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

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

May 22, 2020

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

RE: **Notice of Exempt Modification**
Eversource Site # C0060800
18 Kluge Road, Prospect, CT 06712
Latitude: 41-28-20.5 N / Longitude: 72-58-13.1 W

Dear Ms. Bachman:

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource") currently maintains 12 antennas at various mounting heights on an existing 152-foot self-support tower located at 18 Kluge Road in Prospect. 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 147 feet above ground level ("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 April 28, 2020 and Attachment C, Structural Analysis, dated March 4, 2020.

The Connecticut Siting Council approved the self-support tower at this location in Petition No. 745 in November 2005. The proposed installation is part of Eversource's program to update the current obsolete analog voice radio communications system to a modern digital voice communications system. The new system will enable the highest level of voice communications under all operating conditions, including during critical emergency and storm restoration activities. The new radio system will also provide for remote control of distribution safety equipment.

Please accept this letter as notification pursuant to Regulations of Connecticut State Agencies ("R.C.S.A.") §16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this notice is being delivered to Robert J. Chatfield, Mayor for the Town of Prospect and Mary Barton, Land Use Inspector for the Town of Prospect 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 6, 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 Robert J. Chatfield, Mayor, Town of Prospect
Mary Barton, Land Use Inspector, Town of Prospect

Attachments

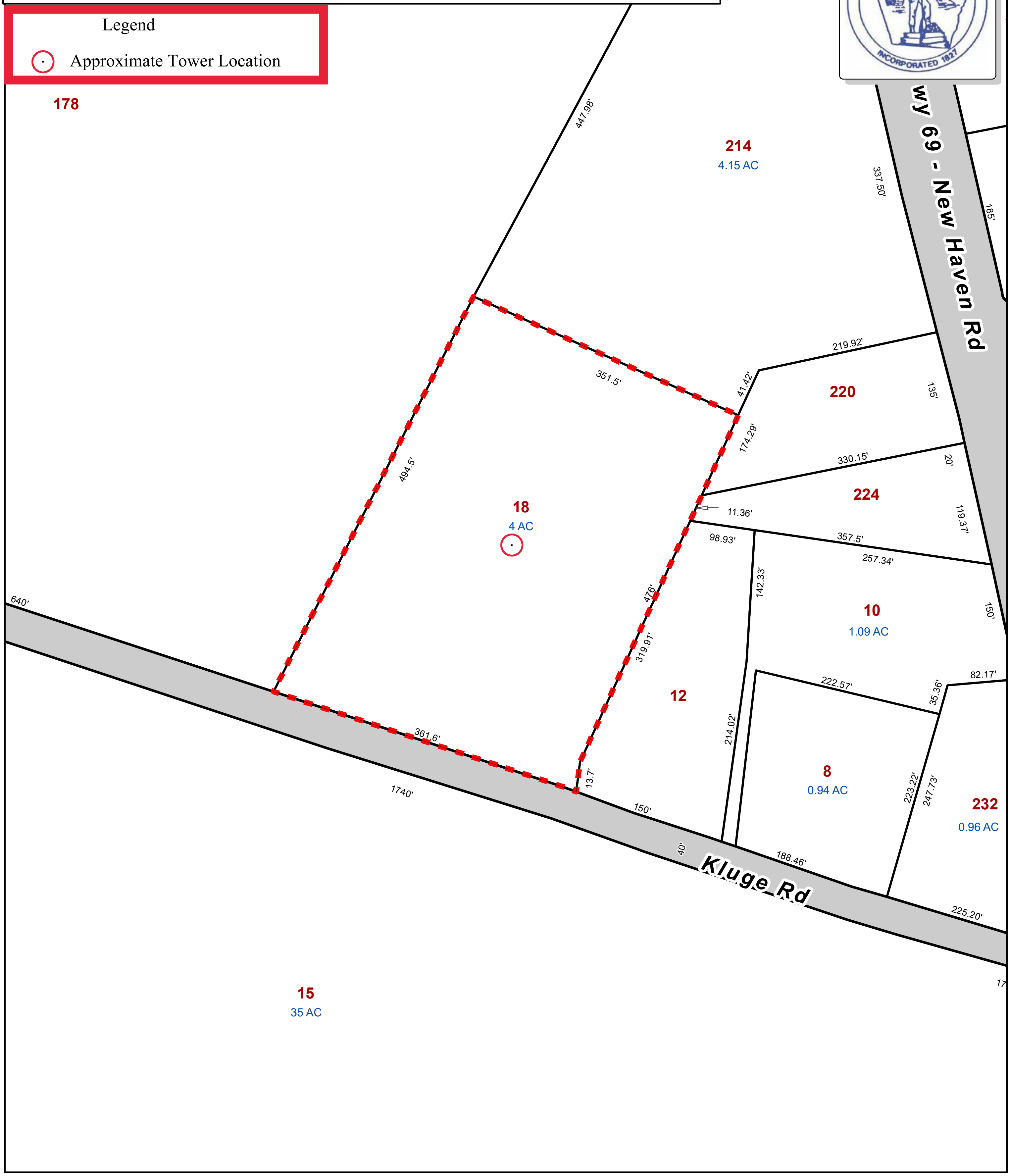
A. Parcel Map and Property Card
B. Construction Drawings
C. Structural Analysis
D. Proof of Delivery of Notice
E. Power Density Report

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

ATTACHMENT A – PARCEL MAP AND PROPERTY CARD

Town of Prospect, Connecticut - Assessment Parcel Map

Unique ID: C0060800
MBL: 112-74-18
Address: 18 KLUGE RD



Approximate Scale:

1 inch = 200 feet

Disclaimer:
This map is for informational purposes only.
All information is subject to verification by any user.
The Town of Prospect and its mapping contractors
assume no legal responsibility for the information contained herein.

Map Produced
September 2019

The Assessor's office is responsible for the maintenance of records on the ownership of properties. Assessments are computed at 70% of the estimated market value of real property at the time of the last revaluation which was 2015.

Information on the Property Records for the Municipality of Prospect was last updated on 9/19/2019.

Parcel Information

Location:	18 KLUGE RD	Property Use:	Residential	Primary Use:	Residential
Unique ID:	C0060800	Map Block Lot:	112 74 18	Acres:	4.00
490 Acres:	0.00	Zone:	RA-1	Volume / Page:	0028/0272
Developers Map / Lot:		Census:	3472		

Value Information

	Appraised Value	**Assessed Value**
Land	126,290	88,400
Buildings	0	0
Detached Outbuildings	0	0
Total	126,290	88,400

Owner's Information

Owner's Data
CONN LIGHT & POWER CO POB 270 HARTFORD CT 06141

Building Permits

Permit Number	Permit Type	Date Opened	Date Closed	Permit Status	Reason
6633	Commercial	08/01/2012		Closed	

Information Published With Permission From The Assessor

ATTACHMENT B – CONSTRUCTION DRAWINGS

EVERSOURCE ENERGY

PROSPECT RADIO
18 KLUGE ROAD
PROSPECT, CT 06712

PROJECT SUMMARY

THE GENERAL SCOPE OF WORK CONSISTS OF THE FOLLOWING:

1. INSTALL (1) NEW OMNI/WHIP ANTENNA AT ELEVATION 172'–0"± AGL
2. INSTALL (1) NEW RACK WITH DMR EQUIPMENT IN EXISTING EQUIPMENT BUILDING

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:	PROSPECT RADIO
SITE ID NUMBER:	#C0060800
SITE ADDRESS:	18 KLUGE RD PROSPECT, CT 06712
MAP:	112
BLOCK:	74
LOT:	18
ZONE:	RA–1
LATITUDE:	41° 28' 20.5" N
LONGITUDE:	72° 58' 13.1" W
ELEVATION:	795'± AMSL
FEMA/FIRM DESIGNATION:	X
ACREAGE:	4± AC (BOOK:0028, PAGE:0272)

CONTACT INFORMATION

APPLICANTS:
EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037

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

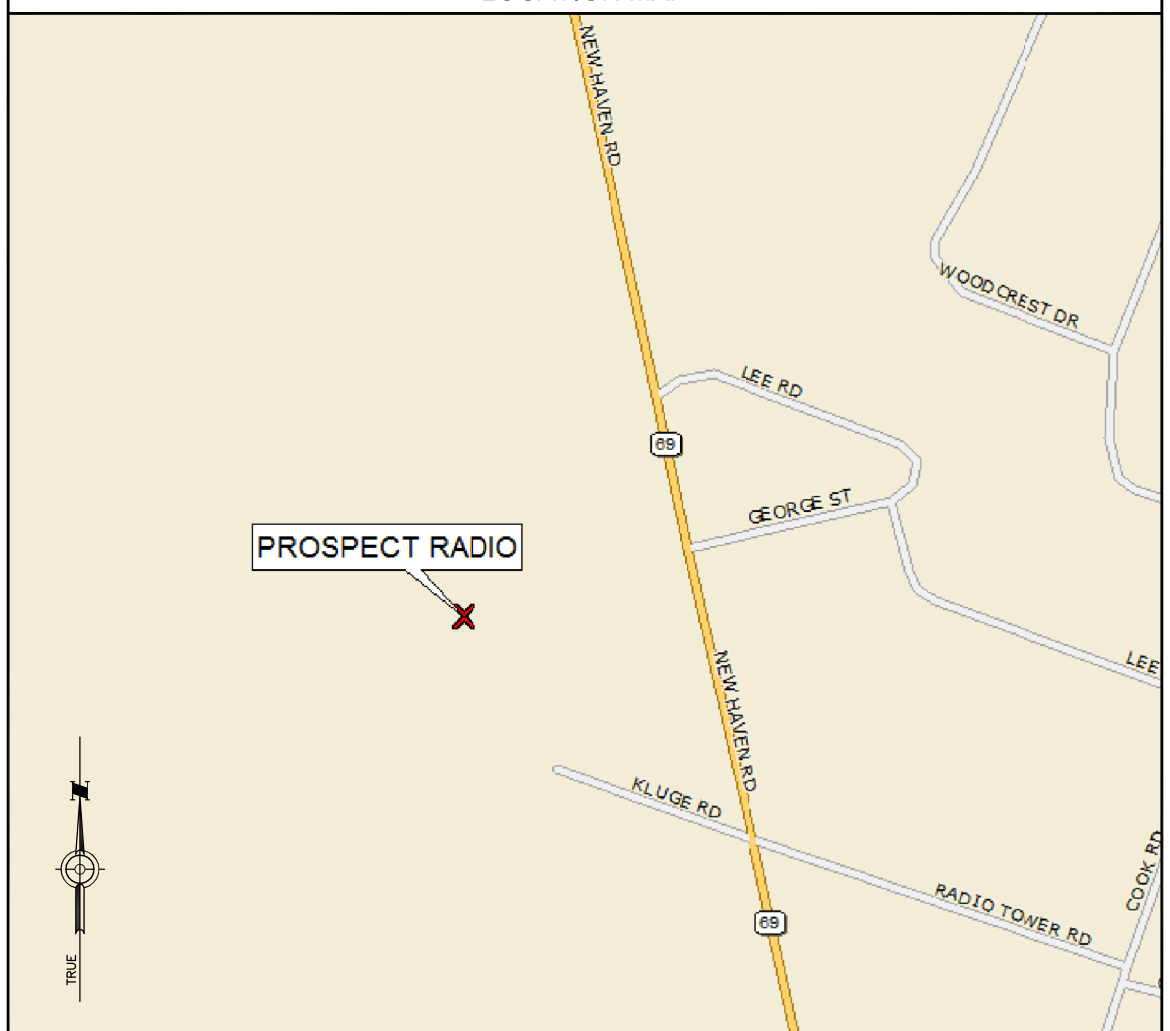
EVERSOURCE ENERGY PROJECT MANAGER:
NIKOLL PRECI
(860) 655–3079

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:	TCG
CHECKED BY:	TH

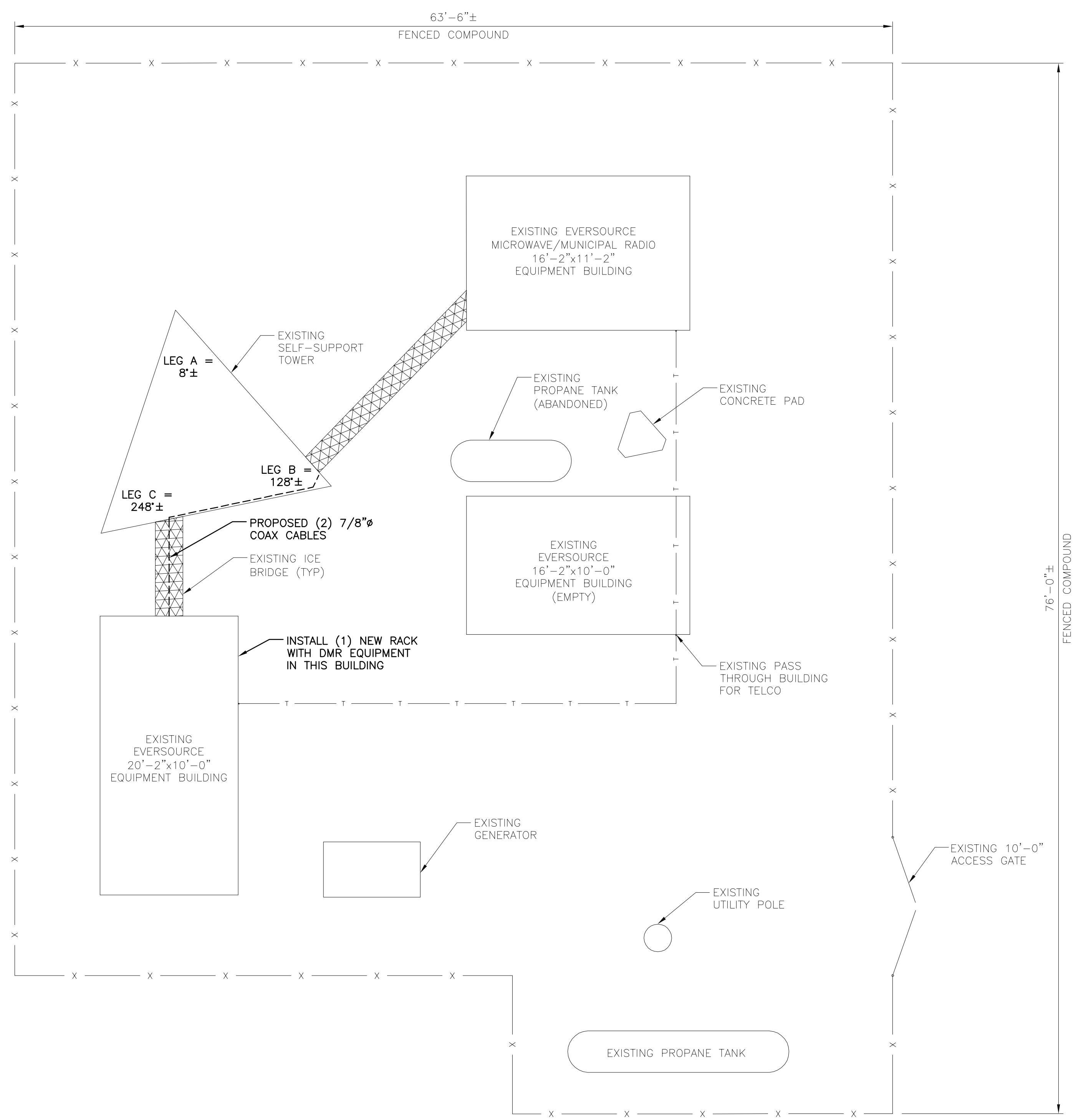
REV	DATE	DESCRIPTION
0	02/28/20	ISSUED FOR CONSTRUCTION

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.

PROSPECT RADIO
18 KLUGE RD
PROSPECT, CT 06712

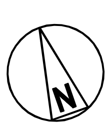
SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1



SITE PLAN

NO SCALE



EVERSOURCE ENERGY

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

BLACK & VEATCH

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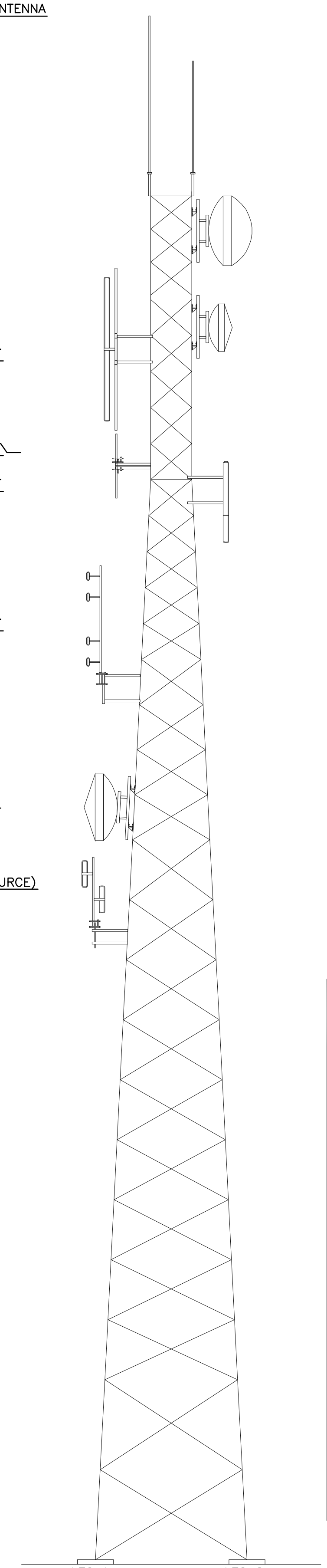
18 KLUGE RD
PROSPECT, CT 06712

SHEET TITLE

SITE PLAN

SHEET NUMBER

C-1

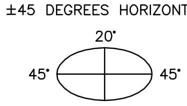


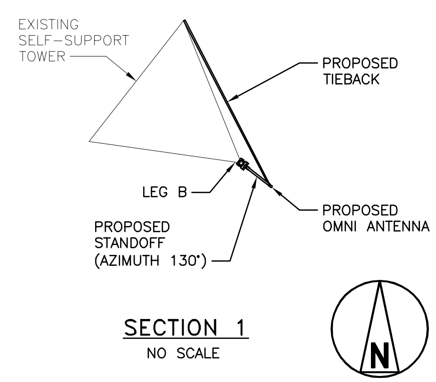
TOWER ELEVATION FACE AC
NO SCALE

NOTES

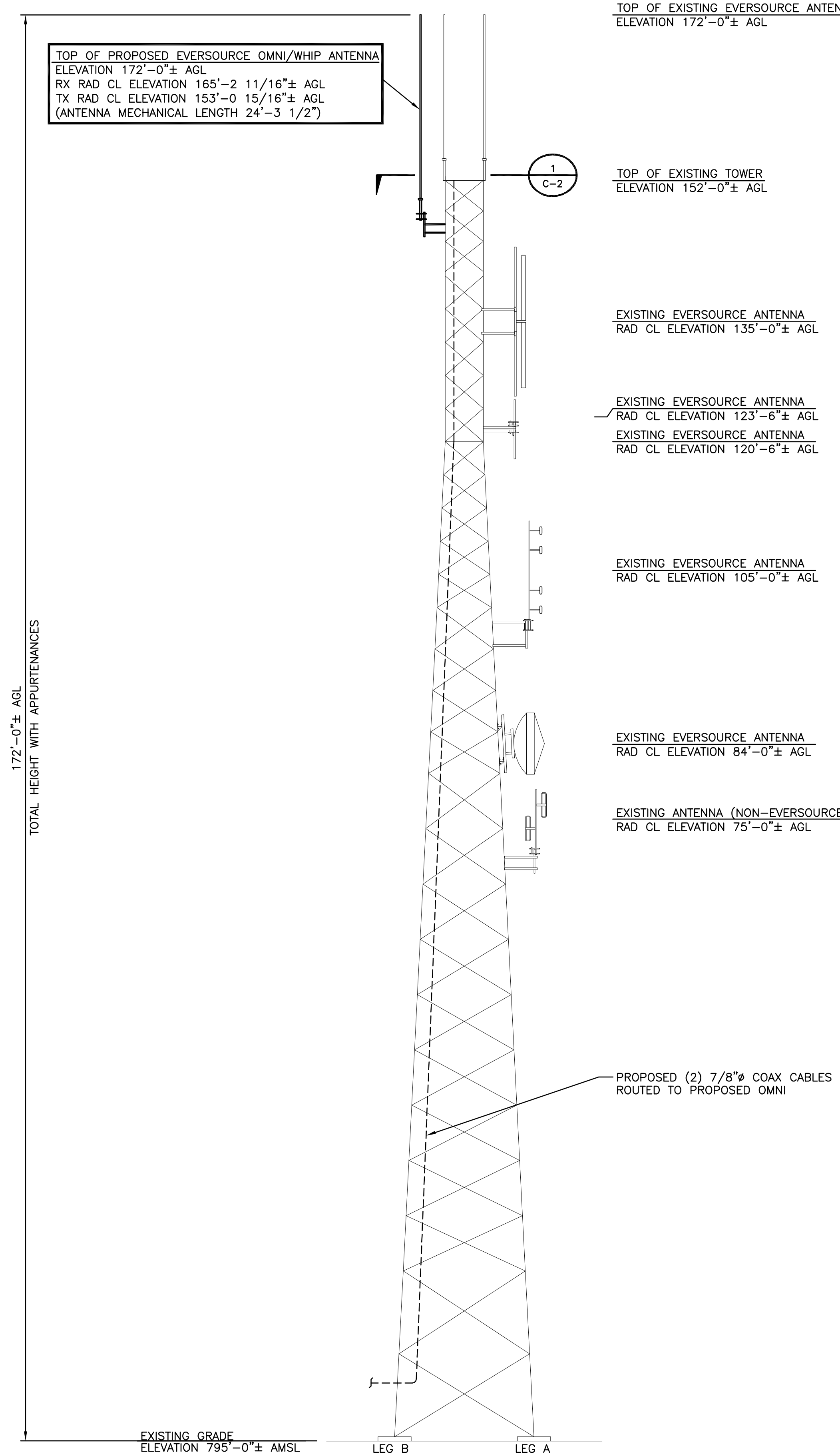
1. ATTACH TIEBACK TO FRAME MAST BETWEEN TOP AND BOTTOM HSS ARMS. ATTACH OPPOSITE END TO EITHER ADJACENT TOWER LEG. REFER TO ALLOWABLE TIEBACK ANGLE DIAGRAM.
2. TRIM TIEBACK PIPE AS REQUIRED TO MAINTAIN A 6" DISTANCE BETWEEN ENDS OF CLAMPS AND ENDS OF PIPE.

ALLOWABLE TIEBACK ANGLE
±20 DEGREES VERTICAL
±45 DEGREES HORIZONTAL





SECTION 1
NO SCALE



TOWER ELEVATION FACE BA
NO SCALE

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

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

PROJECT NO:	403093
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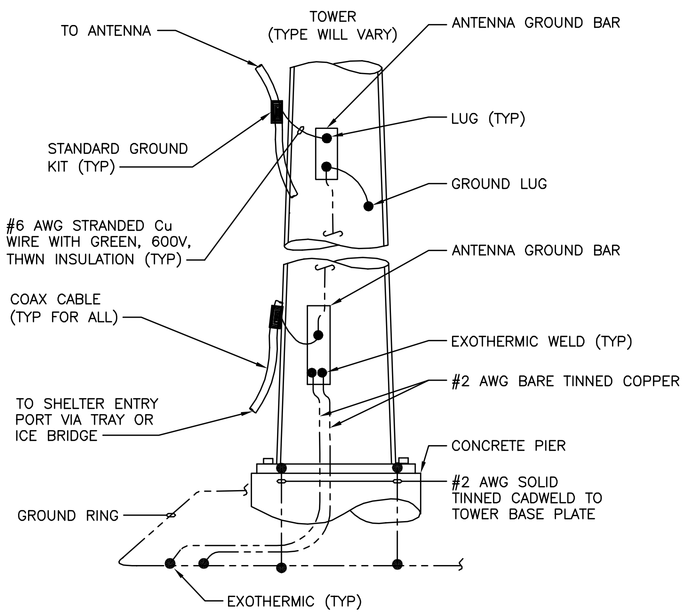
PROSPECT RADIO
18 KLUGE RD
PROSPECT, CT 06712

SHEET TITLE
TOWER ELEVATION & ANTENNA EQUIPMENT

SHEET NUMBER
C-2

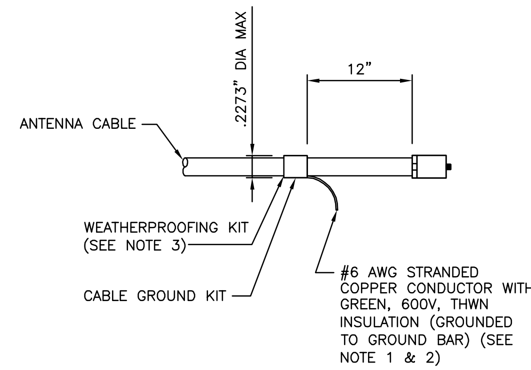


NOTE

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

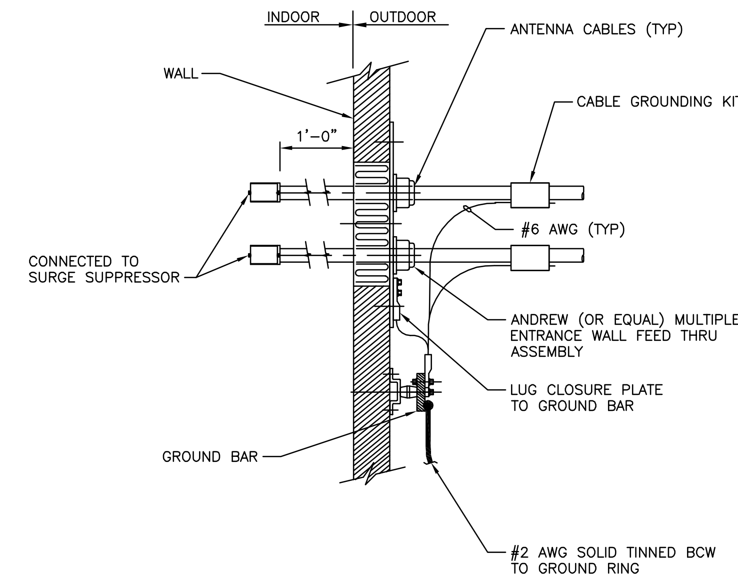


NOTES

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.

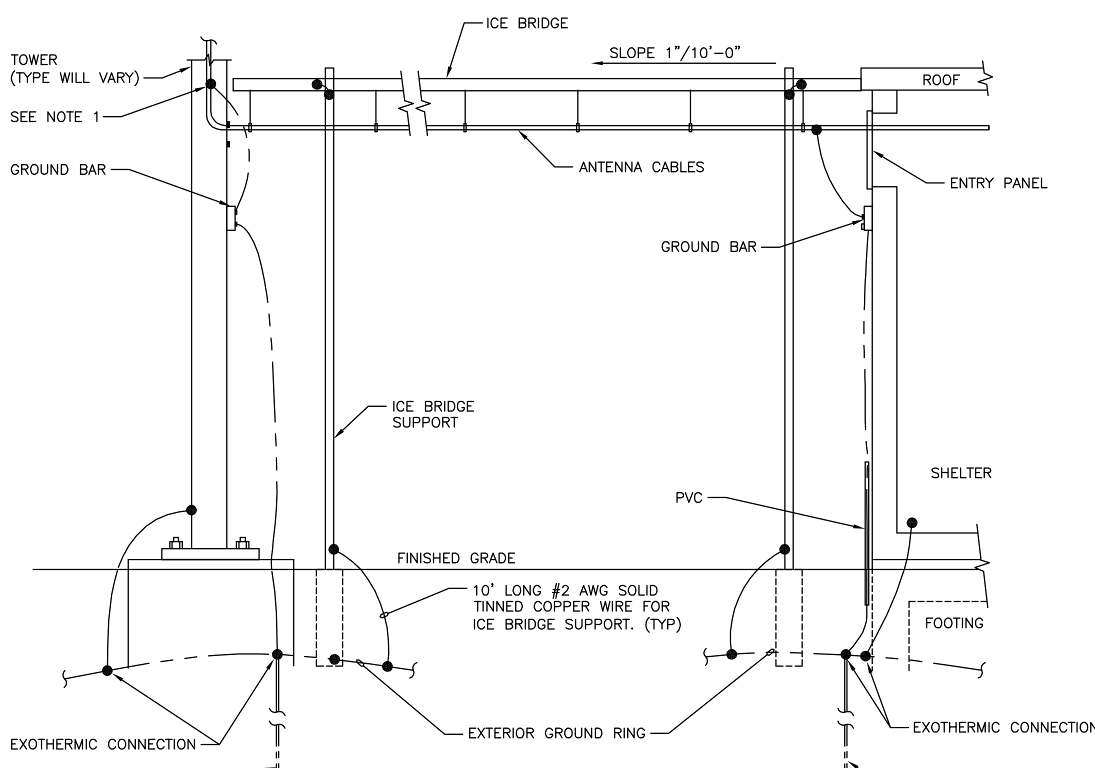
CONNECTION OF CABLE GROUND KIT TO ANTENNA CABLE

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

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OVERLAND PARK, KS 66211
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PROSPECT RADIO
18 KLUGE RD
PROSPECT, CT 06712

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.

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

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0	02/28/20	ISSUED FOR CONSTRUCTION

PROSPECT RADIO
18 KLUGE RD
PROSPECT, CT 06712

SHEET TITLE

NOTES & SPECIFICATIONS

SHEET NUMBER

N-1

ELECTRICAL

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

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:	TCG
CHECKED BY:	TH

REV	DATE	DESCRIPTION
0	02/28/20	ISSUED FOR CONSTRUCTION

PROSPECT RADIO
18 KLUGE RD
PROSPECT, CT 06712

SHEET TITLE

NOTES & SPECIFICATIONS

SHEET NUMBER

N-2

SYMBOLS

- ● EXOTHERMIC CONNECTION
- ■ COMPRESSION CONNECTION
- 5/8"øx10'-0" COPPER CLAD STEEL GROUND ROD.
- TEST GROUND ROD WITH INSPECTION SLEEVE
- — - - - GROUNDING CONDUCTOR
- (A) KEY NOTES

CHAINLINK FENCE	—— x —— x —— x —— x —— x ——
WOOD FENCE	—□——□——□——□——□——□——□—
LEASE AREA	— — — — — — — — — — — — — — —
ICE BRIDGE	
CABLE TRAY	
GAS LINE	—— G —— G —— G —— G —— G ——
UNDERGROUND ELECTRICAL/TELCO	—— E/T —— E/T —— E/T —— E/T ——
UNDERGROUND ELECTRICAL/CONTROL	—— E/C —— E/C —— E/C —— E/C ——
UNDERGROUND ELECTRICAL	—— E —— E —— E —— E —— E ——
UNDERGROUND TELCO	—— T —— T —— T —— T —— T ——
PROPERTY LINE (PL)	—— — — —— — — —— — — —— — — ——

ABBREVIATIONS

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

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PROSPECT, CT 06712

SHEET TITLE
NOTES & SPECIFICATIONS

SHEET NUMBER
N-3

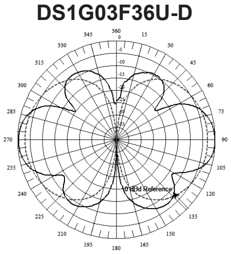
REFERENCE CUTSHEETS

VHF Omni Antennas (160-222 MHz)

		160-174 MHz						217-222 MHz									
	Model Number	DS1G03F36U-N	DS1G03F36U-D	DS1G06F36U-N	DS1G06F36U-D	DS1G03F36D-N	DS1G03F36D-D	DS2C00F36U-N	DS2C00F36U-D	DS2C03F36U-N	DS2C03F36U-D	DS2C06F36U-N	DS2C06F36U-D	DS2C00F36D-N	DS2C00F36D-D	DS2C03F36D-N	DS2C03F36D-D
	Input Connector	N(F)	7/16 DIN	N(F)	7/16 DIN	N(F)	7/16 DIN	N(F)	7/16 DIN	N(F)	7/16 DIN	N(F)	7/16 DIN	N(F)	7/16 DIN	N(F)	7/16 DIN
	Type	Single		Single		Dual		Single		Single		Single		Dual		Dual	
ELECTRICAL	**Bandwidth**, MHz	14		14		14		5		5		5		5		5	
	Power, Watts	500		500		350		500		500		500		350		350	
	Gain, dBd	3		6		3		0		3		6		0		3	
	Horizontal Beamwidth, degrees	360		360		360		360		360		360		360		360	
	Vertical Beamwidth, degrees	30		16		30		60		30		16		60		30	
	Beam Tilt, degrees	0		0		0		0		0		0		0		0	
	Isolation (minimum), dB	N/A		N/A		30		N/A		N/A		N/A		30		30	
MECHANICAL	**Number of Connectors**	1		1		2		1		1		1		2		2	
	Flat Plate Area, ft²(m²)	2.53 (0.24)		4.38 (0.41)		4.5 (0.42)		1.9 (0.18)		1.9 (0.18)		2.58 (0.24)		2.4 (0.22)		4.1 (0.38)	
	Lateral Windload Thrust, lbf(N)	95 (423)		164 (730)		169 (752)		53 (236)		69 (307)		108 (480)		90 (400)		169 (752)	
	Survival Wind Speed																
	without ice, mph(kph)	110 (177)		75 (121)		75 (121)		222 (357)		172 (277)		110 (177)		130 (209)		75 (121)	
	with 0.5" radial ice, mph(kph)	93 (150)		60 (97)		65 (105)		193 (311)		150 (241)		96 (154)		115 (185)		65 (105)	
	Mounting Hardware included	DSH3V3R		DSH3V3N		DSH3V3N		DSH2V3R		DSH2V3R		DSH3V3N		DSH3V3R		DSH3V3N	
DIMENSIONS	**Length**, ft(m)	12.7 (3.9)		21.9 (6.7)		22.3 (6.8)		7.7 (2.3)		9.9 (3)		18.1 (5.5)		13.6 (4.1)		24.3 (7.4)	
	Radome O.D., in(cm)	3 (7.6)		3 (7.6)		3 (7.6)		3 (7.6)		3 (7.6)		3 (7.6)		3 (7.6)		3 (7.6)	
	Mast O.D., in(cm)	2.5 (6.4)		2.5 (6.4)		2.5 (6.4)		2.5 (6.4)		2.5 (6.4)		2.5 (6.4)		2.5 (6.4)		2.5 (6.4)	
	Net Weight w/o bracket, lb(kg)	37 (16.8)		60 (27.2)		63 (28.6)		19 (8.6)		26 (11.8)		47 (21.3)		40 (18.1)		70 (31.8)	
	Shipping Weight, lb(kg)	67 (30.4)		90 (40.8)		93 (42.2)		39 (17.7)		56 (25.4)		77 (34.9)		70 (31.8)		100 (45.4)	

VERTICAL PATTERNS

DS1G03F36U-N
DS1G03F36U-D



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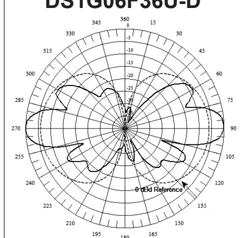

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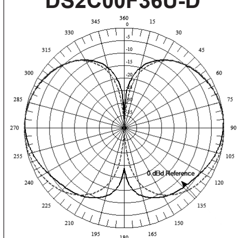

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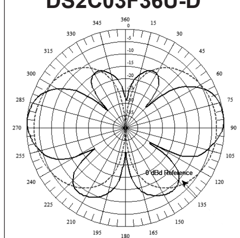
DS2C03F36U-D



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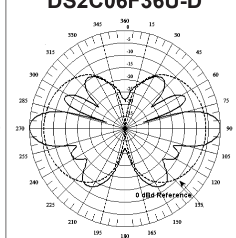

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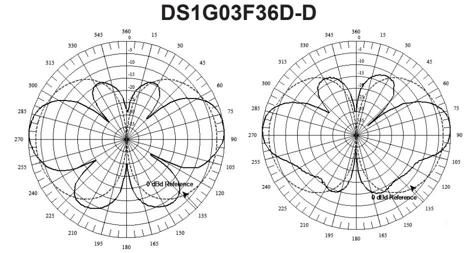

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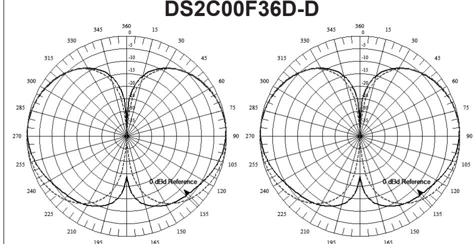

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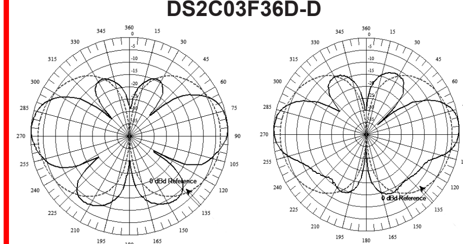
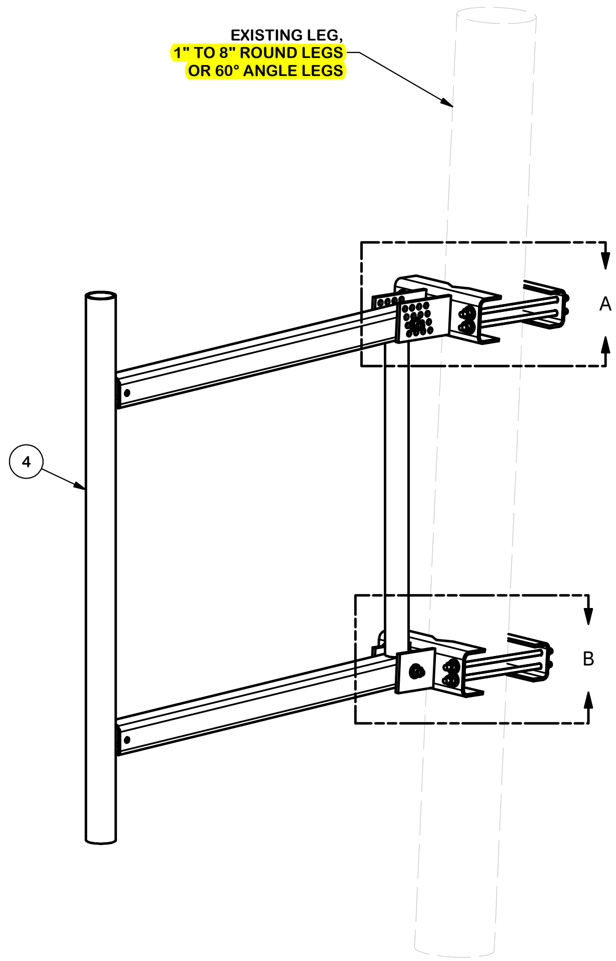


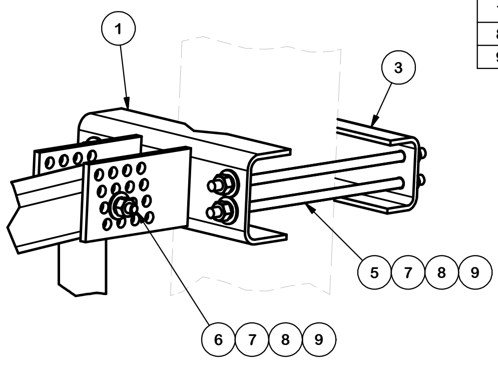
Top Bottom

TOWER/MAST SIZE AT PROPOSED ANTENNA ATTACHMENT = 2.875" ± DIAMETER.

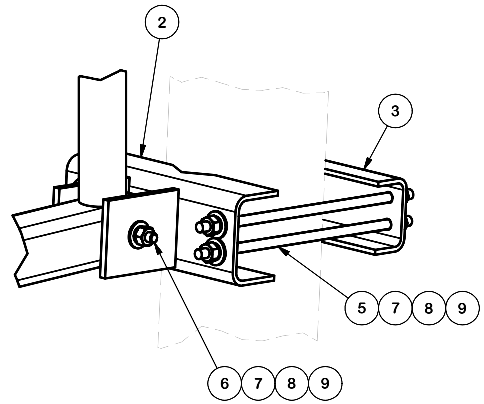
PARTS LIST

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

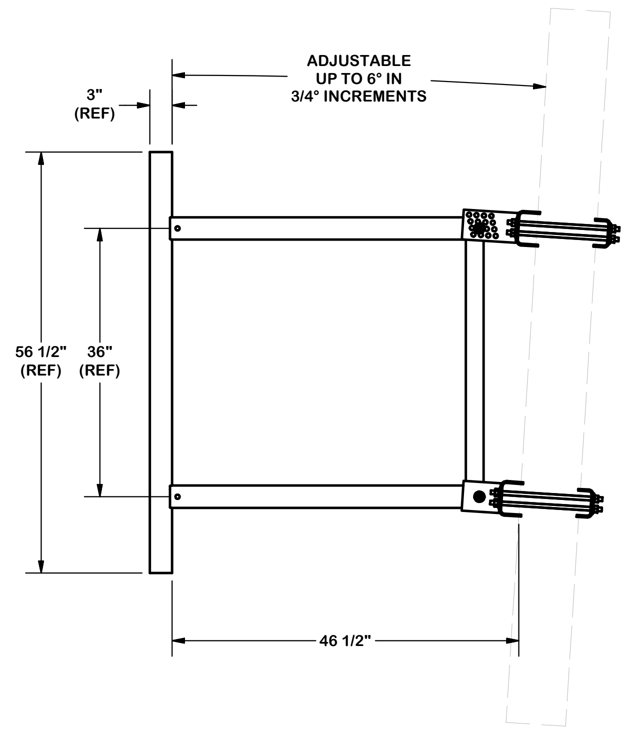




DETAIL A



DETAIL B



TOLERANCE NOTES

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

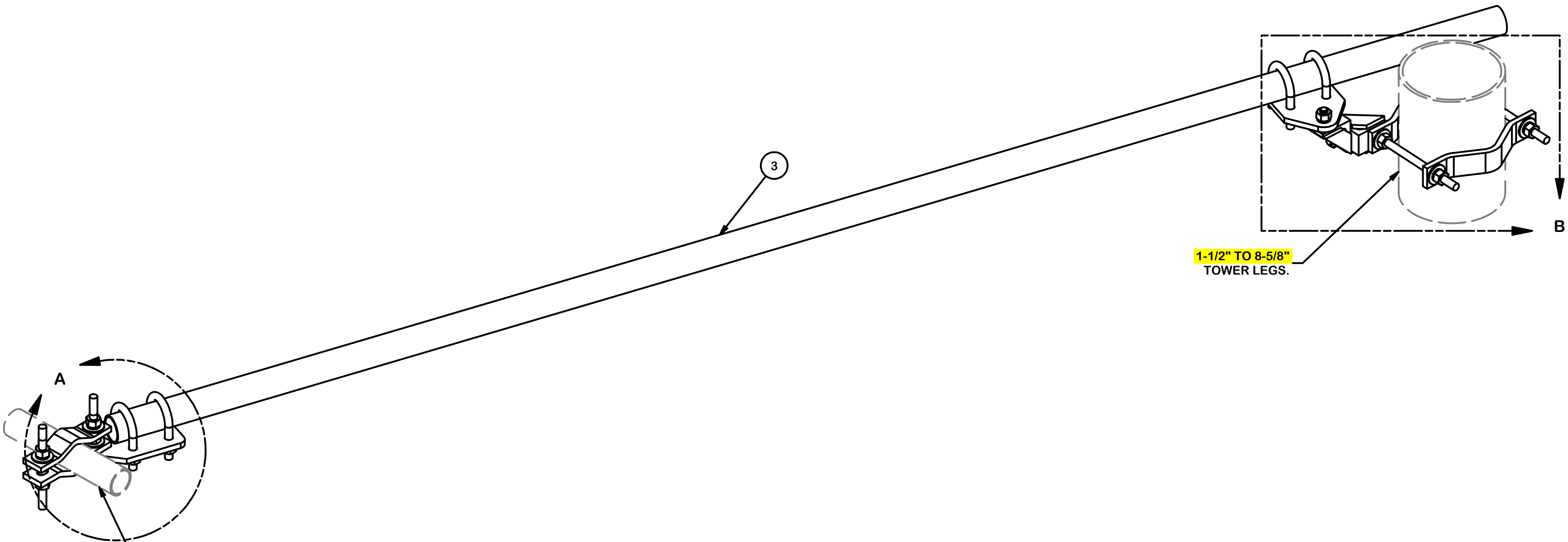
DESCRIPTION
48" ULTIMATE UNIVERSAL
STANDOFF FRAME

SITE PRO 1
A valmont COMPANY
Engineering Support Team:
1-888-753-7446
Locations:
New York, NY
Atlanta, GA
Los Angeles, CA
Plymouth, IN
Salem, OR
Dallas, TX

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

TOWER/MAST SIZE AT PROPOSED ANTENNA ATTACHMENT = 2.875" ± DIAMETER.
FRAME MAST SIZE AT PROPOSED ANTENNA ATTACHMENT = 3.000" ± DIAMETER.

PARTS LIST						
ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	2	X-SPTB	SLIDING PIPE TIE BACK PLATE	5 1/2 in	5.87	11.74
2	2	X-TBCA	TIE BACK CLIP ANGLE		2.08	4.16
3	1	P2126	2-3/8" OD X 126" SCH 40 GALVANIZED PIPE	126 in	40.75	40.75
4	2	MCP	CLAMP HALF 1/2" THICK, 11-5/8" LONG	12 1/16 in	3.59	7.19
5	4	DCP	1/2" THICK, 5-3/4" CNTER TO CENTER CLAMP HALF	8 1/8 in	2.42	9.68
6	2	G58R-12	5/8" x 12" THREADED ROD (HDG.)		1.05	2.09
7	4	G58R-8	5/8" x 8" THREADED ROD (HDG.)		0.70	2.79
8	4	X-UB5258	5/8" X 2-5/8" X 4-1/2" X 2" U-BOLT (HDG.)		1.00	4.00
9	4	G5804	5/8" x 4" HDG HEX BOLT GR5		0.44	1.78
10	2	G5802	5/8" x 2" HDG HEX BOLT GR5		0.27	0.54
11	10	G58FW	5/8" HDG USS FLATWASHER	1/8 in	0.07	0.70
12	18	G58LW	5/8" HDG LOCKWASHER		0.03	0.47
13	20	G58NUT	5/8" HDG HEAVY 2H HEX NUT		0.13	2.60
					TOTAL WT. #	88.49



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DRILLED AND GAS CUT HOLES *(± 0.030")* - NO CONING OF HOLES
LASER CUT EDGES AND HOLES *(± 0.010")* - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING *(± 0.030")*
ALL OTHER ASSEMBLY *(± 0.060")*

DESCRIPTION
SLIDING PIPE
TIE BACK ASSEMBLY

SITE PRO 1
A valmont COMPANY

Engineering Support Team:
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Locations:
New York, NY
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Los Angeles, CA
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Salem, OR
Dallas, TX

CPD NO.		DRAWN BY	ENG. APPROVAL	PART NO.
		CEK 10/19/2016		SPTB
CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.
81	02	CUSTOMER	BMC 11/17/2016	SPTB

ATTACHMENT C – STRUCTURAL ANALYSIS REPORT

Date: **March 4, 2020**

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

Subject:	**Structural Analysis Report**	
Eversource Designation:	**Site Number:** **Site Name:**	ES-005 ProspectRS
Engineering Firm Designation:	**Black & Veatch Corp. Project Number:**	403093
Site Data:	**18 Kluge Road, Prospect, New Haven, CT** **Latitude *41° 28' 20.5"*, Longitude *-72° 58' 13.1"*** **152 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 – 88.0%**

This analysis utilizes an ultimate 3-second gust wind speed of 135 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: Shreya Naphade

Respectfully submitted by:

Joshua J. Riley, P.E.

Professional Engineer

03/04/2020

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 152 ft Self Support tower designed by Rohn in November of 2005.

2) ANALYSIS CRITERIA

TIA-222 Revision: TIA-222-H
Risk Category: III
Wind Speed: 135 mph Ultimate
Exposure Category: C
Topographic Factor: 1
Ice Thickness: 1.5 in
Wind Speed with Ice: 50 mph
Seismic Ss: 0.188
Seismic S1: 0.063
Service Wind Speed: 60 mph

Table 1 - Proposed Equipment Configuration

<table>
<tr><th>Mounting Level (ft)</th><th>Center Line Elevation (ft)</th><th>Number of Antennas</th><th>Antenna Manufacturer</th><th>Antenna Model</th><th>Number of Feed Lines</th><th>Feed Line Size (in)</th><th>Note</th></tr>
<tr><td rowspan="2">147.0</td><td>160.0</td><td>1</td><td>dbspectra</td><td>DS2C03F36D-D</td><td rowspan="2">2</td><td rowspan="2">7/8</td><td rowspan="2">-</td></tr>
<tr><td>147.0</td><td>1</td><td>andrew</td><td>USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]</td></tr>
</table>

Table 2 - Existing Antenna and Cable Information

<table>
<tr><th>Mounting Level (ft)</th><th>Center Line Elevation (ft)</th><th>Number of Antennas</th><th>Antenna Manufacturer</th><th>Antenna Model</th><th>Number of Feed Lines</th><th>Feed Line Size (in)</th><th>Note</th></tr>
<tr><td rowspan="2">152.0</td><td>162.0</td><td>2</td><td>generic</td><td>2” Dia 20’ Omni</td><td rowspan="2">3</td><td rowspan="2">7/8</td><td rowspan="2">1</td></tr>
<tr><td>159.5</td><td>1</td><td>generic</td><td>2” Dia 15’ Omni</td></tr>
<tr><td rowspan="2">148.0</td><td rowspan="2">148.0</td><td>1</td><td>tower mounts</td><td>Pipe Mount [PM 602-1]</td><td rowspan="2">1</td><td rowspan="2">EW63</td><td rowspan="2">1</td></tr>
<tr><td>1</td><td>rfs celwave</td><td>PAL8-59A</td></tr>
<tr><td rowspan="2">141.0</td><td rowspan="2">141.0</td><td>1</td><td>tower mounts</td><td>Pipe Mount [PM 602-1]</td><td rowspan="2">1</td><td rowspan="2">EW63</td><td rowspan="2">1</td></tr>
<tr><td>1</td><td>celwave</td><td>4' PAD w/ Radome</td></tr>
<tr><td rowspan="2">135.0</td><td rowspan="2">135.0</td><td>1</td><td>generic</td><td>Folded Dipole</td><td rowspan="2">1</td><td rowspan="2">7/8</td><td rowspan="2">1</td></tr>
<tr><td>1</td><td>tower mounts</td><td>Side Arm Mount [SO 305-1]</td></tr>
<tr><td rowspan="3">122.0</td><td>123.5</td><td>1</td><td>decibel</td><td>DB586-Y</td><td rowspan="3">2</td><td rowspan="3">7/8</td><td rowspan="3">1</td></tr>
<tr><td>122.0</td><td>1</td><td>tower mounts</td><td>Side Arm Mount [SO 305-1]</td></tr>
<tr><td>120.5</td><td>1</td><td>decibel</td><td>DB586-Y</td></tr>
<tr><td rowspan="2">118.0</td><td rowspan="2">118.0</td><td>1</td><td>generic</td><td>Folded Dipole</td><td rowspan="2">1</td><td rowspan="2">7/8</td><td rowspan="2">1</td></tr>
<tr><td>1</td><td>tower mounts</td><td>Side Arm Mount [SO 305-1]</td></tr>
<tr><td rowspan="2">100.0</td><td>105.0</td><td>1</td><td>celwave</td><td>ANT220D6-9 9DT</td><td rowspan="2">1</td><td rowspan="2">7/8</td><td rowspan="2">1</td></tr>
<tr><td>100.0</td><td>1</td><td>tower mounts</td><td>Side Arm Mount [SO 311-1]</td></tr>
</table>

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
84.0	84.0	1	tower mounts	Pipe Mount [PM 602-1]	1	EW63	1
		1	rfs celwave	PAL8-59A			
70.0	75.0	1	decibel	DB222	1	1/2	1
	70.0	1	tower mounts	Side Arm Mount [SO 305-1]			

Notes:
1) Existing Equipment

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
GEOTECHNICAL REPORTS	Dr. Clarence Welti, P.E., P.C., dated 10/15/2005	-	Eversource
TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Rohn, dated 11/22/2005	-	Eversource
TOWER MANUFACTURER DRAWINGS	Rohn, dated 11/22/2005	-	Eversource
TOWER STRUCTURAL ANALYSIS REPORTS	NATCOMM, Inc., dated 10/20/2005	-	Eversource

3.1) Analysis Method

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

3.2) Assumptions

1) Tower and structures were built and maintained in accordance with the manufacturer's specifications.
2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
3) The existing base plate grout was considered in this analysis. Grout must be maintained and inspected periodically and must be replaced if damaged or cracked.
4) 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.
5) Tower loading is based on 2018 drone mapping photos.

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	152 - 140	Leg	ROHN 2.5 STD	1	-10.880	80.281	13.6	Pass

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T2	140 - 120	Leg	ROHN 2.5 STD	25	-36.743	66.738	55.1	Pass
T3	120 - 100	Leg	ROHN 2.5 STD	58	-57.427	66.697	86.1	Pass
T4	100 - 80	Leg	ROHN 3 EH	94	-75.732	116.144	65.2	Pass
T5	80 - 60	Leg	ROHN 3.5 EH	121	-95.741	132.009	72.5	Pass
T6	60 - 40	Leg	ROHN 3.5 EH	142	-116.113	132.012	88.0	Pass
T7	40 - 20	Leg	ROHN 4 EH	163	-136.305	167.903	81.2	Pass
T8	20 - 0	Leg	ROHN 5 EH	184	-154.098	211.294	72.9	Pass
T1	152 - 140	Diagonal	L1 3/4x1 3/4x3/16	8	-2.557	16.138	15.8 42.2 (b)	Pass
T2	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	29	-3.685	15.741	23.4 59.8 (b)	Pass
T3	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	64	-2.329	11.652	20.0 39.2 (b)	Pass
T4	100 - 80	Diagonal	L1 3/4x1 3/4x3/16	102	-2.876	6.867	41.9 47.1 (b)	Pass
T5	80 - 60	Diagonal	L2x2x3/16	126	-3.447	6.383	54.0	Pass
T6	60 - 40	Diagonal	L2 1/2x2 1/2x3/16	147	-3.823	9.683	39.5 46.1 (b)	Pass
T7	40 - 20	Diagonal	L2 1/2x2 1/2x3/16	169	-4.279	7.589	56.4	Pass
T8	20 - 0	Diagonal	L3x3x3/16	190	-5.147	8.990	57.2 58.8 (b)	Pass
T1	152 - 140	Top Girt	L1 3/4x1 3/4x3/16	4	-0.102	9.092	1.1 1.6 (b)	Pass
T3	120 - 100	Top Girt	L1 3/4x1 3/4x3/16	62	-0.399	9.092	4.4 7.0 (b)	Pass
							Summary	
						Leg (T6)	88.0	Pass
						Diagonal (T2)	59.8	Pass
						Top Girt (T3)	7.0	Pass
						Bolt Checks	59.8	Pass
						Rating =	88.0	Pass

Table 5 - Tower Component Stresses vs. Capacity - LC1

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	41.8	Pass
1	Base Foundation	0	32.2	Pass
1	Base Foundation Soil Interaction		46.8	Pass

Structure Rating (max from all components) =	88.0%

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

4.1) Recommendations

The tower and its foundations 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	152 - 140	4.015	42	0.271	0.037	OK
T2	140 - 120	3.338	40	0.266	0.028	OK
T3	120 - 100	2.285	40	0.224	0.014	OK
T4	100 - 80	1.486	40	0.153	0.009	OK
T5	80 - 60	0.914	40	0.113	0.01	OK
T6	60 - 40	0.494	47	0.08	0.006	OK

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

1) Maximum Rotation = 4 Degrees

2) Maximum Deflection = 0.03 * Tower Height = 55 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?*
148	PAL8-59A	0.27	0.035	8	10	10 dB	0.664	Not Exceeded
141	4' PAD w/ Radome	0.267	0.029	4	10	10 dB	1.328	Not Exceeded
84	PAL8-59A	0.12	0.01	8	10	10 dB	0.664	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	152 - 140	12.305	40	0.83	0.114	0.838	OK**
T2	140 - 120	10.211	40	0.816	0.086	0.821	OK**
T3	120 - 100	6.967	40	0.685	0.044	0.686	OK**
T4	100 - 80	4.537	47	0.467	0.029	0.468	OK
T5	80 - 60	2.808	47	0.345	0.03	0.346	OK
T6	60 - 40	1.524	47	0.245	0.019	0.246	OK

*Up to 0.5 degree is considered acceptable per SUB090 Section 7
**Deflection approved by Eversource Energy

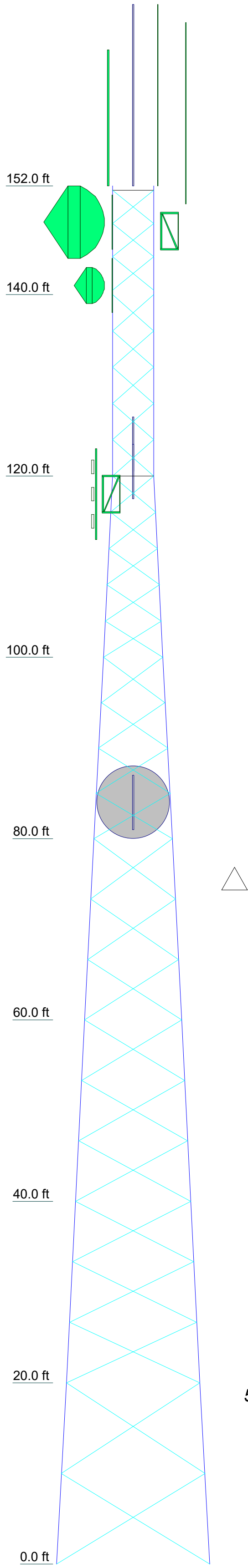
Critical Deflections of Tower at the MW Dish Elevations - Design Wind

Elevation ft	*Appurtenance*	*Gov. Load Comb.*	*Deflection in*	*Tilt °*	*Twist °*	*Radius of Curvature ft*
148	PAL8-59A	40	11.604	0.828	0.106	67859.000
141	4' PAD w/ Radome	40	10.384	0.818	0.089	28902.000
84	PAL8-59A	47	3.113	0.364	0.031	10398.000

APPENDIX A

TNXTOWER OUTPUT

Section	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Face Width (ft)	# Panels @ (ft)	Weight (K)
T1	ROHN 2.5 STD	A572-50	L1 3/4x1 3/4x3/16	A36	L1 3/4x1 3/4x3/16	4.58	3 @ 3.66667	0.5
T2					N.A.		10 @ 4	0.8
T3					L1 3/4x1 3/4x3/16			0.9
T4	ROHN 3 EH				N.A.	6.58	4 @ 5	1.1
T5	ROHN 3.5 EH		L2x2x3/16			8.59	9 @ 6.66667	1.3
T6			L2 1/2x2 1/2x3/16			10.65		1.6
T7	ROHN 4 EH					12.69		1.8
T8	ROHN 5 EH		L3x3x3/16			14.74	2 @ 10	2.2
						16.83		10.2



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
2" Dia 20' Omni	152	12"x12"x6" Junction Box	130
2" Dia 20' Omni	152	DB586-Y	122
2" Dia 15' Omni	152	Side Arm Mount [SO 305-1]	122
Pipe Mount [PM 602-1]	148	DB586-Y	122
PAL8-59A	148	Side Arm Mount [SO 305-1]	118
DS2C03F36D-D	147	Folded Dipole	118
USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]	147	ANT220D6-9 9DT	100
		Side Arm Mount [SO 311-1]	100
Pipe Mount [PM 602-1]	141	Pipe Mount [PM 602-1]	84
4' PAD w/ Radome	141	PAL8-59A	84
Folded Dipole	135	DB222	70
Side Arm Mount [SO 305-1]	135	Side Arm Mount [SO 305-1]	70

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 135 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 1.50 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. Risk Category III.
9. TOWER RATING: 88%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 159 K
SHEAR: 17 K

UPLIFT: -142 K
SHEAR: 15 K

AXIAL 54 K
SHEAR 7 K
MOMENT 617 kip-ft
TORQUE 6 kip-ft
50 mph WIND - 1.500 in ICE

AXIAL 16 K
SHEAR 27 K
MOMENT 2239 kip-ft
TORQUE 13 kip-ft
REACTIONS - 135 mph WIND

BLACK & VEATCH
Building a world of difference.

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6800 W. 115th St., Suite 2292
Overland Park, KS 66211
Phone: (913) 458-2984
FAX: (913) 458-8136

Job: ES-005 ProspectRS		
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 152.000 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 4.580 ft at the top and 16.830 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

1) Tower is located in New Haven County, Connecticut.
2) Tower base elevation above sea level: 795.000 ft.
3) Basic wind speed of 135 mph.
4) Risk Category III.
5) Exposure Category C.
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 1.500 in.
10) Ice thickness is considered to increase with height.
11) Ice density of 56.000 pcf.
12) A wind speed of 50 mph is used in combination with ice.
13) Temperature drop of 50.000 °F.
14) Deflections calculated using a wind speed of 60 mph.
15) Risk Category III..
16) Pressures are calculated at each section.
17) Stress ratio used in tower member design is 1.05.
18) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

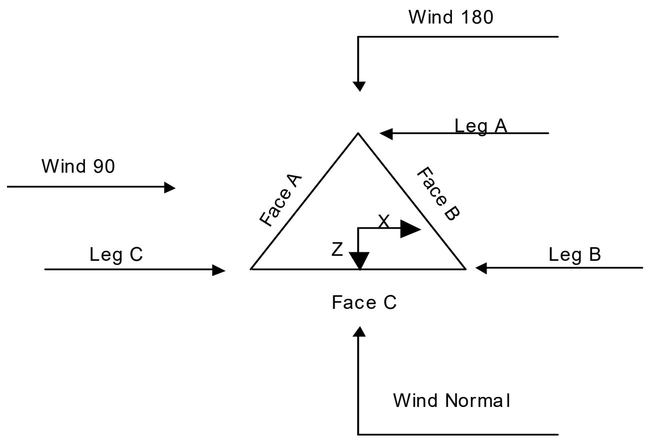
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
Use Code Stress Ratios
Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
√ Secondary Horizontal 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	152.000-140.000			4.580	1	12.000
T2	140.000-120.000			4.580	1	20.000
T3	120.000-100.000			4.580	1	20.000
T4	100.000-80.000			6.580	1	20.000
T5	80.000-60.000			8.590	1	20.000
T6	60.000-40.000			10.650	1	20.000
T7	40.000-20.000			12.690	1	20.000
T8	20.000-0.000			14.740	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	152.000-140.000	3.667	X Brace	No	No	6.000	6.000
T2	140.000-120.000	4.000	X Brace	No	No	0.000	0.000
T3	120.000-100.000	4.000	X Brace	No	No	0.000	0.000
T4	100.000-80.000	5.000	X Brace	No	No	0.000	0.000
T5	80.000-60.000	6.667	X Brace	No	No	0.000	0.000
T6	60.000-40.000	6.667	X Brace	No	No	0.000	0.000
T7	40.000-20.000	6.667	X Brace	No	No	0.000	0.000
T8	20.000-0.000	10.000	X Brace	No	No	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 152.000-140.000	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T2 140.000-120.000	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T3 120.000-100.000	Pipe	ROHN 2.5 STD	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T4 100.000-80.000	Pipe	ROHN 3 EH	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T5 80.000-60.000	Pipe	ROHN 3.5 EH	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T6 60.000-40.000	Pipe	ROHN 3.5 EH	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T7 40.000-20.000	Pipe	ROHN 4 EH	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T8 20.000-0.000	Pipe	ROHN 5 EH	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Top Girt Type*	*Top Girt Size*	*Top Girt Grade*	*Bottom Girt Type*	*Bottom Girt Size*	*Bottom Girt Grade*
T1 152.000-140.000	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)	Solid Round		A36 (36 ksi)
T3 120.000-100.000	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)	Solid Round		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation *ft*	*Gusset Area (per face)* *ft²*	*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 152.000-140.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T2 140.000-120.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T3 120.000-100.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T4 100.000-80.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T5 80.000-60.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T6 60.000-40.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T7 40.000-20.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt
T8 20.000-0.000	0.000	0.250	A36 (36 ksi)	1.05	1	1.05	Mid-Pt	Mid-Pt	Mid-Pt

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Calc K Single Angles*	*Calc K Solid Rounds*	*K Factors[1]* Legs	*X Brace Diags X Y*	*K Brace Diags X Y*	*Single Diags X Y*	*Girts X Y*	*Horiz. X Y*	*Sec. Horiz. X Y*	*Inner Brace X Y*
T1 152.000-140.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 140.000-120.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 120.000-100.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 100.000-80.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 80.000-60.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 60.000-40.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 40.000-20.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 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 152.000-140.000	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 140.000-120.000	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
T3 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
T4 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
T5 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
T6 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
T7 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
T8 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 152.000-140.000	Flange	0.625 A325N	4	0.625 A325N	1	0.625 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T2 140.000-120.000	Flange	0.625 A325N	4	0.625 A325N	1	0.000 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T3 120.000-100.000	Flange	0.750 A325N	4	0.625 A325N	1	0.625 A325N	1	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T4 100.000-80.000	Flange	0.875 A325N	4	0.625 A325N	1	0.000 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T5 80.000-60.000	Flange	0.875 A325N	4	0.625 A325N	1	0.000 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T6 60.000-40.000	Flange	1.000 A325N	4	0.625 A325N	1	0.000 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T7 40.000-20.000	Flange	1.000 A325N	4	0.625 A325N	1	0.000 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	0.625 A325N	0
T8 20.000-0.000	Flange	1.000 F1554-105	0	0.625 A325N	1	0.000 A325N	0	0.000 A325N	0	0.625 A325N	0	0.000 A325N	0	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
Safety Line 3/8	B	No	No	Ar (CaAa)	152.000 - 0.000	0.000	0.49	1	1	0.375	0.375		0.220
Feedline Ladder (Af)	B	No	No	Af (CaAa)	140.000 - 8.000	0.000	0.2	1	1	3.000	3.000		8.400
LDF5-50A(7/8")	B	No	No	Ar (CaAa)	152.000 - 8.000	0.000	0.13	1	1	0.500	1.090		0.330
LDF5-50A(7/8")	B	No	No	Ar (CaAa)	152.000 - 135.000	0.000	0.23	2	2	0.500	1.090		0.330
LDF5-50A(7/8")	B	No	No	Ar (CaAa)	135.000 - 130.000	0.000	0.23	3	3	0.500	1.090		0.330
LDF5-50A(7/8")	B	No	No	Ar (CaAa)	122.000 - 118.000	0.000	0.23	5	5	0.500	1.090		0.330
LDF5-50A(7/8")	B	No	No	Ar (CaAa)	118.000 - 100.000	0.000	0.23	6	6	0.500	1.090		0.330
LDF5-50A(7/8")	B	No	No	Ar (CaAa)	100.000 - 70.000	0.000	0.23	7	6	0.500	1.090		0.330
(6) LDF5-50A(7/8") + (1) LDF4-50A(1/2")	B	No	No	Ar (CaAa)	70.000 - 8.000	0.000	0.23	8	6	0.500	1.090		0.330
EW63	B	No	No	Ar (CaAa)	148.000 - 141.000	0.000	0.17	1	1	0.500	1.574		0.510
EW63	B	No	No	Ar (CaAa)	141.000 - 84.000	0.000	0.17	2	2	0.500	1.574		0.510
EW63	B	No	No	Ar (CaAa)	84.000 - 8.000	0.000	0.17	3	2	0.500	1.574		0.510
***													
Proposed													
LCF78-50J(7/8)	B	No	No	Ar (CaAa)	147.000 - 0.000	0.000	0.24	2	2	0.500	1.100		0.530

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
T1	152.000-140.000	A	0.000	0.000	0.000	0.000	0.000

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
		B	0.000	0.000	7.331	0.000	0.027
		C	0.000	0.000	0.000	0.000	0.000
T2	140.000-120.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	27.442	0.000	0.232
		C	0.000	0.000	0.000	0.000	0.000
T3	120.000-100.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	36.489	0.000	0.260
		C	0.000	0.000	0.000	0.000	0.000
T4	100.000-80.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	39.517	0.000	0.269
		C	0.000	0.000	0.000	0.000	0.000
T5	80.000-60.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	43.125	0.000	0.280
		C	0.000	0.000	0.000	0.000	0.000
T6	60.000-40.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	44.215	0.000	0.284
		C	0.000	0.000	0.000	0.000	0.000
T7	40.000-20.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	44.215	0.000	0.284
		C	0.000	0.000	0.000	0.000	0.000
T8	20.000-0.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	28.589	0.000	0.180
		C	0.000	0.000	0.000	0.000	0.000

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	152.000-140.000	A	2.002	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	35.762	0.000	0.458
		C		0.000	0.000	0.000	0.000	0.000
T2	140.000-120.000	A	1.978	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	95.444	0.000	1.397
		C		0.000	0.000	0.000	0.000	0.000
T3	120.000-100.000	A	1.946	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	114.506	0.000	1.658
		C		0.000	0.000	0.000	0.000	0.000
T4	100.000-80.000	A	1.907	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	115.903	0.000	1.690
		C		0.000	0.000	0.000	0.000	0.000
T5	80.000-60.000	A	1.860	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	117.050	0.000	1.708
		C		0.000	0.000	0.000	0.000	0.000
T6	60.000-40.000	A	1.798	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	115.033	0.000	1.656
		C		0.000	0.000	0.000	0.000	0.000
T7	40.000-20.000	A	1.709	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	112.099	0.000	1.568
		C		0.000	0.000	0.000	0.000	0.000
T8	20.000-0.000	A	1.531	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	73.625	0.000	0.937
		C		0.000	0.000	0.000	0.000	0.000

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	152.000-140.000	2.931	0.374	4.886	0.914
T2	140.000-120.000	5.283	0.446	7.141	0.942
T3	120.000-100.000	6.660	0.783	8.935	1.290

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T4	100.000-80.000	9.311	1.046	12.632	1.780
T5	80.000-60.000	11.490	1.259	15.355	2.147
T6	60.000-40.000	11.511	1.376	16.381	2.371
T7	40.000-20.000	12.234	1.509	17.466	2.578
T8	20.000-0.000	9.423	1.344	14.728	2.735

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	Safety Line 3/8	140.00 - 152.00	0.6000	0.4808
T1	3	LDF5-50A(7/8")	140.00 - 152.00	0.6000	0.4808
T1	4	LDF5-50A(7/8")	140.00 - 152.00	0.6000	0.4808
T1	14	EW63	141.00 - 148.00	0.6000	0.4808
T1	15	EW63	140.00 - 141.00	0.6000	0.4808
T1	22	LCF78-50J(7/8)	140.00 - 147.00	0.6000	0.4808
T2	1	Safety Line 3/8	120.00 - 140.00	0.6000	0.5087
T2	2	Feedline Ladder (Af)	120.00 - 140.00	0.6000	0.5087
T2	3	LDF5-50A(7/8")	120.00 - 140.00	0.6000	0.5087
T2	4	LDF5-50A(7/8")	135.00 - 140.00	0.6000	0.5087
T2	5	LDF5-50A(7/8")	130.00 - 135.00	0.6000	0.5087
T2	6	LDF5-50A(7/8")	120.00 - 122.00	0.6000	0.5087
T2	15	EW63	120.00 - 140.00	0.6000	0.5087
T2	22	LCF78-50J(7/8)	120.00 - 140.00	0.6000	0.5087
T3	1	Safety Line 3/8	100.00 - 120.00	0.6000	0.5437
T3	2	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.5437
T3	3	LDF5-50A(7/8")	100.00 - 120.00	0.6000	0.5437
T3	6	LDF5-50A(7/8")	118.00 - 120.00	0.6000	0.5437
T3	7	LDF5-50A(7/8")	100.00 - 118.00	0.6000	0.5437
T3	15	EW63	100.00 - 120.00	0.6000	0.5437
T3	22	LCF78-50J(7/8)	100.00 - 120.00	0.6000	0.5437
T4	1	Safety Line 3/8	80.00 - 100.00	0.6000	0.6000
T4	2	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T4	3	LDF5-50A(7/8")	80.00 - 100.00	0.6000	0.6000
T4	8	LDF5-50A(7/8")	80.00 - 100.00	0.6000	0.6000
T4	15	EW63	84.00 - 100.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T4	16	EW63	80.00 - 84.00	0.6000	0.6000
T4	22	LCF78-50J(7/8)	80.00 - 100.00	0.6000	0.6000
T5	1	Safety Line 3/8	60.00 - 80.00	0.6000	0.6000
T5	2	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T5	3	LDF5-50A(7/8")	60.00 - 80.00	0.6000	0.6000
T5	8	LDF5-50A(7/8")	70.00 - 80.00	0.6000	0.6000
T5	9	(6) LDF5-50A(7/8") + (1) LDF4-50A(1/2")	60.00 - 70.00	0.6000	0.6000
T5	16	EW63	60.00 - 80.00	0.6000	0.6000
T5	22	LCF78-50J(7/8)	60.00 - 80.00	0.6000	0.6000
T6	1	Safety Line 3/8	40.00 - 60.00	0.6000	0.6000
T6	2	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T6	3	LDF5-50A(7/8")	40.00 - 60.00	0.6000	0.6000
T6	9	(6) LDF5-50A(7/8") + (1) LDF4-50A(1/2")	40.00 - 60.00	0.6000	0.6000
T6	16	EW63	40.00 - 60.00	0.6000	0.6000
T6	22	LCF78-50J(7/8)	40.00 - 60.00	0.6000	0.6000
T7	1	Safety Line 3/8	20.00 - 40.00	0.6000	0.6000
T7	2	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T7	3	LDF5-50A(7/8")	20.00 - 40.00	0.6000	0.6000
T7	9	(6) LDF5-50A(7/8") + (1) LDF4-50A(1/2")	20.00 - 40.00	0.6000	0.6000
T7	16	EW63	20.00 - 40.00	0.6000	0.6000
T7	22	LCF78-50J(7/8)	20.00 - 40.00	0.6000	0.6000
T8	1	Safety Line 3/8	0.00 - 20.00	0.6000	0.6000
T8	2	Feedline Ladder (Af)	8.00 - 20.00	0.6000	0.6000
T8	3	LDF5-50A(7/8")	8.00 - 20.00	0.6000	0.6000
T8	9	(6) LDF5-50A(7/8") + (1) LDF4-50A(1/2")	8.00 - 20.00	0.6000	0.6000
T8	16	EW63	8.00 - 20.00	0.6000	0.6000
T8	22	LCF78-50J(7/8)	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
2" Dia 20' Omni	A	From Leg	0.500 0.000 10.000	0.000	152.000	No Ice 1/2" Ice	4.000 6.025 8.067	4.000 6.025 8.067	0.021 0.052 0.095

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	12.200	12.200	0.220
						2" Ice			
2" Dia 20' Omni	B	From Leg	0.500	0.000	152.000	No Ice	4.000	4.000	0.021
			0.000			1/2"	6.025	6.025	0.052
			10.000			Ice	8.067	8.067	0.095
						1" Ice	12.200	12.200	0.220
						2" Ice			
2" Dia 15' Omni	C	From Leg	0.500	0.000	152.000	No Ice	3.000	3.000	0.020
			0.000			1/2"	4.525	4.525	0.043
			7.500			Ice	6.067	6.067	0.076
						1" Ice	9.200	9.200	0.170
						2" Ice			
Pipe Mount [PM 602-1]	C	From Leg	0.000	0.000	148.000	No Ice	2.780	2.780	0.093
			0.000			1/2"	3.210	3.210	0.115
			0.000			Ice	3.640	3.640	0.141
						1" Ice	4.540	4.540	0.209
						2" Ice			
Pipe Mount [PM 602-1]	C	From Leg	0.000	0.000	141.000	No Ice	2.780	2.780	0.093
			0.000			1/2"	3.210	3.210	0.115
			0.000			Ice	3.640	3.640	0.141
						1" Ice	4.540	4.540	0.209
						2" Ice			
Folded Dipole	A	From Leg	2.000	0.000	135.000	No Ice	1.852	1.852	0.016
			0.000			1/2"	2.933	2.933	0.031
			0.000			Ice	4.031	4.031	0.052
						1" Ice	6.019	6.019	0.116
						2" Ice			
Side Arm Mount [SO 305-1]	A	From Leg	0.000	0.000	135.000	No Ice	0.530	1.520	0.030
			0.000			1/2"	0.780	2.070	0.044
			0.000			Ice	1.060	2.660	0.064
						1" Ice	1.730	3.910	0.125
						2" Ice			
12"x12"x6" Junction Box	B	From Face	0.000	0.000	130.000	No Ice	1.200	0.600	0.050
			0.000			1/2"	1.337	0.704	0.060
			0.000			Ice	1.481	0.815	0.073
						1" Ice	1.793	1.059	0.105
						2" Ice			
DB586-Y	A	From Leg	3.000	0.000	122.000	No Ice	1.014	1.014	0.008
			0.000			1/2"	1.282	1.282	0.017
			1.500			Ice	1.558	1.558	0.028
						1" Ice	2.139	2.139	0.061
						2" Ice			
DB586-Y	A	From Leg	3.000	0.000	122.000	No Ice	1.014	1.014	0.008
			0.000			1/2"	1.282	1.282	0.017
			-1.500			Ice	1.558	1.558	0.028
						1" Ice	2.139	2.139	0.061
						2" Ice			
Side Arm Mount [SO 305-1]	A	From Leg	0.000	0.000	122.000	No Ice	0.530	1.520	0.030
			0.000			1/2"	0.780	2.070	0.044
			0.000			Ice	1.060	2.660	0.064
						1" Ice	1.730	3.910	0.125
						2" Ice			
Folded Dipole	C	From Leg	2.000	0.000	118.000	No Ice	1.852	1.852	0.016
			0.000			1/2"	2.933	2.933	0.031
			0.000			Ice	4.031	4.031	0.052
						1" Ice	6.019	6.019	0.116
						2" Ice			
Side Arm Mount [SO 305-1]	C	From Leg	0.000	0.000	118.000	No Ice	0.530	1.520	0.030
			0.000			1/2"	0.780	2.070	0.044
			0.000			Ice	1.060	2.660	0.064
						1" Ice	1.730	3.910	0.125
						2" Ice			
ANT220D6-9 9DT	A	From Leg	3.000	0.000	100.000	No Ice	3.300	3.300	0.036
			0.000			1/2"	4.433	4.433	0.060
			5.000			Ice	5.583	5.583	0.091

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft²*	*C_AA_A Side* *ft²*	*Weight* *K*
						1" Ice 2" Ice	7.115	7.115	0.175
Side Arm Mount [SO 311-1]	A	From Leg	0.000 0.000 0.000	0.000	100.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.670 2.430 3.210 4.840	4.530 6.410 8.370 12.720	0.062 0.099 0.148 0.283
Pipe Mount [PM 602-1]	A	From Leg	0.000 0.000 0.000	0.000	84.000	No Ice 1/2" Ice 1" Ice 2" Ice	2.780 3.210 3.640 4.540	2.780 3.210 3.640 4.540	0.093 0.115 0.141 0.209
Side Arm Mount [SO 305-1]	A	From Leg	0.000 0.000 0.000	0.000	70.000	No Ice 1/2" Ice 1" Ice 2" Ice	0.530 0.780 1.060 1.730	1.520 2.070 2.660 3.910	0.030 0.044 0.064 0.125
DB222	A	From Leg	3.000 0.000 5.000	0.000	70.000	No Ice 1/2" Ice 1" Ice 2" Ice	1.600 2.880 4.160 6.720	1.600 2.880 4.160 6.720	0.016 0.021 0.026 0.035
***Proposed** DS2C03F36D-D	B	From Leg	4.000 0.000 13.000	0.000	147.000	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	0.070 0.122 0.190 0.372
USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]	B	From Leg	2.000 0.000 0.000	0.000	147.000	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	0.177 0.220 0.277 0.435
**********									

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* *ft²*	*Weight* *K*
PAL8-59A	C	Paraboloid w/Radome	From Leg	1.000 0.000 0.000	0.000		148.000	8.000	No Ice 1/2" Ice 1" Ice 2" Ice	50.240 51.292 52.344 54.448	0.280 0.543 0.807 1.333
4' PAD w/ Radome	C	Paraboloid w/Radome	From Leg	1.000 0.000 0.000	0.000		141.000	4.000	No Ice 1/2" Ice 1" Ice 2" Ice	12.570 13.100 13.630 14.690	0.135 0.185 0.235 0.335
PAL8-59A	A	Paraboloid w/Radome	From Leg	1.000 0.000 0.000	0.000		84.000	8.000	No Ice 1/2" Ice 1" Ice 2" Ice	50.240 51.292 52.344 54.448	0.280 0.543 0.807 1.333
Proposed											

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	152 - 140	Leg	Max Tension	7	9.770	0.501	-0.170
			Max. Compression	18	-10.880	0.533	-0.206
			Max. Mx	8	8.181	-0.594	0.038
			Max. My	3	-9.715	-0.117	0.544
			Max. Vy	8	2.200	-0.594	0.038
			Max. Vx	2	-2.034	-0.116	0.544
		Diagonal	Max Tension	20	2.577	0.000	0.000
			Max. Compression	8	-2.557	0.000	0.000

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	30	0.665	0.014	-0.001
			Max. My	22	-2.251	-0.001	0.005
			Max. Vy	30	-0.020	0.014	-0.001
			Max. Vx	22	-0.002	0.000	0.000
		Top Girt	Max Tension	7	0.097	0.000	0.000
			Max. Compression	4	-0.102	0.000	0.000
			Max. Mx	26	-0.036	-0.036	0.000
			Max. Vy	26	0.031	0.000	0.000
T2	140 - 120	Leg	Max Tension	7	36.398	-0.041	0.044
			Max. Compression	18	-36.743	0.193	-0.119
			Max. Mx	8	10.374	-0.594	0.038
			Max. My	3	-12.003	-0.117	0.544
			Max. Vy	8	-0.197	-0.594	0.038
			Max. Vx	3	0.183	-0.117	0.544
		Diagonal	Max Tension	9	3.652	0.022	0.003
			Max. Compression	8	-3.685	0.000	0.000
			Max. Mx	4	1.246	0.030	0.001
			Max. My	23	-0.892	-0.018	0.008
			Max. Vy	31	-0.023	0.023	0.001
			Max. Vx	23	-0.003	0.000	0.000
T3	120 - 100	Leg	Max Tension	7	56.158	-0.118	-0.005
			Max. Compression	18	-57.427	0.107	0.009
			Max. Mx	18	-42.158	0.226	-0.007
			Max. My	5	-1.547	-0.007	-0.266
			Max. Vy	10	0.091	0.221	0.009
			Max. Vx	12	0.129	-0.009	-0.231
		Diagonal	Max Tension	20	2.389	0.000	0.000
			Max. Compression	10	-2.418	0.000	0.000
			Max. Mx	8	0.735	0.031	-0.004
			Max. My	20	-2.337	-0.016	0.009
			Max. Vy	29	0.028	0.024	0.002
			Max. Vx	20	-0.003	0.000	0.000
		Top Girt	Max Tension	6	0.427	0.000	0.000
			Max. Compression	19	-0.399	0.000	0.000
			Max. Mx	26	0.016	-0.035	0.000
			Max. My	26	0.031	0.000	0.001
			Max. Vy	26	0.030	0.000	0.000
			Max. Vx	26	0.001	0.000	0.000
T4	100 - 80	Leg	Max Tension	7	72.803	-0.256	0.069
			Max. Compression	18	-75.732	0.281	-0.084
			Max. Mx	14	54.466	-0.357	0.014
			Max. My	8	-3.410	-0.022	0.393
			Max. Vy	14	-0.567	-0.357	0.014
			Max. Vx	20	-0.701	-0.039	-0.310
		Diagonal	Max Tension	16	2.875	0.000	0.000
			Max. Compression	16	-2.876	0.000	0.000
			Max. Mx	29	0.566	0.037	0.004
			Max. My	27	-0.864	0.030	-0.005
			Max. Vy	29	0.035	0.037	0.004
			Max. Vx	27	0.002	0.000	0.000
T5	80 - 60	Leg	Max Tension	7	89.734	-0.265	0.005
			Max. Compression	18	-95.741	0.251	0.024
			Max. Mx	14	63.428	-0.284	0.022
			Max. My	8	-3.303	-0.022	0.393
			Max. Vy	19	-0.082	0.272	-0.008
			Max. Vx	10	0.107	-0.110	0.250
		Diagonal	Max Tension	12	3.344	0.000	0.000
			Max. Compression	10	-3.447	0.000	0.000
			Max. Mx	29	0.658	0.059	-0.008
			Max. My	38	-1.043	0.052	-0.008
			Max. Vy	29	0.046	0.059	-0.008
			Max. Vx	38	0.003	0.000	0.000
T6	60 - 40	Leg	Max Tension	7	106.888	-0.223	-0.020
			Max. Compression	18	-116.113	0.252	0.016
			Max. Mx	35	-41.045	0.259	0.004
			Max. My	4	-4.167	-0.003	-0.329
			Max. Vy	37	-0.071	-0.191	-0.006
			Max. Vx	4	-0.097	-0.003	-0.329
		Diagonal	Max Tension	12	3.788	0.000	0.000

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	10	-3.823	0.000	0.000
			Max. Mx	29	0.592	0.098	0.011
			Max. My	27	0.304	0.095	-0.012
			Max. Vy	29	0.063	0.098	0.011
			Max. Vx	27	0.003	0.000	0.000
T7	40 - 20	Leg	Max Tension	7	123.704	-0.206	-0.017
			Max. Compression	18	-136.305	0.545	0.021
			Max. Mx	29	21.266	-0.770	-0.009
			Max. My	4	-5.712	-0.013	-0.412
			Max. Vy	37	0.203	-0.763	-0.006
			Max. Vx	4	-0.119	-0.013	-0.412
		Diagonal	Max Tension	12	4.199	0.000	0.000
			Max. Compression	2	-4.279	0.000	0.000
			Max. Mx	29	0.267	0.114	-0.013
			Max. My	27	1.010	0.098	-0.014
			Max. Vy	29	0.067	0.101	0.014
			Max. Vx	27	0.004	0.000	0.000
T8	20 - 0	Leg	Max Tension	7	138.248	-0.489	-0.031
			Max. Compression	18	-154.098	0.000	0.000
			Max. Mx	29	23.606	-0.770	-0.009
			Max. My	4	-6.541	-0.041	-1.127
			Max. Vy	37	-0.161	-0.763	-0.006
			Max. Vx	4	-0.218	-0.041	-1.127
		Diagonal	Max Tension	12	4.836	0.000	0.000
			Max. Compression	2	-5.147	0.000	0.000
			Max. Mx	29	-0.028	0.169	-0.018
			Max. My	28	1.595	0.138	-0.024
			Max. Vy	30	0.079	0.139	0.023
			Max. Vx	28	0.005	0.000	0.000

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	18	158.915	14.497	-8.190
	Max. H_x	18	158.915	14.497	-8.190
	Max. H_z	7	-142.144	-12.779	7.214
	Min. Vert	7	-142.144	-12.779	7.214
	Min. H_x	7	-142.144	-12.779	7.214
	Min. H_z	18	158.915	14.497	-8.190
Leg B	Max. Vert	10	152.813	-13.642	-8.300
	Max. H_x	23	-122.411	11.229	6.837
	Max. H_z	23	-122.411	11.229	6.837
	Min. Vert	23	-122.411	11.229	6.837
	Min. H_x	10	152.813	-13.642	-8.300
	Min. H_z	10	152.813	-13.642	-8.300
Leg A	Max. Vert	2	152.690	0.452	15.965
	Max. H_x	20	2.843	1.792	0.211
	Max. H_z	2	152.690	0.452	15.965
	Min. Vert	15	-127.774	-0.378	-13.672
	Min. H_x	11	-67.126	-1.850	-7.301
	Min. H_z	15	-127.774	-0.378	-13.672

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	13.585	0.000	0.000	-0.923	-5.625	-0.000
1.2 Dead+1.0 Wind 0 deg -	16.302	0.361	-25.900	-2146.282	-60.052	12.850

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
No Ice						
0.9 Dead+1.0 Wind 0 deg - No Ice	12.227	0.361	-25.900	-2146.005	-58.364	12.850
1.2 Dead+1.0 Wind 30 deg - No Ice	16.302	12.990	-22.251	-1888.640	-1116.324	12.362
0.9 Dead+1.0 Wind 30 deg - No Ice	12.227	12.990	-22.251	-1888.363	-1114.637	12.362
1.2 Dead+1.0 Wind 60 deg - No Ice	16.302	21.634	-12.355	-1056.687	-1852.645	3.938
0.9 Dead+1.0 Wind 60 deg - No Ice	12.227	21.634	-12.355	-1056.410	-1850.957	3.938
1.2 Dead+1.0 Wind 90 deg - No Ice	16.302	25.495	0.149	3.698	-2171.717	-5.317
0.9 Dead+1.0 Wind 90 deg - No Ice	12.227	25.495	0.149	3.975	-2170.030	-5.317
1.2 Dead+1.0 Wind 120 deg - No Ice	16.302	22.519	12.782	1037.505	-1881.390	-10.165
0.9 Dead+1.0 Wind 120 deg - No Ice	12.227	22.519	12.782	1037.782	-1879.702	-10.165
1.2 Dead+1.0 Wind 150 deg - No Ice	16.302	11.920	19.894	1617.953	-1003.933	-9.452
0.9 Dead+1.0 Wind 150 deg - No Ice	12.227	11.920	19.894	1618.230	-1002.246	-9.452
1.2 Dead+1.0 Wind 180 deg - No Ice	16.302	0.044	23.409	1921.453	-12.906	-11.192
0.9 Dead+1.0 Wind 180 deg - No Ice	12.227	0.044	23.409	1921.730	-11.219	-11.192
1.2 Dead+1.0 Wind 210 deg - No Ice	16.302	-12.866	22.061	1828.181	1067.388	-11.513
0.9 Dead+1.0 Wind 210 deg - No Ice	12.227	-12.866	22.061	1828.458	1069.075	-11.513
1.2 Dead+1.0 Wind 240 deg - No Ice	16.302	-23.343	13.675	1133.980	1928.386	-4.734
0.9 Dead+1.0 Wind 240 deg - No Ice	12.227	-23.343	13.675	1134.257	1930.074	-4.734
1.2 Dead+1.0 Wind 270 deg - No Ice	16.302	-24.710	0.377	37.766	2043.162	3.475
0.9 Dead+1.0 Wind 270 deg - No Ice	12.227	-24.710	0.377	38.043	2044.850	3.475
1.2 Dead+1.0 Wind 300 deg - No Ice	16.302	-19.554	-11.206	-922.598	1594.581	9.302
0.9 Dead+1.0 Wind 300 deg - No Ice	12.227	-19.554	-11.206	-922.321	1596.269	9.302
1.2 Dead+1.0 Wind 330 deg - No Ice	16.302	-10.997	-19.782	-1634.274	872.207	10.446
0.9 Dead+1.0 Wind 330 deg - No Ice	12.227	-10.997	-19.782	-1633.997	873.895	10.446
1.2 Dead+1.0 Ice+1.0 Temp	54.110	0.000	0.000	-2.419	-36.651	-0.000
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	54.110	0.054	-6.565	-564.043	-44.671	5.583
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	54.110	3.375	-5.776	-503.125	-330.684	5.247
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	54.110	5.829	-3.326	-291.485	-543.219	2.820
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	54.110	6.679	0.022	-1.829	-616.572	-0.710
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	54.110	5.732	3.257	273.236	-528.919	-3.304
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	54.110	3.185	5.371	453.531	-311.116	-4.596
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	54.110	0.007	6.273	532.188	-37.498	-5.338
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	54.110	-3.356	5.746	489.503	252.040	-5.121
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	54.110	-6.013	3.481	295.273	477.749	-2.937
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	54.110	-6.562	0.055	3.394	526.114	0.438
1.2 Dead+1.0 Wind 300	54.110	-5.361	-3.063	-263.839	420.338	3.177

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 330 deg+1.0 Ice+1.0 Temp	54.110	-3.048	-5.356	-460.573	220.242	4.742
Dead+Wind 0 deg - Service	13.585	0.071	-5.116	-424.661	-16.154	2.538
Dead+Wind 30 deg - Service	13.585	2.566	-4.395	-373.769	-224.800	2.442
Dead+Wind 60 deg - Service	13.585	4.273	-2.441	-209.432	-370.246	0.778
Dead+Wind 90 deg - Service	13.585	5.036	0.029	0.026	-433.273	-1.050
Dead+Wind 120 deg - Service	13.585	4.448	2.525	204.235	-375.924	-2.008
Dead+Wind 150 deg - Service	13.585	2.355	3.930	318.892	-202.599	-1.867
Dead+Wind 180 deg - Service	13.585	0.009	4.624	378.842	-6.841	-2.211
Dead+Wind 210 deg - Service	13.585	-2.541	4.358	360.418	206.551	-2.274
Dead+Wind 240 deg - Service	13.585	-4.611	2.701	223.292	376.624	-0.935
Dead+Wind 270 deg - Service	13.585	-4.881	0.074	6.756	399.296	0.686
Dead+Wind 300 deg - Service	13.585	-3.863	-2.214	-182.946	310.688	1.837
Dead+Wind 330 deg - Service	13.585	-2.172	-3.908	-323.524	167.996	2.063

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	0.000	-13.585	0.000	-0.000	13.585	0.000	0.000%
2	0.361	-16.302	-25.900	-0.361	16.302	25.900	0.000%
3	0.361	-12.227	-25.900	-0.361	12.227	25.900	0.000%
4	12.990	-16.302	-22.251	-12.990	16.302	22.251	0.000%
5	12.990	-12.227	-22.251	-12.990	12.227	22.251	0.000%
6	21.634	-16.302	-12.355	-21.634	16.302	12.355	0.000%
7	21.634	-12.227	-12.355	-21.634	12.227	12.355	0.000%
8	25.495	-16.302	0.149	-25.495	16.302	-0.149	0.000%
9	25.495	-12.227	0.149	-25.495	12.227	-0.149	0.000%
10	22.519	-16.302	12.782	-22.519	16.302	-12.782	0.000%
11	22.519	-12.227	12.782	-22.519	12.227	-12.782	0.000%
12	11.920	-16.302	19.894	-11.920	16.302	-19.894	0.000%
13	11.920	-12.227	19.894	-11.920	12.227	-19.894	0.000%
14	0.044	-16.302	23.409	-0.044	16.302	-23.409	0.000%
15	0.044	-12.227	23.409	-0.044	12.227	-23.409	0.000%
16	-12.866	-16.302	22.061	12.866	16.302	-22.061	0.000%
17	-12.866	-12.227	22.061	12.866	12.227	-22.061	0.000%
18	-23.343	-16.302	13.675	23.343	16.302	-13.675	0.000%
19	-23.343	-12.227	13.675	23.343	12.227	-13.675	0.000%
20	-24.710	-16.302	0.377	24.710	16.302	-0.377	0.000%
21	-24.710	-12.227	0.377	24.710	12.227	-0.377	0.000%
22	-19.554	-16.302	-11.206	19.554	16.302	11.206	0.000%
23	-19.554	-12.227	-11.206	19.554	12.227	11.206	0.000%
24	-10.997	-16.302	-19.782	10.997	16.302	19.782	0.000%
25	-10.997	-12.227	-19.782	10.997	12.227	19.782	0.000%
26	0.000	-54.110	0.000	-0.000	54.110	-0.000	0.000%
27	0.054	-54.110	-6.565	-0.054	54.110	6.565	0.000%
28	3.375	-54.110	-5.776	-3.375	54.110	5.776	0.000%
29	5.829	-54.110	-3.326	-5.829	54.110	3.326	0.000%
30	6.679	-54.110	0.022	-6.679	54.110	-0.022	0.000%
31	5.732	-54.110	3.257	-5.732	54.110	-3.257	0.000%
32	3.185	-54.110	5.371	-3.185	54.110	-5.371	0.000%
33	0.007	-54.110	6.273	-0.007	54.110	-6.273	0.000%
34	-3.356	-54.110	5.746	3.356	54.110	-5.746	0.000%
35	-6.013	-54.110	3.481	6.013	54.110	-3.481	0.000%
36	-6.562	-54.110	0.055	6.562	54.110	-0.055	0.000%
37	-5.361	-54.110	-3.063	5.361	54.110	3.063	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
38	-3.048	-54.110	-5.356	3.048	54.110	5.356	0.000%
39	0.071	-13.585	-5.116	-0.071	13.585	5.116	0.000%
40	2.566	-13.585	-4.395	-2.566	13.585	4.395	0.000%
41	4.273	-13.585	-2.441	-4.273	13.585	2.441	0.000%
42	5.036	-13.585	0.029	-5.036	13.585	-0.029	0.000%
43	4.448	-13.585	2.525	-4.448	13.585	-2.525	0.000%
44	2.355	-13.585	3.930	-2.355	13.585	-3.930	0.000%
45	0.009	-13.585	4.624	-0.009	13.585	-4.624	0.000%
46	-2.541	-13.585	4.358	2.541	13.585	-4.358	0.000%
47	-4.611	-13.585	2.701	4.611	13.585	-2.701	0.000%
48	-4.881	-13.585	0.074	4.881	13.585	-0.074	0.000%
49	-3.863	-13.585	-2.214	3.863	13.585	2.214	0.000%
50	-2.172	-13.585	-3.908	2.172	13.585	3.908	0.000%

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	152 - 140	4.015	42	0.271	0.037
T2	140 - 120	3.338	40	0.266	0.028
T3	120 - 100	2.285	40	0.224	0.014
T4	100 - 80	1.486	40	0.153	0.009
T5	80 - 60	0.914	40	0.113	0.010
T6	60 - 40	0.494	47	0.080	0.006
T7	40 - 20	0.214	47	0.047	0.004
T8	20 - 0	0.056	47	0.020	0.002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
152.000	2" Dia 20' Omni	42	4.015	0.271	0.037	176758
148.000	PAL8-59A	40	3.788	0.270	0.035	176758
147.000	DS2C03F36D-D	40	3.731	0.270	0.034	176758
141.000	4' PAD w/ Radome	40	3.394	0.267	0.029	77023
135.000	Folded Dipole	40	3.060	0.260	0.023	38185
130.000	12"x12"x6" Junction Box	40	2.790	0.251	0.017	25490
122.000	DB586-Y	40	2.381	0.230	0.015	16601
118.000	Folded Dipole	40	2.193	0.217	0.014	15621
100.000	ANT220D6-9 9DT	40	1.486	0.153	0.009	20684
84.000	PAL8-59A	40	1.015	0.120	0.010	31642
70.000	Side Arm Mount [SO 305-1]	40	0.686	0.097	0.008	34412

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	152 - 140	20.346	5	1.375	0.189
T2	140 - 120	16.876	4	1.351	0.142
T3	120 - 100	11.510	4	1.133	0.072
T4	100 - 80	7.514	19	0.771	0.048
T5	80 - 60	4.649	19	0.569	0.049
T6	60 - 40	2.524	19	0.406	0.031

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T7	40 - 20	1.094	19	0.239	0.021
T8	20 - 0	0.286	19	0.100	0.009

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
152.000	2" Dia 20' Omni	5	20.346	1.375	0.189	41813
148.000	PAL8-59A	5	19.184	1.372	0.175	41813
147.000	DS2C03F36D-D	5	18.894	1.371	0.171	41813
141.000	4' PAD w/ Radome	4	17.163	1.355	0.147	17681
135.000	Folded Dipole	4	15.456	1.320	0.114	7843
130.000	12"x12"x6" Junction Box	4	14.075	1.273	0.086	5046
122.000	DB586-Y	4	11.996	1.166	0.075	3245
118.000	Folded Dipole	19	11.041	1.098	0.069	3057
100.000	ANT220D6-9 9DT	19	7.514	0.771	0.048	4086
84.000	PAL8-59A	19	5.155	0.601	0.052	6296
70.000	Side Arm Mount [SO 305-1]	19	3.501	0.489	0.040	6870

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	152	Leg	A325N	0.625	4	2.443	20.340	0.120	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	2.577	5.811	0.443	1.05	Member Block Shear
		Top Girt	A325N	0.625	1	0.097	5.811	0.017	1.05	Member Block Shear
T2	140	Leg	A325N	0.625	4	9.099	20.340	0.447	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	3.652	5.811	0.628	1.05	Member Block Shear
T3	120	Leg	A325N	0.750	4	14.040	30.101	0.466	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	2.389	5.811	0.411	1.05	Member Block Shear
		Top Girt	A325N	0.625	1	0.427	5.811	0.073	1.05	Member Block Shear
T4	100	Leg	A325N	0.875	4	18.201	41.556	0.438	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	2.875	5.811	0.495	1.05	Member Block Shear
T5	80	Leg	A325N	0.875	4	22.433	41.556	0.540	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	3.344	6.831	0.490	1.05	Member Block Shear
T6	60	Leg	A325N	1.000	4	26.722	54.517	0.490	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	3.788	7.830	0.484	1.05	Member Bearing
T7	40	Leg	A325N	1.000	4	30.926	54.517	0.567	1.05	Bolt Tension
		Diagonal	A325N	0.625	1	4.199	7.830	0.536	1.05	Member Bearing
T8	20	Diagonal	A325N	0.625	1	4.836	7.830	0.618	1.05	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	152 - 140	ROHN 2.5 STD	12.000	0.500	6.3 K=1.00	1.704	-10.880	76.458	0.142 [1]
T2	140 - 120	ROHN 2.5 STD	20.000	4.000	50.7 K=1.00	1.704	-36.743	63.560	0.578 [1]
T3	120 - 100	ROHN 2.5 STD	20.033	4.007	50.7 K=1.00	1.704	-57.427	63.521	0.904 [1]
T4	100 - 80	ROHN 3 EH	20.034	5.008	52.9 K=1.00	3.016	-75.732	110.613	0.685 [1]
T5	80 - 60	ROHN 3.5 EH	20.035	6.678	61.3 K=1.00	3.678	-95.741	125.723	0.762 [1]
T6	60 - 40	ROHN 3.5 EH	20.035	6.678	61.3 K=1.00	3.678	-116.113	125.726	0.924 [1]
T7	40 - 20	ROHN 4 EH	20.035	6.678	54.3 K=1.00	4.407	-136.305	159.908	0.852 [1]
T8	20 - 0	ROHN 5 EH	20.036	10.018	65.4 K=1.00	6.112	-154.098	201.232	0.766 [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	152 - 140	L1 3/4x1 3/4x3/16	5.867	2.660	99.7 K=1.07	0.621	-2.557	15.369	0.166 [1]
T2	140 - 120	L1 3/4x1 3/4x3/16	6.081	2.762	102.4 K=1.06	0.621	-3.685	14.992	0.246 [1]
T3	120 - 100	L1 3/4x1 3/4x3/16	7.531	3.622	126.6 K=1.00	0.621	-2.329	11.097	0.210 [1]
T4	100 - 80	L1 3/4x1 3/4x3/16	9.724	4.719	164.9 K=1.00	0.621	-2.876	6.540	0.440 [1]
T5	80 - 60	L2x2x3/16	12.276	6.024	183.5 K=1.00	0.715	-3.447	6.079	0.567 [1]
T6	60 - 40	L2 1/2x2 1/2x3/16	14.036	6.902	167.3 K=1.00	0.902	-3.823	9.222	0.415 [1]
T7	40 - 20	L2 1/2x2 1/2x3/16	15.868	7.796	189.0 K=1.00	0.902	-4.279	7.228	0.592 [1]
T8	20 - 0	L3x3x3/16	19.132	9.481	190.9 K=1.00	1.090	-5.147	8.562	0.601 [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	152 - 140	L1 3/4x1 3/4x3/16	4.580	4.101	143.3 K=1.00	0.621	-0.102	8.659	0.012 [1]
T3	120 - 100	L1 3/4x1 3/4x3/16	4.580	4.101	143.3 K=1.00	0.621	-0.399	8.659	0.046 [1]

[1] P_u / ϕP_n controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	152 - 140	ROHN 2.5 STD	12.000	0.500	6.3	1.704	9.770	76.682	0.127 [1]
T2	140 - 120	ROHN 2.5 STD	20.000	4.000	50.7	1.704	36.398	76.682	0.475 [1]
T3	120 - 100	ROHN 2.5 STD	20.033	4.007	50.7	1.704	56.158	76.682	0.732 [1]
T4	100 - 80	ROHN 3 EH	20.034	5.008	52.9	3.016	72.803	135.717	0.536 [1]
T5	80 - 60	ROHN 3.5 EH	20.035	6.678	61.3	3.678	89.734	165.529	0.542 [1]
T6	60 - 40	ROHN 3.5 EH	20.035	6.678	61.3	3.678	106.888	165.529	0.646 [1]
T7	40 - 20	ROHN 4 EH	20.035	6.678	54.3	4.407	123.704	198.335	0.624 [1]
T8	20 - 0	ROHN 5 EH	20.036	10.018	65.4	6.112	138.248	275.039	0.503 [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	152 - 140	L1 3/4x1 3/4x3/16	5.867	2.660	62.1	0.360	2.577	15.675	0.164 [1]
T2	140 - 120	L1 3/4x1 3/4x3/16	6.081	2.762	64.4	0.360	3.652	15.675	0.233 [1]
T3	120 - 100	L1 3/4x1 3/4x3/16	6.546	3.138	72.8	0.360	2.389	15.675	0.152 [1]
T4	100 - 80	L1 3/4x1 3/4x3/16	9.724	4.719	108.1	0.360	2.875	15.675	0.183 [1]
T5	80 - 60	L2x2x3/16	12.276	6.024	119.5	0.431	3.344	18.739	0.178 [1]
T6	60 - 40	L2 1/2x2 1/2x3/16	14.036	6.902	108.3	0.571	3.788	24.840	0.152 [1]
T7	40 - 20	L2 1/2x2 1/2x3/16	15.868	7.796	122.1	0.571	4.199	24.840	0.169 [1]
T8	20 - 0	L3x3x3/16	19.132	9.481	122.7	0.712	4.836	30.973	0.156 [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	152 - 140	L1 3/4x1 3/4x3/16	4.580	4.101	97.0	0.360	0.097	15.675	0.006 [1]
T3	120 - 100	L1 3/4x1 3/4x3/16	4.580	4.101	97.0	0.360	0.427	15.675	0.027 [1]

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T1	152 - 140	Leg	ROHN 2.5 STD	1	-10.880	80.281	13.6	Pass
T2	140 - 120	Leg	ROHN 2.5 STD	25	-36.743	66.738	55.1	Pass
T3	120 - 100	Leg	ROHN 2.5 STD	58	-57.427	66.697	86.1	Pass
T4	100 - 80	Leg	ROHN 3 EH	94	-75.732	116.144	65.2	Pass

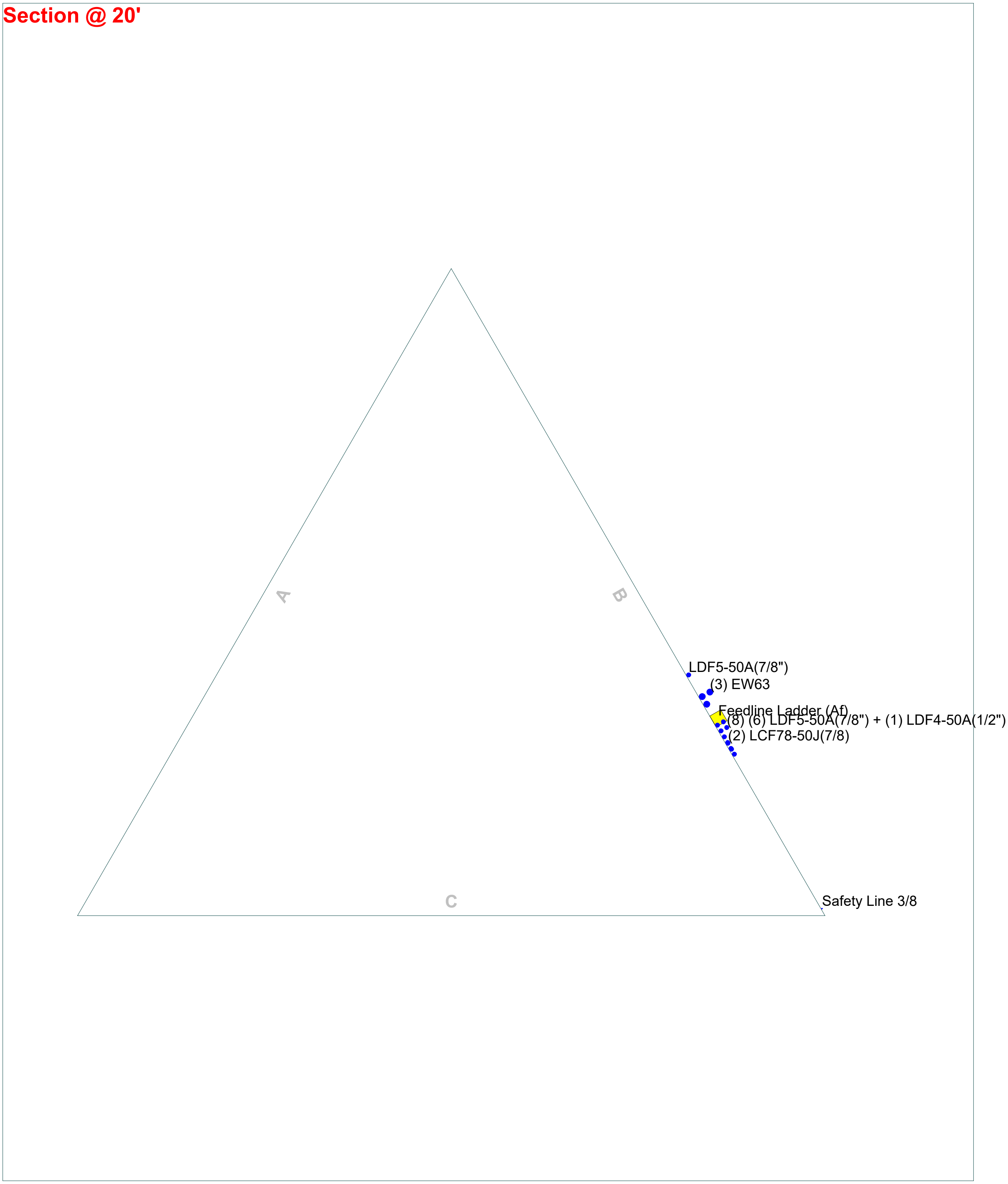
Section No.	*Elevation ft*	*Component Type*	*Size*	*Critical Element*	*P K*	*$øP_{allow}$ K*	*% Capacity*	*Pass Fail*
T5	80 - 60	Leg	ROHN 3.5 EH	121	-95.741	132.009	72.5	Pass
T6	60 - 40	Leg	ROHN 3.5 EH	142	-116.113	132.012	88.0	Pass
T7	40 - 20	Leg	ROHN 4 EH	163	-136.305	167.903	81.2	Pass
T8	20 - 0	Leg	ROHN 5 EH	184	-154.098	211.294	72.9	Pass
T1	152 - 140	Diagonal	L1 3/4x1 3/4x3/16	8	-2.557	16.138	15.8 42.2 (b)	Pass
T2	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	29	-3.685	15.741	23.4 59.8 (b)	Pass
T3	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	64	-2.329	11.652	20.0 39.2 (b)	Pass
T4	100 - 80	Diagonal	L1 3/4x1 3/4x3/16	102	-2.876	6.867	41.9 47.1 (b)	Pass
T5	80 - 60	Diagonal	L2x2x3/16	126	-3.447	6.383	54.0	Pass
T6	60 - 40	Diagonal	L2 1/2x2 1/2x3/16	147	-3.823	9.683	39.5 46.1 (b)	Pass
T7	40 - 20	Diagonal	L2 1/2x2 1/2x3/16	169	-4.279	7.589	56.4	Pass
T8	20 - 0	Diagonal	L3x3x3/16	190	-5.147	8.990	57.2 58.8 (b)	Pass
T1	152 - 140	Top Girt	L1 3/4x1 3/4x3/16	4	-0.102	9.092	1.1 1.6 (b)	Pass
T3	120 - 100	Top Girt	L1 3/4x1 3/4x3/16	62	-0.399	9.092	4.4 7.0 (b)	Pass
							Summary	
						Leg (T6)	88.0	Pass
						Diagonal (T2)	59.8	Pass
						Top Girt (T3)	7.0	Pass
						Bolt Checks	59.8	Pass
						RATING =	**88.0**	**Pass**

APPENDIX B

BASE LEVEL DRAWING

Feed Line Plan
20'

Round Flat App In Face App Out Face



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Job: **ES-005 ProspectRS**		
Project: **403093**		
Client: Eversource	Drawn by: Shreya Naphade	App'd:
Code: TIA-222-H	Date: 02/19/20	Scale: NTS
Path: Y:\TELECOM\2020\Engineering\Projects\Ever Source SA\ProspectRS\Structural\Rev. H\ES-005 ProspectRS Structural Analysis.eri		Dwg No. E-7

APPENDIX C

ADDITIONAL CALCULATIONS

Eversource #:
Site Name:

Designed By:
Checked By:
Date: 2/19/2020

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▸ References

ANCHOR ROD ANALYSIS

Project Information

Site Name: ES-005 ProspectRS

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*
$Axial\_C := 159 \cdot kip$	$Axial\_U := 142 \cdot kip$
$Shear\_C := 17 \cdot kip$	$Shear\_U := 15 \cdot kip$

Anchor Rod Data

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

Number of Anchor Rods: $N := 6$

Length from top of concrete to bottom of anchor rod leveling nut: $lar := 1.5 \cdot in$

Anchor Rod Grade: 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, A500-50, A514-GR100, A53-B-35

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:

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

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:

$$Put := \frac{Axial\_U}{N} = 23.667 \cdot kip$$

Compression Demand:

$$Puc := \frac{Axial\_C}{N} = 26.5 \cdot kip$$

Shear Demand:

$$Vut := \frac{Shear\_U}{N} = 2.5 \cdot kip$$

$$Vuc := \frac{Shear\_C}{N} = 2.833 \cdot kip$$

Moment Demand:

$$Mut := 0.65 \cdot lar \cdot Vut = 0.813 \cdot kip \cdot in$$

$$Muc := 0.65 \cdot lar \cdot Vuc = 0.921 \cdot kip \cdot in$$

Anchor Rod Interaction Check

TIA-222-G Section 4.9.9

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

$$SR\_g = 0.497$$

Anchor Rod Interaction Check

TIA-222-H Section 4.9.9

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

$SR\_Pt = 0.178$

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

$SR\_Pc = 0.439$

$$SR := \begin{cases} SR\_g & \text{if } TIA = \text{"Rev-G"} \\ \max(SR\_Pt, SR\_Pc) & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"No"} \\ \frac{\max(SR\_Pt, SR\_Pc)}{1.05} & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"Yes"} \end{cases} = 0.418$$

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

Anchor Rod Results

Axial Tension Demand:	$Put = 23.667 \cdot kip$
Axial Tension Capacity:	$\phi Rnt = 56.788 \cdot kip$
Axial Compression Demand:	$Puc = 26.5 \cdot kip$
Axial Compression Capacity:	$\phi Rnc = 63.603 \cdot kip$
Shear Tension Demand:	$Vut = 2.5 \cdot kip$
Tension Shear Capacity:	$\phi Rnv = 36.816 \cdot kip$
Shear Compression Demand:	$Vuc = 2.833 \cdot kip$
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

$SR = 41.781 \cdot \%$

$Check_{SR}$ = "Passing"

SST Unit Base Foundation

ES-005
ProspectRS

TIA-222 Revision: H

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

Superstructure Analysis Reactions		
Global Moment, **M**:	2239	ft-kips
Global Axial, **P**:	16	kips
Global Shear, **V**:	27	kips
Leg Compression, $\mathbf{P}_{comp}$:	159	kips
Leg Comp. Shear, $\mathbf{V}_{u\_comp}$:	17	kips
Leg Uplift, $\mathbf{P}_{uplift}$:	142	kips
Leg Uplift. Shear, $\mathbf{V}_{u\_uplift}$:	15	kips
Tower Height, **H**:	152	ft
Base Face Width, **BW**:	16.83	ft
BP Dist. Above Fdn, $\mathbf{bp}_{dist}$:	2	in

Foundation Analysis Checks				
	Capacity	**Demand**	**Rating**	**Check**
Lateral (Sliding) (kips)	160.85	27.00	**16.8%**	**Pass**
Bearing Pressure (ksf)	9.00	1.53	**17.0%**	**Pass**
*Overturning (kip*ft)*	5169.95	2419.00	**46.8%**	**Pass**
*Pier Flexure (Comp.) (kip*ft)*	632.22	76.50	**12.1%**	**Pass**
*Pier Flexure (Tension) (kip*ft)*	383.62	67.50	**17.6%**	**Pass**
Pier Compression (kip)	3130.41	164.73	**5.3%**	**Pass**
*Pad Flexure (kip*ft)*	1980.55	444.29	**22.4%**	**Pass**
Pad Shear - 1-way (kips)	480.63	95.98	**20.0%**	**Pass**
Pad Shear - Comp 2-way (ksi)	0.164	0.051	**31.1%**	**Pass**
*Flexural 2-way (Comp) (kip*ft)*	1281.89	45.90	**3.6%**	**Pass**
Pad Shear - Tension 2-way (ksi)	0.164	0.053	**32.2%**	**Pass**
*Flexural 2-way (Tension) (kip*ft)*	1281.89	40.50	**3.2%**	**Pass**

Soil Rating:	**46.8%**
Structural Rating:	**32.2%**

Pier Properties		
Pier Shape:	Circular	
Pier Diameter, **dpier**:	3.0	ft
Ext. Above Grade, **E**:	0.50	ft
Pier Rebar Size, **Sc**:	7	
Pier Rebar Quantity, **mc**:	14	
Pier Tie/Spiral Size, **St**:	4	
Pier Tie/Spiral Quantity, **mt**:	5	
Pier Reinforcement Type:	Tie	
Pier Clear Cover, $\mathbf{cc}_{pier}$:	3	in

Pad Properties		
Depth, **D**:	6.00	ft
Pad Width, **W**:	25.00	ft
Pad Thickness, **T**:	2.00	ft
Pad Rebar Size (Bottom), **Sp**:	8	
Pad Rebar Quantity (Bottom), **mp**:	30	
Pad Clear Cover, $\mathbf{cc}_{pad}$:	3	in

Material Properties		
Rebar Grade, **Fy**:	60	ksi
Concrete Compressive Strength, **F'c**:	3	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**:		ksf
Friction Angle, φ:	28	degrees
SPT Blow Count, $\mathbf{N}_{blows}$:		
Base Friction, μ:		
Neglected Depth, **N**:	3.3	ft
Foundation Bearing on Rock?	No	
Groundwater Depth, **gw**:	n/a	ft

<-- Toggle between Gross and Net

TIA-222- H ACI : 2014

PHYSICAL PARAMETERS

Pier Height Above Water Table:	h_{pier_above} = (MIN(gw,D-T) + E)	h_{pier_above} =	4.5	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} = (π/4) * (dpier^2) * hpier_above * δc / 1000 + (π/4) * (dpier^2) * hpier_below * (δc-62.4) / 1000	W_{pier} =	4.77	kips
Pad Height Above Water Table:	h_{pad_above} = IF(gw<=D-T,0,IF(gw>D,T,T-(D-gw)))	h_{pad_above} =	2	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} =	187.50	kips
Concrete weight:	W_c = V * δc	W_c =	201.8	kips
Soil weight:	W_s = (D - T) * (W² - 3*(dpier² / 4 * π)) * γ	W_s =	241.5	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} =	75.61	kips
Factored Total Weight for Compression:	$P_{factored\_comp}$ = φD * (Wc + Ws + P / 1.2)	$P_{factored\_comp}$ =	411.00	kips
Nominal Base Friction Resistance (Comp):	R_{s_comp} = P * TAN((2/3)*ϕ)	R_{s_comp} =	138.85	kips
Lateral Resistance (Comp):	ΦVn = Φs * (Pp_total + Rs_comp)	ΦVn =	160.85	kips

Check **ΦVn = 160.85 kips >= Vu = 27.00 kips** **RATING: 16.79% OK**

PIER REINFORCEMENT

Pier / Column Compression

Pier Cross-Sectional Area:	A_1 = dpier^2 * π/4	A_1 =	1017.88	in²
Support Area (2H:1V Slope):	A_2 = (MIN((2*(W/2-(2/3)*BW*cos(30°)+Offset)),(W-BW),dpier+4*T))²*(π/4)	A_2 =	3504.29	in²
Compressive Resistance (H/D < 3):	$ΦP_{n1}$ = 0.65*0.85 * F'c * A1 * MIN(√(A2/A1),2)	$ΦP_{n1}$ =	3130.41	kips
Rebar:	$s_{\_pier}$ = 7; $m_{\_pier}$ = 14; d_{b_pier} = 0.875 in; A_{b_pier} = 0.6 in^2			
Provided area of steel:	A_{s_pier} = Ab_pier * m_pier	A_{s_pier} =	8.40	in^2
Compressive Resistance (H/D >= 3):	$ΦP_{n2}$ = 0.65 * 0.8 * (0.85 * (F\c) * (A_1 - As_pier) + ((Fy) * As_pier))	$ΦP_{n2}$ =	1600.65	kips
	H/D = (D - T + E) / dpier	H/D =	1.50	
Utilized Compressive Resistance:	$ΦP_n$ = Pn1	$ΦP_n$ =	3130.41	kips
Applied Compressive Force:	P_u = Pcomp + 1.2 * Wpier	P_u =	164.73	kips

Check **$ΦP_n$ = 3130.41 kips >= P_u = 164.73 kips** **RATING: 5.26% OK**

Pier Flexure

Cross-sectional area:	A_g = dpier² * π / 4	A_g =	1017.88	in^2
Min. area of steel (pier):	A_{smin_pier} = Ag * 0.005	A_{smin_pier} =	5.09	in^2
Cage Diameter:	d_o = dpier - 2 * cc - 2 * tie - d_b	d_o =	28.13	in

Check **A_{s_pier} = 8.40 in^2 >= A_{smin_pier} = 5.09 in^2** **OK**

Applied Moment to DSMC (Compression):	M_{u_comp} = IF(T>D,E,(D - T + E)) * Vu_comp	M_{u_comp} =	76.50	ft-kips
Pier Moment Capacity (Compression):	$ΦM_{n\_comp}$ = *from DSMC*	$ΦM_{n\_comp}$ =	632.22	ft-kips

Check **M_{u_comp} = 76.50 ft-kips >= $ΦM_{n\_comp}$ = 632.22 ft-kips** **RATING: 12.10% OK**

Applied Moment to DSMC (Tension):	$M_{u\_tension}$ = IF(T>D,E,(D - T + E)) * Vu_uplift	$M_{u\_tension}$ =	67.50	ft-kips
Pier Moment Capacity (Tension):	$ΦM_{n\_tension}$ = *from DSMC*	$ΦM_{n\_tension}$ =	383.62	ft-kips

Check **M_{u_comp} = 67.50 ft-kips >= $ΦM_{n\_comp}$ = 383.62 ft-kips** **RATING: 17.60% 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} =	7.64	ft
*Overturning Moment (0.9*D LC):*	$M_{o\_0.9}$ = M + V * (D + E + bpdist/12) + (0.9/1.2)*(P+3*Wpier*1.2)*Offset	$M_{o\_0.9}$ =	2419.00	ft-kips
*Overturning Moment (1.2*D LC):*	$M_{o\_1.2}$ = M + V * (D + E + bpdist/12) + (1.2/1.2)*(P+3*Wpier*1.2)*Offset	$M_{o\_1.2}$ =	2419.00	ft-kips
Compressive Load for Bearing:	$P_{bearing}$ = Wc + Ws + P / 1.2	$P_{bearing}$ =	456.66	kips
*Load Eccentricity (0.9*D LC):*	$e_{c\_0.9}$ = Mo / 0.9*Pbearing	$e_{c\_0.9}$ =	5.89	ft L/6 < e <= L/
*Load Eccentricity (1.2*D LC):*	$e_{c\_1.2}$ = Mo / 1.2*Pbearing	$e_{c\_1.2}$ =	4.41	ft L/6 < e <= L/
Elastic Section Modulus:	S = W³ / 6	S =	2604.17	ft³
*Positive Pressure (0.9*D LC):*	$P_{pos\_st\_0.9}$ = 0.9*Pbearing / Area + Mo / S	$P_{pos\_st\_0.9}$ =	1.59	ksf
*Positive Pressure (1.2*D LC):*	$P_{pos\_st\_1.2}$ = 1.2*Pbearing / Area + Mo / S	$P_{pos\_st\_1.2}$ =	1.81	ksf
*Negative Pressure (0.9*D LC):*	$P_{neg\_st\_0.9}$ = 0.9*Pbearing / Area - Mo / S **Note: The stress resultant is NOT within the kern. Bearing area has been adjusted below.**	$P_{neg\_st\_0.9}$ =	-0.27	ksf
*Negative Pressure (1.2*D LC):*	$P_{neg\_st\_1.2}$ = 1.2*Pbearing / Area - Mo / S **Note: The stress resultant is NOT within the kern. Bearing area has been adjusted below.**	$P_{neg\_st\_1.2}$ =	-0.05	ksf
*Adjusted Pressure (0.9*D LC):*	$P_{adj\_0.9}$ = (2 * 0.9*Pbearing) / (3 * W * (W / 2 - ec_0.9))	$P_{adj\_0.9}$ =	1.66	ksf
*Adjusted Pressure (1.2*D LC):*	$P_{adj\_1.2}$ = (2 * 1.2*Pbearing) / (3 * W * (W / 2 - ec_1.2))	$P_{adj\_1.2}$ =	1.81	ksf
*Maximum Pressure (0.9*D LC):*	$q_{u\_st\_0.9}$ = IF(Pneg ≥ 0, Ppos , Padj)	$q_{u\_st\_0.9}$ =	1.66	ksf
*Maximum Pressure (1.2*D LC):*	$q_{u\_st\_1.2}$ = IF(Pneg ≥ 0, Ppos , Padj)	$q_{u\_st\_1.2}$ =	1.81	ksf

One-Way Shear

Rebar: $s_{\_pad}$ = 8, $m_{\_pad}$ = 30 — *Equally spaced, top and bottom, both directions.* d_{b_pad} = 1 in; A_{b_pad} = 0.79 in^2

Effective depth:	d_c = T - cc - 1.5 * db	d_c =	19.5	in
Distance from Edge of Pad to Column Face:	d' = Ledge - dpier/2	d' =	6.1	ft
Distance from Edge of Pad to dc from Column Face:	d'' = d' - d_c / 12	d'' =	4.52	ft
Distance to qs (0.9D LC):	$L'_{\_0.9}$ = (W / 2 - ec_0.9) * 3	$L'_{\_0.9}$ =	19.84	ft
Distance to qs (1.2D LC):	$L'_{\_1.2}$ = (W / 2 - ec_1.2) * 3	$L'_{\_1.2}$ =	24.26	ft
*Slope of qs (0.9*D LC):*	$sq_{s\_0.9}$ = IF(L' > W, (Ppos - Pneg) / W, qu / L')	$sq_{s\_0.9}$ =	0.08	kcf
*Slope of qs (1.2*D LC):*	$sq_{s\_1.2}$ = IF(L' > W, (Ppos - Pneg) / W, qu / L')	$sq_{s\_1.2}$ =	0.07	kcf
Nominal Shear Strength:	V_{n1} = 2 * W * √(F'c*1000) * dc	V_{n1} =	640.84	kips
Shear Reduction Factor:	φ_{shear} = 0.75	φ_{shear} =	0.75	
Design Shear Strength:	φV_{n1} = φshear * V_{n1}	φV_{n1} =	480.63	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:	4	0.100	40.65	54.20
Soil Below Water Table:	0	0.038	0.00	0.00
Pad Above Water Table:	2	0.150	30.49	40.65
Pad Below Water Table:	0	0.088	0.00	0.00
Total:			71.14	94.85

*Applied Shear (0.9*D LC):*	$V_{u1\_0.9}$ = 'Pad Shear and Moment Diagrams'!$AY$21	$V_{u1\_0.9}$ =	95.98	kips
*Applied Shear (1.2*D LC):*	$V_{u1\_1.2}$ = 'Pad Shear and Moment Diagrams'!$CG$21	$V_{u1\_1.2}$ =	92.00	kips

Check **φV_{n1} = 480.63 kips >= V_{u1} = 95.98 kips** **RATING: 19.97% 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} =	20.00	in
Radius of Two-Way Shear Plane:	r_{2way} = 0.5*(dpier + dc_2/12)	r_{2way} =	2.33	ft
Length to Edge of Pad from Pier Centroid:	L_{edge2} = W/2 - 2/3*SIN(60°)*BW + Offset	L_{edge2} =	2.78	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: Circular	Pier Shape:	Circular	
Pier Diameter:	d_{pier1} = d_{pier} * 12 in / ft	d_{pier1} =	36.00	in
Equivalent Square Pier Diameter:	d_{pier_sq} = √π / 2 * dpier	d_{pier_sq} =	31.90	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 =	918.00	kip*in
Circular Critical Perimeter:	P_{crit_cir} = (dpier+dc_2/12)*PI() - $L$171)*12	P_{crit_cir} =	175.93	in
Equivalent Square Critical Perimeter 1:	$P_{crit\_sq\_1}$ = 4*(dpier_sq+dc_2)	$P_{crit\_sq\_1}$ =	207.62	in
Equivalent Square Critical Perimeter 2:	$P_{crit\_sq\_2}$ = 2*(dpier_sq + dc_2) + (W*12-BW*12)	$P_{crit\_sq\_2}$ =	201.85	in
Equivalent Square Critical Perimeter 3:	$P_{crit\_sq\_3}$ = 2 * (dpier_sq + dc_2 + (W - BW * COS(RADIANS(30)) - Ledge2)*12)	$P_{crit\_sq\_3}$ =	287.21	in
Equivalent Square Critical Perimeter 4:	$P_{crit\_sq\_4}$ = 2 * (dpier_sq + dc_2 + Ledge2 * 12)	$P_{crit\_sq\_4}$ =	170.61	in
Equivalent Square Critical Perimeter 5:	$P_{crit\_sq\_5}$ = dpier_sq + dc_2 + 0.5*(W-BW)*12 + (W - BW * COS(RADIANS(30)) - Ledge	$P_{crit\_sq\_5}$ =	192.62	in
Area of Concrete in Shear:	A_c = ((dpier1 + dc_2)*PI()) * dc_2	A_c =	3518.58	in^2
Eq. Square Area of Concrete in Shear (1):	$A_{c\_sq\_1}$ = $P_{crit\_sq\_1}$ * d_{c_2}	$A_{c\_sq\_1}$ =	4152.33	in^2
Eq. Square Area of Concrete in Shear (2):	$A_{c\_sq\_2}$ = $P_{crit\_sq\_2}$ * d_{c_2}	$A_{c\_sq\_2}$ =	4036.97	in^2
Eq. Square Area of Concrete in Shear (3):	$A_{c\_sq\_3}$ = $P_{crit\_sq\_3}$ * d_{c_2}	$A_{c\_sq\_3}$ =	5744.13	in^2
Eq. Square Area of Concrete in Shear (4):	$A_{c\_sq\_4}$ = $P_{crit\_sq\_4}$ * d_{c_2}	$A_{c\_sq\_4}$ =	3412.10	in^2
Eq. Square Area of Concrete in Shear (5):	$A_{c\_sq\_5}$ = $P_{crit\_sq\_5}$ * d_{c_2}	$A_{c\_sq\_5}$ =	3852.47	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} =	2416213.33	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	$J_{c\_sq\_1}$ =	1933632.94	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	$J_{c\_sq\_2}$ =	1665976.73	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	$J_{c\_sq\_3}$ =	1234472.67	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	$J_{c\_sq\_4}$ =	1234472.67	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	$J_{c\_sq\_5}$ =	966816.47	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})	$V_{u\_1.2}$ =	164.73	kip
*Controlling Shear Stress (1.2*D LC):*	$v_{u\_1.2\_controlling}$ = $V_{u\_1.2}$ / A_c + (Υ_v * M_v * (d_{pier1} + dc_2)/2) / J_{c_1}	$v_{u\_1.2\_controlling}$ =	0.051	ksi
*Eq. Sq. Controlling Shear Stress (1.2*D LC):*	$v_{u\_1.2\_controlling\_sq}$ = $V_{u\_1.2}$ / A_c + (Υ_v * M_v * (d_{pier_sq} + dc_2)/2) / J_c	$v_{u\_1.2\_controlling\_sq}$ =	0.056	ksi
Shear Stress Capacity:	Φv_n = φs * 4 * (√F'c*1000) / 1000	Φv_n =	0.164	ksi

Check **Φv_n = 0.164 ksi >= v_{u_demand} = 0.051 ksi** **RATING: 31.08% OK**

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

Distance To Outside Edge:	$dist_{outside}$ = MIN((W-BW)/2,BW/2)*2	$dist_{outside}$ =	8.17	ft
Effective Pad Width:	$b_{\_pad}$ = MIN(dpier+3*T,W,dist_outside)	$b_{\_pad}$ =	8.17	ft
Bar Spacing:	B_{s_pad} = Bs_pad (see design checks below)	B_{s_pad} =	10.10	in
Fraction of Bars in Effective Width:	$m_{\_effective}$ = IF(b_pad=W,mp,12*b_pad/Bs_pad)	$m_{\_effective}$ =	9.70	
Area of Steel in Effective Width:	$A_{s\_effective}$ = VLOOKUP(Sp,Ref!$A$2:$C$12,3,0)*m_slab	$A_{s\_effective}$ =	7.67	in²
Depth of Equivalent Rectangular Stress Block:	$a_{\_effective}$ = $A_{s\_effective}$ * Fy / (0.85 * F'c * $b_{\_slab}$*12)	$a_{\_effective}$ =	1.84	in
	β_{pad} = β_{pad} (see design checks below)	β_{pad} =	0.85	
Distance from Top to Nuetral Axis:	$c_{\_effective}$ = $a_{\_effective}$ / β_{pad}	$c_{\_effective}$ =	2.16	
Effective depth:	dc = dc (see One-Way Shear check above)	dc =	19.5	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	$\varepsilon_{s\_effective}$ =	0.02403	in/in
Compression-Controlled Strain Limit::	ε_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)	$M_{n\_effective}$ =	712.16	ft-kips
Design Flexural Strength:	$\varphi M_{n\_effective}$ = φflex_effective * Mn_effective	$\varphi M_{n\_effective}$ =	640.95	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$12`	$B_{s\_pad\_top}$ =	8.17	in
Fraction of Bars in Effective Width:	$m_{\_effective\_top}$ = IF(b_pad=W,mp,12*b_pad/Bs_pad_top)	$m_{\_effective\_top}$ =	9.70	
Area of Steel in Effective Width:	$A_{s\_effective\_top}$ = `VLOOKUP(Sptop,Ref!$A$2:$C$12,3,0)*m_slab`	$A_{s\_effective\_top}$ =	7.67	in²
Depth of Equivalent Rectangular Stress Block:	$a_{\_effective\_top}$ = $A_{s\_effective\_top}$ * Fy / (0.85 * F'c * $b_{\_slab}$*12)	$a_{\_effective\_top}$ =	1.84	in
Distance from Top to Nuetral Axis:	$c_{\_effective\_top}$ = $a_{\_effective\_top}$ / β_{pad}	$c_{\_effective\_top}$ =	2.16	
Effective depth:	dc_top = `T *12 - ccpad - 1.5 * VLOOKUP(sptop,Ref!$A$2:$C$12,2,0)`	d_{c_top} =	19.5	in
Strain in Steel:	$\varepsilon_{s\_effective\_top}$ = 0.003 * (dc_top-c_effective_top) / c_effective_top	$\varepsilon_{s\_effective\_top}$ =	0.02403	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)	$M_{n\_effective\_top}$ =	712.16	ft-kips
Design Flexural Strength:	$\varphi M_{n\_effective\_top}$ = φflex_effective * Mn_effective	$\varphi M_{n\_effective\_top}$ =	640.95	ft-kips
Applied Moment:	$Yf{*}M_{u\_comp}$ = $Yf{*}M_{u\_comp}$	$Yf{*}M_{u\_comp}$ =	45.9	ft-kips

Check **$\varphi M_{n\_effective}$ = 1281.89 ksi >= $Yf{*}M_{u\_comp}$ = 45.90 ksi** **RATING: 3.58% OK**

Two-Way Shear (Uplift)

Moment applied at base of Pier:	M_{v_tens} = $M_{u\_tension}$ * 12 in / ft	M_{v_tens} =	810.00	kip*in
Diameter of Longitudinal Rebar Cage:	$d_{\_cage}$ = `dpier*12-2*(ccpier+VLOOKUP(St,Ref!$A$2:$C$12,2,0))-VLOOKUP(Sc,Ref!$A$2:$C$12,2,0)`	$d_{\_cage}$ =	28.13	in
Eq. Sq. Diameter of Longitudinal Rebar Cage:	$d_{\_cage\_sq}$ = SQRT(PI())/2*d_cage	$d_{\_cage\_sq}$ =	24.93	in
Steel Embedment Length:	L_{embed} = dc_2 (see One-Way Shear check above)	L_{embed} =	20.00	in
Radius of Two-Way Shear Plane:	r_{2way_tens} = 0.5*(d_cage/12 + Lembed/12)	r_{2way_tens} =	2.01	ft
	$r_{2way\_tens\_sq}$ = 0.5*(SQRT(PI())/2*d_cage/12 + Lembed/12)	$r_{2way\_tens\_sq}$ =	1.87	ft
Length of Shear Perimeter to Deduct:	s_{tens} = r_tens*RADIANS(2*ACOS(((r_tens-MAX(r_tens-Ledge,0))/r_tens))*180/PI())	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} =	151.19	in
Equivalent Square Critical Perimeter 1:	$P_{crit\_tens\_sq\_1}$ = 4*(d_cage_sq+Lembed)	$P_{crit\_tens\_sq\_1}$ =	179.70	in
Equivalent Square Critical Perimeter 2:	$P_{crit\_tens\_sq\_2}$ = 2*(d_cage_sq + Lembed) + (W*12-BW*12)	$P_{crit\_tens\_sq\_2}$ =	187.89	in
Equivalent Square Critical Perimeter 3:	$P_{crit\_tens\_sq\_3}$ = 2 * (d_cage_sq + Lembed) + (W - BW * COS(RADIANS(30)) - Ledge2)*12)	$P_{crit\_tens\_sq\_3}$ =	273.25	in
Equivalent Square Critical Perimeter 4:	$P_{crit\_tens\_sq\_4}$ = 2 * (d_cage_sq + Lembed + Ledge2 * 12)	$P_{crit\_tens\_sq\_4}$ =	156.65	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)) -	$P_{crit\_tens\_sq\_5}$ =	185.64	in
Area of Concrete in Shear:	A_{c_tens} = Pcrit_tens*Lembed	A_{c_tens} =	3023.78	in^2
Equivalent Square Area of Concrete in Shear:	$A_{c\_tens\_sq1}$ = Pcrit_tens_sq1*Lembed	$A_{c\_tens\_sq1}$ =	3594.01	in^2
	$A_{c\_tens\_sq2}$ = 'Pcrit_tens_sq2*Lembed	$A_{c\_tens\_sq2}$ =	3757.81	in^2
	$A_{c\_tens\_sq3}$ = Pcrit_tens_sq3*Lembed	$A_{c\_tens\_sq3}$ =	5464.97	in^2
	$A_{c\_tens\_sq4}$ = Pcrit_tens_sq4*Lembed	$A_{c\_tens\_sq4}$ =	3132.94	in^2
	$A_{c\_tens\_sq5}$ = Pcrit_tens_sq5*Lembed	$A_{c\_tens\_sq5}$ =	3712.89	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} =	992985.43	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	$J_{c\_tens\_sq\_1}$ =	1268845.97	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	$J_{c\_tens\_sq\_2}$ = 1087777.66	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	$J_{c\_tens\_sq\_3}$ = 815491.30	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	$J_{c\_tens\_sq\_4}$ = 815491.30	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	$J_{c\_tens\_sq\_5}$ = 634422.99	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),0)	$V_{u\_0.9\_tens}$ = 137.71	kip
*Controlling Shear Stress (0.9*D LC):*	$v_{u\_0.9\_controlling\_tens}$ = $V_{u\_0.9}$ / A_{c_tens} + (Υ_v * M_v * (d_{cage} + Lembed)/2) / J_{c_tens}	$v_{u\_0.9\_controlling\_tens}$ = 0.053	ksi
*Equivalent Square Shear Stress (0.9*D LC):*	$v_{u\_0.9\_tens\_sq}$ = Vu_0.9_tens/Ac_tens_sq4 + (Ύv * Mv_tens * (d_cage_sq + Lembed)/2) / Jc	$v_{u\_0.9\_tens\_sq}$ = 0.053	ksi
Shear Stress Capacity:	Φv_n = φs * 4 * (√F'c*1000) / 1000	Φv_n = 0.164	ksi

Check **Φv_n = 0.164 ksi >= v_{u_demand} = 0.053 ksi RATING: 32.18% OK**

Two-Way Shear (Uplift, Flexural Component)

Applied Moment:	Yf*$M_{u\_tension}$ = Yf*$M_{u\_tension}$	Yf*$M_{u\_tension}$ = 40.5	

Check **$\varphi M_{n\_effective}$ = 1281.89 ksi >= ʹf*$M_{u\_tension}$ = 40.50 ksi RATING: 3.16% 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} = 23.70	in^2
Depth of Equivalent Rectangular Stress Block:	a = A_{s_pad} * Fy / (0.85 * F'c * W)	a = 1.86	in
Distance from Top to Nuetral Axis:	c = a / β_{pad}	c = 2.19	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 = 0.02375	in/in
Compression-Controlled Strain Limit::	ε_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 = 2200.61	ft-kips
Design Flexural Strength:	φM_n = φflex * Mn	φM_n = 1980.55	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 = 1.14	ksf
*Bearing Press. at Crit. Section (1.2*D LC):*	qmid_1.2 = qu_st_1.2 - sqs_1.2 * d'	qmid_1.2 = 1.35	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:	4	0.100	55.27	73.70	3.070798742	169.74	226.32
Soil Below Water Table:	0	0.038	0.00	0.00	3.070798742	0.00	0.00
Pad Above Water Table:	2	0.150	41.46	55.27	3.070798742	127.30	169.74
Pad Below Water Table:	0	0.088	0.00	0.00	3.070798742	0.00	0.00
Total:			96.73	128.97		297.04	396.05

*Factored Bending Moment (0.9*D LC):*	Mu_pad_0.9 = 'Pad Shear and Moment Diagrams'!$AZ$21	Mu_pad_0.9 = 444.29	ft-kips
*Factored Bending Moment (1.2*D LC):*	Mu_pad_1.2 = 'Pad Shear and Moment Diagrams'!$CH$21	Mu_pad_1.2 = 406.45	ft-kips

Check **φM_n = 1980.55 ft-kips >= M_{u_pad} = 444.29 ft-kips RATING: 22.43% OK**

PIER DESIGN CHECKS

Minimum Steel

	Min. area of steel (pier):	A_{st_c} = Ag * 0.005				A_{st_c} =	5.09	in^2
Check	**A_{s_pier} =**	**8.40 in²**	**>=**	**A_{st_c} =**	**5.09 in²**	**RATING:**	**60.59%**	**OK**

Bar Spacing

	Bar separation:	B_{s_pier} = (do * π) / m_pier - db_pier				B_{s_pier} =	5.44	in
Check		**18.00 in**	**>=**	**B_{s_pier} =**	**5.44 in**	**RATING:**	**30.20%**	**OK**

Vertical Rebar Development Length

	Reinforcement location:	α_c =	if space under bar > 12", 1.3, else use 1.0	α_c =	1.3		
	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	$\alpha\beta_c$ =	1.3		
	Reinforcement size:	γ_c =	if bar size is 6 or less, 0.8, else use 1.0	γ_c =	1		
	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	$c_{\_c}$ =	3.2	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' =	2.500		
	Excess reinforcement:	R_c =	Ast_c / As_c	R_c =	0.61		
	Development (tensile):	$L_{dt'\_c}$ =	(3 / 40) * (Fy*1000 / √(F'c*1000)) * αβ_c * γ_c * λ_c * R_c * db_c / c_c'	$L_{dt'\_c}$ =	22.65	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} =	22.65	in	
	Development (comp.):	$L_{dc'\_c}$ =	0.02 * db_c * Fy*1000 / √(F'c*1000)	$L_{dc'\_c}$ =	19.17	in	
		$L_{dc''\_c}$ =	0.0003 * db_c * Fy*1000	$L_{dc''\_c}$ =	15.75	in	
	Development length:	L_{dc_c} =	MAX(8, Ldc'_c, Ldc''_c)	L_{dc_c} =	19.17	in	
	Length available in pier:	L_{vc} =	D - T + E - cc	L_{vc} =	51.0	in	
Check	**L_{vc} =**	**51.00 in**	**>= L_{dt_c} = 22.65 in**				**OK**
Check	**L_{vc} =**	**51.00 in**	**>= L_{dc_c} = 19.17 in**				**OK**
	Length available in pad:	L_{vp} =	T - ccpad	L_{vp} =	21.0	in	
Check	**L_{vp} =**	**21.00 in**	**>= L_{dt_c} = 22.65 in**				**HOOKS**
Check	**L_{vp} =**	**21.00 in**	**>= L_{dc_c} = 19.17 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 =	0.7		
	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}' =	13.4	in	
	Minimum length:	L_{dh_min} =	the larger of: 8 * d_b or 6 in	L_{dh_min} =	7.0	in	
	Development length:	L_{dh} =	MAX(Ldh_min, Ldh')	L_{dh} =	13.4	in	
Check	**L_{vp} =**	**21.00 in**	**>= L_{dh} = 13.42 in**				**OK**
	Hook tail length:	L_{h_tail} =	12 * db beyond the bend radius	L_{h_tail} =	14.0	in	
	Length available in pad:	L_{h_pad} =	12*MIN((W/2-(2/3)*BW*cos(30°)+Offset-dpier/2),(W-BW-dpier)/2) + ccpier - ccpad	L_{h_pad} =	15.4	in	
Check	**L_{h_pad} =**	**15.40 in**	**>= L_{dh_tail} = 14.00 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:	$s_{\_t}$ =	4	d_{b_t} = 0.5 in			
	$m_{\_t}$ =	5	A_{b_t} = 0.2 in^2			
Allowable tie spacing per vertical rebar:	$B_{s\_t\_max1}$ =	8 / z * db_c		$B_{s\_t\_max1}$ =	14	in
per tie size:	$B_{s\_t\_max2}$ =	24 / z * db_t		$B_{s\_t\_max2}$ =	24	in

per pier diameter:	$B_{s\_t\_max3}$ = di / (4 * z²)	$B_{s\_t\_max3}$ =	36	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)	$B_{s\_t\_max}$ =	14	in
Minimum required ties:	$m_{\_t\_min}$ = (D - T + E) / Bs_t_max + 2	$m_{\_t\_min}$ =	6.00	

Check **$m_{\_t}$ = 5.00 >= $m_{\_t\_min}$ = 6.00**

PAD DESIGN CHECKS

Minimum Steel Required for Shrinkage

Shrinkage:	ρ_{sh} = IF(Fy >= 60, 0.0018, 0.002)	ρ_{sh} =	0.0018	
Min. Required Shrinkage Steel:	$A_{st\_p\_sh}$ = ρsh * W * T	$A_{st\_p\_sh}$ =	12.960	in^2

Check **A_{s_p} = 23.70 in^2 >= A_{st_p} = 12.96 in^2** **OK**

Bar Separation

Bar separation:	B_{s_pad} = (W - 2 * cc - db) / (m - 1)	B_{s_pad} =	10.10	in

Check **18" >= B_{s_p} = 10.10 in >= 2"** **OK**

Pad Development Length

Reinforcement location:	α_p = if space under bar > 12", 1.3, else use 1.0	α_p =	1.3	
Epoxy coating:	β_p = for non- epoxy coated, use 1.0	β_p =	1.0	
Max term:	$\alpha\beta_p$ = product of α x β not to exceed 1.7	$\alpha\beta_p$ =	1.3	
Reinforcement size:	γ_p = if bar size is 6 or less, 0.8, else use 1.0	γ_p =	1	
Light weight concrete:	λ_p = 1.0	λ_p =	1.0	
Spacing/cover:	c_p = use smaller of half of bar spacing or concrete cover	c_p =	3.50	in
Transverse bars:	k_{tr_p} = 0 in (per simplification)	k_{tr_p} =	0	in
Max term:	c_p' = MIN(2.5, (c + ktr) / db)	c_p' =	2.500	
Required moment (φt = 0.9):	M_{nr} = Mu_pad / φflex	M_{nr} =	493.7	ft-kips
Steel estimate:	A_{st_p}' = Mn / (φt * Fy * dc)	A_{st_p}' =	5.626	in^2
	a_p = Ast' * Fy / (β * F'c * W)	a_p =	0.44	in
Required steel:	$A_{st\_p\_st}$ = M_{nr} / (Fy * (dc - ap / 2))	$A_{st\_p\_st}$ =	5.121	in^2
Excess reinforcement:	R_p = Ast_p / As_p	R_p =	0.55	
Development (tensile):	L_d = (3 / 40) * (Fy*1000 / √(F'c*1000)) * αβ * γ * λ * R * db / c'	L_d =	23.36	in
Minimum length:	L_{d_min} = 12 inches	L_{d_min} =	12.0	in
Development length:	L_{dp} = MAX(Ld_min, Ldp')	L_{dp} =	23.36	in
Length available in pad:	L_{pad} = 12*MIN((W/2-(2/3)*BW*cos(30°)+Offset-dpier/2),(W-BW-dpier)/2)- ccpad	L_{pad} =	70.70	in

Check **L_{pad} = 70.70 in >= L_{dp} = 23.36 in** **OK**

Moment Capacity of Drilled Concrete Shaft (Caisson) for TIA Rev F, G, or H

Note: Shaft assumed to have ties, not spiral, transverse reinforcing

Site Data

ES-005
ProspectRS

Maximum Shaft Superimposed Forces		
TIA Revision:	H	
Max. Factored Shaft Mu:	67.5	ft-kips **(* Note)**
Max. Factored Shaft Pu:	142	kips
Max Axial Force Type:	Tension	

(*) Note: Max Shaft Superimposed Moment does not necessarily equal to the shaft top reaction moment

Loads Already Factored		
For M (WL):	1.00	
For P (DL):	1.00	

Load Factor	Shaft Factored Loads		
1.00	Mu:	67.5	ft-kips
1.00	Pu:	142	kips

Pier Properties		
Concrete:		
Pier Diameter =	3.0	ft
Concrete Area =	1017.9	in^2
Reinforcement:		
Clear Cover to **Tie**=	3.00	in
Horiz. **Tie** Bar Size=	4	
Vert. Cage Diameter =	2.34	ft
Vert. Cage Diameter =	28.13	in
Vertical Bar Size =	7	
Bar Diameter =	0.88	in
Bar Area =	0.6	in^2
Number of Bars =	14	
As Total=	8.4	in^2
A s/ Aconc, Rho:	0.0083	0.83%

Material Properties		
Concrete Comp. strength, f'c =	3000	psi
Reinforcement yield strength, Fy =	60	ksi
Reinforcing Modulus of Elasticity, E =	29000	ksi
Reinforcement yield strain =	0.00207	
Limiting compressive strain =	0.003	
ACI 318 Code		
Select Analysis ACI Code=	2014	

SOLVE <-- Press Upon Completing All Input

ACI 10.5 , ACI 21.10.4, and IBC 1810.

Min As for Flexural, Tension Controlled, Shafts:

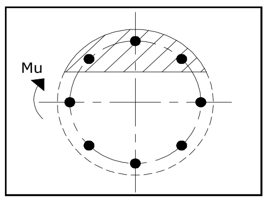
(3)*(Sqrt(f'c)/Fy:	0.0027
200 / Fy:	0.0033

Minimum Rho Check:

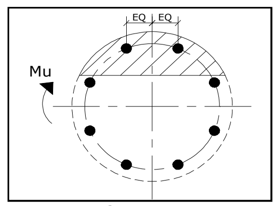
Assumed Min. Rho:	0.50%	
Provided Rho:	0.83%	OK

Results:

Governing Orientation Case: **2**



Case 1



Case 2

Dist. From Edge to Neutral Axis:	**5.82**	in
Extreme Steel Strain, εt:	**0.0133**	
	εt > 0.0050, Tension Controlled	
Reduction Factor,φ:	**0.900**	

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn. Pn		
per ACI 318 (10-2)	1600.65	kips
at Mu=(ϕ=0.65)Mn=	399.04	ft-kips
Max Tu, (φ=0.9) Tn =	453.6	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Output Note: Negative Pu=Tension

For Axial Compression, φ Pn = Pu:	-127.80	kips
Drilled Shaft Moment Capacity, φMn:	**383.62**	ft-kips
Drilled Shaft Superimposed Mu:	**67.50**	ft-kips
(Mu/φMn, Drilled Shaft Flexure CSR:	**17.6%**	

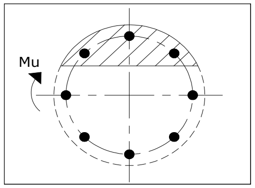
Maximum Allowable Moment of a Circular Pier

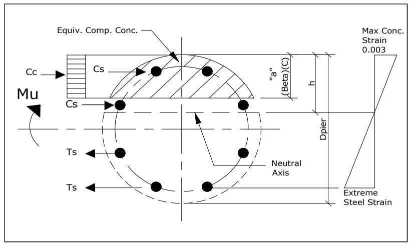
Pu: 142 kips (from Results Tab)
Axial Force type: Tension (from Results Tab)

For Internal Calculations:
Axial Load (Negative for Compression) = 142.00 kips

	Case 1	Case 2	
Reduction factor, ϕ2002 =	0.90	0.90	<-- ϕ based on ACI 318 2002, Section 9.3.2.2 and corresponding comentaries. Transition zone equation for ties: φ=0.48+83(εt). Transition zone equation for spirals: φ=0.57+67(εt).
Reduction factor, ϕ2005 =	0.90	0.90	<-- ϕ based on ACI 318 2005, Section 9.3.2.2 and corresponding comentaries. Transition zone equation for ties: φ=0.65+((εt)-0.002)(250/3). Transition zone equation for spirals: φ=0.70+((εt)-0.002)(200/3).
Reduction factor, ϕ2014 =	0.90	0.90	<-- ϕ based on ACI 318 2014, Section 21.2 and corresponding comentaries. Transition zone equation for ties: φ=0.65+0.25((εt-εty)/(0.005-εty). Transition zone equation for spirals: φ=0.75+0.15((εt-εty)/(0.005-εty).
ł ACI code:	0.90	0.90	

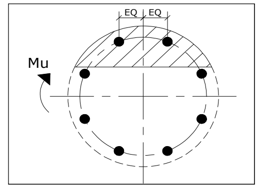
Case 1: Single Bar Near the Extreme Fiber





General Sketch (Variables) for both cases

Case 2: (2) Equidistant Bars Near the Extreme Fiber



Case 1

Neutral Axis

Distance from extreme edge to neutral axis, h = 5.86 in
Equivalent compression zone factor = 0.85
Distance from extreme edge to equivalent compression zone factor, a = 4.98 in
Distance from centroid to neutral axis = 12.14 in

Compression Zone

Area of steel in compression zone, Asc = 0.60 in^2
Angle from centroid of pier to intersection of equivalent compression zone and edge of pier = 43.67 deg <-- 1/2 of total angle
Area of concrete in compression, Acc = 85.13 in^2
Force in concrete = 0.85 * f'c * Acc, Fc = 217.08 kips <-- ϕ Not Involved = Concrete Pn
Total reinforcement forces, Fs = -359.08 kips <-- ϕ Not Involved = Total Steel Pn
Case 1, φ= 0.900
Axial (comp=negative), Pu = 142.00 kips <-- Pu
Balance Force in concrete, Fs+Fu = -217.08 kips
Shaft Comp. Capacity, ϕPn= **-127.80** kips <--φ Pn=Pu

Sum of the axial forces in the shaft = 0.00 kips OK

Maximum Moment

First moment of the concrete area in compression about the centoid = 1280.13 in^3
Distance between centroid of concrete in compression and centroid of pier = 15.04 in
Moment of concrete in compression = 3264.34 in-kips 272.0281 ft-kips
Total reinforcement moment = 1861.52 in-kips 155.127 ft-kips
Nominal Moment strength of Drilled Shaft Mn = 5125.86 in-kips
Moment Capacity of Drilled Shaft, ϕMn = 4613.28 in-kips 384.4396 ft-kips

Case 1, φMn = 384.44 ft-kips

Case 2

Neutral Axis

Distance from extreme edge to neutral axis, h = 5.82 in
Equivalent compression zone factor = 0.85
Distance from extreme edge to equivalent compression zone factor, a = 4.95 in
Distance from centroid to neutral axis = 12.18 in

Compression Zone

Area of steel in compression zone, Asc = 1.20 in^2
Angle from centroid of pier to intersection of equivalent compression zone and edge of pier = 43.51 deg <-- 1/2 of total angle
Area of concrete in compression, Acc = 84.28 in^2
Force in concrete = 0.85 * f'c * Acc, Fc = 214.92 kips <-- ϕ Not Involved = Concrete Pn
Total reinforcement forces, Fs = -356.92 kips <-- ϕ Not Involved = Total Steel Pn
Case 2, φ= 0.900
Axial (comp=negative), Pu = 142.00 kips <-- Pu
Balance Force in concrete, Fs+Fu = -214.92 kips
Shaft Comp. Capacity, ϕPn= **-127.80** kips <--φ Pn=Pu

Sum of the axial forces in concrete in the shaft= 0.00 kips OK

Maximum Moment

First moment of the concrete area in compression about the centoid = 1269.07 in^3
Distance between centroid of concrete in compression and centroid of pier = 15.06 in
Moment of concrete in compression = 3236.12 in-kips 269.6766 ft-kips
Total reinforcement moment = 1878.81 in-kips 156.5671 ft-kips
Nominal Moment strength of Drilled Shaft Mn = 5114.93 in-kips
Moment Capacity of Drilled Shaft, ϕMn = 4603.43 in-kips 383.6194 ft-kips

Case 2, φMn = 383.62 ft-kips

Case 3: = Case 1, but Pu set at Max Axial Compression per ACI 318 (10-2) and phi=0.65.

Neutral Axis

Distance from extreme edge to neutral axis, h = 33.08 in
Equivalent compression zone factor = 0.85
Distance from extreme edge to equivalent compression zone factor, a = 28.12 in
Distance from centroid to neutral axis = -15.08 in

Compression Zone

Area of steel in compression zone, Asc = 6.60 in^2
Angle from centroid of pier to intersection of equivalent compression zone and edge of pier = 124.20 deg <-- 1/2 of total angle
Area of concrete in compression, Acc = 852.96 in^2
Force in concrete = 0.85 * f'c * Acc, Fc = 2175.05 kips <-- ϕ Not Involved = Concrete Pn
Total reinforcement forces, Fs = 287.48 kips <-- ϕ Not Involved = Total Steel Pn
φ= 0.65
Magnified, Max Axial Comp, Pn, per ACI 318 (10-2)/(ϕ=0.65)= -2462.53 kips <-- (Pn per ACI 10-2)/ϕ
Balance Force in concrete, Fs+Fu = -2175.05 kips
Shaft Comp. Capacity, (ϕ=0.65)Pn= **1600.65** kips <--φ Pn=Pu

Sum of the axial forces in the shaft = 0.00 kips OK

Maximum Moment

First moment of the concrete area in compression about the centoid = 2199.71 in^3
Distance between centroid of concrete in compression and centroid of pier = 2.58 in
Moment of concrete in compression = 5609.26 in-kips 467.4386 ft-kips
Total reinforcement moment = 1757.71 in-kips 146.476 ft-kips
Nominal Moment strength of Drilled Shaft Mn = 7366.97 in-kips
Moment Capacity of Drilled Shaft, (ϕ=0.65)Mn = 4788.53 in-kips 399.0445 ft-kips

Case 3, at Pmax, (φ=0.65)Mn = 399.04 ft-kips

Final Results

Final Results		
Governing Orientation Case=	**2**	
phi, φ=	0.900	
Shaft ϕ*Mn=	**383.62**	ft-kips
Distance from Edge of Shaft to N.A.=	5.82	in
Shaft Beta=	0.85	
Maximum Tensile Strain=	-0.01335	<------------ εt > 0.0050, Tension Controlled — TC
Shaft Tension Cap., φTn= (φ=0.9)*(Total As)(Fy)=	453.60	kips
Shaft Max Comp, (φ=0.65)(0.80)[0.85*f'c*(Ag-Ast)+Ast*Fy]=	1600.65	kips

Individual Bars (Case 1)

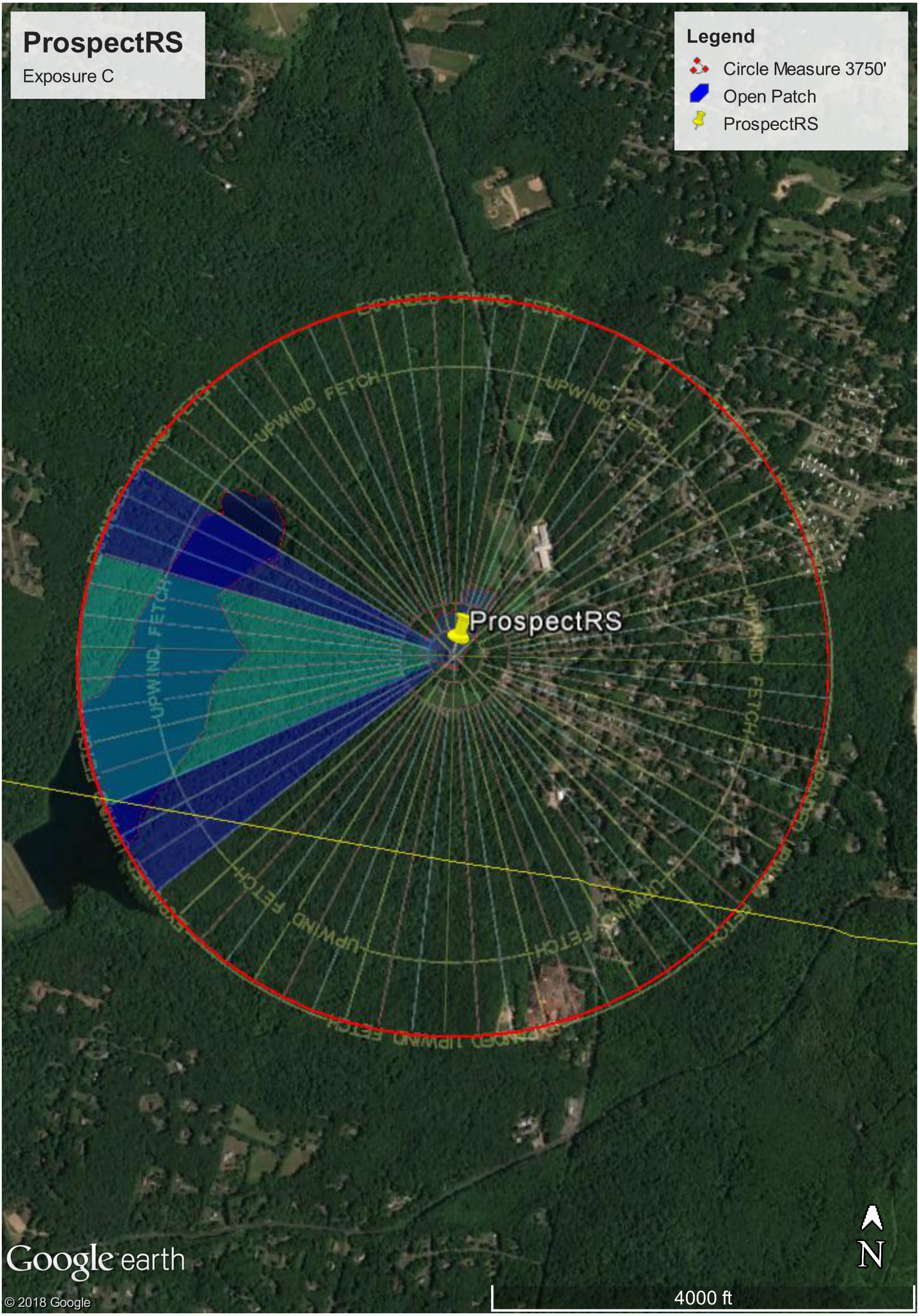
Bar #	Angle from first bar (deg)	Distance to center of shaft (in)	Distance to neutral axis (in)	Distance to equivalent comp. zone (in)	Strain	Area of steel in compression (in^2)	Stress (ksi)	Axial force (kips)	Moment (in-kips)
1	0.00	14.06	1.92	1.04	0.00098	0.60	28.53	15.59	219.25
2	25.71	12.67	0.53	-0.35	0.00027	0.00	7.86	4.71	59.72
3	51.43	8.77	-3.37	-4.25	-0.00173	0.00	-50.08	-30.05	-263.47
4	77.14	3.13	-9.01	-9.89	-0.00461	0.00	-60.00	-36.00	-112.65
5	102.86	-3.13	-15.27	-16.15	-0.00782	0.00	-60.00	-36.00	112.65
6	128.57	-8.77	-20.91	-21.79	-0.01071	0.00	-60.00	-36.00	315.64
7	154.29	-12.67	-24.81	-25.69	-0.01270	0.00	-60.00	-36.00	456.12
8	180.00	-14.06	-26.20	-27.08	-0.01342	0.00	-60.00	-36.00	506.25
9	205.71	-12.67	-24.81	-25.69	-0.01270	0.00	-60.00	-36.00	456.12
10	231.43	-8.77	-20.91	-21.79	-0.01071	0.00	-60.00	-36.00	315.64
11	257.14	-3.13	-15.27	-16.15	-0.00782	0.00	-60.00	-36.00	112.65
12	282.86	3.13	-9.01	-9.89	-0.00461	0.00	-60.00	-36.00	-112.65
13	308.57	8.77	-3.37	-4.25	-0.00173	0.00	-50.08	-30.05	-263.47
14	334.29	12.67	0.53	-0.35	0.00027	0.00	7.86	4.71	59.72

(Case 2)

Bar #	Angle from first bar (deg)	Distance to center of shaft (in)	Distance to neutral axis (in)	Distance to equivalent comp. zone (in)	Strain	Area of steel in compression (in^2)	Stress (ksi)	Axial force (kips)	Moment (in-kips)
1	12.86	13.71	1.53	0.66	0.00079	0.60	22.86	12.19	167.06
2	38.57	10.99	-1.19	-2.06	-0.00061	0.00	-17.74	-10.64	-117.02
3	64.29	6.10	-6.08	-6.95	-0.00313	0.00	-60.00	-36.00	-219.65
4	90.00	0.00	-12.18	-13.05	-0.00628	0.00	-60.00	-36.00	0.00
5	115.71	-6.10	-18.28	-19.16	-0.00943	0.00	-60.00	-36.00	219.65
6	141.43	-10.99	-23.18	-24.05	-0.01195	0.00	-60.00	-36.00	395.80
7	167.14	-13.71	-25.89	-26.76	-0.01335	0.00	-60.00	-36.00	493.56
8	192.86	-13.71	-25.89	-26.76	-0.01335	0.00	-60.00	-36.00	493.56
9	218.57	-10.99	-23.18	-24.05	-0.01195	0.00	-60.00	-36.00	395.80
10	244.29	-6.10	-18.28	-19.16	-0.00943	0.00	-60.00	-36.00	219.65
11	270.00	0.00	-12.18	-13.05	-0.00628	0.00	-60.00	-36.00	0.00
12	295.71	6.10	-6.08	-6.95	-0.00313	0.00	-60.00	-36.00	-219.65
13	321.43	10.99	-1.19	-2.06	-0.00061	0.00	-17.74	-10.64	-117.02
14	347.14	13.71	1.53	0.66	0.00079	0.60	22.86	12.19	167.06

Individual Bars (Case 3)

Bar #	Angle from first bar (deg)	Distance to center of shaft (in)	Distance to neutral axis (in)	Distance to equivalent comp. zone (in)	Strain	Area of steel in compression (in^2)	Stress (ksi)	Axial force (kips)	Moment (in-kips)
1	0.00	14.06	29.14	24.18	0.00264	0.60	60.00	34.47	484.73
2	25.71	12.67	27.75	22.79	0.00252	0.60	60.00	34.47	436.73
3	51.43	8.77	23.85	18.89	0.00216	0.60	60.00	34.47	302.23
4	77.14	3.13	18.21	13.25	0.00165	0.60	47.89	27.20	85.13
5	102.86	-3.13	11.95	6.99	0.00108	0.60	31.43	17.33	-54.22
6	128.57	-8.77	6.31	1.35	0.00057	0.60	16.60	8.43	-73.91
7	154.29	-12.67	2.41	-2.55	0.00022	0.00	6.34	3.80	-48.18
8	180.00	-14.06	1.02	-3.94	0.00009	0.00	2.67	1.60	-22.57
9	205.71	-12.67	2.41	-2.55	0.00022	0.00	6.34	3.80	-48.18
10	231.43	-8.77	6.31	1.35	0.00057	0.60	16.60	8.43	-73.91
11	257.14	-3.13	11.95	6.99	0.00108	0.60	31.43	17.33	-54.22
12	282.86	3.13	18.21	13.25	0.00165	0.60	47.89	27.20	85.13
13	308.57	8.77	23.85	18.89	0.00216	0.60	60.00	34.47	302.23
14	334.29	12.67	27.75	22.79	0.00252	0.60	60.00	34.47	436.73


ProspectRS
Exposure C
Legend
Circle Measure 3750'
Open Patch
ProspectRS
ProspectRS
UPWIND FETCH
Google earth
© 2018 Google
4000 ft
N

ATTACHMENT D – PROOF OF DELIVERY OF NOTICE

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

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 22MAY20
ACTWGT: 1.20 LB MAN
CAD: 0765627/CAFE3311

BILL THIRD PARTY

TO **MARY BARTON LAND USE INSPECTOR**
TOWN OF PROSPECT
36 CENTER STREET

PROSPECT CT 06712
REF: PROSPECT BLACK&VEATCH
DEPT: BL GRAPHICS

56SC3/2925/05A2

FedEx Express

E

J191219082001uv

TRK# 0201 **1714 2090 3881**

TUE – 26 MAY 10:30A
PRIORITY OVERNIGHT

00 BNHA

06712
CT-US **BDL**

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

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 22MAY20
ACTWGT: 1.20 LB
CAD: 0765627/CAFE3311

BILL THIRD PARTY

TO **MAYOR ROBERT J. CHATFIELD**
TOWN OF PROSPECT
36 CENTER STREET

PROSPECT CT 06712
REF: PROSPECT BLACK&VEATCH
DEPT: BL GRAPHICS

56SC3/2925/05A2

FedEx Express

E

J191219082001uv

TRK# 0201 **1714 2090 3870**

TUE – 26 MAY 10:30A
PRIORITY OVERNIGHT

00 BNHA

06712
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-005

18 Kluge Road

Prospect, CT 06712

April 6, 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 addition of an Eversource antenna to the existing self-support tower at 18 Kluge Road in Prospect, CT.

Eversource is proposing to install one omnidirectional antenna as part of its 220 MHz communications system.

This report considers the proposed 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 proposed Eversource omnidirectional antenna has a narrow vertical beamwidth of 30°; therefore, the majority of the RF power is focused out towards the horizon. Please refer to Attachment C, for the vertical pattern of the proposed Eversource antenna. 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 to account for the lower relative gain below the omni-directional antennas, and a nominal 30 dB off-beam pattern loss for the highly directional point-to -point microwave antenna. Any inactive or receive-only antennas are not listed in the table, as they 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
CL&P (Eversource)	130	37.8	1	100	0.0002	0.2000	0.12%
CL&P (Eversource)	100	37.8	1	100	0.0004	0.2000	0.20%
CL&P (Eversource)	150	154.46375	1	990	0.0017	0.2000	0.86%
CL&P (Eversource)	130	220	5	10	0.0001	0.2000	0.06%
CL&P (Eversource)	150	451.25	1	158	0.0003	0.3008	0.09%
CL&P (Eversource)	156	6805	1	7943	0.0127	1.0000	1.27%
CL&P (Eversource)	81	6855	1	794	0.0051	1.0000	0.51%
CL&P (Eversource)	142	153.695	1	0	0.0000	0.2000	0.00%
Eversource	159.5	47.8	1	100	0.0002	0.2000	0.08%
Eversource	162	154.46375	1	990	0.0015	0.2000	0.73%
Eversource	162	451.25	1	158	0.0002	0.3008	0.08%
Eversource	120.5	900	1	220	0.0006	0.6000	0.10%
Eversource	118	37.8	1	100	0.0003	0.2000	0.14%
Eversource	84	6855	1	10000	0.0006	1.0000	0.06%
Eversource	153	217	4	124.17	0.0008	0.2000	0.41%
						Total	**1.60%**

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

The CT Siting Council power density database (12/13/2019) reflects entries for existing CL&P (now Eversource) antennas. These entries are shaded grey in the table above and have been replaced by the unshaded entries in the calculations, which are based upon updated operating parameters provided by Eversource as part of this project. The blue entry reflects the parameters of the proposed Eversource transmit antenna. Therefore, the total % MPE calculated is based upon only the unshaded and blue entries in the table.

[1] 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 based upon the Black & Veatch Structural Analysis Report dated March 4, 2020. The specific ERP for the 6855 MHz point-to-point transmitter was unavailable and a nominal ERP 10 kW (70 dBm) was considered in the calculations.

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 **1.60% 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.

Keith Vellante

April 6, 2020

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

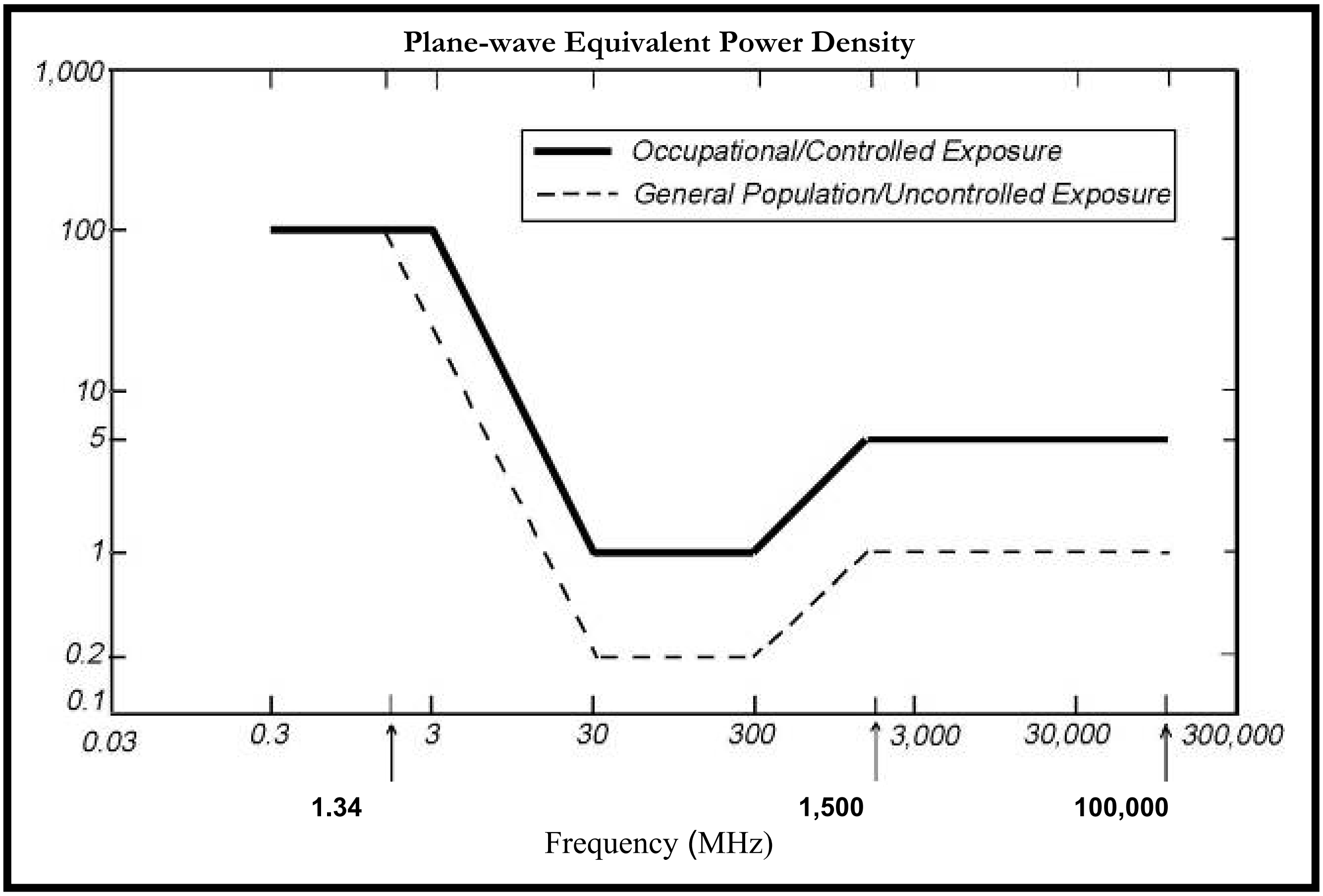


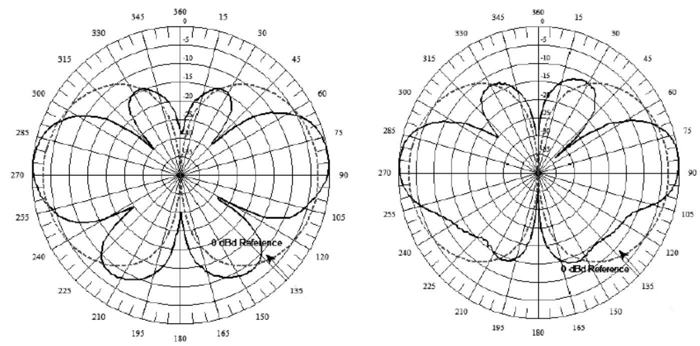
Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Eversource Antenna Data Sheet 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’

DS2C03F36D-N
DS2C03F36D-D



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