Jon Ritter

16 Chestnut Street, Suite 420
Foxboro, MA 02035
Tel (774) 264-0016
Fax (774) 215-5423

Melanie Bachman
Executive Director
Connecticut Siting Counsel
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – 14-20 Isham Road, West Hartford, CT**

Dear Ms. Bachman:

Please accept this letter as notification pursuant to R.C.S.A Section 16-50j-73, for construction that constitutes modification pursuant to R.C.S.A Section 16-50j-72(b) and 16-50j-73. In accordance with R.C.S.A Section 16-50j-73, a copy of this submission is being sent to the Mayor of West Hartford, Scott Slifka. A copy of this submission is also being sent to Mike Gassner, the property owner on which the tower is located. Additionally, a copy sent to American Tower Company, the Tower owner.

Clearwireless's Proposed Wireless Modifications

Clearwireless, LLC (Clearwire) achieved an initial approval from the Siting Council to install antennas as well as related ground equipment and currently maintains this equipment at the address listed above. The facility consists of a One-Hundred and Seventeen (117') foot high communications tower within a fenced in compound. This tower was approved August 11th 1997 with the condition that the tower should be no greater than 100' in height, included in this application is that approval document. Additionally included in this application is Petition No. 1039 which extended the existing allowable equipment up to 132' above the ground level without any applicable conditions.
Clearwire now intends to modify the facility as shown on the enclosed plans prepared by CHA Engineering and annexed hereto in Exhibit 1. The modifications will consist of adding one (1) new dish style antenna originally approved by the Siting Council on May 27, 2010 at the AGL of 119' and to add one (1) ½" Coax line connecting the ground equipment to this new Dish Antenna Also, the required guyed wires will be attached to support the modified antenna array. A structural analysis has been completed for the site and attached as Exhibit 1.

Clearwireless, LLC's Proposed Wireless Modifications Constitutes An "Exempt Modification"

The proposed modification to the above mentioned Facility constitutes an exempt modification of an existing facility provided for in R.C.S.A Section 16-50j-72(b)(2) and Council regulations promulgated pursuant thereto.

1) The proposed modification will not result in an increase in the height of the existing tower. There are currently antennas at a higher AGL than Clearwire proposes.
2) The modifications will remain entirely within the limits of the leased area. The modifications therefor, will not require the extension of the boundary.
3) The proposed modification does not increase the noise levels at the boundary by six (6) decibels or more under normal conditions.
4) Clearwire's proposed facility will not increase the cumulative radio frequency electromagnetic radiation power density at the Tower sites' boundary to or above the standard adopted by the Connecticut Department of Environmental Protection as set forth in Section 22a-162 of the Connecticut General Statutes and MPE limits established by the Federal Communications Commission. The proposed antenna is highly directional.
5) The facility has received all municipal zoning approvals and building permits. (Regs., Conn. State Agencies Section 16-50j-72))

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

Respectfully submitted,

Jonathan H Ritter

Jon Ritter 774.264.0016
On behalf of Clearwireless
c/o Tower Resource Management, Inc.
16 Chestnut Street, Suite 420
Foxboro, MA 02035

cc: **Town of West Hartford**
Town Coucil (Major) Scott Slifka
Mike Gassner (Property Owner)
American Tower (Tower Owner)

Exhibit 1

Site Plan

Exhibit 2

Structural Analysis

Exhibit 3

Emissions Report

**DEPARTMENT OF
COMMUNITY SERVICES**

August 11, 1997

Michael Gassner
10 Isham Road
West Hartford, CT 06107

Subject: 14-20 Isham Road - Site Plan Approval

Dear Mr. Gassner:

Donald R. Foster, Town Planner, has approved the site plan application for the subject property with the following conditions.

1. Site Plan approval is limited to 1,000 square feet of office area to be occupied by "General Communications" with a rooftop communication tower as an accessory use. The tower should be no greater than 100 feet in height.

2. The remaining portion of the building, approximately 13,500 square feet, should remain vacant until such time that a comprehensive site plan is submitted demonstrating compliance with the zoning regulations for additional uses.

Please submit to the Planning Office one (1) mylar of the approved plan, signed and sealed by the professional responsible for preparing the plan.

If you have comments or questions, please call me at 523-3123.

Very truly yours,

mla

Mila Limson
Senior Planner

c: Ron Van Winkle, Director of Community Services
Don Foster, Town Planner
Pat Alair, Asst. Corp. Counsel

14-20Isham

Petition No. 1039
MetroPCS
West Hartford, Connecticut
Staff Report
November 15, 2012

On September 28, 2012, the Connecticut Siting Council (Council) received a petition from MetroPCS for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the extension of an existing telecommunications facility at 14-20 Isham Road in West Hartford, Connecticut. Council member Michael Caron and Siting Analyst David Martin visited the site on November 8, 2012 to review the proposal. Alex Ignachuk of TRM, Inc. represented MetroPCS at the field review.

The existing telecommunications tower at 14-20 Isham Road is a 100-foot tall rooftop guyed lattice tower that reaches an overall height of 125 feet above ground level. It is owned by M+R Gassner Family II LLC. The existing tower has two wireless carrier placements. Nextel/Clearwire is at a centerline height of 123 feet above ground level and Verizon is at a centerline height of 108 feet above ground level. In addition, there are two unidentified whip antennas at the top of the tower. MetroPCS proposes to extend the height of the tower ten feet in order to install six antennas and associated equipment at a centerline height of 132 feet above ground level. MetroPCS could not install antennas lower than Verizon because the surrounding buildings would block its signal. MetroPCS would place its ground equipment on a steel frame to be installed on the roof of the building.

Isham Road is in downtown West Hartford. The development in this area is predominantly commercial; the Blue Back Square development is directly to the south of the building on which the tower is located.

Council staff calculates that the addition of MetroPCS's antennas would bring the facility's cumulative power density to 42.5% of the FCC limit for maximum permissible exposure.

The proposed tower extension is not expected to have any substantial adverse environmental effects. Staff recommends approval with the condition that MetroPCS implement the modifications identified in Appendix D of the Structural Analysis Report with Modification Design prepared by GPD Group dated October 19 and stamped by David Granger.

View of Existing Tower

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environmental | engineering | due diligence

RADIO FREQUENCY EMISSIONS ANALYSIS REPORT
EVALUATION OF HUMAN EXPOSURE POTENTIAL TO NON-IONIZING EMISSIONS

CLEARWIRE Existing Facility

Site ID: CT-HFD0063A

M&R Gassner
14 Isham Road
West Hartford, CT 06197

February 2, 2016

EBI Project Number: 6616000015

Site Compliance Summary	
Compliance Status:	COMPLIANT
Site total MPE% of FCC general public allowable limit:	6.53 %

EBI Consulting
environmental | engineering | due diligence

February 2, 2016

CLEARWIRE
Attn: James Burgess / TRM, Inc.
16 Chestnut Street
Suite 420
Foxborough, MA 02035

Emissions Analysis for Site: **CT-HFD0063A – M&R Gassner**

EBI Consulting was directed to analyze the proposed CLEARWIRE facility located at **14 Isham Road, West Hartford, CT**, for the purpose of determining whether the emissions from the Proposed CLEARWIRE Antenna Installation located on this property are within specified federal limits.

All information used in this report was analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter (μW/cm2). The number of $\mu W/cm^2$ calculated at each sample point is called the power density. The exposure limit for power density varies depending upon the frequencies being utilized. Wireless Carriers and Paging Services use different frequency bands each with different exposure limits, therefore it is necessary to report results and limits in terms of percent MPE rather than power density.

All results were compared to the FCC (Federal Communications Commission) radio frequency exposure rules, 47 CFR 1.1307(b)(1) – (b)(3), to determine compliance with the Maximum Permissible Exposure (MPE) limits for General Population/Uncontrolled environments as defined below.

General population/uncontrolled exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general public would always be considered under this category when exposure is not employment related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area.

Public exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter ($\mu W/cm^2$). The general population exposure limits for the 2495 MHz to 2690 MHz (BRS Band) and the 18 GHz and 21 GHz frequency bands is 1000 $\mu W/cm^2$. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Additional details can be found in FCC OET 65.

CALCULATIONS

Calculations were done for the proposed CLEARWIRE Wireless antenna facility located at **14 Isham Road, West Hartford, CT**, using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since CLEARWIRE is proposing highly focused directional panel antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was focused at the base of the tower. For this report the sample point is the top of a 6 foot person standing at the base of the tower.

For all calculations, all equipment was calculated using the following assumptions:

1) 2 WiMAX channels (2495 MHz to 2690 MHz BRS Band) were considered for each sector of the proposed installation. These Channels have a maximum transmit power of 20 Watts per Channel at the radio.

2) 2 Microwave channels (23 GHz Band) were considered for the proposed installation. These Channels have a maximum transmit power of 1 Watt per Channel at the radio.

3) 1 Microwave channel (18 GHz Band) was considered for the proposed installation. These Channels have a maximum transmit power of 1 Watt per Channel at the radio.

4) All radios at the proposed installation were considered to be running at full power and were uncombined in their RF transmissions paths per carrier prescribed configuration. Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.

5) For the following calculations the sample point was the top of a six foot person standing at the base of the tower. The maximum gain of the antenna per the antenna manufactures supplied specifications minus 10 dB was used in this direction for broadcast in the 2495 MHz to 2690 MHz BRS Band and 30 dB for Microwave broadcast (23 GHz and 18 GHz) due to their extremely focused broadcast pattern. These values are very conservative estimates as gain reductions for these particular antennas are typically much higher in this direction.

6) The antennas used in this modeling are the **Argus LLPX310R-V4** for transmission in the 2495 MHz to 2990 MHz (BRS Band), the **Andrew VHLP1-23** for microwave transmission in the 23 GHz frequency band and the **Andrew VHLP2-18** for microwave transmission in the 18 GHz frequency band. This is based on feedback from the carrier with regards to anticipated antenna selection. Maximum gain values for all antennas are listed in the Inventory and Power Data table below. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB for broadcast in the 2495 MHz to 2690 MHz (BRS Band) and 30 dB for Microwave broadcast (23 GHz and 18 GHz) due to their extremely focused broadcast pattern, were used for all calculations. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

7) The antenna mounting height centerline of the proposed antennas is **114 feet** above ground level (AGL) for the three (3) **Argus LLPX310R-V4 antennas, 110 feet** above ground for the **two (2) Andrew VHLP1-23** microwave antennas and **119 feet** above ground for the **one (1) Andrew VHLP2-18** microwave antenna.

8) Emissions values for additional carriers were taken from the Connecticut Siting Council active database. Values in this database are provided by the individual carriers themselves.

All calculations were done with respect to uncontrolled / general public threshold limits.

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environmental | engineering | due diligence

CLEARWIRE Site Inventory and Power Data

Sector:	A	Sector:	B	Sector:	C
Antenna #:	**1**	Antenna #:	**1**	Antenna #:	**1**
Make / Model:	Argus LLPX310R-V4	Make / Model:	Argus LLPX310R-V4	Make / Model:	Argus LLPX310R-V4
Gain:	15.59 dBd	Gain:	15.59 dBd	Gain:	15.59 dBd
Height (AGL):	114 feet	Height (AGL):	114 feet	Height (AGL):	114 feet
Azimuth (Degrees):	25	Azimuth (Degrees):	145	Azimuth (Degrees):	275
Frequency Bands	2495 MHz to 2690 MHz (BRS)	Frequency Bands	2495 MHz to 2690 MHz (BRS)	Frequency Bands	2495 MHz to 2690 MHz (BRS)
Channel Count	2	Channel Count	2	Channel Count	2
Total TX Power(W):	40	Total TX Power(W):	40	Total TX Power(W):	40
ERP (W):	1,448.92	ERP (W):	1,448.92	ERP (W):	1,448.92
Antenna A1 MPE%	**0.96**	Antenna B1 MPE%	**0.96**	Antenna C1 MPE%	**0.96**
Antenna #:	**Microwave 1**	Antenna #:	**Microwave 2**	Antenna #:	**Microwave 3**
Make / Model:	Andrew VHLP1-23	Make / Model:	Andrew VHLP1-23	Make / Model:	Andrew VHLP2-18
Gain:	33.15 dBd	Gain:	33.15 dBd	Gain:	36.15 dBd
Height (AGL):	110	Height (AGL):	110	Height (AGL):	119
Azimuth (Degrees):	152	Azimuth (Degrees):	200	Azimuth (Degrees):	220
Frequency Bands	23 GHz	Frequency Bands	23 GHz	Frequency Bands	18 GHz
Channel Count	1	Channel Count	1	Channel Count	1
Total TX Power(W):	0.60	Total TX Power(W):	0.60	Total TX Power(W):	0.60
ERP (W):	1239.23	ERP (W):	1239.23	ERP (W):	2060.49
Antenna A2 MPE%	**0.004%**	Antenna B2 MPE%	**0.004%**	Antenna C2 MPE%	**0.006%**

Site Composite MPE%	
Carrier	**MPE%**
CLEARWIRE – Max per sector (BRS)	**0.96 %**
Clearwire MW1 (23 GHz)	**0.004 %**
Clearwire MW2 (23 GHz)	**0.004 %**
Clearwire MW3 (18 GHz)	**0.006 %**
Verizon Wireless	4.20 %
Nextel	0.56 %
MetroPCS	0.80 %
Site Total MPE %:	**6.53 %**

CLEARWIRE Sector 1 Total:	0.96 %
CLEARWIRE Sector 2 Total:	0.96 %
CLEARWIRE Sector 3 Total:	0.96 %
CLEARWIRE MW1	0.004 %
CLEARWIRE MW2	0.004 %
CLEARWIRE MW3	0.006 %
Site Total:	6.53 %

CLEARWIRE _ Per Sector (with all Microwave)	**# Channels**	**Watts ERP (Per Channel)**	**Height (feet)**	**Total Power Density ($\mu W/cm^2$)**	**Frequency (MHz)**	**Allowable MPE ($\mu W/cm^2$)**	**Calculated % MPE**
CLEARWIRE 2495 MHz to 2690 MHz (BRS)	2	724.49	114	4.47	2495	1000	0.96 %
Clearwire MW1 (23 GHz)	1	1239.23	110	0.04	23000	1000	0.004 %
Clearwire MW2 (23 GHz)	1	1239.23	110	0.04	23000	1000	0.004 %
Clearwire MW3 (18 GHz)	1	2060.49	119	0.06	18000	1000	0.006 %
						Total:	0.97 %

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Summary

All calculations performed for this analysis yielded results that were **within** the allowable limits for general public exposure to RF Emissions.

The anticipated maximum composite contributions from the CLEARWIRE facility as well as the site composite emissions value with regards to compliance with FCC's allowable limits for general public exposure to RF Emissions are shown here:

CLEARWIRE Sector Totals	Power Density Value (%)
Sector 1:	0.96 %
Sector 2:	0.96 %
Sector 3 :	0.96 %
CLEARWIRE Maximum Total (per sector):	0.96 %
Clearwire Total for Microwave:	0.014%
Site Total:	6.53 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **6.53%** of the allowable FCC established general public limit sampled at the ground level. This is based upon values listed in the Connecticut Siting Council database for existing carrier emissions.

FCC guidelines state that if a site is found to be out of compliance (over allowable thresholds), that carriers over a 5% contribution to the composite value will require measures to bring the site into compliance. For this facility, the composite values calculated were well within the allowable 100% threshold standard per the federal government.

Scott Heffernan
RF Engineering Director

EBI Consulting
21 B Street
Burlington, MA 01803

clearwire®
TECHNOLOGIES, INC.

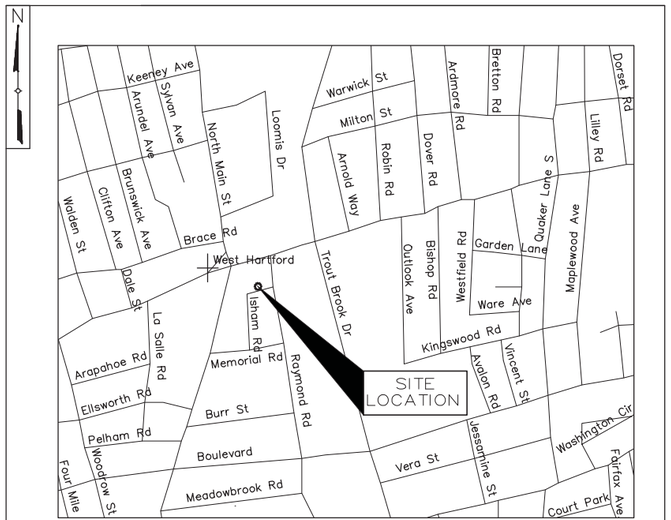
M & R GASSNER
HOST ID#: CT0765
CW ID#: CT-HFD0063A

SITE ADDRESS

20 ISHAM ROAD
WEST HARTFORD, CT 06107

SHT. NO.	DESCRIPTION	REV NO	REVISION DATE
T01	TITLE SHEET	1	03/14/16
C01	ROOF PLAN & GENERAL NOTES	1	03/14/16
C02	BUILDING & TOWER ELEVATION	1	03/14/16
C03	STRUCTURAL NOTES & DETAILS	1	03/14/16
C04	STRUCTURAL NOTES & DETAILS	1	03/14/16
C05	ANTENNA SCHEDULE & DETAILS	1	03/14/16
C06	EQUIPMENT SPECIFICATIONS & BILL OF MATERIALS	1	03/14/16

SHEET INDEX



FROM 100 CORPORATE PLACE, ROCKY HILL, CT.:

HEAD SOUTH ON CORPORATE PL TOWARD WEST ST. (322 FT) TURN LEFT AT WEST ST. (0.2 MI) TURN RIGHT TO MERGE ONTO I-91 N TOWARD MARTFORD. (8.7 MI) TAKE EXIT 32A ON THE LEFT TO MERGE ONTO I-84 W TOWARD WATERBURY. (4.9 MI) TAKE EXIT 43 TOWARD PARK RD/W HARTFORD CENTER. (0.4 MI) MERGE ONTO TROUT BROOK CON. (0.1 MI) TURN LEFT AT PARK RD. (443 FT) TAKE THE 1ST RIGHT ONTO RAYMOND RD. (0.5 MI) TURN LEFT AT ISHAM RD. DESTINATION WILL BE ON THE LEFT

VICINITY MAP — NO SCALE

PROJECT DESCRIPTION:	PROPOSED ADDITION OF (1) DISH ANTENNA ON EXISTING TOWER. ADDITION WILL REQUIRE REATTACHMENT OF EXISTING GUYS AND ADDITION OF NEW GUYS TO NEW TORQUE ARM. SITE IS AN UNMANNED TELECOMMUNICATIONS FACILITY.
SITE NAME:	M & R GASSNER
CW ID#:	CT-HFD0063A
SITE ADDRESS:	20 ISHAM ROAD WEST HARTFORD, CT 06107
COUNTY:	HARTFORD
COORDINATES:	N 41.761417° (NAD 83) W -72.740694° (NAD 83)
PROPERTY OWNER:	M & R GASSNER
CONTACT PERSON:	PHIL COTE (860) 794-1142
APPLICANT:	CLEARWIRE TECHNOLOGIES, INC. 5808 LAKE WASHINGTON BLVD. NE STE. 300 KIRKLAND, WA 98033
ENGINEER:	CHA CONSULTING, INC. 16 MAIN STREET WEST SUITE 830 ROCHESTER, NY 14614-1607 CHRISTOPHER J.B. JEDRICH, P.E. (585) 262-2640

PROJECT SUMMARY

clearwire®
TECHNOLOGIES, INC.
5808 LAKE WASHINGTON
BLVD. NE, STE. 300
KIRKLAND, WA 98033
OFFICE: (425) 216-7600
FAX: (425) 216-7900

CHA
Powers Building, 16 West Main Street, Suite 830
Rochester, NY 14614-1607
Main: (585) 262-2640 • www.chacompanies.com

CHA PROJECT NO:
30119 – 1003

NO.	SUBMITTAL		
0	08/27/15	ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ
1	03/14/16	RE-ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ

SITE NAME:
M & R GASSNER

CW ID#:
CT-HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T01

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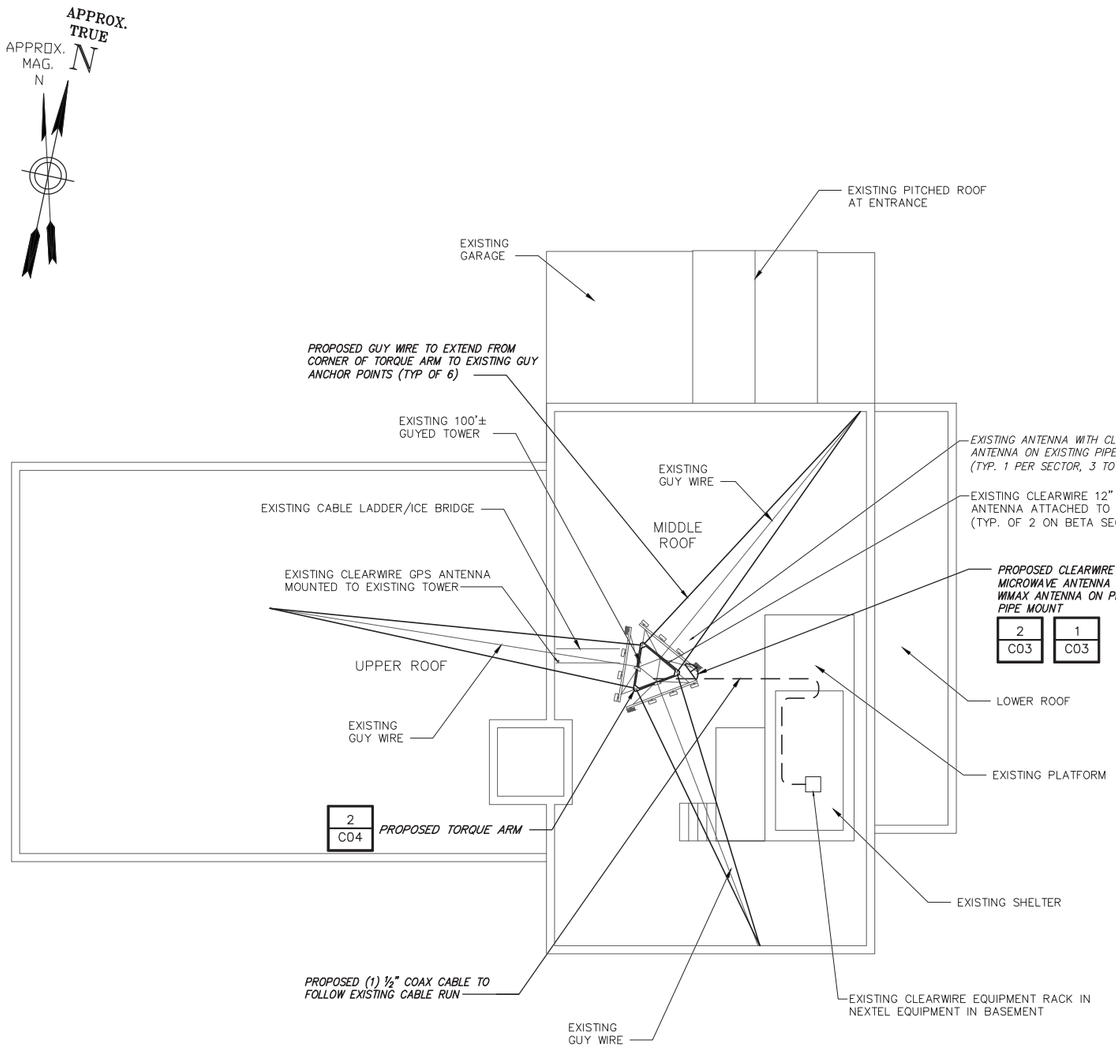

IN NO CASE SHALL CLEARWIRE'S MICROWAVE OR WIMAX ANTENNAS BE INSTALLED SUCH THAT THE TIP–TO–TIP DISTANCE BETWEEN ANY CLEARWIRE ANTENNA AND ANY SPRINT ANTENNA IS LESS THAN 2 FEET. IN ADDITION, NO MICROWAVE ANTENNA SHALL BE LOCATED WITHIN 2 FEET OF SPRINT'S RAD CENTER AND ORIENTED SUCH THAT THE MICROWAVE AZIMUTH CROSSES SPRINT'S ANTENNA AZIMUTHS FOR THAT SECTOR OR IS AIMED DIRECTLY AT ANY SPRINT ANTENNA.

1 – ROOF PLAN

GRAPHIC SCALE

20 0 10 20

IN FEET

GENERAL NOTES

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO EXAMINE ALL PLAN SHEETS AND SPECIFICATIONS AND COORDINATE HIS WORK WITH THE WORK OF ALL OTHER CONTRACTORS TO ENSURE THAT WORK PROGRESSION IS NOT INTERRUPTED.
2. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING A NEAT AND ORDERLY SITE, YARD AND GROUNDS. REMOVE AND DISPOSE OFF SITE ALL RUBBISH, WASTE MATERIALS, LITTER, AND ALL FOREIGN SUBSTANCES. REMOVE PETRO–CHEMICAL SPILLS, STAINS AND OTHER FOREIGN DEPOSITS. RAKE GROUNDS TO A SMOOTH EVEN–TEXTURED SURFACE.
3. THE OWNER OR OWNER'S REPRESENTATIVE SHALL BE NOTIFIED IN WRITING OF ANY CONDITIONS THAT VARY FROM THOSE SHOWN ON THE PLANS. THE CONTRACTOR'S WORK SHALL NOT VARY FROM THE PLANS WITHOUT THE EXPRESSED APPROVAL OF THE OWNER OR OWNER'S REPRESENTATIVE.
4. THE CONTRACTOR IS INSTRUCTED TO COOPERATE WITH ANY AND ALL OTHER CONTRACTORS PERFORMING WORK ON THIS JOB SITE DURING THE PERFORMANCE OF THIS CONTRACT.
5. THE CONTRACTOR SHALL RESTORE ALL PUBLIC OR PRIVATE PROPERTY DAMAGED OR REMOVED TO AT LEAST AS GOOD OF CONDITION AS BEFORE DISTURBED AS DETERMINED BY THE OWNER OR OWNER'S REPRESENTATIVE.
6. THE CONTRACTOR SHALL COMPLY WITH ALL REQUIRED PERMITS.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING, AND INCURRING THE COST OF ALL REQUIRED PERMITS, INSPECTIONS, CERTIFICATES, ETC.
8. ALL UTILITY WORK INVOLVING CONNECTIONS TO EXISTING SYSTEMS SHALL BE COORDINATED WITH THE OWNER OR OWNER'S REPRESENTATIVE AND THE UTILITY OWNER. NOTIFY THE OWNER OR OWNER'S REPRESENTATIVE AND THE UTILITY OWNER BEFORE EACH AND EVERY CONNECTION TO EXISTING SYSTEMS IS MADE.

BASEMAP NOTES:

1. BASEMAP FROM A FIELD VISIT PERFORMED BY CLOUGH HARBOUR & ASSOCIATES ON NOVEMBER 4, 2009, AND DOES NOT REPRESENT AN ACTUAL FIELD SURVEY.

GRAPHIC SCALE

5 0 2.5 5

IN FEET

clearwire TECHNOLOGIES, INC.
5808 LAKE WASHINGTON BLVD. NE STE. 300
KIRKLAND, WA 98033
OFFICE: (425) 216–7600
FAX: (425) 216–7900

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Rochester, NY 14614-1607
Main: (585) 262-2640 • www.chacompanies.com

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	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ

STATE OF CONNECTICUT
CHRISTOPHER J.B. JEDRICH
No. 21640
LICENSED PROFESSIONAL ENGINEER

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

SITE NAME:
M & R GASSNER

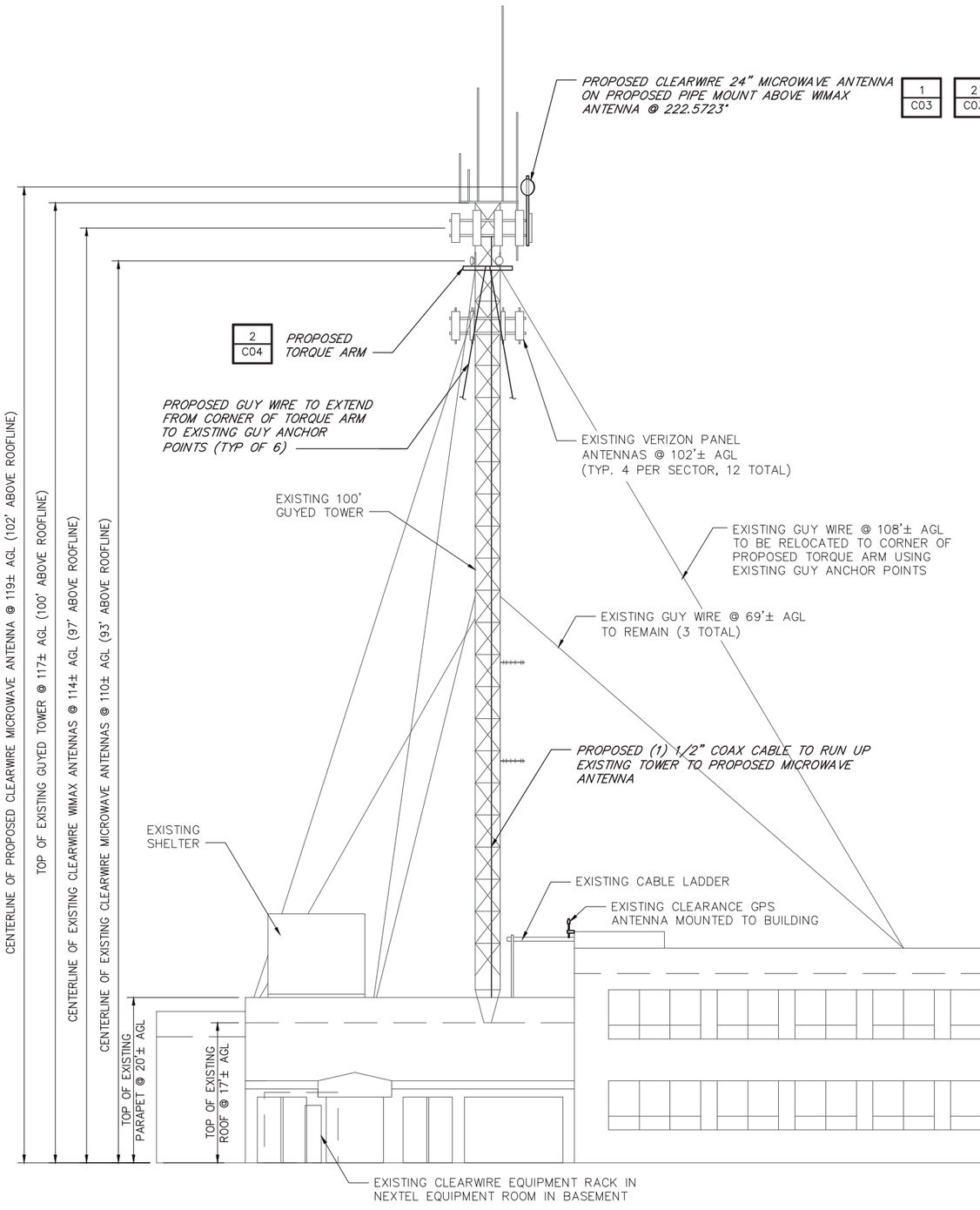
CW ID#:
CT–HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

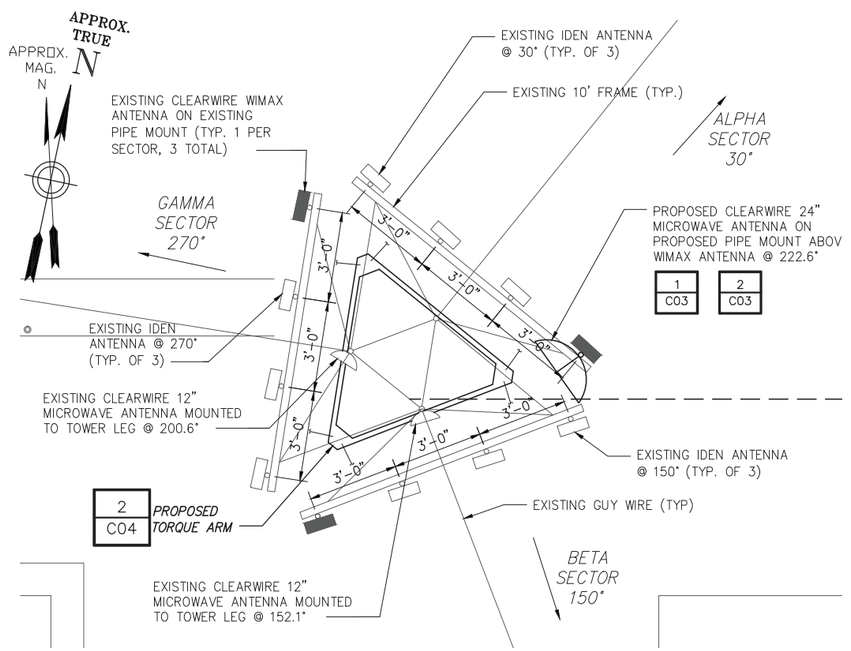
SHEET TITLE
BUILDING & TOWER ELEVATION

SHEET NUMBER
C01

File: V:\PROJECTS\ANY\K4\30119\CADD_ACAD\CT–HFD0063A_C01.DWG Saved: 3/11/2016 5:04:51 PM PLotted: 3/14/2016 2:58:05 PM User: Farone, Michael



1 / – NORTH BUILDING & TOWER ELEVATION
NO SCALE



2 / – PROPOSED MICROWAVE ANTENNA CONFIGURATION
NO SCALE

clearwire TECHNOLOGIES, INC.
5808 LAKE WASHINGTON BLVD. NE, STE. 300
KIRKLAND, WA 98033
OFFICE: (425) 216-7600
FAX: (425) 216-7900

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STATE OF CONNECTICUT
CHRISTOPHER J.B. JEDRICH
No. 21640
LICENSED PROFESSIONAL ENGINEER

SITE NAME:
M & R GASSNER

CW ID#:
CT-HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
BUILDING & TOWER ELEVATION

SHEET NUMBER
C02

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GENERAL NOTES

1. ALL DIMENSIONS TO, OF, AND ON EXISTING BUILDINGS SHALL BE VERIFIED IN FIELD BY CONTRACTOR WITH ALL DISCREPANCIES REPORTED TO THE ENGINEER IN WRITING.
2. DO NOT CHANGE SIZE NOR SPACING OF STRUCTURAL ELEMENTS.
3. DETAILS SHOWN ARE TYPICAL; SIMILAR DETAILS APPLY TO SIMILAR CONDITIONS UNLESS OTHERWISE NOTED.
4. THESE DRAWINGS DO NOT INCLUDE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY.
5. BRACE STRUCTURES UNTIL ALL STRUCTURAL ELEMENTS NEEDED FOR STABILITY ARE INSTALLED. THESE ELEMENTS ARE AS FOLLOWS: LATERAL BRACING, ANCHOR BOLTS, ETC.
6. DETERMINE EXACT LOCATION OF EXISTING UTILITIES, GROUNDS, DRAINS, DRAIN PIPES, VENTS, ETC. BEFORE COMMENCING WORK.
7. INCORRECTLY FABRICATED, DAMAGED, OR OTHERWISE MISFITTING OR NONCONFORMING MATERIALS OR CONDITIONS SHALL BE REPORTED TO THE OWNER PRIOR TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE APPROVAL.
8. EACH CONTRACTOR SHALL COOPERATE WITH THE OWNER'S REPRESENTATIVE, AND COORDINATE HIS WORK WITH THE WORK OF OTHERS.
9. CONTRACTOR TO FOLLOW ALL STATE, LOCAL AND NATIONAL CODES AS APPLICABLE.

DESIGN DATA

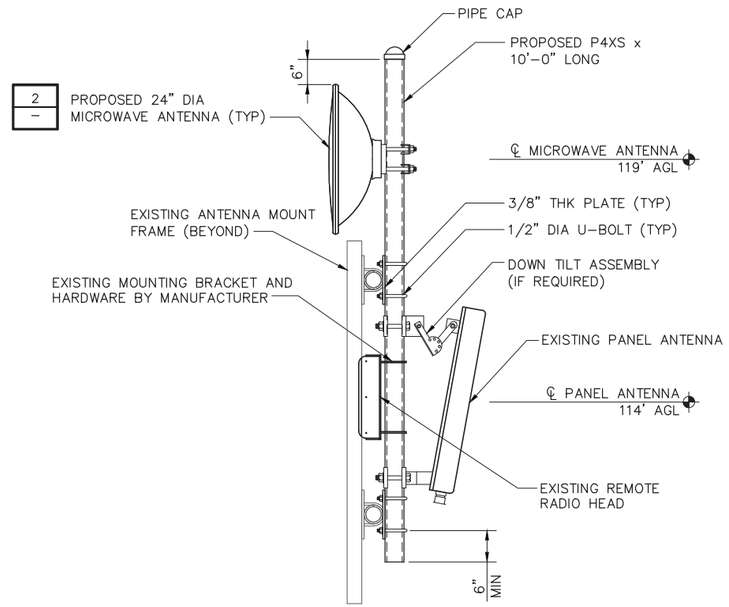
LIVE LOADS: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE
WIND LOADS: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE
ICE LOADS: 1/2" RADIAL ON ALL COMPONENTS & CABLE
SNOW LOAD: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE
SEISMIC LOADS: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE

ANTENNA SUPPORT BRACKET NOTES

1. DESIGN RESPONSIBILITY OF ANTENNA MOUNTING BRACKETS, POLES AND ALL COMPONENTS THERE OF AND ATTACHMENT THERE TO SHALL BE THE RESPONSIBILITY OF THE MANUFACTURER. MFR. SHALL PROVIDE TO THE ENGINEER FOR APPROVAL, DRAWINGS DETAILING ALL COMPONENTS OF THE ASSEMBLY, INCLUDING CONNECTIONS, DESIGN LOADS, AND ALL OTHER PERTINENT DATA. ALL SUBMISSIONS SHALL BEAR THE STAMP AND SIGNATURE OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE THE WORK IS BEING PERFORMED.
2. BRACKETS SHALL BE DESIGNED TO SUPPORT CURRENT AND FUTURE PANEL ANTENNAS AND COAXIAL CABLES AS SHOWN.

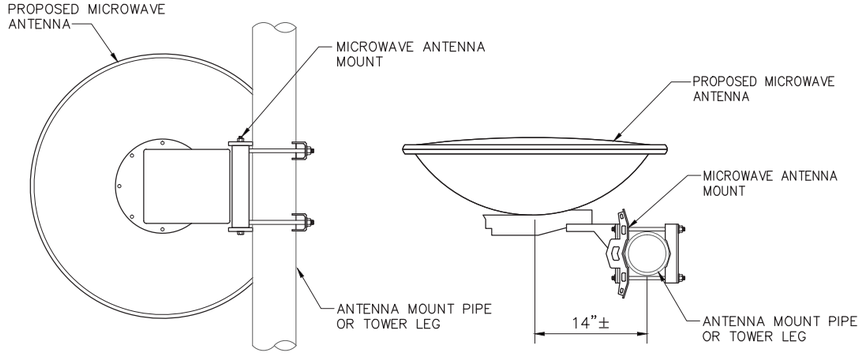
STRUCTURAL STEEL NOTES

1. STRUCTURAL STEEL SHALL CONFORM TO THE LATEST EDITION OF THE AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS". ALL W-SHAPES SHALL BE ASTM A992. ALL STEEL PIPE SHALL BE ASTM A53 GRADE B. ALL RECTANGULAR HOLLOW STRUCTURAL STEEL SHALL BE ASTM A500. ALL OTHER STEEL SHALL BE ASTM A-36.
2. ALL INTERIOR STRUCTURAL STEEL USED SHALL BE, WHEN DELIVERED, FINISHED WITH ONE COAT FABRICATOR'S NON-LEAD, RED OXIDE PRIMER. PRIMING SHALL BE PERFORMED AFTER SHOP FABRICATION TO THE GREATEST EXTENT POSSIBLE. ALL DINGS, SCRAPES, MARS, AND WELDS IN THE PRIMED AREAS SHALL BE REPAIRED BY FIELD TOUCHUP PRIOR TO COMPLETION OF THE WORK.
3. ALL EXTERIOR STEEL WORK SHALL BE GALVANIZED IN ACCORDANCE WITH SPECIFICATION ASTM A123 UNLESS OTHERWISE NOTED. GALVANIZING SHALL BE PERFORMED AFTER SHOP FABRICATION TO THE GREATEST EXTENT POSSIBLE. ALL DINGS, SCRAPES, MARS, AND WELDS IN THE GALVANIZED AREAS SHALL BE REPAIRED BY FIELD TOUCHUP PRIOR TO COMPLETION OF THE WORK USING ZRC COLD GALVANIZING COMPOUND OR APPROVED EQUAL.
4. DO NOT PLACE HOLES THROUGH STRUCTURAL STEEL MEMBERS EXCEPT AS SHOWN AND DETAILED ON STRUCTURAL DRAWINGS.
5. CONNECTIONS:
   A. ALL WELDING SHALL BE DONE BY A CERTIFIED WELDER USING E70XX ELECTRODES AND WELDING SHALL CONFORM TO AISC AND AWS D1.1. WHERE FILLET WELD SIZES ARE NOT SHOWN, PROVIDE THE MINIMUM SIZE PER TABLE J2.4 IN THE AISC "MANUAL OF STEEL CONSTRUCTION ", 9TH EDITION. AT THE COMPLETION OF WELDING, ALL DAMAGE TO GALVANIZED COATING SHALL BE REPAIRED.
   B. BOLTED CONNECTIONS SHALL USE BEARING TYPE GALVANIZED ASTM A325 BOLTS (3/4" DIA.) AND SHALL HAVE MINIMUM OF TWO BOLTS UNLESS NOTED OTHERWISE.
   C. NON-STRUCTURAL CONNECTIONS FOR STEEL GRATING MAY USE 5/8" DIA. GALVANIZED ASTM A 307 BOLTS UNLESS NOTED OTHERWISE.
   D. CONNECTION DESIGN BY FABRICATOR WILL BE SUBJECT TO REVIEW AND APPROVAL BY ENGINEER.
   E. AT ALL BOLTED CONNECTIONS, PROVIDE A NUT AND A WASHER CONFORMING TO ASTM F436. PROVIDE A WASHER MATCHING THE BOLT SIZE UNDER ALL BOLT HEADS AND NUTS THAT WILL BE TURNED IN TIGHTENING THE CONNECTION. TIGHTEN TO AISC "SNUGTIGHT" CRITERIA.



2 — PROPOSED 24" DIA MICROWAVE ANTENNA (TYP)

1 — ALPHA SECTOR ANTENNA MOUNTING DETAIL
SCALE: NTS



2 — MICROWAVE ANTENNA MOUNTING DETAIL
SCALE: NTS

clearwire TECHNOLOGIES, INC.
5808 LAKE WASHINGTON BLVD. NE, STE. 300
KIRKLAND, WA 98033
OFFICE: (425) 216-7600
FAX: (425) 216-7900

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Powers Building, 16 West Main Street, Suite 830
Rochester, NY 14614-1607
Main: (585) 262-2640 • www.chacompanies.com

CHA PROJECT NO:
30119 - 1003

NO.	SUBMITTAL		
0	08/27/15	ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ
1	03/14/16	RE-ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ

STATE OF CONNECTICUT
CHRISTOPHER J.B. JEDRICH
No. 21640
LICENSED PROFESSIONAL ENGINEER

SITE NAME:
M & R GASSNER

CW ID#:
CT-HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
STRUCTURAL NOTES & DETAILS

SHEET NUMBER
C03

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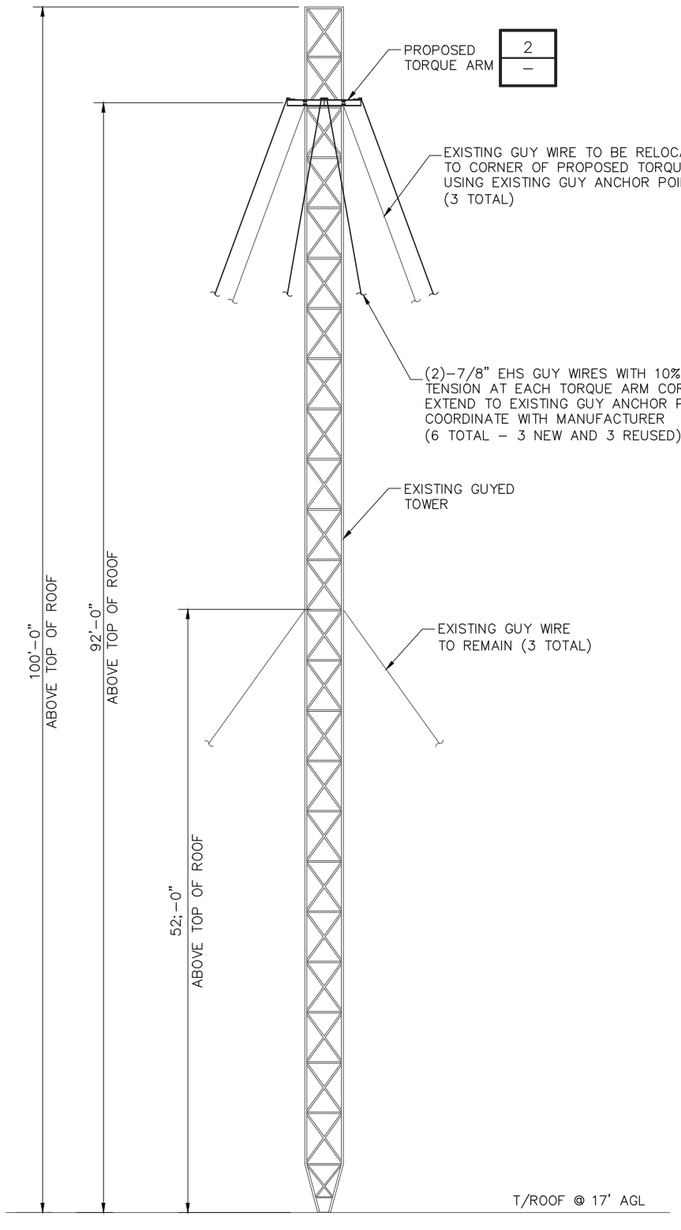
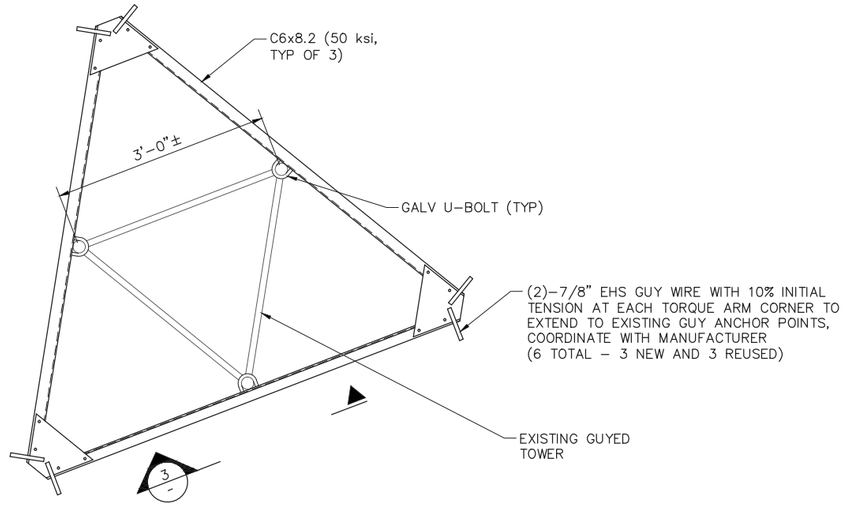


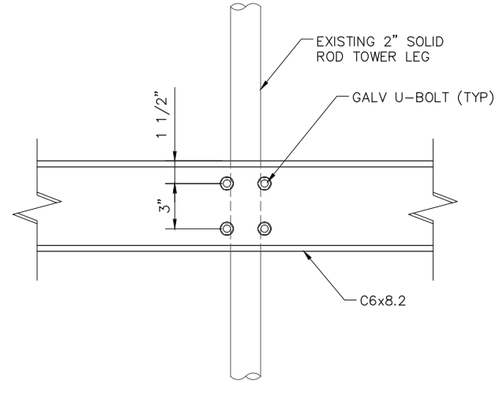
1 – TOWER ELEVATION
SCALE: NTS



2 – TORQUE ARM PLAN
SCALE: NTS

NOTE:

CONTACTOR TO COORDINATE TORQUE ARM DESIGN AND FABRICATION WITH VALMONT STRUCTURES. TOWER FACE WIDTH IS 3'–0" AND CHANNEL SIZE IS C6x8.2 w/A YIELD STRESS OF 50 ksi. TORQUE ARM STYLE IS BAT WING. THIS INFORMATION IS TO BE PROVIDED TO VALMONT STRUCTURES FOR FABRICATION OF TORQUE ARM. TORQUE ARM TO BE DESIGNED TO RESIST MAXIMUM GUY FORCE TENSION OF 20 k.



3 – SECTION "A"
SCALE: NTS

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STATE OF CONNECTICUT
CHRISTOPHER J.B. JEDRICH
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LICENSED PROFESSIONAL ENGINEER

SITE NAME:
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CW ID#:
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SITE ADDRESS:
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W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
STRUCTURAL DETAILS

SHEET NUMBER
C04

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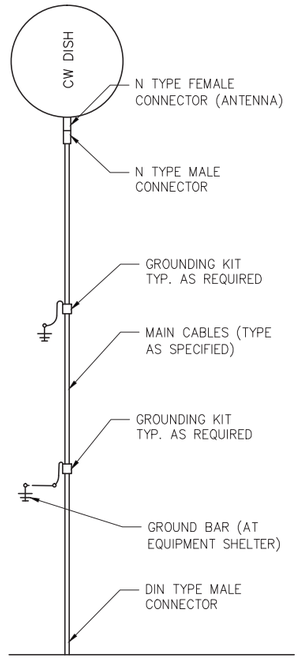
MICROWAVE BACKHAUL						
LINE	BAND 1	BAND 2	BAND 3	BAND 4		COMMENT
1	GREY					CLOSEST TO 0° TN
2	GREY	GREY				2nd CLOCKWISE DISH
3	GREY	GREY	GREY			3rd CLOCKWISE DISH ETC.
4	GREY	GREY	GREY	GREY		
5	GREY	GREY	GREY	GREY	ETC.	
DPRM	GREY'S (AS ABOVE)		RED			
1+1	GREY'S (AS ABOVE)		RED			

SAMSUNG WIMAX					
SECTORS	1st DAP	2nd DAP			COMMENT
ALPHA	RED	VIOLET			FIBER/POWER – CLOSEST TO 0° TN
BETA	BLUE	WHITE			FIBER/POWER
GAMMA	YELLOW	ORANGE			FIBER/POWER
RF JUMPERS	DAP TO ANTENNA (COLORS DEFINED ABOVE)				
1st JUMPER	SECTOR COLOR				
2nd JUMPER	SECTOR COLOR	SECTOR COLOR			
3rd JUMPER	SECTOR COLOR	SECTOR COLOR	SECTOR COLOR		
4th JUMPER	SECTOR COLOR	SECTOR COLOR	SECTOR COLOR	SECTOR COLOR	

1 – ANTENNA COLOR CODING
NO SCALE



NOTES:
1. SEE LAYOUT DRAWINGS FOR DISH LOCATION.
2. DO NOT INSTALL DISH GROUND KIT ON CABLE BEND.
3. CW PANEL PIPE MAST TO BE GROUNDED.

2 – CABLE INSTALLATION DIAGRAM
NO SCALE

PROPOSED CLEARWIRE MICROWAVE DISH ANTENNA AND CABLE SCHEDULE															
SECTOR	ANTENNA	AZIMUTH (TN)	DOWN TILT–M	DOWN TILT–E	RAD CENTER (FT. AGL)	MAKE	MODEL	FEED	CABLE SIZE	CABLE MANUF.	CABLE LENGTH	JUMPER SIZE	JUMPER MANUF.	JUMPER MODEL	JUMPER LENGTH–TOP	JUMPER LENGTH–BOT
ALPHA	MW DISH	222.57°	–	–	119'–0"	ANDREW	VHLP2–18	BACK	1/2"	EUPEN EC4–50	205'±	1/2"	–	–	–	–

EXISTING CLEARWIRE MICROWAVE DISH ANTENNA AND CABLE SCHEDULE															
SECTOR	ANTENNA	AZIMUTH (TN)	DOWN TILT–M	DOWN TILT–E	RAD CENTER (FT. AGL)	MAKE	MODEL	FEED	CABLE SIZE	CABLE MANUF.	CABLE LENGTH	JUMPER SIZE	JUMPER MANUF.	JUMPER MODEL	JUMPER LENGTH–TOP	JUMPER LENGTH–BOT
BETA	MW DISH	152.1°	–	–	110'–0"	ANDREW	VHLP1–23	BACK	1/2"	EUPEN EC4–50	195'±	1/2"	–	–	–	–
BETA	MW DISH	200.6°	–	–	110'–0"	ANDREW	VHLP1–23	BACK	1/2"	EUPEN EC4–50	195'±	1/2"	–	–	–	–

3 – PROPOSED AND EXISTING ANTENNA AND CABLE SCHEDULES
NO SCALE

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CHA PROJECT NO:
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SHEET TITLE
ANTENNA SCHEDULE & DETAILS

SHEET NUMBER
C05

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Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

VHLP2-18-2GR/B

0.6 m | 2 ft ValuLine® High Performance Low Profile Antenna, single-polarized, 17.700–19.700 GHz, PBR220, gray antenna, polymer gray radome without flash, standard pack–one-piece reflector

General Specifications

Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Diameter, nominal	0.6 m | 2 ft
Packing	Compact pack
Radome Color	Gray
Radome Material	Polymer
Reflector Construction	One-piece reflector
Antenna Input	PBR220
Antenna Color	Gray
Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Diameter, nominal	0.6 m | 2 ft
Flash Included	No
Polarization	Single

Electrical Specifications

Operating Frequency Band	17.700 – 19.700 GHz
Beamwidth, Horizontal	2.1 °
Beamwidth, Vertical	2.1 °
Cross Polarization Discrimination (XPD)	30 dB
Electrical Compliance	Brazil Anatel Class 2 | Canada SRSP 317.8 Part A | ETSI 302 217 Class 3 | US FCC Part 101A
Front-to-Back Ratio	66 dB
Gain, Low Band	38.4 dBi
Gain, Mid Band	38.9 dBi
Gain, Top Band	39.1 dBi
Operating Frequency Band	17.700 – 19.700 GHz
Radiation Pattern Envelope Reference (RPE)	7204B
Return Loss	17.7 dB
VSWR	1.30

Mechanical Specifications

Fine Azimuth Adjustment	±15°
Fine Elevation Adjustment	±15°
Mounting Pipe Diameter	48 mm–115 mm | 1.9 in–4.5 in
Net Weight	11 kg | 25 lb

1 / – 2 FT MW ANTENNA SPEC SHEET (OR EQUIVALENT)

NO SCALE

BILL OF MATERIALS

ITEM	DESCRIPTION	QTY (EA)	DIMENSIONS	WEIGHT (LBS)	PART/MODEL #
1	CW DISH ANTENNA – ALPHA SECTOR	1	2.5'	6LBS + MOUNTING HW	ANDREW VHLP2.5–1835. OR EQUIVALENT
2	MAIN CABLE RUNS BTS TO MW DISHES, ALPHA SECTOR	1	210 FEET	N/A	EUPEN EC4–50 COAX
3	COAX JUMPERS	TBD	6 FEET	N/A	L4–PDMDM–6 (OR EQUIVALENT)
4	CONNECTORS, GROUND KITS, WEATHERPROOFING	TBD	N/A	N/A	AS NEEDED (DIN, N, RG45 TYP.)
5	3/4" – EHS GUY WIRE	3	N/A	N/A	TBD

2 / – BILL OF MATERIALS (BOM)

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W. HARTFORD, CT 06107
HARTFORD COUNTY

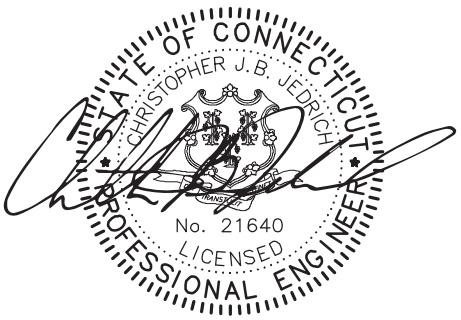
SHEET TITLE
EQUIPMENT SPECIFICATIONS

SHEET NUMBER
C06

Isham Road Tower

Hartford County, Connecticut
CT-HFD0063A

Prepared for:
Clearwire Technologies, Inc.
5808 Lake Washington BLVD. NE Ste. 300
Kirkland, WA 98033
March 14, 2016



CHA
2139 Silas Deane Highway, Suite 212
Rocky Hill, CT 06067-2336
CHA Project No. 30119.1003 R1
(Previous CHA Project No. 20592.1045.28000 R4)

March 14, 2016

Mr. Joseph Guidebeck
Ericsson RNAM
US MARW 1
joseph.guidebeck@ericsson.com

RE: Retrofit Structural Analysis & Construction Drawings for Guyed Tower at 20 Isham Rd. Located in West Hartford, CT
Site ID: CT-HFD0063
CHA Project No.: 30119-1003 r1

Dear Mr. Guidebeck:

CHA has completed a proposed equipment structural review for Site # CT-HFD0063 per your request. The analysis was based on the current Connecticut State Building Code (2003 IBC), with the 2005 Connecticut Supplement and the 2009 Amendment to the 2005 Connecticut Supplement. The Connecticut State Building Code references the TIA/EIA-222-G, "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", and is referenced in the analysis. Furthermore the structural review was based on the following information:

- Site visits performed by CHA on November 4, 2009 and September 30, 2010.
- A previous analysis by URS Corporation, dated May 23, 2008.
- Drawing S-1 by CNC Structural Engineers, dated October 27, 1997.
- Updated proposed equipment provided by Clearwire, dated October 6, 2010.
- E-mail correspondences between CHA and Ericson in the months of April and May 2015.
- E-mail correspondences between CHA and Ericson in the months of October 2015 and January 2016.

Per your initial request the existing tower was analyzed for the following two proposed options:

Option #1
Addition of (1) – 24" microwave antenna (Andrew VHLP2-18) with an azimuth of 222.5723° installed on the southernmost tower leg at an above ground level elevation of 108'.

Option #2
Addition of (1) – 24" microwave antenna (Andrew VHLP2-18) with an azimuth of 222.5723° installed on the easternmost antenna pipe mount at an above ground level elevation of 119'-0".

(Note: This is the same location proposed for a 30" microwave antenna in the previous construction drawings issued by CHA dated October 7, 2010.)

After completing this initial analysis CHA found that both of these proposed options resulted in the tower being **structurally unstable under extreme loading conditions**. Given these results, it was evident that the proposed equipment could not be added without a retrofit of the existing tower. This was communicated to you, the client, and you requested that CHA proceed to design a suitable retrofit of the existing tower.

Per your follow-up request, **CHA has successfully developed a retrofit design of the existing tower such that it is structurally stable with the addition of the proposed 24" microwave antenna at the Option #2 location.** This proposed retrofit consists of the top guy connections being removed from the existing tower legs and modified for re-attachment to a new torque arm at the same elevation. An additional three (3) guy wires will also be added at these locations with the existing guy anchor point locations to be reused. Per your review request, **CHA has reanalyzed the tower to account for updates to the existing tower equipment and successfully revised the retrofit tower design for the proposed conditions.**

In the attached document please find the executive summary, structural analysis, and retrofit design construction drawings. If you have any questions or if we can be of further assistance, please call.

Very truly yours,

Christopher J. B. Jedrich, P.E.
Associate Vice President

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EXECUTIVE SUMMARY

Isham Road Tower, West Hartford, CT

March 14, 2016

TOWER INFORMATION:

Tower Owner:	Unknown
Tower Manufacturer:	Unknown
Tower Height:	100 feet (base height approx 17' AGL)
Tower Type:	Guyed

PROPOSED ANTENNA DATA:

Clearwire

- One (1) Andrew VHLP2-18 microwave antennas mounted to the easternmost tower leg at an antenna centerline elevation of 119' A.G.L. with one (1) 1/2" diameter coaxial cables.

EXISTING ANTENNA AND APPURTENANCE DATA:

Clearwire

- Three (3) Argus LLPX310R panel antennas and three (3) Remote Radio Units mounted to existing pipes at an antenna centerline elevation of 114' A.G.L. with six (6) 5/16" diameter coaxial cables in a 2" innerduct.
- Two (2) Andrew VHLP1-23-1GR microwave antennas mounted to the tower leg at an antenna centerline elevation of 110' A.G.L. with two (2) 1/2" diameter coaxial cables.

Sprint Nextel

- (9) ALP 9212 panel antennas mounted on a boom gate at an elevation of 114' A.G.L. with (9) 1-1/4" coaxial cables.

Verizon

- One (1) Antel BXA-70063-6CF, one (1) Antel BXA-171063-8BF, one (1) Antel BXA-80063-4CF, one (1) Antel BXA-171063-12CF, two (2) Swedcom SLCP 2x6014, four (4) Swedcom SACP 2x5516, and two (2) Swedcom SLCP 2x6015 panel antennas mounted on three (3) – 12' Lightweight T-Frame at an elevation of 102' A.G.L. with (12) 1-5/8"coaxial cables.
- Three (3) Alcatel-Lucent RRH2x40-AWS and three (3) Alcatel-Lucent RRH2x40-07-U remote radio heads mounted on tower faces and legs at an elevation of 102' A.G.L.
- (2) GPS antennas mounted to the tower leg at an elevation of 102' A.G.L. with (2) 1/2" diameter coaxial cables.
- One (1) RFS DB-T1-6Z-8AB-0Z main distribution box mounted to tower leg at an elevation of 106' A.G.L.

Unknown Owner

- One (1) – 16' x 3" diameter omni antenna at an elevation of 124' A.G.L. with (1) 1-5/8" coaxial cable.
- One (1) – 12' x 3" diameter omni antenna at an elevation of 117' A.G.L. with (1) 1-5/8" coaxial cable.

- One (1) – 4 bay dipole antenna at an elevation of 124’ A.G.L. with (1) 7/8” coaxial cable.
- One (1) – 4 bay dipole antenna at an elevation of 121’ A.G.L. with (1) 7/8” coaxial cable.
- One (1) – 7.5’ x 3” diameter omni antenna at an elevation of 120’ A.G.L. with (1) 7/8” coaxial cable.
- One (1) – 4’ x 3” diameter omni antenna at an elevation of 119’ A.G.L. with (1) 7/8” coaxial cable.
- One (1) GPS antennas at an elevation of 32’ A.G.L. with (1) 1/2” coaxial cables.
- Three (3) GPS antennas at an elevation of 27’ A.G.L. with (3) 1/2” coaxial cables.

(* All antenna elevations shown are to centerline of antenna.)

LOAD CASE:

The tower was analyzed for the following loading conditions per TIA-222-Rev. G:

1) 105 mph wind with no ice.
2) 50 mph wind with 0.5” ice.

The loading conditions stated above incorporates the following when performing the analysis:

1) Weight of Tower, Existing and Proposed Antennas and Appurtenances plus wind load without radial ice.
2) Weight of Tower, Existing and Proposed Antennas and Appurtenances plus wind load on iced tower and weight of 1/2” radial ice. *

*Reduction for wind forces applied simultaneously per the ANSI/TIA/EIA-222-G Code allowance.

TOWER SUPERSTRUCTURE COMPONENTS:

Tower Leg Members: *(50 ksi)*

0’ – 4’:	2” Solid Round Pipe
4’ – 20’:	2” Solid Round Pipe
20’ – 40’:	2” Solid Round Pipe
40’ – 60’:	2-1/4” Solid Round Pipe
60’ – 100’:	2” Solid Round Pipe
100’ – 120’:	2” Solid Round Pipe

Tower Diagonal Members: *(36 ksi)*

4’ – 100’:	7/8” Solid Round Pipe

Tower Horizontal Members: *(36 ksi*)

4’ – 40’:	L2 x 2 x 1/8” Angle
40’ – 100’:	L2 x 2 x 3/16” Angle

Guy Wires:

52’:	7/8” EHS
(Existing) 92’:	7/8" EHS: To be removed and replaced with new torque arm and guy wires
(Proposed) 92’:	7/8" EHS from New Torque Arm

ANALYSIS OF EXISTING TOWER SUPERSTRUCTURE UNDER PROPOSED OPTIONS:

Proposed Option #1:

1. Addition of (1) – 24" microwave antenna (Andrew VHLP2-18) with an azimuth of 222.5723°installed on the southernmost tower leg at an above ground level elevation of 108'.

The following is a summary of the analysis resulting in a structurally unstable tower:

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	117 - 97	Leg	2" solid	1	-25496.30	72468.20	87.2	Pass
		Diagonal	7/8" solid	38	258354.00	19482.80	1326.1	Fail
		Horizontal	L2x2x3/16	45	758366.00	23166.00	3273.6	Fail
		Top Girt	L2x2x3/16	5	762020.00	23166.00	3289.4	Fail
		Bottom Girt	L2x2x3/16	7	738201.00	23166.00	3186.6	Fail
		Guy A@109.033	3/4	255	31634.70	34980.00	90.4	Pass
		Guy B@109.033	3/4	254	33430.60	34980.00	95.6	Pass
		Guy C@109.033	3/4	253	32490.00	34980.00	92.9	Pass
		Top Guy Pull-Off@109.033	L2x2x3/16	35	766009.00	23166.00	3306.6	Fail
T2	97 - 77	Leg	2" solid	54	-90846.60	72873.70	124.7	Fail
		Diagonal	7/8" solid	98	245769.00	19482.80	1261.5	Fail
		Horizontal	L2x2x3/16	96	727771.00	23166.00	3141.6	Fail
		Top Girt	L2x2x3/16	57	737247.00	23166.00	3182.4	Fail
		Bottom Girt	L2x2x3/16	58	705424.00	23166.00	3045.1	Fail
T3	77 - 57	Leg	2 1/4" solid	105	-126000.00	105993.00	118.9	Fail
		Diagonal	7/8" solid	149	235617.00	19482.80	1209.4	Fail
		Horizontal	L2x2x3/16	147	697106.00	23166.00	3009.2	Fail
		Top Girt	L2x2x3/16	108	704356.00	23166.00	3040.5	Fail
		Bottom Girt	L2x2x3/16	111	630916.00	23166.00	2723.5	Fail
		Guy A@68.9833	7/8	258	39058.20	47820.00	81.7	Pass
		Guy B@68.9833	7/8	257	44558.60	47820.00	93.2	Pass
		Guy C@68.9833	7/8	256	41324.70	47820.00	86.4	Pass
		Top Guy Pull-Off@68.9833	L2x2x3/16	137	700591.00	23166.00	3024.2	Fail
T4	57 - 37	Leg	2" solid	156	-86649.20	72873.70	118.9	Fail
		Diagonal	7/8" solid	199	206234.00	19482.80	1058.5	Fail
		Horizontal	L2x2x1/8	198	411420.00	15693.80	2621.5	Fail
		Top Girt	L2x2x1/8	157	426534.00	15693.80	2717.9	Fail
		Bottom Girt	L2x2x1/8	161	361924.00	15693.80	2306.2	Fail
T5	37 - 21	Leg	2" solid	205	-44299.60	73076.70	760.8	Fail
		Diagonal	7/8" solid	241	174751.00	19482.80	896.9	Fail
		Horizontal	L2x2x1/8	239	347419.00	15693.80	2213.7	Fail
		Top Girt	L2x2x1/8	210	360857.00	15693.80	2299.4	Fail
		Bottom Girt	L2x2x1/8	212	316355.00	15693.80	2015.8	Fail
T6	21 - 17	Leg	2" solid	248	343390.00	141372.00	1027.1	Fail
		Top Girt	L3x3x3/8	251	1345740.00	68364.00	1968.5	Fail
							Summary	
						Leg (T6)	1027.1	Fail
						Diagonal (T1)	1326.1	Fail
						Horizontal (T1)	3273.6	Fail
						Top Girt (T1)	3289.4	Fail
						Bottom Girt (T1)	3186.6	Fail

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
						Guy A (T1)	90.4	Pass
						Guy B (T1)	95.6	Pass
						Guy C (T1)	92.9	Pass
						Top Guy Pull-Off (T1)	3306.6	Fail ✗
						RATING =	**3306.6**	**Fail ✗**

Proposed Option #2:

1. Addition of (1) – 24" microwave antenna (Andrew VHLP2-18) with an azimuth of 222.5723°installed on the easternmost antenna pipe mount at an above ground level elevation of 119'-0". *(Note: This is the same location proposed for a 30" microwave antenna in the previous construction drawings issued by CHA dated October 7, 2010.)*

The following is a summary of the analysis resulting in a structurally unstable tower:

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	117 - 97	Leg	2" solid	3	-35179.40	72468.20	48.5	Pass
		Diagonal	7/8" solid	40	13019.60	19482.80	66.8	Pass
		Horizontal	L2x2x3/16	45	-9015.87	15470.70	58.3	Pass
		Top Girt	L2x2x3/16	6	-4945.89	15470.70	32.0	Pass
		Bottom Girt	L2x2x3/16	9	-4194.50	15470.70	27.1	Pass
		Guy A@109.033	3/4	255	31721.80	34980.00	90.7	Pass
		Guy B@109.033	3/4	254	33529.80	34980.00	95.9	Pass
		Guy C@109.033	3/4	253	32596.20	34980.00	93.2	Pass
		Top Guy Pull-Off@109.033	L2x2x3/16	36	-7208.47	15470.70	46.6	Pass
T2	97 - 77	Leg	2" solid	54	-91657.80	72873.70	125.8	Fail ✗
		Diagonal	7/8" solid	61	12576.80	19482.80	64.6	Pass
		Horizontal	L2x2x3/16	67	-9543.30	15470.70	61.7	Pass
		Top Girt	L2x2x3/16	57	-4062.35	15470.70	26.3	Pass
		Bottom Girt	L2x2x3/16	58	-5722.37	15470.70	37.0	Pass
T3	77 - 57	Leg	2 1/4" solid	105	-126672.00	105993.00	119.5	Fail ✗
		Diagonal	7/8" solid	139	14298.40	19482.80	73.4	Pass
		Horizontal	L2x2x3/16	145	-11859.00	15561.20	76.2	Pass
		Top Girt	L2x2x3/16	106	-4840.18	15561.20	31.1	Pass
		Bottom Girt	L2x2x3/16	111	-4194.08	15561.20	27.0	Pass
		Guy A@68.9833	7/8	258	39045.90	47820.00	81.7	Pass
		Guy B@68.9833	7/8	257	44551.10	47820.00	93.2	Pass
		Guy C@68.9833	7/8	256	41310.60	47820.00	86.4	Pass
		Top Guy Pull-Off@68.9833	L2x2x3/16	138	-4502.57	15561.20	28.9	Pass
T4	57 - 37	Leg	2" solid	156	-87205.90	72873.70	119.7	Fail ✗
		Diagonal	7/8" solid	203	9265.10	19482.80	47.6	Pass
		Horizontal	L2x2x1/8	198	-6415.36	10336.40	62.1	Pass
		Top Girt	L2x2x1/8	159	-3468.36	10336.40	33.6	Pass
		Bottom Girt	L2x2x1/8	160	-3293.20	10336.40	31.9	Pass
T5	37 - 21	Leg	2" solid	207	-51770.70	73076.70	70.8	Pass
		Diagonal	7/8" solid	217	6871.05	19482.80	35.3	Pass
		Horizontal	L2x2x1/8	220	-6488.09	10336.40	62.8	Pass
		Top Girt	L2x2x1/8	208	-3134.63	10336.40	30.3	Pass
		Bottom Girt	L2x2x1/8	211	2285.40	15693.80	14.6	Pass
T6	21 - 17	Leg	2" solid	248	-48835.20	65416.60	74.7	Pass
		Top Girt	L3x3x3/8	250	6453.67	68364.00	9.4	Pass
							Summary	
						Leg (T2)	125.8	Fail ✗
						Diagonal (T3)	73.4	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
						Horizontal (T3)	76.2	Pass
						Top Girt (T4)	33.6	Pass
						Bottom Girt (T2)	37.0	Pass
						Guy A (T1)	90.7	Pass
						Guy B (T1)	95.9	Pass
						Guy C (T1)	93.2	Pass
						Top Guy Pull-Off (T1)	46.6	Pass
						RATING =	**125.8**	**Fail** ✗

ANALYSIS OF TOWER SUPERSTRUCTURE WITH PROPOSED RETROFIT:

CHA notified the client that their initial proposed locations for the microwave antenna failed under existing conditions. The client then requested that a retrofit design of the tower be developed using the microwave antenna location from Option #2, which is an above ground level elevation of 119'. The proposed retrofit developed by CHA consists of the top guy connections at above ground level elevation 109'(above tower bottom elevation of 92') being removed from the existing tower legs and modified for re-attachment to a new torque arm at the same elevation. An additional three (3) guys would also be added at these locations with existing guy anchor point locations to be reused. It should be noted that after the initial retrofit analysis, the client presented CHA with updates to the existing tower equipment information. The retrofit analysis and design has been updated to take this information into account. The following is a summary of the analysis resulting in a structurally stable tower using the proposed retrofit:

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	117 - 97	Leg	2" solid	2	-56703.10	72468.20	78.2	Pass
		Diagonal	7/8" solid	40	14765.90	19482.80	75.8	Pass
		Guy Lower Diagonal@109.033	L3x3x3/16	28	18281.70	35316.00	51.8	Pass
		Horizontal	L2x2x3/16	27	-14672.60	15470.70	94.8	Pass
		Top Girt	L2x2x3/16	4	-4793.26	15470.70	31.0	Pass
		Bottom Girt	L2x2x3/16	7	-3614.89	15470.70	23.4	Pass
		Guy A@109.033	7/8	265	26903.20	47820.00	56.3	Pass
		Guy B@109.033	7/8	260	29485.30	47820.00	61.7	Pass
		Guy C@109.033	7/8	254	28330.90	47820.00	59.2	Pass
		Top Guy Pull-Off@109.033	3x1 1/2	34	-26580.80	104373.00	25.5	Pass
		Torque Arm Top@109.033	C6x8.2	261	22687.60	108000.00	21.0 71.8 (b)	Pass
		Torque Arm Bottom@109.033	C6x8.2	263	-30549.10	45353.70	67.4 85.4 (b)	Pass
T2	97 - 77	Leg	2" solid	54	-61439.60	72873.70	84.3	Pass
		Diagonal	7/8" solid	63	9516.83	19482.80	48.8	Pass
		Horizontal	L2x2x3/16	94	-7317.37	15470.70	47.3	Pass
		Top Girt	L2x2x3/16	57	-3946.35	15470.70	25.5	Pass
		Bottom Girt	L2x2x3/16	60	-3809.93	15470.70	24.6	Pass
T3	77 - 57	Leg	2 1/4" solid	105	-88452.00	105993.00	83.5	Pass
		Diagonal	7/8" solid	141	11439.60	19482.80	58.7	Pass
		Horizontal	L2x2x3/16	145	-8404.20	15561.20	54.0	Pass
		Top Girt	L2x2x3/16	108	-3658.08	15561.20	23.5	Pass
		Bottom Girt	L2x2x3/16	109	-3782.50	15561.20	24.3	Pass
		Guy A@68.9833	7/8	273	31257.40	47820.00	65.4	Pass
		Guy B@68.9833	7/8	272	35668.30	47820.00	74.6	Pass
		Guy C@68.9833	7/8	271	33334.50	47820.00	69.7	Pass
		Top Guy Pull-	L2x2x3/16	136	-5074.65	15561.20	32.6	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
		Off@68.9833						
T4	57 - 37	Leg	2" solid	155	-67673.50	72873.70	92.9	Pass
		Diagonal	7/8" solid	204	6686.66	19482.80	34.3	Pass
		Horizontal	L2x2x1/8	169	-5992.16	10336.40	58.0	Pass
		Top Girt	L2x2x1/8	159	-2614.03	10336.40	25.3	Pass
		Bottom Girt	L2x2x1/8	160	-3159.00	10336.40	30.6	Pass
T5	37 - 21	Leg	2" solid	206	-67723.30	73076.70	92.7	Pass
		Diagonal	7/8" solid	217	6507.09	19482.80	33.4	Pass
		Horizontal	L2x2x1/8	220	-6004.40	10336.40	58.1	Pass
		Top Girt	L2x2x1/8	208	-3171.28	10336.40	30.7	Pass
		Bottom Girt	L2x2x1/8	211	3616.09	15693.80	23.0	Pass
T6	21 - 17	Leg	2" solid	248	-62208.30	65416.60	95.1	Pass
		Top Girt	L3x3x3/8	250	8773.88	68364.00	12.8	Pass
							Summary	
						Leg (T6)	95.1	Pass
						Diagonal (T1)	75.8	Pass
						Guy Lower Diagonal (T1)	51.8	Pass
						Horizontal (T1)	94.8	Pass
						Top Girt (T1)	31.0	Pass
						Bottom Girt (T4)	30.6	Pass
						Guy A (T3)	65.4	Pass
						Guy B (T3)	74.6	Pass
						Guy C (T3)	69.7	Pass
						Top Guy Pull-Off (T3)	32.6	Pass
						Torque Arm Top (T1)	71.8	Pass
						Torque Arm Bottom (T1)	85.4	Pass
						Bolt Checks	85.4	Pass
						RATING =	**95.1**	**Pass**

CONCLUSION:

The existing tower was initially analyzed for the two conditions proposed by the client for the addition of one (1) Andrew VHLP2-18 – 24" microwave dish antenna. The analysis resulted in the tower being structurally unstable for both cases. A retrofit design of the tower was successfully developed and analyzed to withstand the loads with the addition of the microwave dish antenna at an above ground elevation of 119'. It should be noted that after the initial retrofit analysis, the client presented CHA with updates to the existing tower equipment information. The retrofit analysis and design has been updated to take this information into account. A reanalysis of the retrofit design was required to account for updates to existing equipment and verified that the tower still yields structurally stable results under the proposed conditions. We have included a copy of the structural analysis results from the tnxTower program used to analyze the various conditions and the developed retrofit design construction drawings for your review. If you have any questions, or if we can be of further assistance, please do not hesitate to call.

tnxTOWER ANALYSIS:

Existing Tower with Proposed Microwave Antenna
Option #1 Location

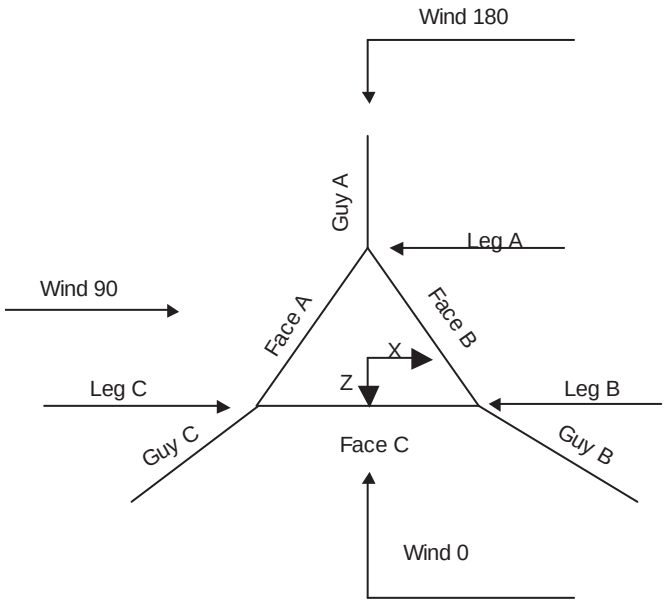
Tower Input Data

The main tower is a 3x guyed tower with an overall height of 117.00 ft above the ground line.
The base of the tower is set at an elevation of 17.00 ft above the ground line.
The face width of the tower is 3.04 ft at the top and tapered at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Hartford County, Connecticut.
Basic wind speed of 105 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
Tower is roof top mounted and located approx 25' above mean grade level..
Tension only take-up is 0.0313 in.
Pressures are calculated at each section.
Safety factor used in guy design is 1.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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



Corner & Starmount Guyed Tower

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	117.00-97.00			3.04	1	20.00
T2	97.00-77.00			3.04	1	20.00
T3	77.00-57.00			3.04	1	20.00
T4	57.00-37.00			3.04	1	20.00
T5	37.00-21.00			3.04	1	16.00
T6	21.00-17.00			3.04	1	4.00

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	117.00-97.00	3.98	TX Brace	No	Yes	0.0000	1.0000
T2	97.00-77.00	3.97	TX Brace	No	Yes	1.0000	1.0000
T3	77.00-57.00	3.97	TX Brace	No	Yes	1.0000	1.0000
T4	57.00-37.00	3.97	TX Brace	No	Yes	1.0000	1.0000

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
T5	37.00-21.00	3.96	TX Brace	No	Yes	1.0000	1.0000
T6	21.00-17.00	3.92	X Brace	No	Yes	1.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 117.00-97.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T2 97.00-77.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T3 77.00-57.00	Solid Round	2 1/4" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T4 57.00-37.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T5 37.00-21.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T6 21.00-17.00	Solid Round	2" solid	A572-50 (50 ksi)	Flat Bar	2x3/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 117.00-97.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T2 97.00-77.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T3 77.00-57.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 57.00-37.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T5 37.00-21.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 21.00-17.00	Equal Angle	L3x3x3/8	A36 (36 ksi)	Flat Bar	2x3/8	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 117.00-97.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T2 97.00-77.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T3 77.00-57.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 57.00-37.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T5 37.00-21.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 21.00-17.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 117.00-97.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T2 97.00-77.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T3 77.00-57.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T4 57.00-37.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T5 37.00-21.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T6 21.00-17.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1	No	No	1	1	1	1	1	1	1	1
117.00-97.00				1	1	1	1	1	1	1
T2	No	No	1	1	1	1	1	1	1	1
97.00-77.00				1	1	1	1	1	1	1
T3	No	No	1	1	1	1	1	1	1	1
77.00-57.00				1	1	1	1	1	1	1
T4	No	No	1	1	1	1	1	1	1	1
57.00-37.00				1	1	1	1	1	1	1
T5	No	No	1	1	1	1	1	1	1	1
37.00-21.00				1	1	1	1	1	1	1
T6	No	No	1	1	1	1	1	1	1	1
21.00-17.00				1	1	1	1	1	1	1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		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 117.00-97.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 97.00-77.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 77.00-57.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 57.00-37.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 37.00-21.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 21.00-17.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Guy Data

Guy Elevation ft	Guy Grade		Guy Size	Initial Tension lb	%	Guy Modulus ksi	Guy Weight plf	L_u ft	Anchor Radius ft	Anchor Azimuth Adj. °	Anchor Elevation ft	End Fitting Efficiency %
109.033	EHS	A	3/4	5830.00	10%	19000	1.155	101.59	45.00	0.0000	17.00	100%
		B	3/4	5830.00	10%	19000	1.155	99.19	39.00	0.0000	17.00	100%
		C	3/4	5830.00	10%	19000	1.155	91.24	37.50	0.0000	25.00	100%
68.9833	EHS	A	7/8	7970.00	10%	19000	1.581	67.56	45.00	0.0000	17.00	100%
		B	7/8	7970.00	10%	19000	1.581	63.89	39.00	0.0000	17.00	100%
		C	7/8	7970.00	10%	19000	1.581	56.62	37.50	0.0000	25.00	100%

Guy Data*(cont'd)*

Guy Elevation ft	Mount Type	Torque-Arm Spread ft	Torque-Arm Leg Angle °	Torque-Arm Style	Torque-Arm Grade	Torque-Arm Type	Torque-Arm Size
109.033	Corner						
68.9833	Corner						

Guy Data *(cont'd)*

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
109.03	A36 (36 ksi)	Solid Round			No	A36 (36 ksi)	Equal Angle	L2x2x3/16
68.98	A36 (36 ksi)	Solid Round			No	A36 (36 ksi)	Equal Angle	L2x2x3/16

Guy Data *(cont'd)*

Guy Elevation ft	Cable Weight A lb	Cable Weight B lb	Cable Weight C lb	Cable Weight D lb	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
109.033	117.34	114.57	105.38		1.01 1.7 sec/pulse	0.97 1.7 sec/pulse	0.82 1.6 sec/pulse	
68.9833	106.81	101.01	89.52		0.45 1.2 sec/pulse	0.40 1.1 sec/pulse	0.32 1.0 sec/pulse	

Guy Data *(cont'd)*

Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Torque Arm K_x	Torque Arm K_y	Pull Off K_x	Pull Off K_y	Diagonal K_x	Diagonal K_y
109.033	No	No			1	1	1	1
68.9833	No	No			1	1	1	1

Guy Data *(cont'd)*

Guy Elevation ft	Torque-Arm Bolt Size in	Torque-Arm Number	Torque-Arm Net Width Deduct in	Torque-Arm U	Pull Off Bolt Size in	Pull Off Number	Pull Off Net Width Deduct in	Pull Off U	Diagonal Bolt Size in	Diagonal Number	Diagonal Net Width Deduct in	Diagonal U
109.033	0.7500 A325N	2	0.0000	1	0.6250 A325N	0	0.0000	0.75	0.6250 A325N	0	0.0000	0.75
68.9833	0.0000 A325N	0	0.0000	1	0.6250 A325N	0	0.0000	0.75	0.6250 A325N	0	0.0000	0.75

Guy Pressures

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
109.033	A	63.02	28	6	2.1337
	B	63.02	28	6	2.1337
	C	67.02	28	6	2.1468

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
68.9833	A	42.99	25	6	2.0536
	B	42.99	25	6	2.0536
	C	46.99	26	6	2.0720

Guy-Mast Forces (Excluding Wind) - No Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top / Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
109.033	A	64.8326	5936.20 5830.00	0.00	5383.26	-2501.79	-9454.63	0.00	0.00
	B	67.9680	5936.20 5830.00	1911.16	5510.75	1103.41	4839.27	0.00	-8381.86
	C	66.9575	5926.97 5830.00	-1992.60	5462.14	1150.43	4796.58	-0.00	8307.92
			Sum:	**-81.44**	16356.16	**-247.95**	**181.22**	-0.00	**-73.94**
68.9833	A	50.2437	8052.11 7970.00	0.00	6212.06	-5123.16	-10910.24	0.00	0.00
	B	54.3801	8052.11 7970.00	4040.53	6562.67	2332.80	5763.00	0.00	-9981.82
	C	50.9005	8039.47 7970.00	-4371.94	6256.84	2524.14	5494.44	-0.00	9516.65
			Sum:	**-331.41**	19031.56	**-266.22**	**347.21**	-0.00	**-465.17**

Guy-Mast Forces (Excluding Wind) - Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top / Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
109.033	A	64.8326	8862.62 8065.31	0.00	8100.35	-3595.90	-14226.63	0.00	0.00
	B	67.9680	8743.50 7946.18	2708.40	8165.06	1563.70	7170.15	0.00	-12419.06
	C	66.9575	8686.28 7951.46	-2817.57	8053.98	1626.72	7072.60	-0.00	12250.10
			Sum:	**-109.17**	24319.38	**-405.48**	**16.11**	-0.00	**-168.96**
68.9833	A	50.2437	11483.14 11019.44	0.00	8950.84	-7193.39	-15720.36	0.00	0.00
	B	54.3801	11384.88 10921.18	5623.91	9351.17	3246.96	8211.73	0.00	-14223.13
	C	50.9005	11329.90 10932.63	-6078.36	8894.08	3509.34	7810.34	-0.00	13527.90
			Sum:	**-454.45**	27196.09	**-437.09**	**301.70**	-0.00	**-695.23**

Guy-Mast Forces (Excluding Wind) - Service

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom	F_x	F_y	F_z	M_x	M_y	M_z
ft		°	lb	lb	lb	lb	lb-ft	lb-ft	lb-ft
109.033	A	64.8326	5936.20 5830.00	0.00	5383.26	-2501.79	-9454.63	0.00	0.00
	B	67.9680	5936.20 5830.00	1911.16	5510.75	1103.41	4839.27	0.00	-8381.86
	C	66.9575	5926.97 5830.00	-1992.60	5462.14	1150.43	4796.58	-0.00	8307.92
			Sum:	**-81.44**	16356.16	**-247.95**	**181.22**	-0.00	**-73.94**
68.9833	A	50.2437	8052.11 7970.00	0.00	6212.06	-5123.16	-10910.24	0.00	0.00
	B	54.3801	8052.11 7970.00	4040.53	6562.67	2332.80	5763.00	0.00	-9981.82
	C	50.9005	8039.47 7970.00	-4371.94	6256.84	2524.14	5494.44	-0.00	9516.65
			Sum:	**-331.41**	19031.56	**-266.22**	**347.21**	-0.00	**-465.17**

Guy-Tensioning Information

Guy Elevation		H	V	Temperature At Time Of Tensioning													
				0 F		20 F		40 F		60 F		80 F		100 F		120 F	
				Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept
ft		ft	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft
109.033	A	43.24	92.03	6278	0.94	6129	0.96	5979	0.99	5830	1.01	5681	1.04	5532	1.07	5383	1.10
	B	37.24	92.03	6179	0.91	6063	0.93	5946	0.95	5830	0.97	5714	0.99	5598	1.01	5482	1.03
	C	35.74	84.03	6210	0.77	6083	0.78	5957	0.80	5830	0.82	5703	0.84	5577	0.86	5450	0.88
68.9833	A	43.24	51.98	9356	0.38	8893	0.40	8431	0.43	7970	0.45	7509	0.48	7049	0.51	6590	0.54
	B	37.24	51.98	9121	0.35	8737	0.37	8353	0.38	7970	0.40	7587	0.42	7205	0.45	6823	0.47
	C	35.74	43.98	9320	0.27	8870	0.28	8420	0.30	7970	0.32	7521	0.34	7072	0.36	6625	0.38

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement	Face Offset	Lateral Offset (Frac FW)	#		C_AA_A	Weight
				ft	in				ft^2/ft	plf
LDF7-50A (1-5/8 FOAM) (E-VZW)	C	No	CaAa (Out Of Face)	102.00 - 21.00	0.0000	0	12	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF6-50A (1-1/4 FOAM) (E-NEXTEL)	B	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.1	11	No Ice	0.16	0.66
								1/2" Ice	0.25	1.91
								1" Ice	0.35	3.78
LDF6-50A (1-1/4 FOAM) (E-NEXTEL)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.2	1	No Ice	0.16	0.66
								1/2" Ice	0.25	1.91
								1" Ice	0.35	3.78
LDF7-50A (1-5/8 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.4	1	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF4RN-50A (1/2 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.5	2	No Ice	0.06	0.15
								1/2" Ice	0.16	0.84
								1" Ice	0.26	2.14
LDF5-50A (7/8 FOAM)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.2	1	No Ice	0.11	0.33
								1/2" Ice	0.21	1.30

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#		C_AA_A ft^2/ft	Weight plf
(E)								1" Ice	0.31	2.88
LDF7-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.24	1	No Ice	0.20	0.82
(1-5/8 FOAM)								1/2" Ice	0.30	2.33
(E)								1" Ice	0.40	4.46
LDF5-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.27	1	No Ice	0.11	0.33
(7/8 FOAM)								1/2" Ice	0.21	1.30
(E)								1" Ice	0.31	2.88
LDF7-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.31	1	No Ice	0.20	0.82
(1-5/8 FOAM)								1/2" Ice	0.30	2.33
(E)								1" Ice	0.40	4.46
LDF4RN-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.35	1	No Ice	0.06	0.15
(1/2 FOAM)								1/2" Ice	0.16	0.84
(E)								1" Ice	0.26	2.14
LDF5-50A	A	No	CaAa (Out Of Face)	27.00 - 21.00	0.0000	0.4	3	No Ice	0.11	0.33
(7/8 FOAM)								1/2" Ice	0.21	1.30
(E)								1" Ice	0.31	2.88
***CLEARW										
IRE***										
LDF4RN-50A	C	No	CaAa (Out Of Face)	110.00 - 21.00	0.0000	0.35	2	No Ice	0.06	0.15
(1/2 FOAM)								1/2" Ice	0.16	0.84
(P)								1" Ice	0.26	2.14
LDF4RN-50A	C	No	CaAa (Out Of Face)	114.00 - 21.00	0.0000	0.37	1	No Ice	0.06	0.15
(1/2 FOAM)								1/2" Ice	0.16	0.84
(P)								1" Ice	0.26	2.14
2" Rigid	C	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.4	1	No Ice	0.20	2.80
Conduit								1/2" Ice	0.30	4.33
(P)								1" Ice	0.40	6.47

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 lb
T1	117.00-97.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	18.589	111.65
T2	97.00-77.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T3	77.00-57.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T4	57.00-37.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T5	37.00-21.00	A	0.000	0.000	0.000	20.458	73.62
		B	0.000	0.000	0.000	27.281	116.16
		C	0.000	0.000	0.000	44.240	209.44
T6	21.00-17.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
T1	117.00-97.00	A	2.250	0.000	0.000	0.000	104.108	1929.11
		B		0.000	0.000	0.000	133.085	2560.18
		C		0.000	0.000	0.000	73.930	1448.76
T2	97.00-77.00	A	2.204	0.000	0.000	0.000	102.449	1855.31
		B		0.000	0.000	0.000	131.058	2466.68
		C		0.000	0.000	0.000	196.329	3791.96
T3	77.00-57.00	A	2.147	0.000	0.000	0.000	100.404	1764.29
		B		0.000	0.000	0.000	128.558	2351.39
		C		0.000	0.000	0.000	192.692	3620.30
T4	57.00-37.00	A	2.072	0.000	0.000	0.000	97.711	1644.50
		B		0.000	0.000	0.000	125.268	2199.64
		C		0.000	0.000	0.000	187.906	3394.36
T5	37.00-21.00	A	1.974	0.000	0.000	0.000	84.426	1343.52
		B		0.000	0.000	0.000	96.776	1617.71
		C		0.000	0.000	0.000	145.324	2503.51
T6	21.00-17.00	A	1.893	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	117.00-97.00	0.8998	-0.2393	0.7711	-0.5435
T2	97.00-77.00	-0.7583	0.6343	-0.6803	0.3217
T3	77.00-57.00	-0.7545	0.6311	-0.6802	0.3235
T4	57.00-37.00	-0.7583	0.6343	-0.6816	0.3268
T5	37.00-21.00	-0.7429	0.4468	-0.6649	0.0954
T6	21.00-17.00	0.0000	0.0000	0.0000	0.0000

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
W.Monroe - 12' Omni	C	From Leg	0.00		0.0000	117.00	No Ice	3.00	3.00	20.45
(E)			0.00				1/2" Ice	7.05	7.05	42.76
			0.00				1" Ice	11.10	11.10	65.06
Albion - 16' Omni w/ Pipe	B	From Leg	0.00		0.0000	124.00	No Ice	4.32	4.59	60.59

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
Mount			0.00			1/2" Ice	6.08	6.53	97.01
(E)			0.00			1" Ice	7.84	8.46	133.42
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	A	From Leg	0.00	0.0000	124.00	No Ice	5.39	6.03	48.93
			0.00			1/2" Ice	16.58	17.53	103.58
(E)			0.00			1" Ice	27.52	28.69	155.94
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	B	From Leg	0.00	0.0000	121.00	No Ice	5.39	6.03	48.93
			0.00			1/2" Ice	16.58	17.53	103.58
(E)			0.00			1" Ice	27.52	28.69	155.94
W.Monroe - 7.5' Omni	B	From Leg	2.00	0.0000	120.00	No Ice	2.10	6.50	45.01
(E)			0.00			1/2" Ice	4.60	15.68	96.07
			0.00			1" Ice	7.10	24.86	147.13
Cobleskill - 4' Omni with Mounts	A	From Leg	0.00	0.0000	119.00	No Ice	1.91	1.15	11.10
			0.00			1/2" Ice	1.91	1.91	22.70
(E)			0.00			1" Ice	1.99	2.50	33.01
(4) ALP 9212	A	From Leg	4.00	0.0000	115.00	No Ice	5.46	5.46	17.20
(E)			0.00			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
(4) ALP 9212	B	From Leg	4.00	0.0000	115.00	No Ice	5.46	5.46	17.20
(E)			0.00			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
(4) ALP 9212	C	From Leg	4.00	0.0000	115.00	No Ice	5.46	5.46	17.20
(E)			0.00			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
LPA-80063/4CF	A	From Leg	4.00	0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00			1/2" Ice	7.41	6.48	72.62
			0.00			1" Ice	7.83	6.89	130.34
LPA-80063/4CF	B	From Leg	4.00	0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00			1/2" Ice	7.41	6.48	72.62
			0.00			1" Ice	7.83	6.89	130.34
LPA-80063/4CF	C	From Leg	4.00	0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00			1/2" Ice	7.41	6.48	72.62
			0.00			1" Ice	7.83	6.89	130.34
(2) LPA-171063/8CF	A	From Leg	4.00	0.0000	102.00	No Ice	3.69	3.69	11.50
(E)			0.00			1/2" Ice	4.06	4.06	40.29
			0.00			1" Ice	4.43	4.43	73.40
(2) LPA-171063/8CF	B	From Leg	4.00	0.0000	102.00	No Ice	3.69	3.69	11.50
(E)			0.00			1/2" Ice	4.06	4.06	40.29
			0.00			1" Ice	4.43	4.43	73.40
(2) LPA-171063/8CF	C	From Leg	4.00	0.0000	102.00	No Ice	3.69	3.69	11.50
(E)			0.00			1/2" Ice	4.06	4.06	40.29
			0.00			1" Ice	4.43	4.43	73.40
PiROD 13' Lightweight T-Frame	A	From Leg	0.00	0.0000	102.00	No Ice	10.60	10.60	255.00
			0.00			1/2" Ice	16.80	16.80	359.00
(E)			0.00			1" Ice	23.00	23.00	463.00
PiROD 13' Lightweight T-Frame	B	From Leg	0.00	0.0000	102.00	No Ice	10.60	10.60	255.00
			0.00			1/2" Ice	16.80	16.80	359.00
(E)			0.00			1" Ice	23.00	23.00	463.00
PiROD 13' Lightweight T-Frame	C	From Leg	0.00	0.0000	102.00	No Ice	10.60	10.60	255.00
			0.00			1/2" Ice	16.80	16.80	359.00
(E)			0.00			1" Ice	23.00	23.00	463.00
LPA-80063/4CF	A	From Leg	4.00	0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00			1/2" Ice	7.41	6.48	72.62
			0.00			1" Ice	7.83	6.89	130.34
LPA-80063/4CF	B	From Leg	4.00	0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00			1/2" Ice	7.41	6.48	72.62
			0.00			1" Ice	7.83	6.89	130.34
LPA-80063/4CF	C	From Leg	4.00	0.0000	102.00	No Ice	7.00	6.08	20.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
(E)			0.00				1/2" Ice	7.41	6.48	72.62
			0.00				1" Ice	7.83	6.89	130.34
(2) GPS Antenna	A	From Leg	0.00		0.0000	102.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
GPS Antenna	A	From Leg	0.00		0.0000	27.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
GPS Antenna	B	From Leg	0.00		0.0000	27.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
GPS Antenna	C	From Leg	0.00		0.0000	27.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
CLEARWIRE										
LLPX310R w/ mounting pipe	A	From Leg	4.00		0.0000	114.00	No Ice	4.94	2.82	43.26
(P)			0.00				1/2" Ice	5.33	3.34	78.28
			0.00				1" Ice	5.72	3.87	120.86
LLPX310R w/ mounting pipe	B	From Leg	4.00		0.0000	114.00	No Ice	4.94	2.82	43.26
(P)			0.00				1/2" Ice	5.33	3.34	78.28
			0.00				1" Ice	5.72	3.87	120.86
LLPX310R w/ mounting pipe	C	From Leg	4.00		0.0000	114.00	No Ice	4.94	2.82	43.26
(P)			0.00				1/2" Ice	5.33	3.34	78.28
			0.00				1" Ice	5.72	3.87	120.86
4'x4" Pipe Mount	B	From Leg	0.00		0.0000	110.00	No Ice	1.32	1.32	44.00
(P)			0.00				1/2" Ice	1.58	1.58	56.99
			0.00				1" Ice	1.84	1.84	73.03
4'x4" Pipe Mount	B	From Leg	0.00		0.0000	117.00	No Ice	1.32	1.32	44.00
(P)			0.00				1/2" Ice	1.58	1.58	56.99
			0.00				1" Ice	1.84	1.84	73.03
4'x4" Pipe Mount	A	From Leg	0.00		0.0000	114.00	No Ice	1.32	1.32	44.00
(P)			0.00				1/2" Ice	1.58	1.58	56.99
			0.00				1" Ice	1.84	1.84	73.03
6'8"x4" Pipe Mount	B	From Leg	0.00		0.0000	114.00	No Ice	2.60	2.60	72.00
(P)			0.00				1/2" Ice	3.01	3.01	93.13
			0.00				1" Ice	3.42	3.42	118.95
10' x 4.5" od pipe mount	C	From Leg	0.00		0.0000	114.00	No Ice	4.50	4.50	150.00
(P)			0.00				1/2" Ice	5.24	5.24	181.31
			0.00				1" Ice	5.85	5.85	219.35
existing										
(2) 1-1/2" Pipe	A	From Leg	0.00		0.0000	102.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
1-1/2" Pipe	A	From Leg	0.00		0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
1-1/2" Pipe	B	From Leg	0.00		0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
1-1/2" Pipe	C	From Leg	0.00		0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
10' Boom Gate w/3 - 2 3/8"	B	From Leg	0.00		0.0000	115.00	No Ice	35.30	35.30	1750.00
Pipe (Tapered) (3)			0.00				1/2" Ice	46.40	46.40	2400.00
(E)			0.00				1" Ice	57.50	57.50	3050.00
CLEARWIRE										
Remote RU	A	From Leg	0.00		0.0000	114.00	No Ice	0.00	0.86	33.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
Remote RU	B	From Leg	0.00	0.0000	114.00	No Ice	0.00	0.86	33.00
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
Remote RU	C	From Leg	0.00	0.0000	114.00	No Ice	0.00	0.86	33.00
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
GPS	C	From Leg	0.50	0.0000	32.00	No Ice	0.12	0.12	5.00
(P)			0.00			1/2" Ice	0.17	0.17	5.71
			0.00			1" Ice	0.22	0.22	6.85

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight lb
VHLP1-23-1GR (12")	B	Paraboloid w/o Radome	From Leg	0.00	Worst		110.00	1.00	No Ice	0.79	28.00
(P)				0.00					1/2" Ice	0.92	35.28
				0.00					1" Ice	1.06	42.56
VHLP1-23-1GR (12")	C	Paraboloid w/o Radome	From Leg	0.00	Worst		110.00	1.00	No Ice	0.79	28.00
(P)				0.00					1/2" Ice	0.92	35.28
				0.00					1" Ice	1.06	42.56
VHLP2-180	C	Paraboloid w/o Radome	From Leg	0.00	Worst		108.00	2.00	No Ice	3.14	25.00
(Ericson)				0.00					1/2" Ice	3.41	42.49
				0.00					1" Ice	3.67	59.98

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	107.00	1.284	31	64.173	A	3.019	10.627	6.667	48.85	0.000	23.120
117.00-97.00					B	3.019	10.627		48.85	0.000	34.101
					C	3.019	10.627		48.85	0.000	18.589
T2 97.00-77.00	87.00	1.229	29	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T3 77.00-57.00	67.00	1.163	28	64.590	A	2.997	11.466	7.500	51.85	0.000	23.120
					B	2.997	11.466		51.85	0.000	34.101
					C	2.997	11.466		51.85	0.000	55.300
T4 57.00-37.00	47.00	1.08	26	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120

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
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T5 37.00-21.00	29.00	0.975	23	51.339	A	2.516	8.490	5.333	48.46	0.000	20.458
					B	2.516	8.490		48.46	0.000	27.281
					C	2.516	8.490		48.46	0.000	44.240
T6 21.00-17.00	19.00	0.892	21	6.797	A	0.738	1.529	1.456	64.23	0.000	0.000
					B	0.738	1.529		64.23	0.000	0.000
					C	0.738	1.529		64.23	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 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 117.00-97.00	107.00	1.284	7	2.2497	71.672	A	3.019	51.818	21.664	39.51	0.000	104.108
						B	3.019	51.818		39.51	0.000	133.085
						C	3.019	51.818		39.51	0.000	73.930
T2 97.00-77.00	87.00	1.229	7	2.2036	71.519	A	3.019	50.916	21.357	39.60	0.000	102.449
						B	3.019	50.916		39.60	0.000	131.058
						C	3.019	50.916		39.60	0.000	196.329
T3 77.00-57.00	67.00	1.163	6	2.1468	71.746	A	2.997	50.550	21.812	40.73	0.000	100.404
						B	2.997	50.550		40.73	0.000	128.558
						C	2.997	50.550		40.73	0.000	192.692
T4 57.00-37.00	47.00	1.08	6	2.0720	71.080	A	3.019	48.510	20.480	39.74	0.000	97.711
						B	3.019	48.510		39.74	0.000	125.268
						C	3.019	48.510		39.74	0.000	187.906
T5 37.00-21.00	29.00	0.975	5	1.9743	56.604	A	2.516	37.556	15.863	39.59	0.000	84.426
						B	2.516	37.556		39.59	0.000	96.776
						C	2.516	37.556		39.59	0.000	145.324
T6 21.00-17.00	19.00	0.892	5	1.8926	8.147	A	0.738	5.354	4.212	69.14	0.000	0.000
						B	0.738	5.354		69.14	0.000	0.000
						C	0.738	5.354		69.14	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	107.00	1.284	10	64.173	A	3.019	10.627	6.667	48.85	0.000	23.120
117.00-97.00					B	3.019	10.627		48.85	0.000	34.101
					C	3.019	10.627		48.85	0.000	18.589
T2 97.00-77.00	87.00	1.229	10	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T3 77.00-57.00	67.00	1.163	9	64.590	A	2.997	11.466	7.500	51.85	0.000	23.120
					B	2.997	11.466		51.85	0.000	34.101

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
					C	2.997	11.466		51.85	0.000	55.300
T4 57.00-37.00	47.00	1.08	8	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T5 37.00-21.00	29.00	0.975	8	51.339	A	2.516	8.490	5.333	48.46	0.000	20.458
					B	2.516	8.490		48.46	0.000	27.281
					C	2.516	8.490		48.46	0.000	44.240
T6 21.00-17.00	19.00	0.892	7	6.797	A	0.738	1.529	1.456	64.23	0.000	0.000
					B	0.738	1.529		64.23	0.000	0.000
					C	0.738	1.529		64.23	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	31	1	1	9.149	2596.37	129.82	C
117.00-97.00			B	0.213	2.554		1	1	9.149			
			C	0.213	2.554		1	1	9.149			
T2	491.60	1297.78	A	0.212	2.555	29	1	1	9.143	3405.50	170.28	C
97.00-77.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T3	491.60	1502.23	A	0.224	2.518	28	1	1	9.637	3244.82	162.24	C
77.00-57.00			B	0.224	2.518		1	1	9.637			
			C	0.224	2.518		1	1	9.637			
T4	491.60	1246.22	A	0.212	2.555	26	1	1	9.143	2991.45	149.57	C
57.00-37.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T5	399.22	1000.19	A	0.214	2.549	23	1	1	7.416	2205.12	137.82	C
37.00-21.00			B	0.214	2.549		1	1	7.416			
			C	0.214	2.549		1	1	7.416			
T6	0.00	245.11	A	0.334	2.211	21	1	1	1.671	67.20	16.80	C
21.00-17.00			B	0.334	2.211		1	1	1.671			
			C	0.334	2.211		1	1	1.671			
Sum Weight:	2215.47	6590.29								14510.46		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	31	0.8	1	8.545	2555.99	127.80	C
117.00-97.00			B	0.213	2.554		0.8	1	8.545			
			C	0.213	2.554		0.8	1	8.545			
T2	491.60	1297.78	A	0.212	2.555	29	0.8	1	8.539	3366.84	168.34	C
97.00-77.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T3	491.60	1502.23	A	0.224	2.518	28	0.8	1	9.038	3209.01	160.45	C
77.00-57.00			B	0.224	2.518		0.8	1	9.038			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.224	2.518		0.8	1	9.038			
T4	491.60	1246.22	A	0.212	2.555	26	0.8	1	8.539	2957.49	147.87	C
57.00-37.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T5	399.22	1000.19	A	0.214	2.549	23	0.8	1	6.913	2179.62	136.23	C
37.00-21.00			B	0.214	2.549		0.8	1	6.913			
			C	0.214	2.549		0.8	1	6.913			
T6	0.00	245.11	A	0.334	2.211	21	0.8	1	1.523	61.27	15.32	C
21.00-17.00			B	0.334	2.211		0.8	1	1.523			
			C	0.334	2.211		0.8	1	1.523			
Sum Weight:	2215.47	6590.29								14330.21		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	31	0.85	1	8.696	2566.08	128.30	C
117.00-97.00			B	0.213	2.554		0.85	1	8.696			
			C	0.213	2.554		0.85	1	8.696			
T2	491.60	1297.78	A	0.212	2.555	29	0.85	1	8.690	3376.51	168.83	C
97.00-77.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T3	491.60	1502.23	A	0.224	2.518	28	0.85	1	9.188	3217.96	160.90	C
77.00-57.00			B	0.224	2.518		0.85	1	9.188			
			C	0.224	2.518		0.85	1	9.188			
T4	491.60	1246.22	A	0.212	2.555	26	0.85	1	8.690	2965.98	148.30	C
57.00-37.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T5	399.22	1000.19	A	0.214	2.549	23	0.85	1	7.039	2185.99	136.62	C
37.00-21.00			B	0.214	2.549		0.85	1	7.039			
			C	0.214	2.549		0.85	1	7.039			
T6	0.00	245.11	A	0.334	2.211	21	0.85	1	1.560	62.75	15.69	C
21.00-17.00			B	0.334	2.211		0.85	1	1.560			
			C	0.334	2.211		0.85	1	1.560			
Sum Weight:	2215.47	6590.29								14375.27		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4055.11	A	0.765	1.794	7	1	1	47.521	2353.05	117.65	C
117.00-97.00			B	0.765	1.794		1	1	47.521			
			C	0.765	1.794		1	1	47.521			
T2	8113.95	3961.51	A	0.754	1.789	7	1	1	46.328	2913.89	145.69	C
97.00-77.00			B	0.754	1.789		1	1	46.328			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.754	1.789		1	1	46.328			
T3	7735.98	4097.17	A	0.746	1.786	6	1	1	45.701	2707.17	135.36	C
77.00-57.00			B	0.746	1.786		1	1	45.701			
			C	0.746	1.786		1	1	45.701			
T4	7238.51	3662.69	A	0.725	1.78	6	1	1	43.235	2435.31	121.77	C
57.00-37.00			B	0.725	1.78		1	1	43.235			
			C	0.725	1.78		1	1	43.235			
T5	5464.74	2812.41	A	0.708	1.777	5	1	1	33.190	1738.44	108.65	C
37.00-21.00			B	0.708	1.777		1	1	33.190			
			C	0.708	1.777		1	1	33.190			
T6	0.00	489.84	A	0.748	1.787	5	1	1	5.267	38.82	9.71	C
21.00-17.00			B	0.748	1.787		1	1	5.267			
			C	0.748	1.787		1	1	5.267			
Sum Weight:	34491.23	19078.72								12186.69		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4055.11	A	0.765	1.794	7	0.8	1	46.918	2346.62	117.33	C
117.00-97.00			B	0.765	1.794		0.8	1	46.918			
			C	0.765	1.794		0.8	1	46.918			
T2	8113.95	3961.51	A	0.754	1.789	7	0.8	1	45.724	2907.75	145.39	C
97.00-77.00			B	0.754	1.789		0.8	1	45.724			
			C	0.754	1.789		0.8	1	45.724			
T3	7735.98	4097.17	A	0.746	1.786	6	0.8	1	45.102	2701.41	135.07	C
77.00-57.00			B	0.746	1.786		0.8	1	45.102			
			C	0.746	1.786		0.8	1	45.102			
T4	7238.51	3662.69	A	0.725	1.78	6	0.8	1	42.631	2429.95	121.50	C
57.00-37.00			B	0.725	1.78		0.8	1	42.631			
			C	0.725	1.78		0.8	1	42.631			
T5	5464.74	2812.41	A	0.708	1.777	5	0.8	1	32.687	1734.41	108.40	C
37.00-21.00			B	0.708	1.777		0.8	1	32.687			
			C	0.708	1.777		0.8	1	32.687			
T6	0.00	489.84	A	0.748	1.787	5	0.8	1	5.119	37.73	9.43	C
21.00-17.00			B	0.748	1.787		0.8	1	5.119			
			C	0.748	1.787		0.8	1	5.119			
Sum Weight:	34491.23	19078.72								12157.87		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4055.11	A	0.765	1.794	7	0.85	1	47.068	2348.22	117.41	C
117.00-97.00			B	0.765	1.794		0.85	1	47.068			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.765	1.794		0.85	1	47.068			
T2	8113.95	3961.51	A	0.754	1.789	7	0.85	1	45.875	2909.29	145.46	C
97.00-77.00			B	0.754	1.789		0.85	1	45.875			
			C	0.754	1.789		0.85	1	45.875			
T3	7735.98	4097.17	A	0.746	1.786	6	0.85	1	45.252	2702.85	135.14	C
77.00-57.00			B	0.746	1.786		0.85	1	45.252			
			C	0.746	1.786		0.85	1	45.252			
T4	7238.51	3662.69	A	0.725	1.78	6	0.85	1	42.782	2431.29	121.56	C
57.00-37.00			B	0.725	1.78		0.85	1	42.782			
			C	0.725	1.78		0.85	1	42.782			
T5	5464.74	2812.41	A	0.708	1.777	5	0.85	1	32.813	1735.42	108.46	C
37.00-21.00			B	0.708	1.777		0.85	1	32.813			
			C	0.708	1.777		0.85	1	32.813			
T6	0.00	489.84	A	0.748	1.787	5	0.85	1	5.156	38.01	9.50	C
21.00-17.00			B	0.748	1.787		0.85	1	5.156			
			C	0.748	1.787		0.85	1	5.156			
Sum Weight:	34491.23	19078.72								12165.08		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	10	1	1	9.149	847.79	42.39	C
117.00-97.00			B	0.213	2.554		1	1	9.149			
			C	0.213	2.554		1	1	9.149			
T2	491.60	1297.78	A	0.212	2.555	10	1	1	9.143	1112.00	55.60	C
97.00-77.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T3	491.60	1502.23	A	0.224	2.518	9	1	1	9.637	1059.53	52.98	C
77.00-57.00			B	0.224	2.518		1	1	9.637			
			C	0.224	2.518		1	1	9.637			
T4	491.60	1246.22	A	0.212	2.555	8	1	1	9.143	976.80	48.84	C
57.00-37.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T5	399.22	1000.19	A	0.214	2.549	8	1	1	7.416	720.04	45.00	C
37.00-21.00			B	0.214	2.549		1	1	7.416			
			C	0.214	2.549		1	1	7.416			
T6	0.00	245.11	A	0.334	2.211	7	1	1	1.671	21.94	5.49	C
21.00-17.00			B	0.334	2.211		1	1	1.671			
			C	0.334	2.211		1	1	1.671			
Sum Weight:	2215.47	6590.29								4738.11		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	10	0.8	1	8.545	834.61	41.73	C
117.00-97.00			B	0.213	2.554		0.8	1	8.545			
			C	0.213	2.554		0.8	1	8.545			
T2	491.60	1297.78	A	0.212	2.555	10	0.8	1	8.539	1099.38	54.97	C
97.00-77.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T3	491.60	1502.23	A	0.224	2.518	9	0.8	1	9.038	1047.84	52.39	C
77.00-57.00			B	0.224	2.518		0.8	1	9.038			
			C	0.224	2.518		0.8	1	9.038			
T4	491.60	1246.22	A	0.212	2.555	8	0.8	1	8.539	965.71	48.29	C
57.00-37.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T5	399.22	1000.19	A	0.214	2.549	8	0.8	1	6.913	711.71	44.48	C
37.00-21.00			B	0.214	2.549		0.8	1	6.913			
			C	0.214	2.549		0.8	1	6.913			
T6	0.00	245.11	A	0.334	2.211	7	0.8	1	1.523	20.01	5.00	C
21.00-17.00			B	0.334	2.211		0.8	1	1.523			
			C	0.334	2.211		0.8	1	1.523			
Sum Weight:	2215.47	6590.29								4679.25		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	10	0.85	1	8.696	837.90	41.90	C
117.00-97.00			B	0.213	2.554		0.85	1	8.696			
			C	0.213	2.554		0.85	1	8.696			
T2	491.60	1297.78	A	0.212	2.555	10	0.85	1	8.690	1102.53	55.13	C
97.00-77.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T3	491.60	1502.23	A	0.224	2.518	9	0.85	1	9.188	1050.76	52.54	C
77.00-57.00			B	0.224	2.518		0.85	1	9.188			
			C	0.224	2.518		0.85	1	9.188			
T4	491.60	1246.22	A	0.212	2.555	8	0.85	1	8.690	968.48	48.42	C
57.00-37.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T5	399.22	1000.19	A	0.214	2.549	8	0.85	1	7.039	713.79	44.61	C
37.00-21.00			B	0.214	2.549		0.85	1	7.039			
			C	0.214	2.549		0.85	1	7.039			
T6	0.00	245.11	A	0.334	2.211	7	0.85	1	1.560	20.49	5.12	C
21.00-17.00			B	0.334	2.211		0.85	1	1.560			
			C	0.334	2.211		0.85	1	1.560			
Sum Weight:	2215.47	6590.29								4693.97		

Discrete Appurtenance Pressures - No Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
W.Monroe - 12' Omni	240.0000	20.45	-1.52	0.88	117.00	1.308	31	3.00	3.00
Albion - 16' Omni w/ Pipe Mount	120.0000	60.59	1.52	0.88	124.00	1.324	32	4.32	4.59
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	48.93	0.00	-1.76	124.00	1.324	32	5.39	6.03
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	48.93	1.52	0.88	121.00	1.317	32	5.39	6.03
W.Monroe - 7.5' Omni	120.0000	45.01	3.25	1.88	120.00	1.315	32	2.10	6.50
Cobleskill - 4' Omni with Mounts	0.0000	11.10	0.00	-1.76	119.00	1.313	31	1.91	1.15
ALP 9212	0.0000	68.80	0.00	-5.76	115.00	1.303	31	21.84	21.84
ALP 9212	120.0000	68.80	4.99	2.88	115.00	1.303	31	21.84	21.84
ALP 9212	240.0000	68.80	-4.99	2.88	115.00	1.303	31	21.84	21.84
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	30	7.00	6.08
LPA-171063/8CF	0.0000	23.00	0.00	-5.76	102.00	1.271	30	7.39	7.39
LPA-171063/8CF	120.0000	23.00	4.99	2.88	102.00	1.271	30	7.39	7.39
LPA-171063/8CF	240.0000	23.00	-4.99	2.88	102.00	1.271	30	7.39	7.39
PiROD 13' Lightweight T-Frame	0.0000	255.00	0.00	-1.76	102.00	1.271	30	10.60	10.60
PiROD 13' Lightweight T-Frame	120.0000	255.00	1.52	0.88	102.00	1.271	30	10.60	10.60
PiROD 13' Lightweight T-Frame	240.0000	255.00	-1.52	0.88	102.00	1.271	30	10.60	10.60
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	30	7.00	6.08
GPS Antenna	0.0000	16.00	0.00	-1.76	102.00	1.271	30	0.01	0.01
GPS Antenna	0.0000	8.00	0.00	-1.76	27.00	0.961	23	0.00	0.00
GPS Antenna	120.0000	8.00	1.52	0.88	27.00	0.961	23	0.00	0.00
GPS Antenna	240.0000	8.00	-1.52	0.88	27.00	0.961	23	0.00	0.00
LLPX310R w/ mounting pipe	0.0000	43.26	0.00	-5.76	114.00	1.301	31	4.94	2.82
LLPX310R w/ mounting pipe	120.0000	43.26	4.99	2.88	114.00	1.301	31	4.94	2.82
LLPX310R w/ mounting pipe	240.0000	43.26	-4.99	2.88	114.00	1.301	31	4.94	2.82
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	110.00	1.291	31	1.32	1.32
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	117.00	1.308	31	1.32	1.32
4'x4" Pipe Mount	0.0000	44.00	0.00	-1.76	114.00	1.301	31	1.32	1.32
6'8"x4" Pipe Mount	120.0000	72.00	1.52	0.88	114.00	1.301	31	2.60	2.60
10' x 4.5" od pipe mount	240.0000	150.00	-1.52	0.88	114.00	1.301	31	4.50	4.50
1-1/2" Pipe	0.0000	10.88	0.00	-1.76	102.00	1.271	30	0.50	0.50
1-1/2" Pipe	0.0000	5.44	0.00	-1.76	27.00	0.961	23	0.25	0.25
1-1/2" Pipe	120.0000	5.44	1.52	0.88	27.00	0.961	23	0.25	0.25
1-1/2" Pipe	240.0000	5.44	-1.52	0.88	27.00	0.961	23	0.25	0.25
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	1750.00	1.52	0.88	115.00	1.303	31	35.30	35.30
Remote RU	0.0000	33.00	0.00	-1.76	114.00	1.301	31	0.00	0.86
Remote RU	120.0000	33.00	1.52	0.88	114.00	1.301	31	0.00	0.86
Remote RU	240.0000	33.00	-1.52	0.88	114.00	1.301	31	0.00	0.86
GPS	240.0000	5.00	-1.95	1.13	32.00	0.996	24	0.12	0.12
	Sum Weight:	3800.40							

Discrete Appurtenance Pressures - With Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2	t_z in
W.Monroe - 12' Omni	240.0000	121.70	-1.52	0.88	117.00	1.308	7	21.38	21.38	2.2699
Albion - 16' Omni w/ Pipe Mount	120.0000	226.87	1.52	0.88	124.00	1.324	7	12.37	13.43	2.2831
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	293.23	0.00	-1.76	124.00	1.324	7	55.92	57.77	2.2831
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	292.63	1.52	0.88	121.00	1.317	7	55.80	57.65	2.2775
W.Monroe - 7.5' Omni	120.0000	277.39	3.25	1.88	120.00	1.315	7	13.47	48.28	2.2756
Cobleskill - 4' Omni with Mounts	0.0000	60.93	0.00	-1.76	119.00	1.313	7	3.37	4.23	2.2737
ALP 9212	0.0000	629.14	0.00	-5.76	115.00	1.303	7	33.26	33.26	2.2659
ALP 9212	120.0000	629.14	4.99	2.88	115.00	1.303	7	33.26	33.26	2.2659
ALP 9212	240.0000	629.14	-4.99	2.88	115.00	1.303	7	33.26	33.26	2.2659
LPA-80063/4CF	0.0000	301.66	0.00	-5.76	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	120.0000	301.66	4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	240.0000	301.66	-4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
LPA-171063/8CF	0.0000	359.22	0.00	-5.76	102.00	1.271	7	10.80	10.80	2.2389
LPA-171063/8CF	120.0000	359.22	4.99	2.88	102.00	1.271	7	10.80	10.80	2.2389
LPA-171063/8CF	240.0000	359.22	-4.99	2.88	102.00	1.271	7	10.80	10.80	2.2389
PiROD 13' Lightweight T-Frame	0.0000	720.70	0.00	-1.76	102.00	1.271	7	38.36	38.36	2.2389
PiROD 13' Lightweight T-Frame	120.0000	720.70	1.52	0.88	102.00	1.271	7	38.36	38.36	2.2389
PiROD 13' Lightweight T-Frame	240.0000	720.70	-1.52	0.88	102.00	1.271	7	38.36	38.36	2.2389
LPA-80063/4CF	0.0000	301.66	0.00	-5.76	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	120.0000	301.66	4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	240.0000	301.66	-4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
GPS Antenna	0.0000	24.75	0.00	-1.76	102.00	1.271	7	0.35	0.35	2.2389
GPS Antenna	0.0000	10.58	0.00	-1.76	27.00	0.961	5	0.13	0.13	1.9603
GPS Antenna	120.0000	10.58	1.52	0.88	27.00	0.961	5	0.13	0.13	1.9603
GPS Antenna	240.0000	10.58	-1.52	0.88	27.00	0.961	5	0.13	0.13	1.9603
LLPX310R w/ mounting pipe	0.0000	263.65	0.00	-5.76	114.00	1.301	7	6.77	5.40	2.2640
LLPX310R w/ mounting pipe	120.0000	263.65	4.99	2.88	114.00	1.301	7	6.77	5.40	2.2640
LLPX310R w/ mounting pipe	240.0000	263.65	-4.99	2.88	114.00	1.301	7	6.77	5.40	2.2640
4'x4" Pipe Mount	120.0000	131.15	1.52	0.88	110.00	1.291	7	2.64	2.64	2.2559
4'x4" Pipe Mount	120.0000	132.03	1.52	0.88	117.00	1.308	7	2.65	2.65	2.2699
4'x4" Pipe Mount	0.0000	131.66	0.00	-1.76	114.00	1.301	7	2.64	2.64	2.2640
6'8"x4" Pipe Mount	120.0000	211.04	1.52	0.88	114.00	1.301	7	4.53	4.53	2.2640
10' x 4.5" od pipe mount	240.0000	353.27	-1.52	0.88	114.00	1.301	7	7.43	7.43	2.2640
1-1/2" Pipe	0.0000	63.66	0.00	-1.76	102.00	1.271	7	1.91	1.91	2.2389
1-1/2" Pipe	0.0000	25.09	0.00	-1.76	27.00	0.961	5	0.84	0.84	1.9603
1-1/2" Pipe	120.0000	25.09	1.52	0.88	27.00	0.961	5	0.84	0.84	1.9603
1-1/2" Pipe	240.0000	25.09	-1.52	0.88	27.00	0.961	5	0.84	0.84	1.9603
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	4695.72	1.52	0.88	115.00	1.303	7	85.60	85.60	2.2659
Remote RU	0.0000	110.07	0.00	-1.76	114.00	1.301	7	0.00	1.58	2.2640
Remote RU	120.0000	110.07	1.52	0.88	114.00	1.301	7	0.00	1.58	2.2640
Remote RU	240.0000	110.07	-1.52	0.88	114.00	1.301	7	0.00	1.58	2.2640
GPS	240.0000	10.74	-1.95	1.13	32.00	0.996	5	0.37	0.37	1.9939
	Sum Weight:	15192.10								

Discrete Appurtenance Pressures - Service $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
W.Monroe - 12' Omni	240.0000	20.45	-1.52	0.88	117.00	1.308	10	3.00	3.00
Albion - 16' Omni w/ Pipe Mount	120.0000	60.59	1.52	0.88	124.00	1.324	10	4.32	4.59
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	48.93	0.00	-1.76	124.00	1.324	10	5.39	6.03
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	48.93	1.52	0.88	121.00	1.317	10	5.39	6.03
W.Monroe - 7.5' Omni	120.0000	45.01	3.25	1.88	120.00	1.315	10	2.10	6.50
Cobleskill - 4' Omni with Mounts	0.0000	11.10	0.00	-1.76	119.00	1.313	10	1.91	1.15
ALP 9212	0.0000	68.80	0.00	-5.76	115.00	1.303	10	21.84	21.84
ALP 9212	120.0000	68.80	4.99	2.88	115.00	1.303	10	21.84	21.84
ALP 9212	240.0000	68.80	-4.99	2.88	115.00	1.303	10	21.84	21.84
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	10	7.00	6.08
LPA-171063/8CF	0.0000	23.00	0.00	-5.76	102.00	1.271	10	7.39	7.39
LPA-171063/8CF	120.0000	23.00	4.99	2.88	102.00	1.271	10	7.39	7.39
LPA-171063/8CF	240.0000	23.00	-4.99	2.88	102.00	1.271	10	7.39	7.39
PiROD 13' Lightweight T-Frame	0.0000	255.00	0.00	-1.76	102.00	1.271	10	10.60	10.60
PiROD 13' Lightweight T-Frame	120.0000	255.00	1.52	0.88	102.00	1.271	10	10.60	10.60
PiROD 13' Lightweight T-Frame	240.0000	255.00	-1.52	0.88	102.00	1.271	10	10.60	10.60
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	10	7.00	6.08
GPS Antenna	0.0000	16.00	0.00	-1.76	102.00	1.271	10	0.01	0.01
GPS Antenna	0.0000	8.00	0.00	-1.76	27.00	0.961	8	0.00	0.00
GPS Antenna	120.0000	8.00	1.52	0.88	27.00	0.961	8	0.00	0.00
GPS Antenna	240.0000	8.00	-1.52	0.88	27.00	0.961	8	0.00	0.00
LLPX310R w/ mounting pipe	0.0000	43.26	0.00	-5.76	114.00	1.301	10	4.94	2.82
LLPX310R w/ mounting pipe	120.0000	43.26	4.99	2.88	114.00	1.301	10	4.94	2.82
LLPX310R w/ mounting pipe	240.0000	43.26	-4.99	2.88	114.00	1.301	10	4.94	2.82
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	110.00	1.291	10	1.32	1.32
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	117.00	1.308	10	1.32	1.32
4'x4" Pipe Mount	0.0000	44.00	0.00	-1.76	114.00	1.301	10	1.32	1.32
6'8"x4" Pipe Mount	120.0000	72.00	1.52	0.88	114.00	1.301	10	2.60	2.60
10' x 4.5" od pipe mount	240.0000	150.00	-1.52	0.88	114.00	1.301	10	4.50	4.50
1-1/2" Pipe	0.0000	10.88	0.00	-1.76	102.00	1.271	10	0.50	0.50
1-1/2" Pipe	0.0000	5.44	0.00	-1.76	27.00	0.961	8	0.25	0.25
1-1/2" Pipe	120.0000	5.44	1.52	0.88	27.00	0.961	8	0.25	0.25
1-1/2" Pipe	240.0000	5.44	-1.52	0.88	27.00	0.961	8	0.25	0.25
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	1750.00	1.52	0.88	115.00	1.303	10	35.30	35.30
Remote RU	0.0000	33.00	0.00	-1.76	114.00	1.301	10	0.00	0.86
Remote RU	120.0000	33.00	1.52	0.88	114.00	1.301	10	0.00	0.86
Remote RU	240.0000	33.00	-1.52	0.88	114.00	1.301	10	0.00	0.86
GPS	240.0000	5.00	-1.95	1.13	32.00	0.996	8	0.12	0.12
	Sum Weight:	3800.40							

Dish Pressures - No Ice

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
110.00	VHLP1-23-1GR (12")	120.0000	28.00	1.52	0.88	1.291	0.79	31
110.00	VHLP1-23-1GR (12")	240.0000	28.00	-1.52	0.88	1.291	0.79	31
108.00	VHLP2-180	240.0000	25.00	-1.52	0.88	1.286	3.14	31
		Sum Weight:	81.00					

Dish Pressures - With Ice

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf	t_z in
110.00	VHLP1-23-1GR (12")	120.0000	60.85	1.52	0.88	1.291	1.40	7	2.2559
110.00	VHLP1-23-1GR (12")	240.0000	60.85	-1.52	0.88	1.291	1.40	7	2.2559
108.00	VHLP2-180	240.0000	103.77	-1.52	0.88	1.286	4.34	7	2.2518
		Sum Weight:	225.46						

Dish Pressures - Service

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
110.00	VHLP1-23-1GR (12")	120.0000	28.00	1.52	0.88	1.291	0.79	10
110.00	VHLP1-23-1GR (12")	240.0000	28.00	-1.52	0.88	1.291	0.79	10
108.00	VHLP2-180	240.0000	25.00	-1.52	0.88	1.286	3.14	10
		Sum Weight:	81.00					

Force Totals (Does not include forces on guys)

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques lb-ft
Leg Weight	4067.10			
Bracing Weight	2523.19			
Total Member Self-Weight	6590.29			
Guy Weight	634.62			
Total Weight	13321.78			
Wind 0 deg - No Ice		61.63	-21180.94	1574.29
Wind 30 deg - No Ice		10539.01	-18256.98	2363.87
Wind 60 deg - No Ice		18153.45	-10553.72	2515.41
Wind 90 deg - No Ice		20971.28	-61.63	1993.99
Wind 120 deg - No Ice		18247.92	10537.10	943.51
Wind 150 deg - No Ice		10432.27	18195.35	-369.88
Wind 180 deg - No Ice		-61.63	21000.70	-1579.68
Wind 210 deg - No Ice		-10539.01	18256.98	-2363.87
Wind 240 deg - No Ice		-18309.55	10643.84	-2517.80
Wind 270 deg - No Ice		-20971.28	61.63	-1993.99
Wind 300 deg - No Ice		-18091.82	-10446.98	-935.73
Wind 330 deg - No Ice		-10432.27	-18195.35	369.88
Member Ice	12488.43			

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques lb-ft
Guy Ice	3590.74			
Total Weight Ice	73212.87			
Wind 0 deg - Ice		99.38	-15972.18	1753.42
Wind 30 deg - Ice		8012.26	-13863.28	2049.40
Wind 60 deg - Ice		13772.02	-8057.74	1795.70
Wind 90 deg - Ice		15852.39	-99.38	1060.75
Wind 120 deg - Ice		13697.60	7900.02	42.06
Wind 150 deg - Ice		7840.13	13763.91	-988.65
Wind 180 deg - Ice		-99.38	15943.36	-1754.21
Wind 210 deg - Ice		-8012.26	13863.28	-2049.40
Wind 240 deg - Ice		-13796.98	8072.15	-1795.48
Wind 270 deg - Ice		-15852.39	99.38	-1060.75
Wind 300 deg - Ice		-13672.64	-7885.62	-41.49
Wind 330 deg - Ice		-7840.13	-13763.91	988.65
Total Weight	13321.78			
Wind 0 deg - Service		20.12	-6916.23	514.05
Wind 30 deg - Service		3441.31	-5961.46	771.88
Wind 60 deg - Service		5927.66	-3446.11	821.36
Wind 90 deg - Service		6847.76	-20.12	651.10
Wind 120 deg - Service		5958.50	3440.69	308.08
Wind 150 deg - Service		3406.45	5941.34	-120.78
Wind 180 deg - Service		-20.12	6857.37	-515.81
Wind 210 deg - Service		-3441.31	5961.46	-771.88
Wind 240 deg - Service		-5978.63	3475.54	-822.14
Wind 270 deg - Service		-6847.76	20.12	-651.10
Wind 300 deg - Service		-5907.53	-3411.26	-305.55
Wind 330 deg - Service		-3406.45	-5941.34	120.78

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy
4	1.2 Dead+1.6 Wind 60 deg - No Ice+1.0 Guy
5	1.2 Dead+1.6 Wind 90 deg - No Ice+1.0 Guy
6	1.2 Dead+1.6 Wind 120 deg - No Ice+1.0 Guy
7	1.2 Dead+1.6 Wind 150 deg - No Ice+1.0 Guy
8	1.2 Dead+1.6 Wind 180 deg - No Ice+1.0 Guy
9	1.2 Dead+1.6 Wind 210 deg - No Ice+1.0 Guy
10	1.2 Dead+1.6 Wind 240 deg - No Ice+1.0 Guy
11	1.2 Dead+1.6 Wind 270 deg - No Ice+1.0 Guy
12	1.2 Dead+1.6 Wind 300 deg - No Ice+1.0 Guy
13	1.2 Dead+1.6 Wind 330 deg - No Ice+1.0 Guy
14	1.2 Dead+1.0 Ice+1.0 Temp+Guy
15	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy
16	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy
17	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy
18	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy
19	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy
20	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy
21	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy
22	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy

Comb. No.	Description
23	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy
24	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy
25	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy
26	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy
27	Dead+Wind 0 deg - Service+Guy
28	Dead+Wind 30 deg - Service+Guy
29	Dead+Wind 60 deg - Service+Guy
30	Dead+Wind 90 deg - Service+Guy
31	Dead+Wind 120 deg - Service+Guy
32	Dead+Wind 150 deg - Service+Guy
33	Dead+Wind 180 deg - Service+Guy
34	Dead+Wind 210 deg - Service+Guy
35	Dead+Wind 240 deg - Service+Guy
36	Dead+Wind 270 deg - Service+Guy
37	Dead+Wind 300 deg - Service+Guy
38	Dead+Wind 330 deg - Service+Guy

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
T1	117 - 97	Leg	Max Tension	8	795.09	-173.55	-669.19
			Max. Compression	6	-34357.84	226.37	128.30
			Max. Mx	10	-25494.98	-3031.42	1197.49
			Max. My	2	-12386.92	-106.73	-1603.20
			Max. Vy	10	-68871.11	2707.81	-1055.54
			Max. Vx	10	30395.77	1159.17	-1240.65
		Diagonal	Max Tension	10	258354.20	0.00	0.00
		Horizontal	Max Tension	10	758365.71	0.00	0.00
			Max. Compression	13	-9039.07	0.00	0.00
			Max. Mx	23	516.76	-20.20	0.00
			Max. My	10	758263.89	0.00	0.01
			Max. Vy	23	26.56	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
		Top Girt	Max Tension	10	762020.13	0.00	0.00
			Max. Compression	12	-4916.85	0.00	0.00
			Max. Mx	14	-4451.35	-20.20	0.00
			Max. My	10	761436.14	0.00	0.01
			Max. Vy	14	26.56	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
		Bottom Girt	Max Tension	10	738200.96	0.00	0.00
			Max. Compression	5	-4181.69	0.00	0.00
			Max. Mx	23	-3713.64	-20.20	0.00
			Max. My	10	738200.96	0.00	0.01
			Max. Vy	23	26.56	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
		Guy A	Bottom Tension	9	31531.97		
			Top Tension	9	31634.68		
			Top Cable Vert	9	28572.25		
			Top Cable Norm	9	13576.52		
			Top Cable Tan	9	240.71		
			Bot Cable Vert	9	-28366.47		
			Bot Cable Norm	9	13764.78		
			Bot Cable Tan	9	373.40		
		Guy B	Bottom Tension	11	33328.50		
			Top Tension	11	33430.60		
			Top Cable Vert	11	30905.22		
			Top Cable Norm	11	12743.06		

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Top Cable Tan	11	294.75		
			Bot Cable Vert	11	-30711.30		
			Bot Cable Norm	11	12939.20		
			Bot Cable Tan	11	426.54		
		Guy C	Bottom Tension	3	32396.59		
			Top Tension	3	32489.98		
			Top Cable Vert	3	29821.10		
			Top Cable Norm	3	12892.58		
			Top Cable Tan	3	285.96		
			Bot Cable Vert	3	-29639.54		
			Bot Cable Norm	3	13071.74		
			Bot Cable Tan	3	408.11		
		Top Guy Pull-Off	Max Tension	10	766008.63	0.00	0.00
			Max. Compression	12	-7281.52	0.00	0.00
			Max. Mx	23	-4843.15	-20.20	0.00
			Max. My	10	763658.69	0.00	0.01
			Max. Vy	23	26.56	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
T2	97 - 77	Leg	Max Tension	4	44959.91	171.11	-59.88
			Max. Compression	2	-90846.61	-50.89	-257.38
			Max. Mx	10	-25496.58	2888.92	-1126.42
			Max. My	10	-15645.01	-1283.45	1313.86
			Max. Vy	10	-68935.83	2888.92	-1126.42
			Max. Vx	10	30436.25	1274.05	-1222.48
		Diagonal	Max Tension	10	245768.89	0.00	0.00
		Horizontal	Max Tension	10	727770.87	0.00	0.00
			Max. Compression	2	-9512.73	0.00	0.00
			Max. Mx	14	515.06	-19.72	0.00
			Max. My	10	727669.85	0.00	0.01
			Max. Vy	14	-25.93	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
		Top Girt	Max Tension	10	737247.46	0.00	0.00
			Max. Compression	12	-4086.86	0.00	0.00
			Max. Mx	23	-3516.79	-19.72	0.00
			Max. My	10	737204.62	0.00	0.01
			Max. Vy	23	-25.93	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
		Bottom Girt	Max Tension	10	705423.59	0.00	0.00
			Max. Compression	2	-5709.76	0.00	0.00
			Max. Mx	15	-4348.77	-19.72	0.00
			Max. My	10	705423.59	0.00	0.00
			Max. Vy	15	25.93	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
T3	77 - 57	Leg	Max Tension	4	54991.54	84.94	-31.03
			Max. Compression	2	-126000.44	-22.29	81.01
			Max. Mx	10	-81542.95	3937.55	-1514.93
			Max. My	10	-20382.77	76.17	-3932.56
			Max. Vy	10	-86515.23	3937.55	-1514.93
			Max. Vx	10	-90401.24	76.17	-3932.56
		Diagonal	Max Tension	10	235616.82	0.00	0.00
		Horizontal	Max Tension	10	697105.53	0.00	0.00
			Max. Compression	2	-11838.19	0.00	0.00
			Max. Mx	14	692.49	-19.15	0.00
			Max. My	10	696772.60	0.00	0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
		Top Girt	Max Tension	10	704355.64	0.00	0.00
			Max. Compression	6	-4828.92	0.00	0.00
			Max. Mx	15	-4045.66	-19.15	0.00
			Max. My	10	704078.34	0.00	0.00
			Max. Vy	15	-25.18	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vx	10	-0.01	0.00	0.00
		Bottom Girt	Max Tension	10	630915.80	0.00	0.00
			Max. Compression	4	-4197.55	0.00	0.00
			Max. Mx	19	-3574.35	-19.15	0.00
			Max. My	10	630721.26	0.00	0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	10	-0.00	0.00	0.00
		Guy A	Bottom Tension	9	38977.43		
			Top Tension	9	39058.24		
			Top Cable Vert	9	29978.68		
			Top Cable Norm	9	25035.73		
			Top Cable Tan	9	193.65		
			Bot Cable Vert	9	-29799.45		
			Bot Cable Norm	9	25122.80		
			Bot Cable Tan	9	278.71		
		Guy B	Bottom Tension	13	44478.10		
			Top Tension	13	44558.61		
			Top Cable Vert	13	36123.45		
			Top Cable Norm	13	26086.32		
			Top Cable Tan	13	264.90		
			Bot Cable Vert	13	-35954.05		
			Bot Cable Norm	13	26181.80		
			Bot Cable Tan	13	348.33		
		Guy C	Bottom Tension	3	41256.46		
			Top Tension	3	41324.70		
			Top Cable Vert	3	31997.01		
			Top Cable Norm	3	26150.69		
			Top Cable Tan	3	251.30		
			Bot Cable Vert	3	-31845.55		
			Bot Cable Norm	3	26226.93		
			Bot Cable Tan	3	324.38		
		Top Guy Pull-Off	Max Tension	10	700590.73	0.00	0.00
			Max. Compression	25	-4508.13	0.00	0.00
			Max. Mx	14	-4164.69	-19.15	0.00
			Max. My	10	700092.34	0.00	0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	10	-0.01	0.00	0.00
T4	57 - 37	Leg	Max Tension	4	10868.07	-102.17	65.48
			Max. Compression	2	-86649.21	-10.80	101.12
			Max. Mx	10	-42861.87	2397.48	-984.65
			Max. My	10	-40804.92	-75.51	-2641.47
			Max. Vy	10	-55994.43	2397.48	-984.65
			Max. Vx	10	-62133.89	-75.51	-2641.47
		Diagonal	Max Tension	10	206233.52	0.00	0.00
		Horizontal	Max Tension	10	411419.85	0.00	0.00
			Max. Compression	4	-6422.46	0.00	0.00
			Max. Mx	19	792.11	-17.09	0.00
			Max. My	10	411246.19	0.00	0.00
			Max. Vy	19	22.48	0.00	0.00
			Max. Vx	10	-0.00	0.00	0.00
		Top Girt	Max Tension	10	426534.30	0.00	0.00
			Max. Compression	5	-3465.80	0.00	0.00
			Max. Mx	19	-2831.43	-17.09	0.00
			Max. My	10	426534.30	0.00	0.00
			Max. Vy	14	-22.48	0.00	0.00
			Max. Vx	10	-0.00	0.00	0.00
		Bottom Girt	Max Tension	10	361923.49	0.00	0.00
			Max. Compression	8	-3296.59	0.00	0.00
			Max. Mx	21	-2688.26	-17.09	0.00
			Max. My	10	361759.00	0.00	0.00
			Max. Vy	21	-22.48	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vx	10	-0.00	0.00	0.00
T5	37 - 21	Leg	Max Tension	10	65832.13	-24264.78	13792.79
			Max. Compression	2	-51492.14	-6.23	47.67
			Max. Mx	10	65830.36	24645.85	-8559.48
			Max. My	10	60266.23	-439.07	-26942.60
			Max. Vy	10	-586927.79	24645.85	-8559.48
			Max. Vx	10	-618629.21	-439.07	-26942.60
		Diagonal	Max Tension	10	174750.92	0.00	0.00
		Horizontal	Max Tension	10	347418.50	0.00	0.00
			Max. Compression	8	-6492.44	0.00	0.00
			Max. Mx	21	762.59	-16.15	0.00
			Max. My	10	347181.87	0.00	0.00
			Max. Vy	21	-21.23	0.00	0.00
			Max. Vx	10	-0.00	0.00	0.00
		Top Girt	Max Tension	10	360857.27	0.00	0.00
			Max. Compression	8	-3139.80	0.00	0.00
			Max. Mx	21	-2618.29	-16.15	0.00
			Max. My	10	360743.42	0.00	0.00
			Max. Vy	21	-21.23	0.00	0.00
			Max. Vx	10	-0.00	0.00	0.00
		Bottom Girt	Max Tension	10	316355.21	0.00	0.00
			Max. Compression	36	-512.39	0.00	0.00
			Max. Mx	21	1497.17	-16.15	0.00
			Max. My	10	316221.43	0.00	0.00
			Max. Vy	21	-21.23	0.00	0.00
			Max. Vx	10	-0.00	0.00	0.00
T6	21 - 17	Leg	Max Tension	10	356311.50	36469.07	2354.31
			Max. Compression	15	-48824.59	-4.00	571.05
			Max. Mx	10	343390.42	40272.81	2517.41
			Max. My	10	343389.03	-38392.84	-6726.16
			Max. Vy	10	864340.92	-38392.84	-6726.16
			Max. Vx	10	101564.05	-38392.84	-6726.16
		Top Girt	Max Tension	10	1345740.96	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	15	6452.97	-26.57	0.00
			Max. My	23	6006.18	0.00	-5.83
			Max. Vy	15	35.68	0.00	0.00
			Max. Vx	23	-7.83	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Mast	Max. Vert	15	131484.28	13.05	362.77
	Max. H_x	10	-773891.46	11125.04	-5431.58
	Max. H_z	11	112520.43	4.30	762.07
	Max. M_x	1	0.00	27.57	1.56
	Max. M_z	1	0.00	27.57	1.56
	Max. Torsion	9	1552.38	-592.35	-726.71
	Min. Vert	10	-773891.46	11125.04	-5431.58
	Min. H_x	4	75432.30	-972.63	564.28
	Min. H_z	10	-773891.46	11125.04	-5431.58
	Min. M_x	1	0.00	27.57	1.56
	Min. M_z	1	0.00	27.57	1.56
	Min. Torsion	10	-8791.87	11125.04	-5431.58
Guy C @ 37.5 ft	Max. Vert	10	-442.82	-73.85	41.59

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Elev 25 ft Azimuth 240 deg					
	Max. H_x	10	-442.82	-73.85	41.59
	Max. H_z	3	-61485.09	-33667.39	20283.69
	Min. Vert	3	-61485.09	-33667.39	20283.69
	Min. H_x	5	-61143.19	-34203.73	18906.47
	Min. H_z	9	-640.87	-236.73	26.19
Guy B @ 39 ft Elev 17 ft Azimuth 120 deg	Max. Vert	6	-636.81	131.19	75.82
	Max. H_x	11	-66562.55	34212.76	18831.70
	Max. H_z	13	-66515.29	33440.57	20192.83
	Min. Vert	11	-66562.55	34212.76	18831.70
	Min. H_x	6	-636.81	131.19	75.82
	Min. H_z	7	-833.25	295.84	47.16
Guy A @ 45 ft Elev 17 ft Azimuth 0 deg	Max. Vert	2	-496.99	0.68	-129.89
	Max. H_x	10	-50628.18	1149.70	-33639.94
	Max. H_z	2	-496.99	0.68	-129.89
	Min. Vert	9	-58165.92	652.11	-38887.58
	Min. H_x	6	-50112.39	-804.48	-33709.09
	Min. H_z	9	-58165.92	652.11	-38887.58

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	48149.13	-27.57	-1.56	0.00	0.00	-33.62
1.2 Dead+1.6 Wind 0 deg - No Ice+1.0 Guy	127629.88	-41.86	761.57	0.00	0.00	954.75
1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy	111925.59	666.39	377.61	0.00	0.00	1587.29
1.2 Dead+1.6 Wind 60 deg - No Ice+1.0 Guy	75432.30	972.63	-564.28	0.00	0.00	2150.99
1.2 Dead+1.6 Wind 90 deg - No Ice+1.0 Guy	106917.88	151.97	-634.53	0.00	0.00	1305.76
1.2 Dead+1.6 Wind 120 deg - No Ice+1.0 Guy	119640.96	-401.45	4.38	0.00	0.00	555.16
1.2 Dead+1.6 Wind 150 deg - No Ice+1.0 Guy	105298.54	-531.22	824.98	0.00	0.00	-241.08
1.2 Dead+1.6 Wind 180 deg - No Ice+1.0 Guy	71627.33	-18.24	1451.98	0.00	0.00	-1338.44
1.2 Dead+1.6 Wind 210 deg - No Ice+1.0 Guy	108642.70	592.35	726.71	0.00	0.00	-1552.38
1.2 Dead+1.6 Wind 240 deg - No Ice+1.0 Guy	773891.46	-11125.04	5431.58	0.00	0.00	8791.87
1.2 Dead+1.6 Wind 270 deg - No Ice+1.0 Guy	112520.43	-4.30	-762.07	0.00	0.00	-1399.69
1.2 Dead+1.6 Wind 300 deg - No Ice+1.0 Guy	78150.70	-1032.05	-564.36	0.00	0.00	-841.69
1.2 Dead+1.6 Wind 330 deg - No Ice+1.0 Guy	114146.65	-766.41	471.42	0.00	0.00	291.73
1.2 Dead+1.0 Ice+1.0 Temp+Guy	110799.28	8.70	-31.72	0.00	0.00	0.69
1.2 Dead+1.0 Wind 0 deg+1.0	131484.28	-13.05	-362.77	0.00	0.00	999.98

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 30 deg+1.0	126054.20	429.04	-390.32	0.00	0.00	1212.84
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 60 deg+1.0	117714.07	676.10	-408.81	0.00	0.00	1109.89
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 90 deg+1.0	122761.51	584.16	-172.61	0.00	0.00	604.32
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 120 deg+1.0	126621.27	391.56	257.01	0.00	0.00	22.40
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 150 deg+1.0	121745.15	169.13	649.02	0.00	0.00	-562.79
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 180 deg+1.0	114647.67	13.79	839.06	0.00	0.00	-1098.80
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 210 deg+1.0	123050.55	-98.05	617.27	0.00	0.00	-1219.83
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 240 deg+1.0	129106.73	-289.64	189.63	0.00	0.00	-1026.56
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 270 deg+1.0	124489.41	-525.83	-230.51	0.00	0.00	-634.68
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 300 deg+1.0	116717.97	-685.33	-428.70	0.00	0.00	-26.42
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 330 deg+1.0	126445.55	-450.36	-385.94	0.00	0.00	584.52
Dead+Wind 0 deg - Service+Guy	48442.50	-36.06	-416.48	0.00	0.00	344.20
Dead+Wind 30 deg - Service+Guy	48812.00	146.11	-346.51	0.00	0.00	516.52
Dead+Wind 60 deg - Service+Guy	48998.45	279.31	-194.12	0.00	0.00	538.64
Dead+Wind 90 deg - Service+Guy	48943.64	335.46	6.04	0.00	0.00	419.04
Dead+Wind 120 deg - Service+Guy	48683.46	299.79	210.34	0.00	0.00	200.52
Dead+Wind 150 deg - Service+Guy	48333.51	160.71	349.10	0.00	0.00	-74.71
Dead+Wind 180 deg - Service+Guy	47948.73	-21.74	395.63	0.00	0.00	-339.32
Dead+Wind 210 deg - Service+Guy	47611.28	-206.10	341.29	0.00	0.00	-517.58
Dead+Wind 240 deg - Service+Guy	47416.51	-351.02	196.92	0.00	0.00	-549.78
Dead+Wind 270 deg - Service+Guy	47474.13	-393.34	-9.62	0.00	0.00	-431.73
Dead+Wind 300 deg - Service+Guy	47716.19	-344.05	-207.60	0.00	0.00	-204.53
Dead+Wind 330 deg - Service+Guy	48066.44	-216.05	-354.45	0.00	0.00	78.22

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX lb	PY lb	PZ lb	PX lb	PY lb	PZ lb	% Error
1	0.00	-13321.68	0.00	-0.44	13319.50	-0.98	0.018%
2	97.02	-15860.19	-35021.28	-97.04	15860.18	35021.09	0.001%
3	17439.69	-15836.38	-30191.96	-17439.68	15836.36	30191.94	0.000%
4	30053.91	-15818.84	-17453.95	-30054.05	15818.84	17453.70	0.001%
5	34722.76	-15849.49	-97.79	-34722.56	15849.48	97.89	0.001%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
6	30206.53	-15882.56	17430.03	-30206.21	15882.53	-17429.82	0.001%
7	17271.41	-15872.22	30096.07	-17271.23	15872.21	-30095.93	0.001%
8	-97.02	-15858.04	34732.88	96.42	15858.04	-34732.88	0.002%
9	-17439.69	-15881.85	30191.96	17439.58	15881.85	-30191.89	0.000%
10	**-30303.67**	**-15899.39**	**17598.15**	42479.80	-883387.55	-22561.00	**2337.205**%
11	-34722.76	-15868.74	97.79	34722.62	15868.73	-97.74	0.000%
12	-29956.77	-15835.66	-17285.83	29957.18	15835.66	17285.10	0.002%
13	-17271.41	-15846.00	-30096.07	17271.30	15845.98	30095.55	0.001%
14	0.00	-75749.59	0.00	-0.24	75749.59	-1.14	0.002%
15	97.82	-75750.09	-16989.28	-97.84	75750.08	16989.10	0.000%
16	8530.41	-75730.27	-14744.53	-8530.42	75730.26	14744.43	0.000%
17	14676.98	-75715.77	-8567.92	-14677.08	75715.77	8567.62	0.000%
18	16901.26	-75742.13	-98.47	-16901.08	75742.12	98.58	0.000%
19	14604.18	-75770.36	8412.94	-14603.85	75770.34	-8412.73	0.001%
20	8360.88	-75761.45	14647.84	-8360.70	75761.45	-14647.73	0.000%
21	-97.82	-75749.10	16960.47	97.80	75749.10	-16960.41	0.000%
22	-8530.41	-75768.92	14744.53	8530.29	75768.92	-14744.47	0.000%
23	-14701.93	-75783.42	8582.33	14701.70	75783.41	-8582.22	0.000%
24	-16901.26	-75757.06	98.47	16901.11	75757.06	-98.40	0.000%
25	-14579.22	-75728.83	-8398.53	14579.38	75728.82	8397.74	0.001%
26	-8360.88	-75737.73	-14647.84	8360.82	75737.72	14647.31	0.001%
27	19.80	-13321.90	-7147.20	-19.80	13321.90	7147.19	0.000%
28	3559.12	-13317.04	-6161.62	-3559.12	13317.04	6161.62	0.000%
29	6133.45	-13313.46	-3562.03	-6133.45	13313.46	3562.03	0.000%
30	7086.28	-13319.72	-19.96	-7086.27	13319.71	19.96	0.000%
31	6164.60	-13326.47	3557.15	-6164.54	13326.46	-3557.11	0.000%
32	3524.78	-13324.36	6142.06	-3524.52	13324.31	-6141.80	0.002%
33	-19.80	-13321.46	7088.34	19.80	13321.46	-7088.34	0.000%
34	-3559.12	-13326.32	6161.62	3559.12	13326.32	-6161.62	0.000%
35	-6184.42	-13329.90	3591.46	6184.42	13329.90	-3591.46	0.000%
36	-7086.28	-13323.64	19.96	7086.27	13323.64	-19.96	0.000%
37	-6113.63	-13316.89	-3527.72	6113.57	13316.88	3527.68	0.000%
38	-3524.78	-13319.00	-6142.06	3524.57	13318.96	6141.61	0.003%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	No	500	0.05844938	0.00000000
2	Yes	14	0.00000001	0.00004038
3	Yes	15	0.00000001	0.00009454
4	Yes	15	0.00000001	0.00006216
5	Yes	13	0.00000001	0.00005916
6	Yes	13	0.00000001	0.00009226
7	Yes	13	0.00000001	0.00003062
8	Yes	14	0.00000001	0.00005041
9	Yes	14	0.00000001	0.00007099
10	No	500	0.42304236	0.00000000
11	Yes	14	0.00000001	0.00004399
12	Yes	17	0.00000001	0.00003998
13	Yes	13	0.00000001	0.00006355
14	Yes	7	0.00000001	0.00008976
15	Yes	13	0.00000001	0.00004556
16	Yes	13	0.00000001	0.00003086
17	Yes	10	0.00000001	0.00009333
18	Yes	12	0.00000001	0.00004255

19	Yes	12	0.00000001	0.00005613
20	Yes	12	0.00000001	0.00004192
21	Yes	10	0.00000001	0.00003473
22	Yes	13	0.00000001	0.00003746
23	Yes	13	0.00000001	0.00005557
24	Yes	13	0.00000001	0.00002859
25	Yes	10	0.00000001	0.00008347
26	Yes	12	0.00000001	0.00008868
27	Yes	9	0.00000001	0.00005265
28	Yes	10	0.00000001	0.00001224
29	Yes	10	0.00000001	0.00001251
30	Yes	9	0.00000001	0.00007002
31	Yes	8	0.00000001	0.00007267
32	Yes	7	0.00000001	0.00007974
33	Yes	9	0.00000001	0.00005168
34	Yes	10	0.00000001	0.00001381
35	Yes	10	0.00000001	0.00001634
36	Yes	9	0.00000001	0.00007778
37	Yes	8	0.00000001	0.00005993
38	Yes	7	0.00000001	0.00009136

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	117 - 97	2.135	37	0.1658	0.4729
T2	97 - 77	1.525	37	0.1560	0.4403
T3	77 - 57	0.910	37	0.1232	0.4060
T4	57 - 37	0.524	38	0.0691	0.3761
T5	37 - 21	0.278	38	0.0613	0.3491
T6	21 - 17	0.059	38	0.0686	0.3219

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	Albion - 16' Omni w/ Pipe Mount	37	2.135	0.1658	0.4729	211590
121.00	Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	37	2.135	0.1658	0.4729	211590
120.00	W.Monroe - 7.5' Omni	37	2.135	0.1658	0.4729	211590
119.00	Cobleskill - 4' Omni with Mounts	37	2.135	0.1658	0.4729	211590
117.00	W.Monroe - 12' Omni	37	2.135	0.1658	0.4729	211590
115.00	(4) ALP 9212	37	2.076	0.1652	0.4697	211590
114.00	LLPX310R w/ mounting pipe	37	2.046	0.1650	0.4681	211590
110.00	VHLP1-23-1GR (12")	37	1.926	0.1638	0.4617	151136
109.03	Guy	37	1.897	0.1634	0.4602	132797
108.00	VHLP2-180	37	1.866	0.1631	0.4585	117550
102.00	LPA-80063/4CF	37	1.683	0.1600	0.4487	70530
68.98	Guy	37	0.726	0.1005	0.3932	16786
32.00	GPS	38	0.213	0.0634	0.3410	75637
27.00	GPS Antenna	38	0.145	0.0658	0.3323	105411

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	117 - 97	24.318	10	1.5563	9.1582
T2	97 - 77	17.792	10	1.5224	8.8929
T3	77 - 57	11.576	10	1.2895	8.5825
T4	57 - 37	6.953	10	0.9469	8.0877
T5	37 - 21	3.440	10	0.8262	7.4715
T6	21 - 17	0.698	10	0.8323	6.8947

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	Albion - 16' Omni w/ Pipe Mount	10	24.318	1.5563	9.1582	91046
121.00	Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	10	24.318	1.5563	9.1582	91046
120.00	W.Monroe - 7.5' Omni	10	24.318	1.5563	9.1582	91046
119.00	Cobleskill - 4' Omni with Mounts	10	24.318	1.5563	9.1582	91046
117.00	W.Monroe - 12' Omni	10	24.318	1.5563	9.1582	91046
115.00	(4) ALP 9212	10	23.666	1.5573	9.1318	91046
114.00	LLPX310R w/ mounting pipe	10	23.340	1.5578	9.1185	91046
110.00	VHLP1-23-1GR (12")	10	22.037	1.5583	9.0655	65033
109.03	Guy	10	21.722	1.5579	9.0527	57142
108.00	VHLP2-180	10	21.385	1.5573	9.0390	50581
102.00	LPA-80063/4CF	10	19.427	1.5457	8.9594	30349
68.98	Guy	10	9.521	1.1470	8.4049	2500
32.00	GPS	10	2.593	0.8248	7.2957	20399
27.00	GPS Antenna	10	1.737	0.8277	7.1140	27061

Guy Design Data

Section No.	Elevation ft	Size	Initial Tension lb	Breaking Load lb	Actual T_u lb	Allowable ϕT_n lb	Required S.F.	Actual S.F.
T1	109.03 (A) (255)	3/4 EHS	5830.00	58299.91	31634.70	34980.00	1.000	1.106 ✔
	109.03 (B) (254)	3/4 EHS	5830.00	58299.91	33430.60	34980.00	1.000	1.046 ✔
	109.03 (C) (253)	3/4 EHS	5830.00	58299.91	32490.00	34980.00	1.000	1.077 ✔
T3	68.98 (A) (258)	7/8 EHS	7970.00	79699.84	39058.20	47820.00	1.000	1.224 ✔
	68.98 (B) (257)	7/8 EHS	7970.00	79699.84	44558.60	47820.00	1.000	1.073 ✔
	68.98 (C) (256)	7/8 EHS	7970.00	79699.84	41324.70	47820.00	1.000	1.157 ✔

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	Mast Stability Index	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	2" solid	20.00	3.98	95.6 K=1.00	3.1416	1.00	-34357.80	72468.20	0.474 [1] ✓
T2	97 - 77	2" solid	20.00	3.97	95.2 K=1.00	3.1416	1.00	-90846.60	72873.70	1.247 [1] ✗
T3	77 - 57	4.9-3 (1.25 CR) - 54 2 1/4" solid	20.00	3.97	84.6 K=1.00	3.9761	1.00	-126000.00	105993.00	1.189 [1] ✗
T4	57 - 37	4.9-3 (1.19 CR) - 105/3 2" solid	20.00	3.97	95.2 K=1.00	3.1416	1.00	-86649.20	72873.70	1.189 [1] ✗
T5	37 - 21	4.9-3 (1.19 CR) - 156/5 2" solid	16.00	3.96	95.0 K=1.00	3.1416	1.00	-51492.10	73076.70	0.705 [1] ✓
T6	21 - 17	fv/Fv (7.31 CR) - 207/4 2" solid fv/Fv (10.27 CR) - 248	4.37	4.28	102.7 K=1.00	3.1416	1.00	-48824.60	65416.60	0.746 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-9039.07	15470.70	0.584 [1] ✓
T2	97 - 77	4.9-3 (32.74 CR) - 45 L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-9512.73	15470.70	0.615 [1] ✓
T3	77 - 57	4.9-3 (30.61 CR) - 67 L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-11838.20	15561.20	0.761 [1] ✓
T4	57 - 37	4.9-3 (30.08 CR) - 145 L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-6422.46	10336.40	0.621 [1] ✓
T5	37 - 21	4.9-3 (26.22 CR) - 198 L2x2x1/8 4.9-3 (20.77 CR) - 220	3.04	2.88	86.8 K=1.00	0.4844	-6492.44	10336.40	0.628 [1] ✓

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

[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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-4916.85	15470.70	0.318 [1]
T2	97 - 77	4.9-3 (32.88 CR) - 6 L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-4086.86	15470.70	0.264 [1]
T3	77 - 57	4.9-3 (31.82 CR) - 57 L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-4828.92	15561.20	0.310 [1]
T4	57 - 37	4.9-3 (30.40 CR) - 108 L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-3465.80	10336.40	0.335 [1]
T5	37 - 21	4.9-3 (27.17 CR) - 159 L2x2x1/8 4.9-3 (22.99 CR) - 208	3.04	2.88	86.8 K=1.00	0.4844	-3139.80	10336.40	0.304 [1]

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-4181.69	15470.70	0.270 [1]
T2	97 - 77	4.9-3 (31.87 CR) - 9 L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-5709.76	15470.70	0.369 [1]
T3	77 - 57	4.9-3 (30.45 CR) - 58 L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-4197.55	15561.20	0.270 [1]
T4	57 - 37	4.9-3 (27.23 CR) - 111 L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-3296.59	10336.40	0.319 [1]
T5	37 - 21	4.9-3 (23.05 CR) - 160 L2x2x1/8 4.9-3 (20.15 CR) - 213	3.04	2.88	86.8 K=1.00	0.4844	-460.81	10336.40	0.045 [*1]

* DL controls
[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16 4.9-3 (32.90 CR) - 36	3.04	2.88	87.6 K=1.00	0.7150	-7281.52	15470.70	0.471 [1]
T3	77 - 57	L2x2x3/16 4.9-3 (30.08 CR) - 138	3.04	2.85	86.9 K=1.00	0.7150	-4508.13	15561.20	0.290 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	117 - 97	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000
T3	77 - 57	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	117 - 97	L2x2x3/16	0.471	0.000	0.000	0.471 [1] ✔	1.000	4.9-3 ✔
T3	77 - 57	L2x2x3/16	0.290	0.000	0.000	0.290 [1] ✔	1.000	4.9-3 ✔

[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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	2" solid	20.00	3.98	95.6	3.1416	795.09	141372.00	0.006 [1] ✔
T2	97 - 77	2" solid	20.00	3.97	95.2	3.1416	44959.90	141372.00	0.318 [1] ✔
T3	77 - 57	4.9-3 (1.12 CR) - 52 2 1/4" solid	20.00	3.97	84.6	3.9761	54991.50	178924.00	0.307 [1] ✔
T4	57 - 37	4.9-3 (1.06 CR) - 103/4 2" solid	20.00	3.97	95.2	3.1416	10868.10	141372.00	0.077 [1] ✔
T5	37 - 21	4.9-3 (1.07 CR) - 154/5 2" solid	16.00	3.96	95.0	3.1416	65832.10	141372.00	0.466 [1] ✔
T6	21 - 17	fv/Fv (7.61 CR) - 205 2" solid fv/Fv (9.29 CR) - 247	4.37	4.28	102.7	3.1416	356312.00	141372.00	2.520 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	7/8" solid	5.01	4.74	259.9	0.6013	258354.00	19482.80	13.261 [1] ✘
T2	97 - 77	4.9-3 (13.26 CR) - 38 7/8" solid	5.00	4.72	259.2	0.6013	245769.00	19482.80	12.615 [1] ✘
T3	77 - 57	4.9-3 (12.61 CR) - 98 7/8" solid	5.00	4.69	257.3	0.6013	235617.00	19482.80	12.094 [1] ✘
T4	57 - 37	4.9-3 (12.09 CR) - 149 7/8" solid	5.00	4.72	259.2	0.6013	206234.00	19482.80	10.585 [1] ✘
T5	37 - 21	4.9-3 (10.59 CR) - 199 7/8" solid 4.9-3 (8.97 CR) - 241	4.99	4.72	258.9	0.6013	174751.00	19482.80	8.969 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	55.9	0.7150	758366.00	23166.00	32.736 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T2	97 - 77	4.9-3 (32.74 CR) - 45 L2x2x3/16	3.04	2.88	55.9	0.7150	727771.00	23166.00	31.416 [1]
T3	77 - 57	4.9-3 (31.42 CR) - 96 L2x2x3/16	3.04	2.85	55.5	0.7150	697106.00	23166.00	30.092 [1]
T4	57 - 37	4.9-3 (30.09 CR) - 147 L2x2x1/8	3.04	2.88	55.1	0.4844	411420.00	15693.80	26.215 [1]
T5	37 - 21	4.9-3 (26.22 CR) - 198 L2x2x1/8	3.04	2.88	55.1	0.4844	347419.00	15693.80	22.137 [1]
		4.9-3 (22.14 CR) - 239							

[1] $P_u / \phi P_n$ controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	55.9	0.7150	762020.00	23166.00	32.894 [1]
T2	97 - 77	4.9-3 (32.89 CR) - 5 L2x2x3/16	3.04	2.88	55.9	0.7150	737247.00	23166.00	31.824 [1]
T3	77 - 57	4.9-3 (31.82 CR) - 57 L2x2x3/16	3.04	2.85	55.5	0.7150	704356.00	23166.00	30.405 [1]
T4	57 - 37	4.9-3 (30.40 CR) - 108 L2x2x1/8	3.04	2.88	55.1	0.4844	426534.00	15693.80	27.179 [1]
T5	37 - 21	4.9-3 (27.18 CR) - 157 L2x2x1/8	3.04	2.88	55.1	0.4844	360857.00	15693.80	22.994 [1]
T6	21 - 17	4.9-3 (22.99 CR) - 210 L3x3x3/8	2.98	2.81	37.0	2.1100	1345740.00	68364.00	19.685 [1]
		4.9-3 (19.68 CR) - 251							

[1] $P_u / \phi P_n$ controls

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	55.9	0.7150	738201.00	23166.00	31.866 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T2	97 - 77	4.9-3 (31.87 CR) - 7 L2x2x3/16	3.04	2.88	55.9	0.7150	705424.00	23166.00	30.451 [1]
T3	77 - 57	4.9-3 (30.45 CR) - 58 L2x2x3/16	3.04	2.85	55.5	0.7150	630916.00	23166.00	27.235 [1]
T4	57 - 37	4.9-3 (27.23 CR) - 111 L2x2x1/8	3.04	2.88	55.1	0.4844	361924.00	15693.80	23.062 [1]
T5	37 - 21	4.9-3 (23.06 CR) - 161 L2x2x1/8	3.04	2.88	55.1	0.4844	316355.00	15693.80	20.158 [1]
		4.9-3 (20.16 CR) - 212							

[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	55.9	0.7150	766009.00	23166.00	33.066 [1]
T3	77 - 57	4.9-3 (33.07 CR) - 35 L2x2x3/16 4.9-3 (30.24 CR) - 137	3.04	2.85	55.5	0.7150	700591.00	23166.00	30.242 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	117 - 97	L2x2x3/16	-2.87	1301.02	0.002	-2.87	664.35	0.004
T3	77 - 57	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	117 - 97	L2x2x3/16	33.066	0.002	0.004	33.066 [1]	1.000	4.9-3
T3	77 - 57	L2x2x3/16	30.242	0.000	0.000	30.242 [1]	1.000	4.9-3

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	117 - 97	Leg	2" solid	1	-25496.30	72468.20	87.2	Pass
		Diagonal	7/8" solid	38	258354.00	19482.80	1326.1	Fail
		Horizontal	L2x2x3/16	45	758366.00	23166.00	3273.6	Fail
		Top Girt	L2x2x3/16	5	762020.00	23166.00	3289.4	Fail
		Bottom Girt	L2x2x3/16	7	738201.00	23166.00	3186.6	Fail
		Guy A@109.033	3/4	255	31634.70	34980.00	90.4	Pass
		Guy B@109.033	3/4	254	33430.60	34980.00	95.6	Pass
		Guy C@109.033	3/4	253	32490.00	34980.00	92.9	Pass
		Top Guy Pull-Off@109.033	L2x2x3/16	35	766009.00	23166.00	3306.6	Fail
T2	97 - 77	Leg	2" solid	54	-90846.60	72873.70	124.7	Fail
		Diagonal	7/8" solid	98	245769.00	19482.80	1261.5	Fail
		Horizontal	L2x2x3/16	96	727771.00	23166.00	3141.6	Fail
		Top Girt	L2x2x3/16	57	737247.00	23166.00	3182.4	Fail
		Bottom Girt	L2x2x3/16	58	705424.00	23166.00	3045.1	Fail
T3	77 - 57	Leg	2 1/4" solid	105	-126000.00	105993.00	118.9	Fail
		Diagonal	7/8" solid	149	235617.00	19482.80	1209.4	Fail
		Horizontal	L2x2x3/16	147	697106.00	23166.00	3009.2	Fail
		Top Girt	L2x2x3/16	108	704356.00	23166.00	3040.5	Fail
		Bottom Girt	L2x2x3/16	111	630916.00	23166.00	2723.5	Fail
		Guy A@68.9833	7/8	258	39058.20	47820.00	81.7	Pass
		Guy B@68.9833	7/8	257	44558.60	47820.00	93.2	Pass
		Guy C@68.9833	7/8	256	41324.70	47820.00	86.4	Pass
		Top Guy Pull-Off@68.9833	L2x2x3/16	137	700591.00	23166.00	3024.2	Fail
T4	57 - 37	Leg	2" solid	156	-86649.20	72873.70	118.9	Fail
		Diagonal	7/8" solid	199	206234.00	19482.80	1058.5	Fail
		Horizontal	L2x2x1/8	198	411420.00	15693.80	2621.5	Fail
		Top Girt	L2x2x1/8	157	426534.00	15693.80	2717.9	Fail
		Bottom Girt	L2x2x1/8	161	361924.00	15693.80	2306.2	Fail
T5	37 - 21	Leg	2" solid	205	-44299.60	73076.70	760.8	Fail
		Diagonal	7/8" solid	241	174751.00	19482.80	896.9	Fail
		Horizontal	L2x2x1/8	239	347419.00	15693.80	2213.7	Fail
		Top Girt	L2x2x1/8	210	360857.00	15693.80	2299.4	Fail
		Bottom Girt	L2x2x1/8	212	316355.00	15693.80	2015.8	Fail
T6	21 - 17	Leg	2" solid	248	343390.00	141372.00	1027.1	Fail
		Top Girt	L3x3x3/8	251	1345740.00	68364.00	1968.5	Fail
							Summary	
						Leg (T6)	1027.1	Fail
						Diagonal (T1)	1326.1	Fail
						Horizontal (T1)	3273.6	Fail
						Top Girt (T1)	3289.4	Fail
						Bottom Girt (T1)	3186.6	Fail

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
						Guy A (T1)	90.4	Pass
						Guy B (T1)	95.6	Pass
						Guy C (T1)	92.9	Pass
						Top Guy Pull-Off (T1)	3306.6	Fail
						RATING =	**3306.6**	**Fail**

tnxTOWER ANALYSIS:

Existing Tower with Proposed Microwave Antenna
Option #2 Location

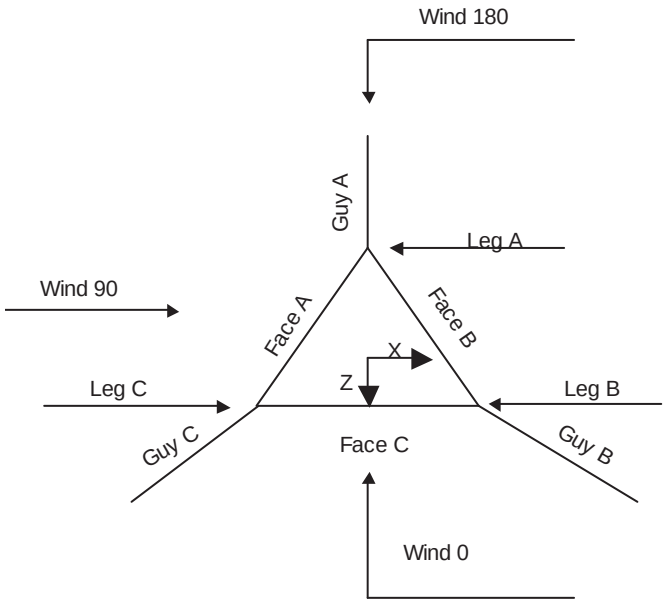
Tower Input Data

The main tower is a 3x guyed tower with an overall height of 117.00 ft above the ground line.
The base of the tower is set at an elevation of 17.00 ft above the ground line.
The face width of the tower is 3.04 ft at the top and tapered at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Hartford County, Connecticut.
Basic wind speed of 105 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
Tower is roof top mounted and located approx 25' above mean grade level..
Tension only take-up is 0.0313 in.
Pressures are calculated at each section.
Safety factor used in guy design is 1.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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



Corner & Starmount Guyed Tower

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	117.00-97.00			3.04	1	20.00
T2	97.00-77.00			3.04	1	20.00
T3	77.00-57.00			3.04	1	20.00
T4	57.00-37.00			3.04	1	20.00
T5	37.00-21.00			3.04	1	16.00
T6	21.00-17.00			3.04	1	4.00

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	117.00-97.00	3.98	TX Brace	No	Yes	0.0000	1.0000
T2	97.00-77.00	3.97	TX Brace	No	Yes	1.0000	1.0000
T3	77.00-57.00	3.97	TX Brace	No	Yes	1.0000	1.0000
T4	57.00-37.00	3.97	TX Brace	No	Yes	1.0000	1.0000

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
T5	37.00-21.00	3.96	TX Brace	No	Yes	1.0000	1.0000
T6	21.00-17.00	3.92	X Brace	No	Yes	1.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 117.00-97.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T2 97.00-77.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T3 77.00-57.00	Solid Round	2 1/4" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T4 57.00-37.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T5 37.00-21.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T6 21.00-17.00	Solid Round	2" solid	A572-50 (50 ksi)	Flat Bar	2x3/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 117.00-97.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T2 97.00-77.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T3 77.00-57.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 57.00-37.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T5 37.00-21.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 21.00-17.00	Equal Angle	L3x3x3/8	A36 (36 ksi)	Flat Bar	2x3/8	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 117.00-97.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T2 97.00-77.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T3 77.00-57.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 57.00-37.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T5 37.00-21.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 21.00-17.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 117.00-97.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T2 97.00-77.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T3 77.00-57.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T4 57.00-37.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T5 37.00-21.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T6 21.00-17.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1	No	No	1	1	1	1	1	1	1	1
117.00-97.00				1	1	1	1	1	1	1
T2	No	No	1	1	1	1	1	1	1	1
97.00-77.00				1	1	1	1	1	1	1
T3	No	No	1	1	1	1	1	1	1	1
77.00-57.00				1	1	1	1	1	1	1
T4	No	No	1	1	1	1	1	1	1	1
57.00-37.00				1	1	1	1	1	1	1
T5	No	No	1	1	1	1	1	1	1	1
37.00-21.00				1	1	1	1	1	1	1
T6	No	No	1	1	1	1	1	1	1	1
21.00-17.00				1	1	1	1	1	1	1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		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 117.00-97.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 97.00-77.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 77.00-57.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 57.00-37.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 37.00-21.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 21.00-17.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Guy Data

Guy Elevation ft	Guy Grade		Guy Size	Initial Tension lb	%	Guy Modulus ksi	Guy Weight plf	L_u ft	Anchor Radius ft	Anchor Azimuth Adj. °	Anchor Elevation ft	End Fitting Efficiency %
109.033	EHS	A	3/4	5830.00	10%	19000	1.155	101.59	45.00	0.0000	17.00	100%
		B	3/4	5830.00	10%	19000	1.155	99.19	39.00	0.0000	17.00	100%
		C	3/4	5830.00	10%	19000	1.155	91.24	37.50	0.0000	25.00	100%
68.9833	EHS	A	7/8	7970.00	10%	19000	1.581	67.56	45.00	0.0000	17.00	100%
		B	7/8	7970.00	10%	19000	1.581	63.89	39.00	0.0000	17.00	100%
		C	7/8	7970.00	10%	19000	1.581	56.62	37.50	0.0000	25.00	100%

Guy Data*(cont'd)*

Guy Elevation ft	Mount Type	Torque-Arm Spread ft	Torque-Arm Leg Angle °	Torque-Arm Style	Torque-Arm Grade	Torque-Arm Type	Torque-Arm Size
109.033	Corner						
68.9833	Corner						

Guy Data *(cont'd)*

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
109.03	A36 (36 ksi)	Solid Round			No	A36 (36 ksi)	Equal Angle	L2x2x3/16
68.98	A36 (36 ksi)	Solid Round			No	A36 (36 ksi)	Equal Angle	L2x2x3/16

Guy Data *(cont'd)*

Guy Elevation ft	Cable Weight A lb	Cable Weight B lb	Cable Weight C lb	Cable Weight D lb	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
109.033	117.34	114.57	105.38		1.01 1.7 sec/pulse	0.97 1.7 sec/pulse	0.82 1.6 sec/pulse	
68.9833	106.81	101.01	89.52		0.45 1.2 sec/pulse	0.40 1.1 sec/pulse	0.32 1.0 sec/pulse	

Guy Data *(cont'd)*

Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Torque Arm K_x	Torque Arm K_y	Pull Off K_x	Pull Off K_y	Diagonal K_x	Diagonal K_y
109.033	No	No			1	1	1	1
68.9833	No	No			1	1	1	1

Guy Data *(cont'd)*

Guy Elevation ft	Torque-Arm Bolt Size in	Torque-Arm Number	Torque-Arm Net Width Deduct in	Torque-Arm U	Pull Off Bolt Size in	Pull Off Number	Pull Off Net Width Deduct in	Pull Off U	Diagonal Bolt Size in	Diagonal Number	Diagonal Net Width Deduct in	Diagonal U
109.033	0.7500 A325N	2	0.0000	1	0.6250 A325N	0	0.0000	0.75	0.6250 A325N	0	0.0000	0.75
68.9833	0.0000 A325N	0	0.0000	1	0.6250 A325N	0	0.0000	0.75	0.6250 A325N	0	0.0000	0.75

Guy Pressures

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
109.033	A	63.02	28	6	2.1337
	B	63.02	28	6	2.1337
	C	67.02	28	6	2.1468

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
68.9833	A	42.99	25	6	2.0536
	B	42.99	25	6	2.0536
	C	46.99	26	6	2.0720

Guy-Mast Forces (Excluding Wind) - No Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top / Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
109.033	A	64.8326	5936.20 / 5830.00	0.00	5383.26	-2501.79	-9454.63	0.00	0.00
	B	67.9680	5936.20 / 5830.00	1911.16	5510.75	1103.41	4839.27	0.00	-8381.86
	C	66.9575	5926.97 / 5830.00	-1992.60	5462.14	1150.43	4796.58	-0.00	8307.92
			Sum:	**-81.44**	16356.16	**-247.95**	**181.22**	-0.00	**-73.94**
68.9833	A	50.2437	8052.11 / 7970.00	0.00	6212.06	-5123.16	-10910.24	0.00	0.00
	B	54.3801	8052.11 / 7970.00	4040.53	6562.67	2332.80	5763.00	0.00	-9981.82
	C	50.9005	8039.47 / 7970.00	-4371.94	6256.84	2524.14	5494.44	-0.00	9516.65
			Sum:	**-331.41**	19031.56	**-266.22**	**347.21**	-0.00	**-465.17**

Guy-Mast Forces (Excluding Wind) - Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top / Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
109.033	A	64.8326	8862.62 / 8065.31	0.00	8100.35	-3595.90	-14226.63	0.00	0.00
	B	67.9680	8743.50 / 7946.18	2708.40	8165.06	1563.70	7170.15	0.00	-12419.06
	C	66.9575	8686.28 / 7951.46	-2817.57	8053.98	1626.72	7072.60	-0.00	12250.10
			Sum:	**-109.17**	24319.38	**-405.48**	**16.11**	-0.00	**-168.96**
68.9833	A	50.2437	11483.14 / 11019.44	0.00	8950.84	-7193.39	-15720.36	0.00	0.00
	B	54.3801	11384.88 / 10921.18	5623.91	9351.17	3246.96	8211.73	0.00	-14223.13
	C	50.9005	11329.90 / 10932.63	-6078.36	8894.08	3509.34	7810.34	-0.00	13527.90
			Sum:	**-454.45**	27196.09	**-437.09**	**301.70**	-0.00	**-695.23**

Guy-Mast Forces (Excluding Wind) - Service

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom	F_x	F_y	F_z	M_x	M_y	M_z
ft		°	lb	lb	lb	lb	lb-ft	lb-ft	lb-ft
109.033	A	64.8326	5936.20 5830.00	0.00	5383.26	-2501.79	-9454.63	0.00	0.00
	B	67.9680	5936.20 5830.00	1911.16	5510.75	1103.41	4839.27	0.00	-8381.86
	C	66.9575	5926.97 5830.00	-1992.60	5462.14	1150.43	4796.58	-0.00	8307.92
			Sum:	**-81.44**	16356.16	**-247.95**	**181.22**	-0.00	**-73.94**
68.9833	A	50.2437	8052.11 7970.00	0.00	6212.06	-5123.16	-10910.24	0.00	0.00
	B	54.3801	8052.11 7970.00	4040.53	6562.67	2332.80	5763.00	0.00	-9981.82
	C	50.9005	8039.47 7970.00	-4371.94	6256.84	2524.14	5494.44	-0.00	9516.65
			Sum:	**-331.41**	19031.56	**-266.22**	**347.21**	-0.00	**-465.17**

Guy-Tensioning Information

Guy Elevation		H	V	Temperature At Time Of Tensioning													
				0 F		20 F		40 F		60 F		80 F		100 F		120 F	
				Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept
ft		ft	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft
109.033	A	43.24	92.03	6278	0.94	6129	0.96	5979	0.99	5830	1.01	5681	1.04	5532	1.07	5383	1.10
	B	37.24	92.03	6179	0.91	6063	0.93	5946	0.95	5830	0.97	5714	0.99	5598	1.01	5482	1.03
	C	35.74	84.03	6210	0.77	6083	0.78	5957	0.80	5830	0.82	5703	0.84	5577	0.86	5450	0.88
68.9833	A	43.24	51.98	9356	0.38	8893	0.40	8431	0.43	7970	0.45	7509	0.48	7049	0.51	6590	0.54
	B	37.24	51.98	9121	0.35	8737	0.37	8353	0.38	7970	0.40	7587	0.42	7205	0.45	6823	0.47
	C	35.74	43.98	9320	0.27	8870	0.28	8420	0.30	7970	0.32	7521	0.34	7072	0.36	6625	0.38

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement	Face Offset	Lateral Offset (Frac FW)	#		C_AA_A	Weight
				ft	in				ft^2/ft	plf
LDF7-50A (1-5/8 FOAM) (E-VZW)	C	No	CaAa (Out Of Face)	102.00 - 21.00	0.0000	0	12	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF6-50A (1-1/4 FOAM) (E-NEXTEL)	B	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.1	11	No Ice	0.16	0.66
								1/2" Ice	0.25	1.91
								1" Ice	0.35	3.78
LDF6-50A (1-1/4 FOAM) (E-NEXTEL)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.2	1	No Ice	0.16	0.66
								1/2" Ice	0.25	1.91
								1" Ice	0.35	3.78
LDF7-50A (1-5/8 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.4	1	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF4RN-50A (1/2 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.5	2	No Ice	0.06	0.15
								1/2" Ice	0.16	0.84
								1" Ice	0.26	2.14
LDF5-50A (7/8 FOAM)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.2	1	No Ice	0.11	0.33
								1/2" Ice	0.21	1.30

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#		C_AA_A ft^2/ft	Weight plf
(E)								1" Ice	0.31	2.88
LDF7-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.24	1	No Ice	0.20	0.82
(1-5/8 FOAM)								1/2" Ice	0.30	2.33
(E)								1" Ice	0.40	4.46
LDF5-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.27	1	No Ice	0.11	0.33
(7/8 FOAM)								1/2" Ice	0.21	1.30
(E)								1" Ice	0.31	2.88
LDF7-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.31	1	No Ice	0.20	0.82
(1-5/8 FOAM)								1/2" Ice	0.30	2.33
(E)								1" Ice	0.40	4.46
LDF4RN-50A	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.35	1	No Ice	0.06	0.15
(1/2 FOAM)								1/2" Ice	0.16	0.84
(E)								1" Ice	0.26	2.14
LDF5-50A	A	No	CaAa (Out Of Face)	27.00 - 21.00	0.0000	0.4	3	No Ice	0.11	0.33
(7/8 FOAM)								1/2" Ice	0.21	1.30
(E)								1" Ice	0.31	2.88
***CLEARW										
IRE***										
LDF4RN-50A	C	No	CaAa (Out Of Face)	110.00 - 21.00	0.0000	0.35	2	No Ice	0.06	0.15
(1/2 FOAM)								1/2" Ice	0.16	0.84
(P)								1" Ice	0.26	2.14
LDF4RN-50A	C	No	CaAa (Out Of Face)	114.00 - 21.00	0.0000	0.37	1	No Ice	0.06	0.15
(1/2 FOAM)								1/2" Ice	0.16	0.84
(P)								1" Ice	0.26	2.14
2" Rigid	C	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.4	1	No Ice	0.20	2.80
Conduit								1/2" Ice	0.30	4.33
(P)								1" Ice	0.40	6.47

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 lb
T1	117.00-97.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	18.589	111.65
T2	97.00-77.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T3	77.00-57.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T4	57.00-37.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T5	37.00-21.00	A	0.000	0.000	0.000	20.458	73.62
		B	0.000	0.000	0.000	27.281	116.16
		C	0.000	0.000	0.000	44.240	209.44
T6	21.00-17.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
T1	117.00-97.00	A	2.250	0.000	0.000	0.000	104.108	1929.11
		B		0.000	0.000	0.000	133.085	2560.18
		C		0.000	0.000	0.000	73.930	1448.76
T2	97.00-77.00	A	2.204	0.000	0.000	0.000	102.449	1855.31
		B		0.000	0.000	0.000	131.058	2466.68
		C		0.000	0.000	0.000	196.329	3791.96
T3	77.00-57.00	A	2.147	0.000	0.000	0.000	100.404	1764.29
		B		0.000	0.000	0.000	128.558	2351.39
		C		0.000	0.000	0.000	192.692	3620.30
T4	57.00-37.00	A	2.072	0.000	0.000	0.000	97.711	1644.50
		B		0.000	0.000	0.000	125.268	2199.64
		C		0.000	0.000	0.000	187.906	3394.36
T5	37.00-21.00	A	1.974	0.000	0.000	0.000	84.426	1343.52
		B		0.000	0.000	0.000	96.776	1617.71
		C		0.000	0.000	0.000	145.324	2503.51
T6	21.00-17.00	A	1.893	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	117.00-97.00	0.8998	-0.2393	0.7711	-0.5435
T2	97.00-77.00	-0.7583	0.6343	-0.6803	0.3217
T3	77.00-57.00	-0.7545	0.6311	-0.6802	0.3235
T4	57.00-37.00	-0.7583	0.6343	-0.6816	0.3268
T5	37.00-21.00	-0.7429	0.4468	-0.6649	0.0954
T6	21.00-17.00	0.0000	0.0000	0.0000	0.0000

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
W.Monroe - 12' Omni	C	From Leg	0.00	0.0000	117.00	No Ice	3.00	3.00	20.45
(E)			0.00			1/2" Ice	7.05	7.05	42.76
			0.00			1" Ice	11.10	11.10	65.06
Albion - 16' Omni w/ Pipe	B	From Leg	0.00	0.0000	124.00	No Ice	4.32	4.59	60.59

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
Mount			0.00					1/2" Ice	6.08	6.53	97.01
(E)			0.00					1" Ice	7.84	8.46	133.42
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	A	From Leg	0.00			0.0000	124.00	No Ice	5.39	6.03	48.93
			0.00					1/2" Ice	16.58	17.53	103.58
(E)			0.00					1" Ice	27.52	28.69	155.94
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	B	From Leg	0.00			0.0000	121.00	No Ice	5.39	6.03	48.93
			0.00					1/2" Ice	16.58	17.53	103.58
(E)			0.00					1" Ice	27.52	28.69	155.94
W.Monroe - 7.5' Omni	B	From Leg	2.00			0.0000	120.00	No Ice	2.10	6.50	45.01
(E)			0.00					1/2" Ice	4.60	15.68	96.07
			0.00					1" Ice	7.10	24.86	147.13
Cobleskill - 4' Omni with Mounts	A	From Leg	0.00			0.0000	119.00	No Ice	1.91	1.15	11.10
			0.00					1/2" Ice	1.91	1.91	22.70
(E)			0.00					1" Ice	1.99	2.50	33.01
(4) ALP 9212	A	From Leg	4.00			0.0000	115.00	No Ice	5.46	5.46	17.20
(E)			0.00					1/2" Ice	6.09	6.09	50.00
			0.00					1" Ice	6.72	6.72	80.00
(4) ALP 9212	B	From Leg	4.00			0.0000	115.00	No Ice	5.46	5.46	17.20
(E)			0.00					1/2" Ice	6.09	6.09	50.00
			0.00					1" Ice	6.72	6.72	80.00
(4) ALP 9212	C	From Leg	4.00			0.0000	115.00	No Ice	5.46	5.46	17.20
(E)			0.00					1/2" Ice	6.09	6.09	50.00
			0.00					1" Ice	6.72	6.72	80.00
LPA-80063/4CF	A	From Leg	4.00			0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00					1/2" Ice	7.41	6.48	72.62
			0.00					1" Ice	7.83	6.89	130.34
LPA-80063/4CF	B	From Leg	4.00			0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00					1/2" Ice	7.41	6.48	72.62
			0.00					1" Ice	7.83	6.89	130.34
LPA-80063/4CF	C	From Leg	4.00			0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00					1/2" Ice	7.41	6.48	72.62
			0.00					1" Ice	7.83	6.89	130.34
(2) LPA-171063/8CF	A	From Leg	4.00			0.0000	102.00	No Ice	3.69	3.69	11.50
(E)			0.00					1/2" Ice	4.06	4.06	40.29
			0.00					1" Ice	4.43	4.43	73.40
(2) LPA-171063/8CF	B	From Leg	4.00			0.0000	102.00	No Ice	3.69	3.69	11.50
(E)			0.00					1/2" Ice	4.06	4.06	40.29
			0.00					1" Ice	4.43	4.43	73.40
(2) LPA-171063/8CF	C	From Leg	4.00			0.0000	102.00	No Ice	3.69	3.69	11.50
(E)			0.00					1/2" Ice	4.06	4.06	40.29
			0.00					1" Ice	4.43	4.43	73.40
PiROD 13' Lightweight T-Frame	A	From Leg	0.00			0.0000	102.00	No Ice	10.60	10.60	255.00
			0.00					1/2" Ice	16.80	16.80	359.00
(E)			0.00					1" Ice	23.00	23.00	463.00
PiROD 13' Lightweight T-Frame	B	From Leg	0.00			0.0000	102.00	No Ice	10.60	10.60	255.00
			0.00					1/2" Ice	16.80	16.80	359.00
(E)			0.00					1" Ice	23.00	23.00	463.00
PiROD 13' Lightweight T-Frame	C	From Leg	0.00			0.0000	102.00	No Ice	10.60	10.60	255.00
			0.00					1/2" Ice	16.80	16.80	359.00
(E)			0.00					1" Ice	23.00	23.00	463.00
LPA-80063/4CF	A	From Leg	4.00			0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00					1/2" Ice	7.41	6.48	72.62
			0.00					1" Ice	7.83	6.89	130.34
LPA-80063/4CF	B	From Leg	4.00			0.0000	102.00	No Ice	7.00	6.08	20.00
(E)			0.00					1/2" Ice	7.41	6.48	72.62
			0.00					1" Ice	7.83	6.89	130.34
LPA-80063/4CF	C	From Leg	4.00			0.0000	102.00	No Ice	7.00	6.08	20.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
(E)			0.00				1/2" Ice	7.41	6.48	72.62
			0.00				1" Ice	7.83	6.89	130.34
(2) GPS Antenna	A	From Leg	0.00		0.0000	102.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
GPS Antenna	A	From Leg	0.00		0.0000	27.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
GPS Antenna	B	From Leg	0.00		0.0000	27.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
GPS Antenna	C	From Leg	0.00		0.0000	27.00	No Ice	0.00	0.00	8.00
(E)			0.00				1/2" Ice	0.02	0.02	8.11
			0.00				1" Ice	0.05	0.05	8.49
CLEARWIRE										
LLPX310R w/ mounting pipe	A	From Leg	4.00		0.0000	114.00	No Ice	4.94	2.82	43.26
(P)			0.00				1/2" Ice	5.33	3.34	78.28
			0.00				1" Ice	5.72	3.87	120.86
LLPX310R w/ mounting pipe	B	From Leg	4.00		0.0000	114.00	No Ice	4.94	2.82	43.26
(P)			0.00				1/2" Ice	5.33	3.34	78.28
			0.00				1" Ice	5.72	3.87	120.86
LLPX310R w/ mounting pipe	C	From Leg	4.00		0.0000	114.00	No Ice	4.94	2.82	43.26
(P)			0.00				1/2" Ice	5.33	3.34	78.28
			0.00				1" Ice	5.72	3.87	120.86
4'x4" Pipe Mount	B	From Leg	0.00		0.0000	110.00	No Ice	1.32	1.32	44.00
(P)			0.00				1/2" Ice	1.58	1.58	56.99
			0.00				1" Ice	1.84	1.84	73.03
4'x4" Pipe Mount	B	From Leg	0.00		0.0000	117.00	No Ice	1.32	1.32	44.00
(P)			0.00				1/2" Ice	1.58	1.58	56.99
			0.00				1" Ice	1.84	1.84	73.03
4'x4" Pipe Mount	A	From Leg	0.00		0.0000	114.00	No Ice	1.32	1.32	44.00
(P)			0.00				1/2" Ice	1.58	1.58	56.99
			0.00				1" Ice	1.84	1.84	73.03
6'8"x4" Pipe Mount	B	From Leg	0.00		0.0000	114.00	No Ice	2.60	2.60	72.00
(P)			0.00				1/2" Ice	3.01	3.01	93.13
			0.00				1" Ice	3.42	3.42	118.95
10' x 4.5" od pipe mount	C	From Leg	0.00		0.0000	114.00	No Ice	4.50	4.50	150.00
(P)			0.00				1/2" Ice	5.24	5.24	181.31
			0.00				1" Ice	5.85	5.85	219.35
existing										
(2) 1-1/2" Pipe	A	From Leg	0.00		0.0000	102.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
1-1/2" Pipe	A	From Leg	0.00		0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
1-1/2" Pipe	B	From Leg	0.00		0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
1-1/2" Pipe	C	From Leg	0.00		0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00				1/2" Ice	0.38	0.38	8.04
			0.00				1" Ice	0.51	0.51	12.17
10' Boom Gate w/3 - 2 3/8"	B	From Leg	0.00		0.0000	115.00	No Ice	35.30	35.30	1750.00
Pipe (Tapered) (3)			0.00				1/2" Ice	46.40	46.40	2400.00
(E)			0.00				1" Ice	57.50	57.50	3050.00
CLEARWIRE										
Remote RU	A	From Leg	0.00		0.0000	114.00	No Ice	0.00	0.86	33.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
Remote RU	B	From Leg	0.00	0.0000	114.00	No Ice	0.00	0.86	33.00
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
Remote RU	C	From Leg	0.00	0.0000	114.00	No Ice	0.00	0.86	33.00
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
GPS	C	From Leg	0.50	0.0000	32.00	No Ice	0.12	0.12	5.00
(P)			0.00			1/2" Ice	0.17	0.17	5.71
			0.00			1" Ice	0.22	0.22	6.85

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight lb
VHLP2-180	A	Paraboloid w/o	From	4.00	Worst		119.00	2.00	No Ice	3.14	25.00
(Ericson)		Radome	Leg	0.00					1/2" Ice	3.41	42.49
				0.00					1" Ice	3.67	59.98
VHLP1-23-1GR (12")	B	Paraboloid w/o	From	0.00	Worst		110.00	1.00	No Ice	0.79	28.00
(P)		Radome	Leg	0.00					1/2" Ice	0.92	35.28
				0.00					1" Ice	1.06	42.56
VHLP1-23-1GR (12")	C	Paraboloid w/o	From	0.00	Worst		110.00	1.00	No Ice	0.79	28.00
(P)		Radome	Leg	0.00					1/2" Ice	0.92	35.28
				0.00					1" Ice	1.06	42.56

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	107.00	1.284	31	64.173	A	3.019	10.627	6.667	48.85	0.000	23.120
117.00-97.00					B	3.019	10.627		48.85	0.000	34.101
					C	3.019	10.627		48.85	0.000	18.589
T2 97.00-77.00	87.00	1.229	29	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T3 77.00-57.00	67.00	1.163	28	64.590	A	2.997	11.466	7.500	51.85	0.000	23.120
					B	2.997	11.466		51.85	0.000	34.101
					C	2.997	11.466		51.85	0.000	55.300
T4 57.00-37.00	47.00	1.08	26	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T5 37.00-21.00	29.00	0.975	23	51.339	A	2.516	8.490	5.333	48.46	0.000	20.458
					B	2.516	8.490		48.46	0.000	27.281
					C	2.516	8.490		48.46	0.000	44.240
T6 21.00-17.00	19.00	0.892	21	6.797	A	0.738	1.529	1.456	64.23	0.000	0.000
					B	0.738	1.529		64.23	0.000	0.000
					C	0.738	1.529		64.23	0.000	0.000

Tower Pressure - With Ice

$G_H = 0.850$

Section Elevation	z	K_Z	q_z	t_Z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	in	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
T1 117.00-97.00	107.00	1.284	7	2.2497	71.672	A	3.019	51.818	21.664	39.51	0.000	104.108
						B	3.019	51.818		39.51	0.000	133.085
						C	3.019	51.818		39.51	0.000	73.930
T2 97.00-77.00	87.00	1.229	7	2.2036	71.519	A	3.019	50.916	21.357	39.60	0.000	102.449
						B	3.019	50.916		39.60	0.000	131.058
						C	3.019	50.916		39.60	0.000	196.329
T3 77.00-57.00	67.00	1.163	6	2.1468	71.746	A	2.997	50.550	21.812	40.73	0.000	100.404
						B	2.997	50.550		40.73	0.000	128.558
						C	2.997	50.550		40.73	0.000	192.692
T4 57.00-37.00	47.00	1.08	6	2.0720	71.080	A	3.019	48.510	20.480	39.74	0.000	97.711
						B	3.019	48.510		39.74	0.000	125.268
						C	3.019	48.510		39.74	0.000	187.906
T5 37.00-21.00	29.00	0.975	5	1.9743	56.604	A	2.516	37.556	15.863	39.59	0.000	84.426
						B	2.516	37.556		39.59	0.000	96.776
						C	2.516	37.556		39.59	0.000	145.324
T6 21.00-17.00	19.00	0.892	5	1.8926	8.147	A	0.738	5.354	4.212	69.14	0.000	0.000
						B	0.738	5.354		69.14	0.000	0.000
						C	0.738	5.354		69.14	0.000	0.000

Tower Pressure - Service

$G_H = 0.850$

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
T1	107.00	1.284	10	64.173	A	3.019	10.627	6.667	48.85	0.000	23.120
117.00-97.00					B	3.019	10.627		48.85	0.000	34.101
					C	3.019	10.627		48.85	0.000	18.589
T2 97.00-77.00	87.00	1.229	10	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T3 77.00-57.00	67.00	1.163	9	64.590	A	2.997	11.466	7.500	51.85	0.000	23.120
					B	2.997	11.466		51.85	0.000	34.101

Section Elevation	z	K_Z	q_z	A_G	Face	A_F	A_R	A_{leg}	Leg %	C_AA_A In Face	C_AA_A Out Face
ft	ft		psf	ft^2		ft^2	ft^2	ft^2		ft^2	ft^2
					C	2.997	11.466		51.85	0.000	55.300
T4 57.00-37.00	47.00	1.08	8	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T5 37.00-21.00	29.00	0.975	8	51.339	A	2.516	8.490	5.333	48.46	0.000	20.458
					B	2.516	8.490		48.46	0.000	27.281
					C	2.516	8.490		48.46	0.000	44.240
T6 21.00-17.00	19.00	0.892	7	6.797	A	0.738	1.529	1.456	64.23	0.000	0.000
					B	0.738	1.529		64.23	0.000	0.000
					C	0.738	1.529		64.23	0.000	0.000

Tower Forces - No Ice - Wind Normal 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	lb	lb				psf			ft^2	lb	plf	
T1	341.45	1298.76	A	0.213	2.554	31	1	1	9.149	2596.37	129.82	C
117.00-97.00			B	0.213	2.554		1	1	9.149			
			C	0.213	2.554		1	1	9.149			
T2	491.60	1297.78	A	0.212	2.555	29	1	1	9.143	3405.50	170.28	C
97.00-77.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T3	491.60	1502.23	A	0.224	2.518	28	1	1	9.637	3244.82	162.24	C
77.00-57.00			B	0.224	2.518		1	1	9.637			
			C	0.224	2.518		1	1	9.637			
T4	491.60	1246.22	A	0.212	2.555	26	1	1	9.143	2991.45	149.57	C
57.00-37.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T5	399.22	1000.19	A	0.214	2.549	23	1	1	7.416	2205.12	137.82	C
37.00-21.00			B	0.214	2.549		1	1	7.416			
			C	0.214	2.549		1	1	7.416			
T6	0.00	245.11	A	0.334	2.211	21	1	1	1.671	67.20	16.80	C
21.00-17.00			B	0.334	2.211		1	1	1.671			
			C	0.334	2.211		1	1	1.671			
Sum Weight:	2215.47	6590.29								14510.46		

Tower Forces - No 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	lb	lb				psf			ft^2	lb	plf	
T1	341.45	1298.76	A	0.213	2.554	31	0.8	1	8.545	2555.99	127.80	C
117.00-97.00			B	0.213	2.554		0.8	1	8.545			
			C	0.213	2.554		0.8	1	8.545			
T2	491.60	1297.78	A	0.212	2.555	29	0.8	1	8.539	3366.84	168.34	C
97.00-77.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T3	491.60	1502.23	A	0.224	2.518	28	0.8	1	9.038	3209.01	160.45	C
77.00-57.00			B	0.224	2.518		0.8	1	9.038			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.224	2.518		0.8	1	9.038			
T4	491.60	1246.22	A	0.212	2.555	26	0.8	1	8.539	2957.49	147.87	C
57.00-37.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T5	399.22	1000.19	A	0.214	2.549	23	0.8	1	6.913	2179.62	136.23	C
37.00-21.00			B	0.214	2.549		0.8	1	6.913			
			C	0.214	2.549		0.8	1	6.913			
T6	0.00	245.11	A	0.334	2.211	21	0.8	1	1.523	61.27	15.32	C
21.00-17.00			B	0.334	2.211		0.8	1	1.523			
			C	0.334	2.211		0.8	1	1.523			
Sum Weight:	2215.47	6590.29								14330.21		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	31	0.85	1	8.696	2566.08	128.30	C
117.00-97.00			B	0.213	2.554		0.85	1	8.696			
			C	0.213	2.554		0.85	1	8.696			
T2	491.60	1297.78	A	0.212	2.555	29	0.85	1	8.690	3376.51	168.83	C
97.00-77.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T3	491.60	1502.23	A	0.224	2.518	28	0.85	1	9.188	3217.96	160.90	C
77.00-57.00			B	0.224	2.518		0.85	1	9.188			
			C	0.224	2.518		0.85	1	9.188			
T4	491.60	1246.22	A	0.212	2.555	26	0.85	1	8.690	2965.98	148.30	C
57.00-37.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T5	399.22	1000.19	A	0.214	2.549	23	0.85	1	7.039	2185.99	136.62	C
37.00-21.00			B	0.214	2.549		0.85	1	7.039			
			C	0.214	2.549		0.85	1	7.039			
T6	0.00	245.11	A	0.334	2.211	21	0.85	1	1.560	62.75	15.69	C
21.00-17.00			B	0.334	2.211		0.85	1	1.560			
			C	0.334	2.211		0.85	1	1.560			
Sum Weight:	2215.47	6590.29								14375.27		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4055.11	A	0.765	1.794	7	1	1	47.521	2353.05	117.65	C
117.00-97.00			B	0.765	1.794		1	1	47.521			
			C	0.765	1.794		1	1	47.521			
T2	8113.95	3961.51	A	0.754	1.789	7	1	1	46.328	2913.89	145.69	C
97.00-77.00			B	0.754	1.789		1	1	46.328			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.754	1.789		1	1	46.328			
T3	7735.98	4097.17	A	0.746	1.786	6	1	1	45.701	2707.17	135.36	C
77.00-57.00			B	0.746	1.786		1	1	45.701			
			C	0.746	1.786		1	1	45.701			
T4	7238.51	3662.69	A	0.725	1.78	6	1	1	43.235	2435.31	121.77	C
57.00-37.00			B	0.725	1.78		1	1	43.235			
			C	0.725	1.78		1	1	43.235			
T5	5464.74	2812.41	A	0.708	1.777	5	1	1	33.190	1738.44	108.65	C
37.00-21.00			B	0.708	1.777		1	1	33.190			
			C	0.708	1.777		1	1	33.190			
T6	0.00	489.84	A	0.748	1.787	5	1	1	5.267	38.82	9.71	C
21.00-17.00			B	0.748	1.787		1	1	5.267			
			C	0.748	1.787		1	1	5.267			
Sum Weight:	34491.23	19078.72								12186.69		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4055.11	A	0.765	1.794	7	0.8	1	46.918	2346.62	117.33	C
117.00-97.00			B	0.765	1.794		0.8	1	46.918			
			C	0.765	1.794		0.8	1	46.918			
T2	8113.95	3961.51	A	0.754	1.789	7	0.8	1	45.724	2907.75	145.39	C
97.00-77.00			B	0.754	1.789		0.8	1	45.724			
			C	0.754	1.789		0.8	1	45.724			
T3	7735.98	4097.17	A	0.746	1.786	6	0.8	1	45.102	2701.41	135.07	C
77.00-57.00			B	0.746	1.786		0.8	1	45.102			
			C	0.746	1.786		0.8	1	45.102			
T4	7238.51	3662.69	A	0.725	1.78	6	0.8	1	42.631	2429.95	121.50	C
57.00-37.00			B	0.725	1.78		0.8	1	42.631			
			C	0.725	1.78		0.8	1	42.631			
T5	5464.74	2812.41	A	0.708	1.777	5	0.8	1	32.687	1734.41	108.40	C
37.00-21.00			B	0.708	1.777		0.8	1	32.687			
			C	0.708	1.777		0.8	1	32.687			
T6	0.00	489.84	A	0.748	1.787	5	0.8	1	5.119	37.73	9.43	C
21.00-17.00			B	0.748	1.787		0.8	1	5.119			
			C	0.748	1.787		0.8	1	5.119			
Sum Weight:	34491.23	19078.72								12157.87		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4055.11	A	0.765	1.794	7	0.85	1	47.068	2348.22	117.41	C
117.00-97.00			B	0.765	1.794		0.85	1	47.068			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
			C	0.765	1.794		0.85	1	47.068			
T2	8113.95	3961.51	A	0.754	1.789	7	0.85	1	45.875	2909.29	145.46	C
97.00-77.00			B	0.754	1.789		0.85	1	45.875			
			C	0.754	1.789		0.85	1	45.875			
T3	7735.98	4097.17	A	0.746	1.786	6	0.85	1	45.252	2702.85	135.14	C
77.00-57.00			B	0.746	1.786		0.85	1	45.252			
			C	0.746	1.786		0.85	1	45.252			
T4	7238.51	3662.69	A	0.725	1.78	6	0.85	1	42.782	2431.29	121.56	C
57.00-37.00			B	0.725	1.78		0.85	1	42.782			
			C	0.725	1.78		0.85	1	42.782			
T5	5464.74	2812.41	A	0.708	1.777	5	0.85	1	32.813	1735.42	108.46	C
37.00-21.00			B	0.708	1.777		0.85	1	32.813			
			C	0.708	1.777		0.85	1	32.813			
T6	0.00	489.84	A	0.748	1.787	5	0.85	1	5.156	38.01	9.50	C
21.00-17.00			B	0.748	1.787		0.85	1	5.156			
			C	0.748	1.787		0.85	1	5.156			
Sum Weight:	34491.23	19078.72								12165.08		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	10	1	1	9.149	847.79	42.39	C
117.00-97.00			B	0.213	2.554		1	1	9.149			
			C	0.213	2.554		1	1	9.149			
T2	491.60	1297.78	A	0.212	2.555	10	1	1	9.143	1112.00	55.60	C
97.00-77.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T3	491.60	1502.23	A	0.224	2.518	9	1	1	9.637	1059.53	52.98	C
77.00-57.00			B	0.224	2.518		1	1	9.637			
			C	0.224	2.518		1	1	9.637			
T4	491.60	1246.22	A	0.212	2.555	8	1	1	9.143	976.80	48.84	C
57.00-37.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T5	399.22	1000.19	A	0.214	2.549	8	1	1	7.416	720.04	45.00	C
37.00-21.00			B	0.214	2.549		1	1	7.416			
			C	0.214	2.549		1	1	7.416			
T6	0.00	245.11	A	0.334	2.211	7	1	1	1.671	21.94	5.49	C
21.00-17.00			B	0.334	2.211		1	1	1.671			
			C	0.334	2.211		1	1	1.671			
Sum Weight:	2215.47	6590.29								4738.11		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	10	0.8	1	8.545	834.61	41.73	C
117.00-97.00			B	0.213	2.554		0.8	1	8.545			
			C	0.213	2.554		0.8	1	8.545			
T2	491.60	1297.78	A	0.212	2.555	10	0.8	1	8.539	1099.38	54.97	C
97.00-77.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T3	491.60	1502.23	A	0.224	2.518	9	0.8	1	9.038	1047.84	52.39	C
77.00-57.00			B	0.224	2.518		0.8	1	9.038			
			C	0.224	2.518		0.8	1	9.038			
T4	491.60	1246.22	A	0.212	2.555	8	0.8	1	8.539	965.71	48.29	C
57.00-37.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T5	399.22	1000.19	A	0.214	2.549	8	0.8	1	6.913	711.71	44.48	C
37.00-21.00			B	0.214	2.549		0.8	1	6.913			
			C	0.214	2.549		0.8	1	6.913			
T6	0.00	245.11	A	0.334	2.211	7	0.8	1	1.523	20.01	5.00	C
21.00-17.00			B	0.334	2.211		0.8	1	1.523			
			C	0.334	2.211		0.8	1	1.523			
Sum Weight:	2215.47	6590.29								4679.25		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	341.45	1298.76	A	0.213	2.554	10	0.85	1	8.696	837.90	41.90	C
117.00-97.00			B	0.213	2.554		0.85	1	8.696			
			C	0.213	2.554		0.85	1	8.696			
T2	491.60	1297.78	A	0.212	2.555	10	0.85	1	8.690	1102.53	55.13	C
97.00-77.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T3	491.60	1502.23	A	0.224	2.518	9	0.85	1	9.188	1050.76	52.54	C
77.00-57.00			B	0.224	2.518		0.85	1	9.188			
			C	0.224	2.518		0.85	1	9.188			
T4	491.60	1246.22	A	0.212	2.555	8	0.85	1	8.690	968.48	48.42	C
57.00-37.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T5	399.22	1000.19	A	0.214	2.549	8	0.85	1	7.039	713.79	44.61	C
37.00-21.00			B	0.214	2.549		0.85	1	7.039			
			C	0.214	2.549		0.85	1	7.039			
T6	0.00	245.11	A	0.334	2.211	7	0.85	1	1.560	20.49	5.12	C
21.00-17.00			B	0.334	2.211		0.85	1	1.560			
			C	0.334	2.211		0.85	1	1.560			
Sum Weight:	2215.47	6590.29								4693.97		

Discrete Appurtenance Pressures - No Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
W.Monroe - 12' Omni	240.0000	20.45	-1.52	0.88	117.00	1.308	31	3.00	3.00
Albion - 16' Omni w/ Pipe Mount	120.0000	60.59	1.52	0.88	124.00	1.324	32	4.32	4.59
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	48.93	0.00	-1.76	124.00	1.324	32	5.39	6.03
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	48.93	1.52	0.88	121.00	1.317	32	5.39	6.03
W.Monroe - 7.5' Omni	120.0000	45.01	3.25	1.88	120.00	1.315	32	2.10	6.50
Cobleskill - 4' Omni with Mounts	0.0000	11.10	0.00	-1.76	119.00	1.313	31	1.91	1.15
ALP 9212	0.0000	68.80	0.00	-5.76	115.00	1.303	31	21.84	21.84
ALP 9212	120.0000	68.80	4.99	2.88	115.00	1.303	31	21.84	21.84
ALP 9212	240.0000	68.80	-4.99	2.88	115.00	1.303	31	21.84	21.84
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	30	7.00	6.08
LPA-171063/8CF	0.0000	23.00	0.00	-5.76	102.00	1.271	30	7.39	7.39
LPA-171063/8CF	120.0000	23.00	4.99	2.88	102.00	1.271	30	7.39	7.39
LPA-171063/8CF	240.0000	23.00	-4.99	2.88	102.00	1.271	30	7.39	7.39
PiROD 13' Lightweight T-Frame	0.0000	255.00	0.00	-1.76	102.00	1.271	30	10.60	10.60
PiROD 13' Lightweight T-Frame	120.0000	255.00	1.52	0.88	102.00	1.271	30	10.60	10.60
PiROD 13' Lightweight T-Frame	240.0000	255.00	-1.52	0.88	102.00	1.271	30	10.60	10.60
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	30	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	30	7.00	6.08
GPS Antenna	0.0000	16.00	0.00	-1.76	102.00	1.271	30	0.01	0.01
GPS Antenna	0.0000	8.00	0.00	-1.76	27.00	0.961	23	0.00	0.00
GPS Antenna	120.0000	8.00	1.52	0.88	27.00	0.961	23	0.00	0.00
GPS Antenna	240.0000	8.00	-1.52	0.88	27.00	0.961	23	0.00	0.00
LLPX310R w/ mounting pipe	0.0000	43.26	0.00	-5.76	114.00	1.301	31	4.94	2.82
LLPX310R w/ mounting pipe	120.0000	43.26	4.99	2.88	114.00	1.301	31	4.94	2.82
LLPX310R w/ mounting pipe	240.0000	43.26	-4.99	2.88	114.00	1.301	31	4.94	2.82
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	110.00	1.291	31	1.32	1.32
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	117.00	1.308	31	1.32	1.32
4'x4" Pipe Mount	0.0000	44.00	0.00	-1.76	114.00	1.301	31	1.32	1.32
6'8"x4" Pipe Mount	120.0000	72.00	1.52	0.88	114.00	1.301	31	2.60	2.60
10' x 4.5" od pipe mount	240.0000	150.00	-1.52	0.88	114.00	1.301	31	4.50	4.50
1-1/2" Pipe	0.0000	10.88	0.00	-1.76	102.00	1.271	30	0.50	0.50
1-1/2" Pipe	0.0000	5.44	0.00	-1.76	27.00	0.961	23	0.25	0.25
1-1/2" Pipe	120.0000	5.44	1.52	0.88	27.00	0.961	23	0.25	0.25
1-1/2" Pipe	240.0000	5.44	-1.52	0.88	27.00	0.961	23	0.25	0.25
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	1750.00	1.52	0.88	115.00	1.303	31	35.30	35.30
Remote RU	0.0000	33.00	0.00	-1.76	114.00	1.301	31	0.00	0.86
Remote RU	120.0000	33.00	1.52	0.88	114.00	1.301	31	0.00	0.86
Remote RU	240.0000	33.00	-1.52	0.88	114.00	1.301	31	0.00	0.86
GPS	240.0000	5.00	-1.95	1.13	32.00	0.996	24	0.12	0.12
	Sum Weight:	3800.40							

Discrete Appurtenance Pressures - With Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2	t_z in
W.Monroe - 12' Omni	240.0000	121.70	-1.52	0.88	117.00	1.308	7	21.38	21.38	2.2699
Albion - 16' Omni w/ Pipe Mount	120.0000	226.87	1.52	0.88	124.00	1.324	7	12.37	13.43	2.2831
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	293.23	0.00	-1.76	124.00	1.324	7	55.92	57.77	2.2831
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	292.63	1.52	0.88	121.00	1.317	7	55.80	57.65	2.2775
W.Monroe - 7.5' Omni	120.0000	277.39	3.25	1.88	120.00	1.315	7	13.47	48.28	2.2756
Cobleskill - 4' Omni with Mounts	0.0000	60.93	0.00	-1.76	119.00	1.313	7	3.37	4.23	2.2737
ALP 9212	0.0000	629.14	0.00	-5.76	115.00	1.303	7	33.26	33.26	2.2659
ALP 9212	120.0000	629.14	4.99	2.88	115.00	1.303	7	33.26	33.26	2.2659
ALP 9212	240.0000	629.14	-4.99	2.88	115.00	1.303	7	33.26	33.26	2.2659
LPA-80063/4CF	0.0000	301.66	0.00	-5.76	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	120.0000	301.66	4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	240.0000	301.66	-4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
LPA-171063/8CF	0.0000	359.22	0.00	-5.76	102.00	1.271	7	10.80	10.80	2.2389
LPA-171063/8CF	120.0000	359.22	4.99	2.88	102.00	1.271	7	10.80	10.80	2.2389
LPA-171063/8CF	240.0000	359.22	-4.99	2.88	102.00	1.271	7	10.80	10.80	2.2389
PiROD 13' Lightweight T-Frame	0.0000	720.70	0.00	-1.76	102.00	1.271	7	38.36	38.36	2.2389
PiROD 13' Lightweight T-Frame	120.0000	720.70	1.52	0.88	102.00	1.271	7	38.36	38.36	2.2389
PiROD 13' Lightweight T-Frame	240.0000	720.70	-1.52	0.88	102.00	1.271	7	38.36	38.36	2.2389
LPA-80063/4CF	0.0000	301.66	0.00	-5.76	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	120.0000	301.66	4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
LPA-80063/4CF	240.0000	301.66	-4.99	2.88	102.00	1.271	7	8.92	7.94	2.2389
GPS Antenna	0.0000	24.75	0.00	-1.76	102.00	1.271	7	0.35	0.35	2.2389
GPS Antenna	0.0000	10.58	0.00	-1.76	27.00	0.961	5	0.13	0.13	1.9603
GPS Antenna	120.0000	10.58	1.52	0.88	27.00	0.961	5	0.13	0.13	1.9603
GPS Antenna	240.0000	10.58	-1.52	0.88	27.00	0.961	5	0.13	0.13	1.9603
LLPX310R w/ mounting pipe	0.0000	263.65	0.00	-5.76	114.00	1.301	7	6.77	5.40	2.2640
LLPX310R w/ mounting pipe	120.0000	263.65	4.99	2.88	114.00	1.301	7	6.77	5.40	2.2640
LLPX310R w/ mounting pipe	240.0000	263.65	-4.99	2.88	114.00	1.301	7	6.77	5.40	2.2640
4'x4" Pipe Mount	120.0000	131.15	1.52	0.88	110.00	1.291	7	2.64	2.64	2.2559
4'x4" Pipe Mount	120.0000	132.03	1.52	0.88	117.00	1.308	7	2.65	2.65	2.2699
4'x4" Pipe Mount	0.0000	131.66	0.00	-1.76	114.00	1.301	7	2.64	2.64	2.2640
6'8"x4" Pipe Mount	120.0000	211.04	1.52	0.88	114.00	1.301	7	4.53	4.53	2.2640
10' x 4.5" od pipe mount	240.0000	353.27	-1.52	0.88	114.00	1.301	7	7.43	7.43	2.2640
1-1/2" Pipe	0.0000	63.66	0.00	-1.76	102.00	1.271	7	1.91	1.91	2.2389
1-1/2" Pipe	0.0000	25.09	0.00	-1.76	27.00	0.961	5	0.84	0.84	1.9603
1-1/2" Pipe	120.0000	25.09	1.52	0.88	27.00	0.961	5	0.84	0.84	1.9603
1-1/2" Pipe	240.0000	25.09	-1.52	0.88	27.00	0.961	5	0.84	0.84	1.9603
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	4695.72	1.52	0.88	115.00	1.303	7	85.60	85.60	2.2659
Remote RU	0.0000	110.07	0.00	-1.76	114.00	1.301	7	0.00	1.58	2.2640
Remote RU	120.0000	110.07	1.52	0.88	114.00	1.301	7	0.00	1.58	2.2640
Remote RU	240.0000	110.07	-1.52	0.88	114.00	1.301	7	0.00	1.58	2.2640
GPS	240.0000	10.74	-1.95	1.13	32.00	0.996	5	0.37	0.37	1.9939
	Sum Weight:	15192.10								

Discrete Appurtenance Pressures - Service $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
W.Monroe - 12' Omni	240.0000	20.45	-1.52	0.88	117.00	1.308	10	3.00	3.00
Albion - 16' Omni w/ Pipe Mount	120.0000	60.59	1.52	0.88	124.00	1.324	10	4.32	4.59
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	48.93	0.00	-1.76	124.00	1.324	10	5.39	6.03
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	48.93	1.52	0.88	121.00	1.317	10	5.39	6.03
W.Monroe - 7.5' Omni	120.0000	45.01	3.25	1.88	120.00	1.315	10	2.10	6.50
Cobleskill - 4' Omni with Mounts	0.0000	11.10	0.00	-1.76	119.00	1.313	10	1.91	1.15
ALP 9212	0.0000	68.80	0.00	-5.76	115.00	1.303	10	21.84	21.84
ALP 9212	120.0000	68.80	4.99	2.88	115.00	1.303	10	21.84	21.84
ALP 9212	240.0000	68.80	-4.99	2.88	115.00	1.303	10	21.84	21.84
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	10	7.00	6.08
LPA-171063/8CF	0.0000	23.00	0.00	-5.76	102.00	1.271	10	7.39	7.39
LPA-171063/8CF	120.0000	23.00	4.99	2.88	102.00	1.271	10	7.39	7.39
LPA-171063/8CF	240.0000	23.00	-4.99	2.88	102.00	1.271	10	7.39	7.39
PiROD 13' Lightweight T-Frame	0.0000	255.00	0.00	-1.76	102.00	1.271	10	10.60	10.60
PiROD 13' Lightweight T-Frame	120.0000	255.00	1.52	0.88	102.00	1.271	10	10.60	10.60
PiROD 13' Lightweight T-Frame	240.0000	255.00	-1.52	0.88	102.00	1.271	10	10.60	10.60
LPA-80063/4CF	0.0000	20.00	0.00	-5.76	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	120.0000	20.00	4.99	2.88	102.00	1.271	10	7.00	6.08
LPA-80063/4CF	240.0000	20.00	-4.99	2.88	102.00	1.271	10	7.00	6.08
GPS Antenna	0.0000	16.00	0.00	-1.76	102.00	1.271	10	0.01	0.01
GPS Antenna	0.0000	8.00	0.00	-1.76	27.00	0.961	8	0.00	0.00
GPS Antenna	120.0000	8.00	1.52	0.88	27.00	0.961	8	0.00	0.00
GPS Antenna	240.0000	8.00	-1.52	0.88	27.00	0.961	8	0.00	0.00
LLPX310R w/ mounting pipe	0.0000	43.26	0.00	-5.76	114.00	1.301	10	4.94	2.82
LLPX310R w/ mounting pipe	120.0000	43.26	4.99	2.88	114.00	1.301	10	4.94	2.82
LLPX310R w/ mounting pipe	240.0000	43.26	-4.99	2.88	114.00	1.301	10	4.94	2.82
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	110.00	1.291	10	1.32	1.32
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	117.00	1.308	10	1.32	1.32
4'x4" Pipe Mount	0.0000	44.00	0.00	-1.76	114.00	1.301	10	1.32	1.32
6'8"x4" Pipe Mount	120.0000	72.00	1.52	0.88	114.00	1.301	10	2.60	2.60
10' x 4.5" od pipe mount	240.0000	150.00	-1.52	0.88	114.00	1.301	10	4.50	4.50
1-1/2" Pipe	0.0000	10.88	0.00	-1.76	102.00	1.271	10	0.50	0.50
1-1/2" Pipe	0.0000	5.44	0.00	-1.76	27.00	0.961	8	0.25	0.25
1-1/2" Pipe	120.0000	5.44	1.52	0.88	27.00	0.961	8	0.25	0.25
1-1/2" Pipe	240.0000	5.44	-1.52	0.88	27.00	0.961	8	0.25	0.25
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	1750.00	1.52	0.88	115.00	1.303	10	35.30	35.30
Remote RU	0.0000	33.00	0.00	-1.76	114.00	1.301	10	0.00	0.86
Remote RU	120.0000	33.00	1.52	0.88	114.00	1.301	10	0.00	0.86
Remote RU	240.0000	33.00	-1.52	0.88	114.00	1.301	10	0.00	0.86
GPS	240.0000	5.00	-1.95	1.13	32.00	0.996	8	0.12	0.12
	Sum Weight:	3800.40							

Dish Pressures - No Ice

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
119.00	VHLP2-180	0.0000	25.00	0.00	-5.76	1.313	3.14	31
110.00	VHLP1-23-1GR (12")	120.0000	28.00	1.52	0.88	1.291	0.79	31
110.00	VHLP1-23-1GR (12")	240.0000	28.00	-1.52	0.88	1.291	0.79	31
		Sum Weight:	81.00					

Dish Pressures - With Ice

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf	t_z in
119.00	VHLP2-180	0.0000	104.53	0.00	-5.76	1.313	4.36	7	2.2737
110.00	VHLP1-23-1GR (12")	120.0000	60.85	1.52	0.88	1.291	1.40	7	2.2559
110.00	VHLP1-23-1GR (12")	240.0000	60.85	-1.52	0.88	1.291	1.40	7	2.2559
		Sum Weight:	226.23						

Dish Pressures - Service

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
119.00	VHLP2-180	0.0000	25.00	0.00	-5.76	1.313	3.14	10
110.00	VHLP1-23-1GR (12")	120.0000	28.00	1.52	0.88	1.291	0.79	10
110.00	VHLP1-23-1GR (12")	240.0000	28.00	-1.52	0.88	1.291	0.79	10
		Sum Weight:	81.00					

Force Totals (Does not include forces on guys)

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques lb-ft
Leg Weight	4067.10			
Bracing Weight	2523.19			
Total Member Self-Weight	6590.29			
Guy Weight	634.62			
Total Weight	13321.78			
Wind 0 deg - No Ice		61.63	-21183.77	1782.75
Wind 30 deg - No Ice		10540.43	-18259.42	2081.62
Wind 60 deg - No Ice		18155.90	-10555.13	1818.09
Wind 90 deg - No Ice		20974.11	-61.63	1068.43
Wind 120 deg - No Ice		18250.37	10538.51	37.72
Wind 150 deg - No Ice		10433.68	18197.80	-1013.19
Wind 180 deg - No Ice		-61.63	21003.52	-1788.14
Wind 210 deg - No Ice		-10540.43	18259.42	-2081.62
Wind 240 deg - No Ice		-18312.00	10645.26	-1820.47
Wind 270 deg - No Ice		-20974.11	61.63	-1068.43
Wind 300 deg - No Ice		-18094.27	-10448.39	-29.94
Wind 330 deg - No Ice		-10433.68	-18197.80	1013.19
Member Ice	12488.43			

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Torques lb-ft
Guy Ice	3590.74			
Total Weight Ice	73213.63			
Wind 0 deg - Ice		99.38	-15973.18	1818.83
Wind 30 deg - Ice		8012.76	-13864.15	1960.50
Wind 60 deg - Ice		13772.89	-8058.25	1576.32
Wind 90 deg - Ice		15853.40	-99.38	769.67
Wind 120 deg - Ice		13698.47	7900.53	-242.73
Wind 150 deg - Ice		7840.63	13764.78	-1190.83
Wind 180 deg - Ice		-99.38	15944.37	-1819.62
Wind 210 deg - Ice		-8012.76	13864.15	-1960.50
Wind 240 deg - Ice		-13797.85	8072.65	-1576.10
Wind 270 deg - Ice		-15853.40	99.38	-769.67
Wind 300 deg - Ice		-13673.52	-7886.12	243.30
Wind 330 deg - Ice		-7840.63	-13764.78	1190.83
Total Weight	13321.78			
Wind 0 deg - Service		20.12	-6917.15	582.12
Wind 30 deg - Service		3441.77	-5962.26	679.71
Wind 60 deg - Service		5928.46	-3446.57	593.66
Wind 90 deg - Service		6848.69	-20.12	348.87
Wind 120 deg - Service		5959.30	3441.15	12.32
Wind 150 deg - Service		3406.92	5942.14	-330.84
Wind 180 deg - Service		-20.12	6858.29	-583.88
Wind 210 deg - Service		-3441.77	5962.26	-679.71
Wind 240 deg - Service		-5979.43	3476.00	-594.44
Wind 270 deg - Service		-6848.69	20.12	-348.87
Wind 300 deg - Service		-5908.33	-3411.72	-9.78
Wind 330 deg - Service		-3406.92	-5942.14	330.84

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy
4	1.2 Dead+1.6 Wind 60 deg - No Ice+1.0 Guy
5	1.2 Dead+1.6 Wind 90 deg - No Ice+1.0 Guy
6	1.2 Dead+1.6 Wind 120 deg - No Ice+1.0 Guy
7	1.2 Dead+1.6 Wind 150 deg - No Ice+1.0 Guy
8	1.2 Dead+1.6 Wind 180 deg - No Ice+1.0 Guy
9	1.2 Dead+1.6 Wind 210 deg - No Ice+1.0 Guy
10	1.2 Dead+1.6 Wind 240 deg - No Ice+1.0 Guy
11	1.2 Dead+1.6 Wind 270 deg - No Ice+1.0 Guy
12	1.2 Dead+1.6 Wind 300 deg - No Ice+1.0 Guy
13	1.2 Dead+1.6 Wind 330 deg - No Ice+1.0 Guy
14	1.2 Dead+1.0 Ice+1.0 Temp+Guy
15	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy
16	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy
17	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy
18	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy
19	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy
20	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy
21	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy
22	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy

Comb. No.	Description
23	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy
24	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy
25	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy
26	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy
27	Dead+Wind 0 deg - Service+Guy
28	Dead+Wind 30 deg - Service+Guy
29	Dead+Wind 60 deg - Service+Guy
30	Dead+Wind 90 deg - Service+Guy
31	Dead+Wind 120 deg - Service+Guy
32	Dead+Wind 150 deg - Service+Guy
33	Dead+Wind 180 deg - Service+Guy
34	Dead+Wind 210 deg - Service+Guy
35	Dead+Wind 240 deg - Service+Guy
36	Dead+Wind 270 deg - Service+Guy
37	Dead+Wind 300 deg - Service+Guy
38	Dead+Wind 330 deg - Service+Guy

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
T1	117 - 97	Leg	Max Tension	4	1457.76	-676.01	180.52
			Max. Compression	2	-35179.40	-58.44	-277.07
			Max. Mx	11	-10638.96	-1405.31	-106.75
			Max. My	2	-12208.68	-104.86	-1602.77
			Max. Vy	10	-2146.84	-71.40	43.02
			Max. Vx	2	-2344.10	-1.22	-81.77
		Diagonal	Max Tension	8	13019.57	0.00	0.00
		Horizontal	Max Tension	2	609.33	0.00	0.00
			Max. Compression	11	-9015.87	0.00	0.00
			Max. Mx	23	514.36	-20.20	0.00
			Max. My	16	478.07	0.00	0.00
			Max. Vy	23	26.56	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	12	-4945.89	0.00	0.00
			Max. Mx	23	-4091.52	-20.20	0.00
			Max. My	16	-4417.44	0.00	0.00
			Max. Vy	23	26.56	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	5	-4194.50	0.00	0.00
			Max. Mx	14	-3689.31	-20.20	0.00
			Max. My	16	-3714.60	0.00	0.00
			Max. Vy	14	26.56	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Guy A	Bottom Tension	9	31619.10		
			Top Tension	9	31721.79		
			Top Cable Vert	9	28650.41		
			Top Cable Norm	9	13614.93		
			Top Cable Tan	9	244.22		
			Bot Cable Vert	9	-28444.63		
			Bot Cable Norm	9	13803.19		
			Bot Cable Tan	9	376.91		
		Guy B	Bottom Tension	11	33427.71		
			Top Tension	11	33529.83		
			Top Cable Vert	11	30996.48		
			Top Cable Norm	11	12782.12		

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Top Cable Tan	11	291.04		
			Bot Cable Vert	11	-30802.56		
			Bot Cable Norm	11	12978.26		
			Bot Cable Tan	11	422.83		
		Guy C	Bottom Tension	3	32502.82		
			Top Tension	3	32596.18		
			Top Cable Vert	3	29917.96		
			Top Cable Norm	3	12936.07		
			Top Cable Tan	3	290.33		
			Bot Cable Vert	3	-29736.40		
			Bot Cable Norm	3	13115.23		
			Bot Cable Tan	3	412.48		
		Top Guy Pull-Off	Max Tension	1	0.00	0.00	0.00
			Max. Compression	12	-7208.47	0.00	0.00
			Max. Mx	23	-4848.19	-20.20	0.00
			Max. My	16	-6071.67	0.00	0.00
			Max. Vy	23	26.56	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
T2	97 - 77	Leg	Max Tension	4	45419.42	164.45	-67.83
			Max. Compression	2	-91657.84	-54.62	-255.91
			Max. Mx	10	-87105.30	-234.72	91.70
			Max. My	2	-91288.14	-54.57	-255.94
			Max. Vy	10	-4494.27	139.79	-69.40
			Max. Vx	2	-5038.03	1.19	163.87
		Diagonal	Max Tension	4	12576.75	0.00	0.00
		Horizontal	Max Tension	2	1587.56	0.00	0.00
			Max. Compression	2	-9543.30	0.00	0.00
			Max. Mx	14	514.36	-19.72	0.00
			Max. My	16	865.15	0.00	0.00
			Max. Vy	14	-25.93	0.00	0.00
			Max. Vx	16	0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	12	-4062.35	0.00	0.00
			Max. Mx	14	-3683.48	-19.72	0.00
			Max. My	16	-3739.93	0.00	0.00
			Max. Vy	14	-25.93	0.00	0.00
			Max. Vx	16	0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-5722.37	0.00	0.00
			Max. Mx	15	-4355.45	-19.72	0.00
			Max. My	16	-3521.21	0.00	0.00
			Max. Vy	15	25.93	0.00	0.00
			Max. Vx	16	0.00	0.00	0.00
T3	77 - 57	Leg	Max Tension	4	55358.76	81.61	-34.58
			Max. Compression	2	-126671.93	-23.02	81.43
			Max. Mx	10	-103726.05	514.04	-230.22
			Max. My	2	-91290.57	57.00	583.27
			Max. Vy	10	-4490.51	514.01	-230.32
			Max. Vx	2	-5033.86	57.00	583.27
		Diagonal	Max Tension	4	14298.38	0.00	0.00
		Horizontal	Max Tension	2	2194.02	0.00	0.00
			Max. Compression	2	-11859.00	0.00	0.00
			Max. Mx	14	692.04	-19.15	0.00
			Max. My	16	1164.18	0.00	0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-4840.18	0.00	0.00
			Max. Mx	15	-4052.94	-19.15	0.00
			Max. My	16	-3733.95	0.00	0.00
			Max. Vy	15	-25.18	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vx	16	-0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-4194.08	0.00	0.00
			Max. Mx	19	-3575.24	-19.15	0.00
			Max. My	15	-3103.42	0.00	-0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Guy A	Bottom Tension	9	38965.14		
			Top Tension	9	39045.95		
			Top Cable Vert	9	29969.30		
			Top Cable Norm	9	25027.76		
			Top Cable Tan	9	196.00		
			Bot Cable Vert	9	-29790.07		
			Bot Cable Norm	9	25114.83		
			Bot Cable Tan	9	281.06		
		Guy B	Bottom Tension	13	44470.63		
			Top Tension	13	44551.13		
			Top Cable Vert	13	36117.38		
			Top Cable Norm	13	26081.88		
			Top Cable Tan	13	271.02		
			Bot Cable Vert	13	-35947.98		
			Bot Cable Norm	13	26177.36		
			Bot Cable Tan	13	354.44		
		Guy C	Bottom Tension	3	41242.42		
			Top Tension	3	41310.65		
			Top Cable Vert	3	31986.20		
			Top Cable Norm	3	26141.69		
			Top Cable Tan	3	254.21		
			Bot Cable Vert	3	-31834.74		
			Bot Cable Norm	3	26217.93		
			Bot Cable Tan	3	327.30		
		Top Guy Pull-Off	Max Tension	2	1875.10	0.00	0.00
			Max. Compression	25	-4502.57	0.00	0.00
			Max. Mx	14	-4169.87	-19.15	0.00
			Max. My	16	-3046.67	0.00	0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	16	-0.00	0.00	0.00
T4	57 - 37	Leg	Max Tension	4	11156.52	-103.55	64.22
			Max. Compression	2	-87205.93	-11.17	101.93
			Max. Mx	12	-6721.47	-149.90	-83.37
			Max. My	8	-7037.40	-23.11	170.32
			Max. Vy	12	3042.72	103.65	52.82
			Max. Vx	8	-3399.81	9.94	-113.12
		Diagonal	Max Tension	4	9265.10	0.00	0.00
		Horizontal	Max Tension	2	1510.45	0.00	0.00
			Max. Compression	4	-6415.36	0.00	0.00
			Max. Mx	19	792.56	-17.09	0.00
			Max. My	15	969.27	0.00	-0.00
			Max. Vy	19	22.48	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	5	-3468.36	0.00	0.00
			Max. Mx	19	-2832.30	-17.09	0.00
			Max. My	15	-2070.89	0.00	-0.00
			Max. Vy	14	-22.48	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-3293.20	0.00	0.00
			Max. Mx	21	-2688.50	-17.09	0.00
			Max. My	15	-2319.31	0.00	-0.00
			Max. Vy	21	-22.48	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vx	15	0.00	0.00	0.00
T5	37 - 21	Leg	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-51770.66	-6.16	48.21
			Max. Mx	15	-44534.00	856.74	160.64
			Max. My	23	-43555.84	254.77	-806.23
			Max. Vy	23	-7597.41	571.88	621.22
			Max. Vx	23	8532.48	254.77	-806.23
		Diagonal	Max Tension	8	6871.05	0.00	0.00
		Horizontal	Max Tension	2	896.69	0.00	0.00
			Max. Compression	8	-6488.09	0.00	0.00
			Max. Mx	21	762.51	-16.15	0.00
			Max. My	15	890.08	0.00	-0.00
			Max. Vy	21	-21.23	0.00	0.00
			Max. Vx	15	-0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-3134.63	0.00	0.00
			Max. Mx	21	-2618.61	-16.15	0.00
			Max. My	15	-2269.50	0.00	-0.00
			Max. Vy	21	-21.23	0.00	0.00
			Max. Vx	15	-0.00	0.00	0.00
		Bottom Girt	Max Tension	15	2285.40	0.00	0.00
			Max. Compression	36	-512.35	0.00	0.00
			Max. Mx	21	1497.01	-16.15	0.00
			Max. My	15	2185.45	0.00	-0.00
			Max. Vy	21	-21.23	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
T6	21 - 17	Leg	Max Tension	1	0.00	0.00	0.00
			Max. Compression	15	-48835.22	-3.78	591.67
			Max. Mx	15	-44269.36	822.29	-264.89
			Max. My	4	-26273.79	-57.46	897.70
			Max. Vy	15	9956.51	-83.84	-227.35
			Max. Vx	8	608.11	50.01	330.53
		Top Girt	Max Tension	15	6453.67	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	15	6453.67	-26.57	0.00
			Max. My	15	6159.55	0.00	-5.83
			Max. Vy	15	35.68	0.00	0.00
			Max. Vx	15	-7.83	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Mast	Max. Vert	15	131549.10	13.47	348.30
	Max. H_x	12	78216.10	1021.59	540.19
	Max. H_z	11	112634.66	-20.14	764.21
	Max. M_x	1	0.00	27.73	0.65
	Max. M_z	1	0.00	27.73	0.65
	Max. Torsion	8	1516.12	20.86	-1435.35
	Min. Vert	35	47410.14	348.79	-196.91
	Min. H_x	4	75483.07	-961.40	546.02
	Min. H_z	8	71681.22	20.86	-1435.35
	Min. M_x	1	0.00	27.73	0.65
	Min. M_z	1	0.00	27.73	0.65
	Min. Torsion	4	-1564.72	-961.40	546.02
Guy C @ 37.5 ft	Max. Vert	10	-468.56	-85.07	49.92

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Elev 25 ft Azimuth 240 deg					
	Max. H_x	10	-468.56	-85.07	49.92
	Max. H_z	3	-61571.14	-33693.63	20307.24
	Min. Vert	3	-61571.14	-33693.63	20307.24
	Min. H_x	5	-61225.13	-34223.74	18933.00
	Min. H_z	9	-639.80	-236.35	25.92
Guy B @ 39 ft Elev 17 ft Azimuth 120 deg	Max. Vert	6	-635.69	130.85	75.48
	Max. H_x	11	-66642.58	34233.04	18857.81
	Max. H_z	13	-66607.23	33466.98	20222.67
	Min. Vert	11	-66642.58	34233.04	18857.81
	Min. H_x	6	-635.69	130.85	75.48
	Min. H_z	7	-832.05	295.50	46.83
Guy A @ 45 ft Elev 17 ft Azimuth 0 deg	Max. Vert	2	-496.11	0.70	-129.47
	Max. H_x	10	-50680.96	910.18	-34021.25
	Max. H_z	2	-496.11	0.70	-129.47
	Min. Vert	9	-58234.71	657.97	-38918.03
	Min. H_x	6	-50178.13	-816.78	-33744.49
	Min. H_z	9	-58234.71	657.97	-38918.03

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	48149.14	-27.73	-0.65	0.00	0.00	-32.86
1.2 Dead+1.6 Wind 0 deg - No Ice+1.0 Guy	127783.61	-41.11	795.06	0.00	0.00	1071.94
1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy	112053.89	660.89	407.47	0.00	0.00	1407.39
1.2 Dead+1.6 Wind 60 deg - No Ice+1.0 Guy	75483.07	961.40	-546.02	0.00	0.00	1564.72
1.2 Dead+1.6 Wind 90 deg - No Ice+1.0 Guy	107038.02	128.20	-637.58	0.00	0.00	701.41
1.2 Dead+1.6 Wind 120 deg - No Ice+1.0 Guy	119774.51	-427.23	-7.81	0.00	0.00	32.06
1.2 Dead+1.6 Wind 150 deg - No Ice+1.0 Guy	105406.83	-551.06	808.29	0.00	0.00	-660.49
1.2 Dead+1.6 Wind 180 deg - No Ice+1.0 Guy	71681.22	-20.86	1435.35	0.00	0.00	-1516.12
1.2 Dead+1.6 Wind 210 deg - No Ice+1.0 Guy	108749.76	612.10	710.31	0.00	0.00	-1369.75
1.2 Dead+1.6 Wind 240 deg - No Ice+1.0 Guy	125196.88	610.16	-155.94	0.00	0.00	-1108.96
1.2 Dead+1.6 Wind 270 deg - No Ice+1.0 Guy	112634.66	20.14	-764.21	0.00	0.00	-794.25
1.2 Dead+1.6 Wind 300 deg - No Ice+1.0 Guy	78216.10	-1021.59	-540.19	0.00	0.00	-63.70
1.2 Dead+1.6 Wind 330 deg - No Ice+1.0 Guy	114280.26	-759.09	502.92	0.00	0.00	708.57
1.2 Dead+1.0 Ice+1.0 Temp+Guy	110800.79	7.85	-27.18	0.00	0.00	0.67
1.2 Dead+1.0 Wind 0 deg+1.0	131549.10	-13.47	-348.30	0.00	0.00	1035.99

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 30 deg+1.0	126107.04	427.56	-377.11	0.00	0.00	1162.41
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 60 deg+1.0	117726.11	673.85	-399.79	0.00	0.00	976.42
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 90 deg+1.0	122774.13	579.95	-168.66	0.00	0.00	436.04
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 120 deg+1.0	126640.11	386.79	258.87	0.00	0.00	-136.21
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 150 deg+1.0	121759.17	165.38	649.97	0.00	0.00	-680.43
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 180 deg+1.0	114648.80	11.82	840.37	0.00	0.00	-1139.65
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 210 deg+1.0	123050.05	-97.63	618.96	0.00	0.00	-1167.94
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 240 deg+1.0	129110.38	-287.89	192.33	0.00	0.00	-904.27
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 270 deg+1.0	124488.21	-524.57	-225.49	0.00	0.00	-464.59
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 300 deg+1.0	116735.08	-685.26	-417.89	0.00	0.00	153.39
Ice+1.0 Temp+1.0 Guy 1.2 Dead+1.0 Wind 330 deg+1.0	126502.36	-449.84	-372.15	0.00	0.00	700.97
Dead+Wind 0 deg - Service+Guy	48442.90	-36.20	-412.86	0.00	0.00	388.99
Dead+Wind 30 deg - Service+Guy	48809.77	144.75	-343.24	0.00	0.00	456.59
Dead+Wind 60 deg - Service+Guy	48993.47	276.95	-191.77	0.00	0.00	391.32
Dead+Wind 90 deg - Service+Guy	48939.34	332.55	7.12	0.00	0.00	224.21
Dead+Wind 120 deg - Service+Guy	48682.40	297.09	210.05	0.00	0.00	6.31
Dead+Wind 150 deg - Service+Guy	48335.69	158.81	347.71	0.00	0.00	-210.05
Dead+Wind 180 deg - Service+Guy	47950.23	-22.11	393.89	0.00	0.00	-383.77
Dead+Wind 210 deg - Service+Guy	47608.75	-204.92	340.05	0.00	0.00	-457.16
Dead+Wind 240 deg - Service+Guy	47410.14	-348.79	196.91	0.00	0.00	-399.35
Dead+Wind 270 deg - Service+Guy	47468.34	-390.79	-8.14	0.00	0.00	-231.52
Dead+Wind 300 deg - Service+Guy	47714.11	-341.89	-205.05	0.00	0.00	-5.56
Dead+Wind 330 deg - Service+Guy	48067.76	-214.95	-350.86	0.00	0.00	216.23

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	lb	lb	lb	lb	lb	lb	
1	0.00	-13321.68	0.00	-0.50	13319.66	-0.92	0.017%
2	97.02	-15860.19	-35025.80	-97.04	15860.18	35025.61	0.001%
3	17441.95	-15836.38	-30195.88	-17441.94	15836.36	30195.86	0.000%
4	30057.83	-15818.84	-17456.21	-30057.97	15818.84	17455.95	0.001%
5	34727.28	-15849.49	-97.79	-34727.09	15849.48	97.89	0.001%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
6	30210.45	-15882.56	17432.29	-30210.13	15882.54	-17432.08	0.001%
7	17273.67	-15872.22	30099.99	-17273.49	15872.21	-30099.85	0.001%
8	-97.02	-15858.04	34737.40	96.42	15858.04	-34737.40	0.002%
9	-17441.95	-15881.85	30195.88	17441.84	15881.84	-30195.81	0.000%
10	-30307.59	-15899.39	17600.41	30307.38	15899.38	-17600.30	0.001%
11	-34727.28	-15868.74	97.79	34726.69	15868.71	-97.56	0.002%
12	-29960.69	-15835.66	-17288.10	29961.11	15835.66	17287.35	0.002%
13	-17273.67	-15846.00	-30099.99	17273.56	15845.98	30099.46	0.001%
14	0.00	-75750.36	0.00	-0.23	75750.36	-1.18	0.002%
15	97.82	-75750.85	-16990.29	-97.84	75750.85	16990.10	0.000%
16	8530.91	-75731.03	-14745.40	-8530.92	75731.03	14745.31	0.000%
17	14677.85	-75716.54	-8568.42	-14677.95	75716.54	8568.12	0.000%
18	16902.26	-75742.89	-98.47	-16902.09	75742.89	98.59	0.000%
19	14605.05	-75771.12	8413.44	-14604.72	75771.11	-8413.24	0.001%
20	8361.38	-75762.22	14648.71	-8361.20	75762.21	-14648.60	0.000%
21	-97.82	-75749.87	16961.47	97.81	75749.87	-16961.42	0.000%
22	-8530.91	-75769.69	14745.40	8530.79	75769.68	-14745.34	0.000%
23	-14702.80	-75784.18	8582.83	14702.58	75784.18	-8582.72	0.000%
24	-16902.26	-75757.83	98.47	16901.64	75757.81	-98.15	0.001%
25	-14580.10	-75729.60	-8399.04	14580.26	75729.59	8398.22	0.001%
26	-8361.38	-75738.50	-14648.71	8361.32	75738.48	14648.18	0.001%
27	19.80	-13321.90	-7148.12	-19.80	13321.90	7148.12	0.000%
28	3559.58	-13317.04	-6162.42	-3559.58	13317.04	6162.42	0.000%
29	6134.25	-13313.46	-3562.49	-6134.25	13313.46	3562.49	0.000%
30	7087.20	-13319.72	-19.96	-7087.14	13319.71	19.98	0.000%
31	6165.40	-13326.47	3557.61	-6165.03	13326.46	-3557.40	0.003%
32	3525.24	-13324.36	6142.86	-3525.19	13324.34	-6142.82	0.000%
33	-19.80	-13321.46	7089.27	19.80	13321.46	-7089.26	0.000%
34	-3559.58	-13326.32	6162.42	3559.58	13326.32	-6162.42	0.000%
35	-6185.22	-13329.90	3591.92	6185.22	13329.90	-3591.92	0.000%
36	-7087.20	-13323.64	19.96	7087.14	13323.63	-19.96	0.000%
37	-6114.43	-13316.89	-3528.18	6114.07	13316.89	3527.90	0.003%
38	-3525.24	-13319.00	-6142.86	3525.21	13318.99	6142.79	0.001%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	No	500	0.05742109	0.00000000
2	Yes	14	0.00000001	0.00005267
3	Yes	15	0.00000001	0.00007827
4	Yes	15	0.00000001	0.00004730
5	Yes	13	0.00000001	0.00003688
6	Yes	13	0.00000001	0.00005935
7	Yes	13	0.00000001	0.00003646
8	Yes	14	0.00000001	0.00005712
9	Yes	14	0.00000001	0.00004265
10	Yes	14	0.00000001	0.00005063
11	Yes	13	0.00000001	0.00008860
12	Yes	17	0.00000001	0.00001151
13	Yes	13	0.00000001	0.00007482
14	Yes	7	0.00000001	0.00009287
15	Yes	13	0.00000001	0.00004685
16	Yes	13	0.00000001	0.00003011
17	Yes	10	0.00000001	0.00008780
18	Yes	12	0.00000001	0.00003822

19	Yes	12	0.00000001	0.00005701
20	Yes	12	0.00000001	0.00004554
21	Yes	10	0.00000001	0.00003615
22	Yes	13	0.00000001	0.00003626
23	Yes	13	0.00000001	0.00005117
24	Yes	12	0.00000001	0.00009354
25	Yes	10	0.00000001	0.00008664
26	Yes	12	0.00000001	0.00009628
27	Yes	9	0.00000001	0.00006684
28	Yes	9	0.00000001	0.00008393
29	Yes	9	0.00000001	0.00006025
30	Yes	8	0.00000001	0.00007813
31	Yes	7	0.00000001	0.00007594
32	Yes	8	0.00000001	0.00008678
33	Yes	9	0.00000001	0.00006559
34	Yes	9	0.00000001	0.00008939
35	Yes	9	0.00000001	0.00006814
36	Yes	8	0.00000001	0.00007919
37	Yes	7	0.00000001	0.00007729
38	Yes	8	0.00000001	0.00009133

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	117 - 97	2.146	37	0.1679	0.4125
T2	97 - 77	1.528	37	0.1572	0.3794
T3	77 - 57	0.909	37	0.1237	0.3445
T4	57 - 37	0.523	38	0.0692	0.3154
T5	37 - 21	0.277	38	0.0611	0.2907
T6	21 - 17	0.058	38	0.0683	0.2675

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	Albion - 16' Omni w/ Pipe Mount	37	2.146	0.1679	0.4125	228696
121.00	Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	37	2.146	0.1679	0.4125	228696
120.00	W.Monroe - 7.5' Omni	37	2.146	0.1679	0.4125	228696
119.00	VHLP2-180	37	2.146	0.1679	0.4125	228696
117.00	W.Monroe - 12' Omni	37	2.146	0.1679	0.4125	228696
115.00	(4) ALP 9212	37	2.085	0.1673	0.4093	228696
114.00	LLPX310R w/ mounting pipe	37	2.055	0.1670	0.4077	228696
110.00	VHLP1-23-1GR (12")	37	1.934	0.1656	0.4012	163355
109.03	Guy	37	1.904	0.1652	0.3996	143533
102.00	LPA-80063/4CF	37	1.687	0.1614	0.3879	76232
68.98	Guy	37	0.725	0.1008	0.3319	16708
32.00	GPS	38	0.212	0.0632	0.2837	76425
27.00	GPS Antenna	38	0.144	0.0655	0.2764	106321

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	117 - 97	23.097	10	1.5725	1.5192
T2	97 - 77	16.689	10	1.5333	1.3539
T3	77 - 57	10.641	10	1.2705	1.1879
T4	57 - 37	6.260	10	0.8756	1.0709
T5	37 - 21	3.064	10	0.7347	0.9945
T6	21 - 17	0.620	10	0.7373	0.9167

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	Albion - 16' Omni w/ Pipe Mount	10	23.097	1.5725	1.5192	95564
121.00	Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	10	23.097	1.5725	1.5192	95564
120.00	W.Monroe - 7.5' Omni	10	23.097	1.5725	1.5192	95564
119.00	VHLP2-180	10	23.097	1.5725	1.5192	95564
117.00	W.Monroe - 12' Omni	10	23.097	1.5725	1.5192	95564
115.00	(4) ALP 9212	10	22.457	1.5731	1.5029	95564
114.00	LLPX310R w/ mounting pipe	10	22.136	1.5733	1.4947	95564
110.00	VHLP1-23-1GR (12")	10	20.855	1.5728	1.4620	68260
109.03	Guy	10	20.545	1.5721	1.4541	59977
102.00	LPA-80063/4CF	10	18.291	1.5580	1.3960	31855
68.98	Guy	10	8.674	1.1003	1.1317	2478
32.00	GPS	10	2.307	0.7317	0.9714	20672
27.00	GPS Antenna	10	1.543	0.7337	0.9467	27346

Guy Design Data

Section No.	Elevation ft	Size	Initial Tension lb	Breaking Load lb	Actual T_u lb	Allowable ϕT_n lb	Required S.F.	Actual S.F.
T1	109.03 (A) (255)	3/4 EHS	5830.00	58299.91	31721.80	34980.00	1.000	1.103 ✔
	109.03 (B) (254)	3/4 EHS	5830.00	58299.91	33529.80	34980.00	1.000	1.043 ✔
	109.03 (C) (253)	3/4 EHS	5830.00	58299.91	32596.20	34980.00	1.000	1.073 ✔
T3	68.98 (A) (258)	7/8 EHS	7970.00	79699.84	39045.90	47820.00	1.000	1.225 ✔
	68.98 (B) (257)	7/8 EHS	7970.00	79699.84	44551.10	47820.00	1.000	1.073 ✔
	68.98 (C) (256)	7/8 EHS	7970.00	79699.84	41310.60	47820.00	1.000	1.158 ✔

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	Mast Stability Index	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	2" solid	20.00	3.98	95.6 K=1.00	3.1416	1.00	-35179.40	72468.20	0.485 [1] ✓
T2	97 - 77	2" solid 4.9-3 (1.26 CR) - 54	20.00	3.97	95.2 K=1.00	3.1416	1.00	-91657.80	72873.70	1.258 [1] ✗
T3	77 - 57	2 1/4" solid 4.9-3 (1.20 CR) - 105/3	20.00	3.97	84.6 K=1.00	3.9761	1.00	-126672.00	105993.00	1.195 [1] ✗
T4	57 - 37	2" solid 4.9-3 (1.20 CR) - 156/5	20.00	3.97	95.2 K=1.00	3.1416	1.00	-87205.90	72873.70	1.197 [1] ✗
T5	37 - 21	2" solid	16.00	3.96	95.0 K=1.00	3.1416	1.00	-51770.70	73076.70	0.708 [1] ✓
T6	21 - 17	2" solid	4.37	4.28	102.7 K=1.00	3.1416	1.00	-48835.20	65416.60	0.747 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-9015.87	15470.70	0.583 [1] ✓
T2	97 - 77	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-9543.30	15470.70	0.617 [1] ✓
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-11859.00	15561.20	0.762 [1] ✓
T4	57 - 37	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-6415.36	10336.40	0.621 [1] ✓
T5	37 - 21	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-6488.09	10336.40	0.628 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-4945.89	15470.70	0.320 [1] ✔
T2	97 - 77	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-4062.35	15470.70	0.263 [1] ✔
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-4840.18	15561.20	0.311 [1] ✔
T4	57 - 37	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-3468.36	10336.40	0.336 [1] ✔
T5	37 - 21	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-3134.63	10336.40	0.303 [1] ✔

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-4194.50	15470.70	0.271 [1] ✔
T2	97 - 77	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-5722.37	15470.70	0.370 [1] ✔
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-4194.08	15561.20	0.270 [1] ✔
T4	57 - 37	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-3293.20	10336.40	0.319 [1] ✔
T5	37 - 21	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-460.83	10336.40	0.045*[1] ✔

* DL controls
[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-7208.47	15470.70	0.466 [1]
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-4502.57	15561.20	0.289 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	117 - 97	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000
T3	77 - 57	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	117 - 97	L2x2x3/16	0.466	0.000	0.000	0.466 [1] ✔	1.000	4.9-3 ✔
T3	77 - 57	L2x2x3/16	0.289	0.000	0.000	0.289 [1] ✔	1.000	4.9-3 ✔

[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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	2" solid	20.00	3.98	95.6	3.1416	1457.76	141372.00	0.010 [1] ✔
T2	97 - 77	2" solid	20.00	3.97	95.2	3.1416	45419.40	141372.00	0.321 [1] ✔
T3	77 - 57	4.9-3 (1.20 CR) - 52 2 1/4" solid	20.00	3.97	84.6	3.9761	55358.80	178924.00	0.309 [1] ✔
T4	57 - 37	4.9-3 (1.14 CR) - 103/4 2" solid 4.9-3 (1.13 CR) - 154/5	20.00	3.97	95.2	3.1416	11156.50	141372.00	0.079 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	7/8" solid	5.01	4.74	259.9	0.6013	13019.60	19482.80	0.668 [1] ✔
T2	97 - 77	7/8" solid	5.00	4.72	259.2	0.6013	12576.80	19482.80	0.646 [1] ✔
T3	77 - 57	7/8" solid	5.00	4.69	257.3	0.6013	14298.40	19482.80	0.734 [1] ✔
T4	57 - 37	7/8" solid	5.00	4.72	259.2	0.6013	9265.10	19482.80	0.476 [1] ✔
T5	37 - 21	7/8" solid	4.99	4.72	258.9	0.6013	6871.05	19482.80	0.353 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	55.9	0.7150	609.33	23166.00	0.026 [1] ✔
T2	97 - 77	L2x2x3/16	3.04	2.88	55.9	0.7150	1587.56	23166.00	0.069 [1] ✔
T3	77 - 57	L2x2x3/16	3.04	2.85	55.5	0.7150	2194.02	23166.00	0.095 [1] ✔
T4	57 - 37	L2x2x1/8	3.04	2.88	55.1	0.4844	1510.45	15693.80	0.096 [1] ✔
T5	37 - 21	L2x2x1/8	3.04	2.88	55.1	0.4844	896.69	15693.80	0.057 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T6	21 - 17	L3x3x3/8	2.98	2.81	37.0	2.1100	6453.67	68364.00	0.094 [1] ✔

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T5	37 - 21	L2x2x1/8	3.04	2.88	55.1	0.4844	2285.40	15693.80	0.146 [1] ✔

[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T3	77 - 57	L2x2x3/16	3.04	2.85	55.5	0.7150	1875.10	23166.00	0.081 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T3	77 - 57	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T3	77 - 57	L2x2x3/16	0.081	0.000	0.000	0.081 [1] ✔	1.000	4.9-4 ✔

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	117 - 97	Leg	2" solid	3	-35179.40	72468.20	48.5	Pass
		Diagonal	7/8" solid	40	13019.60	19482.80	66.8	Pass
		Horizontal	L2x2x3/16	45	-9015.87	15470.70	58.3	Pass
		Top Girt	L2x2x3/16	6	-4945.89	15470.70	32.0	Pass
		Bottom Girt	L2x2x3/16	9	-4194.50	15470.70	27.1	Pass
		Guy A@109.033	3/4	255	31721.80	34980.00	90.7	Pass
		Guy B@109.033	3/4	254	33529.80	34980.00	95.9	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
		Guy C@109.033	3/4	253	32596.20	34980.00	93.2	Pass
		Top Guy Pull-Off@109.033	L2x2x3/16	36	-7208.47	15470.70	46.6	Pass
T2	97 - 77	Leg	2" solid	54	-91657.80	72873.70	125.8	Fail
		Diagonal	7/8" solid	61	12576.80	19482.80	64.6	Pass
		Horizontal	L2x2x3/16	67	-9543.30	15470.70	61.7	Pass
		Top Girt	L2x2x3/16	57	-4062.35	15470.70	26.3	Pass
		Bottom Girt	L2x2x3/16	58	-5722.37	15470.70	37.0	Pass
T3	77 - 57	Leg	2 1/4" solid	105	-126672.00	105993.00	119.5	Fail
		Diagonal	7/8" solid	139	14298.40	19482.80	73.4	Pass
		Horizontal	L2x2x3/16	145	-11859.00	15561.20	76.2	Pass
		Top Girt	L2x2x3/16	106	-4840.18	15561.20	31.1	Pass
		Bottom Girt	L2x2x3/16	111	-4194.08	15561.20	27.0	Pass
		Guy A@68.9833	7/8	258	39045.90	47820.00	81.7	Pass
		Guy B@68.9833	7/8	257	44551.10	47820.00	93.2	Pass
		Guy C@68.9833	7/8	256	41310.60	47820.00	86.4	Pass
		Top Guy Pull-Off@68.9833	L2x2x3/16	138	-4502.57	15561.20	28.9	Pass
T4	57 - 37	Leg	2" solid	156	-87205.90	72873.70	119.7	Fail
		Diagonal	7/8" solid	203	9265.10	19482.80	47.6	Pass
		Horizontal	L2x2x1/8	198	-6415.36	10336.40	62.1	Pass
		Top Girt	L2x2x1/8	159	-3468.36	10336.40	33.6	Pass
		Bottom Girt	L2x2x1/8	160	-3293.20	10336.40	31.9	Pass
T5	37 - 21	Leg	2" solid	207	-51770.70	73076.70	70.8	Pass
		Diagonal	7/8" solid	217	6871.05	19482.80	35.3	Pass
		Horizontal	L2x2x1/8	220	-6488.09	10336.40	62.8	Pass
		Top Girt	L2x2x1/8	208	-3134.63	10336.40	30.3	Pass
		Bottom Girt	L2x2x1/8	211	2285.40	15693.80	14.6	Pass
T6	21 - 17	Leg	2" solid	248	-48835.20	65416.60	74.7	Pass
		Top Girt	L3x3x3/8	250	6453.67	68364.00	9.4	Pass
						Summary		
						Leg (T2)	125.8	Fail
						Diagonal (T3)	73.4	Pass
						Horizontal (T3)	76.2	Pass
						Top Girt (T4)	33.6	Pass
						Bottom Girt (T2)	37.0	Pass
						Guy A (T1)	90.7	Pass
						Guy B (T1)	95.9	Pass
						Guy C (T1)	93.2	Pass
						Top Guy Pull-Off (T1)	46.6	Pass
						RATING =	**125.8**	**Fail**

tnxTOWER ANALYSIS:

Retrofitted Tower with Proposed Microwave Antenna
Option #2 Location

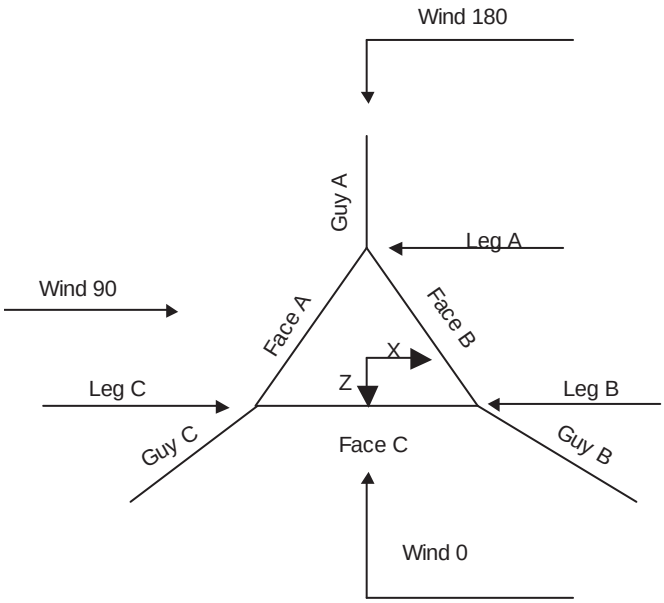
Tower Input Data

The main tower is a 3x guyed tower with an overall height of 117.00 ft above the ground line.
The base of the tower is set at an elevation of 17.00 ft above the ground line.
The face width of the tower is 3.04 ft at the top and tapered at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

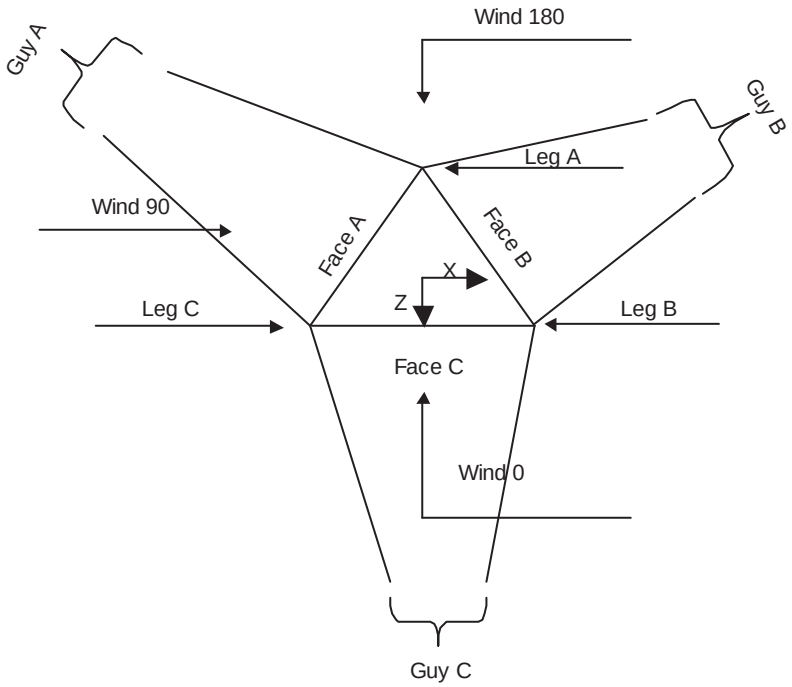
Tower is located in Hartford County, Connecticut.
Basic wind speed of 105 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
Tower is roof top mounted and located approx 25' above mean grade level..
Tension only take-up is 0.0313 in.
Pressures are calculated at each section.
Safety factor used in guy design is 1.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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



Corner & Starmount Guyed Tower



Face Guyed

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	117.00-97.00			3.04	1	20.00
T2	97.00-77.00			3.04	1	20.00
T3	77.00-57.00			3.04	1	20.00
T4	57.00-37.00			3.04	1	20.00
T5	37.00-21.00			3.04	1	16.00
T6	21.00-17.00			3.04	1	4.00

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	117.00-97.00	3.98	TX Brace	No	Yes	0.0000	1.0000
T2	97.00-77.00	3.97	TX Brace	No	Yes	1.0000	1.0000
T3	77.00-57.00	3.97	TX Brace	No	Yes	1.0000	1.0000
T4	57.00-37.00	3.97	TX Brace	No	Yes	1.0000	1.0000
T5	37.00-21.00	3.96	TX Brace	No	Yes	1.0000	1.0000
T6	21.00-17.00	3.92	X Brace	No	Yes	1.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 117.00-97.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T2 97.00-77.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T3 77.00-57.00	Solid Round	2 1/4" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T4 57.00-37.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T5 37.00-21.00	Solid Round	2" solid	A572-50 (50 ksi)	Solid Round	7/8" solid	A36 (36 ksi)
T6 21.00-17.00	Solid Round	2" solid	A572-50 (50 ksi)	Flat Bar	2x3/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 117.00-97.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T2 97.00-77.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T3 77.00-57.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 57.00-37.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T5 37.00-21.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 21.00-17.00	Equal Angle	L3x3x3/8	A36 (36 ksi)	Flat Bar	2x3/8	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 117.00-97.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T2 97.00-77.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T3 77.00-57.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 57.00-37.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T5 37.00-21.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 21.00-17.00	None	Flat Bar		A36 (36 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 117.00-97.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T2 97.00-77.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T3 77.00-57.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T4 57.00-37.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T5 37.00-21.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000
T6 21.00-17.00	0.00	0.0000	A36 (36 ksi)	1.05	1.05	1.2	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1	No	No	1	1	1	1	1	1	1	1
117.00-97.00				1	1	1	1	1	1	1
T2	No	No	1	1	1	1	1	1	1	1
97.00-77.00				1	1	1	1	1	1	1
T3	No	No	1	1	1	1	1	1	1	1
77.00-57.00				1	1	1	1	1	1	1
T4	No	No	1	1	1	1	1	1	1	1
57.00-37.00				1	1	1	1	1	1	1
T5	No	No	1	1	1	1	1	1	1	1
37.00-21.00				1	1	1	1	1	1	1

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T6	No	No	1	1	1	1	1	1	1	1
21.00-17.00				1	1	1	1	1	1	1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		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 117.00-97.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 97.00-77.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 77.00-57.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 57.00-37.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 37.00-21.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 21.00-17.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Guy Data

Guy Elevation ft	Guy Grade		Guy Size	Initial Tension lb	%	Guy Modulus ksi	Guy Weight plf	L_u ft	Anchor Radius ft	Anchor Azimuth Adj. °	Anchor Elevation ft	End Fitting Efficiency %
109.033	EHS	A	7/8	7970.00	10%	19000	1.581	101.64	45.00	0.0000	17.00	100%
		B	7/8	7970.00	10%	19000	1.581	99.24	39.00	0.0000	17.00	100%
		C	7/8	7970.00	10%	19000	1.581	91.29	37.50	0.0000	25.00	100%
68.9833	EHS	A	7/8	7970.00	10%	19000	1.581	67.56	45.00	0.0000	17.00	100%
		B	7/8	7970.00	10%	19000	1.581	63.89	39.00	0.0000	17.00	100%
		C	7/8	7970.00	10%	19000	1.581	56.62	37.50	0.0000	25.00	100%

Guy Data*(cont'd)*

Guy Elevation ft	Mount Type	Torque-Arm Spread ft	Torque-Arm Leg Angle °	Torque-Arm Style	Torque-Arm Grade	Torque-Arm Type	Torque-Arm Size
109.033	Torque Arm	6.08	35.0000	Bat Ear	A572-50 (50 ksi)	Channel	C6x8.2
68.9833	Corner						

Guy Data *(cont'd)*

Guy Elevation ft	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
109.03	A36 (36 ksi)	Equal Angle		L3x3x3/16	No	A36 (36 ksi)	Flat Bar	3x1 1/2
68.98	A36 (36 ksi)	Solid Round			No	A36 (36 ksi)	Equal Angle	L2x2x3/16

Guy Data *(cont'd)*

Guy Elevation ft	Cable Weight A lb	Cable Weight B lb	Cable Weight C lb	Cable Weight D lb	Tower Intercept A ft	Tower Intercept B ft	Tower Intercept C ft	Tower Intercept D ft
109.033	160.69	156.90	144.32		1.02 1.7 sec/pulse	0.97 1.7 sec/pulse	0.82 1.6 sec/pulse	
68.9833	106.81	101.01	89.52		0.45 1.2 sec/pulse	0.40 1.1 sec/pulse	0.32 1.0 sec/pulse	

Guy Data *(cont'd)*

Guy Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Torque Arm K_x	Torque Arm K_y	Pull Off K_x	Pull Off K_y	Diagonal K_x	Diagonal K_y
109.033	No	No	1	1	1	1	1	1
68.9833	No	No			1	1	1	1

Guy Data *(cont'd)*

Guy Elevation ft	Torque-Arm Bolt Size in	Torque-Arm Number	Torque-Arm Net Width Deduct in	Torque-Arm U	Pull Off Bolt Size in	Pull Off Number	Pull Off Net Width Deduct in	Pull Off U	Diagonal Bolt Size in	Diagonal Number	Diagonal Net Width Deduct in	Diagonal U
109.033	0.7500 A325N	2	0.0000	1	0.6250 A325N	0	0.0000	0.75	0.6250 A325N	0	0.0000	0.75
68.9833	0.0000 A325N	0	0.0000	1	0.6250 A325N	0	0.0000	0.75	0.6250 A325N	0	0.0000	0.75

Guy Pressures

Guy Elevation ft	Guy Location	z ft	q_z psf	q_z Ice psf	Ice Thickness in
109.033	A	63.02	28	6	2.1337
	B	63.02	28	6	2.1337
	C	67.02	28	6	2.1468
68.9833	A	42.99	25	6	2.0536
	B	42.99	25	6	2.0536
	C	46.99	26	6	2.0720

Guy-Mast Forces (Excluding Wind) - No Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
109.033	A	64.7781	8115.37 7970.00	-240.48	7356.25	-3418.62	-12919.78	10821.80	-22377.72
	A	64.7781	8115.37 7970.00	240.48	7356.25	-3418.62	-12919.78	-10821.80	22377.72
	B	67.9017	8115.37 7970.00	2734.64	7530.30	1294.44	26450.92	9605.70	0.00
	B	67.9017	8115.37 7970.00	2488.34	7530.30	1721.05	-13225.46	-9605.70	-22907.17
	C	66.8829	8102.73 7970.00	-2588.76	7463.23	1803.56	-13107.66	10033.08	22703.14
	C	66.8829	8102.73 7970.00	-2856.31	7463.23	1340.15	26215.33	-10033.08	0.00
			Sum:	**-222.09**	44699.56	**-678.03**	**493.56**	0.00	**-204.03**
68.9833	A	50.2437	8052.11 7970.00	0.00	6212.06	-5123.16	-10910.24	0.00	0.00
	B	54.3801	8052.11 7970.00	4040.53	6562.67	2332.80	5763.00	0.00	-9981.82
	C	50.9005	8039.47 7970.00	-4371.94	6256.84	2524.14	5494.44	-0.00	9516.65
			Sum:	**-331.41**	19031.56	**-266.22**	**347.21**	-0.00	**-465.17**

Guy-Mast Forces (Excluding Wind) - Ice

Guy Elevation ft	Guy Location	Chord Angle °	Guy Tension Top Bottom lb	F_x lb	F_y lb	F_z lb	M_x lb-ft	M_y lb-ft	M_z lb-ft
109.033	A	64.7781	11761.00 10894.54	-338.51	10726.16	-4812.07	-18838.35	15232.83	-32628.98
	A	64.7781	11761.00 10894.54	338.51	10726.16	-4812.07	-18838.35	-15232.83	32628.98
	B	67.9017	11653.10 10786.63	3812.72	10862.82	1804.75	38156.73	13392.54	0.00
	B	67.9017	11653.10 10786.63	3469.32	10862.82	2399.53	-19078.36	-13392.54	-33044.69
	C	66.8829	11593.16 10795.04	-3604.15	10728.76	2510.97	-18842.92	13968.36	32636.90

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom lb	F_x	F_y	F_z	M_x	M_y	M_z
ft		°		lb	lb	lb	lb-ft	lb-ft	lb-ft
	C	66.8829	11593.16 10795.04	-3976.64	10728.76	1865.80	37685.85	-13968.36	0.00
			Sum:	**-298.77**	64635.49	**-1043.07**	**244.58**	0.00	**-407.79**
68.9833	A	50.2437	11483.14 11019.44	0.00	8950.84	-7193.39	-15720.36	0.00	0.00
	B	54.3801	11384.88 10921.18	5623.91	9351.17	3246.96	8211.73	0.00	-14223.13
	C	50.9005	11329.90 10932.63	-6078.36	8894.08	3509.34	7810.34	-0.00	13527.90
			Sum:	**-454.45**	27196.09	**-437.09**	**301.70**	-0.00	**-695.23**

Guy-Mast Forces (Excluding Wind) - Service

Guy Elevation	Guy Location	Chord Angle	Guy Tension Top Bottom lb	F_x	F_y	F_z	M_x	M_y	M_z
ft		°		lb	lb	lb	lb-ft	lb-ft	lb-ft
109.033	A	64.7781	8115.37 7970.00	-240.48	7356.25	-3418.62	-12919.78	10821.80	-22377.72
	A	64.7781	8115.37 7970.00	240.48	7356.25	-3418.62	-12919.78	-10821.80	22377.72
	B	67.9017	8115.37 7970.00	2734.64	7530.30	1294.44	26450.92	9605.70	0.00
	B	67.9017	8115.37 7970.00	2488.34	7530.30	1721.05	-13225.46	-9605.70	-22907.17
	C	66.8829	8102.73 7970.00	-2588.76	7463.23	1803.56	-13107.66	10033.08	22703.14
	C	66.8829	8102.73 7970.00	-2856.31	7463.23	1340.15	26215.33	-10033.08	0.00
			Sum:	**-222.09**	44699.56	**-678.03**	**493.56**	0.00	**-204.03**
68.9833	A	50.2437	8052.11 7970.00	0.00	6212.06	-5123.16	-10910.24	0.00	0.00
	B	54.3801	8052.11 7970.00	4040.53	6562.67	2332.80	5763.00	0.00	-9981.82
	C	50.9005	8039.47 7970.00	-4371.94	6256.84	2524.14	5494.44	-0.00	9516.65
			Sum:	**-331.41**	19031.56	**-266.22**	**347.21**	-0.00	**-465.17**

Guy-Tensioning Information

				Temperature At Time Of Tensioning													
				0 F		20 F		40 F		60 F		80 F		100 F		120 F	
Guy Elevation		H	V	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept
ft		ft	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft
109.033	A	43.35	92.03	8585	0.94	8380	0.97	8175	0.99	7970	1.02	7765	1.04	7561	1.07	7357	1.10
	B	37.37	92.03	8450	0.91	8290	0.93	8130	0.95	7970	0.97	7810	0.99	7651	1.01	7491	1.03
	C	35.87	84.03	8493	0.77	8319	0.79	8144	0.80	7970	0.82	7796	0.84	7622	0.86	7448	0.88
68.9833	A	43.24	51.98	9356	0.38	8893	0.40	8431	0.43	7970	0.45	7509	0.48	7049	0.51	6590	0.54
	B	37.24	51.98	9121	0.35	8737	0.37	8353	0.38	7970	0.40	7587	0.42	7205	0.45	6823	0.47

				Temperature At Time Of Tensioning													
				0 F		20 F		40 F		60 F		80 F		100 F		120 F	
Guy Elevation	H	V		Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept	Initial Tension	Intercept
ft	ft	ft		lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft	lb	ft
	C	35.74	43.98	9320	0.27	8870	0.28	8420	0.30	7970	0.32	7521	0.34	7072	0.36	6625	0.38

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#		C_AA_A ft^2/ft	Weight plf
LDF7-50A (1-5/8 FOAM) (E-VZW)	C	No	CaAa (Out Of Face)	102.00 - 21.00	0.0000	0	12	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF6-50A (1-1/4 FOAM) (E-NEXTEL)	B	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.1	11	No Ice	0.16	0.66
								1/2" Ice	0.25	1.91
								1" Ice	0.35	3.78
LDF6-50A (1-1/4 FOAM) (E-NEXTEL)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.2	1	No Ice	0.16	0.66
								1/2" Ice	0.25	1.91
								1" Ice	0.35	3.78
LDF7-50A (1-5/8 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.4	1	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF4RN-50A (1/2 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.5	2	No Ice	0.06	0.15
								1/2" Ice	0.16	0.84
								1" Ice	0.26	2.14
LDF5-50A (7/8 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.2	1	No Ice	0.11	0.33
								1/2" Ice	0.21	1.30
								1" Ice	0.31	2.88
LDF7-50A (1-5/8 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.24	1	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF5-50A (7/8 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.27	1	No Ice	0.11	0.33
								1/2" Ice	0.21	1.30
								1" Ice	0.31	2.88
LDF7-50A (1-5/8 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.31	1	No Ice	0.20	0.82
								1/2" Ice	0.30	2.33
								1" Ice	0.40	4.46
LDF4RN-50A (1/2 FOAM) (E)	A	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.35	1	No Ice	0.06	0.15
								1/2" Ice	0.16	0.84
								1" Ice	0.26	2.14
LDF5-50A (7/8 FOAM) (E) ***CLEARWIRE***	A	No	CaAa (Out Of Face)	27.00 - 21.00	0.0000	0.4	3	No Ice	0.11	0.33
								1/2" Ice	0.21	1.30
								1" Ice	0.31	2.88
LDF4RN-50A (1/2 FOAM) (P)	C	No	CaAa (Out Of Face)	110.00 - 21.00	0.0000	0.35	2	No Ice	0.06	0.15
								1/2" Ice	0.16	0.84
								1" Ice	0.26	2.14
LDF4RN-50A (1/2 FOAM) (P)	C	No	CaAa (Out Of Face)	114.00 - 21.00	0.0000	0.37	1	No Ice	0.06	0.15
								1/2" Ice	0.16	0.84
								1" Ice	0.26	2.14
2" Rigid Conduit (P)	C	No	CaAa (Out Of Face)	117.00 - 21.00	0.0000	0.4	1	No Ice	0.20	2.80
								1/2" Ice	0.30	4.33
								1" Ice	0.40	6.47

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 lb
T1	117.00-97.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	18.589	111.65
T2	97.00-77.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T3	77.00-57.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T4	57.00-37.00	A	0.000	0.000	0.000	23.120	84.60
		B	0.000	0.000	0.000	34.101	145.20
		C	0.000	0.000	0.000	55.300	261.80
T5	37.00-21.00	A	0.000	0.000	0.000	20.458	73.62
		B	0.000	0.000	0.000	27.281	116.16
		C	0.000	0.000	0.000	44.240	209.44
T6	21.00-17.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
T1	117.00-97.00	A	2.250	0.000	0.000	0.000	104.108	1929.11
		B		0.000	0.000	0.000	133.085	2560.18
		C		0.000	0.000	0.000	73.930	1448.76
T2	97.00-77.00	A	2.204	0.000	0.000	0.000	102.449	1855.31
		B		0.000	0.000	0.000	131.058	2466.68
		C		0.000	0.000	0.000	196.329	3791.96
T3	77.00-57.00	A	2.147	0.000	0.000	0.000	100.404	1764.29
		B		0.000	0.000	0.000	128.558	2351.39
		C		0.000	0.000	0.000	192.692	3620.30
T4	57.00-37.00	A	2.072	0.000	0.000	0.000	97.711	1644.50
		B		0.000	0.000	0.000	125.268	2199.64
		C		0.000	0.000	0.000	187.906	3394.36
T5	37.00-21.00	A	1.974	0.000	0.000	0.000	84.426	1343.52
		B		0.000	0.000	0.000	96.776	1617.71
		C		0.000	0.000	0.000	145.324	2503.51
T6	21.00-17.00	A	1.893	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	117.00-97.00	0.8711	-0.2316	0.7650	-0.5392
T2	97.00-77.00	-0.7583	0.6343	-0.6803	0.3217
T3	77.00-57.00	-0.7545	0.6311	-0.6802	0.3235

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
T4	57.00-37.00	-0.7583	0.6343	-0.6816	0.3268
T5	37.00-21.00	-0.7429	0.4468	-0.6649	0.0954
T6	21.00-17.00	0.0000	0.0000	0.0000	0.0000

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
W.Monroe - 12' Omni	C	From Leg	0.00	0.00	0.0000	117.00	No Ice	3.00	3.00	20.45
(E)			0.00	0.00			1/2" Ice	7.05	7.05	42.76
			0.00	0.00			1" Ice	11.10	11.10	65.06
Albion - 16' Omni w/ Pipe Mount	B	From Leg	0.00	0.00	0.0000	124.00	No Ice	4.32	4.59	60.59
			0.00	0.00			1/2" Ice	6.08	6.53	97.01
(E)			0.00	0.00			1" Ice	7.84	8.46	133.42
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	A	From Leg	0.00	0.00	0.0000	124.00	No Ice	5.39	6.03	48.93
			0.00	0.00			1/2" Ice	16.58	17.53	103.58
(E)			0.00	0.00			1" Ice	27.52	28.69	155.94
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	B	From Leg	0.00	0.00	0.0000	121.00	No Ice	5.39	6.03	48.93
			0.00	0.00			1/2" Ice	16.58	17.53	103.58
(E)			0.00	0.00			1" Ice	27.52	28.69	155.94
W.Monroe - 7.5' Omni	B	From Leg	2.00	0.00	0.0000	120.00	No Ice	2.10	6.50	45.01
(E)			0.00	0.00			1/2" Ice	4.60	15.68	96.07
			0.00	0.00			1" Ice	7.10	24.86	147.13
Cobleskill - 4' Omni with Mounts	A	From Leg	0.00	0.00	0.0000	119.00	No Ice	1.91	1.15	11.10
			0.00	0.00			1/2" Ice	1.91	1.91	22.70
(E)			0.00	0.00			1" Ice	1.99	2.50	33.01
ALP 9212	A	From Leg	4.00	0.00	0.0000	114.00	No Ice	5.46	5.46	17.20
(E)			1.50	0.00			1/2" Ice	6.09	6.09	50.00
			0.00	0.00			1" Ice	6.72	6.72	80.00
ALP 9212	B	From Leg	4.00	0.00	0.0000	114.00	No Ice	5.46	5.46	17.20
(E)			1.50	0.00			1/2" Ice	6.09	6.09	50.00
			0.00	0.00			1" Ice	6.72	6.72	80.00
ALP 9212	C	From Leg	4.00	0.00	0.0000	114.00	No Ice	5.46	5.46	17.20
(E)			1.50	0.00			1/2" Ice	6.09	6.09	50.00
			0.00	0.00			1" Ice	6.72	6.72	80.00
BXA-80063/4CF w/Mount Pipe	A	From Leg	4.00	0.00	0.0000	102.00	No Ice	5.89	3.91	35.45
			6.00	0.00			1/2" Ice	6.59	4.94	78.94
(E)			0.00	0.00			1" Ice	7.17	5.68	132.62
SLCP 2x6014 w/Mount Pipe	B	From Leg	4.00	0.00	0.0000	102.00	No Ice	7.25	6.72	36.73
(E)			6.00	0.00			1/2" Ice	7.70	7.42	97.55
			0.00	0.00			1" Ice	8.16	8.13	167.66
SLCP 2x6014 w/Mount Pipe	C	From Leg	4.00	0.00	0.0000	102.00	No Ice	7.25	6.72	36.73
(E)			6.00	0.00			1/2" Ice	7.70	7.42	97.55
			0.00	0.00			1" Ice	8.16	8.13	167.66

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Offsets: Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
BXA-171063/8BF w/Mount Pipe	A	From Leg	4.00	0.0000	102.00	No Ice		2.96	3.06	24.47
			4.00			1/2" Ice		3.28	3.62	52.59
(E)			0.00			1" Ice		3.64	4.19	88.41
SACP 2x5516 w/Mount Pipe	B	From Leg	4.00	0.0000	102.00	No Ice		5.32	4.36	33.64
(E)			4.00			1/2" Ice		5.76	5.00	76.18
			0.00			1" Ice		6.21	5.67	127.75
SACP 2x5516 w/Mount Pipe	C	From Leg	4.00	0.0000	102.00	No Ice		5.32	4.36	33.64
(E)			4.00			1/2" Ice		5.76	5.00	76.18
			0.00			1" Ice		6.21	5.67	127.75
PiROD 12' Lightweight T-Frame	A	From Leg	0.00	0.0000	102.00	No Ice		10.20	10.20	253.00
			0.00			1/2" Ice		16.20	16.20	355.00
(E)			0.00			1" Ice		22.20	22.20	457.00
PiROD 12' Lightweight T-Frame	B	From Leg	0.00	0.0000	102.00	No Ice		10.20	10.20	253.00
			0.00			1/2" Ice		16.20	16.20	355.00
(E)			0.00			1" Ice		22.20	22.20	457.00
PiROD 12' Lightweight T-Frame	C	From Leg	0.00	0.0000	102.00	No Ice		10.20	10.20	253.00
			0.00			1/2" Ice		16.20	16.20	355.00
(E)			0.00			1" Ice		22.20	22.20	457.00
BXA-70063/6CF w/Mount Pipe	A	From Leg	4.00	0.0000	102.00	No Ice		7.77	5.20	39.20
			0.00			1/2" Ice		8.32	6.15	93.45
(E)			0.00			1" Ice		8.88	6.97	158.69
SLCP 2x6015 w/Mount Pipe	B	From Leg	4.00	0.0000	102.00	No Ice		10.52	9.80	54.03
(E)			0.00			1/2" Ice		11.13	11.01	139.49
			0.00			1" Ice		11.74	11.99	237.33
SLCP 2x6015 w/Mount Pipe	C	From Leg	4.00	0.0000	102.00	No Ice		10.52	9.80	54.03
(E)			0.00			1/2" Ice		11.13	11.01	139.49
			0.00			1" Ice		11.74	11.99	237.33
(2) GPS Antenna	A	From Leg	0.00	0.0000	102.00	No Ice		0.00	0.00	8.00
(E)			0.00			1/2" Ice		0.02	0.02	8.11
			0.00			1" Ice		0.05	0.05	8.49
GPS Antenna	A	From Leg	0.00	0.0000	27.00	No Ice		0.00	0.00	8.00
(E)			0.00			1/2" Ice		0.02	0.02	8.11
			0.00			1" Ice		0.05	0.05	8.49
GPS Antenna	B	From Leg	0.00	0.0000	27.00	No Ice		0.00	0.00	8.00
(E)			0.00			1/2" Ice		0.02	0.02	8.11
			0.00			1" Ice		0.05	0.05	8.49
GPS Antenna	C	From Leg	0.00	0.0000	27.00	No Ice		0.00	0.00	8.00
(E)			0.00			1/2" Ice		0.02	0.02	8.11
			0.00			1" Ice		0.05	0.05	8.49
CLEARWIRE										
LLPX310R w/ mounting pipe	A	From Leg	4.00	0.0000	114.00	No Ice		4.94	2.82	43.26
(P)			4.00			1/2" Ice		5.33	3.34	78.28
			0.00			1" Ice		5.72	3.87	120.86
LLPX310R w/ mounting pipe	B	From Leg	4.00	0.0000	114.00	No Ice		4.94	2.82	43.26
(P)			4.00			1/2" Ice		5.33	3.34	78.28
			0.00			1" Ice		5.72	3.87	120.86
LLPX310R w/ mounting pipe	C	From Leg	4.00	0.0000	114.00	No Ice		4.94	2.82	43.26
(P)			4.00			1/2" Ice		5.33	3.34	78.28
			0.00			1" Ice		5.72	3.87	120.86
4'x4" Pipe Mount	B	From Leg	0.00	0.0000	110.00	No Ice		1.32	1.32	44.00
(P)			0.00			1/2" Ice		1.58	1.58	56.99
			0.00			1" Ice		1.84	1.84	73.03
4'x4" Pipe Mount	B	From Leg	0.00	0.0000	117.00	No Ice		1.32	1.32	44.00
(P)			0.00			1/2" Ice		1.58	1.58	56.99
			0.00			1" Ice		1.84	1.84	73.03
4'x4" Pipe Mount	A	From Leg	0.00	0.0000	114.00	No Ice		1.32	1.32	44.00
(P)			0.00			1/2" Ice		1.58	1.58	56.99

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
			0.00			1" Ice	1.84	1.84	73.03
6'8"x4" Pipe Mount	B	From Leg	0.00	0.0000	114.00	No Ice	2.60	2.60	72.00
(P)			0.00			1/2" Ice	3.01	3.01	93.13
			0.00			1" Ice	3.42	3.42	118.95
existing									
(2) 1-1/2" Pipe	A	From Leg	0.00	0.0000	102.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00			1/2" Ice	0.38	0.38	8.04
			0.00			1" Ice	0.51	0.51	12.17
1-1/2" Pipe	A	From Leg	0.00	0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00			1/2" Ice	0.38	0.38	8.04
			0.00			1" Ice	0.51	0.51	12.17
1-1/2" Pipe	B	From Leg	0.00	0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00			1/2" Ice	0.38	0.38	8.04
			0.00			1" Ice	0.51	0.51	12.17
1-1/2" Pipe	C	From Leg	0.00	0.0000	27.00	No Ice	0.25	0.25	5.44
(E-GPS)			0.00			1/2" Ice	0.38	0.38	8.04
			0.00			1" Ice	0.51	0.51	12.17
10' Boom Gate w/3 - 2 3/8"	B	From Leg	2.00	0.0000	115.00 - 114.00	No Ice	35.30	35.30	1750.00
Pipe (Tapered) (3)			0.00			1/2" Ice	46.40	46.40	2400.00
(E)			0.00			1" Ice	57.50	57.50	3050.00
CLEARWIRE									
Remote RU	A	From Leg	0.00	0.0000	114.00	No Ice	0.00	0.86	33.00
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
Remote RU	B	From Leg	0.00	0.0000	114.00	No Ice	0.00	0.86	33.00
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
Remote RU	C	From Leg	0.00	0.0000	114.00	No Ice	0.00	0.86	33.00
(P)			0.00			1/2" Ice	0.00	1.00	44.97
			0.00			1" Ice	0.00	1.15	59.27
GPS	C	From Leg	0.50	0.0000	32.00	No Ice	0.12	0.12	5.00
(P)			0.00			1/2" Ice	0.17	0.17	5.71
			0.00			1" Ice	0.22	0.22	6.85
****ADDITIONAL VERIZON****									
BXA-171063/12CF w/Mount Pipe	A	From Leg	4.00	0.0000	102.00	No Ice	4.84	5.10	35.46
			-6.00			1/2" Ice	5.30	6.08	76.87
			0.00			1" Ice	5.77	6.91	129.12
SACP 2x5516 w/Mount Pipe	B	From Leg	4.00	0.0000	102.00	No Ice	5.32	4.36	33.64
			-6.00			1/2" Ice	5.76	5.00	76.18
			0.00			1" Ice	6.21	5.67	127.75
SACP 2x5516 w/Mount Pipe	C	From Leg	4.00	0.0000	102.00	No Ice	5.32	4.36	33.64
			-6.00			1/2" Ice	5.76	5.00	76.18
			0.00			1" Ice	6.21	5.67	127.75
****ADDITIONAL SPRINT-NEXTEL****									
ALP 9212	A	From Leg	4.00	0.0000	114.00	No Ice	5.46	5.46	17.20
			-1.50			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
ALP 9212	A	From Leg	4.00	0.0000	114.00	No Ice	5.46	5.46	17.20
			-4.50			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
ALP 9212	B	From Leg	4.00	0.0000	114.00	No Ice	5.46	5.46	17.20
			-1.50			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
ALP 9212	B	From Leg	4.00	0.0000	114.00	No Ice	5.46	5.46	17.20
			-4.50			1/2" Ice	6.09	6.09	50.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
			0.00			1" Ice	6.72	6.72	80.00
ALP 9212	C	From Leg	4.00	0.0000	114.00	No Ice	5.46	5.46	17.20
			-1.50			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
ALP 9212	C	From Leg	4.00	0.0000	114.00	No Ice	5.46	5.46	17.20
			-4.50			1/2" Ice	6.09	6.09	50.00
			0.00			1" Ice	6.72	6.72	80.00
ADDITIONAL VERIZON RRH									
RRH2x40-07-U	A	From Face	0.00	0.0000	102.00	No Ice	2.25	1.23	50.00
			0.00			1/2" Ice	2.45	1.39	66.85
			0.00			1" Ice	2.66	1.55	86.39
RRH2x40-07-U	B	From Face	0.00	0.0000	102.00	No Ice	2.25	1.23	50.00
			0.00			1/2" Ice	2.45	1.39	66.85
			0.00			1" Ice	2.66	1.55	86.39
RRH2x40-07-U	C	From Face	0.00	0.0000	102.00	No Ice	2.25	1.23	50.00
			0.00			1/2" Ice	2.45	1.39	66.85
			0.00			1" Ice	2.66	1.55	86.39
RRH2x40-AWS	A	From Face	0.00	0.0000	102.00	No Ice	2.52	1.59	44.00
			0.00			1/2" Ice	2.75	1.80	61.40
			0.00			1" Ice	2.99	2.01	81.69
RRH2x40-AWS	B	From Face	0.00	0.0000	102.00	No Ice	2.52	1.59	44.00
			0.00			1/2" Ice	2.75	1.80	61.40
			0.00			1" Ice	2.99	2.01	81.69
RRH2x40-AWS	C	From Face	0.00	0.0000	102.00	No Ice	2.52	1.59	44.00
			0.00			1/2" Ice	2.75	1.80	61.40
			0.00			1" Ice	2.99	2.01	81.69
ADDITIONAL VERIZON RFS									
RFS Unit	A	From Leg	0.00	0.0000	106.00	No Ice	1.40	0.70	50.00
			0.00			1/2" Ice	1.56	0.82	60.34
			0.00			1" Ice	1.73	0.95	72.81
ADDITIONAL TOWER MOUNTS									
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	A	From Leg	2.00	0.0000	114.00	No Ice	35.30	35.30	1750.00
			0.00			1/2" Ice	46.40	46.40	2400.00
			0.00			1" Ice	57.50	57.50	3050.00
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	C	From Leg	2.00	0.0000	114.00	No Ice	35.30	35.30	1750.00
			0.00			1/2" Ice	46.40	46.40	2400.00
			0.00			1" Ice	57.50	57.50	3050.00
10'6"x4" Pipe Mount	A	From Leg	4.00	0.0000	114.00	No Ice	4.72	4.72	114.00
			4.50			1/2" Ice	5.62	5.62	146.84
			0.00			1" Ice	6.25	6.25	186.71

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft	Aperture Area ft^2	Weight lb

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 ft²	Weight lb
VHLP2-180 (Ericson)	A	Paraboloid w/o Radome	From Leg	4.00 4.50 0.00	Worst		119.00	2.00	No Ice 1/2" Ice 1" Ice	3.14 3.41 3.67	25.00 42.49 59.98
VHLP1-23-1GR (12") (P)	B	Paraboloid w/o Radome	From Leg	0.00 0.00 0.00	Worst		110.00	1.00	No Ice 1/2" Ice 1" Ice	0.79 0.92 1.06	28.00 35.28 42.56
VHLP1-23-1GR (12") (P)	C	Paraboloid w/o Radome	From Leg	0.00 0.00 0.00	Worst		110.00	1.00	No Ice 1/2" Ice 1" Ice	0.79 0.92 1.06	28.00 35.28 42.56

Tower Pressures - No Ice

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 117.00-97.00	107.00	1.284	31	64.173	A	8.245	9.176	6.667	38.27	0.000	23.120
					B	8.245	9.176		38.27	0.000	34.101
					C	8.245	9.176		38.27	0.000	18.589
T2 97.00-77.00	87.00	1.229	29	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T3 77.00-57.00	67.00	1.163	28	64.590	A	2.997	11.466	7.500	51.85	0.000	23.120
					B	2.997	11.466		51.85	0.000	34.101
					C	2.997	11.466		51.85	0.000	55.300
T4 57.00-37.00	47.00	1.08	26	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T5 37.00-21.00	29.00	0.975	23	51.339	A	2.516	8.490	5.333	48.46	0.000	20.458
					B	2.516	8.490		48.46	0.000	27.281
					C	2.516	8.490		48.46	0.000	44.240
T6 21.00-17.00	19.00	0.892	21	6.797	A	0.738	1.529	1.456	64.23	0.000	0.000
					B	0.738	1.529		64.23	0.000	0.000
					C	0.738	1.529		64.23	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 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 117.00-97.00	107.00	1.284	7	2.2497	71.672	A	8.245	50.367	21.664	36.96	0.000	104.108
						B	8.245	50.367		36.96	0.000	133.085
						C	8.245	50.367		36.96	0.000	73.930
T2 97.00-77.00	87.00	1.229	7	2.2036	71.519	A	3.019	50.916	21.357	39.60	0.000	102.449
						B	3.019	50.916		39.60	0.000	131.058
						C	3.019	50.916		39.60	0.000	196.329
T3 77.00-57.00	67.00	1.163	6	2.1468	71.746	A	2.997	50.550	21.812	40.73	0.000	100.404

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
						B	2.997	50.550		40.73	0.000	128.558
						C	2.997	50.550		40.73	0.000	192.692
T4 57.00-37.00	47.00	1.08	6	2.0720	71.080	A	3.019	48.510	20.480	39.74	0.000	97.711
						B	3.019	48.510		39.74	0.000	125.268
						C	3.019	48.510		39.74	0.000	187.906
T5 37.00-21.00	29.00	0.975	5	1.9743	56.604	A	2.516	37.556	15.863	39.59	0.000	84.426
						B	2.516	37.556		39.59	0.000	96.776
						C	2.516	37.556		39.59	0.000	145.324
T6 21.00-17.00	19.00	0.892	5	1.8926	8.147	A	0.738	5.354	4.212	69.14	0.000	0.000
						B	0.738	5.354		69.14	0.000	0.000
						C	0.738	5.354		69.14	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	107.00	1.284	10	64.173	A	8.245	9.176	6.667	38.27	0.000	23.120
117.00-97.00					B	8.245	9.176		38.27	0.000	34.101
					C	8.245	9.176		38.27	0.000	18.589
T2 97.00-77.00	87.00	1.229	10	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T3 77.00-57.00	67.00	1.163	9	64.590	A	2.997	11.466	7.500	51.85	0.000	23.120
					B	2.997	11.466		51.85	0.000	34.101
					C	2.997	11.466		51.85	0.000	55.300
T4 57.00-37.00	47.00	1.08	8	64.173	A	3.019	10.618	6.667	48.89	0.000	23.120
					B	3.019	10.618		48.89	0.000	34.101
					C	3.019	10.618		48.89	0.000	55.300
T5 37.00-21.00	29.00	0.975	8	51.339	A	2.516	8.490	5.333	48.46	0.000	20.458
					B	2.516	8.490		48.46	0.000	27.281
					C	2.516	8.490		48.46	0.000	44.240
T6 21.00-17.00	19.00	0.892	7	6.797	A	0.738	1.529	1.456	64.23	0.000	0.000
					B	0.738	1.529		64.23	0.000	0.000
					C	0.738	1.529		64.23	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	341.45	1559.82	A	0.271	2.375	31	1	1	13.664	2834.03	141.70	C
117.00-97.00		TA 473.58	B	0.271	2.375		1	1	13.664			
			C	0.271	2.375		1	1	13.664			
T2	491.60	1297.78	A	0.212	2.555	29	1	1	9.143	3405.50	170.28	C
97.00-77.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T3	491.60	1502.23	A	0.224	2.518	28	1	1	9.637	3244.82	162.24	C

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
77.00-57.00			B	0.224	2.518		1	1	9.637			
			C	0.224	2.518		1	1	9.637			
T4	491.60	1246.22	A	0.212	2.555	26	1	1	9.143	2991.45	149.57	C
57.00-37.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T5	399.22	1000.19	A	0.214	2.549	23	1	1	7.416	2205.12	137.82	C
37.00-21.00			B	0.214	2.549		1	1	7.416			
			C	0.214	2.549		1	1	7.416			
T6	0.00	245.11	A	0.334	2.211	21	1	1	1.671	67.20	16.80	C
21.00-17.00			B	0.334	2.211		1	1	1.671			
			C	0.334	2.211		1	1	1.671			
Sum Weight:	2215.47	7324.93								14748.13		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1559.82	A	0.271	2.375	31	0.8	1	12.015	2731.52	136.58	C
117.00-97.00		TA 473.58	B	0.271	2.375		0.8	1	12.015			
			C	0.271	2.375		0.8	1	12.015			
T2	491.60	1297.78	A	0.212	2.555	29	0.8	1	8.539	3366.84	168.34	C
97.00-77.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T3	491.60	1502.23	A	0.224	2.518	28	0.8	1	9.038	3209.01	160.45	C
77.00-57.00			B	0.224	2.518		0.8	1	9.038			
			C	0.224	2.518		0.8	1	9.038			
T4	491.60	1246.22	A	0.212	2.555	26	0.8	1	8.539	2957.49	147.87	C
57.00-37.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T5	399.22	1000.19	A	0.214	2.549	23	0.8	1	6.913	2179.62	136.23	C
37.00-21.00			B	0.214	2.549		0.8	1	6.913			
			C	0.214	2.549		0.8	1	6.913			
T6	0.00	245.11	A	0.334	2.211	21	0.8	1	1.523	61.27	15.32	C
21.00-17.00			B	0.334	2.211		0.8	1	1.523			
			C	0.334	2.211		0.8	1	1.523			
Sum Weight:	2215.47	7324.93								14505.75		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1559.82	A	0.271	2.375	31	0.85	1	12.428	2757.15	137.86	C
117.00-97.00		TA 473.58	B	0.271	2.375		0.85	1	12.428			
			C	0.271	2.375		0.85	1	12.428			
T2	491.60	1297.78	A	0.212	2.555	29	0.85	1	8.690	3376.51	168.83	C

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
97.00-77.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T3	491.60	1502.23	A	0.224	2.518	28	0.85	1	9.188	3217.96	160.90	C
77.00-57.00			B	0.224	2.518		0.85	1	9.188			
			C	0.224	2.518		0.85	1	9.188			
T4	491.60	1246.22	A	0.212	2.555	26	0.85	1	8.690	2965.98	148.30	C
57.00-37.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T5	399.22	1000.19	A	0.214	2.549	23	0.85	1	7.039	2185.99	136.62	C
37.00-21.00			B	0.214	2.549		0.85	1	7.039			
			C	0.214	2.549		0.85	1	7.039			
T6	0.00	245.11	A	0.334	2.211	21	0.85	1	1.560	62.75	15.69	C
21.00-17.00			B	0.334	2.211		0.85	1	1.560			
			C	0.334	2.211		0.85	1	1.560			
Sum Weight:	2215.47	7324.93								14566.34		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4886.05	A	0.818	1.83	7	1	1	53.544	2428.61	121.43	C
117.00-97.00		TA	B	0.818	1.83		1	1	53.544			
		1609.09	C	0.818	1.83		1	1	53.544			
T2	8113.95	3961.51	A	0.754	1.789	7	1	1	46.328	2913.89	145.69	C
97.00-77.00			B	0.754	1.789		1	1	46.328			
			C	0.754	1.789		1	1	46.328			
T3	7735.98	4097.17	A	0.746	1.786	6	1	1	45.701	2707.17	135.36	C
77.00-57.00			B	0.746	1.786		1	1	45.701			
			C	0.746	1.786		1	1	45.701			
T4	7238.51	3662.69	A	0.725	1.78	6	1	1	43.235	2435.31	121.77	C
57.00-37.00			B	0.725	1.78		1	1	43.235			
			C	0.725	1.78		1	1	43.235			
T5	5464.74	2812.41	A	0.708	1.777	5	1	1	33.190	1738.44	108.65	C
37.00-21.00			B	0.708	1.777		1	1	33.190			
			C	0.708	1.777		1	1	33.190			
T6	0.00	489.84	A	0.748	1.787	5	1	1	5.267	38.82	9.71	C
21.00-17.00			B	0.748	1.787		1	1	5.267			
			C	0.748	1.787		1	1	5.267			
Sum Weight:	34491.23	21518.75								12262.25		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	5938.05	4886.05	A	0.818	1.83	7	0.8	1	51.895	2410.70	120.53	C

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
117.00-97.00		TA	B	0.818	1.83		0.8	1	51.895			
		1609.09	C	0.818	1.83		0.8	1	51.895			
T2	8113.95	3961.51	A	0.754	1.789	7	0.8	1	45.724	2907.75	145.39	C
97.00-77.00			B	0.754	1.789		0.8	1	45.724			
			C	0.754	1.789		0.8	1	45.724			
T3	7735.98	4097.17	A	0.746	1.786	6	0.8	1	45.102	2701.41	135.07	C
77.00-57.00			B	0.746	1.786		0.8	1	45.102			
			C	0.746	1.786		0.8	1	45.102			
T4	7238.51	3662.69	A	0.725	1.78	6	0.8	1	42.631	2429.95	121.50	C
57.00-37.00			B	0.725	1.78		0.8	1	42.631			
			C	0.725	1.78		0.8	1	42.631			
T5	5464.74	2812.41	A	0.708	1.777	5	0.8	1	32.687	1734.41	108.40	C
37.00-21.00			B	0.708	1.777		0.8	1	32.687			
			C	0.708	1.777		0.8	1	32.687			
T6	0.00	489.84	A	0.748	1.787	5	0.8	1	5.119	37.73	9.43	C
21.00-17.00			B	0.748	1.787		0.8	1	5.119			
			C	0.748	1.787		0.8	1	5.119			
Sum Weight:	34491.23	21518.75								12221.95		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	5938.05	4886.05	A	0.818	1.83	7	0.85	1	52.308	2415.18	120.76	C
117.00-97.00		TA	B	0.818	1.83		0.85	1	52.308			
		1609.09	C	0.818	1.83		0.85	1	52.308			
T2	8113.95	3961.51	A	0.754	1.789	7	0.85	1	45.875	2909.29	145.46	C
97.00-77.00			B	0.754	1.789		0.85	1	45.875			
			C	0.754	1.789		0.85	1	45.875			
T3	7735.98	4097.17	A	0.746	1.786	6	0.85	1	45.252	2702.85	135.14	C
77.00-57.00			B	0.746	1.786		0.85	1	45.252			
			C	0.746	1.786		0.85	1	45.252			
T4	7238.51	3662.69	A	0.725	1.78	6	0.85	1	42.782	2431.29	121.56	C
57.00-37.00			B	0.725	1.78		0.85	1	42.782			
			C	0.725	1.78		0.85	1	42.782			
T5	5464.74	2812.41	A	0.708	1.777	5	0.85	1	32.813	1735.42	108.46	C
37.00-21.00			B	0.708	1.777		0.85	1	32.813			
			C	0.708	1.777		0.85	1	32.813			
T6	0.00	489.84	A	0.748	1.787	5	0.85	1	5.156	38.01	9.50	C
21.00-17.00			B	0.748	1.787		0.85	1	5.156			
			C	0.748	1.787		0.85	1	5.156			
Sum Weight:	34491.23	21518.75								12232.03		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1559.82	A	0.271	2.375	10	1	1	13.664	925.40	46.27	C
117.00-97.00		TA 473.58	B	0.271	2.375		1	1	13.664			
			C	0.271	2.375		1	1	13.664			
T2	491.60	1297.78	A	0.212	2.555	10	1	1	9.143	1112.00	55.60	C
97.00-77.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T3	491.60	1502.23	A	0.224	2.518	9	1	1	9.637	1059.53	52.98	C
77.00-57.00			B	0.224	2.518		1	1	9.637			
			C	0.224	2.518		1	1	9.637			
T4	491.60	1246.22	A	0.212	2.555	8	1	1	9.143	976.80	48.84	C
57.00-37.00			B	0.212	2.555		1	1	9.143			
			C	0.212	2.555		1	1	9.143			
T5	399.22	1000.19	A	0.214	2.549	8	1	1	7.416	720.04	45.00	C
37.00-21.00			B	0.214	2.549		1	1	7.416			
			C	0.214	2.549		1	1	7.416			
T6	0.00	245.11	A	0.334	2.211	7	1	1	1.671	21.94	5.49	C
21.00-17.00			B	0.334	2.211		1	1	1.671			
			C	0.334	2.211		1	1	1.671			
Sum Weight:	2215.47	7324.93								4815.72		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	341.45	1559.82	A	0.271	2.375	10	0.8	1	12.015	891.93	44.60	C
117.00-97.00		TA 473.58	B	0.271	2.375		0.8	1	12.015			
			C	0.271	2.375		0.8	1	12.015			
T2	491.60	1297.78	A	0.212	2.555	10	0.8	1	8.539	1099.38	54.97	C
97.00-77.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T3	491.60	1502.23	A	0.224	2.518	9	0.8	1	9.038	1047.84	52.39	C
77.00-57.00			B	0.224	2.518		0.8	1	9.038			
			C	0.224	2.518		0.8	1	9.038			
T4	491.60	1246.22	A	0.212	2.555	8	0.8	1	8.539	965.71	48.29	C
57.00-37.00			B	0.212	2.555		0.8	1	8.539			
			C	0.212	2.555		0.8	1	8.539			
T5	399.22	1000.19	A	0.214	2.549	8	0.8	1	6.913	711.71	44.48	C
37.00-21.00			B	0.214	2.549		0.8	1	6.913			
			C	0.214	2.549		0.8	1	6.913			
T6	0.00	245.11	A	0.334	2.211	7	0.8	1	1.523	20.01	5.00	C
21.00-17.00			B	0.334	2.211		0.8	1	1.523			
			C	0.334	2.211		0.8	1	1.523			
Sum Weight:	2215.47	7324.93								4736.57		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
T1	341.45	1559.82	A	0.271	2.375	10	0.85	1	12.428	900.29	45.01	C
117.00-97.00		TA 473.58	B	0.271	2.375		0.85	1	12.428			
			C	0.271	2.375		0.85	1	12.428			
T2	491.60	1297.78	A	0.212	2.555	10	0.85	1	8.690	1102.53	55.13	C
97.00-77.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T3	491.60	1502.23	A	0.224	2.518	9	0.85	1	9.188	1050.76	52.54	C
77.00-57.00			B	0.224	2.518		0.85	1	9.188			
			C	0.224	2.518		0.85	1	9.188			
T4	491.60	1246.22	A	0.212	2.555	8	0.85	1	8.690	968.48	48.42	C
57.00-37.00			B	0.212	2.555		0.85	1	8.690			
			C	0.212	2.555		0.85	1	8.690			
T5	399.22	1000.19	A	0.214	2.549	8	0.85	1	7.039	713.79	44.61	C
37.00-21.00			B	0.214	2.549		0.85	1	7.039			
			C	0.214	2.549		0.85	1	7.039			
T6	0.00	245.11	A	0.334	2.211	7	0.85	1	1.560	20.49	5.12	C
21.00-17.00			B	0.334	2.211		0.85	1	1.560			
			C	0.334	2.211		0.85	1	1.560			
Sum Weight:	2215.47	7324.93								4756.36		

Discrete Appurtenance Pressures - No Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft²	C_AA_C Side ft²
Torque Arm Face C	180.0000	0.00	0.00	2.20	107.70	1.286	31	8.05	10.58
Torque Arm Face B	60.0000	0.00	1.90	-1.10	107.70	1.286	31	8.05	10.58
Torque Arm Face A	300.0000	0.00	-1.90	-1.10	107.70	1.286	31	8.05	10.58
W.Monroe - 12' Omni	240.0000	20.45	-1.52	0.88	117.00	1.308	31	3.00	3.00
Albion - 16' Omni w/ Pipe Mount	120.0000	60.59	1.52	0.88	124.00	1.324	32	4.32	4.59
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	48.93	0.00	-1.76	124.00	1.324	32	5.39	6.03
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	48.93	1.52	0.88	121.00	1.317	32	5.39	6.03
W.Monroe - 7.5' Omni	120.0000	45.01	3.25	1.88	120.00	1.315	32	2.10	6.50
Cobleskill - 4' Omni with Mounts	0.0000	11.10	0.00	-1.76	119.00	1.313	31	1.91	1.15
ALP 9212	0.0000	17.20	1.50	-5.76	114.00	1.301	31	5.46	5.46
ALP 9212	120.0000	17.20	4.24	4.18	114.00	1.301	31	5.46	5.46
ALP 9212	240.0000	17.20	-5.74	1.58	114.00	1.301	31	5.46	5.46
BXA-80063/4CF w/Mount Pipe	0.0000	35.45	6.00	-5.76	102.00	1.271	30	5.89	3.91
SLCP 2x6014 w/Mount Pipe	120.0000	36.73	1.99	8.07	102.00	1.271	30	7.25	6.72
SLCP 2x6014 w/Mount Pipe	240.0000	36.73	-7.99	-2.32	102.00	1.271	30	7.25	6.72
BXA-171063/8BF w/Mount Pipe	0.0000	24.47	4.00	-5.76	102.00	1.271	30	2.96	3.06
SACP 2x5516 w/Mount Pipe	120.0000	33.64	2.99	6.34	102.00	1.271	30	5.32	4.36
SACP 2x5516 w/Mount Pipe	240.0000	33.64	-6.99	-0.59	102.00	1.271	30	5.32	4.36
PiROD 12' Lightweight	0.0000	253.00	0.00	-1.76	102.00	1.271	30	10.20	10.20

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
T-Frame PiROD 12' Lightweight	120.0000	253.00	1.52	0.88	102.00	1.271	30	10.20	10.20
T-Frame PiROD 12' Lightweight	240.0000	253.00	-1.52	0.88	102.00	1.271	30	10.20	10.20
T-Frame BXA-70063/6CF w/Mount Pipe	0.0000	39.20	0.00	-5.76	102.00	1.271	30	7.77	5.20
SLCP 2x6015 w/Mount Pipe	120.0000	54.03	4.99	2.88	102.00	1.271	30	10.52	9.80
SLCP 2x6015 w/Mount Pipe	240.0000	54.03	-4.99	2.88	102.00	1.271	30	10.52	9.80
GPS Antenna	0.0000	16.00	0.00	-1.76	102.00	1.271	30	0.01	0.01
GPS Antenna	0.0000	8.00	0.00	-1.76	27.00	0.961	23	0.00	0.00
GPS Antenna	120.0000	8.00	1.52	0.88	27.00	0.961	23	0.00	0.00
GPS Antenna	240.0000	8.00	-1.52	0.88	27.00	0.961	23	0.00	0.00
LLPX310R w/ mounting pipe	0.0000	43.26	4.00	-5.76	114.00	1.301	31	4.94	2.82
LLPX310R w/ mounting pipe	120.0000	43.26	2.99	6.34	114.00	1.301	31	4.94	2.82
LLPX310R w/ mounting pipe	240.0000	43.26	-6.99	-0.59	114.00	1.301	31	4.94	2.82
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	110.00	1.291	31	1.32	1.32
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	117.00	1.308	31	1.32	1.32
4'x4" Pipe Mount	0.0000	44.00	0.00	-1.76	114.00	1.301	31	1.32	1.32
6'8"x4" Pipe Mount	120.0000	72.00	1.52	0.88	114.00	1.301	31	2.60	2.60
1-1/2" Pipe	0.0000	10.88	0.00	-1.76	102.00	1.271	30	0.50	0.50
1-1/2" Pipe	0.0000	5.44	0.00	-1.76	27.00	0.961	23	0.25	0.25
1-1/2" Pipe	120.0000	5.44	1.52	0.88	27.00	0.961	23	0.25	0.25
1-1/2" Pipe	240.0000	5.44	-1.52	0.88	27.00	0.961	23	0.25	0.25
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	1750.00	3.25	1.88	114.50	1.302	31	35.30	35.30
Remote RU	0.0000	33.00	0.00	-1.76	114.00	1.301	31	0.00	0.86
Remote RU	120.0000	33.00	1.52	0.88	114.00	1.301	31	0.00	0.86
Remote RU	240.0000	33.00	-1.52	0.88	114.00	1.301	31	0.00	0.86
GPS	240.0000	5.00	-1.95	1.13	32.00	0.996	24	0.12	0.12
BXA-171063/12CF w/Mount Pipe	0.0000	35.46	-6.00	-5.76	102.00	1.271	30	4.84	5.10
SACP 2x5516 w/Mount Pipe	120.0000	33.64	7.99	-2.32	102.00	1.271	30	5.32	4.36
SACP 2x5516 w/Mount Pipe	240.0000	33.64	-1.99	8.07	102.00	1.271	30	5.32	4.36
ALP 9212	0.0000	17.20	-1.50	-5.76	114.00	1.301	31	5.46	5.46
ALP 9212	0.0000	17.20	-4.50	-5.76	114.00	1.301	31	5.46	5.46
ALP 9212	120.0000	17.20	5.74	1.58	114.00	1.301	31	5.46	5.46
ALP 9212	120.0000	17.20	7.24	-1.02	114.00	1.301	31	5.46	5.46
ALP 9212	240.0000	17.20	-4.24	4.18	114.00	1.301	31	5.46	5.46
ALP 9212	240.0000	17.20	-2.74	6.78	114.00	1.301	31	5.46	5.46
RRH2x40-07-U	300.0000	50.00	-0.76	-0.44	102.00	1.271	30	2.25	1.23
RRH2x40-07-U	60.0000	50.00	0.76	-0.44	102.00	1.271	30	2.25	1.23
RRH2x40-07-U	180.0000	50.00	0.00	0.88	102.00	1.271	30	2.25	1.23
RRH2x40-AWS	300.0000	44.00	-0.76	-0.44	102.00	1.271	30	2.52	1.59
RRH2x40-AWS	60.0000	44.00	0.76	-0.44	102.00	1.271	30	2.52	1.59
RRH2x40-AWS	180.0000	44.00	0.00	0.88	102.00	1.271	30	2.52	1.59
RFS Unit	0.0000	50.00	0.00	-1.76	106.00	1.281	31	1.40	0.70
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	0.0000	1750.00	0.00	-3.76	114.00	1.301	31	35.30	35.30
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	240.0000	1750.00	-3.25	1.88	114.00	1.301	31	35.30	35.30
10'6"x4" Pipe Mount	0.0000	114.00	4.50	-5.76	114.00	1.301	31	4.72	4.72
	Sum Weight:	7800.46							

Discrete Appurtenance Pressures - With Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2	t_z in
Torque Arm Face C	180.0000	0.00	0.00	2.20	107.70	1.286	7	11.32	14.75	2.2497
Torque Arm Face B	60.0000	0.00	1.90	-1.10	107.70	1.286	7	11.32	14.75	2.2497
Torque Arm Face A	300.0000	0.00	-1.90	-1.10	107.70	1.286	7	11.32	14.75	2.2497
W.Monroe - 12' Omni	240.0000	121.70	-1.52	0.88	117.00	1.308	7	21.38	21.38	2.2699
Albion - 16' Omni w/ Pipe Mount	120.0000	226.87	1.52	0.88	124.00	1.324	7	12.37	13.43	2.2831
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	293.23	0.00	-1.76	124.00	1.324	7	55.92	57.77	2.2831
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	292.63	1.52	0.88	121.00	1.317	7	55.80	57.65	2.2775
W.Monroe - 7.5' Omni	120.0000	277.39	3.25	1.88	120.00	1.315	7	13.47	48.28	2.2756
Cobleskill - 4' Omni with Mounts	0.0000	60.93	0.00	-1.76	119.00	1.313	7	3.37	4.23	2.2737
ALP 9212	0.0000	157.16	1.50	-5.76	114.00	1.301	7	8.31	8.31	2.2640
ALP 9212	120.0000	157.16	4.24	4.18	114.00	1.301	7	8.31	8.31	2.2640
ALP 9212	240.0000	157.16	-5.74	1.58	114.00	1.301	7	8.31	8.31	2.2640
BXA-80063/4CF w/Mount Pipe	0.0000	306.25	6.00	-5.76	102.00	1.271	7	8.67	7.60	2.2389
SLCP 2x6014 w/Mount Pipe	120.0000	382.48	1.99	8.07	102.00	1.271	7	9.34	10.01	2.2389
SLCP 2x6014 w/Mount Pipe	240.0000	382.48	-7.99	-2.32	102.00	1.271	7	9.34	10.01	2.2389
BXA-171063/8BF w/Mount Pipe	0.0000	210.99	4.00	-5.76	102.00	1.271	7	4.61	5.73	2.2389
SACP 2x5516 w/Mount Pipe	120.0000	294.85	2.99	6.34	102.00	1.271	7	7.37	7.43	2.2389
SACP 2x5516 w/Mount Pipe	240.0000	294.85	-6.99	-0.59	102.00	1.271	7	7.37	7.43	2.2389
PiROD 12' Lightweight T-Frame	0.0000	709.74	0.00	-1.76	102.00	1.271	7	37.07	37.07	2.2389
PiROD 12' Lightweight T-Frame	120.0000	709.74	1.52	0.88	102.00	1.271	7	37.07	37.07	2.2389
PiROD 12' Lightweight T-Frame	240.0000	709.74	-1.52	0.88	102.00	1.271	7	37.07	37.07	2.2389
BXA-70063/6CF w/Mount Pipe	0.0000	367.17	0.00	-5.76	102.00	1.271	7	10.30	9.07	2.2389
SLCP 2x6015 w/Mount Pipe	120.0000	532.60	4.99	2.88	102.00	1.271	7	13.31	14.53	2.2389
SLCP 2x6015 w/Mount Pipe	240.0000	532.60	-4.99	2.88	102.00	1.271	7	13.31	14.53	2.2389
GPS Antenna	0.0000	24.75	0.00	-1.76	102.00	1.271	7	0.35	0.35	2.2389
GPS Antenna	0.0000	10.58	0.00	-1.76	27.00	0.961	5	0.13	0.13	1.9603
GPS Antenna	120.0000	10.58	1.52	0.88	27.00	0.961	5	0.13	0.13	1.9603
GPS Antenna	240.0000	10.58	-1.52	0.88	27.00	0.961	5	0.13	0.13	1.9603
LLPX310R w/ mounting pipe	0.0000	263.65	4.00	-5.76	114.00	1.301	7	6.77	5.40	2.2640
LLPX310R w/ mounting pipe	120.0000	263.65	2.99	6.34	114.00	1.301	7	6.77	5.40	2.2640
LLPX310R w/ mounting pipe	240.0000	263.65	-6.99	-0.59	114.00	1.301	7	6.77	5.40	2.2640
4'x4" Pipe Mount	120.0000	131.15	1.52	0.88	110.00	1.291	7	2.64	2.64	2.2559
4'x4" Pipe Mount	120.0000	132.03	1.52	0.88	117.00	1.308	7	2.65	2.65	2.2699
4'x4" Pipe Mount	0.0000	131.66	0.00	-1.76	114.00	1.301	7	2.64	2.64	2.2640
6'8"x4" Pipe Mount	120.0000	211.04	1.52	0.88	114.00	1.301	7	4.53	4.53	2.2640
1-1/2" Pipe	0.0000	63.66	0.00	-1.76	102.00	1.271	7	1.91	1.91	2.2389

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2	t_z in
1-1/2" Pipe	0.0000	25.09	0.00	-1.76	27.00	0.961	5	0.84	0.84	1.9603
1-1/2" Pipe	120.0000	25.09	1.52	0.88	27.00	0.961	5	0.84	0.84	1.9603
1-1/2" Pipe	240.0000	25.09	-1.52	0.88	27.00	0.961	5	0.84	0.84	1.9603
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	4694.44	3.25	1.88	114.50	1.302	7	85.58	85.58	2.2650
Remote RU	0.0000	110.07	0.00	-1.76	114.00	1.301	7	0.00	1.58	2.2640
Remote RU	120.0000	110.07	1.52	0.88	114.00	1.301	7	0.00	1.58	2.2640
Remote RU	240.0000	110.07	-1.52	0.88	114.00	1.301	7	0.00	1.58	2.2640
GPS	240.0000	10.74	-1.95	1.13	32.00	0.996	5	0.37	0.37	1.9939
BXA-171063/12CF w/Mount Pipe	0.0000	304.28	-6.00	-5.76	102.00	1.271	7	6.98	9.05	2.2389
SACP 2x5516 w/Mount Pipe	120.0000	294.85	7.99	-2.32	102.00	1.271	7	7.37	7.43	2.2389
SACP 2x5516 w/Mount Pipe	240.0000	294.85	-1.99	8.07	102.00	1.271	7	7.37	7.43	2.2389
ALP 9212	0.0000	157.16	-1.50	-5.76	114.00	1.301	7	8.31	8.31	2.2640
ALP 9212	0.0000	157.16	-4.50	-5.76	114.00	1.301	7	8.31	8.31	2.2640
ALP 9212	120.0000	157.16	5.74	1.58	114.00	1.301	7	8.31	8.31	2.2640
ALP 9212	120.0000	157.16	7.24	-1.02	114.00	1.301	7	8.31	8.31	2.2640
ALP 9212	240.0000	157.16	-4.24	4.18	114.00	1.301	7	8.31	8.31	2.2640
ALP 9212	240.0000	157.16	-2.74	6.78	114.00	1.301	7	8.31	8.31	2.2640
RRH2x40-07-U	300.0000	150.69	-0.76	-0.44	102.00	1.271	7	3.22	2.01	2.2389
RRH2x40-07-U	60.0000	150.69	0.76	-0.44	102.00	1.271	7	3.22	2.01	2.2389
RRH2x40-07-U	180.0000	150.69	0.00	0.88	102.00	1.271	7	3.22	2.01	2.2389
RRH2x40-AWS	300.0000	148.90	-0.76	-0.44	102.00	1.271	7	3.63	2.59	2.2389
RRH2x40-AWS	60.0000	148.90	0.76	-0.44	102.00	1.271	7	3.63	2.59	2.2389
RRH2x40-AWS	180.0000	148.90	0.00	0.88	102.00	1.271	7	3.63	2.59	2.2389
RFS Unit	0.0000	117.16	0.00	-1.76	106.00	1.281	7	2.19	1.32	2.2475
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	0.0000	4693.15	0.00	-3.76	114.00	1.301	7	85.56	85.56	2.2640
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	240.0000	4693.15	-3.25	1.88	114.00	1.301	7	85.56	85.56	2.2640
10'6"x4" Pipe Mount	0.0000	326.90	4.50	-5.76	114.00	1.301	7	7.91	7.91	2.2640
	Sum Weight:	26371.41								

Discrete Appurtenance Pressures - Service $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
Torque Arm Face C	180.0000	0.00	0.00	2.20	107.70	1.286	10	8.05	10.58
Torque Arm Face B	60.0000	0.00	1.90	-1.10	107.70	1.286	10	8.05	10.58
Torque Arm Face A	300.0000	0.00	-1.90	-1.10	107.70	1.286	10	8.05	10.58
W.Monroe - 12' Omni	240.0000	20.45	-1.52	0.88	117.00	1.308	10	3.00	3.00
Albion - 16' Omni w/ Pipe Mount	120.0000	60.59	1.52	0.88	124.00	1.324	10	4.32	4.59
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	0.0000	48.93	0.00	-1.76	124.00	1.324	10	5.39	6.03
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	120.0000	48.93	1.52	0.88	121.00	1.317	10	5.39	6.03
W.Monroe - 7.5' Omni	120.0000	45.01	3.25	1.88	120.00	1.315	10	2.10	6.50
Cobleskill - 4' Omni with Mounts	0.0000	11.10	0.00	-1.76	119.00	1.313	10	1.91	1.15
ALP 9212	0.0000	17.20	1.50	-5.76	114.00	1.301	10	5.46	5.46
ALP 9212	120.0000	17.20	4.24	4.18	114.00	1.301	10	5.46	5.46
ALP 9212	240.0000	17.20	-5.74	1.58	114.00	1.301	10	5.46	5.46
BXA-80063/4CF	0.0000	35.45	6.00	-5.76	102.00	1.271	10	5.89	3.91

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
w/Mount Pipe									
SLCP 2x6014 w/Mount Pipe	120.0000	36.73	1.99	8.07	102.00	1.271	10	7.25	6.72
SLCP 2x6014 w/Mount Pipe	240.0000	36.73	-7.99	-2.32	102.00	1.271	10	7.25	6.72
BXA-171063/8BF w/Mount Pipe	0.0000	24.47	4.00	-5.76	102.00	1.271	10	2.96	3.06
SACP 2x5516 w/Mount Pipe	120.0000	33.64	2.99	6.34	102.00	1.271	10	5.32	4.36
SACP 2x5516 w/Mount Pipe	240.0000	33.64	-6.99	-0.59	102.00	1.271	10	5.32	4.36
PiROD 12' Lightweight T-Frame	0.0000	253.00	0.00	-1.76	102.00	1.271	10	10.20	10.20
PiROD 12' Lightweight T-Frame	120.0000	253.00	1.52	0.88	102.00	1.271	10	10.20	10.20
PiROD 12' Lightweight T-Frame	240.0000	253.00	-1.52	0.88	102.00	1.271	10	10.20	10.20
BXA-70063/6CF w/Mount Pipe	0.0000	39.20	0.00	-5.76	102.00	1.271	10	7.77	5.20
SLCP 2x6015 w/Mount Pipe	120.0000	54.03	4.99	2.88	102.00	1.271	10	10.52	9.80
SLCP 2x6015 w/Mount Pipe	240.0000	54.03	-4.99	2.88	102.00	1.271	10	10.52	9.80
GPS Antenna	0.0000	16.00	0.00	-1.76	102.00	1.271	10	0.01	0.01
GPS Antenna	0.0000	8.00	0.00	-1.76	27.00	0.961	8	0.00	0.00
GPS Antenna	120.0000	8.00	1.52	0.88	27.00	0.961	8	0.00	0.00
GPS Antenna	240.0000	8.00	-1.52	0.88	27.00	0.961	8	0.00	0.00
LLPX310R w/ mounting pipe	0.0000	43.26	4.00	-5.76	114.00	1.301	10	4.94	2.82
LLPX310R w/ mounting pipe	120.0000	43.26	2.99	6.34	114.00	1.301	10	4.94	2.82
LLPX310R w/ mounting pipe	240.0000	43.26	-6.99	-0.59	114.00	1.301	10	4.94	2.82
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	110.00	1.291	10	1.32	1.32
4'x4" Pipe Mount	120.0000	44.00	1.52	0.88	117.00	1.308	10	1.32	1.32
4'x4" Pipe Mount	0.0000	44.00	0.00	-1.76	114.00	1.301	10	1.32	1.32
6'8"x4" Pipe Mount	120.0000	72.00	1.52	0.88	114.00	1.301	10	2.60	2.60
1-1/2" Pipe	0.0000	10.88	0.00	-1.76	102.00	1.271	10	0.50	0.50
1-1/2" Pipe	0.0000	5.44	0.00	-1.76	27.00	0.961	8	0.25	0.25
1-1/2" Pipe	120.0000	5.44	1.52	0.88	27.00	0.961	8	0.25	0.25
1-1/2" Pipe	240.0000	5.44	-1.52	0.88	27.00	0.961	8	0.25	0.25
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	120.0000	1750.00	3.25	1.88	114.50	1.302	10	35.30	35.30
Remote RU	0.0000	33.00	0.00	-1.76	114.00	1.301	10	0.00	0.86
Remote RU	120.0000	33.00	1.52	0.88	114.00	1.301	10	0.00	0.86
Remote RU	240.0000	33.00	-1.52	0.88	114.00	1.301	10	0.00	0.86
GPS	240.0000	5.00	-1.95	1.13	32.00	0.996	8	0.12	0.12
BXA-171063/12CF w/Mount Pipe	0.0000	35.46	-6.00	-5.76	102.00	1.271	10	4.84	5.10
SACP 2x5516 w/Mount Pipe	120.0000	33.64	7.99	-2.32	102.00	1.271	10	5.32	4.36
SACP 2x5516 w/Mount Pipe	240.0000	33.64	-1.99	8.07	102.00	1.271	10	5.32	4.36
ALP 9212	0.0000	17.20	-1.50	-5.76	114.00	1.301	10	5.46	5.46
ALP 9212	0.0000	17.20	-4.50	-5.76	114.00	1.301	10	5.46	5.46
ALP 9212	120.0000	17.20	5.74	1.58	114.00	1.301	10	5.46	5.46
ALP 9212	120.0000	17.20	7.24	-1.02	114.00	1.301	10	5.46	5.46
ALP 9212	240.0000	17.20	-4.24	4.18	114.00	1.301	10	5.46	5.46
ALP 9212	240.0000	17.20	-2.74	6.78	114.00	1.301	10	5.46	5.46
RRH2x40-07-U	300.0000	50.00	-0.76	-0.44	102.00	1.271	10	2.25	1.23
RRH2x40-07-U	60.0000	50.00	0.76	-0.44	102.00	1.271	10	2.25	1.23

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
RRH2x40-07-U	180.0000	50.00	0.00	0.88	102.00	1.271	10	2.25	1.23
RRH2x40-AWS	300.0000	44.00	-0.76	-0.44	102.00	1.271	10	2.52	1.59
RRH2x40-AWS	60.0000	44.00	0.76	-0.44	102.00	1.271	10	2.52	1.59
RRH2x40-AWS	180.0000	44.00	0.00	0.88	102.00	1.271	10	2.52	1.59
RFS Unit	0.0000	50.00	0.00	-1.76	106.00	1.281	10	1.40	0.70
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	0.0000	1750.00	0.00	-3.76	114.00	1.301	10	35.30	35.30
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	240.0000	1750.00	-3.25	1.88	114.00	1.301	10	35.30	35.30
10'6"x4" Pipe Mount	0.0000	114.00	4.50	-5.76	114.00	1.301	10	4.72	4.72
	Sum Weight:	7800.46							

Dish Pressures - No Ice

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
119.00	VHLP2-180	0.0000	25.00	0.00	-5.76	1.313	3.14	31
110.00	VHLP1-23-1GR (12")	120.0000	28.00	1.52	0.88	1.291	0.79	31
110.00	VHLP1-23-1GR (12")	240.0000	28.00	-1.52	0.88	1.291	0.79	31
		Sum Weight:	81.00					

Dish Pressures - With Ice

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf	t_z in
119.00	VHLP2-180	0.0000	104.53	0.00	-5.76	1.313	4.36	7	2.2737
110.00	VHLP1-23-1GR (12")	120.0000	60.85	1.52	0.88	1.291	1.40	7	2.2559
110.00	VHLP1-23-1GR (12")	240.0000	60.85	-1.52	0.88	1.291	1.40	7	2.2559
		Sum Weight:	226.23						

Dish Pressures - Service

Elevation ft	Dish Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	K_z	A_A ft^2	q_z psf
119.00	VHLP2-180	0.0000	25.00	0.00	-5.76	1.313	3.14	10
110.00	VHLP1-23-1GR (12")	120.0000	28.00	1.52	0.88	1.291	0.79	10
110.00	VHLP1-23-1GR (12")	240.0000	28.00	-1.52	0.88	1.291	0.79	10
		Sum Weight:	81.00					

Force Totals (Does not include forces on guys)

Load Case	*Vertical Forces* *lb*	*Sum of Forces X* *lb*	*Sum of Forces Z* *lb*	*Sum of Torques* *lb-ft*
Leg Weight	4067.10			
Bracing Weight	3257.83			
Total Member Self-Weight	7324.93			
Guy Weight	1221.16			
Total Weight	18643.02			
Wind 0 deg - No Ice		61.63	-24207.52	1361.99
Wind 30 deg - No Ice		12006.90	-20837.71	1466.65
Wind 60 deg - No Ice		20682.46	-12035.94	1176.69
Wind 90 deg - No Ice		23907.06	-61.63	572.99
Wind 120 deg - No Ice		20830.74	12050.39	-181.73
Wind 150 deg - No Ice		11900.16	20776.08	-893.66
Wind 180 deg - No Ice		-61.63	23965.13	-1362.97
Wind 210 deg - No Ice		-12006.90	20837.71	-1466.65
Wind 240 deg - No Ice		-20892.37	12157.13	-1180.26
Wind 270 deg - No Ice		-23907.06	61.63	-572.99
Wind 300 deg - No Ice		-20620.83	-11929.19	186.28
Wind 330 deg - No Ice		-11900.16	-20776.08	893.66
Member Ice	14193.82			
Guy Ice	5986.15			
Total Weight Ice	89814.93			
Wind 0 deg - Ice		99.38	-17401.79	1445.30
Wind 30 deg - Ice		8716.92	-15093.91	1380.15
Wind 60 deg - Ice		14990.05	-8766.81	945.21
Wind 90 deg - Ice		17261.71	-99.38	256.88
Wind 120 deg - Ice		14925.57	8614.83	-500.39
Wind 150 deg - Ice		8544.79	14994.53	-1123.27
Wind 180 deg - Ice		-99.38	17361.49	-1445.36
Wind 210 deg - Ice		-8716.92	15093.91	-1380.15
Wind 240 deg - Ice		-15024.95	8786.96	-944.92
Wind 270 deg - Ice		-17261.71	99.38	-256.88
Wind 300 deg - Ice		-14890.67	-8594.68	500.15
Wind 330 deg - Ice		-8544.79	-14994.53	1123.27
Total Weight	18643.02			
Wind 0 deg - Service		20.12	-7904.49	444.73
Wind 30 deg - Service		3920.62	-6804.15	478.90
Wind 60 deg - Service		6753.46	-3930.10	384.22
Wind 90 deg - Service		7806.39	-20.12	187.10
Wind 120 deg - Service		6801.87	3934.82	-59.34
Wind 150 deg - Service		3885.77	6784.03	-291.81
Wind 180 deg - Service		-20.12	7825.35	-445.05
Wind 210 deg - Service		-3920.62	6804.15	-478.90
Wind 240 deg - Service		-6822.00	3969.68	-385.39
Wind 270 deg - Service		-7806.39	20.12	-187.10
Wind 300 deg - Service		-6733.33	-3895.25	60.83
Wind 330 deg - Service		-3885.77	-6784.03	291.81

Load Combinations

Comb. No.	*Description*
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy
4	1.2 Dead+1.6 Wind 60 deg - No Ice+1.0 Guy

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
T1	117 - 97	Leg	Max Tension	4	846.55	-738.33	393.81
			Max. Compression	13	-56703.14	254.42	319.51
			Max. Mx	11	-14247.11	-1391.50	23.32
			Max. My	2	-12473.17	-70.73	-1362.11
			Max. Vy	11	-2309.15	874.90	23.32
			Max. Vx	2	-2126.64	-70.73	934.02
		Diagonal	Max Tension	7	14765.94	0.00	0.00
		Guy Lower Diagonal	Max Tension	11	18281.72	0.00	0.00
		Horizontal	Max Tension	13	982.13	0.00	0.00
			Max. Compression	12	-14672.58	0.00	0.00
			Max. Mx	14	699.40	-20.20	0.00
			Max. My	2	929.50	0.00	-0.00
			Max. Vy	14	26.56	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-4793.26	0.00	0.00
			Max. Mx	14	-4314.99	-20.20	0.00
			Max. My	2	-4601.03	0.00	0.00
			Max. Vy	14	26.56	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vx	2	-0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-3614.89	0.00	0.00
			Max. Mx	21	-3143.31	-20.20	0.00
			Max. My	2	-2759.39	0.00	-0.00
			Max. Vy	21	26.56	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Guy A	Bottom Tension	7	26760.15		
			Top Tension	7	26903.17		
			Top Cable Vert	7	24346.39		
			Top Cable Norm	7	11446.83		
			Top Cable Tan	7	61.05		
			Bot Cable Vert	7	-24079.10		
			Bot Cable Norm	7	11673.23		
			Bot Cable Tan	7	195.83		
		Guy B	Bottom Tension	13	29342.85		
			Top Tension	13	29485.28		
			Top Cable Vert	13	27302.48		
			Top Cable Norm	13	11133.12		
			Top Cable Tan	13	99.71		
			Bot Cable Vert	13	-27049.25		
			Bot Cable Norm	13	11370.46		
			Bot Cable Tan	13	230.58		
		Guy C	Bottom Tension	3	28200.71		
			Top Tension	3	28330.85		
			Top Cable Vert	3	26051.61		
			Top Cable Norm	3	11132.75		
			Top Cable Tan	3	112.57		
			Bot Cable Vert	3	-25822.32		
			Bot Cable Norm	3	11331.89		
			Bot Cable Tan	3	276.59		
		Top Guy Pull-Off	Max Tension	4	3406.00	0.00	0.00
			Max. Compression	2	-26580.76	0.00	0.00
			Max. Mx	14	-10398.83	43.32	0.00
			Max. My	2	-4004.78	0.00	-0.00
			Max. Vy	14	-56.96	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Torque Arm Top	Max Tension	2	22687.58	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	23	8096.39	40.78	0.00
			Max. My	2	7895.55	0.00	0.00
			Max. Vy	23	-53.63	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Torque Arm Bottom	Max Tension	1	0.00	0.00	0.00
			Max. Compression	13	-30549.05	0.00	0.00
			Max. Mx	16	-9545.28	67.40	0.00
			Max. My	2	-7769.15	0.00	-0.35
			Max. Vy	16	-53.79	0.00	0.00
			Max. Vx	2	0.28	0.00	0.00
T2	97 - 77	Leg	Max Tension	4	47.41	140.05	-79.80
			Max. Compression	2	-61439.65	-21.56	-221.86
			Max. Mx	10	-54651.59	-189.36	100.88
			Max. My	2	-60705.28	-21.55	-221.87
			Max. Vy	10	-3163.10	74.21	-36.82
			Max. Vx	2	-3774.29	-1.25	92.63
		Diagonal	Max Tension	12	9516.83	0.00	0.00
		Horizontal	Max Tension	2	1064.17	0.00	0.00
			Max. Compression	8	-7317.37	0.00	0.00
			Max. Mx	14	704.27	-19.72	0.00
			Max. My	2	1064.17	0.00	-0.00
			Max. Vy	14	25.93	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vx	2	0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	12	-3946.35	0.00	0.00
			Max. Mx	21	-3207.74	-19.72	0.00
			Max. My	2	-2971.85	0.00	-0.00
			Max. Vy	21	25.93	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-3809.93	0.00	0.00
			Max. Mx	14	-2991.77	-19.72	0.00
			Max. My	2	-2301.69	0.00	-0.00
			Max. Vy	14	25.93	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
T3	77 - 57	Leg	Max Tension	4	8119.48	87.01	-49.88
			Max. Compression	2	-88451.98	-10.70	27.57
			Max. Mx	5	-8705.76	-351.89	99.73
			Max. My	2	-60707.55	19.06	407.02
			Max. Vy	10	-3162.41	337.72	-174.48
			Max. Vx	2	-3773.22	19.06	407.02
		Diagonal	Max Tension	12	11439.55	0.00	0.00
		Horizontal	Max Tension	2	1532.03	0.00	0.00
			Max. Compression	3	-8404.20	0.00	0.00
			Max. Mx	14	894.35	-19.15	0.00
			Max. My	2	1532.03	0.00	-0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	4	-3658.08	0.00	0.00
			Max. Mx	14	-3204.35	-19.15	0.00
			Max. My	2	-2976.28	0.00	-0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-3782.50	0.00	0.00
			Max. Mx	14	-2946.44	-19.15	0.00
			Max. My	2	-2545.39	0.00	-0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
		Guy A	Bottom Tension	7	31176.25		
			Top Tension	7	31257.38		
			Top Cable Vert	7	24020.02		
			Top Cable Norm	7	20001.39		
			Top Cable Tan	7	84.05		
			Bot Cable Vert	7	-23840.81		
			Bot Cable Norm	7	20088.45		
			Bot Cable Tan	7	169.11		
		Guy B	Bottom Tension	13	35587.46		
			Top Tension	13	35668.32		
			Top Cable Vert	13	28950.36		
			Top Cable Norm	13	20834.77		
			Top Cable Tan	13	135.37		
			Bot Cable Vert	13	-28780.96		
			Bot Cable Norm	13	20930.25		
			Bot Cable Tan	13	218.79		
		Guy C	Bottom Tension	3	33266.03		
			Top Tension	3	33334.50		
			Top Cable Vert	3	25837.71		
			Top Cable Norm	3	21061.37		
			Top Cable Tan	3	143.25		
			Bot Cable Vert	3	-25686.26		
			Bot Cable Norm	3	21137.60		

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Bot Cable Tan	3	216.33		
		Top Guy Pull-Off	Max Tension	2	2376.00	0.00	0.00
			Max. Compression	8	-5074.65	0.00	0.00
			Max. Mx	14	-3180.57	-19.15	0.00
			Max. My	2	-5.69	0.00	-0.00
			Max. Vy	14	-25.18	0.00	0.00
			Max. Vx	2	0.00	0.00	0.00
T4	57 - 37	Leg	Max Tension	1	0.00	0.00	0.00
			Max. Compression	13	-67673.49	1.36	-10.48
			Max. Mx	6	-54052.70	131.85	74.59
			Max. My	2	-58750.19	4.35	-155.51
			Max. Vy	4	-2222.24	-60.74	34.89
			Max. Vx	8	-2450.03	5.68	-61.90
		Diagonal	Max Tension	8	6686.66	0.00	0.00
		Horizontal	Max Tension	13	1172.14	0.00	0.00
			Max. Compression	8	-5992.16	0.00	0.00
			Max. Mx	19	1060.80	-17.09	0.00
			Max. My	15	1090.34	0.00	-0.00
			Max. Vy	19	22.48	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-2614.03	0.00	0.00
			Max. Mx	14	-2059.19	-17.09	0.00
			Max. My	15	-1893.20	0.00	-0.00
			Max. Vy	14	-22.48	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
		Bottom Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-3159.00	0.00	0.00
			Max. Mx	19	-1544.63	-17.09	0.00
			Max. My	15	-1931.98	0.00	-0.00
			Max. Vy	19	22.48	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
T5	37 - 21	Leg	Max Tension	1	0.00	0.00	0.00
			Max. Compression	13	-67723.26	-12.50	-18.44
			Max. Mx	2	-56849.87	930.75	482.14
			Max. My	10	-55294.01	60.91	-1019.47
			Max. Vy	10	-9401.32	853.39	553.32
			Max. Vx	21	10537.32	22.57	-1010.15
		Diagonal	Max Tension	8	6507.09	0.00	0.00
		Horizontal	Max Tension	13	1173.00	0.00	0.00
			Max. Compression	8	-6004.40	0.00	0.00
			Max. Mx	14	982.22	-16.15	0.00
			Max. My	15	1093.80	0.00	-0.00
			Max. Vy	14	-21.23	0.00	0.00
			Max. Vx	15	-0.00	0.00	0.00
		Top Girt	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-3171.28	0.00	0.00
			Max. Mx	19	-1497.58	-16.15	0.00
			Max. My	15	-1948.81	0.00	-0.00
			Max. Vy	19	-21.23	0.00	0.00
			Max. Vx	15	-0.00	0.00	0.00
		Bottom Girt	Max Tension	2	3616.09	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	14	3031.67	-16.15	0.00
			Max. My	15	3393.40	0.00	-0.00
			Max. Vy	14	-21.23	0.00	0.00
			Max. Vx	15	0.00	0.00	0.00
T6	21 - 17	Leg	Max Tension	1	0.00	0.00	0.00
			Max. Compression	2	-62208.34	35.14	100.04
			Max. Mx	2	-56363.16	1047.10	-44.08
			Max. My	4	-35467.33	-28.01	148.78

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. Vy	15	13164.88	-158.41	2.02
			Max. Vx	9	725.16	-105.95	-33.72
		Top Girt	Max Tension	2	8773.88	0.00	0.00
			Max. Compression	1	0.00	0.00	0.00
			Max. Mx	14	7520.91	-26.57	0.00
			Max. My	16	7658.20	0.00	-5.83
			Max. Vy	14	-35.68	0.00	0.00
			Max. Vx	16	-7.83	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Mast	Max. Vert	15	164316.99	-19.50	1699.65
	Max. H_x	12	106312.35	2643.19	1489.32
	Max. H_z	3	143185.42	-1411.45	1796.78
	Max. M_x	1	0.00	11.54	-22.00
	Max. M_z	1	0.00	11.54	-22.00
	Max. Torsion	11	211.64	2399.36	260.76
	Min. Vert	36	80348.71	671.06	-13.15
	Min. H_x	4	105406.84	-2518.87	1438.04
	Min. H_z	8	100074.37	8.24	-3225.89
	Min. M_x	1	0.00	11.54	-22.00
	Min. M_z	1	0.00	11.54	-22.00
	Min. Torsion	4	-258.40	-2518.87	1438.04
Guy C @ 37.5 ft Elev 25 ft Azimuth 240 deg	Max. Vert	10	-1285.25	-284.19	165.65
	Max. H_x	10	-1285.25	-284.19	165.65
	Max. H_z	3	-76799.44	-37350.98	22370.34
	Min. Vert	3	-76799.44	-37350.98	22370.34
	Min. H_x	5	-76319.07	-37814.56	21070.12
	Min. H_z	9	-1746.69	-606.15	143.65
Guy B @ 39 ft Elev 17 ft Azimuth 120 deg	Max. Vert	6	-1700.96	395.10	227.88
	Max. H_x	11	-81787.65	37621.19	20885.64
	Max. H_z	13	-82069.17	37045.37	22262.76
	Min. Vert	13	-82069.17	37045.37	22262.76
	Min. H_x	6	-1700.96	395.10	227.88
	Min. H_z	7	-2231.49	745.84	201.96
Guy A @ 45 ft Elev 17 ft Azimuth 0 deg	Max. Vert	2	-1309.29	1.37	-391.73
	Max. H_x	10	-62075.40	946.61	-37322.97
	Max. H_z	2	-1309.29	1.37	-391.73
	Min. Vert	9	-71393.09	621.72	-43014.83
	Min. H_x	6	-61721.41	-885.23	-37205.93
	Min. H_z	9	-71393.09	621.72	-43014.83

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Dead Only	81113.26	-11.54	22.00	0.00	0.00	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice+1.0 Guy	161627.08	-54.05	-1795.44	0.00	0.00	182.16
1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy	143185.42	1411.45	-1796.78	0.00	0.00	239.69
1.2 Dead+1.6 Wind 60 deg - No Ice+1.0 Guy	105406.84	2518.87	-1438.04	0.00	0.00	258.40
1.2 Dead+1.6 Wind 90 deg - No Ice+1.0 Guy	136970.79	2425.22	-166.54	0.00	0.00	127.06
1.2 Dead+1.6 Wind 120 deg - No Ice+1.0 Guy	151808.77	1803.28	1264.45	0.00	0.00	46.75
1.2 Dead+1.6 Wind 150 deg - No Ice+1.0 Guy	134668.38	1024.86	2545.38	0.00	0.00	-32.09
1.2 Dead+1.6 Wind 180 deg - No Ice+1.0 Guy	100074.37	-8.24	3225.89	0.00	0.00	-133.55
1.2 Dead+1.6 Wind 210 deg - No Ice+1.0 Guy	137485.17	-999.20	2485.62	0.00	0.00	-156.27
1.2 Dead+1.6 Wind 240 deg - No Ice+1.0 Guy	156895.33	-1728.63	1159.65	0.00	0.00	-205.35
1.2 Dead+1.6 Wind 270 deg - No Ice+1.0 Guy	142043.77	-2399.36	-260.76	0.00	0.00	-211.64
1.2 Dead+1.6 Wind 300 deg - No Ice+1.0 Guy	106312.35	-2643.19	-1489.32	0.00	0.00	-94.13
1.2 Dead+1.6 Wind 330 deg - No Ice+1.0 Guy	145396.08	-1521.57	-1774.27	0.00	0.00	75.56
1.2 Dead+1.0 Ice+1.0 Temp+Guy	152909.41	55.47	16.11	0.00	0.00	1.91
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp+1.0 Guy	164316.99	19.50	-1699.65	0.00	0.00	137.86
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp+1.0 Guy	161706.14	836.89	-1449.87	0.00	0.00	149.11
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp+1.0 Guy	158412.19	1455.11	-791.06	0.00	0.00	82.46
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp+1.0 Guy	158757.85	1740.42	89.28	0.00	0.00	3.71
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp+1.0 Guy	158967.89	1597.90	961.25	0.00	0.00	-20.44
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp+1.0 Guy	157283.69	959.97	1535.79	0.00	0.00	-28.61
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp+1.0 Guy	155156.55	72.04	1723.39	0.00	0.00	-78.96
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp+1.0 Guy	157283.19	-849.87	1525.28	0.00	0.00	-128.79
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp+1.0 Guy	159789.25	-1502.23	928.83	0.00	0.00	-96.96
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp+1.0 Guy	158214.49	-1683.76	63.42	0.00	0.00	-23.28
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp+1.0 Guy	156704.71	-1389.11	-838.17	0.00	0.00	18.92
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp+1.0 Guy	161332.54	-785.80	-1481.88	0.00	0.00	73.71
Dead+Wind 0 deg - Service+Guy	81311.34	-21.55	-676.48	0.00	0.00	9.27
Dead+Wind 30 deg - Service+Guy	81729.51	308.14	-568.98	0.00	0.00	27.16
Dead+Wind 60 deg - Service+Guy	81998.22	550.09	-310.14	0.00	0.00	34.60
Dead+Wind 90 deg - Service+Guy	82019.99	646.37	34.27	0.00	0.00	33.11
Dead+Wind 120 deg - Service+Guy	81813.14	571.32	380.40	0.00	0.00	26.55

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Dead+Wind 150 deg - Service+Guy	81452.33	327.07	623.16	0.00	0.00	12.88
Dead+Wind 180 deg - Service+Guy	81026.17	-1.73	707.05	0.00	0.00	-5.53
Dead+Wind 210 deg - Service+Guy	80621.93	-333.49	613.19	0.00	0.00	-23.89
Dead+Wind 240 deg - Service+Guy	80360.77	-585.82	362.60	0.00	0.00	-31.77
Dead+Wind 270 deg - Service+Guy	80348.71	-671.06	13.15	0.00	0.00	-30.70
Dead+Wind 300 deg - Service+Guy	80549.96	-584.09	-329.13	0.00	0.00	-23.88
Dead+Wind 330 deg - Service+Guy	80888.40	-348.70	-580.40	0.00	0.00	-10.36

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	lb	lb	lb	lb	lb	lb	
1	0.00	-18642.71	0.00	-0.69	18641.79	-0.22	0.006%
2	96.78	-22119.90	-40824.14	-96.83	22119.88	40823.61	0.001%
3	20276.27	-22088.00	-35154.03	-20276.28	22087.99	35153.77	0.001%
4	34949.52	-22066.81	-20307.85	-34949.92	22066.81	20307.06	0.002%
5	40402.80	-22113.21	-97.62	-40402.14	22113.19	97.98	0.002%
6	35188.55	-22163.17	20334.10	-35188.35	22163.16	-20333.97	0.001%
7	20108.44	-22152.29	35058.58	-20107.82	22152.27	-35058.11	0.002%
8	-96.78	-22134.27	40436.32	96.02	22134.26	-40436.02	0.002%
9	-20276.27	-22166.16	35154.03	20276.00	22166.15	-35153.87	0.001%
10	-35285.38	-22187.35	20501.75	35284.83	22187.33	-20501.47	0.001%
11	-40402.80	-22140.95	97.62	40402.44	22140.94	-97.47	0.001%
12	-34852.69	-22091.00	-20140.19	34852.87	22091.00	20139.86	0.001%
13	-20108.44	-22101.87	-35058.58	20108.37	22101.86	35058.25	0.001%
14	0.00	-93297.45	0.00	-0.39	93297.44	-0.81	0.001%
15	97.55	-93291.97	-19136.97	-97.70	93291.94	19135.74	0.001%
16	9599.78	-93266.29	-16597.86	-9599.86	93266.29	16597.36	0.001%
17	16529.77	-93249.15	-9637.55	-16529.81	93249.13	9636.28	0.001%
18	19045.27	-93287.19	-98.26	-19044.54	93287.17	98.79	0.001%
19	16467.28	-93327.84	9488.82	-16467.00	93327.84	-9488.64	0.000%
20	9430.76	-93318.34	16501.63	-9429.88	93318.32	-16501.07	0.001%
21	-97.55	-93302.92	19096.67	97.40	93302.91	-19096.01	0.001%
22	-9599.78	-93328.60	16597.86	9599.36	93328.59	-16597.66	0.000%
23	-16564.67	-93345.75	9657.70	16563.59	93345.72	-9657.16	0.001%
24	-19045.27	-93307.71	98.26	19044.72	93307.70	-97.96	0.001%
25	-16432.38	-93267.05	-9468.67	16432.28	93267.05	9468.27	0.000%
26	-9430.76	-93276.56	-16501.63	9430.68	93276.54	16500.91	0.001%
27	19.75	-18641.24	-8331.46	-20.05	18641.24	8330.36	0.006%
28	4138.01	-18634.73	-7174.29	-4137.96	18634.73	7173.48	0.004%
29	7132.56	-18630.41	-4144.46	-7132.10	18630.40	4144.04	0.003%
30	8245.47	-18639.88	-19.92	-8244.81	18639.87	20.01	0.003%
31	7181.34	-18650.07	4149.82	-7180.66	18650.07	-4149.33	0.004%
32	4103.76	-18647.85	7154.81	-4103.31	18647.85	-7154.13	0.004%
33	-19.75	-18644.18	8252.31	19.79	18644.17	-8251.59	0.004%
34	-4138.01	-18650.68	7174.29	4137.57	18650.68	-7173.77	0.003%
35	-7201.10	-18655.01	4184.03	7200.29	18655.01	-4183.79	0.004%
36	-8245.47	-18645.54	19.92	8244.53	18645.54	-20.16	0.005%
37	-7112.79	-18635.35	-4110.24	7111.87	18635.34	4109.51	0.006%
38	-4103.76	-18637.56	-7154.81	4103.15	18637.56	7153.83	0.006%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	7	0.00000001	0.00008607
2	Yes	12	0.00000001	0.00004148
3	Yes	12	0.00000001	0.00002683
4	Yes	10	0.00000001	0.00007268
5	Yes	11	0.00000001	0.00006838
6	Yes	12	0.00000001	0.00002089
7	Yes	11	0.00000001	0.00007250
8	Yes	9	0.00000001	0.00008600
9	Yes	12	0.00000001	0.00003259
10	Yes	12	0.00000001	0.00005150
11	Yes	12	0.00000001	0.00003625
12	Yes	12	0.00000001	0.00003587
13	Yes	12	0.00000001	0.00003017
14	Yes	7	0.00000001	0.00004013
15	Yes	10	0.00000001	0.00008881
16	Yes	10	0.00000001	0.00004266
17	Yes	8	0.00000001	0.00006936
18	Yes	9	0.00000001	0.00007620
19	Yes	10	0.00000001	0.00003368
20	Yes	9	0.00000001	0.00009159
21	Yes	8	0.00000001	0.00005458
22	Yes	10	0.00000001	0.00004903
23	Yes	10	0.00000001	0.00009872
24	Yes	10	0.00000001	0.00006183
25	Yes	9	0.00000001	0.00003445
26	Yes	10	0.00000001	0.00005923
27	Yes	6	0.00000001	0.00006794
28	Yes	6	0.00000001	0.00004926
29	Yes	6	0.00000001	0.00003548
30	Yes	6	0.00000001	0.00003900
31	Yes	6	0.00000001	0.00005023
32	Yes	6	0.00000001	0.00004994
33	Yes	6	0.00000001	0.00004678
34	Yes	6	0.00000001	0.00004472
35	Yes	6	0.00000001	0.00005144
36	Yes	6	0.00000001	0.00005284
37	Yes	6	0.00000001	0.00006169
38	Yes	6	0.00000001	0.00006616

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	117 - 97	1.329	37	0.0706	0.0484
T2	97 - 77	1.072	37	0.0675	0.0322
T3	77 - 57	0.750	37	0.0700	0.0258
T4	57 - 37	0.521	37	0.0461	0.0233
T5	37 - 21	0.310	37	0.0625	0.0220
T6	21 - 17	0.067	37	0.0777	0.0203

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	Albion - 16' Omni w/ Pipe Mount	37	1.329	0.0706	0.0484	138896
121.00	Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	37	1.329	0.0706	0.0484	138896
120.00	W.Monroe - 7.5' Omni	37	1.329	0.0706	0.0484	138896
119.00	VHLP2-180	37	1.329	0.0706	0.0484	138896
117.00	W.Monroe - 12' Omni	37	1.329	0.0706	0.0484	138896
115.00	10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	37	1.306	0.0700	0.0463	138896
114.50	10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	37	1.300	0.0699	0.0458	138896
114.00	ALP 9212	37	1.294	0.0697	0.0453	138896
110.00	VHLP1-23-1GR (12")	37	1.246	0.0687	0.0412	99211
109.03	Guy	37	1.234	0.0685	0.0402	87173
106.00	RFS Unit	37	1.196	0.0679	0.0373	63134
102.00	BXA-80063/4CF w/Mount Pipe	37	1.144	0.0674	0.0347	46299
68.98	Guy	37	0.647	0.0600	0.0239	36391
32.00	GPS	37	0.241	0.0678	0.0215	40107
27.00	GPS Antenna	37	0.165	0.0724	0.0209	60752

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	117 - 97	13.335	2	0.6977	0.3588
T2	97 - 77	10.481	2	0.6951	0.2623
T3	77 - 57	7.488	10	0.6809	0.2035
T4	57 - 37	5.096	10	0.5336	0.1752
T5	37 - 21	2.799	10	0.6098	0.1642
T6	21 - 17	0.585	10	0.6870	0.1514

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
124.00	Albion - 16' Omni w/ Pipe Mount	2	13.335	0.6977	0.3588	31577
121.00	Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles	2	13.335	0.6977	0.3588	31577
120.00	W.Monroe - 7.5' Omni	2	13.335	0.6977	0.3588	31577
119.00	VHLP2-180	2	13.335	0.6977	0.3588	31577
117.00	W.Monroe - 12' Omni	2	13.335	0.6977	0.3588	31577
115.00	10' Boom Gate w/3 - 2 3/8" Pipe	2	13.059	0.6964	0.3485	31577

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
114.50	(Tapered) (3) 10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	2	12.989	0.6961	0.3459	31577
114.00	ALP 9212	2	12.920	0.6958	0.3433	31577
110.00	VHLP1-23-1GR (12")	2	12.363	0.6936	0.3229	22555
109.03	Guy	2	12.228	0.6932	0.3180	19818
106.00	RFS Unit	2	11.799	0.6923	0.3031	14353
102.00	BXA-80063/4CF w/Mount Pipe	2	11.223	0.6924	0.2841	10526
68.98	Guy	10	6.470	0.6193	0.1902	7218
32.00	GPS	10	2.142	0.6365	0.1604	8131
27.00	GPS Antenna	10	1.448	0.6598	0.1564	12277

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	117	Torque Arm Top@109.033	A325N	0.7500	2	11343.80	15795.00	0.718 ✔	1	Member Bearing
		Torque Arm Bottom@109.033	A325N	0.7500	2	15274.50	17892.40	0.854 ✔	1	Bolt Shear

Guy Design Data

Section No.	Elevation ft	Size	Initial Tension lb	Breaking Load lb	Actual T_u lb	Allowable ϕT_n lb	Required S.F.	Actual S.F.
T1	109.03 (A) (265)	7/8 EHS	7970.00	79699.84	26903.20	47820.00	1.000	1.777 ✔
	109.03 (A) (266)	7/8 EHS	7970.00	79699.84	26377.60	47820.00	1.000	1.813 ✔
	109.03 (B) (259)	7/8 EHS	7970.00	79699.84	29236.30	47820.00	1.000	1.636 ✔
	109.03 (B) (260)	7/8 EHS	7970.00	79699.84	29485.30	47820.00	1.000	1.622 ✔
	109.03 (C) (253)	7/8 EHS	7970.00	79699.84	27766.30	47820.00	1.000	1.722 ✔
	109.03 (C) (254)	7/8 EHS	7970.00	79699.84	28330.90	47820.00	1.000	1.688 ✔
T3	68.98 (A) (273)	7/8 EHS	7970.00	79699.84	31257.40	47820.00	1.000	1.530 ✔
	68.98 (B) (272)	7/8 EHS	7970.00	79699.84	35668.30	47820.00	1.000	1.341 ✔
	68.98 (C) (271)	7/8 EHS	7970.00	79699.84	33334.50	47820.00	1.000	1.435 ✔

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	Mast Stability Index	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	2" solid	20.00	3.98	95.6 K=1.00	3.1416	1.00	-56703.10	72468.20	0.782 [1] ✔
T2	97 - 77	2" solid	20.00	3.97	95.2 K=1.00	3.1416	1.00	-61439.60	72873.70	0.843 [1] ✔
T3	77 - 57	2 1/4" solid	20.00	3.97	84.6 K=1.00	3.9761	1.00	-88452.00	105993.00	0.835 [1] ✔
T4	57 - 37	2" solid	20.00	3.97	95.2 K=1.00	3.1416	1.00	-67673.50	72873.70	0.929 [1] ✔
T5	37 - 21	2" solid	16.00	3.96	95.0 K=1.00	3.1416	1.00	-67723.30	73076.70	0.927 [1] ✔
T6	21 - 17	2" solid	4.37	4.28	102.7 K=1.00	3.1416	1.00	-62208.30	65416.60	0.951 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-14672.60	15470.70	0.948 [1] ✔
T2	97 - 77	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-7317.37	15470.70	0.473 [1] ✔
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-8404.20	15561.20	0.540 [1] ✔
T4	57 - 37	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-5992.16	10336.40	0.580 [1] ✔
T5	37 - 21	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-6004.40	10336.40	0.581 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-4793.26	15470.70	0.310 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T2	97 - 77	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-3946.35	15470.70	0.255 [1] ✔
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-3658.08	15561.20	0.235 [1] ✔
T4	57 - 37	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-2614.03	10336.40	0.253 [1] ✔
T5	37 - 21	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-3171.28	10336.40	0.307 [1] ✔

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-3614.89	15470.70	0.234 [1] ✔
T2	97 - 77	L2x2x3/16	3.04	2.88	87.6 K=1.00	0.7150	-3809.93	15470.70	0.246 [1] ✔
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-3782.50	15561.20	0.243 [1] ✔
T4	57 - 37	L2x2x1/8	3.04	2.88	86.8 K=1.00	0.4844	-3159.00	10336.40	0.306 [1] ✔

[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	3x1 1/2	3.04	2.88	79.7 K=1.00	4.5000	-26580.80	104373.00	0.255 [1]
T3	77 - 57	L2x2x3/16	3.04	2.85	86.9 K=1.00	0.7150	-5074.65	15561.20	0.326 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	117 - 97	3x1 1/2	0.00	9112.50	0.000	0.00	4556.25	0.000
T3	77 - 57	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	117 - 97	3x1 1/2	0.255	0.000	0.000	0.255 [1] ✔	1.000	4.9-3 ✔
T3	77 - 57	L2x2x3/16	0.326	0.000	0.000	0.326 [1] ✔	1.000	4.9-3 ✔

[1] P_u / ϕP_n controls

Torque-Arm Bottom Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97 (257)	C6x8.2	5.01	4.87	108.9 K=1.00	2.4000	-27955.50	45353.70	0.616 [1] ✔
T1	117 - 97 (258)	C6x8.2	5.01	4.87	108.9 K=1.00	2.4000	-27952.20	45353.70	0.616 [1] ✔
T1	117 - 97 (263)	C6x8.2	5.01	4.87	108.9 K=1.00	2.4000	-30549.10	45353.70	0.674 [1] ✔
T1	117 - 97 (264)	C6x8.2	5.01	4.87	108.9 K=1.00	2.4000	-28960.60	45353.70	0.639 [1] ✔
T1	117 - 97 (269)	C6x8.2	5.01	4.87	108.9 K=1.00	2.4000	-29283.60	45353.70	0.646 [1] ✔
T1	117 - 97 (270)	C6x8.2	5.01	4.87	108.9 K=1.00	2.4000	-27690.50	45353.70	0.611 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	2" solid	20.00	3.98	95.6	3.1416	846.55	141372.00	0.006 [1] ✔
T2	97 - 77	2" solid	20.00	3.97	95.2	3.1416	47.41	141372.00	0.000 [1] ✔
T3	77 - 57	2 1/4" solid	20.00	3.97	84.6	3.9761	8119.48	178924.00	0.045 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	7/8" solid	5.01	4.74	259.9	0.6013	14765.90	19482.80	0.758 [1] ✔
T2	97 - 77	7/8" solid	5.00	4.72	259.2	0.6013	9516.83	19482.80	0.488 [1] ✔
T3	77 - 57	7/8" solid	5.00	4.69	257.3	0.6013	11439.60	19482.80	0.587 [1] ✔
T4	57 - 37	7/8" solid	5.00	4.72	259.2	0.6013	6686.66	19482.80	0.343 [1] ✔
T5	37 - 21	7/8" solid	4.99	4.72	258.9	0.6013	6507.09	19482.80	0.334 [1] ✔

[1] P_u / ϕP_n controls

Guy Lower Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L3x3x3/16	5.01	4.74	60.5	1.0900	18281.70	35316.00	0.518 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	L2x2x3/16	3.04	2.88	55.9	0.7150	982.13	23166.00	0.042 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T2	97 - 77	L2x2x3/16	3.04	2.88	55.9	0.7150	1064.17	23166.00	0.046 [1]
T3	77 - 57	L2x2x3/16	3.04	2.85	55.5	0.7150	1532.03	23166.00	0.066 [1]
T4	57 - 37	L2x2x1/8	3.04	2.88	55.1	0.4844	1172.14	15693.80	0.075 [1]
T5	37 - 21	L2x2x1/8	3.04	2.88	55.1	0.4844	1173.00	15693.80	0.075 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T6	21 - 17	L3x3x3/8	2.98	2.81	37.0	2.1100	8773.88	68364.00	0.128 [1]

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T5	37 - 21	L2x2x1/8	3.04	2.88	55.1	0.4844	3616.09	15693.80	0.230 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97	3x1 1/2	3.04	2.88	79.7	4.5000	3406.00	145800.00	0.023 [1]
T3	77 - 57	L2x2x3/16	3.04	2.85	55.5	0.7150	2376.00	23166.00	0.103 [1]

[1] P_u / ϕP_n controls

Top Guy Pull-Off Bending Design Data

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
T1	117 - 97	3x1 1/2	0.00	9112.50	0.000	0.00	4556.25	0.000
T3	77 - 57	L2x2x3/16	0.00	1301.02	0.000	0.00	664.35	0.000

Top Guy Pull-Off Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	117 - 97	3x1 1/2	0.023	0.000	0.000	0.023 [1] ✔	1.000	4.9-4 ✔
T3	77 - 57	L2x2x3/16	0.103	0.000	0.000	0.103 [1] ✔	1.000	4.9-4 ✔

[1] $P_u / \phi P_n$ controls

Torque-Arm Top Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	117 - 97 (255)	C6x8.2	3.04	2.96	66.1	2.4000	20771.10	108000.00	0.192 [1] ✔
T1	117 - 97 (256)	C6x8.2	3.04	2.96	66.1	2.4000	20898.70	108000.00	0.194 [1] ✔
T1	117 - 97 (261)	C6x8.2	3.04	2.96	66.1	2.4000	22687.60	108000.00	0.210 [1] ✔
T1	117 - 97 (262)	C6x8.2	3.04	2.96	66.1	2.4000	21033.80	108000.00	0.195 [1] ✔
T1	117 - 97 (267)	C6x8.2	3.04	2.96	66.1	2.4000	22244.50	108000.00	0.206 [1] ✔
T1	117 - 97 (268)	C6x8.2	3.04	2.96	66.1	2.4000	20717.50	108000.00	0.192 [1] ✔

[1] $P_u / \phi P_n$ controls

Section Capacity Table

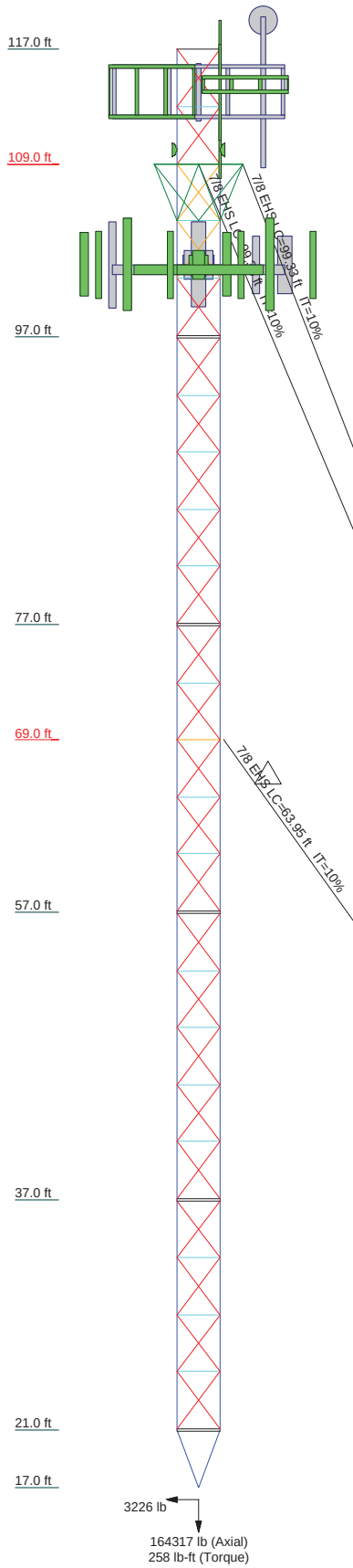
Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	117 - 97	Leg	2" solid	2	-56703.10	72468.20	78.2	Pass

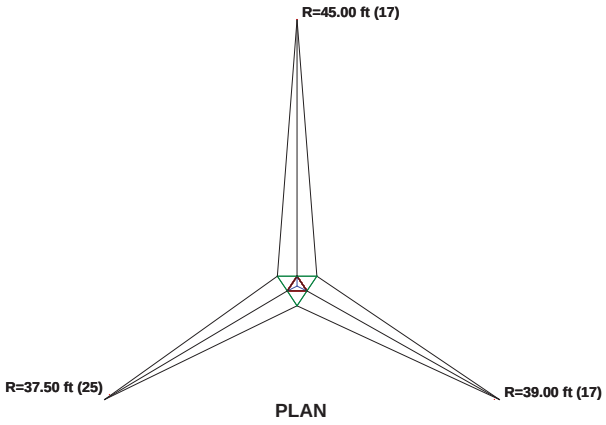
Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
		Diagonal	7/8" solid	40	14765.90	19482.80	75.8	Pass
		Guy Lower Diagonal@109.033	L3x3x3/16	28	18281.70	35316.00	51.8	Pass
		Horizontal	L2x2x3/16	27	-14672.60	15470.70	94.8	Pass
		Top Girt	L2x2x3/16	4	-4793.26	15470.70	31.0	Pass
		Bottom Girt	L2x2x3/16	7	-3614.89	15470.70	23.4	Pass
		Guy A@109.033	7/8	265	26903.20	47820.00	56.3	Pass
		Guy B@109.033	7/8	260	29485.30	47820.00	61.7	Pass
		Guy C@109.033	7/8	254	28330.90	47820.00	59.2	Pass
		Top Guy Pull-Off@109.033	3x1 1/2	34	-26580.80	104373.00	25.5	Pass
		Torque Arm Top@109.033	C6x8.2	261	22687.60	108000.00	21.0 71.8 (b)	Pass
		Torque Arm Bottom@109.033	C6x8.2	263	-30549.10	45353.70	67.4 85.4 (b)	Pass
T2	97 - 77	Leg	2" solid	54	-61439.60	72873.70	84.3	Pass
		Diagonal	7/8" solid	63	9516.83	19482.80	48.8	Pass
		Horizontal	L2x2x3/16	94	-7317.37	15470.70	47.3	Pass
		Top Girt	L2x2x3/16	57	-3946.35	15470.70	25.5	Pass
		Bottom Girt	L2x2x3/16	60	-3809.93	15470.70	24.6	Pass
T3	77 - 57	Leg	2 1/4" solid	105	-88452.00	105993.00	83.5	Pass
		Diagonal	7/8" solid	141	11439.60	19482.80	58.7	Pass
		Horizontal	L2x2x3/16	145	-8404.20	15561.20	54.0	Pass
		Top Girt	L2x2x3/16	108	-3658.08	15561.20	23.5	Pass
		Bottom Girt	L2x2x3/16	109	-3782.50	15561.20	24.3	Pass
		Guy A@68.9833	7/8	273	31257.40	47820.00	65.4	Pass
		Guy B@68.9833	7/8	272	35668.30	47820.00	74.6	Pass
		Guy C@68.9833	7/8	271	33334.50	47820.00	69.7	Pass
		Top Guy Pull-Off@68.9833	L2x2x3/16	136	-5074.65	15561.20	32.6	Pass
T4	57 - 37	Leg	2" solid	155	-67673.50	72873.70	92.9	Pass
		Diagonal	7/8" solid	204	6686.66	19482.80	34.3	Pass
		Horizontal	L2x2x1/8	169	-5992.16	10336.40	58.0	Pass
		Top Girt	L2x2x1/8	159	-2614.03	10336.40	25.3	Pass
		Bottom Girt	L2x2x1/8	160	-3159.00	10336.40	30.6	Pass
T5	37 - 21	Leg	2" solid	206	-67723.30	73076.70	92.7	Pass
		Diagonal	7/8" solid	217	6507.09	19482.80	33.4	Pass
		Horizontal	L2x2x1/8	220	-6004.40	10336.40	58.1	Pass
		Top Girt	L2x2x1/8	208	-3171.28	10336.40	30.7	Pass
		Bottom Girt	L2x2x1/8	211	3616.09	15693.80	23.0	Pass
T6	21 - 17	Leg	2" solid	248	-62208.30	65416.60	95.1	Pass
		Top Girt	L3x3x3/8	250	8773.88	68364.00	12.8	Pass
							Summary	
							Leg (T6) 95.1	Pass
							Diagonal (T1) 75.8	Pass
							Guy Lower Diagonal (T1) 51.8	Pass
							Horizontal (T1) 94.8	Pass
							Top Girt (T1) 31.0	Pass
							Bottom Girt (T4) 30.6	Pass
							Guy A (T3) 65.4	Pass
							Guy B (T3) 74.6	Pass
							Guy C (T3) 69.7	Pass
							Top Guy Pull-Off (T3) 32.6	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
						Torque Arm Top (T1)	71.8	Pass
						Torque Arm Bottom (T1)	85.4	Pass
						Bolt Checks	85.4	Pass
						RATING =	**95.1**	**Pass**

RETROFIT TOWER PROFILE

Section	T1	T2	T3	T4	T5	T6
Legs	SR 2" solid	SR 2" solid	SR 2 1/4" solid	SR 2" solid	SR 2" solid	
Leg Grade			A572-50			
Diagonals			SR 7/8" solid			N.A.
Diagonal Grade			A36			N.A.
Top Girts		L2x2x3/16		L2x2x1/8	N.A.	L3x3x3/8
Bottom Girts		L2x2x3/16		L2x2x1/8	N.A.	N.A.
Horizontals		L2x2x3/16		L2x2x1/8	N.A.	N.A.
Top Guy Pull-Offs	3x1 1/2	N.A.	L2x2x3/16	N.A.		
Guy Low-Diagonals	L3x3x3/16		N.A.			
Face Width (ft)	3.042					
# Panels @ (ft)	5 @ 3.98333		15 @ 3.96667		4 @ 3.95833	A
Weight (lb)	2033.4	1297.8	1502.2	1246.2	1000.2	245.1





PLAN

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Albion - 16' Omni w/ Pipe Mount (E)	124	4'x4" Pipe Mount (P)	110
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles (E)	124	VHLP1-23-1GR (12") (P)	110
		VHLP1-23-1GR (12") (P)	110
Coe Hill - Quad Dipole, 1/2" Bar 34" Dipoles (E)	121	RFS Unit	106
W.Monroe - 7.5' Omni (E)	120	PiROD 12' Lightweight T-Frame (E)	102
Cobleskill - 4' Omni with Mounts (E)	119	PiROD 12' Lightweight T-Frame (E)	102
VHLP2-180 (Ericson)	119	PiROD 12' Lightweight T-Frame (E)	102
4'x4" Pipe Mount (P)	117	BXA-70063/6CF w/Mount Pipe (E)	102
W.Monroe - 12' Omni (E)	117	BXA-171063/12CF w/Mount Pipe	102
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3) (E)	115 - 114	SACP 2x5516 w/Mount Pipe	102
		SACP 2x5516 w/Mount Pipe	102
LLPX310R w/ mounting pipe (P)	114	SLCP 2x6015 w/Mount Pipe (E)	102
LLPX310R w/ mounting pipe (P)	114	SLCP 2x6015 w/Mount Pipe (E)	102
LLPX310R w/ mounting pipe (P)	114	(2) GPS Antenna (E)	102
ALP 9212 (E)	114	RRH2x40-07-U	102
4'x4" Pipe Mount (P)	114	RRH2x40-07-U	102
6'8"x4" Pipe Mount (P)	114	RRH2x40-07-U	102
ALP 9212 (E)	114	RRH2x40-AWS	102
Remote RU (P)	114	RRH2x40-AWS	102
Remote RU (P)	114	RRH2x40-AWS	102
Remote RU (P)	114	(2) 1-1/2" Pipe (E-GPS)	102
ALP 9212	114	BXA-80063/4CF w/Mount Pipe (E)	102
ALP 9212	114	SLCP 2x6014 w/Mount Pipe (E)	102
ALP 9212	114	SLCP 2x6014 w/Mount Pipe (E)	102
ALP 9212	114	BXA-171063/8BF w/Mount Pipe (E)	102
ALP 9212	114	SACP 2x5516 w/Mount Pipe (E)	102
ALP 9212	114	SACP 2x5516 w/Mount Pipe (E)	102
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	114	GPS (P)	32
		1-1/2" Pipe (E-GPS)	27
10' Boom Gate w/3 - 2 3/8" Pipe (Tapered) (3)	114	GPS Antenna (E)	27
		1-1/2" Pipe (E-GPS)	27
10'6"x4" Pipe Mount	114	1-1/2" Pipe (E-GPS)	27
ALP 9212 (E)	114	GPS Antenna (E)	27
		GPS Antenna (E)	27

SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	1 @ 3.91667		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 105 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. Weld together tower sections have flange connections.
9. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
10. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
11. Welds are fabricated with ER-70S-6 electrodes.
12. Tower is roof top mounted and located approx 25' above mean grade level.
13. TOWER RATING: 95.1%

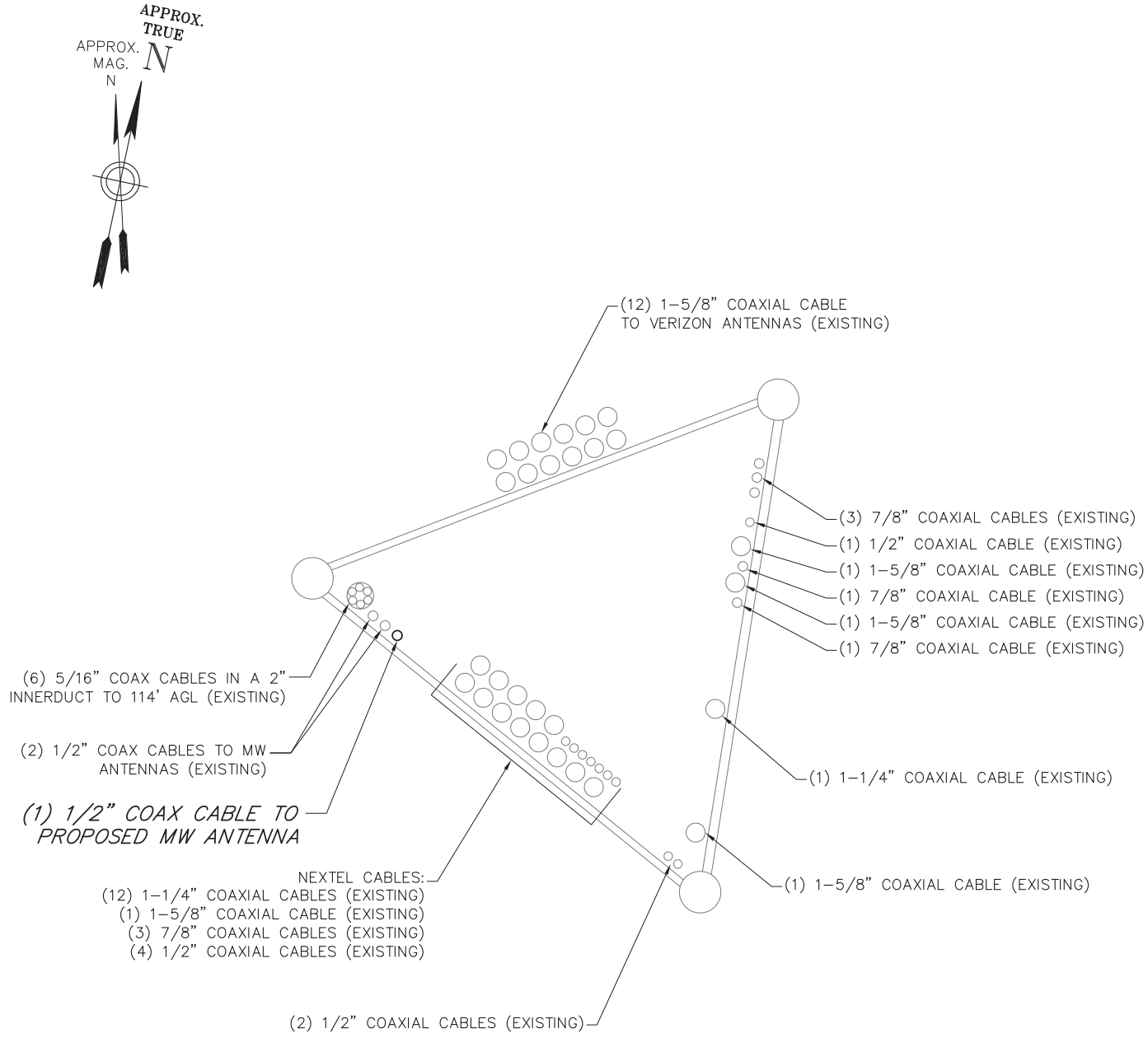
ALL F

82069 lb

CHA Consulting, Inc.
III Winners Circle
Albany, NY 12205
CHA, Inc.
Phone: (518) 453-4500
FAX:

Job: ***30119-1003-28040***			
Project: ***CT-HFD0063***			
Client: Clearwire	Drawn by: Bryan Jones	App'd:	
Code: TIA-222-G	Date: 03/14/16	Scale: NTS	
Path: V:\Projects\ANY\K4\30119\Tech\Modeling\[Retrofit Model - 2016-03r1.mod (rev 2016-03) - retrofit w proposed mw option #2eri		Dwg No. E-1	

RETROFIT CABLE LAYOUT



CABLE LAYOUT DIAGRAM

NOTE:
CONTRACTOR TO VERIFY THAT THE EXISTING COAXIAL CABLE CONFIGURATION SHOWN IS ACCURATE AND NOTIFY ENGINEER IMMEDIATELY IF CABLES ARE INSTALLED DIFFERENTLY PRIOR TO THE START OF CONSTRUCTION.

CHA
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clearwire TECHNOLOGIES, INC.
5808 LAKE WASHINGTON BLVD. NE STE. 300
KIRKLAND, WA 98033
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ISHAM ROAD TOWER
WEST HARTFORD, CT

CHA PROJ. NO. – 30119-1002

RETROFIT SUPPLEMENTAL CALCULATIONS

CHA REVISED 3/14/16 WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY:	B. JONES
CHECKED BY:	MS 8-11-15
PROJECT NAME:	CT-HFD0063 RETROFIT
PROJECT LOCATION:	

PROJECT	PHASE	ORG
30119	1002	

SHEET #: 1 OF

DATE: 7/30/15

SUBJECT: GUY ANCHOR A

GUY ANCHOR "A" CHECK

@ 45 FT / ELEV = 17 FT / AZIMUTH = 0° (PER MODEL)

RETROFIT MAX VERTICAL REACTION LOADS

DEAD LOAD: DL = 19.315 k

FACTORED DEAD LOAD: 1.2DL = (1.2)(19.315 k) = 23.178 k

TOTAL CONTROLLING COMBINATION LOAD:

1.2 DL + 1.6WL + 1.0 GUY = 71.393 k

23.178 k + 1.6 WL + 0 = 71.393 k [ASSUME 1.0GUY IS NEGLIGIBLE]

⇒ WIND LOAD: WL = 30.134 k

TOTAL UNFACTORED LOAD:

DL + WL = 19.315 k + 30.134 k = 49.449 k

TOTAL RETROFIT VERTICAL UNFACTORED LOADS		ALLOWABLE VERTICAL UNFACTORED LOADS (PER ORIGINAL DRAWINGS)
49.449 k	>	40.3 k (N.G.) *✓

*SINCE TOTAL RETROFIT VERTICAL UNFACTORED LOADS ARE GREATER THAN THE ALLOWABLE VERTICAL UNFACTORED LOADS SHOWN ON ORIGINAL DRAWINGS, ANCHOR MUST BE ANALYZED TO DETERMINE TRUE CAPACITY OF ANCHOR CONNECTION. SEE ATTACHED CAPACITY CALCULATIONS IN LATER PAGES.

CHA REVISED 3/14/16 WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY: B. Jones
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PROJECT NAME: CT-HFD0063
PROJECT LOCATION:

PROJECT: 30119 PHASE: 1002 ORG:
SHEET #: 2 OF
DATE: 7/30/15
SUBJECT: Guy Anchor A

(Guy Anchor "A" cont)

Retrofit Max Horizontal Reaction Loads

Dead Load: $DL = \sqrt{(11.291\text{ k})^2 + (0.002\text{ k})^2} = 11.291\text{ k}$

Factored Dead: $1.2\,DL = 1.2\,(11.291\text{ k}) = 13.549\text{ k}$

Total Controlling Combination Load:

$1.2DL + 1.6WL + 1.0\,Guy = \sqrt{(43.015\text{ k})^2 + (0.622\text{ k})^2}$

$13.549\text{ k} + 1.6WL + 0 = 43.019\text{ k}$

$\Rightarrow$ Wind Load: $WL = 18.418\text{ k}$

Total Unfactored Load:

$DL + WL = 11.291\text{ k} + 18.418\text{ k} = 29.709\text{ k}$

Total Retrofit Horizontal Unfactored Loads		Allowable Horizontal Unfactored Loads (Per Original Drawings)
29.709 k	>	28.1 k (N.G.)

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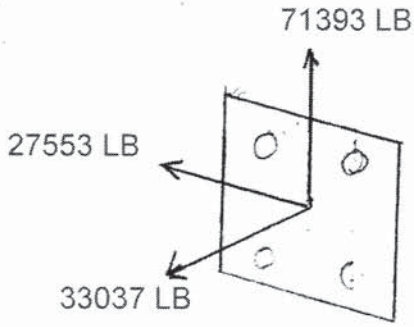
PROJECT LOCATION:

PROJECT: 30119 PHASE: ORG:
SHEET #: 3 OF:
DATE:
SUBJECT: GUY ANCHOR A

CAPACITY CHECK OF GUY ANCHOR CONNECTION "A"

SEE ATTACHED DIAGRAM FOR TRANSLATED LOADS

VERTICAL SHEAR = 71393 LB
HORIZONTAL SHEAR = 27070 LB + 483 LB = 27553 LB
TENSION = 33428 LB - 391 LB = 33037 LB



DESIGN BEARING STENGTH OF PLATE

$$\phi_v R_n = 0.75(2.4\, d\, t\, F_u) = 0.75(2.4)(1.125\ in)(1.5\ in)(58\ ksi) \Rightarrow \phi_v R_n = 176.175\ k \quad \text{(PER ROD)}$$

DESIGN SHEAR STRENGTH

$$A_b = \frac{\pi(1.125\ in)^2}{4} = 0.994\ in^2$$

$$\phi_v R_n = 0.75(F_{nv} A_b) = 0.75(32\ ksi)(0.994\ in^2) \Rightarrow \phi_v R_n = 23.856\ k \quad \text{(PER ROD)}$$

VERTICAL SHEAR/BEARING LOAD (PER ROD), $V_{u\,VERT} = \frac{71.393\ k}{4} = 17.848\ k$

$V_{u\,VERT} = 17.848\ k < 176.175\ K = \phi_v R_n$ [BEARING] (OK) ✓

REVISED 3/14/16

WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY: B. JONES

CHECKED BY: 08-13-15

PROJECT NAME:

PROJECT LOCATION:

PROJECT: 30119 PHASE: ORG:

SHEET #: 4 OF

DATE:

SUBJECT: GUY ANCHOR A

$V_{u\,VERT} = 17.848\text{ k} < 23.856\text{ k} = \phi_v R_n$ [SHEAR] (OK) ✓

HORIZONTAL SHEAR/BEARING LOAD (PER ROD), $V_{u\,HORIZ}$

$$V_{u\,HORIZ} = \frac{27.553\text{ k}}{4} = 6.888\text{ k}$$

$V_{u\,HORIZ} = 6.888\text{ k} < 176.175\text{ k} = \phi_v R_n$ [BEARING] (OK) ✓

$V_{u\,HORIZ} = 6.888\text{ k} < 23.856\text{ k} = \phi_v R_n$ [SHEAR] (OK) ✓

COMBINED HORIZONTAL AND VERTICAL (RESULTANT) SHEAR/BEARING LOAD (PER ROD), $V_{u\,COM}$

$$V_{u\,COM} = \frac{\left(\sqrt{(71.393\text{ k})^2 + (27.553\text{ k})^2}\right)}{4} = \frac{76.525\text{ k}}{4} = 19.131\text{ k}$$

$V_{u\,COM} = 19.131\text{ k} < 176.175\text{ k} = \phi_v R_n$ [BEARING] (OK) ✓

$V_{u\,COM} = 19.131\text{ k} < 23.856\text{ k} = \phi_v R_n$ [SHEAR] (OK) ✓

AVAILABLE TENSILE STRENGTH

$$F_{nt}' = 1.3F_{nt} - \frac{F_{nt}}{\phi F_{nv}} f_v \leq F_{nt}$$ [AISC EQN J3-3a]

$$f_v = \frac{V_{u\,rod}}{A_b} = \frac{19.131\text{ k}}{0.994\text{ in}^2} = 19.246\text{ ksi}$$

AISI 314 Threaded Rod, $F_u = 80$ ksi

Nominal Tensile Stress, $F_{nt} = 0.75(Fu) = 0.75(80\text{ ksi}) = 60$ ksi

Nominal Shear Stress, $F_{nv} = 0.40(Fu) = 0.40(80\text{ ksi}) = 32$ ksi

REVISED 3/14/16

CHA

WCM 3-14-16 **CHA COMPUTATION PAD**

		PROJECT	PHASE	ORG
COMPLETED BY:	B. Jones	30119		
CHECKED BY:	~~MS~~ 08-13-15	SHEET #: 5	OF	
PROJECT NAME:		DATE:		
PROJECT LOCATION:		SUBJECT:	Guy Anchor A	

$$F_{nt}' = 1.3(60\text{ ksi}) - \frac{(60\text{ ksi})}{(0.75)(32\text{ ksi})}(19.246\text{ ksi}) \leq F_{nt}$$

$$F_{nt}' = 29.885\text{ ksi} \leq 60\text{ ksi}$$

Design Tensile Strength

$$\phi R_{n_{TENS}} = 0.75(F_{nt}' A_b) = 0.75(29.885\text{ ksi})(0.994\text{ in}^2)$$

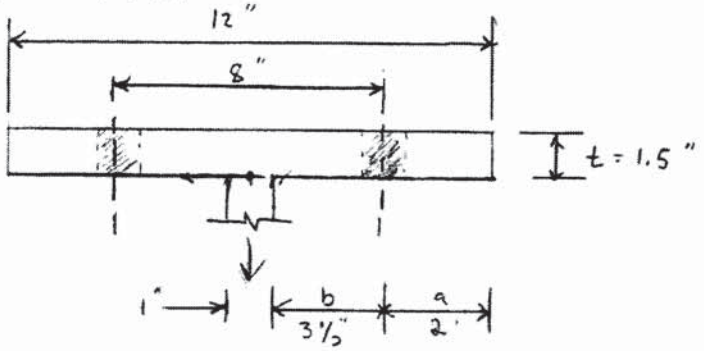
$$\Rightarrow \phi R_{n_{TENS}} = 22.279\text{ k}$$

Tensile Load (Per Rod)

$$T_u = \frac{33.037\text{ k}}{4} = 8.259\text{ k}$$

$T_u = 8.259\text{ k} < 22.279\text{ k} = \phi R_{n_{TENS}}$ [TENSILE] (OK) ✓

Check Prying Action



$1.25b = 1.25(3.5\text{ in}) = 4.375\text{ in} > 2" = a$ ∴ use $a = 2"$

$$b' = b - \frac{d}{2} = 3.5\text{ in} - \frac{1.125\text{ in}}{2} = 2.938\text{ in}$$

REVISED 3/14/16

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WCM 3-14-16

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CHECKED BY: JLS 08-13-15
PROJECT NAME:
PROJECT LOCATION:

PROJECT: 30119 | PHASE: | ORG:
SHEET #: 6 OF
DATE:
SUBJECT: Guy Anchor A

$a' = a + \frac{d}{2} = 2_{IN} + \frac{1.125_{IN}}{2} = 2.562_{IN}$

$d' = d + \frac{1}{8} = 1.125_{IN} + 0.125_{IN} = 1.25_{IN}$

TRIBUTARY LENGTH OF PLATE PER ROD, $p = \frac{12_{IN}}{2} = 6_{IN}$

$\delta = 1 - \frac{d'}{p} = 1 - \frac{1.250_{IN}}{6_{IN}} = 0.792$

$B = \phi R_{n_{TENS}} = 22.279\ k$ [DESIGN TENSILE STRENGTH PER ROD]

$\frac{B}{T_u} - 1 = \frac{22.279\ k}{8.259\ k} - 1 = 1.698$

$\alpha = \frac{\left(\frac{B}{T_u} - 1\right)\left(\frac{a'}{b'}\right)}{\delta\left[1 - \left(\frac{B}{T} - 1\right)\left(\frac{a'}{b'}\right)\right]} = \frac{(1.698)\left(\frac{2.562_{IN}}{2.938_{IN}}\right)}{0.792\left[1 - (1.698)\left(\frac{2.562_{IN}}{2.938_{IN}}\right)\right]} = \frac{1.481}{-0.381}$

$\Rightarrow \alpha = -3.887$

Since $|\alpha| = 3.215 > 1.0$ USE $\alpha = 1.0$

THICKNESS OF PLATE, t_{req}

$t_{req} = \sqrt{\frac{4.44\,T\,b'}{p\,F_u\,(1+\delta\alpha)}} = \sqrt{\frac{4.44\,(8.259\ k)\,(2.938_{IN})}{6_{IN}\,(58\ k_{SI})\,(1+(0.792)(1.0))}} = \sqrt{\frac{107.736}{623.616}}$

$\Rightarrow$ $t_{req} = 0.416\ in < 1.5_{IN} = t$ (OK) [PLATE ADEQUATE]

$\alpha = \frac{1}{\delta}\left[\frac{4.44\,T\,b'}{p\,t^2\,F_u} - 1\right] = \frac{1}{0.792}\left[\frac{4.44\,(8.259\ k)\,(2.938_{IN})}{6_{IN}\,(1.5_{IN})^2\,(58\ ksi)} - 1\right]$

$\alpha = \frac{1}{0.792}\left[\frac{107.736}{783.000} - 1\right] = -1.089$ $\therefore$ USE $\alpha = 1.0$

REVISED 3/14/16

CHA WCM 3-14-16 **CHA COMPUTATION PAD**

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PROJECT NAME:	
PROJECT LOCATION:	

PROJECT	PHASE	ORG
30119		

SHEET #: 7 OF

DATE:

SUBJECT: GUY ANCHOR A

TOTAL TENSILE LOAD PER R_{od} W/ PRYING ACTION

$$B_u = T\left[1 + \frac{\delta\alpha}{(1+\delta\alpha)}\frac{b'}{a'}\right] = (8.259\text{ k})\left[1 + \left(\frac{(0.792)(1.0)}{[1+(0.792)(1.0)]}\right)\left(\frac{2.938\text{ in}}{2.562\text{ in}}\right)\right]$$

$$= (8.259\text{ k})[1 + 0.507] = 12.446\text{ k}$$

$B_u = 12.446\text{ k} < 22.279\text{ k} = B_n = \phi R_{n_{TENS}}$ (OK)

CHECK WALL AT ANCHOR

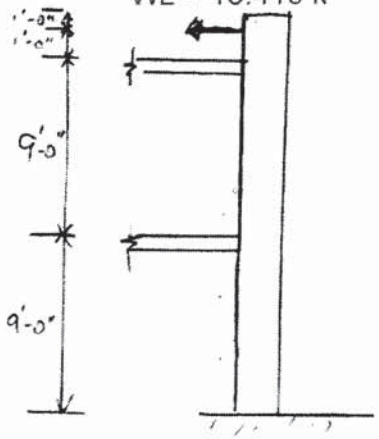
MODELED USING ENERCALC, (SEE ATTACHED)

ASSUMED THE FOLLOWING

- CONCRETE STRENGTH = 4 KSI
- 12" THICK WALL (PER DWGS)
- (2) 9'-0" FLOORS W/ 2'-0" PARAPET
- #5 @ 12" REINFORCEMENT @ EF
- 6FT SECTION OF WALL

DL = 11.291 k

WL = 18.418 k



PER ENERCALC RESULTS

MAX BENDING STRESS RATIO
= 0.734 < 1.0 (OK)

⇒ WALL PASSES

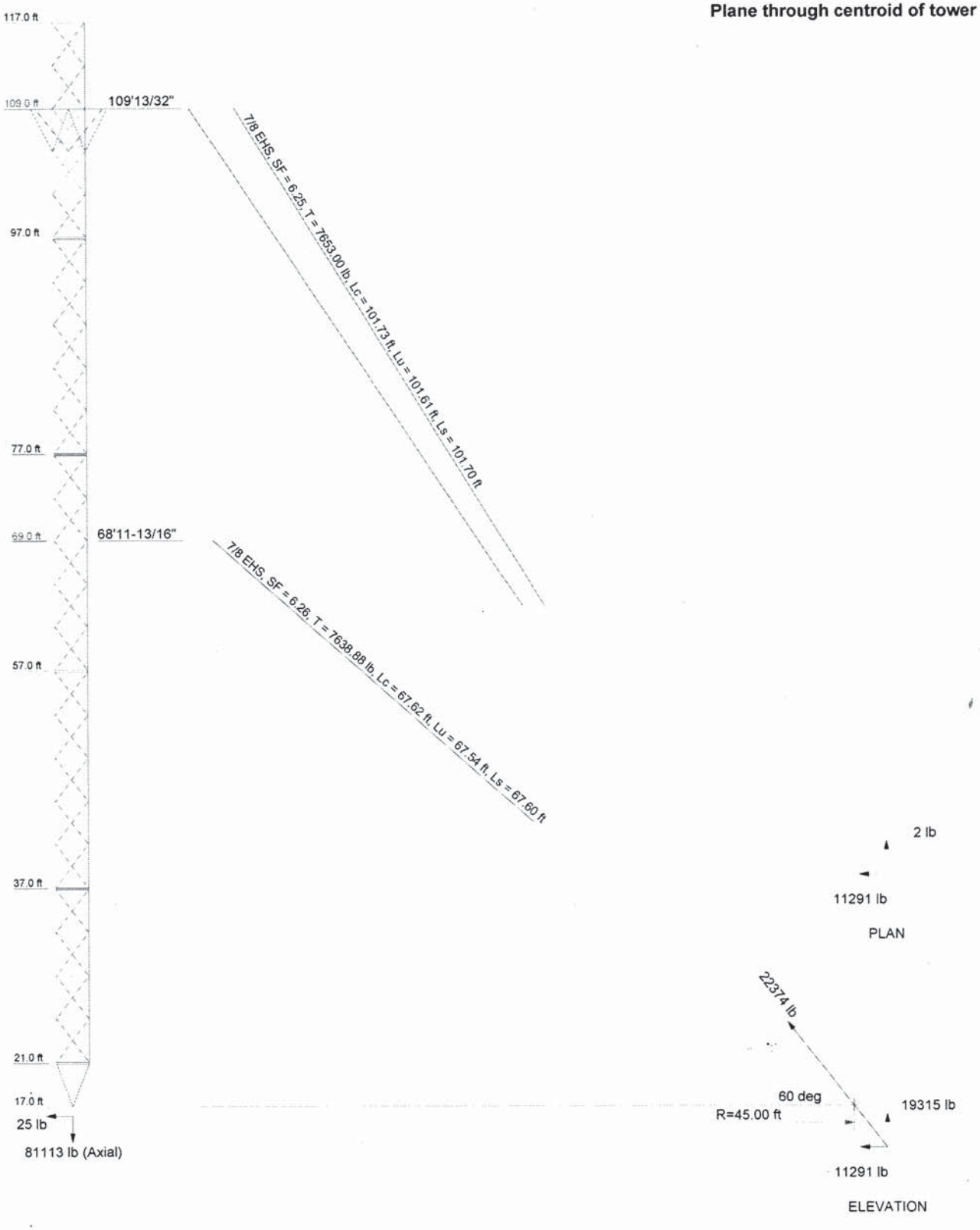
Guy Tensions and Tower Reactions

TIA-222-G - Dead Load

Dead Only

Anchor 'A'@45 ft Azimuth 0 deg Elev 17 ft

Plane through centroid of tower



CHA Consulting, Inc.	Job: *30119-1003-28040*		
III Winners Circle Albany, NY 12205	Project: *CT-HFD0063*		
	Client: Clearwire	Drawn by: Bryan Jones	App'd:
CHA, Inc. Phone: (518) 453-4500 FAX:	Code: TIA-222-G	Date: 03/14/16	Scale: NTS
	Path:		Dwg No. E-6

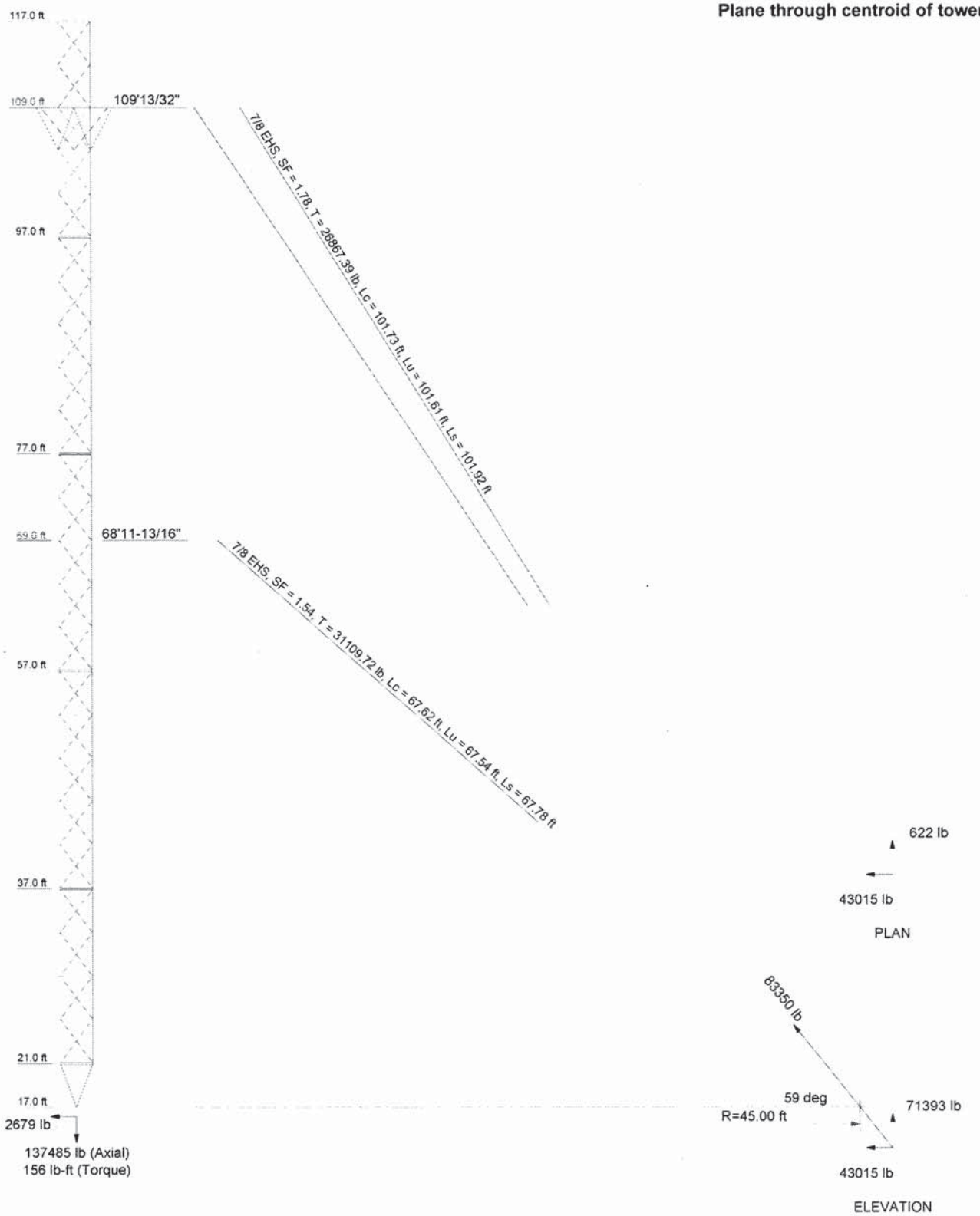
Guy Tensions and Tower Reactions

TIA-222-G - 105 mph/50 mph 1.0000 in Ice Exposure C

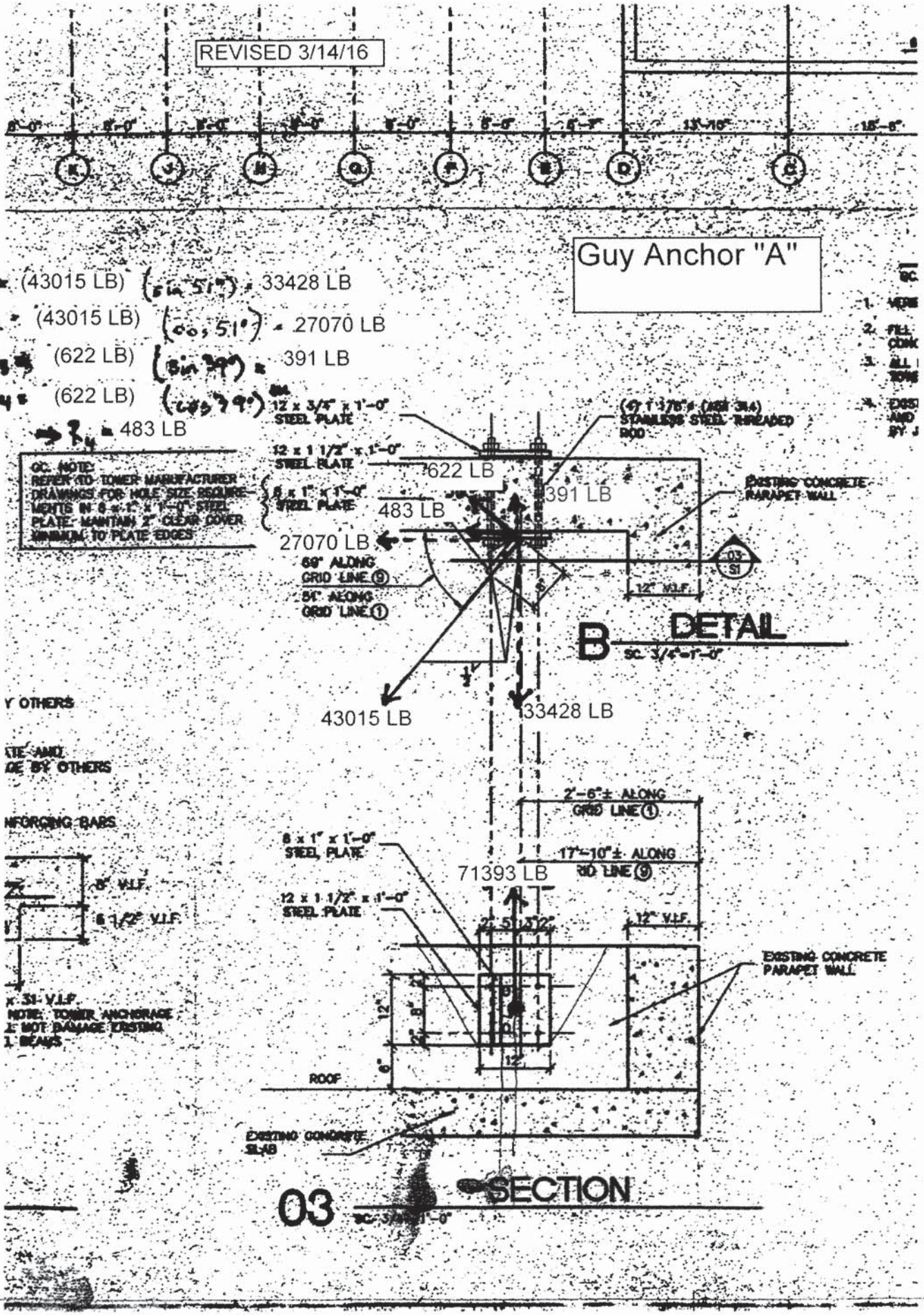
1.2 Dead+1.6 Wind 210 deg - No Ice+1.0 Guy

Anchor 'A'@45 ft Azimuth 0 deg Elev 17 ft

Plane through centroid of tower



CHA Consulting, Inc.	Job: ***30119-1003-28040***		
III Winners Circle Albany, NY 12205	Project: ***CT-HFD0063***		
	Client: Clearwire	Drawn by: Bryan Jones	App'd:
CHA, Inc. Phone: (518) 453-4500 FAX:	Code: TIA-222-G	Date: 03/14/16	Scale: NTS
	Path:		Dwg No. E-6


REVISED 3/14/16
Guy Anchor "A"
R1 = (43015 LB) (sin 51°) = 33428 LB
R2 = (43015 LB) (cos 51°) = 27070 LB
R3 = (622 LB) (sin 39°) = 391 LB
R4 = (622 LB) (cos 39°) = 483 LB
12 x 3/4" x 1'-0" STEEL PLATE
12 x 1 1/2" x 1'-0" STEEL PLATE
6 x 1" x 1'-0" STEEL PLATE
622 LB
391 LB
483 LB
27070 LB
68" ALONG GRID LINE ⑤
84" ALONG GRID LINE ①
43015 LB
33428 LB
EXISTING CONCRETE PARAPET WALL
12" V.I.F.
B DETAIL
SC. 3/4"=1'-0"
2'-6"± ALONG GRID LINE ①
17'-10"± ALONG GRID LINE ⑤
71393 LB
ROOF
EXISTING CONCRETE SLAB
03 SECTION
SC. 3/4"=1'-0"

Concrete Slender Wall

Description : Guy Anchor A Wall Check

Code References

Calculations per ACI 318-11 Sec 14.8, IBC 2012, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-05

General Information

f'c : Concrete 28 day strength	=	4.0 ksi
Fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
λ : Lt Wt Conc Factor	=	1.0
Fr : Rupture Modulus	=	316.228 psi
Max % of ρ balanced	=	0.01806
Max Pu/Ag = f'c *	=	0.060
Concrete Density	=	144.0 pcf
Width of Design Strip	=	60.0 in

Wall Thickness		12.0 in
Rebar at each face		
Rebar "d" distance		1.250 in
Lower Level Rebar . . .		
Bar Size	#	5
Bar Spacing		12.0 in
Upper Level Rebar . . .		
Bar Size	#	5
Bar Spacing		16.0 in

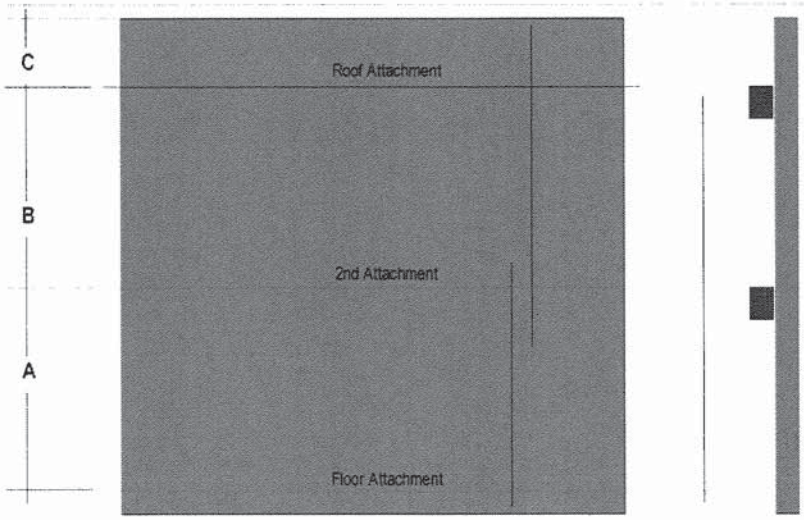
Temp Diff across thickness = deg F
Min Allow Out-of-Plane Defl Ratio = L / 0
Minimum Vertical Steel % = 0.0020
Using Stiff. Reduction Factor per ACI R.10.12.3

Two-Story Wall Dimensions

A 1st Story Height	=	9.0 ft
B 2nd Story Height	=	9.0 ft
C Parapet height	=	2.0 ft

Wall Support Condition Top & Bottom Pinned

Initial Lateral Disp. @ Top Support in



Lateral Loads

Wind Loads :

Full area WIND load			15.0 psf
Fp	1.0	=	25.0 psf

Seismic Loads :

Wall Weight Seismic Load Input Method :	Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load	25.0 psf

	D	Lr	L	E	W	Height	*(Applied to full "STRIP Width")*
Point Lateral Load	11.291				18.418 k	19.0 ft	

Concrete Slender Wall

Description : Guy Anchor A Wall Check

DESIGN SUMMARY

Results reported for "Strip Width" of 60.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.20D+0.50Lr+0.50L+1.60W	Maximum Bending Stress Ratio = **0.7341**			
		Max Mu	-43.258 k-ft	Phi * Mn	58.923 k-ft
PASS	Service Deflection Check W Only	Actual Defl. Ratio L/	6,052	Allowable Defl. Ratio	150
		Max. Deflection	-0.01785 in		
PASS	Axial Load Check +1.20D+0.50Lr+0.50L+1.60W	Max Pu / Ag	3.642 psi	Max. Allow. Defl.	0.720 in
		Location	17.850 ft	0.06 * f'c	240.0 psi
PASS	Reinforcing Limit Check	Controlling As/bd	0.002403	As/bd = 0.0 rho bal	0.01806
PASS	Minimum Moment Check +1.40D	Mcracking	37.947 k-ft	Minimum Phi Mn	76.239 k-ft
		Maximum Reactions . . .	*for Load Combination....*		
		Top Horizontal	+D+W+H		33.404 k
		Base Horizontal	+D+W+H		1.219 k
		Mid-Ht Horizontal	+D+W+H		3.414 k
		Vertical Reaction	+D+0.750Lr+0.750L+0.5250E+H		14.40 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.06*f'c*b*t k	Mcr k-ft	Moment Values Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal
+1.40D at 17.70 to 18.00	0.000	34.560	0.00	3.16	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50Lr+1.60L+1.60H at 17.70 to 18.	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60L+0.50S+1.60H at 17.70 to 18.0	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60Lr+0.50L at 17.70 to 18.00	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60Lr+0.80W at 17.70 to 18.00	0.000	34.560	0.00	5.68	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50L+1.60S at 17.70 to 18.00	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60S+0.80W at 17.70 to 18.00	0.000	34.560	0.00	5.68	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50Lr+0.50L+1.60W at 17.70 to 18.	0.000	34.560	0.00	8.65	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50L+0.50S+1.60W at 17.70 to 18.0	0.000	34.560	0.00	8.65	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50L+0.20S+E at 17.70 to 18.00	0.000	34.560	0.00	2.76	0.90	11.78	0.233	0.0018	0.0181
+0.90D+1.60W+1.60H at 17.70 to 18.00	0.000	34.560	0.00	7.97	0.90	11.78	0.233	0.0018	0.0181
+0.90D+E+1.60H at 17.70 to 18.00	0.000	34.560	0.00	2.08	0.90	11.78	0.233	0.0018	0.0181

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
D Only at 14.70 to 15.00	0.763	0.00	0.80	1,728.00	267.12	267.115	0.011	9,827.6
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
W Only at 14.70 to 15.00	0.000	0.00	1.23	1,728.00	253.55	253.549	0.018	6,051.7
E Only at 13.80 to 14.10	0.000	0.00	0.12	1,728.00	253.55	253.549	0.002	68,230.9
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Results reported for "Strip Width" = 12 in.

Load Combination	Base Horizontal	Mid Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.4 k	1.607 k	12.53 k	14.400 k
+D+L+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+Lr+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+S+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+0.750Lr+0.750L+H	0.4 k	1.607 k	12.53 k	14.400 k

Concrete Slender Wall

Description : Guy Anchor A Wall Check

Reactions - Vertical & Horizontal

Results reported for "Strip Width" = 12 in.

Load Combination	Base Horizontal	Mid Horizontal	Top Horizontal	Vertical @ Wall Base
+D+0.750L+0.750S+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+W+H	1.2 k	3.414 k	33.40 k	14.400 k
+D+0.70E+H	0.7 k	0.658 k	13.03 k	14.400 k
+D+0.750Lr+0.750L+0.750W+H	1.0 k	2.962 k	28.19 k	14.400 k
+D+0.750L+0.750S+0.750W+H	1.0 k	2.962 k	28.19 k	14.400 k
+D+0.750Lr+0.750L+0.5250E+H	0.6 k	0.895 k	12.91 k	14.400 k
+D+0.750L+0.750S+0.5250E+H	0.6 k	0.895 k	12.91 k	14.400 k
+0.60D+W+H	1.1 k	2.777 k	28.39 k	8.640 k
+0.60D+0.70E+H	0.5 k	0.017 k	8.02 k	8.640 k
D Only	0.4 k	1.607 k	12.53 k	14.400 k
Lr Only	0.0 k	0.000 k	0.00 k	0.000 k
L Only	0.0 k	0.000 k	0.00 k	0.000 k
S Only	0.0 k	0.000 k	0.00 k	0.000 k
W Only	0.9 k	1.818 k	20.88 k	0.000 k
E Only	0.4 k	1.355 k	0.71 k	0.000 k
H Only	0.0 k	0.000 k	0.00 k	0.000 k
D Only	0.4 k	1.607 k	12.53 k	14.400 k
+D+L+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+Lr+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+S+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+0.750Lr+0.750L+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+0.750L+0.750S+H	0.4 k	1.607 k	12.53 k	14.400 k
+D+W+H	1.2 k	3.414 k	33.40 k	14.400 k
+D+0.70E+H	0.7 k	0.658 k	13.03 k	14.400 k
+D+0.750Lr+0.750L+0.750W+H	1.0 k	2.962 k	28.19 k	14.400 k

REVISED 3/14/16
WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY: B. JONES
CHECKED BY: MS 08-13-15
PROJECT NAME: CT-HFD0063 RETROFIT
PROJECT LOCATION:

PROJECT: 30119 PHASE: 1002 ORG:
SHEET #: 1 OF
DATE: 7/30/15
SUBJECT: ANCHOR B

GUY ANCHOR "B" CHECK

@ 39 FT / ELEV = 17 FT / AZIMUTH = 120° (PER MODEL)

RETROFIT MAX VERTICAL REACTION LOADS

DEAD LOAD: $DL = 22.320\ k$

FACTORED DEAD LOAD: $1.2DL = 1.2(22.320\ k) = 26.784\ k$

TOTAL CONTROLLING COMBINATION LOAD:

$1.2DL + 1.6WL + 1.0\ GUY = 82.069\ k$

$26.784\ k + 1.6WL + 0 = 82.069\ k$

$\Rightarrow$ WIND LOAD: $WL = 34.553\ k$

TOTAL UNFACTORED LOAD:

$DL + WL = 22.320\ k + 34.553\ k = 56.873\ k$

TOTAL RETROFIT VERTICAL UNFACTORED LOADS		ALLOWABLE VERTICAL UNFACTORED LOADS (PER ORIGINAL DRAWINGS)
56.873 k	>	51.6 k (N.G.)

*Since total retrofit unfactored loads are greater than the allowable unfactored loads shown on original drawings, anchor must be analyzed to determine true capacity of anchor connection. See attached capacity calculations in later pages.

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CHA COMPUTATION PAD

COMPLETED BY:	B. Jones
CHECKED BY:	MS 08-13-15
PROJECT NAME:	CT-HFD0063
PROJECT LOCATION:	

PROJECT	PHASE	ORG
3 0 1 1 9	1 0 0 2	

SHEET #: 2 OF
DATE: 1/30/15
SUBJECT: Anchor B

(Guy Anchor "B" cont)

Retrofit Max Horizontal Reaction Loads

Dead Load: $DL = \sqrt{(11.296\text{ k})^2 + (0.003\text{ k})^2} = 11.296\text{ k}$

Factored Dead: $1.2\,DL = 1.2(11.296\text{ k}) = 13.555\text{ k}$

Total Controling Combination Load:

$1.2\,DL + 1.6\,WL + 1.0\,Guy = \sqrt{(43.214\text{ k})^2 + (0.757\text{ k})^2}$

$13.555\text{ k} + 1.6\,WL + 0 = 43.221\text{ k}$

$\Rightarrow$ Wind Load: $WL = 18.541\text{ k}$

Total Unfactored Load:

$DL + WL = 11.296\text{ k} + 18.541\text{ k} = 29.837\text{ k}$

Total Retrofit Horizontal Unfactored Loads		Allowable Horizontal Unfactored Loads (Per Original Drawings)
29.837 k	<	32.0 K

(OK) ✓

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CHECKED BY: 08-13-15

PROJECT NAME:

PROJECT LOCATION:

PROJECT: 30119 PHASE: ORG:

SHEET #: 3 OF:

DATE:

SUBJECT: Guy Anchor B

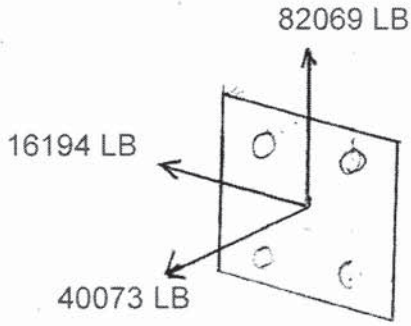
Capacity Check of Guy Anchor Connection "B"

SEE ATTACHED DIAGRAM FOR TRANSLATED LOADS

VERTICAL SHEAR = 82069 LB

HORIZONTAL SHEAR = 15487 LB + 707 LB = 16194 LB

TENSION = 40344 LB - 271 LB = 40073 LB



DESIGN BEARING STENGTH OF PLATE

$$\phi_v R_n = 0.75(2.4 d t F_u) = 0.75(2.4)(1.125\ in)(1.5\ in)(58\ ksi) \Rightarrow \phi_v R_n = 176.175\ k \text{ (PER ROD)}$$

DESIGN SHEAR STRENGTH

$$A_b = \frac{\pi (1.125\ in)^2}{4} = 0.994\ in^2$$

$$\phi_v R_n = 0.75(F_{nv} A_b) = 0.75(32\ ksi)(0.994\ in^2) \Rightarrow \phi_v R_n = 23.856\ k \text{ (PER ROD)}$$

VERTICAL SHEAR/BEARING LOAD (PER ROD), $V_{u\,VERT} = \frac{82.069\ k}{4} = 20.517\ k$

$V_{u\,VERT} = 20.517\ k < 176.175\ K = \phi_v R_n$ [BEARING] (OK) ✓

REVISED 3/14/16
WCM 3-14-16

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PROJECT NAME:
PROJECT LOCATION:

PROJECT: 30119 PHASE: ORG:
SHEET #: 4 OF:
DATE:
SUBJECT: Guy Anchor B

$V_{u\,VERT} = 20.517\text{ k} < 23.856\text{ k} = \phi_v R_n$ [SHEAR] (OK) ✓

HORIZONTAL SHEAR/BEARING LOAD (PER ROD), $V_{u\,HORIZ}$

$$V_{u\,HORIZ} = \frac{16.194\text{ k}}{4} = 4.049\text{ k}$$

$V_{u\,HORIZ} = 4.049\text{ k} < 176.975\text{ k} = \phi_v R_n$ [BEARING] (OK) ✓

$V_{u\,HORIZ} = 4.049\text{ k} < 23.856\text{ k} = \phi_v R_n$ [SHEAR] (OK) ✓

COMBINED HORIZONTAL AND VERTICAL (RESULTANT) SHEAR/BEARING LOAD (PER ROD), $V_{u\,COM}$

$$V_{u\,COM} = \frac{\left(\sqrt{(82.069\text{ k})^2 + (16.194\text{ k})^2}\right)}{4} = \frac{83.651\text{ k}}{4} = 20.913\text{ k}$$

$V_{u\,COM} = 20.913\text{ k} < 176.175\text{ k} = \phi_v R_n$ [BEARING] (OK) ✓

$V_{u\,COM} = 20.913\text{ k} < 23.856\text{ k} = \phi_v R_n$ [SHEAR] (OK) ✓

AVAILABLE TENSILE STRENGTH

$$F_{nt}' = 1.3F_{nt} - \frac{F_{nt}}{\phi F_{nv}} f_v \leq F_{nt}$$ [AISC EQN. J3-3a]

$$f_v = \frac{V_{u\,rod}}{A_b} = \frac{20.913\text{ k}}{0.994\text{ in}^2} = 21.039\text{ ksi}$$

AISI 314 Threaded Rod, $F_u = 80$ ksi

Nominal Tensile Stress, $F_{nt} = 0.75(Fu) = 0.75(80\text{ ksi}) = 60$ ksi

Nominal Shear Stress, $F_{nv} = 0.40(Fu) = 0.40(80\text{ ksi}) = 32$ ksi

REVISED 3/14/16
WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY:	B. Jones	PROJECT	PHASE	ORG	
CHECKED BY:	MS 08-13-15	30119			
PROJECT NAME:		SHEET #: 5	OF		
PROJECT LOCATION:		DATE:			
		SUBJECT:	Guy Anchor B		

$$F_{nt}' = 1.3(60\text{ ksi}) - \frac{(60\text{ ksi})}{(0.75)(32\text{ ksi})}(21.039\text{ ksi}) \leq F_{nt}$$

$$F_{nt}' = 25.403\text{ ksi} \leq 60\text{ ksi}$$

Design Tensile Strength

$$\phi R_{n_{TENS}} = 0.75(F_{nt}' A_b) = 0.75(25.403\text{ ksi})(0.994\text{ in}^2)$$

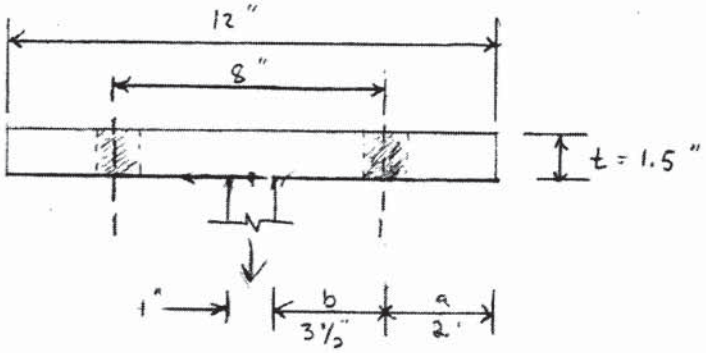
$$\Rightarrow \phi R_{n_{TENS}} = 18.938\text{ k}$$

Tensile Load (Per Rod)

$$T_u = \frac{40.073\text{ k}}{4} = 10.018\text{ k}$$

$T_u = 10.018\text{ k} < 18.938\text{ k} = \phi R_{n_{TENS}}$ [TENSILE] (OK) ✓

Check Prying Action



$1.25b = 1.25(3.5\text{ in}) = 4.375\text{ in} > 2" = a$ ∴ use $a = 2"$

$$b' = b - \frac{d}{2} = 3.5\text{ in} - \frac{1.125\text{ in}}{2} = 2.938\text{ in}$$

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CHA COMPUTATION PAD

COMPLETED BY: B. Jones

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PROJECT NAME:

PROJECT LOCATION:

PROJECT	PHASE	ORG
30179		

SHEET #: 6 OF

DATE:

SUBJECT: Guy Anchor B

$a' = a + \frac{d}{2} = 2_{IN} + \frac{1.125_{IN}}{2} = 2.562_{IN}$

$d' = d + \frac{1}{8} = 1.125_{IN} + 0.125_{IN} = 1.25_{IN}$

TRIBUTARY LENGTH OF PLATE PER ROD, $p = \frac{12_{IN}}{2} = 6_{IN}$

$\delta = 1 - \frac{d'}{p} = 1 - \frac{1.250_{IN}}{6_{IN}} = 0.792$

$B = \phi R_{n_{TENS}} = 18.938\ k$ [DESIGN TENSILE STRENGTH PER ROD]

$\frac{B}{T_u} - 1 = \frac{18.938\ k}{10.018\ k} - 1 = 0.890$

$\alpha = \frac{\left(\frac{B}{T_u} - 1\right)\left(\frac{a'}{b'}\right)}{\delta\left[1 - \left(\frac{B}{T} - 1\right)\left(\frac{a'}{b'}\right)\right]} = \frac{(0.890)\left(\frac{2.562_{IN}}{2.938_{IN}}\right)}{0.792\left[1 - (0.890)\left(\frac{2.562_{IN}}{2.938_{IN}}\right)\right]} = \frac{0.776}{0.177}$

$\Rightarrow \alpha = 4.384$

SINCE $|\alpha| = 4.384 > 1.0$ USE $\alpha = 1.0$

THICKNESS OF PLATE, t_{req}

$t_{req} = \sqrt{\frac{4.44\,T\,b'}{p\,F_u\,(1+\delta\alpha)}} = \sqrt{\frac{4.44\,(10.018\ k)\,(2.938_{IN})}{6_{IN}\,(58\ k_{SI})\,(1+(0.792)(1.0))}} = \sqrt{\frac{130.682}{623.616}}$

$\Rightarrow$ $t_{req} = 0.458\ in < 1.5_{IN} = t$ (OK) [PLATE ADEQUATE] ✓

$\alpha = \frac{1}{\delta}\left[\frac{4.44\,T\,b'}{p\,t^2\,F_u} - 1\right] = \frac{1}{0.792}\left[\frac{4.44\,(10.018\ k)\,(2.938_{IN})}{6_{IN}\,(1.5_{IN})^2\,(58\ KSI)} - 1\right]$

$\alpha = \frac{1}{0.792}\left[\frac{130.682}{783.000} - 1\right] = -1.052$ $\therefore$ USE $\alpha = 1.0$

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CHA COMPUTATION PAD

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PROJECT NAME:	
PROJECT LOCATION:	

PROJECT	PHASE	ORG
30119		

SHEET #: 7 OF

DATE:

SUBJECT: Guy Anchor B

TOTAL TENSILE LOAD PER ROD W/ PRYING ACTION

$$B_u = T\left[1 + \frac{\delta\alpha}{(1+\delta\alpha)}\frac{b'}{a'}\right] = (10.018\text{ k})\left[1 + \left(\frac{(0.792)(1.0)}{[1+(0.792)(1.0)]}\right)\left(\frac{2.938\text{ in}}{2.562\text{ in}}\right)\right]$$

$$= (10.018\text{ k})[1 + 0.507] = 15.097\text{ k}$$

$B_u = 15.097\text{ k} < 18.938\text{ k} = B_n = \phi R_{n_{TENS}}$ (OK)

CHECK WALL AT ANCHOR

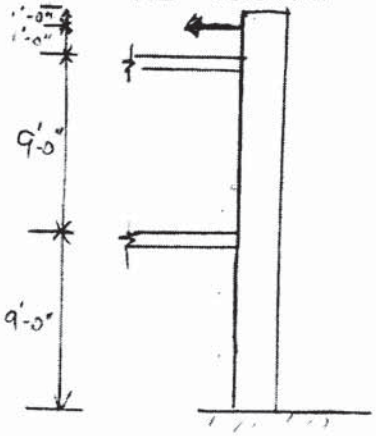
MODELED USING ENERCALC, (SEE ATTACHED)

ASSUMED THE FOLLOWING

- CONCRETE STRENGTH = 4 KSI
- 12" THICK WALL (PER DWGS)
- (2) 9'-0" FLOORS W/ 2'-0" PARAPET
- #5 @ 12" REINFORCEMENT @ EF
- 6FT SECTION OF WALL

DL = 11.296 k

WL = 18.541 k



PER ENERCALC RESULTS

MAX BENDING STRESS RATIO
= 0.738 < 1.0 (OK)

⇒ WALL PASSES

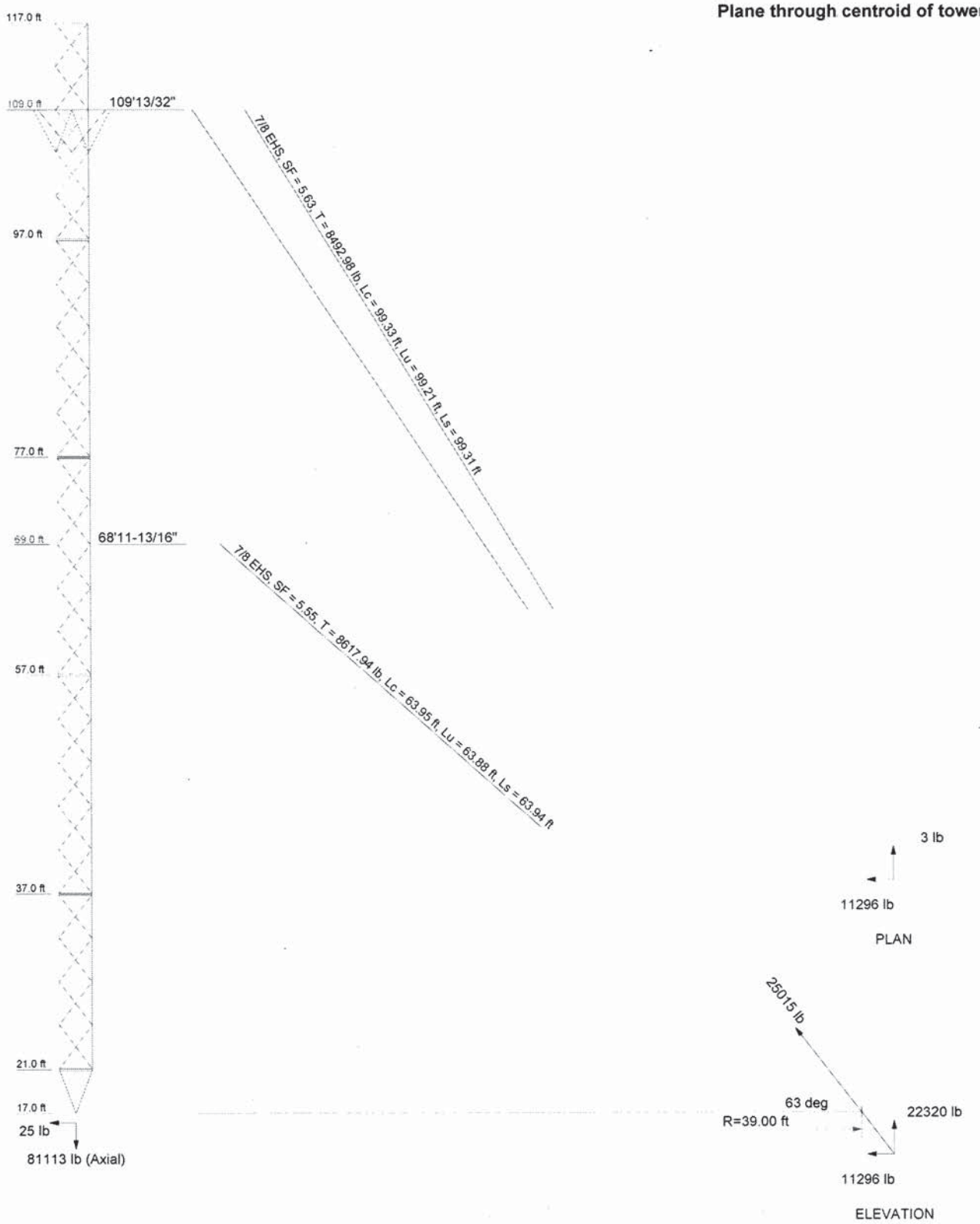
Guy Tensions and Tower Reactions

TIA-222-G - Dead Load

Dead Only

Anchor 'B'@39 ft Azimuth 120 deg Elev 17 ft

Plane through centroid of tower



CHA Consulting, Inc.	Job: **30119-1003-28040**		
III Winners Circle Albany, NY 12205	Project: **CT-HFD0063**		
	Client: Clearwire	Drawn by: Bryan Jones	App'd:
CHA, Inc. Phone: (518) 453-4500 FAX:	Code: TIA-222-G	Date: 03/14/16	Scale: NTS
	Path:		Dwg No. E-6

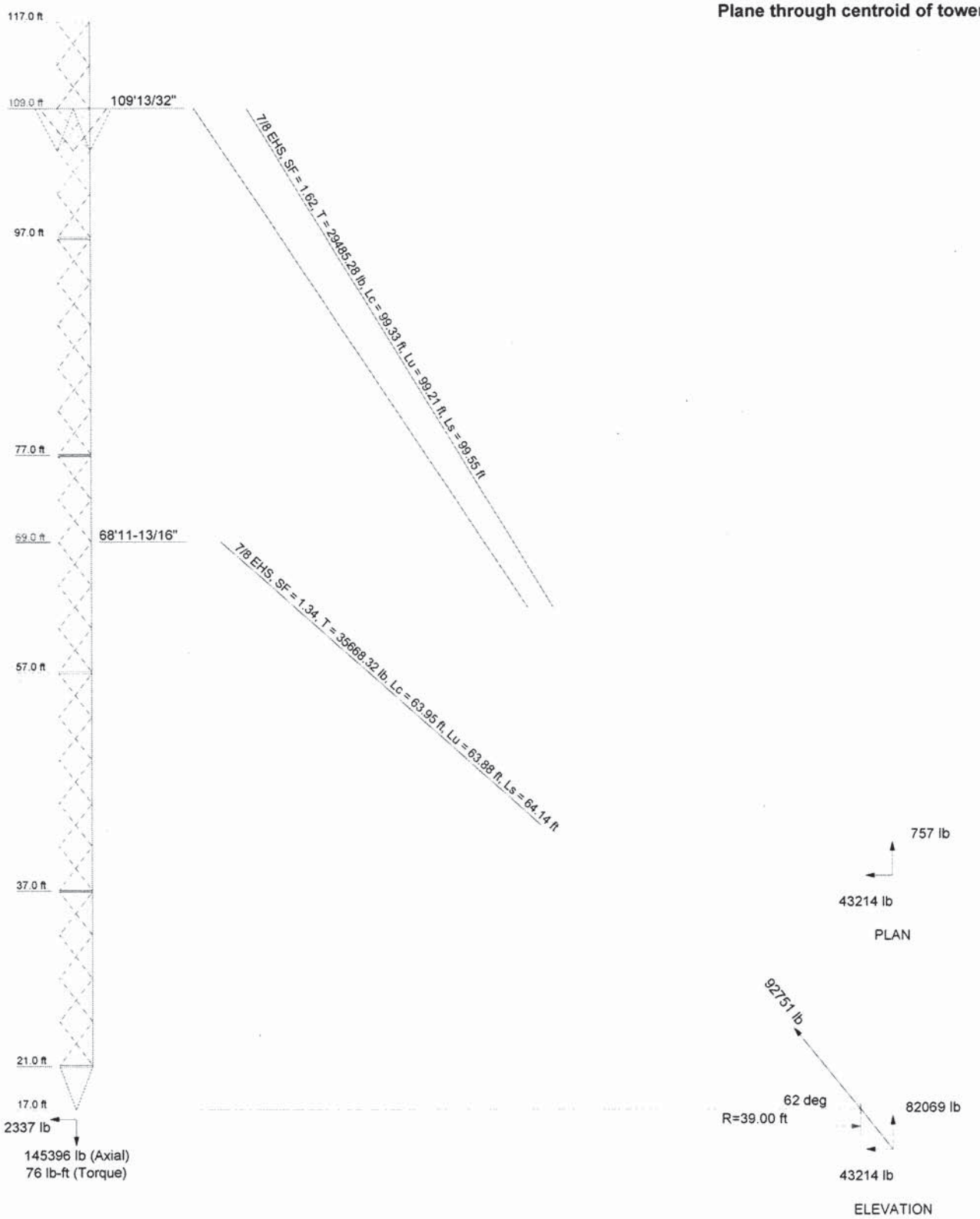
Guy Tensions and Tower Reactions

TIA-222-G - 105 mph/50 mph 1.0000 in Ice Exposure C

1.2 Dead+1.6 Wind 330 deg - No Ice+1.0 Guy

Anchor 'B'@39 ft Azimuth 120 deg Elev 17 ft

Plane through centroid of tower



CHA Consulting, Inc.	Job: ***30119-1003-28040***		
III Winners Circle	Project: ***CT-HFD0063***		
Albany, NY 12205	Client: Clearwire	Drawn by: Bryan Jones	App'd:
CHA, Inc. Phone: (518) 453-4500	Code: TIA-222-G	Date: 03/14/16	Scale: NTS
FAX:	Path:		Dwg No E-6

REVISED 3/11/16

Guy Anchor "B"

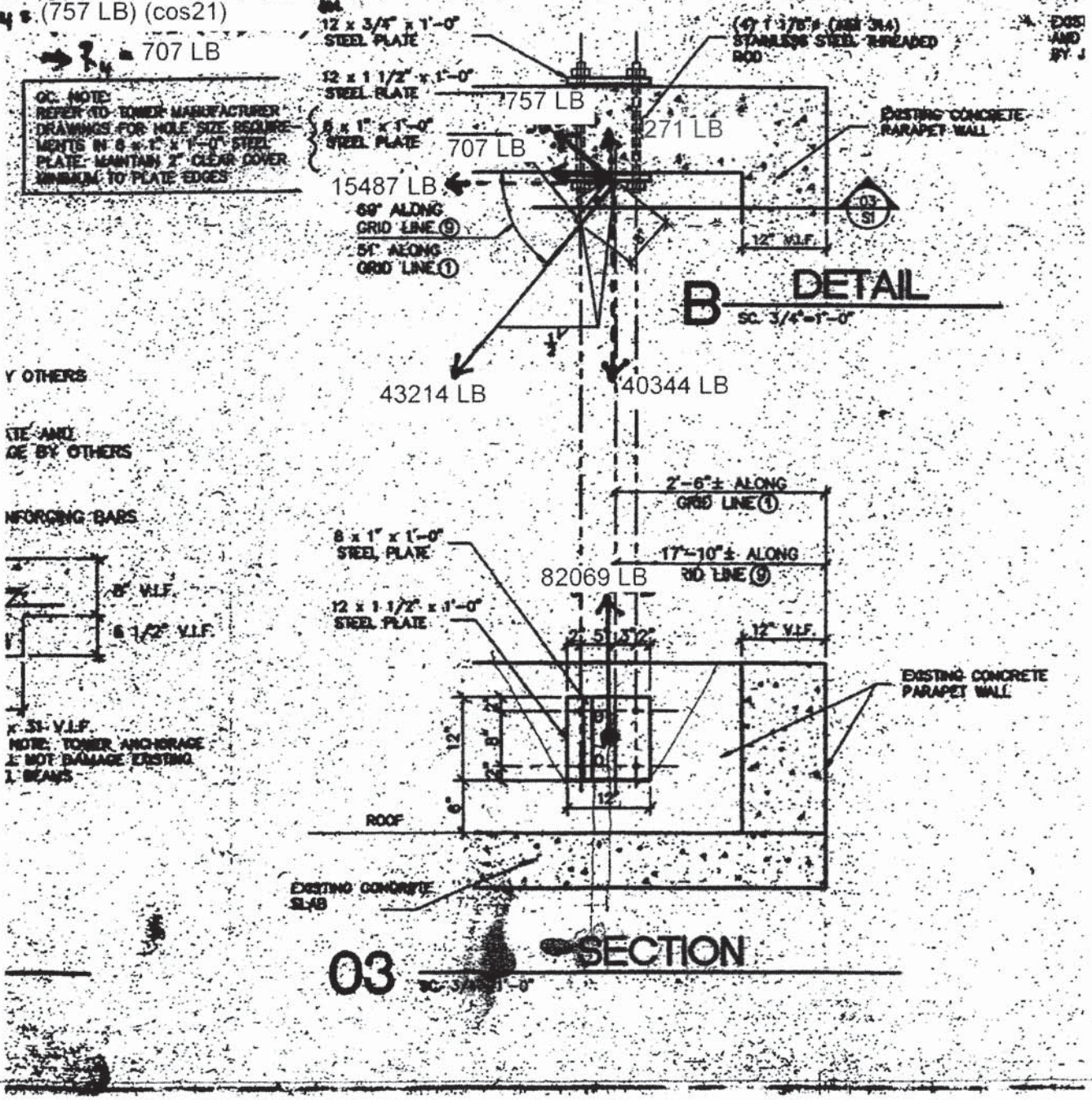
R_1 = (43214 LB) (sin69) = 40344 LB

R_2 = (43214 LB) (cos69) = 15487 LB

R_3 = (757 LB) (sin21) = 271 LB

R_4 = (757 LB) (cos21)

$\Rightarrow R_4$ = 707 LB



B DETAIL
SC. 3/4"=1'-0"

03 SECTION
SC. 3/4"=1'-0"

QC. NOTE:
REFER TO TOWER MANUFACTURER DRAWINGS FOR HOLE SIZE REQUIREMENTS IN 6 x 1" x 1'-0" STEEL PLATE. MAINTAIN 2" CLEAR COVER MINIMUM TO PLATE EDGES

Y OTHERS

TE AND
GE BY OTHERS

NFORCING BARS

8" V.I.F.
6 1/2" V.I.F.

X 31" V.I.F.
NOTE: TOWER ANCHORAGE
T NOT DAMAGE EXISTING
L BEAMS

Concrete Slender Wall

Description : Guy Anchor B Wall Check

Code References

Calculations per ACI 318-11 Sec 14.8, IBC 2012, CBC 2013, ASCE 7-10
Load Combinations Used : ASCE 7-05

General Information

f'c : Concrete 28 day strength	=	4.0 ksi
Fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
λ : Lt Wt Conc Factor	=	1.0
Fr : Rupture Modulus	=	316.228 psi
Max % of ρ balanced	=	0.01806
Max Pu/Ag = f'c *	=	0.060
Concrete Density	=	144.0 pcf
Width of Design Strip	=	60.0 in

Wall Thickness		12.0 in
Rebar at each face		
Rebar "d" distance		1.250 in
Lower Level Rebar . . .		
Bar Size	#	5
Bar Spacing		12.0 in
Upper Level Rebar . . .		
Bar Size	#	5
Bar Spacing		16.0 in

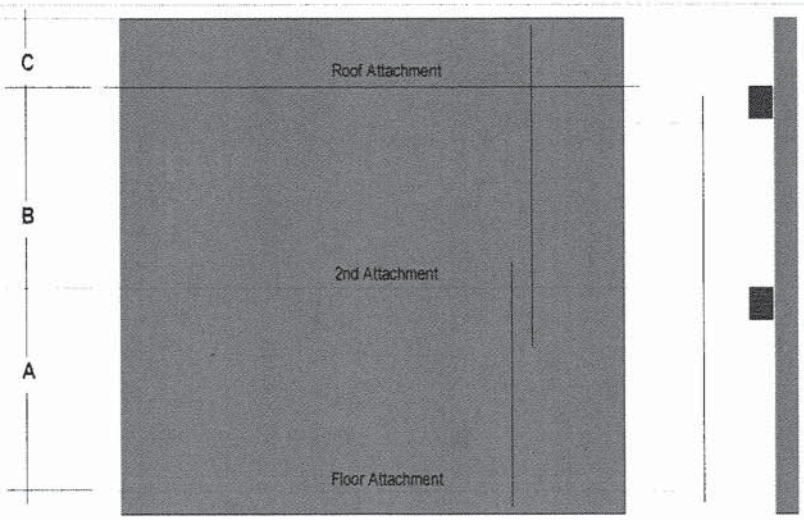
Temp Diff across thickness = deg F
Min Allow Out-of-Plane Defl Ratio = L / 0
Minimum Vertical Steel % = 0.0020
Using Stiff. Reduction Factor per ACI R.10.12.3

Two-Story Wall Dimensions

A 1st Story Height	=	9.0 ft
B 2nd Story Height	=	9.0 ft
C Parapet height	=	2.0 ft

Wall Support Condition Top & Bottom Pinned

Initial Lateral Disp. @ Top Support in



Lateral Loads

Wind Loads :

Full area WIND load			15.0 psf
Fp	1.0	=	25.0 psf

Seismic Loads :

Wall Weight Seismic Load Input Method :	Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load	25.0 psf

	D	Lr	L	E	W	Height	*(Applied to full "STRIP Width")*
Point Lateral Load	11.296				18.541 k	19.0 ft	

Concrete Slender Wall

Description : Guy Anchor B Wall Check

DESIGN SUMMARY

Results reported for "Strip Width" of 60.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.20D+0.50Lr+0.50L+1.60W	Maximum Bending Stress Ratio = **0.7376**			
		Max Mu	-43.461 k-ft	Phi * Mn	58.923 k-ft
PASS	Service Deflection Check W Only	Actual Defl. Ratio L/	6,010	Allowable Defl. Ratio	150
		Max. Deflection	-0.01797 in		
PASS	Axial Load Check +1.20D+0.50Lr+0.50L+1.60W	Max Pu / Ag	3.642 psi	Max. Allow. Defl.	0.720 in
		Location	17.850 ft	0.06 * f'c	240.0 psi
PASS	Reinforcing Limit Check	Controlling As/bd	0.002403	As/bd = 0.0 rho bal	0.01806
PASS	Minimum Moment Check +1.40D	Mcracking	37.947 k-ft	Minimum Phi Mn	76.239 k-ft
		Maximum Reactions . . .	*for Load Combination....*		
		Top Horizontal	+D+W+H		33.547 k
		Base Horizontal	+D+W+H		1.223 k
		Mid-Ht Horizontal	+D+W+H		3.433 k
		Vertical Reaction	+D+W+H		14.40 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.06*f'c*b*t k	Mcr k-ft	Moment Values Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal
+1.40D at 17.70 to 18.00	0.000	34.560	0.00	3.16	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50Lr+1.60L+1.60H at 17.70 to 18.	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60L+0.50S+1.60H at 17.70 to 18.0	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60Lr+0.50L at 17.70 to 18.00	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60Lr+0.80W at 17.70 to 18.00	0.000	34.560	0.00	5.70	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50L+1.60S at 17.70 to 18.00	0.000	34.560	0.00	2.71	0.90	11.78	0.233	0.0018	0.0181
+1.20D+1.60S+0.80W at 17.70 to 18.00	0.000	34.560	0.00	5.70	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50Lr+0.50L+1.60W at 17.70 to 18.	0.000	34.560	0.00	8.69	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50L+0.50S+1.60W at 17.70 to 18.0	0.000	34.560	0.00	8.69	0.90	11.78	0.233	0.0018	0.0181
+1.20D+0.50L+0.20S+E at 17.70 to 18.00	0.000	34.560	0.00	2.76	0.90	11.78	0.233	0.0018	0.0181
+0.90D+1.60W+1.60H at 17.70 to 18.00	0.000	34.560	0.00	8.01	0.90	11.78	0.233	0.0018	0.0181
+0.90D+E+1.60H at 17.70 to 18.00	0.000	34.560	0.00	2.08	0.90	11.78	0.233	0.0018	0.0181

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
D Only at 14.70 to 15.00	0.763	0.00	0.80	1,728.00	267.12	267.115	0.011	9,823.3
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
W Only at 14.70 to 15.00	0.000	0.00	1.24	1,728.00	253.55	253.549	0.018	6,009.5
E Only at 13.80 to 14.10	0.000	0.00	0.12	1,728.00	253.55	253.549	0.002	68,230.9
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Results reported for "Strip Width" = 12 in.

Load Combination	Base Horizontal	Mid Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.4 k	1.607 k	12.54 k	14.400 k
+D+L+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+Lr+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+S+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+0.750Lr+0.750L+H	0.4 k	1.607 k	12.54 k	14.400 k

Description : Guy Anchor B Wall Check

Reactions - Vertical & Horizontal

Results reported for "Strip Width" = 12 in.

Load Combination	Base Horizontal	Mid Horizontal	Top Horizontal	Vertical @ Wall Base
+D+0.750L+0.750S+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+W+H	1.2 k	3.433 k	33.55 k	14.400 k
+D+0.70E+H	0.7 k	0.659 k	13.04 k	14.400 k
+D+0.750Lr+0.750L+0.750W+H	1.0 k	2.976 k	28.29 k	14.400 k
+D+0.750L+0.750S+0.750W+H	1.0 k	2.976 k	28.29 k	14.400 k
+D+0.750Lr+0.750L+0.5250E+H	0.6 k	0.896 k	12.91 k	14.400 k
+D+0.750L+0.750S+0.5250E+H	0.6 k	0.896 k	12.91 k	14.400 k
+0.60D+W+H	1.1 k	2.795 k	28.53 k	8.640 k
+0.60D+0.70E+H	0.5 k	0.017 k	8.02 k	8.640 k
D Only	0.4 k	1.607 k	12.54 k	14.400 k
Lr Only	0.0 k	0.000 k	0.00 k	0.000 k
L Only	0.0 k	0.000 k	0.00 k	0.000 k
S Only	0.0 k	0.000 k	0.00 k	0.000 k
W Only	0.9 k	1.836 k	21.01 k	0.000 k
E Only	0.4 k	1.355 k	0.71 k	0.000 k
H Only	0.0 k	0.000 k	0.00 k	0.000 k
D Only	0.4 k	1.607 k	12.54 k	14.400 k
+D+L+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+Lr+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+S+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+0.750Lr+0.750L+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+0.750L+0.750S+H	0.4 k	1.607 k	12.54 k	14.400 k
+D+W+H	1.2 k	3.433 k	33.55 k	14.400 k
+D+0.70E+H	0.7 k	0.659 k	13.04 k	14.400 k
+D+0.750Lr+0.750L+0.750W+H	1.0 k	2.976 k	28.29 k	14.400 k

CHA

REVISED 3/14/16
WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY:	B. JONES
CHECKED BY:	JJS 08-13-15
PROJECT NAME:	CT-HFD0063 RETROFIT
PROJECT LOCATION:	

PROJECT	PHASE	ORG
30191	1002	

SHEET #: 1 OF
DATE: 7/30/15
SUBJECT: GUY ANCHOR C

GUY ANCHOR "C" CHECK

@ 37.5 FT / ELEV = 25 FT / AZIMUTH = 240° (PER MODEL)

RETROFIT MAX VERTICAL REACTION LOADS

DEAD LOAD: DL = 20.836 k

FACTORED DEAD LOAD: $1.2DL = 1.2(20.836\text{ k}) = 25.003\text{ k}$

TOTAL CONTROLLING COMBINATION LOAD:

$1.2DL + 1.6WL + 1.0\,Guy = 76.799\text{ k}$

$25.003\text{ k} + 1.6WL + 0 = 76.799\text{ k}$

$\Rightarrow$ WIND LOAD: $WL = 32.373\text{ k}$

TOTAL UNFACTORED LOAD:

$DL + WL = 20.836\text{ k} + 32.373\text{ k} = 53.209\text{ k}$

TOTAL RETROFIT VERTICAL UNFACTORED LOADS		ALLOWABLE VERTICAL UNFACTORED LOADS (PER ORIGINAL DRAWINGS)
53.209 k	>	43.7 K (N.G.)* ✓

* SINCE TOTAL RETROFIT VERTICAL UNFACTORED LOADS ARE GREATER THAN THE ALLOWABLE VERTICAL UNFACTORED LOADS SHOWN ON ORIGINAL DRAWINGS ANCHOR MUST BE ANALYZED TO DETERMINE TRUE CAPACITY OF ANCHOR CONNECTION. SEE ATTACHED CAPACITY CALCULATIONS IN LATER PAGES

REVISED 3/14/16

WCM 3-14-16

CHA COMPUTATION PAD

		PROJECT	PHASE	ORG
COMPLETED BY:	B. Jones	3 0 1 1 7	1 0 0 2	
CHECKED BY:	MS 08-13-15	SHEET #: 2	OF	
PROJECT NAME:	CT-HFD0063	DATE: 7/30/15		
PROJECT LOCATION:		SUBJECT:		

(GUY ANCHOR CONT)

RETROFIT MAX HORIZONTAL REACTION LOADS

DEAD LOAD: $DL = \sqrt{(11.314\text{ k})^2 + (0.006\text{ k})^2} = 11.314\text{ k}$

FACTORED DEAD: $1.2\,DL = 1.2\,(11.314\text{ k}) = 13.577\text{ k}$

TOTAL CONTROLING COMBINATION LOAD:

$1.2\,DL + 1.6\,WL + 1.0\,GUY = \sqrt{(43.532\text{ k})^2 + (0.698\text{ k})^2}$

$13.577\text{ k} + 1.6\,WL + 0 = 43.538\text{ k}$

$\Rightarrow$ WIND LOAD: $WL = 18.726\text{ k}$

TOTAL UNFACTORED LOAD:

$DL + WL = 11.314\text{ k} + 18.726\text{ k} = 30.040\text{ k}$

TOTAL RETROFIT HORIZONTAL UNFACTORED LOADS		ALLOWABLE HORIZONTAL UNFACTORED LOADS (PER ORIGINAL DRAWINGS)
30.040 k	>	28.6 K (N.G.)

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REVISED 3/14/16
WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY: B. JONES
CHECKED BY: JS 08-13-15
PROJECT NAME:
PROJECT LOCATION:

PROJECT: 30119 | PHASE: | ORG:
SHEET #: 3 OF
DATE:
SUBJECT: GUY ANCHOR C

CAPACITY CHECK OF GUY ANCHOR CONNECTION "C"

SEE ATTACHED DIAGRAM FOR TRANSLATED LOADS

SHEAR PARALLEL TO GUY = 42.996 k − 0.109 k = 42.887 k
SHEAR PERPENDICULAR TO GUY = 6.810 k + 0.689 k = 7.499 k
TENSION (VERTICAL) = 76.799 k

NOTE: MULTIPLE COMPONENTS ARE THE SAME OR SIMILAR TO GUY ANCHOR CONNECTION "A" THEREFORE DESIGN CAPACITIES ARE THE SAME FOR MULTIPLE CAPACITIES (SEE PREVIOUS CALCS)

DESIGN BEARING STRENGTH (PLATE) $\Rightarrow \phi_v R_{n_{BEAR}} = 176.175$ k (PER ROD)

DESIGN SHEAR STRENGTH $\Rightarrow \phi_v R_{n_v} = 23.856$ k (PER ROD)

SHEAR/BEARING LOAD PARALLEL TO GUY (PER ROD), $V_{u_{||}}$

$$V_{u_{||}} = \frac{42.887 \text{ k}}{4} = 10.722 \text{ k}$$

$V_{u_{||}} = 10.722$ k < 176.175 k $= \phi_v R_{n_{BEAR}}$ [BEARING] (OK)

REVISED 3/14/16

WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY: B. Jones

CHECKED BY: JLS 08-13-15

PROJECT NAME:

PROJECT LOCATION:

PROJECT	PHASE	ORG
30119		

SHEET #: 4 OF

DATE:

SUBJECT: Guy Anchor C

$V_{u_{II}} = 10.722\text{ k} < 23.856\text{ k} = \phi_v R_{nv}$ [SHEAR] (OK)

SHEAR / BEARING PERPENDICULAR TO GUY (PER ROD), $V_{u_\perp}$

$V_{u_\perp} = \frac{7.499\text{ k}}{4} = 1.875\text{ k}$ ± 2

$V_{u_\perp} = 1.875\text{ k} < 176.175\text{ k} = \phi_v R_{n_{BEAR}}$ [BEARING] (OK)

$V_{u_\perp} = 1.875\text{ k} < 23.856\text{ k} = \phi_v R_{nv}$ [SHEAR] (OK)

COMBINED PERPENDICULAR + PARALLEL (RESULTANT) SHEAR/BEARING LOAD (PER ROD), $V_{u_{com}}$

$V_{u_{com}} = \frac{\left(\sqrt{(42.887\text{ k})^2 + (7.499\text{ k})^2}\right)}{4} = \frac{43.538\text{ k}}{4} = 10.885\text{ k}$

$V_{u_{com}} = 10.885\text{ k} < 176.175\text{ k} = \phi_v R_{n_{BEAR}}$ [BEARING] (OK)

$V_{u_{com}} = 10.885\text{ k} < 23.856\text{ k} = \phi_v R_{nv}$ [SHEAR] (OK)

REVISED 3/14/16

WCM 3-14-16

CHA COMPUTATION PAD

COMPLETED BY:	JWR	PROJECT / PHASE / ORG	30141 / 1002 /
CHECKED BY:	WCM	SHEET #:	1 OF
PROJECT NAME:	CT-HFD0063 Retrofit	DATE:	8/20/15
PROJECT LOCATION:		SUBJECT:	Guy Anchor C

Design Tension Check

AISC Table J3.2 ⇒ $F_{nt} = 0.75 F_u$

AISI 314 stainless steel Rod ⇒ $F_u = 80$ ksi (asm.matweb.com)

$F_{nt} = 0.75(80 \text{ ksi}) = 60$ ksi

$F_{nt}' = 1.3 F_{nt} - \frac{F_{nt}}{\phi F_{nv}} f_v \leq F_{nt}$ (AISC Eqn J3-3a)

Fv = V_{urod}/A_b = 10.885 k / 0.994 in^2 = 10.951 ksi

$F_{nv} = 0.4 F_u$ (AISC Table J3.2, threads not excluded from shear)

$F_{nv} = 0.4(80 \text{ ksi}) = 32$ ksi

$F_{nt}' = 1.3(60) - \frac{60}{(0.75)(32)}(10.951 \text{ ksi}) = 50.623 \text{ ksi}$

Design Tensile Strength:

$\phi R_{nten} = 0.75(F_{nt}' A_b) = 0.75(50.623 \text{ ksi})(0.994 \text{ in}^2) = 37.739 \text{ k}$

Tensile load (Per Rod)

$T_u = \frac{76.799 \text{ k}}{4} = 19.200 \text{ k}$

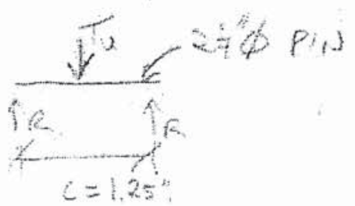
T_u = 19.200 k < 37.739 k = ϕR_{nten} [Tensile] (OK)

Threaded Rod & Turnbuckle & Clevis

Clevis:

tensile load = 19.200 k < 93.8^k = Available strength (AISC Table 15-3)

Pin:



CHA

REVISED 3/14/16
WCM 3-14-16

CHA COMPUTATION PAD

		PROJECT	PHASE	ORG
COMPLETED BY:	JMR	3019	0002	
CHECKED BY:	WCM	SHEET #: 2	OF	
PROJECT NAME:		DATE: 8/25/15		
PROJECT LOCATION:		SUBJECT:		

Pin, cont'd:

$$M_{max} = \frac{PL}{4} = \frac{(76.799\ k)(1.25)}{4} = 24.000\ k\text{-in}$$

$\phi M_n = \phi F_y Z$ Assume Pin is A36 Steel

$F_y = 36\ ksi$

$$Z = \frac{d^3}{6} = \frac{2.25^3}{6} = 1.898\ in^3$$

$\phi M_n = 0.9(36)(1.898) = 61.495\ k\text{-in}$

$M_{max} = 24.000 < 61.495 = \phi M_n$ OK

Threaded Rod:

$\phi R_n = \phi F_n A_b$ (AISC J3-1)

$A_b = \pi(0.875)^2 = 2.405\ in^2$

$F_n = 0.75 F_u = 0.75(58) = 43.5\ ksi$

$\phi R_n = 0.75(43.5\ ksi)(2.405\ in^2) = 78.46^k$

$T_u = 76.799^k < 78.46^k = \phi R_n$ OK

Check yielding:

$\phi R_n = \phi F_y A_g = 0.9(36\ ksi)(2.405\ in^2) = 77.922^k$

$T_u = 76.799^k < 77.922^k = \phi R_n$ OK

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WCM 3-14-16

CHA COMPUTATION PAD

		PROJECT	PHASE	ORG
COMPLETED BY:	JMR	3017		
CHECKED BY:	WCM	SHEET #: 3	OF	
PROJECT NAME:		DATE: 8/25/15		
PROJECT LOCATION:		SUBJECT:		

Turnbuckle check:

T_u = 76.799 k > 70.8 = ϕR_n (N.G.) (AISC Table 15-5)

*See attached sheet for Turnbuckle Re-Evaluation

Lower level Anchor Rods:

A325 $1\frac{1}{8}\phi$ threaded rods

F_{nt} = 90 ksi F_{nv} = 48 ksi (AISC Table J3.2)

$F_{nt}' = 1.3F_{nt} - \frac{F_{nt}}{\phi F_{nv}} f_v \leq F_{nt}$ (AISC Eqn. J3-3A)

f_v = 10.951 ksi

$F_{nt}' = 1.3(90) - \frac{90}{(0.75)(48)}(10.951) =$ 89.623 ksi < 90ksi

Design Tensile Strength:

$\phi R_{nTens} = \phi F_{nt}' A_b = 0.75(89.623)(0.994\,in^2) =$ 66.814 k

Tensile load (per Rod):

$T_u = \frac{66.814\text{ k}}{4} =$ 16.703 k

T_u = 16.703 k < 66.814 k = ϕR_{nTens} OK

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CHA COMPUTATION PAD

COMPLETED BY:	B. JONES
CHECKED BY:	WCM 3-14-16
PROJECT NAME:	
PROJECT LOCATION:	

PROJECT	PHASE	ORG
30119		

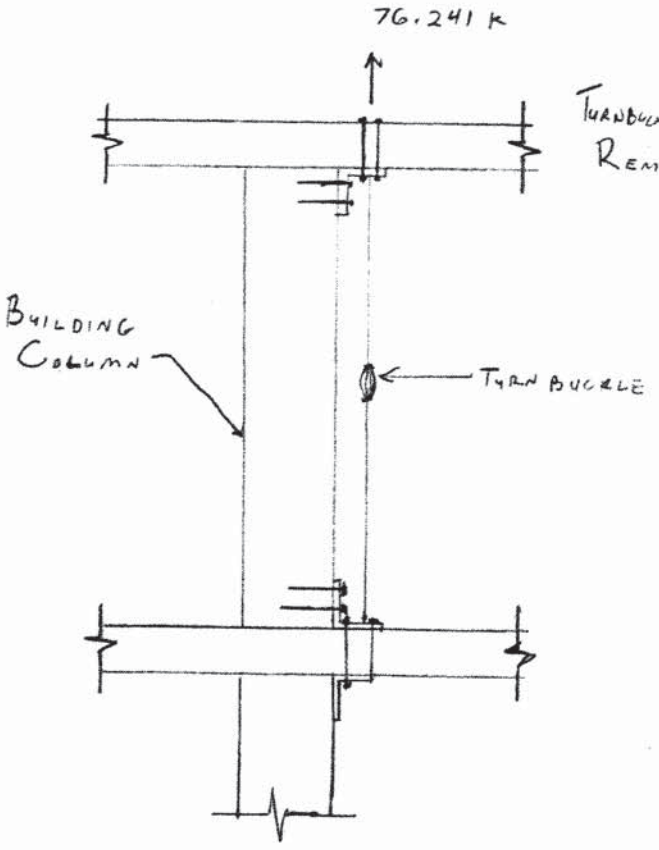
SHEET #: ____ OF ____

DATE: 3/14/16

SUBJECT:

TURNBUCKLE RE-CHECK

ASSUMPTION THAT 100% OF VERTICAL TENSION LOAD IS CARRIED THROUGH TURNBUCKLE IS TOO CONSERVATIVE BECAUSE ANCHOR SYSTEM IS ATTACHED TO BUILDING COLUMN.



TENSION: 76.799 K

TURNBUCKLE MAX STRENGTH: − 70.800 K

REMAINING LOAD: 5.999 K

PERCENTAGE OF TOTAL LOAD TO BE RESISTED BY COLUMN + BUILDING

$= \frac{5.999\ K}{76.241\ K} = 7.87\% < 8\%$ (OK)

ACCEPTABLE TO ASSUME TURNBUCKLE WILL BE LOADED W/ 92% OR LESS OF TENSION LOAD DURING EXTREME LOAD CASE THEREFORE TURNBUCKLE IS ACCEPTABLE

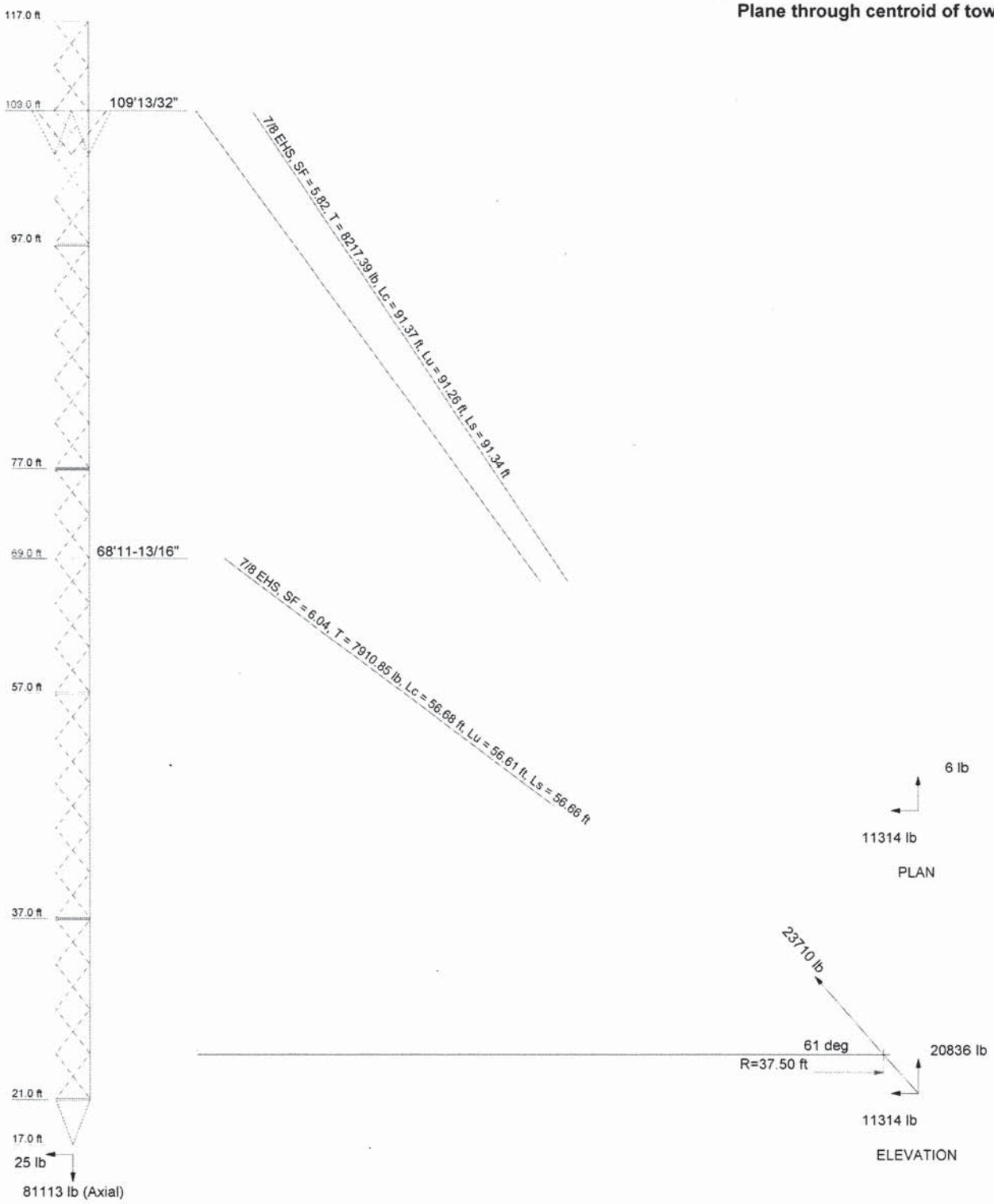
Guy Tensions and Tower Reactions

TIA-222-G - Dead Load

Dead Only

Anchor 'C'@37.5 ft Azimuth 240 deg Elev 25 ft

Plane through centroid of tower



CHA Consulting, Inc.	Job: ***30119-1003-28040***		
III Winners Circle	Project: ***CT-HFD0063***		
Albany, NY 12205	Client: Clearwire	Drawn by: Bryan Jones	App'd:
CHA, Inc. Phone: (518) 453-4500	Code: TIA-222-G	Date: 03/14/16	Scale: NTS
FAX:	Path:		Dwg No. E-6

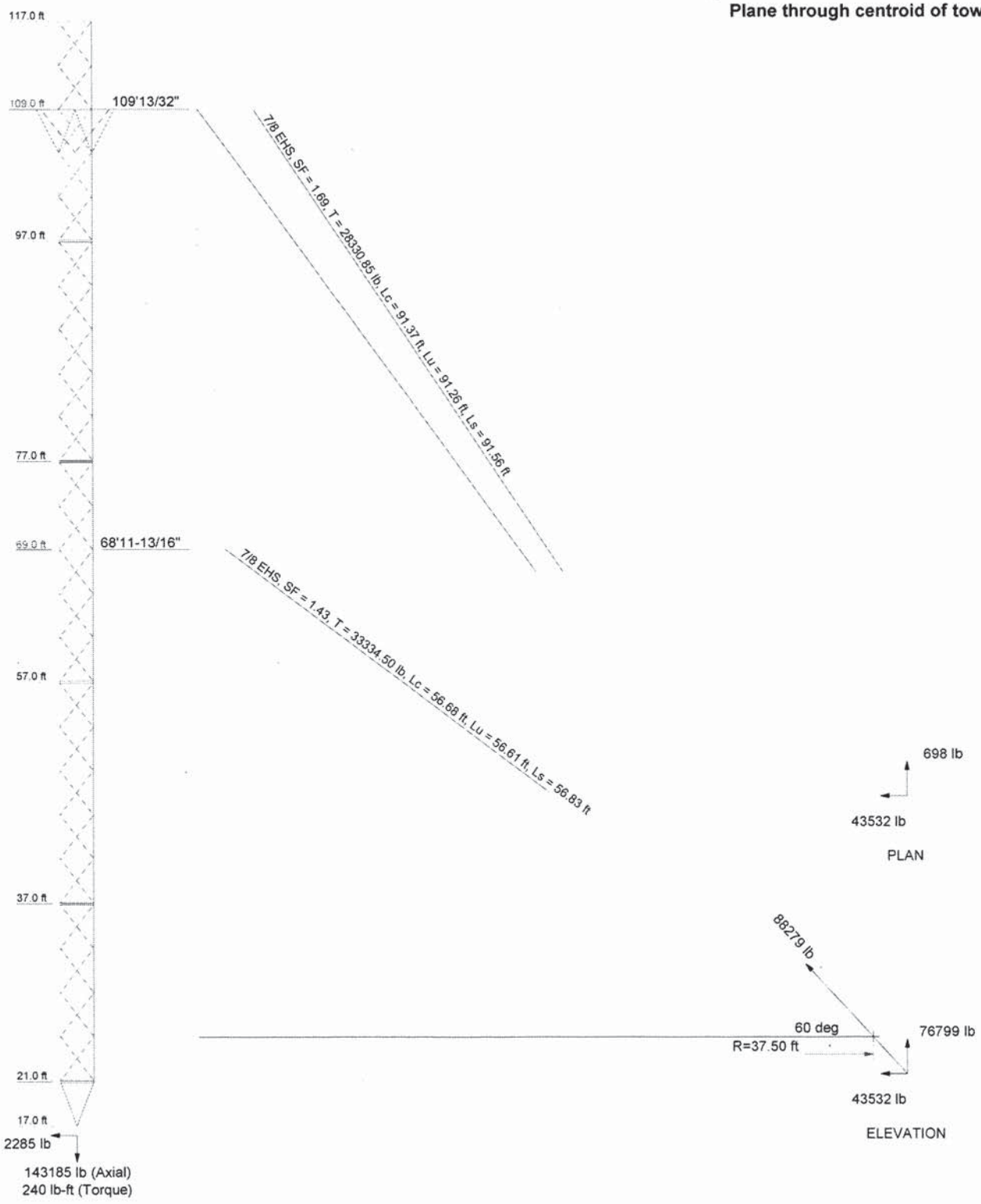
Guy Tensions and Tower Reactions

TIA-222-G - 105 mph/50 mph 1.0000 in Ice Exposure C

1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy

Anchor 'C'@37.5 ft Azimuth 240 deg Elev 25 ft

Plane through centroid of tower



CHA Consulting, Inc.	Job: ***30119-1003-28040***		
III Winners Circle	Project: ***CT-HFD0063***		
Albany, NY 12205	Client: Clearwire	Drawn by: Bryan Jones	App'd:
CHA, Inc. Phone: (518) 453-4500	Code: TIA-222-G	Date: 03/14/16	Scale: NTS
FAX:	Path:		Dwg No. E-6

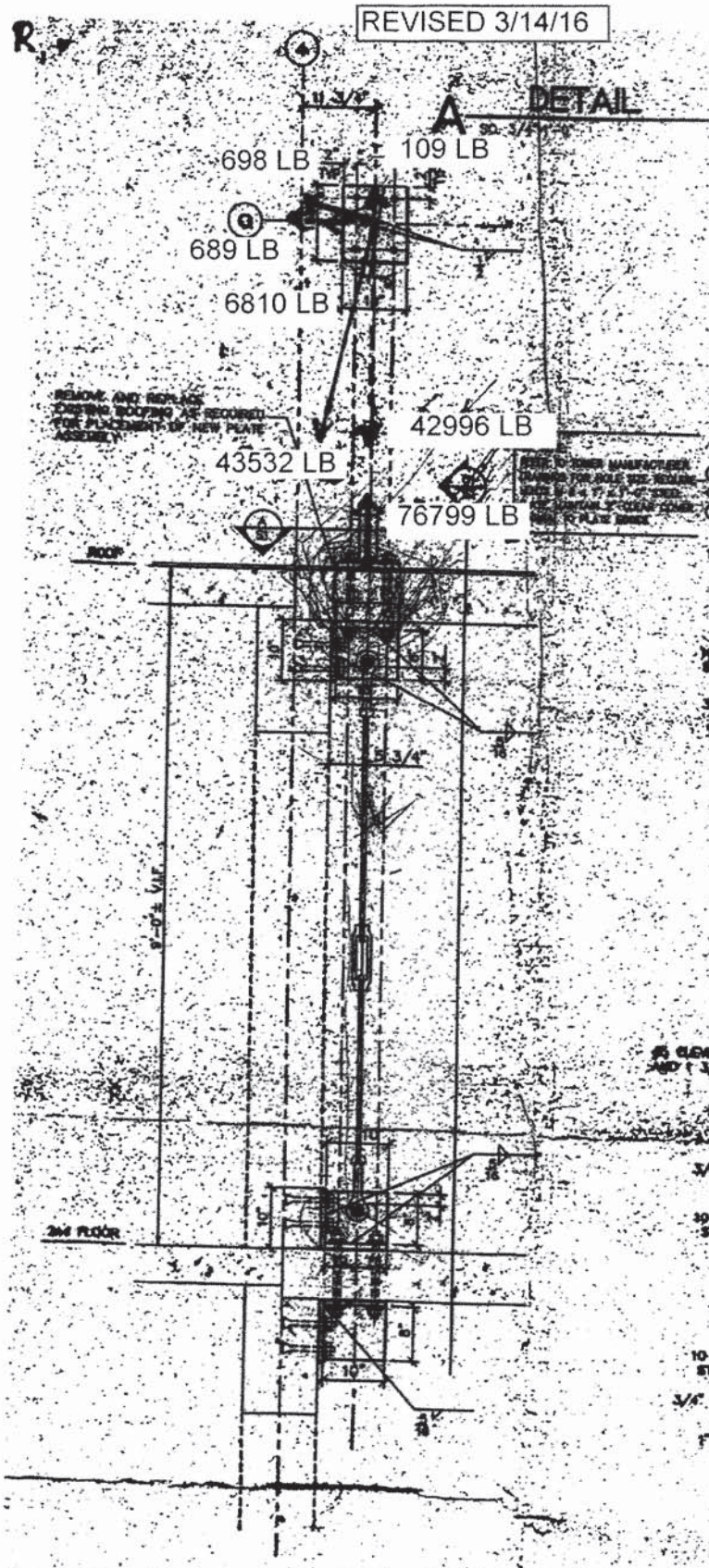
REVISED 3/14/16

R_1 = 43532 LB (cos 9°) = 42996 LB

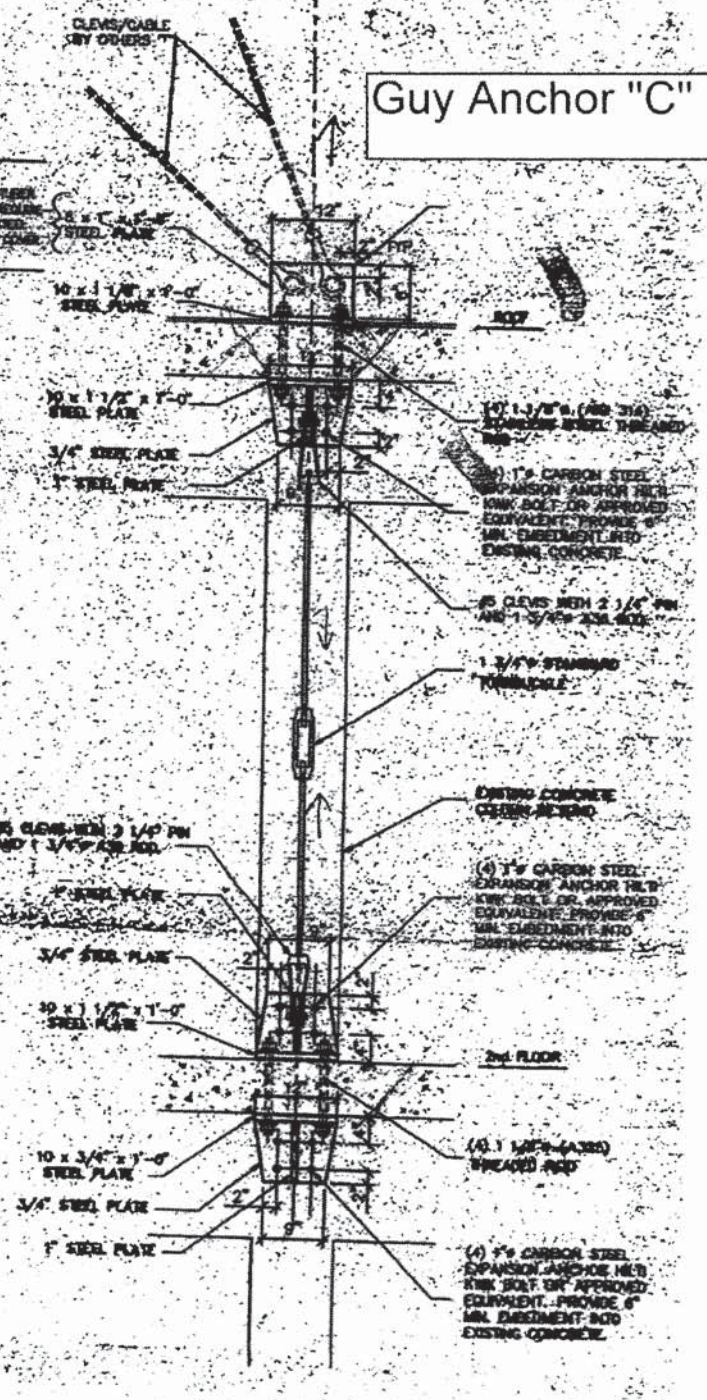
R_2 = 43532 LB (sin 9°) = 6810 LB

R_3 = 698 LB (sin 9°) = 109 LB

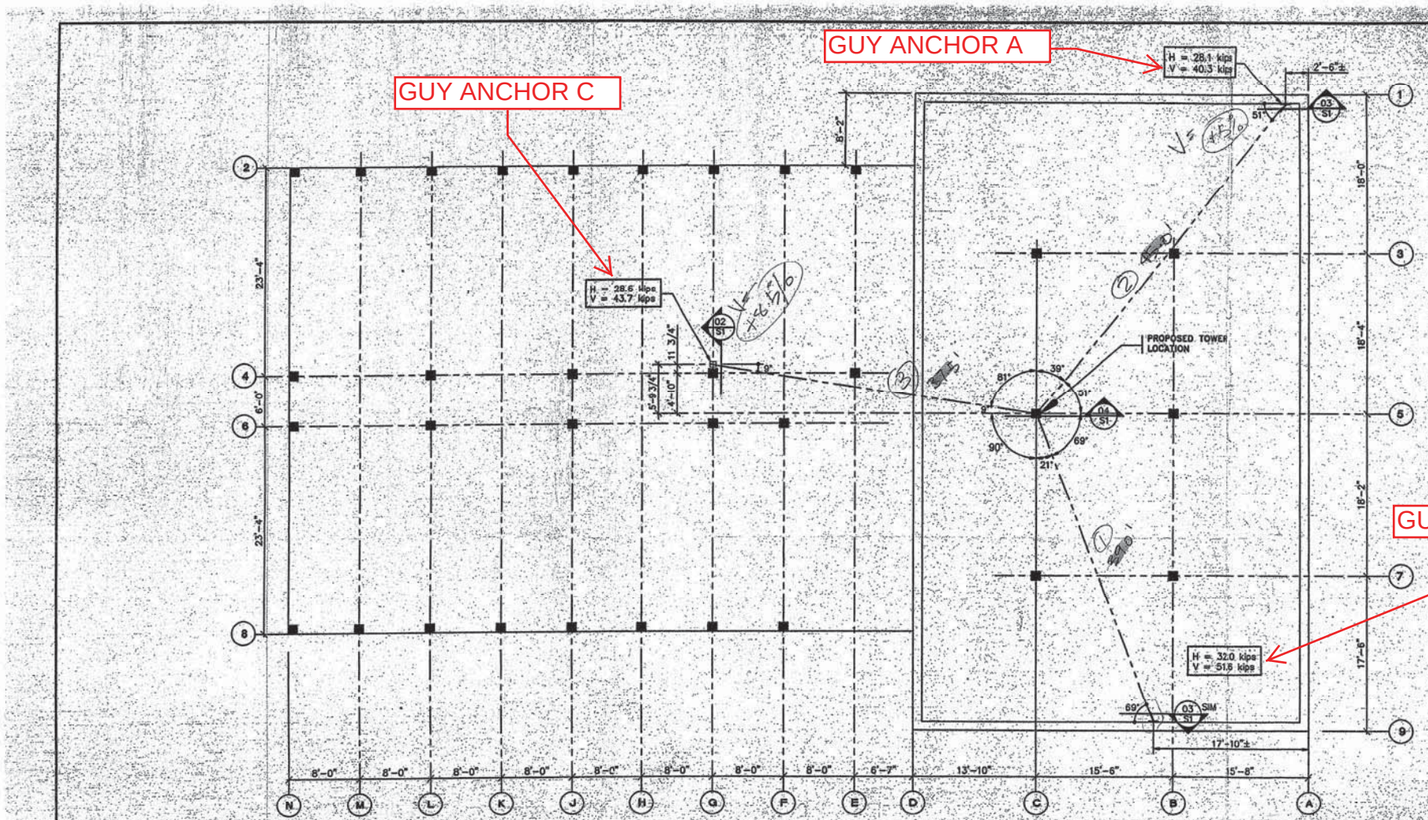
R_4 = 698 LB (cos 9°) = 689 LB



02 SECTION



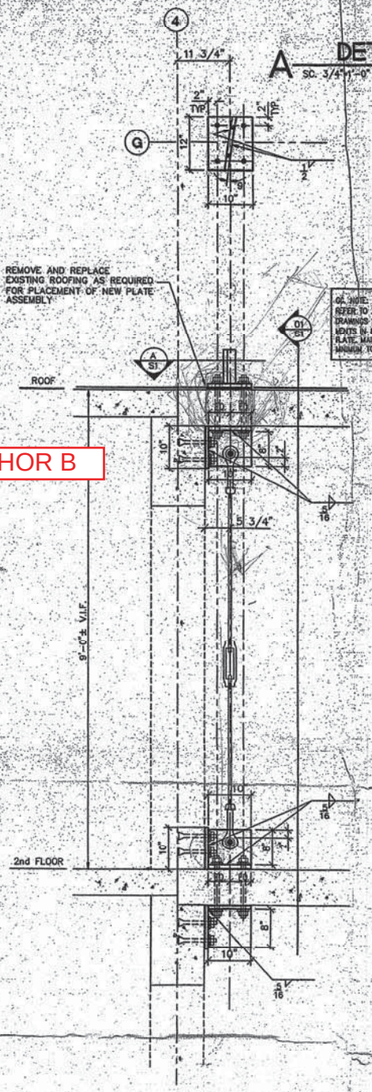
01 SECTION



ROOF FRAMING PLAN

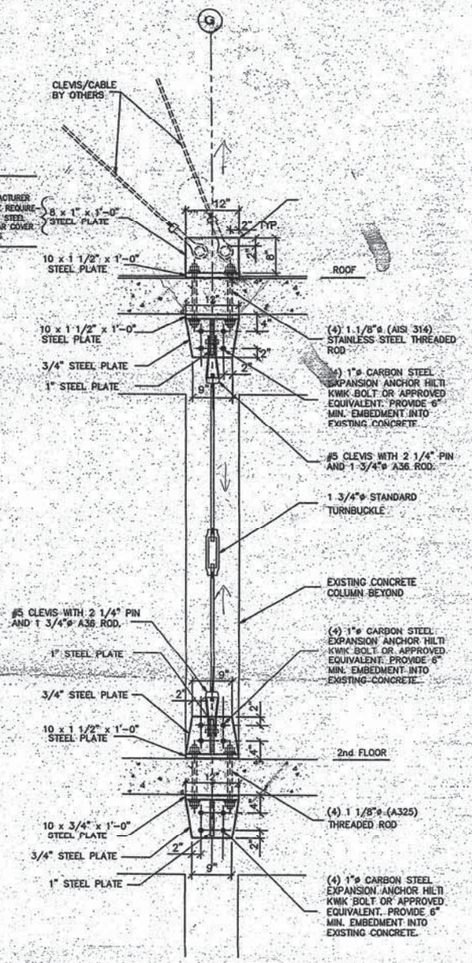
SC. 1/8"=1'-0"

1. VERIFY ALL DIMENSIONS IN THE FIELD PRIOR TO START OF NEW WORK.
2. FILL ALL VOIDS WHERE NEW PLATES COME IN CONTACT WITH EXISTING CONCRETE WITH NON-SHRINK GROUT FOR FULL BEARING.
3. ALL REACTIONS ARE FURNISED BY PAUL J. FORD AND CO. DATED 10/14/97. TOWER AND CABLE DESIGNS FURNISHED BY OTHERS
4. EXISTING DRAWING INFORMATION PER DRAWINGS PREPARED BY MYLCHREEST AND REYNOLDS CONSULTING ENGINEERS DATED MARCH 1946 AND DRAWINGS BY JOHN HUNTINGTON A.I.A DATED MAY 1952.



A DETAIL

SC. 3/4"=1'-0"

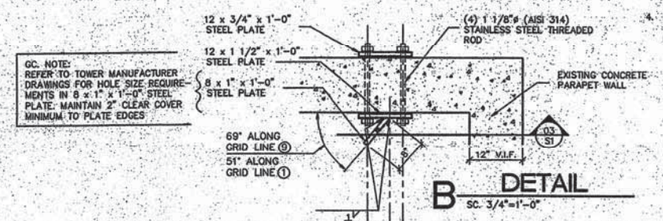


01 SECTION

SC. 3/4"=1'-0"

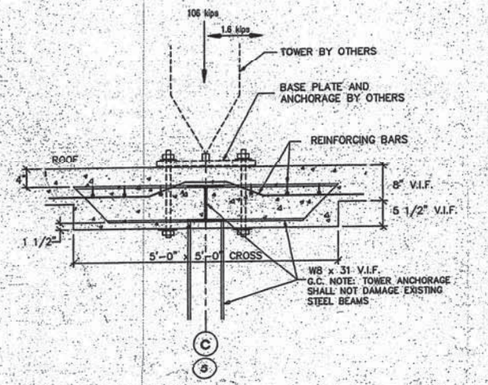
02 SECTION

SC. 3/4"=1'-0"



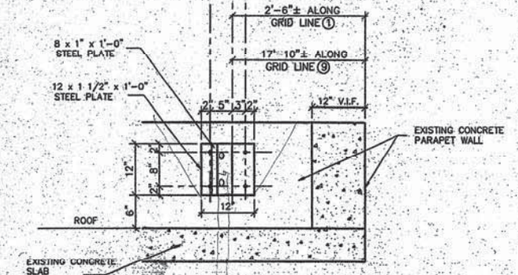
B DETAIL

SC. 3/4"=1'-0"



04 SECTION

SC. 3/4"=1'-0"



03 SECTION

SC. 3/4"=1'-0"

STEEL NOTES:

1. ALL STEEL SHALL BE ASTM-A36 (UNLESS OTHERWISE NOTED ON DRAWINGS).
2. ALL STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH THE AISC "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS – ALLOWABLE STRESS DESIGN AND PLASTIC DESIGN" (AISC/ASD – 89).
3. ALL EXTERIOR STEEL SHALL BE HOT DIPPED GALVANIZED.
4. ALL WELDS SHALL BE MADE ONLY BY WELDERS WHO HAVE BEEN QUALIFIED AS PRESCRIBED IN THE "STANDARD CODE OF WELDING IN BUILDING CONSTRUCTION" OF THE AMERICAN WELDING SOCIETY (AWS D1.1–90).
5. SUBMIT SHOP DRAWINGS, FOR REVIEW PRIOR TO FABRICATION.

rev. no.	by	date	remarks

CELLULAR ANTENNA •
14 – 20 ISHAM ROAD
WEST HARTFORD, CONNECTICUT

ROOF FRAMING PLAN

CIANCI & CIANCI
STRUCTURAL ENGINEERS
HARTFORD, CT (860)527-6415

job no.	scale	date	drawing no.
97.113.01	AS NOTED	10/22/97	S-1

RETROFIT CONSTRUCTION DRAWINGS

clearwire®
TECHNOLOGIES, INC.

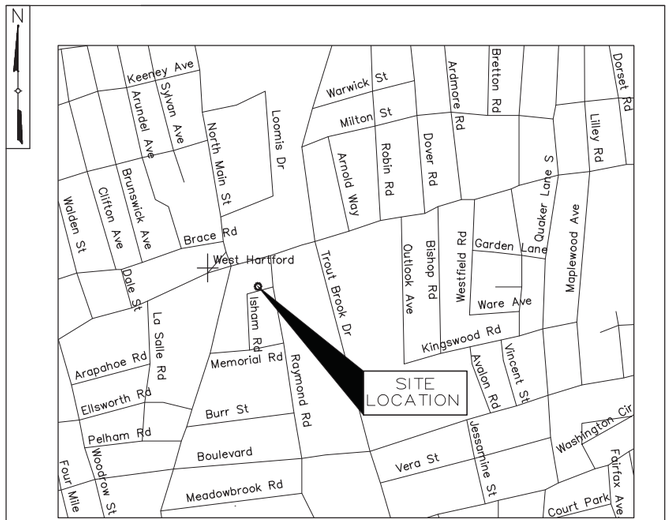
M & R GASSNER
HOST ID#: CT0765
CW ID#: CT-HFD0063A

SITE ADDRESS

20 ISHAM ROAD
WEST HARTFORD, CT 06107

SHT. NO.	DESCRIPTION	REV NO	REVISION DATE
T01	TITLE SHEET	1	03/14/16
C01	ROOF PLAN & GENERAL NOTES	1	03/14/16
C02	BUILDING & TOWER ELEVATION	1	03/14/16
C03	STRUCTURAL NOTES & DETAILS	1	03/14/16
C04	STRUCTURAL NOTES & DETAILS	1	03/14/16
C05	ANTENNA SCHEDULE & DETAILS	1	03/14/16
C06	EQUIPMENT SPECIFICATIONS & BILL OF MATERIALS	1	03/14/16

SHEET INDEX



FROM 100 CORPORATE PLACE, ROCKY HILL, CT.:

HEAD SOUTH ON CORPORATE PL TOWARD WEST ST. (322 FT) TURN LEFT AT WEST ST. (0.2 MI) TURN RIGHT TO MERGE ONTO I-91 N TOWARD MARTFORD. (8.7 MI) TAKE EXIT 32A ON THE LEFT TO MERGE ONTO I-84 W TOWARD WATERBURY. (4.9 MI) TAKE EXIT 43 TOWARD PARK RD/W HARTFORD CENTER. (0.4 MI) MERGE ONTO TROUT BROOK CON. (0.1 MI) TURN LEFT AT PARK RD. (443 FT) TAKE THE 1ST RIGHT ONTO RAYMOND RD. (0.5 MI) TURN LEFT AT ISHAM RD. DESTINATION WILL BE ON THE LEFT

VICINITY MAP — NO SCALE

PROJECT DESCRIPTION:	PROPOSED ADDITION OF (1) DISH ANTENNA ON EXISTING TOWER. ADDITION WILL REQUIRE REATTACHMENT OF EXISTING GUYS AND ADDITION OF NEW GUYS TO NEW TORQUE ARM. SITE IS AN UNMANNED TELECOMMUNICATIONS FACILITY.
SITE NAME:	M & R GASSNER
CW ID#:	CT-HFD0063A
SITE ADDRESS:	20 ISHAM ROAD WEST HARTFORD, CT 06107
COUNTY:	HARTFORD
COORDINATES:	N 41.761417° (NAD 83) W -72.740694° (NAD 83)
PROPERTY OWNER:	M & R GASSNER
CONTACT PERSON:	PHIL COTE (860) 794-1142
APPLICANT:	CLEARWIRE TECHNOLOGIES, INC. 5808 LAKE WASHINGTON BLVD. NE STE. 300 KIRKLAND, WA 98033
ENGINEER:	CHA CONSULTING, INC. 16 MAIN STREET WEST SUITE 830 ROCHESTER, NY 14614-1607 CHRISTOPHER J.B. JEDRICH, P.E. (585) 262-2640

PROJECT SUMMARY

clearwire®
TECHNOLOGIES, INC.
5808 LAKE WASHINGTON
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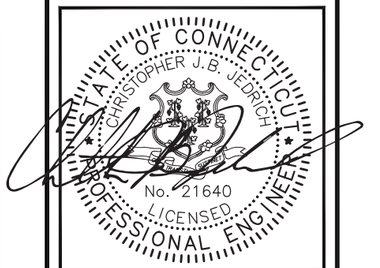
Rochester, NY 14614-1607
Main: (585) 262-2640 • www.chacompanies.com

CHA PROJECT NO:
30119 – 1003

NO.	SUBMITTAL		
0	08/27/15	ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ
1	03/14/16	RE-ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ



SITE NAME:
M & R GASSNER

CW ID#:
CT-HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T01

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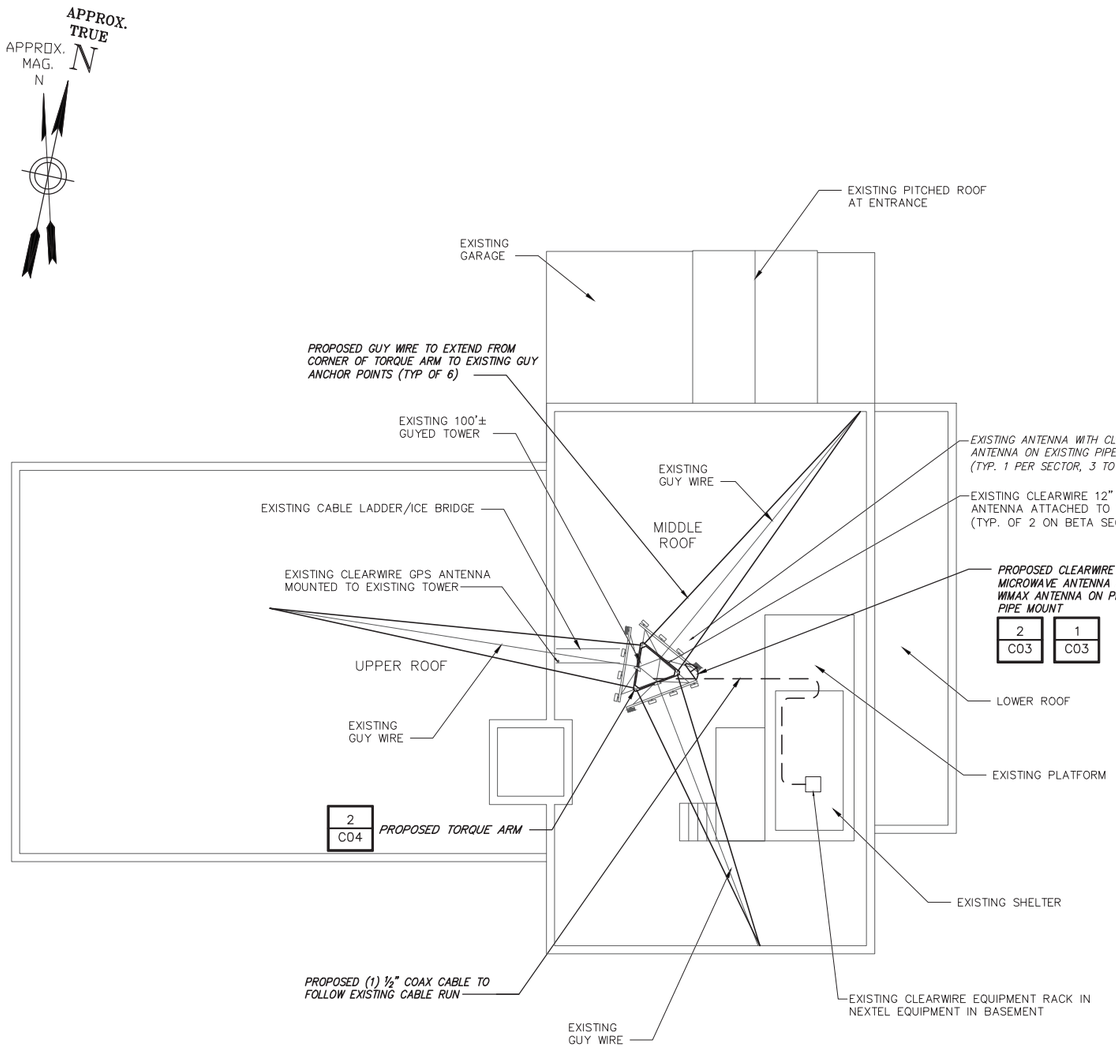

IN NO CASE SHALL CLEARWIRE'S MICROWAVE OR WIMAX ANTENNAS BE INSTALLED SUCH THAT THE TIP–TO–TIP DISTANCE BETWEEN ANY CLEARWIRE ANTENNA AND ANY SPRINT ANTENNA IS LESS THAN 2 FEET. IN ADDITION, NO MICROWAVE ANTENNA SHALL BE LOCATED WITHIN 2 FEET OF SPRINT'S RAD CENTER AND ORIENTED SUCH THAT THE MICROWAVE AZIMUTH CROSSES SPRINT'S ANTENNA AZIMUTHS FOR THAT SECTOR OR IS AIMED DIRECTLY AT ANY SPRINT ANTENNA.

1 / – ROOF PLAN

GRAPHIC SCALE

20 0 10 20

IN FEET

GENERAL NOTES

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO EXAMINE ALL PLAN SHEETS AND SPECIFICATIONS AND COORDINATE HIS WORK WITH THE WORK OF ALL OTHER CONTRACTORS TO ENSURE THAT WORK PROGRESSION IS NOT INTERRUPTED.
2. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING A NEAT AND ORDERLY SITE, YARD AND GROUNDS. REMOVE AND DISPOSE OFF SITE ALL RUBBISH, WASTE MATERIALS, LITTER, AND ALL FOREIGN SUBSTANCES. REMOVE PETRO–CHEMICAL SPILLS, STAINS AND OTHER FOREIGN DEPOSITS. RAKE GROUNDS TO A SMOOTH EVEN–TEXTURED SURFACE.
3. THE OWNER OR OWNER'S REPRESENTATIVE SHALL BE NOTIFIED IN WRITING OF ANY CONDITIONS THAT VARY FROM THOSE SHOWN ON THE PLANS. THE CONTRACTOR'S WORK SHALL NOT VARY FROM THE PLANS WITHOUT THE EXPRESSED APPROVAL OF THE OWNER OR OWNER'S REPRESENTATIVE.
4. THE CONTRACTOR IS INSTRUCTED TO COOPERATE WITH ANY AND ALL OTHER CONTRACTORS PERFORMING WORK ON THIS JOB SITE DURING THE PERFORMANCE OF THIS CONTRACT.
5. THE CONTRACTOR SHALL RESTORE ALL PUBLIC OR PRIVATE PROPERTY DAMAGED OR REMOVED TO AT LEAST AS GOOD OF CONDITION AS BEFORE DISTURBED AS DETERMINED BY THE OWNER OR OWNER'S REPRESENTATIVE.
6. THE CONTRACTOR SHALL COMPLY WITH ALL REQUIRED PERMITS.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING, AND INCURRING THE COST OF ALL REQUIRED PERMITS, INSPECTIONS, CERTIFICATES, ETC.
8. ALL UTILITY WORK INVOLVING CONNECTIONS TO EXISTING SYSTEMS SHALL BE COORDINATED WITH THE OWNER OR OWNER'S REPRESENTATIVE AND THE UTILITY OWNER. NOTIFY THE OWNER OR OWNER'S REPRESENTATIVE AND THE UTILITY OWNER BEFORE EACH AND EVERY CONNECTION TO EXISTING SYSTEMS IS MADE.

BASEMAP NOTES:

1. BASEMAP FROM A FIELD VISIT PERFORMED BY CLOUGH HARBOUR & ASSOCIATES ON NOVEMBER 4, 2009, AND DOES NOT REPRESENT AN ACTUAL FIELD SURVEY.

GRAPHIC SCALE

5 0 2.5 5

IN FEET

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Rochester, NY 14614-1607
Main: (585) 262-2640 • www.chacompanies.com

CHA PROJECT NO:
30119 – 1003

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1	03/14/16	RE–ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ

STATE OF CONNECTICUT
CHRISTOPHER J.B. JEDRICH
No. 21640
LICENSED PROFESSIONAL ENGINEER

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

SITE NAME:
M & R GASSNER

CW ID#:
CT–HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
BUILDING & TOWER ELEVATION

SHEET NUMBER
C01

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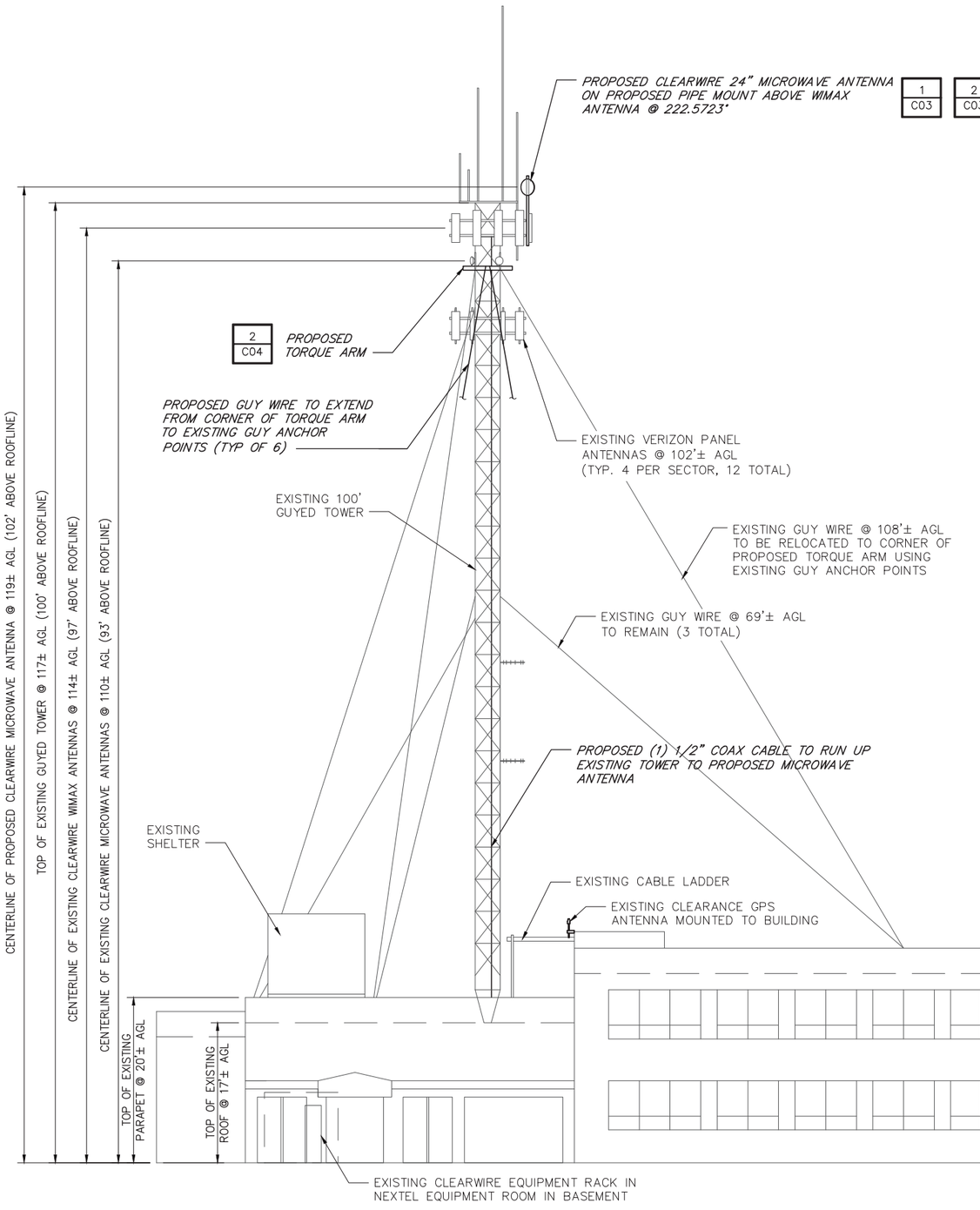
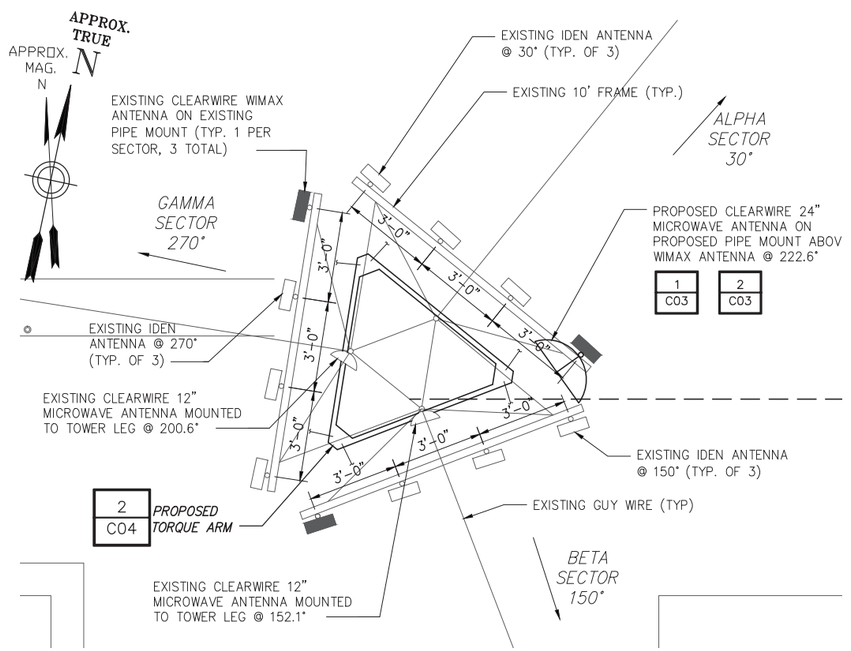


1 / – NORTH BUILDING & TOWER ELEVATION
NO SCALE



2 / – PROPOSED MICROWAVE ANTENNA CONFIGURATION
NO SCALE

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CW ID#:
CT-HFD0063A

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W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
BUILDING & TOWER ELEVATION

SHEET NUMBER
C02

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GENERAL NOTES

1. ALL DIMENSIONS TO, OF, AND ON EXISTING BUILDINGS SHALL BE VERIFIED IN FIELD BY CONTRACTOR WITH ALL DISCREPANCIES REPORTED TO THE ENGINEER IN WRITING.
2. DO NOT CHANGE SIZE NOR SPACING OF STRUCTURAL ELEMENTS.
3. DETAILS SHOWN ARE TYPICAL; SIMILAR DETAILS APPLY TO SIMILAR CONDITIONS UNLESS OTHERWISE NOTED.
4. THESE DRAWINGS DO NOT INCLUDE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY.
5. BRACE STRUCTURES UNTIL ALL STRUCTURAL ELEMENTS NEEDED FOR STABILITY ARE INSTALLED. THESE ELEMENTS ARE AS FOLLOWS: LATERAL BRACING, ANCHOR BOLTS, ETC.
6. DETERMINE EXACT LOCATION OF EXISTING UTILITIES, GROUNDS, DRAINS, DRAIN PIPES, VENTS, ETC. BEFORE COMMENCING WORK.
7. INCORRECTLY FABRICATED, DAMAGED, OR OTHERWISE MISFITTING OR NONCONFORMING MATERIALS OR CONDITIONS SHALL BE REPORTED TO THE OWNER PRIOR TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE APPROVAL.
8. EACH CONTRACTOR SHALL COOPERATE WITH THE OWNER'S REPRESENTATIVE, AND COORDINATE HIS WORK WITH THE WORK OF OTHERS.
9. CONTRACTOR TO FOLLOW ALL STATE, LOCAL AND NATIONAL CODES AS APPLICABLE.

DESIGN DATA

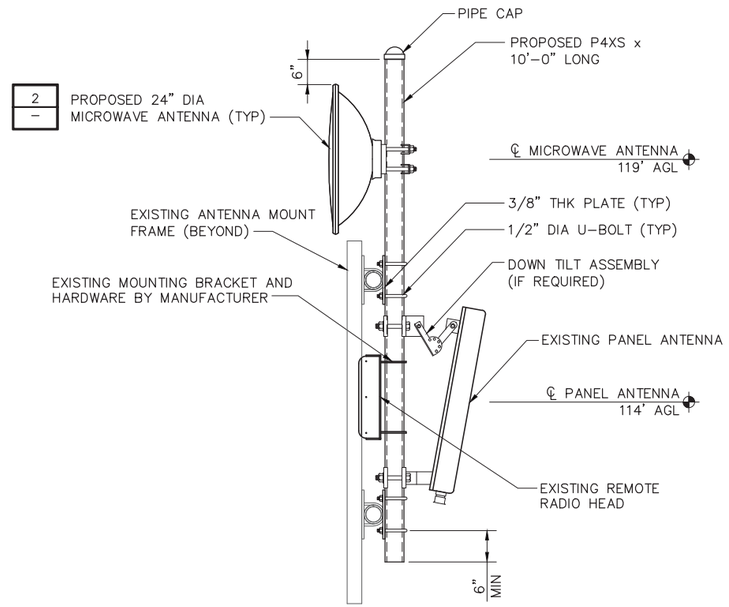
LIVE LOADS: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE
WIND LOADS: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE
ICE LOADS: 1/2" RADIAL ON ALL COMPONENTS & CABLE
SNOW LOAD: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE
SEISMIC LOADS: PER STATE, LOCAL AND NATIONAL CODES AS APPLICABLE

ANTENNA SUPPORT BRACKET NOTES

1. DESIGN RESPONSIBILITY OF ANTENNA MOUNTING BRACKETS, POLES AND ALL COMPONENTS THERE OF AND ATTACHMENT THERE TO SHALL BE THE RESPONSIBILITY OF THE MANUFACTURER. MFR. SHALL PROVIDE TO THE ENGINEER FOR APPROVAL, DRAWINGS DETAILING ALL COMPONENTS OF THE ASSEMBLY, INCLUDING CONNECTIONS, DESIGN LOADS, AND ALL OTHER PERTINENT DATA. ALL SUBMISSIONS SHALL BEAR THE STAMP AND SIGNATURE OF A PROFESSIONAL ENGINEER REGISTERED IN THE STATE THE WORK IS BEING PERFORMED.
2. BRACKETS SHALL BE DESIGNED TO SUPPORT CURRENT AND FUTURE PANEL ANTENNAS AND COAXIAL CABLES AS SHOWN.

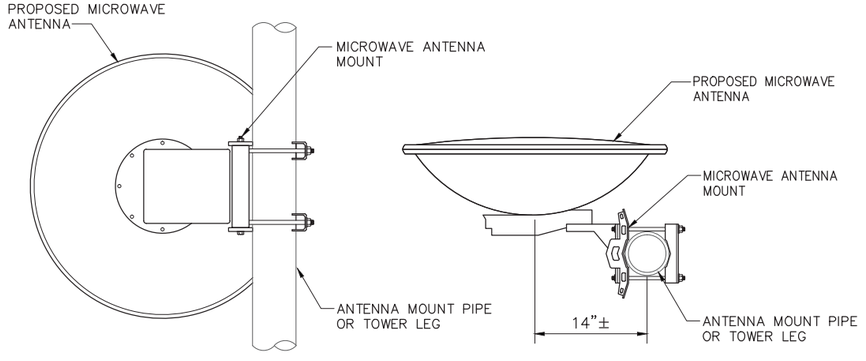
STRUCTURAL STEEL NOTES

1. STRUCTURAL STEEL SHALL CONFORM TO THE LATEST EDITION OF THE AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS". ALL W-SHAPES SHALL BE ASTM A992. ALL STEEL PIPE SHALL BE ASTM A53 GRADE B. ALL RECTANGULAR HOLLOW STRUCTURAL STEEL SHALL BE ASTM A500. ALL OTHER STEEL SHALL BE ASTM A-36.
2. ALL INTERIOR STRUCTURAL STEEL USED SHALL BE, WHEN DELIVERED, FINISHED WITH ONE COAT FABRICATOR'S NON-LEAD, RED OXIDE PRIMER. PRIMING SHALL BE PERFORMED AFTER SHOP FABRICATION TO THE GREATEST EXTENT POSSIBLE. ALL DINGS, SCRAPES, MARS, AND WELDS IN THE PRIMED AREAS SHALL BE REPAIRED BY FIELD TOUCHUP PRIOR TO COMPLETION OF THE WORK.
3. ALL EXTERIOR STEEL WORK SHALL BE GALVANIZED IN ACCORDANCE WITH SPECIFICATION ASTM A123 UNLESS OTHERWISE NOTED. GALVANIZING SHALL BE PERFORMED AFTER SHOP FABRICATION TO THE GREATEST EXTENT POSSIBLE. ALL DINGS, SCRAPES, MARS, AND WELDS IN THE GALVANIZED AREAS SHALL BE REPAIRED BY FIELD TOUCHUP PRIOR TO COMPLETION OF THE WORK USING ZRC COLD GALVANIZING COMPOUND OR APPROVED EQUAL.
4. DO NOT PLACE HOLES THROUGH STRUCTURAL STEEL MEMBERS EXCEPT AS SHOWN AND DETAILED ON STRUCTURAL DRAWINGS.
5. CONNECTIONS:
   A. ALL WELDING SHALL BE DONE BY A CERTIFIED WELDER USING E70XX ELECTRODES AND WELDING SHALL CONFORM TO AISC AND AWS D1.1. WHERE FILLET WELD SIZES ARE NOT SHOWN, PROVIDE THE MINIMUM SIZE PER TABLE J2.4 IN THE AISC "MANUAL OF STEEL CONSTRUCTION ", 9TH EDITION. AT THE COMPLETION OF WELDING, ALL DAMAGE TO GALVANIZED COATING SHALL BE REPAIRED.
   B. BOLTED CONNECTIONS SHALL USE BEARING TYPE GALVANIZED ASTM A325 BOLTS (3/4" DIA.) AND SHALL HAVE MINIMUM OF TWO BOLTS UNLESS NOTED OTHERWISE.
   C. NON-STRUCTURAL CONNECTIONS FOR STEEL GRATING MAY USE 5/8" DIA. GALVANIZED ASTM A 307 BOLTS UNLESS NOTED OTHERWISE.
   D. CONNECTION DESIGN BY FABRICATOR WILL BE SUBJECT TO REVIEW AND APPROVAL BY ENGINEER.
   E. AT ALL BOLTED CONNECTIONS, PROVIDE A NUT AND A WASHER CONFORMING TO ASTM F436. PROVIDE A WASHER MATCHING THE BOLT SIZE UNDER ALL BOLT HEADS AND NUTS THAT WILL BE TURNED IN TIGHTENING THE CONNECTION. TIGHTEN TO AISC "SNUGTIGHT" CRITERIA.



2 — PROPOSED 24" DIA MICROWAVE ANTENNA (TYP)

1 — ALPHA SECTOR ANTENNA MOUNTING DETAIL
SCALE: NTS



2 — MICROWAVE ANTENNA MOUNTING DETAIL
SCALE: NTS

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SHEET TITLE
STRUCTURAL NOTES & DETAILS

SHEET NUMBER
C03

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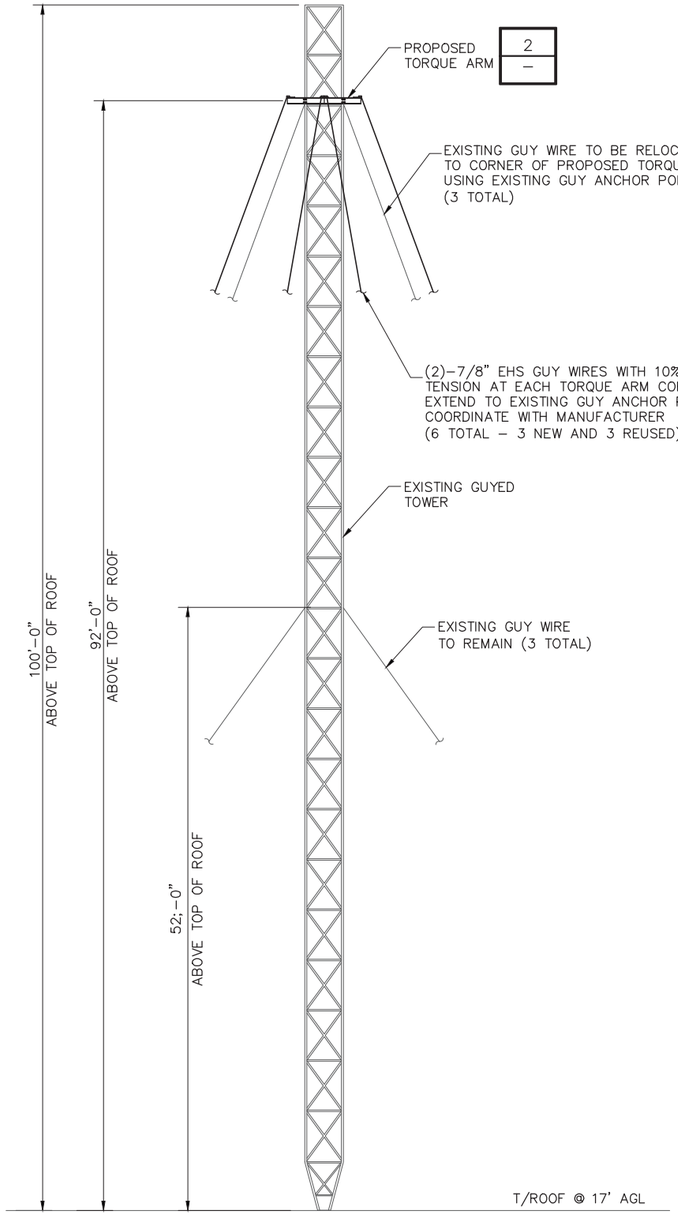
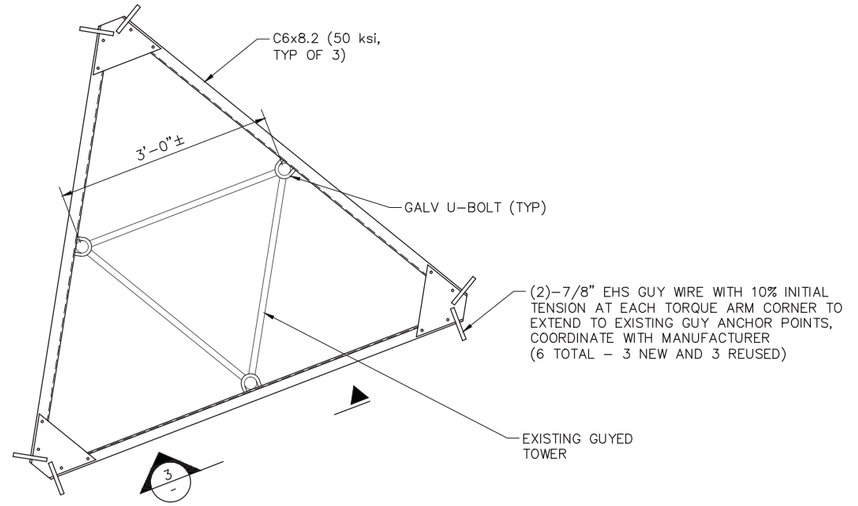


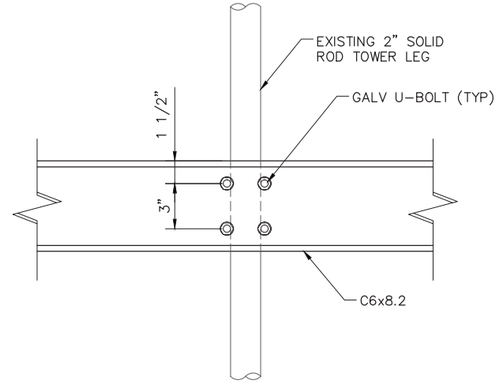
1 – TOWER ELEVATION
SCALE: NTS



2 – TORQUE ARM PLAN
SCALE: NTS

NOTE:

CONTACTOR TO COORDINATE TORQUE ARM DESIGN AND FABRICATION WITH VALMONT STRUCTURES. TOWER FACE WIDTH IS 3'–0" AND CHANNEL SIZE IS C6x8.2 w/A YIELD STRESS OF 50 ksi. TORQUE ARM STYLE IS BAT WING. THIS INFORMATION IS TO BE PROVIDED TO VALMONT STRUCTURES FOR FABRICATION OF TORQUE ARM. TORQUE ARM TO BE DESIGNED TO RESIST MAXIMUM GUY FORCE TENSION OF 20 k.



3 – SECTION "A"
SCALE: NTS

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SHEET TITLE
STRUCTURAL DETAILS

SHEET NUMBER
C04

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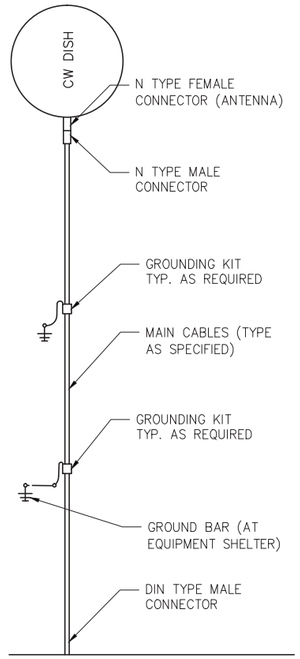
MICROWAVE BACKHAUL						
LINE	BAND 1	BAND 2	BAND 3	BAND 4		COMMENT
1	GREY					CLOSEST TO 0° TN
2	GREY	GREY				2nd CLOCKWISE DISH
3	GREY	GREY	GREY			3rd CLOCKWISE DISH ETC.
4	GREY	GREY	GREY	GREY		
5	GREY	GREY	GREY	GREY	ETC.	
DPRM	GREY'S (AS ABOVE)		RED			
1+1	GREY'S (AS ABOVE)		RED			

SAMSUNG WIMAX					
SECTORS	1st DAP	2nd DAP			COMMENT
ALPHA	RED	VIOLET			FIBER/POWER – CLOSEST TO 0° TN
BETA	BLUE	WHITE			FIBER/POWER
GAMMA	YELLOW	ORANGE			FIBER/POWER
RF JUMPERS	DAP TO ANTENNA (COLORS DEFINED ABOVE)				
1st JUMPER	SECTOR COLOR				
2nd JUMPER	SECTOR COLOR	SECTOR COLOR			
3rd JUMPER	SECTOR COLOR	SECTOR COLOR	SECTOR COLOR		
4th JUMPER	SECTOR COLOR	SECTOR COLOR	SECTOR COLOR	SECTOR COLOR	

1 – ANTENNA COLOR CODING

NO SCALE



NOTES:
1. SEE LAYOUT DRAWINGS FOR DISH LOCATION.
2. DO NOT INSTALL DISH GROUND KIT ON CABLE BEND.
3. CW PANEL PIPE MAST TO BE GROUNDED.

2 – CABLE INSTALLATION DIAGRAM

NO SCALE

PROPOSED CLEARWIRE MICROWAVE DISH ANTENNA AND CABLE SCHEDULE															
SECTOR	ANTENNA	AZIMUTH (TN)	DOWN TILT–M	DOWN TILT–E	RAD CENTER (FT. AGL)	MAKE	MODEL	FEED	CABLE SIZE	CABLE MANUF.	CABLE LENGTH	JUMPER SIZE	JUMPER MANUF.	JUMPER MODEL	JUMPER LENGTH–TOP	JUMPER LENGTH–BOT
ALPHA	MW DISH	222.57°	–	–	119'–0"	ANDREW	VHLP2–18	BACK	1/2"	EUPEN EC4–50	205'±	1/2"	–	–	–	–

EXISTING CLEARWIRE MICROWAVE DISH ANTENNA AND CABLE SCHEDULE															
SECTOR	ANTENNA	AZIMUTH (TN)	DOWN TILT–M	DOWN TILT–E	RAD CENTER (FT. AGL)	MAKE	MODEL	FEED	CABLE SIZE	CABLE MANUF.	CABLE LENGTH	JUMPER SIZE	JUMPER MANUF.	JUMPER MODEL	JUMPER LENGTH–TOP	JUMPER LENGTH–BOT
BETA	MW DISH	152.1°	–	–	110'–0"	ANDREW	VHLP1–23	BACK	1/2"	EUPEN EC4–50	195'±	1/2"	–	–	–	–
BETA	MW DISH	200.6°	–	–	110'–0"	ANDREW	VHLP1–23	BACK	1/2"	EUPEN EC4–50	195'±	1/2"	–	–	–	–

3 – PROPOSED AND EXISTING ANTENNA AND CABLE SCHEDULES

NO SCALE

clearwire®
TECHNOLOGIES, INC.
5808 LAKE WASHINGTON BLVD. NE, STE. 300
KIRKLAND, WA 98033
OFFICE: (425) 216–7600
FAX: (425) 216–7900

CHA
Powers Building, 16 West Main Street, Suite 830
Rochester, NY 14614-1607
Main: (585) 262-2640 • www.chacompanies.com

CHA PROJECT NO:
30119 – 1003

NO.	SUBMITTAL		
0	08/27/15	ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ
1	03/14/16	RE–ISSUED FOR CONSTRUCTION	
	BY: BWJ/MCF	CHK: JSS	APP'D: CJBJ

STATE OF CONNECTICUT
CHRISTOPHER J.B. JEDRICH
No. 21640
LICENSED PROFESSIONAL ENGINEER

SITE NAME:
M & R GASSNER

CW ID#:
CT–HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
ANTENNA SCHEDULE & DETAILS

SHEET NUMBER
C05

File: V:\PROJECTS\ANY\K4\30119\CADD_ACAD\CT-HFD0063A_C05.DWG Saved: 8/27/2015 3:56:21 PM PLotted: 3/14/2016 2:58:38 PM User: Farone, Michael

Product Specifications

COMMSCOPE®

POWERED BY ANDREW.

VHLP2-18-2GR/B

0.6 m | 2 ft ValuLine® High Performance Low Profile Antenna, single-polarized, 17.700–19.700 GHz, PBR220, gray antenna, polymer gray radome without flash, standard pack–one-piece reflector

General Specifications

Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Diameter, nominal	0.6 m | 2 ft
Packing	Compact pack
Radome Color	Gray
Radome Material	Polymer
Reflector Construction	One-piece reflector
Antenna Input	PBR220
Antenna Color	Gray
Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Diameter, nominal	0.6 m | 2 ft
Flash Included	No
Polarization	Single

Electrical Specifications

Operating Frequency Band	17.700 – 19.700 GHz
Beamwidth, Horizontal	2.1 °
Beamwidth, Vertical	2.1 °
Cross Polarization Discrimination (XPD)	30 dB
Electrical Compliance	Brazil Anatel Class 2 | Canada SRSP 317.8 Part A | ETSI 302 217 Class 3 | US FCC Part 101A
Front-to-Back Ratio	66 dB
Gain, Low Band	38.4 dBi
Gain, Mid Band	38.9 dBi
Gain, Top Band	39.1 dBi
Operating Frequency Band	17.700 – 19.700 GHz
Radiation Pattern Envelope Reference (RPE)	7204B
Return Loss	17.7 dB
VSWR	1.30

Mechanical Specifications

Fine Azimuth Adjustment	±15°
Fine Elevation Adjustment	±15°
Mounting Pipe Diameter	48 mm–115 mm | 1.9 in–4.5 in
Net Weight	11 kg | 25 lb

1 / – 2 FT MW ANTENNA SPEC SHEET (OR EQUIVALENT)

NO SCALE

BILL OF MATERIALS

ITEM	DESCRIPTION	QTY (EA)	DIMENSIONS	WEIGHT (LBS)	PART/MODEL #
1	CW DISH ANTENNA – ALPHA SECTOR	1	2.5'	6LBS + MOUNTING HW	ANDREW VHLP2.5–1835. OR EQUIVALENT
2	MAIN CABLE RUNS BTS TO MW DISHES, ALPHA SECTOR	1	210 FEET	N/A	EUPEN EC4–50 COAX
3	COAX JUMPERS	TBD	6 FEET	N/A	L4–PDMDM–6 (OR EQUIVALENT)
4	CONNECTORS, GROUND KITS, WEATHERPROOFING	TBD	N/A	N/A	AS NEEDED (DIN, N, RG45 TYP.)
5	3/4" – EHS GUY WIRE	3	N/A	N/A	TBD

2 / – BILL OF MATERIALS (BOM)

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STATE OF CONNECTICUT
CHRISTOPHER J.B. JEDRICH
No. 21640
LICENSED PROFESSIONAL ENGINEER

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

SITE NAME:
M & R GASSNER

CW ID#:
CT–HFD0063A

SITE ADDRESS:
20 ISHAM ROAD
W. HARTFORD, CT 06107
HARTFORD COUNTY

SHEET TITLE
EQUIPMENT SPECIFICATIONS

SHEET NUMBER
C06