and Technology to determine the impact of Radio Frequency radiation on Humans. The guideline was published in August 1997.

OSHA (Occupational Safety and Health Administration) – Under the Occupational Safety and Health Act of 1970, employers are responsible for providing a safe and healthy workplace for their employees. OSHA's role is to promote the safety and health of America's working men and women by setting and enforcing standards; providing training, outreach and education; establishing partnerships; and encouraging continual process improvement in workplace safety and health. For more information, visit www.osha.gov.

Radio Frequency (RF) – The frequencies of electromagnetic waves which are used for radio communications. Approximately 3 kHz to 300 GHz.

Radio Frequency Exposure (RFE) – The amount of RF power density that a person is or might be exposed to.

Spatial Average Measurement – A technique used to average a minimum of ten (10) measurements taken in a ten (10) second interval from zero (0) to six (6) feet. This measurement is intended to model the average power density an average sized human will be exposed to at a location.

Transmitter Power Output (TPO) – The radio frequency output power of a transmitter's final radio frequency stage as measured at the output terminal while connected to a load.

8618 Westwood Center Drive • Suite 315 • Vienna, VA 22182 • info@sitesafe.com • 703.276.1100

Appendix F – References

The following references can be followed for further information about RF Health and Safety.

Sitesafe, LLC.
http://www.sitesafe.com
FCC Radio Frequency Safety
http://www.fcc.gov/encyclopedia/radio-frequency-safety
National Council on Radiation Protection and Measurements (NCRP)
http://www.ncrponline.org
Institute of Electrical and Electronics Engineers, Inc., (IEEE)
http://www.ieee.org
American National Standards Institute (ANSI)
http://www.ansi.org
Environmental Protection Agency (EPA)
http://www.epa.gov/radtown/wireless-tech.html
National Institutes of Health (NIH)
http://www.niehs.nih.gov/health/topics/agents/emf/
Occupational Safety and Health Agency (OSHA)
http://www.osha.gov/SLTC/radiofrequencyradiation/
International Commission on Non-Ionizing Radiation Protection (ICNIRP)
http://www.icnirp.org
World Health Organization (WHO)
http://www.who.int/peh-emf/en/
National Cancer Institute
http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones
American Cancer Society (ACS)
http://www.cancer.org/docroot/PED/content/PED_1_3X_Cellular_Phone_Towers.asp?sitearea=PED
European Commission Scientific Committee on Emerging and Newly Identified Health Risks
http://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_022.pdf
Fairfax County, Virginia Public School Survey
http://www.fcps.edu/fts/safety-security/RFEESurvey/
UK Health Protection Agency Advisory Group on Non-ionising Radiation
http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1317133826368
Norwegian Institute of Public Health
http://www.fhi.no/dokumenter/545eea7147.pdf

PROJECT:	LTE 3C/4C
SITE NUMBER:	CTL02147
FA NUMBER:	10035298
PTN NUMBER:	-
PACE NUMBER:	MRCTB025509, MRCTB025517
SITE NAME:	WESTPORT SP TOWER
SITE ADDRESS:	880 POST ROAD EAST WESTPORT, CT 06880

at&t
550 COCHITUATE ROAD
SUITE 550 13 AND 14
FRAMINGHAM, MA 01701

smartlink
1362 MELLON ROAD
SUITE 140
HANOVER, MD 21076

FULLERTON
ENGINEERING·DESIGN
1100 E. WOODFIELD ROAD, SUITE 500
SCHAUMBURG, ILLINOIS 60173
TEL: 847-908-8400
COA# PEC.0001444
www.FullertonEngineering.com

REV	DATE	DESCRIPTION	BY
0	09/25/17	90% REVIEW	EB
1	11/03/17	FOR PERMIT	EB
2	03/07/18	REVISION	KC
3	04/06/18	FOR CONSTRUCTION	EB

I HEREBY CERTIFY THAT THESE DRAWINGS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND CONTROL, AND TO THE BEST OF MY KNOWLEDGE AND BELIEF COMPLY WITH THE REQUIREMENTS OF ALL APPLICABLE CODES.

PROJECT INFORMATION

SITE NAME:	WESTPORT SP TOWER
SITE NUMBER:	CTL02147
SITE ADDRESS:	880 POST ROAD EAST WESTPORT, CT 06880
FA NUMBER:	10035298
PTN NUMBER:	–
PACE NUMBER:	MRCTB025509, MRCTB025517
USID NUMBER:	60430
APPLICANT:	AT&T WIRELESS 550 COCHITUATE ROAD SUITE 550 13 AND 14 FRAMINGHAM, MA 01701
OWNER:	STATE OF CONNECTICUT DEPARTMENT OF PUBLIC SAFETY
JURISDICTION:	TOWN OF WESTPORT
COUNTY:	FAIRFIELD
SITE COORDINATES FROM	(RFDS)
LATITUDE:	41.1374639°
LONGITUDE:	–73.33436°
GROUND ELEV.:	58'
PROPOSED USE:	TELECOMMUNICATIONS FACILITY
AT&T RF MANAGER:	DEEPAK RATHORE
PHONE:	(860) 965–3068
EMAIL:	dr701e@att.com

PROJECT CONSULTANTS

PROJECT MANAGER:	SMARTLINK
ADDRESS:	85 RANGEWAY ROAD, SUITE 102 NORTH BILLERICA, MA 01862
CONTACT:	EDWARD WEISSMAN (917) 528–1857
EMAIL:	Edward.Weissman@smartlinkllc.com
SITE AQUISITION:	SMARTLINK
ADDRESS:	85 RANGEWAY ROAD, SUITE 102 NORTH BILLERICA, MA 01862
CONTACT:	SHARON KEEFE (978) 930–3918
EMAIL:	Sharon.Keefe@smartlinkllc.com
ENGINEER/ARCHITECT:	FULLERTON ENGINEERING
ADDRESS:	1100 E. WOODFIELD ROAD, SUITE 500 SCHAUMBURG, IL 60173
CONTACT:	MILEN DIMITROV (847) 908–8439
EMAIL:	MDimitrov@FullertonEngineering.com
CONSTRUCTION:	SMARTLINK
ADDRESS:	85 RANGEWAY ROAD, SUITE 102 NORTH BILLERICA, MA 01862
CONTACT:	MARK DONNELLY (617) 515–2080
EMAIL:	mark.donnelly@smartlinkllc.com

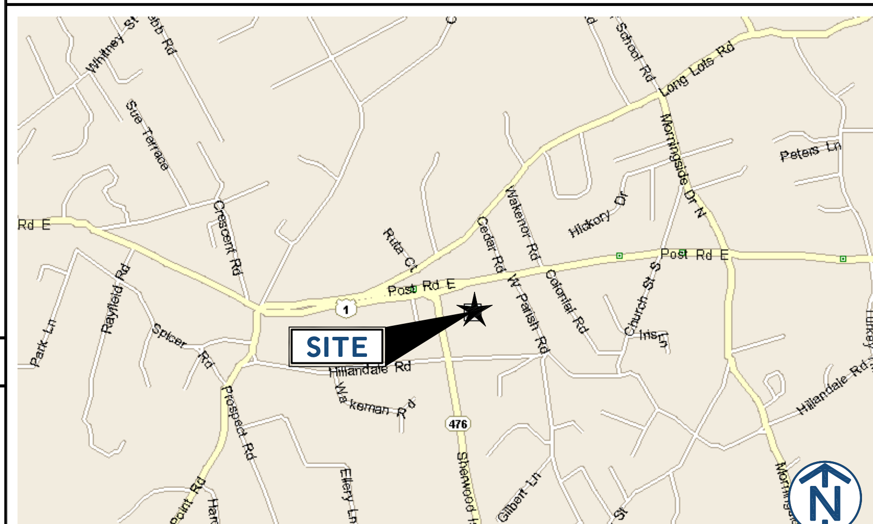
SCOPE OF WORK

LTE WCS/AWS WILL BE 3C/4C AT THE SITE WITH BRONZE CONFIGURATION. PROPOSED 3C/4C PROJECT SCOPE HEREIN BASED ON RFDS ID # 1839944, VERSION 3.00 LAST UPDATED 03/01/18.

- (3) NEW ANTENNAS TO REPLACE (3) EXISTING ANTENNAS
- (3) NEW RRUS–32 B66 UNITS
- (3) NEW RRUS–32 UNITS
- (6) NEW LOW BAND COMBINER UNITS
- (1) NEW RAYCAP UNIT
- (1) FIBER CABLE AND (2) DC POWER CABLES
- UPGRADE DUS TO 5216 AND ADD XMU
- INSTALL NEW DC12 IN LTE RACK

- CONTRACTOR SHALL FURNISH ALL MATERIAL WITH THE EXCEPTION OF AT&T SUPPLIED MATERIAL.
- ALL MATERIAL SHALL BE INSTALLED BY THE CONTRACTOR, UNLESS STATED OTHERWISE.

SITE LOCATION MAP



NO SCALE

DIRECTIONS

SCAN QR CODE FOR LINK TO SITE LOCATION MAP

APPLICABLE BUILDING CODES AND STANDARDS

ALL WORK AND MATERIALS SHALL BE PERFORMED AND INSTALLED IN ACCORDANCE WITH THE CURRENT EDITIONS OF THE FOLLOWING CODES AS ADOPTED BY THE LOCAL GOVERNING AUTHORITIES.

BUILDING CODE:	2012 INTERNATIONAL BUILDING CODE 2016 CONNECTICUT STATE BUILDING CODE SUPPLEMENT
ELECTRICAL CODE:	2014 NATIONAL ELECTRIC CODE

- FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION.
- ADA ACCESS REQUIREMENTS ARE NOT REQUIRED.
- THIS FACILITY DOES NOT REQUIRE POTABLE WATER AND WILL NOT PRODUCE ANY SEWAGE

DRAWING INDEX

NOTE: DRAWING SCALES ARE FOR 11"x17" SHEETS UNLESS OTHERWISE NOTED

SITE NAME	WESTPORT SP TOWER
SITE NUMBER:	CTL02147
SITE ADDRESS	880 POST ROAD EAST WESTPORT, CT 06880
SHEET NAME	TITLE SHEET
SHEET NUMBER	T1

PROJECT# 2017.0278.0024

GENERAL CONSTRUCTION

1. FOR THE PURPOSE OF CONSTRUCTION DRAWINGS, THE FOLLOWING DEFINITIONS SHALL APPLY:
   CONTRACTOR/CM – SMARTLINK
   OWNER – AT&T WIRELESS
2. ALL SITE WORK SHALL BE COMPLETED AS INDICATED ON THE DRAWINGS AND AT&T PROJECT SPECIFICATIONS.
3. GENERAL CONTRACTOR SHALL VISIT THE SITE AND SHALL FAMILIARIZE HIMSELF WITH ALL CONDITIONS AFFECTING THE PROPOSED WORK AND SHALL MAKE PROVISIONS. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR FAMILIARIZING HIMSELF WITH ALL CONTRACT DOCUMENTS, FIELD CONDITIONS, DIMENSIONS, AND CONFIRMING THAT THE WORK MAY BE ACCOMPLISHED AS SHOWN PRIOR TO PROCEEDING WITH CONSTRUCTION. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO THE COMMENCEMENT OF WORK.
4. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. GENERAL CONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF WORK.
5. ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES, AND APPLICABLE REGULATIONS.
6. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
7. PLANS ARE NOT TO BE SCALED. THESE PLANS ARE INTENDED TO BE A DIAGRAMMATIC OUTLINE ONLY UNLESS OTHERWISE NOTED. DIMENSIONS SHOWN ARE TO FINISH SURFACES UNLESS OTHERWISE NOTED. SPACING BETWEEN EQUIPMENT IS THE MINIMUM REQUIRED CLEARANCE. THEREFORE, IT IS CRITICAL TO FIELD VERIFY DIMENSIONS, SHOULD THERE BE ANY QUESTIONS REGARDING THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A CLARIFICATION FROM THE ENGINEER PRIOR TO PROCEEDING WITH THE WORK. DETAILS ARE INTENDED TO SHOW DESIGN INTENT. MODIFICATIONS MAY BE REQUIRED TO SUIT JOB DIMENSIONS OR CONDITIONS AND SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF WORK AND PREPARED BY THE ENGINEER PRIOR TO PROCEEDING WITH WORK.
8. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
9. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION SPACE FOR APPROVAL BY THE ENGINEER PRIOR TO PROCEEDING.
10. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF WORK AREA, ADJACENT AREAS AND BUILDING OCCUPANTS THAT ARE LIKELY TO BE AFFECTED BY THE WORK UNDER THIS CONTRACT. WORK SHALL CONFIRM TO ALL OSHA REQUIREMENTS AND THE LOCAL JURISDICTION.
11. GENERAL CONTRACTOR SHALL COORDINATE WORK AND SCHEDULE WORK ACTIVITIES WITH OTHER DISCIPLINES.
12. ERECTION SHALL BE DONE IN A WORKMANLIKE MANNER BY COMPETENT EXPERIENCED WORKMAN IN ACCORDANCE WITH APPLICABLE CODES AND THE BEST ACCEPTED PRACTICE. ALL MEMBERS SHALL BE LAID PLUMB AND TRUE AS INDICATED ON THE DRAWINGS.
13. SEAL PENETRATIONS THROUGH FIRE RATED AREAS WITH UL LISTED MATERIALS APPROVED BY LOCAL JURISDICTION. CONTRACTOR SHALL KEEP AREA CLEAN, HAZARD FREE, AND DISPOSE OF ALL DEBRIS.
14. WORK PREVIOUSLY COMPLETED IS REPRESENTED BY LIGHT SHADED LINES AND NOTES. THE SCOPE OF WORK FOR THIS PROJECT IS REPRESENTED BY DARK SHADED LINES AND NOTES. CONTRACTOR SHALL NOTIFY THE GENERAL CONTRACTOR OF ANY EXISTING CONDITIONS THAT DEVIATE FROM THE DRAWINGS PRIOR TO BEGINNING CONSTRUCTION.
15. CONTRACTOR SHALL PROVIDE WRITTEN NOTICE TO THE CONSTRUCTION MANAGER 48 HOURS PRIOR TO COMMENCEMENT OF WORK.
16. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES. ANY DAMAGED PART SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE OWNER.
17. THE CONTRACTOR SHALL CONTACT UTILITY LOCATING SERVICES PRIOR TO THE START OF CONSTRUCTION.
18. GENERAL CONTRACTOR SHALL COORDINATE AND MAINTAIN ACCESS FOR ALL TRADES AND CONTRACTORS TO THE SITE AND/OR BUILDING.
19. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR SECURITY OF THE SITE FOR THE DURATION OF CONSTRUCTION UNTIL JOB COMPLETION.
20. THE GENERAL CONTRACTOR SHALL MAINTAIN IN GOOD CONDITION ONE COMPLETE SET OF PLANS WITH ALL REVISIONS, ADDENDA, AND CHANGE ORDERS ON THE PREMISES AT ALL TIMES.
21. THE GENERAL CONTRACTOR SHALL PROVIDE PORTABLE FIRE EXTINGUISHERS WITH A RATING OF NOT LESS THAN 2–A OT 2–A:10–B:C AND SHALL BE WITHIN 25 FEET OF TRAVEL DISTANCE TO ALL PORTIONS OF WHERE THE WORK IS BEING COMPLETED DURING CONSTRUCTION.
22. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC, AND OTHER UTILITIES SHALL BE PROTECTED AT ALL TIMES, AND WHERE REQUIRED FOR THE PROPER EXECUTION OF THE WORK, SHALL BE RELOCATED AS DIRECTED BY THE ENGINEER. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR DRILLING PIERS AROUND OR NEAR UTILITIES. CONTRACTOR SHALL PROVIDE SAFETY TRAINING FOR THE WORKING CREW. THIS SHALL INCLUDE BUT NOT BE LIMITED TO A) FALL PROTECTION, B) CONFINED SPACE, C) ELECTRICAL SAFETY, AND D) TRENCHING & EXCAVATION.
23. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC, AND OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED, CAPPED, PLUGGED OR OTHERWISE DISCONNECTED AT POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, AS DIRECTED BY THE RESPONSIBLE ENGINEER, AND SUBJECT TO THE APPROVAL OF THE OWNER AND/OR LOCAL UTILITIES.
24. THE AREAS OF THE OWNER'S PROPERTY DISTURBED BY THE WORK AND NOT COVERED BY THE TOWER, EQUIPMENT OR DRIVEWAY, SHALL BE GRADED TO A UNIFORM SLOPE, AND STABILIZED TO PREVENT EROSION.
25. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO THE EXISTING SITE DURING CONSTRUCTION. EROSION CONTROL MEASURES, IF REQUIRED DURING CONSTRUCTION, SHALL BE IN CONFORMANCE WITH THE FEDERAL AND LOCAL JURISDICTION FOR EROSION AND SEDIMENT CONTROL.
26. NO FILL OR EMBANKMENT MATERIAL SHALL BE PLACED ON FROZEN GROUNDING. FROZEN MATERIALS, SNOW OR ICE SHALL NOT BE PLACED IN ANY FILL OR EMBANKMENT.
27. THE SUBGRADE SHALL BE BROUGHT TO A SMOOTH UNIFORM GRADE AND COMPACTED TO 95 PERCENT STANDARD PROCTOR DENSITY UNDER PAVEMENT AND STRUCTURES AND 80 PERCENT STANDARD PROCTOR DENSITY IN OPEN SPACE. ALL TRENCHES IN PUBLIC RIGHT OF WAY SHALL BE BACKFILLED WITH FLOWABLE FILL OR OTHER MATERIAL PRE–APPROVED BY THE LOCAL JURISDICTION.
28. ALL NECESSARY RUBBISH, STUMPS, DEBRIS, STICKS, STONES, AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A LAWFUL MANNER.
29. ALL BROCHURES, OPERATING AND MAINTENANCE MANUALS, CATALOGS, SHOP DRAWINGS, AND OTHER DOCUMENTS SHALL BE TURNED OVER TO THE GENERAL CONTRACTOR AT COMPLETION OF CONSTRUCTION AND PRIOR TO PAYMENT.
30. CONTRACTOR SHALL SUBMIT A COMPLETE SET OF AS–BUILT REDLINES TO THE GENERAL CONTRACTOR UPON COMPLETION OF PROJECT AND PRIOR TO FINAL PAYMENT.
31. CONTRACTOR SHALL LEAVE PREMISES IN A CLEAN CONDITION.
32. THE PROPOSED FACILITY WILL BE UNMANNED AND DOES NOT REQUIRE POTABLE WATER OR SEWER SERVICE, AND IS NOT FOR HUMAN HABITAT (NO HANDICAP ACCESS REQUIRED).
33. OCCUPANCY IS LIMITED TO PERIODIC MAINTENANCE AND INSPECTION, APPROXIMATELY 2 TIMES PER MONTH, BY AT&T TECHNICIANS.
34. NO OUTDOOR STORAGE OR SOLID WASTE CONTAINERS ARE PROPOSED.
35. ALL MATERIAL SHALL BE FURNISHED AND WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST REVISION AT&T MOBILITY GROUNDING STANDARD "TECHNICAL SPECIFICATION FOR CONSTRUCTION OF GSM/GPRS WIRELESS SITES" AND "TECHNICAL SPECIFICATION FOR FACILITY GROUNDING". IN CASE OF A CONFLICT BETWEEN THE CONSTRUCTION SPECIFICATION AND THE DRAWINGS, THE DRAWINGS SHALL GOVERN.
36. CONTRACTORS SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS AND INSPECTIONS REQUIRED FOR CONSTRUCTION. IF CONTRACTOR CANNOT OBTAIN A PERMIT, THEY MUST NOTIFY THE GENERAL CONTRACTOR IMMEDIATELY.
37. CONTRACTOR SHALL REMOVE ALL TRASH AND DEBRIS FROM THE SITE ON A DAILY BASIS.
38. INFORMATION SHOWN ON THESE DRAWINGS WAS OBTAINED FROM SITE VISITS AND/OR DRAWINGS PROVIDED BY THE SITE OWNER. CONTRACTORS SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION.
39. NO WHITE STROBE LIGHTS ARE PERMITTED. LIGHTING IF REQUIRED, WILL MEET FAA STANDARDS AND REQUIREMENTS.

ANTENNA MOUNTING

40. DESIGN AND CONSTRUCTION OF ANTENNA SUPPORTS SHALL CONFORM TO CURRENT ANSI/TIA–222 OR APPLICABLE LOCAL CODES.
41. ALL STEEL MATERIALS SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT–DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS", UNLESS NOTED OTHERWISE.
42. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC–COATING (HOT–DIP) ON IRON AND STEEL HARDWARE", UNLESS NOTED OTHERWISE.
43. DAMAGED GALVANIZED SURFACES SHALL BE REPAIRED BY COLD GALVANIZING IN ACCORDANCE WITH ASTM A780.
44. ALL ANTENNA MOUNTS SHALL BE INSTALLED WITH LOCK NUTS, DOUBLE NUTS AND SHALL BE TORQUED TO MANUFACTURER'S RECOMMENDATIONS.
45. CONTRACTOR SHALL INSTALL ANTENNA PER MANUFACTURER'S RECOMMENDATION FOR INSTALLATION AND GROUNDING.
46. ALL UNUSED PORTS ON ANY ANTENNAS SHALL BE TERMINATED WITH A 50–OHM LOAD TO ENSURE ANTENNAS PERFORM AS DESIGNED.
47. PRIOR TO SETTING ANTENNA AZIMUTHS AND DOWNTILTS, ANTENNA CONTRACTOR SHALL CHECK THE ANTENNA MOUNT FOR TIGHTNESS AND ENSURE THAT THEY ARE PLUMB. ANTENNA AZIMUTHS SHALL BE SET FROM TRUE NORTH AND BE ORIENTED WITHIN +/– 5% AS DEFINED BY THE RFDS. ANTENNA DOWNTILTS SHALL BE WITHIN +/– 0.5% AS DEFINED BY THE RFDS. REFER TO ND–00246.
48. JUMPERS FROM THE TMA'S MUST TERMINATE TO OPPOSITE POLARIZATION'S IN EACH SECTOR.
49. CONTRACTOR SHALL RECORD THE SERIAL #, SECTOR, AND POSITION OF EACH ACTUATOR INSTALLED AT THE ANTENNAS AND PROVIDE THE INFORMATION TO AT&T.
50. TMA'S SHALL BE MOUNTED ON PIPE DIRECTLY BEHIND ANTENNAS AS CLOSE TO ANTENNA AS FEASIBLE IN A VERTICAL POSITION.

TORQUE REQUIREMENTS

51. ALL RF CONNECTIONS SHALL BE TIGHTENED BY A TORQUE WRENCH.
52. ALL RF CONNECTIONS, GROUNDING HARDWARE AND ANTENNA HARDWARE SHALL HAVE A TORQUE MARK INSTALLED IN A CONTINUOUS STRAIGHT LINE FROM BOTH SIDES OF THE CONNECTION.
    A. RF CONNECTION BOTH SIDES OF THE CONNECTOR.
    B. GROUNDING AND ANTENNA HARDWARE ON THE NUT SIDE STARTING FROM THE THREADS TO THE SOLID SURFACE. EXAMPLE OF SOLID SURFACE: GROUND BAR, ANTENNA BRACKET METAL.

FIBER & POWER CABLE MOUNTING

53. THE FIBER OPTIC TRUNK CABLES SHALL BE INSTALLED INTO CONDUITS, CHANNEL CABLE TRAYS, OR CABLE TRAY. WHEN INSTALLING FIBER OPTIC TRUNK CABLES INTO A CABLE TRAY SYSTEM, THEY SHALL BE INSTALLED INTO AN INTER DUCT AND A PARTITION BARRIER SHALL BE INSTALLED BETWEEN THE 600 VOLT CABLES AND THE INTER DUCT IN ORDER TO SEGREGATE CABLE TYPES. OPTIC FIBER TRUNK CABLES SHALL HAVE APPROVED CABLE RESTRAINTS EVERY (60) SIXTY FEET AND SECURELY FASTENED TO THE CABLE TRAY SYSTEM. NFPA 70 (NEC) ARTICLE 770 RULES SHALL APPLY.
54. THE TYPE TC–ER CABLES SHALL BE INSTALLED INTO CONDUITS, CHANNEL CABLE TRAYS, OR CABLE TRAY AND SHALL BE SECURED AT INTERVALS NOT EXCEEDING (6) SIX FEET. AN EXCEPTION; WHERE TYPE TC–ER CABLES ARE NOT SUBJECT TO PHYSICAL DAMAGE, CABLES SHALL BE PERMITTED TO MAKE A TRANSITION BETWEEN CONDUITS, CHANNEL CABLE TRAYS, OR CABLE TRAY WHICH ARE SERVING UTILIZATION EQUIPMENT OR DEVICES, A DISTANCE (6) SIX FEET SHALL NOT BE EXCEEDED WITHOUT CONTINUOUS SUPPORTING. NFPA 70 (NEC) ARTICLES 336 AND 392 RULES SHALL APPLY.
55. WHEN INSTALLING OPTIC FIBER TRUNK CABLES OR TYPE TC–ER CABLES INTO CONDUITS, NFPA 70 (NEC) ARTICLE 300 RULES SHALL APPLY.

COAXIAL CABLE NOTES

62. TYPES AND SIZES OF THE ANTENNA CABLE ARE BASED ON ESTIMATED LENGTHS. PRIOR TO

    ORDERING CABLE, CONTRACTOR SHALL VERIFY ACTUAL LENGTH BASED ON CONSTRUCTION LAYOUT AND NOTIFY THE PROJECT MANAGER IF ACTUAL LENGTHS EXCEED ESTIMATED LENGTHS.
63. CONTRACTOR SHALL VERIFY THE DOWN–TILT OF EACH ANTENNA WITH A DIGITAL LEVEL.
64. CONTRACTOR SHALL CONFIRM COAX COLOR CODING PRIOR TO CONSTRUCTION.
65. ALL JUMPERS TO THE ANTENNAS FROM THE MAIN TRANSMISSION LINE SHALL BE 1/2" DIA. LDF AND SHALL NOT EXCEED 6'–0".
66. ALL COAXIAL CABLE SHALL BE SECURED TO THE DESIGNED SUPPORT STRUCTURE, IN AN APPROVED MANNER, AT DISTANCES NOT TO EXCEED 4'–0" OC.
67. CONTRACTOR SHALL FOLLOW ALL MANUFACTURER'S RECOMMENDATIONS REGARDING BOTH THE INSTALLATION AND GROUNDING OF ALL COAXIAL CABLES, CONNECTORS, ANTENNAS, AND ALL OTHER EQUIPMENT.
68. CONTRACTOR SHALL GROUND ALL EQUIPMENT. INCLUDING ANTENNAS, RET MOTORS, TMA'S, COAX CABLES, AND RET CONTROL CABLES AS A COMPLETE SYSTEM. GROUNDING SHALL BE EXECUTED BY QUALIFIED WIREMEN IN COMPLIANCE WITH MANUFACTURER'S SPECIFICATION AND RECOMMENDATION.
69. CONTRACTOR SHALL PROVIDE STRAIN–RELIEF AND CABLE SUPPORTS FOR ALL CABLE ASSEMBLIES, COAX CABLES, AND RET CONTROL CABLES. CABLE STRAIN–RELIEFS AND CABLE SUPPORTS SHALL BE APPROVED FOR THE PURPOSE. INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS.
70. CONTRACTOR TO VERIFY THAT EXISTING COAX HANGERS ARE STACKABLE SNAP IN HANGERS. IF EXISTING HANGERS ARE NOT STACKABLE SNAP IN HANGERS THE CONTRACTOR SHALL REPLACE EXISTING HANGERS WITH NEW SNAP IN HANGERS IF APPLICABLE.

GENERAL CABLE AND EQUIPMENT NOTES

71. CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY ANTENNA, TMAS, DIPLEXERS, AND COAX CONFIGURATION, MAKE AND MODELS PRIOR TO INSTALLATION.
72. ALL CONNECTIONS FOR HANGERS, SUPPORTS, BRACING, ETC. SHALL BE INSTALLED PER TOWER MANUFACTURER'S RECOMMENDATIONS.
73. CONTRACTOR SHALL REFERENCE THE TOWER STRUCTURAL ANALYSIS/DESIGN DRAWINGS FOR DIRECTIONS ON CABLE DISTRIBUTION/ROUTING.
74. ALL OUTDOOR RF CONNECTORS/CONNECTIONS SHALL BE WEATHERPROOFED, EXCEPT THE RET CONNECTORS, USING BUTYL TAPE AFTER INSTALLATION AND FINAL CONNECTIONS ARE MADE. BUTYL TAPE SHALL HAVE A MINIMUM OF ONE–HALF TAPE WIDTH OVERLAP ON EACH TURN AND EACH LAYER SHALL BE WRAPPED THREE TIMES. WEATHERPROOFING SHALL BE SMOOTH WITHOUT BUCKLING. BUTYL BLEEDING IS NOT ALLOWED.
75. IF REQUIRED TO PAINT ANTENNAS AND/OR COAX:
    A. TEMPERATURE SHALL BE ABOVE 50° F.
    B. PAINT COLOR MUST BE APPROVED BY BUILDING OWNER/LANDLORD.
    C. FOR REGULATED TOWERS, FAA/FCC APPROVED PAINT IS REQUIRED.
    D. DO NOT PAINT OVER COLOR CODING OR ON EQUIPMENT MODEL NUMBERS
76. ALL CABLES SHALL BE GROUNDED WITH COAXIAL CABLE GROUND KITS. FOLLOW THE MANUFACTURER'S RECOMMENDATIONS.
    A. GROUNDING AT THE ANTENNA LEVEL.
    B. GROUNDING AT MID LEVEL, TOWERS WHICH ARE OVER 200'–0", ADDITIONAL CABLE GROUNDING REQUIRED.
    C. GROUNDING AT BASE OF TOWER PRIOR TO TURNING HORIZONTAL.
    D. GROUNDING OUTSIDE THE EQUIPMENT SHELTER AT ENTRY PORT.
    E. GROUNDING INSIDE THE EQUIPMENT SHELTER AT THE ENTRY PORT.
77. ALL PROPOSED GROUND BAR DOWNLEADS ARE TO BE TERMINATED TO THE EXISTING ADJACENT GROUND BAR DOWNLEADS A MINIMUM DISTANCE OF 4'–0" BELOW GROUND BAR. TERMINATIONS MAY BE EXOTHERMIC OR COMPRESSION.

at&t
550 COCHITUATE ROAD
SUITE 550 13 AND 14
FRAMINGHAM, MA 01701

smartlink
1362 MELLON ROAD
SUITE 140
HANOVER, MD 21076

FULLERTON
ENGINEERING · DESIGN
1100 E. WOODFIELD ROAD, SUITE 500
SCHAUMBURG, ILLINOIS 60173
TEL: 847-908-8400
COA# PEC.0001444
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0	09/25/17	90% REVIEW	EB
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3	04/06/18	FOR CONSTRUCTION	EB

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STATE OF CONNECTICUT · HENRY M. BELLAGAMBA · 25358 · LICENSED PROFESSIONAL ENGINEER

SITE NAME

WESTPORT SP TOWER

SITE NUMBER:

CTL02147

SITE ADDRESS

880 POST ROAD EAST
WESTPORT, CT 06880

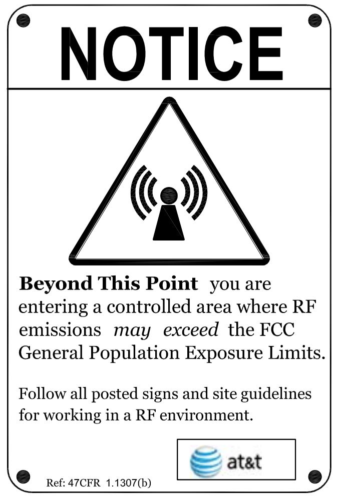
SHEET NAME

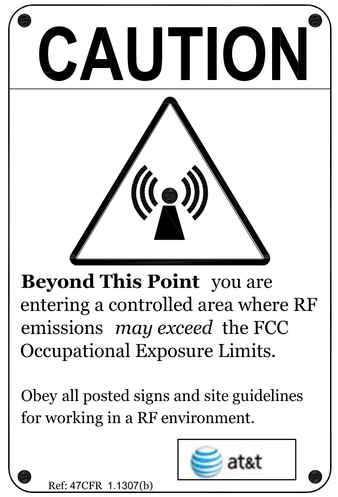
NOTES AND SPECIFICATIONS

SHEET NUMBER

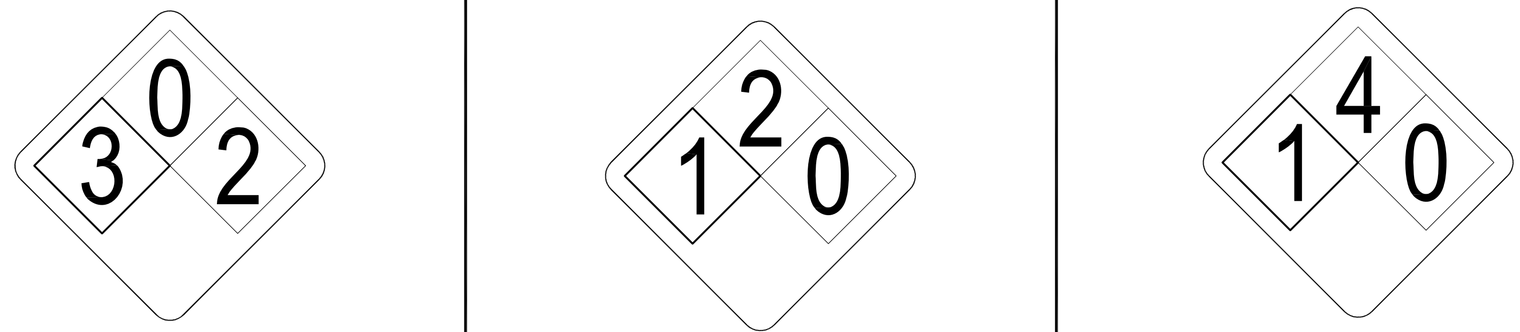
SP1

PROJECT# 2017.0278.0024





ALERTING SIGNS

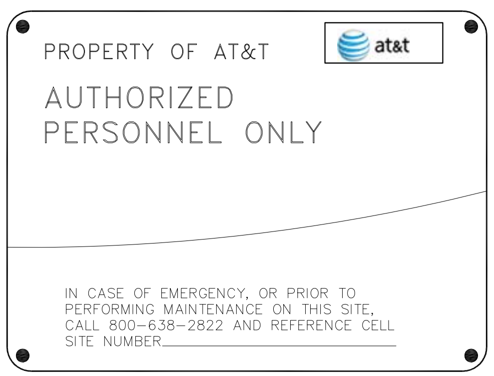


ALERTING SIGN (FOR CELL SITE BATTERIES)

ALERTING SIGN (FOR DIESEL FUEL)

ALERTING SIGN (FOR PROPANE)

ALERTING SIGN



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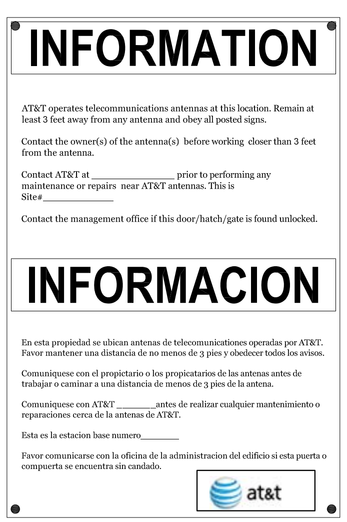

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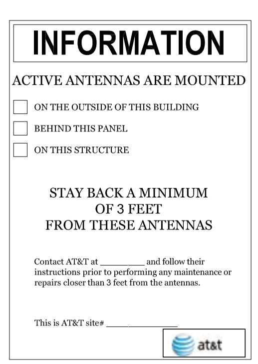

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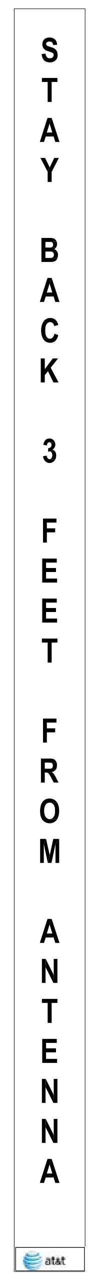

INFO SIGN #3

GENERAL SIGNAGE GUIDELINES

STRUCTURE TYPE	INFO SIGN #1	INFO SIGN #2	INFO SIGN #3	INFO SIGN #4	STRIPING	NOTICE SIGN	CAUTION SIGN
TOWERS							
MONOPOLE/MONOPINE/MONOPALM	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS	CLIMBING SIDE OF THE TOWER	ON BACKSIDE OF ANTENNAS	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS			AT THE HEIGHT OF THE FIRST CLIMBING STEP, MIN 9 FT ABOVE GROUND
SEC TOWERS/TOWERS WITH HIGH VOLTAGE	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS	CLIMBING SIDE OF THE TOWER	ON BACKSIDE OF ANTENNAS	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS			
LIGHT POLES/FLAG POLES	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS	ON THE POLE, NO LESS THAN 3FT BELOW THE ANTENNA AND LESS THAN 9FT ABOVE GROUND	ON BACKSIDE OF ANTENNAS	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS			
UTILITY WOOD POLES (JPA)	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS	ON THE POLE, NO LESS THAN 3FT BELOW THE ANTENNA AND LESS THAN 9FT ABOVE GROUND	ON BACKSIDE OF ANTENNAS	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS		IF GP MAX VALUE OF MPE AT ANTENNA LEVEL IS: 0-99%; NOTICE SIGN; OVER 99%: CAUTION SIGN AT NO LESS THAN 3FT BELOW ANTENNA AND 9FT ABOVE GROUND	
MICROCELLS MOUNTED ON NON-JPA POLES	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS	ON THE POLE, NO LESS THAN 3FT BELOW THE ANTENNA AND LESS THAN 9FT ABOVE GROUND	ON BACKSIDE OF ANTENNAS	ENTRANCE GATES, SHELTER DOORS OR ON THE OUTDOOR CABINETS		NOTICE OR CAUTION SIGN AT NO LESS THAN 9FT ABOVE GROUND: ONLY IF THE EXPOSURE EXCEEDS 90% OF THE GENERAL PUBLIC EXPOSURE AT EXPOSURE AT 6FT ABOVE GROUND OR AT OUTSIDE OF SURFACE OF ADJACENT BUILDING	
TOWERS							
AT ALL ACCESS POINTS TO THE ROOF	X			X			
ON ANTENNAS	X		X	X			
CONCEALED ANTENNAS	X	X		X			
ANTENNAS MOUNTED FACING OUTSIDE THE BUILDING	X	X		X			
ANTENNAS ON SUPPORT STRUCTURE	X	X		X			
ROOFVIEW GRAPH							
RADIATION AREA IS WITHIN 3FT FROM ANTENNA	X	ADJACENT TO EACH ANTENNA		X		EITHER NOTICE OR CAUTION SIGN (BASED ON ROOFVIEW RESULTS) AT ANTENNA /BARRIER	
RADIATION AREA IS BEYOND 3FT FROM ANTENNA	X	ADJACENT TO EACH ANTENNA		X	DIAGONAL, YELLOW STRIPING AS TO ROOFVIEW GRAPH		
CHURCH STEEPLES	ACCESS TO STEEPLE	ADJACENT TO ANTENNAS IF ANTENNAS ARE CONCEALED	ON BACKSIDE OF ANTENNAS	ACCESS TO STEEPLE			CAUTION SIGN AT THE ANTENNAS
WATER STATIONS	ACCESS TO LADDER	ADJACENT TO ANTENNAS IF ANTENNAS ARE CONCEALED	ON BACKSIDE OF ANTENNAS	ACCESS TO LADDER			CAUTION SIGN BESIDE INFO SIGN #1, MIN. 9FT ABOVE GROUND

NOTES FOR ROOFTOP SITES:

1. EITHER NOTICE OR CAUTION SIGNS NEED TO BE POSTED AT EACH SECTOR AS CLOSE AS POSSIBLE TO: THE OUTER EDGE OF THE STRIPED OFF AREA OR THE OUTER ANTENNAS OF THE SECTOR
2. IF ROOFVIEWS SHOWS: ONLY BLUE = NOTICE SIGN, BLUE AND YELLOW = CAUTION SIGN, ONLY YELLOW = CAUTION SIGN TO BE INSTALLED
3. SHOULD THE REQUIRED STRIPING AREAS INTERFERE WITH ANY STRUCTURE OR EQUIPMENT (A/C, VENTS, ROOF HATCH, DOORS, OTHER ANTENNAS, DISHES, ETC.). PLEASE NOTIFY AT&T TO MODIFY THE STRIPING AREA, PRIOR TO STARTING THE WORK.

SIGNAGE GUIDELINES CHART

at&t
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SUITE 550 13 AND 14
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SITE NUMBER:
CTL02147

SITE ADDRESS
880 POST ROAD EAST
WESTPORT, CT 06880

SHEET NAME
NOTES AND SPECIFICATIONS

SHEET NUMBER
SP2

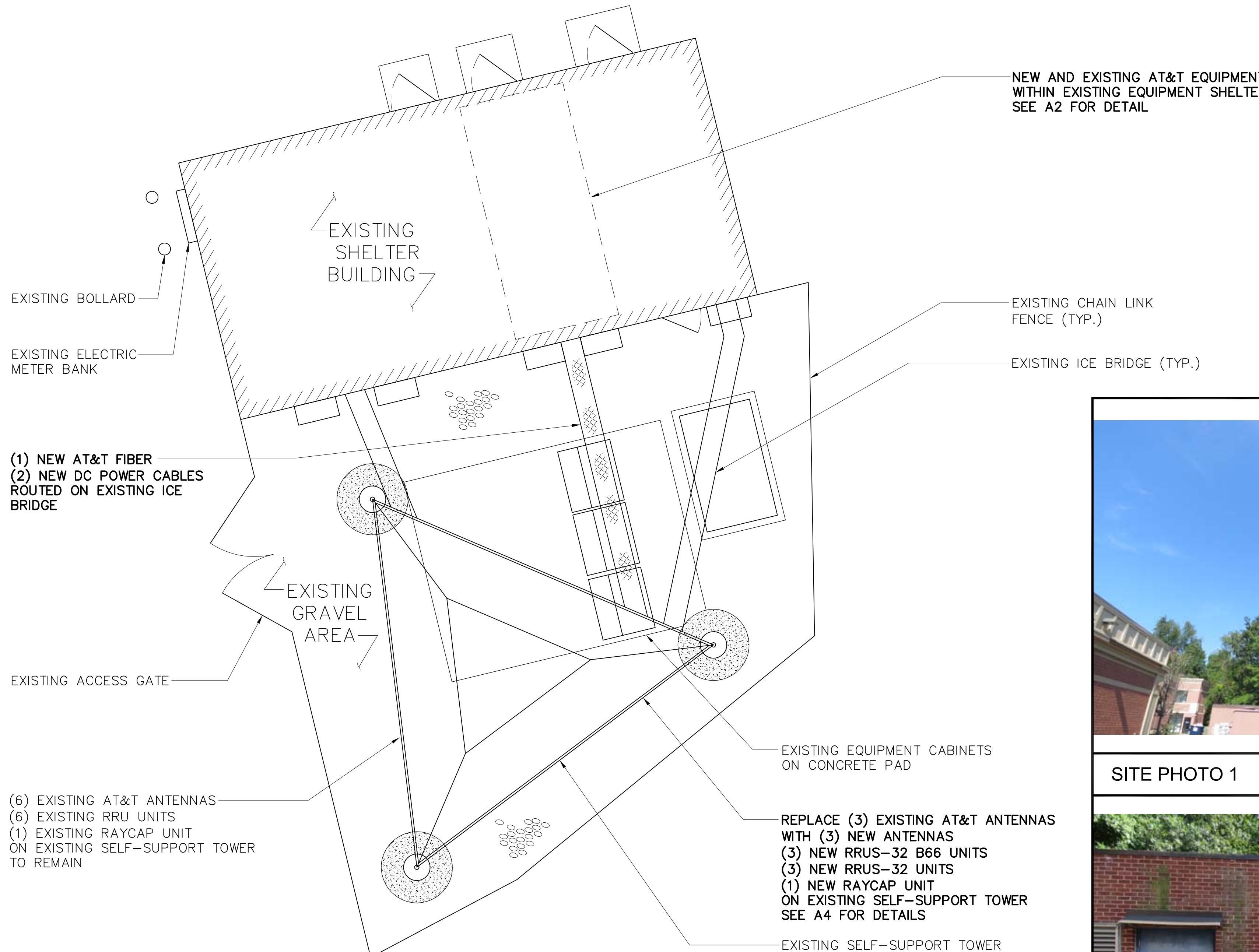
PROJECT# 2017.0278.0024

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AGL	ABOVE GRADE LEVEL
AMSL	ABOVE MEAN SEA LEVEL
APPROX	APPROXIMATE
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BLDG	BUILDING
BTS	BASE TRANSMISSION STATION
℄	CENTERLINE
CLR	CLEAR
COL	COLUMN
CONC	CONCRETE
CND	CONDUIT
DWG	DRAWING
FT	FOOT(FEET)
EGB	EQUIPMENT GROUND BAR
ELEC	ELECTRICAL
EMT	ELECTRICAL METALLIC TUBING
ELEV	ELEVATION
EQUIP	EQUIPMENT
(E)	EXISTING
EXT	EXTERIOR
FND	FOUNDATION
F	FIBER
FIF	FACILITY INTERFACE FRAME
GA	GAUGE
GALV	GALVANIZED
GPS	GLOBAL POSITIONING SYSTEM
GND	GROUND
GSM	GLOBAL SYSTEM FOR MOBILE COMMUNICATION
LTE	LONG TERM EVOLUTION
MAX	MAXIMUM
MCPA	MULTI-CARRIER POWER AMPLIFIER
MFR	MANUFACTURER
MGB	MASTER GROUND BAR
MIN	MINIMUM
MTS	MANUAL TRANSFER SWITCH
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
OE/OT	OVERHEAD ELECTRIC/TELCO
PPC	POWER PROTECTION CABINET
PL	PROPERY LINE
RBS	RADIO BASED STATION
RET	REMOTE ELECTRIC TILT
RRU	REMOTE RADIO UNIT
RGS	RIGID GALVANIZED STEEL
IN	INCH(ES)
INT	INTERIOR
LB(S), #	POUND(S)
SF	SQUARE FOOT
STL	STEEL
TMA	TOWER MOUNTED AMPLIFIER
TYP	TYPICAL
UE/UT	UNDERGROUND ELECTRIC/TELCO
UNO	UNLESS NOTED OTHERWISE
UMTS	UNIVERSAL MOBILE TELE-COMMUNICATION SYSTEM
VIF	VERIFY IN FIELD
W/	WITH
XFMR	TRANSFORMER

SYMBOLS

REVISION
WORK POINT
UTILITY POLE
COMPRESSED STONE
BRICK
CONCRETE
EARTH
GRAVEL
MASONRY
STEEL
CENTERLINE
PROPERTY LINE
LEASE LINE
EASEMENT LINE
CHAIN LINK FENCE
WOOD FENCE
UE — BELOW GRADE ELECTRIC
UT — BELOW GRADE TELEPHONE
OE/OT — OVERHEAD ELECTRIC/TELEPHONE
SECTION REFERENCE



COMPOUND PLAN — SCALE: 3/32" = 1'-0" — 1

SITE PHOTO 1 — SCALE: N.T.S. — 2

SITE PHOTO 2 — SCALE: N.T.S. — 3

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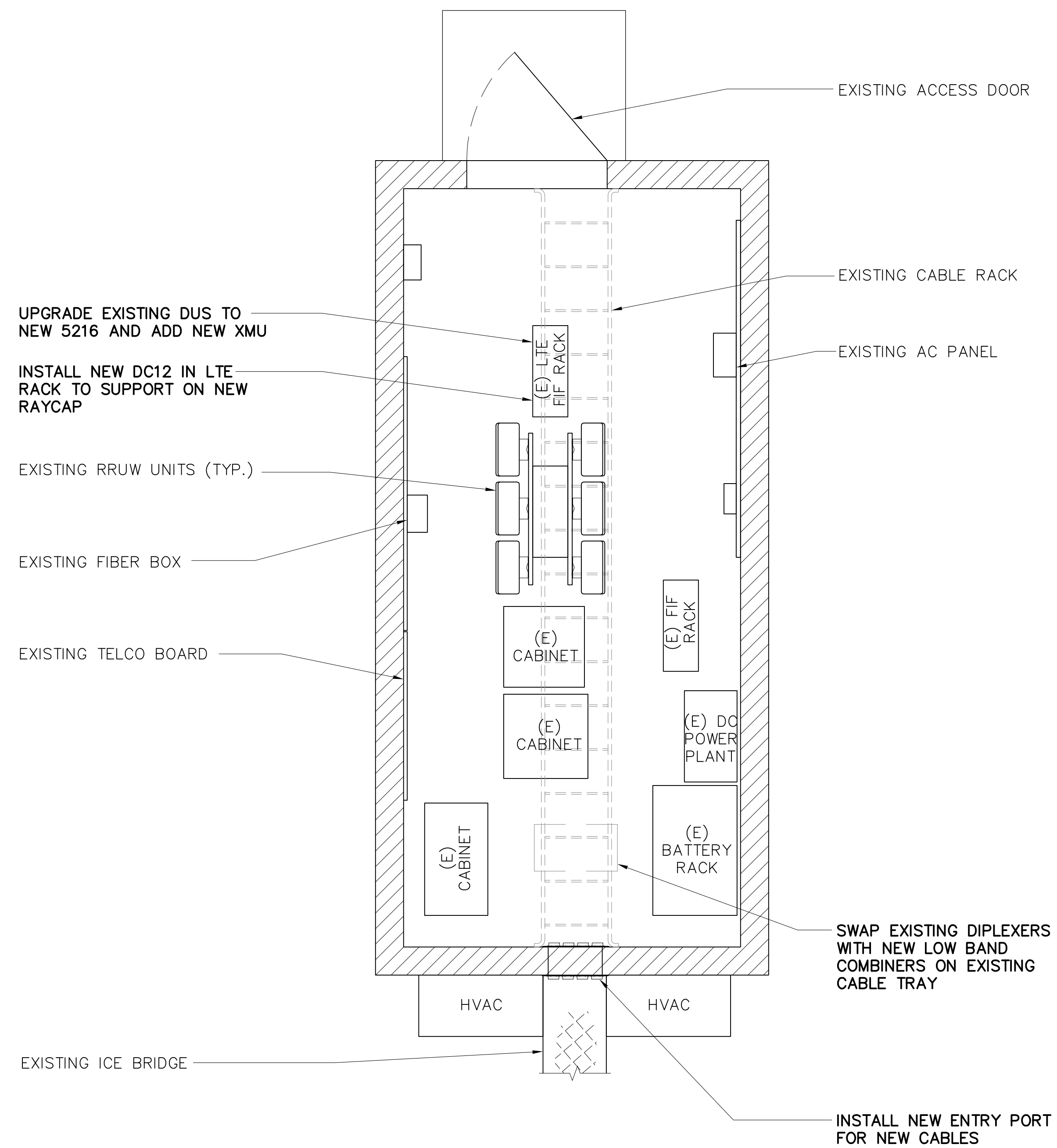
SITE ADDRESS
880 POST ROAD EAST
WESTPORT, CT 06880

SHEET NAME
COMPOUND PLAN

SHEET NUMBER
A1

PROJECT# 2017.0278.0024



EQUIPMENT PLAN

SCALE: 1/4" = 1'-0" 1

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STATE OF CONNECTICUT HENRY M. BELLAGAMBA 25358 LICENSED PROFESSIONAL ENGINEER

SITE NAME

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SITE NUMBER:

CTL02147

SITE ADDRESS

880 POST ROAD EAST
WESTPORT, CT 06880

SHEET NAME

EQUIPMENT PLAN

SHEET NUMBER

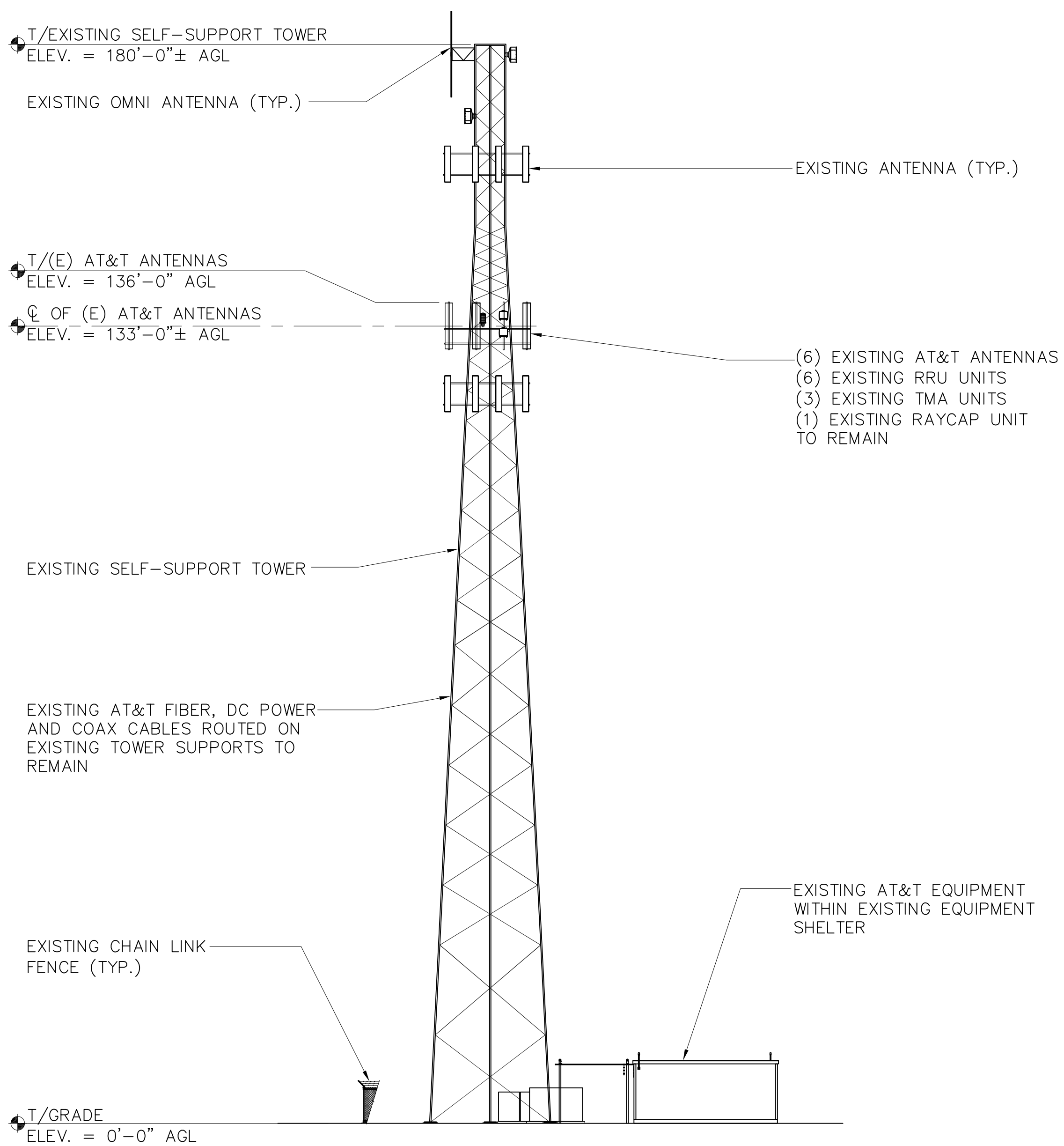
A2

PROJECT# 2017.0278.0024

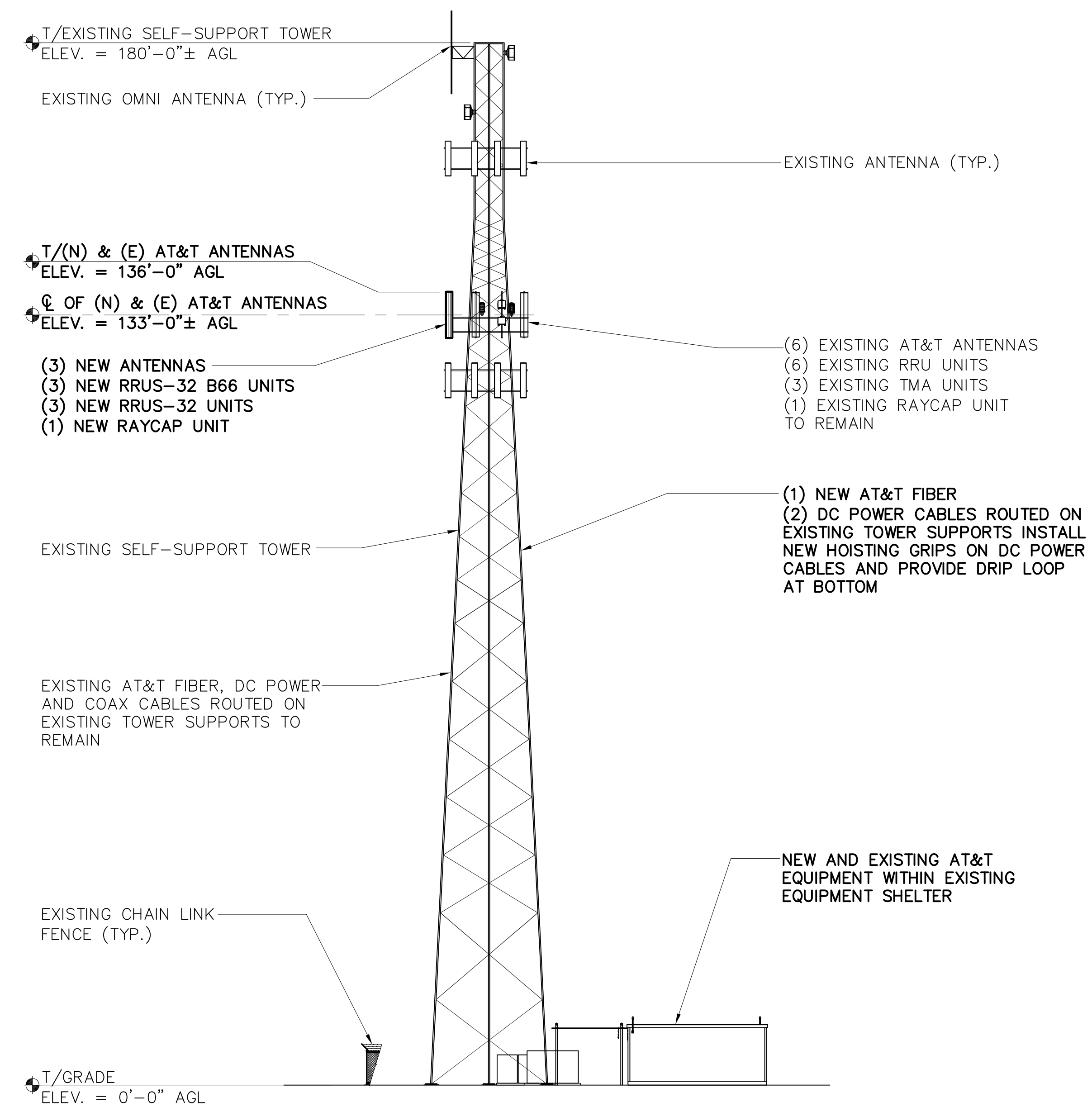
NOTES:

1. CALCULATIONS FOR THE STRUCTURE WERE PREPARED BY OTHERS AND THOSE CALCULATIONS CERTIFY THE CAPACITY OF THE STRUCTURE TO SUPPORT THE NEW EQUIPMENT
2. CALCULATIONS FOR THE ANTENNA MOUNTS WERE PREPARED BY FULLERTON AND THOSE CALCULATIONS CERTIFY THE CAPACITY OF THE STRUCTURE TO SUPPORT THE NEW EQUIPMENT
3. CABLES NOT SHOWN FOR CLARITY

NOTE:
3 FEET MINIMUM SEPARATION BETWEEN LTE ANTENNAS.
6 FEET MINIMUM SEPARATION BETWEEN 700BC & 700 DE



EXISTING ELEVATION — SCALE: 1" = 30'-0" — 1



NEW ELEVATION — SCALE: 1" = 30'-0" — 2

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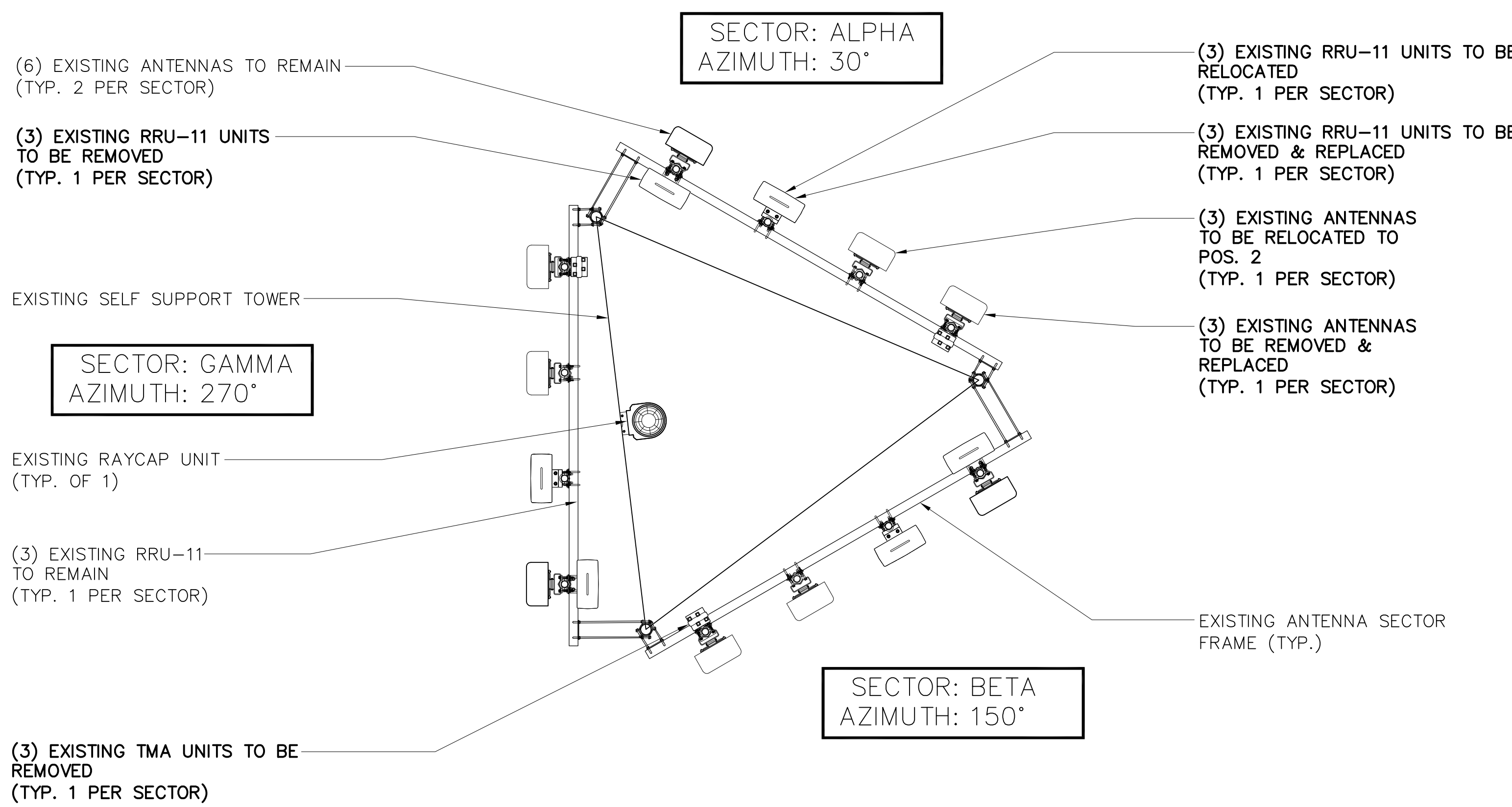
SHEET NAME
ELEVATIONS

SHEET NUMBER
A3

PROJECT# 2017.0278.0024

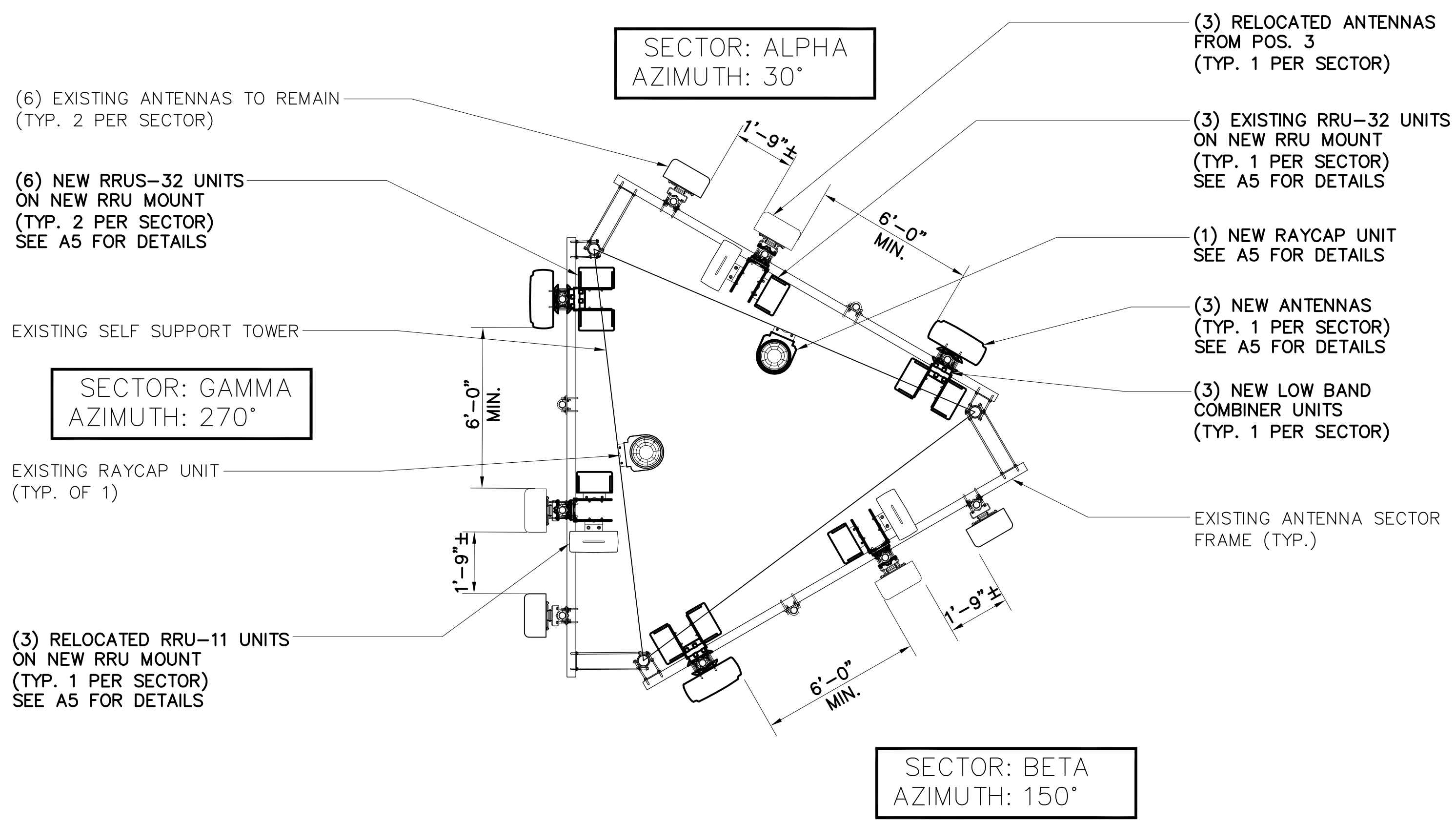


EXISTING ANTENNA PLAN

SCALE: 3/16" = 1'-0" 1

NOTES:
1. EXISTING ANTENNA MOUNTING PIPE TO BE REUSED, RELOCATED OR REPLACED AS REQUIRED
2. IF REQUIRED INSTALL NEW GALV. MOUNTING PIPE(S) 2.5 STD. (2-7/8" O.D.)

NOTE:
3 FEET MINIMUM SEPARATION BETWEEN LTE ANTENNAS.
6 FEET MINIMUM SEPARATION BETWEEN 700BC & 700 DE



FINAL ANTENNA PLAN

SCALE: 3/16" = 1'-0" 2

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STATE OF CONNECTICUT
HENRY M. BELLAGAMBA
25358
LICENSED
PROFESSIONAL ENGINEER

SITE NAME
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SITE ADDRESS
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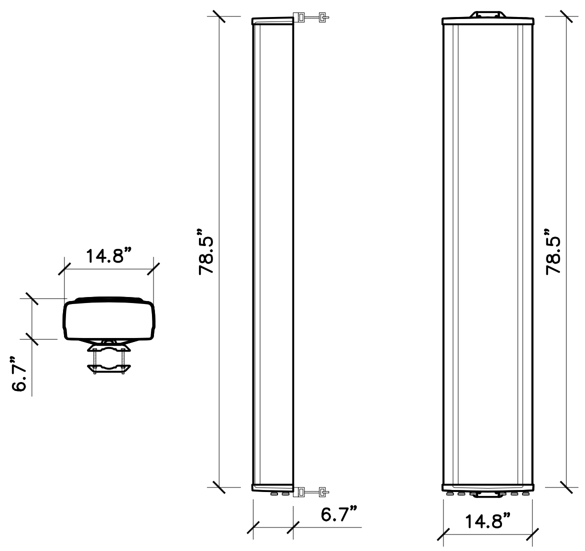
WESTPORT, CT 06880

SHEET NAME
ANTENNA PLANS

SHEET NUMBER
A4

PROJECT# 2017.0278.0024



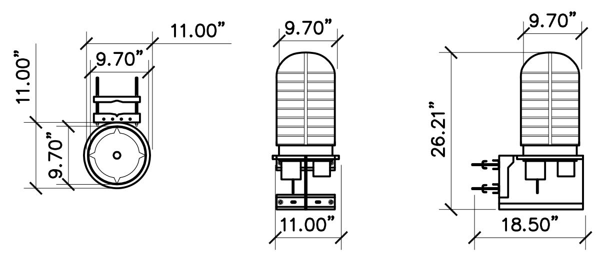
PLAN VIEW SIDE VIEW FRONT VIEW

KATHREIN – 800 10798

12-PORT ANTENNA FREQUENCY RANGE DUAL POLARIZATION

FREQUENCY RANGE	698–894 MHz 1695–2690 MHz
ANTENNA w/CLAMPS	86.3 Lbs

ANTENNA SPEC SCALE: N.T.S. 1



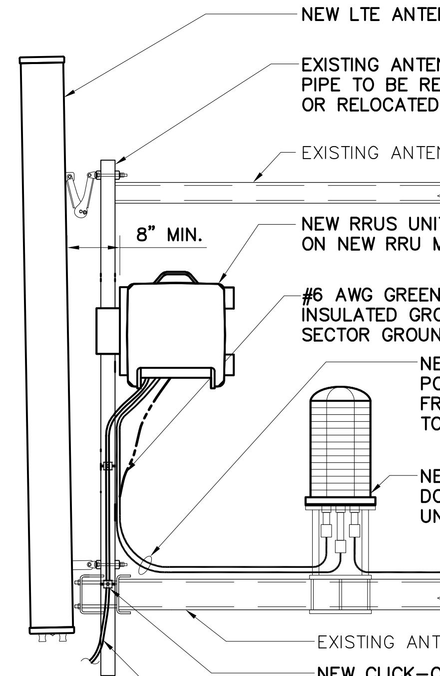
PLAN VIEW FRONT VIEW SIDE VIEW

RAYCAP – DC6-48-60-18-8F

TOWER DC OVER VOLTAGE PROTECTION POWER CONNECTION SOLUTION

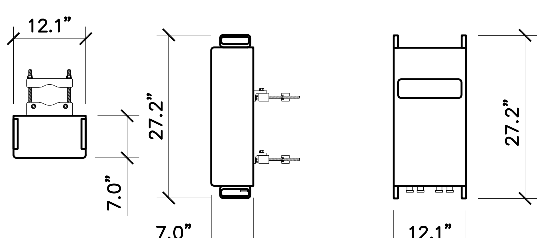
UNIT WEIGHT 32.8 Lbs

RAYCAP SPEC SCALE: N.T.S. 2



ANTENNA SCHEMATIC SCALE: N.T.S. 3

NOT USED SCALE: N.T.S. 4

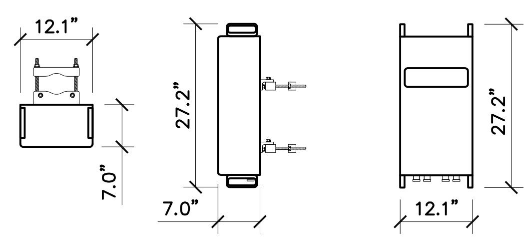


PLAN VIEW SIDE VIEW FRONT VIEW

ERICSSON – RRUS 32

UNIT WEIGHT 60 Lbs

RRU SPEC SCALE: N.T.S. 5



PLAN VIEW SIDE VIEW FRONT VIEW

ERICSSON – RRUS 32 B66

UNIT WEIGHT 60 Lbs

NOT USED SCALE: N.T.S. 6

NOT USED SCALE: N.T.S. 7

NOT USED SCALE: N.T.S. 8

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SHEET NAME

EQUIPMENT DETAILS

SHEET NUMBER

A5

PROJECT# 2017.0278.0024

FINAL ANTENNA CONFIGURATION AND CABLE SCHEDULE
SUPPLIED BY AT&T WIRELESS, FROM RF CONFIG. DATED (03/01/18)

SECTOR	ANTENNA NUMBER	ANTENNA STATUS & TYPE	ANTENNA MODEL NUMBER	ANTENNA VENDOR	TMA/RRU UNIT	AZIMUTH	ANTENNA CL FROM GROUND	CABLE FEEDER TYPE	CABLE FEEDER LENGTH	RAYCAP UNIT
ALPHA	A–1	(E) UMTS ANTENNA	P65–16–XLR–RR	POWERWAVE	–	30°	133'–0"	7/8"ø LDF5–50A 7/8"ø LDF5–50A	175'–0" 175'–0"	(1) (E) DC6–48–60–18–8F UNIT (1) (N) DC6–48–60–18–8F UNIT
	A–2	(E) LTE1C/2C ANTENNA	HPA–65R–BUU–H6	CCI	(1) EXISTING RRUS–11 UNIT (1) EXISTING RRUS–32 B2 UNIT	30°	133'–0"	(1) EXISTING FIBER CABLE (2) EXISTING DC POWER CABLES	175'–0" 175'–0"	
	A–3	–	–	–	–	–	–	–	–	
	A–4	(N) LTE3C/4C ANTENNA	800–10798	KATHREIN	(1) NEW RRUS–32 B66 UNIT (1) NEW RRUS–32 UNIT (1) NEW KAELUS DBC0061F1V51–2 LOW BAND COMBINER UNIT	30°	133'–0"	(2) 7/8"ø LDF5–50A (2) (1) NEW FIBER & NEW DC POWER CABLES	175'–0" 175'–0"	
BETA	B–1	(E) UMTS ANTENNA	P65–16–XLR–RR	POWERWAVE	–	150°	133'–0"	7/8"ø LDF5–50A 7/8"ø LDF5–50A	175'–0" 175'–0"	
	B–2	(E) LTE1C/2C ANTENNA	HPA–65R–BUU–H6	CCI	(1) EXISTING RRUS–11 UNIT (1) EXISTING RRUS–32 B2 UNIT	150°	133'–0"	SEE ANTENNA A–2 FOR CABLE TYPE AND LENGTH		
	B–3	–	–	–	–	–	–	–	–	
	B–4	(N) LTE3C/4C ANTENNA	800–10798	KATHREIN	(1) NEW RRUS–32 B66 UNIT (1) NEW RRUS–32 UNIT (1) NEW KAELUS DBC0061F1V51–2 LOW BAND COMBINER UNIT	150°	133'–0"	(2) 7/8"ø LDF5–50A SEE ANTENNA A–4 FOR CABLE TYPE AND LENGTH	175'–0"	
GAMMA	C–1	(E) UMTS ANTENNA	P65–16–XLR–RR	POWERWAVE	–	270°	133'–0"	7/8"ø LDF5–50A 7/8"ø LDF5–50A	175'–0" 175'–0"	
	C–2	(E) LTE1C/2C ANTENNA	HPA–65R–BUU–H6	CCI	(1) EXISTING RRUS–11 UNIT (1) EXISTING RRUS–32 B2 UNIT	270°	133'–0"	SEE ANTENNA A–2 FOR CABLE TYPE AND LENGTH		
	C–3	–	–	–	–	–	–	–	–	
	C–4	(N) LTE3C/4C ANTENNA	800–10798	KATHREIN	(1) NEW RRUS–32 B66 UNIT (1) NEW RRUS–32 UNIT (1) NEW KAELUS DBC0061F1V51–2 LOW BAND COMBINER UNIT	270°	133'–0"	(2) 7/8"ø LDF5–50A SEE ANTENNA A–4 FOR CABLE TYPE AND LENGTH	175'–0"	

ANTENNA & CABLE CONFIGURATION

SCALE: N.T.S. 1

at&t
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REV	DATE	DESCRIPTION	BY
0	09/25/17	90% REVIEW	EB
1	11/03/17	FOR PERMIT	EB
2	03/07/18	REVISION	KC
3	04/06/18	FOR CONSTRUCTION	EB

I HEREBY CERTIFY THAT THESE DRAWINGS WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND CONTROL, AND TO THE BEST OF MY KNOWLEDGE AND BELIEF COMPLY WITH THE REQUIREMENTS OF ALL APPLICABLE CODES.

SITE NAME
WESTPORT SP TOWER

SITE NUMBER:
CTL02147

SITE ADDRESS
880 POST ROAD EAST
WESTPORT, CT 06880

SHEET NAME
ANTENNA & CABLE CONFIGURATION

SHEET NUMBER
A6

PROJECT# 2017.0278.0024

1. CONTRACTOR IS TO REFER TO AT&T'S MOST CURRENT RADIO FREQUENCY DATA SHEET (RFDS) PRIOR TO CONSTRUCTION.
2. THE SIZE, HEIGHT, AND DIRECTION OF THE ANTENNAS SHALL BE ADJUSTED TO ACHIEVE THE AZIMUTHS SPECIFIED AND LIMIT SHADOWING AND TO MEET THE SYSTEM REQUIREMENTS.
3. CONTRACTOR SHALL VERIFY THE HEIGHT OF THE ANTENNA WITH THE AT&T WIRELESS PROJECT MANAGER.
4. VERIFY TYPE AND SIZE OF TOWER LEG PRIOR TO ORDERING ANY ANTENNA MOUNT.
5. UNLESS NOTED OTHERWISE THE CONTRACTOR MUST PROVIDE ALL MATERIAL NECESSARY.
6. ANTENNA AZIMUTHS ARE DEGREES OFF OF TRUE NORTH, BEARING CLOCKWISE, IN WHICH ANTENNA FACE IS DIRECTED. ALL ANTENNAS (AND SUPPORTING STRUCTURES AS PRACTICAL) SHALL BE ACCURATELY ORIENTED IN THE SPECIFIED DIRECTION.
7. CONTRACTOR SHALL VERIFY ALL RF INFORMATION PRIOR TO CONSTRUCTION.
8. SWEEP TEST SHALL BE PERFORMED BY GENERAL CONTRACTOR AND SUBMITTED TO AT&T WIRELESS CONSTRUCTION SPECIALIST. TEST SHALL BE PERFORMED PER AT&T WIRELESS STANDARDS.
9. CABLE LENGTHS WERE DETERMINED BASED ON THE DESIGN DRAWING. CONTRACTOR TO VERIFY ACTUAL LENGTH DURING PRE-CONSTRUCTION WALK.
10. CONTRACTOR TO USE ROSENBERGER FIBER LINE HANGER COMPONENTS (OR ENGINEER APPROVED EQUAL).

ANTENNA AND CABLING NOTES
SCALE: N.T.S. 1

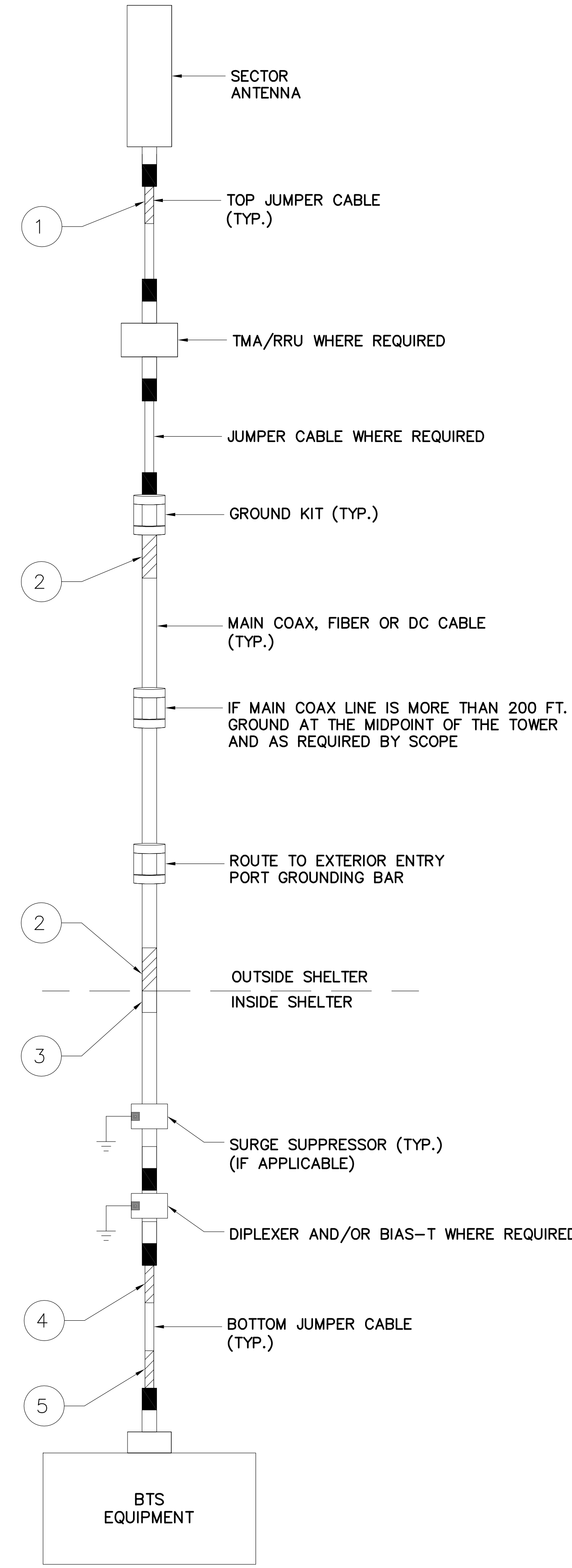
RF, DC, & COAX CABLE MARKING LOCATIONS TABLE

NO	LOCATIONS
1	EACH TOP-JUMPER SHALL BE COLOR CODED WITH (1) SET OF 3" WIDE BANDS.
2	EACH MAIN COAX SHALL BE COLOR CODED WITH (1) SET OF 3" WIDE BANDS NEAR THE TOP-JUMPER CONNECTION AND WITH (1) SET OF 3/4" WIDE COLOR BANDS JUST PRIOR TO ENTERING THE BTS OR TRANSMITTER BUILDING.
3	CABLE ENTRY PORT ON THE INTERIOR OF THE SHELTER.
4	ALL BOTTOM JUMPERS SHALL BE COLOR CODED WITH (1) SET OF 3/4" WIDE BANDS ON EACH END OF THE BOTTOM JUMPER.
5	ALL BOTTOM JUMPERS SHALL BE COLOR CODED WITH (1) SET OF 3/4" WIDE BANDS ON EACH END OF THE BOTTOM JUMPER.

CABLE MARKING DIAGRAM
SCALE: N.T.S. 2

1. THE ANTENNA SYSTEM COAX SHALL BE LABELED WITH VINYL TAPE.
2. THE STANDARD IS BASED ON EIGHT COLORED TAPES—RED, BLUE, GREEN, YELLOW, ORANGE, BROWN, WHITE, AND VIOLET. THESE TAPES MUST BE 3/4" WIDE & UV RESISTANT SUCH AS SCOTCH 35 VINYL ELECTRICAL COLOR CODING TAPE AND SHOULD BE READILY AVAILABLE TO THE ELECTRICIAN OR CONTRACTOR ON SITE.
3. USING COLOR BANDS ON THE CABLES, MARK ALL RF CABLE BY SECTOR AND CABLE NUMBER AS SHOWN ON "CABLE COLOR CHART".
4. WHEN AN EXISTING COAXIAL LINE THAT IS INTENDED TO BE A SHARED LINE BETWEEN TECHNOLOGIES IS ENCOUNTERED, THE CONTRACTOR SHALL REMOVE THE EXISTING COLOR CODING SCHEME AND REPLACE IT WITH THE COLOR CODING STANDARD. IN THE ABSENCE OF AN EXISTING COLOR CODING AND TAGGING SCHEME, OR WHEN INSTALLING PROPOSED COAXIAL CABLES, THIS GUIDELINE SHALL BE IMPLEMENTED AT THAT SITE REGARDLESS OF TECHNOLOGY.
5. ALL COLOR CODE TAPE SHALL BE 3M-35 AND SHALL BE INSTALLED USING A MINIMUM OF (3) THREE WRAPS OF TAPE AND SHALL BE NEATLY TRIMMED AND SMOOTHED OUT SO AS TO AVOID UNRAVELING.
6. ALL COLOR BANDS INSTALLED AT THE TOP OF THE TOWER SHALL BE A MINIMUM OF 3" WIDE, AND SHALL HAVE A MINIMUM OF 3/4" OF SPACE BETWEEN EACH COLOR.
7. ALL COLOR CODES SHALL BE INSTALLED SO AS TO ALIGN NEATLY WITH ONE ANOTHER FROM SIDE-TO-SIDE.
8. IF EXISTING CABLES AT THE SITE ALREADY HAVE A COLOR CODING SCHEME AND THEY ARE NOT INTENDED TO BE REUSED OR SHARED WITH THE NEW TECHNOLOGY, THE EXISTING COLOR CODING SCHEME SHALL REMAIN UNTOUCHED.

CABLE MARKING NOTES
SCALE: N.T.S. 3



CABLE COLOR CODING DIAGRAM
SCALE: N.T.S. 4

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STATE OF CONNECTICUT
HENRY M. BELLAGAMBA
25358
LICENSED
PROFESSIONAL ENGINEER

SITE NAME
WESTPORT SP TOWER

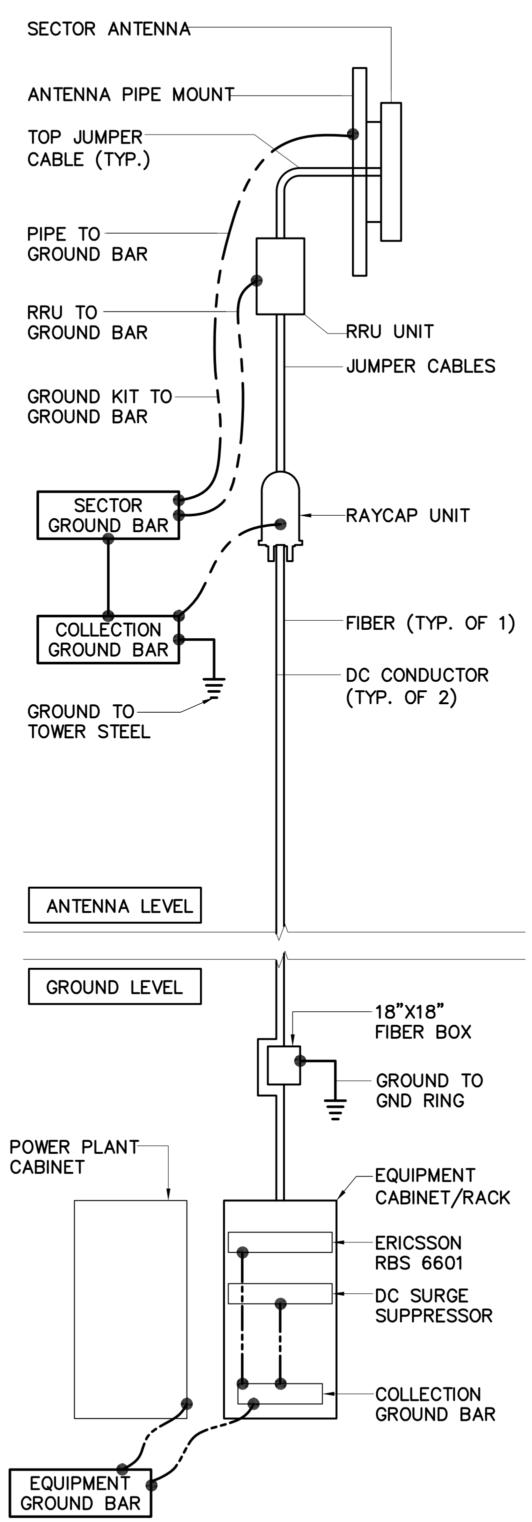
SITE NUMBER:
CTL02147

SITE ADDRESS
880 POST ROAD EAST
WESTPORT, CT 06880

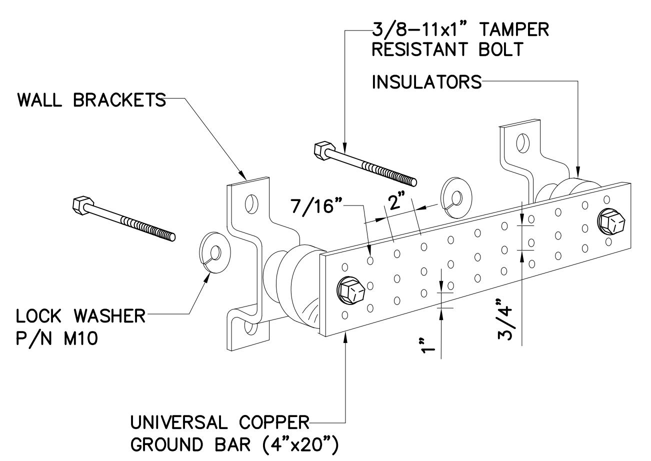
SHEET NAME
CABLE NOTES AND COLOR CODING

SHEET NUMBER
A7

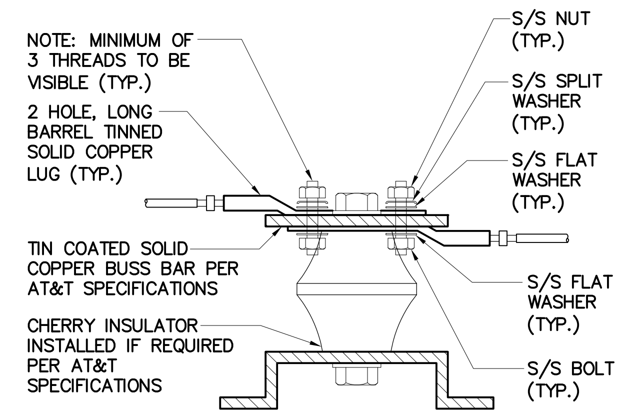
PROJECT# 2017.0278.0024



GROUNDING SCHEMATIC SCALE: N.T.S. 1



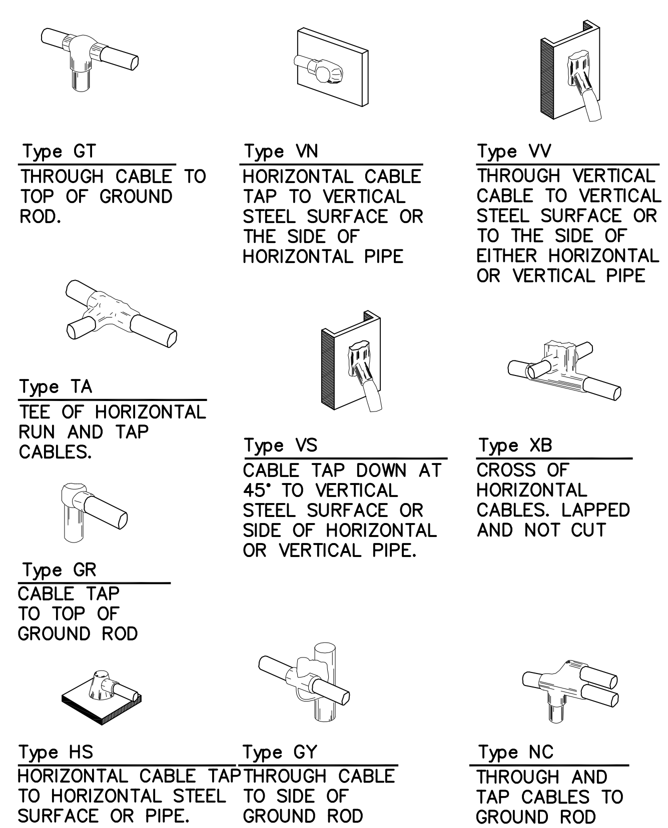
GROUND BAR DETAIL SCALE: N.T.S. 2



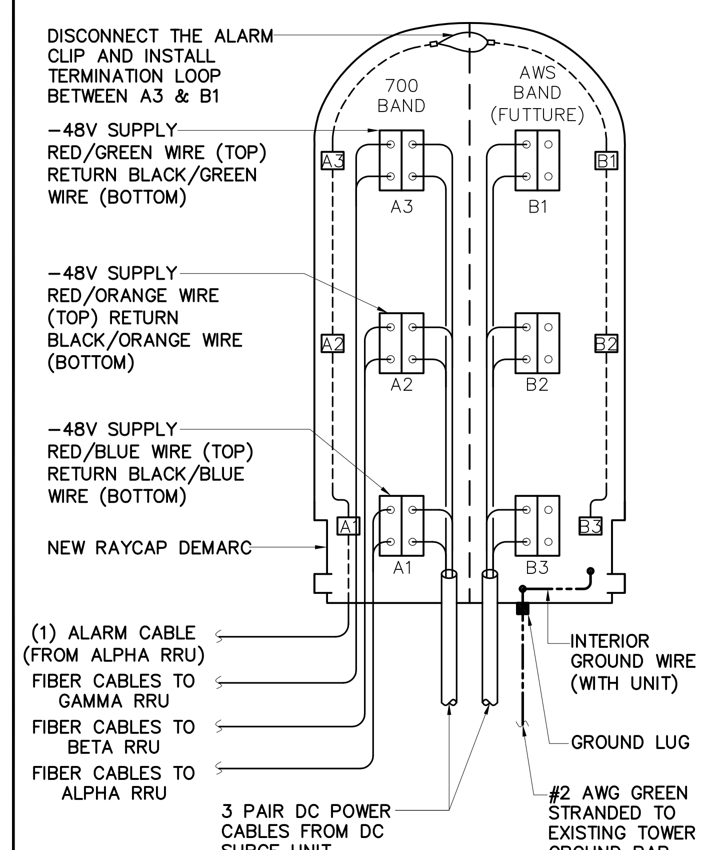
NOTES:

1. ALL HARDWARE 18-8 STAINLESS STEEL INCLUDING SPLIT WASHERS.
2. COAT WIRE END WITH ANTI-OXIDATION COMPOUND PRIOR TO INSERTION INTO LUG BARREL AND CRIMPING.
3. APPLY ANTI-OXIDATION COMPOUND BETWEEN ALL LUGS AND BUSS BARS PRIOR TO MATING AND BOLTING.

LUG DETAIL SCALE: N.T.S. 3



EXOTHERMIC WELD DETAILS SCALE: N.T.S. 4



RAYCAP DC POWER AND ALARM DET. SCALE: N.T.S. 5

NOT USED SCALE: N.T.S. 6

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SITE NAME

WESTPORT SP TOWER

SITE NUMBER:

CTL02147

SITE ADDRESS

880 POST ROAD EAST
WESTPORT, CT 06880

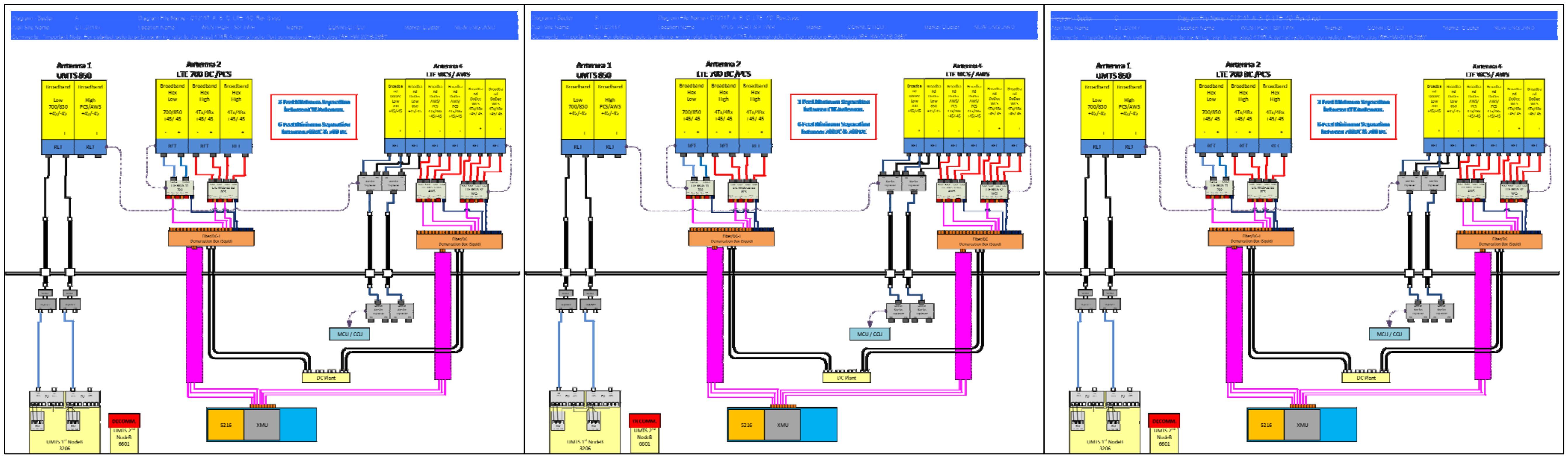
SHEET NAME

GROUNDING DETAILS

SHEET NUMBER

A8

PROJECT# 2017.0278.0024



*BASED ON RFDS VX.0, DATED (03/01/18)

PLUMBING DIAGRAMS

SCALE: N.T.S. 1

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STATE OF CONNECTICUT
HENRY M. BELLAGAMBA
25358
LICENSED PROFESSIONAL ENGINEER

SITE NAME
WESTPORT SP TOWER

SITE NUMBER:
CTL02147

SITE ADDRESS
880 POST ROAD EAST
WESTPORT, CT 06880

SHEET NAME
PLUMBING DIAGRAMS

SHEET NUMBER
A9

PROJECT# 2017.0278.0024

AECOM

Submitted to
AT&T / Smartlink
85 Rangeway Rd.
Building #3, Suite 102
N. Billerica, MA 01862

Submitted by
AECOM
500 Enterprise Drive,
Suite 3B
Rocky Hill, CT 06067
July 13, 2018

DETAILED STRUCTURAL ANALYSIS AND MODIFICATION OF AN EXISTING 180' SELF SUPPORTING LATTICE TOWER AND FOUNDATION FOR PROPOSED ANTENNA ARRANGEMENT

at&t

smartlink

Site ID : CTLO2147
Site Name: CT State Police Tower
Site Address: 880 Post Road East
Westport, Connecticut
CSP Tower # 32

60581632
SMK-004

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis and modification of the 180' self-supporting lattice tower located at 880 Post Road East in Westport, Connecticut.

The structural analysis was conducted in accordance with the 2016 Connecticut State Building Code which includes the TIA-222-G[1] Standard, 2012 International Building Code, the 2016 Connecticut State Building Code Amendments, the AISC[2] Load Resistance Factor Design (LRFD), the ASCE 7[3] design Code, and the Connecticut State Police Requirements which include the TIA/EIA-222-F[4].

The antenna loading considered in the analysis consists of all the existing antennas, transmission lines and ancillary items as outlined in the Introduction Section of this report.

The proposed AT&T antenna modifications are listed below:

Antennas and other Appurtenances	Carrier	Antenna Center Elevation
Remove: **(3) Powerwave P65-16-XLH-RR Panel Antennas** **(6) Ericsson RRUS-11 RRH Units** **(3) TT19-08BP111-001 Twin TMA's**	**AT&T (existing)**	**@ 133'**
Install: **(3) Kathrein 800-10798 Panel Antennas** **(3) Ericsson RRUS-32 B66 RRH Units** **(3) Ericsson RRUS-32 RRH Units** **(3) Kaelus DBC0061F1V51-2 Combiner Units** **(1) Raycap DC6-48-60-18-8F Surge Protector (Squid) Unit** **(1) Fiber Optic Cable (Analysis applied 1-5/8" O.D. cable)** **(2) DC Power Cables (Analysis applied 0.4 O.D. cables)**	**AT&T (Proposed)**	**@ 133'**

The results of an initial analysis indicated the existing tower structure did not have enough capacity for the proposed loading conditions above. The tower structure requires modifications shown SK-1 through SK-4. **Once the modifications indicated on sheets SK-1 through SK-4 are performed, the modified structure is considered structurally adequate with the load specification specified above with the existing and proposed antenna loading herein.**

The results of the analysis indicate the modified tower's sway (deflection) is 0.4361 degrees and the modified tower's twist (rotation) is 0.2923 degrees. These figures combined are within the Connecticut State Police requirements of 0.75 degrees for combined twist (rotation) and sway (deflection) when applying the TIA/EIA-222-F design conditions.

1. TIA = Telecommunications Industry Association Structural Standard for Antenna Supporting Structures and Antennas (Version G)

2. AISC = American Institute of Steel Construction (14th Edition)

3. ASCE 7 = American Society of Civil Engineers Standard 7 (2010 Edition)

4. TIA/EIA = Telecommunications Industry Association Structural Standard for Antenna Supporting Structures and Antennas (Version F)

1. EXECUTIVE SUMMARY *(continued)*

This analysis is based on:

1) The tower structure's theoretical capacity not including any assessment of the condition of the tower.
2) Original tower report prepared by Rohn Industries, Inc., engineering file 26263DL and drawing C910693 dated February 1, 1991.
3) Soil investigation and foundation capacity report prepared by Dr. Clarence Welti, P.E., P.C., dated October 10, 2002.
4) Tower Mapping and Inventory by D&K Nationwide Communications Inc., performed on March 18, 2016.
5) Existing antenna inventory provided by Motorola / Connecticut State Police via e-mail dated June 22, 2016.
6) Previous structural analysis and evaluation provided by AECOM on behalf of Motorola / Connecticut State Police, project PNS-606 / 60509756.06, signed and sealed on September 16, 2016.
7) Previous structural analysis and modification performed by AECOM on behalf of Verizon, project number 60519605 / VZ5-202, and on behalf of AT&T, project number 60553537 / SAI-099, signed and sealed on September 20, 2017.
8) Previous structural analysis and evaluation performed by AECOM on behalf of AT&T, project number 60565639 / SMK-002, signed and sealed on June 20, 2018.
9) Proposed antenna inventory obtained from contract drawings dated April 6, 2018, via e-mail dated June 22, 2018.
10) Antenna and mount configuration as specified on the following page of this report.

This report is only valid as per the information and data provided by others for antenna inventory, mounts, tower structure, existing foundation and associated cables. The user of this report shall field verify the antenna, cabling and mount configuration used, as well as the physical condition of the tower members, connections and foundations. Notify the engineer in writing immediately if any of the information in this report is found to be other than specified.

If you should have any questions, please call.

Sincerely,

AECOM,

STATE OF CONNECTICUT
RICHARD A. SAMBOR
No. 9057
LICENSED
PROFESSIONAL ENGINEER

Richard A. Sambor, P.E.
Senior Structural Engineer
RAS/mcd

2. INTRODUCTION

The subject tower is located at 880 Post Road East in Westport, Connecticut. The structure is a 180' self-supporting lattice tower manufactured by Rohn Industries Incorporated.

The structural analysis was conducted in accordance with the following:

- TIA-222-G Standard for Standard for a wind velocity of range of 95 mph to 115 mph (3-second gust) and 50 mph (3-second gust) concurrent with 0.75" ice thickness, considered to increase in thickness with height
- 2012 International Building Code with 2016 Connecticut State Building Code Amendments for a wind speed of 101 mph (3-second gust) – increased to county maximum speed due to location within ASCE "Special Wind Region" → 110 mph
- 2010 AISC Load Resistance Factor Design (LRFD)
- 2010 ASCE 7 Minimum Design Loads for Buildings and Other Structures for the ice thickness referenced in the TIA-222-G Standard
- Connecticut State Police Requirements for a wind velocity of 90 mph (fastest mile) and 90 mph (fastest mile) concurrent with 0.5" ice. Twist (rotation) and sway (deflection) were determined in accordance with Connecticut State Police Requirements for a wind velocity of 90 mph (fastest mile) concurrent with 0.5" ice, analyzed under the TIA/EIA-222-F design Standard.

The inventory together with the proposed AT&T antenna arrangement is summarized in the table below:

Antenna Type	*Carrier*	*Mount*	*Antenna Centerline Elevation*	*Cable*
(1) Decibel DB-536 Omni Antenna	D&K-53 CSP-45 (existing)	Mount shared with D&K #48	@ 178'	(1) LDF5-50A
(1) Sinclair SE419-SWBPALDF(D00) Panel Antenna (Troop G (RX))	CSP (existing)	4' Side Arm Mount	@ 175'	(1) LDF4-50A Jumper from below TTA (Tr. G)
(1) Celwave PA6-65 Dish with Radome	D&K-52 CSP-42 (existing)	Dish Standoff	@ 177'	(1) EW-63
(1) Scala AP11-850 antenna	D&K-49 CSP-46 (existing)	*Shared with above mount*	@ 175'	(1) LDF7-50A
(1) Amphenol WPA-700102-4CF-EDIN-9 Panel Antenna (Troop G (TX))	CSP (existing)	*Shared with below Mount*	@ 170'	(1) AVA7-50A
(1) Bird 432E-83I-01T TTA Unit (Troop G)	CSP (existing)	Existing Antenna Mount Frame	@ 170'	(1) AVA7-50A (1) LDF4-50A
(1) Sinclair SE419-SWBPALDF(D00) Panel Antenna	CSP (existing)	*Shared with above Mount*	@ 170'	(1) LDF4-50A Jumper from above TTA (Tr. G)
(1) 4' Yagi Antenna	D&K-51 CSP-1 (existing)	Pipe Mounted to Leg	@ 169'	(1) LDF5-50A
(1) (inverted) Scala OGT9-806 Omni Antenna	D&K-48 CSP-49 (existing)	4' Side Arm Mount	@ 164'	(1) LDF7-50A

Antenna Type	***Carrier***	***Mount***	***Antenna Centerline Elevation***	***Cable***
(3) Commscope SBNHH-1D65B Panel Antennas (700 MHz / LTE shared with 1900 MHz / PCS) (3) Alcatel Lucent 2x60-700MHz RRH Units (1) DB-T1-6Z-8AB-0Z Distribution Box (700 MHz / LTE) (3) Alcatel Lucent 2x90-1900MHz RRH Units (B66a RRH Units) (3) Commscope SBNHH-1D65B Panel Antennas (2100 MHz / AWS) (3) Alcatel Lucent 2x60-AWS (2100 MHz) RRH Units (1) Amphenol BXA 70080-4CF Panel Antennas (Alpha Sector) (2) Amphenol 70063-4CF Panel Antennas (Beta and Gamma Sectors) (1) Raycap DB-T1-6Z-8AB-0Z Distribution Box	Verizon (existing)	(3) 15' T-Frames	@ 160'	(3) 1 5/8" Fiber Optic Cable (8) LDF7-50A
(1) (inverted) Scala OGT9-806 Omni Antenna	D&K-47 CSP-48 (existing)	3' Side Arm Mount	@ 159'	(1) LDF7-50A
(3) 800-10798 Panel Antennas **(3) RRUS-32 B66 RRH Units** **(3) RRUS-32 RRH Units** **(3) DBS0061F1V51-2 Combiner Units** **(1) DC6-48-60-18-8F Surge Protector**	**AT&T (Proposed)**	*See Below Mounts*	**@ 133'**	**(1) Fiber Optic Cable** **(2) DC Cables**
(3) P65-16-XLH-H-RR Panel Antennas (3) CCI HPA-65R-BUU-6 Antenna Panels (3) RRUS-11 Units (3) RRUS-32 B2 Units (1) DC6-48-60-18-8F Distribution Box	AT&T (existing)	(3) Existing Antenna Mount Frames	@ 133'	(12) LDF5-50A (1) Fiber Optic Cable (2) DC Cables
(9) TMAs (6) Ericsson Air 21 antennas (3) Commscope LNX-6515DS-VTM Panel Antennas (3) Ericsson RRUS-11 Remote Radio Units	D&K-2 – 12 T-Mobile (existing)	(3) Antenna Frame Mounts (Valmont Site Pro 1 part # LTF12-372)	@ 125'	(18) LDF7-50A (1) LDF4-50A (1) Huber Suhner Hybrid cable

Antenna Type	*Carrier*	*Mount*	*Antenna Centerline Elevation*	*Cable*
(1) GPS Antenna	D&K-1 CSP-43 (existing)	Leg Mount	@ 61’	(1) LDF4-50A

NOTES: Antenna ID Numbering and elevations obtained from Tower Mapping and Existing inventory via tower climb performed by D&K Nationwide Communications, Inc. on March 18, 2016.

This structural analysis of the communications tower was performed by AECOM for AT&T. The purpose of this analysis was to assess the modified tower for its existing and proposed antenna loads. This analysis was conducted to evaluate twist (rotation), sway (deflection), stress on the tower, and the effect of forces to the foundation of the tower resulting from existing and proposed antenna arrangements.

3. ANALYSIS METHODOLOGY AND LOADING CONDITIONS

The structural analysis was done in accordance with, the TIA-222-G–Structural Standard for Antenna Towers and Antenna Supporting Structures and Antennas, the 2012 International Building Code with 2016 Connecticut State Building Code Amendments and the American Institute of Steel Construction (AISC) Manual of Steel Construction – Load Resistance Factor Design (LRFD)

The structural analysis was conducted using TNX Tower version 7.0.8.5 and used the following conditions for this tower review (following the TIA/EIA-222-G Standard):

- Structure Class 3 – (Essential Communications)
  - NOTE: ASCE 7 and CT State Building Code Applied Risk Category 4 for design wind loads (see below)
- Topographic Category 1 – (No Abrupt Changes in General Topography)
- Exposure Class C – (Open Terrain with scattered obstructions)
- Load Conditions:
  - Two load conditions were evaluated as shown which were compared to design stresses according to AISC and TIA/EIA-222-G Standard.

Basic Wind Speed:

- TIA-222-G:
  - Fairfield County (Wind Speed Range): V = 90 mph - 110 mph (3-second gust) [Annex of TIA-222-G 2006]
- IBC 2012 w/ 2016 CT State Building Code Amendment:
  - (2012) IBC Section 1609.1.1 – Determination of Wind Loads – Exception 5 "Designs using TIA-222" applies for determination of Design Wind Load obtained as "V.ult" are to be converted to "V.asd" when applying the TIA-222-G design Standard (under Section 1609.3) for Basic Wind Speed.
  - (2016) CT State Building Code Amendment to the IBC Section 1609.3 wind loads are obtained from Appendix N of the State Building Code.
    - V.asd = 101 mph (3-Second Gust) Wind Design Parameter for the Town of Westport, Connecticut for Risk Category four (IV) for essential communications (Connecticut State Police).
    - NOTE: Due to the location of the Tower and Risk Category for the structure, the wind speed shall be increased to the TIA-222-G maximum listed speed (indicated above) to address additional wind effects within the "Special Wind Region" designated by ASCE and indicated within the "Wind-Borne Debris Region" per the CT State Building Code.

LOAD CONDITION 1 = 110 MPH (3-SECOND GUST) WIND LOAD (WITHOUT ICE) + TOWER DEAD LOAD
Load Condition 2 = 50 mph (3-second gust) Wind Load (with ice) + Ice Load + Tower Dead Load

Ice thickness used for this analysis is **0.75 inch** (assumed to start at the base of the tower) and is considered to increase in thickness with height. The initial ice thickness for design is referenced in the Annex of TIA-222-G and follows the same design criteria as the ASCE 7 Standard.

The load condition below implements the design requirements of the Connecticut State Police for the tower structures deflection limits with the allowable deflection limit of the combination of the tower's sway (deflection) and twist (rotation) under the TIA/EIA-222-F design Standard. This design limit required the design combined value of sway (deflection) and twist (rotation) to be under 0.75 degrees following the TIA/EIA-222-F design Standard.

3. ANALYSIS METHODOLOGY AND LOADING CONDITIONS (cont.)

Load Condition 3 = 90 mph (fastest mile) Wind Load (with Ice) + Ice Load + Dead Load

Seismic event consideration factors/values for design:

- S.s = 0.226 (2016 CT State Building Code – Location Specific Value)
- S.1 = 0.067 (2016 CT State Building Code – Location Specific Value)
- Site Classification = “D”
- Seismic Design Category = “A” – (2012 International Building Code)
- F.a = 1.6 (Obtained from TIA-222-G Table 2-12 Considering above conditions)
- F.v = 2.4 (Obtained from TIA-222-G Table 2-13 Considering above conditions)

Strength Limit State Load Combinations (TIA-222-G Section 2.3.2):

The structural analysis herein has considered the following load combinations within the analysis:

1. ***1.2 Dead Load Tower structure + 1.0 Dead Load Guy Assemblies + 1.6 Wind load without ice***
2. 1.2 Dead Load Tower structure + 1.0 Dead Load Guy Assemblies + 1.0 Dead weight of ice due to factored ice thickness + 1.0 Concurrent wind load with factored ice thickness + 1.0 Load effects due to temperature
3. 1.2 Dead Load Tower structure + 1.0 Dead Load Guy Assemblies + 1.0 Earthquake Load

NOTE 1: The above **bolded** load combination is considered to create the governing design loads per the results of the analysis.
NOTE 2: The above “Dead Load Guy Assemblies” are not considered as part of the analysis and are considered as a value of zero.
NOTE 3: The “Load effects due to temperature” do not apply for structures that are self-supporting (from the TIA-222-G Standard)

4. FINDINGS AND EVALUATION

The combined axial and bending stresses on the tower structure were evaluated to compare with the strength design in accordance with AISC (LRFD). The results of an intial analysis indicated that the existing tower did not have enough capacity to support the proposed loading conditions. The tower structure requires modifications shown on SK-1 through SK-4. Once the modifications indicated on sheets SK-1 through SK-4 are performed, the modified structure and existing foundation are considered structurally adequate with the wind load classification specified with the existing and proposed antennal loading noted herein.

The tower sway (deflection) is 0.4361 degrees and tower twist (rotation) is 0.2923 degrees. These figures combined are within the Connecticut State Police required maximum 0.75 degrees for combined twist and sway when applying the TIA/EIA-222-F design conditions.

Tower Base Reactions (TIA-222-G):

Description	Ultimate Reactions (Geotech 10/10/2002) (TIA-222-G)	Current (Factored) TIA-222-G	Stress (% capacity)	Pass/ Fail
Pier Compression (kips)	665	420	63.2	Pass
Pier Uplift (kips)	492	384	78.0	Pass
Overall Overturning (kip-ft)	---	9592	---	---
Overall Shear (kips)	---	103	---	---
Shear per Leg (kips)	---	59	---	---

Tower Component Stress vs. Capacity Summary:

Component / (Section No.)	Controlling Component/ Elevation	Stress (% capacity)	Pass/ Fail	Comments:
Tower Leg (T7)	ROHN 6 EH / 80’ – 100’	84.4	Pass	
Diagonal (T9)	ROHN 3 STD / 60’ – 80’	88.2	Pass	
Horizontal (T11)	ROHN 2.5 STD / 30’-40’	93.9	Pass	
Top Girt (T12)	ROHN 2.5 STD / 20’-30’	86.6	Pass	
Redund Horz 1 Bracing (T13)	ROHN 1.5 STD / 0’-20’	32.9	Pass	
Redund Diag 1 Bracing (T13)	ROHN 2 STD / 0’-20’	41.7	Pass	
Redund Hip 1 Bracing (T13)	ROHN 2.5 STD / 0’-20’	0.1	Pass	
Inner Bracing (T5)	L2x2x1/8 / 120’-126.667’	6.0	Pass	
Tower Bolt	(6) ¾” Diameter ASTM A325N Bolts / Tension / Leg Flange Connection Bolts / 100’	84.4	Pass	
Anchor Bolts – Uplift & Shear Capacity (TIA-222-G – 4.9.9)	1” Dia. / Tension	81.1	Pass	(10) ASTM A 354 – Gr BC Bolts – 1” Diameter

4. FINDINGS AND EVALUATION (cont.)

Maximum Deformations – Proposed Condition

TIA-222-G Section 2.8.2 - Limit State Deformations

1. A rotation of 4 degrees about the vertical axis (twist) or any horizontal axis (sway) of the structure
2. A horizontal displacement (in feet) of 3% of the height of the structure.

Load Case Description	Current		Allowable	
	Sway (degree)	Displacement (Feet)	Sway (degree)	Displacement (Feet)
Service Wind Load	0.1152	0.2083	4.0	5.40

Tower Twist & Sway at Top (Connecticut State Police Requirements – TIA/EIA-222-F):

Description	Current	Total	Allowable
Tower Twist (degrees)	0.2923	0.7284	0.750
Tower Sway (degrees)	0.4361		

5. CONCLUSIONS

The results of an initial analysis indicated the existing tower structure did not have enough capacity for the proposed loading conditions above. The tower structure requires modifications shown SK-1 through SK-4. **Once the modifications indicated on sheets SK-1 through SK-4 are performed, the modified structure is considered structurally adequate with the load specification specified above with the existing and proposed antenna loading herein.**

The results of the analysis indicate the modified tower's sway (deflection) is 0.4361 degrees and the modified tower's twist (rotation) is 0.2923 degrees. These figures combined are within the Connecticut State Police requirements of 0.75 degrees for combined twist (rotation) and sway (deflection) when applying the TIA/EIA-222-F deign conditions.

Limitations/Assumptions:

This report is based on the following:

1. Tower inventory as listed in this report.
2. Tower is properly installed and maintained.
3. All members are as specified in the original design documents and are in good condition.
4. All required members are in place.
5. All bolts are in place and are properly tightened.
6. Tower is in plumb condition.
7. All member protective coatings are in good condition.
8. All tower members were properly designed, detailed, fabricated, and installed and have been properly maintained since erection.
9. Foundations are in good condition without defects and were properly constructed to support original design loads as specified in the original design documents.

AECOM is not responsible for any modifications completed prior to or hereafter in which AECOM is not or was not directly involved. Modifications include but are not limited to:

A. Adding antennas
B. Removing/replacing antennas
C. Adding coaxial cables

AECOM hereby states that this document represents the entire report and that it assumes no liability for any factual changes that may occur after the date of this report. All representations, recommendations, and conclusions are based upon information contained and set forth herein. If you are aware of any information which conflicts with that which is contained herein, or you are aware of any defects arising from original design, material, fabrication, or erection deficiencies, you should disregard this report and immediately contact AECOM. AECOM disclaims all liability for any representation, recommendation, or conclusion not expressly stated herein.

Ongoing and Periodic Inspection and Maintenance:

After the Contractor has successfully completed the installation and the work has been accepted, the tower owner will be responsible for the ongoing and periodic inspection and maintenance of the tower.

The tower owner shall refer to TIA-222-G Section 14.2 for recommendations for maintenance and inspection. The frequency of the inspection and maintenance intervals is to be determined by the owner based upon actual site and environmental conditions. It is recommended that a complete and thorough inspection of the entire tower structural system be performed at least yearly and more frequently as conditions warrant. It is also recommended that the structure be inspected after severe wind and/or ice storms or other extreme loading conditions.

6. DRAWINGS AND DATA

REINFORCEMENT DRAWINGS SK-1 THROUGH SK-4

GENERAL CONSTRUCTION NOTES

1. ALL WORK SHALL COMPLY WITH THE CONNECTICUT STATE BUILDING AND LIFE SAFETY CODES, SUPPLEMENTS AND AMENDMENTS.

2. CONTRACTOR IS TO REVIEW ALL DRAWINGS AND NOTES IN THE CONTRACT DOCUMENT SET. CONTRACTOR SHALL COORDINATE ALL WORK SHOWN IN THE SET OF DRAWINGS. THE CONTRACTOR SHALL PROVIDE A COMPLETE SET OF DRAWINGS TO ALL SUB-CONTRACTORS AND ALL RELATED PARTIES. THE SUB-CONTRACTORS SHALL EXAMINE ALL THE DRAWINGS AND SPECIFICATIONS FOR THE INFORMATION THAT AFFECTS THEIR WORK.

3. CONTRACTOR SHALL PROVIDE A COMPLETE BUILD-OUT WITH ALL FINISHES, STRUCTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS AND PROVIDE ALL ITEMS AS SHOWN OR INDICATED ON DRAWINGS OR WRITTEN IN SPECIFICATIONS.

4. CONTRACTOR SHALL FURNISH ALL MATERIAL, LABOR AND EQUIPMENT TO COMPLETE THE WORK AND FURNISH A COMPLETED JOB ALL IN ACCORDANCE WITH LOCAL AND STATE GOVERNING AUTHORITIES AND OTHER AUTHORITIES HAVING LAWFUL JURISDICTION OVER THE WORK.

5. CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS AND ALL INSPECTIONS REQUIRED AND SHALL ALSO PAY FEES REQUIRED FOR THE GENERAL CONSTRUCTION AND ELECTRICAL SUB-CONTRACTORS SHALL PAY FOR THEIR PERMITS.

6. CONTRACTOR SHALL MAINTAIN A CURRENT SET OF DRAWINGS ON SITE AT ALL TIMES AND ENSURE THE DISTRIBUTION OF NEW DRAWINGS TO SUB-CONTRACTORS AND OTHER RELEVANT PARTIES AS SOON AS THEY ARE MADE AVAILABLE. ALL OLD DRAWINGS SHALL BE MARKED VOID AND REMOVED FROM THE CONTRACT AREA. CONTRACTOR SHALL FURNISH 'AS-BUILT' SET OF DRAWINGS TO OWNER UPON COMPLETION OF PROJECT.

7. INSTALLATION OF THIS WIRELESS COMMUNICATIONS EQUIPMENT SITE REQUIRES WORK IN THE IMMEDIATE VICINITY OF EXISTING OPERATING TELECOMMUNICATION SYSTEMS. THE CONTRACTOR SHALL PROVIDE AND COORDINATE THE METHODS OF PROTECTION WITH THE VARIOUS TELECOMMUNICATION CARRIERS AND THE TOWER OWNER. THERE SHALL BE NO INTERRUPTION OF OPERATION WITHOUT TIMELY COORDINATION WITH AND APPROVAL BY THE VARIOUS COMMUNICATIONS OPERATORS INCLUDING THE CONNECTICUT STATE POLICE.

8. THE REINFORCEMENT OF PORTIONS OF THIS TOWER STRUCTURE WILL AFFECT CRITICAL CONNECTICUT STATE POLICE ANTENNAS. NO MOVEMENT, ALTERATION, OR DISCONNECTION OF CONNECTICUT STATE POLICE ANTENNAS MAY OCCUR WITHOUT THE NOTIFICATION AND APPROVAL OF THE CONNECTICUT STATE POLICE. CONTACT THE NETWORK CONTROL CENTER AT 860-865-8008.

9. TOWER REINFORCING WORK AFFECTING CRITICAL CONNECTICUT STATE POLICE ANTENNAS MAY BE REQUIRED TO BE CONDUCTED AT TIMES AS DETERMINED BY THE REQUIREMENTS OF THE CONNECTICUT STATE POLICE.

10. ALL EQUIPMENT AND PRODUCTS PURCHASED ARE TO BE REVIEWED BY CONTRACTOR AND ALL APPLICABLE SUB-CONTRACTORS FOR ANY CONDITION PER MFR'S RECOMMENDATIONS. CONTRACTOR TO SUPPLY THESE ITEMS AT NO COST TO OWNER OR ARCHITECT.

11. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ON-SITE SAFETY FROM THE TIME THE JOB IS AWARDED UNTIL ALL WORK IS COMPLETE AND ACCEPTED BY THE OWNER.

12. SHOP DRAWINGS ARE REQUIRED. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES, AND EXISTING CONDITIONS ON THE TOWER AND INCLUDE THE GATHERED INFORMATION ON THE SHOP DRAWINGS. NOTE ANY DISCREPANCIES ENCOUNTERED ON THE SHOP DRAWINGS. NO FABRICATION OR INSTALLATION OF STEEL SHALL OCCUR PRIOR TO THE RECEIPT AND APPROVAL OF SHOP DRAWINGS.

13. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ARCHITECT FOR REVIEW. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTAL TO THE ARCHITECT FOR REVIEW.

14. THE CONTRACTOR IS SOLELY RESPONSIBLE TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE, AND TO ENSURE THE SAFETY OF THE EXISTING STRUCTURE AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, BRACING, UNDERPINNING, ETC. THAT MAY BE NECESSARY.

15. CONTRACTOR TO CONTACT "CALL BEFORE YOU DIG" AT 1-800-922-4455 TO VERIFY AND IDENTIFY THE EXACT LOCATIONS OF ALL UNDERGROUND UTILITIES AND OBSTRUCTIONS IDENTIFIED PRIOR TO COMMENCING WORK IN THE CONTRACT AREA.

16. CONTRACTOR SHALL COMPLY WITH OWNER ENVIRONMENTAL ENGINEER ON ALL METHODS AND PROVISIONS FOR ALL EXCAVATION ACTIVITIES INCLUDING SOIL DISPOSAL. ALL BACKFILL MATERIALS TO BE PROVIDED BY THE CONTRACTOR.

17. DIMENSIONS OF EXISTING TOWER ARE BASED ON MANUFACTURER'S DRAWINGS PREPARED BY ROHN INDUSTRIES. DATED FEBRUARY 1, 1991, AND ARE NOT GUARANTEED. CONTRACTOR SHALL TAKE FIELD DIMENSIONS AS NECESSARY TO ASSURE PROPER FIT OF ALL FINISHED WORK AND SHALL ASSUME FULL RESPONSIBILITY FOR THEIR ACCURACY. WHEN SHOP DRAWINGS BASED ON FIELD MEASUREMENT ARE SUBMITTED FOR REVIEW, DIMENSIONS ARE PROVIDED FOR THE ENGINEER'S REFERENCE ONLY.

18. TOWER INVENTORY IS BASED ON INFORMATION OBTAINED FROM MOTOROLA/CONNECTICUT STATE POLICE DATED JUNE 22, 2016 AND AT&T DATED APRIL 6, 2018. TOWER MAPPING AND EXISTING INVENTORY OBTAINED FROM D&K NATIONWIDE COMMUNICATIONS, INC. DATED MARCH 18, 2016.

19. CONTRACTOR TO VERIFY REQUIRED CLEARANCES INCLUDING BUT NOT LIMITED TO EXISTING BUILDINGS, EQUIPMENT PADS AND SHELTERS PRIOR TO COMMENCING WORK.

20. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION. NO MEMBER OF THE TOWER SHALL BE LEFT DISCONNECTED FOR THE NEXT WORKING DAY. THE CONTRACTOR SHALL BE AWARE OF WEATHER AND WIND CONDITIONS AND NOT PERFORM MEMBER REPLACEMENT IN A WIND GUSTING MORE THAN 10 MPH.

STRUCTURAL NOTES

STRUCTURAL STEEL MATERIAL:

EXISTING PIPE/TUBE LEG .... ASTM A572-50
1/3 HSS REINFORCING .... ASTM 501-Gr. B (50 ksi)
EXISTING PLATES & ANGLES .... ASTM A36
BOLTS .... ASTM A325N, 325X

STRUCTURAL STEEL SHALL CONFORM TO ALL THE REQUIREMENTS OF THE ASTM SPECIFICATION, AS REFERENCED IN THE CODE.

UNLESS OTHERWISE NOTED, ALL STEEL WILL BE GALVANIZED IN ACCORDANCE WITH ASTM 123 AFTER FABRICATION. TOUCH UP ALL DAMAGED GALVANIZED STEEL WITH APPROVED COLD ZINC, "GALVANOX", "DRY GALV", "ZINC-IT", OR APPROVED EQUIVALENT, IN ACCORDANCE WITH MANUFACTURERS GUIDELINES. TOUCH-UP DAMAGED NON GALVANIZED STEEL WITH SAME PAINT APPLIED IN SHOP OR FIELD.

SHOP AND ERECTION DRAWINGS SHALL BE SUBMITTED FOR ALL STRUCTURAL STEEL WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. SUBMIT 2 SETS OF PRINTS FOR THE ENGINEER REVIEW. REFER TO NOTE 12 ABOVE.

MILL BEARING ENDS OF COLUMNS, STIFFENERS, AND OTHER BEARING SURFACES TO TRANSFER LOAD OVER ENTIRE CROSS SECTION.

THE OMISSION OF ANY MATERIAL THAT WAS SHOWN ON THE CONTRACT DRAWINGS SHALL NOT RELIEVE THE CONTRACTOR OF PROVIDING THE SAME.

CONNECTIONS / FIELD ASSEMBLY:

BOLTED CONNECTIONS: UNLESS OTHERWISE NOTED, ALL JOINTS ARE SLIP CRITICAL TYPE, REQUIRING 5/8", 3/4", 7/8" & 1" DIA. A325N BOLTS, A563 NUTS AND F436 WASHERS, ALL GALVANIZED. BEVELED WASHERS SHALL BE USED ON BEAM FLANGES HAVING A SLOPE GREATER THAN 1:20.

STRUCTURE IS DESIGNED TO BE LEVEL AND PLUMB, SELF-SUPPORTING AND STABLE AFTER WORK IS COMPLETED.

COMMENCEMENT OF WORK WITHOUT NOTIFYING THE ENGINEER OF ANY DISCREPANCIES WILL BE CONSIDERED ACCEPTANCE OF PRECEDING WORK.

INSPECTIONS:

SPECIAL INSPECTIONS ARE REQUIRED PER THE CODE FOR STRUCTURAL STEEL WORK.

OWNER WILL SUPPLY THE SERVICES OF A SPECIAL INSPECTOR AND TESTING AGENTS AS REQUIRED. CONTRACTOR SHALL COORDINATE INSPECTIONS OF FABRICATOR'S AND ERECTOR'S WORK AND MATERIALS TO MEET THE REQUIREMENTS OF THE STATEMENT OF SPECIAL INSPECTIONS FOR THIS PROJECT.

COPIES OF TESTING AND INSPECTION REPORTS WILL BE PROVIDED TO THE OWNER, BUILDING OFFICIAL, ENGINEER OF RECORD AND CONTRACTOR.

PROJECT NO. 60581632
Designed by: MCD
Drawn by: GAT
Checked by: ICA
Approved by: RAS

AECOM
500 ENTERPRISE DRIVE
ROCKY HILL, CONNECTICUT
(860)-529-8882

at&t

WESTPORT, AT&T SITE CTLO2147
SITE ADDRESS: 880 POST ROAD EAST
WESTPORT, CONNECTICUT

REV.	DATE:	DESCRIPTION

Scale: AS NOTED
Date: 7/13/2018
Job No. SMK-004
File No.

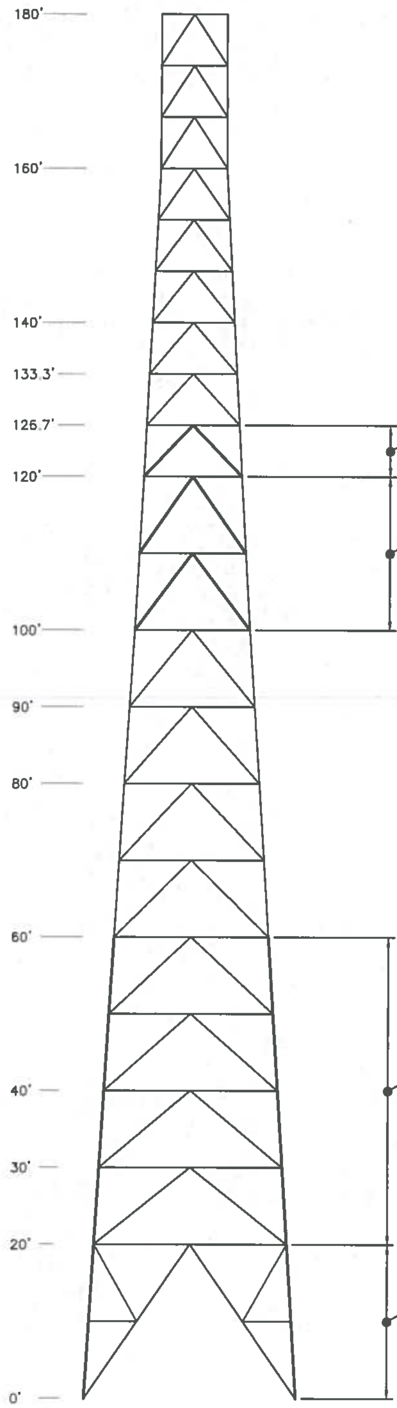
Dwg. No. SK-1
Dwg. 1 of 4

STRUCTURAL NOTES

SEE SHEET SK-1 FOR STRUCTURAL NOTES

NOTES:

1. REFER TO STRUCTURAL NOTES ON SK-1 FOR STEEL GRADE REQUIREMENTS FOR REPLACEMENT AND REINFORCEMENT MEMBERS.
2. CONTRACTOR SHALL COORDINATE WITH ROHN INDUSTRIES INC. FOR DIAGONAL AND HORIZONTAL PIPE ASSEMBLY REPLACEMENT INDICATED ON SHEET.
3. REINFORCEMENT OF TOWER IS REQUIRED FOR ALL 3 SIDES OF EXISTING TOWER STRUCTURE.
4. 1/3 HSS TUBES SHALL BE ATTACHED TO TOWER STRUCTURE WITH U-BOLTS. SEE SK-3 AND SK-4 FOR DETAILS.
5. CONNECTION BOLTS FOR REPLACEMENT MEMBERS SHALL BE REPLACED IN KIND. EXISTING BOLTS SHALL NOT BE RE-USED FOR CONNECTION OF REPLACEMENT MEMBERS.



REPLACE EXISTING ROHN 2 X-STR (P2x0.128) PIPE WITH ROHN 2-XXS (P2x0.436) EL. 120'-126.7'.

REPLACE EXISTING ROHN 2.5 EH (P2.5x0.276) PIPE WITH ROHN 2.5-XXS (P2.5x0.552) EL. 100'-120'.

INSTALL 1/3 HSS 9.6250 O.D. x 0.375 TUBE ON EXISTING ROHN 8 EH (8.750 x 0.3750) EL 20'-60'. SEE SK-3 AND SK-4 FOR DETAILS.

INSTALL 1/3 HSS 9.6250 O.D. x 0.375 TUBE ON EXISTING ROHN 8 EH (8.6250 x 0.500) EL 0'-20'. SEE SK-3 AND SK-4 FOR DETAILS.

1 / SK-2 **TOWER ELEVATION**

SCALE: 1" = 25'-0"

STATE OF CONNECTICUT · RICHARD A. SAMBOR · No. 9057 · LICENSED PROFESSIONAL ENGINEER

PROJECT NO. 60581632	AECOM	at&t
Designed by: MCD	500 ENTERPRISE DRIVE	WESTPORT, AT&T SITE CTLO2147
Drawn by: GAT	ROCKY HILL, CONNECTICUT	SITE ADDRESS: 880 POST ROAD EAST
Checked by: ICA	(860)-529-8882	WESTPORT, CONNECTICUT
Approved by: RAS		

REV.	DATE:	DESCRIPTION

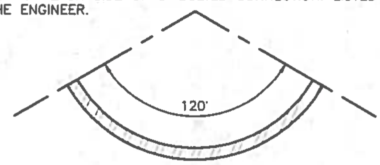
Scale: AS NOTED | Date: 7/13/2018 | Dwg. No. SK-2

Job No. SMK-004 | File No. | Dwg. 2 of 4

ELEVATION	TOWER LEG DIAMETER 1/3 HSS TUBE EXISTING LEG SIZE (IN)	1/3 HSS TUBE REINFORCING DIMENSIONS (IN)	MINIMUM # U-BOLTS AT EACH END OF 20' SECTION SPACED AS INDICATED C-TO-C (# PER TOWER LEG)	MINIMUM U-BOLTS REMAINING PER LEG (QTY)	TOTAL U-BOLTS PER LEG PER 20' SECTION (MIN.)(QTY)	DIAMETER U-BOLTS (IN)	MINIMUM SPACING REMAINING U-BOLTS C-TO-C (IN)	MAXIMUM SPACING REMAINING U-BOLTS C-TO-C (IN)	INSTALLING PRETENSION FORCE ON U-BOLT CONNECTION (KIPS) (LRFD)
0'-20'	8.6250x0.500	9.6250x0.375	15	10	40	5/8	8	12	10
20' - 40'	8.750x0.375	9.6250x0.375	23	12	58	5/8	6.5	7	6.85
40'-60'	8.750x0.375	9.6250x0.375	23	12	58	5/8	6.5	7	6.85

NOTES:

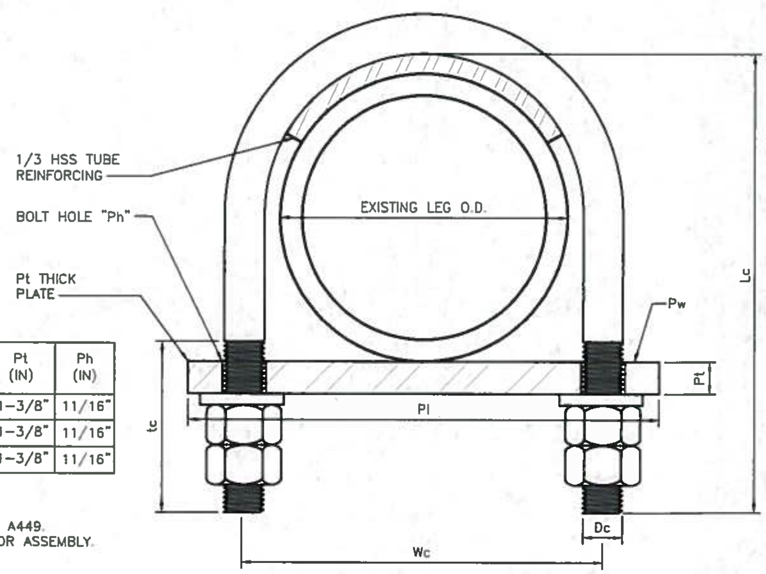
- U-BOLTS SHALL MEET THE STRENGTH REQUIREMENTS OF ASTM A449. BASIS OF DESIGN IS PORTLAND BOLT OF PORTLAND, OREGON, USA. ALTERNATIVE SUPPLIER SHALL MATCH OR EXCEED QUALITY OF PORTLAND BOLT.
- CONTRACTOR SHALL TAKE SPECIFIC CARE WHEN INSTALLING U-BOLTS AND NOT ALLOW ANY VISIBLE DEFORMATION OF THE EXISTING TOWER LEG MEMBERS.
- THE 1/3 (ONE-THIRD) HSS TUBE REFERS TO THE REQUIRED PORTION OF HSS TUBING TO BE INSTALLED FOR REINFORCING.
- EXISTING TOWER LEGS HAVE STEP BOLTS. PLACEMENT OF THE 1/3 HSS TUBING SHALL NOT CONFLICT WITH EXISTING TOWER STEP BOLTS.
- SPACING DIMENSIONS FOR U-BOLTS ARE MAXIMUM ALLOWABLE DISTANCES (CENTER-TO-CENTER). ADDITIONAL U-BOLTS MAY BE REQUIRED DUE TO INTERRUPTION CAUSED BY EXISTING TOWER CONDITIONS. SHOP DRAWINGS SHALL ILLUSTRATE ACTUAL BOLT SPACING REQUIRED BASED ON VERIFIED FIELD CONDITIONS.
- 1/3 HSS TUBES SHALL BE CONTINUOUS, SINGLE PIECE MEMBERS APPROXIMATELY 20' LENGTH (TO BE FIELD VERIFIED BEFORE ORDERING).
- INSTALLING PRETENSION FORCE IS FOR EACH SIDE OF U-BOLTED CONNECTION. LISTED PRETENSION SHALL NOT BE EXCEEDED WITHOUT NOTIFYING THE ENGINEER.



PLAN VIEW OF 1/3 HSS TUBE

2 SK-3 1/3 HSS TUBE REINFORCEMENT

SCALE: N.T.S.



ELEVATION	TOWER LEG DIAMETER (IN)	HSS REINFORCING O.D. (IN)	Dc (IN)	Lc (IN)	Wc (IN)	tc (IN)	Pl (IN)	Pw (IN)	Pt (IN)	Ph (IN)
0-20'	8.625	9.625	5/8"	12"	9-5/8"	3"	12-1/4"	2-1/2"	1-3/8"	11/16"
20'-40'	8.75	9.625	5/8"	12-1/8"	9-5/8"	3"	12-1/4"	2"	1-3/8"	11/16"
40'-60'	8.75	9.625	5/8"	12-1/8"	9-5/8"	3"	12-1/4"	2"	1-3/8"	11/16"

NOTES:

1. U-BOLT ATTACHMENT PLATE MATERIAL SHALL MEET STRENGTH REQUIREMENTS OF ASTM A449. COORDINATE WITH ABOVE U-BOLT TABLE FOR QUANTITIES AND SPACING OF U-BOLT FOR ASSEMBLY.
2. "Pw" REFERS TO PLATE WIDTH MEASUREMENT IN THE ABOVE TABLE.

1 SK-3 U-BOLT FOR LEG REINFORCEMENT

SCALE: N.T.S.

STATE OF CONNECTICUT RICHARD A. SAMBOR No. 9057 LICENSED PROFESSIONAL ENGINEER

PROJECT NO. 60581632
Designed by: MCD
Drawn by: GAT
Checked by: ICA
Approved by: RAS

AECOM
500 ENTERPRISE DRIVE
ROCKY HILL, CONNECTICUT
(860)-529-8882

at&t

WESTPORT, AT&T SITE CTL02147
SITE ADDRESS: 880 POST ROAD EAST
WESTPORT, CONNECTICUT

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Scale: AS NOTED | Date: 7/13/2018
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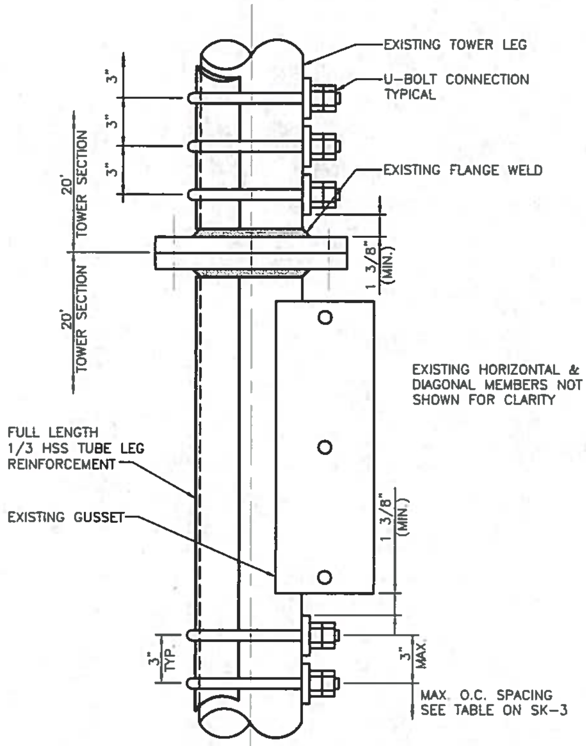
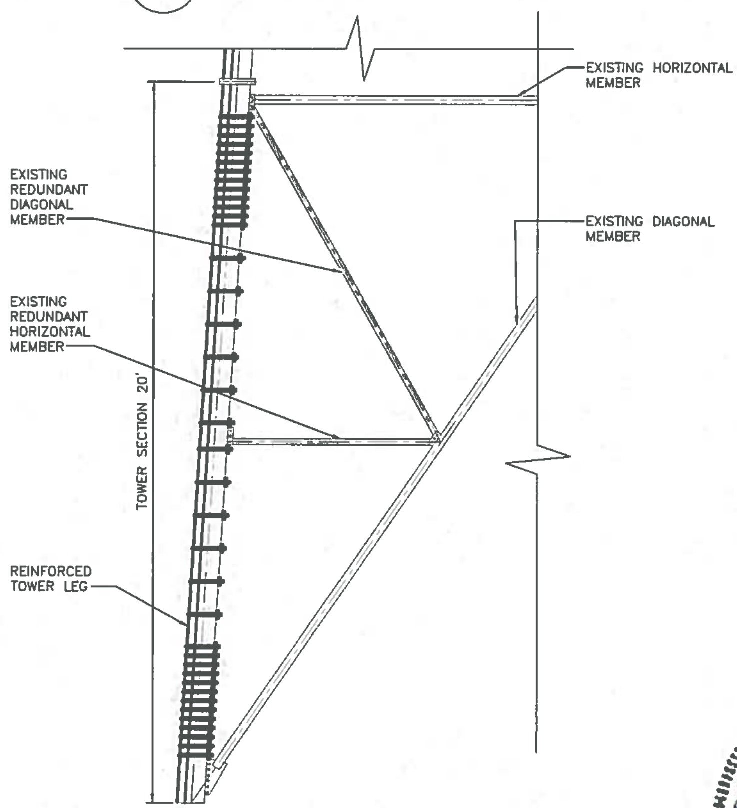
Dwg. No. SK-3



1 SK-4 **LEG REINFORCEMENT**
SCALE: 1" = 1'-0"



2 SK-4 **DIAGRAMATIC U-BOLT LAYOUT AT TOWER BASE SECTION**
SCALE: 3/16" = 1'-0"

STATE OF CONNECTICUT RICHARD A. SAMBOR No. 9057 LICENSED PROFESSIONAL ENGINEER

PROJECT NO. 60581632	AECOM 500 ENTERPRISE DRIVE ROCKY HILL, CONNECTICUT (860)-529-8882	at&t
Designed by: MCD		WESTPORT, AT&T SITE CTLO2147
Drawn by: GAT		SITE ADDRESS: 880 POST ROAD EAST WESTPORT, CONNECTICUT
Checked by: ICA		
Approved by: RAS		

REV.	DATE:	DESCRIPTION

Dwg. No. SK-4

Scale: AS NOTED | Date: 7/13/2018

Job No. SMK-004 | File No. | Dwg. 4 of 4

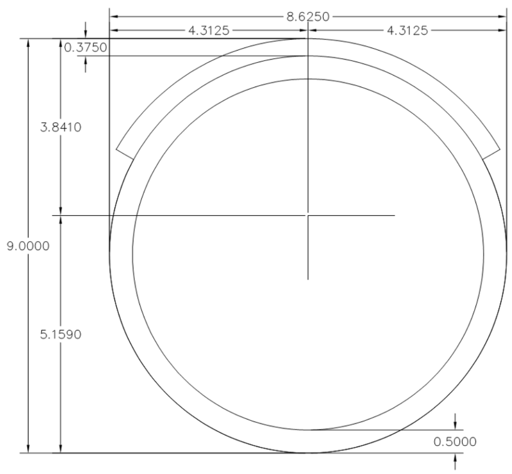
Leg Property - HSS 8.6250x0.500 with Built up 1/3 HSS 9.6250x0.375 (Elevations 0' - 20')

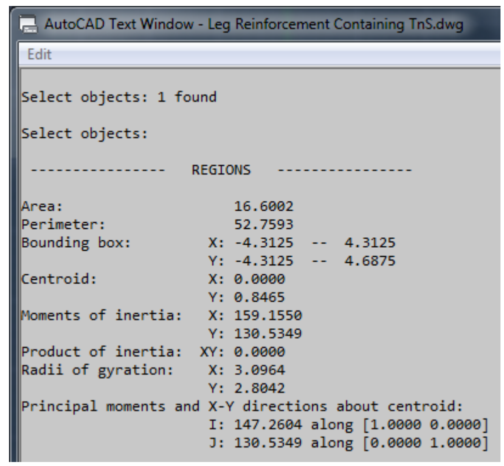
$Height_{sect} := 9.00\,in$ $D_{Leg} := 8.6250\,in$

$Width_{sect} := 8.6250\,in$

$WindApplied := \max(Height_{sect}, Width_{sect}) = 9 \cdot in$

$Perimeter_{sect} := 52.7593\,in$





$Steel_{Modulus} := 29000\,ksi$

$Steel_{Density} := 490\,pcf$

$Section_{Area} := 16.6002\,in^2$

$I_{x.Section} := 147.2604\,in^4$

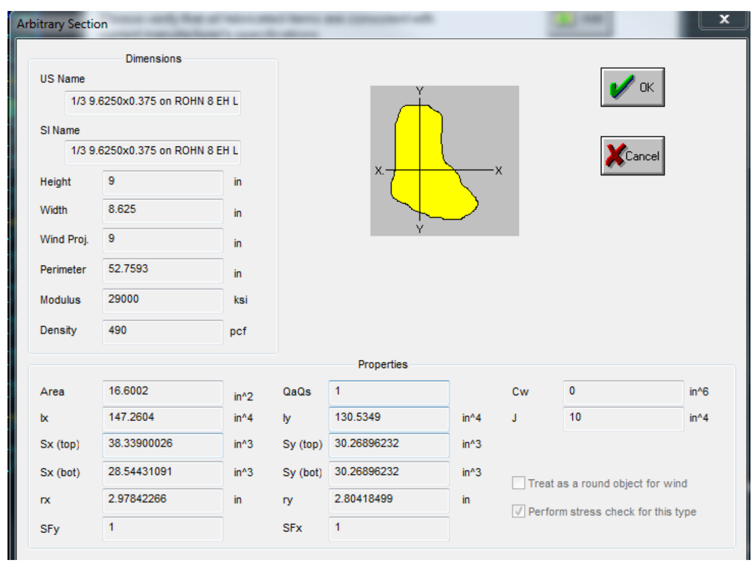
$I_{y.Section} := 130.5349\,in^4$

$d_{yT.Section} := 4.31250\,in$

$d_{yB.Section} := 4.31250\,in$

$d_{xT.Section} := 3.8410\,in$

$d_{xB.Section} := 5.1590\,in$



$$S_{y.TOP.Section} := \frac{I_{y.Section}}{d_{yT.Section}} = 30.26896232 \cdot in^3$$

$$S_{y.BOTTOM.Section} := \frac{I_{y.Section}}{d_{yB.Section}} = 30.26896232 \cdot in^3$$

$$S_{x.TOP.Section} := \frac{I_{x.Section}}{d_{xT.Section}} = 38.33907837 \cdot in^3$$

$$S_{x.BOTTOM.Section} := \frac{I_{x.Section}}{d_{xB.Section}} = 28.54436906 \cdot in^3$$

NOTE: The intent of this additional steel identified as HSS 9.6250x0.375 is additional steel required to address the Connecticut State Police requirment for combined Twist and Sway to be below 0.75 degrees.

The following calculation is shown to determine the maximum number of clamps required for a development length at the end of the reinforcing member (similar to welds at ends of built-up sections).
Per TIA-222 Standard, the use of AISC Group "A" bolts shall be considered as design criteria for the number of bolts required for installation.

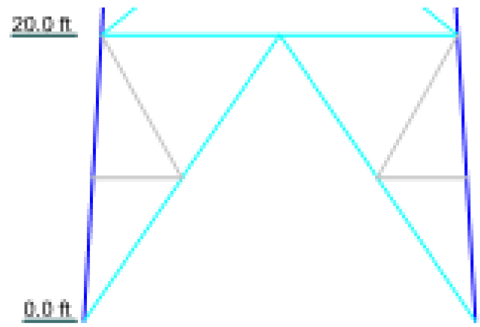
Elevation Length --> $L_{total} := 20ft$

Number of Bays within Elevation Region -->

$Num_{bays} := 2$

Maximum Length of unbraced Leg-->

$$L_{max.Unbraced} := \frac{L_{total}}{Num_{bays}} = 120 \cdot in$$



Existing Leg - Prior to MODification --> 8.6250 O.D. x 0.500" (t) (50 ksi Yield Strength) - Reference: ROHN Industries Engineering File 26263DL - Drawing C910693.

$K_{unbraced} := 1.0$ (Conservative Assumption)

$r_{existing.leg} := 2.89in$

$F_{y.leg} := 50ksi$

$A_{existing.leg} := 11.9205in^2$ (AISC Design Thickness determined Area)

NOTE: Because the existing Leg is 60 ksi, the effective leg strength is to apply AISC Chapter E.

Slenderness Check [AISC B4.1a]

$$Slenderness_{CHECK} := if\left(\frac{8.6250in}{0.465in} < 0.11 \cdot \frac{Steel_{Modulus}}{F_{y.leg}}, \text{"Not Slender - Compression"}, \text{"Slender - Compression"}\right)$$

$Slenderness_{CHECK} = \text{"Not Slender - Compression"}$

For Non-Slender Members, Apply AISC Equation E3-2

$$\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{existing.leg}} = 41.52$$

$$F_e := \frac{\pi^2 \cdot 29000ksi}{\left(\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{existing.leg}}\right)^2} = 166.01 \cdot ksi$$

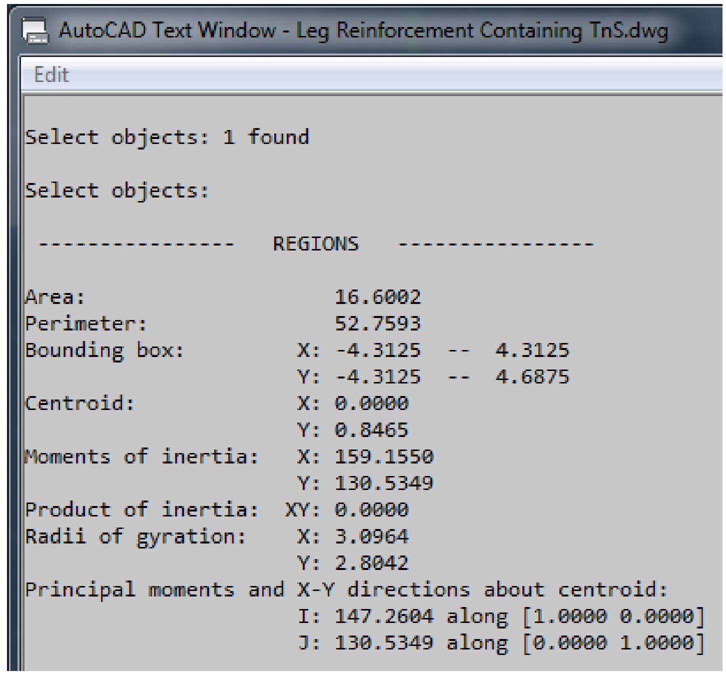
$$F_{cr} := \left[0.658^{\left(\frac{F_{y.leg}}{F_e}\right)}\right] \cdot F_{y.leg} = 44.08 \cdot ksi$$

Existing Leg Strength - Prior to MODification --> (ϕ = 0.90 - Compression - LRFD [AISC Chapter E])

$$P_{Str.Leg} := 0.90 \cdot F_{cr} \cdot A_{existing.leg} = 472.89 \cdot kip$$

Built-up / Reinforcement Section additional to the existing Leg member:

Determine governing radius of gyration of material:



```
AutoCAD Text Window - Leg Reinforcement Containing TnS.dwg
Edit

Select objects: 1 found

Select objects:

 ----------------   REGIONS   ----------------

Area:                    16.6002
Perimeter:               52.7593
Bounding box:         X: -4.3125  --  4.3125
                      Y: -4.3125  --  4.6875
Centroid:             X: 0.0000
                      Y: 0.8465
Moments of inertia:   X: 159.1550
                      Y: 130.5349
Product of inertia:  XY: 0.0000
Radii of gyration:    X: 3.0964
                      Y: 2.8042
Principal moments and X-Y directions about centroid:
                      I: 147.2604 along [1.0000 0.0000]
                      J: 130.5349 along [0.0000 1.0000]
```

$$A_{reinf} := 16.6002 in^2$$

$$I_{x.reinf} := 147.2604 in^4$$

$$I_{y.reinf} := 130.5349 in^4$$

$$r_{design.reinf} := \min\left(\sqrt{\frac{I_{x.reinf}}{A_{reinf}}}, \sqrt{\frac{I_{y.reinf}}{A_{reinf}}}\right) = 2.8 \cdot in$$

$$\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{design.reinf}} = 42.79$$

$$F_{e.reinf} := \frac{\pi^2 \cdot 29000 ksi}{\left(\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{design.reinf}}\right)^2} = 156.3 \cdot ksi$$

$$F_{cr.BU} := \left[0.658^{\left(\frac{42ksi}{F_{e.reinf}}\right)}\right] \cdot 42ksi = 37.53 \cdot ksi$$

NOTE: "42 ksi" applied due to built-up pipe material having a minimum Fy = 42 ksi

Existing Leg Strength - After MODification --> (ϕ = 0.90 - Compression - LRFD [AISC Chapter E])

$$P_{Str.Reinf} := 0.90 \cdot F_{cr.BU} \cdot A_{reinf} = 560.74 \cdot kip$$

Difference in materials required to be Developed at end points of reinforcing:

$$U_{Bolt.Design.Force} := P_{Str.Reinf} - P_{Str.Leg} = 87.85 \cdot kip$$ <------ INSERT THIS VALUE INTO TABLE (Next Page)

TIA-222-G U-Bolt Strength Design Check:

$$\left(\frac{V_{us}}{\phi_u \cdot R_{ns}}\right)^2 + \left(\frac{T_{ur}}{\phi_u \cdot R_{nr}}\right)^2 \le 1.0$$

$V_{us} := 87.85\text{kip}$ $\quad F_{y.UBolt} := 92\text{ksi}$ $\quad dia_{UBolt} := \frac{5}{8}\text{in}$

$T_{ur} := 0\text{kip}$ $\quad FU_{UBolt} := 120\text{ksi}$ $\quad A_{g.UBolt} := \left(\frac{\pi}{4}\right)\cdot\left(dia_{UBolt}\right)^2$

$N_{UBolt.Ends} := 15$ $\quad R_{ns} := 0.30\cdot\left(2\cdot T_p - T_{ut}\right)$ $\quad n_{threads} := 11$

$\phi_u := 1.00$

$T_p := 10000\text{lbf}$ <-- Installation Pretension Force per Bolt Leg - Manual Input

$T_{ut} := 0\text{kip}$

$R_{ns} := 0.30\cdot\left(2\cdot T_p - T_{ut}\right)$ $\quad R_{ns} = 6\cdot\text{kip}$

$$A_{tensBolt} := \left(\frac{\pi}{4}\right)\left(dia_{UBolt} - \frac{0.9743\text{in}}{n_{threads}}\right)^2 = 0.23\cdot\text{in}^2$$

Maximum U-Bolt Tension Capacity, where the tensile capacity of each leg of the U-Bolt shall not exceed 0.85 Fy*Ag & 0.75*Fu*A.tension of bolt used.

$Check_{UBolt1} := \text{if}\left(T_p < 0.85\cdot F_{y.UBolt}\cdot A_{g.UBolt}, \text{"OK for Use"}, \text{"NOT ok for Use"}\right)$ $\quad Check_{UBolt1} = \text{"OK for Use"}$

$Check_{UBolt2} := \text{if}\left(T_p < 0.75\cdot FU_{UBolt}\cdot A_{tensBolt}, \text{"OK for Use"}, \text{"NOT ok for Use"}\right)$ $\quad Check_{UBolt2} = \text{"OK for Use"}$

$R_{nr} := 0.5\cdot D_{Leg}\cdot R_{ns}$

$$UBolt_{Str.Ratio} := \left(\frac{\frac{V_{us}}{N_{UBolt.Ends}}}{\phi_u\cdot R_{ns}}\right)^2 + \left(\frac{T_{ur}}{\phi_u\cdot R_{nr}}\right)^2$$

$UBolt_{Str.Ratio} = 0.95$

$Check_{UBolt} := \text{if}\left(UBolt_{Str.Ratio} \le 1.0, \text{"OK for Use"}, \text{"NOT ok for Use"}\right)$ $\quad Check_{UBolt} = \text{"OK for Use"}$

CHECK Existing Leg Capacity for Pipe Crushing Capacity (localized impact) to select maximum permissible U-Bolt Diameter Limit:

$$R_u := \phi\cdot\left[5.5\cdot F_y\cdot t^2\left(1 + 0.25\cdot\frac{l_b}{D}\right)\cdot Q_f\right]$$ [AISC Equation K1-2]

$F_{y.leg} = 50\cdot\text{ksi}$

$D := 8.6250\text{in}$

$t := 0.50\text{in}$

$l_b := 0\text{in}$ (Conservative Assumption)

$U := 1$ Assuming @ Capacity value (Conservative Assumption)

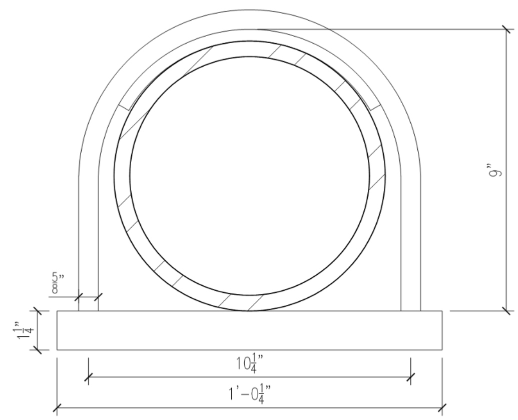
$Q_f := 1 - 0.3\cdot U\cdot(1 + U)$ $\quad Q_f = 0.4$ [AISC Equation K1-5]

$$R_{u.crushingHSS} := 0.9\cdot\left[5.5\cdot F_{y.leg}\cdot t^2\left(1 + 0.25\cdot\frac{l_b}{D}\right)\cdot Q_f\right]$$ $R_{u.crushingHSS} = 24.75\cdot\text{kip}$

$Check_{UBolt.Leg} := \text{if}\left(R_{ns} < R_{u.crushingHSS}, \text{"OK for Use"}, \text{"NOT ok for Use"}\right)$ $\quad Check_{UBolt.Leg} = \text{"OK for Use"}$

CHECK Plastic Bending Capacity of connecting Plates to hold U-Bolt and Clamped reinforcing pipe to leg:

$$\sigma := \frac{M}{Z} = \frac{\frac{P \cdot L}{4}}{\left(\frac{b \cdot d^2}{4}\right)} \quad \text{--->} \quad P := \frac{4 \cdot (0.9 \cdot \sigma) \cdot \left(\frac{b \cdot d^2}{4}\right)}{L}$$



$\sigma := 50000\text{psi}$ $\qquad d_{Plate.Thick} := 1\text{in} + \frac{6}{16}\text{in}$

$b_{PlateHeight} := 2.5\text{in}$ $\qquad L_{clamp.ends} := 10.25\text{in}$

$$P_{U\_Bolt.Plate} := \frac{4 \cdot (0.9 \cdot \sigma) \cdot \left(\frac{b_{PlateHeight} \cdot d_{Plate.Thick}{}^2}{4}\right)}{L_{clamp.ends}} = 20750.76 \cdot \text{lbf}$$

$Check_{UBolt.Plate} := \text{if}\left(2 \cdot T_p < P_{U\_Bolt.Plate}, \text{"OK for Use"}, \text{"NOT ok for Use"}\right)$ $\qquad Check_{UBolt.Plate} = \text{"OK for Use"}$

U-Bolt CHECK **Summary** for all parts of U-bolting to address Reinforcing Tube at ends to develop Reinforcement properties

$Check_{UBolt} = \text{"OK for Use"}$ $\qquad \frac{2 \cdot T_p}{\left(0.85 \cdot F_{y.UBolt} \cdot A_{g.UBolt}\right)} = 0.83$ $\qquad Check_{UBolt.Leg} = \text{"OK for Use"}$

$$\frac{2 \cdot T_p}{R_{u.crushingHSS}} = 0.81$$

$Check_{UBolt.Plate} = \text{"OK for Use"}$ $\qquad \frac{2 \cdot T_p}{P_{U\_Bolt.Plate}} = 0.96$

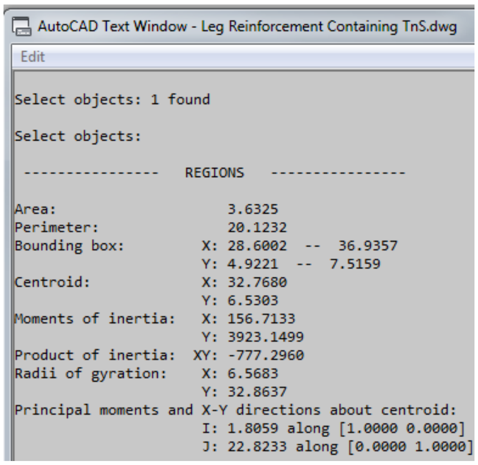
Design Required for Remainder of Clamps required for installation to keep Reinforcement attached to Leg:

Consider --> 1/3 HSS 9.6250x0.375

$$I_{x.Pipe} := 1.8059 in^4$$

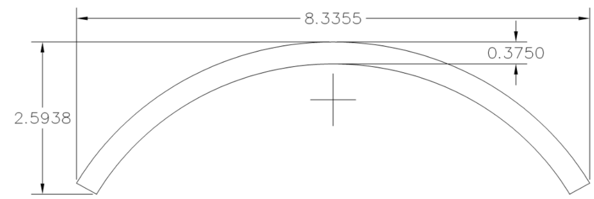
$$I_{y.Pipe} := 22.8233 in^4$$

$$A_{pipe} := 3.6325 in^2$$


AutoCAD Text Window - Leg Reinforcement Containing TnS.dwg

Edit

```
Select objects: 1 found
Select objects:
 ----------------   REGIONS   ----------------
Area:                    3.6325
Perimeter:               20.1232
Bounding box:         X: 28.6002  --  36.9357
                      Y: 4.9221  --  7.5159
Centroid:             X: 32.7680
                      Y: 6.5303
Moments of inertia:   X: 156.7133
                      Y: 3923.1499
Product of inertia:  XY: -777.2960
Radii of gyration:    X: 6.5683
                      Y: 32.8637
Principal moments and X-Y directions about centroid:
                      I: 1.8059 along [1.0000 0.0000]
                      J: 22.8233 along [0.0000 1.0000]
```



$$r_{design.Pipe} := \min\left(\sqrt{\frac{I_{x.Pipe}}{A_{pipe}}}, \sqrt{\frac{I_{y.Pipe}}{A_{pipe}}}\right) = 0.71 \cdot in$$

Determine the minimum number of clamps per bay to keep the effective strength of the "bonded" bracing ends:

$$KL_{Leg} := \frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{existing.leg}} = 41.52$$

Enter Minimum # of clamps here ---> $Num_{clamps.min} := 6$

$$KL_{Reinf} := \frac{\frac{L_{max.Unbraced}}{(Num_{clamps.min} - 1)}}{r_{design.Pipe}} = 34.04$$

$$Min_{clamps} := \text{if}\left(KL_{Reinf} < KL_{Leg}, \text{"Number of Clamps Determined"}, \text{"Add clamp"}\right)$$

$$Min_{clamps} = \text{"Number of Clamps Determined"}$$

Determine maximim of separation of u-bolts per bay to keep effective strength of the "bonded bracing ends:

$$\frac{L_{max.Unbraced}}{Num_{clamps.min}} = 20 \cdot in$$

The figure to the left is always considered rounded down. This indicates the maximum permissible spacing of any U-bolt clamps not associated to the "bonding" ends of the reinforcement to the tower structure.

AECOM

				Page	of
Job	180' ROHN Lattice Tower - Westport, CT	Project No.	SMK-004	Sheet 1	of 6
Description	U-Bolted Connecting Pipes Design	Computed by	MCD	Date	07/13/18
	TIA-222-G Design Standard	Checked by		Date	

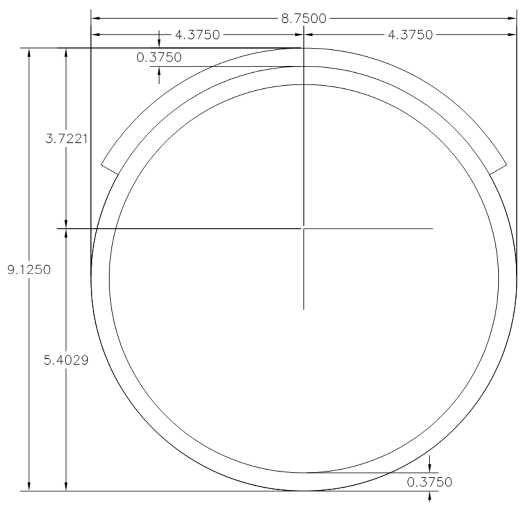
Leg Property - HSS 8.750x0.3750 with Built up 1/3 HSS 9.6250x0.375 (Elevations 20' - 60')

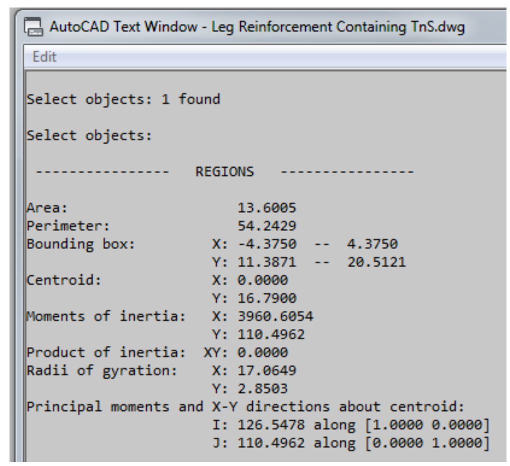
$Height_{sect} := 9.1250in$ $D_{Leg} := 8.750in$

$Width_{sect} := 8.750in$

$WindApplied := \max\left(Height_{sect}, Width_{sect}\right) = 9.125 \cdot in$

$Perimeter_{sect} := 54.2429in$





$Steel_{Modulus} := 29000ksi$

$Steel_{Density} := 490pcf$

$Section_{Area} := 13.6005in^2$

$I_{x.Section} := 126.5478in^4$

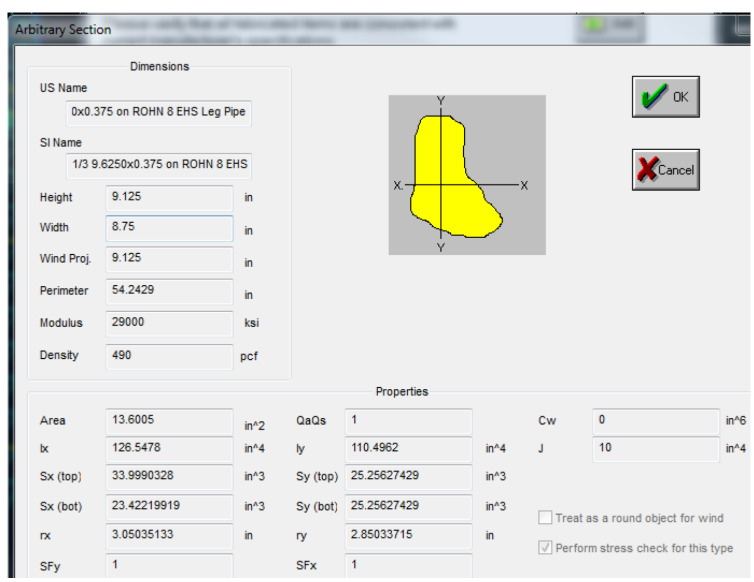
$I_{y.Section} := 110.4962in^4$

$d_{yT.Section} := 4.3750in$

$d_{yB.Section} := 4.3750in$

$d_{xT.Section} := 3.7221in$

$d_{xB.Section} := 5.4029in$



$$S_{y.TOP.Section} := \frac{I_{y.Section}}{d_{yT.Section}} = 25.25627429 \cdot in^3$$

$$S_{y.BOTTOM.Section} := \frac{I_{y.Section}}{d_{yB.Section}} = 25.25627429 \cdot in^3$$

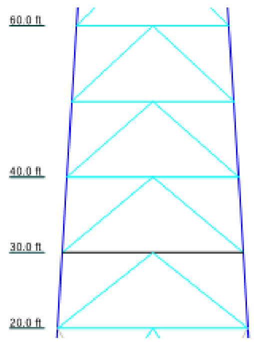
$$S_{x.TOP.Section} := \frac{I_{x.Section}}{d_{xT.Section}} = 33.9990328 \cdot in^3$$

$$S_{x.BOTTOM.Section} := \frac{I_{x.Section}}{d_{xB.Section}} = 23.42219919 \cdot in^3$$

NOTE: The intent of this additional steel identified as HSS 9.6250x0.375 is additional steel required to address the Connecticut State Police requirment for combined Twist and Sway to be below 0.75 degrees.

The following calculation is shown to determine the maximum number of clamps required for a development length at the end of the reinforcing member (similar to welds at ends of built-up sections).
Per TIA-222 Standard, the use of AISC Group "A" bolts shall be considered as design criteria for the number of bolts required for installation.

Elevation Length --> $L_{total} := 40ft$



Number of Bays within Elevation Region -->

$Num_{bays} := 4$

Maximum Length of unbraced Leg-->

$$L_{max.Unbraced} := \frac{L_{total}}{Num_{bays}} = 120 \cdot in$$

Existing Leg - Prior to MODification --> 8.75 O.D. x 0.375 (t) (50 ksi Yield Strength) - Reference: ROHN Industries Engineering File 26263DL - Drawing C910693.

$K_{unbraced} := 1.0$ (Conservative Assumption) $F_{y.leg} := 50ksi$

$r_{existing.leg} := 2.972843799in$ (AISC Design "r" determined - AISC Page 1-5 "Hollow Steel Sections")

$A_{existing.leg} := 9.2047in^2$ (AISC Design Thickness determined Area - AISC Page 1-5 "Hollow Steel Sections")

NOTE: Because the existing Leg is 60 ksi, the effective leg strength is to apply AISC Chapter E.

Slenderness Check [AISC B4.1a]

$$Slenderness_{CHECK} := if\left(\frac{8.6250in}{0.34875in} < 0.11 \cdot \frac{Steel_{Modulus}}{F_{y.leg}}, \text{"Not Slender - Compression"}, \text{"Slender - Compression"}\right)$$

$$Slenderness_{CHECK} = \text{"Not Slender - Compression"}$$

For Non-Slender Members, Apply AISC Equation E3-2

$$\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{existing.leg}} = 40.37$$

$$F_e := \frac{\pi^2 \cdot 29000ksi}{\left(\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{existing.leg}}\right)^2} = 175.66 \cdot ksi$$

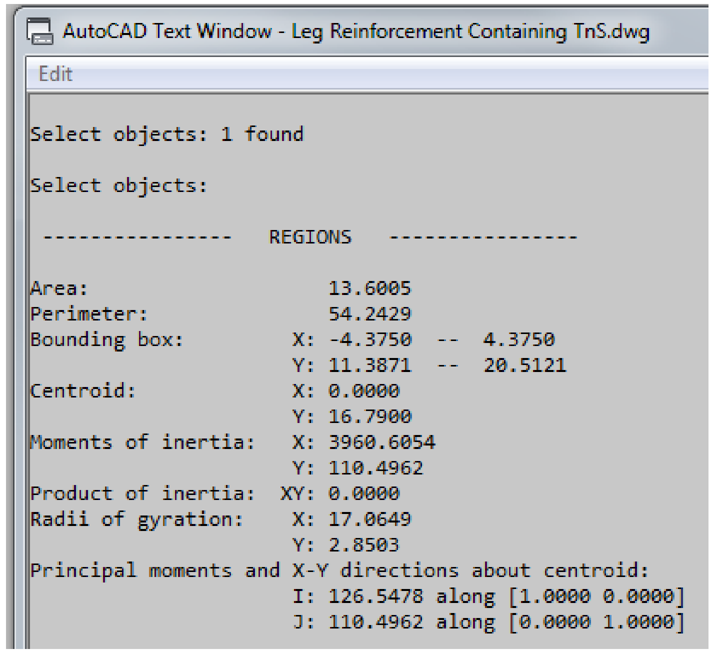
$$F_{cr} := \left[0.658^{\left(\frac{F_{y.leg}}{F_e}\right)}\right] \cdot F_{y.leg} = 44.38 \cdot ksi$$

Existing Leg Strength - Prior to MODification --> (ϕ = 0.90 - Compression - LRFD [AISC Chapter E])

$$P_{Str.Leg} := 0.90 \cdot F_{cr} \cdot A_{existing.leg} = 367.69 \cdot kip$$

Built-up / Reinforcement Section additional to the existing Leg member:

Determine governing radius of gyration of material:


AutoCAD Text Window - Leg Reinforcement Containing TnS.dwg

Edit

```
Select objects: 1 found

Select objects:

 ----------------   REGIONS   ----------------

Area:                        13.6005
Perimeter:                   54.2429
Bounding box:           X: -4.3750  --  4.3750
                        Y: 11.3871  --  20.5121
Centroid:               X: 0.0000
                        Y: 16.7900
Moments of inertia:     X: 3960.6054
                        Y: 110.4962
Product of inertia:    XY: 0.0000
Radii of gyration:      X: 17.0649
                        Y: 2.8503
Principal moments and X-Y directions about centroid:
                        I: 126.5478 along [1.0000 0.0000]
                        J: 110.4962 along [0.0000 1.0000]
```

$$A_{reinf} := 13.6005\,in^2$$

$$I_{x.reinf} := 126.5478\,in^4$$

$$I_{y.reinf} := 110.4962\,in^4$$

$$r_{design.reinf} := \min\left(\sqrt{\frac{I_{x.reinf}}{A_{reinf}}}, \sqrt{\frac{I_{y.reinf}}{A_{reinf}}}\right) = 2.85 \cdot in$$

$$\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{design.reinf}} = 42.1$$

$$F_{e.reinf} := \frac{\pi^2 \cdot 29000ksi}{\left(\frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{design.reinf}}\right)^2} = 161.48 \cdot ksi$$

$$F_{cr.BU} := \left[0.658^{\left(\frac{42ksi}{F_{e.reinf}}\right)}\right] \cdot 42ksi = 37.67 \cdot ksi$$

NOTE: "42 ksi" applied due to built-up pipe material having a minimum Fy = 42 ksi

Existing Leg Strength - After MODification --> (ϕ = 0.90 - Compression - LRFD [AISC Chapter E])

$$P_{Str.Reinf} := 0.90 \cdot F_{cr.BU} \cdot A_{reinf} = 461.07 \cdot kip$$

Difference in materials required to be Developed at end points of reinforcing:

$$U_{Bolt.Design.Force} := P_{Str.Reinf} - P_{Str.Leg} = 93.38 \cdot kip$$ <------ INSERT THIS VALUE INTO TABLE (Next Page)

TIA-222-G U-Bolt Strength Design Check:

$V_{us} := 93.38kip$ $\quad F_{y.UBolt} := 92ksi$ $\quad dia_{UBolt} := \frac{5}{8}in$

$$\left(\frac{V_{us}}{\phi_u \cdot R_{ns}}\right)^2 + \left(\frac{T_{ur}}{\phi_u \cdot R_{nr}}\right)^2 \le 1.0$$

$T_{ur} := 0kip$ $\quad FU_{UBolt} := 120ksi$ $\quad A_{g.UBolt} := \left(\frac{\pi}{4}\right)\cdot(dia_{UBolt})^2$

$N_{UBolt.Ends} := 23$ $\quad R_{ns} := 0.30\cdot(2\cdot T_p - T_{ut})$ $\quad n_{threads} := 11$

$\phi_u := 1.00$

$T_p := 6850lbf$ <-- Installation Pretension Force per Bolt Leg - Manual Input

$T_{ut} := 0kip$

$R_{ns} := 0.30\cdot(2\cdot T_p - T_{ut})$ $\quad R_{ns} = 4.11\cdot kip$

$$A_{tensBolt} := \left(\frac{\pi}{4}\right)\left(dia_{UBolt} - \frac{0.9743in}{n_{threads}}\right)^2 = 0.23\cdot in^2$$

Maximum U-Bolt Tension Capacity, where the tensile capacity of each leg of the U-Bolt shall not exceed 0.85 Fy*Ag & 0.75*Fu*A.tension of bolt used.

$Check_{UBolt1} := if(T_p < 0.85\cdot F_{y.UBolt}\cdot A_{g.UBolt}, \text{"OK for Use"}, \text{"NOT ok for Use"})$ $\quad Check_{UBolt1} = \text{"OK for Use"}$

$Check_{UBolt2} := if(T_p < 0.75\cdot FU_{UBolt}\cdot A_{tensBolt}, \text{"OK for Use"}, \text{"NOT ok for Use"})$ $\quad Check_{UBolt2} = \text{"OK for Use"}$

$R_{nr} := 0.5\cdot D_{Leg}\cdot R_{ns}$

$$UBolt_{Str.Ratio} := \left(\frac{\frac{V_{us}}{N_{UBolt.Ends}}}{\phi_u \cdot R_{ns}}\right)^2 + \left(\frac{T_{ur}}{\phi_u \cdot R_{nr}}\right)^2 \qquad UBolt_{Str.Ratio} = 0.98$$

$Check_{UBolt} := if(UBolt_{Str.Ratio} \le 1.0, \text{"OK for Use"}, \text{"NOT ok for Use"})$ $\quad Check_{UBolt} = \text{"OK for Use"}$

CHECK Existing Leg Capacity for Pipe Crushing Capacity (localized impact) to select maximum permissible U-Bolt Diameter Limit:

$$R_u := \phi\cdot\left[5.5\cdot F_y\cdot t^2\left(1 + 0.25\cdot\frac{l_b}{D}\right)\cdot Q_f\right]$$ [AISC Equation K1-2]

$F_{y.leg} = 50\cdot ksi$

$D := 8.750in$

$t := 0.3750in$

$l_b := 0in$ (Conservative Assumption)

$U := 1$ Assuming @ Capacity value (Conservative Assumption)

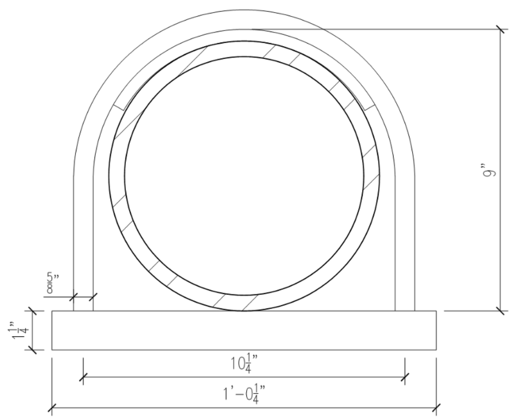
$Q_f := 1 - 0.3\cdot U\cdot(1 + U)$ $\quad Q_f = 0.4$ [AISC Equation K1-5]

$$R_{u.crushingHSS} := 0.9\cdot\left[5.5\cdot F_{y.leg}\cdot t^2\left(1 + 0.25\cdot\frac{l_b}{D}\right)\cdot Q_f\right] \qquad R_{u.crushingHSS} = 13.9219\cdot kip$$

$Check_{UBolt.Leg} := if(R_{ns} < R_{u.crushingHSS}, \text{"OK for Use"}, \text{"NOT ok for Use"})$ $\quad Check_{UBolt.Leg} = \text{"OK for Use"}$

CHECK Plastic Bending Capacity of connecting Plates to hold U-Bolt and Clamped reinforcing pipe to leg:

$$\sigma := \frac{M}{Z} = \frac{\frac{P \cdot L}{4}}{\left(\frac{b \cdot d^2}{4}\right)} \quad \text{--->} \quad P := \frac{4 \cdot (0.9 \cdot \sigma) \cdot \left(\frac{b \cdot d^2}{4}\right)}{L}$$



$\sigma := 50000\text{psi}$ $\quad d_{Plate.Thick} := 1\text{in} + \frac{6}{16}\text{in}$

$b_{PlateHeight} := 2\text{in}$ $\quad L_{clamp.ends} := 10.25\text{in}$

$$P_{U\_Bolt.Plate} := \frac{4 \cdot (0.9 \cdot \sigma) \cdot \left(\frac{b_{PlateHeight} \cdot d_{Plate.Thick}^{\ 2}}{4}\right)}{L_{clamp.ends}} = 16600.61 \cdot \text{lbf}$$

$Check_{UBolt.Plate} := \text{if}\left(2 \cdot T_p < P_{U\_Bolt.Plate}, \text{"OK for Use"}, \text{"NOT ok for Use"}\right)$ $\quad Check_{UBolt.Plate} = \text{"OK for Use"}$

U-Bolt CHECK **Summary** for all parts of U-bolting to address Reinforcing Tube at ends to develop Reinforcement properties

$Check_{UBolt} = \text{"OK for Use"}$ $\quad \frac{2 \cdot T_p}{\left(0.75 \cdot FU_{UBolt} \cdot A_{tensBolt}\right)} = 0.67$ $\quad Check_{UBolt.Leg} = \text{"OK for Use"}$

$$\frac{2 \cdot T_p}{R_{u.crushingHSS}} = 0.984$$

$Check_{UBolt.Plate} = \text{"OK for Use"}$ $\quad \frac{2 \cdot T_p}{P_{U\_Bolt.Plate}} = 0.825$

Design Required for Remainder of Clamps required for installation to keep Reinforcement attached to Leg:

Consider --> 1/3 HSS 9.6250x0.375

$I_{x.Pipe} := 1.8059 in^4$

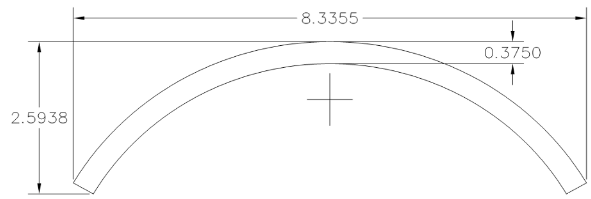
$I_{y.Pipe} := 22.8233 in^4$

$A_{pipe} := 3.6325 in^2$

AutoCAD Text Window - Leg Reinforcement Containing TnS.dwg

```
Edit

Select objects: 1 found
Select objects:
 ----------------   REGIONS   ----------------
Area:                     3.6325
Perimeter:                20.1232
Bounding box:         X: 28.6002  --  36.9357
                      Y: 4.9221  --  7.5159
Centroid:             X: 32.7680
                      Y: 6.5303
Moments of inertia:   X: 156.7133
                      Y: 3923.1499
Product of inertia:  XY: -777.2960
Radii of gyration:    X: 6.5683
                      Y: 32.8637
Principal moments and X-Y directions about centroid:
                      I: 1.8059 along [1.0000 0.0000]
                      J: 22.8233 along [0.0000 1.0000]
```



$$r_{design.Pipe} := \min\left(\sqrt{\frac{I_{x.Pipe}}{A_{pipe}}}, \sqrt{\frac{I_{y.Pipe}}{A_{pipe}}}\right) = 0.71 \cdot in$$

Determine the minimum number of clamps per bay to keep the effective strength of the "bonded" bracing ends:

$$KL_{Leg} := \frac{K_{unbraced} \cdot L_{max.Unbraced}}{r_{existing.leg}} = 40.37$$

Enter Minimum # of clamps here ---> $Num_{clamps.min} := 6$

$$KL_{Reinf} := \frac{\frac{L_{max.Unbraced}}{(Num_{clamps.min} - 1)}}{r_{design.Pipe}} = 34.04$$

$$Min_{clamps} := \text{if}\left(KL_{Reinf} < KL_{Leg}, \text{"Number of Clamps Determined"}, \text{"Add clamp"}\right)$$

$$Min_{clamps} = \text{"Number of Clamps Determined"}$$

Determine maximim of separation of u-bolts per bay to keep effective strength of the "bonded bracing ends:

$$\frac{L_{max.Unbraced}}{Num_{clamps.min}} = 20 \cdot in$$

The figure to the left is always considered rounded down. This indicates the maximum permissible spacing of any U-bolt clamps not associated to the "bonding" ends of the reinforcement to the tower structure.

Portland Bolt
& MANUFACTURING COMPANY
Established 1912

(800) 547-6758
sales@portlandbolt.com

ASTM A449

ASTM A449 covers headed bolts, rods, and anchor bolts in diameters ranging from 1/4″ through 3″ inclusive. It is a medium strength bolt manufactured from a medium carbon or alloy steel that develops its mechanical values through a heat treating process. It is intended for general engineering applications.

ASTM A449 is virtually identical in chemistry and strength to ASTM A325 and SAE J429 grade 5. However, A449 is more flexible in the sense that it covers a larger diameter range and is not restricted by a specific configuration.

A449 Types

TYPE 1	Plain carbon steel, carbon boron steel, alloy steel, or alloy boron steel.
TYPE 2	Withdrawn 2003
TYPE 3	Weathering steel.

A449 Mechanical Properties

Size	Tensile, ksi	Yield, ksi	Elong. %, min	RA %, min
¼ - 1	120 min	92 min	14	35
1⅛ - 1½	105 min	81 min	14	35
1⅝ - 3	90 min	58 min	14	35

A449 Chemical Properties

Type 1 Bolts				
Element	**Carbon Steel**	**Carbon Boron Steel**	**Alloy Steel**	**Alloy Boron Steel**
Carbon	0.30 - 0.52%	0.30 - 0.52%	0.30 - 0.52%	0.30 - 0.52%
Manganese, min	0.60%	0.60%	0.60%	0.60%
Phosphorus, max	0.040%	0.040%	0.035%	0.035%
Sulfur, max	0.050%	0.050%	0.040%	0.040%
Silicon	0.15-0.30%	0.10 - 0.30%	0.15 - 0.35%	0.15 - 0.35%
Boron		0.0005 - 0.003%		0.0005 - 0.003%
Alloying Elements			*	*

* Steel, as defined by the American Iron and Steel Institute, shall be considered to be alloy when the maximum range given for the content of alloying elements exceeds one of more of the following limits: Manganese, 1.65%, silicon, 0.60%, copper, 0.60%, or in which a definite range or a minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99%, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium or any other alloying elements added to obtain a desired alloying effect.

Type 3 Bolts, Class *						
Element	**A**	**B**	**C**	**D**	**E**	**F**
Carbon	0.33 - 0.40%	0.38 - 0.48%	0.15 - 0.25%	0.15 - 0.25%	0.20 - 0.25%	0.20 - 0.25%
Manganese	0.90 - 1.20%	0.70 - 0.90%	0.80 - 1.35%	0.40 - 1.20%	0.60 - 1.00%	0.90 - 1.20%
Phosphorus	0.035% max	0.06 - 0.12%	0.035% max	0.035% max	0.035%	0.035%
Sulfur, max	0.040%	0.040%	0.040%	0.040%	0.040%	0.040%
Silicon	0.15 - 0.35%	0.30 - 0.50%	0.15 - 0.35%	0.25 - 0.50%	0.15 - 0.35%	0.15 - 0.35%
Copper	0.25 - 0.45%	0.20 - 0.40%	0.20 - 0.50%	0.30 - 0.50%	0.30 - 0.60%	0.20 - 0.40%
Nickel	0.25 - 0.45%	0.50 - 0.80%	0.25 - 0.50%	0.50 - 0.80%	0.30 - 0.60%	0.20 - 0.40%
Chromium	0.45 - 0.65%	0.50 - 0.75%	0.30 - 0.50%	0.50 - 1.00%	0.60 - 0.90%	0.45 - 0.65%
Vanadium			0.020% min			
Molybdenum		0.06% max		0.10% max		
Titanium				0.05% max		
* Selection of a class shall be at the option of the manufacturer						

A449 Recommended Hardware

Nuts				Washers
Plain		Galvanized		
1/4 - 1-1/2	1-5/8 - 3	1/4 - 3		
A563B Hex	A563A Heavy Hex	A563DH Heavy Hex		F436

Note: Nuts of other grades having proof load stresses greater than the specified grade are suitable. The ASTM A563 Nut Compatibility Chart has a complete list of specifications.

SEISMIC BASE SHEAR ANALYSIS

Seismic (Vs) Base Shear Implementing ANSI/TIA–222-G, IBC 2012 & Connecticut State Building Code of 2016

Calculation of Seismic Base Shear Implementing ANSI/TIA-222-G, IBC 2012 & & CT State Building Code 2016.

Location: Westport, CT -Site Class “D”

$S_{DS} = \frac{2}{3}F_A S_S$, where $S_S = 0.226$ and $F_A = 1.6$ $S_{DS} = \frac{2}{3}F_A S_S = \frac{2}{3} * 1.6 * 0.226 = 0.241$
$S_{D1} = \frac{2}{3}F_V S_1$, where $S_1 = 0.067$ and $F_V = 2.4$ $S_{D1} = \frac{2}{3}F_V S_1 = \frac{2}{3} * 2.4 * 0.067 = 0.107$

TIA-222-G SECTION 2.7 EARTHQUATE LOADS (PROCEDURES):

1. Importance Factor “I” (tables 2-3 TIA-222-G) = 1.5 (Structure Class 3)

ANSI/TIA-222-G 2.7.7.1 (TOTAL BASE SEISMIC SHEAR (Vs)

W=DL TOWER	= 34.20	Kips
W=Antennas/Mounts	= 11.99	Kips
W=Cables	= 6.385	Kips
	52.574 Kip	= WT Total = “W”

$$V_S = \frac{S_{DS} * W * I}{R} = \frac{0.226 * 52.574 kips * 1.5}{3.0} = 5.94086\ kips,$$ where R = 3.0 for Lattice Tower

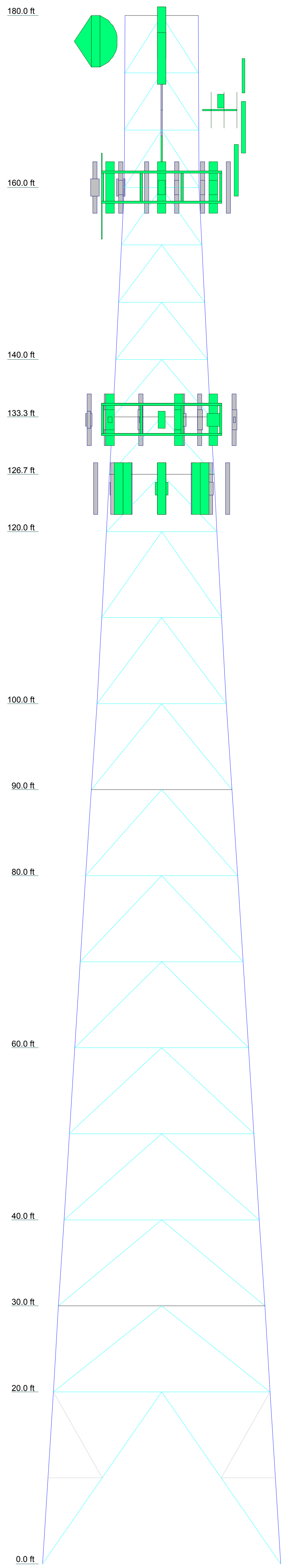
$$V_{S.min} = \frac{0.5 * S_{D1} * W * I}{R} = \frac{0.5 * 0.107 * 52.574 kips * 1.5}{3.0} = 1.4064\ kips$$

*By visual inspection, the above “Base Shear” value when considering the following Load Combination is less that the base shear of wind on structure.

$1.2 * DL + 1.0\,E < 1.2\,DL + 1.6\,W$, (103.0 Kips), therefore seismic effect on structure <u>Does NOT control Design.</u>

TNX TOWER INPUT / OUTPUT SUMMARY

Section	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Horizontals	Red. Horizontals	Red. Diagonals	Red. Hips	Inner Bracing	Face Width (ft)	# Panels @ (ft)	Weight (K)
T1	ROHN 3 STD	A572-50	ROHN 2 STD	A572-50	ROHN 1.5 STD		N.A.	N.A.	N.A.	L2x2x1/8	8.542	9 @ 6.66667	1.3
T2	ROHN 4 STD	A572-50	ROHN 2 STD	A572-50	N.A.	ROHN 1.5 STD	N.A.	N.A.	N.A.	L2x2x1/8	8.625	9 @ 6.66667	1.5
T3	ROHN 5 EH	A572-50	ROHN 2 EH	A572-50	N.A.	ROHN 2 STD	N.A.	N.A.	N.A.	L2x2x1/8	10.709	9 @ 6.66667	0.8
T4	ROHN 5 EH	A572-50	ROHN 2 EH	A572-50	ROHN 2 STD	N.A.	N.A.	N.A.	N.A.	L2x2x1/8	11.4033	9 @ 6.66667	0.8
T5	ROHN 5 EH	A572-50	ROHN 2 XXS	A572-50	ROHN 2 STD	N.A.	N.A.	N.A.	N.A.	L2x2x1/8	12.0977	9 @ 6.66667	1.1
T6	ROHN 6 EHS	A572-50	Pipe 2.5 XXS	A572-50	N.A.	ROHN 2 STD	N.A.	N.A.	N.A.	L2 1/2x2 1/2x3/16	12.792	10 @ 10	3.8
T7	ROHN 6 EH	A572-50	ROHN 3 STD	A572-50	N.A.	ROHN 2 STD	N.A.	N.A.	N.A.	L2 1/2x2 1/2x3/16	15.042	10 @ 10	1.7
T8	ROHN 6 EH	A572-50	ROHN 3 STD	A572-50	ROHN 2 STD	N.A.	N.A.	N.A.	N.A.	L2 1/2x2 1/2x3/16	16.3595	10 @ 10	1.7
T9	ROHN 8 EHS	A572-50	ROHN 3 STD	A572-50	N.A.	ROHN 2.5 STD	N.A.	N.A.	N.A.	L3x3x3/16	17.677	10 @ 10	4.1
T10	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	A572-42	P3.5x.226	A572-50	N.A.	ROHN 2.5 STD	N.A.	N.A.	N.A.	L3x3x3/16	20.177	10 @ 10	5.5
T11	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	A572-42	P3.5x.226	A572-50	N.A.	ROHN 2.5 STD	N.A.	N.A.	N.A.	L3 1/2x3 1/2x1/4	22.677	10 @ 10	2.8
T12	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	A572-42	P3.5x.226	A572-50	ROHN 2.5 EH	N.A.	N.A.	N.A.	N.A.	L3 1/2x3 1/2x1/4	23.927	10 @ 10	3.0
T13	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	A572-42	P3.5x.226	A572-50	N.A.	P3.5x.226	ROHN 1.5 STD	ROHN 2 STD	ROHN 2.5 STD	ROHN 2 STD	25.177	1 @ 20	6.0
											27.677		34.2



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
AP11-850/090/ADT w/Mount Pipe (DNK-54 / CSP-47)	178	HPA-65R-BUU-H6 Panel (ATT)	133
4'x4" Pipe Mount (DNK-52)	177	RRUS-32 (ATT)	133
PA6-65AC (DNK-52 / CSP-42)	177	DC6-48-60-18-8F (Squid) Suppressor (ATT)	133
SE419-SWBPALDF Panel Antenna (Troop G SZ)	175	P65-16-XLH-RR (ATT)	133
2" Dia 10' Omni (DNK-48 / CSP-49)	171	RRUS-11 (ATT)	133
4' Standoff (DNK-48,53)	171	HPA-65R-BUU-H6 Panel (ATT)	133
2" Dia 10' Omni (DNK-53 / CSP-45)	171	RRUS-32 (ATT)	133
WPA-700102-4CF-EDIN-X w/ Mount Kit (Troop G TX)	170	P65-16-XLH-RR (ATT)	133
432E-83I-01T TTA Unit (Troop G)	170	RRUS-11 (ATT)	133
SE419-SWBPALDF(D00) (Troop G RX)	170	HPA-65R-BUU-H6 Panel (ATT)	133
6' Side-Arm (Troop G)	170	RRUS-32 (ATT)	133
3' Yagi (DNK-51 / CSP-1)	169	800-10798 Kathrein Panel (PROPOSED - ATT)	133
AP11-850/090/ADT w/Mount Pipe (DNK-49 / CSP-46)	162	RRUS-32 B66 (PROPOSED - ATT)	133
5' Standoff (DNK-49 / CSP-46)	162	RRUS-32 (PROPOSED - ATT)	133
8'x2 1/2" Pipe Mount (DNK-50 / CSP-60)	162	DBC0061F1V51-2 Combiner Units (PROPOSED - ATT)	133
Pirod 15' T-Frame Sector Mount (1) (Verizon)	160	800-10798 Kathrein Panel (PROPOSED - ATT)	133
Pirod 15' T-Frame Sector Mount (1) (Verizon)	160	RRUS-32 B66 (PROPOSED - ATT)	133
Pirod 15' T-Frame Sector Mount (1) (Verizon)	160	RRUS-32 (PROPOSED - ATT)	133
SBNHH-1D65B (Verizon - LTE PCS)	160	DBC0061F1V51-2 Combiner Units (PROPOSED - ATT)	133
RH_2x60-07-L (700 MHz) (Verizon LTE)	160	800-10798 Kathrein Panel (PROPOSED - ATT)	133
DB-T1-6Z-8AB-0Z Dist. Box (Verizon LTE)	160	RRUS-32 B66 (PROPOSED - ATT)	133
B66A RRH Unit (Verizon PCS)	160	RRUS-32 (PROPOSED - ATT)	133
SBNHH-1D65B (Verizon AWS)	160	DBC0061F1V51-2 Combiner Units (PROPOSED - ATT)	133
RRH_2x60-AWS (Verizon AWS)	160	DC6-48-60-18-8F (Squid) Suppressor (PROPOSED - ATT)	133
DB-T1-6Z-8AB-0Z Dist. Box (Verizon AWS)	160	AIR21 B2A/B4P (T-Mobile)	125
BXA-70080-4CF-EDIN Panel (Verizon 850 MHz)	160	AIR21 B2A/B4P (T-Mobile)	125
SBNHH-1D65B (Verizon - LTE PCS)	160	LNX-6515DS-VTM (T-Mobile)	125
RH_2x60-07-L (700 MHz) (Verizon LTE)	160	LNX-6515DS-VTM (T-Mobile)	125
B66A RRH Unit (Verizon PCS)	160	AIR21 B2A/B4P (T-Mobile)	125
SBNHH-1D65B (Verizon AWS)	160	TMA (T-Mobile)	125
RRH_2x60-AWS (Verizon AWS)	160	AIR21 B2A/B4P (T-Mobile)	125
BXA-70080-4CF-EDIN Panel (Verizon 850 MHz)	160	RRUS-11 (T-Mobile)	125
SBNHH-1D65B (Verizon - LTE PCS)	160	RRUS-11 (T-Mobile)	125
RH_2x60-07-L (700 MHz) (Verizon LTE)	160	RRUS-11 (T-Mobile)	125
B66A RRH Unit (Verizon PCS)	160	TMA (T-Mobile)	125
SBNHH-1D65B (Verizon AWS)	160	TMA (T-Mobile)	125
RRH_2x60-AWS (Verizon AWS)	160	LNX-6515DS-VTM (T-Mobile)	125
BXA-70080-4CF-EDIN Panel (Verizon 850 MHz)	160	LTF12=372 Sector Mount (1) (T-Mobile)	125
2" Dia 10' Omni (DNK-47 / CSP-48)	159	LTF12=372 Sector Mount (1) (T-Mobile)	125
3' Side Arm (DNK-47 / CSP-48)	159	LTF12=372 Sector Mount (1) (T-Mobile)	125
Pirod 15' T-Frame Sector Mount (1) (ATT)	133	AIR21 B2A/B4P (T-Mobile)	125
Pirod 15' T-Frame Sector Mount (1) (ATT)	133	AIR21 B2A/B4P (T-Mobile)	125
Pirod 15' T-Frame Sector Mount (1) (ATT)	133	4' Standoff (DNK-1 / GPS)	60
P65-16-XLH-RR (ATT)	133	GPS (DNK-1 / GPS)	60
RRUS-11 (ATT)	133		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A572-42	42 ksi	60 ksi

TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-G Standard.
2. Tower designed for a 110 mph basic wind in accordance with the TIA-222-G Standard.
3. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Structure Class III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. P-Delta for analysis does not apply for this case - TIA-222-G Section 3.5
8. NOTE: The location of the tower lies within a "Special Wind Region" for Structure Class 3 / Risk Category 4, therefore the maximum applied wind speed will be used for TIA-222-G with Importance Factor applied (1.15)
9. TOWER RATING: 93.9%

ALL REACTIONS
ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 420 K
SHEAR: 59 K

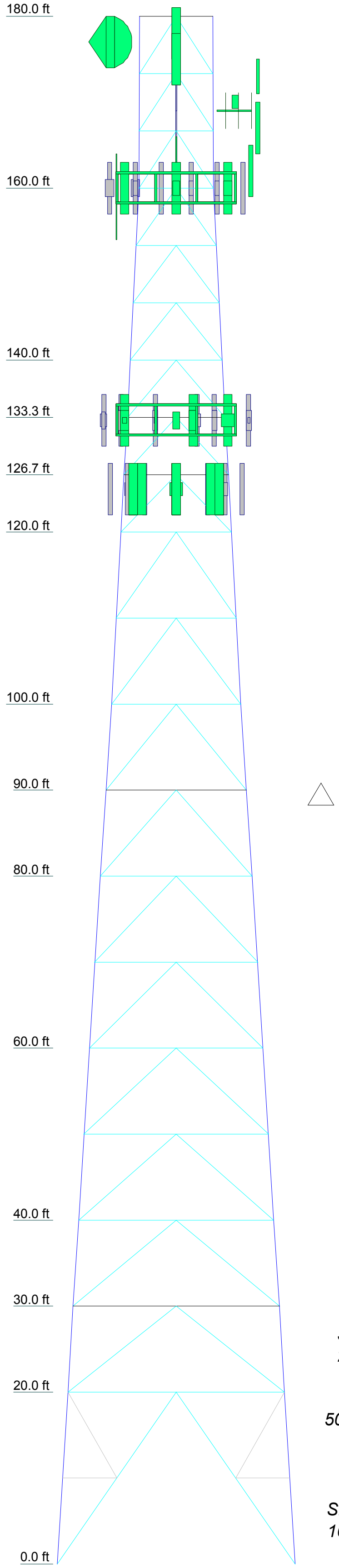
UPLIFT: -384 K
SHEAR: 55 K

AXIAL 192 K
SHEAR 23 K
MOMENT 2475 kip-ft
TORQUE 29 kip-ft
50 mph WIND - 0.7500 in ICE

AXIAL 59 K
SHEAR 103 K
MOMENT 9592 kip-ft
TORQUE 168 kip-ft
REACTIONS - 110 mph WIND

AECOM 500 Enterprise Drive, Suite 3B Rocky Hill, CT Phone: 860-529-8882 FAX: 860-529-3991	Job: 180' CSP Lattice Tower - MODification		
	Project: Westport, Connecticut		
	Client: SMK-004 / AT&T / Smartlink	Drawn by: MCD	App'd:
	Code: TIA-222-G	Date: 07/12/18	Scale: NTS
	Path:		Dwg No. E-1

Section	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	
Legs	ROHN 3 STD	ROHN 4 STD	ROHN 5 EH			ROHN 6 EHS	ROHN 6 EH		ROHN 8 EHS	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe			A	
Leg Grade	A572-50									A572-42				
Diagonals	ROHN 2 STD		ROHN 2 EH		B	Pipe 2.5 XXS	ROHN 3 STD			P3.5x.226				
Diagonal Grade	A572-50													
Top Girts	ROHN 1.5 STD	N.A.		ROHN 2 STD		N.A.		ROHN 2 STD	N.A.			ROHN 2.5 EH	N.A.	
Horizontals	ROHN 1.5 STD		C	N.A.		ROHN 2 STD		N.A.	ROHN 2.5 STD			N.A.	P3.5x.226	
Red. Horizontals	N.A.												ROHN 1.5 STD	
Red. Diagonals	N.A.												ROHN 2 STD	
Red. Hips	N.A.												ROHN 2.5 STD	
Inner Bracing	L2x2x1/8					L2 1/2x2 1/2x3/16			L3x3x3/16	L3 1/2x3 1/2x1/4			ROHN 2 STD	
Face Width (ft)	8.542	8.625	10.709	11.4033	12.0977	12.792	15.042	16.3595	17.677	20.177	22.677	23.927	25.177	27.677
# Panels @ (ft)	9 @ 6.66667								10 @ 10				1 @ 20	
Weight (K)	1.3	1.5	0.8	0.8	1.1	3.8	1.7	1.7	4.1	5.5	2.8	3.0	6.0	34.2



SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	C	ROHN 2 STD
B	ROHN 2 XXS		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A572-42	42 ksi	60 ksi

TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-G Standard.
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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.
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5. Tower Structure Class III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. P-Delta for analysis does not apply for this case - TIA-222-G Section 3.5
8. NOTE: The location of the tower lies within a "Special Wind Region" for Structure Class 3 / Risk Category 4, therefore the maximum applied wind speed will be used for TIA-222-G with Importance Factor applied (1.15)
9. TOWER RATING: 93.9%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:

DOWN: 420 K
SHEAR: 59 K

UPLIFT: -384 K
SHEAR: 55 K

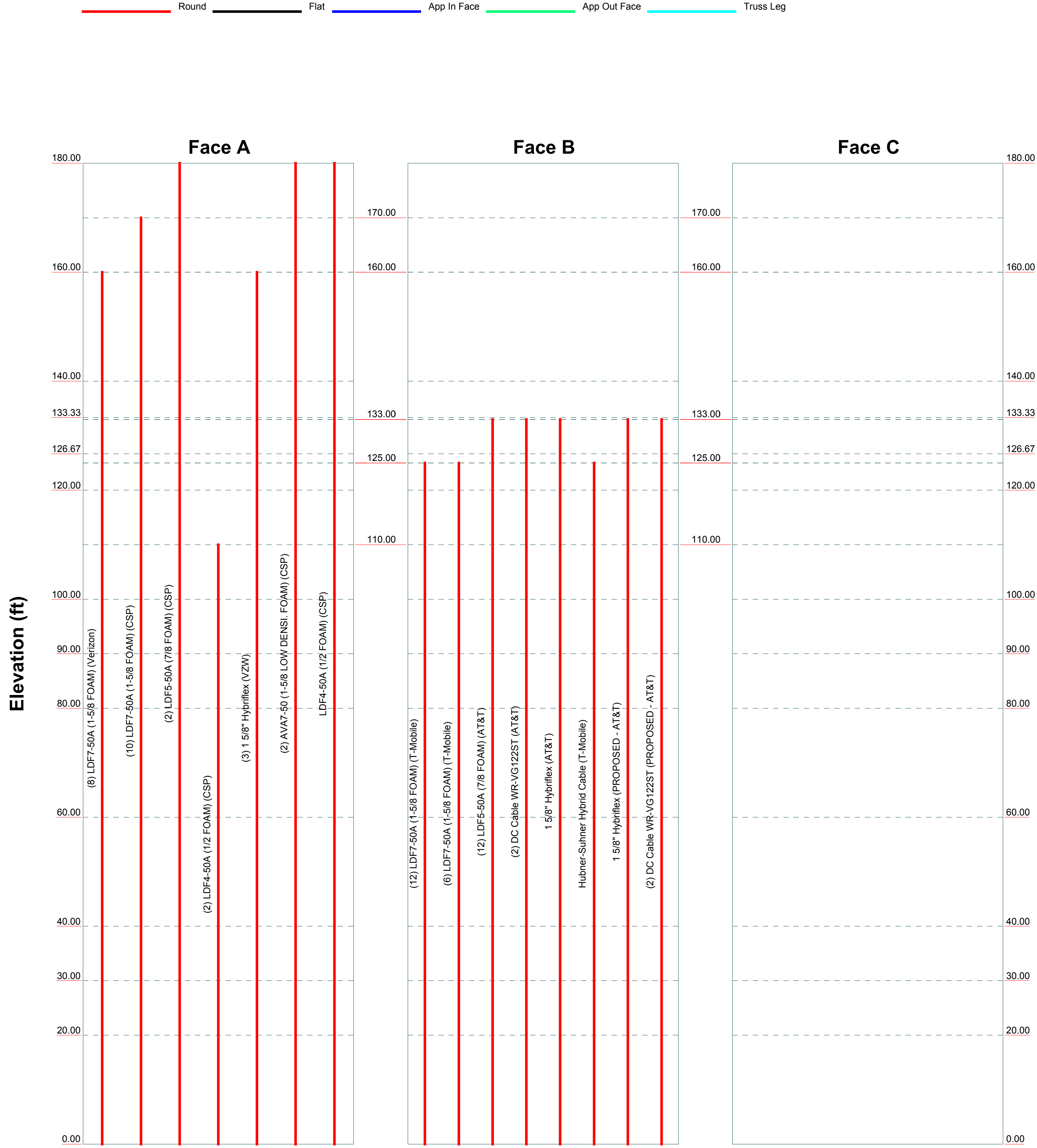
AXIAL 192 K
SHEAR 23 K
MOMENT 2475 kip-ft
TORQUE 29 kip-ft
50 mph WIND - 0.7500 in ICE

AXIAL 59 K
SHEAR 103 K
MOMENT 9592 kip-ft
TORQUE 168 kip-ft
REACTIONS - 110 mph WIND

AECOM 500 Enterprise Drive, Suite 3B Rocky Hill, CT Phone: 860-529-8882 FAX: 860-529-3991	Job: ***180' CSP Lattice Tower - MODification***		
	Project: ***Westport, Connecticut***		
	Client: SMK-004 / AT&T / Smartlink	Drawn by: MCD	App'd:
	Code: TIA-222-G	Date: 07/12/18	Scale: NTS
	Path:		Dwg No. E-1

TNX TOWER FEEDLINE DISTRIBUTION

Feed Line Distribution Chart
0' - 180'

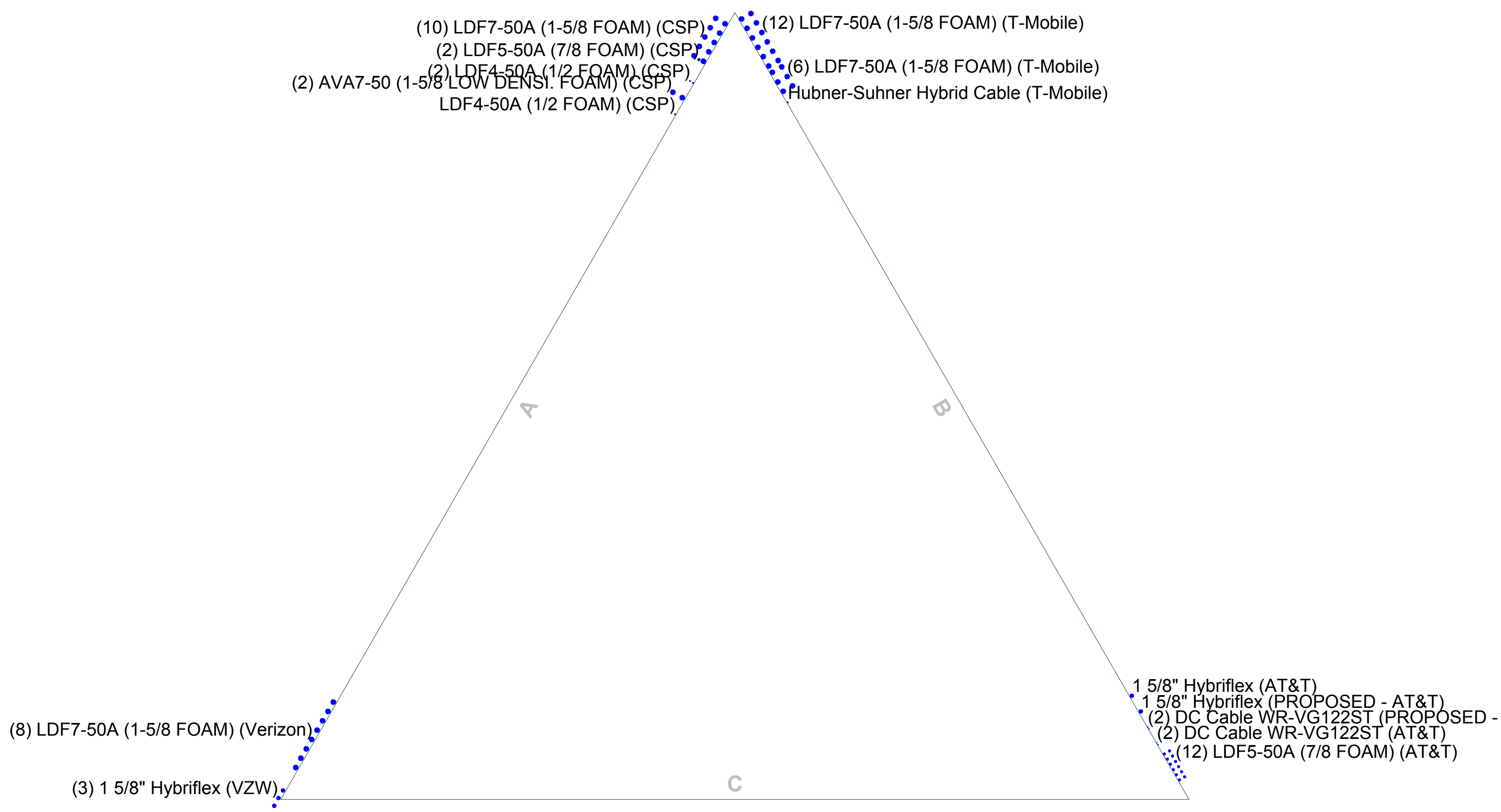


AECOM 500 Enterprise Drive, Suite 3B Rocky Hill, CT Phone: 860-529-8882 FAX: 860-529-3991	Job: ***180' CSP Lattice Tower - MODification*** Project: ***Westport, Connecticut*** Client: SMK-004 / AT&T / Smartlink — Drawn by: MCD — App'd: Code: TIA-222-G — Date: 07/12/18 — Scale: NTS Path: — Dwg No. E-7

TNX TOWER FEEDLINE PLAN

Feed Line Plan

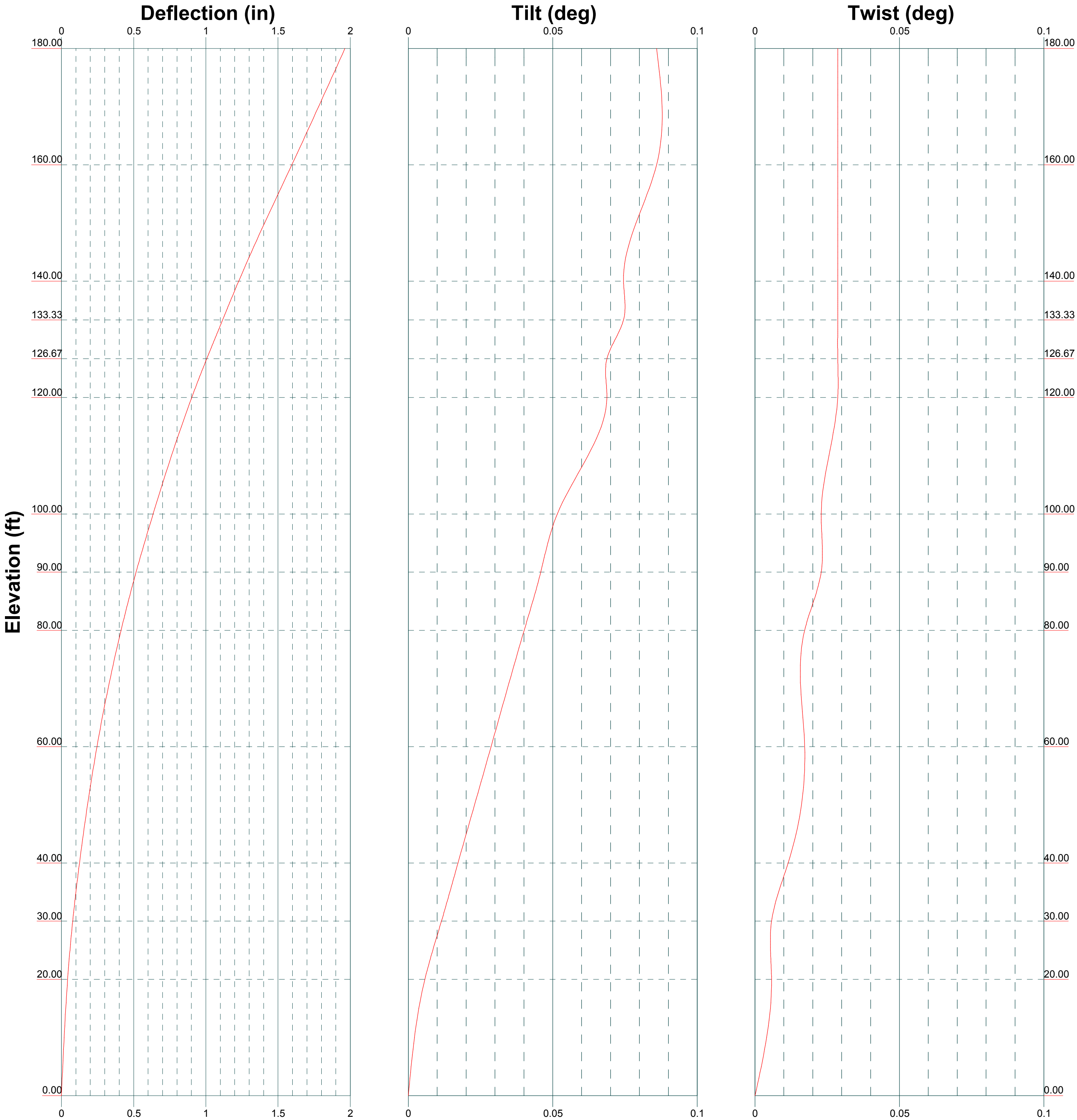
Round — Flat — App In Face — App Out Face



AECOM 500 Enterprise Drive, Suite 3B Rocky Hill, CT Phone: 860-529-8882 FAX: 860-529-3991	Job: ***180' CSP Lattice Tower - MODification***			
	Project: ***Westport, Connecticut***			
	Client: SMK-004 / AT&T / Smartlink	Drawn by: MCD	App'd:	
	Code: TIA-222-G	Date: 07/12/18	Scale: NTS	
	Path: P:\Projects\Telcom\StructuralsByLocation\Connecticut\WestportCSP#32\10-60581632-SMK-004 MOD_G_\MOD_G_180' Self-Supported Lattice Tower.eri		Dwg No. E-7	

TNX TOWER DEFLECTION, TILT, AND TWIST

TIA-222-G - Service - 60 mph **Maximum Values**



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Rocky Hill, CT
Phone: 860-529-8882
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Job: ***180' CSP Lattice Tower - MODification***
Project: ***Westport, Connecticut***
Client: SMK-004 / AT&T / Smartlink Drawn by: MCD App'd:
Code: TIA-222-G Date: 07/12/18 Scale: NTS
Path: Dwg No. E-5

TNX TOWER DETAILED OUTPUT

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 180.00 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 8.54 ft at the top and 27.68 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Basic wind speed of 110 mph.
Structure Class III.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 0.7500 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Deflections calculated using a wind speed of 60 mph.
P-Delta for analysis does not apply for this case - TIA-222-G Section 3.5.
NOTE: The location of the tower lies within a "Special Wind Region" for Structure Class 3 / Risk Category 4, therefore the maximum applied wind speed will be used for TIA-222-G with Importance Factor applied (1.15).
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

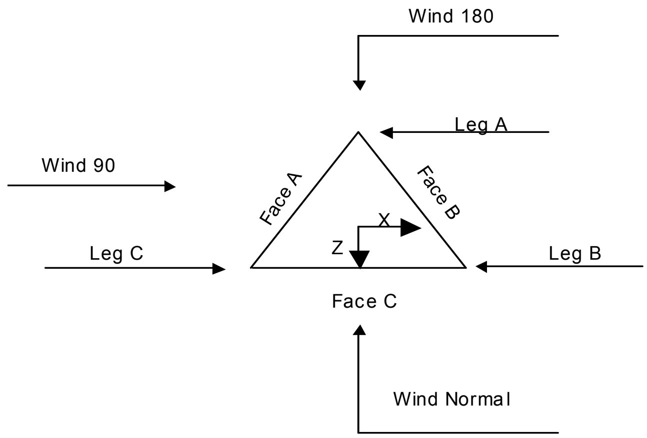
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
√ Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
√ Secondary Horizontal Braces Leg
Use Diamond Inner Bracing (4 Sided)
√ SR Members Have Cut Ends
SR Members Are Concentric

Distribute Leg Loads As Uniform
Assume Legs Pinned
Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
Retension Guys To Initial Tension
√ Bypass Mast Stability Checks
Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
Autocalc Torque Arm Areas
Add IBC .6D+W Combination
√ Sort Capacity Reports By Component
Triangulate Diamond Inner Bracing
Treat Feed Line Bundles As Cylinder

Use ASCE 10 X-Brace Ly Rules
√ Calculate Redundant Bracing Forces
Ignore Redundant Members in FEA
√ SR Leg Bolts Resist Compression
√ All Leg Panels Have Same Allowable
Offset Girt At Foundation
√ Consider Feed Line Torque
√ Include Angle Block Shear Check
Use TIA-222-G Bracing Resist. Exemption
Use TIA-222-G Tension Splice Exemption

Poles

√ Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets



Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation* *ft*	*Assembly Database*	*Description*	*Section Width* *ft*	*Number of Sections*	*Section Length* *ft*
T1	180.00-160.00			8.54	1	20.00
T2	160.00-140.00			8.63	1	20.00
T3	140.00-133.33			10.71	1	6.67
T4	133.33-126.67			11.40	1	6.67
T5	126.67-120.00			12.10	1	6.67
T6	120.00-100.00			12.79	1	20.00
T7	100.00-90.00			15.04	1	10.00
T8	90.00-80.00			16.36	1	10.00
T9	80.00-60.00			17.68	1	20.00
T10	60.00-40.00			20.18	1	20.00
T11	40.00-30.00			22.68	1	10.00
T12	30.00-20.00			23.93	1	10.00
T13	20.00-0.00			25.18	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	180.00-160.00	6.67	K Brace Down	No	Yes	0.0000	0.0000
T2	160.00-140.00	6.67	K Brace Down	No	Yes	0.0000	0.0000

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T3	140.00-133.33	6.67	K Brace Down	No	Yes	0.0000	0.0000
T4	133.33-126.67	6.67	K Brace Down	No	Yes	0.0000	0.0000
T5	126.67-120.00	6.67	K Brace Down	No	Yes	0.0000	0.0000
T6	120.00-100.00	10.00	K Brace Down	No	Yes	0.0000	0.0000
T7	100.00-90.00	10.00	K Brace Down	No	Yes	0.0000	0.0000
T8	90.00-80.00	10.00	K Brace Down	No	Yes	0.0000	0.0000
T9	80.00-60.00	10.00	K Brace Down	No	Yes	0.0000	0.0000
T10	60.00-40.00	10.00	K Brace Down	No	Yes	0.0000	0.0000
T11	40.00-30.00	10.00	K Brace Down	No	Yes	0.0000	0.0000
T12	30.00-20.00	10.00	K Brace Down	No	Yes	0.0000	0.0000
T13	20.00-0.00	20.00	K1 Down	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 180.00-160.00	Pipe	ROHN 3 STD	A572-50 (50 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T2 160.00-140.00	Pipe	ROHN 4 STD	A572-50 (50 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T3 140.00-133.33	Pipe	ROHN 5 EH	A572-50 (50 ksi)	Pipe	ROHN 2 EH	A572-50 (50 ksi)
T4 133.33-126.67	Pipe	ROHN 5 EH	A572-50 (50 ksi)	Pipe	ROHN 2 EH	A572-50 (50 ksi)
T5 126.67-120.00	Pipe	ROHN 5 EH	A572-50 (50 ksi)	Pipe	ROHN 2 XXS	A572-50 (50 ksi)
T6 120.00-100.00	Pipe	ROHN 6 EHS	A572-50 (50 ksi)	Pipe	Pipe 2.5 XXS	A572-50 (50 ksi)
T7 100.00-90.00	Pipe	ROHN 6 EH	A572-50 (50 ksi)	Pipe	ROHN 3 STD	A572-50 (50 ksi)
T8 90.00-80.00	Pipe	ROHN 6 EH	A572-50 (50 ksi)	Pipe	ROHN 3 STD	A572-50 (50 ksi)
T9 80.00-60.00	Pipe	ROHN 8 EHS	A572-50 (50 ksi)	Pipe	ROHN 3 STD	A572-50 (50 ksi)
T10 60.00-40.00	Arbitrary Shape	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	A572-42 (42 ksi)	Pipe	P3.5x.226	A572-50 (50 ksi)
T11 40.00-30.00	Arbitrary Shape	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	A572-42 (42 ksi)	Pipe	P3.5x.226	A572-50 (50 ksi)
T12 30.00-20.00	Arbitrary Shape	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	A572-42 (42 ksi)	Pipe	P3.5x.226	A572-50 (50 ksi)
T13 20.00-0.00	Arbitrary Shape	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	A572-42 (42 ksi)	Pipe	P3.5x.226	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T4 133.33-126.67	Pipe	ROHN 2 STD	A572-50 (50 ksi)	Solid Round		A36 (36 ksi)
T5 126.67-120.00	Pipe	ROHN 2 STD	A572-50	Solid Round		A36

Tower Elevation ft	*Top Girt Type*	*Top Girt Size*	*Top Girt Grade*	*Bottom Girt Type*	*Bottom Girt Size*	*Bottom Girt Grade*
			(50 ksi)			(36 ksi)
T8 90.00-80.00	Pipe	ROHN 2 STD	A572-50 (50 ksi)	Single Angle		A36 (36 ksi)
T12 30.00-20.00	Pipe	ROHN 2.5 EH	A572-50 (50 ksi)	Single Angle		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*
T1 180.00-160.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 1.5 STD	A572-50 (50 ksi)
T2 160.00-140.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 1.5 STD	A572-50 (50 ksi)
T3 140.00-133.33	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T4 133.33-126.67	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T5 126.67-120.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T6 120.00-100.00	None	Single Angle		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T7 100.00-90.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T8 90.00-80.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T9 80.00-60.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)
T10 60.00-40.00	None	Single Angle		A36 (36 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)
T11 40.00-30.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)
T12 30.00-20.00	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)
T13 20.00-0.00	None	Flat Bar		A36 (36 ksi)	Pipe	P3.5x.226	A572-50 (50 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*
T1 180.00-160.00	Solid Round		A36 (36 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T2 160.00-140.00	Solid Round		A36 (36 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T3 140.00-133.33	Solid Round		A36 (36 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)

Tower Elevation ft	Secondary Horizontal Type	Secondary Horizontal Size	Secondary Horizontal Grade	Inner Bracing Type	Inner Bracing Size	Inner Bracing Grade
T4 133.33-126.67	Solid Round		A36 (36 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T5 126.67-120.00	Solid Round		A36 (36 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T6 120.00-100.00	Single Angle		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T7 100.00-90.00	Solid Round		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T8 90.00-80.00	Solid Round		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T9 80.00-60.00	Solid Round		A36 (36 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T10 60.00-40.00	Single Angle		A36 (36 ksi)	Single Angle	L3 1/2x3 1/2x1/4	A572-50 (50 ksi)
T11 40.00-30.00	Single Angle		A572-50 (50 ksi)	Single Angle	L3 1/2x3 1/2x1/4	A572-50 (50 ksi)
T12 30.00-20.00	Single Angle		A572-50 (50 ksi)	Single Angle	L3 1/2x3 1/2x1/4	A572-50 (50 ksi)
T13 20.00-0.00	Solid Round		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Redundant Bracing Grade		Redundant Type	Redundant Size	K Factor
T13 20.00-0.00	A572-50 (50 ksi)	Horizontal (1) Diagonal (1) Hip (1)	Pipe Pipe Pipe	ROHN 1.5 STD ROHN 2 STD ROHN 2.5 STD	0.8 0.8 0.8

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 180.00-160.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T2 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T3 140.00-133.33	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T4 133.33-126.67	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T5 126.67-120.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T6 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T7 100.00-90.00	0.00	0.0000	A36 (36 ksi)	1	1	1	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
T8 90.00-80.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T9 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T10 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T11 40.00-30.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T12 30.00-20.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T13 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

			K Factors[1]							
Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	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 180.00-160.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 160.00-140.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 140.00-133.33	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 133.33-126.67	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 126.67-120.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 120.00-100.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 100.00-90.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 90.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T9 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T10 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T11 40.00-30.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T12 30.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T13 20.00-0.00	Yes	Yes	1	1 1	0.5 0.5	1 1	1 1	1 1	1 1	1 1

[1]Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 180.00-160.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 160.00-140.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 140.00-133.33	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 133.33-126.67	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 126.67-120.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 120.00-100.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 100.00-90.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T8 90.00-80.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T9 80.00-60.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T10 60.00-40.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T11 40.00-30.00	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T12 30.00-20.00	0.0000	0.75	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 20.00-0.00	0.0000	0.75	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	Connection Offsets							
	Diagonal				K-Bracing			
	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.
ft	in	in	in	in	in	in	in	in
T1 180.00-160.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T2 160.00-140.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T3 140.00-133.33	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T4 133.33-126.67	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T5 126.67-120.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T6 120.00-100.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T7 100.00-90.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T8 90.00-80.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T9 80.00-60.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T10 60.00-40.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000

Tower Elevation	Connection Offsets							
	Diagonal				K-Bracing			
	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.	Vert. Top	Horiz. Top	Vert. Bot.	Horiz. Bot.
ft	in	in	in	in	in	in	in	in
T11 40.00-30.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T12 30.00-20.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000
T13 20.00-0.00	0.0000	3.0000	0.0000	3.0000	0.0000	0.0000	0.0000	0.0000

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 180.00-160.00	Flange	0.8750 A325N	4	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T2 160.00-140.00	Flange	0.8750 A325N	4	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T3 140.00-133.33	Flange	0.7500 A325N	6	0.6250 A325N	3	0.6250 A325N	2	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T4 133.33-126.67	Flange	0.7500 A325N	6	0.6250 A325N	3	0.6250 A325N	2	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T5 126.67-120.00	Flange	0.7500 A325N	6	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T6 120.00-100.00	Flange	0.7500 A325N	6	0.6250 A325N	3	0.6250 A325N	2	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T7 100.00-90.00	Flange	0.7500 A325N	6	0.6250 A325N	3	0.6250 A325N	2	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T8 90.00-80.00	Flange	1.0000 A325N	6	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T9 80.00-60.00	Flange	1.0000 A325N	6	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T10 60.00-40.00	Flange	1.0000 A325N	8	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T11 40.00-30.00	Flange	1.0000 A325N	8	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T12 30.00-20.00	Flange	1.0000 A325N	8	0.6250 A325N	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	2	0.6250 A325N	0
T13 20.00-0.00	Flange	1.0000 A325N	8	0.6250 A325X	3	0.6250 A325N	2	0.6250 A325N	0	0.6250 A325N	0	0.7500 A325N	2	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
LDF7-50A (1-5/8 FOAM) (Verizon)	A	No	Ar (CaAa)	160.00 - 0.00	0.0000	-0.42	8	8	1.9800	1.9800		0.82

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
LDF7-50A (1-5/8 FOAM) (T-Mobile)	B	No	Ar (CaAa)	125.00 - 0.00	0.0000	-0.46	12	6	1.9800	1.9800		0.82
LDF7-50A (1-5/8 FOAM) (T-Mobile)	B	No	Ar (CaAa)	125.00 - 0.00	0.0000	-0.41	6	3	1.9800	1.9800		0.82
LDF7-50A (1-5/8 FOAM) (CSP)	A	No	Ar (CaAa)	170.00 - 0.00	0.0000	0.46	10	5	1.9800	1.9800		0.82
LDF5-50A (7/8 FOAM) (CSP)	A	No	Ar (CaAa)	180.00 - 0.00	0.0000	0.435	2	1	1.0900	1.0900		0.33
LDF4-50A (1/2 FOAM) (CSP)	A	No	Ar (CaAa)	110.00 - 0.00	0.0000	0.41	2	1	0.6300	0.6300		0.15
1 5/8" Hybriflex (VZW)	A	No	Ar (CaAa)	160.00 - 0.00	0.0000	-0.5	3	3	1.6250	1.6250		1.13
LDF5-50A (7/8 FOAM) (AT&T)	B	No	Ar (CaAa)	133.00 - 0.00	0.0000	0.46	12	6	1.0900	1.0900		0.33
DC Cable WR-VG122S T (AT&T)	B	No	Ar (CaAa)	133.00 - 0.00	0.0000	0.43	2	2	0.4000	0.4000		0.25
1 5/8" Hybriflex (AT&T)	B	No	Ar (CaAa)	133.00 - 0.00	0.0000	0.37	1	1	1.6250	1.6250		1.13
Hubner-Suhne r Hybrid Cable (T-Mobile)	B	No	Ar (CaAa)	125.00 - 0.00	0.0000	-0.385	1	1	0.7087	0.7087		0.48
AVA7-50 (1-5/8 LOW DENSI. FOAM) (CSP)	A	No	Ar (CaAa)	180.00 - 0.00	0.0000	0.39	2	1	1.9800	1.9800		0.72
LDF4-50A (1/2 FOAM) (CSP)	A	No	Ar (CaAa)	180.00 - 0.00	0.0000	0.37	1	1	0.6300	0.6300		0.15
*** Proposed AT&T/SMK-0 02												
1 5/8" Hybriflex (PROPOSED - AT&T)	B	No	Ar (CaAa)	133.00 - 0.00	0.0000	0.39	1	1	1.6250	1.6250		1.13
DC Cable WR-VG122S T (PROPOSED - AT&T)	B	No	Ar (CaAa)	133.00 - 0.00	0.0000	0.41	2	2	0.4000	0.4000		0.25

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

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	180.00-160.00	A	0.000	0.000	33.340	0.000	0.13
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T2	160.00-140.00	A	0.000	0.000	94.570	0.000	0.41
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T3	140.00-133.33	A	0.000	0.000	31.523	0.000	0.14
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T4	133.33-126.67	A	0.000	0.000	31.523	0.000	0.14
		B	0.000	0.000	11.356	0.000	0.05
		C	0.000	0.000	0.000	0.000	0.00
T5	126.67-120.00	A	0.000	0.000	31.523	0.000	0.14
		B	0.000	0.000	30.128	0.000	0.12
		C	0.000	0.000	0.000	0.000	0.00
T6	120.00-100.00	A	0.000	0.000	95.830	0.000	0.41
		B	0.000	0.000	108.557	0.000	0.45
		C	0.000	0.000	0.000	0.000	0.00
T7	100.00-90.00	A	0.000	0.000	48.545	0.000	0.21
		B	0.000	0.000	54.279	0.000	0.22
		C	0.000	0.000	0.000	0.000	0.00
T8	90.00-80.00	A	0.000	0.000	48.545	0.000	0.21
		B	0.000	0.000	54.279	0.000	0.22
		C	0.000	0.000	0.000	0.000	0.00
T9	80.00-60.00	A	0.000	0.000	97.090	0.000	0.41
		B	0.000	0.000	108.557	0.000	0.45
		C	0.000	0.000	0.000	0.000	0.00
T10	60.00-40.00	A	0.000	0.000	97.090	0.000	0.41
		B	0.000	0.000	108.557	0.000	0.45
		C	0.000	0.000	0.000	0.000	0.00
T11	40.00-30.00	A	0.000	0.000	48.545	0.000	0.21
		B	0.000	0.000	54.279	0.000	0.22
		C	0.000	0.000	0.000	0.000	0.00
T12	30.00-20.00	A	0.000	0.000	48.545	0.000	0.21
		B	0.000	0.000	54.279	0.000	0.22
		C	0.000	0.000	0.000	0.000	0.00
T13	20.00-0.00	A	0.000	0.000	97.090	0.000	0.41
		B	0.000	0.000	108.557	0.000	0.45
		C	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	180.00-160.00	A	2.209	0.000	0.000	94.841	0.000	1.83
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T2	160.00-140.00	A	2.182	0.000	0.000	246.078	0.000	4.72
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T3	140.00-133.33	A	2.161	0.000	0.000	81.777	0.000	1.56
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T4	133.33-126.67	A	2.151	0.000	0.000	81.644	0.000	1.55
		B		0.000	0.000	33.185	0.000	0.54
		C		0.000	0.000	0.000	0.000	0.00
T5	126.67-120.00	A	2.139	0.000	0.000	81.505	0.000	1.54

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	65.734	0.000	1.33
		C		0.000	0.000	0.000	0.000	0.00
T6	120.00-100.00	A	2.115	0.000	0.000	253.383	0.000	4.73
		B		0.000	0.000	226.990	0.000	4.72
		C		0.000	0.000	0.000	0.000	0.00
T7	100.00-90.00	A	2.084	0.000	0.000	130.899	0.000	2.40
		B		0.000	0.000	112.784	0.000	2.33
		C		0.000	0.000	0.000	0.000	0.00
T8	90.00-80.00	A	2.061	0.000	0.000	130.392	0.000	2.38
		B		0.000	0.000	112.252	0.000	2.31
		C		0.000	0.000	0.000	0.000	0.00
T9	80.00-60.00	A	2.021	0.000	0.000	259.044	0.000	4.67
		B		0.000	0.000	222.674	0.000	4.55
		C		0.000	0.000	0.000	0.000	0.00
T10	60.00-40.00	A	1.955	0.000	0.000	256.108	0.000	4.53
		B		0.000	0.000	219.587	0.000	4.43
		C		0.000	0.000	0.000	0.000	0.00
T11	40.00-30.00	A	1.886	0.000	0.000	126.552	0.000	2.19
		B		0.000	0.000	108.214	0.000	2.16
		C		0.000	0.000	0.000	0.000	0.00
T12	30.00-20.00	A	1.824	0.000	0.000	125.185	0.000	2.13
		B		0.000	0.000	106.776	0.000	2.10
		C		0.000	0.000	0.000	0.000	0.00
T13	20.00-0.00	A	1.664	0.000	0.000	243.390	0.000	3.93
		B		0.000	0.000	206.196	0.000	3.93
		C		0.000	0.000	0.000	0.000	0.00

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	180.00-160.00	-1.9322	-19.0732	-2.0403	-17.5275
T2	160.00-140.00	-15.7656	-13.5812	-13.7730	-9.1447
T3	140.00-133.33	-16.9708	-14.6577	-14.9568	-9.8877
T4	133.33-126.67	-3.8427	-7.4811	-5.8643	-5.2384
T5	126.67-120.00	-1.2871	-22.3794	-4.1494	-12.8688
T6	120.00-100.00	-0.9150	-28.7746	-4.2645	-17.4875
T7	100.00-90.00	-1.0634	-31.7132	-4.7873	-20.0425
T8	90.00-80.00	-1.1568	-33.9341	-5.1596	-21.4207
T9	80.00-60.00	-1.2286	-35.3400	-5.5759	-22.8272
T10	60.00-40.00	-1.0865	-30.6332	-5.7217	-22.8910
T11	40.00-30.00	-1.1739	-32.7004	-6.2450	-24.4129
T12	30.00-20.00	-1.2300	-34.0263	-6.6338	-25.3961
T13	20.00-0.00	-1.3300	-36.4567	-7.4401	-27.0098

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	4	LDF7-50A (1-5/8 FOAM)	160.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
			170.00		
T1	5	LDF5-50A (7/8 FOAM)	160.00 - 180.00	0.6000	0.6000
T1	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	160.00 - 180.00	0.6000	0.6000
T1	15	LDF4-50A (1/2 FOAM)	160.00 - 180.00	0.6000	0.6000
T2	1	LDF7-50A (1-5/8 FOAM)	140.00 - 160.00	0.6000	0.6000
T2	4	LDF7-50A (1-5/8 FOAM)	140.00 - 160.00	0.6000	0.6000
T2	5	LDF5-50A (7/8 FOAM)	140.00 - 160.00	0.6000	0.6000
T2	7	1 5/8" Hybriflex	140.00 - 160.00	0.6000	0.6000
T2	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	140.00 - 160.00	0.6000	0.6000
T2	15	LDF4-50A (1/2 FOAM)	140.00 - 160.00	0.6000	0.6000
T3	1	LDF7-50A (1-5/8 FOAM)	133.33 - 140.00	0.6000	0.6000
T3	4	LDF7-50A (1-5/8 FOAM)	133.33 - 140.00	0.6000	0.6000
T3	5	LDF5-50A (7/8 FOAM)	133.33 - 140.00	0.6000	0.6000
T3	7	1 5/8" Hybriflex	133.33 - 140.00	0.6000	0.6000
T3	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	133.33 - 140.00	0.6000	0.6000
T3	15	LDF4-50A (1/2 FOAM)	133.33 - 140.00	0.6000	0.6000
T4	1	LDF7-50A (1-5/8 FOAM)	126.67 - 133.33	0.6000	0.6000
T4	4	LDF7-50A (1-5/8 FOAM)	126.67 - 133.33	0.6000	0.6000
T4	5	LDF5-50A (7/8 FOAM)	126.67 - 133.33	0.6000	0.6000
T4	7	1 5/8" Hybriflex	126.67 - 133.33	0.6000	0.6000
T4	8	LDF5-50A (7/8 FOAM)	126.67 - 133.00	0.6000	0.6000
T4	9	DC Cable WR-VG122ST	126.67 - 133.00	0.6000	0.6000
T4	12	1 5/8" Hybriflex	126.67 - 133.00	0.6000	0.6000
T4	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	126.67 - 133.33	0.6000	0.6000
T4	15	LDF4-50A (1/2 FOAM)	126.67 - 133.33	0.6000	0.6000
T4	17	1 5/8" Hybriflex	126.67 - 133.00	0.6000	0.6000
T4	18	DC Cable WR-VG122ST	126.67 - 133.00	0.6000	0.6000
T5	1	LDF7-50A (1-5/8 FOAM)	120.00 - 126.67	0.6000	0.6000
T5	2	LDF7-50A (1-5/8 FOAM)	120.00 - 125.00	0.6000	0.6000
T5	3	LDF7-50A (1-5/8 FOAM)	120.00 - 125.00	0.6000	0.6000
T5	4	LDF7-50A (1-5/8 FOAM)	120.00 - 126.67	0.6000	0.6000
T5	5	LDF5-50A (7/8 FOAM)	120.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
			126.67		
T5	7	1 5/8" Hybriflex	120.00 - 126.67	0.6000	0.6000
T5	8	LDF5-50A (7/8 FOAM)	120.00 - 126.67	0.6000	0.6000
T5	9	DC Cable WR-VG122ST	120.00 - 126.67	0.6000	0.6000
T5	12	1 5/8" Hybriflex	120.00 - 126.67	0.6000	0.6000
T5	13	Hubner-Suhner Hybrid Cable	120.00 - 125.00	0.6000	0.6000
T5	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	120.00 - 126.67	0.6000	0.6000
T5	15	LDF4-50A (1/2 FOAM)	120.00 - 126.67	0.6000	0.6000
T5	17	1 5/8" Hybriflex	120.00 - 126.67	0.6000	0.6000
T5	18	DC Cable WR-VG122ST	120.00 - 126.67	0.6000	0.6000
T6	1	LDF7-50A (1-5/8 FOAM)	100.00 - 120.00	0.6000	0.6000
T6	2	LDF7-50A (1-5/8 FOAM)	100.00 - 120.00	0.6000	0.6000
T6	3	LDF7-50A (1-5/8 FOAM)	100.00 - 120.00	0.6000	0.6000
T6	4	LDF7-50A (1-5/8 FOAM)	100.00 - 120.00	0.6000	0.6000
T6	5	LDF5-50A (7/8 FOAM)	100.00 - 120.00	0.6000	0.6000
T6	6	LDF4-50A (1/2 FOAM)	100.00 - 110.00	0.6000	0.6000
T6	7	1 5/8" Hybriflex	100.00 - 120.00	0.6000	0.6000
T6	8	LDF5-50A (7/8 FOAM)	100.00 - 120.00	0.6000	0.6000
T6	9	DC Cable WR-VG122ST	100.00 - 120.00	0.6000	0.6000
T6	12	1 5/8" Hybriflex	100.00 - 120.00	0.6000	0.6000
T6	13	Hubner-Suhner Hybrid Cable	100.00 - 120.00	0.6000	0.6000
T6	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	100.00 - 120.00	0.6000	0.6000
T6	15	LDF4-50A (1/2 FOAM)	100.00 - 120.00	0.6000	0.6000
T6	17	1 5/8" Hybriflex	100.00 - 120.00	0.6000	0.6000
T6	18	DC Cable WR-VG122ST	100.00 - 120.00	0.6000	0.6000
T7	1	LDF7-50A (1-5/8 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	2	LDF7-50A (1-5/8 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	3	LDF7-50A (1-5/8 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	4	LDF7-50A (1-5/8 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	5	LDF5-50A (7/8 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	6	LDF4-50A (1/2 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	7	1 5/8" Hybriflex	90.00 - 100.00	0.6000	0.6000
T7	8	LDF5-50A (7/8 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	9	DC Cable WR-VG122ST	90.00 - 100.00	0.6000	0.6000
T7	12	1 5/8" Hybriflex	90.00 - 100.00	0.6000	0.6000
T7	13	Hubner-Suhner Hybrid Cable	90.00 - 100.00	0.6000	0.6000
T7	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	90.00 - 100.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T7	15	LDF4-50A (1/2 FOAM)	90.00 - 100.00	0.6000	0.6000
T7	17	1 5/8" Hybriflex	90.00 - 100.00	0.6000	0.6000
T7	18	DC Cable WR-VG122ST	90.00 - 100.00	0.6000	0.6000
T8	1	LDF7-50A (1-5/8 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	2	LDF7-50A (1-5/8 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	3	LDF7-50A (1-5/8 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	4	LDF7-50A (1-5/8 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	5	LDF5-50A (7/8 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	6	LDF4-50A (1/2 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	7	1 5/8" Hybriflex	80.00 - 90.00	0.6000	0.6000
T8	8	LDF5-50A (7/8 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	9	DC Cable WR-VG122ST	80.00 - 90.00	0.6000	0.6000
T8	12	1 5/8" Hybriflex	80.00 - 90.00	0.6000	0.6000
T8	13	Hubner-Suhner Hybrid Cable	80.00 - 90.00	0.6000	0.6000
T8	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	80.00 - 90.00	0.6000	0.6000
T8	15	LDF4-50A (1/2 FOAM)	80.00 - 90.00	0.6000	0.6000
T8	17	1 5/8" Hybriflex	80.00 - 90.00	0.6000	0.6000
T8	18	DC Cable WR-VG122ST	80.00 - 90.00	0.6000	0.6000
T9	1	LDF7-50A (1-5/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	2	LDF7-50A (1-5/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	3	LDF7-50A (1-5/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	4	LDF7-50A (1-5/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	5	LDF5-50A (7/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	6	LDF4-50A (1/2 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	7	1 5/8" Hybriflex	60.00 - 80.00	0.6000	0.6000
T9	8	LDF5-50A (7/8 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	9	DC Cable WR-VG122ST	60.00 - 80.00	0.6000	0.6000
T9	12	1 5/8" Hybriflex	60.00 - 80.00	0.6000	0.6000
T9	13	Hubner-Suhner Hybrid Cable	60.00 - 80.00	0.6000	0.6000
T9	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	60.00 - 80.00	0.6000	0.6000
T9	15	LDF4-50A (1/2 FOAM)	60.00 - 80.00	0.6000	0.6000
T9	17	1 5/8" Hybriflex	60.00 - 80.00	0.6000	0.6000
T9	18	DC Cable WR-VG122ST	60.00 - 80.00	0.6000	0.6000
T10	1	LDF7-50A (1-5/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	2	LDF7-50A (1-5/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	3	LDF7-50A (1-5/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	4	LDF7-50A (1-5/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	5	LDF5-50A (7/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	6	LDF4-50A (1/2 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	7	1 5/8" Hybriflex	40.00 - 60.00	0.6000	0.6000
T10	8	LDF5-50A (7/8 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	9	DC Cable WR-VG122ST	40.00 - 60.00	0.6000	0.6000
T10	12	1 5/8" Hybriflex	40.00 - 60.00	0.6000	0.6000
T10	13	Hubner-Suhner Hybrid Cable	40.00 - 60.00	0.6000	0.6000
T10	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	40.00 - 60.00	0.6000	0.6000
T10	15	LDF4-50A (1/2 FOAM)	40.00 - 60.00	0.6000	0.6000
T10	17	1 5/8" Hybriflex	40.00 - 60.00	0.6000	0.6000
T10	18	DC Cable WR-VG122ST	40.00 - 60.00	0.6000	0.6000
T11	1	LDF7-50A (1-5/8 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	2	LDF7-50A (1-5/8 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	3	LDF7-50A (1-5/8 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	4	LDF7-50A (1-5/8 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	5	LDF5-50A (7/8 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	6	LDF4-50A (1/2 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	7	1 5/8" Hybriflex	30.00 - 40.00	0.6000	0.6000
T11	8	LDF5-50A (7/8 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	9	DC Cable WR-VG122ST	30.00 - 40.00	0.6000	0.6000
T11	12	1 5/8" Hybriflex	30.00 - 40.00	0.6000	0.6000
T11	13	Hubner-Suhner Hybrid Cable	30.00 - 40.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T11	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	30.00 - 40.00	0.6000	0.6000
T11	15	LDF4-50A (1/2 FOAM)	30.00 - 40.00	0.6000	0.6000
T11	17	1 5/8" Hybriflex	30.00 - 40.00	0.6000	0.6000
T11	18	DC Cable WR-VG122ST	30.00 - 40.00	0.6000	0.6000
T12	1	LDF7-50A (1-5/8 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	2	LDF7-50A (1-5/8 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	3	LDF7-50A (1-5/8 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	4	LDF7-50A (1-5/8 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	5	LDF5-50A (7/8 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	6	LDF4-50A (1/2 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	7	1 5/8" Hybriflex	20.00 - 30.00	0.6000	0.6000
T12	8	LDF5-50A (7/8 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	9	DC Cable WR-VG122ST	20.00 - 30.00	0.6000	0.6000
T12	12	1 5/8" Hybriflex	20.00 - 30.00	0.6000	0.6000
T12	13	Hubner-Suhner Hybrid Cable	20.00 - 30.00	0.6000	0.6000
T12	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	20.00 - 30.00	0.6000	0.6000
T12	15	LDF4-50A (1/2 FOAM)	20.00 - 30.00	0.6000	0.6000
T12	17	1 5/8" Hybriflex	20.00 - 30.00	0.6000	0.6000
T12	18	DC Cable WR-VG122ST	20.00 - 30.00	0.6000	0.6000
T13	1	LDF7-50A (1-5/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	2	LDF7-50A (1-5/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	3	LDF7-50A (1-5/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	4	LDF7-50A (1-5/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	5	LDF5-50A (7/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	6	LDF4-50A (1/2 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	7	1 5/8" Hybriflex	0.00 - 20.00	0.6000	0.6000
T13	8	LDF5-50A (7/8 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	9	DC Cable WR-VG122ST	0.00 - 20.00	0.6000	0.6000
T13	12	1 5/8" Hybriflex	0.00 - 20.00	0.6000	0.6000
T13	13	Hubner-Suhner Hybrid Cable	0.00 - 20.00	0.6000	0.6000
T13	14	AVA7-50 (1-5/8 LOW DENSI. FOAM)	0.00 - 20.00	0.6000	0.6000
T13	15	LDF4-50A (1/2 FOAM)	0.00 - 20.00	0.6000	0.6000
T13	17	1 5/8" Hybriflex	0.00 - 20.00	0.6000	0.6000
T13	18	DC Cable WR-VG122ST	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert	Azimuth Adjustment	Placement		C_AA_A Front	C_AA_A Side	Weight
			ft ft ft	°	ft		ft^2	ft^2	K
AIR21 B2A/B4P (T-Mobile)	A	From Face	3.00 -4.00 0.00	0.0000	125.00	No Ice 1/2" Ice 1" Ice	6.05 6.42 6.80	5.54 6.19 6.85	0.11 0.17 0.23
AIR21 B2A/B4P (T-Mobile)	B	From Face	3.00 -4.00 0.00	0.0000	125.00	No Ice 1/2" Ice 1" Ice	6.05 6.42 6.80	5.54 6.19 6.85	0.11 0.17 0.23
AIR21 B2A/B4P (T-Mobile)	C	From Face	3.00 -4.00	0.0000	125.00	No Ice 1/2" Ice	6.05 6.42	5.54 6.19	0.11 0.17

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert*	*Azimuth Adjustment*	*Placement*		*C_AA_A Front*	*C_AA_A Side*	*Weight*
			ft ft ft	*°*	*ft*		*ft²*	*ft²*	*K*
			0.00			1" Ice	6.80	6.85	0.23
TMA	A	From Face	3.00	0.0000	125.00	No Ice	1.06	0.45	0.02
(T-Mobile)			0.00			1/2" Ice	1.21	0.57	0.03
			0.00			1" Ice	1.37	0.71	0.03
TMA	B	From Face	3.00	0.0000	125.00	No Ice	1.06	0.45	0.02
(T-Mobile)			0.00			1/2" Ice	1.21	0.57	0.03
			0.00			1" Ice	1.37	0.71	0.03
TMA	C	From Face	3.00	0.0000	125.00	No Ice	1.06	0.45	0.02
(T-Mobile)			0.00			1/2" Ice	1.21	0.57	0.03
			0.00			1" Ice	1.37	0.71	0.03
LNX-6515DS-VTM	A	From Face	3.00	0.0000	125.00	No Ice	11.39	9.92	0.09
(T-Mobile)			0.00			1/2" Ice	12.01	11.38	0.18
			0.00			1" Ice	12.63	12.46	0.28
LNX-6515DS-VTM	B	From Face	3.00	0.0000	125.00	No Ice	11.39	9.92	0.09
(T-Mobile)			0.00			1/2" Ice	12.01	11.38	0.18
			0.00			1" Ice	12.63	12.46	0.28
LNX-6515DS-VTM	C	From Face	3.00	0.0000	125.00	No Ice	11.39	9.92	0.09
(T-Mobile)			0.00			1/2" Ice	12.01	11.38	0.18
			0.00			1" Ice	12.63	12.46	0.28
AIR21 B2A/B4P	A	From Face	3.00	0.0000	125.00	No Ice	6.05	5.54	0.11
(T-Mobile)			4.00			1/2" Ice	6.42	6.19	0.17
			0.00			1" Ice	6.80	6.85	0.23
AIR21 B2A/B4P	B	From Face	3.00	0.0000	125.00	No Ice	6.05	5.54	0.11
(T-Mobile)			4.00			1/2" Ice	6.42	6.19	0.17
			0.00			1" Ice	6.80	6.85	0.23
AIR21 B2A/B4P	C	From Face	3.00	0.0000	125.00	No Ice	6.05	5.54	0.11
(T-Mobile)			4.00			1/2" Ice	6.42	6.19	0.17
			0.00			1" Ice	6.80	6.85	0.23
LTF12=372 Sector Mount (1)	A	None		0.0000	125.00	No Ice	13.60	13.60	0.47
(T-Mobile)						1/2" Ice	18.40	18.40	0.60
						1" Ice	23.20	23.20	0.73
LTF12=372 Sector Mount (1)	B	None		0.0000	125.00	No Ice	13.60	13.60	0.47
(T-Mobile)						1/2" Ice	18.40	18.40	0.60
						1" Ice	23.20	23.20	0.73
LTF12=372 Sector Mount (1)	C	None		0.0000	125.00	No Ice	13.60	13.60	0.47
(T-Mobile)						1/2" Ice	18.40	18.40	0.60
						1" Ice	23.20	23.20	0.73
RRUS-11	A	From Face	3.00	0.0000	125.00	No Ice	2.57	1.07	0.05
(T-Mobile)			0.00			1/2" Ice	2.76	1.21	0.07
			0.00			1" Ice	2.97	1.36	0.09
RRUS-11	B	From Face	3.00	0.0000	125.00	No Ice	2.57	1.07	0.05
(T-Mobile)			0.00			1/2" Ice	2.76	1.21	0.07
			0.00			1" Ice	2.97	1.36	0.09
RRUS-11	C	From Face	3.00	0.0000	125.00	No Ice	2.57	1.07	0.05
(T-Mobile)			0.00			1/2" Ice	2.76	1.21	0.07
			0.00			1" Ice	2.97	1.36	0.09
GPS	C	From Face	1.00	0.0000	60.00	No Ice	0.00	0.00	0.00
(DNK-1 / GPS)			0.00			1/2" Ice	0.00	0.00	0.00
			0.00			1" Ice	0.00	0.00	0.00
4' Standoff	C	None		0.0000	60.00	No Ice	3.42	3.42	0.11
(DNK-1 / GPS)						1/2" Ice	3.67	3.67	0.15
						1" Ice	3.92	3.92	0.19
2" Dia 10' Omni	C	From Leg	3.00	0.0000	159.00	No Ice	2.00	2.00	0.01
(DNK-47 / CSP-48)			0.00			1/2" Ice	3.03	3.03	0.03
			0.00			1" Ice	4.06	4.06	0.04
3' Side Arm	C	None		0.0000	159.00	No Ice	2.72	2.72	0.05
(DNK-47 / CSP-48)						1/2" Ice	4.91	4.91	0.09

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert*	*Azimuth Adjustment*	*Placement*		C_AA_A *Front*	C_AA_A *Side*	*Weight*
			ft *ft* *ft*	°	*ft*		*ft*^{2}	*ft*^{2}	*K*
						1" Ice	7.10	7.10	0.13
2" Dia 10' Omni	A	From Leg	4.00	0.0000	171.00	No Ice	2.00	2.00	0.01
(DNK-48 / CSP-49)			0.00			1/2" Ice	3.03	3.03	0.03
			-3.00			1" Ice	4.06	4.06	0.04
4' Standoff	A	None		0.0000	171.00	No Ice	3.42	3.42	0.11
(DNK-48,53)						1/2" Ice	3.67	3.67	0.15
						1" Ice	3.92	3.92	0.19
2" Dia 10' Omni	A	From Leg	4.00	0.0000	171.00	No Ice	2.00	2.00	0.01
(DNK-53 / CSP-45)			0.00			1/2" Ice	3.03	3.03	0.03
			3.00			1" Ice	4.06	4.06	0.04
AP11-850/090/ADT w/Mount	B	From Leg	5.00	0.0000	162.00	No Ice	5.31	3.92	0.04
Pipe			0.00			1/2" Ice	5.93	4.96	0.08
(DNK-49 / CSP-46)			0.00			1" Ice	6.44	5.72	0.14
5' Standoff	B	None		0.0000	162.00	No Ice	3.42	3.42	0.11
(DNK-49 / CSP-46)						1/2" Ice	3.67	3.67	0.15
						1" Ice	3.92	3.92	0.19
8'x2 1/2" Pipe Mount	C	None		0.0000	162.00	No Ice	2.20	2.20	0.04
(DNK-50 / CSP-60)						1/2" Ice	3.13	3.13	0.06
						1" Ice	3.62	3.62	0.08
3' Yagi	B	From Leg	0.50	0.0000	169.00	No Ice	2.08	2.08	0.03
(DNK-51 / CSP-1)			0.00			1/2" Ice	3.79	3.79	0.05
			0.00			1" Ice	5.52	5.52	0.09
4'x4" Pipe Mount	C	None		0.0000	177.00	No Ice	1.00	1.00	0.04
(DNK-52)						1/2" Ice	1.58	1.58	0.06
						1" Ice	1.84	1.84	0.07
AP11-850/090/ADT w/Mount	B	None		0.0000	178.00	No Ice	5.31	3.92	0.04
Pipe						1/2" Ice	5.93	4.96	0.08
(DNK-54 / CSP-47)						1" Ice	6.44	5.72	0.14
WPA-700102-4CF-EDIN-X	B	From Leg	6.00	0.0000	170.00	No Ice	3.58	3.66	0.04
w/ Mount Kit			0.00			1/2" Ice	3.88	4.21	0.08
(Troop G TX)			3.00			1" Ice	4.20	4.77	0.12
432E-83I-01T TTA Unit	B	From Leg	3.00	0.0000	170.00	No Ice	2.85	0.97	0.03
(Troop G)			0.00			1/2" Ice	3.06	1.11	0.04
			0.00			1" Ice	3.28	1.26	0.07
SE419-SWBPALDF(D00)	B	From Leg	6.00	0.0000	170.00	No Ice	25.03	9.80	0.05
(Troop G RX)			0.00			1/2" Ice	25.87	10.44	0.18
			-3.00			1" Ice	26.71	11.09	0.31
SE419-SWBPALDF Panel	B	None		0.0000	175.00	No Ice	11.64	7.88	0.05
Antenna						1/2" Ice	12.29	8.51	0.11
(Troop G SZ)						1" Ice	12.95	9.14	0.19
6' Side-Arm	B	None		0.0000	170.00	No Ice	10.60	10.60	0.14
(Troop G)						1/2" Ice	15.40	15.40	0.21
						1" Ice	20.20	20.20	0.28
*** VZW Antennas									
12/20/2016									
Pirod 15' T-Frame Sector	A	None		0.0000	160.00	No Ice	15.00	15.00	0.50
Mount (1)						1/2" Ice	20.60	20.60	0.65
(Verizon)						1" Ice	26.20	26.20	0.80
Pirod 15' T-Frame Sector	B	None		0.0000	160.00	No Ice	15.00	15.00	0.50
Mount (1)						1/2" Ice	20.60	20.60	0.65
(Verizon)						1" Ice	26.20	26.20	0.80
Pirod 15' T-Frame Sector	C	None		0.0000	160.00	No Ice	15.00	15.00	0.50
Mount (1)						1/2" Ice	20.60	20.60	0.65
(Verizon)						1" Ice	26.20	26.20	0.80
SBNHH-1D65B	A	From Face	3.00	0.0000	160.00	No Ice	8.20	5.42	0.04
(Verizon - LTE & PCS)			0.00			1/2" Ice	8.66	5.88	0.09
			0.00			1" Ice	9.13	6.35	0.15

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
RH_2x60-07-L (700 MHz) (Verizon LTE)	A	From Face	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	1.82 1.99 2.18	1.52 1.69 1.86	0.06 0.08 0.10
DB-T1-6Z-8AB-0Z Dist. Box (Verizon LTE)	A	From Face	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	4.80 5.07 5.35	2.00 2.19 2.39	0.05 0.08 0.12
** SBNHH-1D65B Shared (above)									
B66A RRH Unit (Verizon PCS)	A	From Face	3.00 4.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	3.01 3.26 3.52	1.83 2.05 2.28	0.08 0.10 0.12
SBNHH-1D65B (Verizon AWS)	A	From Face	3.00 -6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	8.20 8.66 9.13	5.42 5.88 6.35	0.04 0.09 0.15
RRH_2x60-AWS (Verizon AWS)	A	From Face	3.00 -6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	1.87 2.04 2.23	1.23 1.38 1.53	0.04 0.06 0.08
DB-T1-6Z-8AB-0Z Dist. Box (Verizon AWS)	A	From Face	3.00 -6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	4.80 5.07 5.35	2.00 2.19 2.39	0.05 0.08 0.12
BXA-70080-4CF-EDIN Panel (Verizon 850 MHz)	A	From Face	3.00 6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	3.62 3.93 4.25	5.03 5.59 6.17	0.04 0.08 0.13
SBNHH-1D65B (Verizon - LTE & PCS)	B	From Face	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	8.20 8.66 9.13	5.42 5.88 6.35	0.04 0.09 0.15
RH_2x60-07-L (700 MHz) (Verizon LTE)	B	From Face	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	1.82 1.99 2.18	1.52 1.69 1.86	0.06 0.08 0.10
** SBNHH-1D65B Shared (above)									
B66A RRH Unit (Verizon PCS)	B	From Face	3.00 4.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	3.01 3.26 3.52	1.83 2.05 2.28	0.08 0.10 0.12
SBNHH-1D65B (Verizon AWS)	B	From Face	3.00 -6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	8.20 8.66 9.13	5.42 5.88 6.35	0.04 0.09 0.15
RRH_2x60-AWS (Verizon AWS)	B	From Face	3.00 -6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	1.87 2.04 2.23	1.23 1.38 1.53	0.04 0.06 0.08
BXA-70080-4CF-EDIN Panel (Verizon 850 MHz)	B	From Face	3.00 6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	3.62 3.93 4.25	5.03 5.59 6.17	0.04 0.08 0.13
SBNHH-1D65B (Verizon - LTE & PCS)	C	From Face	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	8.20 8.66 9.13	5.42 5.88 6.35	0.04 0.09 0.15
RH_2x60-07-L (700 MHz) (Verizon LTE)	C	From Face	3.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	1.82 1.99 2.18	1.52 1.69 1.86	0.06 0.08 0.10
** SBNHH-1D65B Shared (above)									
B66A RRH Unit (Verizon PCS)	C	From Face	3.00 4.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	3.01 3.26 3.52	1.83 2.05 2.28	0.08 0.10 0.12
SBNHH-1D65B (Verizon AWS)	C	From Face	3.00 -6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	8.20 8.66 9.13	5.42 5.88 6.35	0.04 0.09 0.15

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
RRH_2x60-AWS (Verizon AWS)	C	From Face	3.00 -6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	1.87 2.04 2.23	1.23 1.38 1.53	0.04 0.06 0.08
BXA-70080-4CF-EDIN Panel (Verizon 850 MHz)	C	From Face	3.00 6.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	3.62 3.93 4.25	5.03 5.59 6.17	0.04 0.08 0.13
*** AT-T Antennas 12/20/2016									
*** AT&T/SMK-004 Antennas - Existing									
Pirod 15' T-Frame Sector Mount (1) (AT&T)	A	None		0.0000	133.00	No Ice 1/2" Ice 1" Ice	15.00 20.60 26.20	15.00 20.60 26.20	0.50 0.65 0.80
Pirod 15' T-Frame Sector Mount (1) (AT&T)	B	None		0.0000	133.00	No Ice 1/2" Ice 1" Ice	15.00 20.60 26.20	15.00 20.60 26.20	0.50 0.65 0.80
Pirod 15' T-Frame Sector Mount (1) (AT&T)	C	None		0.0000	133.00	No Ice 1/2" Ice 1" Ice	15.00 20.60 26.20	15.00 20.60 26.20	0.50 0.65 0.80
P65-16-XLH-RR (AT&T)	A	From Face	3.00 -6.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	8.40 8.95 9.51	4.70 5.15 5.60	0.06 0.11 0.16
RRUS-11 (AT&T)	A	From Face	3.00 -6.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	2.57 2.76 2.97	1.07 1.21 1.36	0.05 0.07 0.09
HPA-65R-BUU-H6 Panel (AT&T)	A	From Face	3.00 -2.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	9.49 9.96 10.43	5.49 5.94 6.41	0.05 0.11 0.17
RRUS-32 (AT&T)	A	From Face	3.00 -2.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	2.74 2.96 3.19	1.67 1.86 2.05	0.06 0.08 0.11
DC6-48-60-18-8F (Squid) Suppressor (AT&T)	A	From Face	3.00 -6.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	0.79 1.27 1.45	0.79 1.27 1.45	0.02 0.04 0.05
P65-16-XLH-RR (AT&T)	B	From Face	3.00 -6.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	8.40 8.95 9.51	4.70 5.15 5.60	0.06 0.11 0.16
RRUS-11 (AT&T)	B	From Face	3.00 -6.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	2.57 2.76 2.97	1.07 1.21 1.36	0.05 0.07 0.09
HPA-65R-BUU-H6 Panel (AT&T)	B	From Face	3.00 -2.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	9.49 9.96 10.43	5.49 5.94 6.41	0.05 0.11 0.17
RRUS-32 (AT&T)	B	From Face	3.00 -2.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	2.74 2.96 3.19	1.67 1.86 2.05	0.06 0.08 0.11
P65-16-XLH-RR (AT&T)	C	From Face	3.00 -6.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	8.40 8.95 9.51	4.70 5.15 5.60	0.06 0.11 0.16
RRUS-11 (AT&T)	C	From Face	3.00 -6.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	2.57 2.76 2.97	1.07 1.21 1.36	0.05 0.07 0.09
HPA-65R-BUU-H6 Panel (AT&T)	C	From Face	3.00 -2.00 0.00	0.0000	133.00	No Ice 1/2" Ice 1" Ice	9.49 9.96 10.43	5.49 5.94 6.41	0.05 0.11 0.17
RRUS-32 (AT&T)	C	From Face	3.00 -2.00	0.0000	133.00	No Ice 1/2" Ice	2.74 2.96	1.67 1.86	0.06 0.08

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	3.19	2.05	0.11
*** AT&T/SMK-004 Antennas - Existing									
*** AT&T/SMK-004 Antennas - Proposed									
800-10798 Kathrein Panel	A	From Face	3.00	0.0000	133.00	No Ice	10.70	7.25	0.11
(PROPOSED - AT&T)			6.00			1/2" Ice	11.21	8.37	0.19
			0.00			1" Ice	11.72	9.27	0.28
RRUS-32 B66	A	From Face	3.00	0.0000	133.00	No Ice	2.74	1.67	0.06
(PROPOSED - AT&T)			6.00			1/2" Ice	2.96	1.86	0.08
			0.00			1" Ice	3.19	2.05	0.11
RRUS-32	A	From Face	3.00	0.0000	133.00	No Ice	2.74	1.67	0.06
(PROPOSED - AT&T)			-2.00			1/2" Ice	2.96	1.86	0.08
			0.00			1" Ice	3.19	2.05	0.11
DBC0061F1V51-2 Combiner Units	A	From Face	3.00	0.0000	133.00	No Ice	0.41	0.43	0.03
			6.00			1/2" Ice	0.50	0.52	0.03
(PROPOSED - AT&T)			0.00			1" Ice	0.59	0.61	0.04
800-10798 Kathrein Panel	B	From Face	3.00	0.0000	133.00	No Ice	10.70	7.25	0.11
(PROPOSED - AT&T)			6.00			1/2" Ice	11.21	8.37	0.19
			0.00			1" Ice	11.72	9.27	0.28
RRUS-32 B66	B	From Face	3.00	0.0000	133.00	No Ice	2.74	1.67	0.06
(PROPOSED - AT&T)			6.00			1/2" Ice	2.96	1.86	0.08
			0.00			1" Ice	3.19	2.05	0.11
RRUS-32	B	From Face	3.00	0.0000	133.00	No Ice	2.74	1.67	0.06
(PROPOSED - AT&T)			-2.00			1/2" Ice	2.96	1.86	0.08
			0.00			1" Ice	3.19	2.05	0.11
DBC0061F1V51-2 Combiner Units	B	From Face	3.00	0.0000	133.00	No Ice	0.41	0.43	0.03
			6.00			1/2" Ice	0.50	0.52	0.03
(PROPOSED - AT&T)			0.00			1" Ice	0.59	0.61	0.04
800-10798 Kathrein Panel	C	From Face	3.00	0.0000	133.00	No Ice	10.70	7.25	0.11
(PROPOSED - AT&T)			6.00			1/2" Ice	11.21	8.37	0.19
			0.00			1" Ice	11.72	9.27	0.28
RRUS-32 B66	C	From Face	3.00	0.0000	133.00	No Ice	2.74	1.67	0.06
(PROPOSED - AT&T)			6.00			1/2" Ice	2.96	1.86	0.08
			0.00			1" Ice	3.19	2.05	0.11
RRUS-32	C	From Face	3.00	0.0000	133.00	No Ice	2.74	1.67	0.06
(PROPOSED - AT&T)			-2.00			1/2" Ice	2.96	1.86	0.08
			0.00			1" Ice	3.19	2.05	0.11
DBC0061F1V51-2 Combiner Units	C	From Face	3.00	0.0000	133.00	No Ice	0.41	0.43	0.03
			6.00			1/2" Ice	0.50	0.52	0.03
(PROPOSED - AT&T)			0.00			1" Ice	0.59	0.61	0.04
DC6-48-60-18-8F (Squid) Suppressor	C	From Face	3.00	0.0000	133.00	No Ice	0.79	0.79	0.02
			0.00			1/2" Ice	1.27	1.27	0.04
(PROPOSED - AT&T)			0.00			1" Ice	1.45	1.45	0.05
*** AT&T/SMK-004 Antennas - Proposed									

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)
PA6-65AC	C	Paraboloid	From	1.00	Worst		177.00	6.00	No Ice	28.27	0.09
(DNK-52 / CSP-42)		w/Radome	Leg	0.00					1/2" Ice	29.05	0.24
				0.00					1" Ice	29.83	0.39

222-G Verification Constants

Constant	Value
Wind Importance Factor Without Ice	1.15
Wind Importance Factor With Ice Factor	1
Ice Importance Factor	1.25
K_d	0.85
Z_g	900
α	9.5
K_{zmin}	0.85
K_e	1
K_t	1
f	1

222-G Section Verification ArRr By Element

Section Elevation (ft)	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r (ft^2)	A_r w/Ice (ft^2)	A_rR_r (ft^2)	A_rR_r w/Ice (ft^2)
T1 180.00-160.00	1	ROHN 3 STD	40.93	39.248	C	0.139	0.354	5.833	13.197	3.055	8.151
	1	ROHN 3 STD	40.93	39.248	A	0.139	0.354	5.833	13.197	3.055	8.151
	2	ROHN 3 STD	40.93	39.248	C	0.139	0.354	5.833	13.197	3.055	8.151
	2	ROHN 3 STD	40.93	39.248	B	0.139	0.354	5.833	13.197	3.055	8.151
	3	ROHN 3 STD	40.93	39.248	B	0.139	0.354	5.833	13.197	3.055	8.151
	3	ROHN 3 STD	40.93	39.248	A	0.139	0.354	5.833	13.197	3.055	8.151
	4	ROHN 1.5 STD	22.219	31.317	C	0.139	0.354	1.306	4.344	0.740	2.683
	5	ROHN 1.5 STD	22.219	31.317	B	0.139	0.354	1.306	4.344	0.740	2.683
	6	ROHN 1.5 STD	22.219	31.317	A	0.139	0.354	1.306	4.344	0.740	2.683
	7	ROHN 1.5 STD	22.219	31.317	C	0.139	0.354	1.315	4.373	0.745	2.701
	8	ROHN 2 STD	27.774	33.671	C	0.139	0.354	1.518	4.343	0.860	2.682
	9	ROHN 2 STD	27.774	33.671	C	0.139	0.354	1.518	4.343	0.860	2.682
	10	ROHN 1.5 STD	22.219	31.317	B	0.139	0.354	1.315	4.373	0.745	2.701
	11	ROHN 2 STD	27.774	33.671	B	0.139	0.354	1.518	4.343	0.860	2.682
	12	ROHN 2 STD	27.774	33.671	B	0.139	0.354	1.518	4.343	0.860	2.682
	13	ROHN 1.5 STD	22.219	31.317	A	0.139	0.354	1.315	4.373	0.745	2.701
	14	ROHN 2 STD	27.774	33.671	A	0.139	0.354	1.518	4.343	0.860	2.682
	15	ROHN 2 STD	27.774	33.671	A	0.139	0.354	1.518	4.343	0.860	2.682
	19	ROHN 1.5 STD	22.219	31.317	C	0.139	0.354	1.311	4.358	0.743	2.692
	20	ROHN 2 STD	27.774	33.671	C	0.139	0.354	1.517	4.338	0.859	2.680
	21	ROHN 2 STD	27.774	33.671	C	0.139	0.354	1.517	4.338	0.859	2.680
	22	ROHN 1.5 STD	22.219	31.317	B	0.139	0.354	1.311	4.358	0.743	2.692
	23	ROHN 2 STD	27.774	33.671	B	0.139	0.354	1.517	4.338	0.859	2.680
	24	ROHN 2 STD	27.774	33.671	B	0.139	0.354	1.517	4.338	0.859	2.680
	25	ROHN 1.5 STD	22.219	31.317	A	0.139	0.354	1.311	4.358	0.743	2.692
	26	ROHN 2 STD	27.774	33.671	A	0.139	0.354	1.517	4.338	0.859	2.680
	27	ROHN 2 STD	27.774	33.671	A	0.139	0.354	1.517	4.338	0.859	2.680
	31	ROHN 2 STD	27.774	33.671	C	0.139	0.354	1.515	4.333	0.858	2.677

Section Elevation *ft*	*Elem. Num.*	*Size*	*C*	*C w/Ice*	*Face*	*e*	*e w/Ice*	A_r ft^2	A_r *w/Ice* ft^2	A_rR_r ft^2	A_rR_r *w/Ice* ft^2
	32	ROHN 2 STD	27.774	33.671	C	0.139	0.354	1.515	4.333	0.858	2.677
	33	ROHN 2 STD	27.774	33.671	B	0.139	0.354	1.515	4.333	0.858	2.677
	34	ROHN 2 STD	27.774	33.671	B	0.139	0.354	1.515	4.333	0.858	2.677
	35	ROHN 2 STD	27.774	33.671	A	0.139	0.354	1.515	4.333	0.858	2.677
	36	ROHN 2 STD	27.774	33.671	A	0.139	0.354	1.515	4.333	0.858	2.677
					A		Sum:	24.699	65.497	13.494	40.456
					B			24.699	65.497	13.494	40.456
					C			24.699	65.497	13.494	40.456
T2 160.00-140.00	40	ROHN 4 STD	51.935	43.357	C	0.144	0.34	7.514	14.798	3.550	9.061
	40	ROHN 4 STD	51.935	43.357	A	0.144	0.34	7.514	14.798	3.550	9.061
	41	ROHN 4 STD	51.935	43.357	C	0.144	0.34	7.514	14.798	3.550	9.061
	41	ROHN 4 STD	51.935	43.357	B	0.144	0.34	7.514	14.798	3.550	9.061
	42	ROHN 4 STD	51.935	43.357	B	0.144	0.34	7.514	14.798	3.550	9.061
	42	ROHN 4 STD	51.935	43.357	A	0.144	0.34	7.514	14.798	3.550	9.061
	43	ROHN 1.5 STD	21.928	30.638	C	0.144	0.34	1.526	5.031	0.865	3.080
	44	ROHN 2 STD	27.41	32.962	C	0.144	0.34	1.634	4.635	0.926	2.838
	45	ROHN 2 STD	27.41	32.962	C	0.144	0.34	1.634	4.635	0.926	2.838
	46	ROHN 1.5 STD	21.928	30.638	B	0.144	0.34	1.526	5.031	0.865	3.080
	47	ROHN 2 STD	27.41	32.962	B	0.144	0.34	1.634	4.635	0.926	2.838
	48	ROHN 2 STD	27.41	32.962	B	0.144	0.34	1.634	4.635	0.926	2.838
	49	ROHN 1.5 STD	21.928	30.638	A	0.144	0.34	1.526	5.031	0.865	3.080
	50	ROHN 2 STD	27.41	32.962	A	0.144	0.34	1.634	4.635	0.926	2.838
	51	ROHN 2 STD	27.41	32.962	A	0.144	0.34	1.634	4.635	0.926	2.838
	55	ROHN 1.5 STD	21.928	30.638	C	0.144	0.34	1.416	4.668	0.803	2.858
	56	ROHN 2 STD	27.41	32.962	C	0.144	0.34	1.589	4.508	0.901	2.760
	57	ROHN 2 STD	27.41	32.962	C	0.144	0.34	1.589	4.508	0.901	2.760
	58	ROHN 1.5 STD	21.928	30.638	B	0.144	0.34	1.416	4.668	0.803	2.858
	59	ROHN 2 STD	27.41	32.962	B	0.144	0.34	1.589	4.508	0.901	2.760
	60	ROHN 2 STD	27.41	32.962	B	0.144	0.34	1.589	4.508	0.901	2.760
	61	ROHN 1.5 STD	21.928	30.638	A	0.144	0.34	1.416	4.668	0.803	2.858
	62	ROHN 2 STD	27.41	32.962	A	0.144	0.34	1.589	4.508	0.901	2.760
	63	ROHN 2 STD	27.41	32.962	A	0.144	0.34	1.589	4.508	0.901	2.760
	67	ROHN 1.5 STD	21.928	30.638	C	0.144	0.34	1.319	4.349	0.748	2.663
	68	ROHN 2 STD	27.41	32.962	C	0.144	0.34	1.546	4.385	0.876	2.685
	69	ROHN 2 STD	27.41	32.962	C	0.144	0.34	1.546	4.385	0.876	2.685
	70	ROHN 1.5 STD	21.928	30.638	B	0.144	0.34	1.319	4.349	0.748	2.663
	71	ROHN 2 STD	27.41	32.962	B	0.144	0.34	1.546	4.385	0.876	2.685
	72	ROHN 2 STD	27.41	32.962	B	0.144	0.34	1.546	4.385	0.876	2.685
	73	ROHN 1.5 STD	21.928	30.638	A	0.144	0.34	1.319	4.349	0.748	2.663
	74	ROHN 2 STD	27.41	32.962	A	0.144	0.34	1.546	4.385	0.876	2.685
	75	ROHN 2 STD	27.41	32.962	A	0.144	0.34	1.546	4.385	0.876	2.685
					A		Sum:	28.825	70.700	14.923	43.287
					B			28.825	70.700	14.923	43.287
					C			28.825	70.700	14.923	43.287
T3 140.00-133.33	79	ROHN 5 EH	63.577	47.888	C	0.151	0.33	3.096	5.502	1.304	3.351
	79	ROHN 5 EH	63.577	47.888	A	0.151	0.33	3.096	5.502	1.304	3.351
	80	ROHN 5 EH	63.577	47.888	C	0.151	0.33	3.096	5.502	1.304	3.351
	80	ROHN 5 EH	63.577	47.888	B	0.151	0.33	3.096	5.502	1.304	3.351
	81	ROHN 5 EH	63.577	47.888	B	0.151	0.33	3.096	5.502	1.304	3.351
	81	ROHN 5 EH	63.577	47.888	A	0.151	0.33	3.096	5.502	1.304	3.351
	82	ROHN 2 STD	27.143	32.444	C	0.151	0.33	2.045	5.768	1.161	3.513
	83	ROHN 2 EH	27.2	32.469	C	0.151	0.33	1.670	4.702	0.948	2.863
	84	ROHN 2 EH	27.2	32.469	C	0.151	0.33	1.670	4.702	0.948	2.863
	85	ROHN 2 STD	27.143	32.444	B	0.151	0.33	2.045	5.768	1.161	3.513
	86	ROHN 2 EH	27.2	32.469	B	0.151	0.33	1.670	4.702	0.948	2.863
	87	ROHN 2 EH	27.2	32.469	B	0.151	0.33	1.670	4.702	0.948	2.863
	88	ROHN 2 STD	27.143	32.444	A	0.151	0.33	2.045	5.768	1.161	3.513
	89	ROHN 2 EH	27.2	32.469	A	0.151	0.33	1.670	4.702	0.948	2.863

Section Elevation *ft*	*Elem. Num.*	*Size*	*C*	*C w/Ice*	*Face*	*e*	*e w/Ice*	A_r ft^2	A_r *w/Ice* ft^2	A_rR_r ft^2	A_rR_r *w/Ice* ft^2
	90	ROHN 2 EH	27.2	32.469	A	0.151	0.33	1.670	4.702	0.948	2.863
					A		Sum:	11.577	26.175	5.663	15.941
					B			11.577	26.175	5.663	15.941
					C			11.577	26.175	5.663	15.941
T4 133.33-126.67	94	ROHN 5 EH	63.243	47.532	C	0.145	0.319	3.096	5.490	1.299	3.321
	94	ROHN 5 EH	63.243	47.532	A	0.145	0.319	3.096	5.490	1.299	3.321
	95	ROHN 5 EH	63.243	47.532	C	0.145	0.319	3.096	5.490	1.299	3.321
	95	ROHN 5 EH	63.243	47.532	B	0.145	0.319	3.096	5.490	1.299	3.321
	96	ROHN 5 EH	63.243	47.532	B	0.145	0.319	3.096	5.490	1.299	3.321
	96	ROHN 5 EH	63.243	47.532	A	0.145	0.319	3.096	5.490	1.299	3.321
	97	ROHN 2 STD	27	32.17	C	0.145	0.319	2.165	6.086	1.228	3.682
	98	ROHN 2 STD	27	32.17	B	0.145	0.319	2.165	6.086	1.228	3.682
	99	ROHN 2 STD	27	32.17	A	0.145	0.319	2.165	6.086	1.228	3.682
	100	ROHN 2 EH	27.057	32.194	C	0.145	0.319	1.717	4.821	0.974	2.916
	101	ROHN 2 EH	27.057	32.194	C	0.145	0.319	1.717	4.821	0.974	2.916
	102	ROHN 2 EH	27.057	32.194	B	0.145	0.319	1.717	4.821	0.974	2.916
	103	ROHN 2 EH	27.057	32.194	B	0.145	0.319	1.717	4.821	0.974	2.916
	104	ROHN 2 EH	27.057	32.194	A	0.145	0.319	1.717	4.821	0.974	2.916
	105	ROHN 2 EH	27.057	32.194	A	0.145	0.319	1.717	4.821	0.974	2.916
					A		Sum:	11.792	26.708	5.774	16.157
					B			11.792	26.708	5.774	16.157
					C			11.792	26.708	5.774	16.157
T5 126.67-120.00	109	ROHN 5 EH	62.894	47.161	C	0.14	0.308	3.096	5.477	1.297	3.295
	109	ROHN 5 EH	62.894	47.161	A	0.14	0.308	3.096	5.477	1.297	3.295
	110	ROHN 5 EH	62.894	47.161	C	0.14	0.308	3.096	5.477	1.297	3.295
	110	ROHN 5 EH	62.894	47.161	B	0.14	0.308	3.096	5.477	1.297	3.295
	111	ROHN 5 EH	62.894	47.161	B	0.14	0.308	3.096	5.477	1.297	3.295
	111	ROHN 5 EH	62.894	47.161	A	0.14	0.308	3.096	5.477	1.297	3.295
	112	ROHN 2 STD	26.851	31.884	C	0.14	0.308	2.303	6.451	1.305	3.881
	113	ROHN 2 STD	26.851	31.884	B	0.14	0.308	2.303	6.451	1.305	3.881
	114	ROHN 2 STD	26.851	31.884	A	0.14	0.308	2.303	6.451	1.305	3.881
	115	ROHN 2 XXS	26.851	31.884	C	0.14	0.308	1.763	4.938	0.999	2.971
	116	ROHN 2 XXS	26.851	31.884	C	0.14	0.308	1.763	4.938	0.999	2.971
	117	ROHN 2 XXS	26.851	31.884	B	0.14	0.308	1.763	4.938	0.999	2.971
	118	ROHN 2 XXS	26.851	31.884	B	0.14	0.308	1.763	4.938	0.999	2.971
	119	ROHN 2 XXS	26.851	31.884	A	0.14	0.308	1.763	4.938	0.999	2.971
	120	ROHN 2 XXS	26.851	31.884	A	0.14	0.308	1.763	4.938	0.999	2.971
					A		Sum:	12.020	27.281	5.895	16.413
					B			12.020	27.281	5.895	16.413
					C			12.020	27.281	5.895	16.413
T6 120.00-100.00	124	ROHN 6 EHS	74.004	51.395	C	0.133	0.265	11.065	18.129	4.542	10.675
	124	ROHN 6 EHS	74.004	51.395	A	0.133	0.265	11.065	18.129	4.542	10.675
	125	ROHN 6 EHS	74.004	51.395	C	0.133	0.265	11.065	18.129	4.542	10.675
	125	ROHN 6 EHS	74.004	51.395	B	0.133	0.265	11.065	18.129	4.542	10.675
	126	ROHN 6 EHS	74.004	51.395	B	0.133	0.265	11.065	18.129	4.542	10.675
	126	ROHN 6 EHS	74.004	51.395	A	0.133	0.265	11.065	18.129	4.542	10.675
	127	ROHN 2 STD	26.53	31.272	C	0.133	0.265	2.645	7.356	1.497	4.331
	128	Pipe 2.5 XXS	32.115	33.639	C	0.133	0.265	2.889	7.139	1.634	4.204
	129	Pipe 2.5 XXS	32.115	33.639	C	0.133	0.265	2.889	7.139	1.634	4.204
	130	ROHN 2 STD	26.53	31.272	B	0.133	0.265	2.645	7.356	1.497	4.331
	131	Pipe 2.5 XXS	32.115	33.639	B	0.133	0.265	2.889	7.139	1.634	4.204
	132	Pipe 2.5 XXS	32.115	33.639	B	0.133	0.265	2.889	7.139	1.634	4.204
	133	ROHN 2 STD	26.53	31.272	A	0.133	0.265	2.645	7.356	1.497	4.331
	134	Pipe 2.5 XXS	32.115	33.639	A	0.133	0.265	2.889	7.139	1.634	4.204
	135	Pipe 2.5 XXS	32.115	33.639	A	0.133	0.265	2.889	7.139	1.634	4.204
	139	ROHN 2 STD	26.53	31.272	C	0.133	0.265	2.440	6.786	1.381	3.995
	140	Pipe 2.5 XXS	32.115	33.639	C	0.133	0.265	2.804	6.930	1.586	4.080

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft^2	A_r w/Ice ft^2	A_rR_r ft^2	A_rR_r w/Ice ft^2
	141	Pipe 2.5 XXS	32.115	33.639	C	0.133	0.265	2.804	6.930	1.586	4.080
	142	ROHN 2 STD	26.53	31.272	B	0.133	0.265	2.440	6.786	1.381	3.995
	143	Pipe 2.5 XXS	32.115	33.639	B	0.133	0.265	2.804	6.930	1.586	4.080
	144	Pipe 2.5 XXS	32.115	33.639	B	0.133	0.265	2.804	6.930	1.586	4.080
	145	ROHN 2 STD	26.53	31.272	A	0.133	0.265	2.440	6.786	1.381	3.995
	146	Pipe 2.5 XXS	32.115	33.639	A	0.133	0.265	2.804	6.930	1.586	4.080
	147	Pipe 2.5 XXS	32.115	33.639	A	0.133	0.265	2.804	6.930	1.586	4.080
					A		Sum:	38.601	78.538	18.400	46.244
					B			38.601	78.538	18.400	46.244
					C			38.601	78.538	18.400	46.244
T7 100.00-90.00	151	ROHN 6 EH	72.871	50.321	C	0.131	0.252	5.537	9.020	2.265	5.282
	151	ROHN 6 EH	72.871	50.321	A	0.131	0.252	5.537	9.020	2.265	5.282
	152	ROHN 6 EH	72.871	50.321	C	0.131	0.252	5.537	9.020	2.265	5.282
	152	ROHN 6 EH	72.871	50.321	B	0.131	0.252	5.537	9.020	2.265	5.282
	153	ROHN 6 EH	72.871	50.321	B	0.131	0.252	5.537	9.020	2.265	5.282
	153	ROHN 6 EH	72.871	50.321	A	0.131	0.252	5.537	9.020	2.265	5.282
	154	ROHN 2 STD	26.123	30.506	C	0.131	0.252	2.868	7.901	1.623	4.627
	155	ROHN 3 STD	38.498	35.751	C	0.131	0.252	3.643	7.981	1.945	4.674
	156	ROHN 3 STD	38.498	35.751	C	0.131	0.252	3.643	7.981	1.945	4.674
	157	ROHN 2 STD	26.123	30.506	B	0.131	0.252	2.868	7.901	1.623	4.627
	158	ROHN 3 STD	38.498	35.751	B	0.131	0.252	3.643	7.981	1.945	4.674
	159	ROHN 3 STD	38.498	35.751	B	0.131	0.252	3.643	7.981	1.945	4.674
	160	ROHN 2 STD	26.123	30.506	A	0.131	0.252	2.868	7.901	1.623	4.627
	161	ROHN 3 STD	38.498	35.751	A	0.131	0.252	3.643	7.981	1.945	4.674
	162	ROHN 3 STD	38.498	35.751	A	0.131	0.252	3.643	7.981	1.945	4.674
					A		Sum:	21.227	41.903	10.043	24.538
					B			21.227	41.903	10.043	24.538
					C			21.227	41.903	10.043	24.538
T8 90.00-80.00	166	ROHN 6 EH	72.022	49.523	C	0.124	0.24	5.537	8.982	2.247	5.232
	166	ROHN 6 EH	72.022	49.523	A	0.124	0.24	5.537	8.982	2.247	5.232
	167	ROHN 6 EH	72.022	49.523	C	0.124	0.24	5.537	8.982	2.247	5.232
	167	ROHN 6 EH	72.022	49.523	B	0.124	0.24	5.537	8.982	2.247	5.232
	168	ROHN 6 EH	72.022	49.523	B	0.124	0.24	5.537	8.982	2.247	5.232
	168	ROHN 6 EH	72.022	49.523	A	0.124	0.24	5.537	8.982	2.247	5.232
	169	ROHN 2 STD	25.819	29.939	C	0.124	0.24	3.129	8.559	1.769	4.986
	170	ROHN 2 STD	25.819	29.939	B	0.124	0.24	3.129	8.559	1.769	4.986
	171	ROHN 2 STD	25.819	29.939	A	0.124	0.24	3.129	8.559	1.769	4.986
	172	ROHN 3 STD	38.05	35.123	C	0.124	0.24	3.773	8.216	2.019	4.786
	173	ROHN 3 STD	38.05	35.123	C	0.124	0.24	3.773	8.216	2.019	4.786
	174	ROHN 3 STD	38.05	35.123	B	0.124	0.24	3.773	8.216	2.019	4.786
	175	ROHN 3 STD	38.05	35.123	B	0.124	0.24	3.773	8.216	2.019	4.786
	176	ROHN 3 STD	38.05	35.123	A	0.124	0.24	3.773	8.216	2.019	4.786
	177	ROHN 3 STD	38.05	35.123	A	0.124	0.24	3.773	8.216	2.019	4.786
					A		Sum:	21.747	42.954	10.301	25.023
					B			21.747	42.954	10.301	25.023
					C			21.747	42.954	10.301	25.023
T9 80.00-60.00	181	ROHN 8 EHS	91.868	57.192	C	0.135	0.242	14.412	21.168	5.926	12.341
	181	ROHN 8 EHS	91.868	57.192	A	0.135	0.242	14.412	21.168	5.926	12.341
	182	ROHN 8 EHS	91.868	57.192	C	0.135	0.242	14.412	21.168	5.926	12.341
	182	ROHN 8 EHS	91.868	57.192	B	0.135	0.242	14.412	21.168	5.926	12.341
	183	ROHN 8 EHS	91.868	57.192	B	0.135	0.242	14.412	21.168	5.926	12.341
	183	ROHN 8 EHS	91.868	57.192	A	0.135	0.242	14.412	21.168	5.926	12.341
	184	ROHN 2.5 STD	30.623	31.233	C	0.135	0.242	4.362	10.497	2.470	6.120
	185	ROHN 3 STD	37.28	34.054	C	0.135	0.242	3.997	8.614	2.161	5.022
	186	ROHN 3 STD	37.28	34.054	C	0.135	0.242	3.997	8.614	2.161	5.022
	187	ROHN 2.5 STD	30.623	31.233	B	0.135	0.242	4.362	10.497	2.470	6.120
	188	ROHN 3 STD	37.28	34.054	B	0.135	0.242	3.997	8.614	2.161	5.022
	189	ROHN 3 STD	37.28	34.054	B	0.135	0.242	3.997	8.614	2.161	5.022
	190	ROHN 2.5 STD	30.623	31.233	A	0.135	0.242	4.362	10.497	2.470	6.120
	191	ROHN 3 STD	37.28	34.054	A	0.135	0.242	3.997	8.614	2.161	5.022

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft^2	A_r w/Ice ft^2	A_rR_r ft^2	A_rR_r w/Ice ft^2
	192	ROHN 3 STD	37.28	34.054	A	0.135	0.242	3.997	8.614	2.161	5.022
	196	ROHN 2.5 STD	30.623	31.233	C	0.135	0.242	4.103	9.872	2.323	5.756
	197	ROHN 3 STD	37.28	34.054	C	0.135	0.242	3.865	8.329	2.089	4.856
	198	ROHN 3 STD	37.28	34.054	C	0.135	0.242	3.865	8.329	2.089	4.856
	199	ROHN 2.5 STD	30.623	31.233	B	0.135	0.242	4.103	9.872	2.323	5.756
	200	ROHN 3 STD	37.28	34.054	B	0.135	0.242	3.865	8.329	2.089	4.856
	201	ROHN 3 STD	37.28	34.054	B	0.135	0.242	3.865	8.329	2.089	4.856
	202	ROHN 2.5 STD	30.623	31.233	A	0.135	0.242	4.103	9.872	2.323	5.756
	203	ROHN 3 STD	37.28	34.054	A	0.135	0.242	3.865	8.329	2.089	4.856
	204	ROHN 3 STD	37.28	34.054	A	0.135	0.242	3.865	8.329	2.089	4.856
					A		Sum:	53.013	96.590	25.145	56.312
					B			53.013	96.590	25.145	56.312
					C			53.013	96.590	25.145	56.312
T10 60.00-40.00	211	ROHN 2.5 STD	29.557	29.563	C	0.135	0.223	4.959	11.701	2.807	6.774
	212	P3.5x.226	41.123	34.465	C	0.135	0.223	4.879	9.647	2.546	5.585
	213	P3.5x.226	41.123	34.465	C	0.135	0.223	4.879	9.647	2.546	5.585
	214	ROHN 2.5 STD	29.557	29.563	B	0.135	0.223	4.959	11.701	2.807	6.774
	215	P3.5x.226	41.123	34.465	B	0.135	0.223	4.879	9.647	2.546	5.585
	216	P3.5x.226	41.123	34.465	B	0.135	0.223	4.879	9.647	2.546	5.585
	217	ROHN 2.5 STD	29.557	29.563	A	0.135	0.223	4.959	11.701	2.807	6.774
	218	P3.5x.226	41.123	34.465	A	0.135	0.223	4.879	9.647	2.546	5.585
	219	P3.5x.226	41.123	34.465	A	0.135	0.223	4.879	9.647	2.546	5.585
	223	ROHN 2.5 STD	29.557	29.563	C	0.135	0.223	4.662	11.001	2.639	6.368
	224	P3.5x.226	41.123	34.465	C	0.135	0.223	4.720	9.334	2.464	5.403
	225	P3.5x.226	41.123	34.465	C	0.135	0.223	4.720	9.334	2.464	5.403
	226	ROHN 2.5 STD	29.557	29.563	B	0.135	0.223	4.662	11.001	2.639	6.368
	227	P3.5x.226	41.123	34.465	B	0.135	0.223	4.720	9.334	2.464	5.403
	228	P3.5x.226	41.123	34.465	B	0.135	0.223	4.720	9.334	2.464	5.403
	229	ROHN 2.5 STD	29.557	29.563	A	0.135	0.223	4.662	11.001	2.639	6.368
	230	P3.5x.226	41.123	34.465	A	0.135	0.223	4.720	9.334	2.464	5.403
	231	P3.5x.226	41.123	34.465	A	0.135	0.223	4.720	9.334	2.464	5.403
					A		Sum:	28.819	60.663	15.467	35.119
					B			28.819	60.663	15.467	35.119
					C			28.819	60.663	15.467	35.119
T11 40.00-30.00	238	ROHN 2.5 STD	28.468	27.899	C	0.128	0.211	5.258	12.158	2.974	7.009
	239	P3.5x.226	39.608	32.62	C	0.128	0.211	5.041	9.794	2.662	5.647
	240	P3.5x.226	39.608	32.62	C	0.128	0.211	5.041	9.794	2.662	5.647
	241	ROHN 2.5 STD	28.468	27.899	B	0.128	0.211	5.258	12.158	2.974	7.009
	242	P3.5x.226	39.608	32.62	B	0.128	0.211	5.041	9.794	2.662	5.647
	243	P3.5x.226	39.608	32.62	B	0.128	0.211	5.041	9.794	2.662	5.647
	244	ROHN 2.5 STD	28.468	27.899	A	0.128	0.211	5.258	12.158	2.974	7.009
	245	P3.5x.226	39.608	32.62	A	0.128	0.211	5.041	9.794	2.662	5.647
	246	P3.5x.226	39.608	32.62	A	0.128	0.211	5.041	9.794	2.662	5.647
					A		Sum:	15.339	31.745	8.298	18.302
					B			15.339	31.745	8.298	18.302
					C			15.339	31.745	8.298	18.302
T12 30.00-20.00	253	ROHN 2.5 EH	27.477	26.422	C	0.124	0.203	5.558	12.609	3.142	7.251
	254	ROHN 2.5 EH	27.477	26.422	B	0.124	0.203	5.558	12.609	3.142	7.251
	255	ROHN 2.5 EH	27.477	26.422	A	0.124	0.203	5.558	12.609	3.142	7.251
	256	P3.5x.226	38.229	30.98	C	0.124	0.203	5.205	9.951	2.781	5.723
	257	P3.5x.226	38.229	30.98	C	0.124	0.203	5.205	9.951	2.781	5.723
	258	P3.5x.226	38.229	30.98	B	0.124	0.203	5.205	9.951	2.781	5.723
	259	P3.5x.226	38.229	30.98	B	0.124	0.203	5.205	9.951	2.781	5.723
	260	P3.5x.226	38.229	30.98	A	0.124	0.203	5.205	9.951	2.781	5.723
	261	P3.5x.226	38.229	30.98	A	0.124	0.203	5.205	9.951	2.781	5.723
					A		Sum:	15.968	32.511	8.705	18.697
					B			15.968	32.511	8.705	18.697
					C			15.968	32.511	8.705	18.697
T13 20.00-0.00	268	P3.5x.226	36.252	28.15	C	0.111	0.177	8.149	14.929	4.424	8.522
	269	P3.5x.226	36.252	28.15	C	0.111	0.177	7.900	14.473	4.289	8.262

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft²	A_r w/Ice ft²	A_rR_r ft²	A_rR_r w/Ice ft²
	270	ROHN 1.5 STD	17.22	20.083	C	0.111	0.177	0.940	2.586	0.531	1.476
	271	ROHN 2 STD	21.525	21.908	C	0.111	0.177	2.130	5.115	1.203	2.920
	272	P3.5x.226	36.252	28.15	C	0.111	0.177	7.900	14.473	4.289	8.262
	273	ROHN 1.5 STD	17.22	20.083	C	0.111	0.177	0.940	2.586	0.531	1.476
	274	ROHN 2 STD	21.525	21.908	C	0.111	0.177	2.130	5.115	1.203	2.920
	275	P3.5x.226	36.252	28.15	B	0.111	0.177	8.149	14.929	4.424	8.522
	276	P3.5x.226	36.252	28.15	B	0.111	0.177	7.900	14.473	4.289	8.262
	277	ROHN 1.5 STD	17.22	20.083	B	0.111	0.177	0.940	2.586	0.531	1.476
	278	ROHN 2 STD	21.525	21.908	B	0.111	0.177	2.130	5.115	1.203	2.920
	279	P3.5x.226	36.252	28.15	B	0.111	0.177	7.900	14.473	4.289	8.262
	280	ROHN 1.5 STD	17.22	20.083	B	0.111	0.177	0.940	2.586	0.531	1.476
	281	ROHN 2 STD	21.525	21.908	B	0.111	0.177	2.130	5.115	1.203	2.920
	283	P3.5x.226	36.252	28.15	A	0.111	0.177	8.149	14.929	4.424	8.522
	284	P3.5x.226	36.252	28.15	A	0.111	0.177	7.900	14.473	4.289	8.262
	285	ROHN 1.5 STD	17.22	20.083	A	0.111	0.177	0.940	2.586	0.531	1.476
	286	ROHN 2 STD	21.525	21.908	A	0.111	0.177	2.130	5.115	1.203	2.920
	287	P3.5x.226	36.252	28.15	A	0.111	0.177	7.900	14.473	4.289	8.262
	288	ROHN 1.5 STD	17.22	20.083	A	0.111	0.177	0.940	2.586	0.531	1.476
	289	ROHN 2 STD	21.525	21.908	A	0.111	0.177	2.130	5.115	1.203	2.920
					A		Sum:	30.089	59.277	16.468	33.837
					B			30.089	59.277	16.468	33.837
					C			30.089	59.277	16.468	33.837

222-G Section Verification Tables - No Ice

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft²
T1 180.00-160.00	170.00		1.415	1	1		43	A	0.139	13.494
								B	0.139	13.494
								C	0.139	13.494
T2 160.00-140.00	150.00		1.378	1	1		42	A	0.144	14.923
								B	0.144	14.923
								C	0.144	14.923
T3 140.00-133.33	136.67		1.352	1	1		41	A	0.151	5.663
								B	0.151	5.663
								C	0.151	5.663
T4 133.33-126.67	130.00		1.337	1	1		40	A	0.145	5.774
								B	0.145	5.774
								C	0.145	5.774
T5 126.67-120.00	123.33		1.323	1	1		40	A	0.14	5.895
								B	0.14	5.895
								C	0.14	5.895
T6 120.00-100.00	110.00		1.291	1	1		39	A	0.133	18.400
								B	0.133	18.400
								C	0.133	18.400
T7 100.00-90.00	95.00		1.252	1	1		38	A	0.131	10.043
								B	0.131	10.043
								C	0.131	10.043
T8 90.00-80.00	85.00		1.223	1	1		37	A	0.124	10.301
								B	0.124	10.301
								C	0.124	10.301

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
T9 80.00-60.00	70.00		1.174	1	1		36	A	0.135	25.145
								B	0.135	25.145
								C	0.135	25.145
T10 60.00-40.00	50.00		1.094	1	1		33	A	0.135	15.467
								B	0.135	15.467
								C	0.135	15.467
T11 40.00-30.00	35.00		1.015	1	1		31	A	0.128	8.298
								B	0.128	8.298
								C	0.128	8.298
T12 30.00-20.00	25.00		0.945	1	1		29	A	0.124	8.705
								B	0.124	8.705
								C	0.124	8.705
T13 20.00-0.00	10.00		0.85	1	1		26	A	0.111	17.320
								B	0.111	17.320
								C	0.111	17.320

222-G Section Verification Tables - Ice

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
T1 180.00-160.00	170.00	170.00	1.415	1	1	2.2090	8	A	0.354	40.456
								B	0.354	40.456
								C	0.354	40.456
T2 160.00-140.00	150.00	150.00	1.378	1	1	2.1815	7	A	0.34	43.287
								B	0.34	43.287
								C	0.34	43.287
T3 140.00-133.33	136.67	136.67	1.352	1	1	2.1613	7	A	0.33	15.941
								B	0.33	15.941
								C	0.33	15.941
T4 133.33-126.67	130.00	130.00	1.337	1	1	2.1505	7	A	0.319	16.157
								B	0.319	16.157
								C	0.319	16.157
T5 126.67-120.00	123.33	123.33	1.323	1	1	2.1392	7	A	0.308	16.413
								B	0.308	16.413
								C	0.308	16.413
T6 120.00-100.00	110.00	110.00	1.291	1	1	2.1149	7	A	0.265	46.244
								B	0.265	46.244
								C	0.265	46.244
T7 100.00-90.00	95.00	95.00	1.252	1	1	2.0841	7	A	0.252	24.538
								B	0.252	24.538
								C	0.252	24.538
T8 90.00-80.00	85.00	85.00	1.223	1	1	2.0611	7	A	0.24	25.023
								B	0.24	25.023
								C	0.24	25.023
T9 80.00-60.00	70.00	70.00	1.174	1	1	2.0214	6	A	0.242	56.312
								B	0.242	56.312
								C	0.242	56.312
T10 60.00-40.00	50.00	50.00	1.094	1	1	1.9546	6	A	0.223	35.119
								B	0.223	35.119
								C	0.223	35.119
T11 40.00-30.00	35.00	35.00	1.015	1	1	1.8861	6	A	0.211	18.302
								B	0.211	18.302
								C	0.211	18.302
T12 30.00-20.00	25.00	25.00	0.945	1	1	1.8237	5	A	0.203	18.697
								B	0.203	18.697

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
								C	0.203	18.697
T13 20.00-0.00	10.00	10.00	0.85	1	1	1.6640	5	A	0.177	35.694
								B	0.177	35.694
								C	0.177	35.694

222-G Section Verification Tables - Service

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
T1 180.00-160.00	170.00		1.415	1	1		11	A	0.139	13.494
								B	0.139	13.494
								C	0.139	13.494
T2 160.00-140.00	150.00		1.378	1	1		11	A	0.144	14.923
								B	0.144	14.923
								C	0.144	14.923
T3 140.00-133.33	136.67		1.352	1	1		11	A	0.151	5.663
								B	0.151	5.663
								C	0.151	5.663
T4 133.33-126.67	130.00		1.337	1	1		10	A	0.145	5.774
								B	0.145	5.774
								C	0.145	5.774
T5 126.67-120.00	123.33		1.323	1	1		10	A	0.14	5.895
								B	0.14	5.895
								C	0.14	5.895
T6 120.00-100.00	110.00		1.291	1	1		10	A	0.133	18.400
								B	0.133	18.400
								C	0.133	18.400
T7 100.00-90.00	95.00		1.252	1	1		10	A	0.131	10.043
								B	0.131	10.043
								C	0.131	10.043
T8 90.00-80.00	85.00		1.223	1	1		10	A	0.124	10.301
								B	0.124	10.301
								C	0.124	10.301
T9 80.00-60.00	70.00		1.174	1	1		9	A	0.135	25.145
								B	0.135	25.145
								C	0.135	25.145
T10 60.00-40.00	50.00		1.094	1	1		9	A	0.135	15.467
								B	0.135	15.467
								C	0.135	15.467
T11 40.00-30.00	35.00		1.015	1	1		8	A	0.128	8.298
								B	0.128	8.298
								C	0.128	8.298
T12 30.00-20.00	25.00		0.945	1	1		7	A	0.124	8.705
								B	0.124	8.705
								C	0.124	8.705
T13 20.00-0.00	10.00		0.85	1	1		7	A	0.111	17.320
								B	0.111	17.320
								C	0.111	17.320

Tower Pressures - No Ice

$G_H = 0.850$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
T1 180.00-160.00	170.00	1.415	43	177.503	A	0.000	24.699	11.667	47.24	33.340	0.000
					B	0.000	24.699		47.24	0.000	0.000
					C	0.000	24.699		47.24	0.000	0.000
T2 160.00-140.00	150.00	1.378	42	200.850	A	0.000	28.825	15.027	52.13	94.570	0.000
					B	0.000	28.825		52.13	0.000	0.000
					C	0.000	28.825		52.13	0.000	0.000
T3 140.00-133.33	136.67	1.352	41	76.803	A	0.000	11.577	6.192	53.49	31.523	0.000
					B	0.000	11.577		53.49	0.000	0.000
					C	0.000	11.577		53.49	0.000	0.000
T4 133.33-126.67	130.00	1.337	40	81.431	A	0.000	11.792	6.192	52.51	31.523	0.000
					B	0.000	11.792		52.51	11.356	0.000
					C	0.000	11.792		52.51	0.000	0.000
T5 126.67-120.00	123.33	1.323	40	86.060	A	0.000	12.020	6.192	51.52	31.523	0.000
					B	0.000	12.020		51.52	30.128	0.000
					C	0.000	12.020		51.52	0.000	0.000
T6 120.00-100.00	110.00	1.291	39	289.399	A	0.000	38.601	22.130	57.33	95.830	0.000
					B	0.000	38.601		57.33	108.557	0.000
					C	0.000	38.601		57.33	0.000	0.000
T7 100.00-90.00	95.00	1.252	38	162.540	A	0.000	21.227	11.074	52.17	48.545	0.000
					B	0.000	21.227		52.17	54.279	0.000
					C	0.000	21.227		52.17	0.000	0.000
T8 90.00-80.00	85.00	1.223	37	175.715	A	0.000	21.747	11.074	50.92	48.545	0.000
					B	0.000	21.747		50.92	54.279	0.000
					C	0.000	21.747		50.92	0.000	0.000
T9 80.00-60.00	70.00	1.174	36	392.943	A	0.000	53.013	28.825	54.37	97.090	0.000
					B	0.000	53.013		54.37	108.557	0.000
					C	0.000	53.013		54.37	0.000	0.000
T10 60.00-40.00	50.00	1.094	33	440.971	A	30.496	28.819	30.496	51.41	97.090	0.000
					B	30.496	28.819		51.41	108.557	0.000
					C	30.496	28.819		51.41	0.000	0.000
T11 40.00-30.00	35.00	1.015	31	239.236	A	15.248	15.339	15.248	49.85	48.545	0.000
					B	15.248	15.339		49.85	54.279	0.000
					C	15.248	15.339		49.85	0.000	0.000
T12 30.00-20.00	25.00	0.945	29	251.736	A	15.248	15.968	15.248	48.85	48.545	0.000
					B	15.248	15.968		48.85	54.279	0.000
					C	15.248	15.968		48.85	0.000	0.000
T13 20.00-0.00	10.00	0.85	26	541.368	A	30.078	30.089	30.078	49.99	97.090	0.000
					B	30.078	30.089		49.99	108.557	0.000
					C	30.078	30.089		49.99	0.000	0.000

Tower Pressure - With Ice

$G_H = 0.850$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
T1 180.00-160.00	170.00	1.415	8	2.2090	184.867	A	0.000	65.497	26.393	40.30	94.841	0.000
						B	0.000	65.497		40.30	0.000	0.000
						C	0.000	65.497		40.30	0.000	0.000
T2 160.00-140.00	150.00	1.378	7	2.1815	208.132	A	0.000	70.700	29.597	41.86	246.078	0.000
						B	0.000	70.700		41.86	0.000	0.000
						C	0.000	70.700		41.86	0.000	0.000
T3	136.67	1.352	7	2.1613	79.207	A	0.000	26.175	11.004	42.04	81.777	0.000

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
140.00-133.33						B	0.000	26.175		42.04	0.000	0.000
						C	0.000	26.175		42.04	0.000	0.000
T4	130.00	1.337	7	2.1505	83.824	A	0.000	26.708	10.980	41.11	81.644	0.000
133.33-126.67						B	0.000	26.708		41.11	33.185	0.000
						C	0.000	26.708		41.11	0.000	0.000
T5	123.33	1.323	7	2.1392	88.440	A	0.000	27.281	10.955	40.15	81.505	0.000
126.67-120.00						B	0.000	27.281		40.15	65.734	0.000
						C	0.000	27.281		40.15	0.000	0.000
T6	110.00	1.291	7	2.1149	296.460	A	0.000	78.538	36.259	46.17	253.383	0.000
120.00-100.00						B	0.000	78.538		46.17	226.990	0.000
						C	0.000	78.538		46.17	0.000	0.000
T7 100.00-90.00	95.00	1.252	7	2.0841	166.021	A	0.000	41.903	18.041	43.05	130.899	0.000
						B	0.000	41.903		43.05	112.784	0.000
						C	0.000	41.903		43.05	0.000	0.000
T8 90.00-80.00	85.00	1.223	7	2.0611	179.158	A	0.000	42.954	17.964	41.82	130.392	0.000
						B	0.000	42.954		41.82	112.252	0.000
						C	0.000	42.954		41.82	0.000	0.000
T9 80.00-60.00	70.00	1.174	6	2.0214	399.694	A	0.000	96.590	42.336	43.83	259.044	0.000
						B	0.000	96.590		43.83	222.674	0.000
						C	0.000	96.590		43.83	0.000	0.000
T10 60.00-40.00	50.00	1.094	6	1.9546	447.499	A	39.205	60.663	39.205	39.26	256.108	0.000
						B	39.205	60.663		39.26	219.587	0.000
						C	39.205	60.663		39.26	0.000	0.000
T11 40.00-30.00	35.00	1.015	6	1.8861	242.385	A	19.450	31.745	19.450	37.99	126.552	0.000
						B	19.450	31.745		37.99	108.214	0.000
						C	19.450	31.745		37.99	0.000	0.000
T12 30.00-20.00	25.00	0.945	5	1.8237	254.781	A	19.311	32.511	19.311	37.26	125.185	0.000
						B	19.311	32.511		37.26	106.776	0.000
						C	19.311	32.511		37.26	0.000	0.000
T13 20.00-0.00	10.00	0.85	5	1.6640	546.926	A	37.493	59.277	37.493	38.74	243.390	0.000
						B	37.493	59.277		38.74	206.196	0.000
						C	37.493	59.277		38.74	0.000	0.000

Tower Pressure - Service

$G_H = 0.850$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
T1	170.00	1.415	11	177.503	A	0.000	24.699	11.667	47.24	33.340	0.000
180.00-160.00					B	0.000	24.699		47.24	0.000	0.000
					C	0.000	24.699		47.24	0.000	0.000
T2	150.00	1.378	11	200.850	A	0.000	28.825	15.027	52.13	94.570	0.000
160.00-140.00					B	0.000	28.825		52.13	0.000	0.000
					C	0.000	28.825		52.13	0.000	0.000
T3	136.67	1.352	11	76.803	A	0.000	11.577	6.192	53.49	31.523	0.000
140.00-133.33					B	0.000	11.577		53.49	0.000	0.000
					C	0.000	11.577		53.49	0.000	0.000
T4	130.00	1.337	10	81.431	A	0.000	11.792	6.192	52.51	31.523	0.000
133.33-126.67					B	0.000	11.792		52.51	11.356	0.000
					C	0.000	11.792		52.51	0.000	0.000
T5	123.33	1.323	10	86.060	A	0.000	12.020	6.192	51.52	31.523	0.000
126.67-120.00					B	0.000	12.020		51.52	30.128	0.000

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
					C	0.000	12.020		51.52	0.000	0.000
T6 120.00-100.00	110.00	1.291	10	289.399	A	0.000	38.601	22.130	57.33	95.830	0.000
					B	0.000	38.601		57.33	108.557	0.000
					C	0.000	38.601		57.33	0.000	0.000
T7 100.00-90.00	95.00	1.252	10	162.540	A	0.000	21.227	11.074	52.17	48.545	0.000
					B	0.000	21.227		52.17	54.279	0.000
					C	0.000	21.227		52.17	0.000	0.000
T8 90.00-80.00	85.00	1.223	10	175.715	A	0.000	21.747	11.074	50.92	48.545	0.000
					B	0.000	21.747		50.92	54.279	0.000
					C	0.000	21.747		50.92	0.000	0.000
T9 80.00-60.00	70.00	1.174	9	392.943	A	0.000	53.013	28.825	54.37	97.090	0.000
					B	0.000	53.013		54.37	108.557	0.000
					C	0.000	53.013		54.37	0.000	0.000
T10 60.00-40.00	50.00	1.094	9	440.971	A	30.496	28.819	30.496	51.41	97.090	0.000
					B	30.496	28.819		51.41	108.557	0.000
					C	30.496	28.819		51.41	0.000	0.000
T11 40.00-30.00	35.00	1.015	8	239.236	A	15.248	15.339	15.248	49.85	48.545	0.000
					B	15.248	15.339		49.85	54.279	0.000
					C	15.248	15.339		49.85	0.000	0.000
T12 30.00-20.00	25.00	0.945	7	251.736	A	15.248	15.968	15.248	48.85	48.545	0.000
					B	15.248	15.968		48.85	54.279	0.000
					C	15.248	15.968		48.85	0.000	0.000
T13 20.00-0.00	10.00	0.85	7	541.368	A	30.078	30.089	30.078	49.99	97.090	0.000
					B	30.078	30.089		49.99	108.557	0.000
					C	30.078	30.089		49.99	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1 180.00-160.00	0.13	1.25	A	0.139	2.812	43	1	1	13.494	2.11	105.53	C
			B	0.139	2.812		1	1	13.494			
			C	0.139	2.812		1	1	13.494			
T2 160.00-140.00	0.41	1.50	A	0.144	2.796	42	1	1	14.923	3.49	174.65	C
			B	0.144	2.796		1	1	14.923			
			C	0.144	2.796		1	1	14.923			
T3 140.00-133.33	0.14	0.83	A	0.151	2.769	41	1	1	5.663	1.20	180.52	C
			B	0.151	2.769		1	1	5.663			
			C	0.151	2.769		1	1	5.663			
T4 133.33-126.67	0.18	0.84	A	0.145	2.791	40	1	1	5.774	1.44	216.04	C
			B	0.145	2.791		1	1	5.774			
			C	0.145	2.791		1	1	5.774			
T5 126.67-120.00	0.26	1.08	A	0.14	2.81	40	1	1	5.895	1.82	273.49	C
			B	0.14	2.81		1	1	5.895			
			C	0.14	2.81		1	1	5.895			
T6 120.00-100.00	0.86	3.82	A	0.133	2.834	39	1	1	18.400	5.81	290.41	C
			B	0.133	2.834		1	1	18.400			
			C	0.133	2.834		1	1	18.400			
T7 100.00-90.00	0.43	1.68	A	0.131	2.844	38	1	1	10.043	2.91	290.85	C
			B	0.131	2.844		1	1	10.043			
			C	0.131	2.844		1	1	10.043			
T8 90.00-80.00	0.43	1.72	A	0.124	2.87	37	1	1	10.301	2.87	287.28	C
			B	0.124	2.87		1	1	10.301			
			C	0.124	2.87		1	1	10.301			
T9	0.86	4.10	A	0.135	2.828	36	1	1	25.145	5.88	293.85	C

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
80.00-60.00			B	0.135	2.828		1	1	25.145			
			C	0.135	2.828		1	1	25.145			
T10	0.86	5.50	A	0.135	2.829	33	1	1	45.962	7.13	356.71	C
60.00-40.00			B	0.135	2.829		1	1	45.962			
			C	0.135	2.829		1	1	45.962			
T11	0.43	2.84	A	0.128	2.855	31	1	1	23.546	3.37	336.64	C
40.00-30.00			B	0.128	2.855		1	1	23.546			
			C	0.128	2.855		1	1	23.546			
T12	0.43	3.03	A	0.124	2.869	29	1	1	23.953	3.17	317.31	C
30.00-20.00			B	0.124	2.869		1	1	23.953			
			C	0.124	2.869		1	1	23.953			
T13	0.86	6.02	A	0.111	2.92	26	1	1	47.398	5.73	286.34	C
20.00-0.00			B	0.111	2.92		1	1	47.398			
			C	0.111	2.92		1	1	47.398			
Sum Weight:	6.29	34.20						OTM	3641.25 kip-ft	46.94		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1	0.13	1.25	A	0.139	2.812	43	0.825	1	13.494	2.11	105.53	C
180.00-160.00			B	0.139	2.812		0.825	1	13.494			
			C	0.139	2.812		0.825	1	13.494			
T2	0.41	1.50	A	0.144	2.796	42	0.825	1	14.923	3.49	174.65	C
160.00-140.00			B	0.144	2.796		0.825	1	14.923			
			C	0.144	2.796		0.825	1	14.923			
T3	0.14	0.83	A	0.151	2.769	41	0.825	1	5.663	1.20	180.52	C
140.00-133.33			B	0.151	2.769		0.825	1	5.663			
			C	0.151	2.769		0.825	1	5.663			
T4	0.18	0.84	A	0.145	2.791	40	0.825	1	5.774	1.44	216.04	C
133.33-126.67			B	0.145	2.791		0.825	1	5.774			
			C	0.145	2.791		0.825	1	5.774			
T5	0.26	1.08	A	0.14	2.81	40	0.825	1	5.895	1.82	273.49	C
126.67-120.00			B	0.14	2.81		0.825	1	5.895			
			C	0.14	2.81		0.825	1	5.895			
T6	0.86	3.82	A	0.133	2.834	39	0.825	1	18.400	5.81	290.41	C
120.00-100.00			B	0.133	2.834		0.825	1	18.400			
			C	0.133	2.834		0.825	1	18.400			
T7	0.43	1.68	A	0.131	2.844	38	0.825	1	10.043	2.91	290.85	C
100.00-90.00			B	0.131	2.844		0.825	1	10.043			
			C	0.131	2.844		0.825	1	10.043			
T8	0.43	1.72	A	0.124	2.87	37	0.825	1	10.301	2.87	287.28	C
90.00-80.00			B	0.124	2.87		0.825	1	10.301			
			C	0.124	2.87		0.825	1	10.301			
T9	0.86	4.10	A	0.135	2.828	36	0.825	1	25.145	5.88	293.85	C
80.00-60.00			B	0.135	2.828		0.825	1	25.145			
			C	0.135	2.828		0.825	1	25.145			
T10	0.86	5.50	A	0.135	2.829	33	0.825	1	40.626	6.71	335.46	C
60.00-40.00			B	0.135	2.829		0.825	1	40.626			
			C	0.135	2.829		0.825	1	40.626			
T11	0.43	2.84	A	0.128	2.855	31	0.825	1	20.878	3.17	316.75	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
40.00-30.00			B	0.128	2.855		0.825	1	20.878			
			C	0.128	2.855		0.825	1	20.878			
T12	0.43	3.03	A	0.124	2.869	29	0.825	1	21.285	2.99	298.68	C
30.00-20.00			B	0.124	2.869		0.825	1	21.285			
			C	0.124	2.869		0.825	1	21.285			
T13	0.86	6.02	A	0.111	2.92	26	0.825	1	42.134	5.39	269.53	C
20.00-0.00			B	0.111	2.92		0.825	1	42.134			
			C	0.111	2.92		0.825	1	42.134			
Sum Weight:	6.29	34.20						OTM	3605.02 kip-ft	45.79		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.13	1.25	A	0.139	2.812	43	0.8	1	13.494	2.11	105.53	C
180.00-160.00			B	0.139	2.812		0.8	1	13.494			
			C	0.139	2.812		0.8	1	13.494			
T2	0.41	1.50	A	0.144	2.796	42	0.8	1	14.923	3.49	174.65	C
160.00-140.00			B	0.144	2.796		0.8	1	14.923			
			C	0.144	2.796		0.8	1	14.923			
T3	0.14	0.83	A	0.151	2.769	41	0.8	1	5.663	1.20	180.52	C
140.00-133.33			B	0.151	2.769		0.8	1	5.663			
			C	0.151	2.769		0.8	1	5.663			
T4	0.18	0.84	A	0.145	2.791	40	0.8	1	5.774	1.44	216.04	C
133.33-126.67			B	0.145	2.791		0.8	1	5.774			
			C	0.145	2.791		0.8	1	5.774			
T5	0.26	1.08	A	0.14	2.81	40	0.8	1	5.895	1.82	273.49	C
126.67-120.00			B	0.14	2.81		0.8	1	5.895			
			C	0.14	2.81		0.8	1	5.895			
T6	0.86	3.82	A	0.133	2.834	39	0.8	1	18.400	5.81	290.41	C
120.00-100.00			B	0.133	2.834		0.8	1	18.400			
			C	0.133	2.834		0.8	1	18.400			
T7	0.43	1.68	A	0.131	2.844	38	0.8	1	10.043	2.91	290.85	C
100.00-90.00			B	0.131	2.844		0.8	1	10.043			
			C	0.131	2.844		0.8	1	10.043			
T8	0.43	1.72	A	0.124	2.87	37	0.8	1	10.301	2.87	287.28	C
90.00-80.00			B	0.124	2.87		0.8	1	10.301			
			C	0.124	2.87		0.8	1	10.301			
T9	0.86	4.10	A	0.135	2.828	36	0.8	1	25.145	5.88	293.85	C
80.00-60.00			B	0.135	2.828		0.8	1	25.145			
			C	0.135	2.828		0.8	1	25.145			
T10	0.86	5.50	A	0.135	2.829	33	0.8	1	39.863	6.65	332.42	C
60.00-40.00			B	0.135	2.829		0.8	1	39.863			
			C	0.135	2.829		0.8	1	39.863			
T11	0.43	2.84	A	0.128	2.855	31	0.8	1	20.497	3.14	313.91	C
40.00-30.00			B	0.128	2.855		0.8	1	20.497			
			C	0.128	2.855		0.8	1	20.497			
T12	0.43	3.03	A	0.124	2.869	29	0.8	1	20.904	2.96	296.02	C
30.00-20.00			B	0.124	2.869		0.8	1	20.904			
			C	0.124	2.869		0.8	1	20.904			
T13	0.86	6.02	A	0.111	2.92	26	0.8	1	41.382	5.34	267.12	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
20.00-0.00			B	0.111	2.92		0.8	1	41.382			
			C	0.111	2.92		0.8	1	41.382			
Sum Weight:	6.29	34.20						OTM	3599.84 kip-ft	45.63		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
T1	0.13	1.25	A	0.139	2.812	43	0.85	1	13.494	2.11	105.53	C
180.00-160.00			B	0.139	2.812		0.85	1	13.494			
			C	0.139	2.812		0.85	1	13.494			
T2	0.41	1.50	A	0.144	2.796	42	0.85	1	14.923	3.49	174.65	C
160.00-140.00			B	0.144	2.796		0.85	1	14.923			
			C	0.144	2.796		0.85	1	14.923			
T3	0.14	0.83	A	0.151	2.769	41	0.85	1	5.663	1.20	180.52	C
140.00-133.33			B	0.151	2.769		0.85	1	5.663			
			C	0.151	2.769		0.85	1	5.663			
T4	0.18	0.84	A	0.145	2.791	40	0.85	1	5.774	1.44	216.04	C
133.33-126.67			B	0.145	2.791		0.85	1	5.774			
			C	0.145	2.791		0.85	1	5.774			
T5	0.26	1.08	A	0.14	2.81	40	0.85	1	5.895	1.82	273.49	C
126.67-120.00			B	0.14	2.81		0.85	1	5.895			
			C	0.14	2.81		0.85	1	5.895			
T6	0.86	3.82	A	0.133	2.834	39	0.85	1	18.400	5.81	290.41	C
120.00-100.00			B	0.133	2.834		0.85	1	18.400			
			C	0.133	2.834		0.85	1	18.400			
T7	0.43	1.68	A	0.131	2.844	38	0.85	1	10.043	2.91	290.85	C
100.00-90.00			B	0.131	2.844		0.85	1	10.043			
			C	0.131	2.844		0.85	1	10.043			
T8	0.43	1.72	A	0.124	2.87	37	0.85	1	10.301	2.87	287.28	C
90.00-80.00			B	0.124	2.87		0.85	1	10.301			
			C	0.124	2.87		0.85	1	10.301			
T9	0.86	4.10	A	0.135	2.828	36	0.85	1	25.145	5.88	293.85	C
80.00-60.00			B	0.135	2.828		0.85	1	25.145			
			C	0.135	2.828		0.85	1	25.145			
T10	0.86	5.50	A	0.135	2.829	33	0.85	1	41.388	6.77	338.50	C
60.00-40.00			B	0.135	2.829		0.85	1	41.388			
			C	0.135	2.829		0.85	1	41.388			
T11	0.43	2.84	A	0.128	2.855	31	0.85	1	21.259	3.20	319.59	C
40.00-30.00			B	0.128	2.855		0.85	1	21.259			
			C	0.128	2.855		0.85	1	21.259			
T12	0.43	3.03	A	0.124	2.869	29	0.85	1	21.666	3.01	301.34	C
30.00-20.00			B	0.124	2.869		0.85	1	21.666			
			C	0.124	2.869		0.85	1	21.666			
T13	0.86	6.02	A	0.111	2.92	26	0.85	1	42.886	5.44	271.93	C
20.00-0.00			B	0.111	2.92		0.85	1	42.886			
			C	0.111	2.92		0.85	1	42.886			
Sum Weight:	6.29	34.20						OTM	3610.19 kip-ft	45.95		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1 180.00-160.00	1.83	5.32	A	0.354	2.162	8	1	1	40.456	0.94	47.23	C
			B	0.354	2.162		1	1	40.456			
			C	0.354	2.162		1	1	40.456			
T2 160.00-140.00	4.72	5.86	A	0.34	2.196	7	1	1	43.287	1.55	77.34	C
			B	0.34	2.196		1	1	43.287			
			C	0.34	2.196		1	1	43.287			
T3 140.00-133.33	1.56	2.46	A	0.33	2.218	7	1	1	15.941	0.53	79.15	C
			B	0.33	2.218		1	1	15.941			
			C	0.33	2.218		1	1	15.941			
T4 133.33-126.67	2.09	2.52	A	0.319	2.248	7	1	1	16.157	0.65	97.60	C
			B	0.319	2.248		1	1	16.157			
			C	0.319	2.248		1	1	16.157			
T5 126.67-120.00	2.88	2.80	A	0.308	2.274	7	1	1	16.413	0.77	115.29	C
			B	0.308	2.274		1	1	16.413			
			C	0.308	2.274		1	1	16.413			
T6 120.00-100.00	9.45	8.60	A	0.265	2.393	7	1	1	46.244	2.38	119.09	C
			B	0.265	2.393		1	1	46.244			
			C	0.265	2.393		1	1	46.244			
T7 100.00-90.00	4.74	4.29	A	0.252	2.43	7	1	1	24.538	1.19	119.17	C
			B	0.252	2.43		1	1	24.538			
			C	0.252	2.43		1	1	24.538			
T8 90.00-80.00	4.69	4.40	A	0.24	2.469	7	1	1	25.023	1.17	117.27	C
			B	0.24	2.469		1	1	25.023			
			C	0.24	2.469		1	1	25.023			
T9 80.00-60.00	9.22	10.15	A	0.242	2.463	6	1	1	56.312	2.32	116.10	C
			B	0.242	2.463		1	1	56.312			
			C	0.242	2.463		1	1	56.312			
T10 60.00-40.00	8.96	12.99	A	0.223	2.52	6	1	1	74.324	2.39	119.55	C
			B	0.223	2.52		1	1	74.324			
			C	0.223	2.52		1	1	74.324			
T11 40.00-30.00	4.35	6.58	A	0.211	2.559	6	1	1	37.752	1.11	111.41	C
			B	0.211	2.559		1	1	37.752			
			C	0.211	2.559		1	1	37.752			
T12 30.00-20.00	4.23	6.73	A	0.203	2.585	5	1	1	38.008	1.04	103.77	C
			B	0.203	2.585		1	1	38.008			
			C	0.203	2.585		1	1	38.008			
T13 20.00-0.00	7.86	11.95	A	0.177	2.675	5	1	1	73.187	1.83	91.48	C
			B	0.177	2.675		1	1	73.187			
			C	0.177	2.675		1	1	73.187			
Sum Weight:	66.56	84.66						OTM	1484.33 kip-ft	17.88		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	q_z *psf*	D_F	D_R	A_E ft^2	*F* *K*	*w* *plf*	*Ctrl. Face*
T1	1.83	5.32	A	0.354	2.162	8	0.825	1	40.456	0.94	47.23	C

Section Elevation	*Add Weight*	*Self Weight*	*Face*	*e*	C_F	q_z	D_F	D_R	A_E	*F*	*w*	*Ctrl. Face*
ft	*K*	*K*				*psf*			*ft²*	*K*	*plf*	
180.00-160.00			B	0.354	2.162		0.825	1	40.456			
			C	0.354	2.162		0.825	1	40.456			
T2	4.72	5.86	A	0.34	2.196	7	0.825	1	43.287	1.55	77.34	C
160.00-140.00			B	0.34	2.196		0.825	1	43.287			
			C	0.34	2.196		0.825	1	43.287			
T3	1.56	2.46	A	0.33	2.218	7	0.825	1	15.941	0.53	79.15	C
140.00-133.33			B	0.33	2.218		0.825	1	15.941			
			C	0.33	2.218		0.825	1	15.941			
T4	2.09	2.52	A	0.319	2.248	7	0.825	1	16.157	0.65	97.60	C
133.33-126.67			B	0.319	2.248		0.825	1	16.157			
			C	0.319	2.248		0.825	1	16.157			
T5	2.88	2.80	A	0.308	2.274	7	0.825	1	16.413	0.77	115.29	C
126.67-120.00			B	0.308	2.274		0.825	1	16.413			
			C	0.308	2.274		0.825	1	16.413			
T6	9.45	8.60	A	0.265	2.393	7	0.825	1	46.244	2.38	119.09	C
120.00-100.00			B	0.265	2.393		0.825	1	46.244			
			C	0.265	2.393		0.825	1	46.244			
T7	4.74	4.29	A	0.252	2.43	7	0.825	1	24.538	1.19	119.17	C
100.00-90.00			B	0.252	2.43		0.825	1	24.538			
			C	0.252	2.43		0.825	1	24.538			
T8	4.69	4.40	A	0.24	2.469	7	0.825	1	25.023	1.17	117.27	C
90.00-80.00			B	0.24	2.469		0.825	1	25.023			
			C	0.24	2.469		0.825	1	25.023			
T9	9.22	10.15	A	0.242	2.463	6	0.825	1	56.312	2.32	116.10	C
80.00-60.00			B	0.242	2.463		0.825	1	56.312			
			C	0.242	2.463		0.825	1	56.312			
T10	8.96	12.99	A	0.223	2.52	6	0.825	1	67.463	2.30	115.18	C
60.00-40.00			B	0.223	2.52		0.825	1	67.463			
			C	0.223	2.52		0.825	1	67.463			
T11	4.35	6.58	A	0.211	2.559	6	0.825	1	34.349	1.07	107.33	C
40.00-30.00			B	0.211	2.559		0.825	1	34.349			
			C	0.211	2.559		0.825	1	34.349			
T12	4.23	6.73	A	0.203	2.585	5	0.825	1	34.628	1.00	99.95	C
30.00-20.00			B	0.203	2.585		0.825	1	34.628			
			C	0.203	2.585		0.825	1	34.628			
T13	7.86	11.95	A	0.177	2.675	5	0.825	1	66.625	1.76	88.03	C
20.00-0.00			B	0.177	2.675		0.825	1	66.625			
			C	0.177	2.675		0.825	1	66.625			
Sum Weight:	66.56	84.66						OTM	1476.88 kip-ft	17.64		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	*Add Weight*	*Self Weight*	*Face*	*e*	C_F	q_z	D_F	D_R	A_E	*F*	*w*	*Ctrl. Face*
ft	*K*	*K*				*psf*			*ft²*	*K*	*plf*	
T1	1.83	5.32	A	0.354	2.162	8	0.8	1	40.456	0.94	47.23	C
180.00-160.00			B	0.354	2.162		0.8	1	40.456			
			C	0.354	2.162		0.8	1	40.456			
T2	4.72	5.86	A	0.34	2.196	7	0.8	1	43.287	1.55	77.34	C
160.00-140.00			B	0.34	2.196		0.8	1	43.287			
			C	0.34	2.196		0.8	1	43.287			
T3	1.56	2.46	A	0.33	2.218	7	0.8	1	15.941	0.53	79.15	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
140.00-133.33			B	0.33	2.218		0.8	1	15.941			
			C	0.33	2.218		0.8	1	15.941			
T4	2.09	2.52	A	0.319	2.248	7	0.8	1	16.157	0.65	97.60	C
133.33-126.67			B	0.319	2.248		0.8	1	16.157			
			C	0.319	2.248		0.8	1	16.157			
T5	2.88	2.80	A	0.308	2.274	7	0.8	1	16.413	0.77	115.29	C
126.67-120.00			B	0.308	2.274		0.8	1	16.413			
			C	0.308	2.274		0.8	1	16.413			
T6	9.45	8.60	A	0.265	2.393	7	0.8	1	46.244	2.38	119.09	C
120.00-100.00			B	0.265	2.393		0.8	1	46.244			
			C	0.265	2.393		0.8	1	46.244			
T7	4.74	4.29	A	0.252	2.43	7	0.8	1	24.538	1.19	119.17	C
100.00-90.00			B	0.252	2.43		0.8	1	24.538			
			C	0.252	2.43		0.8	1	24.538			
T8	4.69	4.40	A	0.24	2.469	7	0.8	1	25.023	1.17	117.27	C
90.00-80.00			B	0.24	2.469		0.8	1	25.023			
			C	0.24	2.469		0.8	1	25.023			
T9	9.22	10.15	A	0.242	2.463	6	0.8	1	56.312	2.32	116.10	C
80.00-60.00			B	0.242	2.463		0.8	1	56.312			
			C	0.242	2.463		0.8	1	56.312			
T10	8.96	12.99	A	0.223	2.52	6	0.8	1	66.483	2.29	114.55	C
60.00-40.00			B	0.223	2.52		0.8	1	66.483			
			C	0.223	2.52		0.8	1	66.483			
T11	4.35	6.58	A	0.211	2.559	6	0.8	1	33.862	1.07	106.74	C
40.00-30.00			B	0.211	2.559		0.8	1	33.862			
			C	0.211	2.559		0.8	1	33.862			
T12	4.23	6.73	A	0.203	2.585	5	0.8	1	34.146	0.99	99.41	C
30.00-20.00			B	0.203	2.585		0.8	1	34.146			
			C	0.203	2.585		0.8	1	34.146			
T13	7.86	11.95	A	0.177	2.675	5	0.8	1	65.688	1.75	87.54	C
20.00-0.00			B	0.177	2.675		0.8	1	65.688			
			C	0.177	2.675		0.8	1	65.688			
Sum Weight:	66.56	84.66						OTM	1475.82 kip-ft	17.61		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	1.83	5.32	A	0.354	2.162	8	0.85	1	40.456	0.94	47.23	C
180.00-160.00			B	0.354	2.162		0.85	1	40.456			
			C	0.354	2.162		0.85	1	40.456			
T2	4.72	5.86	A	0.34	2.196	7	0.85	1	43.287	1.55	77.34	C
160.00-140.00			B	0.34	2.196		0.85	1	43.287			
			C	0.34	2.196		0.85	1	43.287			
T3	1.56	2.46	A	0.33	2.218	7	0.85	1	15.941	0.53	79.15	C
140.00-133.33			B	0.33	2.218		0.85	1	15.941			
			C	0.33	2.218		0.85	1	15.941			
T4	2.09	2.52	A	0.319	2.248	7	0.85	1	16.157	0.65	97.60	C
133.33-126.67			B	0.319	2.248		0.85	1	16.157			
			C	0.319	2.248		0.85	1	16.157			
T5	2.88	2.80	A	0.308	2.274	7	0.85	1	16.413	0.77	115.29	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
126.67-120.00			B	0.308	2.274		0.85	1	16.413			
			C	0.308	2.274		0.85	1	16.413			
T6	9.45	8.60	A	0.265	2.393	7	0.85	1	46.244	2.38	119.09	C
120.00-100.00			B	0.265	2.393		0.85	1	46.244			
			C	0.265	2.393		0.85	1	46.244			
T7	4.74	4.29	A	0.252	2.43	7	0.85	1	24.538	1.19	119.17	C
100.00-90.00			B	0.252	2.43		0.85	1	24.538			
			C	0.252	2.43		0.85	1	24.538			
T8	4.69	4.40	A	0.24	2.469	7	0.85	1	25.023	1.17	117.27	C
90.00-80.00			B	0.24	2.469		0.85	1	25.023			
			C	0.24	2.469		0.85	1	25.023			
T9	9.22	10.15	A	0.242	2.463	6	0.85	1	56.312	2.32	116.10	C
80.00-60.00			B	0.242	2.463		0.85	1	56.312			
			C	0.242	2.463		0.85	1	56.312			
T10	8.96	12.99	A	0.223	2.52	6	0.85	1	68.443	2.32	115.80	C
60.00-40.00			B	0.223	2.52		0.85	1	68.443			
			C	0.223	2.52		0.85	1	68.443			
T11	4.35	6.58	A	0.211	2.559	6	0.85	1	34.835	1.08	107.91	C
40.00-30.00			B	0.211	2.559		0.85	1	34.835			
			C	0.211	2.559		0.85	1	34.835			
T12	4.23	6.73	A	0.203	2.585	5	0.85	1	35.111	1.00	100.50	C
30.00-20.00			B	0.203	2.585		0.85	1	35.111			
			C	0.203	2.585		0.85	1	35.111			
T13	7.86	11.95	A	0.177	2.675	5	0.85	1	67.563	1.77	88.53	C
20.00-0.00			B	0.177	2.675		0.85	1	67.563			
			C	0.177	2.675		0.85	1	67.563			
Sum Weight:	66.56	84.66						OTM	1477.95 kip-ft	17.68		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.13	1.25	A	0.139	2.812	11	1	1	13.494	0.55	27.30	C
180.00-160.00			B	0.139	2.812		1	1	13.494			
			C	0.139	2.812		1	1	13.494			
T2	0.41	1.50	A	0.144	2.796	11	1	1	14.923	0.90	45.18	C
160.00-140.00			B	0.144	2.796		1	1	14.923			
			C	0.144	2.796		1	1	14.923			
T3	0.14	0.83	A	0.151	2.769	11	1	1	5.663	0.31	46.70	C
140.00-133.33			B	0.151	2.769		1	1	5.663			
			C	0.151	2.769		1	1	5.663			
T4	0.18	0.84	A	0.145	2.791	10	1	1	5.774	0.37	55.89	C
133.33-126.67			B	0.145	2.791		1	1	5.774			
			C	0.145	2.791		1	1	5.774			
T5	0.26	1.08	A	0.14	2.81	10	1	1	5.895	0.47	70.75	C
126.67-120.00			B	0.14	2.81		1	1	5.895			
			C	0.14	2.81		1	1	5.895			
T6	0.86	3.82	A	0.133	2.834	10	1	1	18.400	1.50	75.13	C
120.00-100.00			B	0.133	2.834		1	1	18.400			
			C	0.133	2.834		1	1	18.400			
T7	0.43	1.68	A	0.131	2.844	10	1	1	10.043	0.75	75.25	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
100.00-90.00			B	0.131	2.844		1	1	10.043			
			C	0.131	2.844		1	1	10.043			
T8	0.43	1.72	A	0.124	2.87	10	1	1	10.301	0.74	74.32	C
90.00-80.00			B	0.124	2.87		1	1	10.301			
			C	0.124	2.87		1	1	10.301			
T9	0.86	4.10	A	0.135	2.828	9	1	1	25.145	1.52	76.02	C
80.00-60.00			B	0.135	2.828		1	1	25.145			
			C	0.135	2.828		1	1	25.145			
T10	0.86	5.50	A	0.135	2.829	9	1	1	45.962	1.85	92.29	C
60.00-40.00			B	0.135	2.829		1	1	45.962			
			C	0.135	2.829		1	1	45.962			
T11	0.43	2.84	A	0.128	2.855	8	1	1	23.546	0.87	87.09	C
40.00-30.00			B	0.128	2.855		1	1	23.546			
			C	0.128	2.855		1	1	23.546			
T12	0.43	3.03	A	0.124	2.869	7	1	1	23.953	0.82	82.09	C
30.00-20.00			B	0.124	2.869		1	1	23.953			
			C	0.124	2.869		1	1	23.953			
T13	0.86	6.02	A	0.111	2.92	7	1	1	47.398	1.48	74.08	C
20.00-0.00			B	0.111	2.92		1	1	47.398			
			C	0.111	2.92		1	1	47.398			
Sum Weight:	6.29	34.20						OTM	942.04 kip-ft	12.14		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.13	1.25	A	0.139	2.812	11	0.825	1	13.494	0.55	27.30	C
180.00-160.00			B	0.139	2.812		0.825	1	13.494			
			C	0.139	2.812		0.825	1	13.494			
T2	0.41	1.50	A	0.144	2.796	11	0.825	1	14.923	0.90	45.18	C
160.00-140.00			B	0.144	2.796		0.825	1	14.923			
			C	0.144	2.796		0.825	1	14.923			
T3	0.14	0.83	A	0.151	2.769	11	0.825	1	5.663	0.31	46.70	C
140.00-133.33			B	0.151	2.769		0.825	1	5.663			
			C	0.151	2.769		0.825	1	5.663			
T4	0.18	0.84	A	0.145	2.791	10	0.825	1	5.774	0.37	55.89	C
133.33-126.67			B	0.145	2.791		0.825	1	5.774			
			C	0.145	2.791		0.825	1	5.774			
T5	0.26	1.08	A	0.14	2.81	10	0.825	1	5.895	0.47	70.75	C
126.67-120.00			B	0.14	2.81		0.825	1	5.895			
			C	0.14	2.81		0.825	1	5.895			
T6	0.86	3.82	A	0.133	2.834	10	0.825	1	18.400	1.50	75.13	C
120.00-100.00			B	0.133	2.834		0.825	1	18.400			
			C	0.133	2.834		0.825	1	18.400			
T7	0.43	1.68	A	0.131	2.844	10	0.825	1	10.043	0.75	75.25	C
100.00-90.00			B	0.131	2.844		0.825	1	10.043			
			C	0.131	2.844		0.825	1	10.043			
T8	0.43	1.72	A	0.124	2.87	10	0.825	1	10.301	0.74	74.32	C
90.00-80.00			B	0.124	2.87		0.825	1	10.301			
			C	0.124	2.87		0.825	1	10.301			
T9	0.86	4.10	A	0.135	2.828	9	0.825	1	25.145	1.52	76.02	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
80.00-60.00			B	0.135	2.828		0.825	1	25.145			
			C	0.135	2.828		0.825	1	25.145			
T10	0.86	5.50	A	0.135	2.829	9	0.825	1	40.626	1.74	86.79	C
60.00-40.00			B	0.135	2.829		0.825	1	40.626			
			C	0.135	2.829		0.825	1	40.626			
T11	0.43	2.84	A	0.128	2.855	8	0.825	1	20.878	0.82	81.95	C
40.00-30.00			B	0.128	2.855		0.825	1	20.878			
			C	0.128	2.855		0.825	1	20.878			
T12	0.43	3.03	A	0.124	2.869	7	0.825	1	21.285	0.77	77.27	C
30.00-20.00			B	0.124	2.869		0.825	1	21.285			
			C	0.124	2.869		0.825	1	21.285			
T13	0.86	6.02	A	0.111	2.92	7	0.825	1	42.134	1.39	69.73	C
20.00-0.00			B	0.111	2.92		0.825	1	42.134			
			C	0.111	2.92		0.825	1	42.134			
Sum Weight:	6.29	34.20						OTM	932.67 kip-ft	11.85		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.13	1.25	A	0.139	2.812	11	0.8	1	13.494	0.55	27.30	C
180.00-160.00			B	0.139	2.812		0.8	1	13.494			
			C	0.139	2.812		0.8	1	13.494			
T2	0.41	1.50	A	0.144	2.796	11	0.8	1	14.923	0.90	45.18	C
160.00-140.00			B	0.144	2.796		0.8	1	14.923			
			C	0.144	2.796		0.8	1	14.923			
T3	0.14	0.83	A	0.151	2.769	11	0.8	1	5.663	0.31	46.70	C
140.00-133.33			B	0.151	2.769		0.8	1	5.663			
			C	0.151	2.769		0.8	1	5.663			
T4	0.18	0.84	A	0.145	2.791	10	0.8	1	5.774	0.37	55.89	C
133.33-126.67			B	0.145	2.791		0.8	1	5.774			
			C	0.145	2.791		0.8	1	5.774			
T5	0.26	1.08	A	0.14	2.81	10	0.8	1	5.895	0.47	70.75	C
126.67-120.00			B	0.14	2.81		0.8	1	5.895			
			C	0.14	2.81		0.8	1	5.895			
T6	0.86	3.82	A	0.133	2.834	10	0.8	1	18.400	1.50	75.13	C
120.00-100.00			B	0.133	2.834		0.8	1	18.400			
			C	0.133	2.834		0.8	1	18.400			
T7	0.43	1.68	A	0.131	2.844	10	0.8	1	10.043	0.75	75.25	C
100.00-90.00			B	0.131	2.844		0.8	1	10.043			
			C	0.131	2.844		0.8	1	10.043			
T8	0.43	1.72	A	0.124	2.87	10	0.8	1	10.301	0.74	74.32	C
90.00-80.00			B	0.124	2.87		0.8	1	10.301			
			C	0.124	2.87		0.8	1	10.301			
T9	0.86	4.10	A	0.135	2.828	9	0.8	1	25.145	1.52	76.02	C
80.00-60.00			B	0.135	2.828		0.8	1	25.145			
			C	0.135	2.828		0.8	1	25.145			
T10	0.86	5.50	A	0.135	2.829	9	0.8	1	39.863	1.72	86.00	C
60.00-40.00			B	0.135	2.829		0.8	1	39.863			
			C	0.135	2.829		0.8	1	39.863			
T11	0.43	2.84	A	0.128	2.855	8	0.8	1	20.497	0.81	81.21	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
40.00-30.00			B	0.128	2.855		0.8	1	20.497			
			C	0.128	2.855		0.8	1	20.497			
T12	0.43	3.03	A	0.124	2.869	7	0.8	1	20.904	0.77	76.58	C
30.00-20.00			B	0.124	2.869		0.8	1	20.904			
			C	0.124	2.869		0.8	1	20.904			
T13	0.86	6.02	A	0.111	2.92	7	0.8	1	41.382	1.38	69.11	C
20.00-0.00			B	0.111	2.92		0.8	1	41.382			
			C	0.111	2.92		0.8	1	41.382			
Sum Weight:	6.29	34.20						OTM	931.33 kip-ft	11.80		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
T1	0.13	1.25	A	0.139	2.812	11	0.85	1	13.494	0.55	27.30	C
180.00-160.00			B	0.139	2.812		0.85	1	13.494			
			C	0.139	2.812		0.85	1	13.494			
T2	0.41	1.50	A	0.144	2.796	11	0.85	1	14.923	0.90	45.18	C
160.00-140.00			B	0.144	2.796		0.85	1	14.923			
			C	0.144	2.796		0.85	1	14.923			
T3	0.14	0.83	A	0.151	2.769	11	0.85	1	5.663	0.31	46.70	C
140.00-133.33			B	0.151	2.769		0.85	1	5.663			
			C	0.151	2.769		0.85	1	5.663			
T4	0.18	0.84	A	0.145	2.791	10	0.85	1	5.774	0.37	55.89	C
133.33-126.67			B	0.145	2.791		0.85	1	5.774			
			C	0.145	2.791		0.85	1	5.774			
T5	0.26	1.08	A	0.14	2.81	10	0.85	1	5.895	0.47	70.75	C
126.67-120.00			B	0.14	2.81		0.85	1	5.895			
			C	0.14	2.81		0.85	1	5.895			
T6	0.86	3.82	A	0.133	2.834	10	0.85	1	18.400	1.50	75.13	C
120.00-100.00			B	0.133	2.834		0.85	1	18.400			
			C	0.133	2.834		0.85	1	18.400			
T7	0.43	1.68	A	0.131	2.844	10	0.85	1	10.043	0.75	75.25	C
100.00-90.00			B	0.131	2.844		0.85	1	10.043			
			C	0.131	2.844		0.85	1	10.043			
T8	0.43	1.72	A	0.124	2.87	10	0.85	1	10.301	0.74	74.32	C
90.00-80.00			B	0.124	2.87		0.85	1	10.301			
			C	0.124	2.87		0.85	1	10.301			
T9	0.86	4.10	A	0.135	2.828	9	0.85	1	25.145	1.52	76.02	C
80.00-60.00			B	0.135	2.828		0.85	1	25.145			
			C	0.135	2.828		0.85	1	25.145			
T10	0.86	5.50	A	0.135	2.829	9	0.85	1	41.388	1.75	87.57	C
60.00-40.00			B	0.135	2.829		0.85	1	41.388			
			C	0.135	2.829		0.85	1	41.388			
T11	0.43	2.84	A	0.128	2.855	8	0.85	1	21.259	0.83	82.68	C
40.00-30.00			B	0.128	2.855		0.85	1	21.259			
			C	0.128	2.855		0.85	1	21.259			
T12	0.43	3.03	A	0.124	2.869	7	0.85	1	21.666	0.78	77.96	C
30.00-20.00			B	0.124	2.869		0.85	1	21.666			
			C	0.124	2.869		0.85	1	21.666			
T13	0.86	6.02	A	0.111	2.92	7	0.85	1	42.886	1.41	70.35	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
20.00-0.00			B	0.111	2.92		0.85	1	42.886			
			C	0.111	2.92		0.85	1	42.886			
Sum Weight:	6.29	34.20						OTM	934.01 kip-ft	11.89		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	16.40					
Bracing Weight	17.80					
Total Member Self-Weight	34.20			-24.93	4.29	
Total Weight	49.51			-24.93	4.29	
Wind 0 deg - No Ice		-0.38	-63.74	-6113.45	66.56	-10.88
Wind 30 deg - No Ice		31.27	-54.16	-5239.71	-3006.46	-61.87
Wind 45 deg - No Ice		44.30	-43.99	-4260.51	-4282.13	-81.59
Wind 60 deg - No Ice		54.25	-30.89	-2994.56	-5263.80	-95.58
Wind 90 deg - No Ice		63.19	0.38	37.34	-6125.08	-105.07
Wind 120 deg - No Ice		55.76	32.20	3073.26	-5361.93	-87.91
Wind 135 deg - No Ice		45.51	45.20	4319.95	-4391.43	-68.16
Wind 150 deg - No Ice		31.92	54.54	5252.13	-3114.32	-43.20
Wind 180 deg - No Ice		0.38	62.43	6022.18	-57.98	10.75
Wind 210 deg - No Ice		-31.27	54.16	5189.85	3015.05	61.87
Wind 225 deg - No Ice		-44.30	43.99	4210.65	4290.72	81.59
Wind 240 deg - No Ice		-55.39	31.54	2965.40	5308.24	98.79
Wind 270 deg - No Ice		-63.19	-0.38	-87.20	6133.66	105.07
Wind 300 deg - No Ice		-54.63	-31.54	-3102.41	5334.65	84.83
Wind 315 deg - No Ice		-45.51	-45.20	-4369.81	4400.01	68.16
Wind 330 deg - No Ice		-31.92	-54.54	-5301.98	3122.91	43.20
Member Ice	50.45					
Total Weight Ice	181.75			-274.50	33.38	
Wind 0 deg - Ice		-0.07	-23.30	-2547.84	44.29	-9.14
Wind 30 deg - Ice		11.53	-19.97	-2232.28	-1096.95	-21.59
Wind 45 deg - Ice		16.31	-16.26	-1869.01	-1570.05	-25.80
Wind 60 deg - Ice		19.98	-11.46	-1397.46	-1933.48	-28.23
Wind 90 deg - Ice		23.17	0.07	-263.59	-2246.19	-27.54
Wind 120 deg - Ice		20.27	11.71	871.62	-1951.77	-19.64
Wind 135 deg - Ice		16.55	16.49	1339.81	-1589.85	-13.26
Wind 150 deg - Ice		11.64	20.03	1694.19	-1115.86	-5.95
Wind 180 deg - Ice		0.07	23.03	1990.32	22.46	8.99
Wind 210 deg - Ice		-11.53	19.97	1683.28	1163.70	21.59
Wind 225 deg - Ice		-16.31	16.26	1320.00	1636.80	25.80
Wind 240 deg - Ice		-20.21	11.59	852.71	2007.60	28.78
Wind 270 deg - Ice		-23.17	-0.07	-285.42	2312.94	27.54
Wind 300 deg - Ice		-20.04	-11.57	-1416.37	2011.15	19.23
Wind 315 deg - Ice		-16.55	-16.49	-1888.82	1656.60	13.26
Wind 330 deg - Ice		-11.64	-20.03	-2243.20	1182.61	5.95
Total Weight	49.51			-24.93	4.29	
Wind 0 deg - Service		-0.10	-16.49	-1574.01	15.89	-2.82
Wind 30 deg - Service		8.09	-14.01	-1347.96	-779.14	-16.01
Wind 45 deg - Service		11.46	-11.38	-1094.63	-1109.18	-21.11
Wind 60 deg - Service		14.04	-7.99	-767.11	-1363.15	-24.73

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 90 deg - Service		16.35	0.10	17.28	-1585.97	-27.18
Wind 120 deg - Service		14.43	8.33	802.72	-1388.54	-22.74
Wind 135 deg - Service		11.77	11.69	1125.25	-1137.45	-17.63
Wind 150 deg - Service		8.26	14.11	1366.42	-807.05	-11.18
Wind 180 deg - Service		0.10	16.15	1565.64	-16.33	2.78
Wind 210 deg - Service		-8.09	14.01	1350.31	778.70	16.01
Wind 225 deg - Service		-11.46	11.38	1096.98	1108.74	21.11
Wind 240 deg - Service		-14.33	8.16	774.81	1371.98	25.56
Wind 270 deg - Service		-16.35	-0.10	-14.94	1585.53	27.18
Wind 300 deg - Service		-14.13	-8.16	-795.01	1378.82	21.95
Wind 315 deg - Service		-11.77	-11.69	-1122.90	1137.01	17.63
Wind 330 deg - Service		-8.26	-14.11	-1364.07	806.61	11.18

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 45 deg - No Ice
7	0.9 Dead+1.6 Wind 45 deg - No Ice
8	1.2 Dead+1.6 Wind 60 deg - No Ice
9	0.9 Dead+1.6 Wind 60 deg - No Ice
10	1.2 Dead+1.6 Wind 90 deg - No Ice
11	0.9 Dead+1.6 Wind 90 deg - No Ice
12	1.2 Dead+1.6 Wind 120 deg - No Ice
13	0.9 Dead+1.6 Wind 120 deg - No Ice
14	1.2 Dead+1.6 Wind 135 deg - No Ice
15	0.9 Dead+1.6 Wind 135 deg - No Ice
16	1.2 Dead+1.6 Wind 150 deg - No Ice
17	0.9 Dead+1.6 Wind 150 deg - No Ice
18	1.2 Dead+1.6 Wind 180 deg - No Ice
19	0.9 Dead+1.6 Wind 180 deg - No Ice
20	1.2 Dead+1.6 Wind 210 deg - No Ice
21	0.9 Dead+1.6 Wind 210 deg - No Ice
22	1.2 Dead+1.6 Wind 225 deg - No Ice
23	0.9 Dead+1.6 Wind 225 deg - No Ice
24	1.2 Dead+1.6 Wind 240 deg - No Ice
25	0.9 Dead+1.6 Wind 240 deg - No Ice
26	1.2 Dead+1.6 Wind 270 deg - No Ice
27	0.9 Dead+1.6 Wind 270 deg - No Ice
28	1.2 Dead+1.6 Wind 300 deg - No Ice
29	0.9 Dead+1.6 Wind 300 deg - No Ice
30	1.2 Dead+1.6 Wind 315 deg - No Ice
31	0.9 Dead+1.6 Wind 315 deg - No Ice
32	1.2 Dead+1.6 Wind 330 deg - No Ice
33	0.9 Dead+1.6 Wind 330 deg - No Ice
34	1.2 Dead+1.0 Ice
35	1.2 Dead+1.0 Wind 0 deg+1.0 Ice
36	1.2 Dead+1.0 Wind 30 deg+1.0 Ice
37	1.2 Dead+1.0 Wind 45 deg+1.0 Ice
38	1.2 Dead+1.0 Wind 60 deg+1.0 Ice
39	1.2 Dead+1.0 Wind 90 deg+1.0 Ice

Comb. No.	Description
40	1.2 Dead+1.0 Wind 120 deg+1.0 Ice
41	1.2 Dead+1.0 Wind 135 deg+1.0 Ice
42	1.2 Dead+1.0 Wind 150 deg+1.0 Ice
43	1.2 Dead+1.0 Wind 180 deg+1.0 Ice
44	1.2 Dead+1.0 Wind 210 deg+1.0 Ice
45	1.2 Dead+1.0 Wind 225 deg+1.0 Ice
46	1.2 Dead+1.0 Wind 240 deg+1.0 Ice
47	1.2 Dead+1.0 Wind 270 deg+1.0 Ice
48	1.2 Dead+1.0 Wind 300 deg+1.0 Ice
49	1.2 Dead+1.0 Wind 315 deg+1.0 Ice
50	1.2 Dead+1.0 Wind 330 deg+1.0 Ice
51	Dead+Wind 0 deg - Service
52	Dead+Wind 30 deg - Service
53	Dead+Wind 45 deg - Service
54	Dead+Wind 60 deg - Service
55	Dead+Wind 90 deg - Service
56	Dead+Wind 120 deg - Service
57	Dead+Wind 135 deg - Service
58	Dead+Wind 150 deg - Service
59	Dead+Wind 180 deg - Service
60	Dead+Wind 210 deg - Service
61	Dead+Wind 225 deg - Service
62	Dead+Wind 240 deg - Service
63	Dead+Wind 270 deg - Service
64	Dead+Wind 300 deg - Service
65	Dead+Wind 315 deg - Service
66	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	180 - 160	Leg	Max Tension	9	4.86	-0.38	-0.32
			Max. Compression	12	-6.24	0.06	0.02
			Max. Mx	28	-0.10	-1.03	0.18
			Max. My	32	-0.23	0.07	-1.61
			Max. Vy	28	-0.65	-1.03	0.18
			Max. Vx	16	0.88	-0.07	-1.11
		Diagonal	Max Tension	27	5.30	0.00	0.00
			Max. Compression	26	-5.37	0.00	0.00
			Max. Mx	34	-0.11	0.07	0.00
			Max. Vy	34	-0.04	0.00	0.00
		Horizontal	Max Tension	26	2.96	-0.01	0.00
			Max. Compression	11	-2.92	0.00	0.00
			Max. Mx	38	-0.05	-0.04	-0.00
			Max. My	28	-0.63	-0.01	-0.01
			Max. Vy	38	0.04	-0.04	-0.00
			Max. Vx	28	0.00	-0.01	-0.01
		Top Girt	Max Tension	19	0.65	0.00	0.00
			Max. Compression	2	-0.65	-0.01	-0.00
			Max. Mx	48	-0.05	-0.03	-0.00
			Max. My	2	0.45	-0.01	0.00
			Max. Vy	48	0.04	-0.03	-0.00
			Max. Vx	2	-0.00	0.00	0.00
		Inner Bracing	Max Tension	2	0.01	0.00	0.00
			Max. Compression	2	-0.01	0.00	0.00
			Max. Mx	34	-0.00	-0.04	0.00
			Max. Vy	34	-0.03	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T2	160 - 140	Leg	Max Tension	29	37.01	-0.15	-0.02
			Max. Compression	12	-41.23	0.25	0.01
			Max. Mx	28	36.39	-0.26	-0.01
			Max. My	26	-3.84	0.00	-0.38
			Max. Vy	28	-2.58	-0.06	-0.02
			Max. Vx	16	-2.71	0.02	-0.05
		Diagonal	Max Tension	27	9.42	0.00	0.00
			Max. Compression	26	-9.49	0.00	0.00
			Max. Mx	34	-0.18	0.09	0.00
			Max. Vy	34	-0.04	0.00	0.00
		Horizontal	Max Tension	4	5.77	-0.01	-0.00
			Max. Compression	12	-5.79	0.00	0.00
			Max. Mx	48	-0.07	-0.05	-0.00
			Max. My	12	2.04	-0.00	0.01
			Max. Vy	48	-0.05	-0.05	-0.00
			Max. Vx	12	-0.00	-0.00	0.01
		Inner Bracing	Max Tension	13	0.01	0.00	0.00
			Max. Compression	28	-0.01	0.00	0.00
			Max. Mx	34	-0.01	-0.05	0.00
			Max. Vy	34	-0.04	0.00	0.00
T3	140 - 133.333	Leg	Max Tension	29	49.34	-0.26	-0.01
			Max. Compression	12	-54.01	0.15	0.02
			Max. Mx	28	48.69	-0.26	-0.01
			Max. My	26	-4.36	0.00	-0.38
			Max. Vy	18	-0.10	-0.25	-0.09
			Max. Vx	8	0.20	0.11	0.37
		Diagonal	Max Tension	5	9.60	0.00	0.00
			Max. Compression	4	-9.71	0.00	0.00
			Max. Mx	34	-0.24	0.11	0.00
			Max. Vy	34	-0.05	0.00	0.00
		Horizontal	Max Tension	4	6.27	-0.02	-0.00
			Max. Compression	5	-6.24	-0.01	-0.00
			Max. Mx	48	0.01	-0.07	-0.00
			Max. My	28	-0.47	-0.03	-0.02
			Max. Vy	48	-0.06	-0.07	-0.00
			Max. Vx	28	-0.00	0.00	0.00
		Inner Bracing	Max Tension	13	0.01	0.00	0.00
			Max. Compression	28	-0.01	0.00	0.00
			Max. Mx	34	-0.01	-0.05	0.00
			Max. Vy	34	0.04	0.00	0.00
T4	133.333 - 126.667	Leg	Max Tension	29	61.30	-0.16	-0.02
			Max. Compression	12	-67.94	1.59	0.03
			Max. Mx	28	59.41	-1.67	-0.03
			Max. My	26	-6.44	-0.03	-1.66
			Max. Vy	8	-2.41	-0.15	0.04
			Max. Vx	32	2.36	-0.00	0.07
		Diagonal	Max Tension	5	13.18	0.00	0.00
			Max. Compression	4	-13.30	0.00	0.00
			Max. Mx	34	-0.26	0.12	0.00
			Max. Vy	34	-0.05	0.00	0.00
		Top Girt	Max Tension	7	8.97	-0.01	0.01
			Max. Compression	22	-8.99	0.00	0.00
			Max. Mx	48	-0.40	-0.08	-0.01
			Max. My	12	1.69	-0.00	0.02
			Max. Vy	48	-0.06	-0.08	-0.01
			Max. Vx	12	0.00	0.00	0.00
		Inner Bracing	Max Tension	22	0.16	0.00	0.00
			Max. Compression	22	-0.16	0.00	0.00
			Max. Mx	34	0.00	-0.06	0.00
			Max. Vy	34	0.04	0.00	0.00

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial K*	*Major Axis Moment kip-ft*	*Minor Axis Moment kip-ft*
T5	126.667 - 120	Leg	Max Tension	29	76.59	-1.66	-0.03
			Max. Compression	12	-85.77	1.20	0.22
			Max. Mx	28	75.46	-1.67	-0.03
			Max. My	26	-6.96	-0.03	-1.66
			Max. Vy	18	-1.76	-1.65	-0.03
			Max. Vx	10	1.80	-0.05	1.66
		Diagonal	Max Tension	5	16.16	0.00	0.00
			Max. Compression	4	-16.35	0.00	0.00
			Max. Mx	34	-0.30	0.17	0.00
			Max. Vy	34	0.07	0.00	0.00
		Top Girt	Max Tension	7	11.25	-0.01	0.01
			Max. Compression	22	-11.26	0.00	0.00
			Max. Mx	48	-0.39	-0.09	-0.01
			Max. My	12	1.54	-0.00	0.03
			Max. Vy	48	0.06	-0.09	-0.01
			Max. Vx	12	-0.00	-0.00	0.03
		Inner Bracing	Max Tension	22	0.20	0.00	0.00
			Max. Compression	22	-0.20	0.00	0.00
			Max. Mx	34	0.00	-0.07	0.00
			Max. Vy	34	0.05	0.00	0.00
T6	120 - 100	Leg	Max Tension	29	123.46	-0.67	-0.33
			Max. Compression	12	-135.75	0.43	0.25
			Max. Mx	28	93.71	-1.25	-0.22
			Max. My	26	-8.82	-0.02	-1.50
			Max. Vy	18	-0.20	-1.23	-0.00
			Max. Vx	26	-0.41	-0.01	-1.08
		Diagonal	Max Tension	21	21.46	0.00	0.00
			Max. Compression	20	-21.78	0.00	0.00
			Max. Mx	34	-0.45	0.35	0.00
			Max. Vy	34	-0.11	0.00	0.00
		Horizontal	Max Tension	20	12.99	0.00	0.00
			Max. Compression	21	-12.89	0.00	0.00
			Max. Mx	48	-0.35	-0.11	-0.01
			Max. My	28	-0.65	-0.05	-0.03
			Max. Vy	48	-0.07	-0.11	-0.01
			Max. Vx	28	-0.00	0.00	0.00
		Inner Bracing	Max Tension	13	0.01	0.00	0.00
			Max. Compression	28	-0.01	0.00	0.00
			Max. Mx	34	-0.01	-0.11	0.00
			Max. Vy	34	0.06	0.00	0.00
T7	100 - 90	Leg	Max Tension	29	150.99	-0.46	-0.26
			Max. Compression	12	-164.92	0.78	0.27
			Max. Mx	28	148.79	-0.82	-0.27
			Max. My	26	-11.99	-0.02	-1.09
			Max. Vy	18	0.18	-0.81	-0.00
			Max. Vx	10	-0.40	-0.04	1.09
		Diagonal	Max Tension	21	20.25	0.00	0.00
			Max. Compression	20	-20.47	0.00	0.00
			Max. Mx	34	-0.54	0.31	0.00
			Max. Vy	34	0.10	0.00	0.00
		Horizontal	Max Tension	6	13.02	-0.03	0.01
			Max. Compression	23	-13.02	0.00	0.00
			Max. Mx	48	-0.71	-0.12	-0.01
			Max. My	28	-0.25	-0.06	-0.02
			Max. Vy	48	-0.08	-0.12	-0.01
			Max. Vx	28	0.00	-0.06	-0.02
		Inner Bracing	Max Tension	13	0.00	0.00	0.00
			Max. Compression	43	-0.01	0.00	0.00
			Max. Mx	34	-0.01	-0.13	0.00
			Max. Vy	34	0.07	0.00	0.00
T8	90 - 80	Leg	Max Tension	29	175.59	-0.82	-0.27

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	12	-190.92	0.98	0.30
			Max. Mx	28	173.19	-1.02	-0.30
			Max. My	26	-13.13	-0.02	-1.44
			Max. Vy	18	0.16	-1.01	-0.01
			Max. Vx	10	-0.38	-0.04	1.44
		Diagonal	Max Tension	21	20.50	0.00	0.00
			Max. Compression	20	-20.75	0.00	0.00
			Max. Mx	34	-0.61	0.34	0.00
			Max. Vy	34	0.10	0.00	0.00
		Top Girt	Max Tension	6	13.75	-0.03	0.01
			Max. Compression	23	-13.70	0.00	0.00
			Max. Mx	48	-0.51	-0.14	-0.01
			Max. My	28	0.52	-0.06	-0.02
			Max. Vy	48	-0.08	-0.14	-0.01
			Max. Vx	28	-0.00	-0.06	-0.02
		Inner Bracing	Max Tension	23	0.23	0.00	0.00
			Max. Compression	22	-0.24	0.00	0.00
			Max. Mx	34	-0.00	-0.15	0.00
			Max. Vy	34	0.07	0.00	0.00
T9	80 - 60	Leg	Max Tension	29	223.47	-1.47	-0.20
			Max. Compression	12	-241.95	1.33	0.30
			Max. Mx	28	196.77	-1.48	-0.20
			Max. My	26	-15.54	-0.02	-1.71
			Max. Vy	18	0.22	-1.45	0.02
			Max. Vx	26	0.38	-0.00	-1.61
		Diagonal	Max Tension	21	21.90	0.00	0.00
			Max. Compression	20	-22.24	0.00	0.00
			Max. Mx	34	-0.76	0.41	0.00
			Max. Vy	34	-0.11	0.00	0.00
		Horizontal	Max Tension	6	15.85	-0.07	0.01
			Max. Compression	23	-15.75	0.00	0.00
			Max. Mx	48	-0.52	-0.24	-0.01
			Max. My	28	1.05	-0.12	-0.03
			Max. Vy	48	-0.12	-0.24	-0.01
			Max. Vx	28	-0.00	-0.12	-0.03
		Inner Bracing	Max Tension	13	0.00	0.00	0.00
			Max. Compression	43	-0.02	0.00	0.00
			Max. Mx	34	-0.02	-0.22	0.00
			Max. Vy	34	0.09	0.00	0.00
T10	60 - 40	Leg	Max Tension	29	270.57	-1.63	-0.16
			Max. Compression	12	-293.15	1.24	0.18
			Max. Mx	28	243.90	-1.64	-0.16
			Max. My	26	-16.24	-0.02	-1.71
			Max. Vy	13	0.27	1.63	0.17
			Max. Vx	10	0.48	-0.05	1.70
		Diagonal	Max Tension	21	23.34	0.00	0.00
			Max. Compression	20	-23.80	0.00	0.00
			Max. Mx	34	-0.94	0.54	0.00
			Max. Vy	34	-0.14	0.00	0.00
		Horizontal	Max Tension	6	17.92	-0.09	0.01
			Max. Compression	23	-17.75	0.00	0.00
			Max. Mx	48	-0.51	-0.28	-0.01
			Max. My	13	3.46	-0.05	0.03
			Max. Vy	48	-0.13	-0.28	-0.01
			Max. Vx	28	0.00	-0.12	-0.03
		Inner Bracing	Max Tension	13	0.00	0.00	0.00
			Max. Compression	43	-0.02	0.00	0.00
			Max. Mx	34	-0.02	-0.34	0.00
			Max. Vy	34	-0.13	0.00	0.00
T11	40 - 30	Leg	Max Tension	29	294.03	-1.30	-0.18
			Max. Compression	12	-319.02	2.87	0.14

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial K*	*Major Axis Moment kip-ft*	*Minor Axis Moment kip-ft*
			Max. Mx	12	-319.02	2.87	0.14
			Max. My	26	-19.23	-0.05	-1.57
			Max. Vy	13	-0.38	2.85	0.14
			Max. Vx	26	-0.41	-0.05	-1.57
		Diagonal	Max Tension	21	24.01	0.00	0.00
			Max. Compression	20	-24.51	0.00	0.00
			Max. Mx	34	-1.00	0.57	0.00
			Max. Vy	34	-0.15	0.00	0.00
		Horizontal	Max Tension	6	18.87	-0.11	0.01
			Max. Compression	23	-18.70	0.00	0.00
			Max. Mx	48	-0.57	-0.30	-0.01
			Max. My	13	3.74	-0.06	0.03
			Max. Vy	48	-0.13	-0.30	-0.01
			Max. Vx	13	-0.00	-0.06	0.03
		Inner Bracing	Max Tension	13	0.00	0.00	0.00
			Max. Compression	43	-0.02	0.00	0.00
			Max. Mx	34	-0.02	-0.36	0.00
			Max. Vy	34	0.13	0.00	0.00
T12	30 - 20	Leg	Max Tension	29	317.28	-2.73	-0.13
			Max. Compression	12	-344.91	-2.27	0.74
			Max. Mx	12	-344.41	2.87	0.14
			Max. My	26	-21.42	-0.53	-5.69
			Max. Vy	12	0.71	2.87	0.14
			Max. Vx	26	0.80	-0.53	-5.69
		Diagonal	Max Tension	21	24.71	0.00	0.00
			Max. Compression	20	-25.29	0.00	0.00
			Max. Mx	34	-1.07	0.61	0.00
			Max. Vy	34	-0.15	0.00	0.00
		Top Girt	Max Tension	6	19.70	-0.16	0.01
			Max. Compression	23	-19.41	0.00	0.00
			Max. Mx	48	-0.24	-0.37	-0.01
			Max. My	13	3.23	-0.09	0.03
			Max. Vy	48	-0.15	-0.37	-0.01
			Max. Vx	13	0.00	0.00	0.00
		Inner Bracing	Max Tension	23	0.33	0.00	0.00
			Max. Compression	22	-0.35	0.00	0.00
			Max. Mx	34	-0.02	-0.39	0.00
			Max. Vy	34	0.13	0.00	0.00
T13	20 - 0	Leg	Max Tension	29	338.54	1.58	-0.72
			Max. Compression	12	-370.00	0.00	-0.00
			Max. Mx	12	-369.51	8.12	-1.08
			Max. My	26	-22.48	-0.53	-5.69
			Max. Vy	12	-1.22	8.12	-1.08
			Max. Vx	26	-1.39	-0.53	-5.69
		Diagonal	Max Tension	7	36.77	-0.16	-0.05
			Max. Compression	22	-37.55	0.00	0.00
			Max. Mx	30	20.09	-0.27	-0.05
			Max. My	12	-34.52	0.01	-0.06
			Max. Vy	49	-0.10	-0.24	0.00
			Max. Vx	12	-0.01	0.00	0.00
		Horizontal	Max Tension	6	21.05	-0.20	0.02
			Max. Compression	23	-21.02	0.00	0.00
			Max. Mx	48	0.47	-0.52	-0.01
			Max. My	13	4.75	-0.04	0.06
			Max. Vy	48	0.18	-0.52	-0.01
			Max. Vx	13	0.00	0.00	0.00
		Redund Horz 1 Bracing	Max Tension	12	6.42	0.00	0.00
			Max. Compression	12	-6.42	0.00	0.00
			Max. Mx	34	1.25	0.05	0.00
			Max. Vy	34	0.03	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
		Redund Diag 1 Bracing	Max Tension	12	5.87	0.00	0.00
			Max. Compression	12	-5.87	0.00	0.00
			Max. Mx	34	1.15	0.10	0.00
			Max. Vy	34	-0.04	0.00	0.00
		Redund Hip 1 Bracing	Max Tension	13	0.01	0.00	0.00
			Max. Compression	28	-0.02	0.00	0.00
			Max. Mx	34	-0.02	0.08	0.00
			Max. Vy	34	-0.05	0.00	0.00
		Inner Bracing	Max Tension	1	0.00	0.00	0.00
			Max. Compression	43	-0.02	0.00	0.00
			Max. Mx	34	-0.02	0.25	0.00
			Max. Vy	34	-0.08	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	24	412.93	49.08	-32.14
	Max. H_x	24	412.93	49.08	-32.14
	Max. H_z	7	-362.50	-43.00	31.13
	Min. Vert	9	-376.60	-45.78	30.07
	Min. H_x	9	-376.60	-45.78	30.07
	Min. H_z	22	396.37	45.48	-32.60
Leg B	Max. Vert	12	419.76	-49.82	-32.17
	Max. H_x	29	-384.08	46.52	30.12
	Max. H_z	31	-370.81	43.86	31.12
	Min. Vert	29	-384.08	46.52	30.12
	Min. H_x	12	419.76	-49.82	-32.17
	Min. H_z	14	404.03	-46.33	-32.58
Leg A	Max. Vert	2	414.62	-0.34	58.61
	Max. H_x	27	19.94	14.25	1.64
	Max. H_z	2	414.62	-0.34	58.61
	Min. Vert	19	-375.34	0.33	-54.67
	Min. H_x	10	16.89	-14.25	1.30
	Min. H_z	19	-375.34	0.33	-54.67

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	49.49	0.00	0.00	-24.93	4.29	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	59.39	-0.60	-101.89	-9463.51	104.78	-17.41
0.9 Dead+1.6 Wind 0 deg - No Ice	44.54	-0.60	-101.89	-9456.03	103.50	-17.41
1.2 Dead+1.6 Wind 30 deg - No Ice	59.39	49.99	-86.59	-8111.66	-4660.85	-99.01
0.9 Dead+1.6 Wind 30 deg - No Ice	44.54	49.99	-86.59	-8104.18	-4662.13	-99.01

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
1.2 Dead+1.6 Wind 45 deg - No Ice	59.39	70.83	-70.34	-6593.66	-6639.95	-130.56
0.9 Dead+1.6 Wind 45 deg - No Ice	44.54	70.83	-70.34	-6586.18	-6641.23	-130.56
1.2 Dead+1.6 Wind 60 deg - No Ice	59.39	86.75	-49.39	-4631.04	-8163.50	-152.96
0.9 Dead+1.6 Wind 60 deg - No Ice	44.54	86.75	-49.39	-4623.56	-8164.79	-152.96
1.2 Dead+1.6 Wind 90 deg - No Ice	59.39	101.03	0.60	69.72	-9499.42	-168.14
0.9 Dead+1.6 Wind 90 deg - No Ice	44.54	101.03	0.60	77.20	-9500.70	-168.14
1.2 Dead+1.6 Wind 120 deg - No Ice	59.39	89.15	51.47	4773.17	-8314.04	-140.66
0.9 Dead+1.6 Wind 120 deg - No Ice	44.54	89.15	51.47	4780.65	-8315.32	-140.66
1.2 Dead+1.6 Wind 135 deg - No Ice	59.39	71.68	71.19	6674.73	-6780.85	-109.06
0.9 Dead+1.6 Wind 135 deg - No Ice	44.54	71.68	71.19	6682.21	-6782.14	-109.06
1.2 Dead+1.6 Wind 150 deg - No Ice	59.39	51.04	87.19	8151.46	-4833.42	-69.13
0.9 Dead+1.6 Wind 150 deg - No Ice	44.54	51.04	87.19	8158.94	-4834.71	-69.13
1.2 Dead+1.6 Wind 180 deg - No Ice	59.39	0.60	99.82	9344.91	-94.49	17.20
0.9 Dead+1.6 Wind 180 deg - No Ice	44.54	0.60	99.82	9352.39	-95.77	17.20
1.2 Dead+1.6 Wind 210 deg - No Ice	59.39	-49.99	86.59	8051.83	4671.15	99.01
0.9 Dead+1.6 Wind 210 deg - No Ice	44.54	-49.99	86.59	8059.31	4669.86	99.01
1.2 Dead+1.6 Wind 225 deg - No Ice	59.39	-70.83	70.34	6533.83	6650.25	130.56
0.9 Dead+1.6 Wind 225 deg - No Ice	44.54	-70.83	70.34	6541.31	6648.96	130.56
1.2 Dead+1.6 Wind 240 deg - No Ice	59.39	-88.54	50.43	4600.60	8224.70	158.07
0.9 Dead+1.6 Wind 240 deg - No Ice	44.54	-88.54	50.43	4608.08	8223.41	158.07
1.2 Dead+1.6 Wind 270 deg - No Ice	59.39	-101.03	-0.60	-129.55	9509.72	168.14
0.9 Dead+1.6 Wind 270 deg - No Ice	44.54	-101.03	-0.60	-122.07	9508.43	168.14
1.2 Dead+1.6 Wind 300 deg - No Ice	59.39	-87.35	-50.43	-4803.61	8273.44	135.76
0.9 Dead+1.6 Wind 300 deg - No Ice	44.54	-87.35	-50.43	-4796.13	8272.15	135.76
1.2 Dead+1.6 Wind 315 deg - No Ice	59.39	-71.68	-71.19	-6734.56	6791.15	109.06
0.9 Dead+1.6 Wind 315 deg - No Ice	44.54	-71.68	-71.19	-6727.08	6789.86	109.06
1.2 Dead+1.6 Wind 330 deg - No Ice	59.39	-51.04	-87.19	-8211.29	4843.72	69.13
0.9 Dead+1.6 Wind 330 deg - No Ice	44.54	-51.04	-87.19	-8203.81	4842.43	69.13
1.2 Dead+1.0 Ice	191.57	0.00	0.00	-279.49	34.23	-0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice	191.57	-0.07	-23.29	-2475.03	45.15	-9.14
1.2 Dead+1.0 Wind 30 deg+1.0 Ice	191.57	11.52	-19.96	-2170.64	-1057.62	-21.59

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
1.2 Dead+1.0 Wind 45 deg+1.0 Ice	191.57	16.31	-16.25	-1819.69	-1514.88	-25.80
1.2 Dead+1.0 Wind 60 deg+1.0 Ice	191.57	19.97	-11.45	-1364.12	-1866.24	-28.23
1.2 Dead+1.0 Wind 90 deg+1.0 Ice	191.57	23.16	0.07	-268.57	-2168.39	-27.54
1.2 Dead+1.0 Wind 120 deg+1.0 Ice	191.57	20.27	11.70	827.74	-1883.54	-19.64
1.2 Dead+1.0 Wind 135 deg+1.0 Ice	191.57	16.40	16.35	1276.15	-1530.33	-13.26
1.2 Dead+1.0 Wind 150 deg+1.0 Ice	191.57	11.64	20.03	1622.58	-1076.53	-5.95
1.2 Dead+1.0 Wind 180 deg+1.0 Ice	191.57	0.07	23.02	1908.68	23.31	8.99
1.2 Dead+1.0 Wind 210 deg+1.0 Ice	191.57	-11.52	19.96	1611.66	1126.09	21.59
1.2 Dead+1.0 Wind 225 deg+1.0 Ice	191.57	-16.31	16.25	1260.71	1583.35	25.80
1.2 Dead+1.0 Wind 240 deg+1.0 Ice	191.57	-20.20	11.59	808.82	1941.09	28.78
1.2 Dead+1.0 Wind 270 deg+1.0 Ice	191.57	-23.16	-0.07	-290.41	2236.85	27.54
1.2 Dead+1.0 Wind 300 deg+1.0 Ice	191.57	-20.04	-11.57	-1383.03	1945.62	19.23
1.2 Dead+1.0 Wind 315 deg+1.0 Ice	191.57	-16.40	-16.35	-1835.13	1598.79	13.26
1.2 Dead+1.0 Wind 330 deg+1.0 Ice	191.57	-11.64	-20.03	-2181.56	1145.00	5.95
Dead+Wind 0 deg - Service	49.49	-0.10	-16.48	-1550.30	20.40	-2.81
Dead+Wind 30 deg - Service	49.49	8.08	-14.00	-1331.71	-750.18	-16.01
Dead+Wind 45 deg - Service	49.49	11.45	-11.37	-1086.26	-1070.19	-21.11
Dead+Wind 60 deg - Service	49.49	14.03	-7.99	-768.91	-1316.55	-24.73
Dead+Wind 90 deg - Service	49.49	16.34	0.10	-8.82	-1532.56	-27.19
Dead+Wind 120 deg - Service	49.49	14.41	8.32	751.71	-1340.89	-22.74
Dead+Wind 135 deg - Service	49.49	11.59	11.51	1059.19	-1092.98	-17.63
Dead+Wind 150 deg - Service	49.49	8.25	14.10	1297.97	-778.09	-11.18
Dead+Wind 180 deg - Service	49.49	0.10	16.14	1490.94	-11.82	2.78
Dead+Wind 210 deg - Service	49.49	-8.08	14.00	1281.86	758.76	16.01
Dead+Wind 225 deg - Service	49.49	-11.45	11.37	1036.40	1078.78	21.11
Dead+Wind 240 deg - Service	49.49	-14.32	8.15	723.81	1333.36	25.56
Dead+Wind 270 deg - Service	49.49	-16.34	-0.10	-41.04	1541.14	27.19
Dead+Wind 300 deg - Service	49.49	-14.12	-8.15	-796.82	1341.24	21.95
Dead+Wind 315 deg - Service	49.49	-11.59	-11.51	-1109.04	1101.56	17.63
Dead+Wind 330 deg - Service	49.49	-8.25	-14.10	-1347.83	786.67	11.18

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-49.49	0.00	0.00	49.49	0.00	0.000%
2	-0.60	-59.39	-101.89	0.60	59.39	101.89	0.000%
3	-0.60	-44.54	-101.89	0.60	44.54	101.89	0.000%
4	49.99	-59.39	-86.59	-49.99	59.39	86.59	0.000%
5	49.99	-44.54	-86.59	-49.99	44.54	86.59	0.000%
6	70.83	-59.39	-70.34	-70.83	59.39	70.34	0.000%
7	70.83	-44.54	-70.34	-70.83	44.54	70.34	0.000%
8	86.75	-59.39	-49.39	-86.75	59.39	49.39	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
9	86.75	-44.54	-49.39	-86.75	44.54	49.39	0.000%
10	101.03	-59.39	0.60	-101.03	59.39	-0.60	0.000%
11	101.03	-44.54	0.60	-101.03	44.54	-0.60	0.000%
12	89.15	-59.39	51.47	-89.15	59.39	-51.47	0.000%
13	89.15	-44.54	51.47	-89.15	44.54	-51.47	0.000%
14	71.68	-59.39	71.19	-71.68	59.39	-71.19	0.000%
15	71.68	-44.54	71.19	-71.68	44.54	-71.19	0.000%
16	51.04	-59.39	87.19	-51.04	59.39	-87.19	0.000%
17	51.04	-44.54	87.19	-51.04	44.54	-87.19	0.000%
18	0.60	-59.39	99.82	-0.60	59.39	-99.82	0.000%
19	0.60	-44.54	99.82	-0.60	44.54	-99.82	0.000%
20	-49.99	-59.39	86.59	49.99	59.39	-86.59	0.000%
21	-49.99	-44.54	86.59	49.99	44.54	-86.59	0.000%
22	-70.83	-59.39	70.34	70.83	59.39	-70.34	0.000%
23	-70.83	-44.54	70.34	70.83	44.54	-70.34	0.000%
24	-88.54	-59.39	50.43	88.54	59.39	-50.43	0.000%
25	-88.54	-44.54	50.43	88.54	44.54	-50.43	0.000%
26	-101.03	-59.39	-0.60	101.03	59.39	0.60	0.000%
27	-101.03	-44.54	-0.60	101.03	44.54	0.60	0.000%
28	-87.35	-59.39	-50.43	87.35	59.39	50.43	0.000%
29	-87.35	-44.54	-50.43	87.35	44.54	50.43	0.000%
30	-71.68	-59.39	-71.19	71.68	59.39	71.19	0.000%
31	-71.68	-44.54	-71.19	71.68	44.54	71.19	0.000%
32	-51.04	-59.39	-87.19	51.04	59.39	87.19	0.000%
33	-51.04	-44.54	-87.19	51.04	44.54	87.19	0.000%
34	0.00	-191.57	0.00	0.00	191.57	0.00	0.000%
35	-0.07	-191.57	-23.29	0.07	191.57	23.29	0.000%
36	11.52	-191.57	-19.96	-11.52	191.57	19.96	0.000%
37	16.31	-191.57	-16.25	-16.31	191.57	16.25	0.000%
38	19.97	-191.57	-11.45	-19.97	191.57	11.45	0.000%
39	23.16	-191.57	0.07	-23.16	191.57	-0.07	0.000%
40	20.27	-191.57	11.70	-20.27	191.57	-11.70	0.000%
41	16.40	-191.57	16.35	-16.40	191.57	-16.35	0.000%
42	11.64	-191.57	20.03	-11.64	191.57	-20.03	0.000%
43	0.07	-191.57	23.02	-0.07	191.57	-23.02	0.000%
44	-11.52	-191.57	19.96	11.52	191.57	-19.96	0.000%
45	-16.31	-191.57	16.25	16.31	191.57	-16.25	0.000%
46	-20.20	-191.57	11.59	20.20	191.57	-11.59	0.000%
47	-23.16	-191.57	-0.07	23.16	191.57	0.07	0.000%
48	-20.04	-191.57	-11.57	20.04	191.57	11.57	0.000%
49	-16.40	-191.57	-16.35	16.40	191.57	16.35	0.000%
50	-11.64	-191.57	-20.03	11.64	191.57	20.03	0.000%
51	-0.10	-49.49	-16.48	0.10	49.49	16.48	0.000%
52	8.08	-49.49	-14.00	-8.08	49.49	14.00	0.000%
53	11.45	-49.49	-11.37	-11.45	49.49	11.37	0.000%
54	14.03	-49.49	-7.99	-14.03	49.49	7.99	0.000%
55	16.34	-49.49	0.10	-16.34	49.49	-0.10	0.000%
56	14.41	-49.49	8.32	-14.41	49.49	-8.32	0.000%
57	11.59	-49.49	11.51	-11.59	49.49	-11.51	0.000%
58	8.25	-49.49	14.10	-8.25	49.49	-14.10	0.000%
59	0.10	-49.49	16.14	-0.10	49.49	-16.14	0.000%
60	-8.08	-49.49	14.00	8.08	49.49	-14.00	0.000%
61	-11.45	-49.49	11.37	11.45	49.49	-11.37	0.000%
62	-14.32	-49.49	8.15	14.32	49.49	-8.15	0.000%
63	-16.34	-49.49	-0.10	16.34	49.49	0.10	0.000%
64	-14.12	-49.49	-8.15	14.12	49.49	8.15	0.000%
65	-11.59	-49.49	-11.51	11.59	49.49	11.51	0.000%
66	-8.25	-49.49	-14.10	8.25	49.49	14.10	0.000%

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 160	1.963	64	0.0857	0.0284
T2	160 - 140	1.595	64	0.0848	0.0292
T3	140 - 133.333	1.227	65	0.0769	0.0288
T4	133.333 - 126.667	1.116	65	0.0743	0.0280
T5	126.667 - 120	1.006	65	0.0714	0.0274
T6	120 - 100	0.902	65	0.0677	0.0270
T7	100 - 90	0.635	65	0.0544	0.0247
T8	90 - 80	0.517	65	0.0481	0.0223
T9	80 - 60	0.413	65	0.0414	0.0197
T10	60 - 40	0.246	65	0.0286	0.0147
T11	40 - 30	0.125	56	0.0189	0.0099
T12	30 - 20	0.078	56	0.0138	0.0074
T13	20 - 0	0.043	56	0.0085	0.0051

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
178.00	AP11-850/090/ADT w/Mount Pipe	64	1.926	0.0858	0.0285	811774
177.00	PA6-65AC	64	1.908	0.0859	0.0286	811774
175.00	SE419-SWBPALDF Panel Antenna	64	1.872	0.0860	0.0286	811774
171.00	2" Dia 10' Omni	64	1.799	0.0860	0.0288	450990
170.00	WPA-700102-4CF-EDIN-X w/ Mount Kit	64	1.780	0.0860	0.0289	405891
169.00	3' Yagi	64	1.762	0.0860	0.0289	368993
162.00	AP11-850/090/ADT w/Mount Pipe	64	1.633	0.0852	0.0291	239393
160.00	Pirod 15' T-Frame Sector Mount (1)	64	1.595	0.0848	0.0292	267699
159.00	2" Dia 10' Omni	64	1.576	0.0845	0.0292	319154
133.00	Pirod 15' T-Frame Sector Mount (1)	65	1.111	0.0742	0.0279	894382
125.00	AIR21 B2A/B4P	65	0.979	0.0705	0.0273	66222
60.00	GPS	65	0.246	0.0286	0.0147	109775

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 160	12.036	28	0.5257	0.1758
T2	160 - 140	9.784	28	0.5190	0.1805
T3	140 - 133.333	7.530	28	0.4703	0.1781
T4	133.333 - 126.667	6.849	28	0.4546	0.1731
T5	126.667 - 120	6.173	28	0.4366	0.1697
T6	120 - 100	5.537	28	0.4141	0.1671
T7	100 - 90	3.905	13	0.3326	0.1526
T8	90 - 80	3.185	13	0.2942	0.1379
T9	80 - 60	2.548	13	0.2527	0.1216
T10	60 - 40	1.527	13	0.1748	0.0906

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T11	40 - 30	0.774	13	0.1153	0.0609
T12	30 - 20	0.481	12	0.0841	0.0455
T13	20 - 0	0.262	12	0.0520	0.0318

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
178.00	AP11-850/090/ADT w/Mount Pipe	28	11.813	0.5262	0.1763	135965
177.00	PA6-65AC	28	11.702	0.5264	0.1766	135965
175.00	SE419-SWBPALDF Panel Antenna	28	11.479	0.5268	0.1771	135965
171.00	2" Dia 10' Omni	28	11.031	0.5269	0.1782	75536
170.00	WPA-700102-4CF-EDIN-X w/ Mount Kit	28	10.919	0.5268	0.1784	67983
169.00	3' Yagi	28	10.807	0.5265	0.1787	61802
162.00	AP11-850/090/ADT w/Mount Pipe	28	10.014	0.5217	0.1802	40138
160.00	Pirod 15' T-Frame Sector Mount (1)	28	9.784	0.5190	0.1805	45079
159.00	2" Dia 10' Omni	28	9.669	0.5174	0.1807	54048
133.00	Pirod 15' T-Frame Sector Mount (1)	28	6.816	0.4538	0.1728	148554
125.00	AIR21 B2A/B4P	28	6.009	0.4314	0.1691	10782
60.00	GPS	13	1.527	0.1748	0.0906	17945

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	180	Leg	A325N	0.8750	4	1.22	40.59	0.030 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	3	1.79	12.43	0.144 ✔	1	Bolt Shear
		Horizontal	A325N	0.6250	2	1.48	12.43	0.119 ✔	1	Bolt Shear
		Top Girt	A325N	0.6250	2	0.32	12.43	0.026 ✔	1	Bolt Shear
T2	160	Leg	A325N	0.8750	4	9.25	40.59	0.228 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	3	3.16	12.43	0.255 ✔	1	Bolt Shear
		Horizontal	A325N	0.6250	2	2.90	12.43	0.233 ✔	1	Bolt Shear
T3	140	Leg	A325N	0.7500	6	8.22	29.82	0.276 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	3	3.24	12.43	0.261 ✔	1	Bolt Shear
		Horizontal	A325N	0.6250	2	3.14	12.43	0.252 ✔	1	Bolt Shear
T4	133.333	Leg	A325N	0.7500	6	10.22	29.82	0.343 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	3	4.43	12.43	0.357 ✔	1	Bolt Shear
		Top Girt	A325N	0.6250	2	4.49	12.43	0.362 ✔	1	Bolt Shear
T5	126.667	Leg	A325N	0.7500	6	12.77	29.82	0.428 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	3	5.45	12.43	0.439 ✔	1	Bolt Shear
		Top Girt	A325N	0.6250	2	5.63	12.43	0.453 ✔	1	Bolt Shear

Section No.	*Elevation* *ft*	*Component Type*	*Bolt Grade*	*Bolt Size* *in*	*Number Of Bolts*	*Maximum Load per Bolt* *K*	*Allowable Load* *K*	*Ratio Load / Allowable*	*Allowable Ratio*	*Criteria*
T6	120	Leg	A325N	0.7500	6	20.58	29.82	0.690 ✓	1	Bolt Tension
		Diagonal	A325N	0.6250	3	7.26	12.43	0.584 ✓	1	Bolt Shear
		Horizontal	A325N	0.6250	2	6.49	12.43	0.523 ✓	1	Bolt Shear
T7	100	Leg	A325N	0.7500	6	25.16	29.82	0.844 ✓	1	Bolt Tension
		Diagonal	A325N	0.6250	3	6.82	12.43	0.549 ✓	1	Bolt Shear
		Horizontal	A325N	0.6250	2	6.51	12.43	0.524 ✓	1	Bolt Shear
T8	90	Leg	A325N	1.0000	6	29.26	53.01	0.552 ✓	1	Bolt Tension
		Diagonal	A325N	0.6250	3	6.92	12.43	0.557 ✓	1	Bolt Shear
		Top Girt	A325N	0.6250	2	6.87	12.43	0.553 ✓	1	Bolt Shear
T9	80	Leg	A325N	1.0000	6	37.24	53.01	0.703 ✓	1	Bolt Tension
		Diagonal	A325N	0.6250	3	7.41	12.43	0.597 ✓	1	Bolt Shear
		Horizontal	A325N	0.6250	2	7.92	12.43	0.638 ✓	1	Bolt Shear
T10	60	Leg	A325N	1.0000	8	33.82	53.01	0.638 ✓	1	Bolt Tension
		Diagonal	A325N	0.6250	3	7.93	12.43	0.639 ✓	1	Bolt Shear
		Horizontal	A325N	0.6250	2	8.96	12.43	0.721 ✓	1	Bolt Shear
T11	40	Leg	A325N	1.0000	8	36.75	53.01	0.693 ✓	1	Bolt Tension
		Diagonal	A325N	0.6250	3	8.17	12.43	0.658 ✓	1	Bolt Shear
		Horizontal	A325N	0.6250	2	9.44	12.43	0.759 ✓	1	Bolt Shear
T12	30	Leg	A325N	1.0000	8	39.66	53.01	0.748 ✓	1	Bolt Tension
		Diagonal	A325N	0.6250	3	8.43	12.43	0.678 ✓	1	Bolt Shear
		Top Girt	A325N	0.6250	2	9.85	12.43	0.793 ✓	1	Bolt Shear
T13	20	Leg	A325N	1.0000	8	42.25	53.01	0.797 ✓	1	Bolt Tension
		Diagonal	A325X	0.6250	3	12.52	15.19	0.824 ✓	1	Bolt Shear
		Horizontal	A325N	0.7500	2	10.53	17.89	0.588 ✓	1	Bolt Shear

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	180 - 160	ROHN 3 STD	20.00	6.67	68.8 K=1.00	2.2285	-6.24	70.98	0.088 [1] ✓
T2	160 - 140	ROHN 4 STD	20.04	6.68	53.1 K=1.00	3.1741	-41.23	116.23	0.355 [1] ✓
T3	140 - 133.333	ROHN 5 EH	6.68	6.68	43.6 K=1.00	6.1120	-54.01	239.38	0.226 [1] ✓
T4	133.333 -	ROHN 5 EH	6.68	6.68	43.6	6.1120	-67.94	239.38	0.284 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
	126.667				K=1.00				✔
T5	126.667 - 120	ROHN 5 EH	6.68	6.68	43.6 K=1.00	6.1120	-85.77	239.38	0.358 [1] ✔
T6	120 - 100	ROHN 6 EHS	20.04	10.02	54.0 K=1.00	6.7133	-135.75	244.02	0.556 [1] ✔
T7	100 - 90	ROHN 6 EH	10.03	10.03	54.8 K=1.00	8.4049	-164.92	303.58	0.543 [1] ✔
T8	90 - 80	ROHN 6 EH	10.03	10.03	54.8 K=1.00	8.4049	-190.92	303.58	0.629 [1] ✔
T9	80 - 60	ROHN 8 EHS	20.05	10.03	41.2 K=1.00	9.7193	-241.95	386.31	0.626 [1] ✔
T10	60 - 40	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	20.05	10.03	42.7 K=1.00	13.5568	-293.15	458.18	0.640 [1] ✔
T11	40 - 30	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	10.03	10.03	42.7 K=1.00	13.5568	-319.02	458.18	0.696 [1] ✔
T12	30 - 20	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	10.03	10.03	42.7 K=1.00	13.5568	-344.91	458.18	0.753 [1] ✔
T13	20 - 0	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	20.05	10.03	42.9 K=1.00	16.6002	-370.00	560.41	0.660 [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	180 - 160	ROHN 2 STD	7.94	7.67	117.0 K=1.00	1.0745	-5.37	17.75	0.302 [1] ✔
T2	160 - 140	ROHN 2 STD	8.55	8.25	125.8 K=1.00	1.0745	-9.25	15.33	0.603 [1] ✔
T3	140 - 133.333	ROHN 2 EH	8.77	8.42	131.5 K=1.00	1.4807	-9.71	19.35	0.502 [1] ✔
T4	133.333 - 126.667	ROHN 2 EH	9.00	8.66	135.3 K=1.00	1.4807	-13.30	18.29	0.728 [1] ✔
T5	126.667 - 120	ROHN 2 XXS	9.24	8.91	152.1 K=1.00	2.6559	-16.35	25.94	0.630 [1] ✔
T6	120 - 100	Pipe 2.5 XXS	12.52	12.06	171.4 K=1.00	4.0285	-21.78	30.98	0.703 [1] ✔
T7	100 - 90	ROHN 3 STD	12.92	12.49	128.8 K=1.00	2.2285	-20.47	30.35	0.675 [1] ✔
T8	90 - 80	ROHN 3 STD	13.35	12.93	133.4 K=1.00	2.2285	-20.75	28.29	0.733 [1] ✔
T9	80 - 60	ROHN 3 STD	14.21	13.70	141.3 K=1.00	2.2285	-22.24	25.21	0.882 [1] ✔
T10	60 - 40	P3.5x.226	15.12	14.64	131.5 K=1.00	2.6795	-23.80	35.03	0.679 [1] ✔
T11	40 - 30	P3.5x.226	15.60	15.13	135.8 K=1.00	2.6795	-24.51	32.82	0.747 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T12	30 - 20	P3.5x.226	16.08	15.62	140.2 K=1.00	2.6795	-25.29	30.78	0.822 [1] ✔
T13	20 - 0	P3.5x.226	24.33	23.70	106.4 K=0.50	2.6795	-37.55	52.71	0.712 [1] ✔

[1] P_u / ϕP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	ROHN 1.5 STD	8.60	4.15	80.0 K=1.00	0.7995	-2.92	22.52	0.130 [1] ✔
T2	160 - 140	ROHN 1.5 STD	10.01	4.82	92.9 K=1.00	0.7995	-5.74	19.14	0.300 [1] ✔
T3	140 - 133.333	ROHN 2 STD	10.71	5.17	78.8 K=1.00	1.0745	-6.24	30.72	0.203 [1] ✔
T6	120 - 100	ROHN 2 STD	13.92	6.68	101.9 K=1.00	1.0745	-12.89	22.64	0.569 [1] ✔
T7	100 - 90	ROHN 2 STD	15.04	7.24	110.5 K=1.00	1.0745	-13.02	19.82	0.657 [1] ✔
T9	80 - 60	ROHN 2.5 STD	18.93	9.10	115.3 K=1.00	1.7040	-15.75	28.95	0.544 [1] ✔
T10	60 - 40	ROHN 2.5 STD	21.43	10.35	131.1 K=1.00	1.7040	-17.75	22.38	0.793 [1] ✔
T11	40 - 30	ROHN 2.5 STD	22.68	10.98	139.1 K=1.00	1.7040	-18.70	19.91	0.939 [1] ✔
T13	20 - 0	P3.5x.226	25.18	12.23	109.8 K=1.00	2.6795	-21.02	49.95	0.421 [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	180 - 160	ROHN 1.5 STD	8.54	4.13	79.5 K=1.00	0.7995	-0.65	22.66	0.029 [1] ✔
T4	133.333 - 126.667	ROHN 2 STD	11.40	5.47	83.4 K=1.00	1.0745	-8.99	29.08	0.309 [1] ✔
T5	126.667 - 120	ROHN 2 STD	12.10	5.82	88.7 K=1.00	1.0745	-11.26	27.21	0.414 [1] ✔
T8	90 - 80	ROHN 2 STD	16.36	7.90	120.5 K=1.00	1.0745	-13.70	16.72	0.820 [1] ✔
T12	30 - 20	ROHN 2.5 EH	23.93	11.60	150.7	2.2535	-19.41	22.42	0.866 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
					K=1.00				✔

[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 $\frac{P_u}{\phi P_n}$
T13	20 - 0	ROHN 1.5 STD	6.29	5.93	91.5 K=0.80	0.7995	-6.42	19.50	0.329 [1] ✔

[1] P_u / ϕP_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 $\frac{P_u}{\phi P_n}$
T13	20 - 0	ROHN 2 STD	11.50	10.77	131.4 K=0.80	1.0745	-5.87	14.06	0.417 [1] ✔

[1] P_u / ϕP_n controls

Redundant Hip (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 $\frac{P_u}{\phi P_n}$
T13	20 - 0	ROHN 2.5 STD	6.29	6.29	63.8 K=0.80	1.7040	-0.02	56.95	0.000 [1] ✔

[1] P_u / ϕP_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 $\frac{P_u}{\phi P_n}$
T1	180 - 160	L2x2x1/8	4.27	4.27	128.9 K=1.00	0.4844	-0.01	6.51	0.002 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	160 - 140	L2x2x1/8	5.01	5.01	151.1 K=1.00	0.4844	-0.01	4.79	0.001 [1] ✔
T3	140 - 133.333	L2x2x1/8	5.35	5.35	161.6 K=1.00	0.4844	-0.01	4.19	0.002 [1] ✔
T4	133.333 - 126.667	L2x2x1/8	5.70	5.70	172.1 K=1.00	0.4844	-0.16	3.69	0.043 [1] ✔
T5	126.667 - 120	L2x2x1/8	6.05	6.05	182.6 K=1.00	0.4844	-0.20	3.28	0.060 [1] ✔
T6	120 - 100	L2 1/2x2 1/2x3/16	6.96	6.96	168.7 K=1.00	0.9020	-0.01	7.16	0.002 [1] ✔
T7	100 - 90	L2 1/2x2 1/2x3/16	7.52	7.52	182.3 K=1.00	0.9020	-0.01	6.13	0.002 [1] ✔
T8	90 - 80	L2 1/2x2 1/2x3/16	8.18	8.18	198.3 K=1.00	0.9020	-0.24	5.18	0.047 [1] ✔
T9	80 - 60	L3x3x3/16	9.46	9.46	190.5 K=1.00	1.0900	-0.02	6.78	0.003 [1] ✔
T10	60 - 40	L3 1/2x3 1/2x1/4	10.71	10.71	185.2 K=1.00	1.6900	-0.02	11.13	0.002 [1] ✔
T11	40 - 30	L3 1/2x3 1/2x1/4	11.34	11.34	196.1 K=1.00	1.6900	-0.02	9.93	0.002 [1] ✔
T12	30 - 20	L3 1/2x3 1/2x1/4	11.96	11.96	206.9 K=1.00	1.6900	-0.35	8.92	0.039 [1] ✔
T13	20 - 0	ROHN 2 STD	12.59	12.59	191.9 K=1.00	1.0745	-0.02	6.59	0.003 [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	180 - 160	ROHN 3 STD	20.00	6.67	68.8	2.2285	4.86	100.28	0.049 [1] ✔
T2	160 - 140	ROHN 4 STD	20.04	6.68	53.1	3.1741	37.01	142.83	0.259 [1] ✔
T3	140 - 133.333	ROHN 5 EH	6.68	6.68	43.6	6.1120	49.34	275.04	0.179 [1] ✔
T4	133.333 - 126.667	ROHN 5 EH	6.68	6.68	43.6	6.1120	61.30	275.04	0.223 [1] ✔
T5	126.667 - 120	ROHN 5 EH	6.68	6.68	43.6	6.1120	76.59	275.04	0.278 [1] ✔
T6	120 - 100	ROHN 6 EHS	20.04	10.02	54.0	6.7133	123.46	302.10	0.409 [1] ✔
T7	100 - 90	ROHN 6 EH	10.03	10.03	54.8	8.4049	150.99	378.22	0.399 [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	90 - 80	ROHN 6 EH	10.03	10.03	54.8	8.4049	175.59	378.22	0.464 [1]
T9	80 - 60	ROHN 8 EHS	20.05	10.03	41.2	9.7193	223.47	437.37	0.511 [1]
T10	60 - 40	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	20.05	10.03	42.7	13.5568	270.57	512.45	0.528 [1]
T11	40 - 30	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	10.03	10.03	42.7	13.5568	294.03	512.45	0.574 [1]
T12	30 - 20	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	10.03	10.03	42.7	13.5568	317.28	512.45	0.619 [1]
T13	20 - 0	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	20.05	10.03	42.9	16.6002	338.54	627.49	0.540 [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	180 - 160	ROHN 2 STD	7.94	7.67	117.0	1.0745	5.30	48.35	0.110 [1]
T2	160 - 140	ROHN 2 STD	8.14	7.84	119.5	1.0745	9.42	48.35	0.195 [1]
T3	140 - 133.333	ROHN 2 EH	8.77	8.42	131.5	1.4807	9.60	66.63	0.144 [1]
T4	133.333 - 126.667	ROHN 2 EH	9.00	8.66	135.3	1.4807	13.18	66.63	0.198 [1]
T5	126.667 - 120	ROHN 2 XXS	9.24	8.91	152.1	2.6559	16.16	119.52	0.135 [1]
T6	120 - 100	Pipe 2.5 XXS	12.52	12.06	171.4	4.0285	21.46	181.28	0.118 [1]
T7	100 - 90	ROHN 3 STD	12.92	12.49	128.8	2.2285	20.25	100.28	0.202 [1]
T8	90 - 80	ROHN 3 STD	13.35	12.93	133.4	2.2285	20.50	100.28	0.204 [1]
T9	80 - 60	ROHN 3 STD	14.21	13.70	141.3	2.2285	21.90	100.28	0.218 [1]
T10	60 - 40	P3.5x.226	15.12	14.64	131.5	2.6795	23.34	120.58	0.194 [1]
T11	40 - 30	P3.5x.226	15.60	15.13	135.8	2.6795	24.01	120.58	0.199 [1]
T12	30 - 20	P3.5x.226	16.08	15.62	140.2	2.6795	24.71	120.58	0.205 [1]
T13	20 - 0	P3.5x.226	24.33	23.70	212.8	2.6795	36.77	120.58	0.305 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	ROHN 1.5 STD	8.60	4.15	80.0	0.7995	2.96	35.98	0.082 [1] ✔
T2	160 - 140	ROHN 1.5 STD	10.01	4.82	92.9	0.7995	5.77	35.98	0.160 [1] ✔
T3	140 - 133.333	ROHN 2 STD	10.71	5.17	78.8	1.0745	6.27	48.35	0.130 [1] ✔
T6	120 - 100	ROHN 2 STD	13.92	6.68	101.9	1.0745	12.99	48.35	0.269 [1] ✔
T7	100 - 90	ROHN 2 STD	15.04	7.24	110.5	1.0745	13.02	48.35	0.269 [1] ✔
T9	80 - 60	ROHN 2.5 STD	18.93	9.10	115.3	1.7040	15.85	76.68	0.207 [1] ✔
T10	60 - 40	ROHN 2.5 STD	21.43	10.35	131.1	1.7040	17.92	76.68	0.234 [1] ✔
T11	40 - 30	ROHN 2.5 STD	22.68	10.98	139.1	1.7040	18.87	76.68	0.246 [1] ✔
T13	20 - 0	P3.5x.226	25.18	12.23	109.8	2.6795	21.05	120.58	0.175 [1] ✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	ROHN 1.5 STD	8.54	4.13	79.5	0.7995	0.65	35.98	0.018 [1] ✔
T4	133.333 - 126.667	ROHN 2 STD	11.40	5.47	83.4	1.0745	8.97	48.35	0.186 [1] ✔
T5	126.667 - 120	ROHN 2 STD	12.10	5.82	88.7	1.0745	11.25	48.35	0.233 [1] ✔
T8	90 - 80	ROHN 2 STD	16.36	7.90	120.5	1.0745	13.75	48.35	0.284 [1] ✔
T12	30 - 20	ROHN 2.5 EH	23.93	11.60	150.7	2.2535	19.70	101.41	0.194 [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 $\frac{P_u}{\phi P_n}$
T13	20 - 0	ROHN 1.5 STD	6.29	5.93	114.4	0.7995	6.42	35.98	0.179 [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 $\frac{P_u}{\phi P_n}$
T13	20 - 0	ROHN 2 STD	11.50	10.77	164.2	1.0745	5.87	48.35	0.121 [1] ✔

[1] P_u / ϕP_n controls

Redundant Hip (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 $\frac{P_u}{\phi P_n}$
T13	20 - 0	ROHN 2.5 STD	6.29	6.29	79.7	1.7040	0.01	76.68	0.000 [1] ✔

[1] P_u / ϕP_n controls

Inner Bracing 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	180 - 160	L2x2x1/8	4.27	4.27	81.8	0.4844	0.01	15.69	0.001 [1] ✔
T2	160 - 140	L2x2x1/8	4.31	4.31	82.6	0.4844	0.01	15.69	0.000 [1] ✔
T3	140 - 133.333	L2x2x1/8	5.35	5.35	102.6	0.4844	0.01	15.69	0.000 [1] ✔
T4	133.333 - 126.667	L2x2x1/8	5.70	5.70	109.3	0.4844	0.16	15.69	0.010 [1] ✔
T5	126.667 - 120	L2x2x1/8	6.05	6.05	115.9	0.4844	0.20	15.69	0.012 [1] ✔
T6	120 - 100	L2 1/2x2 1/2x3/16	6.40	6.40	98.7	0.9020	0.01	29.22	0.000 [1] ✔
T7	100 - 90	L2 1/2x2 1/2x3/16	7.52	7.52	116.0	0.9020	0.00	29.22	0.000 [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	90 - 80	L2 1/2x2 1/2x3/16	8.18	8.18	126.2	0.9020	0.23	29.22	0.008 [1] ✔
T9	80 - 60	L3x3x3/16	8.84	8.84	113.0	1.0900	0.00	35.32	0.000 [1] ✔
T10	60 - 40	L3 1/2x3 1/2x1/4	10.09	10.09	111.1	1.6900	0.00	76.05	0.000 [1] ✔
T11	40 - 30	L3 1/2x3 1/2x1/4	11.34	11.34	124.8	1.6900	0.00	76.05	0.000 [1] ✔
T12	30 - 20	L3 1/2x3 1/2x1/4	11.96	11.96	131.7	1.6900	0.33	76.05	0.004 [1] ✔

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T1	180 - 160	Leg	ROHN 3 STD	1	-5.95	70.98	8.4	Pass
		Leg	ROHN 3 STD	2	-6.24	70.98	8.8	Pass
		Leg	ROHN 3 STD	3	-6.00	70.98	8.4	Pass
T2	160 - 140	Leg	ROHN 4 STD	40	-39.14	116.23	33.7	Pass
		Leg	ROHN 4 STD	41	-41.23	116.23	35.5	Pass
		Leg	ROHN 4 STD	42	-39.11	116.23	33.6	Pass
T3	140 - 133.333	Leg	ROHN 5 EH	79	-51.40	239.38	21.5 25.9 (b)	Pass
		Leg	ROHN 5 EH	80	-54.01	239.38	22.6 27.6 (b)	Pass
		Leg	ROHN 5 EH	81	-51.37	239.38	21.5 25.9 (b)	Pass
T4	133.333 - 126.667	Leg	ROHN 5 EH	94	-64.85	239.38	27.1 32.3 (b)	Pass
		Leg	ROHN 5 EH	95	-67.94	239.38	28.4 34.3 (b)	Pass
		Leg	ROHN 5 EH	96	-64.78	239.38	27.1 32.3 (b)	Pass
T5	126.667 - 120	Leg	ROHN 5 EH	109	-82.22	239.38	34.3 40.5 (b)	Pass
		Leg	ROHN 5 EH	110	-85.77	239.38	35.8 42.8 (b)	Pass
		Leg	ROHN 5 EH	111	-82.26	239.38	34.4 40.6 (b)	Pass
T6	120 - 100	Leg	ROHN 6 EHS	124	-131.27	244.02	53.8 66.2 (b)	Pass
		Leg	ROHN 6 EHS	125	-135.75	244.02	55.6 69.0 (b)	Pass
		Leg	ROHN 6 EHS	126	-131.68	244.02	54.0 66.1 (b)	Pass
T7	100 - 90	Leg	ROHN 6 EH	151	-160.00	303.58	52.7 81.3 (b)	Pass
		Leg	ROHN 6 EH	152	-164.92	303.58	54.3 84.4 (b)	Pass
		Leg	ROHN 6 EH	153	-160.57	303.58	52.9 81.2 (b)	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T8	90 - 80	Leg	ROHN 6 EH	166	-185.68	303.58	61.2	Pass
		Leg	ROHN 6 EH	167	-190.92	303.58	62.9	Pass
		Leg	ROHN 6 EH	168	-186.41	303.58	61.4	Pass
T9	80 - 60	Leg	ROHN 8 EHS	181	-236.20	386.31	61.1 68.3 (b)	Pass
		Leg	ROHN 8 EHS	182	-241.95	386.31	62.6 70.3 (b)	Pass
		Leg	ROHN 8 EHS	183	-237.22	386.31	61.4 68.1 (b)	Pass
T10	60 - 40	Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	208	-287.00	458.18	62.6	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	209	-293.15	458.18	64.0	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	210	-288.28	458.18	62.9	Pass
T11	40 - 30	Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	235	-312.71	458.18	68.2	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	236	-319.02	458.18	69.6	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	237	-314.11	458.18	68.6	Pass
T12	30 - 20	Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	250	-338.45	458.18	73.9	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	251	-344.91	458.18	75.3	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EHS Leg Pipe	252	-339.98	458.18	74.2	Pass
T13	20 - 0	Leg	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	265	-363.48	560.41	64.9 78.0 (b)	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	266	-370.00	560.41	66.0 79.7 (b)	Pass
		Leg	1/3 9.6250x0.375 on ROHN 8 EH Leg Pipe	267	-365.31	560.41	65.2 77.7 (b)	Pass
T1	180 - 160	Diagonal	ROHN 2 STD	8	-5.37	17.75	30.2	Pass
		Diagonal	ROHN 2 STD	9	-5.37	17.75	30.2	Pass
		Diagonal	ROHN 2 STD	11	-5.03	17.75	28.3	Pass
		Diagonal	ROHN 2 STD	12	-5.03	17.75	28.3	Pass
		Diagonal	ROHN 2 STD	14	-4.04	17.75	22.7	Pass
		Diagonal	ROHN 2 STD	15	-4.04	17.75	22.7	Pass
		Diagonal	ROHN 2 STD	20	-3.75	17.78	21.1	Pass
		Diagonal	ROHN 2 STD	21	-3.75	17.78	21.1	Pass
		Diagonal	ROHN 2 STD	23	-2.71	17.78	15.3	Pass
		Diagonal	ROHN 2 STD	24	-2.71	17.78	15.3	Pass
		Diagonal	ROHN 2 STD	26	-3.48	17.78	19.6	Pass
		Diagonal	ROHN 2 STD	27	-3.48	17.78	19.6	Pass
		Diagonal	ROHN 2 STD	31	-0.91	17.82	5.1	Pass
		Diagonal	ROHN 2 STD	32	-0.91	17.82	5.1	Pass
		Diagonal	ROHN 2 STD	33	-0.25	17.82	1.4	Pass
		Diagonal	ROHN 2 STD	34	-0.25	17.82	1.4	Pass
		Diagonal	ROHN 2 STD	35	-1.08	17.82	6.1	Pass
		Diagonal	ROHN 2 STD	36	-1.08	17.82	6.1	Pass
T2	160 - 140	Diagonal	ROHN 2 STD	44	-9.04	15.33	59.0	Pass
		Diagonal	ROHN 2 STD	45	-9.05	15.33	59.0	Pass
		Diagonal	ROHN 2 STD	47	-8.70	15.33	56.8	Pass
		Diagonal	ROHN 2 STD	48	-8.70	15.33	56.7	Pass
		Diagonal	ROHN 2 STD	50	-9.25	15.33	60.3	Pass
		Diagonal	ROHN 2 STD	51	-9.24	15.33	60.3	Pass
		Diagonal	ROHN 2 STD	56	-9.29	16.15	57.5	Pass
		Diagonal	ROHN 2 STD	57	-9.30	16.15	57.5	Pass
		Diagonal	ROHN 2 STD	59	-8.79	16.15	54.4	Pass
		Diagonal	ROHN 2 STD	60	-8.79	16.15	54.4	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
		Diagonal	ROHN 2 STD	62	-8.96	16.15	55.5	Pass
		Diagonal	ROHN 2 STD	63	-8.96	16.15	55.5	Pass
		Diagonal	ROHN 2 STD	68	-9.49	17.01	55.8	Pass
		Diagonal	ROHN 2 STD	69	-9.48	17.01	55.8	Pass
		Diagonal	ROHN 2 STD	71	-8.83	17.01	51.9	Pass
		Diagonal	ROHN 2 STD	72	-8.84	17.01	52.0	Pass
		Diagonal	ROHN 2 STD	74	-8.53	17.01	50.2	Pass
		Diagonal	ROHN 2 STD	75	-8.53	17.01	50.1	Pass
T3	140 - 133.333	Diagonal	ROHN 2 EH	83	-9.02	19.35	46.6	Pass
		Diagonal	ROHN 2 EH	84	-9.03	19.35	46.7	Pass
		Diagonal	ROHN 2 EH	86	-8.81	19.35	45.5	Pass
		Diagonal	ROHN 2 EH	87	-8.80	19.35	45.5	Pass
		Diagonal	ROHN 2 EH	89	-9.71	19.35	50.2	Pass
		Diagonal	ROHN 2 EH	90	-9.71	19.35	50.2	Pass
T4	133.333 - 126.667	Diagonal	ROHN 2 EH	100	-12.38	18.29	67.7	Pass
		Diagonal	ROHN 2 EH	101	-12.40	18.29	67.8	Pass
		Diagonal	ROHN 2 EH	102	-12.23	18.29	66.9	Pass
		Diagonal	ROHN 2 EH	103	-12.22	18.29	66.8	Pass
		Diagonal	ROHN 2 EH	104	-13.30	18.29	72.8	Pass
		Diagonal	ROHN 2 EH	105	-13.30	18.29	72.7	Pass
T5	126.667 - 120	Diagonal	ROHN 2 XXS	115	-15.18	25.94	58.5	Pass
		Diagonal	ROHN 2 XXS	116	-15.19	25.94	58.6	Pass
		Diagonal	ROHN 2 XXS	117	-15.29	25.94	59.0	Pass
		Diagonal	ROHN 2 XXS	118	-15.28	25.94	58.9	Pass
		Diagonal	ROHN 2 XXS	119	-16.35	25.94	63.0	Pass
		Diagonal	ROHN 2 XXS	120	-16.35	25.94	63.0	Pass
T6	120 - 100	Diagonal	Pipe 2.5 XXS	128	-18.47	30.98	59.6	Pass
		Diagonal	Pipe 2.5 XXS	129	-18.49	30.98	59.7	Pass
		Diagonal	Pipe 2.5 XXS	131	-20.63	30.98	66.6	Pass
		Diagonal	Pipe 2.5 XXS	132	-20.59	30.98	66.5	Pass
		Diagonal	Pipe 2.5 XXS	134	-21.76	30.98	70.2	Pass
		Diagonal	Pipe 2.5 XXS	135	-21.78	30.98	70.3	Pass
		Diagonal	Pipe 2.5 XXS	140	-19.13	32.74	58.4	Pass
		Diagonal	Pipe 2.5 XXS	141	-19.14	32.74	58.5	Pass
		Diagonal	Pipe 2.5 XXS	143	-20.23	32.74	61.8	Pass
		Diagonal	Pipe 2.5 XXS	144	-20.20	32.74	61.7	Pass
		Diagonal	Pipe 2.5 XXS	146	-21.48	32.74	65.6	Pass
		Diagonal	Pipe 2.5 XXS	147	-21.49	32.74	65.6	Pass
T7	100 - 90	Diagonal	ROHN 3 STD	155	-16.44	30.35	54.2	Pass
		Diagonal	ROHN 3 STD	156	-16.47	30.35	54.3	Pass
		Diagonal	ROHN 3 STD	158	-19.41	30.35	64.0	Pass
		Diagonal	ROHN 3 STD	159	-19.35	30.35	63.8	Pass
		Diagonal	ROHN 3 STD	161	-20.44	30.35	67.4	Pass
		Diagonal	ROHN 3 STD	162	-20.47	30.35	67.5	Pass
T8	90 - 80	Diagonal	ROHN 3 STD	172	-16.17	28.29	57.2	Pass
		Diagonal	ROHN 3 STD	173	-16.19	28.29	57.2	Pass
		Diagonal	ROHN 3 STD	174	-19.84	28.29	70.1	Pass
		Diagonal	ROHN 3 STD	175	-19.77	28.29	69.9	Pass
		Diagonal	ROHN 3 STD	176	-20.71	28.29	73.2	Pass
		Diagonal	ROHN 3 STD	177	-20.75	28.29	73.3	Pass
T9	80 - 60	Diagonal	ROHN 3 STD	185	-16.80	25.21	66.6	Pass
		Diagonal	ROHN 3 STD	186	-16.82	25.21	66.7	Pass
		Diagonal	ROHN 3 STD	188	-21.54	25.21	85.4	Pass
		Diagonal	ROHN 3 STD	189	-21.46	25.21	85.1	Pass
		Diagonal	ROHN 3 STD	191	-22.18	25.21	88.0	Pass
		Diagonal	ROHN 3 STD	192	-22.24	25.21	88.2	Pass
		Diagonal	ROHN 3 STD	197	-16.65	26.89	61.9	Pass
		Diagonal	ROHN 3 STD	198	-16.67	26.89	62.0	Pass
		Diagonal	ROHN 3 STD	200	-20.93	26.89	77.8	Pass
		Diagonal	ROHN 3 STD	201	-20.86	26.89	77.6	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
		Diagonal	ROHN 3 STD	203	-21.68	26.89	80.6	Pass
		Diagonal	ROHN 3 STD	204	-21.73	26.89	80.8	Pass
T10	60 - 40	Diagonal	P3.5x.226	212	-17.69	35.03	50.5	Pass
		Diagonal	P3.5x.226	213	-17.71	35.03	50.6	Pass
		Diagonal	P3.5x.226	215	-23.20	35.03	66.2	Pass
		Diagonal	P3.5x.226	216	-23.12	35.03	66.0	Pass
		Diagonal	P3.5x.226	218	-23.74	35.03	67.8	Pass
		Diagonal	P3.5x.226	219	-23.80	35.03	67.9	Pass
		Diagonal	P3.5x.226	224	-17.08	37.35	45.7 45.8 (b)	Pass
		Diagonal	P3.5x.226	225	-17.10	37.35	45.8 45.9 (b)	Pass
		Diagonal	P3.5x.226	227	-22.31	37.35	59.7 59.9 (b)	Pass
		Diagonal	P3.5x.226	228	-22.23	37.35	59.5 59.6 (b)	Pass
		Diagonal	P3.5x.226	230	-22.89	37.35	61.3 61.4 (b)	Pass
		Diagonal	P3.5x.226	231	-22.95	37.35	61.4 61.6 (b)	Pass
T11	40 - 30	Diagonal	P3.5x.226	239	-18.13	32.82	55.2	Pass
		Diagonal	P3.5x.226	240	-18.15	32.82	55.3	Pass
		Diagonal	P3.5x.226	242	-23.95	32.82	73.0	Pass
		Diagonal	P3.5x.226	243	-23.85	32.82	72.7	Pass
		Diagonal	P3.5x.226	245	-24.44	32.82	74.5	Pass
		Diagonal	P3.5x.226	246	-24.51	32.82	74.7	Pass
T12	30 - 20	Diagonal	P3.5x.226	256	-18.87	30.78	61.3	Pass
		Diagonal	P3.5x.226	257	-18.88	30.78	61.4	Pass
		Diagonal	P3.5x.226	258	-24.75	30.78	80.4	Pass
		Diagonal	P3.5x.226	259	-24.65	30.78	80.1	Pass
		Diagonal	P3.5x.226	260	-25.21	30.78	81.9	Pass
		Diagonal	P3.5x.226	261	-25.29	30.78	82.2	Pass
T13	20 - 0	Diagonal	P3.5x.226	269	-27.43	52.71	52.0 60.2 (b)	Pass
		Diagonal	P3.5x.226	272	-27.49	52.71	52.1 60.3 (b)	Pass
		Diagonal	P3.5x.226	276	-36.95	52.71	70.1 81.1 (b)	Pass
		Diagonal	P3.5x.226	279	-36.17	52.71	68.6 79.4 (b)	Pass
		Diagonal	P3.5x.226	284	-37.15	52.71	70.5 81.5 (b)	Pass
		Diagonal	P3.5x.226	287	-37.55	52.71	71.2 82.4 (b)	Pass
T1	180 - 160	Horizontal	ROHN 1.5 STD	7	-2.92	22.52	13.0	Pass
		Horizontal	ROHN 1.5 STD	10	-2.74	22.52	12.2	Pass
		Horizontal	ROHN 1.5 STD	13	-2.19	22.52	9.7	Pass
		Horizontal	ROHN 1.5 STD	19	-2.35	22.59	10.4	Pass
		Horizontal	ROHN 1.5 STD	22	-1.70	22.59	7.5	Pass
		Horizontal	ROHN 1.5 STD	25	-2.20	22.59	9.7	Pass
T2	160 - 140	Horizontal	ROHN 1.5 STD	43	-5.61	19.14	29.3	Pass
		Horizontal	ROHN 1.5 STD	46	-5.40	19.14	28.2	Pass
		Horizontal	ROHN 1.5 STD	49	-5.74	19.14	30.0	Pass
		Horizontal	ROHN 1.5 STD	55	-5.54	20.90	26.5	Pass
		Horizontal	ROHN 1.5 STD	58	-5.23	20.90	25.0	Pass
		Horizontal	ROHN 1.5 STD	61	-5.34	20.90	25.5	Pass
		Horizontal	ROHN 1.5 STD	67	-5.79	22.66	25.6	Pass
		Horizontal	ROHN 1.5 STD	70	-5.41	22.66	23.9	Pass
		Horizontal	ROHN 1.5 STD	73	-5.29	22.66	23.4	Pass
T3	140 - 133.333	Horizontal	ROHN 2 STD	82	-5.80	30.72	18.9 23.5 (b)	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
		Horizontal	ROHN 2 STD	85	-5.71	30.72	18.6 23.1 (b)	Pass
		Horizontal	ROHN 2 STD	88	-6.24	30.72	20.3 25.2 (b)	Pass
T6	120 - 100	Horizontal	ROHN 2 STD	127	-10.91	22.64	48.2	Pass
		Horizontal	ROHN 2 STD	130	-12.36	22.64	54.6	Pass
		Horizontal	ROHN 2 STD	133	-12.89	22.64	56.9	Pass
		Horizontal	ROHN 2 STD	139	-10.77	25.59	42.1 43.5 (b)	Pass
		Horizontal	ROHN 2 STD	142	-11.53	25.59	45.1 46.5 (b)	Pass
		Horizontal	ROHN 2 STD	145	-12.11	25.59	47.3 48.9 (b)	Pass
T7	100 - 90	Horizontal	ROHN 2 STD	154	-10.31	19.82	52.0	Pass
		Horizontal	ROHN 2 STD	157	-12.51	19.82	63.1	Pass
		Horizontal	ROHN 2 STD	160	-13.02	19.82	65.7	Pass
T9	80 - 60	Horizontal	ROHN 2.5 STD	184	-11.72	28.95	40.5 47.7 (b)	Pass
		Horizontal	ROHN 2.5 STD	187	-15.30	28.95	52.8 61.9 (b)	Pass
		Horizontal	ROHN 2.5 STD	190	-15.75	28.95	54.4 63.8 (b)	Pass
		Horizontal	ROHN 2.5 STD	196	-11.24	32.99	34.1 45.8 (b)	Pass
		Horizontal	ROHN 2.5 STD	199	-14.34	32.99	43.5 58.1 (b)	Pass
		Horizontal	ROHN 2.5 STD	202	-14.82	32.99	44.9 60.0 (b)	Pass
T10	60 - 40	Horizontal	ROHN 2.5 STD	211	-12.95	22.38	57.9	Pass
		Horizontal	ROHN 2.5 STD	214	-17.33	22.38	77.4	Pass
		Horizontal	ROHN 2.5 STD	217	-17.75	22.38	79.3	Pass
		Horizontal	ROHN 2.5 STD	223	-12.22	25.35	48.2 49.8 (b)	Pass
		Horizontal	ROHN 2.5 STD	226	-16.27	25.35	64.2 65.9 (b)	Pass
		Horizontal	ROHN 2.5 STD	229	-16.72	25.35	66.0 67.7 (b)	Pass
T11	40 - 30	Horizontal	ROHN 2.5 STD	238	-13.57	19.91	68.1	Pass
		Horizontal	ROHN 2.5 STD	241	-18.29	19.91	91.9	Pass
		Horizontal	ROHN 2.5 STD	244	-18.70	19.91	93.9	Pass
T13	20 - 0	Horizontal	P3.5x.226	268	-14.98	49.95	30.0 42.1 (b)	Pass
		Horizontal	P3.5x.226	275	-20.65	49.95	41.3 57.7 (b)	Pass
		Horizontal	P3.5x.226	283	-21.02	49.95	42.1 58.8 (b)	Pass
T1	180 - 160	Top Girt	ROHN 1.5 STD	4	-0.59	22.66	2.6	Pass
		Top Girt	ROHN 1.5 STD	5	-0.25	22.66	1.1	Pass
		Top Girt	ROHN 1.5 STD	6	-0.65	22.66	2.9	Pass
T4	133.333 - 126.667	Top Girt	ROHN 2 STD	97	-8.34	29.08	28.7 33.6 (b)	Pass
		Top Girt	ROHN 2 STD	98	-8.48	29.08	29.1 34.1 (b)	Pass
		Top Girt	ROHN 2 STD	99	-8.99	29.08	30.9 36.2 (b)	Pass
T5	126.667 - 120	Top Girt	ROHN 2 STD	112	-10.42	27.21	38.3 41.9 (b)	Pass
		Top Girt	ROHN 2 STD	113	-10.73	27.21	39.4 43.2 (b)	Pass
		Top Girt	ROHN 2 STD	114	-11.26	27.21	41.4 45.3 (b)	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T8	90 - 80	Top Girt	ROHN 2 STD	169	-10.56	16.72	63.2	Pass
		Top Girt	ROHN 2 STD	170	-13.21	16.72	79.0	Pass
		Top Girt	ROHN 2 STD	171	-13.70	16.72	82.0	Pass
T12	30 - 20	Top Girt	ROHN 2.5 EH	253	-14.34	22.42	63.9	Pass
		Top Girt	ROHN 2.5 EH	254	-19.03	22.42	84.9	Pass
		Top Girt	ROHN 2.5 EH	255	-19.41	22.42	86.6	Pass
T13	20 - 0	Redund Horz 1 Bracing	ROHN 1.5 STD	270	-6.31	19.50	32.4	Pass
		Redund Horz 1 Bracing	ROHN 1.5 STD	273	-6.42	19.50	32.9	Pass
		Redund Horz 1 Bracing	ROHN 1.5 STD	277	-6.42	19.50	32.9	Pass
		Redund Horz 1 Bracing	ROHN 1.5 STD	280	-6.34	19.50	32.5	Pass
		Redund Horz 1 Bracing	ROHN 1.5 STD	285	-6.34	19.50	32.5	Pass
		Redund Horz 1 Bracing	ROHN 1.5 STD	288	-6.31	19.50	32.4	Pass
T13	20 - 0	Redund Diag 1 Bracing	ROHN 2 STD	271	-5.76	14.06	41.0	Pass
		Redund Diag 1 Bracing	ROHN 2 STD	274	-5.87	14.06	41.7	Pass
		Redund Diag 1 Bracing	ROHN 2 STD	278	-5.87	14.06	41.7	Pass
		Redund Diag 1 Bracing	ROHN 2 STD	281	-5.79	14.06	41.2	Pass
		Redund Diag 1 Bracing	ROHN 2 STD	286	-5.79	14.06	41.2	Pass
		Redund Diag 1 Bracing	ROHN 2 STD	289	-5.76	14.06	41.0	Pass
T13	20 - 0	Redund Hip 1 Bracing	ROHN 2.5 STD	282	-0.02	56.95	0.1	Pass
		Redund Hip 1 Bracing	ROHN 2.5 STD	290	-0.02	56.95	0.1	Pass
		Redund Hip 1 Bracing	ROHN 2.5 STD	291	-0.02	56.95	0.1	Pass
T1	180 - 160	Inner Bracing	L2x2x1/8	16	-0.00	6.44	0.7	Pass
		Inner Bracing	L2x2x1/8	17	-0.00	6.44	0.7	Pass
		Inner Bracing	L2x2x1/8	18	-0.00	6.44	0.7	Pass
		Inner Bracing	L2x2x1/8	28	-0.00	6.48	0.7	Pass
		Inner Bracing	L2x2x1/8	29	-0.00	6.48	0.7	Pass
		Inner Bracing	L2x2x1/8	30	-0.00	6.48	0.7	Pass
		Inner Bracing	L2x2x1/8	37	-0.01	6.51	0.7	Pass
		Inner Bracing	L2x2x1/8	38	-0.01	6.51	0.7	Pass
		Inner Bracing	L2x2x1/8	39	-0.01	6.51	0.7	Pass
T2	160 - 140	Inner Bracing	L2x2x1/8	52	-0.01	4.79	0.8	Pass
		Inner Bracing	L2x2x1/8	53	-0.01	4.79	0.8	Pass
		Inner Bracing	L2x2x1/8	54	-0.01	4.79	0.8	Pass
		Inner Bracing	L2x2x1/8	64	-0.01	5.53	0.7	Pass
		Inner Bracing	L2x2x1/8	65	-0.01	5.53	0.7	Pass
		Inner Bracing	L2x2x1/8	66	-0.01	5.53	0.7	Pass
		Inner Bracing	L2x2x1/8	76	-0.01	6.40	0.7	Pass
		Inner Bracing	L2x2x1/8	77	-0.01	6.40	0.7	Pass
		Inner Bracing	L2x2x1/8	78	-0.01	6.40	0.7	Pass
T3	140 - 133.333	Inner Bracing	L2x2x1/8	91	-0.01	4.19	0.8	Pass
		Inner Bracing	L2x2x1/8	92	-0.01	4.19	0.8	Pass
		Inner Bracing	L2x2x1/8	93	-0.01	4.19	0.8	Pass
T4	133.333 - 126.667	Inner Bracing	L2x2x1/8	106	-0.15	3.69	4.0	Pass
		Inner Bracing	L2x2x1/8	107	-0.16	3.69	4.3	Pass
		Inner Bracing	L2x2x1/8	108	-0.16	3.69	4.3	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T5	126.667 - 120	Inner Bracing	L2x2x1/8	121	-0.19	3.28	5.7	Pass
		Inner Bracing	L2x2x1/8	122	-0.20	3.28	6.0	Pass
		Inner Bracing	L2x2x1/8	123	-0.20	3.28	6.0	Pass
T6	120 - 100	Inner Bracing	L2 1/2x2 1/2x3/16	136	-0.01	7.16	0.7	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	137	-0.01	7.16	0.7	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	138	-0.01	7.16	0.7	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	148	-0.01	8.48	0.6	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	149	-0.01	8.48	0.6	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	150	-0.01	8.48	0.6	Pass
T7	100 - 90	Inner Bracing	L2 1/2x2 1/2x3/16	163	-0.01	6.13	0.7	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	164	-0.01	6.13	0.7	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	165	-0.01	6.13	0.7	Pass
T8	90 - 80	Inner Bracing	L2 1/2x2 1/2x3/16	178	-0.23	5.18	4.5	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	179	-0.24	5.18	4.7	Pass
		Inner Bracing	L2 1/2x2 1/2x3/16	180	-0.24	5.18	4.7	Pass
T9	80 - 60	Inner Bracing	L3x3x3/16	193	-0.02	6.78	0.9	Pass
		Inner Bracing	L3x3x3/16	194	-0.02	6.78	0.9	Pass
		Inner Bracing	L3x3x3/16	195	-0.02	6.78	0.9	Pass
		Inner Bracing	L3x3x3/16	205	-0.02	7.78	0.8	Pass
		Inner Bracing	L3x3x3/16	206	-0.02	7.78	0.8	Pass
		Inner Bracing	L3x3x3/16	207	-0.02	7.78	0.8	Pass
T10	60 - 40	Inner Bracing	L3 1/2x3 1/2x1/4	220	-0.02	11.13	0.5	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	221	-0.02	11.13	0.5	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	222	-0.02	11.13	0.5	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	232	-0.02	12.55	0.5	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	233	-0.02	12.55	0.5	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	234	-0.02	12.55	0.5	Pass
T11	40 - 30	Inner Bracing	L3 1/2x3 1/2x1/4	247	-0.02	9.93	0.5	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	248	-0.02	9.93	0.5	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	249	-0.02	9.93	0.5	Pass
T12	30 - 20	Inner Bracing	L3 1/2x3 1/2x1/4	262	-0.34	8.92	3.8	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	263	-0.35	8.92	3.9	Pass
		Inner Bracing	L3 1/2x3 1/2x1/4	264	-0.35	8.92	3.9	Pass
T13	20 - 0	Inner Bracing	ROHN 2 STD	292	-0.02	6.59	0.3	Pass
		Inner Bracing	ROHN 2 STD	293	-0.02	6.59	0.3	Pass
		Inner Bracing	ROHN 2 STD	294	-0.02	6.59	0.3	Pass
							Summary	
						Leg (T7)	84.4	Pass
						Diagonal (T9)	88.2	Pass
						Horizontal (T11)	93.9	Pass
						Top Girt (T12)	86.6	Pass
						Redund Horz 1 Bracing (T13)	32.9	Pass
						Redund Diag 1 Bracing (T13)	41.7	Pass
						Redund Hip 1 Bracing (T13)	0.1	Pass
						Inner Bracing (T5)	6.0	Pass
						Bolt Checks	84.4	Pass
						RATING =	**93.9**	**Pass**

Program Version 7.0.8.5 - 9/29/2017 File:P:/Projects/Telcom/StructuralsByLocation/Connecticut/WestportCSP#32/10-60581632-SMK-004 MOD/_G_/MOD_G_180' Self-Supported Lattice Tower.eri

ANCHOR BOLT EVALUATION

ANCHOR BOLT ANALYSIS

Input Data

Tower Reactions:

Uplift:	$Uplift := 384 \cdot kips$	*user input*
Shear:	$Shear := 59 \cdot kips$	*user input*
Compression:	$Compression := 420 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM A354 Gr. BC

Number of Anchor Bolts = N	$N := 10$	*user input*	
Bolt Ultimate Strength:	$F_u := 125 \cdot ksi$	*user input*	
Bolt Yield Strength:	$Fy := 109 \cdot ksi$	*user input*	
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*	
Thickness of Anchor Bolts	$D := 1.0in$	*user input*	
Threads per Inch:	$n := 8$	*user input*	
Coefficient of Friction:	$\mu := 0.55$	*user input*	(for baseplate with grout ASCE 10-15)
Length from top of pier to bottom of leveling nut:	$L_{ar} := 0in$	*user input*	
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*	

Anchor Bolt Section Properties:

Gross Area of Bolt:

$A_g := \frac{\pi}{4} \cdot D^2$ $\qquad A_g = 0.79 \cdot in^2$

Net Area of Bolt:

$A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2$ $\qquad A_n = 0.61 \cdot in^2$

Net Diameter:

$D_n := D - \frac{0.9743in}{n}$ $\qquad D_n = 0.88 \cdot in$

Radius of Gyration of Bolt:

$r := \frac{D_n}{4}$ $\qquad r = 0.22 \cdot in$

Plastic Section Modulus of Bolt:

$Z_x := \frac{D_n^{\ 3}}{6}$ $\qquad Z_x = 0.11 \cdot in^3$

Forces:

Tension Force:

$T_u := \frac{Uplift}{N}$

$T_u = 38.4 \cdot kip$

$T_{ub} := T_u$

Resistance Factor for Flexure (ANSI/TIA-222-G 4.7):

$\phi_f := 0.9$

Resistance Factor for Anchor Bolt (ANSI/TIA-222-G 4.5.4.2):

$\phi_b := 0.80$

Resistance Factor for Tension (ANSI/TIA-222-G 4.9.6.1):

$\phi_t := 0.75$

Shear Force:

$V_u := \frac{Shear}{N}$

$V_u = 5.9 \cdot kip$ $\qquad V_{ub} := V_u$

Resistance Factor for Shear (ANSI/TIA-222-G 4.9.6.3):

$\phi_v := 0.75$

ANSI/TIA-222-G 4.7.1 Flexural Members:

Nominal Flexure Strength, Mn:

$M_n := Fy \cdot Z_x$

$M_n = 1.03 \cdot ft \cdot kip$

$\phi_f \cdot M_n = 0.92 \cdot ft \cdot kip$

Applied Moment due to Shear (worst case lever arm), Mu:

$M_u := L_{ar} \cdot V_u$

$M_u = 0 \cdot ft \cdot kip$

Flexure Check:

$FlexureCheck := if\left(M_u \le \phi_f \cdot M_n, "OK", "NO GOOD"\right)$

$FlexureCheck = "OK"$

$\frac{M_u}{\phi_f \cdot M_n} = 0 \cdot \%$

ANSI/TIA-222-G 4.9.6.1 Tensile Strength:

Design Tensile Strength, Rnt:

$R_{nt} := F_u \cdot A_n$

$R_{nt} = 75.72 \cdot ft \cdot kip$

$\phi_t \cdot R_{nt} = 56.79 \cdot ft \cdot kip$

Tension Check:

$TensionCheck := if\left(T_u \le \phi_t \cdot R_{nt}, "OK", "NO GOOD"\right)$

$TensionCheck = "OK"$

$\frac{T_u}{\phi_t \cdot R_{nt}} = 67.62 \cdot \%$

ANSI/TIA-222-G 4.9.6.3 Design Shear Strength:

Design Shear Strength, Rnv:

$R_{nv} := 0.45 \cdot F_u \cdot A_g$

$R_{nv} = 44.18 \cdot ft \cdot kip$

$\phi_v \cdot R_{nv} = 33.13 \cdot ft \cdot kip$

Shear Check:

$ShearCheck := if\left(V_u \le \phi_v \cdot R_{nv}, "OK", "NO GOOD"\right)$

$ShearCheck = "OK"$

$\frac{V_u}{\phi_v \cdot R_{nv}} = 17.81 \cdot \%$

ANSI/TIA-222-G 4.9.6.4 Combined Shear and Tension:

$$\left[\frac{V_{ub}}{(\phi_v \cdot R_{nv})}\right]^2 + \left[\frac{T_{ub}}{(\phi_t \cdot R_{nt})}\right]^2 \le 1$$

$$\left[\frac{V_{ub}}{(\phi_v \cdot R_{nv})}\right]^2 + \left[\frac{T_{ub}}{(\phi_t \cdot R_{nt})}\right]^2 = 0.49$$

Combined Shear and Tension Check:

$$\text{ShearAndTensionCheck} := \text{if}\left[\left[\frac{V_{ub}}{(\phi_v \cdot R_{nv})}\right]^2 + \left[\frac{T_{ub}}{(\phi_t \cdot R_{nt})}\right]^2 \le 1, \text{"OK"}, \text{"NO GOOD"}\right]$$

ShearAndTensionCheck = "OK"

ANSI/TIA-222-G 4.9.9 Anchor Rods (Capacity):

$$\frac{\left[T_u + \left(\frac{V_u}{\eta}\right)\right]}{\phi_b \cdot P_n} \le 1$$

$\eta := 0.55$ *user input from ANSI/TIA-222-G 4.9.9*

$$\frac{\left[T_u + \left(\frac{V_u}{\eta}\right)\right]}{\phi_b \cdot F_u \cdot A_n} = 0.811$$

Capacity Check:

$$\text{CapacityCheck} := \text{if}\left[\frac{\left[T_u + \left(\frac{V_u}{\eta}\right)\right]}{\phi_b \cdot F_u \cdot A_n} \le 1, \text{"OK"}, \text{"NO GOOD"}\right]$$

CapacityCheck = "OK"

FOUNDATION ANALYSIS
(PERFORMED BY DR. CLARENCE WELTI, P.E., P.C.)

DR. CLARENCE WELTI, P.E., P.C.

GEOTECHNICAL ENGINEERING

227 Williams Street • P.O. Box 397
Glastonbury, CT 06033

(860) 633-4623 / FAX (860) 657-2514

STATE OF CONNECTICUT DR. CLARENCE WELTI, P.E., P.C. NO. EL 0037 CORPORATE PRACTICE OF ENGINEERING

October 10, 2002

Mr. Mohsen Sahirad
URS Corporation
500 Enterprise Drive; Suite 3B
Rocky Hill, CT 06067

Re: Telecommunications Tower; 880 Post Road; Westport, CT ; Evaluation of Existing Foundation for Increased Design Loads

Dear Mohsen:

1.0 Herewith are boring data pertaining to the above. Two borings were drilled to a maximum depth of 12 feet. One boring was drilled 10 feet into bedrock and the second boring was drilled to the top of bedrock. The two borings are shown on the attached photo. Boring B-1 was about 11 feet from the tower leg and boring B-2 was about 15 feet from the tower leg. Considering that the rock outcrops at the third leg, the two borings define rock sufficiently to permit a reasonable interpolation of rock at the actual leg foundations. The former police station site is undergoing environmental remediation. *The borings were drilled by Clarence Welti Associates, Inc. and sampling was conducted by this firm solely to obtain indications of subsurface conditions as part of a geotechnical exploration program. No services were performed to evaluate subsurface environmental conditions.*

2.0 The purpose of this study is to assess the capability of tower legs to receive the proposed revised loadings. The load summary, including initial and revised design loadings is as follows:

Loading Type	Original Reaction	Revised Reactions
Uplift	276.7 kips	324 kips
Download	319.9 kips	374 kips
Shear	41.0 kips	48 kips

3.0 The initial boring data (1990 data from Test Craig Laboratories) indicated bedrock over the entire site. It is understood that there is information indicating that two of the legs were placed in earth instead of rock. The recent boring tends to belie this. The analyses for uplift (which is the only critical item on the above reaction schedule) have been done for both earth and rock. The reference for both analyses is FHWA-1F-025 Publication "Drilled Shafts: Construction Procedures and Design Methods".

3.0.1 The tower legs were each placed on 4.5 feet diameter shafts installed 27 feet deep into either earth or rock. The design uplift was and is based on an effective length of 21 feet.

3.1 Regarding the shaft in earth analysis there were no deep blow counts in the borings, since rock was encountered within 2 feet of grade. It is however reasonable to assume the N value (blows per 12" on split spoon) will be about 60 in the till overlying rock. Using the procedure indicated on the attached calculations the ultimate uplift capacity would be 831 kips. Design capacity would be ½ of this value or 415 kips. In reviewing the reference you cited (Foundation Engineering by Das, 4th edition) a similar ultimate load capacity can also be found if one assumes an angle of internal friction of about 40° (which would be typical for $N = 60$) and a δ/ϕ ratio of 1.0 (relative density of soil $\geq$ 85+%).

3.2 Regarding the shaft in rock the friction is defined in the attached calculations. The ultimate uplift of the shaft placed the Straits Schist rock formation would be about 10 kips/sf. With a factor of safety of 3 (using 3 kips/sf) the allowable loading would be 888 kips.

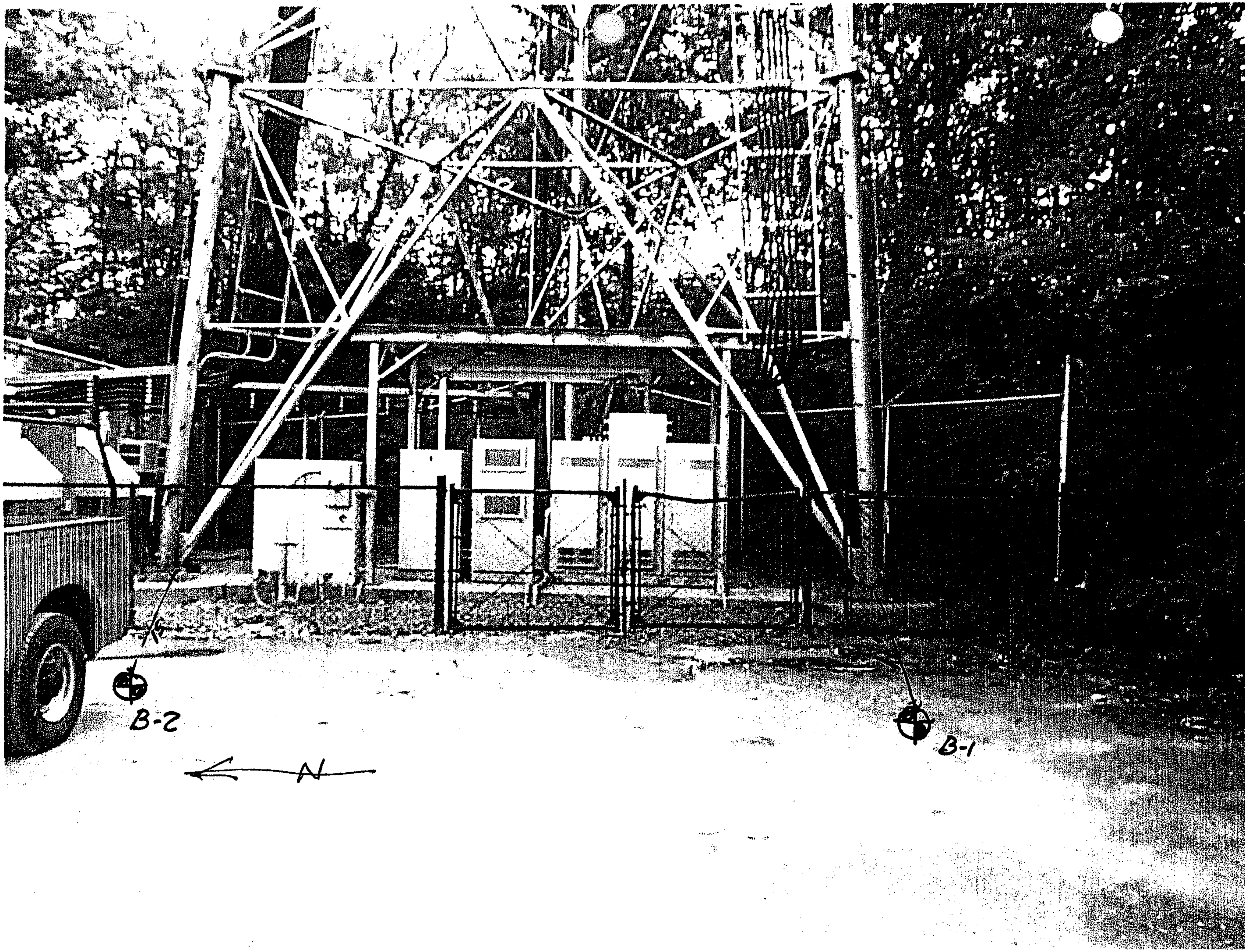
4.0 In summary it is believed that the shafts are in rock. The rock is a Schist with steep foliation and may have been drilled with only moderate effort. If the actual shaft are in earth there would have to have been a deep depression between the rock outcrop (which was cut down about 5 feet at the east leg) and the boring locations west of the two west legs, which indicated rock at 2 feet below grade similar to the original borings on the site. If there was a depression in the rock, the soil would be glacial till similar to what is being excavated to the northwest of the site at the old State Police Station. The analyses included herewith indicate that with either rock or till overburden the shafts have adequate capacity for the revised loading.

If you have any questions, please call me.

Very truly yours.

Clarence Welti, PhD, P. E.
Pres. Dr. Clarence Welti, P. E., P.C.

A:\urstoweranalysis9/04/02


B-2
N
B-1

CLARENCE WELTI ASSOC., INC. P.O. BOX 397 GLASTONBURY, CONN 06033	CLIENT URS CORPORATION	PROJECT NAME CELL TOWER SITE LOCATION 880 POST ROAD WESTPORT, CT

	AUGER	CASING	SAMPLER	CORE BAR.	OFFSET	SURFACE ELEV.	HOLE NO. B-1
TYPE	HSA		SS	NX	LINE & STA.	GROUND WATER OBSERVATIONS AT 2.0 FT. AFTER 0 HOURS	START DATE 10/7/02
SIZE I.D.	3.75"		1.5"	2.0"	N. COORDINATE		
HAMMER WT.			140lbs			AT FT. AFTER HOURS	FINISH DATE 10/7/02
HAMMER FALL			30"		E. COORDINATE		

DEPTH	SAMPLE NO.	SAMPLE BLOWS/6"	SAMPLE DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0	1	4-13-20-60	0.00'-1.50'		ASPHALT	.10
					BR. FINE-CRS. SAND AND FINE GRAVEL - FILL	.80
					GRAY ROCK FRAGMENTS, LITTLE SILT AND FINE SAND	1.5
					GRAY ROCK FRAGMENTS	2.0
					CORED ROCK -	
					RUN #1 2.0' - 7.0' RECOVERED 50"	
5					RUN #2 7.0' - 12.0' RECOVERED 60"	
10						12.0
					BOTTOM OF BORING @ 12.0'	
					NOTE: BORING WAS DRILLED 11.0' WEST OF TOWER LEG	
15						
20						
25						
30						
35						

LEGEND: COL. A:

SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON

PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: BROMLEY
INSPECTOR:

SHEET 1 OF 1 HOLE NO. B-1

CLARENCE WELTI ASSOC., INC. P.O. BOX 397 GLASTONBURY, CONN 06033	CLIENT URS CORPORATION	PROJECT NAME CELL TOWER SITE
		LOCATION 880 POST ROAD WESTPORT, CT

	AUGER	CASING	SAMPLER	CORE BAR.	OFFSET	SURFACE ELEV.	HOLE NO. B-2
TYPE	HSA		SS		LINE & STA.	GROUND WATER OBSERVATIONS	START DATE 10/7/02
SIZE I.D.	3.75"		1.5"		N. COORDINATE	AT none FT. AFTER 0 HOURS	
HAMMER WT.			140lbs			AT FT. AFTER HOURS	FINISH DATE 10/7/02
HAMMER FALL			30"		E. COORDINATE		

DEPTH	SAMPLE NO.	BLOWS/6"	DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0	1	1-8-12-60	0.00'-1.50'		DARK BR. FINE-CRS. SAND, SOME FINE-MED. GRAVEL, TRACE SILT - FILL (1.0)	
					BR./GRAY ROCK FRAGMENTS, SILT AND FINE SAND (1.5)	
					GRAY ROCK FRAGMENTS (2.0)	
					AUGER REFUSAL @ 2.0'	
					NOTE: BORING WAS DRILLED 15'WEST OF TOWER LEG	
5						
10						
15						
20						
25						
30						
35						

LEGEND: COL. A:

SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON

PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: BROMLEY

INSPECTOR:

SHEET 1 OF 1 HOLE NO. B-2

DR. CLARENCE WELTI, PE, PC
P.O. BOX 397
GLASTONBURY, CONNECTICUT 06033 • (860) 633-4623

CLIENT URS
PROJECT Communication Tower Westport
SUBJECT Assessment of Capacity
BY CW DATE 10/ /02 SHEET NO.

Reference: Drilled Shafts Construction Procedures & Design Methods PUBLICATION NO FHWA-IF-99-025

Material: "Intermediate Geo-material" N > 50B/12"
(IGM)

(1) $f_{max_i} = \sigma'_{vi} K_{oi} \tan \phi'_i$

σ'_{vi}: vertical effective stress at middle of layer i ≈ 1.18 ksf

K_{oi}: design value of earth pressure coefficient at rest

ϕ'_i: design value of angle of internal friction for layer i

(2) $\phi'_i = \tan^{-1}\left\{\left[\frac{N_{60}\,(\text{LAYER } i)}{12.3 + 20.3\left(\frac{\sigma'_{vi}}{p_a}\right)}\right]^{0.34}\right\}$

p_a 2 ksf or 14.7 psi

$N_{60}(\text{LAYER } i) = 60$

$= \tan^{-1}\left\{\left[\frac{60}{12.3 + 20.3 \times 0.59}\right]^{.34}\right\} = \tan^{-1}(1.96)^{.34} = 51.5°$

(3) $K_{oi} = (1 - \sin\phi'_i)\left[\frac{0.2\, p_a\, N_{60}\,(\text{layer } i)}{\sigma'_{vi}}\right]^{\sin\phi}$

$= (1 - .78)\left[\frac{0.2 \times 2 \times 60}{1.18}\right]^{.78} = 1.65$

$f_a = (f_m\ (1) = 3.73\ \text{ksf} \times 0.75^{\text{uplift}} = 2.8\ \text{ksf}$

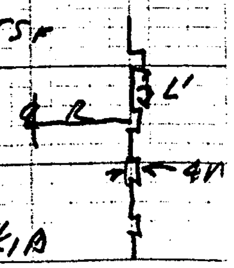
$21' \times 4.5 \times \pi \times 2.8 = 831$ KIPS ULTIMATE UPLIFT CAPACITY

FOR SHAFT IN ROCK

q_u: 5200 psi × 333 TSF

$f_{max} = 0.8\left[\frac{4R}{R}\left(\frac{L'}{L}\right)\right]^{0.45} q_u$

L: 27'
4R: 0.5' L': 0.2'



f_{max}: 5.37 TSF = 10.78 ksf

21' × π × 4.5 = 296 SF

Assume 1/3 for f_{all} ≈ 3 ksf. Q = 888 KIPS

AECOM

Job: Westport, CT (CSP tower)

Project No.

Sheet ___ of ___

Description: Evaluating Foundation Capacity from 2002 assessment

Computed by: McD

Date

Checked by

Date

from Dr. Clarence Welti, P.E., P.C.

Reference

From original Welti Calculation:

HAND CALCULATIONS INITIALLY DERIVED FROM PROJECT (VZ5-202 / SAI-097 DATED DECEMBER 2016)

Given values:

$N_{60} = 60$

$\sigma'_v = 1.8\,ksf$

$P_a = 2000\,psf$ (Atmospheric pressure)

$D_{pier} = 4.5\,ft$

$Ht_{Pier} = 21\,ft$

FHWA-IF-99-025 (Reference for Design for cohesionless IGM - compression)

EQ (B.61) $\phi' = \tan^{-1}\left[\left[\frac{N_{60}}{12.2 + 20.3\left(\frac{\sigma'_v}{P_a}\right)}\right]^{0.34}\right] = \tan^{-1}\left[\left[\frac{60}{12.2 + 20.3\left(\frac{1.8}{2}\right)}\right]^{0.34}\right]$

EQ $\underline{\phi' = 51.5°}$

(B.60) $\text{"OCR"} = \frac{\sigma'_p}{\sigma'_v} = \frac{(0.2)(N_{60})(P_a)}{\sigma'_v} = \frac{(0.2)(60)(2\,ksf)}{1.8\,ksf} = \underline{13.3}$

EQ. (B.59)

EQ (B.51) $K_o = (1 - \sin\phi')(OCR)^{\sin\phi'} = (1 - \sin 51.5°)(13.3)^{\sin 51.5°}$

$\underline{K_o = 1.65}$

EQ. (B.62) $f_{max} = \sigma'_v \times K_o \times \tan\phi' = 1.8\,ksf \times 1.65 \times \tan 51.5° = 3.734\,ksf$

$3.734\,ksf \times 21\,ft \times 4.5\,ft \times \pi = R_n = 1109\,kip \times 0.60$ (cons.) ϕ_{LRFD} (FHWA factor)

$= 665\,kip$ ↓ (Comp Capacity LRFD)

Pg 50 table L/B → ψ factor EQ (B.46)

$L = 21\,ft$

$B = 4.5\,ft$

$\frac{L}{B} \approx 5 \rightarrow \psi = 0.74$

$\text{Uplift} = (\psi)(\text{Comp}) = 492\,k$ Uplift Cap LRFD

Job: Westport, Ct (CSP tower)
Project No.:
Description: Evaluating Fundation Capacity from 2002 Assessment
Computed by: MCD
Date:
Checked by:
Date:

Reference

FHWA-NHI-10-016 – Drilled Shafts: Construction procedures & LRFD Design Methods (follows up to AASHto LRFD 2009)

13.3.5.1 – Cohesionless Soil – Side Resistance

EQ (13-5) $R_n = \pi B \Delta z (\sigma'_v K \tan\delta)$ $\beta = K \cdot \tan\delta$

$= \pi B \Delta z (\sigma'_v \beta)$

[EQ 13-12] (Gravely Soils)

Given by Welti calculation:

$\frac{\sigma'_p}{p_a} = 0.15 \times N60$

$N_{60} = 60$ $z = 27 ft$
$p_a = 2.116 ksf$ $B = 4.5 ft$
$\sigma'_v = 1.8 ksf$

$\sigma'_p = 0.15 \times N_{60} \times p_a = (0.15)(60)(2.116 ksf)$
$= 19.044 ksf$

[EQ 13-13] $\beta \approx (1 - \sin\phi') \left(\frac{\sigma'_p}{\sigma'_v}\right)^{\sin\phi'} \times \tan\phi' \leq K_p \times \tan\phi$

$\phi' = 27.5 + 9.2 [\log(N_1)_{60}] \rightarrow 27.5 + 9.2 [\log(60)] = 43.85° = \phi'$

[EQ 3-8]
(cons.)

[EQ 13-13] $\beta \approx (1 - \sin(43.85°)) \left(\frac{19.044}{1.8}\right)^{\sin 43.85°} \times \tan 43.85° = 1.513$

$K_p \times \tan\phi' = \tan^2\left(45 + \frac{\phi}{2}\right) \times \tan\phi = \tan^2\left(45 + \frac{43.85°}{2}\right) \times \tan 43.85°$
$= 5.29$

$1.513 \leq 5.29$ (OK) $\rightarrow$ use $\beta = 1.513$

$\delta = \phi = 43.85°$

AECOM

Job Westport, Ct (CSP tower) | Project No. | Sheet of

Description Evaluating Foundation Capacity from 2002 Assessment | Computed by MCD | Date

Checked by | Date

Reference

[Eq 13-7] $f_{SN} = \sigma'_N \beta$ = 1.8 ksf x 1.513 = 2.7234 ksf

[Eq 13-5] $R_{SN} = (\pi)(B)(\Delta z)(f_{SN})$ = π x 4.5 ft x 27 ft x 2.7434 ksf

= 1039.5 kips Slide/uplift Resistance (Nominal)

TIA-222-G Reduction Factor <u>0.75</u> - uplift Rock/soil

FHWA pg. 13-13 "Casing reduction factors of 0.6-0.75 are commonly used" (for "Permanent Casing").

check ($0.75 = \phi_{red}$)

∴ 1039.5 kips x 0.75 = 779.625 kip uplift (ult. capacity)

check ($0.60 = \phi_{red}$)

1039.5 kips x 0.6 = 623.7 kip uplift (ult. capacity)

∴ Based off of given soil/geotechnical parameters provided in "Evaluation of Existing Foundation for Increased Design Loads" provided by Dr. Clarence Welti, P.E., P.C., the following shall be used for uplift & compression capacities.

* uplift (LRFD) = 492 kips (614.94 kip) *

compression (LRFD) = 665 kips
Bearing on Rock

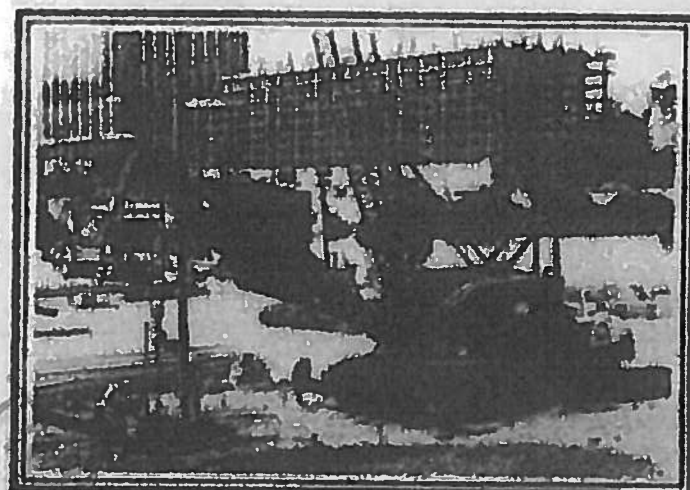
*DR Welti's 2002 Assessment (Attached)

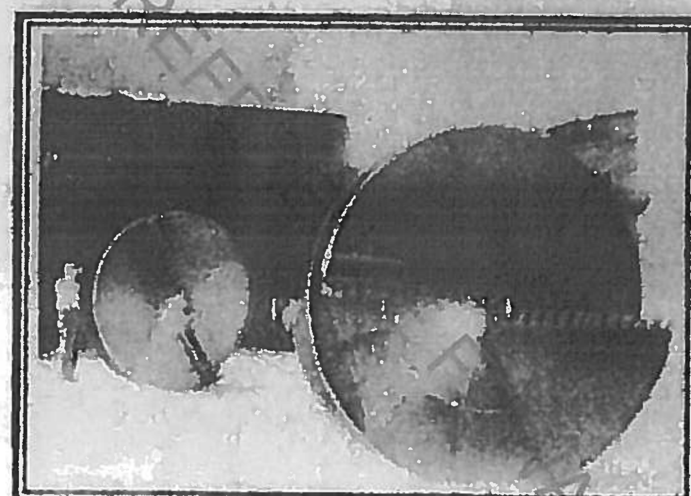
US Department of Transportation
Federal Highway Administration

PUBLICATION No. FHWA-IF-99-025

DRILLED SHAFTS:

CONSTRUCTION PROCEDURES AND DESIGN METHODS





Office Of Infrastructure

Printed August 1999

Little specific experimental information is available on side resistance in uplift for drilled shafts in gravel. Until such information becomes available, f_{max} can be estimated in a gravel layer in the same manner as it is estimated in a sand layer.

While the above method is theoretically correct and is accurate for simulated deep foundations in a geotechnical centrifuge, it has not been tested against full-scale drilled shaft foundations. Therefore, site-specific loading tests should be conducted where they are warranted economically.

Cohesionless Intermediate Geomaterials - Compression

A cohesionless intermediate geomaterial is a sand-like or gravel-like material (transported or residual) that exhibits $N > 50$ blows/0.3 m. f_{max} can be estimated in such soils using Equation (B.50). O'Neill et al. (1996) recommend the following procedure using the SPT N value, based on the original work of Mayne and Harris (1993). This method has been used and verified by load testing of full-scale drilled shafts in residual micaceous sands in the Piedmont province of the United States and has been verified for granular glacial till in the northeastern United States (O'Neill et al., 1996).

Within any one layer, the preconsolidation pressure of the IGM, σ'_p, is estimated from the correlation given in Equation (B.59). Then, after estimating the vertical effective stress at the middle of the layer, σ'_v (Figure 2.4), the overconsolidation ratio, OCR, is then estimated from Equation (B.60).

$$\sigma'_p = 0.2\, N_{60}\, p_a \qquad \text{(B.59)}$$

$$OCR = \sigma'_p / \sigma'_v \qquad \text{(B.60)}$$

N_{60} is the uncorrected SPT blow count in blows/0.3 m for the condition in which 60 per cent of the potential energy of the SPT hammer is transferred into the drive string, and p_a is atmospheric pressure in the units being used in the calculations. ϕ' is then computed from:

$$\phi' = \tan^{-1}\left\{\left[\frac{N_{60}}{12.2 + 20.3\left(\frac{\sigma'_v}{p_a}\right)}\right]^{0.34}\right\} \qquad \text{(B.61)}$$

Then,

$$K_o = (1-\sin\phi')OCR^{\sin\phi'} \quad \text{and} \tag{B.51}$$

$$f_{max} = \sigma'_v K_o \tan\phi' \tag{B.62}$$

The method assumes that $K = K_o$ and that $\delta = \phi'$ in granular IGM's. Obviously, if the contractor were to leave the borehole open for an extended period of time or otherwise deviate from good practice, f_{max} would be overestimated with this procedure.

It is recommended by O'Neill et al. (1996) that N_{60} not be taken to be > 100 with this method, regardless of the actual value of N_{60} measured. Otherwise, the method will overpredict f_{max}. While the method is sound, the various coefficients and exponents are based empirically on residual soils in the Piedmont province. Local correlations are therefore recommended.

Cohesionless Intermediate Geomaterials - Uplift Loading

It can reasonably be assumed that Equations (B.46), (B.57) and (B.58) apply both to granular soils and cohesionless IGM's.

Intermediate Geomaterials -- Considerations for Desert Regions

Some "cohesionless" IGM's exhibit cementation due to the presence of carbonates and other weak cementing agents. Such geomaterials are often found in desert regions. While more research is needed in this subject area, various empirical means have been suggested to estimate unit side resistance values. For example, Ismael et al. (1994) found from uplift loading tests on 0.3-m-diameter drilled shafts in dry cemented sand with N from 60 to 90 that β was 1.47 in the depth range of 3 to 5 m (10 to 16 ft). From uplift tests on 0.5-m-diameter drilled shafts in calcareous sands below the water table in the depth range of 5 to 15 m (16 to 49 ft), Ismael and Al-Sanad (1986) proposed f_{max} (kPa) = 0.96 N (blows/0.3 m), or f_{max} (tsf) = 0.01 N (blows/ft). These relations correspond to $\beta \approx 1$ in that depth range, suggesting relatively high values of f_{max}. The authors caution, however, that they were careful to prevent the intrusion of groundwater into the boreholes by casing off sources of water at shallow depths.

On the other hand, Walsh et al. (1995) reported uplift tests on three small-scale drilled shafts ($102 \text{ mm} \le B \le 254 \text{ mm}$; $0.915 \text{ m} \le L \le 1.53 \text{ m}$) in cemented, fine-grained geomaterials above the water table having carbonate contents ranging from 4 per cent to 50 per cent. These geomaterials exhibited s_u between 250 and 670 kPa (2.6 and 7.0 tsf) based on UU triaxial compression tests with cell pressures equal to the total overburden pressures at the depths from which the samples were recovered. From these tests, and treating the geomaterial as if it were a cohesive soil [Equation (B.32)], it was found that $\alpha = 0.45$ (average over the entire length of the small test shaft). This value is higher than would be expected if the geomaterial is classified as a

Let w (corresponding to failure) = 25 mm = 0.025 m.

H_f = [(50) (1.937) (0.025)]/[π (5) (0.442)(0.688)] = 0.507

(Note that pressure units are all in expressed in MPa, and all length units are expressed in m, so the units are consistent, leading to a value for H_f that is nondimensional.)

K_f = 0.04 + [(0.507 - 0.04) (1 - 0.04)] / [0.507 - 2 (0.04) +1] = 0.354.

d. Compute f_{max} from Equation (B.40):

f_{max} = 0.354 (0.688) = 0.243 MPa = 2.53 tons/ft^2.

Note that this value is about twice the value for the smooth interface. A cost analysis should be performed, perhaps by discussing the issue with drilled shaft contractors, relating to the increased costs incurred in cutting off infiltration of the perched water and roughening and cleaning the sides of the borehole before concreting plus careful inspection versus the benefit achieved in increasing the side resistance (reduced size of the drilled shaft).

Cohesive Intermediate Geomaterials - Uplift Loading

Cohesive IGM's that are loaded in uplift will develop values of f_{max} that are essentially identical to those developed in compression, provided the shaft borehole is classified as "rough." When the borehole is "smooth" the Poisson's effect influences shaft resistance. The shaft expands laterally when it is loaded in compression, increasing the lateral effective stresses against the interface and consequently the shearing resistance of the IGM at the interface, since the interface is drained and frictional. However, when the drilled shaft is loaded in uplift, the shaft contracts laterally, reducing the lateral effective stresses against the interface and the shearing resistance of the IGM at the interface. This effect is illustrated in exaggerated form in Figure B.14. For this reason values of f_{max} for uplift loading should be reduced slightly below the values shown above for compression loading if the shaft is long and flexible. It is recommended that

$$f_{max}\,(uplift) = \Psi f_{max}\,(compression) \qquad \text{(B.46)}$$

in which Ψ is taken to be 1.0 if $(E_c/E_m)(B/D)^2 \geq 4$, or 0.7 if $(E_c/E_m)(B/D)^2 < 4$, unless loading tests in uplift are performed. E_c and E_m are the composite Young's modulus of the shaft's cross section and IGM mass, respectively, B is the socket diameter and D is the socket length. This recommendation is based upon a study by Carter and Kulhawy (1988) for sockets in rock.

U.S. Department of Transportation
Federal Highway Administration

Publication No. FHWA-NHI-10-016
FHWA GEC 010
May 2010

NHI Course No. 132014

Drilled Shafts: Construction Procedures and LRFD Design Methods

Developed following:

AASHTO LRFD Bridge Design Specifications, 4th Edition, 2007, with 2008 and 2009 Interims.

NATIONAL HIGHWAY INSTITUTE

TABLE 3-3 RELATIONSHIP BETWEEN RELATIVE DENSITY, SPT N-VALUE,AND DRAINED FRICTION ANGLE OF COHESIONLESS SOILS (SABATINI ET AL., 2002, AFTER MEYERHOF, 1956)

State of Packing	Relative Density (%)	Standard Penetration Resistance, N (blows per ft)	Friction Angle, ϕ' (degrees)
Very Loose	< 20	< 4	< 30
Loose	20 – 40	4 – 10	30 – 35
Compact	40 – 60	10 – 30	35 – 40
Dense	60 – 80	30 – 50	40 – 45
Very Dense	> 80	> 50	> 45

Note: $N = 15 + (N' - 15)/2$ for $N' > 15$ in saturated or very fine silty sand, where N' = measured blow count and N = blow count corrected for dynamic pore pressure effects during the SPT

$$\phi' = \tan^{-1}\left[\frac{N_{60}}{12.2 + 20.3\left(\frac{\sigma'_{vo}}{p_a}\right)}\right]^{0.34} \qquad \text{3-7}$$

In which: ϕ' = effective stress friction angle, σ'_{vo} = vertical effective stress at the depth of N-value measurement, and p_a = atmospheric pressure in the same units as σ'_{vo} (*e.g.*, 2,116 psf). Equation 3-6 is a derived correlation between ϕ' and normalized SPT resistance, $(N_1)_{60}$, where high quality undisturbed frozen samples of natural sands were obtained that permitted direct measurements of ϕ' in triaxial cells (Hatanaka and Uchida, 1996). Equation 3-7 is a well-known correlation between N_{60} and ϕ' developed by Schmertmann (1975). Results from Equation 3-7 tend to be somewhat conservative, especially for shallow depths (*i.e.*, less than 6 ft).

Kulhawy and Chen (2007) evaluated data compiled from the literature on the strength properties of very coarse-grained soils, including both sands and gravels. The database was used to develop the following correlation, based on regression analysis, between ϕ' and N-value. This equation provides a first-order estimate of ϕ' for a wide range of cohesionless soils and over a wide range of N-values, including values up to 100. Equation 3-8 is the recommended correlation for estimating ϕ' for the purpose of evaluating unit side resistance of drilled shafts in cohesionless soils by the methods described in Chapter 13.

$$\phi' = 27.5 + 9.2\log\left[(N_1)_{60}\right] \qquad \left(r^2 = 0.356, n = 57\right) \qquad \text{3-8}$$

Where r^2 = coefficient of determination and n = number of data pairs used in the regression analysis. AASHTO (2007) states that other in-situ tests, including CPT, may be used to determine ϕ' and refers to GEC No. 5 (Sabatini et al., 2002) for details. The correlation given in GEC No. 5, based on CPT cone resistance, q_c, is given by:

$$\phi' = \tan^{-1}\left[0.1 + 0.38\log\left(\frac{q_c}{\sigma'_{vo}}\right)\right] \qquad \text{3-9}$$

In which σ'_{vo} = vertical effective stress at the depth of the q_c measurement.

13.3.5.1 Cohesionless Soils

Side Resistance

The nominal side resistance of a drilled shaft in cohesionless soil can be expressed as the frictional resistance that develops over a cylindrical shear surface defined by the soil-shaft interface. As illustrated in Figure 13-4, the unit side resistance is directly proportional to the normal stress acting on the interface. By Equation 13-3, nominal side resistance is then given by:

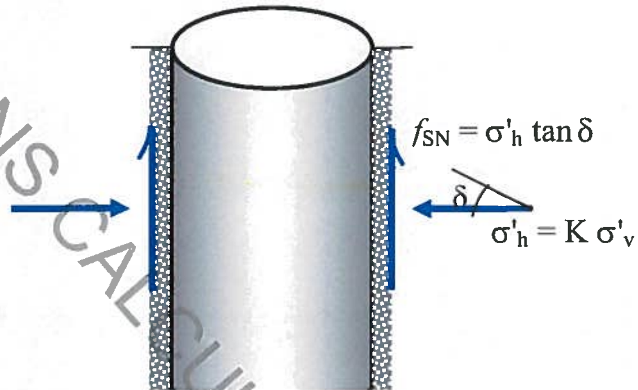


Figure 13-4 Frictional Model of Unit Side Resistance, Drilled Shaft in Cohesionless Soil

$$R_{SN} = \pi B \Delta z\, f_{SN} = \pi B \Delta z\left(\sigma'_v\, K \tan\delta\right) \qquad 13\text{-}5$$

where:

- R_{SN} = nominal side resistance
- B = shaft diameter
- Δz = thickness of the soil layer over which resistance is calculated
- σ'_v = average vertical effective stress over the depth interval Δz
- K = coefficient of horizontal soil stress ($K = \sigma'_h / \sigma'_v$)
- σ'_h = horizontal effective stress
- δ = effective stress angle of friction for the soil-shaft interface

For convenience, the following terms may be combined:

$$\beta = K \tan\delta \qquad 13\text{-}6$$

and

$$f_{SN} = \sigma'_v\, \beta \qquad 13\text{-}7$$

in which β = side resistance coefficient (hence the term "beta method") and f_{SN} = nominal unit side resistance. Several design models have been proposed for evaluating the β term in Equation 13-7. The approach currently recommended in AASHTO (2007) is the "O'Neill and Reese (1999)" method, in reference to equations presented in the previous version of this manual. In this approach, β is calculated solely as a function of depth below the ground surface, without explicit consideration of soil strength or the in-situ state of stress. This approach is based on fitting a design curve to values of β back-calculated from field load tests. A more rational approach, as presented for example by Chen and Kulhawy (2002), is to evaluate separately values of K and δ which are then combined to determine β. Results of research published over the past 15 years demonstrate that this approach can provide reliable estimates of side resistance and represents a rational method to incorporate soil strength and state of stress into design equations. It is recommended that designers employ this model, which is presented below. Additional commentary, including a comparison between the Reese and O'Neill method and the procedure presented herein, is given in Appendix C. It is noted further that this approach is applicable to all cohesionless soils, including those identified previously as cohesionless intermediate geomaterials.

The operative value of K, coefficient of horizontal soil stress, is a function of the in-situ (at-rest) value, K_o, and changes in horizontal stress that occur in response to drilled shaft construction, given by the ratio K/K_o. A rational first-order approximation is that $K/K_o = 1$, assuming there is no stress change induced by construction. For simple virgin loading-unloading of "normal soils" that are not cemented, the K_o value increases with overconsolidation ratio (OCR) and can be approximated according to (Mayne and Kulhawy, 1982):

$$K_o = (1 - \sin\phi')\, OCR^{\sin\phi'} \le K_p \qquad \text{13-8}$$

$$OCR = \frac{\sigma'_p}{\sigma'_v} \qquad \text{13-9}$$

where σ'_p = effective vertical preconsolidation stress. Note that the value of K_o as given by Equation 13-8 is limited to an upper-bound value corresponding to the coefficient of passive earth pressure, which, for a cohesionless soil, is given by:

$$K_p = \tan^2\left(45^\circ + \frac{\phi'}{2}\right) \qquad \text{13-10}$$

A variety of methods have been proposed for evaluation of either K_o or σ'_p by correlations with in-situ test results. For a practical estimate based on the most commonly used in-situ test (SPT) the following correlation is suggested by Mayne (2007):

$$\frac{\sigma'_p}{p_a} \approx 0.47(N_{60})^m \qquad \text{13-11}$$

where m = 0.6 for clean quartzitic sands and m = 0.8 for silty sands to sandy silts (*e.g.*, Piedmont residual soils), and p_a = atmospheric pressure in the same units as σ'_p (for example, 2,116 psf). Kulhawy and Chen (2007) suggest the following correlation provides a good fit for gravelly soils:

$$\frac{\sigma'_p}{p_a} = 0.15 N_{60} \qquad \text{13-12}$$

Substituting Equations 13-9 through 13-12 into Equation 13-6 leads to the following approximation of β for cohesionless soils:

$$\beta \approx (1-\sin\phi')\left(\frac{\sigma'_p}{\sigma'_v}\right)^{\sin\phi'}\tan\phi' \qquad \leq K_p\tan\phi' \qquad \text{13-13}$$

where σ'_p is estimated by Equation 13-11 for sandy soils and Equation 13-12 for gravelly soils. The value of β at shallow depths should be limited to the value corresponding to a depth of 7.5 ft, which corresponds to a vertical effective stress of approximately 900 psf. At lower confining stress, the correlations for effective stress friction angle and preconsolidation stress have not been validated and it would be prudent to limit β to the values corresponding to this depth. The value of β evaluated by Equation 13-13 is substituted into Equation 13-7 for determination of unit side resistance and this value is substituted into Equation 13-5 for determination of nominal side resistance R_{SN} for each layer of cohesionless soil. This model accounts for site-specific variations in horizontal stress and soil strength in a rational manner. The approach is also adaptable to other in-situ methods that allow measurement of horizontal soil stress and its variation with depth, such as pressuremeter test (PMT) and flat plate dilatometer test (DMT). The principal limitation of this approach relates to its reliance on N-values and the correlations employed between N-values, friction angle, and preconsolidation stress. Furthermore, resistance factors have not been established for this method through a probability-based calibration study with AASHTO LRFD load factors. Calibration to allowable stress design (ASD) using a factor of safety of FS = 2.5 yields a resistance factor for side resistance in cohesionless soils of $\varphi_S = 0.55$ as discussed in Chapter 10. Until the proper reliability-based calibration study is conducted, this value is recommended. Agencies are also encouraged to establish resistance factors based on local calibrations.

In the approach described above, it is assumed that no change in horizontal stress, and therefore no change in K, occurs as a result of construction. Experience demonstrates this assumption is valid for dry, slurry (wet-hole), and casing methods of construction with minimal sidewall disturbance, proper handling of slurry and casing, and prompt placement of concrete (Chen and Kulhawy, 2002). However, when these aspects of construction quality are not controlled properly, the coefficient K can be reduced to 2/3 of its initial in-situ value (K_o), or lower in extreme cases of soil caving. Judgment and accurate knowledge of field realities are therefore needed to assess the applicability of the design equations to individual projects. The recommended approach is to take the necessary measures that will assure quality of construction, thereby justifying the use of the design equations presented above.

When permanent casing is used and extends through layers of cohesionless soil, the basic concepts presented above are valid, with proper consideration of differences in the interface shear strength. AASHTO (2007) states that no specific data are available, but that casing reduction factors of 0.60 to 0.75 are commonly used. A common practice is to specify permanent casing in subsurface zones where scour is expected, in which case side resistance may be neglected over this depth.

For each strength or service limit state considered, side resistance in cohesionless soils must account for scour resulting from the design flood. The most significant effect is that all material above the total scour line is assumed to be removed and unavailable for axial support. Changes in subsurface stress also occur in response to removal of soil, and these changes will affect side resistance calculated by the β-method. This issue is considered in Section 13.5.

Illustrative Example 13-1 on the following page demonstrates evaluation of unit side resistance by the β-method as presented above.

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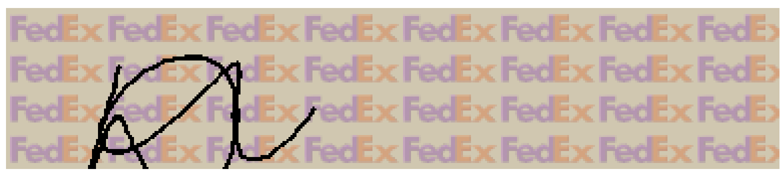

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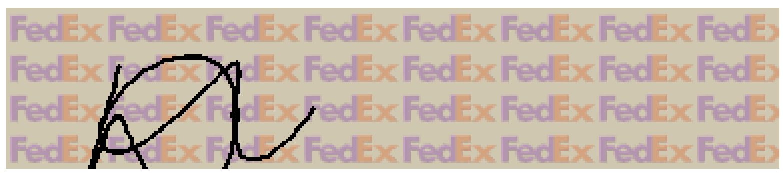

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