EVERSOURCE ENERGY

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

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

October 13, 2020

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

RE: **Notice of Exempt Modification**
Eversource Site # 100020
35A Simons Pond Road, Colebrook, CT 06021
Latitude: 42-1-16.5 N / Longitude: 73-4-42.6 W

Dear Ms. Bachman:

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource") currently maintains multiple antennas on an existing 180-foot self-support tower located at 35A Simons Pond Road in Colebrook. See Attachment A, Parcel Map and Property Card. The tower and property are owned by Litchfield County Dispatch ("LCD"). LCD has agreed for Eversource to maintain the modified equipment on the tower. Eversource plans to install two 4-foot tall reflector antennas, to be mounted at 144.5 feet AGL and 132 feet AGL, and two 7/8-inch diameter coaxial cables. An ice shield and unused mount will be removed. There will be no other changes to the fenced compound, the tower or the existing antennas and equipment on the tower. The tower and existing and proposed equipment are depicted on Attachment B, Construction Drawings, dated July 15, 2020 and Attachment C, Structural Analysis, dated July 14, 2020. The tower was approved by the Town of Colebrook in 2001.

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

Please accept this letter as notification, pursuant to Regulations of Connecticut State Agencies ("R.C.S.A.") §16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this notice is being delivered to Thomas D. McKeon, First Selectman for the Town of Colebrook and Marc Melanson, Building Official for the Town of Colebrook via the United States Postal Service or private carrier. Proof of delivery is attached. See Attachment D, Proof of Delivery of Notice.

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

1. There will be no change to the height of the existing tower.
2. The proposed modifications will not require extension of the site boundary.
3. The proposed modification will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.
4. The operation of the new antennas will not increase radio frequency emissions at the facility to a level at or above the Federal Communications Commission safety standard as shown in the attached Radio Frequency Emissions Report, dated July 28, 2020 (Attachment E – Power Density Report)[1].
5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.
6. The existing structure and its foundation can support the proposed loading.

For the foregoing reasons, Eversource respectfully submits that the proposed modifications to the above referenced telecommunications facility constitute an exempt modification under R.C.S.A. § 16-50j-72(b)(2). One original copy of this notice has been provided via courier to the Council.

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

By: _____
Kathleen M. Shanley
Manager – Transmission Siting

cc: Thomas D. McKeon, First Selectman, Town of Colebrook
Marc Melanson, Building Official, Town of Colebrook
Litchfield County Dispatch

Attachments

A. Parcel Map and Property Card
B. Construction Drawings
C. Structural Analysis
D. Proof of Delivery of Notice
E. Power Density Report

[1] Any inactive or receive-only antennas are not included in the Power Density Report, as they are irrelevant in terms of the % MPE calculations.

ATTACHMENT A – PARCEL MAP AND PROPERTY CARD

LCD Tower site

Simons Pond Rd

Beech Hill Rd

35 Simons Pond Rd

Moses Rd

© 2020 Google

Google earth

1991

Imagery Date: 9/18/2019 42°01'11.93" N 73°04'35.20" W elev 1279 ft eye alt 4830 ft

35A SIMONS POND ROAD

Location	35A SIMONS POND ROAD	**Mblu**	35/ / 8A/ /
Acct#	100490	**Owner**	LITCHFIELD COUNTY DISPATCH
Assessment	$134,600	**Appraisal**	$192,200
PID	100020	**Building Count**	1

Current Value

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2015	$134,700	$57,500	$192,200
Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2015	$94,300	$40,300	$134,600

Owner of Record

Owner	LITCHFIELD COUNTY DISPATCH	**Sale Price**	$75,000
Co-Owner	C/O EMERGENCY MED SERVICES	**Certificate**	
Address	111 WATER ST TORRINGTON, CT 06790	**Book & Page**	0089/0507
		Sale Date	03/26/2018
		Instrument	16

Ownership History

Ownership History					
Owner	**Sale Price**	**Certificate**	**Book & Page**	**Instrument**	**Sale Date**
LITCHFIELD COUNTY DISPATCH	$75,000		0089/0507	16	03/26/2018
LITCHFIELD COUNTY DISPATCH	$0		0063/0511	19	04/04/2000

Building Information

Building 1 : Section 1

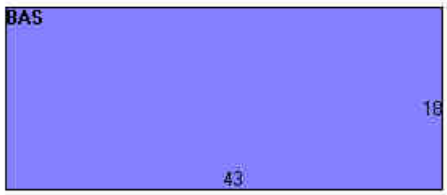
Year Built:	2001
Replacement Cost:	$153,014
Building Percent Good:	88
Replacement Cost Less Depreciation:	$134,700

Building Attributes	
Field	**Description**
STYLE	Tower Accsry Bldg
MODEL	Commercial
Grade	Average
Stories:	1
Occupancy	1.00
Exterior Wall 1	Pre-cast Concr
Exterior Wall 2	
Roof Structure	Flat
Roof Cover	Metal/Tin
Interior Wall 1	Minim/Masonry
Interior Wall 2	
Interior Floor 1	Concr-Finished
Interior Floor 2	
Heating Fuel	Gas
Heating Type	Hot Air-no Duc
AC Type	None
Struct Class	
Bldg Use	Public Serv.
Total Rooms	1
Total Bedrms	00
Total Baths	0
Usrfld 218	
Usrfld 219	
1st Floor Use:	
Heat/AC	None
Frame Type	Rein. Concrete
Baths/Plumbing	None
Ceiling/Wall	Typical
Rooms/Prtns	Light
Wall Height	9.00
% Comn Wall	0.00

Building Photo

(http://images.vgsi.com/photos/ColebrookCTPhotos//default.jpg)

Building Layout



(http://images.vgsi.com/photos/ColebrookCTPhotos//Sketches/100020_113

Building Sub-Areas (sq ft)			Legend
Code	**Description**	**Gross Area**	**Living Area**
BAS	First Floor	774	774
		774	774

Extra Features

Extra Features	Legend
No Data for Extra Features	

Land

Land Use

Use Code	9033
Description	Public Serv.
Zone	R2
Neighborhood	R05
Alt Land Appr	No
Category	

Land Line Valuation

Size (Acres)	2.01
Frontage	
Depth	
Assessed Value	$40,300
Appraised Value	$57,500

Outbuildings

Outbuildings	Legend
No Data for Outbuildings	

Valuation History

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2018	$134,700	$57,500	$192,200
2017	$134,700	$0	$134,700
2015	$134,700	$0	$134,700

Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2018	$94,300	$40,300	$134,600
2017	$94,300	$0	$94,300
2015	$94,300	$0	$94,300

ATTACHMENT B – CONSTRUCTION DRAWINGS

EVERSOURCE ENERGY

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

PROJECT SUMMARY

THE GENERAL SCOPE OF WORK CONSISTS OF THE FOLLOWING:

1. INSTALL (2) NEW REFLECTOR ANTENNAS, (1) AT ELEVATION 146'–6"± AGL AND (1) AT ELEVATION 134'–0"± AGL
2. REMOVE EXISTING DISH MOUNT AND DISH ICE SHIELD AT 140'–0"± AGL AND 144'–6"± AGL, RESPECTIVELY
3. INSTALL (1) NEW RACK WITH DMR EQUIPMENT IN EXISTING TELECOM ROOM

GOVERNING CODES

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

GENERAL NOTES

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

SITE INFORMATION

SITE NAME:	COLEBROOK
SITE ID NUMBER:	#100020
SITE ADDRESS:	35A SIMONS POND ROAD COLEBROOK, CT 06021
MAP:	35
BLOCK:	–
LOT:	8A
ZONE:	R2
LATITUDE:	42° 1' 16.5" N
LONGITUDE:	73° 4' 42.6" W
ELEVATION:	1320'± AMSL
FEMA/FIRM DESIGNATION:	C
ACREAGE:	2.01± AC (BOOK: 0089, PAGE: 0507)

CONTACT INFORMATION

APPLICANTS:
EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037

PROPERTY OWNER:
LITCHFIELD COUNTY DISPATCH
111 WATER ST
TORRINGTON, CT 06790

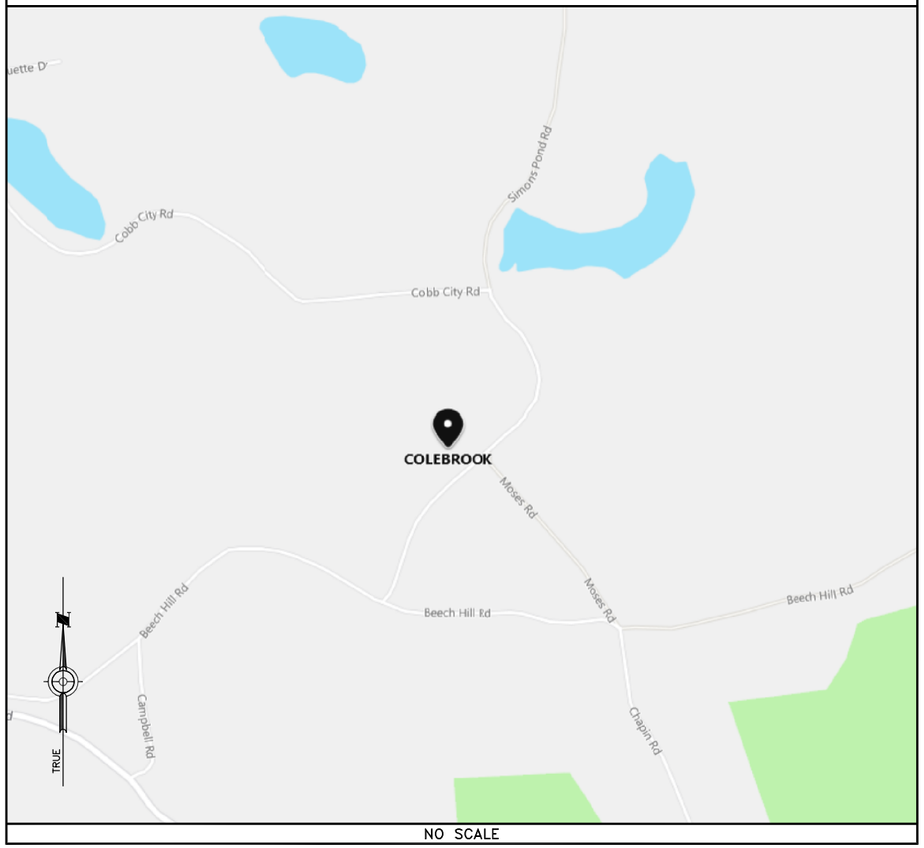
EVERSOURCE ENERGY
PROJECT MANAGER:
NIKOLL PRECI
(860) 655–3079

POWER PROVIDER:
EVERSOURCE ENERGY
(800) 286–2000

TELCO PROVIDER:
FRONTIER
(800) 921–8102

CALL BEFORE YOU DIG:
(800) 922–4455

LOCATION MAP



NO SCALE

DESIGN TYPE

SITE UPGRADE
SELF–SUPPORT TOWER

DRAWING INDEX

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

DO NOT SCALE DRAWINGS

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

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

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

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458–3595

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

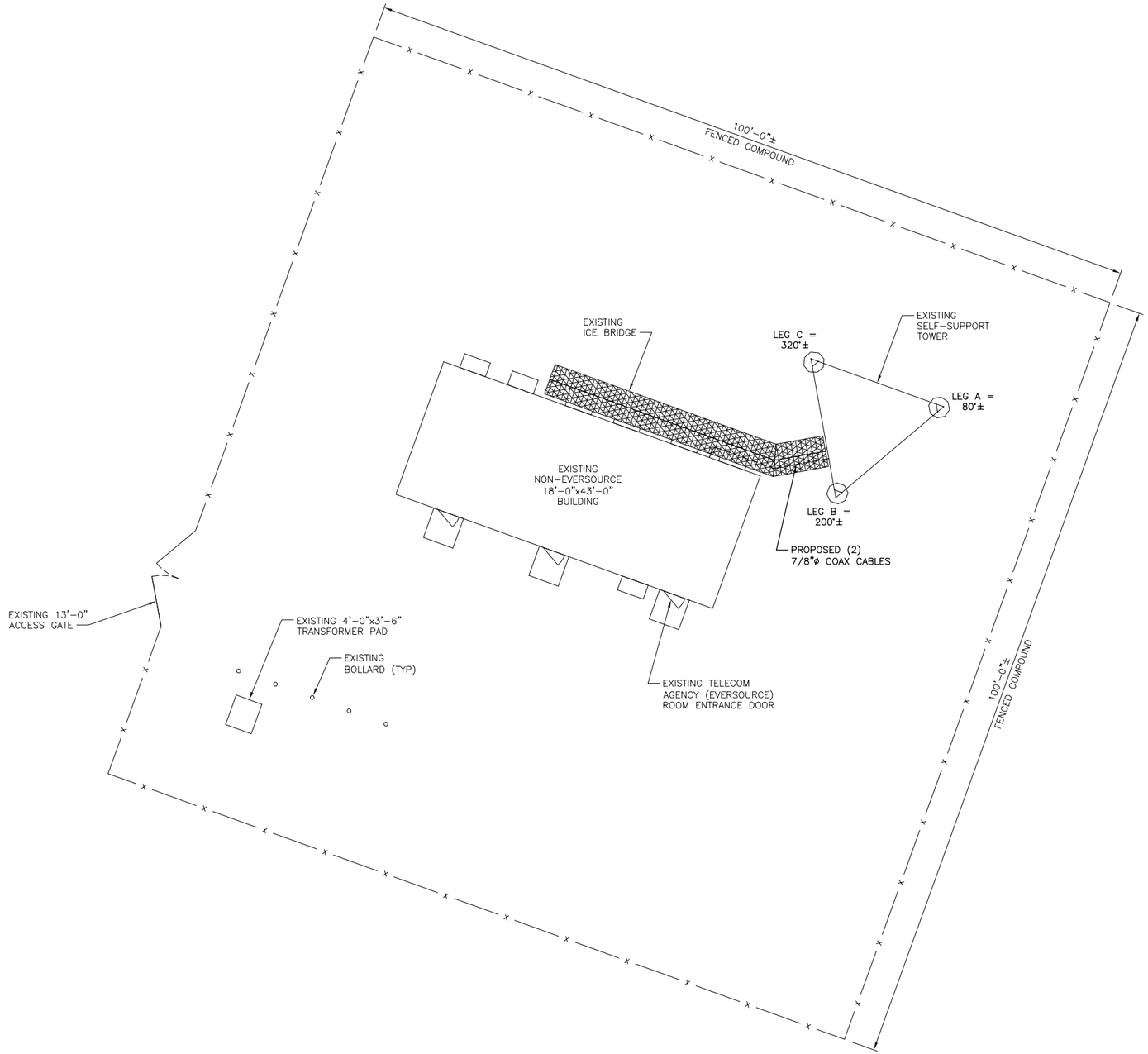
REV	DATE	DESCRIPTION
0	07/15/20	ISSUED FOR FILING

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
07/15/2020

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1



SITE PLAN
NO SCALE

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

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
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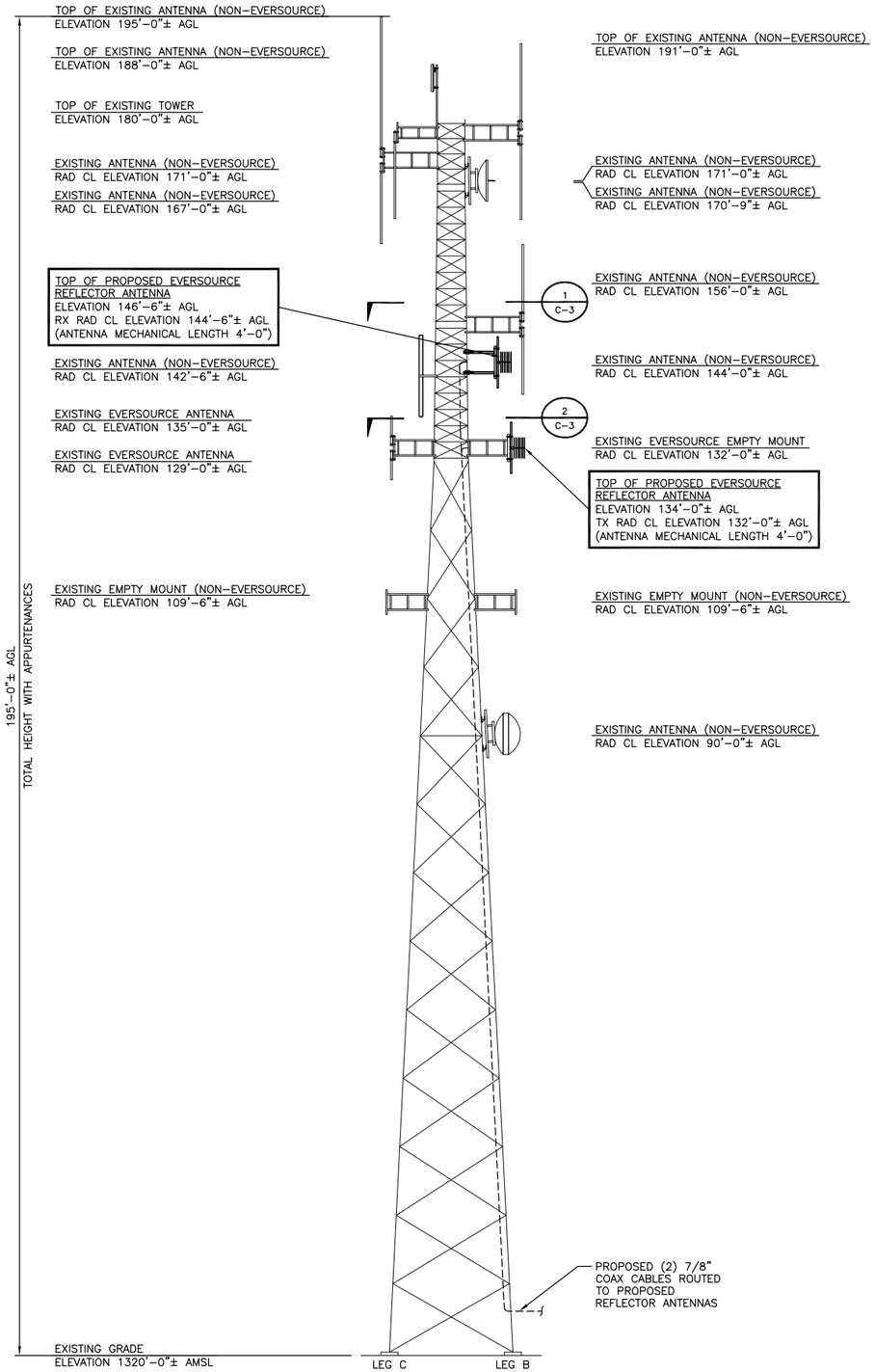
JOSHUA J. RILEY
STATE OF CONNECTICUT
33208
LICENSED
PROFESSIONAL ENGINEER
07/15/2020

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

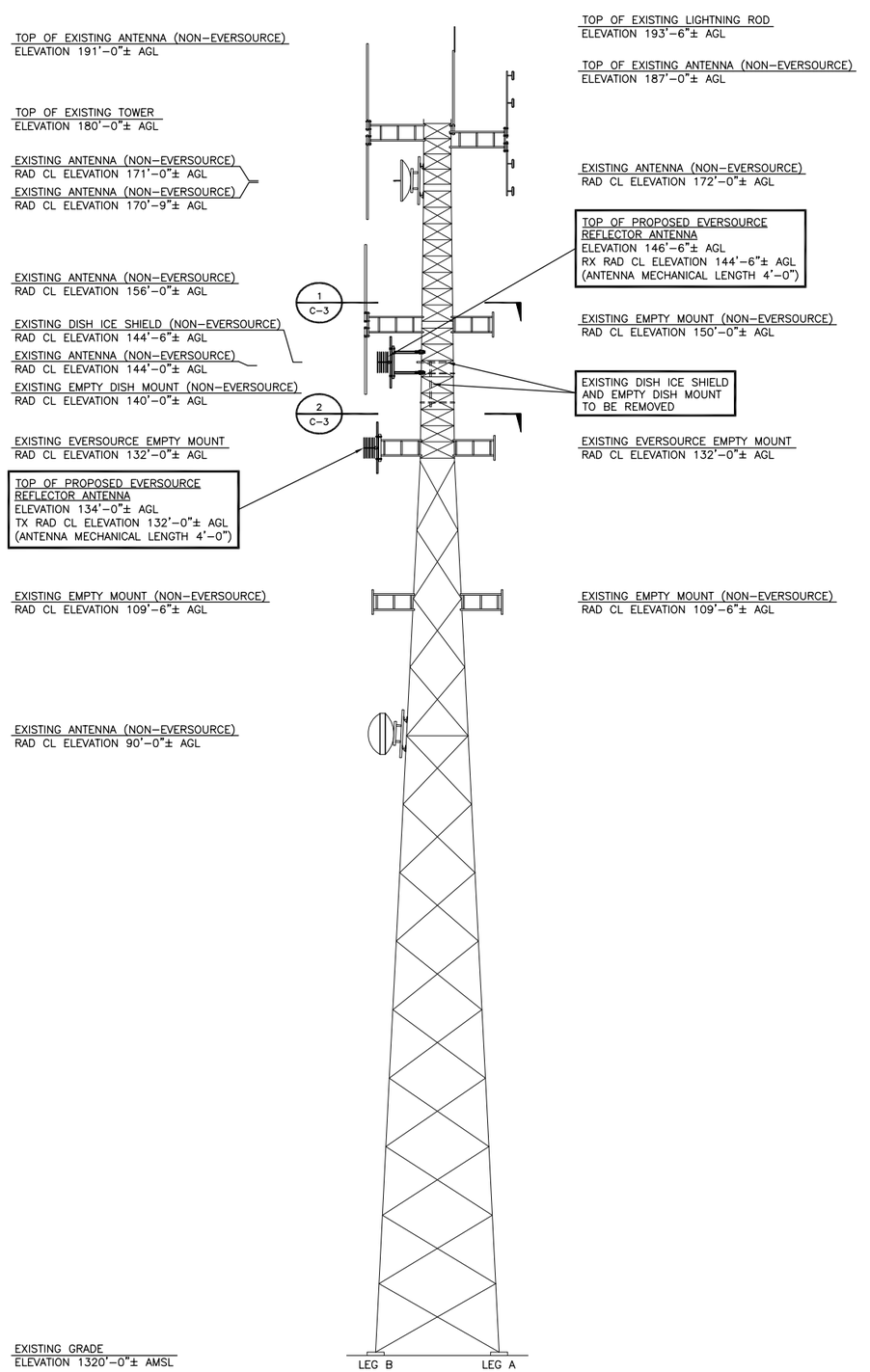
SHEET TITLE
SITE PLAN

SHEET NUMBER
C-1



TOWER ELEVATION FACE CB

NO SCALE



TOWER ELEVATION FACE BA

NO SCALE

EVERSOURCE ENERGY

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

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458-3595

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

REV	DATE	DESCRIPTION
0	07/15/20	ISSUED FOR FILING

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
07/15/2020

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

SHEET TITLE

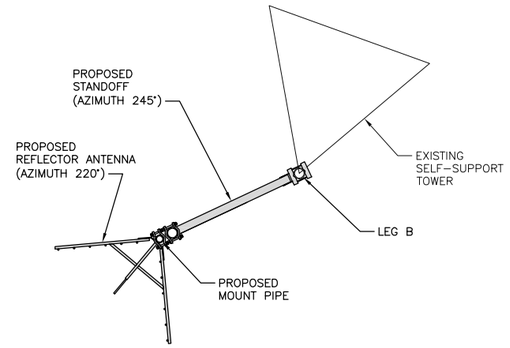
TOWER ELEVATION & ANTENNA EQUIPMENT

SHEET NUMBER

C-2

NOTE

1. DISH MOUNT AND DISH ICE SHIELD BEING REMOVED NOT SHOWN FOR CLARITY.



SECTION 1
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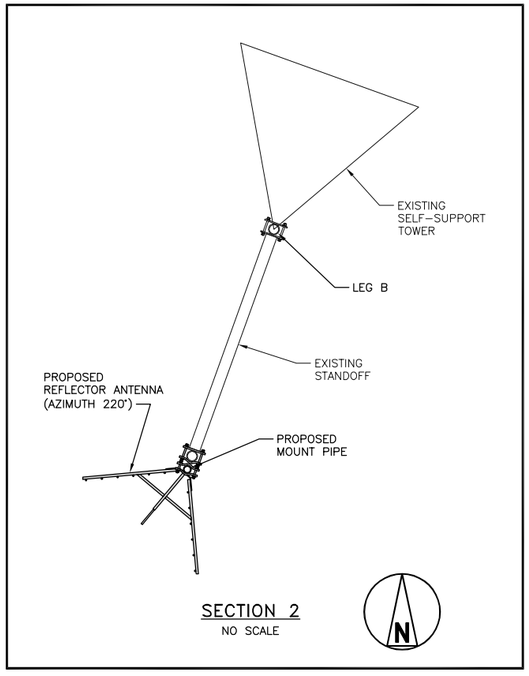


SECTION 2
NO SCALE

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

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458-3595

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

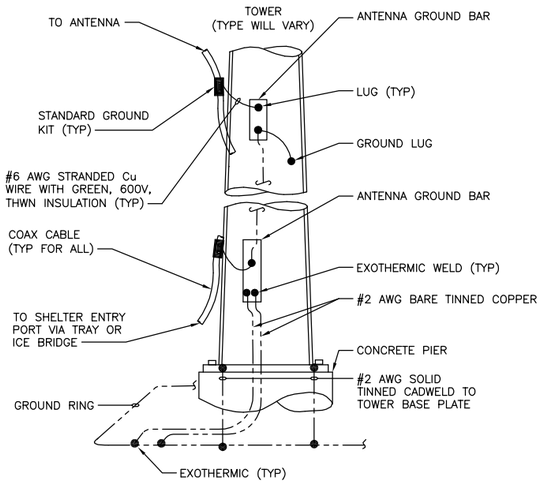
REV	DATE	DESCRIPTION
0	07/15/20	ISSUED FOR FILING

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
07/15/2020

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

SHEET TITLE
ANTENNA EQUIPMENT

SHEET NUMBER
C-3

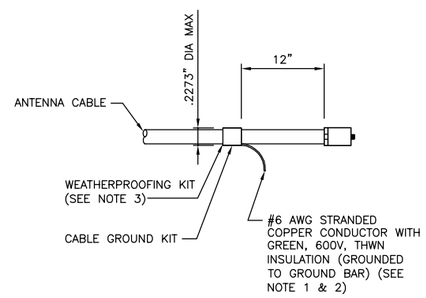


NOTE

1. NUMBER OF GROUND BARS MAY VARY DEPENDING ON THE TYPE OF TOWER, ANTENNA LOCATION AND CONNECTION ORIENTATION. PROVIDE AS REQUIRED.

ANTENNA CABLE GROUNDING

NO SCALE

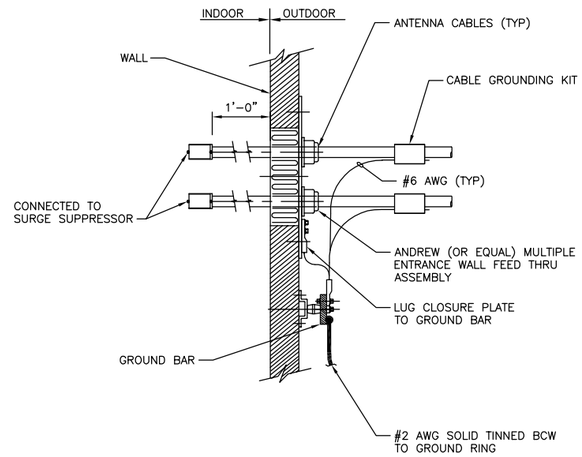


NOTES

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

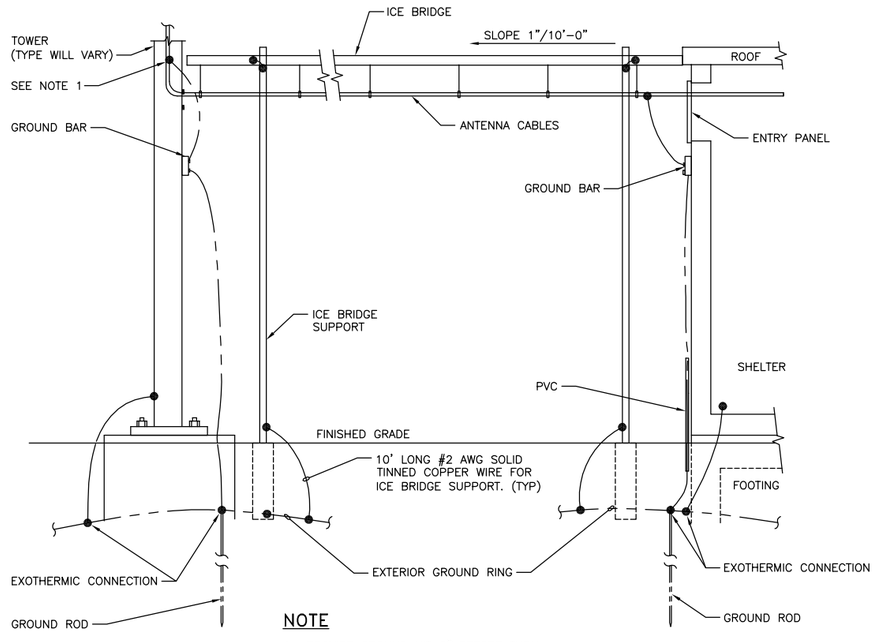
CONNECTION OF CABLE GROUND KIT TO ANTENNA CABLE

NO SCALE



CABLE INSTALLATION WITH WALL FEED THRU ASSEMBLY

NO SCALE



NOTE

1. PROVIDE GROUND KIT 6" BEFORE TURN

ICE BRIDGE AND ANTENNA CABLE DETAIL

NO SCALE

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

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458-3595

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

REV	DATE	DESCRIPTION
0	07/15/20	ISSUED FOR FILING

STATE OF CONNECTICUT
MARK P. STILES
29458
LICENSED
PROFESSIONAL ENGINEER
07/15/2020

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

SHEET TITLE
GROUNDING DETAILS

SHEET NUMBER
G-1

DESIGN BASIS

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

GENERAL CONDITIONS

1. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL BUILDING CODES, PERMIT CONDITIONS AND SAFETY CODES DURING CONSTRUCTION.

2. THE ENGINEER IS NOT: A GUARANTOR OF THE INSTALLING CONTRACTOR'S WORK; RESPONSIBLE FOR SAFETY IN, ON OR ABOUT THE WORK SITE; IN CONTROL OF THE SAFETY OR ADEQUACY OF ANY BUILDING COMPONENT, SCAFFOLDING OR SUPERINTENDING THE WORK.

3. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL PERMITS, INSPECTIONS, TESTING AND CERTIFICATES NEEDED FOR LEGAL OCCUPANCY OF THE FINISHED PROJECT.

4. THE CONTRACTOR IS RESPONSIBLE TO REVIEW THIS COMPLETE PLAN SET AND VERIFY THE EXISTING CONDITIONS SHOWN IN THESE PLANS AS THEY RELATE TO THE WORK PRIOR TO SUBMITTING PRICE. SIGNIFICANT DEVIATIONS FROM WHAT IS SHOWN AFFECTING THE WORK SHALL BE REPORTED IMMEDIATELY TO THE CONSTRUCTION MANAGER.

5. DETAILS INCLUDED IN THIS PLAN SET ARE TYPICAL AND APPLY TO SIMILAR CONDITIONS.

6. EXISTING ELECTRICAL AND MECHANICAL FIXTURES, PIPING, WIRING, AND EQUIPMENT OBSTRUCTING THE WORK SHALL BE REMOVED AND/OR RELOCATED AS DIRECTED BY THE CONSTRUCTION MANAGER. TEMPORARY SERVICE INTERRUPTIONS MUST BE COORDINATED WITH OWNER.

7. THE CONTRACTOR SHALL DILIGENTLY PROTECT THE EXISTING BUILDING/SITE CONDITIONS AND THOSE OF ANY ADJOINING BUILDING/SITES AND RESTORE ANY DAMAGE CAUSED BY HIS ACTIVITIES TO THE PRE-CONSTRUCTION CONDITION.

8. THE CONTRACTOR SHALL SAFEGUARD AGAINST: CREATING A FIRE HAZARD, AFFECTING TENANT EGRESS OR COMPROMISING BUILDING SITE SECURITY MEASURES.

9. THE CONTRACTOR SHALL REMOVE ALL DEBRIS AND CONSTRUCTION WASTE FROM THE SITE EACH DAY. WORK AREAS SHALL BE SWEPT AND MADE CLEAN AT THE END OF EACH WORK DAY.

10. THE CONTRACTOR'S HOURS OF WORK SHALL BE IN ACCORDANCE WITH LOCAL CODES AND ORDINANCES AND BE APPROVED BY OWNER.

11. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE CONSTRUCTION MANAGER IF ASBESTOS IS ENCOUNTERED DURING THE EXECUTION OF HIS WORK. THE CONTRACTOR SHALL CEASE ALL ACTIVITIES WHERE THE ASBESTOS MATERIAL IS FOUND UNTIL NOTIFIED BY THE CONSTRUCTION MANAGER TO RESUME OPERATIONS.

THERMAL & MOISTURE PROTECTION

1. FIRE-STOP ALL PENETRATIONS FOR ELECTRICAL CONDUITS OR WAVEGUIDE CABLING THROUGH BUILDING WALLS, FLOORS, AND CEILINGS SHALL BE FIRESTOPPED WITH ACCEPTED MATERIALS TO MAINTAIN THE FIRE RATING OF THE EXISTING ASSEMBLY. ALL FILL MATERIAL SHALL BE SHAPED, FITTED, AND PERMANENTLY SECURED IN PLACE. FIRESTOPPING SHALL BE INSTALLED IN ACCORDANCE WITH ASTM E814.

2. HILTI CP620 FIRE FOAM OR 3M FIRE BARRIER FILL, VOID OR CAVITY MATERIAL OR ACCEPTED EQUAL SHALL BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND ASSOCIATED UNDERWRITERS LABORATORIES (UL) SYSTEM NUMBER.

3. FIRESTOPPING SHALL BE APPLIED AS SOON AS PRACTICABLE AFTER PENETRATIONS ARE MADE AND EQUIPMENT INSTALLED.

4. FIRESTOPPED PENETRATIONS SHALL BE LEFT EXPOSED AND MADE AVAILABLE FOR INSPECTION BEFORE CONCEALING SUCH PENETRATIONS. FIRESTOPPING MATERIAL CERTIFICATES SHALL BE MADE AVAILABLE AT THE TIME OF INSPECTION.

5. ANY BUILDING ROOF PENETRATION AND/OR RESTORATION SHALL BE PERFORMED SO THAT THE ROOF WARRANTY IN PLACE IS NOT COMPROMISED. CONTRACTOR SHALL ARRANGE FOR OWNER'S ROOFING CONTRACTOR TO PERFORM ANY AND ALL ROOFING WORK IF SO REQUIRED BY EXISTING ROOF WARRANTY. OTHERWISE, ROOF SHALL BE MADE WATERTIGHT WITH LIKE CONSTRUCTION AS SOON AS PRACTICABLE AND AT COMPLETION OF CONSTRUCTION.

6. ALL PENETRATIONS INTO AND/OR THROUGH BUILDING EXTERIOR WALLS SHALL BE SEALED WITH SILICONE SEALER.

7. WHERE CONDUIT AND CABLES PENETRATES FIRE RATED WALLS AND FLOORS, FIRE GROUT ALL PENETRATIONS IN ORDER TO MAINTAIN THE FIRE RATING USING A LISTED FIRE SEALING DEVICE OR GROUT.

8. CONTRACTOR TO REMOVE AND RE-INSTALL ALL FIRE PROOFING AS REQUIRED DURING CONSTRUCTION.

SUBMITTALS

1. CONTRACTOR TO SUBMIT SHOP DRAWINGS TO ENGINEER FOR REVIEW PRIOR TO FABRICATION.

2. CONTRACTOR TO NOTIFY ENGINEER FOR INSPECTION PRIOR TO CLOSING PENETRATIONS.

3. CONTRACTORS SHALL VERIFY ALL DIMENSIONS AND CONDITIONS IN THE FIELD PRIOR TO FABRICATION AND ERECTION OF ANY MATERIAL. THE ENGINEER SHALL BE NOTIFIED OF ANY CONDITIONS WHICH PRECLUDE COMPLETION OF THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

4. ALL STEEL MATERIAL EXPOSED TO WEATHER SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 " ZINC (HOT-DIPPED GALVANIZED) COATINGS" ON IRON AND STEEL PRODUCTS.

5. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NONCONFORMING MATERIALS OR CONDITIONS FOR REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.

STEEL

1. MATERIAL:

WIDE FLANGE:	ASTM A572, GR 50
TUBING:	ASTM A500, GR C
PIPE:	ASTM A53, GR B AND ASTM A572, GR 50
ANGLE:	ASTM A570, GR 50 AND ASTM A36
BOLTS:	ASTM A325
GRATING:	TYPE GW-2 (1"x3/16" BARS)
MISC. MATERIAL:	ASTM A36

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

2. DAMAGED GALVANIZED SURFACES SHALL BE CLEANED WITH A WIRE BRUSH AND PAINTED WITH TWO COATS OF COLD ZINC, "GALVANOX", "DRY GALV", "ZINC IT", OR APPROVED EQUIVALENT, IN ACCORDANCE WITH MANUFACTURER'S GUIDELINES. TOUCH UP DAMAGED NON GALVANIZED STEEL WITH SAME PAINT IN SHOP OR FIELD.

3. DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO THE AISC "MANUAL OF STEEL CONSTRUCTION" 13TH EDITION.

4. THE STEEL STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER COMPLETION. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE AND TO INSURE THE SAFETY OF THE BUILDING AND ITS COMPONENT PARTS DURING ERECTION.

5. ALL STEEL ELEMENTS SHALL BE INSTALLED PLUMB AND LEVEL.

6. TOWER MANUFACTURER'S DESIGNS SHALL PREVAIL FOR TOWER.

SITE GENERAL

1. CONTRACTOR SHALL FOLLOW CONDITIONS OF ALL APPLICABLE PERMITS AND WORK IN ACCORDANCE WITH OSHA REGULATIONS.

2. THESE PLANS DEPICT KNOWN UNDERGROUND STRUCTURES, CONDUITS, AND/OR PIPELINES. THE LOCATIONS FOR THESE ELEMENTS ARE BASED UPON THE VARIOUS RECORD DRAWINGS AVAILABLE. THE CONTRACTOR IS HEREBY ADVISED THAT THESE DRAWINGS MAY NOT ACCURATELY DEPICT AS-BUILT LOCATIONS AND OTHER UNKNOWN STRUCTURES. THE CONTRACTOR SHALL THEREFORE DETERMINE THE EXACT LOCATION OF EXISTING UNDERGROUND ELEMENTS AND EXCAVATE WITH CARE AFTER CALLING MARKOUT SERVICE AT 1-800-272-4480 48 HOURS BEFORE DIGGING, DRILLING OR BLASTING.

3. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC, FIBER OPTIC, AND OTHER UTILITIES WHERE ENCOUNTERED, SHALL BE PROTECTED AT ALL TIMES, AND WHERE REQUIRED FOR THE PROPER EXECUTION, SHALL BE RELOCATED AS DIRECTED BY ENGINEER. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR PIER DRILLING AROUND OR NEAR UTILITIES. CONTRACTOR SHALL HAND DIG UTILITIES AS NEEDED. CONTRACTOR SHALL PROVIDE, BUT IS NOT LIMITED TO, APPROPRIATE A) FALL PROTECTION, B) CONFINED SPACE ENTRY, C) ELECTRICAL SAFETY, AND D) TRENCHING AND EXCAVATION.

4. IF NECESSARY, RUBBISH, STUMPS, DEBRIS, STICKS, STONES, AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF LEGALLY.

5. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC, FIBER OPTIC, OR OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED, AND/OR CAPPED, PLUGGED OR OTHERWISE DISCONTINUED AT THE POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, SUBJECT TO THE APPROVAL OF THE CONSTRUCTION MANAGER.

6. CONTRACTOR IS RESPONSIBLE FOR REPAIRING OR REPLACING STRUCTURES OR UTILITIES DAMAGED DURING CONSTRUCTION.

7. CONTRACTOR SHALL PROTECT EXISTING PAVED AND GRAVEL SURFACES, CURBS, LANDSCAPE AND STRUCTURES AND RESTORE SITE OR PRE-CONSTRUCTION CONDITION WITH AS GOOD, OR BETTER, MATERIALS. NEW MATERIALS SHALL MATCH EXISTING THICKNESS AND TYPE.

8. THE CONTRACTOR SHALL SHORE ALL TRENCH EXCAVATIONS GREATER THAN 5 FEET IN DEPTH OR LESS WHERE SOIL CONDITIONS ARE DEEMED UNSTABLE. ALL SHEETING AND/OR SHORING METHODS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.

9. THE CONTRACTOR IS RESPONSIBLE FOR MANAGING GROUNDWATER LEVELS IN THE VICINITY OF EXCAVATIONS TO PROTECT ADJACENT PROPERTIES AND NEW WORK. GROUNDWATER SHALL BE DRAINED IN ACCORDANCE WITH LOCAL SEDIMENTATION AND EROSION CONTROL GUIDELINES.

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

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211
PHONE: (913) 458-3595

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

REV	DATE	DESCRIPTION
0	07/15/20	ISSUED FOR FILING

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

SHEET TITLE
NOTES
& SPECIFICATIONS

SHEET NUMBER
N-1

ELECTRICAL

1. CONTRACTOR SHALL VERIFY EXISTING ELECTRIC SERVICE TYPE AND CAPACITY AND ORDER NEW ELECTRIC SERVICE FROM LOCAL ELECTRIC UTILITY, WHERE APPLICABLE.
2. ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH ALL APPLICABLE CODES, AND SHALL BE ACCEPTABLE TO ALL AUTHORITIES HAVING JURISDICTION. WHERE A CONFLICT EXISTS BETWEEN CODES, PLAN AND SPECIFICATIONS, OR AUTHORITIES HAVING JURISDICTION, THE MORE STRINGENT AUTHORITIES SHALL APPLY.
3. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, INSURANCE, EQUIPMENT, INSTALLATION, CONSTRUCTION TOOLS, TRANSPORTATION, ETC, FOR A COMPLETE AND PROPERLY OPERATIVE SYSTEM ENERGIZED THROUGHOUT AND AS INDICATED ON THE DRAWINGS AND AS SPECIFIED HEREIN AND/OR OTHERWISE REQUIRED.
4. ALL ELECTRICAL CONDUCTORS SHALL BE 100% COPPER AND SHALL HAVE TYPE THHN INSULATION UNLESS INDICATED OTHERWISE.
5. CONDUIT SHALL BE THREADED RIGID GALVANIZED STEEL OR EMT WITH ONLY COMPRESSION TYPE COUPLINGS AND CONNECTORS, ALL MADE UP WRENCH TIGHT.
6. ALL BURIED CONDUIT SHALL BE MINIMUM SCH 40 PVC UNLESS NOTED OTHERWISE, OR AS PER LOCAL CODE REQUIREMENTS.
7. PROVIDE FLEXIBLE STEEL CONDUIT OR LIQUID TIGHT FLEXIBLE STEEL CONDUIT TO ALL VIBRATING EQUIPMENT, INCLUDING HVAC UNITS, TRANSFORMERS, MOTORS, ETC, OR WHERE EQUIPMENT IS PLACED UPON A SLAB ON GRADE.
8. ALL BRANCH CIRCUITS AND FEEDERS SHALL HAVE A SEPARATE GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR BONDED TO ALL ENCLOSURES, PULLBOXES, ETC.
9. CONDUIT AND CABLE WITHIN CORRIDORS SHALL BE CONCEALED AND EXPOSED ELSEWHERE, UNLESS NOTED OTHERWISE.
10. ELECTRICAL MATERIALS INSTALLED ON ROOFTOP SHALL BE LISTED FOR NEMA 3R USE. –AND ALL WIRING WITHIN A VENTILATION DUCT SHALL BE LISTED FOR SUCH USE. IN GENERAL WIRING METHODS WITHIN A DUCT SHALL BE AN MC CABLE WITH SMOOTH OR CORRUGATED METAL JACKET AND HAVE NO OUTER COVERING OVER THE METAL JACKET. INTERLOCKED ARMOR TYPE OF MC CABLE IS NOT ACCEPTABLE FOR THIS APPLICATION. CONTRACTOR CAN ALSO USE TYPE MI CABLE IN THE VENTILATION DUCT PROVIDED IT DOES NOT HAVE ANY OUTER COVERINGS OVER THE METAL EXTERIOR.
11. WIRING DEVICES SHALL BE SPECIFICATION GRADE, AND WIRING DEVICE COVER PLATES SHALL BE PLASTIC WITH ENGRAVING AS SPECIFIED.

GROUNDING

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

ANTENNA & CABLE NOTES

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

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

REV	DATE	DESCRIPTION
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STATE OF CONNECTICUT · MARK P. STILES · 34358 · LICENSED PROFESSIONAL ENGINEER

07/15/2020

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

SHEET TITLE
NOTES
& SPECIFICATIONS

SHEET NUMBER
N-2

SYMBOLS

●	EXOTHERMIC CONNECTION
■	COMPRESSION CONNECTION
	5/8"ø x 10'-0" COPPER CLAD STEEL GROUND ROD.
	TEST GROUND ROD WITH INSPECTION SLEEVE
	GROUNDING CONDUCTOR
(A)	KEY NOTES
CHAINLINK FENCE	X X X X X
WOOD FENCE	
LEASE AREA	
ICE BRIDGE	
CABLE TRAY	
GAS LINE	G G G G G
UNDERGROUND ELECTRICAL/TELCO	E/T E/T E/T E/T
UNDERGROUND ELECTRICAL/CONTROL	E/C E/C E/C E/C
UNDERGROUND ELECTRICAL	E E E E E
UNDERGROUND TELCO	T T T T T
PROPERTY LINE (PL)	

ABBREVIATIONS

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

EVERSOURCE ENERGY

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STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
07/15/2020

COLEBROOK
35A SIMONS POND ROAD
COLEBROOK, CT 06021

SHEET TITLE

NOTES
& SPECIFICATIONS

SHEET NUMBER

N-3

REFERENCE CUTSHEETS

220 MHz CORNER REFLECTOR — 215-225 MHz

220MHz Corner Reflector Antenna Series

The Corner Reflector Antennas are available in VHF, UHF, 700/800/900 MHz configurations. These antennas have an extremely good front-to-back ratio. They are broadband and are ideal for point-to-point applications. Performance is constant throughout the band.

- Each antenna has a rugged design to withstand harsh environmental conditions.
- Single or Dual Dipole mounted in the front of a 90º reflector, providing good directivity and a very high front-to-back ratio.
- These antennas have ultra-low VSWR ratings, and will not exceed 2.0:1 VSWR ratio with 0.5" (13 mm) of radial ice.
- The supplied mounting hardware allows either vertical or horizontal polarization.
- DC ground for lightning protection.
- Heavy Duty versions are available. Please contact a Comprod Inc. Technical support technician for consultation.

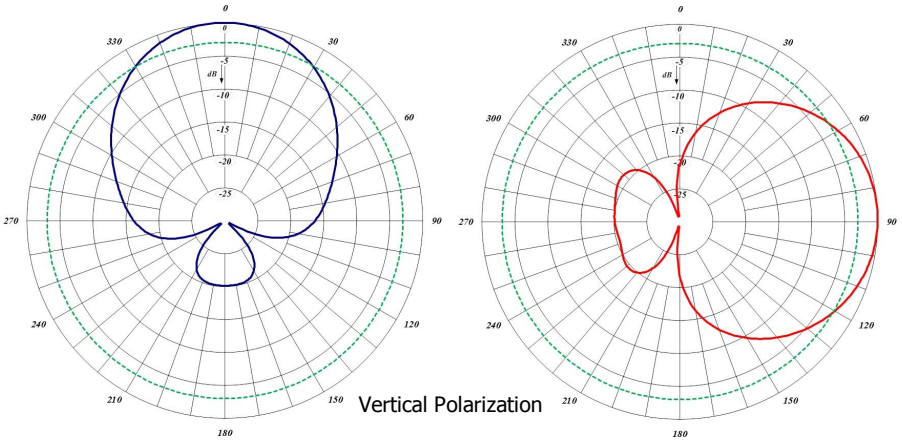
470-70-220

*ORDER MODEL # **470-70-2D**, WHICH HAS HAS DIN MALE TERMINATION*

Electrical Specifications	470-70-220	470-70-220HD	471-70-220
Frequency Range, MHz	215-225	215-225	215-225
Nominal Gain, dBd	7.0	7.0	10.0
Bandwidth: 1.5:1 VSWR, MHz	10	10	10
Polarization	Vert. or Horiz.	Vert. or Horiz.	Vert. or Horiz.
Horizontal Beamwidth (Vert. Pol.)	67º	67º	50º
Vertical Beamwidth (Vert. Pol.)	75º	75º	66º
Front to Back, dB	30	30	30
Pattern	Directional	Directional	Directional
Power Rating, Watts	250	250	250
Nominal Impedance, Ohms	50	50	50
Lightning Protection	DC Ground	DC Ground	DC Ground
Standard Termination	Type DIN Male	Type N Male	Type N Male
Electrical Specifications	**470-70-220**	**470-70-220HD**	**471-70-220**
Length, in (mm)	48 (1219)	48 (1219)	72 (1829)
Width, in (mm)	75 (1905)	75 (1905)	120 (3048)
Weight, lbs. (kg)	39 (17.7)	57 (25.8)	55 (30)
Rated Wind Velocity, No Ice, mph (km/h)	100 (161)	140 (225)	100 (161)
Rated Wind Velocity, 0.5" (13mm) ice, mph (km/h)	85 (137)	100 (161)	85 (137)
Lateral Thrust @ 100 mph, wind, lbs. (kg)	144 (65)	236 (107)	320 (145)
Projected Area, ft² (m²)	5.3 (0.5)	8.8 (0.82)	11.9 (1.10)
Mounting Information: (clamp included) for pipe size O.D. in (mm)	2.9 (73)	2.9 (73)	2.9 (73)

Tel: US 1.877.825.2007 / CAN 1.800.603.1454
Email: sales@comprodcom.com
Fax: 1.800.554.1033

220MHz CORNER REFLECTOR 215-225 MHz

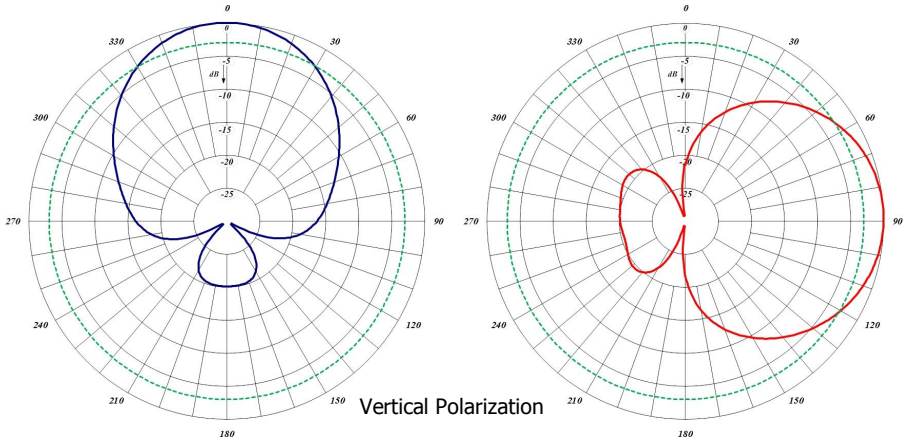


Vertical Polarization

Horizontal Pattern Vertical Pattern

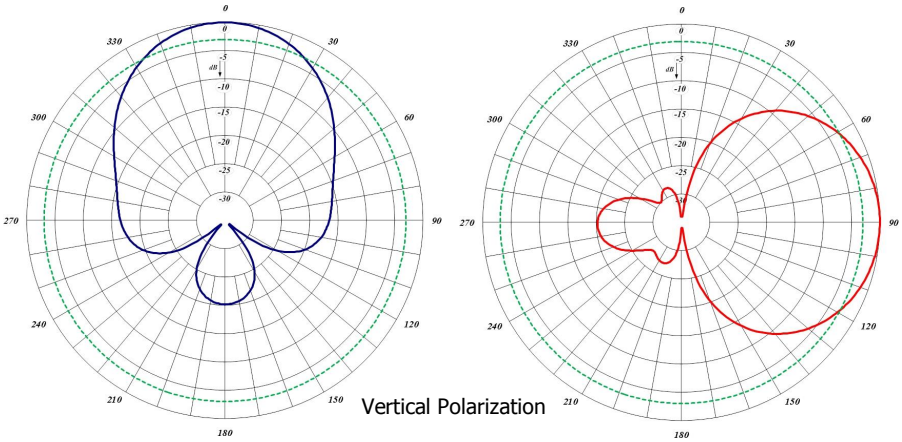
470-70-220

470-70-220HD



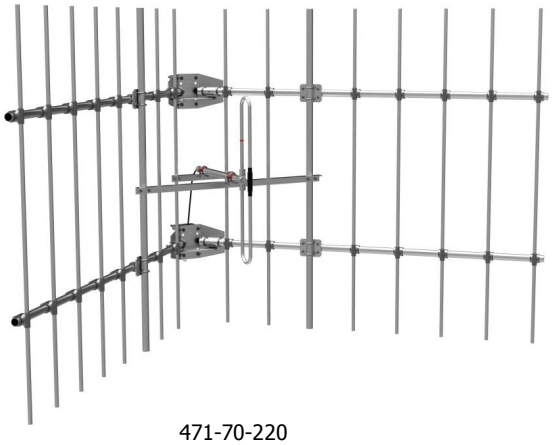
Vertical Polarization

Horizontal Pattern Vertical Pattern



Vertical Polarization

Horizontal Pattern Vertical Pattern



471-70-220

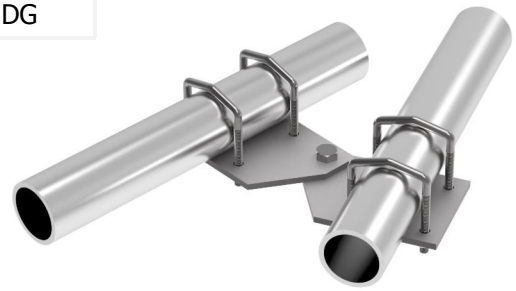
OMNIDIRECTIONAL PIPE-TO-ANGLE

Model	Pipe	Angle	Clamp Material	Screw Material
175-85	1.5" to 3.5" dia.	3" x 3" max. 60º	Steel HDG	Steel HDG
176-85	1.5" to 3.5" dia.	5" x 5" max. 60º	Steel HDG	Steel HDG
177-85	1.5" to 3.5" dia.	8" x 8" max. 60º	Steel HDG	Steel HDG
178-85	1.5" to 3.5" dia.	3" x 3" max. 90º	Steel HDG	Steel HDG
179-85	1.5" to 3.5" dia.	5" x 5" max. 90º	Steel HDG	Steel HDG
180-85	1.5" to 3.5" dia.	8" x 8" max. 90º	Steel HDG	Steel HDG

HDG=Hot Dip Galvanized

OMNIDIRECTIONAL PIPE-TO-PIPE

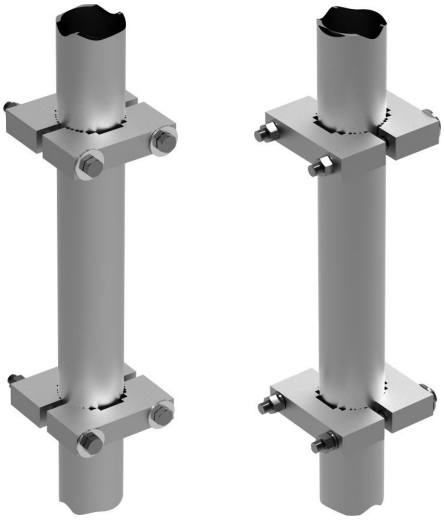
Model	1st Pipe	2nd Pipe	Clamp Material	Screw Material
122-85	0.75″ to 2.38 dia.	0.75″ to 2.38 dia.	Aluminum	Steel HDG



PIPE-TO-FLAT SURFACE

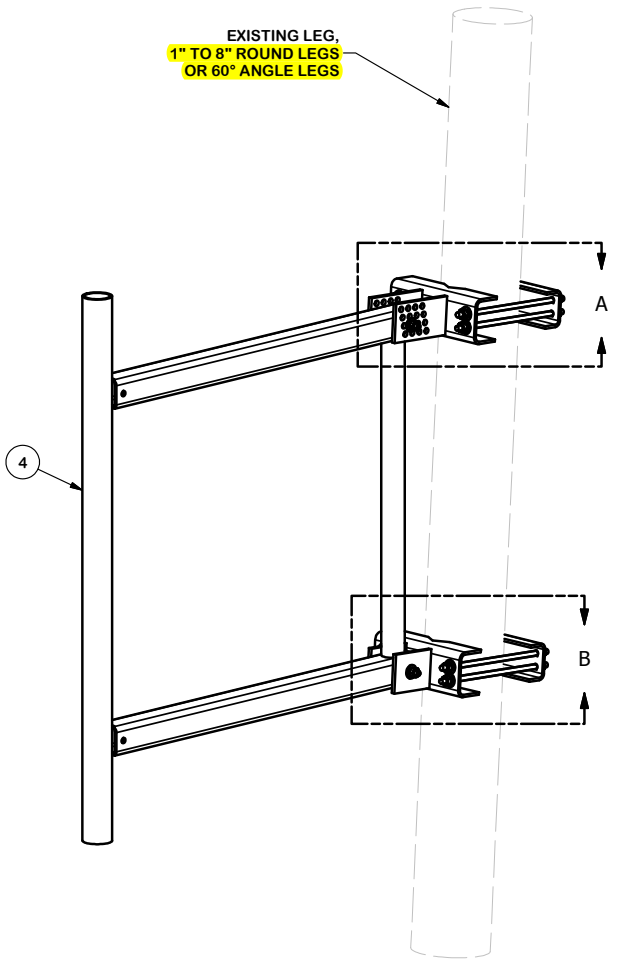
Model	Pipe	Clamp Material	Screw Material
172-85	2.88" dia.	Aluminum	Steel HDG (*)
173-85	2.38" dia.	Aluminum	Steel HDG

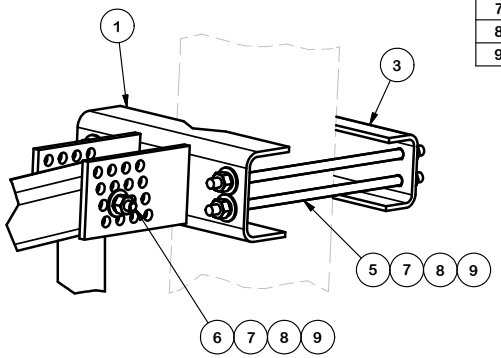
* INCLUDED WITH ANTENNA.



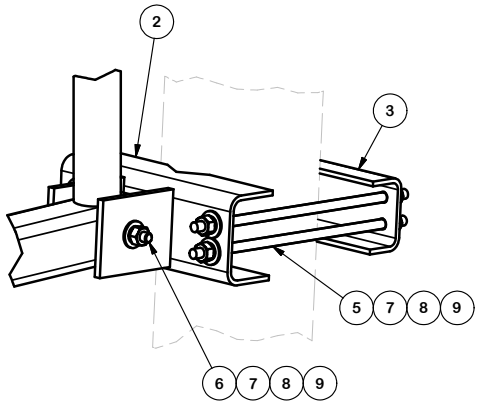
TOWER/MAST SIZE AT PROPOSED ANTENNA ATTACHMENT = 2"± DIAMETER.
(1) SITE PRO 1 USF-4U REQUIRED

PARTS LIST						
ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	1	CFM	UPPER GATE FOOT WELDMENT		13.90	13.90
2	1	CFS	LOWER GATE FOOT WELDMENT		12.72	12.72
3	2	GBB	GATE BACKING BAR		4.53	9.06
4	1	4PBG	48" PIPE MOUNT STANDOFF ARM		113.96	113.96
5	8	G12R-12	1/2" x 12" GALV. THREADED ROD		0.67	5.35
5	8	G12R-15	1/2" x 15" GALV. THREADED ROD		0.84	6.69
6	2	A1205	1/2" x 5" A325 HDG BOLT		0.34	0.69
7	18	G12FW	1/2" HDG USS FLATWASHER		0.03	0.61
8	18	G12LW	1/2" HDG LOCKWASHER		0.01	0.25
9	18	G12NUT	1/2" HDG HEAVY 2H HEX NUT		0.07	1.29
					TOTAL WT. #	164.53

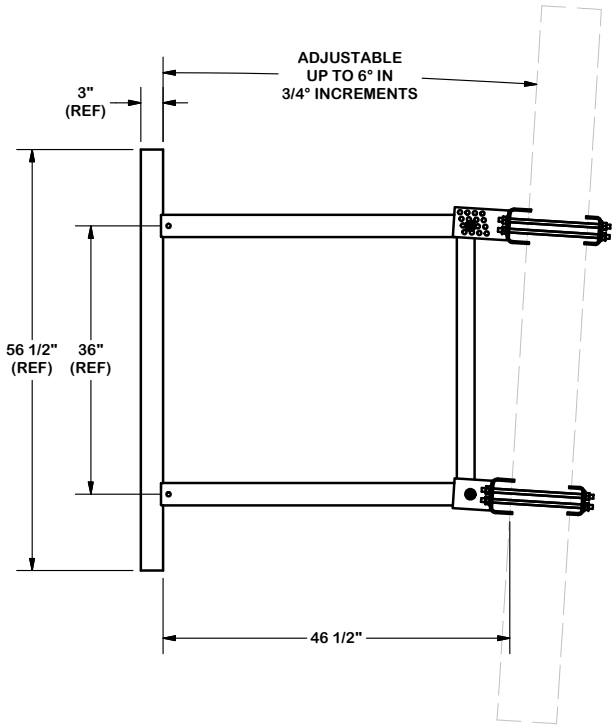




DETAIL A



DETAIL B



TOLERANCE NOTES

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

DESCRIPTION: 48" ULTIMATE UNIVERSAL STANDOFF FRAME

SITE PRO 1 — A valmont COMPANY

Engineering Support Team: 1-888-753-7446

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

CPD NO.	DRAWN BY	ENG. APPROVAL	PART NO.	PAGE
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CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.
81	01	CUSTOMER	BMC 2/16/2011	USF-4U

SITE PRO 1
A valmont COMPANY

Product Info

Pxxx: Bulk Pipe

Features:

- Factory cut end, hot-dip galvanized pipe

Construction:

- ASTM A53 Grade B
- Schedule 40

Design Criteria:

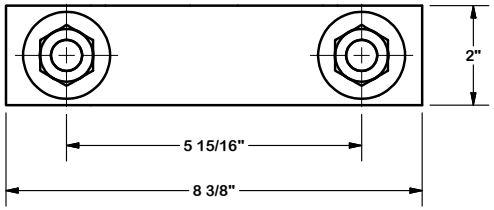
- ASTM A53 Grade B (Yield Fy = 35 ksi [240 MPa] / Tensile Fu = 60 ksi [415 MPa])
- Hot dip galvanized in accordance with ASTM A123 requirements

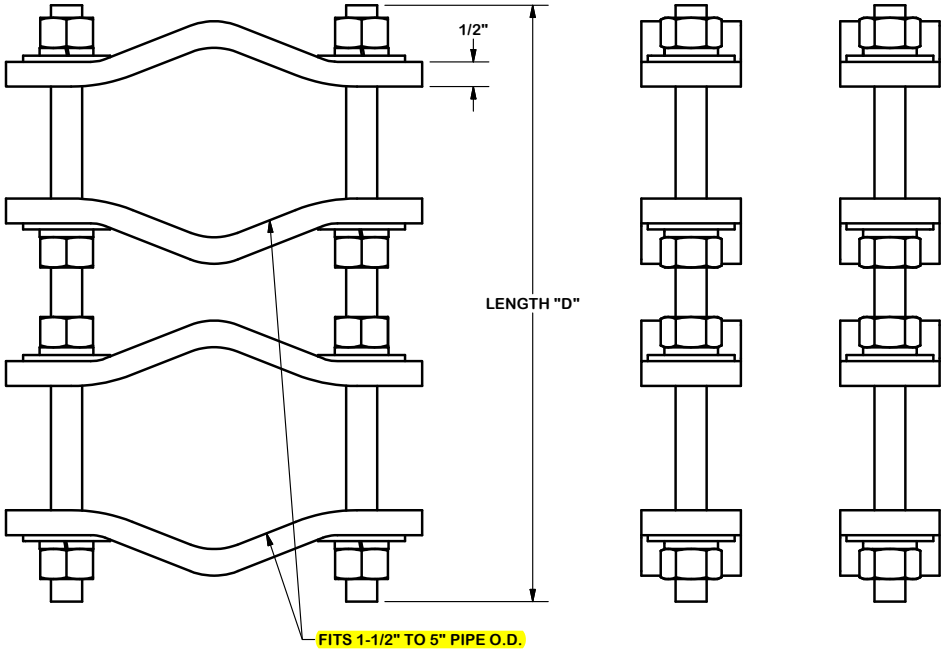
Part #	Length	OD x Length (in)	Weight
P263	5′-3″	2-3/8″ x 63″	20 lb
P272	6′-0″	2-3/8″ x 72″	22 lb
P284	7′-0″	2-3/8″ x 84″	26 lb
P296	8′-0″	2-3/8″ x 96″	30 lb
P2120	10′-0″	2-3/8″ x 120″	37 lb
P2126	10′-6″	2-3/8″ x 126″	39 lb
P2150	12′-6″	2-3/8″ x 150″	46 lb
P2174	14′-6″	2-3/8″ x 174″	53 lb
P3084	7′-0″	2-7/8″ x 84″	41 lb
P3096	8′-0″	2-7/8″ x 96″	47 lb
P30120	10'-0"	2-7/8" x 120"	58 lb
P30126	10′-6″	2-7/8″ x 126″	61 lb
P30150	12′-6″	2-7/8″ x 150″	73 lb
P30174	14′-6″	2-7/8″ x 174″	84 lb
P360	5′-0″	3-1/2″ x 60″	38 lb
P372	6′-0″	3-1/2″ x 72″	46 lb
P396	8′-0″	3-1/2″ x 96″	61 lb
P3150	12′-6″	3-1/2″ x 150″	95 lb
P3160	13′-4″	3-1/2″ x 160″	101 lb
P3174	14′-6″	3-1/2″ x 174″	110 lb
P3216	18′-0″	3-1/2″ x 216″	137 lb
P472	6′-0″	4-1/2″ x 72″	65 lb
P4126	10′-6″	4-1/2″ x 126″	114 lb

(1) SITE PRO 1 P3084 PER STANDOFF FRAME
(TOTAL OF 2 MOUNT PIPES REQUIRED)

created on: 04/05/2019

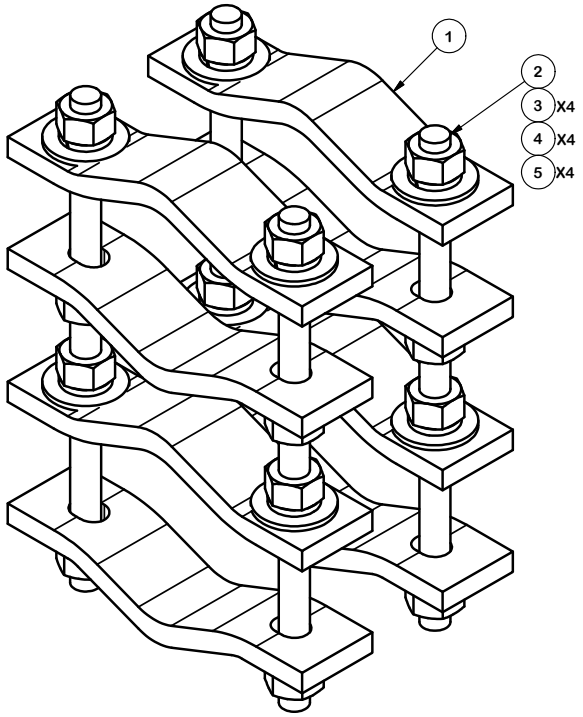
(1) SITE PRO 1 DCP12K PER STANDOFF FRAME
(TOTAL OF 2 CLAMP SETS REQUIRED)





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

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



TOLERANCE NOTES

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

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

SITE PRO 1 — A valmont COMPANY

Engineering Support Team: 1-888-753-7446

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

CPD NO.	DRAWN BY	ENG. APPROVAL	PART NO.	PAGE
	KC8 8/21/2012		SEE ASSEMBLY "A"	1 OF 1

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

ATTACHMENT C – STRUCTURAL ANALYSIS REPORT

Date: **July 9, 2020**

Black & Veatch Corp.
6800 W. 115th St., Suite 2292
Overland Park, KS 66211
(913) 458-2522

Subject:	**Structural Analysis Report**	
Eversource Designation:	**Site Number:**	ES-028
	Site Name:	Colebrook
Engineering Firm Designation:	**Black & Veatch Corp. Project Number:**	405025
Site Data:	**35A Simons Pond Road, Colebrook, Litchfield County, CT** **Latitude *42° 1' 16.5"*, Longitude *-73° 4' 42.6'*** **180 Foot - Self Support Tower**	

Black & Veatch Corp. is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC1: Proposed Equipment Configuration **Sufficient Capacity – 73.5%**

This analysis utilizes an ultimate 3-second gust wind speed of 125 mph as required by the 2018 Connecticut State Building Code. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

Structural analysis prepared by: Robert Hudson II / Cesar Garcia Godos

Respectfully submitted by:

Joshua J Riley, P.E.
Professional Engineer

07/14/2020

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 180 ft Self Support tower designed by Pirod Inc.

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	III
Wind Speed:	125 mph ultimate
Exposure Category:	C
Topographic Factor:	1
Ice Thickness:	1.5 in
Wind Speed with Ice:	40 mph
Seismic Ss:	0.174
Seismic S1:	0.065
Service Wind Speed:	60 mph

Table 1 - Proposed Equipment Configuration

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Notes
144.5	144.5	1	site pro 1	USF-4U [4' SO 203-1 + Vert. Pipe Support]	1	7/8	-
		1	comprod	470-70-220			
		1	mount pipes	7'x2.5" Mount Pipe			
132.0	132.0	1	comprod	470-70-220	1	7/8	1
		1	mount pipes	7'x2.5" Mount Pipe			

Notes:
1) To be installed on empty existing standoff frame at 132 ft.

Table 2 - Other Considered Equipment

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Notes
178.0	185.0	1	generic	12’ Whip	3 1	1 5/8 1/2	1
		1	Amphenol	WPA-700120-6CF-EDIN-0			
	179.0	1	bird technologies group	432E-83I-01-T			
	178.0	2	tower mounts	Sector Mount [SM 501-1]			
	171.0	2	sinclair	SC479-HF1LDF			
177.0	182.0	1	generic	10' 2-Bay Dipole	2	1 5/8	1
	177.0	1	tower mounts	Sector Mount [SM 501-1]			
	172.0	1	generic	10' Inverted 2-Bay Dipole			
174.0	185.0	1	generic	20' Omni	3 1	7/8 1/2	1
	174.0	1	tower mounts	PSA6 [SM 501-1]			
	167.0	1	generic	12' Inverted Whip			
170.8	170.8	1	generic	Grid Dish	1	1 5/8	1
		1	tower mounts	Pipe Mount [PM 601-1]			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Notes
150.0	156.0	1	generic	12' Whip	2	1 5/8	
	150.0	2	tower mounts	Sector Mount [SM 501-1]			
	144.0	1	generic	12' Whip			
142.5	142.5	1	generic	9.5' Elements	1	1 5/8	1
140.0	144.5	1	site pro misc	CIS6 (for 6'MW): Ice Shield	-	-	2
	140.0	1	tower mounts	Pipe Mount [PM 601-1]			
132.0	135.0	1	generic	4' Whip	2 1	7/8 1/2	1
	132.0	1	generic	TMA			
		1	tower mounts	Sector Mount [SM 501-3]			
	129.0	1	generic	4' Whip			
109.5	109.5	1	tower mounts	Side Arm Mount [SO 305-3]	-	-	1
90.0	93.0	1	site pro misc	CIS6 (for 6'MW): Ice Shield	1	EW63	1
	90.0	1	andrew	Andrew 6' w/Radome			
		1	tower mounts	Side Arm Mount [SO 201-1]			

Notes:
1) Existing Equipment; considered in this analysis
2) To be removed; not considered in this analysis

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
TOWER MANUFACTURER DRAWINGS	Pirod Inc., dated 03/02/2001	-	Eversource
TOWER STRUCTURAL ANALYSIS REPORT	KM Consulting Engineers Inc., dated 10/02/2017	-	Eversource

3.1) Analysis Method

tnxTower (version 8.0.5.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built and maintained in accordance with the manufacturer's specifications.
2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
3) The existing baseplate grout was considered in this analysis. Grout must be maintained and inspected periodically and must be replaced if damaged or cracked.
4) Existing tower loading is based on 2018 drone mapping photos and the 2017 Structural Analysis Report prepared by KM Consulting.
5) Foundation information obtained from the 2017 Structural Analysis Report prepared by KM Consulting is correct.
6) This analysis was performed under the assumption that all information provided to Black & Veatch is current and correct. This is to include site data, appurtenance loading,

tower/foundation details, and geotechnical data. If any of this information is not current and correct, this report should be considered obsolete and further analysis will be required.

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

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	180 - 170	Leg	1 1/2	2	9.20	43.89	21.0	Pass
T2	170 - 150	Leg	1 1/2	38	-37.94	54.73	69.3	Pass
T3	150 - 130	Leg	2	102	-78.28	117.05	66.9	Pass
T4	130 - 120	Leg	Pirod 105244	166	-83.38	149.62	55.7	Pass
T5	120 - 100	Leg	Pirod 105216	175	-109.96	149.62	73.5	Pass
T6	100 - 80	Leg	Pirod 105217	190	-132.16	225.60	58.6	Pass
T7	80 - 60	Leg	Pirod 105217	208	-158.39	225.60	70.2	Pass
T8	60 - 40	Leg	Pirod 105218	223	-182.83	315.72	57.9	Pass
T9	40 - 20	Leg	Pirod 105218	238	-206.87	315.72	65.5	Pass
T10	20 - 0	Leg	Pirod 105219	253	-230.06	419.86	54.8	Pass
T1	180 - 170	Diagonal	3/4	14	-2.70	6.39	42.2	Pass
T2	170 - 150	Diagonal	3/4	50	-3.03	5.17	58.6	Pass
T3	150 - 130	Diagonal	7/8	111	-4.94	8.18	60.4	Pass
T4	130 - 120	Diagonal	L2 1/2x2 1/2x3/16	172	-7.92	18.45	42.9 66.0 (b)	Pass
T5	120 - 100	Diagonal	L2 1/2x2 1/2x3/16	178	-5.59	14.57	38.4 55.6 (b)	Pass
T6	100 - 80	Diagonal	L2 1/2x2 1/2x3/16	196	-7.38	11.52	64.0	Pass
T7	80 - 60	Diagonal	L3x3x3/16	211	-6.87	16.11	42.6 55.8 (b)	Pass
T8	60 - 40	Diagonal	L3x3x3/16	226	-6.89	13.01	53.0 54.7 (b)	Pass
T9	40 - 20	Diagonal	L3x3x5/16	241	-7.57	16.96	44.7	Pass
T10	20 - 0	Diagonal	L3x3x5/16	256	-9.09	14.16	64.2	Pass
T1	180 - 170	Horizontal	3/4	16	-0.25	3.48	7.2	Pass
T2	170 - 150	Horizontal	3/4	59	-0.62	2.90	21.2	Pass
T3	150 - 130	Horizontal	7/8	158	-1.08	4.98	21.7	Pass
T1	180 - 170	Top Girt	3/4	6	-0.28	3.48	7.9	Pass
T2	170 - 150	Top Girt	3/4	42	-1.21	3.45	34.9	Pass
T3	150 - 130	Top Girt	7/8	106	-1.54	5.12	30.2	Pass
T1	180 - 170	Bottom Girt	3/4	9	-1.29	3.48	37.0	Pass
T2	170 - 150	Bottom Girt	3/4	43	-1.22	2.74	44.4	Pass
T3	150 - 130	Bottom Girt	7/8	109	-1.27	4.16	30.6	Pass
T6	100 - 80	Mid Girt	L3x3x3/16	194	-2.94	14.05	21.0 26.8 (b)	Pass
							Summary	
						Leg (T5)	73.5	Pass
						Diagonal (T4)	66.0	Pass
						Horizontal (T3)	21.7	Pass
						Top Girt (T2)	34.9	Pass

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
						Bottom Girt (T2)	44.4	Pass
						Mid Girt (T6)	26.8	Pass
						Bolt Checks	66.0	Pass
						Rating =	73.5	Pass

Table 5 - Tower Component Stresses vs. Capacity - LC1

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	38.6	Pass
1	Base Foundation	0	67.9	Pass

Structure Rating (max from all components) =	73.5%

Notes:
1) See additional documentation in "Appendix C - Additional Calculations" for calculations supporting the % capacity consumed. Ratings per TIA-222-H Section 15.5

4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

Maximum Tower Deflections - Service Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load*	*Tilt*	*Twist*	*Check**
	ft	*in*	*Comb.*	°	°	
T1	180 - 170	6.462	48	0.3781	0.1989	OK
T2	170 - 150	5.649	48	0.3736	0.1911	OK
T3	150 - 130	4.119	48	0.3209	0.1512	OK
T4	130 - 120	2.856	48	0.2568	0.1063	OK
T5	120 - 100	2.342	48	0.2235	0.0817	OK
T6	100 - 80	1.526	48	0.1603	0.0544	OK

*Limit State Deformation (TIA-222-H Section 2.8.2)

1) Maximum Rotation = 4 Degrees

2) Maximum Deflection = 0.03 * Tower Height = 65 in.

Critical Deflections of Tower at the MW Dish Elevations - Service Wind

Elevation (ft)	*MW Dish*	*Tilt (°)*	*Twist (°)*	*Diameter, D (ft)*	*Frequency, α (GHz)*	*Decibel Points*	*Deformation Limit (θ)**	*Deformation Limit Exceeded?*
170.75	Grid Dish	0.3744	0.192	6	6	10 dB	1.475	Not Exceeded
90	Andrew 6' w/Radome	0.1382	0.0444	6	6	10 dB	1.475	Not Exceeded

*Limit per TIA-222-H Annex D

Maximum Tower Deflections - Design Wind

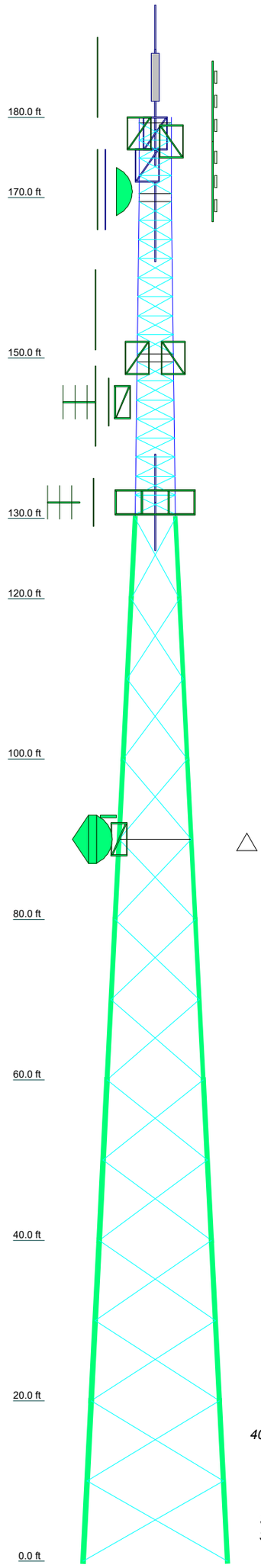
Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load Comb.*	*Tilt*	*Twist*	*Combined Max*
	ft	*in*		°	°	
T1	180 - 170	16.47	48	0.9574	0.5311	1.095
T2	170 - 150	14.411	48	0.9465	0.5086	1.074
T3	150 - 130	10.52	48	0.8159	0.3989	0.908
T4	130 - 120	7.301	48	0.6541	0.2793	0.711
T5	120 - 100	5.99	48	0.5699	0.2145	0.609
T6	100 - 80	3.908	48	0.4086	0.1425	0.433

Critical Deflections of Tower at the MW Dish Elevations - Design Wind

Elevation	*Appurtenance*	*Gov. Load Comb.*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft			*in*	°	°	*ft*
170.75	Grid Dish	48	14.564	0.9485	0.5111	24338.000
90	Andrew 6' w/Radome	48	3.082	0.3523	0.1163	10001.000

APPENDIX A

TNXTOWER OUTPUT



Section	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	
Legs	SR 1 1/2		SR 2	Pirod 105244	Pirod 105216	Pirod 105217		Pirod 105218		Pirod 105219	
Leg Grade	A572-50										
Diagonals	SR 3/4		SR 7/8		L2 1/2x2 1/2x3/16		L3x3x3/16		L3x3x5/16		
Diagonal Grade	A36										
Top Girts	SR 3/4		SR 7/8				N.A.				
Mid Girts	N.A.		N.A.			L3x3x3/16		N.A.			
Bottom Girts	SR 3/4		SR 7/8				N.A.				
Horizontals	SR 3/4		SR 7/8				N.A.				
Face Width (ft)	4		4.5	5	6	8	10	12	14	16	18
# Panels @ (ft)	5 @ 2.20833		16 @ 2.375				13 @ 10				
Weight (K)	0.4	0.8	1.3	1.1	2.0	2.5	2.6	3.0	3.6	4.3	21.6

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod 5/8"x4'	180	Sector Mount [SM 501-1]	150
15'x2.5" Extension Pipe	180	(2) 10' x 2" Horizontal Mount Pipe	150
Sector Mount [SM 501-1]	178	4' x 2" Pipe Mount	150
10' x 2" Horizontal Mount Pipe	178	12' Whip	150
4' x 2" Pipe Mount	178	12' Whip	150
WPA-700120-6CF-EDIN-0	178	Sector Mount [SM 501-1]	150
12'6"x2" Mount Pipe	178	7'x2.5" Mount Pipe	144.5
432E-83I-01-T	178	USF-4U [4' SO 203-1 + Vert. Pipe Support]	144.5
SC479-HF1LDF	178		
Sector Mount [SM 501-1]	178	470-70-220	144.5
(2) 10' x 2" Horizontal Mount Pipe	178	9.5' Elements	142.5
4' x 2" Pipe Mount	178	(2) 10' x 2" Horizontal Mount Pipe	132
12' Whip	178	4' x 2" Pipe Mount	132
SC479-HF1LDF	178	4' Whip	132
Sector Mount [SM 501-1]	177	4' Whip	132
10' x 2" Horizontal Mount Pipe	177	TMA	132
4' x 2" Pipe Mount	177	(2) 10' x 2" Horizontal Mount Pipe	132
10' 2-Bay Dipole	177	4' x 2" Pipe Mount	132
10' Inverted 2-Bay Dipole	177	(2) 10' x 2" Horizontal Mount Pipe	132
PSA6 [SM 501-1]	174	4' x 2" Pipe Mount	132
(2) 10' x 2" Horizontal Mount Pipe	174	470-70-220	132
20' Omni	174	7'x2.5" Mount Pipe	132
12' Inverted Whip	174	Sector Mount [SM 501-3]	132
Pipe Mount [PM 601-1]	170.75	Side Arm Mount [SO 305-3]	109.5
Grid Dish	170.75	Side Arm Mount [SO 201-1]	90
(2) 10' x 2" Horizontal Mount Pipe	150	CIS6 (for 6'MW) : Ice Shield	90
4' x 2" Pipe Mount	150	Andrew 6' w/Radome	90

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-H Standard.
2. Tower designed for a 125 mph basic wind in accordance with the TIA-222-H Standard.
3. Tower is also designed for a 40 mph basic wind with 1.50 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 73.5%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 237 K
SHEAR: 24 K

UPLIFT: -212 K
SHEAR: 21 K

AXIAL 115 K
SHEAR 9 K *MOMENT 1020 kip-ft*

TORQUE 15 kip-ft
40 mph WIND - 1.5000 in ICE

AXIAL 36 K
SHEAR 36 K *MOMENT 3510 kip-ft*

TORQUE 61 kip-ft
REACTIONS - 125 mph WIND

BLACK & VEATCH
Building a world of difference.
Black & Veatch Corp.
6800 W. 115th St., Suite 2292
Overland Park, KS 66211
Phone: (913) 458-2984
FAX: (913) 458-8136

Job: *ES-028 Colebrook*			
Project: *405025*			
Client: Eversource	Drawn by: Josh Riley	App'd:	
Code: TIA-222-H	Date: 07/09/20	Scale: NTS	
Path: C:\Users\V0886\OneDrive - Black & Veatch\Desktop\Eversource\Phase 1 SOWs Single\Colebrook\Tower 54 Update\ES-028 Colebrook Structural Analysis.eri		Dwg No. E-1	

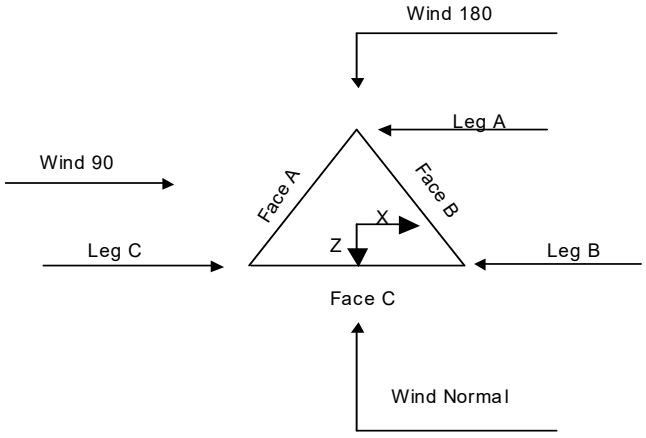
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 180.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 4.00 ft at the top and 18.00 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

1) Tower base elevation above sea level: 1320.00 ft.
2) Basic wind speed of 125 mph.
3) Risk Category III.
4) Exposure Category C.
5) Simplified Topographic Factor Procedure for wind speed-up calculations is used.
6) Topographic Category: 1.
7) Crest Height: 0.00 ft.
8) Nominal ice thickness of 1.5000 in.
9) Ice thickness is considered to increase with height.
10) Ice density of 56 pcf.
11) A wind speed of 40 mph is used in combination with ice.
12) Temperature drop of 50 °F.
13) Deflections calculated using a wind speed of 60 mph.
14) Pressures are calculated at each section.
15) Tower analysis based on target reliabilities in accordance with Annex S.
16) Load Modification Factors used: $K_{es}(F_w) = 1.0$, $K_{es}(t_i) = 1.0$.
17) Stress ratio used in tower member design is 1.05.
18) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Horizontals		Assume Legs Pinned	√	Calculate Redundant Bracing Forces
	Consider Moments - Diagonals	√	Assume Rigid Index Plate		Ignore Redundant Members in FEA
	Use Moment Magnification	√	Use Clear Spans For Wind Area	√	SR Leg Bolts Resist Compression
	Use Code Stress Ratios	√	Use Clear Spans For KL/r		All Leg Panels Have Same Allowable
	Use Code Safety Factors - Guys		Retension Guys To Initial Tension		Offset Girt At Foundation
	Escalate Ice	√	Bypass Mast Stability Checks	√	Consider Feed Line Torque
	Always Use Max Kz		Use Azimuth Dish Coefficients	√	Include Angle Block Shear Check
	Use Special Wind Profile	√	Project Wind Area of Appurt.		Use TIA-222-H Bracing Resist. Exemption
√	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Use TIA-222-H Tension Splice Exemption
	Leg Bolts Are At Top Of Section		Add IBC .6D+W Combination		Poles
√	Secondary Horizontal Braces Leg	√	Sort Capacity Reports By Component		Include Shear-Torsion Interaction
	Use Diamond Inner Bracing (4 Sided)		Triangulate Diamond Inner Bracing		Always Use Sub-Critical Flow
√	SR Members Have Cut Ends		Treat Feed Line Bundles As Cylinder		Use Top Mounted Sockets
	SR Members Are Concentric		Ignore KL/ry For 60 Deg. Angle Legs		Pole Without Linear Attachments
					Pole With Shroud Or No Appurtenances
					Outside and Inside Corner Radii Are Known



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	180.00-170.00			4.00	1	10.00
T2	170.00-150.00			4.00	1	20.00
T3	150.00-130.00			4.50	1	20.00
T4	130.00-120.00			5.00	1	10.00
T5	120.00-100.00			6.00	1	20.00
T6	100.00-80.00			8.00	1	20.00
T7	80.00-60.00			10.00	1	20.00
T8	60.00-40.00			12.00	1	20.00
T9	40.00-20.00			14.00	1	20.00
T10	20.00-0.00			16.00	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T1	180.00-170.00	2.21	X Brace	No	Steps	8.0000	6.0000
T2	170.00-150.00	2.38	X Brace	No	Steps	6.0000	6.0000
T3	150.00-130.00	2.38	X Brace	No	Steps	6.0000	6.0000
T4	130.00-120.00	10.00	X Brace	No	No	0.0000	0.0000
T5	120.00-100.00	10.00	X Brace	No	No	0.0000	0.0000
T6	100.00-80.00	10.00	X Brace	No	No	0.0000	0.0000
T7	80.00-60.00	10.00	X Brace	No	No	0.0000	0.0000
T8	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T9	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T10	20.00-0.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 180.00-170.00	Solid Round	1 1/2	A572-50 (50 ksi)	Solid Round	3/4	A36 (36 ksi)
T2 170.00-150.00	Solid Round	1 1/2	A572-50 (50 ksi)	Solid Round	3/4	A36 (36 ksi)
T3 150.00-130.00	Solid Round	2	A572-50 (50 ksi)	Solid Round	7/8	A36 (36 ksi)
T4 130.00-120.00	Truss Leg	Pirod 105244	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 120.00-100.00	Truss Leg	Pirod 105216	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T6 100.00-80.00	Truss Leg	Pirod 105217	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T7 80.00-60.00	Truss Leg	Pirod 105217	A572-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T8 60.00-40.00	Truss Leg	Pirod 105218	A572-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T9 40.00-20.00	Truss Leg	Pirod 105218	A572-50 (50 ksi)	Single Angle	L3x3x5/16	A36 (36 ksi)
T10 20.00-0.00	Truss Leg	Pirod 105219	A572-50 (50 ksi)	Single Angle	L3x3x5/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 180.00-170.00	Solid Round	3/4	A36 (36 ksi)	Solid Round	3/4	A36 (36 ksi)
T2 170.00-150.00	Solid Round	3/4	A36 (36 ksi)	Solid Round	3/4	A36 (36 ksi)
T3 150.00-130.00	Solid Round	7/8	A36 (36 ksi)	Solid Round	7/8	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 180.00-170.00	None	Flat Bar		A36 (36 ksi)	Solid Round	3/4	A36 (36 ksi)
T2 170.00-150.00	None	Flat Bar		A36 (36 ksi)	Solid Round	3/4	A36 (36 ksi)
T3 150.00-130.00	None	Flat Bar		A36 (36 ksi)	Solid Round	7/8	A36 (36 ksi)
T6 100.00-80.00	1	Single Angle	L3x3x3/16	A36 (36 ksi)	Single Angle		A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 180.00-170.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T2 170.00-150.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T3 150.00-130.00	0.00	0.0000	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T4 130.00-120.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T5 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T6 100.00-80.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T7 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T8 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T9 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T10 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 180.00-170.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 170.00-150.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 150.00-130.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 130.00-120.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 120.00-100.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 100.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T9 40.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T10 20.00-0.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Truss-Leg K Factors					
	Truss-Legs Used As Leg Members			Truss-Legs Used As Inner Members		
	Leg Panels	X Brace Diagonals	Z Brace Diagonals	Leg Panels	X Brace Diagonals	Z Brace Diagonals
T4 130.00-120.00	1	0.5	0.85	1	0.5	0.85
T5 120.00-100.00	1	0.5	0.85	1	0.5	0.85
T6 100.00-80.00	1	0.5	0.85	1	0.5	0.85
T7 80.00-60.00	1	0.5	0.85	1	0.5	0.85
T8 60.00-40.00	1	0.5	0.85	1	0.5	0.85
T9 40.00-20.00	1	0.5	0.85	1	0.5	0.85
T10 20.00-0.00	1	0.5	0.85	1	0.5	0.85

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 180.00-170.00	0.0000	1	0.0000	1	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	1	0.0000	0.75
T2 170.00-150.00	0.0000	1	0.0000	1	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	1	0.0000	0.75
T3 150.00-130.00	0.0000	1	0.0000	1	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	1	0.0000	0.75
T4 130.00-120.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 120.00-100.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T8 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T9 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T10 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 180.00-170.00	Sleeve DS	0.5625 A325N	3	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 170.00-150.00	Sleeve DS	0.6250 A325N	5	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 150.00-130.00	Flange	1.0000 A325N	6	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T4 130.00-120.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 120.00-100.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 100.00-80.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0
T7 80.00-60.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T8 60.00-40.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T9 40.00-20.00	Flange	1.0000 A325N	6	1.0000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T10 20.00-0.00	Flange	0.7500 A325N	0	1.2500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
Face A													
LDF7-50A(1-5/8)	A	No	No	Ar (CaAa)	174.00 - 0.00	-2.0000	-0.42	1	1	0.5000	1.9800		0.82
LDF4-50A(1/2)	A	No	No	Ar (CaAa)	178.00 - 0.00	0.0000	-0.46	1	1	0.5000	0.6250		0.15
LDF4-50A(1/2)	A	No	No	Ar (CaAa)	132.00 - 0.00	-2.5000	-0.405	1	1	0.5000	0.6250		0.15
LDF7-50A(1-5/8)	A	No	No	Ar (CaAa)	170.75 - 150.00	-2.0000	-0.46	1	1	0.5000	1.9800		0.82
LDF7-50A(1-5/8)	A	No	No	Ar (CaAa)	150.00 - 0.00	-2.0000	-0.46	3	3	0.5000	1.9800		0.82
AVA5-50(7/8)	A	No	No	Ar (CaAa)	132.00 - 0.00	-2.2500	-0.39	2	2	0.5000	1.1020		0.30
LCF12-50J(1/2)	A	No	No	Ar (CaAa)	132.00 - 0.00	-2.5000	-0.375	1	1	0.6400	0.6400		0.15
EW63(ELLIPTICAL) ***	A	No	No	Ar (CaAa)	90.00 - 0.00	-2.0000	-0.435	1	1	0.5000	2.0100		0.51
Face C													
LDF7-50A(1-5/8)	A	No	No	Ar (CaAa)	178.00 - 142.50	-5.0000	-0.46	1	1	0.5000	1.9800		0.82
LDF7-50A(1-5/8)	A	No	No	Ar (CaAa)	142.50 - 0.00	-5.0000	-0.46	2	2	0.5000	1.9800		0.82
LCF12-50J(1/2)	A	No	No	Ar (CaAa)	174.00 - 0.00	-5.5000	-0.415	1	1	0.5000	0.6400		0.15
LCF78-50JA(7/8)	A	No	No	Ar (CaAa)	174.00 - 0.00	-5.2500	-0.435	3	3	0.5000	1.0900		0.32
LDF7-50A(1-5/8)	A	No	No	Ar (CaAa)	178.00 - 177.00	-5.0000	-0.39	2	2	0.5000	1.9800		0.82
AVA7-50(1-5/8) ********	A	No	No	Ar (CaAa)	177.00 - 0.00	-5.0000	-0.39	3	3	0.5000	2.0100		0.70
T-Bracket	A	No	No	Af (CaAa)	180.00 - 8.00	-9.0000	-0.38	1	1	1.0000	1.5000		4.20
** Proposed **													
LDF5-50A(7/8)	A	No	No	Ar (CaAa)	144.50 - 132.00	0.0000	-0.47	1	1	0.5000	1.0300		0.33
LDF5-50A(7/8)	A	No	No	Ar (CaAa)	132.00 - 0.00	0.0000	-0.48	2	2	0.5000	1.0300		0.33

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	C_AA_A ft^2/ft	Weight plf
***								

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	180.00-170.00	A	0.000	0.000	11.706	0.000	0.07
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T2	170.00-150.00	A	0.000	0.000	38.010	0.000	0.20
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T3	150.00-130.00	A	0.000	0.000	50.798	0.000	0.25
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T4	130.00-120.00	A	0.000	0.000	30.474	0.000	0.14
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T5	120.00-100.00	A	0.000	0.000	60.948	0.000	0.28
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T6	100.00-80.00	A	0.000	0.000	62.958	0.000	0.29
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T7	80.00-60.00	A	0.000	0.000	64.968	0.000	0.29
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T8	60.00-40.00	A	0.000	0.000	64.968	0.000	0.29
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T9	40.00-20.00	A	0.000	0.000	64.968	0.000	0.29
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00
T10	20.00-0.00	A	0.000	0.000	62.968	0.000	0.26
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.00

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	180.00-170.00	A	2.038	0.000	0.000	37.244	0.000	0.60
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T2	170.00-150.00	A	2.020	0.000	0.000	123.843	0.000	1.92
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T3	150.00-130.00	A	1.993	0.000	0.000	163.005	0.000	2.34
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T4	130.00-120.00	A	1.971	0.000	0.000	107.291	0.000	1.43
		B		0.000	0.000	0.000	0.000	0.00

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
		C		0.000	0.000	0.000	0.000	0.00
T5	120.00-100.00	A	1.946	0.000	0.000	212.945	0.000	2.82
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T6	100.00-80.00	A	1.907	0.000	0.000	216.241	0.000	2.84
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T7	80.00-60.00	A	1.860	0.000	0.000	218.782	0.000	2.85
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T8	60.00-40.00	A	1.798	0.000	0.000	214.515	0.000	2.73
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T9	40.00-20.00	A	1.709	0.000	0.000	208.310	0.000	2.56
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.00
T10	20.00-0.00	A	1.531	0.000	0.000	191.557	0.000	2.16
		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	180.00-170.00	-6.1923	5.4588	-3.6197	3.0292
T2	170.00-150.00	-9.2602	7.4074	-6.4331	4.9873
T3	150.00-130.00	-10.9224	8.4615	-8.1039	6.0353
T4	130.00-120.00	-9.0351	6.9501	-6.4565	4.5464
T5	120.00-100.00	-11.5089	8.3878	-10.9621	7.2380
T6	100.00-80.00	-13.7148	9.6145	-15.7440	9.9037
T7	80.00-60.00	-16.4264	11.1874	-21.5852	13.1396
T8	60.00-40.00	-18.2173	12.2503	-25.4973	15.2922
T9	40.00-20.00	-20.0690	13.3920	-28.1479	16.7836
T10	20.00-0.00	-20.8702	13.9347	-29.2737	17.5793

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	2	LDF7-50A(1-5/8)	170.00 - 174.00	0.6000	0.4030
T1	3	LDF4-50A(1/2)	170.00 - 178.00	0.6000	0.4030
T1	5	LDF7-50A(1-5/8)	170.00 - 170.75	0.6000	0.4030
T1	13	LDF7-50A(1-5/8)	170.00 - 178.00	0.6000	0.4030
T1	15	LCF12-50J(1/2)	170.00 - 174.00	0.6000	0.4030
T1	16	LCF78-50JA(7/8)	170.00 - 174.00	0.6000	0.4030
T1	19	LDF7-50A(1-5/8)	177.00 - 178.00	0.6000	0.4030
T1	20	AVA7-50(1-5/8)	170.00 - 177.00	0.6000	0.4030
T1	22	T-Bracket	170.00 - 180.00	0.6000	0.4030

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T2	2	LDF7-50A(1-5/8)	150.00 - 170.00	0.6000	0.4488
T2	3	LDF4-50A(1/2)	150.00 - 170.00	0.6000	0.4488
T2	5	LDF7-50A(1-5/8)	150.00 - 170.00	0.6000	0.4488
T2	13	LDF7-50A(1-5/8)	150.00 - 170.00	0.6000	0.4488
T2	15	LCF12-50J(1/2)	150.00 - 170.00	0.6000	0.4488
T2	16	LCF78-50JA(7/8)	150.00 - 170.00	0.6000	0.4488
T2	20	AVA7-50(1-5/8)	150.00 - 170.00	0.6000	0.4488
T2	22	T-Bracket	150.00 - 170.00	0.6000	0.4488
T3	2	LDF7-50A(1-5/8)	130.00 - 150.00	0.6000	0.4581
T3	3	LDF4-50A(1/2)	130.00 - 150.00	0.6000	0.4581
T3	4	LDF4-50A(1/2)	130.00 - 132.00	0.6000	0.4581
T3	6	LDF7-50A(1-5/8)	130.00 - 150.00	0.6000	0.4581
T3	8	AVA5-50(7/8)	130.00 - 132.00	0.6000	0.4581
T3	9	LCF12-50J(1/2)	130.00 - 132.00	0.6000	0.4581
T3	13	LDF7-50A(1-5/8)	142.50 - 150.00	0.6000	0.4581
T3	14	LDF7-50A(1-5/8)	130.00 - 142.50	0.6000	0.4581
T3	15	LCF12-50J(1/2)	130.00 - 150.00	0.6000	0.4581
T3	16	LCF78-50JA(7/8)	130.00 - 150.00	0.6000	0.4581
T3	20	AVA7-50(1-5/8)	130.00 - 150.00	0.6000	0.4581
T3	22	T-Bracket	130.00 - 150.00	0.6000	0.4581
T3	24	LDF5-50A(7/8)	132.00 - 144.50	0.6000	0.4581
T3	25	LDF5-50A(7/8)	130.00 - 132.00	0.6000	0.4581
T4	2	LDF7-50A(1-5/8)	120.00 - 130.00	0.6000	0.2940
T4	3	LDF4-50A(1/2)	120.00 - 130.00	0.6000	0.2940
T4	4	LDF4-50A(1/2)	120.00 - 130.00	0.6000	0.2940
T4	6	LDF7-50A(1-5/8)	120.00 - 130.00	0.6000	0.2940
T4	8	AVA5-50(7/8)	120.00 - 130.00	0.6000	0.2940
T4	9	LCF12-50J(1/2)	120.00 - 130.00	0.6000	0.2940
T4	14	LDF7-50A(1-5/8)	120.00 - 130.00	0.6000	0.2940
T4	15	LCF12-50J(1/2)	120.00 - 130.00	0.6000	0.2940
T4	16	LCF78-50JA(7/8)	120.00 - 130.00	0.6000	0.2940
T4	20	AVA7-50(1-5/8)	120.00 - 130.00	0.6000	0.2940
T4	22	T-Bracket	120.00 - 130.00	0.6000	0.2940
T4	25	LDF5-50A(7/8)	120.00 - 130.00	0.6000	0.2940

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T5	2	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.4058
T5	3	LDF4-50A(1/2)	100.00 - 120.00	0.6000	0.4058
T5	4	LDF4-50A(1/2)	100.00 - 120.00	0.6000	0.4058
T5	6	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.4058
T5	8	AVA5-50(7/8)	100.00 - 120.00	0.6000	0.4058
T5	9	LCF12-50J(1/2)	100.00 - 120.00	0.6000	0.4058
T5	14	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.4058
T5	15	LCF12-50J(1/2)	100.00 - 120.00	0.6000	0.4058
T5	16	LCF78-50JA(7/8)	100.00 - 120.00	0.6000	0.4058
T5	20	AVA7-50(1-5/8)	100.00 - 120.00	0.6000	0.4058
T5	22	T-Bracket	100.00 - 120.00	0.6000	0.4058
T5	25	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.4058
T6	2	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.4820
T6	3	LDF4-50A(1/2)	80.00 - 100.00	0.6000	0.4820
T6	4	LDF4-50A(1/2)	80.00 - 100.00	0.6000	0.4820
T6	6	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.4820
T6	8	AVA5-50(7/8)	80.00 - 100.00	0.6000	0.4820
T6	9	LCF12-50J(1/2)	80.00 - 100.00	0.6000	0.4820
T6	10	EW63(ELLIPTICAL)	80.00 - 90.00	0.6000	0.4820
T6	14	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.4820
T6	15	LCF12-50J(1/2)	80.00 - 100.00	0.6000	0.4820
T6	16	LCF78-50JA(7/8)	80.00 - 100.00	0.6000	0.4820
T6	20	AVA7-50(1-5/8)	80.00 - 100.00	0.6000	0.4820
T6	22	T-Bracket	80.00 - 100.00	0.6000	0.4820
T6	25	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.4820
T7	2	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.5643
T7	3	LDF4-50A(1/2)	60.00 - 80.00	0.6000	0.5643
T7	4	LDF4-50A(1/2)	60.00 - 80.00	0.6000	0.5643
T7	6	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.5643
T7	8	AVA5-50(7/8)	60.00 - 80.00	0.6000	0.5643
T7	9	LCF12-50J(1/2)	60.00 - 80.00	0.6000	0.5643
T7	10	EW63(ELLIPTICAL)	60.00 - 80.00	0.6000	0.5643
T7	14	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.5643
T7	15	LCF12-50J(1/2)	60.00 - 80.00	0.6000	0.5643

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	*K_a No Ice*	*K_a Ice*
T7	16	LCF78-50JA(7/8)	60.00 - 80.00	0.6000	0.5643
T7	20	AVA7-50(1-5/8)	60.00 - 80.00	0.6000	0.5643
T7	22	T-Bracket	60.00 - 80.00	0.6000	0.5643
T7	25	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.5643
T8	2	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T8	3	LDF4-50A(1/2)	40.00 - 60.00	0.6000	0.6000
T8	4	LDF4-50A(1/2)	40.00 - 60.00	0.6000	0.6000
T8	6	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T8	8	AVA5-50(7/8)	40.00 - 60.00	0.6000	0.6000
T8	9	LCF12-50J(1/2)	40.00 - 60.00	0.6000	0.6000
T8	10	EW63(ELLIPTICAL)	40.00 - 60.00	0.6000	0.6000
T8	14	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T8	15	LCF12-50J(1/2)	40.00 - 60.00	0.6000	0.6000
T8	16	LCF78-50JA(7/8)	40.00 - 60.00	0.6000	0.6000
T8	20	AVA7-50(1-5/8)	40.00 - 60.00	0.6000	0.6000
T8	22	T-Bracket	40.00 - 60.00	0.6000	0.6000
T8	25	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T9	2	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T9	3	LDF4-50A(1/2)	20.00 - 40.00	0.6000	0.6000
T9	4	LDF4-50A(1/2)	20.00 - 40.00	0.6000	0.6000
T9	6	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T9	8	AVA5-50(7/8)	20.00 - 40.00	0.6000	0.6000
T9	9	LCF12-50J(1/2)	20.00 - 40.00	0.6000	0.6000
T9	10	EW63(ELLIPTICAL)	20.00 - 40.00	0.6000	0.6000
T9	14	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T9	15	LCF12-50J(1/2)	20.00 - 40.00	0.6000	0.6000
T9	16	LCF78-50JA(7/8)	20.00 - 40.00	0.6000	0.6000
T9	20	AVA7-50(1-5/8)	20.00 - 40.00	0.6000	0.6000
T9	22	T-Bracket	20.00 - 40.00	0.6000	0.6000
T9	25	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T10	2	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T10	3	LDF4-50A(1/2)	0.00 - 20.00	0.6000	0.6000
T10	4	LDF4-50A(1/2)	0.00 - 20.00	0.6000	0.6000
T10	6	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T10	8	AVA5-50(7/8)	0.00 - 20.00	0.6000	0.6000
T10	9	LCF12-50J(1/2)	0.00 - 20.00	0.6000	0.6000
T10	10	EW63(ELLIPTICAL)	0.00 - 20.00	0.6000	0.6000
T10	14	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T10	15	LCF12-50J(1/2)	0.00 - 20.00	0.6000	0.6000

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	*K_a No Ice*	*K_a Ice*
T10	16	LCF78-50JA(7/8)	0.00 - 20.00	0.6000	0.6000
T10	20	AVA7-50(1-5/8)	0.00 - 20.00	0.6000	0.6000
T10	22	T-Bracket	8.00 - 20.00	0.6000	0.6000
T10	25	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *K*
Lightning Rod 5/8"x4'	B	From Leg	0.00 0.00 13.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.25 0.66 0.97 1.49	0.25 0.66 0.97 1.49	0.00 0.01 0.01 0.03
15'x2.5" Extension Pipe	B	From Leg	0.00 0.00 3.00	0.0000	180.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.31 5.84 7.39 10.54	4.31 5.84 7.39 10.54	0.09 0.12 0.16 0.27
178 Sector Mount [SM 501-1]	A	From Face	0.00 2.00 0.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.80 21.01 27.22 39.64	6.72 9.55 12.38 18.04	0.30 0.45 0.59 0.89
10' x 2" Horizontal Mount Pipe	A	From Face	0.00 2.00 0.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.38 3.06 3.75 5.15	0.05 0.08 0.11 0.21	0.03 0.05 0.08 0.17
4' x 2" Pipe Mount	A	From Face	1.00 2.00 0.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.79 1.03 1.28 1.81	0.79 1.03 1.28 1.81	0.03 0.04 0.04 0.07
WPA-700120-6CF-EDIN-0	A	From Leg	2.00 0.00 7.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	10.66 11.26 11.87 13.12	5.98 6.55 7.13 8.31	0.02 0.08 0.14 0.29
12'6"x2" Mount Pipe	A	From Leg	0.00 0.00 5.50	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.97 4.25 5.54 8.05	2.97 4.25 5.54 8.05	0.05 0.07 0.10 0.18
432E-83I-01-T	A	From Face	2.00 0.00 1.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.20 1.34 1.48 1.79	0.75 0.86 0.98 1.24	0.03 0.04 0.05 0.09
SC479-HF1LDF	A	From Face	6.00 0.00 -7.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.64 6.54 8.04 10.81	4.64 6.54 8.04 10.81	0.03 0.07 0.11 0.23
Sector Mount [SM 501-1]	C	From Leg	0.00 0.00 0.00	0.0000	178.00	No Ice 1/2" Ice	14.80 21.01 27.22	6.72 9.55 12.38	0.30 0.45 0.59

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		C_AA_A *Front* *ft²*	C_AA_A *Side* *ft²*	*Weight* *K*
						1" Ice	39.64	18.04	0.89
						2" Ice			
(2) 10' x 2" Horizontal Mount Pipe	C	From Leg	0.00 0.00 0.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.38 3.06 3.75 5.15	0.05 0.08 0.11 0.21	0.03 0.05 0.08 0.17
4' x 2" Pipe Mount	C	From Leg	1.00 0.00 0.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.79 1.03 1.28 1.81	0.79 1.03 1.28 1.81	0.03 0.04 0.04 0.07
12' Whip	C	From Leg	6.00 0.00 7.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.40 3.63 4.85 7.30	2.40 3.63 4.85 7.30	0.01 0.03 0.05 0.09
SC479-HF1LDF	C	From Leg	6.00 0.00 -7.00	0.0000	178.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.64 6.54 8.04 10.81	4.64 6.54 8.04 10.81	0.03 0.07 0.11 0.23
177 Sector Mount [SM 501-1]	B	From Leg	0.00 0.00 0.00	0.0000	177.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.80 21.01 27.22 39.64	6.72 9.55 12.38 18.04	0.30 0.45 0.59 0.89
10' x 2" Horizontal Mount Pipe	B	From Leg	0.00 0.00 0.00	0.0000	177.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.38 3.06 3.75 5.15	0.05 0.08 0.11 0.21	0.03 0.05 0.08 0.17
4' x 2" Pipe Mount	B	From Leg	1.00 0.00 0.00	0.0000	177.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.79 1.03 1.28 1.81	0.79 1.03 1.28 1.81	0.03 0.04 0.04 0.07
10' 2-Bay Dipole	B	From Leg	6.00 0.00 5.00	0.0000	177.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.00 3.00 4.00 6.00	2.00 3.00 4.00 6.00	0.03 0.05 0.07 0.12
10' Inverted 2-Bay Dipole	B	From Leg	6.00 0.00 -5.00	0.0000	177.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.00 3.00 4.00 6.00	2.00 3.00 4.00 6.00	0.03 0.05 0.07 0.12
174 PSA6 [SM 501-1]	A	From Face	0.00 0.00 0.00	0.0000	174.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.80 21.01 27.22 39.64	6.72 9.55 12.38 18.04	0.30 0.45 0.59 0.89
(2) 10' x 2" Horizontal Mount Pipe	A	From Leg	0.00 0.00 0.00	0.0000	174.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.38 3.06 3.75 5.15	0.05 0.08 0.11 0.21	0.03 0.05 0.08 0.17
20' Omni	A	From Leg	6.00 0.00 10.00	0.0000	174.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.00 6.00 8.00 12.00	4.00 6.00 8.00 12.00	0.06 0.10 0.14 0.23
12' Inverted Whip	A	From Leg	6.00	0.0000	174.00	No Ice	2.40	2.40	0.01

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* °	*Placement* *ft*		C_AA_A *Front* ft^2	C_AA_A *Side* ft^2	*Weight* *K*
			0.00 -7.00			1/2" Ice 1" Ice 2" Ice	3.63 4.87 7.35	3.63 4.87 7.35	0.03 0.06 0.13
170.75									
Pipe Mount [PM 601-1]	C	From Leg	0.00 0.00 0.00	0.0000	170.75	No Ice 1/2" Ice 1" Ice 2" Ice	3.00 3.74 4.48 5.96	0.90 1.12 1.34 1.78	0.07 0.08 0.09 0.12
150									
Sector Mount [SM 501-1]	B	From Leg	0.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.80 21.01 27.22 39.64	6.72 9.55 12.38 18.04	0.30 0.45 0.59 0.89
(2) 10' x 2" Horizontal Mount Pipe	B	From Leg	0.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.38 3.06 3.75 5.15	0.05 0.08 0.11 0.21	0.03 0.05 0.08 0.17
4' x 2" Pipe Mount	B	From Leg	1.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.79 1.03 1.28 1.81	0.79 1.03 1.28 1.81	0.03 0.04 0.04 0.07
Sector Mount [SM 501-1]	C	From Leg	0.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.80 21.01 27.22 39.64	6.72 9.55 12.38 18.04	0.30 0.45 0.59 0.89
(2) 10' x 2" Horizontal Mount Pipe	C	From Leg	0.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.38 3.06 3.75 5.15	0.05 0.08 0.11 0.21	0.03 0.05 0.08 0.17
4' x 2" Pipe Mount	C	From Leg	1.00 0.00 0.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.79 1.03 1.28 1.81	0.79 1.03 1.28 1.81	0.03 0.04 0.04 0.07
12' Whip	C	From Leg	6.00 0.00 6.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.40 3.63 4.87 7.35	2.40 3.63 4.87 7.35	0.01 0.03 0.06 0.13
12' Whip	C	From Leg	6.00 0.00 -6.00	0.0000	150.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.40 3.63 4.87 7.35	2.40 3.63 4.87 7.35	0.01 0.03 0.06 0.13
144.5									
470-70-220	C	From Leg	6.00 0.00 0.00	0.0000	144.50	No Ice 1/2" Ice 1" Ice 2" Ice	8.26 13.78 19.29 30.32	4.36 7.45 10.55 16.75	0.04 0.06 0.08 0.12
7'x2.5" Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	144.50	No Ice 1/2" Ice 1" Ice 2" Ice	2.01 2.59 3.02 3.90	2.01 2.59 3.02 3.90	0.04 0.06 0.07 0.13
USF-4U [4' SO 203-1 + Vert. Pipe Support]	C	From Leg	2.00 0.00 0.00	0.0000	144.50	No Ice 1/2" Ice	2.96 3.76 4.63	5.64 6.73 7.91	0.18 0.22 0.28

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* ft ft ft	*Azimuth Adjustment* °	*Placement* ft		*C_AA_A Front* ft^2	*C_AA_A Side* ft^2	*Weight* K
						1" Ice	6.57	10.43	0.43
						2" Ice			
142.5									
9.5' Elements	A	From Leg	0.50	0.0000	142.50	No Ice	1.38	4.68	0.04
			0.00			1/2"	1.60	7.03	0.11
			0.00			Ice	1.83	9.38	0.18
						1" Ice	2.29	14.07	0.32
						2" Ice			
140									
132									
Sector Mount [SM 501-3]	C	None		0.0000	132.00	No Ice	24.21	24.21	0.90
						1/2"	34.39	34.39	1.34
						Ice	44.57	44.57	1.78
						1" Ice	64.93	64.93	2.67
						2" Ice			
(2) 10' x 2" Horizontal Mount Pipe	A	From Leg	0.00	0.0000	132.00	No Ice	2.38	0.05	0.03
			0.00			1/2"	3.06	0.08	0.05
			0.00			Ice	3.75	0.11	0.08
						1" Ice	5.15	0.21	0.17
						2" Ice			
4' x 2" Pipe Mount	A	From Leg	1.00	0.0000	132.00	No Ice	0.79	0.79	0.03
			0.00			1/2"	1.03	1.03	0.04
			0.00			Ice	1.28	1.28	0.04
						1" Ice	1.81	1.81	0.07
						2" Ice			
4' Whip	A	From Leg	6.00	0.0000	132.00	No Ice	0.60	0.60	0.02
			0.00			1/2"	0.92	0.92	0.02
			3.00			Ice	1.17	1.17	0.03
						1" Ice	1.70	1.70	0.05
						2" Ice			
4' Whip	A	From Leg	6.00	0.0000	132.00	No Ice	0.60	0.60	0.02
			0.00			1/2"	0.92	0.92	0.02
			-3.00			Ice	1.17	1.17	0.03
						1" Ice	1.70	1.70	0.05
						2" Ice			
TMA	A	From Leg	4.00	0.0000	132.00	No Ice	0.94	0.61	0.02
			0.00			1/2"	1.06	0.71	0.03
			0.00			Ice	1.19	0.82	0.04
						1" Ice	1.47	1.06	0.07
						2" Ice			
(2) 10' x 2" Horizontal Mount Pipe	B	From Leg	0.00	0.0000	132.00	No Ice	2.38	0.05	0.03
			0.00			1/2"	3.06	0.08	0.05
			0.00			Ice	3.75	0.11	0.08
						1" Ice	5.15	0.21	0.17
						2" Ice			
4' x 2" Pipe Mount	B	From Leg	1.00	0.0000	132.00	No Ice	0.79	0.79	0.03
			0.00			1/2"	1.03	1.03	0.04
			0.00			Ice	1.28	1.28	0.04
						1" Ice	1.81	1.81	0.07
						2" Ice			
(2) 10' x 2" Horizontal Mount Pipe	C	From Leg	0.00	0.0000	132.00	No Ice	2.38	0.05	0.03
			0.00			1/2"	3.06	0.08	0.05
			0.00			Ice	3.75	0.11	0.08
						1" Ice	5.15	0.21	0.17
						2" Ice			
4' x 2" Pipe Mount	C	From Leg	1.00	0.0000	132.00	No Ice	0.79	0.79	0.03
			0.00			1/2"	1.03	1.03	0.04
			0.00			Ice	1.28	1.28	0.04
						1" Ice	1.81	1.81	0.07
						2" Ice			
132									
470-70-220	C	From Leg	8.00	0.0000	132.00	No Ice	8.26	4.36	0.04
			0.00			1/2"	13.78	7.45	0.06
			0.00			Ice	19.29	10.55	0.08
						1" Ice	30.32	16.75	0.12

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						2" Ice			
7'x2.5" Mount Pipe	C	From Leg	6.00 0.00 0.00	0.0000	132.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.01 2.59 3.02 3.90	2.01 2.59 3.02 3.90	0.04 0.06 0.07 0.13
109.5									
Side Arm Mount [SO 305-3]	C	From Leg	0.00 0.00 0.00	0.0000	109.50	No Ice 1/2" Ice 1" Ice 2" Ice	2.64 4.10 5.56 8.48	2.64 4.10 5.56 8.48	0.09 0.13 0.17 0.25
94									
CIS6 (for 6'MW) : Ice Shield	C	From Leg	1.50 0.00 3.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.96 3.48 4.00 5.08	2.00 2.36 2.73 3.48	0.74 0.94 1.14 1.59
Side Arm Mount [SO 201-1]	C	From Leg	0.00 0.00 0.00	0.0000	90.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.96 4.10 5.24 7.52	2.11 2.93 3.75 5.39	0.10 0.12 0.14 0.18

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
Grid Dish	C	Grid	From Leg	1.00 0.00 0.00	Worst		170.75	6.00	No Ice 1/2" Ice 1" Ice 2" Ice	28.27 29.07 29.87 31.47	0.38 0.62 0.86 1.34
*****											
Andrew 6' w/Radome	C	Paraboloid w/Radome	From Leg	1.00 0.00 0.00	Worst		90.00	6.00	No Ice 1/2" Ice 1" Ice 2" Ice	28.27 29.07 29.86 31.44	0.38 0.45 0.52 0.66

Truss-Leg Properties

Section Designation	Area in^2	Area Ice in^2	Self Weight K	Ice Weight K	Equiv. Diameter in	Equiv. Diameter Ice in	Leg Area in^2
Pirod 105244	1026.8606	3259.2703	0.56	0.75	7.1310	22.6338	3.6816
Pirod 105216	1998.0891	6681.0482	0.51	1.40	6.9378	23.1981	3.6816
Pirod 105217	2130.7479	6718.8768	0.62	1.37	7.3984	23.3294	5.3014
Pirod 105217	2130.7479	6677.0373	0.62	1.32	7.3984	23.1842	5.3014
Pirod 105218	2263.4687	6694.6418	0.75	1.27	7.8593	23.2453	7.2158
Pirod 105218	2263.4687	6615.4803	0.75	1.17	7.8593	22.9704	7.2158
Pirod 105219	2441.8688	6530.3322	0.94	1.03	8.4787	22.6748	9.4248

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	180 - 170	Leg	Max Tension	23	9.20	-0.81	-0.44
			Max. Compression	18	-10.49	0.03	-0.00
			Max. Mx	8	-0.71	0.93	0.04
			Max. My	2	1.76	-0.15	-0.98
			Max. Vy	8	1.82	0.03	0.00
			Max. Vx	3	-1.97	-0.00	0.01
		Diagonal	Max Tension	5	2.68	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	4	-2.70	0.00	0.00
			Max. Mx	30	0.49	-0.01	-0.00
			Max. My	18	-2.64	-0.00	0.00
			Max. Vy	30	0.01	-0.01	-0.00
			Max. Vx	18	-0.00	-0.00	0.00
		Horizontal	Max Tension	2	0.32	0.00	0.00
			Max. Compression	15	-0.25	0.00	0.00
			Max. Mx	26	0.12	0.02	0.00
			Max. Vy	26	-0.02	0.00	0.00
		Top Girt	Max Tension	23	0.26	0.00	0.00
			Max. Compression	10	-0.28	0.00	0.00
			Max. Mx	26	-0.03	0.02	0.00
			Max. Vy	26	-0.02	0.00	0.00
		Bottom Girt	Max Tension	22	1.30	0.00	0.00
			Max. Compression	11	-1.29	0.00	0.00
			Max. Mx	26	0.03	0.02	0.00
			Max. Vy	26	-0.02	0.00	0.00
T2	170 - 150	Leg	Max Tension	23	38.41	0.66	-0.12
			Max. Compression	10	-40.26	0.42	-0.02
			Max. Mx	10	-12.41	0.89	-0.08
			Max. My	12	-0.78	-0.07	-0.98
			Max. Vy	10	-2.16	0.42	-0.02
			Max. Vx	12	2.28	-0.03	-0.41
		Diagonal	Max Tension	4	3.03	0.00	0.00
			Max. Compression	4	-3.03	0.00	0.00
			Max. Mx	35	0.64	-0.01	-0.00
			Max. My	4	-3.01	-0.00	-0.00
			Max. Vy	35	0.01	-0.01	-0.00
			Max. Vx	4	0.00	0.00	0.00
		Horizontal	Max Tension	14	0.71	0.00	0.00
			Max. Compression	3	-0.62	0.00	0.00
			Max. Mx	26	0.24	0.02	0.00
			Max. Vy	26	-0.02	0.00	0.00
		Top Girt	Max Tension	10	1.21	0.00	0.00
			Max. Compression	23	-1.21	0.00	0.00
			Max. Mx	26	-0.02	0.02	0.00
			Max. Vy	26	-0.02	0.00	0.00
		Bottom Girt	Max Tension	14	1.26	0.00	0.00
			Max. Compression	3	-1.22	0.00	0.00
			Max. Mx	26	0.05	0.02	0.00
			Max. Vy	26	-0.02	0.00	0.00
T3	150 - 130	Leg	Max Tension	23	77.30	0.17	-0.08
			Max. Compression	10	-81.43	1.97	-0.55
			Max. Mx	10	-81.43	1.97	-0.55
			Max. My	12	0.03	-0.14	-1.86
			Max. Vy	22	4.27	-1.96	0.56
			Max. Vx	24	-4.12	0.08	1.85
		Diagonal	Max Tension	23	4.83	0.00	0.00
			Max. Compression	10	-4.94	0.00	0.00
			Max. Mx	35	0.83	-0.01	-0.00
			Max. My	22	-3.74	-0.00	-0.00
			Max. Vy	35	0.02	-0.01	-0.00
			Max. Vx	22	0.00	-0.00	-0.00
		Horizontal	Max Tension	14	1.19	0.00	0.00
			Max. Compression	3	-1.08	0.00	0.00
			Max. Mx	26	0.27	0.03	0.00
			Max. Vy	26	-0.02	0.00	0.00
		Top Girt	Max Tension	10	1.56	0.00	0.00
			Max. Compression	23	-1.54	0.00	0.00
			Max. Mx	26	-0.02	0.02	0.00
			Max. Vy	26	-0.02	0.00	0.00
		Bottom Girt	Max Tension	22	1.37	0.00	0.00
			Max. Compression	11	-1.27	0.00	0.00
			Max. Mx	26	0.06	0.03	0.00
			Max. Vy	26	-0.02	0.00	0.00
T4	130 - 120	Leg	Max Tension	23	79.17	-1.96	0.56
			Max. Compression	10	-83.38	3.94	-0.26
			Max. Mx	22	78.33	-4.33	0.43
			Max. My	20	-4.89	-0.09	-7.01

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	22	0.36	-4.33	0.43
			Max. Vx	24	-0.70	0.10	6.81
		Diagonal	Max Tension	13	7.39	0.00	0.00
			Max. Compression	24	-7.92	0.00	0.00
			Max. Mx	22	1.85	0.09	0.01
			Max. My	14	-3.96	-0.03	-0.04
			Max. Vy	37	0.03	0.05	0.01
			Max. Vx	14	0.01	0.00	0.00
T5	120 - 100	Leg	Max Tension	23	103.14	-4.55	0.24
			Max. Compression	10	-109.96	3.12	-0.26
			Max. Mx	10	-98.82	4.71	-0.19
			Max. My	20	-5.54	-0.09	-7.01
			Max. Vy	10	0.30	4.71	-0.19
			Max. Vx	24	0.53	0.10	6.81
		Diagonal	Max Tension	10	6.23	0.00	0.00
			Max. Compression	23	-6.00	0.00	0.00
			Max. Mx	10	1.97	0.09	-0.02
			Max. My	24	1.38	0.07	0.02
			Max. Vy	37	0.04	0.07	-0.01
			Max. Vx	24	-0.00	0.00	0.00
T6	100 - 80	Leg	Max Tension	23	123.07	-5.16	-0.19
			Max. Compression	10	-132.16	3.14	-0.40
			Max. Mx	10	-120.88	5.61	0.21
			Max. My	24	-13.65	-0.06	6.47
			Max. Vy	6	-0.71	-4.69	-0.00
			Max. Vx	24	-0.86	-0.06	6.47
		Diagonal	Max Tension	23	6.73	0.00	0.00
			Max. Compression	10	-7.38	0.00	0.00
			Max. Mx	37	0.23	0.08	0.01
			Max. My	24	1.92	0.05	0.02
			Max. Vy	37	0.05	0.08	0.01
			Max. Vx	12	0.00	0.00	0.00
		Mid Girt	Max Tension	22	3.29	0.00	0.00
			Max. Compression	11	-2.94	0.00	0.00
			Max. Mx	26	0.76	-0.19	0.00
			Max. My	26	0.74	0.00	0.01
			Max. Vy	26	0.09	0.00	0.00
			Max. Vx	26	-0.00	0.00	0.00
T7	80 - 60	Leg	Max Tension	23	146.09	-4.01	0.17
			Max. Compression	10	-158.39	3.86	-0.13
			Max. Mx	10	-146.62	4.08	-0.10
			Max. My	24	-14.18	-0.06	6.47
			Max. Vy	10	-0.22	4.08	-0.10
			Max. Vx	24	0.49	-0.06	6.47
		Diagonal	Max Tension	10	6.84	0.00	0.00
			Max. Compression	10	-6.87	0.00	0.00
			Max. Mx	35	0.60	0.13	0.02
			Max. My	12	2.40	0.08	-0.02
			Max. Vy	37	0.07	0.12	-0.01
			Max. Vx	38	-0.00	0.00	0.00
T8	60 - 40	Leg	Max Tension	23	167.08	-3.76	0.08
			Max. Compression	10	-182.83	4.74	-0.60
			Max. Mx	10	-182.83	4.74	-0.60
			Max. My	24	-16.45	0.19	4.85
			Max. Vy	11	-0.22	4.73	-0.61
			Max. Vx	24	-0.36	0.19	4.85
		Diagonal	Max Tension	10	6.70	0.00	0.00
			Max. Compression	10	-6.89	0.00	0.00
			Max. Mx	37	0.51	0.14	0.02
			Max. My	38	-0.77	0.11	0.02
			Max. Vy	37	0.08	0.14	0.02
			Max. Vx	38	-0.00	0.00	0.00
T9	40 - 20	Leg	Max Tension	23	187.27	-3.49	0.09
			Max. Compression	10	-206.87	4.19	-0.09
			Max. Mx	10	-194.59	4.74	-0.60
			Max. My	24	-16.70	0.19	4.85
			Max. Vy	29	0.57	-4.31	-0.02
			Max. Vx	24	0.35	0.00	4.16
		Diagonal	Max Tension	10	7.10	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	10	-7.57	0.00	0.00
			Max. Mx	35	1.60	0.19	0.02
			Max. My	38	1.54	0.18	0.03
			Max. Vy	37	0.10	0.19	-0.02
			Max. Vx	38	-0.01	0.00	0.00
T10	20 - 0	Leg	Max Tension	23	206.18	-3.85	0.19
			Max. Compression	10	-230.06	0.00	0.00
			Max. Mx	35	-94.57	6.45	0.06
			Max. My	20	-11.99	-0.24	-6.49
			Max. Vy	29	-0.96	-4.31	-0.02
			Max. Vx	24	0.80	-0.13	6.27
		Diagonal	Max Tension	23	8.32	0.00	0.00
			Max. Compression	10	-9.09	0.00	0.00
			Max. Mx	37	-1.22	0.22	0.03
			Max. My	38	3.13	0.18	0.03
			Max. Vy	36	0.10	0.18	-0.03
			Max. Vx	38	-0.01	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	18	225.71	19.61	-11.50
	Max. H_x	18	225.71	19.61	-11.50
	Max. H_z	7	-198.18	-17.34	10.19
	Min. Vert	7	-198.18	-17.34	10.19
	Min. H_x	7	-198.18	-17.34	10.19
	Min. H_z	18	225.71	19.61	-11.50
Leg B	Max. Vert	10	236.89	-21.64	-10.59
	Max. H_x	23	-211.69	19.28	9.29
	Max. H_z	23	-211.69	19.28	9.29
	Min. Vert	23	-211.69	19.28	9.29
	Min. H_x	10	236.89	-21.64	-10.59
	Min. H_z	10	236.89	-21.64	-10.59
Leg A	Max. Vert	2	217.86	-1.56	22.28
	Max. H_x	15	-190.19	1.50	-19.41
	Max. H_z	2	217.86	-1.56	22.28
	Min. Vert	15	-190.19	1.50	-19.41
	Min. H_x	2	217.86	-1.56	22.28
	Min. H_z	15	-190.19	1.50	-19.41

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	29.98	-0.00	0.00	11.57	20.43	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	35.98	-0.14	-33.48	-3209.22	54.41	-47.11
0.9 Dead+1.0 Wind 0 deg - No Ice	26.98	-0.14	-33.48	-3212.70	48.28	-47.11
1.2 Dead+1.0 Wind 30 deg - No Ice	35.98	15.77	-26.39	-2570.17	-1546.13	-25.03
0.9 Dead+1.0 Wind 30 deg - No Ice	26.98	15.77	-26.39	-2573.64	-1552.26	-25.03
1.2 Dead+1.0 Wind 60 deg - No Ice	35.98	28.66	-15.86	-1526.48	-2839.64	-3.67
0.9 Dead+1.0 Wind 60 deg - No Ice	26.98	28.66	-15.86	-1529.95	-2845.77	-3.67

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
1.2 Dead+1.0 Wind 90 deg - No Ice	35.98	35.44	0.14	43.77	-3487.66	27.45
0.9 Dead+1.0 Wind 90 deg - No Ice	26.98	35.44	0.14	40.30	-3493.79	27.45
1.2 Dead+1.0 Wind 120 deg - No Ice	35.98	31.54	17.68	1714.88	-3058.08	51.20
0.9 Dead+1.0 Wind 120 deg - No Ice	26.98	31.54	17.68	1711.41	-3064.21	51.20
1.2 Dead+1.0 Wind 150 deg - No Ice	35.98	17.72	29.49	2871.35	-1738.50	61.24
0.9 Dead+1.0 Wind 150 deg - No Ice	26.98	17.72	29.49	2867.88	-1744.63	61.24
1.2 Dead+1.0 Wind 180 deg - No Ice	35.98	0.14	31.71	3108.47	-5.37	47.11
0.9 Dead+1.0 Wind 180 deg - No Ice	26.98	0.14	31.71	3105.00	-11.50	47.11
1.2 Dead+1.0 Wind 210 deg - No Ice	35.98	-15.65	26.18	2565.11	1576.22	25.03
0.9 Dead+1.0 Wind 210 deg - No Ice	26.98	-15.65	26.18	2561.64	1570.09	25.03
1.2 Dead+1.0 Wind 240 deg - No Ice	35.98	-29.77	16.50	1580.60	2934.32	3.67
0.9 Dead+1.0 Wind 240 deg - No Ice	26.98	-29.77	16.50	1577.13	2928.19	3.67
1.2 Dead+1.0 Wind 270 deg - No Ice	35.98	-35.20	-0.14	-16.00	3498.79	-27.45
0.9 Dead+1.0 Wind 270 deg - No Ice	26.98	-35.20	-0.14	-19.47	3492.66	-27.45
1.2 Dead+1.0 Wind 300 deg - No Ice	35.98	-30.22	-16.91	-1641.80	3028.65	-51.20
0.9 Dead+1.0 Wind 300 deg - No Ice	26.98	-30.22	-16.91	-1645.27	3022.52	-51.20
1.2 Dead+1.0 Wind 330 deg - No Ice	35.98	-17.72	-29.49	-2843.58	1787.54	-61.24
0.9 Dead+1.0 Wind 330 deg - No Ice	26.98	-17.72	-29.49	-2847.05	1781.41	-61.24
1.2 Dead+1.0 Ice+1.0 Temp	114.92	-0.00	0.00	67.21	125.31	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	114.92	-0.03	-8.19	-778.60	131.81	-12.48
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	114.92	4.15	-6.87	-647.19	-313.74	-7.38
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	114.92	7.31	-4.01	-346.69	-650.65	-0.98
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	114.92	8.79	0.03	73.72	-800.27	6.85
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	114.92	7.65	4.24	497.67	-666.31	13.53
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	114.92	4.31	7.11	791.44	-326.92	15.41
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	114.92	0.03	7.86	873.89	118.81	12.48
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	114.92	-4.04	6.69	753.57	548.17	7.38
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	114.92	-7.23	3.97	468.29	879.06	0.98
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	114.92	-8.58	-0.03	60.71	1018.51	-6.85
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	114.92	-7.55	-4.18	-359.87	911.09	-13.53
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	114.92	-4.31	-7.11	-657.01	577.54	-15.41
Dead+Wind 0 deg - Service	29.98	-0.03	-7.71	-731.03	27.32	-10.85
Dead+Wind 30 deg - Service	29.98	3.63	-6.08	-583.79	-341.45	-5.77
Dead+Wind 60 deg - Service	29.98	6.60	-3.65	-343.33	-639.47	-0.84
Dead+Wind 90 deg - Service	29.98	8.17	0.03	18.46	-788.77	6.32
Dead+Wind 120 deg - Service	29.98	7.27	4.07	403.48	-689.80	11.80
Dead+Wind 150 deg - Service	29.98	4.08	6.79	669.93	-385.77	14.11

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 180 deg - Service	29.98	0.03	7.31	724.57	13.55	10.85
Dead+Wind 210 deg - Service	29.98	-3.60	6.03	599.38	377.94	5.77
Dead+Wind 240 deg - Service	29.98	-6.86	3.80	372.54	690.85	0.84
Dead+Wind 270 deg - Service	29.98	-8.11	-0.03	4.69	820.90	-6.32
Dead+Wind 300 deg - Service	29.98	-6.96	-3.90	-369.90	712.58	-11.80
Dead+Wind 330 deg - Service	29.98	-4.08	-6.79	-646.79	426.63	-14.11

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-29.98	0.00	0.00	29.98	-0.00	0.000%
2	-0.14	-35.98	-33.48	0.14	35.98	33.48	0.000%
3	-0.14	-26.98	-33.48	0.14	26.98	33.48	0.000%
4	15.77	-35.98	-26.39	-15.77	35.98	26.39	0.000%
5	15.77	-26.98	-26.39	-15.77	26.98	26.39	0.000%
6	28.66	-35.98	-15.86	-28.66	35.98	15.86	0.000%
7	28.66	-26.98	-15.86	-28.66	26.98	15.86	0.000%
8	35.44	-35.98	0.14	-35.44	35.98	-0.14	0.000%
9	35.44	-26.98	0.14	-35.44	26.98	-0.14	0.000%
10	31.54	-35.98	17.68	-31.54	35.98	-17.68	0.000%
11	31.54	-26.98	17.68	-31.54	26.98	-17.68	0.000%
12	17.72	-35.98	29.49	-17.72	35.98	-29.49	0.000%
13	17.72	-26.98	29.49	-17.72	26.98	-29.49	0.000%
14	0.14	-35.98	31.71	-0.14	35.98	-31.71	0.000%
15	0.14	-26.98	31.71	-0.14	26.98	-31.71	0.000%
16	-15.65	-35.98	26.18	15.65	35.98	-26.18	0.000%
17	-15.65	-26.98	26.18	15.65	26.98	-26.18	0.000%
18	-29.77	-35.98	16.50	29.77	35.98	-16.50	0.000%
19	-29.77	-26.98	16.50	29.77	26.98	-16.50	0.000%
20	-35.20	-35.98	-0.14	35.20	35.98	0.14	0.000%
21	-35.20	-26.98	-0.14	35.20	26.98	0.14	0.000%
22	-30.22	-35.98	-16.91	30.22	35.98	16.91	0.000%
23	-30.22	-26.98	-16.91	30.22	26.98	16.91	0.000%
24	-17.72	-35.98	-29.49	17.72	35.98	29.49	0.000%
25	-17.72	-26.98	-29.49	17.72	26.98	29.49	0.000%
26	0.00	-114.92	0.00	0.00	114.92	-0.00	0.000%
27	-0.03	-114.92	-8.19	0.03	114.92	8.19	0.000%
28	4.15	-114.92	-6.87	-4.15	114.92	6.87	0.000%
29	7.31	-114.92	-4.01	-7.31	114.92	4.01	0.000%
30	8.79	-114.92	0.03	-8.79	114.92	-0.03	0.000%
31	7.65	-114.92	4.24	-7.65	114.92	-4.24	0.000%
32	4.31	-114.92	7.11	-4.31	114.92	-7.11	0.000%
33	0.03	-114.92	7.86	-0.03	114.92	-7.86	0.000%
34	-4.04	-114.92	6.69	4.04	114.92	-6.69	0.000%
35	-7.23	-114.92	3.97	7.23	114.92	-3.97	0.000%
36	-8.58	-114.92	-0.03	8.58	114.92	0.03	0.000%
37	-7.55	-114.92	-4.18	7.55	114.92	4.18	0.000%
38	-4.31	-114.92	-7.11	4.31	114.92	7.11	0.000%
39	-0.03	-29.98	-7.71	0.03	29.98	7.71	0.000%
40	3.63	-29.98	-6.08	-3.63	29.98	6.08	0.000%
41	6.60	-29.98	-3.65	-6.60	29.98	3.65	0.000%
42	8.17	-29.98	0.03	-8.17	29.98	-0.03	0.000%
43	7.27	-29.98	4.07	-7.27	29.98	-4.07	0.000%
44	4.08	-29.98	6.79	-4.08	29.98	-6.79	0.000%
45	0.03	-29.98	7.31	-0.03	29.98	-7.31	0.000%
46	-3.60	-29.98	6.03	3.60	29.98	-6.03	0.000%
47	-6.86	-29.98	3.80	6.86	29.98	-3.80	0.000%
48	-8.11	-29.98	-0.03	8.11	29.98	0.03	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
49	-6.96	-29.98	-3.90	6.96	29.98	3.90	0.000%
50	-4.08	-29.98	-6.79	4.08	29.98	6.79	0.000%

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 170	6.462	48	0.3781	0.1989
T2	170 - 150	5.649	48	0.3736	0.1911
T3	150 - 130	4.119	48	0.3209	0.1512
T4	130 - 120	2.856	48	0.2568	0.1063
T5	120 - 100	2.342	48	0.2235	0.0817
T6	100 - 80	1.526	48	0.1603	0.0544
T7	80 - 60	0.926	48	0.1190	0.0354
T8	60 - 40	0.499	48	0.0782	0.0221
T9	40 - 20	0.215	48	0.0494	0.0114
T10	20 - 0	0.056	43	0.0210	0.0054

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	Lightning Rod 5/8"x4'	48	6.462	0.3781	0.1989	105970
178.00	Sector Mount [SM 501-1]	48	6.298	0.3779	0.1977	105970
177.00	Sector Mount [SM 501-1]	48	6.217	0.3778	0.1971	105970
174.00	PSA6 [SM 501-1]	48	5.973	0.3768	0.1950	88294
170.75	Grid Dish	48	5.710	0.3744	0.1920	56827
150.00	Sector Mount [SM 501-1]	48	4.119	0.3209	0.1512	16551
144.50	470-70-220	48	3.741	0.3031	0.1391	15779
142.50	9.5' Elements	48	3.609	0.2967	0.1348	15658
132.00	Sector Mount [SM 501-3]	48	2.968	0.2632	0.1112	15073
109.50	Side Arm Mount [SO 305-3]	48	1.882	0.1883	0.0646	19161
90.00	Andrew 6' w/Radome	48	1.203	0.1382	0.0444	25439

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 170	27.265	20	1.5822	0.8630
T2	170 - 150	23.861	20	1.5641	0.8293
T3	150 - 130	17.426	20	1.3495	0.6562
T4	130 - 120	12.100	20	1.0826	0.4614
T5	120 - 100	9.928	20	0.9436	0.3548
T6	100 - 80	6.480	20	0.6768	0.2361
T7	80 - 60	3.940	20	0.5030	0.1535
T8	60 - 40	2.133	11	0.3318	0.0960
T9	40 - 20	0.925	11	0.2098	0.0494
T10	20 - 0	0.244	11	0.0895	0.0235

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	Lightning Rod 5/8"x4'	20	27.265	1.5822	0.8630	28014
178.00	Sector Mount [SM 501-1]	20	26.581	1.5815	0.8581	28014
177.00	Sector Mount [SM 501-1]	20	26.240	1.5809	0.8555	28014
174.00	PSA6 [SM 501-1]	20	25.217	1.5771	0.8464	23336
170.75	Grid Dish	20	24.114	1.5675	0.8331	14866
150.00	Sector Mount [SM 501-1]	20	17.426	1.3495	0.6562	3922
144.50	470-70-220	20	15.834	1.2761	0.6037	3752
142.50	9.5' Elements	20	15.278	1.2495	0.5849	3731
132.00	Sector Mount [SM 501-3]	20	12.574	1.1097	0.4826	3619
109.50	Side Arm Mount [SO 305-3]	20	7.985	0.7950	0.2803	4532
90.00	Andrew 6' w/Radome	20	5.111	0.5836	0.1928	6045

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	180	Leg	A325N	0.5625	3	3.50	22.37	0.156	1.05	Bolt DS
T2	170	Leg	A325N	0.6250	5	8.05	27.61	0.292	1.05	Bolt DS
T3	150	Leg	A325N	1.0000	6	12.88	54.52	0.236	1.05	Bolt Tension
T4	130	Leg	A325N	1.0000	6	13.19	54.52	0.242	1.05	Bolt Tension
		Diagonal	A325N	1.0000	1	7.39	10.66	0.693	1.05	Member Block Shear
T5	120	Leg	A325N	1.0000	6	17.19	54.52	0.315	1.05	Bolt Tension
		Diagonal	A325N	1.0000	1	6.23	10.66	0.584	1.05	Member Block Shear
T6	100	Leg	A325N	1.0000	6	20.53	54.52	0.377	1.05	Bolt Tension
		Diagonal	A325N	1.0000	1	6.73	10.66	0.632	1.05	Member Block Shear
		Mid Girt	A325N	1.0000	1	3.29	11.68	0.281	1.05	Member Block Shear
T7	80	Leg	A325N	1.0000	6	24.35	54.52	0.447	1.05	Bolt Tension
		Diagonal	A325N	1.0000	1	6.84	11.68	0.586	1.05	Member Block Shear
T8	60	Leg	A325N	1.0000	6	27.85	54.52	0.511	1.05	Bolt Tension
		Diagonal	A325N	1.0000	1	6.70	11.68	0.574	1.05	Member Block Shear
T9	40	Leg	A325N	1.0000	6	31.21	54.52	0.573	1.05	Bolt Tension
		Diagonal	A325N	1.0000	1	7.10	19.47	0.365	1.05	Member Block Shear
T10	20	Diagonal	A325N	1.2500	1	8.32	20.30	0.410	1.05	Member Block Shear

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 170	1 1/2	10.00	2.21	70.7 K=1.00	1.7672	-8.62	55.20	0.156 [1]
T2	170 - 150	1 1/2	20.00	2.38	76.0 K=1.00	1.7672	-37.94	52.12	0.728 [1]
T3	150 - 130	2	20.00	2.38	57.0	3.1416	-78.28	111.47	0.702 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T4	130 - 120	Pirod 105244	10.02	10.02	K=1.00 45.4	3.6816	-83.38	142.49	0.585 [1]
T5	120 - 100	Pirod 105216	20.03	10.02	K=1.00 45.4	3.6816	-109.96	142.49	0.772 [1]
T6	100 - 80	Pirod 105217	20.03	10.02	K=1.00 37.8	5.3014	-132.16	214.86	0.615 [1]
T7	80 - 60	Pirod 105217	20.03	10.02	K=1.00 37.8	5.3014	-158.39	214.86	0.737 [1]
T8	60 - 40	Pirod 105218	20.03	10.02	K=1.00 32.4	7.2158	-182.83	300.68	0.608 [1]
T9	40 - 20	Pirod 105218	20.03	10.02	K=1.00 32.4	7.2158	-206.87	300.68	0.688 [1]
T10	20 - 0	Pirod 105219	20.03	10.02	K=1.00 28.4	9.4248	-230.06	399.87	0.575 [1]

[1] P_u / ϕP_n controls

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n K	A in^2	V_u K	ϕV_n K	Stress Ratio
T4	130 - 120	0.5	1.48	121.0	165.67	0.1963	0.70	3.39	0.209
T5	120 - 100	0.5	1.48	121.0	165.67	0.1963	0.53	3.29	0.163
T6	100 - 80	0.5	1.47	120.0	238.57	0.1963	0.87	3.34	0.261
T7	80 - 60	0.5	1.47	120.0	238.57	0.1963	0.49	3.34	0.147
T8	60 - 40	0.5	1.46	119.0	324.71	0.1963	0.36	3.38	0.107
T9	40 - 20	0.5	1.46	119.0	324.71	0.1963	0.57	3.38	0.170
T10	20 - 0	0.625	1.45	94.4	424.12	0.3068	0.96	6.96	0.138

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 170	3/4	4.57	2.21	K=0.90 127.5	0.4418	-2.70	6.08	0.444 [1]
T2	170 - 150	3/4	5.05	2.47	K=0.90 142.4	0.4418	-3.03	4.92	0.615 [1]
T3	150 - 130	7/8	5.50	2.67	K=0.90 132.0	0.6013	-4.94	7.79	0.634 [1]
T4	130 - 120	L2 1/2x2 1/2x3/16	11.42	4.98	K=1.00 120.8	0.9020	-7.92	17.58	0.450 [1]
T5	120 - 100	L2 1/2x2 1/2x3/16	12.50	5.63	K=1.00 136.4	0.9020	-5.59	13.87	0.403 [1]
T6	100 - 80	L2 1/2x2 1/2x3/16	13.80	6.33	K=1.00 153.4	0.9020	-7.38	10.97	0.672 [1]
T7	80 - 60	L3x3x3/16	15.24	7.08	K=1.00 142.6	1.0900	-6.87	15.35	0.447 [1]
T8	60 - 40	L3x3x3/16	16.80	7.88	K=1.00 158.7	1.0900	-6.89	12.39	0.556 [1]
T9	40 - 20	L3x3x5/16	18.45	8.72	K=1.00 177.6	1.7800	-7.57	16.15	0.469 [1]
T10	20 - 0	L3x3x5/16	20.16	9.54	K=1.00 194.4	1.7800	-9.09	13.48	0.674 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	180 - 170	3/4	4.00	3.88	173.6 K=0.70	0.4418	-0.25	3.31	0.076 [1]
T2	170 - 150	3/4	4.37	4.24	190.1 K=0.70	0.4418	-0.62	2.76	0.223 [1]
T3	150 - 130	7/8	4.57	4.41	169.2 K=0.70	0.6013	-1.08	4.75	0.228 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	180 - 170	3/4	4.00	3.88	173.6 K=0.70	0.4418	-0.28	3.31	0.083 [1]
T2	170 - 150	3/4	4.01	3.89	174.2 K=0.70	0.4418	-1.21	3.29	0.367 [1]
T3	150 - 130	7/8	4.51	4.35	166.9 K=0.70	0.6013	-1.54	4.88	0.317 [1]

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	180 - 170	3/4	4.00	3.88	173.6 K=0.70	0.4418	-1.29	3.31	0.389 [1]
T2	170 - 150	3/4	4.49	4.36	195.4 K=0.70	0.4418	-1.22	2.61	0.467 [1]
T3	150 - 130	7/8	4.99	4.82	185.1 K=0.70	0.6013	-1.27	3.96	0.321 [1]

[1] P_u / ϕP_n controls

Mid Girt Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T6	100 - 80	L3x3x3/16	9.00	7.58	152.7 K=1.00	1.0900	-2.94	13.38	0.220 [1]

[1] P_u / ϕP_n controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 170	1 1/2	10.00	0.50	16.0	0.8575	9.20	41.80	0.220 [1] #
T2	170 - 150	1 1/2	20.00	0.50	16.0	1.7672	38.41	79.52	0.483 [1]
T3	150 - 130	2	20.00	0.50	12.0	3.1416	77.30	141.37	0.547 [1]
T4	130 - 120	Pirod 105244	10.02	10.02	45.4	3.6816	79.17	165.67	0.478 [1]
T5	120 - 100	Pirod 105216	20.03	10.02	45.4	3.6816	103.14	165.67	0.623 [1]
T6	100 - 80	Pirod 105217	20.03	10.02	37.8	5.3014	123.21	238.57	0.516 [1]
T7	80 - 60	Pirod 105217	20.03	10.02	37.8	5.3014	146.09	238.57	0.612 [1]
T8	60 - 40	Pirod 105218	20.03	10.02	32.4	7.2158	167.08	324.71	0.515 [1]
T9	40 - 20	Pirod 105218	20.03	10.02	32.4	7.2158	187.27	324.71	0.577 [1]
T10	20 - 0	Pirod 105219	20.03	10.02	28.4	9.4248	206.18	424.12	0.486 [1]

[1] P_u / ϕP_n controls
[#] Based on net area of leg in section below

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n K	A in^2	V_u K	ϕV_n K	Stress Ratio
T4	130 - 120	0.5	1.48	121.0	165.67	0.1963	0.70	3.39	0.209
T5	120 - 100	0.5	1.48	121.0	165.67	0.1963	0.53	3.29	0.163
T6	100 - 80	0.5	1.47	120.0	238.57	0.1963	0.87	3.34	0.261
T7	80 - 60	0.5	1.47	120.0	238.57	0.1963	0.49	3.34	0.147
T8	60 - 40	0.5	1.46	119.0	324.71	0.1963	0.36	3.38	0.107
T9	40 - 20	0.5	1.46	119.0	324.71	0.1963	0.57	3.38	0.170
T10	20 - 0	0.625	1.45	94.4	424.12	0.3068	0.96	6.96	0.138

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 170	3/4	4.57	2.21	141.6	0.4418	2.68	14.31	0.188 [1]
T2	170 - 150	3/4	5.05	2.47	158.2	0.4418	3.03	14.31	0.212 [1]
T3	150 - 130	7/8	5.50	2.67	146.6	0.6013	4.83	19.48	0.248 [1]
T4	130 - 120	L2 1/2x2 1/2x3/16	11.42	4.98	80.1	0.5183	7.39	22.55	0.328 [1]
T5	120 - 100	L2 1/2x2 1/2x3/16	11.93	5.38	86.2	0.5183	6.23	22.55	0.276 [1]
T6	100 - 80	L2 1/2x2 1/2x3/16	13.80	6.33	100.8	0.5183	6.73	22.55	0.299 [1]
T7	80 - 60	L3x3x3/16	14.50	6.73	88.6	0.6593	6.84	28.68	0.239 [1]
T8	60 - 40	L3x3x3/16	16.01	7.49	98.4	0.6593	6.70	28.68	0.234 [1]
T9	40 - 20	L3x3x5/16	17.62	8.31	110.8	1.0713	7.10	46.60	0.152 [1]
T10	20 - 0	L3x3x5/16	20.16	9.54	127.4	1.0127	8.32	44.05	0.189 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 170	3/4	4.00	3.88	248.0	0.4418	0.32	14.31	0.022 [1]
T2	170 - 150	3/4	4.37	4.24	271.6	0.4418	0.71	14.31	0.050 [1]
T3	150 - 130	7/8	4.57	4.41	241.7	0.6013	1.19	19.48	0.061 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 170	3/4	4.00	3.88	248.0	0.4418	0.26	14.31	0.018 [1]
T2	170 - 150	3/4	4.01	3.89	248.8	0.4418	1.21	14.31	0.084 [1]
T3	150 - 130	7/8	4.51	4.35	238.4	0.6013	1.56	19.48	0.080 [1]

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 170	3/4	4.00	3.88	248.0	0.4418	1.30	14.31	0.091 [1]
T2	170 - 150	3/4	4.49	4.36	279.2	0.4418	1.26	14.31	0.088 [1]
T3	150 - 130	7/8	4.99	4.82	264.5	0.6013	1.37	19.48	0.070 [1]

[1] P_u / ϕP_n controls

Mid Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T6	100 - 80	L3x3x3/16	9.00	7.58	102.2	0.6593	3.29	28.68	0.115 [1]

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	180 - 170	Leg	1 1/2	2	9.20	43.89	21.0	Pass
T2	170 - 150	Leg	1 1/2	38	-37.94	54.73	69.3	Pass
T3	150 - 130	Leg	2	102	-78.28	117.05	66.9	Pass
T4	130 - 120	Leg	Pirod 105244	166	-83.38	149.62	55.7	Pass
T5	120 - 100	Leg	Pirod 105216	175	-109.96	149.62	73.5	Pass
T6	100 - 80	Leg	Pirod 105217	190	-132.16	225.60	58.6	Pass
T7	80 - 60	Leg	Pirod 105217	208	-158.39	225.60	70.2	Pass
T8	60 - 40	Leg	Pirod 105218	223	-182.83	315.72	57.9	Pass
T9	40 - 20	Leg	Pirod 105218	238	-206.87	315.72	65.5	Pass

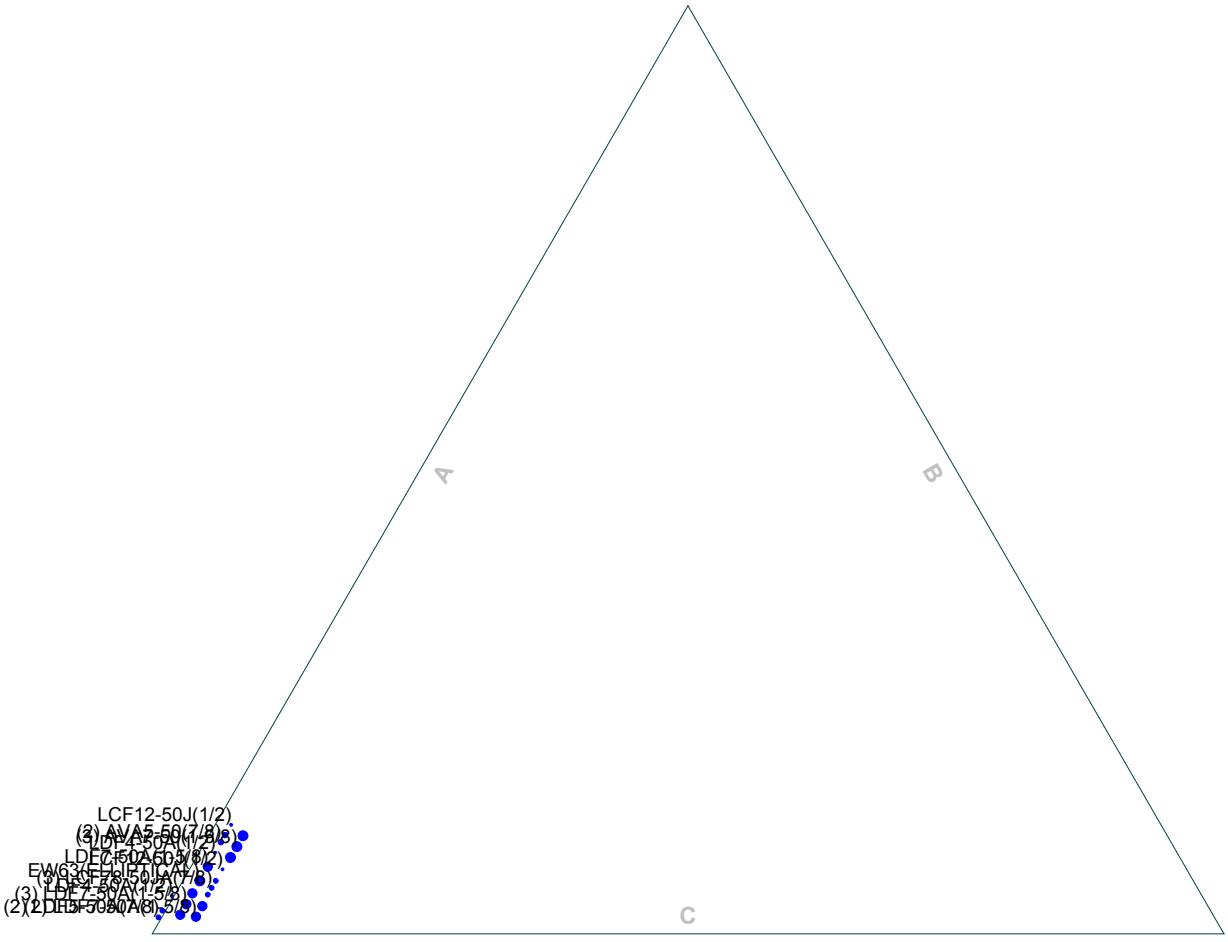
Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T10	20 - 0	Leg	Pirod 105219	253	-230.06	419.86	54.8	Pass
T1	180 - 170	Diagonal	3/4	14	-2.70	6.39	42.2	Pass
T2	170 - 150	Diagonal	3/4	50	-3.03	5.17	58.6	Pass
T3	150 - 130	Diagonal	7/8	111	-4.94	8.18	60.4	Pass
T4	130 - 120	Diagonal	L2 1/2x2 1/2x3/16	172	-7.92	18.45	42.9	Pass
							66.0 (b)	
T5	120 - 100	Diagonal	L2 1/2x2 1/2x3/16	178	-5.59	14.57	38.4	Pass
							55.6 (b)	
T6	100 - 80	Diagonal	L2 1/2x2 1/2x3/16	196	-7.38	11.52	64.0	Pass
T7	80 - 60	Diagonal	L3x3x3/16	211	-6.87	16.11	42.6	Pass
							55.8 (b)	
T8	60 - 40	Diagonal	L3x3x3/16	226	-6.89	13.01	53.0	Pass
							54.7 (b)	
T9	40 - 20	Diagonal	L3x3x5/16	241	-7.57	16.96	44.7	Pass
T10	20 - 0	Diagonal	L3x3x5/16	256	-9.09	14.16	64.2	Pass
T1	180 - 170	Horizontal	3/4	16	-0.25	3.48	7.2	Pass
T2	170 - 150	Horizontal	3/4	59	-0.62	2.90	21.2	Pass
T3	150 - 130	Horizontal	7/8	158	-1.08	4.98	21.7	Pass
T1	180 - 170	Top Girt	3/4	6	-0.28	3.48	7.9	Pass
T2	170 - 150	Top Girt	3/4	42	-1.21	3.45	34.9	Pass
T3	150 - 130	Top Girt	7/8	106	-1.54	5.12	30.2	Pass
T1	180 - 170	Bottom Girt	3/4	9	-1.29	3.48	37.0	Pass
T2	170 - 150	Bottom Girt	3/4	43	-1.22	2.74	44.4	Pass
T3	150 - 130	Bottom Girt	7/8	109	-1.27	4.16	30.6	Pass
T6	100 - 80	Mid Girt	L3x3x3/16	194	-2.94	14.05	21.0	Pass
							26.8 (b)	
						Summary		
						Leg (T5)	73.5	Pass
						Diagonal (T4)	66.0	Pass
						Horizontal (T3)	21.7	Pass
						Top Girt (T2)	34.9	Pass
						Bottom Girt (T2)	44.4	Pass
						Mid Girt (T6)	26.8	Pass
						Bolt Checks	66.0	Pass
						RATING =	**73.5**	**Pass**

APPENDIX B

BASE LEVEL DRAWING

Feed Line Plan

Round Flat App In Face App Out Face Truss-Leg



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Job: ***ES-028 Colebrook***			
Project: ***405025***			
Client: Eversource	Drawn by: TH	App'd:	
Code: TIA-222-H	Date: 07/07/20	Scale: NTS	
Path: C:\Users\hal92311\OneDrive - Black & Veatch\My Desktop\Structural\ES-028 Colebrook Structural Analysis.eri		Dwg No. E-7	

APPENDIX C

ADDITIONAL CALCULATIONS

Eversource #: ES-028
Site Name: Colebrook

Designed By: RAH
Checked By:CAG
Date: 7/9/2020

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References

ANCHOR ROD ANALYSIS

Project Information

Site Name: Colebrook

TIA Revision: Rev-G / Rev-H

TIA-222-G 105% Allowable? No / Yes

Apply TIA-222-H Section 15.5? No / Yes

Max Leg Reactions

Compression	*Uplift*
Axial_C := 237·kip	Axial_U := 212·kip
Shear_C := 24·kip	Shear_U := 21·kip

Anchor Rod Data

Diameter of Anchor Rod: D := 1.25·in

Number of Anchor Rods: N := 6

Length from top of concrete to bottom of anchor rod leveling nut: lar := 2·in

Threads in Shear Plane?: Yes / No

Thread Series: Coarse / Fine / 8-Thread

Consider Base Plate Grout? Yes / No

Grout Factor η: 0.90 / 0.70 / 0.55 / 0.50

Anchor Rod Grade: F1554-105 / A687 / A354-BC / A354-BD / A449 / A572-42 / A572-50 / A572-55 / A572-60 / A572-65 / A588-42 / A588-46 / A588-50 / A36M-42 / A36M-45 / A36M-50 / A36M-55 / A500-50 / A514-GR100 / A53-B-35 / A53-B-42 / A607-60 / A607-65 / S-128 / S-22

Threads per Inch: n = 7 (Thread selection invalid if n = 0)

Rod Ultimate Strength: Fu = 125·ksi

Rod Yield Strength: Fy = 105·ksi

Anchor Rod Plastic Section Modulus: (based on tension root diameter)

$$Z := \frac{1}{6}\cdot\left(D - \frac{0.9743\,in}{n}\right)^3 = 0.228\cdot in^3$$

Radius of Gyration:

$$r := \left(\frac{1}{4}\right)\cdot\left(D - \frac{0.9743\,in}{n}\right) = 0.278\cdot in$$

Net Area of Anchor Rod:

$$An := \frac{\pi}{4}\cdot\left(D - \frac{0.9743\,in}{n}\right)^2 = 0.969\cdot in^2$$

TIA-222-G/H Section 4.9.6.1

Nominal Unthreaded Area of Anchor Rod:

$$Ab := \frac{\pi}{4}\cdot(D)^2 = 1.227\cdot in^2$$

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Anchor Rod Design Capacities

Design Tension Strength: TIA-222-G/H Section 4.9.6.1

$Rnt := Fu \cdot An = 121.139 \cdot kip$

$\phi t = 0.75$

$\phi Rnt := \phi t \cdot Rnt = 90.854 \cdot kip$

Design Compression Strength:

$Rnc := Fy \cdot An = 101.756 \cdot kip$

$\phi c = 1$

$\phi Rnc := \phi c \cdot Rnc = 101.756 \cdot kip$

Design Buckling Strength: TIA-222-H Section 4.5.4.2

$K_0 := 1.2$

$Fcr = 103.803 \cdot ksi$

$Fe = 3.832 \times 10^3 \cdot ksi$

$Rnb := Fcr \cdot An = 100.596 \cdot kip$

$\phi c = 1$

$\phi Rnb := \phi c \cdot Rnb = 100.596 \cdot kip$

Design Shear Strength: TIA-222-G/H Section 4.9.6.3

$$Rnv := \begin{cases} 0.55 \cdot Fu \cdot Ab & \text{if Thread\_Type} = \text{"No"} \wedge \text{TIA} = \text{"Rev-G"} \\ 0.45 \cdot Fu \cdot Ab & \text{if Thread\_Type} = \text{"Yes"} \wedge \text{TIA} = \text{"Rev-G"} \\ 0.625 \cdot Fu \cdot Ab & \text{if Thread\_Type} = \text{"No"} \wedge \text{TIA} = \text{"Rev-H"} \\ 0.5 \cdot Fu \cdot Ab & \text{if Thread\_Type} = \text{"Yes"} \wedge \text{TIA} = \text{"Rev-H"} \end{cases}$$

$Rnv = 76.699 \cdot kip$

$Rnvc := 0.6 \cdot Fy \cdot 0.5 \cdot An = 30.527 \cdot kip$ TIA-222-H Section 4.9.9

$\phi v = 0.75 \qquad \phi c = 1$

$\phi Rnv := \phi v \cdot Rnv = 57.524 \cdot kip \qquad \phi Rnvc := \phi c \cdot Rnvc = 30.527 \cdot kip$

Design Flexural Strength: TIA-222-G/H Section 4.7.1

$Rmn := Fy \cdot Z = 23.986 \cdot kip \cdot in$

$\phi f = 0.9$

$\phi Rmn := \phi f \cdot Rmn = 21.588 \cdot kip \cdot in$

Anchor Rod Loading Demands

Tension Demand:

$$Put := \frac{Axial\_U}{N} = 35.333 \cdot kip$$

Compression Demand:

$$Puc := \frac{Axial\_C}{N} = 39.5 \cdot kip$$

Shear Demand:

$$Vut := \frac{Shear\_U}{N} = 3.5 \cdot kip$$

$$Vuc := \frac{Shear\_C}{N} = 4 \cdot kip$$

Moment Demand:

$$Mut := 0.65 \cdot lar \cdot Vut = 4.55 \cdot kip \cdot in$$

$$Muc := 0.65 \cdot lar \cdot Vuc = 5.2 \cdot kip \cdot in$$

Anchor Rod Interaction Check

TIA-222-G Section 4.9.9

$$SR\_g := \begin{cases} \dfrac{Put + \dfrac{Vut}{\eta}}{\phi Rnt} & \text{if } \eta > 0.50 \\ \dfrac{Put + \dfrac{Vut}{\eta}}{\phi Rnt} & \text{if } \eta = 0.50 \wedge lar \le D \wedge Put > Puc \\ \dfrac{Puc + \dfrac{Vuc}{\eta}}{\phi Rnt} & \text{if } \eta = 0.50 \wedge lar \le D \wedge Put < Puc \\ \left(\dfrac{Vut}{\phi Rnv}\right)^2 + \left(\dfrac{Put}{\phi Rnt} + \dfrac{Mut}{\phi Rmn}\right)^2 & \text{if } \eta = 0.5 \wedge lar > D \wedge Put > Puc \\ \left(\dfrac{Vuc}{\phi Rnv}\right)^2 + \left(\dfrac{Puc}{\phi Rnt} + \dfrac{Muc}{\phi Rmn}\right)^2 & \text{if } \eta = 0.5 \wedge lar > D \wedge Put < Puc \end{cases}$$

$$SR\_g = 0.459$$

Anchor Rod Interaction Check

TIA-222-H Section 4.9.9

$$SR\_Pt := \begin{cases} \left(\frac{Put}{\phi Rnt}\right)^2 + \left(\frac{Vut}{\phi Rnv}\right)^2 & \text{if } lar \le D \\ \left(\frac{Put}{\phi Rnt}\right)^2 + \left(\frac{Vut}{\phi Rnv}\right)^2 & \text{if } D < lar \le 3\cdot in \wedge Grout = \text{"Yes"} \\ \left(\frac{Put}{\phi Rnt} + \frac{Mut}{\phi Rmn}\right)^2 + \left(\frac{Vut}{\phi Rnv}\right)^2 & \text{if } 3\cdot in < lar \wedge Grout = \text{"Yes"} \\ \left(\frac{Put}{\phi Rnt} + \frac{Mut}{\phi Rmn}\right)^2 + \left(\frac{Vut}{\phi Rnv}\right)^2 & \text{if } D < lar \wedge Grout = \text{"No"} \end{cases}$$

$SR\_Pt = 0.155$

$$SR\_Pc := \begin{cases} \left(\frac{Puc}{\phi Rnc}\right) + \left(\frac{Vuc}{\phi Rnvc}\right)^2 & \text{if } lar \le D \\ \left(\frac{Puc}{\phi Rnc}\right) + \left(\frac{Vuc}{\phi Rnvc}\right)^2 & \text{if } D < lar \le 3\cdot in \wedge Grout = \text{"Yes"} \\ \left(\frac{Puc}{\phi Rnc} + \frac{Muc}{\phi Rmn}\right) + \left(\frac{Vuc}{\phi Rnvc}\right)^2 & \text{if } 3\cdot in < lar \wedge Grout = \text{"Yes"} \\ \left(\frac{Puc}{\phi Rnc} + \frac{Muc}{\phi Rmn}\right) + \left(\frac{Vuc}{\phi Rnvc}\right)^2 & \text{if } D < lar \le 4\cdot D \wedge Grout = \text{"No"} \\ \left(\frac{Puc}{\phi Rnb} + \frac{Muc}{\phi Rmn}\right) + \left(\frac{Vuc}{\phi Rnvc}\right)^2 & \text{if } lar > 4\cdot D \wedge Grout = \text{"No"} \end{cases}$$

$SR\_Pc = 0.405$

$$SR := \begin{cases} SR\_g & \text{if } TIA = \text{"Rev-G"} \\ \max(SR\_Pt, SR\_Pc) & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"No"} \\ \frac{\max(SR\_Pt, SR\_Pc)}{1.05} & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"Yes"} \end{cases} = 0.386$$

$$Check_{SR} := \begin{cases} \text{"Passing"} & \text{if } SR \le 1.00 \wedge TIA = \text{"Rev-G"} \wedge S105 = \text{"Yes"} \\ \text{"Acceptable"} & \text{if } 1.00 < SR \le 1.05 \wedge TIA = \text{"Rev-G"} \wedge S105 = \text{"Yes"} \\ \text{"Failing"} & \text{if } SR > 1.05 \wedge TIA = \text{"Rev-G"} \wedge S105 = \text{"Yes"} \\ \text{"Passing"} & \text{if } SR \le 1.00 \wedge TIA = \text{"Rev-G"} \wedge S105 = \text{"No"} \\ \text{"Failing"} & \text{if } SR > 1.00 \wedge TIA = \text{"Rev-G"} \wedge S105 = \text{"No"} \\ \text{"Passing"} & \text{if } SR \le 1.0 \wedge TIA = \text{"Rev-H"} \\ \text{"Failing"} & \text{if } SR > 1.0 \wedge TIA = \text{"Rev-H"} \end{cases} = \text{"Passing"}$$

Eversource #: ES-028
Site Name: Colebrook

Designed By: RAH
Checked By:CAG
Date: 7/9/2020

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Anchor Rod Results

Axial Tension Demand:	$Put = 35.333 \cdot kip$
Axial Tension Capacity:	$\phi Rnt = 90.854 \cdot kip$
Axial Compression Demand:	$Puc = 39.5 \cdot kip$
Axial Compression Capacity:	$\phi Rnc = 101.756 \cdot kip$
Shear Tension Demand:	$Vut = 3.5 \cdot kip$
Tension Shear Capacity:	$\phi Rnv = 57.524 \cdot kip$
Shear Compression Demand:	$Vuc = 4 \cdot kip$
Compresison Shear Capacity:	$\phi R_{nvc} = 30.527 \cdot kip$
Moment Tension Demand:	$M_{ut} = 4.55 \cdot kip \cdot in$
Moment Compression Demand:	$M_{uc} = 5.2 \cdot kip \cdot in$
Moment Capacity:	$\phi R_{mn} = 21.588 \cdot kip \cdot in$

Governing Stress Ratio

$SR = 38.605 \cdot \%$

$Check_{SR} = \text{"Passing"}$

Eversource #: ES-028
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FOUNDATION ANALYSIS

Assumptions:
- The rock anchor proof load is correct.
- The rock anchor proof load is 25% greater than the rock anchor allowable load.

Foundation Loading

Uplift Demand: $P_u := 212 \cdot kip$

Compression Demand: $P_c := 237 kip$

TIA Revision: Rev-G / Rev-H

TIA-222-G 105% Allowable? No / Yes

Apply TIA-222-H Section 15.5? No / Yes

Octagonal Pile Cap Dimensions

$A := 1.537 ft$

$H := 3.0 ft$

Concrete Density: $\gamma_c := 150 \cdot psf$

Foundation Area: $A_{pad} := \left[2 \cdot \left(1 + 2^{0.5}\right) \cdot A^2\right] = 11.407\ ft^2$

Concrete Weight: $W_{pad} := A_{pad} \cdot \gamma_c = 1.711 \cdot kip$

Foundation Uplift Capacity

Rock Anchor Proof Load: $R_{min} := 149 \cdot kip$

Rock Anchor Capacity: $R_a := R_{min} \cdot 0.75 = 111.75 \cdot kip$

Uplift Capacity Per Leg: $\phi_{weight} := 0.9 \qquad \phi_{rock} := 0.75$

$$\phi R_n := \left(\phi_{weight} \cdot W_{pad}\right) + \left(\phi_{rock} \cdot 4 \cdot R_a\right) = 336.79 \cdot kip$$

Foundation Compression Capacity

Total Compression Load: $P_{total} := P_c + 1.2 \cdot W_{pad} = 239.053 \cdot kip$

Compression Capacity: $R_{comp} := \left(\phi_{rock} \cdot 4 R_a\right) = 335.25 \cdot kip$

Eversource #: ES-028
Site Name: Colebrook

Designed by: RAH
Checked by: CAG
Date: 7/9/2020

BLACK & VEATCH
Building a world of difference.

Foundation Results

Uplift Stress Ratio:

$$Sr_u := \frac{P_u}{\phi R_n} = 62.947 \cdot \%$$

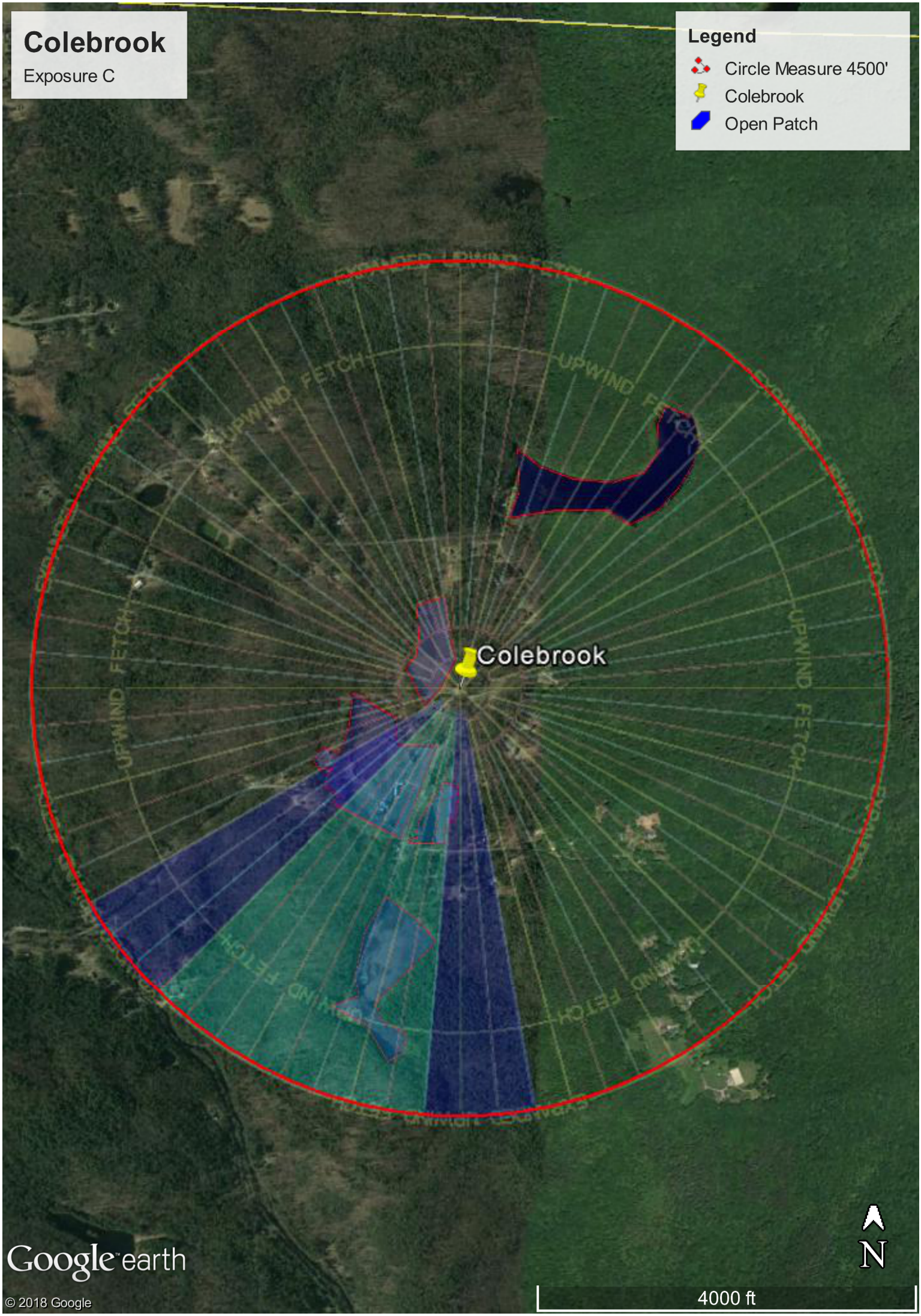
Compression Stress Ratio:

$$Sr_c := \frac{P_{total}}{R_{comp}} = 71.306 \cdot \%$$

Governing Stress Ratio

$SR = 67.91 \cdot \%$

$Check_{SR} = \text{"Passing"}$


Colebrook
Exposure C
Legend
Circle Measure 4500'
Colebrook
Open Patch
UPWIND FETCH
Colebrook
N
4000 ft
Google earth
© 2018 Google

ATTACHMENT D – PROOF OF DELIVERY OF NOTICE

Ref: CT587100-ES-028 Date: 090ct20
Dep: BL GRAPHICS Wgt: 0.90 LBS

DV:

SHIPPING: 0.00
SPECIAL: 0.00
HANDLING: 0.00
0.00 TOTAL: 0.00

Svcs: MORNING 2DAY
TRCK: 9151 3346 5353

ORIGIN ID:RSPA (800) 301-3077

BL COMPANIES
355 RESEARCH PARKWAY

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 090CT20
ACTWGT: 0.90 LB MAN
CAD: 0765627/CAFE3311

BILL THIRD PARTY

565C2/A27E/0562

TO

CONNECTICUT SITING COUNCIL
10 FRANKLIN SQUARE

NEW BRITAIN CT 06051

REF: CT587100-ES-028 COLEBROOK

DEPT: BL GRAPHICS

FedEx Express

J191219082001uv

TUE - 13 OCT 10:30A
MORNING 2DAY

TRK# 0201 **9151 3346 5353**

00 BDLA

06051
CT-US **BDL**

Ref: CT587100-ES-028 Date: 090ct20
Dep: BL GRAPHICS Wgt: 0.90 LBS

DV:

SHIPPING: 0.00
SPECIAL: 0.00
HANDLING: 0.00
0.00 TOTAL: 0.00

Svcs: MORNING 2DAY
TRCK: 9151 3346 5342

ORIGIN ID:RSPA (800) 301-3077

BL COMPANIES
355 RESEARCH PARKWAY

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 090CT20
ACTWGT: 0.90 LB MAN
CAD: 0765627/CAFE3311

BILL THIRD PARTY

565C2/A27E/05A2

TO **C/O EMERGENCY MED SERVICES**
LITCHFIELD COUNTY DISPATCH
111 WATER STREET

TORRINGTON CT 06790

REF: CT587100-ES-028 COLEBROOK

DEPT: BL GRAPHICS

FedEx Express

J191219082001sv

TUE - 13 OCT 10:30A
MORNING 2DAY

TRK# 0201 **9151 3346 5342**

00 HFDA

06790
CT-US **BDL**

Ref: CT587100-ES-028 Date: 090ct20
Dep: BL GRAPHICS Wgt: 0.90 LBS

DV: 0.00

SHIPPING: 0.00
SPECIAL: 0.00
HANDLING: 0.00
TOTAL: 0.00

Svcs: MORNING 2DAY
TRCK: 9151 3346 5331

ORIGIN ID:RSPA (800) 301-3077

BL COMPANIES
355 RESEARCH PARKWAY

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 090CT20
ACTWGT: 0.90 LB MAN
CAD: 0765627/CAFE3311

BILL THIRD PARTY

TO **MARC MELANSON, BUILDING OFFICIAL**
TOWN OF COLEBROOK
562 COLEBROOK ROAD

COLEBROOK CT 06021

REF: CT587100-ES-028 COLEBROOK

DEPT: BL GRAPHICS

565C2/A27E/0582

FedEx Express

J191219882001uv

TUE - 13 OCT 10:30A
MORNING 2DAY

TRK# 0201 **9151 3346 5331**

00 HFDA

06021
CT-US **BDL**

Ref: CT587100-ES-028 Date: 090ct20
Dep: BL GRAPHICS Wgt: 0.90 LBS

DV: 0.00

SHIPPING: 0.00
SPECIAL: 0.00
HANDLING: 0.00
TOTAL: 0.00

Svcs: MORNING 2DAY
TRCK: 9151 3346 5320

ORIGIN ID:RSPA (800) 301-3077

BL COMPANIES
355 RESEARCH PARKWAY

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 090CT20
ACTWGT: 0.90 LB
CAD: 0765627/CAFE3311

BILL THIRD PARTY

565C2/A27E/0582

TO **HONORABLE THOMAS D. MCKEON**
TOWN OF COLEBROOK
562 COLEBROOK ROAD

COLEBROOK CT 06021

REF: CT587100-ES-028 COLEBROOK

DEPT: BL GRAPHICS

FedEx Express

J191219082020 1a

TUE - 13 OCT 10:30A
MORNING 2DAY

TRK# 0201 **9151 3346 5320**

00 HFDA

06021
CT-US **BDL**

ATTACHMENT E - POWER DENSITY REPORT

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

Calculated Radio Frequency Emissions Report

EVERSOURCE ENERGY

ES-028

35A Simons Pond Road

Colebrook, CT 06021

July 28, 2020

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed Eversource installation on the lattice tower at 35A Simons Pond Road in Colebrook, CT. Eversource is proposing to install two directional antennas – one transmit and one receive-only – as part of its 220 MHz communications system.

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

Figure 1: View of ES-028 Colebrook

Site Address	35A Simons Pond Road
Latitude	42° 1' 16.5" N
Longitude	73° 4' 42.6" W
Site Elevation AMSL	1320’
Survey Engineer	Marc Salas
Survey Date/Time	6/17/2020; 8:15 AM – 9:15 AM

Table 1: Survey Information

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

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

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

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

4. Power Density Calculation Methods

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

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

Where:

EIRP = Effective Isotropic Radiated Power = 1.64 x ERP

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

H = Horizontal Distance from antenna

V = Vertical Distance from radiation center of antenna

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

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

5. Proposed Antenna Configuration

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

Operator	Antenna Model	TX Freq. (MHz)	Ant Gain (dBd)	Power per Channel ERP (Watts)	Number of Channels	Vertical Beamwidth	Length (ft)	Antenna Centerline Height (ft)
Eversource	Comprod 470-70-220	217	7.0	124	4	75°	4	132

Table 2: Eversource Antenna Configuration (Proposed)[1] [2]

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

[2] Transmit antenna height listed for the proposed antenna is based on the Black & Veatch Structural Analysis Report dated July 9, 2020.

6. Measurement Procedure

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

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

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

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

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

Manufacturer	Narda Microwave			
Probe	EA 5091, Serial# 0116			
Calibration Date	May 2020			
Calibration Interval	24 Months			
Meter	NBM550, Serial# E-1069			
Calibration Date	May 2020			
Calibration Interval	24 Months			
Probe Specifications	**Frequency Range**	**Field Measured**	**Standard**	**Measurement Range**
	300 KHz-50 GHz	Electric Field	U.S. FCC 1997 Occupational/Controlled	0.2 – 600 % of Standard

Table 3: Instrumentation Information

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

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

7. Surveyed and Calculated % MPE Results

Measured and calculated results and a description of each survey location are detailed in the table below. Measurements were recorded on June 17, 2020 between 8:15 AM and 9:15 AM. The calculated % MPE contribution from the proposed equipment modifications was then added to the measured % MPE values in the "Composite % MPE" column. These calculated values incorporate the antenna pattern of the antenna model specified by Eversource to determine the "Off Beam Loss" factor shown in the power density formula from Section 4. All % MPE values are in reference to the FCC Uncontrolled/General Population exposure limit.

Table 4 below lists 11 measurements recorded in the vicinity of the tower. The highest spatially averaged measurement was 5.52% (Average Uncontrolled/General Population MPE) and was recorded at Location 1 by the compound access gate on the west side of the tower compound. The highest composite (measured + calculated) % MPE value is calculated to be 6.26% (Average Uncontrolled/General Population) and is calculated to occur at the same location (Location 1).

Meas. Location	Location Description	Latitude	Longitude	Dist. From Site (feet)	Measured % MPE (Uncontrolled / General)	Calculated % MPE (Eversource Proposed)	Composite % MPE (Uncontrolled / General)
1	**Compound access gate**	**42.02118**	**-73.07884**	**92**	**5.52%**	**0.75%**	**6.26%**
2	East of compound, near apex of turn into compound access	42.02114	-73.07897	129	3.54%	0.86%	4.39%
3	On access road, by SW corner of compound	42.02102	-73.07887	125	3.30%	0.82%	4.12%
4	On access road, by SE corner of compound	42.02092	-73.07864	124	< 1.00%	0.68%	< 1.68%
5	On access road, just W of turnoff leading to residence on property	42.02093	-73.07826	135	< 1.00%	0.63%	< 1.63%
6	On access road, just E of turnoff leading to residence on property	42.02100	-73.07792	186	4.60%	0.64%	5.24%
7	Next to mailbox for 35 Simons Pond Road	42.02109	-73.07717	369	3.54%	0.41%	3.95%
8	Along road, near marker for 46 Simons Pond Road	42.02186	-73.07575	784	< 1.00%	0.14%	< 1.14%
9	Along road, near marker for 63 Simons Pond Road	42.02413	-73.07561	1315	2.05%	0.05%	2.10%
10	Next to mailbox for 28 Simons Pond Road	42.02035	-73.07806	349	3.64%	0.38%	4.03%
11	Along Simons Pond Road, ~700' S of tower	42.01940	-73.07955	732	2.67%	0.13%	2.80%

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

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

Figures 2 and 3 below are aerial views[5] of the tower location and the surrounding area, along with the measurement locations listed in Table 4.

Figure 2: Measurement Points – Zoom In

Figure 3: All Measurement Points

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

8. Conclusion

A number of accessible areas around the tower at 35A Simons Pond Road in Colebrook, CT were surveyed and found to be well within the mandated General Population/Uncontrolled limits for Maximum Permissible Exposure, as delineated in the Federal Communications Commission's Radio Frequency exposure rules published in 47 CFR 1.1307(b)(1)-(b)(3).

The highest spatially averaged % MPE measurement of all surveyed points based on the 1997 FCC standard for exposure to the general population is 5.52% MPE. This measurement was recorded at Location 1 by the access gate on the west side of the tower compound.

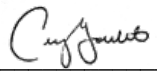
The highest composite (measured + calculated) power density is **6.26% of the FCC General Population MPE limit** with the proposed Eversource equipment is calculated to also occur at Location 1.

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

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

9. Statement of Certification

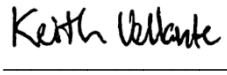
I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in FCC OET Bulletin 65 Edition 97-01, IEEE Std. C95.1, and IEEE Std. C95.3.



July 27, 2020

Report Prepared By: Cory Goulet
Associate RF Engineer
C Squared Systems, LLC

Date



July 28, 2020

Reviewed/Approved By: Keith Vellante
Director of RF Services
C Squared Systems, LLC

Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure[6]

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

(B) Limits for General Population/Uncontrolled Exposure[7]

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

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

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

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

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

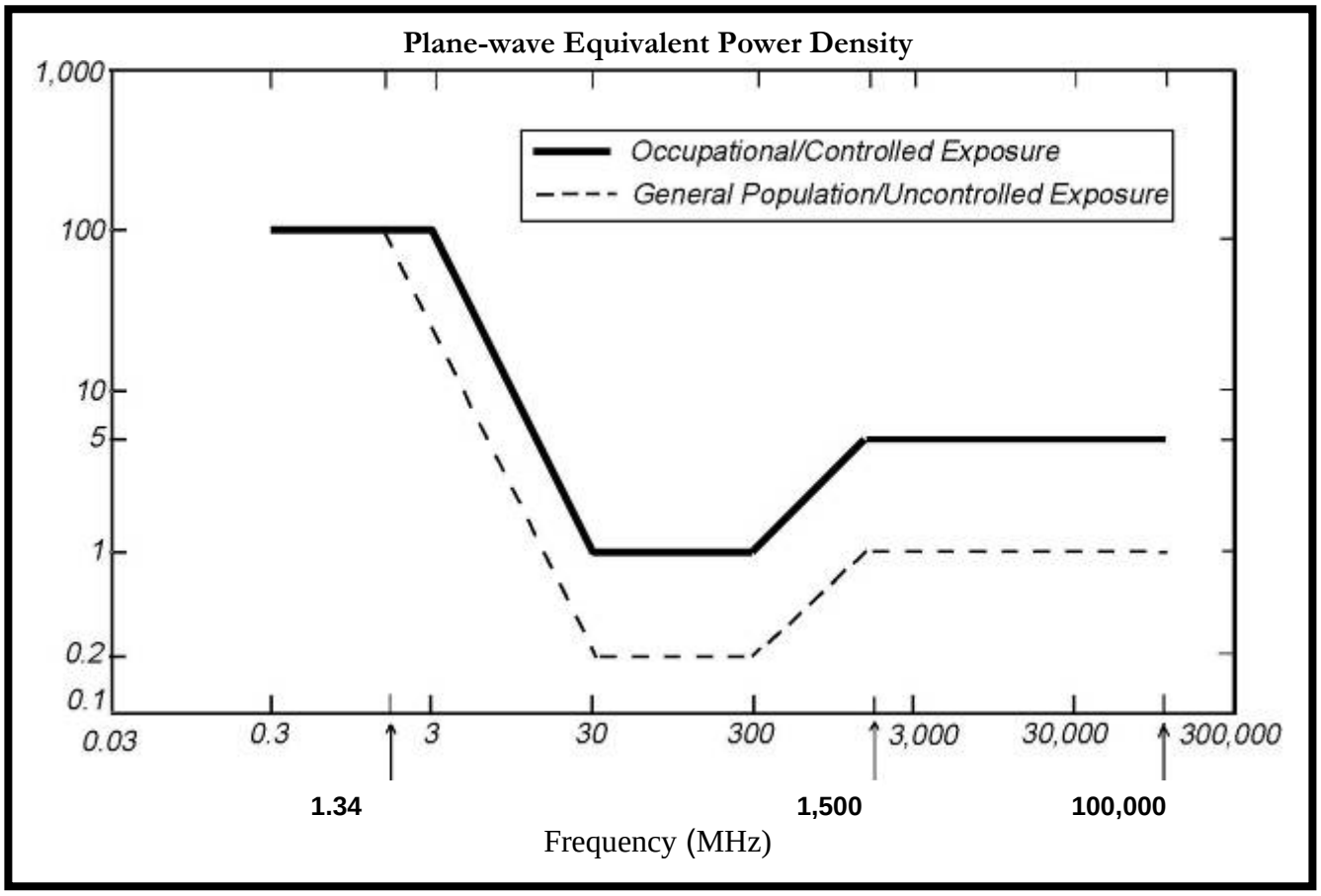
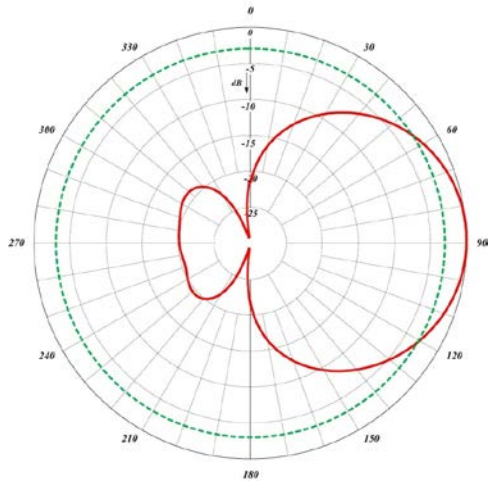


Figure 4: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Eversource Antenna Data Sheet and Electrical Patterns[8]

217 MHz

Manufacturer:	Comprod
Model #:	470-70-220
Frequency Band:	215 - 225 MHz
Gain:	7 dBd
Vertical Beamwidth:	75°
Horizontal Beamwidth:	360°
Polarization:	Vertical
Dimension (L x W):	48” x 75”



[8] In the case where pattern data was unavailable from the manufacturer, vertical patterns shown are for antennas with similar specifications.