EVERSOURCE ENERGY

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

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

April 23, 2020

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

RE: **Notice of Exempt Modification**
Eversource Site # 6581
790 Willis Street, Bristol, CT 06010
Latitude: 41-38-56 N / Longitude: 72-56-50 W

Dear Ms. Bachman:

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource") currently maintains multiple antennas and microwave dishes at various mounting heights on an existing 130-foot self-support tower located at 790 Willis Street in Bristol. See Attachment A, Parcel Map and Property Card. The tower and property are owned by Eversource. Eversource plans to install one 24-foot tall omni-directional antenna to be mounted at 187 feet above ground level ("AGL"), one 5.5-foot tall dipole antenna mounted at 127 feet AGL, and two 7/8-inch diameter coaxial cables. Eversource also plans to install one 6-foot diameter microwave dish mounted at 87 feet AGL, and one 2-inch diameter elliptical waveguide. There will be no changes to the area of the fenced compound, the tower or the existing antennas and equipment currently mounted on the tower. The tower and existing and proposed equipment on the tower are depicted on Attachment B, Construction Drawings, dated March 9, 2020 and Attachment C, Structural Analysis, dated February 26, 2020. 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.

The Connecticut Siting Council approved the self-support tower at this location in Petition No. 800 in January 2007.

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 Ellen Zoppo-Sassu, Mayor for the City of Bristol and Robert M. Flanagan, AICP, City Planner for the City of

Bristol 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 the 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 April 10, 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). Two copies of this notice and a check in the amount of $625 are enclosed.

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: Honorable Ellen Zoppo-Sassu, Mayor, City of Bristol
Robert M. Flanagan, AICP, City Planner, City of Bristol

Attachments

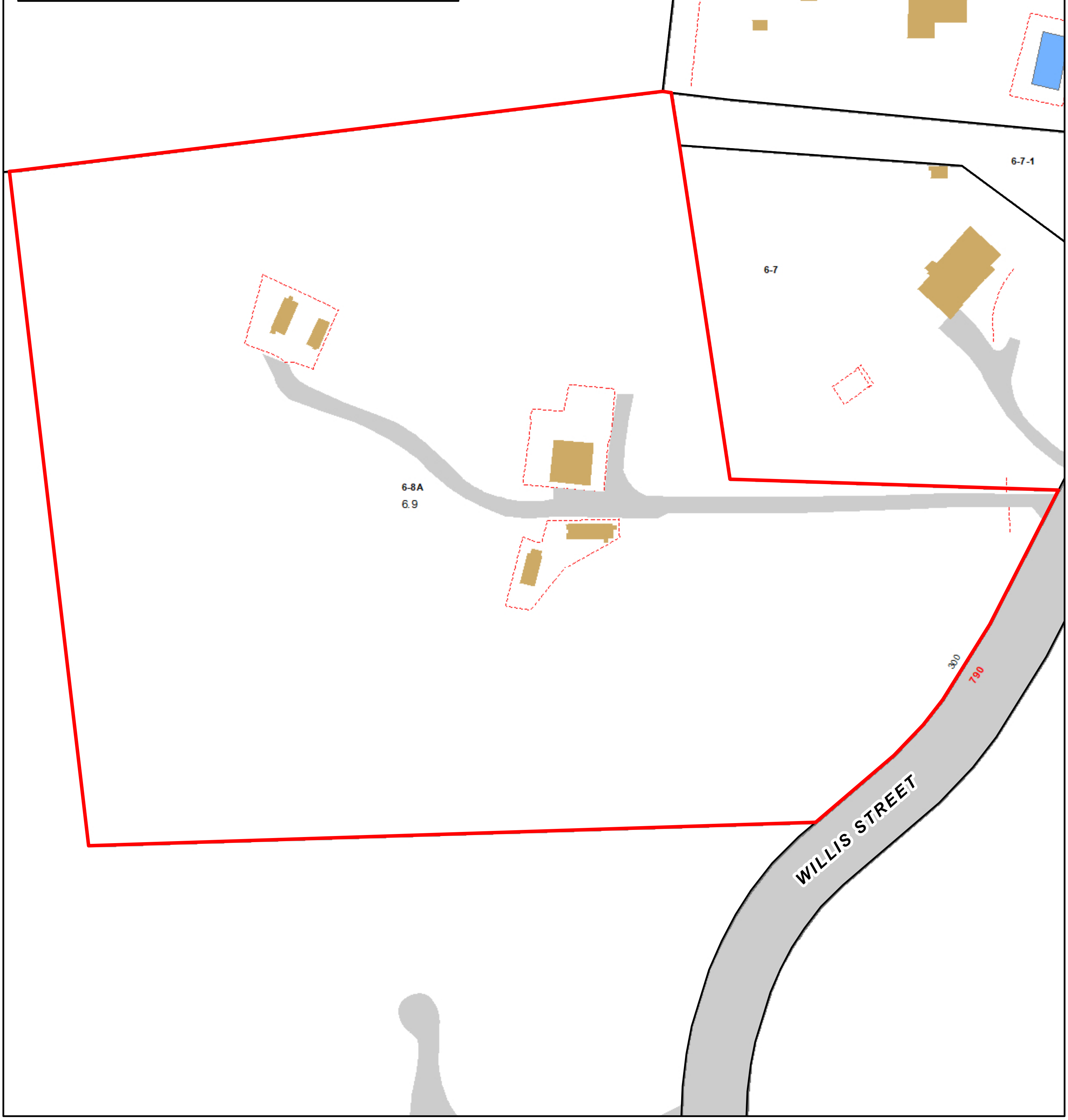
A. Parcel Map and Property Card
B. Construction Drawings
C. Structural Analysis
D. Proof of Delivery of Notice
E. Power Density Report

[1] It should be noted that the Power Density Report denotes each channel as a transmitter. The depiction of antennas in the Structural Analysis and Construction Drawings accurately reflects the number of antennas. Also, the "Antenna Height" column on Table 1 in the Power Density Report reflects the Transmit or "TX" antenna centerline.

ATTACHMENT A – PARCEL MAP AND PROPERTY CARD

City of Bristol, Connecticut
Assessment Parcel Map

Parcel: **0034800**
Account #: 0034800
Address: 790 WILLIS ST



Approximate Scale: 1 inch = 100 feet

Map Produced March 2018

790 WILLIS ST

Location	790 WILLIS ST	**Mblu**	06/ / 8A/ /
Acct#	0034800	**Owner**	CONN LIGHT + POWER CO
Assessment	$449,190	**Appraisal**	$641,700
PID	5681	**Building Count**	1

Current Value

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2017	$392,100	$249,600	$641,700
Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2017	$274,470	$174,720	$449,190

Owner of Record

Owner CONN LIGHT + POWER CO
Co-Owner
Address 107 SELDEN ST
BERLIN, CT 06037

Sale Price $0
Certificate 1
Book & Page 0277/0293
Sale Date 01/25/1952

Ownership History

Ownership History				
Owner	**Sale Price**	**Certificate**	**Book & Page**	**Sale Date**
CONN LIGHT + POWER CO	$0	1	0277/0293	01/25/1952

Building Information

Building 1 : Section 1

Year Built: 1950
Living Area: 900
Replacement Cost: $40,248
Building Percent Good: 65
Replacement Cost Less Depreciation: $26,200

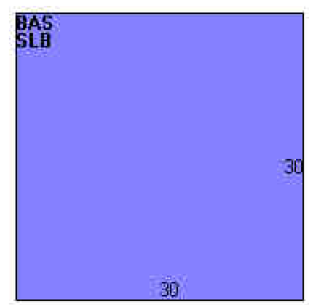
Building Attributes	
Field	**Description**

STYLE	Warehouse
MODEL	Ind/Comm
Stories:	1
Occupancy	1.00
Exterior Wall 1	Concr/Cinder
Exterior Wall 2	
Roof Structure	Gable
Roof Cover	Asphalt Shingl
Interior Wall 1	Minim/Masonry
Interior Wall 2	
Interior Floor 1	Concr-Finished
Interior Floor 2	
Heating Fuel	Electric
Heating Type	Hot Air-no Duc
AC Type	Unit/AC
Struct Class	
Bldg Use	Public Utility
Bedrooms	
Full Baths	
Half Baths	
Usrfld 218	
Usrfld 219	
1st Floor Use:	
Heat/AC	Heat/AC Pkgs
Frame Type	Masonry
Baths/Plumbing	Light
Ceiling/Wall	None
Rooms/Prtns	Light
Wall Height	8.00
% Comn Wall	

Building Photo

(http://images.vgsi.com/photos2/BristolCTPhotos//\00\05\61\14

Building Layout



(http://images.vgsi.com/photos2/BristolCTPhotos//Sketches/568

Building Sub-Areas (sq ft)			Legend
Code	Description	Gross Area	Living Area
BAS	First Floor	900	900
SLB	Slab	900	0
		1,800	900

Extra Features

Extra Features	Legend
No Data for Extra Features	

Land

Land Use

Use Code 436

Land Line Valuation

Size (Acres) 6.9

Description	Public Utility	**Frontage**	300
Zone	R-25	**Depth**	
Neighborhood	50	**Assessed Value**	$174,720
Alt Land Appr	No	**Appraised Value**	$249,600
Category			

Outbuildings

Outbuildings						Legend
Code	**Description**	**Sub Code**	**Sub Description**	**Size**	**Value**	**Bldg #**
CELL	Cell Tower/Site			2.00 UNITS	$210,000	1
CB3	PreCastConcCel			300.00 S.F.	$54,000	1
CB3	PreCastConcCel			300.00 S.F.	$54,000	1
FCP	Carport			900.00 S.F.	$5,600	1
GAR1	Garage	FR	Frame	420.00 S.F.	$6,300	1
CB3	PreCastConcCel			200.00 S.F.	$36,000	1

Valuation History

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
19	$392,100	$249,600	$641,700
2018	$392,100	$249,600	$641,700
2017	$392,100	$249,600	$641,700

Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
19	$274,470	$174,720	$449,190
2018	$274,470	$174,720	$449,190
2017	$274,470	$174,720	$449,190

ATTACHMENT B – CONSTRUCTION DRAWINGS

EVERSOURCE ENERGY

SOUTH MTN RADIO
790 WILLIS ST
BRISTOL, CT 06010

PROJECT SUMMARY

THE GENERAL SCOPE OF WORK CONSISTS OF THE FOLLOWING:

1. INSTALL (1) NEW OMNI/WHIP ANTENNA AT ELEVATION 152'-0"± AGL
2. INSTALL (1) NEW MICROWAVE DISH AT ELEVATION 90'-0"± AGL
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:	SOUTH MTN RADIO
SITE ID NUMBER:	#5681
SITE ADDRESS:	790 WILLIS ST BRISTOL, CT 06010
MAP:	6
BLOCK:	8
LOT:	A
ZONE:	R-25
LATITUDE:	41° 38' 56.0" N
LONGITUDE:	72° 56' 50.0" W
ELEVATION:	1047'± AMSL
FEMA/FIRM DESIGNATION:	X

CONTACT INFORMATION

APPLICANTS:
EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037

PROPERTY OWNER:
EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037

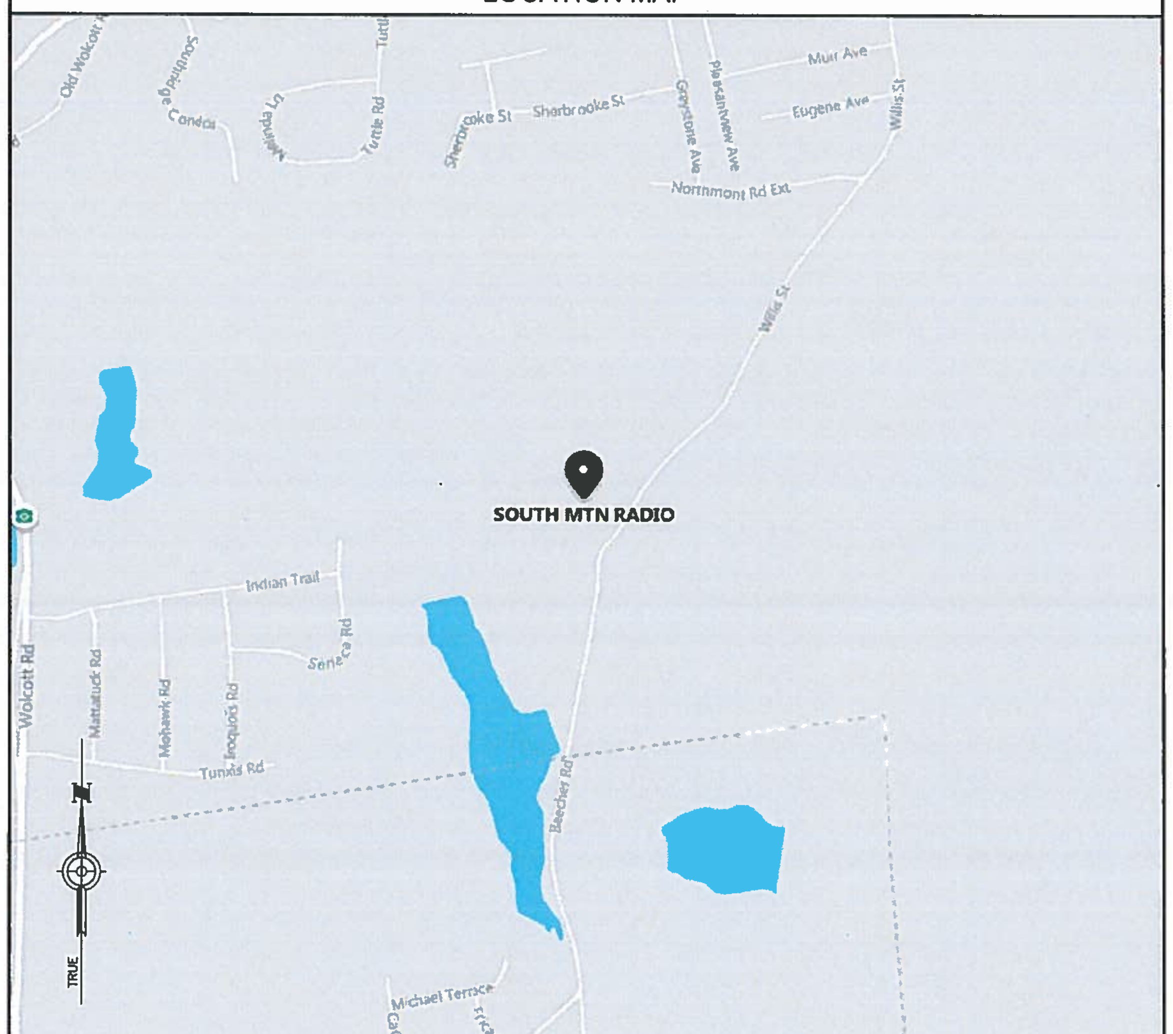
EVERSOURCE ENERGY PROJECT MANAGER:
NIKOLL PRECI
(860) 655-3079

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
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:	403093
DRAWN BY:	TYW
CHECKED BY:	JR

REV	DATE	DESCRIPTION
0	03/09/20	ISSUED FOR FILING

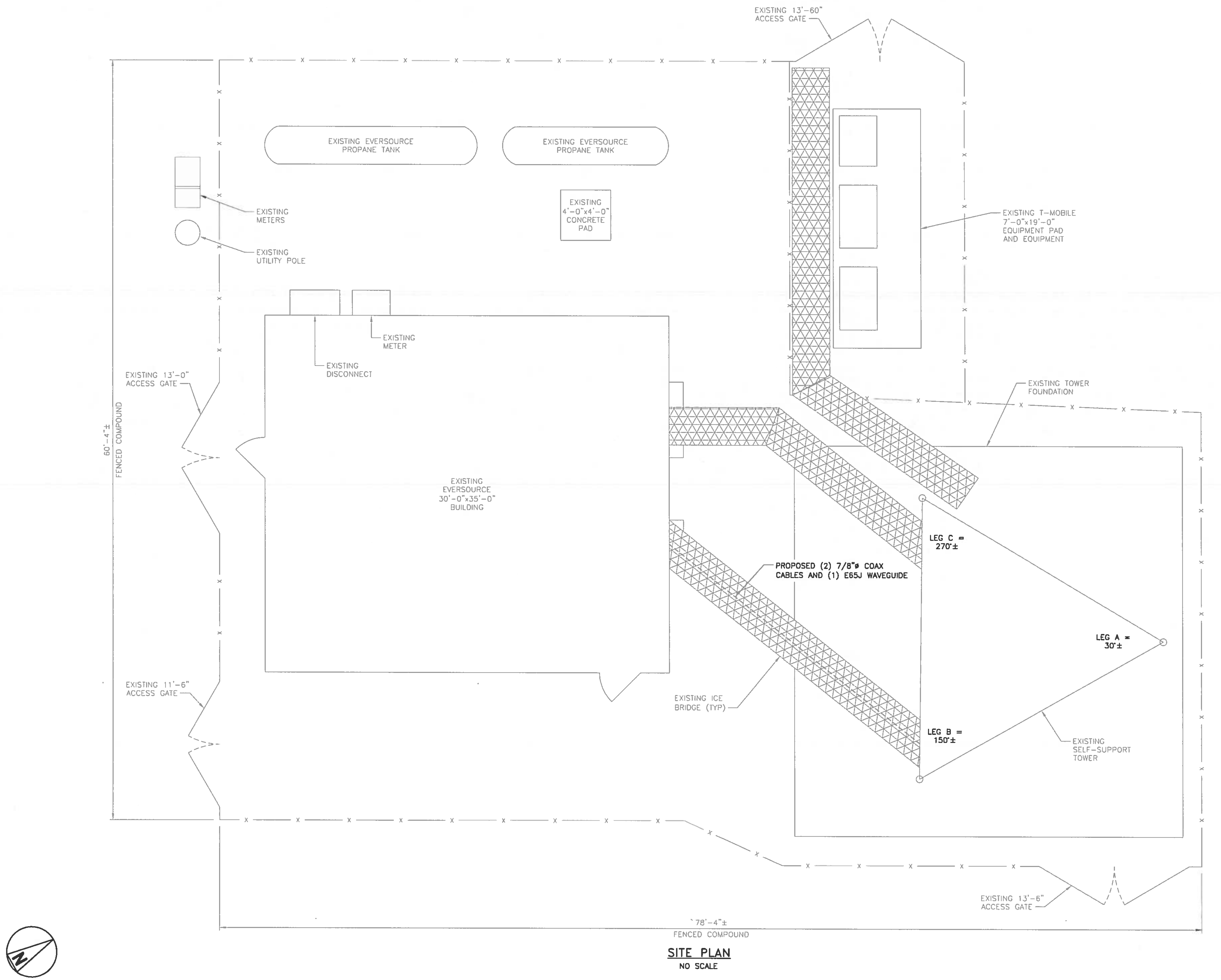
STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
3/9/2020

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

SOUTH MTN RADIO
790 WILLIS ST
BRISTOL, CT 06010

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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STATE OF CONNECTICUT JOSHUA J. RILEY 33208 LICENSED PROFESSIONAL ENGINEER
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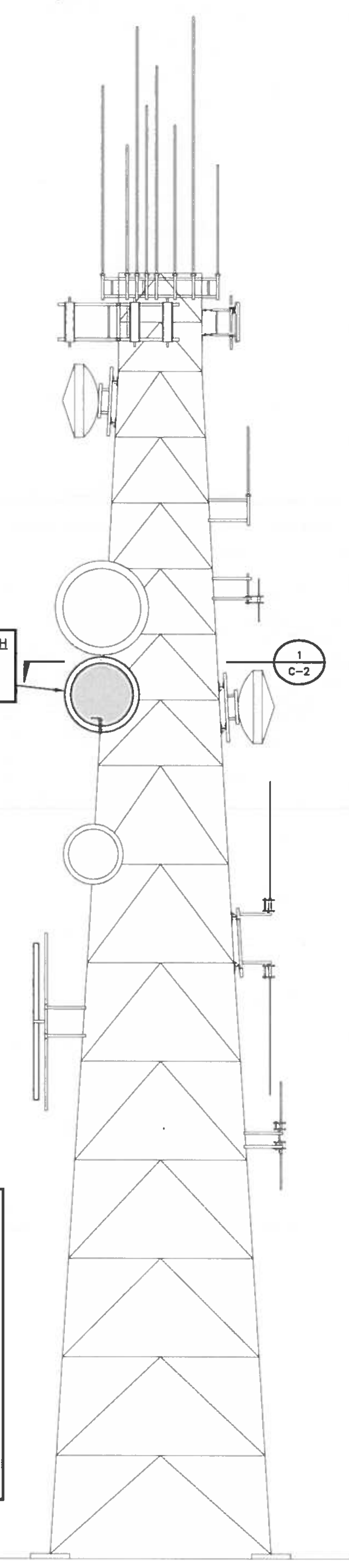
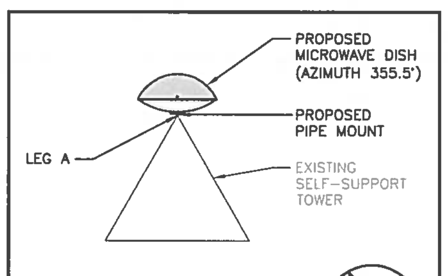
SOUTH MTN RADIO
790 WILLIS ST
BRISTOL, CT 06010

SHEET TITLE
SITE PLAN

SHEET NUMBER
C-1



TOWER ELEVATION FACE AC
NO SCALE

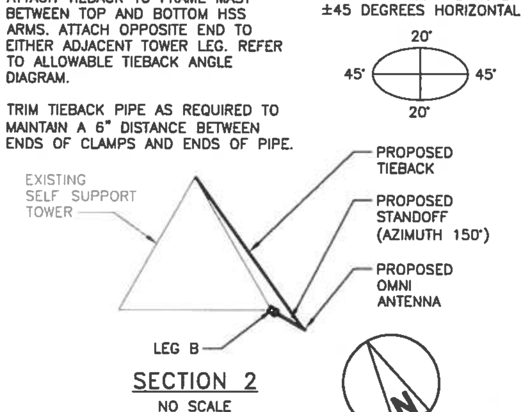


SECTION 1
NO SCALE

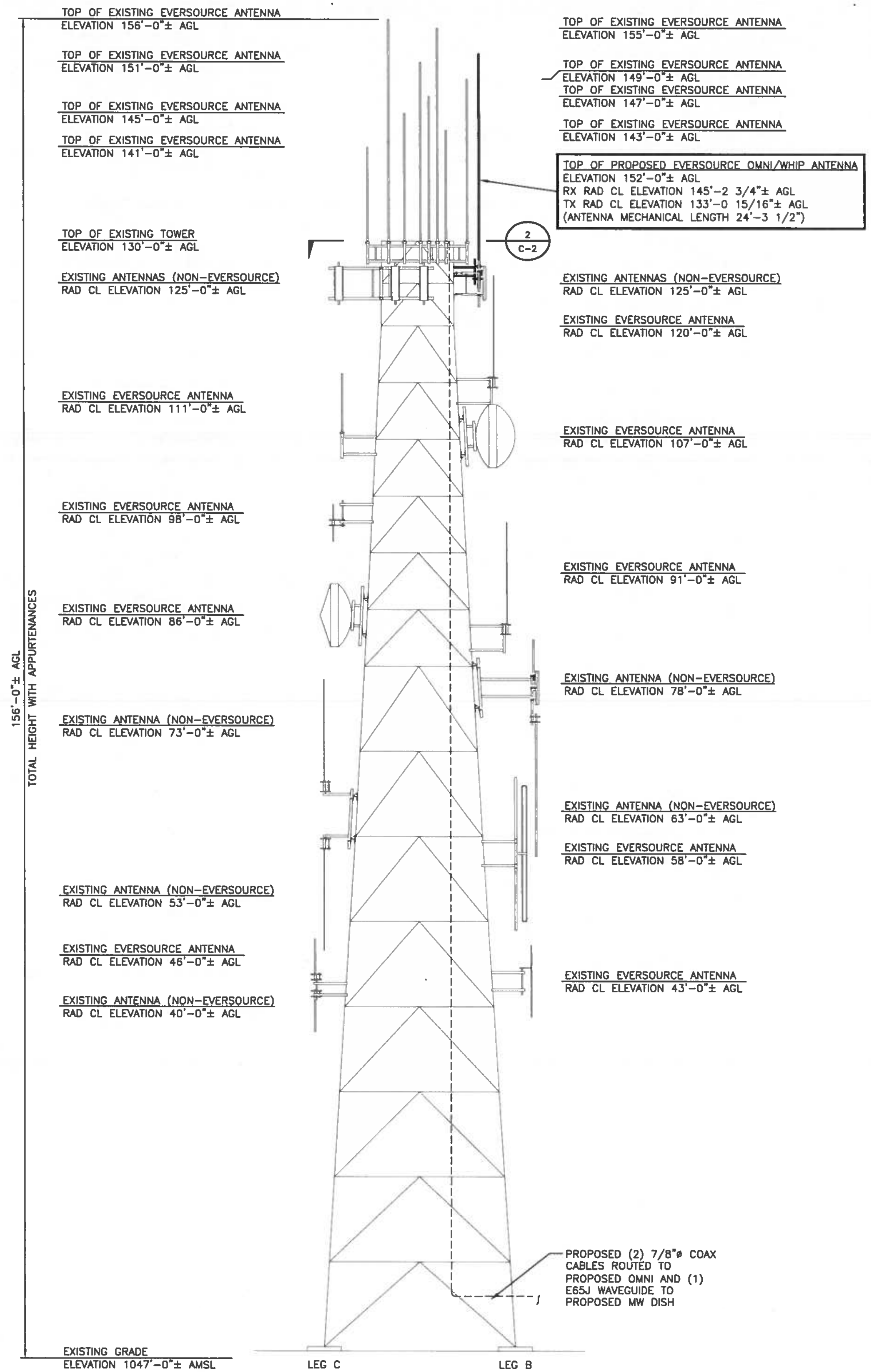
NOTES

1. ATTACH TIEBACK TO FRAME MAST BETWEEN TOP AND BOTTOM HSS ARMS. ATTACH OPPOSITE END TO EITHER ADJACENT TOWER LEG. REFER TO ALLOWABLE TIEBACK ANGLE DIAGRAM.
2. TRIM TIEBACK PIPE AS REQUIRED TO MAINTAIN A 6" DISTANCE BETWEEN ENDS OF CLAMPS AND ENDS OF PIPE.

ALLOWABLE TIEBACK ANGLE
±20 DEGREES VERTICAL
±45 DEGREES HORIZONTAL



SECTION 2
NO SCALE



TOWER ELEVATION FACE CB
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:	403093
DRAWN BY:	TYW
CHECKED BY:	JR

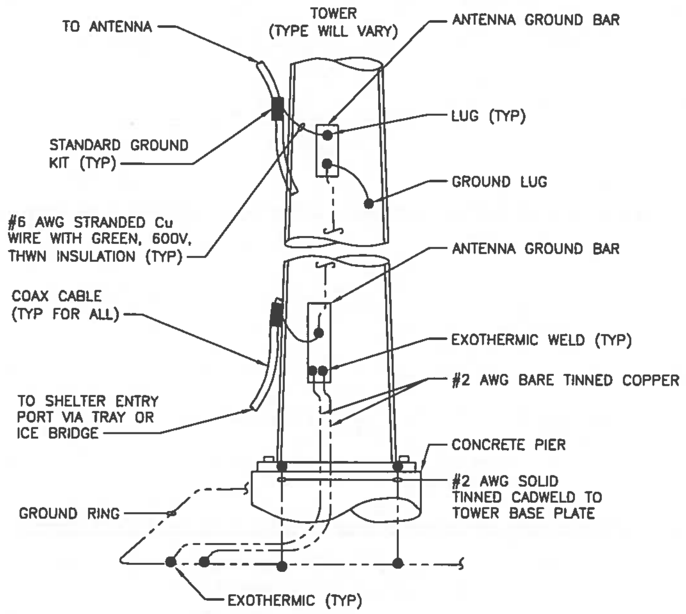
REV	DATE	DESCRIPTION
0	03/09/20	ISSUED FOR FILING

STATE OF CONNECTICUT · JOSHUA J. RILES · 33208 · LICENSED · PROFESSIONAL ENGINEER
3/9/2020

SOUTH MTN RADIO
790 WILLIS ST
BRISTOL, CT 06010

SHEET TITLE
TOWER ELEVATION

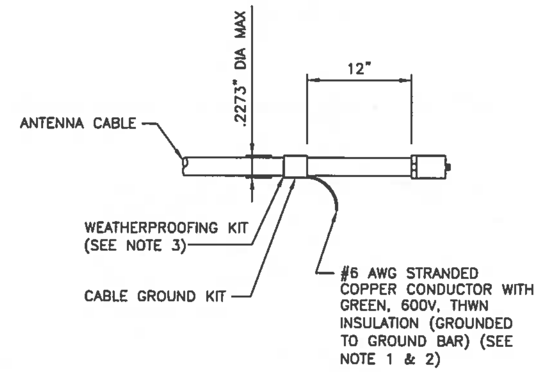
SHEET NUMBER
C-2



NOTE

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

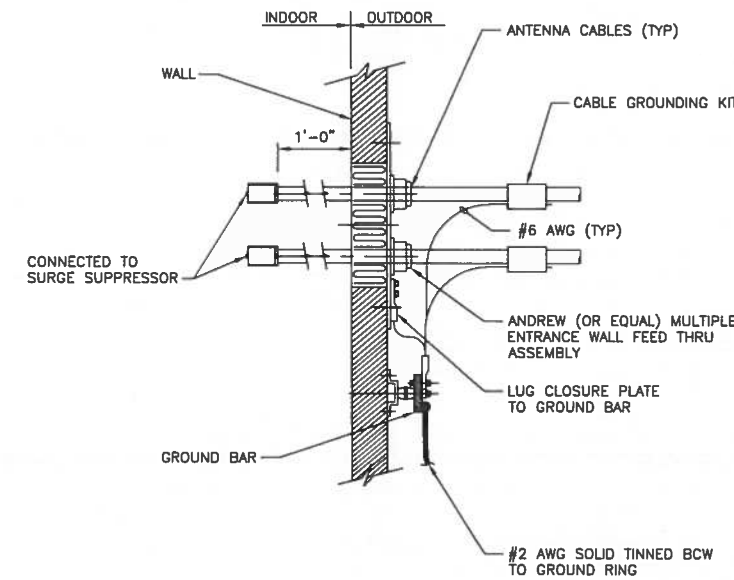
ANTENNA CABLE GROUNDING
NO SCALE



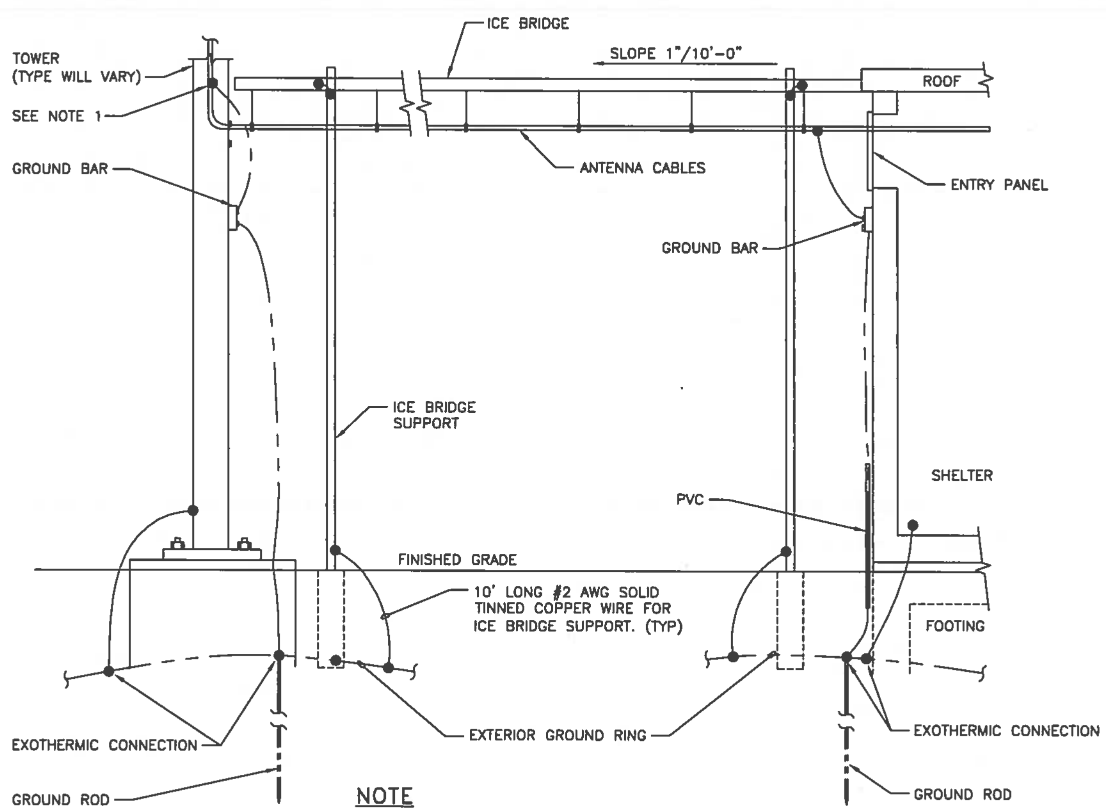
NOTES

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: 403093
DRAWN BY: TYW
CHECKED BY: JR

REV	DATE	DESCRIPTION
0	03/09/20	ISSUED FOR FILING

STATE OF CONNECTICUT MARK P. SULLES 34358 LICENSED PROFESSIONAL ENGINEER
3-9-2020

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

SOUTH MTN RADIO
790 WILLIS ST
BRISTOL, CT 06010

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
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.

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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.

12. GROUNDING SYSTEM RESISTANCE SHALL BE MEASURED, RECORDED, AND DATED USING MEGGER DET14 OR SIMILAR INSTRUMENT. GROUND RESISTANCE SHALL NOT EXCEED 5 OHMS. IF THE RESISTANCE VALUE IS EXCEEDED, NOTIFY CONSTRUCTION MANAGER FOR FURTHER INSTRUCTION.

13. COORDINATE WITH BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK INVOLVING EXISTING SYSTEMS OR EQUIPMENT IN ORDER TO DETERMINE THE EFFECT, IF ANY, ON OTHER TENANTS WITHIN THE BUILDING, AND TO DETERMINE THE APPROPRIATE TIME FOR PERFORMING THIS WORK.

14. THE CONTRACTOR SHALL BE REQUIRED TO VISIT THE SITE PRIOR TO SUBMITTING BID IN ORDER TO DETERMINE THE EXTENT OF THE EXISTING CONDITIONS.

15. ALL CONDUCTOR ENDS SHALL BE TAGGED AND ELECTRICAL EQUIPMENT LABELED WITH ENGRAVED IDENTIFICATION PLATES.

16. CONTRACTOR IS RESPONSIBLE FOR ALL CONTROL WIRING AND ALARM TIE–INS.

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. 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).

4. 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.

5. 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.

6. 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.

7. THE MINIMUM BEND RADIUS SHALL BE 8 INCHES FOR #6 WIRE AND SMALLER AND 12 INCHES FOR WIRE LARGER THAN #6.

8. BOND THE FENCE TO THE GROUND RING AT EACH CORNER, AND AT EACH GATE POST WITH #2 SOLID TINNED WIRE. EXOTHERMIC WELD BOTH ENDS.

9. GROUND KITS SHALL BE SOLID COPPER STRAP WITH #6 WIRE 2–HOLE COMPRESSION CRIMPED LUGS AND SHALL BE SEALED ACCORDING TO MANUFACTURER INSTRUCTIONS.

10. FERROUS METAL CLIPS WHICH COMPLETELY SURROUND THE GROUNDING CONDUCTOR SHALL BE USED.

11. 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.

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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SYMBOLS

●	EXOTHERMIC CONNECTION
■	COMPRESSION CONNECTION
⊣●	5/8"ø×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	(crosshatched band)
CABLE TRAY	(ladder band)
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		

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ATTACHMENT C – STRUCTURAL ANALYSIS REPORT

Date: **February 26, 2020**

Black & Veatch Corp
6800 W. 115th St., Suite 2292
Overland Park, KS 66211
(913) 458-6909

Subject:	**Structural Analysis Report**	
Eversource Designation:	**Crown Castle BU Number:**	ES-004
	Crown Castle Site Name:	SouthMtnsRS
Engineering Firm Designation:	**Black & Veatch Corp Project Number:**	403093
Site Data:	**790 Willis Street, Bristol, Hartford County, CT** **Latitude *41° 38' 56.0"*, Longitude *-72° 56' 50.0'*** **130 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- 42.4%**

This analysis utilizes an ultimate 3-second gust wind of 130 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: Sanyukta R. Arvikar

Respectfully submitted by:

Joshua J Riley, P.E.

Professional Engineer

02/26/2020

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 130 ft Self Support tower manufactured by Radian in December of 2006.

2) ANALYSIS CRITERIA

TIA-222 Revision: TIA-222-H
Risk Category: III
Wind Speed: 130 mph
Exposure Category: B
Topographic Factor: 1
Ice Thickness: 2 in
Wind Speed with Ice: 50 mph
Seismic Ss: 0.185
Seismic S1: 0.064
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)	Note
127.0	140.0	1	dbspectra	DS2C03F36D-D	2	7/8	-
	127.0	1	site pro 1	USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]			
87.0	87.0	1	rfs	PAD6-W59BC	1	E65J	-
		1	site pro 1	R5-LL [PM 602-1]			

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)	Note
127.0	141.5	1	unknown	25’ Omni	10	7/8	1
	141.0	1	unknown	24’ Omni			
	139.0	1	unknown	21' Omni			
	138.0	1	unknown	18' Omni			
	137.0	1	unknown	16' Omni			
	136.0	1	unknown	16' Omni			
	135.0	1	unknown	12' Omni			
	134.0	1	unknown	10' Omni			
	129.0	1	unknown	10"x8"x3" TMA			
	127.0	1	tower mounts	Sector Mount [SM 501-3]			
125.0	125.0	3	ericsson	AIR 32 w/ Mount Pipe	10	1 5/8	1
		1	tower mounts	Sector Mount [SM 502-3]			
		3	ericsson	AIR 21 w/ Mount Pipe			
		3	unknown	10"x8"x3" TMA			
		3	rfscelwave	APXVAARR24_43-U-NA20 w/ Mount Pipe			
		3	ericsson	RADIO 4449 B12/B71			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
117.0	117.0	1	tower mounts	6' x 3" Mount Pipe	1	E60	1
		1	unknown	PA6-59			
113.0	120.0	1	celwave	PD1142-1	1 1	1/2 7/8	1
	113.0	1	tower mounts	Side Arm Mount [SO 306-1]			
107.0	107.0	1	tower mounts	6' x 3" Mount Pipe	1	E65	1
		1	unknown	6 FT Dish			
104.0	111.0	1	celwave	PD1142-1	1	7/8	1
	104.0	1	tower mounts	Side Arm Mount [SO 306-1]			
98.0	98.0	1	antennae	DB205-A	1	7/8	1
		1	tower mounts	Side Arm Mount [SO 306-1]			
96.0	96.0	1	tower mounts	6' x 3" Mount Pipe	1	E60	1
		1	unknown	8 FT Dish			
86.0	86.0	1	tower mounts	6' x 3" Mount Pipe	1	E60	1
		1	unknown	PAD8-59AW			
84.0	91.0	1	celwave	PD1142-1	1	1/2	1
	84.0	1	tower mounts	Side Arm Mount [SO 306-1]			
84.0	84.0	1	antennae	2' Yagi	1	7/8	1
		1	tower mounts	4’x2” Pipe Mount			
77.0	78.0	1	andrew panel antennas	SBNH-1D6565A w/ Mount Pipe	1 4	1/2 1 5/8	1
	77.0	1	tower mounts	Sector Mount [SM 402-1]			
		1	miscl	TMA			
	67.0	2	antennae	3" Dia 20' Omni			
71.0	71.0	1	tower mounts	6' x 3" Mount Pipe	1	E65	1
		1	unknown	4 FT Dish			
63.0	73.0	1	antennae	3" Dia 20' Omni	1 1 3	7/8 1/2 1 5/8	1
		1	unknown	Diamond X-500A			
	63.0	1	tower mounts	Sector Mount [SM 402-1]			
		1	miscl	TMA			
	53.0	2	antennae	3" Dia 20' Omni			
58.0	58.0	1	tower mounts	Side Arm Mount [SO 306-1]	1	1/2	1
		1	decibel	DB212-1			
54.0	54.0	1	tower mounts	Side Arm Mount [SO 306-1]	1	1/2	1
		1	decibel	DB212-1			
43.0	46.0	1	antennae	3" Dia. 6' Omni	1 1	3/8 7/8	1
	43.0	1	tower mounts	Side Arm Mount [SO 306-1]			
	40.0	1	antennae	3" Dia. 6' Omni			
43.0	43.0	1	tower mounts	Side Arm Mount [SO 306-1]	1	3/8	1
	43.0	1	decibel	DB230-2B			

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
TOWER STRUCTURAL ANALYSIS REPORTS	Centek Engineering, Inc., dated 06/14/2019	Tower geometry, geotechnical data and reserved tower loading	Eversource
TOWER STRUCTURAL ANALYSIS REPORTS	Centek Engineering, Inc., dated 09/16/2013	Tower geometry and geotechnical data	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) 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.
4) Tower loading is based on 2018 drone mapping photos and previous tower analyses.
5) The existing base plate grout was considered in this analysis. Grout must be maintained and inspected periodically and must be replaced if damaged or cracked

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	130 - 120	Leg	ROHN 2.5 STD	1	-10.69	60.05	17.8	Pass
T2	120 - 100	Leg	ROHN 3 STD	29	-22.98	74.43	30.9	Pass
T3	100 - 80	Leg	ROHN 4 STD	69	-41.87	122.04	34.3	Pass
T4	80 - 60	Leg	ROHN 5 STD	107	-62.23	150.53	41.3	Pass
T5	60 - 40	Leg	ROHN 5 EH	134	-86.24	211.17	40.8	Pass
T6	40 - 20	Leg	ROHN 6 EHS	161	-108.65	256.16	42.4	Pass
T7	20 - 0	Leg	ROHN 6 EH	188	-130.25	318.80	40.9	Pass
T1	130 - 120	Diagonal	ROHN 2 STD	9	-3.39	25.36	13.4	Pass
T2	120 - 100	Diagonal	ROHN 2.5 STD	36	-4.84	35.92	13.5	Pass
T3	100 - 80	Diagonal	ROHN 2.5 STD	74	-6.36	31.52	20.2	Pass
T4	80 - 60	Diagonal	ROHN 2.5 X-STR	113	-8.56	21.63	39.6	Pass
T5	60 - 40	Diagonal	ROHN 3 STD	138	-8.12	29.61	27.4	Pass
T6	40 - 20	Diagonal	ROHN 3 STD	165	-8.52	26.21	32.5	Pass
T7	20 - 0	Diagonal	ROHN 3 STD	192	-8.69	22.99	37.8	Pass

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	130 - 120	Horizontal	ROHN 1.5 STD	7	-2.47	23.71	10.4	Pass
T2	120 - 100	Horizontal	ROHN 2 STD	34	-2.95	34.21	8.6 10.3 (b)	Pass
T3	100 - 80	Horizontal	ROHN 2 STD	73	-4.31	28.55	15.1	Pass
T4	80 - 60	Horizontal	ROHN 2 STD	112	-5.01	23.75	21.1	Pass
T5	60 - 40	Horizontal	ROHN 2 STD	136	-5.23	17.60	29.7	Pass
T6	40 - 20	Horizontal	ROHN 2.5 STD	163	-5.86	30.30	19.3 20.5 (b)	Pass
T7	20 - 0	Horizontal	ROHN 2.5 STD	190	-6.27	23.43	26.8	Pass
T1	130 - 120	Top Girt	ROHN 1.5 STD	4	-0.32	23.77	1.3	Pass
T1	130 - 120	Inner Bracing	L2x2x1/8	17	-0.00	8.80	0.8	Pass
T2	120 - 100	Inner Bracing	L2x2x1/8	42	-0.01	6.48	0.9	Pass
T3	100 - 80	Inner Bracing	L2x2x1/8	79	-0.01	4.43	1.1	Pass
T4	80 - 60	Inner Bracing	L2x2x1/8	118	-0.01	3.34	1.2	Pass
T5	60 - 40	Inner Bracing	L2 1/2x2 1/2x3/16	147	-0.02	6.99	0.9	Pass
T6	40 - 20	Inner Bracing	L 3x3x3/16	174	-0.02	9.16	0.9	Pass
T7	20 - 0	Inner Bracing	L3 1/2x3 /12x1/4	201	-0.02	14.24	0.8	Pass
							Summary	
						Leg (T6)	42.4	Pass
						Diagonal (T4)	39.6	Pass
						Horizontal (T5)	29.7	Pass
						Top Girt (T1)	1.3	Pass
						Inner Bracing (T4)	1.2	Pass
						Bolt Checks	26.9	Pass
						Rating =	42.4	Pass

Table 5 - Tower Component Stresses vs. Capacity - LC1

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	27.68	Pass
1	Base Foundation	0	28.4	Pass
1	Base Foundation Soil Interaction	0	34.3	Pass

Structure Rating (max from all components) =	42.4%

Note:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity. Rating per TIA-222-H Section 15.5

4.1) Recommendation

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 ft*	*Horz. Deflection in*	*Gov. Load Comb.*	*Tilt °*	*Twist °*	*Check**
T1	130 - 120	1.02	44	0.066	0.011	OK
T2	120 - 100	0.88	44	0.065	0.01	OK
T3	100 - 80	0.614	44	0.057	0.008	OK
T4	80 - 60	0.39	44	0.045	0.008	OK
T5	60 - 40	0.222	44	0.032	0.007	OK
T6	40 - 20	0.102	44	0.021	0.005	OK

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

1) Maximum Rotation = 4 Degrees

2) Maximum Deflection = 0.03 * Tower Height = 47 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?*
117	PA6-59	0.064	0.01	6	10	10 dB	0.885	Not Exceeded
107	6 FT Dish	0.061	0.009	6	10	10 dB	0.885	Not Exceeded
96	8 FT Dish	0.055	0.008	8	10	10 dB	0.664	Not Exceeded
87	PAD6-W59BC	0.05	0.008	6.58333	10	10 dB	0.807	Not Exceeded
86	PAD8-59AW	0.049	0.008	8	10	10 dB	0.664	Not Exceeded
71	4 FT Dish	0.039	0.008	4	10	10 dB	1.328	Not Exceeded

*Limit per TIA-222-H Annex D

Maximum Tower Deflections - Design Wind

Section No.	*Elevation ft*	*Horz. Deflection in*	*Gov. Load Comb.*	*Tilt °*	*Twist °*	*Combined Max*	*Check**
T1	130 - 120	2.831	44	0.183	0.032	0.186	OK
T2	120 - 100	2.44	44	0.18	0.029	0.182	OK
T3	100 - 80	1.705	44	0.158	0.024	0.160	OK
T4	80 - 60	1.084	44	0.124	0.023	0.126	OK
T5	60 - 40	0.619	44	0.089	0.02	0.091	OK
T6	40 - 20	0.285	44	0.058	0.013	0.059	OK

*Up to 0.5 degree is considered acceptable per SUB090 Section 7

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

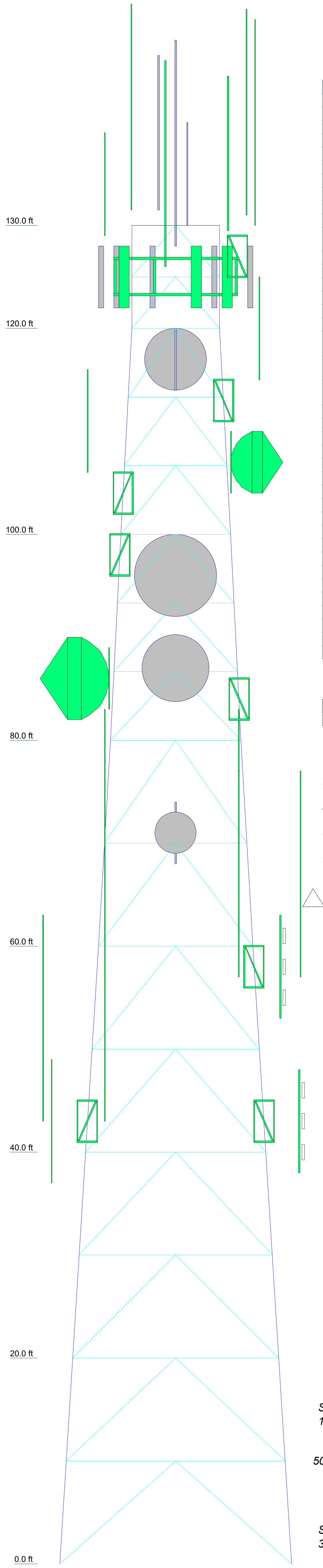
Elevation ft	*Appurtenance*	*Gov. Load Comb.*	*Deflection in*	*Tilt °*	*Twist °*	*Radius of Curvature ft*
117	PA6-59	44	2.325	0.178	0.029	70952.000
107	6 FT Dish	44	1.952	0.168	0.026	49860.000
96	8 FT Dish	44	1.57	0.152	0.023	37246.000
87	PAD6-W59BC	44	1.285	0.137	0.023	31207.000
86	PAD8-59AW	44	1.255	0.135	0.023	30609.000
71	4 FT Dish	44	0.857	0.108	0.022	32065.000

APPENDIX A

TNXTOWER OUTPUT

Section	T1	T2	T3	T4	T5	T6	T7
Legs	ROHN 2.5 STD	ROHN 3 STD	ROHN 4 STD	ROHN 5 STD	ROHN 5 EH	ROHN 6 EHS	ROHN 6 EH
Leg Grade	A572-50						
Diagonals	ROHN 2 STD	ROHN 2.5 STD		ROHN 2.5 X-STR	ROHN 3 STD		
Diagonal Grade	A572-50						
Top Girts	ROHN 1.5 STD	N.A.					
Horizontals	ROHN 1.5 STD	ROHN 2 STD				ROHN 2.5 STD	
Inner Bracing	L2x2x1/8				L 2 1/2x2 1/2x3/16	L 3x3x3/16	L3 1/2x3 1/2x1/4
Face Width (ft)	8.5 / 8.54	8.54 / 10.63	10.63 / 12.71	12.71 / 14.96	14.96 / 17.54	17.54 / 20.04	20.04 / 22.54
# Panels @ (ft)	2 @ 5	6 @ 6.66667			8 @ 10		
Weight (K)	0.7	1.8	2.1	2.5	3.1	3.7	4.4

Total Weight (K): 18.2



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Sector Mount [SM 501-3]	127	Side Arm Mount [SO 306-1]	104
3" Dia 12' Omni	127	PD1142-1	104
2" Dia 10' Omni	127	Side Arm Mount [SO 306-1]	98
2.38" Dia 21' Omni	127	3' Yagi	98
2.5" Dia 16' Omni	127	12' Hori. 5"x5" Tube	96
18' x 3" Dia Omni	127	4' x 2" Horizontal Face Mount Pipe	96
2.5" Dia 16' Omni	127	6' x 3" Mount Pipe	96
2" Dia 24' Omni	127	8 FT Dish	96
2" Dia 25' Omni	127	R5-LL [PM 602-1]	87
10"x8"x3" TMA	127	PAD6-W59BC	87
USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]	127	6' x 3" Mount Pipe	86
		8' Horizontal x 2" Mount Pipe	86
DS2C03F36D-D	127	PAD8-59AW	86
AIR 32 w/ Mount Pipe	125	PD1142-1	84
AIR 32 w/ Mount Pipe	125	4' x 2" Pipe Mount	84
AIR 21 w/ Mount Pipe	125	Side Arm Mount [SO 306-1]	84
AIR 21 w/ Mount Pipe	125	3' Yagi	84
AIR 21 w/ Mount Pipe	125	SBNH-1D6565A w/ Mount Pipe	77
APXVAARR24_43-U-NA20_T-MOBILE_TIA w/ Mount Pipe	125	3" Dia 20' Omni	77
		TMA	77
APXVAARR24_43-U-NA20_T-MOBILE_TIA w/ Mount Pipe	125	3" Dia 20' Omni	77
		3" Dia. 6' Omni	77
APXVAARR24_43-U-NA20_T-MOBILE_TIA w/ Mount Pipe	125	Sector Mount [SM 402-1]	77
RADIO 4449 B12/B71	125	6' x 3" Mount Pipe	71
RADIO 4449 B12/B71	125	4 FT Dish	71
RADIO 4449 B12/B71	125	3" Dia 20' Omni	63
10"x8"x3" TMA	125	3" Dia 20' Omni	63
10"x8"x3" TMA	125	Diamond X-500A	63
10"x8"x3" TMA	125	3" Dia 20' Omni	63
Sector Mount [SM 502-3]	125	Sector Mount [SM 402-1]	63
AIR 32 w/ Mount Pipe	125	TMA	63
6' x 3" Mount Pipe	117	Side Arm Mount [SO 306-1]	58
10' Hori. 5"x5" Tube	117	8'x2 1/2" Pipe Mount	58
4' x 2" Horizontal Face Mount Pipe	117	DB212-1	58
PA6-59	117	(2) 4.5' x 2" horizontal mount pipe	58
Side Arm Mount [SO 306-1]	113	Side Arm Mount [SO 306-1]	54
PD1142-1	113	6' x 2" Mount Pipe	54
6' x 3" Mount Pipe	107	DB212-1	54
10' Hori. 5"x5" Tube	107	Side Arm Mount [SO 306-1]	43
6'x2" Horizontal Face Mount Pipe	107	Side Arm Mount [SO 306-1]	43
10' Hori. 5"x5" Tube	107	3" Dia. 6' Omni	43
6 FT Dish	107	DB230-2B	43
		3" Dia. 6' Omni	43

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure B to the TIA-222-H Standard.
3. Tower designed for a 130 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 2.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Risk Category III.
7. Topographic Category 1 with Crest Height of 0.000 ft
8. TOWER RATING: 42.4%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 140 K
SHEAR: 19 K

UPLIFT: -119 K
SHEAR: 18 K

AXIAL 153 K
SHEAR 12 K
MOMENT 1102 kip-ft
TORQUE 18 kip-ft
50 mph WIND - 2.000 in ICE

AXIAL 40 K
SHEAR 34 K
MOMENT 2596 kip-ft
TORQUE 36 kip-ft
REACTIONS - 130 mph WIND

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Job: ES-004 SouthMtnRS			
Project: 403093			
Client: Eversource	Drawn by: Josh Riley		App'd:
Code: TIA-222-H	Date: 02/25/20		Scale: NTS
Path:			Dwg No. E-1

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 130.000 ft above the ground line.
The base of the tower is set at an elevation of 0.000 ft above the ground line.
The face width of the tower is 8.500 ft at the top and 22.540 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

1. Tower is located in Hartford County, Connecticut.
2. Tower base elevation above sea level: 1047.000 ft.
3. Basic wind speed of 130 mph.
4. Risk Category III.
5. Exposure Category B.
6. Simplified Topographic Factor Procedure for wind speed-up calculations is used.
7. Topographic Category: 1.
8. Crest Height: 0.000 ft.
9. Nominal ice thickness of 2.000 in.
10. Ice thickness is considered to increase with height.
11. Ice density of 56 pcf.
12. A wind speed of 50 mph is used in combination with ice.
13. Temperature drop of 50 °F.
14. Deflections calculated using a wind speed of 60 mph.
15. Pressures are calculated at each section.
16. Stress ratio used in tower member design is 1.05.
17. Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

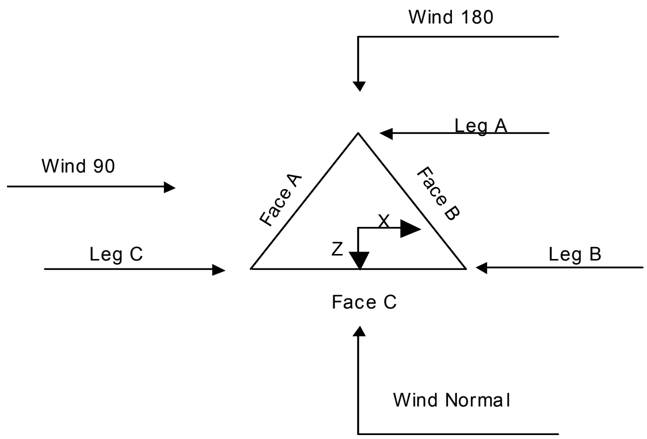
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
Use Code Stress Ratios
Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
√ Secondary Horizontal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

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
Retension Guys To Initial Tension
√ Bypass Mast Stability Checks
√ Use Azimuth Dish Coefficients
√ Project Wind Area of Appurt.
Autocalc Torque Arm Areas
Add IBC .6D+W Combination
√ Sort Capacity Reports By Component
√ Triangulate Diamond Inner Bracing
Treat Feed Line Bundles As Cylinder
Ignore KL/ry For 60 Deg. Angle Legs

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

Poles

Include Shear-Torsion Interaction
Always Use Sub-Critical Flow
Use Top Mounted Sockets
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 ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	130.000-120.000			8.500	1	10.000
T2	120.000-100.000			8.540	1	20.000
T3	100.000-80.000			10.630	1	20.000
T4	80.000-60.000			12.710	1	20.000
T5	60.000-40.000			14.960	1	20.000
T6	40.000-20.000			17.540	1	20.000
T7	20.000-0.000			20.040	1	20.000

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T1	130.000-120.000	5.000	K Brace Down	No	Yes	0.000	0.000
T2	120.000-100.000	6.667	K Brace Down	No	Yes	0.000	0.000
T3	100.000-80.000	6.667	K Brace Down	No	Yes	0.000	0.000
T4	80.000-60.000	10.000	K Brace Down	No	Yes	0.000	0.000
T5	60.000-40.000	10.000	K Brace Down	No	Yes	0.000	0.000
T6	40.000-20.000	10.000	K Brace Down	No	Yes	0.000	0.000
T7	20.000-0.000	10.000	K Brace Down	No	Yes	0.000	0.000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Type*	*Leg Size*	*Leg Grade*	*Diagonal Type*	*Diagonal Size*	*Diagonal Grade*
T1 130.000-120.000	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T2 120.000-100.000	Pipe	ROHN 3 STD	A572-50 (50 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)
T3 100.000-80.000	Pipe	ROHN 4 STD	A572-50 (50 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)
T4 80.000-60.000	Pipe	ROHN 5 STD	A572-50 (50 ksi)	Pipe	ROHN 2.5 X-STR	A572-50 (50 ksi)
T5 60.000-40.000	Pipe	ROHN 5 EH	A572-50 (50 ksi)	Pipe	ROHN 3 STD	A572-50 (50 ksi)
T6 40.000-20.000	Pipe	ROHN 6 EHS	A572-50 (50 ksi)	Pipe	ROHN 3 STD	A572-50 (50 ksi)
T7 20.000-0.000	Pipe	ROHN 6 EH	A572-50 (50 ksi)	Pipe	ROHN 3 STD	A572-50 (50 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 130.000-120.000	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 1.5 STD	A572-50 (50 ksi)
T2 120.000-100.000	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T3 100.000-80.000	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T4 80.000-60.000	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T5 60.000-40.000	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2 STD	A572-50 (50 ksi)
T6 40.000-20.000	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)
T7 20.000-0.000	None	Flat Bar		A36 (36 ksi)	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Secondary Horizontal Type*	*Secondary Horizontal Size*	*Secondary Horizontal Grade*	*Inner Bracing Type*	*Inner Bracing Size*	*Inner Bracing Grade*
T1 130.000-120.000	Solid Round		A572-50 (50 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T2 120.000-100.000	Solid Round		A572-50 (50 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T3 100.000-80.000	Solid Round		A572-50 (50 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T4 80.000-60.000	Solid Round		A572-50 (50 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T5 60.000-40.000	Solid Round		A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T6 40.000-20.000	Solid Round		A572-50 (50 ksi)	Single Angle	L 3x3x3/16	A36 (36 ksi)
T7 20.000-0.000	Solid Round		A572-50 (50 ksi)	Single Angle	L3 1/2x3 /12x1/4	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 130.000-120.000	0.000	0.000	A36 (36 ksi)	1	1.05	1.05	36.000	36.000	36.000
T2 120.000-100.000	0.000	0.000	A36 (36 ksi)	1	1.05	1.05	36.000	36.000	36.000
T3 100.000-80.000	0.000	0.000	A36 (36 ksi)	1	1.05	1.05	36.000	36.000	36.000
T4 80.000-60.000	0.000	0.000	A36 (36 ksi)	1	1.05	1.05	36.000	36.000	36.000
T5 60.000-40.000	0.000	0.000	A36 (36 ksi)	1	1.05	1.05	36.000	36.000	36.000
T6 40.000-20.000	0.000	0.000	A36 (36 ksi)	1	1.05	1.05	36.000	36.000	36.000
T7 20.000-0.000	0.000	0.000	A36 (36 ksi)	1	1.05	1.05	36.000	36.000	36.000

Tower Section Geometry *(cont'd)*

			K Factors[1]							
Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 130.000-120.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 120.000-100.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 100.000-80.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 80.000-60.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 60.000-40.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 40.000-20.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 20.000-0.000	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	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 130.000-120.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T2 120.000-100.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T3 100.000-80.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75

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
T4 80.000-60.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T5 60.000-40.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T6 40.000-20.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T7 20.000-0.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	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 130.000-120.000	Flange	0.750 A325N	4	0.625 A325N	3	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325N	2	0.625 A325N	0
T2 120.000-100.000	Flange	0.875 A325N	4	0.625 A325N	3	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325N	2	0.625 A325N	0
T3 100.000-80.000	Flange	1.000 A325N	4	0.625 A325N	3	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325N	2	0.625 A325N	0
T4 80.000-60.000	Flange	1.000 A325N	4	0.625 A325N	3	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325N	2	0.625 A325N	0
T5 60.000-40.000	Flange	1.000 A325N	6	0.625 A325N	3	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325N	2	0.625 A325N	0
T6 40.000-20.000	Flange	1.000 A325N	6	0.625 A325N	3	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325N	2	0.625 A325N	0
T7 20.000-0.000	Flange	1.000 A325N	0	0.625 A325N	3	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325N	2	0.625 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
Climbing Ladder (Af)	C	No	No	Af (CaAa)	130.000 - 0.000	-10.000	0.4	1	1	3.000	3.000		8.40
Safety Line 3/8	C	No	No	Ar (CaAa)	130.000 - 0.000	-10.000	0.4	1	1	0.375	0.375		0.22
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	130.000 - 7.000	0.000	-0.44	10	10	0.500	1.030		0.33
Feedline Ladder (Af)	C	No	No	Af (CaAa)	130.000 - 0.000	0.000	-0.4	1	1	3.000	3.000		8.40
E60	C	No	No	Ar (CaAa)	117.000 - 107.000	0.000	-0.375	1	1	0.500	2.200		1.10
E65+E60	C	No	No	Ar (CaAa)	107.000 - 96.000	0.000	-0.375	2	2	0.500	2.200		1.10
E60+E65+E60	C	No	No	Ar (CaAa)	96.000 - 86.000	0.000	-0.375	3	3	0.500	2.200		1.10
E60+E60+E65+E60	C	No	No	Ar (CaAa)	86.000 - 71.000	0.000	-0.375	4	4	0.500	2.200		1.10
E65+E60+E60+E65+E60	C	No	No	Ar (CaAa)	71.000 - 7.000	0.000	-0.375	5	5	0.500	2.200		1.10
LDF7-50A(1-5/8")	A	No	No	Ar (CaAa)	125.000 - 7.000	0.000	-0.42	10	5	0.500	1.980		0.82

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
Feedline Ladder (Af)	A	No	No	Af (CaAa)	130.000 - 0.000	0.000	-0.42	1	1	3.000	3.000		8.40
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	113.000 - 7.000	3.000	-0.47	1	1	0.500	1.030		0.33
LDF4-75A(1/2)	C	No	No	Ar (CaAa)	113.000 - 7.000	2.000	-0.454	1	1	0.500	0.630		0.16
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	104.000 - 7.000	1.500	-0.47	1	1	0.500	1.030		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	98.000 - 7.000	4.500	-0.47	1	1	0.500	1.030		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	84.000 - 7.000	2.000	-0.46	1	1	0.500	1.030		0.33
LDF4-50A(1/2)	C	No	No	Ar (CaAa)	84.000 - 7.000	2.000	-0.445	1	1	0.500	0.625		0.15
Feedline Ladder (Af)	C	No	No	Af (CaAa)	80.000 - 0.000	0.000	0.42	1	1	3.000	3.000		8.40
LDF4-50A(1/2)	C	No	No	Ar (CaAa)	77.000 - 7.000	0.000	0.405	1	1	0.500	0.625		0.15
LDF7-50A(1-5/8)	C	No	No	Ar (CaAa)	77.000 - 7.000	0.000	0.37	4	4	0.500	1.980		0.82
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	63.000 - 7.000	0.000	0.44	1	1	0.500	1.030		0.33
LDF4-50A(1/2)	C	No	No	Ar (CaAa)	63.000 - 7.000	0.000	0.415	1	1	0.500	0.625		0.15
LDF7-50A(1-5/8)	C	No	No	Ar (CaAa)	63.000 - 7.000	0.000	0.47	3	3	0.500	1.980		0.82
LDF4-75A(1/2)	C	No	No	Ar (CaAa)	58.000 - 7.000	2.000	-0.438	1	1	0.500	0.630		0.16
LDF4-75A(1/2)	C	No	No	Ar (CaAa)	54.000 - 7.000	2.000	-0.43	1	1	0.500	0.630		0.16
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	43.000 - 7.000	0.000	0.43	1	1	0.500	1.030		0.33
LDF2-50A(3/8)	C	No	No	Ar (CaAa)	43.000 - 7.000	2.000	-0.418	1	1	0.440	0.440		0.08
LDF2-50A(3/8)	C	No	No	Ar (CaAa)	43.000 - 7.000	2.000	-0.424	1	1	0.440	0.440		0.08
****Proposed***													
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	127.000 - 0.000	1.500	-0.412	2	1	0.500	1.030		0.33
E65	C	No	No	Ar (CaAa)	87.000 - 0.000	4.500	-0.412	1	1	0.500	2.200		1.10
**													
**													

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	130.000-120.000	A	0.000	0.000	14.900	0.000	0.13
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	22.117	0.000	0.21
T2	120.000-100.000	A	0.000	0.000	49.600	0.000	0.33
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	53.320	0.000	0.45
T3	100.000-80.000	A	0.000	0.000	49.600	0.000	0.33
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	68.546	0.000	0.52
T4	80.000-60.000	A	0.000	0.000	49.600	0.000	0.33
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	107.445	0.000	0.81
T5	60.000-40.000	A	0.000	0.000	49.600	0.000	0.33
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	127.489	0.000	0.89
T6	40.000-20.000	A	0.000	0.000	49.600	0.000	0.33
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	131.240	0.000	0.90
T7	20.000-0.000	A	0.000	0.000	35.740	0.000	0.27
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	99.051	0.000	0.77

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	130.000-120.000	A	2.628	0.000	0.000	22.577	0.000	0.59
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	61.188	0.000	1.34
T2	120.000-100.000	A	2.594	0.000	0.000	69.438	0.000	1.73
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	164.417	0.000	3.45
T3	100.000-80.000	A	2.543	0.000	0.000	68.881	0.000	1.70
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	221.715	0.000	4.40
T4	80.000-60.000	A	2.480	0.000	0.000	68.199	0.000	1.66
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	328.258	0.000	6.47
T5	60.000-40.000	A	2.398	0.000	0.000	67.313	0.000	1.61
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	402.583	0.000	7.53
T6	40.000-20.000	A	2.278	0.000	0.000	66.024	0.000	1.54
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	421.589	0.000	7.54
T7	20.000-0.000	A	2.041	0.000	0.000	47.613	0.000	1.08
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	291.156	0.000	5.01

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	130.000-120.000	1.819	8.943	1.611	9.365
T2	120.000-100.000	1.587	12.155	4.614	14.505
T3	100.000-80.000	6.622	15.186	12.111	19.485
T4	80.000-60.000	2.668	21.418	8.247	27.474
T5	60.000-40.000	-1.348	25.116	4.360	33.636
T6	40.000-20.000	-1.351	27.616	6.150	38.310
T7	20.000-0.000	-2.672	26.023	3.574	36.202

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	Climbing Ladder (Af)	120.00 - 130.00	0.6000	0.5472
T1	2	Safety Line 3/8	120.00 - 130.00	0.6000	0.5472
T1	3	LDF5-50A(7/8)	120.00 - 130.00	0.6000	0.5472
T1	4	Feedline Ladder (Af)	120.00 - 130.00	0.6000	0.5472
T1	10	LDF7-50A(1-5/8")	120.00 - 125.00	0.6000	0.5472
T1	12	Feedline Ladder (Af)	120.00 - 130.00	0.6000	0.5472
T1	31	LDF5-50A(7/8)	120.00 - 127.00	0.6000	0.5472
T2	1	Climbing Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T2	2	Safety Line 3/8	100.00 - 120.00	0.6000	0.6000
T2	3	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.6000
T2	4	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T2	5	E60	107.00 - 117.00	0.6000	0.6000
T2	6	E65+E60	100.00 - 107.00	0.6000	0.6000
T2	10	LDF7-50A(1-5/8")	100.00 - 120.00	0.6000	0.6000
T2	12	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T2	13	LDF5-50A(7/8)	100.00 - 113.00	0.6000	0.6000
T2	14	LDF4-75A(1/2)	100.00 - 113.00	0.6000	0.6000
T2	15	LDF5-50A(7/8)	100.00 - 104.00	0.6000	0.6000
T2	31	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.6000
T3	1	Climbing Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T3	2	Safety Line 3/8	80.00 - 100.00	0.6000	0.6000
T3	3	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T3	4	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T3	6	E65+E60	96.00 - 100.00	0.6000	0.6000
T3	7	E60+E65+E60	86.00 - 96.00	0.6000	0.6000
T3	8	E60+E60+E65+E60	80.00 - 86.00	0.6000	0.6000
T3	10	LDF7-50A(1-5/8")	80.00 - 100.00	0.6000	0.6000
T3	12	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T3	13	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T3	14	LDF4-75A(1/2)	80.00 - 100.00	0.6000	0.6000
T3	15	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T3	16	LDF5-50A(7/8)	80.00 - 98.00	0.6000	0.6000
T3	17	LDF5-50A(7/8)	80.00 - 84.00	0.6000	0.6000
T3	18	LDF4-50A(1/2)	80.00 - 84.00	0.6000	0.6000
T3	31	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T3	32	E65	80.00 - 87.00	0.6000	0.6000
T4	1	Climbing Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T4	2	Safety Line 3/8	60.00 - 80.00	0.6000	0.6000
T4	3	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T4	4	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T4	8	E60+E60+E65+E60	71.00 - 80.00	0.6000	0.6000
T4	9	E65+E60+E60+E65+E60	60.00 - 71.00	0.6000	0.6000
T4	10	LDF7-50A(1-5/8")	60.00 - 80.00	0.6000	0.6000
T4	12	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T4	13	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T4	14	LDF4-75A(1/2)	60.00 - 80.00	0.6000	0.6000
T4	15	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T4	16	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T4	17	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T4	18	LDF4-50A(1/2)	60.00 - 80.00	0.6000	0.6000
T4	19	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T4	20	LDF4-50A(1/2)	60.00 - 77.00	0.6000	0.6000
T4	21	LDF7-50A(1-5/8)	60.00 - 77.00	0.6000	0.6000
T4	22	LDF5-50A(7/8)	60.00 - 63.00	0.6000	0.6000
T4	23	LDF4-50A(1/2)	60.00 - 63.00	0.6000	0.6000
T4	24	LDF7-50A(1-5/8)	60.00 - 63.00	0.6000	0.6000
T4	31	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T4	32	E65	60.00 - 80.00	0.6000	0.6000
T5	1	Climbing Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T5	2	Safety Line 3/8	40.00 - 60.00	0.6000	0.6000
T5	3	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T5	4	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T5	9	E65+E60+E60+E65+E60	40.00 - 60.00	0.6000	0.6000
T5	10	LDF7-50A(1-5/8")	40.00 - 60.00	0.6000	0.6000
T5	12	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T5	13	LDF5-50A(7/8)	40.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
			60.00		
T5	14	LDF4-75A(1/2)	40.00 - 60.00	0.6000	0.6000
T5	15	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T5	16	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T5	17	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T5	18	LDF4-50A(1/2)	40.00 - 60.00	0.6000	0.6000
T5	19	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T5	20	LDF4-50A(1/2)	40.00 - 60.00	0.6000	0.6000
T5	21	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T5	22	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T5	23	LDF4-50A(1/2)	40.00 - 60.00	0.6000	0.6000
T5	24	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T5	25	LDF4-75A(1/2)	40.00 - 58.00	0.6000	0.6000
T5	26	LDF4-75A(1/2)	40.00 - 54.00	0.6000	0.6000
T5	27	LDF5-50A(7/8)	40.00 - 43.00	0.6000	0.6000
T5	28	LDF2-50A(3/8)	40.00 - 43.00	0.6000	0.6000
T5	29	LDF2-50A(3/8)	40.00 - 43.00	0.6000	0.6000
T5	31	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T5	32	E65	40.00 - 60.00	0.6000	0.6000
T6	1	Climbing Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T6	2	Safety Line 3/8	20.00 - 40.00	0.6000	0.6000
T6	3	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	4	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T6	9	E65+E60+E60+E65+E60	20.00 - 40.00	0.6000	0.6000
T6	10	LDF7-50A(1-5/8")	20.00 - 40.00	0.6000	0.6000
T6	12	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T6	13	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	14	LDF4-75A(1/2)	20.00 - 40.00	0.6000	0.6000
T6	15	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	16	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	17	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	18	LDF4-50A(1/2)	20.00 - 40.00	0.6000	0.6000
T6	19	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T6	20	LDF4-50A(1/2)	20.00 - 40.00	0.6000	0.6000
T6	21	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T6	22	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	23	LDF4-50A(1/2)	20.00 - 40.00	0.6000	0.6000
T6	24	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T6	25	LDF4-75A(1/2)	20.00 - 40.00	0.6000	0.6000
T6	26	LDF4-75A(1/2)	20.00 - 40.00	0.6000	0.6000
T6	27	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	28	LDF2-50A(3/8)	20.00 - 40.00	0.6000	0.6000
T6	29	LDF2-50A(3/8)	20.00 - 40.00	0.6000	0.6000
T6	31	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T6	32	E65	20.00 - 40.00	0.6000	0.6000
T7	1	Climbing Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T7	2	Safety Line 3/8	0.00 - 20.00	0.6000	0.6000
T7	3	LDF5-50A(7/8)	7.00 - 20.00	0.6000	0.6000
T7	4	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T7	9	E65+E60+E60+E65+E60	7.00 - 20.00	0.6000	0.6000
T7	10	LDF7-50A(1-5/8")	7.00 - 20.00	0.6000	0.6000
T7	12	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T7	13	LDF5-50A(7/8)	7.00 - 20.00	0.6000	0.6000
T7	14	LDF4-75A(1/2)	7.00 - 20.00	0.6000	0.6000
T7	15	LDF5-50A(7/8)	7.00 - 20.00	0.6000	0.6000
T7	16	LDF5-50A(7/8)	7.00 - 20.00	0.6000	0.6000
T7	17	LDF5-50A(7/8)	7.00 - 20.00	0.6000	0.6000
T7	18	LDF4-50A(1/2)	7.00 - 20.00	0.6000	0.6000
T7	19	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T7	20	LDF4-50A(1/2)	7.00 - 20.00	0.6000	0.6000
T7	21	LDF7-50A(1-5/8)	7.00 - 20.00	0.6000	0.6000
T7	22	LDF5-50A(7/8)	7.00 - 20.00	0.6000	0.6000
T7	23	LDF4-50A(1/2)	7.00 - 20.00	0.6000	0.6000
T7	24	LDF7-50A(1-5/8)	7.00 - 20.00	0.6000	0.6000
T7	25	LDF4-75A(1/2)	7.00 - 20.00	0.6000	0.6000
T7	26	LDF4-75A(1/2)	7.00 - 20.00	0.6000	0.6000
T7	27	LDF5-50A(7/8)	7.00 - 20.00	0.6000	0.6000
T7	28	LDF2-50A(3/8)	7.00 - 20.00	0.6000	0.6000
T7	29	LDF2-50A(3/8)	7.00 - 20.00	0.6000	0.6000
T7	31	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T7	32	E65	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
Sector Mount [SM 501-3]	A	From Face	0.000 0.000 0.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	20.430 30.050 40.280 64.650	20.430 30.050 40.280 64.650	0.90 1.28 1.80 3.23
3" Dia 12' Omni	B	From Face	0.000	0.000	127.000	No Ice	3.600	3.600	0.02

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
			-2.000 8.000			1/2" Ice 1" Ice 2" Ice	4.833 6.083 8.017	4.833 6.083 8.017	0.05 0.08 0.17
2" Dia 10' Omni	C	From Leg	3.000 0.000 7.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.000 3.030 4.060 6.120	2.000 3.030 4.060 6.120	0.01 0.03 0.04 0.07
2.38" Dia 21' Omni	A	From Face	0.000 1.000 12.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.998 7.126 9.271 13.611	4.998 7.126 9.271 13.611	0.01 0.05 0.10 0.24
2.5" Dia 16' Omni	C	From Face	0.000 1.000 9.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.000 5.629 7.275 10.617	4.000 5.629 7.275 10.617	0.03 0.06 0.10 0.21
18' x 3" Dia Omni	A	From Leg	3.000 0.000 11.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.400 7.233 9.083 12.833	5.400 7.233 9.083 12.833	0.14 0.18 0.23 0.36
2.5" Dia 16' Omni	B	From Leg	1.000 0.000 10.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.000 5.629 7.275 10.617	4.000 5.629 7.275 10.617	0.03 0.06 0.10 0.21
2" Dia 24' Omni	B	From Leg	3.000 0.000 14.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.800 7.225 9.667 14.600	4.800 7.225 9.667 14.600	0.05 0.08 0.13 0.28
2" Dia 25' Omni	C	From Leg	0.000 0.000 14.500	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.000 7.525 10.067 15.200	5.000 7.525 10.067 15.200	0.05 0.09 0.14 0.30
10"x8"x3" TMA	C	From Leg	2.000 0.000 2.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.000 1.131 1.270 1.570	0.410 0.510 0.618 0.853	0.01 0.02 0.03 0.05
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Sector Mount [SM 502-3]	A	None		0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	29.820 42.210 54.430 78.490	29.820 42.210 54.430 78.490	1.67 2.27 3.05 5.18
AIR 32 w/ Mount Pipe	A	From Face	3.000 -5.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	6.412 6.865 7.309 8.221	5.812 6.619 7.335 8.816	0.12 0.18 0.24 0.40
AIR 32 w/ Mount Pipe	B	From Face	3.000 -5.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	6.412 6.865 7.309 8.221	5.812 6.619 7.335 8.816	0.12 0.18 0.24 0.40
AIR 32 w/ Mount Pipe	C	From Face	3.000 -5.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	6.412 6.865 7.309 8.221	5.812 6.619 7.335 8.816	0.12 0.18 0.24 0.40

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*
AIR 21 w/ Mount Pipe	A	From Face	3.000 5.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	6.287 6.732 7.170 8.072	5.701 6.482 7.188 8.648	0.11 0.17 0.23 0.38
AIR 21 w/ Mount Pipe	B	From Face	3.000 5.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	6.287 6.732 7.170 8.072	5.701 6.482 7.188 8.648	0.11 0.17 0.23 0.38
AIR 21 w/ Mount Pipe	C	From Face	3.000 5.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	6.287 6.732 7.170 8.072	5.701 6.482 7.188 8.648	0.11 0.17 0.23 0.38
APXVAARR24_43-U-NA20_T-MOBILE_TIA w/ Mount Pipe	A	From Face	3.000 -2.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	20.480 21.231 21.990 23.444	11.024 12.550 14.099 16.451	0.19 0.32 0.47 0.80
APXVAARR24_43-U-NA20_T-MOBILE_TIA w/ Mount Pipe	B	From Face	3.000 -2.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	20.480 21.231 21.990 23.444	11.024 12.550 14.099 16.451	0.19 0.32 0.47 0.80
APXVAARR24_43-U-NA20_T-MOBILE_TIA w/ Mount Pipe	C	From Face	3.000 -2.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	20.480 21.231 21.990 23.444	11.024 12.550 14.099 16.451	0.19 0.32 0.47 0.80
RADIO 4449 B12/B71	A	From Face	3.000 0.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.650 1.810 1.978 2.336	1.300 1.445 1.597 1.924	0.08 0.09 0.11 0.16
RADIO 4449 B12/B71	B	From Face	3.000 0.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.650 1.810 1.978 2.336	1.300 1.445 1.597 1.924	0.08 0.09 0.11 0.16
RADIO 4449 B12/B71	C	From Face	3.000 0.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.650 1.810 1.978 2.336	1.300 1.445 1.597 1.924	0.08 0.09 0.11 0.16
10"x8"x3" TMA	A	From Face	3.000 0.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.000 1.131 1.270 1.570	0.410 0.510 0.618 0.853	0.01 0.02 0.03 0.05
10"x8"x3" TMA	B	From Face	3.000 0.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.000 1.131 1.270 1.570	0.410 0.510 0.618 0.853	0.01 0.02 0.03 0.05
10"x8"x3" TMA	C	From Face	3.000 0.000 0.000	0.000	125.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.000 1.131 1.270 1.570	0.410 0.510 0.618 0.853	0.01 0.02 0.03 0.05
10' Hori. 5"x5" Tube	B	From Face	0.000 0.000 0.000	0.000	117.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.000 5.712 6.423 7.847	0.208 0.268 0.334 0.490	0.16 0.20 0.25 0.33

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
4' x 2" Horizontal Face Mount Pipe	A	From Leg	0.500 0.000 0.000	0.000	117.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.870 1.110 1.370 1.900	0.010 0.050 0.100 0.240	0.01 0.02 0.03 0.06
6' x 3" Mount Pipe	A	From Leg	0.500 0.000 0.000	0.000	117.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.03 0.04 0.06 0.11
Side Arm Mount [SO 306-1]	B	From Leg	0.000 0.000 0.000	0.000	113.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.410 0.810 1.230 2.080	2.260 3.830 5.480 9.370	0.04 0.06 0.09 0.19
PD1142-1	B	From Leg	4.000 0.000 7.000	0.000	113.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.316 3.210 5.121 8.993	1.316 3.210 5.121 8.993	0.01 0.02 0.05 0.14
10' Hori. 5"x5" Tube	C	From Face	0.000 0.000 0.000	0.000	107.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.000 5.712 6.423 7.847	0.208 0.268 0.334 0.490	0.16 0.20 0.25 0.33
10' Hori. 5"x5" Tube	B	From Face	0.000 0.000 0.000	0.000	107.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.000 5.712 6.423 7.847	0.208 0.268 0.334 0.490	0.16 0.20 0.25 0.33
6'x2" Horizontal Mount Pipe	B	From Face	0.500 0.000 0.000	0.000	107.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.425 1.842 2.266 3.137	0.047 0.077 0.115 0.212	0.03 0.04 0.06 0.11
6' x 3" Mount Pipe	B	From Leg	0.500 0.000 0.000	0.000	107.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.03 0.04 0.06 0.11
Side Arm Mount [SO 306-1]	C	From Leg	0.000 0.000 0.000	0.000	104.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.410 0.810 1.230 2.080	2.260 3.830 5.480 9.370	0.04 0.06 0.09 0.19
PD1142-1	C	From Leg	4.000 0.000 7.000	0.000	104.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.316 3.210 5.121 8.993	1.316 3.210 5.121 8.993	0.01 0.02 0.05 0.14
Side Arm Mount [SO 306-1]	C	From Leg	0.000 0.000 0.000	0.000	98.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.410 0.810 1.230 2.080	2.260 3.830 5.480 9.370	0.04 0.06 0.09 0.19
3' Yagi	C	From Leg	4.000 0.000 0.000	0.000	98.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.083 3.787 5.517 9.055	2.083 3.787 5.517 9.055	0.03 0.05 0.09 0.18
12' Hori. 5"x5" Tube	A	From Face	0.000 0.000 0.000	0.000	96.000	No Ice 1/2" Ice 1" Ice 2" Ice	6.000 6.854 7.708 9.416	0.208 0.268 0.334 0.490	0.19 0.24 0.30 0.40

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
4' x 2" Horizontal Face Mount Pipe	A	From Leg	0.500 0.000 0.000	0.000	96.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.870 1.110 1.370 1.900	0.010 0.050 0.100 0.240	0.01 0.02 0.03 0.06
6' x 3" Mount Pipe	A	From Leg	0.500 0.000 0.000	0.000	96.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.03 0.04 0.06 0.11
8' Horizontal x 2" Mount Pipe	C	From Face	0.500 0.000 0.000	0.000	86.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.900 2.450 3.008 4.145	0.047 0.077 0.115 0.212	0.03 0.05 0.07 0.14
6' x 3" Mount Pipe	C	From Leg	0.500 0.000 0.000	0.000	86.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.03 0.04 0.06 0.11
PD1142-1	B	From Leg	4.000 0.000 7.000	0.000	84.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.316 3.210 5.121 8.993	1.316 3.210 5.121 8.993	0.01 0.02 0.05 0.14
Side Arm Mount [SO 306-1]	B	From Leg	0.000 0.000 0.000	0.000	84.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.410 0.810 1.230 2.080	2.260 3.830 5.480 9.370	0.04 0.06 0.09 0.19
3' Yagi	A	From Leg	0.500 0.000 0.000	0.000	84.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.083 3.787 5.517 9.055	2.083 3.787 5.517 9.055	0.03 0.05 0.09 0.18
4' x 2" Pipe Mount	A	From Leg	0.500 0.000 0.000	0.000	84.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.785 1.028 1.281 1.814	0.785 1.028 1.281 1.814	0.03 0.04 0.04 0.07
Sector Mount [SM 402-1]	B	From Leg	0.000 0.000 0.000	0.000	77.000	No Ice 1/2" Ice 1" Ice 2" Ice	9.720 13.660 17.550 25.280	7.050 9.870 12.660 18.130	0.28 0.40 0.57 1.01
SBNH-1D6565A w/ Mount Pipe	B	From Leg	3.000 -6.000 1.000	0.000	77.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.599 6.007 6.417 7.263	4.774 5.446 6.095 7.443	0.06 0.11 0.16 0.30
3" Dia 20' Omni	B	From Leg	3.000 -6.000 -10.000	0.000	77.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.000 6.000 8.000 12.000	4.000 6.000 8.000 12.000	0.06 0.10 0.14 0.23
3" Dia. 6' Omni	B	From Leg	3.000 6.000 3.000	0.000	77.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.05 0.06 0.08 0.12
3" Dia 20' Omni	B	From Leg	3.000 6.000 -10.000	0.000	77.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.000 6.000 8.000 12.000	4.000 6.000 8.000 12.000	0.06 0.10 0.14 0.23

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
TMA	B	From Leg	3.000 0.000 0.000	0.000	77.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.600 0.704 0.815 1.059	0.407 0.497 0.593 0.815	0.01 0.02 0.02 0.04
6' x 3" Mount Pipe	A	From Leg	0.500 0.000 0.000	0.000	71.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.03 0.04 0.06 0.11
Sector Mount [SM 402-1]	C	From Leg	0.000 0.000 0.000	0.000	63.000	No Ice 1/2" Ice 1" Ice 2" Ice	9.720 13.660 17.550 25.280	7.050 9.870 12.660 18.130	0.28 0.40 0.57 1.01
3" Dia 20' Omni	C	From Leg	3.000 -6.000 10.000	0.000	63.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.000 6.000 8.000 12.000	4.000 6.000 8.000 12.000	0.06 0.10 0.14 0.23
3" Dia 20' Omni	C	From Leg	3.000 -6.000 -10.000	0.000	63.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.000 6.000 8.000 12.000	4.000 6.000 8.000 12.000	0.06 0.10 0.14 0.23
Diamond X-500A	C	From Leg	3.000 6.000 10.000	0.000	63.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.998 7.126 9.271 13.611	4.998 7.126 9.271 13.611	0.01 0.05 0.10 0.24
3" Dia 20' Omni	C	From Leg	3.000 6.000 -10.000	0.000	63.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.000 6.000 8.000 12.000	4.000 6.000 8.000 12.000	0.06 0.10 0.14 0.23
TMA	C	From Leg	3.000 0.000 0.000	0.000	63.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.600 0.704 0.815 1.059	0.407 0.497 0.593 0.815	0.01 0.02 0.02 0.04
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(2) 4.5' x 2" horizontal mount pipe	B	From Leg	1.000 0.000 0.000	0.000	58.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.860 1.180 1.460 2.050	0.010 0.040 0.090 0.210	0.01 0.02 0.03 0.06
8'x2 1/2" Pipe Mount	B	From Leg	1.000 0.000 0.000	0.000	58.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.300 3.132 3.620 4.620	2.300 3.132 3.620 4.620	0.04 0.06 0.08 0.14
DB212-1	B	From Leg	3.000 0.000 0.000	0.000	58.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.400 8.418 12.452 20.570	4.400 8.418 12.452 20.570	0.03 0.07 0.13 0.34
Side Arm Mount [SO 306-1]	B	From Leg	0.000 0.000 0.000	0.000	58.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.410 0.810 1.230 2.080	2.260 3.830 5.480 9.370	0.04 0.06 0.09 0.19
***									
Side Arm Mount [SO 306-1]	A	From Leg	0.000 0.000 0.000	0.000	54.000	No Ice 1/2" Ice	0.410 0.810 1.230	2.260 3.830 5.480	0.04 0.06 0.09

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 2" Ice	2.080	9.370	0.19
6' x 2" Mount Pipe	A	From Leg	0.000 0.000 0.000	0.000	54.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.425 1.925 2.294 3.060	1.425 1.925 2.294 3.060	0.02 0.03 0.05 0.09
DB212-1	A	From Leg	4.000 0.000 0.000	0.000	54.000	No Ice 1/2" Ice 1" Ice 2" Ice	4.400 8.418 12.452 20.570	4.400 8.418 12.452 20.570	0.03 0.07 0.13 0.34
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Side Arm Mount [SO 306-1]	C	From Leg	0.000 0.000 0.000	0.000	43.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.410 0.810 1.230 2.080	2.260 3.830 5.480 9.370	0.04 0.06 0.09 0.19
3" Dia. 6' Omni	C	From Leg	4.000 0.000 3.000	0.000	43.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.05 0.06 0.08 0.12
3" Dia. 6' Omni	C	From Leg	4.000 0.000 -3.000	0.000	43.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.767 2.129 2.501 3.272	1.767 2.129 2.501 3.272	0.05 0.06 0.08 0.12
Side Arm Mount [SO 306-1]	B	From Leg	0.000 0.000 0.000	0.000	43.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.410 0.810 1.230 2.080	2.260 3.830 5.480 9.370	0.04 0.06 0.09 0.19
DB230-2B	B	From Leg	4.000 0.000 0.000	0.000	43.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.100 3.780 5.460 8.820	2.100 3.780 5.460 8.820	0.10 0.14 0.17 0.23
****Proposed***									
USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]	B	From Leg	2.000 0.000 0.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.956 3.757 4.634 6.575	5.636 6.730 7.914 10.428	0.18 0.22 0.28 0.43
DS2C03F36D-D	B	From Leg	4.000 0.000 13.000	0.000	127.000	No Ice 1/2" Ice 1" Ice 2" Ice	7.290 9.753 12.233 17.243	7.290 9.753 12.233 17.243	0.07 0.12 0.19 0.37
R5-LL [PM 602-1]	A	From Leg	0.500 0.000 0.000	0.000	87.000	No Ice 1/2" Ice 1" Ice 2" Ice	5.250 6.500 7.750 10.250	1.580 1.950 2.320 3.060	0.09 0.12 0.14 0.19
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Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
PA6-59	A	Paraboloid w/Radome	From Leg	0.500 0.000 0.000	0.000		117.000	6.000	No Ice 1/2" Ice 1" Ice 2" Ice	28.300 29.050 29.801 31.302	0.19 0.33 0.48 0.78
6 FT Dish	B	Paraboloid w/Radome	From Leg	0.500 0.000 0.000	0.000		107.000	6.000	No Ice 1/2" Ice 1" Ice 2" Ice	28.300 29.050 29.801 31.302	0.19 0.33 0.48 0.78
8 FT Dish	A	Paraboloid w/Radome	From Leg	0.500 0.000 0.000	0.000		96.000	8.000	No Ice 1/2" Ice 1" Ice 2" Ice	50.300 51.292 52.284 54.268	0.04 0.30 0.57 1.09
PAD8-59AW	C	Paraboloid w/Radome	From Leg	0.500 0.000 0.000	0.000		86.000	8.000	No Ice 1/2" Ice 1" Ice 2" Ice	50.300 51.292 52.284 54.268	0.04 0.30 0.57 1.09
4 FT Dish	A	Paraboloid w/Radome	From Leg	0.500 0.000 0.000	0.000		71.000	4.000	No Ice 1/2" Ice 1" Ice 2" Ice	12.570 13.100 13.620 14.680	0.08 0.15 0.21 0.35
*****											
PAD6-W59BC	A	Paraboloid w/Radome	From Leg	1.000 0.000 0.000	-34.500		87.000	6.583	No Ice 1/2" Ice 1" Ice 2" Ice	34.040 34.910 35.770 37.510	0.14 0.29 0.47 0.83

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

Comb. No.	*Description*
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	130 - 120	Leg	Max Tension	23	2.03	-0.35	0.03
			Max. Compression	35	-10.69	-0.02	-0.01
			Max. Mx	14	1.38	0.68	0.06
			Max. My	17	-0.41	-0.00	-0.83
			Max. Vy	6	-1.17	-0.36	-0.08
			Max. Vx	5	-1.20	0.00	-0.43
		Diagonal	Max Tension	9	3.32	0.00	0.00
			Max. Compression	8	-3.39	0.00	0.00
			Max. Mx	26	-0.16	0.07	0.00
			Max. Vy	26	-0.04	0.00	0.00
		Horizontal	Max Tension	6	2.52	0.00	0.00
			Max. Compression	19	-2.47	-0.01	-0.00
			Max. Mx	33	-0.30	-0.05	-0.00
			Max. My	6	-1.22	-0.01	-0.01
			Max. Vy	33	0.05	-0.05	-0.00
			Max. Vx	6	0.00	-0.01	-0.01
		Top Girt	Max Tension	15	0.32	-0.00	0.00
			Max. Compression	18	-0.32	-0.01	-0.00
			Max. Mx	33	-0.08	-0.04	-0.00
			Max. My	18	0.10	-0.01	0.00
			Max. Vy	33	0.05	-0.04	-0.00
			Max. Vx	18	-0.00	-0.01	0.00
		Inner Bracing	Max Tension	18	0.01	0.00	0.00
			Max. Compression	18	-0.01	0.00	0.00
			Max. Mx	26	-0.00	-0.04	0.00
			Max. Vy	26	0.04	0.00	0.00
T2	120 - 100	Leg	Max Tension	15	15.58	-0.22	-0.03
			Max. Compression	31	-22.98	0.06	-0.03
			Max. Mx	14	4.11	0.40	0.02
			Max. My	19	1.40	-0.14	0.44
			Max. Vy	22	0.31	-0.08	0.09
			Max. Vx	18	-0.40	-0.03	0.12
		Diagonal	Max Tension	25	4.72	0.00	0.00
			Max. Compression	24	-4.84	0.00	0.00
			Max. Mx	26	-0.11	0.14	0.00
			Max. Vy	26	0.07	0.00	0.00
		Horizontal	Max Tension	24	2.97	0.00	0.00
			Max. Compression	25	-2.95	0.00	0.00
			Max. Mx	33	-0.16	-0.09	-0.00
			Max. My	22	-0.22	-0.03	-0.01
			Max. Vy	33	0.07	-0.09	-0.00
			Max. Vx	14	-0.00	0.00	0.00
		Inner Bracing	Max Tension	3	0.00	0.00	0.00
			Max. Compression	37	-0.01	0.00	0.00
			Max. Mx	26	-0.01	-0.06	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. Vy	26	-0.05	0.00	0.00
T3	100 - 80	Leg	Max Tension	15	33.75	-0.11	-0.06
			Max. Compression	2	-41.87	0.40	-0.15
			Max. Mx	14	20.25	0.50	0.04
			Max. My	5	-3.42	-0.03	-0.61
			Max. Vy	6	-0.43	-0.19	-0.02
			Max. Vx	11	-0.51	-0.09	-0.20
		Diagonal	Max Tension	13	6.22	0.00	0.00
			Max. Compression	12	-6.36	0.00	0.00
			Max. Mx	26	-0.20	0.18	0.00
			Max. Vy	26	-0.08	0.00	0.00
		Horizontal	Max Tension	12	4.33	-0.02	-0.00
			Max. Compression	13	-4.31	-0.02	-0.00
			Max. Mx	33	-0.04	-0.11	-0.00
			Max. My	11	0.42	-0.00	0.01
			Max. Vy	33	-0.08	-0.11	-0.00
			Max. Vx	11	0.00	0.00	0.00
		Inner Bracing	Max Tension	11	0.00	0.00	0.00
			Max. Compression	33	-0.01	0.00	0.00
			Max. Mx	26	-0.01	-0.08	0.00
			Max. Vy	26	0.06	0.00	0.00
T4	80 - 60	Leg	Max Tension	15	51.73	-0.45	-0.19
			Max. Compression	10	-62.23	0.44	-0.27
			Max. Mx	22	36.78	-0.52	0.20
			Max. My	12	-7.66	-0.06	-0.70
			Max. Vy	29	0.27	-0.43	-0.04
			Max. Vx	24	-0.43	-0.06	0.70
		Diagonal	Max Tension	13	8.36	0.00	0.00
			Max. Compression	12	-8.56	0.00	0.00
			Max. Mx	26	0.00	0.30	0.00
			Max. Vy	26	0.10	0.00	0.00
		Horizontal	Max Tension	12	5.06	-0.03	-0.00
			Max. Compression	13	-5.01	-0.02	-0.00
			Max. Mx	33	-0.32	-0.14	-0.00
			Max. My	14	-0.69	-0.05	-0.01
			Max. Vy	33	0.09	-0.14	-0.00
			Max. Vx	11	-0.00	0.00	0.00
		Inner Bracing	Max Tension	11	0.00	0.00	0.00
			Max. Compression	37	-0.01	0.00	0.00
			Max. Mx	26	-0.01	-0.11	0.00
			Max. Vy	26	-0.06	0.00	0.00
T5	60 - 40	Leg	Max Tension	15	72.72	-0.39	-0.04
			Max. Compression	10	-86.24	0.35	-0.18
			Max. Mx	6	54.37	-0.52	-0.05
			Max. My	12	-8.14	-0.06	-0.70
			Max. Vy	37	-0.18	-0.25	0.12
			Max. Vx	4	-0.24	0.00	-0.40
		Diagonal	Max Tension	9	7.87	0.00	0.00
			Max. Compression	8	-8.12	0.00	0.00
			Max. Mx	26	0.03	0.39	0.00
			Max. Vy	26	-0.12	0.00	0.00
		Horizontal	Max Tension	8	5.26	0.00	0.00
			Max. Compression	11	-5.23	0.00	0.00
			Max. Mx	33	-0.22	-0.17	-0.00
			Max. My	2	0.50	-0.02	0.01
			Max. Vy	33	0.10	-0.17	-0.00
			Max. Vx	2	0.00	-0.02	0.01
		Inner Bracing	Max Tension	1	0.00	0.00	0.00
			Max. Compression	37	-0.02	0.00	0.00
			Max. Mx	26	-0.02	-0.18	0.00
			Max. Vy	26	-0.09	0.00	0.00
T6	40 - 20	Leg	Max Tension	15	92.36	-0.42	0.00
			Max. Compression	10	-108.64	0.28	-0.08
			Max. Mx	14	80.56	-0.43	0.00
			Max. My	12	-10.28	-0.04	-0.56
			Max. Vy	6	-0.09	-0.41	-0.07
			Max. Vx	22	0.13	0.13	0.52
		Diagonal	Max Tension	9	8.17	0.00	0.00
			Max. Compression	8	-8.52	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. Mx	26	-0.04	0.46	0.00
			Max. Vy	26	0.13	0.00	0.00
		Horizontal	Max Tension	8	5.94	0.00	0.00
			Max. Compression	11	-5.86	0.00	0.00
			Max. Mx	33	0.26	-0.27	-0.00
			Max. My	15	-0.20	-0.08	-0.01
			Max. Vy	33	0.13	-0.27	-0.00
			Max. Vx	15	0.00	0.00	0.00
		Inner Bracing	Max Tension	1	0.00	0.00	0.00
			Max. Compression	37	-0.02	0.00	0.00
			Max. Mx	26	-0.02	-0.25	0.00
			Max. Vy	26	0.11	0.00	0.00
T7	20 - 0	Leg	Max Tension	15	110.90	-0.54	-0.01
			Max. Compression	10	-130.25	0.00	-0.00
			Max. Mx	27	-74.01	0.69	-0.00
			Max. My	12	-13.03	-0.04	-0.57
			Max. Vy	6	-0.13	-0.53	-0.06
			Max. Vx	12	-0.15	-0.04	-0.57
		Diagonal	Max Tension	9	8.25	0.00	0.00
			Max. Compression	8	-8.69	0.00	0.00
			Max. Mx	26	-0.10	0.50	0.00
			Max. Vy	26	-0.13	0.00	0.00
		Horizontal	Max Tension	8	6.40	0.00	0.00
			Max. Compression	11	-6.27	0.00	0.00
			Max. Mx	33	0.24	-0.27	-0.00
			Max. My	14	-0.17	-0.12	-0.01
			Max. Vy	33	-0.13	-0.27	-0.00
			Max. Vx	14	-0.00	0.00	0.00
		Inner Bracing	Max Tension	1	0.00	0.00	0.00
			Max. Compression	37	-0.02	0.00	0.00
			Max. Mx	26	-0.02	-0.35	0.00
			Max. Vy	26	0.13	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	18	135.76	16.34	-8.66
	Max. H_x	18	135.76	16.34	-8.66
	Max. H_z	5	-96.41	-12.12	8.25
	Min. Vert	7	-106.53	-14.12	7.41
	Min. H_x	7	-106.53	-14.12	7.41
	Min. H_z	16	124.97	14.29	-9.44
Leg B	Max. Vert	10	139.93	-17.21	-8.86
	Max. H_x	23	-110.99	14.77	7.48
	Max. H_z	25	-100.39	12.54	8.56
	Min. Vert	23	-110.99	14.77	7.48
	Min. H_x	10	139.93	-17.21	-8.86
	Min. H_z	12	127.55	-14.80	-9.82
Leg A	Max. Vert	2	138.72	0.01	19.54
	Max. H_x	21	6.19	2.18	0.61
	Max. H_z	2	138.72	0.01	19.54
	Min. Vert	15	-119.49	-0.07	-17.57
	Min. H_x	8	9.73	-2.28	0.97
	Min. H_z	15	-119.49	-0.07	-17.57

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	32.93	0.00	0.00	28.25	12.22	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	39.52	0.11	-32.53	-2450.60	3.74	1.33
0.9 Dead+1.0 Wind 0 deg - No Ice	29.64	0.11	-32.53	-2459.08	0.07	1.33
1.2 Dead+1.0 Wind 30 deg - No Ice	39.52	15.84	-27.68	-2076.81	-1188.14	22.36
0.9 Dead+1.0 Wind 30 deg - No Ice	29.64	15.84	-27.68	-2085.28	-1191.80	22.36
1.2 Dead+1.0 Wind 60 deg - No Ice	39.52	25.89	-14.84	-1108.80	-1975.21	25.34
0.9 Dead+1.0 Wind 60 deg - No Ice	29.64	25.89	-14.84	-1117.27	-1978.88	25.34
1.2 Dead+1.0 Wind 90 deg - No Ice	39.52	29.49	0.36	67.23	-2281.42	27.17
0.9 Dead+1.0 Wind 90 deg - No Ice	29.64	29.49	0.36	58.75	-2285.09	27.17
1.2 Dead+1.0 Wind 120 deg - No Ice	39.52	27.67	16.19	1286.16	-2114.40	35.71
0.9 Dead+1.0 Wind 120 deg - No Ice	29.64	27.67	16.19	1277.69	-2118.07	35.71
1.2 Dead+1.0 Wind 150 deg - No Ice	39.52	16.91	29.22	2262.99	-1271.60	22.73
0.9 Dead+1.0 Wind 150 deg - No Ice	29.64	16.91	29.22	2254.51	-1275.27	22.73
1.2 Dead+1.0 Wind 180 deg - No Ice	39.52	-0.02	32.68	2533.79	20.23	-2.28
0.9 Dead+1.0 Wind 180 deg - No Ice	29.64	-0.02	32.68	2525.31	16.56	-2.28
1.2 Dead+1.0 Wind 210 deg - No Ice	39.52	-16.16	28.14	2191.47	1254.61	-23.68
0.9 Dead+1.0 Wind 210 deg - No Ice	29.64	-16.16	28.14	2182.99	1250.95	-23.68
1.2 Dead+1.0 Wind 240 deg - No Ice	39.52	-26.18	15.61	1252.03	2040.34	-26.62
0.9 Dead+1.0 Wind 240 deg - No Ice	29.64	-26.18	15.61	1243.56	2036.67	-26.62
1.2 Dead+1.0 Wind 270 deg - No Ice	39.52	-29.05	0.45	80.59	2277.39	-28.59
0.9 Dead+1.0 Wind 270 deg - No Ice	29.64	-29.05	0.45	72.11	2273.72	-28.59
1.2 Dead+1.0 Wind 300 deg - No Ice	39.52	-26.75	-15.44	-1146.31	2061.38	-36.44
0.9 Dead+1.0 Wind 300 deg - No Ice	29.64	-26.75	-15.44	-1154.78	2057.72	-36.44
1.2 Dead+1.0 Wind 330 deg - No Ice	39.52	-16.23	-28.81	-2155.43	1239.88	-23.39
0.9 Dead+1.0 Wind 330 deg - No Ice	29.64	-16.23	-28.81	-2163.90	1236.21	-23.39
1.2 Dead+1.0 Ice+1.0 Temp	152.67	0.00	0.00	203.93	-1.16	-0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	152.67	0.04	-11.85	-692.01	-4.22	4.83
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	152.67	5.71	-9.99	-554.80	-433.23	13.90
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	152.67	9.50	-5.52	-218.35	-725.84	17.37
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	152.67	10.93	0.04	208.07	-838.43	17.86
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	152.67	9.76	5.70	641.24	-746.16	15.51
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	152.67	5.85	10.21	979.67	-443.96	7.20
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	152.67	-0.02	11.88	1102.47	1.11	-4.98
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	152.67	-5.77	10.07	970.43	437.10	-14.11
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	152.67	-9.55	5.65	638.62	729.49	-17.57
1.2 Dead+1.0 Wind 270	152.67	-10.85	0.09	212.91	830.78	-18.09

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
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	152.67	-9.61	-5.58	-221.57	730.48	-15.63
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	152.67	-5.74	-10.14	-565.26	431.75	-7.32
Dead+Wind 0 deg - Service	32.93	0.07	-19.63	-1471.42	5.63	0.80
Dead+Wind 30 deg - Service	32.93	9.56	-16.71	-1245.80	-713.80	13.50
Dead+Wind 60 deg - Service	32.93	15.63	-8.96	-661.49	-1188.89	15.29
Dead+Wind 90 deg - Service	32.93	17.80	0.22	48.36	-1373.72	16.40
Dead+Wind 120 deg - Service	32.93	16.70	9.77	784.13	-1272.90	21.56
Dead+Wind 150 deg - Service	32.93	10.21	17.64	1373.75	-764.18	13.72
Dead+Wind 180 deg - Service	32.93	-0.01	19.73	1537.20	15.58	-1.37
Dead+Wind 210 deg - Service	32.93	-9.75	16.99	1330.58	760.67	-14.29
Dead+Wind 240 deg - Service	32.93	-15.80	9.42	763.53	1234.94	-16.07
Dead+Wind 270 deg - Service	32.93	-17.54	0.27	56.43	1378.02	-17.26
Dead+Wind 300 deg - Service	32.93	-16.14	-9.32	-684.14	1247.64	-22.00
Dead+Wind 330 deg - Service	32.93	-9.80	-17.39	-1293.25	751.77	-14.12

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-32.93	0.00	0.00	32.93	0.00	0.000%
2	0.11	-39.52	-32.53	-0.11	39.52	32.53	0.000%
3	0.11	-29.64	-32.53	-0.11	29.64	32.53	0.000%
4	15.84	-39.52	-27.68	-15.84	39.52	27.68	0.000%
5	15.84	-29.64	-27.68	-15.84	29.64	27.68	0.000%
6	25.89	-39.52	-14.84	-25.89	39.52	14.84	0.000%
7	25.89	-29.64	-14.84	-25.89	29.64	14.84	0.000%
8	29.49	-39.52	0.36	-29.49	39.52	-0.36	0.000%
9	29.49	-29.64	0.36	-29.49	29.64	-0.36	0.000%
10	27.67	-39.52	16.19	-27.67	39.52	-16.19	0.000%
11	27.67	-29.64	16.19	-27.67	29.64	-16.19	0.000%
12	16.91	-39.52	29.22	-16.91	39.52	-29.22	0.000%
13	16.91	-29.64	29.22	-16.91	29.64	-29.22	0.000%
14	-0.02	-39.52	32.68	0.02	39.52	-32.68	0.000%
15	-0.02	-29.64	32.68	0.02	29.64	-32.68	0.000%
16	-16.16	-39.52	28.14	16.16	39.52	-28.14	0.000%
17	-16.16	-29.64	28.14	16.16	29.64	-28.14	0.000%
18	-26.18	-39.52	15.61	26.18	39.52	-15.61	0.000%
19	-26.18	-29.64	15.61	26.18	29.64	-15.61	0.000%
20	-29.05	-39.52	0.45	29.05	39.52	-0.45	0.000%
21	-29.05	-29.64	0.45	29.05	29.64	-0.45	0.000%
22	-26.75	-39.52	-15.44	26.75	39.52	15.44	0.000%
23	-26.75	-29.64	-15.44	26.75	29.64	15.44	0.000%
24	-16.23	-39.52	-28.81	16.23	39.52	28.81	0.000%
25	-16.23	-29.64	-28.81	16.23	29.64	28.81	0.000%
26	0.00	-152.67	0.00	0.00	152.67	0.00	0.000%
27	0.04	-152.67	-11.85	-0.04	152.67	11.85	0.000%
28	5.71	-152.67	-9.99	-5.71	152.67	9.99	0.000%
29	9.50	-152.67	-5.52	-9.50	152.67	5.52	0.000%
30	10.93	-152.67	0.04	-10.93	152.67	-0.04	0.000%
31	9.76	-152.67	5.70	-9.76	152.67	-5.70	0.000%
32	5.85	-152.67	10.21	-5.85	152.67	-10.21	0.000%
33	-0.02	-152.67	11.88	0.02	152.67	-11.88	0.000%
34	-5.77	-152.67	10.07	5.77	152.67	-10.07	0.000%
35	-9.55	-152.67	5.65	9.55	152.67	-5.65	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
36	-10.85	-152.67	0.09	10.85	152.67	-0.09	0.000%
37	-9.61	-152.67	-5.58	9.61	152.67	5.58	0.000%
38	-5.74	-152.67	-10.14	5.74	152.67	10.14	0.000%
39	0.07	-32.93	-19.63	-0.07	32.93	19.63	0.000%
40	9.56	-32.93	-16.71	-9.56	32.93	16.71	0.000%
41	15.63	-32.93	-8.96	-15.63	32.93	8.96	0.000%
42	17.80	-32.93	0.22	-17.80	32.93	-0.22	0.000%
43	16.70	-32.93	9.77	-16.70	32.93	-9.77	0.000%
44	10.21	-32.93	17.64	-10.21	32.93	-17.64	0.000%
45	-0.01	-32.93	19.73	0.01	32.93	-19.73	0.000%
46	-9.75	-32.93	16.99	9.75	32.93	-16.99	0.000%
47	-15.80	-32.93	9.42	15.80	32.93	-9.42	0.000%
48	-17.54	-32.93	0.27	17.54	32.93	-0.27	0.000%
49	-16.14	-32.93	-9.32	16.14	32.93	9.32	0.000%
50	-9.80	-32.93	-17.39	9.80	32.93	17.39	0.000%

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	130 - 120	2.831	44	0.183	0.032
T2	120 - 100	2.440	44	0.180	0.029
T3	100 - 80	1.705	44	0.158	0.024
T4	80 - 60	1.084	44	0.124	0.023
T5	60 - 40	0.619	44	0.089	0.020
T6	40 - 20	0.285	44	0.058	0.013
T7	20 - 0	0.086	44	0.027	0.007

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
127.000	Sector Mount [SM 501-3]	44	2.713	0.182	0.031	160086
125.000	Sector Mount [SM 502-3]	44	2.635	0.182	0.031	160086
117.000	PA6-59	44	2.325	0.178	0.029	70952
113.000	Side Arm Mount [SO 306-1]	44	2.174	0.175	0.027	60969
107.000	6 FT Dish	44	1.952	0.168	0.026	49860
104.000	Side Arm Mount [SO 306-1]	44	1.845	0.164	0.025	45434
98.000	Side Arm Mount [SO 306-1]	44	1.637	0.155	0.024	38887
96.000	8 FT Dish	44	1.570	0.152	0.023	37246
87.000	PAD6-W59BC	44	1.285	0.137	0.023	31207
86.000	PAD8-59AW	44	1.255	0.135	0.023	30609
84.000	PD1142-1	44	1.196	0.132	0.023	29485
77.000	Sector Mount [SM 402-1]	44	1.005	0.119	0.023	28887
71.000	4 FT Dish	44	0.857	0.108	0.022	32065
63.000	Sector Mount [SM 402-1]	44	0.680	0.094	0.020	37642
58.000	(2) 4.5' x 2" horizontal mount pipe	44	0.580	0.086	0.019	39500
54.000	Side Arm Mount [SO 306-1]	44	0.506	0.079	0.018	38500
43.000	Side Arm Mount [SO 306-1]	44	0.327	0.063	0.014	35513

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	130 - 120	4.676	12	0.302	0.053
T2	120 - 100	4.030	12	0.298	0.049
T3	100 - 80	2.816	12	0.261	0.039
T4	80 - 60	1.791	12	0.205	0.038
T5	60 - 40	1.023	12	0.147	0.033
T6	40 - 20	0.472	12	0.096	0.022
T7	20 - 0	0.143	13	0.044	0.011

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
127.000	Sector Mount [SM 501-3]	12	4.481	0.301	0.052	97038
125.000	Sector Mount [SM 502-3]	12	4.351	0.301	0.051	97038
117.000	PA6-59	12	3.840	0.295	0.047	42793
113.000	Side Arm Mount [SO 306-1]	12	3.590	0.289	0.045	36777
107.000	6 FT Dish	12	3.224	0.277	0.042	30157
104.000	Side Arm Mount [SO 306-1]	12	3.047	0.270	0.041	27507
98.000	Side Arm Mount [SO 306-1]	12	2.703	0.256	0.039	23562
96.000	8 FT Dish	12	2.592	0.250	0.039	22565
87.000	PAD6-W59BC	12	2.122	0.226	0.038	18892
86.000	PAD8-59AW	12	2.073	0.223	0.038	18529
84.000	PD1142-1	12	1.976	0.217	0.038	17848
77.000	Sector Mount [SM 402-1]	12	1.660	0.196	0.037	17489
71.000	4 FT Dish	12	1.415	0.178	0.036	19428
63.000	Sector Mount [SM 402-1]	12	1.124	0.155	0.034	22836
58.000	(2) 4.5' x 2" horizontal mount pipe	12	0.959	0.141	0.032	23973
54.000	Side Arm Mount [SO 306-1]	12	0.836	0.131	0.030	23359
43.000	Side Arm Mount [SO 306-1]	12	0.541	0.104	0.024	21528

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	130	Leg	A325N	0.750	4	0.89	30.10	0.030	1.05	Bolt Tension
		Diagonal	A325N	0.625	3	1.13	13.81	0.082	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	1.26	13.81	0.091	1.05	Bolt Shear
T2	120	Leg	A325N	0.875	4	3.90	41.56	0.094	1.05	Bolt Tension
		Diagonal	A325N	0.625	3	1.61	13.81	0.117	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	1.49	13.81	0.108	1.05	Bolt Shear
T3	100	Leg	A325N	1.000	4	8.44	54.52	0.155	1.05	Bolt Tension
		Diagonal	A325N	0.625	3	2.12	13.81	0.154	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	2.17	13.81	0.157	1.05	Bolt Shear
T4	80	Leg	A325N	1.000	4	12.93	54.52	0.237	1.05	Bolt Tension
		Diagonal	A325N	0.625	3	2.85	13.81	0.207	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	2.53	13.81	0.183	1.05	Bolt Shear
T5	60	Leg	A325N	1.000	6	12.12	54.52	0.222	1.05	Bolt Tension
		Diagonal	A325N	0.625	3	2.71	13.81	0.196	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	2.63	13.81	0.191	1.05	Bolt Shear
T6	40	Leg	A325N	1.000	6	15.39	54.52	0.282	1.05	Bolt Tension
		Diagonal	A325N	0.625	3	2.84	13.81	0.206	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	2.97	13.81	0.215	1.05	Bolt Shear
T7	20	Diagonal	A325N	0.625	3	2.90	13.81	0.210	1.05	Bolt Shear
		Horizontal	A325N	0.625	2	3.20	13.81	0.232	1.05	Bolt Shear

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	130 - 120	ROHN 2.5 STD	10.000	5.000	63.3 K=1.00	1.704	-10.69	57.19	0.187 [1]
T2	120 - 100	ROHN 3 STD	20.036	6.679	68.9 K=1.00	2.228	-22.98	70.89	0.324 [1]
T3	100 - 80	ROHN 4 STD	20.036	6.679	53.1 K=1.00	3.174	-41.87	116.23	0.360 [1]
T4	80 - 60	ROHN 5 STD	20.042	10.021	64.0 K=1.00	4.300	-62.23	143.37	0.434 [1]
T5	60 - 40	ROHN 5 EH	20.055	10.028	65.4 K=1.00	6.112	-86.24	201.11	0.429 [1]
T6	40 - 20	ROHN 6 EHS	20.052	10.026	54.1 K=1.00	6.713	-108.65	243.97	0.445 [1]
T7	20 - 0	ROHN 6 EH	20.052	10.026	54.8 K=1.00	8.405	-130.25	303.62	0.429 [1]

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	130 - 120	ROHN 2 STD	6.575	6.391	97.4 K=1.00	1.075	-3.39	24.16	0.140 [1]
T2	120 - 100	ROHN 2.5 STD	8.528	8.295	105.1 K=1.00	1.704	-4.84	34.21	0.141 [1]
T3	100 - 80	ROHN 2.5 STD	9.213	8.941	113.2 K=1.00	1.704	-6.36	30.02	0.212 [1]
T4	80 - 60	ROHN 2.5 X-STR	12.492	12.106	157.2 K=1.00	2.254	-8.56	20.60	0.415 [1]
T5	60 - 40	ROHN 3 STD	13.306	12.955	133.6 K=1.00	2.228	-8.12	28.20	0.288 [1]
T6	40 - 20	ROHN 3 STD	14.161	13.771	142.0 K=1.00	2.228	-8.52	24.96	0.341 [1]
T7	20 - 0	ROHN 3 STD	15.071	14.702	151.6 K=1.00	2.228	-8.69	21.90	0.397 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	130 - 120	ROHN 1.5 STD	8.520	4.140	79.8 K=1.00	0.799	-2.47	22.58	0.109 [1]
T2	120 - 100	ROHN 2 STD	9.933	4.821	73.5 K=1.00	1.075	-2.95	32.58	0.090 [1]
T3	100 - 80	ROHN 2 STD	12.017	5.821	88.7 K=1.00	1.075	-4.31	27.19	0.159 [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	80 - 60	ROHN 2 STD	13.835	6.686	101.9 K=1.00	1.075	-5.01	22.62	0.221 [1]
T5	60 - 40	ROHN 2 STD	16.250	7.893	120.3 K=1.00	1.075	-5.23	16.76	0.312 [1]
T6	40 - 20	ROHN 2.5 STD	18.790	9.119	115.5 K=1.00	1.704	-5.86	28.86	0.203 [1]
T7	20 - 0	ROHN 2.5 STD	21.290	10.369	131.3 K=1.00	1.704	-6.27	22.32	0.281 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	130 - 120	ROHN 1.5 STD	8.500	4.130	79.6 K=1.00	0.799	-0.32	22.63	0.014 [1]

[1] P_u / ϕP_n controls

Inner Bracing Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	130 - 120	L2x2x1/8	4.250	4.250	128.3 K=1.00	0.484	-0.01	8.42	0.001 [1]
T2	120 - 100	L2x2x1/8	4.967	4.967	149.9 K=1.00	0.484	-0.01	6.17	0.001 [1]
T3	100 - 80	L2x2x1/8	6.008	6.008	181.4 K=1.00	0.484	-0.01	4.21	0.002 [1]
T4	80 - 60	L2x2x1/8	6.918	6.918	208.8 K=1.00	0.484	-0.01	3.18	0.004 [1]
T5	60 - 40	L2 1/2x2 1/2x3/16	8.125	8.125	197.0 K=1.00	0.902	-0.02	6.65	0.002 [1]
T6	40 - 20	L 3x3x3/16	9.395	9.395	189.1 K=1.00	1.090	-0.02	8.73	0.002 [1]
T7	20 - 0	L3 1/2x3 /12x1/4	10.645	10.645	184.2 K=1.00	1.688	-0.02	14.24	0.001 [*1]

[*] DL controls
[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	130 - 120	ROHN 2.5 STD	10.000	5.000	63.3	1.704	1.68	76.68	0.022 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	120 - 100	ROHN 3 STD	20.036	6.679	68.9	2.228	15.58	100.28	0.155 [1]
T3	100 - 80	ROHN 4 STD	20.036	6.679	53.1	3.174	33.75	142.83	0.236 [1]
T4	80 - 60	ROHN 5 STD	20.042	10.021	64.0	4.300	51.73	193.49	0.267 [1]
T5	60 - 40	ROHN 5 EH	20.055	10.028	65.4	6.112	72.72	275.04	0.264 [1]
T6	40 - 20	ROHN 6 EHS	20.052	10.026	54.1	6.713	92.36	302.10	0.306 [1]
T7	20 - 0	ROHN 6 EH	20.052	10.026	54.8	8.405	110.90	378.22	0.293 [1]

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	130 - 120	ROHN 2 STD	6.575	6.391	97.4	1.075	3.32	48.35	0.069 [1]
T2	120 - 100	ROHN 2.5 STD	8.528	8.295	105.1	1.704	4.72	76.68	0.061 [1]
T3	100 - 80	ROHN 2.5 STD	9.213	8.941	113.2	1.704	6.22	76.68	0.081 [1]
T4	80 - 60	ROHN 2.5 X-STR	12.492	12.106	157.2	2.254	8.36	101.41	0.082 [1]
T5	60 - 40	ROHN 3 STD	12.890	12.539	129.3	2.228	7.87	100.28	0.078 [1]
T6	40 - 20	ROHN 3 STD	14.161	13.771	142.0	2.228	8.17	100.28	0.081 [1]
T7	20 - 0	ROHN 3 STD	15.071	14.702	151.6	2.228	8.25	100.28	0.082 [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	130 - 120	ROHN 1.5 STD	8.520	4.140	79.8	0.799	2.52	35.98	0.070 [1]
T2	120 - 100	ROHN 2 STD	9.933	4.821	73.5	1.075	2.97	48.35	0.062 [1]
T3	100 - 80	ROHN 2 STD	12.017	5.821	88.7	1.075	4.33	48.35	0.090 [1]
T4	80 - 60	ROHN 2 STD	13.835	6.686	101.9	1.075	5.06	48.35	0.105 [1]
T5	60 - 40	ROHN 2 STD	16.250	7.893	120.3	1.075	5.26	48.35	0.109 [1]
T6	40 - 20	ROHN 2.5 STD	18.790	9.119	115.5	1.704	5.94	76.68	0.077 [1]
T7	20 - 0	ROHN 2.5 STD	21.290	10.369	131.3	1.704	6.40	76.68	0.083 [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	130 - 120	ROHN 1.5 STD	8.500	4.130	79.6	0.799	0.32	35.98	0.009 [1]

[1] P_u / ϕP_n controls

Inner Bracing Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	130 - 120	L2x2x1/8	4.250	4.250	81.4	0.484	0.01	15.69	0.000 [1]
T2	120 - 100	L2x2x1/8	4.270	4.270	81.8	0.484	0.00	15.69	0.000 [1]
T3	100 - 80	L2x2x1/8	6.008	6.008	115.1	0.484	0.00	15.69	0.000 [1]
T4	80 - 60	L2x2x1/8	6.355	6.355	121.8	0.484	0.00	15.69	0.000 [1]

[1] $P_u / \phi P_n$ controls

Section Capacity Table

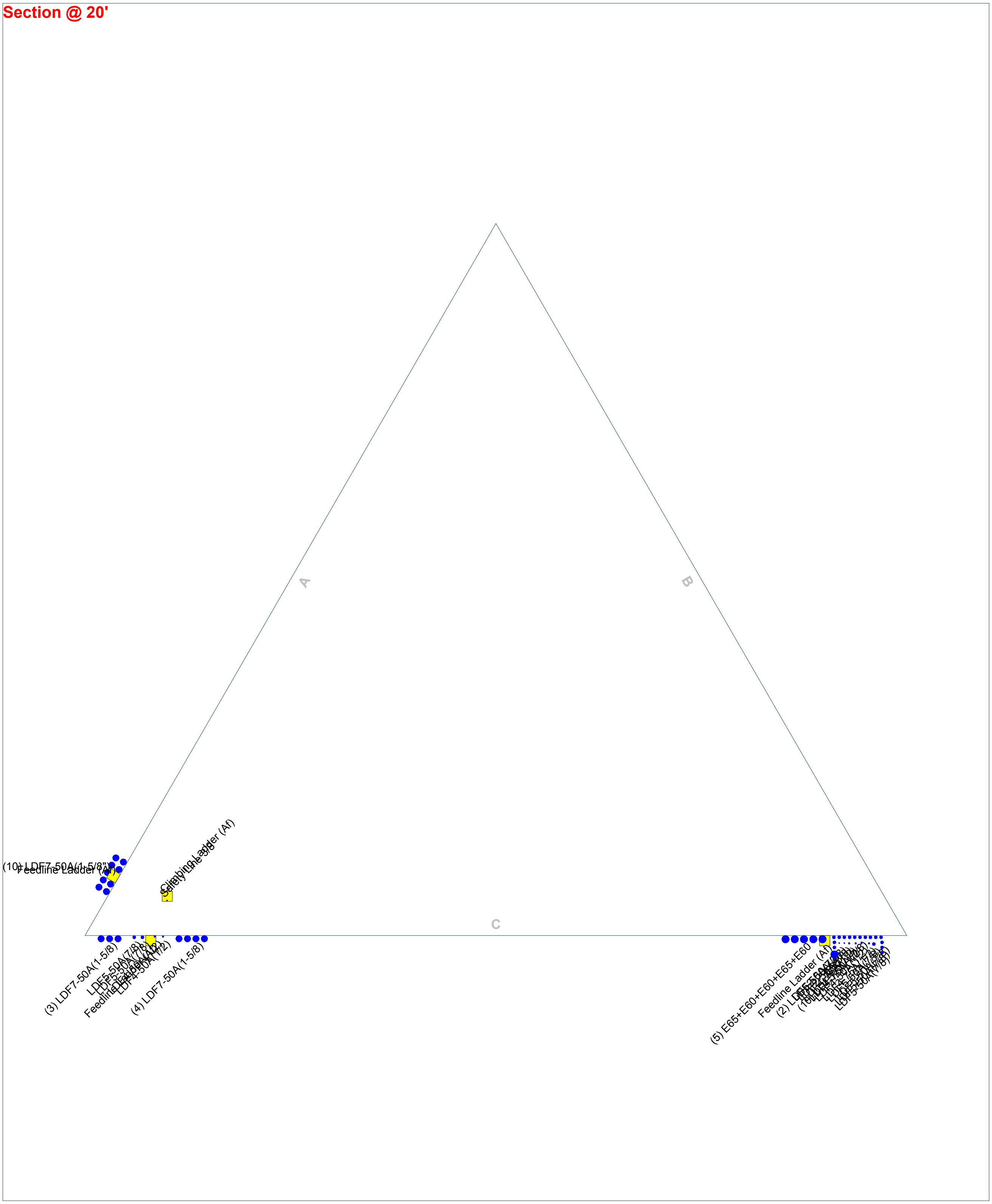
Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T1	130 - 120	Leg	ROHN 2.5 STD	1	-10.69	60.05	17.8	Pass
T2	120 - 100	Leg	ROHN 3 STD	29	-22.98	74.43	30.9	Pass
T3	100 - 80	Leg	ROHN 4 STD	69	-41.87	122.04	34.3	Pass
T4	80 - 60	Leg	ROHN 5 STD	107	-62.23	150.53	41.3	Pass
T5	60 - 40	Leg	ROHN 5 EH	134	-86.24	211.17	40.8	Pass
T6	40 - 20	Leg	ROHN 6 EHS	161	-108.65	256.16	42.4	Pass
T7	20 - 0	Leg	ROHN 6 EH	188	-130.25	318.80	40.9	Pass
T1	130 - 120	Diagonal	ROHN 2 STD	9	-3.39	25.36	13.4	Pass
T2	120 - 100	Diagonal	ROHN 2.5 STD	36	-4.84	35.92	13.5	Pass
T3	100 - 80	Diagonal	ROHN 2.5 STD	74	-6.36	31.52	20.2	Pass
T4	80 - 60	Diagonal	ROHN 2.5 X-STR	113	-8.56	21.63	39.6	Pass
T5	60 - 40	Diagonal	ROHN 3 STD	138	-8.12	29.61	27.4	Pass
T6	40 - 20	Diagonal	ROHN 3 STD	165	-8.52	26.21	32.5	Pass
T7	20 - 0	Diagonal	ROHN 3 STD	192	-8.69	22.99	37.8	Pass
T1	130 - 120	Horizontal	ROHN 1.5 STD	7	-2.47	23.71	10.4	Pass
T2	120 - 100	Horizontal	ROHN 2 STD	34	-2.95	34.21	8.6 10.3 (b)	Pass
T3	100 - 80	Horizontal	ROHN 2 STD	73	-4.31	28.55	15.1	Pass
T4	80 - 60	Horizontal	ROHN 2 STD	112	-5.01	23.75	21.1	Pass
T5	60 - 40	Horizontal	ROHN 2 STD	136	-5.23	17.60	29.7	Pass
T6	40 - 20	Horizontal	ROHN 2.5 STD	163	-5.86	30.30	19.3 20.5 (b)	Pass
T7	20 - 0	Horizontal	ROHN 2.5 STD	190	-6.27	23.43	26.8	Pass
T1	130 - 120	Top Girt	ROHN 1.5 STD	4	-0.32	23.77	1.3	Pass
T1	130 - 120	Inner Bracing	L2x2x1/8	17	-0.00	8.80	0.8	Pass
T2	120 - 100	Inner Bracing	L2x2x1/8	42	-0.01	6.48	0.9	Pass
T3	100 - 80	Inner Bracing	L2x2x1/8	79	-0.01	4.43	1.1	Pass
T4	80 - 60	Inner Bracing	L2x2x1/8	118	-0.01	3.34	1.2	Pass
T5	60 - 40	Inner Bracing	L2 1/2x2 1/2x3/16	147	-0.02	6.99	0.9	Pass
T6	40 - 20	Inner Bracing	L 3x3x3/16	174	-0.02	9.16	0.9	Pass
T7	20 - 0	Inner Bracing	L3 1/2x3 /12x1/4	201	-0.02	14.24	0.8	Pass
							Summary	
						Leg (T6)	42.4	Pass
						Diagonal (T4)	39.6	Pass
						Horizontal (T5)	29.7	Pass
						Top Girt (T1)	1.3	Pass
						Inner Bracing (T4)	1.2	Pass
						Bolt Checks	26.9	Pass
						RATING =	**42.4**	**Pass**

APPENDIX B

BASE LEVEL DRAWING

Feed Line Plan
20'

Round — Flat — App In Face — App Out Face



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Job: ***ES-004 SouthMtnRS***		
Project: ***403093***		
Client: Eversource	Drawn by: Sanyukta R. Arvikar	App'd:
Code: TIA-222-H	Date: 02/19/20	Scale: NTS
Path: Y:\TELECOM\2020\Engineering\Projects\Ever Source SA\SouthMtnRS\Structural\Rev. H\ES-004 SouthMtnRS Structural Analysis.eri		Dwg No. E-7

APPENDIX C

ADDITIONAL CALCULATIONS

▶ References

ANCHOR ROD ANALYSIS

Project Information

Site Name:ES-004 SouthMtnsRS

TIA Revision: Rev-G / **Rev-H** (selected)

TIA-222-G 105% Allowable? **No** (selected) / Yes

Apply TIA-222-H Section 15.5? No / **Yes** (selected)

Max Leg Reactions

Compression	*Uplift*
$Axial\_C := 140 \cdot kip$	$Axial\_U := 119 \cdot kip$
$Shear\_C := 19 \cdot kip$	$Shear\_U := 18 \cdot kip$

Anchor Rod Data

Diameter of Anchor Rod: $D := 1 \cdot in$

Number of Anchor Rods: $N := 8$

Length from top of concrete to bottom of anchor rod leveling nut: $lar := 2.5 \cdot in$

Anchor Rod Grade: A325, A490, A307, A36, A615-75, A193 Gr. B7, F1554-36, F1554-55, **F1554-105** (selected), 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

Threads in Shear Plane?: **Yes** (selected) / No

Thread Series: **Coarse** (selected) / Fine / 8-Thread

Consider Base Plate Grout?: **Yes** (selected) / No

Grout Factor η: 0.90 / 0.70 / **0.55** (selected) / 0.50

Threads per Inch: $n = 8$ (Thread selection invalid if n = 0)

Rod Ultimate Strength: $Fu = 125 \cdot ksi$

Rod Yield Strength: $Fy = 105 \cdot ksi$

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

$$Z := \frac{1}{6} \cdot \left(D - \frac{0.9743in}{n}\right)^3 = 0.113 \cdot in^3$$

Radius of Gyration:

$$r := \left(\frac{1}{4}\right) \cdot \left(D - \frac{0.9743in}{n}\right) = 0.22 \cdot in$$

Net Area of Anchor Rod:

$$An := \frac{\pi}{4} \cdot \left(D - \frac{0.9743in}{n}\right)^2 = 0.606 \cdot in^2$$

TIA-222-G/H Section 4.9.6.1

Nominal Unthreaded Area of Anchor Rod:

$$Ab := \frac{\pi}{4} \cdot (D)^2 = 0.785 \cdot in^2$$

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Anchor Rod Design Capacities

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

$Rnt := Fu \cdot An = 75.718 \cdot kip$

$\phi t = 0.75$

$\phi Rnt := \phi t \cdot Rnt = 56.788 \cdot kip$

Design Compression Strength:

$Rnc := Fy \cdot An = 63.603 \cdot kip$

$\phi c = 1$

$\phi Rnc := \phi c \cdot Rnc = 63.603 \cdot kip$

Design Buckling Strength: TIA-222-H Section 4.5.4.2

$K_0 := 1.2$

$Fcr = 104.88 \cdot ksi$

$Fe = 3.832 \times 10^{4} \cdot ksi$

$Rnb := Fcr \cdot An = 63.53 \cdot kip$

$\phi c = 1$

$\phi Rnb := \phi c \cdot Rnb = 63.53 \cdot kip$

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

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

$Rnv = 49.087 \cdot kip$

$Rnvc := 0.6 \cdot Fy \cdot 0.5 \cdot An = 19.081 \cdot kip$ TIA-222-H Section 4.9.9

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

$\phi Rnv := \phi v \cdot Rnv = 36.816 \cdot kip$ $\phi Rnvc := \phi c \cdot Rnvc = 19.081 \cdot kip$

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

$Rmn := Fy \cdot Z = 11.853 \cdot kip \cdot in$

$\phi f = 0.9$

$\phi Rmn := \phi f \cdot Rmn = 10.668 \cdot kip \cdot in$

Anchor Rod Loading Demands

Tension Demand:

$$Put := \frac{Axial\_U}{N} = 14.875 \cdot kip$$

Compression Demand:

$$Puc := \frac{Axial\_C}{N} = 17.5 \cdot kip$$

Shear Demand:

$$Vut := \frac{Shear\_U}{N} = 2.25 \cdot kip$$

$$Vuc := \frac{Shear\_C}{N} = 2.375 \cdot kip$$

Moment Demand:

$$Mut := 0.65 \cdot lar \cdot Vut = 0.731 \cdot kip \cdot in$$

$$Muc := 0.65 \cdot lar \cdot Vuc = 0.772 \cdot kip \cdot in$$

Anchor Rod Interaction Check TIA-222-G Section 4.9.9

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

$$SR\_g = 0.334$$

Anchor Rod Interaction Check TIA-222-H Section 4.9.9

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

$SR\_Pt = 0.072$

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

$SR\_Pc = 0.291$

$$SR := \begin{cases} SR\_g & \text{if } TIA = \text{"Rev-G"} \\ \max(SR\_Pt, SR\_Pc) & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"No"} \\ \frac{\max(SR\_Pt, SR\_Pc)}{1.05} & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"Yes"} \end{cases} = 0.277$$

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

Anchor Rod Results

Axial Tension Demand:	$Put = 14.875 \cdot kip$
Axial Tension Capacity:	$\phi Rnt = 56.788 \cdot kip$
Axial Compression Demand:	$Puc = 17.5 \cdot kip$
Axial Compression Capacity:	$\phi Rnc = 63.603 \cdot kip$
Shear Tension Demand:	$Vut = 2.25 \cdot kip$
Tension Shear Capacity:	$\phi Rnv = 36.816 \cdot kip$
Shear Compression Demand:	$Vuc = 2.375 \cdot kip$
Compresison Shear Capacity:	$\phi R_{nvc} = 19.081 \cdot kip$
Moment Tension Demand:	M_{ut} = "Moment Not Considered" $\cdot kip \cdot in$
Moment Compression Demand:	M_{uc} = "Moment Not Considered" $\cdot kip \cdot in$
Moment Capacity:	ϕR_{mn} = "Moment Not Considered" $\cdot kip \cdot in$

Governing Stress Ratio

$SR = 27.68 \cdot \%$

$Check_{SR}$ = "Passing"

SST Unit Base Foundation

ES-004
SouthMtnsRS

TIA-222 Revision: H

Top & Bot. Pad Rein. Different?:	☐
Tower Centroid Offset?:	☐
Block Foundation?:	☑

Superstructure Analysis Reactions		
Global Moment, **M**:	2596	ft-kips
Global Axial, **P**:	40	kips
Global Shear, **V**:	34	kips
Leg Compression, $\mathbf{P}_{comp}$:	140	kips
Leg Comp. Shear, $\mathbf{V}_{u\_comp}$:	19	kips
Leg Uplift, $\mathbf{P}_{uplift}$:	119	kips
Leg Uplift. Shear, $\mathbf{V}_{u\_uplift}$:	18	kips
Tower Height, **H**:	130	ft
Base Face Width, **BW**:	22.5417	ft
BP Dist. Above Fdn, $\mathbf{bp}_{dist}$:	4.25	in
Anchor Bolt Circle, **BC**:	10	in

Foundation Analysis Checks				
	Capacity	**Demand**	**Rating***	**Check**
Lateral (Sliding) (kips)	206.28	34.00	**15.7%**	**Pass**
Bearing Pressure (ksf)	9.00	1.15	**12.2%**	**Pass**
*Overturning (kip*ft)*	7975.66	2737.67	**34.3%**	**Pass**
*Pad Flexure (kip*ft)*	1877.46	559.56	**28.4%**	**Pass**
Pad Shear - 1-way (kips)	1541.78	77.21	**4.8%**	**Pass**
Pad Shear - Comp 2-way (ksi)	0.190	0.019	**9.4%**	**Pass**
*Flexural 2-way (Comp) (kip*ft)*	978.81	0.00	**0.0%**	**Pass**
Pad Shear - Tension 2-way (ksi)	0.190	0.016	**8.0%**	**Pass**
*Flexural 2-way (Tension) (kip*ft)*	978.81	0.00	**0.0%**	**Pass**

**Rating per TIA-222-H Section 15.5*

Soil Rating*:	**34.3%**
Structural Rating*:	**28.4%**

Pad Properties		
Depth, **D**:	4.00	ft
Pad Width, **W**:	31.00	ft
Pad Thickness, **T**:	4.00	ft
Pad Rebar Size (Bottom), **Sp**:	7	
Pad Rebar Quantity (Bottom), **mp**:	16	
Pad Clear Cover, $\mathbf{cc}_{pad}$:	3	in

Material Properties		
Rebar Grade, **Fy**:	60	ksi
Concrete Compressive Strength, **F'c**:	4	ksi
Dry Concrete Density, δ**c**:	150	pcf

Soil Properties		
Total Soil Unit Weight, γ:	100	pcf
Ultimate Gross Bearing, Qult:	12.000	ksf
Cohesion, **Cu**:	0.000	ksf
Friction Angle, φ:	34	degrees
SPT Blow Count, $\mathbf{N}_{blows}$:	10	
Base Friction, μ:	0.45	
Neglected Depth, **N**:	3.3	ft
Foundation Bearing on Rock?	No	
Groundwater Depth, **gw**:	N/A	ft

<-- Toggle between Gross and Net

Version 3.2.0

PHYSICAL PARAMETERS

Pier Height Above Water Table:	h_{pier_above} = (MIN(gw,D-T) + E)	h_{pier_above} =	0	ft
Pier Height Below Water Table:	h_{pier_below} = ((D-T) - MIN(gw,D-T))	h_{pier_below} =	0	ft
Buoyant Weight of Pier:	W_{pier} = (dpier^2) * hpier_above * δc / 1000 + (dpier^2) * hpier_below * (δc-62.4) /1000	W_{pier} =	0.00	kips
Pad Height Above Water Table:	h_{pad_above} = IF(gw<=D-T,0,IF(gw>D,T,T-(D-gw)))	h_{pad_above} =	4	ft
Pad Height Below Water Table:	h_{pad_below} = (T-IF(gw<=D-T,0,IF(gw>D,T,T-(D-gw))))	h_{pad_below} =	0	ft
Buoyant Weight of Pad:	W_{pad} = (W^2) * hpad_above * δc / 1000 + (W^2) * hpad_below * (δc-62.4) / 1000	W_{pad} =	576.60	kips
Concrete weight:	W_c = V * δc	W_c =	576.6	kips
Soil weight:	W_s = (D - T) * (W² - 3*dpier²) * γ	W_s =	0.0	kips
EIA/TIA-222 Load Factor:	LF = 1	LF =	1.00	

LATERAL RESISTANCE

Total Nominal Pp Resistance:	P_{p_total} = Pp_pier *Ap_piers + Pp_pad * Ap_pad	P_{p_total} =	28.02	kips
Factored Total Weight for Compression:	$P_{factored\_comp}$ = φD * (Wc + Ws + P / 1.2)	$P_{factored\_comp}$ =	548.94	kips
Nominal Base Friction Resistance (Comp):	R_{s_comp} = P * μ	R_{s_comp} =	247.02	kips
Lateral Resistance (Comp):	ΦVn = Φs * (Pp_total + Rs_comp)	ΦVn =	206.28	kips

Check **ΦVn = 206.28 kips >= Vu = 34.00 kips** **RATING: 16.48% OK**

PAD REINFORCEMENT

Elastic Bearing Pressure for Soil Checks

Tower Cetroid offset from Fdn Centroid:	Offset = 0	Offset =	0.00	ft	
Distance from Leg to Edge of Pad:	L_{edge} = (1/2)*W - Offset - (1/3)*BW*sin(60°)	L_{edge} =	8.99	ft	
*Overturning Moment (0.9*D LC):*	$M_{o\_0.9}$ = M + V * (MAX(T,D) + bpdist/12) + (0.9/1.2)*(P+3*Wpier*1.2)*Offset	$M_{o\_0.9}$ =	2737.67	ft-kips	
*Overturning Moment (1.2*D LC):*	$M_{o\_1.2}$ = M + V * (MAX(T,D) + bpdist/12) + (1.2/1.2)*(P+3*Wpier*1.2)*Offset	$M_{o\_1.2}$ =	2737.67	ft-kips	
Compressive Load for Bearing:	$P_{bearing}$ = Wc + Ws + P / 1.2	$P_{bearing}$ =	609.93	kips	
*Load Eccentricity (0.9*D LC):*	$e_{c\_0.9}$ = Mo / 0.9*Pbearing	$e_{c\_0.9}$ =	4.99	ft	e <= L/6
*Load Eccentricity (1.2*D LC):*	$e_{c\_1.2}$ = Mo / 1.2*Pbearing	$e_{c\_1.2}$ =	3.74	ft	e <= L/6
Elastic Section Modulus:	S = W³ / 6	S =	4965.17	ft³	
*Positive Pressure (0.9*D LC):*	$P_{pos\_st\_0.9}$ = 0.9*Pbearing / Area + Mo / S	$P_{pos\_st\_0.9}$ =	1.12	ksf	
*Positive Pressure (1.2*D LC):*	$P_{pos\_st\_1.2}$ = 1.2*Pbearing / Area + Mo / S	$P_{pos\_st\_1.2}$ =	1.31	ksf	
*Negative Pressure (0.9*D LC):*	$P_{neg\_st\_0.9}$ = 0.9*Pbearing / Area - Mo / S **Note: The resultant stress is within the kern. No adjustment is required.**	$P_{neg\_st\_0.9}$ =	0.02	ksf	
*Negative Pressure (1.2*D LC):*	$P_{neg\_st\_1.2}$ = 1.2*Pbearing / Area - Mo / S **Note: The resultant stress is within the kern. No adjustment is required.**	$P_{neg\_st\_1.2}$ =	0.21	ksf	
*Adjusted Pressure (0.9*D LC):*	$P_{adj\_0.9}$ = (2 * 0.9*Pbearing) / (3 * W * (W / 2 - ec_0.9))	$P_{adj\_0.9}$ =	1.12	ksf	
*Adjusted Pressure (1.2*D LC):*	$P_{adj\_1.2}$ = (2 * 1.2*Pbearing) / (3 * W * (W / 2 - ec_1.2))	$P_{adj\_1.2}$ =	1.34	ksf	
*Maximum Pressure (0.9*D LC):*	$q_{u\_st\_0.9}$ = IF(Pneg ≥ 0, Ppos , Padj)	$q_{u\_st\_0.9}$ =	1.12	ksf	
*Maximum Pressure (1.2*D LC):*	$q_{u\_st\_1.2}$ = IF(Pneg ≥ 0, Ppos , Padj)	$q_{u\_st\_1.2}$ =	1.31	ksf	

One-Way Shear

Rebar:	$s_{\_pad}$ = 7 $m_{\_pad}$ = 16	*Equally spaced, top and bottom, both directions.*	d_{b_pad} = A_{b_pad} =	0.875 0.6	in in^2

Effective depth:	d_c = T - cc - 1.5 * db	d_c =	43.7	in
Distance from Edge of Pad to Column Face:	d' = Ledge-(BC/12)/2	d' =	8.6	ft
Distance from Edge of Pad to dc from Column Face:	d'' = d' - d_c / 12	d'' =	4.94	ft
Distance to qs (0.9D LC):	$L'_{\_0.9}$ = (W / 2 - ec_0.9) * 3	$L'_{\_0.9}$ =	31.54	ft
Distance to qs (1.2D LC):	$L'_{\_1.2}$ = (W / 2 - ec_1.2) * 3	$L'_{\_1.2}$ =	35.28	ft
*Slope of qs (0.9*D LC):*	$sq_{s\_0.9}$ = IF(L' > W, (Ppos - Pneg) / W, qu / L')	$sq_{s\_0.9}$ =	0.04	kcf
*Slope of qs (1.2*D LC):*	$sq_{s\_1.2}$ = IF(L' > W, (Ppos - Pneg) / W, qu / L')	$sq_{s\_1.2}$ =	0.04	kcf
Nominal Shear Strength:	V_{n1} = 2 * W * √(F'c*1000) * dc	V_{n1} =	2055.70	kips
Shear Reduction Factor:	φ_{shear} = 0.75	φ_{shear} =	0.75	
Design Shear Strength:	φV_{n1} = φshear * V_{n1}	φV_{n1} =	1541.78	kips

Resisting Weight above Critical Section:

	Thickness (ft)	Unit Weight (kcf)	Weight (kip) (0.9*D LC)	Weight (kip) (1.2*D LC)
Soil Above Water Table:	0	0.100	0.00	0.00
Soil Below Water Table:	0	0.038	0.00	0.00
Pad Above Water Table:	4	0.150	82.62	110.16
Pad Below Water Table:	0	0.088	0.00	0.00
Total:			82.62	110.16

*Applied Shear (0.9*D LC):*	$V_{u1\_0.9}$ = 'Pad Shear and Moment Diagrams'!$AY$21	$V_{u1\_0.9}$ =	75.62	kips
*Applied Shear (1.2*D LC):*	$V_{u1\_1.2}$ = 'Pad Shear and Moment Diagrams'!$CG$21	$V_{u1\_1.2}$ =	77.21	kips

Check **φV_{n1} = 1541.78 kips >= V_{u1} = 77.21 kips** **RATING: 5.01% OK**

Two-Way Shear (Compression)

Avg. Effective Depth for Punching Shear:	d_{c_2} = T - cc - AVERAGE(0.5 * db , 1.5 * db)	d_{c_2} =	44.13	in
Radius of Two-Way Shear Plane:	r_{2way} = 0.5*(dpier + dc_2/12)	r_{2way} =	1.84	ft
Length to Edge of Pad from Pier Centroid:	L_{edge2} = W/2 - 2/3*SIN(60°)*BW + Offset	L_{edge2} =	2.49	ft
Length of Shear Perimeter to Deduct:	s = r_{2way} * (2 * ACOS(((r_{2way}-MAX(r_{2way}-L_{edge},0))/r_{2way}))	s =	0.00	ft
Pier Shape:	Pier Shape: 0	Pier Shape:	0	
Pier Diameter:	d_{pier1} = d_{pier} * 12 in / ft	d_{pier1} =	10.00	in
Equivalent Square Pier Diameter:	d_{pier_sq} = dpier	d_{pier_sq} =	8.86	in
Factor of transfer of Moment:	Y_f = 1/(1+(2/3)*√(dpier1/dpier1))	Y_f =	0.60	
Factor of transfer of eccentricity of Shear:	Y_v = 1 - Y_f	Y_v =	0.40	
Moment applied at base of Pier:	M_v = M_{u_comp} * 12 in / ft	M_v =	0.00	kip*in
Circular Critical Perimeter:	P_{crit_cir} = PI()*(BC + dc_2)	P_{crit_cir} =	170.04	in
Equivalent Square Critical Perimeter 1:	$P_{crit\_sq\_1}$ = 4*(dpier_sq+dc_2)	$P_{crit\_sq\_1}$ =	211.95	in
Equivalent Square Critical Perimeter 2:	$P_{crit\_sq\_2}$ = 2*(dpier_sq + dc_2) + (W*12-BW*12)	$P_{crit\_sq\_2}$ =	207.47	in
Equivalent Square Critical Perimeter 3:	$P_{crit\_sq\_3}$ = 2 * (dpier_sq + dc_2 + (W - BW * COS(RADIANS(30)) - Ledge2)*12)	$P_{crit\_sq\_3}$ =	321.80	in
Equivalent Square Critical Perimeter 4:	$P_{crit\_sq\_4}$ = 2 * (dpier_sq + dc_2 + Ledge2 * 12)	$P_{crit\_sq\_4}$ =	165.63	in
Equivalent Square Critical Perimeter 5:	$P_{crit\_sq\_5}$ = dpier_sq + dc_2 + 0.5*(W-BW)*12 + (W - BW * COS(RADIANS(30)) - Led	$P_{crit\_sq\_5}$ =	211.65	in

Area of Concrete in Shear:	A_c = ((dpier1 + dc_2)*PI()) * dc_2	A_c =	7502.96	in^2
Eq. Square Area of Concrete in Shear (1):	$A_{c\_sq\_1} = P_{crit\_sq\_1} * d_{c\_2}$	$A_{c\_sq\_1}$ =	9352.25	in^2
Eq. Square Area of Concrete in Shear (2):	$A_{c\_sq\_2} = P_{crit\_sq\_2} * d_{c\_2}$	$A_{c\_sq\_2}$ =	9154.80	in^2
Eq. Square Area of Concrete in Shear (3):	$A_{c\_sq\_3} = P_{crit\_sq\_3} * d_{c\_2}$	$A_{c\_sq\_3}$ =	14199.47	in^2
Eq. Square Area of Concrete in Shear (4):	$A_{c\_sq\_4} = P_{crit\_sq\_4} * d_{c\_2}$	$A_{c\_sq\_4}$ =	7308.32	in^2
Eq. Square Area of Concrete in Shear (5):	$A_{c\_sq\_5} = P_{crit\_sq\_5} * d_{c\_2}$	$A_{c\_sq\_5}$ =	9339.07	in^2
Polar Moment of Inertia at assumed Critical Section:	J_{c_cir} = dc_2*(dpier1+dc_2)^3/6 + ((dpier1+dc_2)*(dc_2^3))/6 + (dc_2*(dpier1+dc_2))*(dpier1+dc_2)^2/(IF($L$169=0,2,4))	J_{c_cir} =	5439306.06	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section 1:	$J_{c\_sq\_1}$ = (dc_2*(dpier_sq+dc_2)^3)/6 + ((dpier_sq+dc_2)*(dc_2^3))/6 + (dc_2*(dpier_sq+dc_2)*(dpier_sq+dc_2)^2)/2	$J_{c\_sq\_1}$ =	5135017.58	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_sq\_2}$ = (dc_2*(dpier_sq+dc_2)^3)/12 + ((dpier_sq+dc_2)*(dc_2^3))/12 + (dc_2*(dpier_sq+dc_2)*(dpier_sq+dc_2)^2)/2	$J_{c\_sq\_2}$ =	4208625.02	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_sq\_3}$ = (dc_2*(dpier_sq+dc_2)^3)/6 + ((dpier_sq+dc_2)*(dc_2^3))/6 + (dc_2*(dpier_sq+dc_2)*(dpier_sq+dc_2)^2)/4	$J_{c\_sq\_3}$ =	3493901.34	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_sq\_4}$ = (dc_2*(dpier_sq+dc_2)^3)/6 + ((dpier_sq+dc_2)*(dc_2^3))/6 + (dc_2*(dpier_sq+dc_2)*(dpier_sq+dc_2)^2)/4	$J_{c\_sq\_4}$ =	3493901.34	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_sq\_5}$ = (dc_2*(dpier_sq+dc_2)^3)/12 + ((dpier_sq+dc_2)*(dc_2^3))/12 + (dc_2*(dpier_sq+dc_2)*(dpier_sq+dc_2)^2)/4	$J_{c\_sq\_5}$ =	2567508.79	in^4
*Applied Shear Force (1.2*D LC):*	$V_{u\_1.2}$ = 1.2*W_{pier} + 1.2 * IF(OR($B$1="G",$B$1="H"), P_{comp} / 1.2, P_{comp})	$V_{u\_1.2}$ =	140.00	kip
*Controlling Shear Stress (1.2*D LC):*	$v_{u\_1.2\_controlling} = V_{u\_1.2} / A_c + (\Upsilon_v * M_v * (d_{pier1} + dc\_2)/2) / J_{c\_1}$	$v_{u\_1.2\_controlling}$ =	0.019	ksi
*Eq. Sq. Controlling Shear Stress (1.2*D LC):*	$v_{u\_1.2\_controlling\_sq} = V_{u\_1.2} / A_c + (\Upsilon_v * M_v * (d_{pier\_sq} + dc\_2)/2) / J_c$	$v_{u\_1.2\_controlling\_sq}$ =	0.019	ksi
Shear Stress Capacity:	Φv_n = φs * 4 * (√F'c*1000) / 1000	Φv_n =	0.190	ksi

Check **Φv_n = 0.190 ksi >= v_{u_demand} = 0.019 ksi** **RATING: 9.83% OK**

Two-Way Shear (Compression, Flexural Component) [BOTTOM REINFORCEMENT]

Distance To Outside Edge:	$dist_{\_outside}$ = MIN((W-BW)/2,BW/2)*2	$dist_{\_outside}$ =	8.4583	ft
Effective Pad Width:	$b_{\_pad}$ = MIN(dpier+3*T,W,dist_outside)	$b_{\_pad}$ =	8.46	ft
Bar Spacing:	B_{s_pad} = Bs_pad (see design checks below)	B_{s_pad} =	24.34	in
Fraction of Bars in Effective Width:	$m_{\_effective}$ = IF(b_pad=W,mp,12*b_pad/Bs_pad)	$m_{\_effective}$ =	4.17	
Area of Steel in Effective Width:	$A_{s\_effective}$ = VLOOKUP(Sp,Ref!$A$2:$C$12,3,0)*m_slab	$A_{s\_effective}$ =	2.50	in²
Depth of Equivalent Rectangular Stress Block:	$a_{\_effective} = A_{s\_effective}$ * Fy / (0.85 * F'c * $b_{\_slab}$*12)	$a_{\_effective}$ =	0.43	in
	$\beta_{pad} = \beta_{pad}$ (see design checks below)	β_{pad} =	0.85	
Distance from Top to Nuetral Axis:	$c_{\_effective} = a_{\_effective} / \beta_{pad}$	$c_{\_effective}$ =	0.51	
Effective depth:	dc = dc (see One-Way Shear check above)	dc =	43.6875	in
Modulus of Elasticity of Steel:	E_s = 29000 ksi	E_s =	29000	ksi
Strain in Steel:	$\varepsilon_{s\_effective}$ = 0.003 * (dc-c) / c	$\varepsilon_{s\_effective}$ =	0.25311	in/in
Compression-Controlled Strain Limit::	$\varepsilon_c = F_y / E_s$	ε_c =	0.00207	in/in
Tension-Controlled Strain Limit::	ε_t = 0.005	ε_t =	0.00500	in/in
Flexure Strength Reduction Factor:	$\varphi flex_{\_effective}$ = IF(εs>=εt,0.9,IF(εs<=εc,0.65,0.65+(0.9-0.65)*((εs-εc)/(εt-εc))))	$\varphi flex_{\_effective}$ =	0.9	
Nominal Flexural Strength:	$M_{n\_effective} = A_{s\_effective} * (F_y) * (dc - a_{\_effective} / 2) * (1/12)$	$M_{n\_effective}$ =	543.78	ft-kips
Design Flexural Strength:	$\varphi M_{n\_effective}$ = φflex_effective * Mn_effective	$\varphi M_{n\_effective}$ =	489.40	ft-kips

Two-Way Shear (Compression, Flexural Component) [TOP REINFORCEMENT]

Bar Spacing:	$B_{s\_pad\_top}$ = IF(Input!$S$6=TRUE,(W*12 - 2 * ccpad - VLOOKUP(sptop,Ref!$A$2:C	$B_{s\_pad\_top}$ =	8.46	in
Fraction of Bars in Effective Width:	$m_{\_effective\_top}$ = IF(b_pad=W,mp,12*b_pad/Bs_pad_top)	$m_{\_effective\_top}$ =	4.17	
Area of Steel in Effective Width:	$A_{s\_effective\_top}$ = VLOOKUP(Sptop,Ref!$A$2:$C$12,3,0)*m_slab	$A_{s\_effective\_top}$ =	2.50	in²
Depth of Equivalent Rectangular Stress Block:	$a_{\_effective\_top}$ = $A_{s\_effective\_top}$ * Fy / (0.85 * F'c * $b_{\_slab}$*12)	$a_{\_effective\_top}$ =	0.43	in
Distance from Top to Nuetral Axis:	$c_{\_effective\_top}$ = $a_{\_effective\_top}$ / β_{pad}	$c_{\_effective\_top}$ =	0.51	
Effective depth:	dc_top = T *12 - ccpad - 1.5 * VLOOKUP(sptop,Ref!$A$2:$C$12,2,0)	d_{c_top} =	43.6875	in
Strain in Steel:	$\varepsilon_{s\_effective\_top}$ = 0.003 * (dc_top-c_effective_top) / c_effective_top	$\varepsilon_{s\_effective\_top}$ =	0.25311	in/in
Flexure Strength Reduction Factor:	$\varphi flex_{\_effective\_top}$ = IF(εs>=εt,0.9,IF(εs<=εc,0.65,0.65+(0.9-0.65)*((εs-εc)/(εt-εc))))	$\varphi flex_{\_effective\_top}$ =	0.9	
Nominal Flexural Strength:	$M_{n\_effective\_top}$ = $A_{s\_effective\_top}$ * (F_y) * (dc_top - $a_{\_effective\_top}$ / 2) * (1/12)	$M_{n\_effective\_top}$ =	543.78	ft-kips
Design Flexural Strength:	$\varphi M_{n\_effective\_top}$ = φflex_effective * Mn_effective	$\varphi M_{n\_effective\_top}$ =	489.40	ft-kips
Applied Moment:	$Yf*M_{u\_comp}$ = $Yf*M_{u\_comp}$	$Yf*M_{u\_comp}$ =	0	ft-kips

Check **$\varphi M_{n\_effective}$ = 978.81 ksi >= $Yf*M_{u\_comp}$ = 0.00 ksi** **RATING: 0.00% OK**

Two-Way Shear (Uplift)

Moment applied at base of Pier:	M_{v_tens} = $M_{u\_tension}$ * 12 in / ft	M_{v_tens} =	0.00	kip*in
Diameter of Longitudinal Rebar Cage:	$d_{\_cage}$ = BC	$d_{\_cage}$ =	10.00	in
Eq. Sq. Diameter of Longitudinal Rebar Cage:	$d_{\_cage\_sq}$ = SQRT(PI())/2*d_cage	$d_{\_cage\_sq}$ =	8.86	in
Steel Embedment Length:	L_{embed} = dc_2 (see One-Way Shear check above)	L_{embed} =	44.13	in
Radius of Two-Way Shear Plane:	r_{2way_tens} = 0.5*(d_cage/12 + Lembed/12)	r_{2way_tens} =	2.26	ft
	$r_{2way\_tens\_sq}$ = 0.5*(SQRT(PI())/2*d_cage/12 + Lembed/12)	$r_{2way\_tens\_sq}$ =	2.21	ft
Length of Shear Perimeter to Deduct:	s_{tens} = 0	s_{tens} =	0.00	ft
Eq. Sq. Length of Shear Perimeter to Deduct:	s_{tens_sq} = 0	s_{tens_sq} =	0.00	ft
Circular Critical Perimeter:	P_{crit_tens} = ((d_cage/12+Lembed/12)*PI() - stens)*12	P_{crit_tens} =	170.04	in
Equivalent Square Critical Perimeter 1:	$P_{crit\_tens\_sq\_1}$ = 4*(d_cage_sq+Lembed)	$P_{crit\_tens\_sq\_1}$ =	211.95	in
Equivalent Square Critical Perimeter 2:	$P_{crit\_tens\_sq\_2}$ = 2*(d_cage_sq + Lembed) + (W*12-BW*12)	$P_{crit\_tens\_sq\_2}$ =	207.47	in
Equivalent Square Critical Perimeter 3:	$P_{crit\_tens\_sq\_3}$ = 2 * (d_cage_sq + Lembed) + (W - BW * COS(RADIANS(30)) - Ledge2)*12	$P_{crit\_tens\_sq\_3}$ =	321.80	in
Equivalent Square Critical Perimeter 4:	$P_{crit\_tens\_sq\_4}$ = 2 * (d_cage_sq + Lembed + Ledge2 * 12)	$P_{crit\_tens\_sq\_4}$ =	165.63	in
Equivalent Square Critical Perimeter 5:	$P_{crit\_tens\_sq\_5}$ = d_cage_sq + Lembed + 0.5*(W-BW)*12 + (W - BW * COS(RADIANS(30))	$P_{crit\_tens\_sq\_5}$ =	211.65	in
Area of Concrete in Shear:	A_{c_tens} = Pcrit_tens*Lembed	A_{c_tens} =	7502.96	in^2
Equivalent Square Area of Concrete in Shear:	$A_{c\_tens\_sq1}$ = Pcrit_tens_sq1*Lembed	$A_{c\_tens\_sq1}$ =	9352.25	in^2
	$A_{c\_tens\_sq2}$ = 'Pcrit_tens_sq2*Lembed	$A_{c\_tens\_sq2}$ =	9154.80	in^2
	$A_{c\_tens\_sq3}$ = Pcrit_tens_sq3*Lembed	$A_{c\_tens\_sq3}$ =	14199.47	in^2
	$A_{c\_tens\_sq4}$ = Pcrit_tens_sq4*Lembed	$A_{c\_tens\_sq4}$ =	7308.32	in^2
	$A_{c\_tens\_sq5}$ = Pcrit_tens_sq5*Lembed	$A_{c\_tens\_sq5}$ =	9339.07	in^2

Polar Moment of Inertia at assumed Critical Section:	J_{c_tens} = Lembed*(d_cage+Lembed)^3/6 + ((d_cage+Lembed)*(Lembed^3))/6 + (Lembed*(d_cage+Lembed))*(d_cage+Lembed)^2/(IF(Ledge2=0,2,4))	J_{c_tens} = 3690190.69	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section 1:	$J_{c\_tens\_sq\_1}$ = (Lembed*(d_cage_sq+Lembed)^3)/6 + ((d_cage_sq+Lembed)*(Lembed^3))/6 + (Lembed*(d_cage_sq+Lembed)*(d_cage_sq+Lembed)^2)/2	$J_{c\_tens\_sq\_1}$ = 5135017.58	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_tens\_sq\_2}$ = (Lembed*(d_cage_sq+Lembed)^3)/12 + ((d_cage_sq+Lembed)*(Lembed^3))/12 + (Lembed*(d_cage_sq+Lembed)*(d_cage_sq+Lembed)^2)/2	$J_{c\_tens\_sq\_2}$ = 4208625.02	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_tens\_sq\_3}$ = (Lembed*(d_cage_sq+Lembed)^3)/6 + ((d_cage_sq+Lembed)*(Lembed^3))/6 + (Lembed*(d_cage_sq+Lembed)*(d_cage_sq+Lembed)^2)/4	$J_{c\_tens\_sq\_3}$ = 3493901.34	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_tens\_sq\_4}$ = (Lembed*(d_cage_sq+Lembed)^3)/6 + ((d_cage_sq+Lembed)*(Lembed^3))/6 + (Lembed*(d_cage_sq+Lembed)*(d_cage_sq+Lembed)^2)/4	$J_{c\_tens\_sq\_4}$ = 3493901.34	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_tens\_sq\_5}$ = (Lembed*(d_cage_sq+Lembed)^3)/12 + ((d_cage_sq+Lembed)*(Lembed^3))/12 + (Lembed*(d_cage_sq+Lembed)*(d_cage_sq+Lembed)^2)/4	$J_{c\_tens\_sq\_5}$ = 2567508.79	in^4
*Applied Shear Force (0.9*D LC):*	$V_{u\_0.9\_tens}$ = MAX(-0.9*Wpier + 0.9 * IF(OR($B$1="G",$B$1="H"), Puplift / 0.9, Puplift),	$V_{u\_0.9\_tens}$ = 119.00	kip
*Controlling Shear Stress (0.9*D LC):*	$v_{u\_0.9\_controlling\_tens} = V_{u\_0.9} / A_{c\_tens} + (\Upsilon_v * M_v * (d_{cage} + Lembed)/2) / J_{c\_tens}$	$v_{u\_0.9\_controlling\_tens}$ = 0.016	ksi
*Equivalent Square Shear Stress (0.9*D LC):*	$v_{u\_0.9\_tens\_sq}$ = Vu_0.9_tens/Ac_tens_sq4 + (Υv * Mv_tens * (d_cage_sq + Lembed)/2) / .	$v_{u\_0.9\_tens\_sq}$ = 0.016	ksi
Shear Stress Capacity:	Φv_n = φs * 4 * (√F'c*1000) / 1000	Φv_n = 0.190	ksi

Check **Φv_n = 0.190 ksi >= v_{u_demand} = 0.016 ksi** **RATING: 8.36% OK**

Two-Way Shear (Uplift, Flexural Component)

Applied Moment:	$Yf*M_{u\_tension} = Yf*M_{u\_tension}$	$Yf*M_{u\_tension}$ = 0	

Check **$\varphi M_{n\_effective}$ = 978.81 ksi >= $f*M_{u\_tension}$ = 0.00 ksi** **RATING: 0.00% OK**

Pad Flexure (Net Bearing Pressure)

	β_{pad} = IF(F'c <= 4, 0.85, IF(F'c >= 8, 0.65, 0.85 - (F'c - 4) * 0.05))	β_{pad} = 0.85	
Provided Steel:	$A_{s\_pad} = A_{b\_pad} * m_{\_pad}$	A_{s_pad} = 9.60	in^2
Depth of Equivalent Rectangular Stress Block:	$a = A_{s\_pad}$ * Fy / (0.85 * F'c * W)	a = 0.46	in
Distance from Top to Nuetral Axis:	$c = a / \beta_{pad}$	c = 0.54	in
Modulus of Elasticity of Steel:	E_s = 29000 ksi	E_s = 29000	ksi
Strain in Steel:	ε_s = 0.003 * (dc-c) / c	ε_s = 0.24162	in/in
Compression-Controlled Strain Limit::	$\varepsilon_c = F_y / E_s$	ε_c = 0.00207	in/in
Tension-Controlled Strain Limit::	ε_t = 0.005	ε_t = 0.00500	in/in
Flexure Strength Reduction Factor:	φflex = IF(εs>=εt,0.9,IF(εs<=εc,0.65,0.65+(0.9-0.65)*((εs-εc)/(εt-εc))))	φflex = 0.9	
Nominal Flexural Strength:	$M_n = As_{\_pad} * (F_y)$ * (dc - a / 2) * (1/12)	M_n = 2086.07	ft-kips
Design Flexural Strength:	φM_n = φflex * Mn	φM_n = 1877.46	ft-kips
*Bearing Press. at Crit. Section (0.9*D LC):*	qmid_0.9 = qu_st_0.9 - sqs_0.9 * d'	qmid_0.9 = 0.82	ksf
*Bearing Press. at Crit. Section (1.2*D LC):*	qmid_1.2 = qu_st_1.2 - sqs_1.2 * d'	qmid_1.2 = 1.01	ksf

Resisting Weight above Critical Section:

	Thickness (ft)	Unit Weight (kcf)	Weight (kip) (0.9*D LC)	Weight (kip) (1.2*D LC)	Moment Arm (ft)	Resisting Moment (ft-kips) (0.9*D LC)	Resisting Moment (ft-kips) (1.2*D LC)
Soil Above Water Table:	0	0.100	0.00	0.00	4.288052526	0.00	0.00
Soil Below Water Table:	0	0.038	0.00	0.00	4.288052526	0.00	0.00
Pad Above Water Table:	4	0.150	143.56	191.42	4.288052526	615.61	820.81
Pad Below Water Table:	0	0.088	0.00	0.00	4.288052526	0.00	0.00
Total:			143.56	191.42		615.61	820.81

*Factored Bending Moment (0.9*D LC):* Mu_pad_0.9 = 'Pad Shear and Moment Diagrams'!$AZ$21 — Mu_pad_0.9 = 547.68 ft-kips

*Factored Bending Moment (1.2*D LC):* Mu_pad_1.2 = 'Pad Shear and Moment Diagrams'!$CH$21 — Mu_pad_1.2 = 559.56 ft-kips

Check **φM_n = 1877.46 ft-kips >= M_{u_pad} = 559.56 ft-kips RATING: 29.80% OK**

PIER DESIGN CHECKS

Minimum Steel

Min. area of steel (pier): A_{st_c} = Ag * 0.005 — A_{st_c} = 0.00 in^2

Check **A_{s_pier} = #N/A in² >= A_{st_c} = 0.00 in² RATING: #N/A #N/A**

Bar Spacing

Bar separation: B_{s_pier} = (do * π) / m_pier - db_pier — B_{s_pier} = 0.00 in

Check **18.00 in >= B_{s_pier} = 0.00 in RATING: 0.00% OK**

Vertical Rebar Development Length

Reinforcement location:	α_c =	if space under bar > 12", 1.3, else use 1.0	α_c =	#N/A	
Epoxy coating:	β_c =	for non- epoxy coated, use 1.0	β_c =	1.0	
Max term:	$\alpha\beta_c$ =	product of α x β not to exceed 1.7	$\alpha\beta_c$ =	#N/A	
Reinforcement size:	γ_c =	if bar size is 6 or less, 0.8, else use 1.0	γ_c =	0.8	
Light weight concrete:	λ_c =	1.0	λ_c =	1.0	
Spacing/cover:	$c_{\_c}$ =	use smaller of half of bar spacing or concrete cover	$c_{\_c}$ =	#N/A	in
Transverse bars:	k_{tr_c} =	0 in (per simplification)	k_{tr_c} =	0	in
Max term:	c_c' =	MIN(2.5, (c_c + ktr_c) / db_c)	c_c' =	#N/A	
Excess reinforcement:	R_c =	Ast_c / As_c	R_c =	#N/A	
Development (tensile):	$L_{dt}'_{\_c}$ =	(3 / 40) * (Fy*1000 / √(F'c*1000)) * αβ_c * γ_c * λ_c * R_c * db_c / c_c'	$L_{dt}'_{\_c}$ =	#N/A	in
Minimum length:	L_{d_min} =	12 inches	L_{d_min} =	12.0	in
Development length:	L_{dt_c} =	MAX(Ld_min, Ldt'_c)	L_{dt_c} =	0.00	in
Development (comp.):	$L_{dc}'_{\_c}$ =	0.02 * db_c * Fy*1000 / √(F'c*1000)	$L_{dc}'_{\_c}$ =	0.00	in
	$L_{dc}''_{\_c}$ =	0.0003 * db_c * Fy*1000	$L_{dc}''_{\_c}$ =	0.00	in
Development length:	L_{dc_c} =	MAX(8, Ldc'_c, Ldc"_c)	L_{dc_c} =	0.00	in
Length available in pier:	L_{vc} =	D - T + E - cc	L_{vc} =	0.0	in

Check **L_{vc} = 0.00 in >= L_{dt_c} = 0.00 in OK**

Check **L_{vc} = 0.00 in >= L_{dc_c} = 0.00 in OK**

Length available in pad: L_{vp} = T - ccpad — L_{vp} = 45.0 in

Check **L_{vp} = 45.00 in >= L_{dt_c} = 0.00 in OK**

Check **L_{vp} = 45.00 in >= L_{dc_c} = 0.00 in OK**

Vertical Rebar Hook Ending

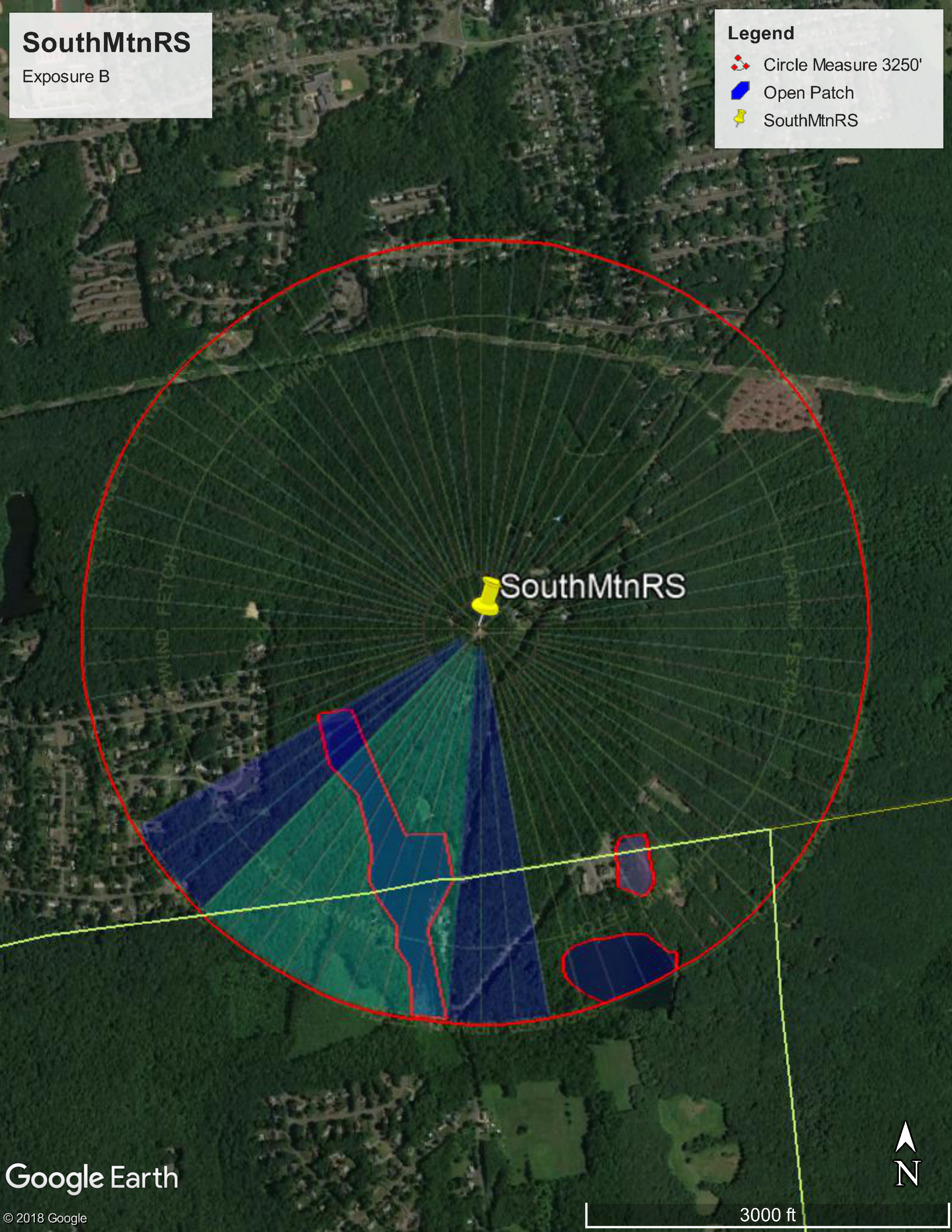
Bar size & clear cover:	α_h = =if bar <= 11, and cc >= 2.5", use 0.7, else use 1.0	α_h =	1	
Epoxy coating:	β_h = for non- epoxy coated, use 1.0	β_h =	1.0	
Light weight concrete:	λ_h = 1.0	λ_h =	1.0	
Development (hook):	L_{dh}' = 0.02 * αh * βh * λh * Fy*1000 / √(F'c*1000) * db_c	L_{dh}' =	#N/A	in
Minimum length:	L_{dh_min} = the larger of: 8 * d_b or 6 in	L_{dh_min} =	#N/A	in
Development length:	L_{dh} = MAX(Ldh_min, Ldh')	L_{dh} =	0.0	in

Check **L_{vp} = 45.00 in >= L_{dh} = 0.00 in** **OK**

Pier Ties

Minimum size: [ACI 7.10.5.1]	$s_{\_t\_min}$ =IF(s_c <= 10, 3, 4)	$s_{\_t\_min}$ =	3	
z factor:	z_seismic = 0.5 if the SDC is A, B, or C, else 1.0	z_seismic =	0.5	
Tie parameters:	$s_{\_t}$ = 0 $m_{\_t}$ = 0	d_{b_t} = A_{b_t} =	#N/A #N/A	in in^2
Allowable tie spacing *per vertical rebar:*	$B_{s\_t\_max1}$ = 8 / z * db_c	$B_{s\_t\_max1}$ =	#N/A	in
per tie size:	$B_{s\_t\_max2}$ = 24 / z * db_t	$B_{s\_t\_max2}$ =	#N/A	in
per pier diameter:	$B_{s\_t\_max3}$ = di / (4 * z²)	$B_{s\_t\_max3}$ =	0	in
per seismic zone:	$B_{s\_t\_max4}$ = 12" in active seismic zones, else 18"	$B_{s\_t\_max4}$ =	18	in
Maximum tie spacing:	$B_{s\_t\_max}$ = MIN(Bs_t_max1, Bs_t_max2, Bs_t_max3, Bs_t_max4)	$B_{s\_t\_max}$ =	#N/A	in
Minimum required ties:	$m_{\_t\_min}$ = (D - T + E) / Bs_t_max + 2	$m_{\_t\_min}$ =	0.00	

Check **$m_{\_t}$ = 0.00 >= $m_{\_t\_min}$ = 0.00** **OK**


SouthMtnRS
Exposure B
Legend
Circle Measure 3250'
Open Patch
SouthMtnRS
SouthMtnRS
Google Earth
© 2018 Google
3000 ft
N

ATTACHMENT D – PROOF OF DELIVERY OF NOTICE

Ref: CT578100 ES-004 Date: 23Apr20 SHIPPING: 0.00
Dep: BL GRAPHICS Wgt: 0.95 LBS SPECIAL: 0.00
HANDLING: 0.00
DV: 0.00 TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT
TRCK: 1714 2090 2451

ORIGIN ID:RSPA (800) 301-3077
BL GRAPHICS
BL GRAPHICS
355 RESEARCH PARKWAY

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 23APR20
ACTWGT: 0.95 LB MAN
CAD: 0765627/CAFE3311

BILL THIRD PARTY

TO **ROBERT M. FLANAGAN, CITY PLANNER**
CITY OF BRISTOL
111 NORTH MAIN STREET

BRISTOL CT 06010
REF: CT578100 ES-004 SOUTH MNT
DEPT: BL GRAPHICS

565C4/7B3A/05A2

FedEx
Express
E

J191219082001uv

FRI - 24 APR 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **1714 2090 2451**

00 BNHA

06010
CT-US **BDL**

Ref: CT578100 ES-004 Date: 23Apr20 SHIPPING: 0.00
Dep: BL GRAPHICS Wgt: 0.95 LBS SPECIAL: 0.00
HANDLING: 0.00
DV: 0.00 TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT
TRCK: 1714 2090 2440

ORIGIN ID:RSPA (800) 301-3077
BL GRAPHICS
BL GRAPHICS
355 RESEARCH PARKWAY

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 23APR20
ACTWGT: 0.95 LB
CAD: 0765627/CAFE3311

BILL THIRD PARTY

TO **MAYOR ELLEN ZOPPO-SASSU**
CITY OF BRISTOL
111 NORTH MAIN STREET

BRISTOL CT 06010

REF: CT578100 ES-004 SOUTH MNT

DEPT: BL GRAPHICS

565C4/7B3A/05A2

FedEx Express

E

J191219082001uv

FRI - 24 APR 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **1714 2090 2440**

00 BNHA

06010
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

ES-004

790 Willis Street

Bristol, CT 06010

April 10, 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 existing self-support tower located at 790 Willis Street in Bristol, CT.

Eversource is proposing to install one omnidirectional antenna as part of its 220 MHz communications system and one microwave dish for backhaul communications.

This report considers the planned antenna configuration as detailed by Eversource along with power density information of the existing antennas to calculate the cumulative % MPE (Maximum Permissible Exposure) of the facility at ground level.

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.

3. 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.

4. Calculated % MPE Results

Table 1 below outlines the power density information for the site. The Eversource omnidirectional and microwave antennas have narrow vertical beamwidths of 30° and 1.7°, respectively; therefore, the majority of the RF power is focused out towards the horizon. Please refer to Attachment C, for the vertical patterns of the proposed Eversource antennas. Likewise, the other transmit antennas exhibit similar directionality of varying vertical beamwidths. As a result, there will be less RF power directed below the antennas relative to the horizon, and consequently lower power density levels around the base of the facility. The calculated results in Table 1 include a nominal 10 dB off-beam pattern loss for the omnidirectional and panel antennas, and 30 dB off-beam pattern loss for the highly directional microwave dish to account for the lower relative gain below the antennas. Any inactive or receive-only antennas are not listed in the table unless specified otherwise, as they are irrelevant in terms of the % MPE calculations.

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm^2)	Limit	% MPE
Eversource	141.5	154.46375	1	250	0.0005	0.2000	0.24%
Eversource	141	153.695	1	250	0.0005	0.2000	0.25%
Eversource	139	145.14	1	250	0.0005	0.2000	0.25%
Eversource	138	224.22	1	250	0.0005	0.2000	0.26%
Eversource	137	451.1	1	250	0.0005	0.3007	0.17%
Eversource	135	939.4375	1	250	0.0005	0.6263	0.09%
Eversource	134	939.95	1	250	0.0005	0.6266	0.09%
Eversource	117	6034.15	1	7000	0.0002	1.0000	0.02%
Eversource	120	47.76	1	250	0.0007	0.2000	0.35%
Eversource	107	6735	1	7000	0.0002	1.0000	0.02%
Eversource	111	37.76	1	250	0.0008	0.2000	0.41%
Eversource	98	174	1	250	0.0011	0.2000	0.53%
Eversource	96	6805	1	7000	0.0003	1.0000	0.03%
Eversource	86	6004.5	1	7000	0.0004	1.0000	0.04%
Eversource	91	37.46	1	250	0.0012	0.2000	0.62%
Eversource	84	900	1	250	0.0015	0.6000	0.25%
Eversource	71	6805	1	7000	0.0006	1.0000	0.06%
Eversource	73	146.52	1	250	0.0020	0.2000	1.00%
Eversource	73	448.375	1	250	0.0020	0.2989	0.67%
Eversource	58	48.34	1	250	0.0033	0.2000	1.66%
Eversource	54	48.4	1	250	0.0039	0.2000	1.95%
Eversource	46	173.25	1	250	0.0056	0.2000	2.81%
Eversource	43	37.6	1	250	0.0066	0.2000	3.28%
CSP	78	851	1	315	0.0022	0.5673	0.39%
CSP	67	775	1	250	0.0024	0.5167	0.47%
CSP	53	775	1	199	0.0032	0.5167	0.63%
CSP	40	851.0125	1	158	0.0049	0.5673	0.87%
T-Mobile	125	2100	2	2334.27	0.0119	1.0000	1.19%
T-Mobile	125	700	1	865.21	0.0022	0.4667	0.47%
T-Mobile	125	1900	2	1167.14	0.0059	1.0000	0.59%
T-Mobile	125	2100	2	1167.14	0.0059	1.0000	0.59%
Eversource	87	5945.2	1	11147	0.0006	1.0000	0.06%
Eversource	133	217	4	124	0.0011	0.2000	0.55%
						Total	**20.86%**

Table 1: Proposed Facility % MPE [1] [2]

[1] The operating parameters for the Eversource and CSP (CT State Police) were provided directly by each respective operator. The T-Mobile information was sourced from the CSC Power Density Database dated 12/13/2019. For reference, this data is included as Attachment D. Please note that % MPE values listed are rounded to two decimal points and the total % MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not identically match the total value reflected in the table.

[2] Antenna heights listed for Eversource are in reference to the antenna centerline and based upon information provided by Eversource with respect to the Black & Veatch Structural Analysis Report dated 2/26/2020. The available data for the CSP antennas do not have a one-to-one match with the structural analysis, so a worst-case antenna height was applied for those antennas.

5. Conclusion

The above analysis concludes that RF exposure at ground level 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. Using the conservative calculation methods discussed herein, the highest expected percent of Maximum Permissible Exposure at ground level with the proposed installation is **20.86% of the FCC General Population/Uncontrolled limit**.

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

6. 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.

Martin J Lavin

	______________________	April 10, 2020
Report Prepared By:	Martin J. Lavin Senior RF Engineer C Squared Systems, LLC	Date

Keith Vellante

	______________________	April 10, 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[3]

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[4]

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 2: FCC Limits for Maximum Permissible Exposure (MPE)

[3] 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

[4] 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

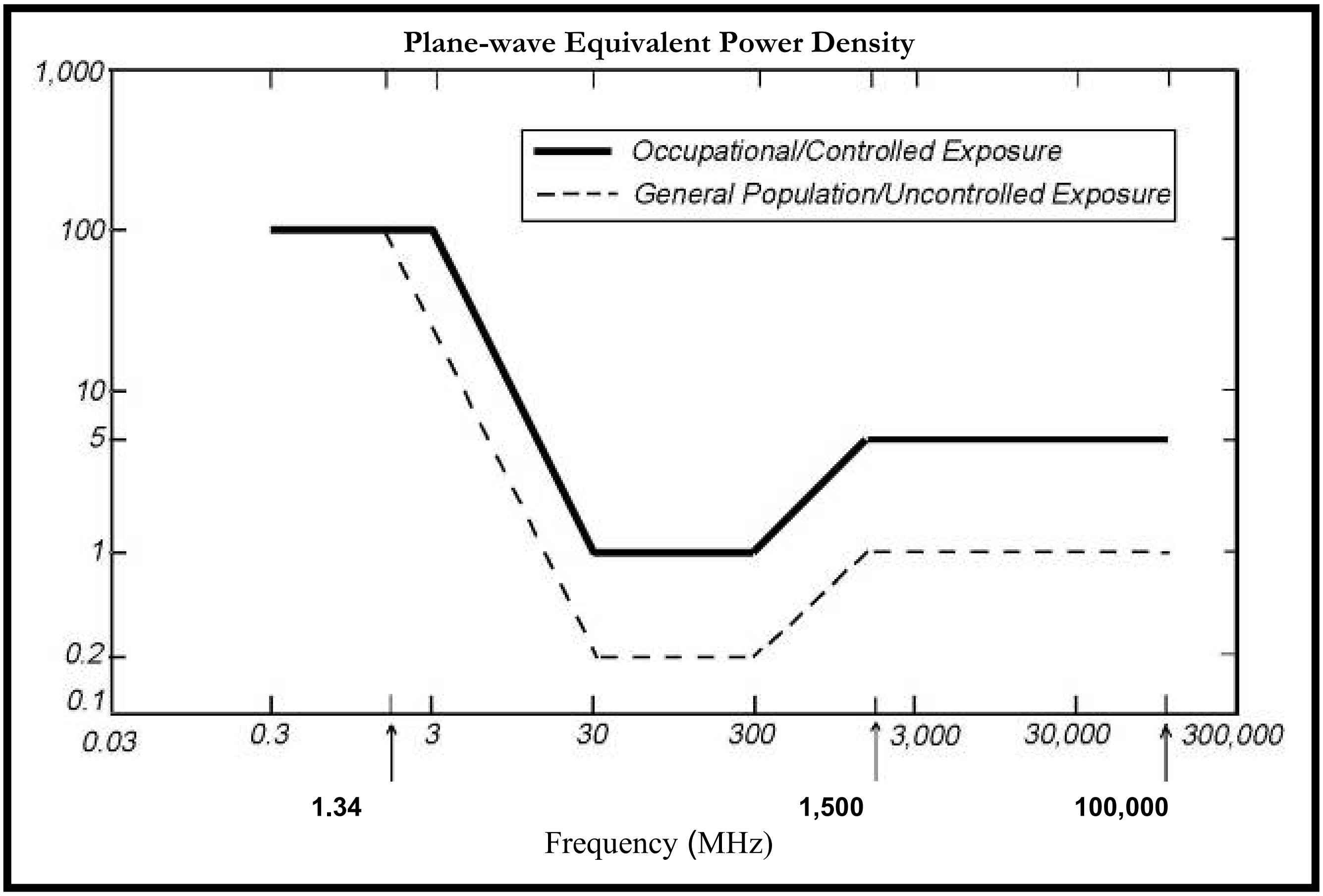
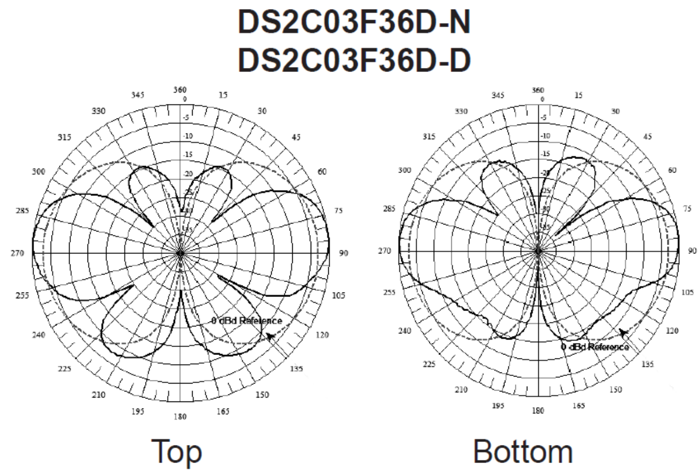


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Eversource Antenna Data Sheets and Electrical Patterns

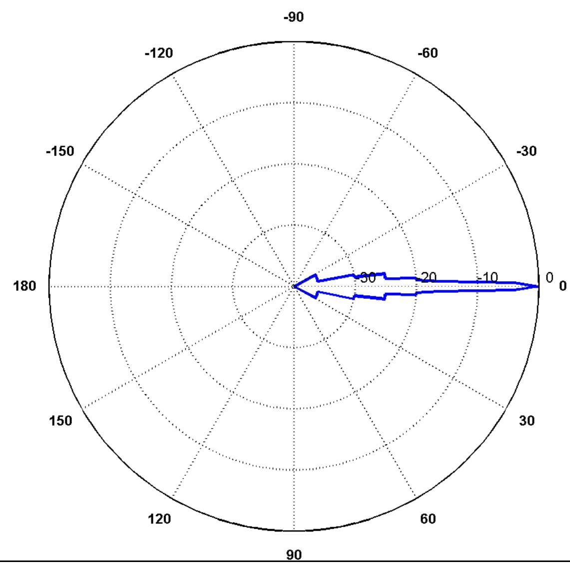
217 MHz

Manufacturer:	dbSpectra
Model #:	DS2C03F36D
Frequency Band:	217-222 MHz
Gain:	3.0 dBd
Vertical Beamwidth:	30°
Horizontal Beamwidth:	360°
Polarization:	Vertical
Length:	24.3’



5945.2 MHz

Manufacturer:	RFS
Model #:	PAD6-59
Frequency Band:	5.925-6.875 MHz
Gain:	38.4 dBi
Vertical Beamwidth:	1.7°
Horizontal Beamwidth:	1.7°
Polarization:	Single
Diameter:	6’



Attachment D: Current CSC Power Density Data for the Subject Facility (12/13/2019)

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm^2)	Limit	% MPE
Amateur Radio	126	448.325	1	650	0.00162	0.2989	0.54%
Amateur Radio	126	224.22	1	100	0.00025	0.2000	0.12%
CL&P	127	153.695	1	5	0.00001	0.2000	0.01%
CL&P	127	451.1	1	189	0.00046	0.3007	0.15%
CL&P	127	154.46375	1	990	0.00243	0.2000	1.22%
CL&P	122	952.55625	1	71	0.00019	0.6350	0.03%
CL&P	125	937	3	200	0.00152	0.6247	0.24%
CL&P	115	48.34	1	100	0.00030	0.2000	0.15%
CL&P	109	6765	1	5250	0.01780	1.0000	1.78%
CL&P	102	6835	1	309	0.00121	1.0000	0.12%
CL&P	102	6735	1	1738	0.00678	1.0000	0.68%
CTSP	108	800	5	100	0.00173	0.5333	0.32%
CL&P	92	6805	1	1660	0.00807	1.0000	0.81%
CL&P	81	6865	1	288	0.00184	1.0000	0.18%
CL&P	81	37.76	1	100	0.00064	0.2000	0.32%
CL&P	58	48.4	1	120	0.00160	0.2000	0.80%
CL&P	53	53.05	1	100	0.00163	0.2000	0.81%
CL&P	52	37.46	1	115	0.00195	0.2000	0.98%
CL&P	38	37.6	1	446	0.01566	0.2000	7.83%
CL&P	37	173.25	1	204	0.00763	0.2000	3.82%
CL&P	37	928.55625	1	32	0.00120	0.6190	0.19%
T-Mobile	125	2100	2	2334.27	0.01186	1.0000	1.19%
T-Mobile	125	700	1	865.21	0.00220	0.4667	0.47%
T-Mobile	125	1900	2	1167.14	0.00593	1.0000	0.59%
T-Mobile	125	2100	2	1167.14	0.00593	1.0000	0.59%
						Total	**23.96%**