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

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

January 10, 2022

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

RE: **Notice of Exempt Modification**
Ekonk CSP Sterling
389 Ekonk Hill Road, Sterling, CT 06354
Latitude: 41-39-49.23 N / Longitude: 71-50-56.45 W

Dear Ms. Bachman:

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource") currently maintains multiple antennas at various mounting heights on an existing 140-foot self-support tower located at 389 Ekonk Hill Road in Sterling. See Attachment A, Parcel Map and Property Card. The tower and property are owned by the State of Connecticut and utilized by the Department of Emergency Services and Public Protection ("DESPP"). Eversource and DESPP have entered into an agreement allowing the modification of Eversource's equipment on the Connecticut State Police tower. See Attachment B, Letter of Authorization. Eversource plans to remove and replace two 12-inch by 12-inch panel antennas with one 26-inch by 17-inch broadband log periodic antenna to be mounted on a new 1-foot stand-off mount at 109 feet above ground level ("AGL"). The existing cabling will be reused for the new antenna. 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 are depicted on Attachment C, Construction Drawings, dated October 15, 2021 and Attachment D, Structural Analysis, dated August 26, 2021. The Connecticut Siting Council approved the self-support tower at this location in Docket No. 157 in March 1993.

The proposed installation is part of Eversource's continued investment in upgrading its communications infrastructure. The current network consists of a combination of fiber and wireless backhaul networks that includes a 900 MHz private radio network which is augmented by cellular services, when possible. These systems are now nearing capacity and require enhancement. The addition of the new 450 MHz base station at this site will provide communications to additional field units to help manage system capacity while providing connectivity to the existing radio network and cellular systems.

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 Lincoln A. Cooper, First Selectman for the Town of Sterling and Melissa Gil, Zoning Enforcement Officer for the Town of Sterling via private carrier. Proof of delivery is attached. See Attachment E, 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 October 6, 2021 (Attachment F – Power Density Report).
5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.
6. The existing structure and its foundation can support the proposed loading.

For the foregoing reasons, Eversource respectfully submits that the proposed modifications to the above referenced telecommunications facility constitute an exempt modification under R.C.S.A. § 16-50j-72(b)(2). One original and 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 Lincoln A. Cooper, First Selectman, Town of Sterling
Melissa Gil, Zoning Enforcement Officer, Town of Sterling
DESPP

Attachments

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

ATTACHMENT A – PARCEL MAP AND PROPERTY CARD


Legend
Approximate Tower Location
EKEKONKIHILL RD
C16
1 AC
363
72
7
0.2 AC
389
8
2.6 AC
393
9
4.6 AC
419
9A
1.4 AC
421
21
9.91 AC
422
21A
0.25 AC
426
396
10
47.8 AC
34
413
267
241
394
60m

tyler clt division

RESIDENTIAL PROPERTY RECORD CARD 2016

TOWN OF STERLING

Situs : 389 EKONK HILL RD	Map ID: 00025400	Class: State	Card: 1 of 1	Printed: March 9, 2016

CURRENT OWNER

CONNECTICUT STATE OF

389 EKONK HILL ROAD
STERLING CT 06377

GENERAL INFORMATION

Living Units	0
Neighborhood	200
Alternate Id	03633-034-0007
Vol / Pg	14/540
District	
Zoning	
Class	400

Property Notes

FORMER FIRE TOWER
CTS SITE # 49 800-842-0200 ASK

Land Information

Type		Size	Influence Factors	Influence %	Value
Primary	AC	0.2000			25,600

Total Acres: .2
Spot: Location:

Assessment Information

	Assessed	Appraised	Cost	Income	
Land	17,920	25,600	25,600	0	25,600
Building	12,750	18,210	18,210	0	18,210
Total	30,670	43,810	43,810	0	43,810

Manual Override Reason
Base Date of Value 10-01-2012
Value Flag COST APPROACH
Effective Date of Value 10-01-2016
Gross Building:

Entrance Information

Date	ID	Entry Code	Source
02/28/07	AS	Exterior	Other

Permit Information

Date Issued	Number	Price	Purpose	% Complet

Sales/Ownership History

Transfer Date	Price	Type	Validity	Deed Reference	Deed Type	Grantee

tyler clt division

RESIDENTIAL PROPERTY RECORD CARD 2016

TOWN OF STERLING

Situs : 389 EKONK HILL RD	Parcel Id: 00025400	Class: State	Card: 1 of 1	Printed: March 9, 2016

Dwelling Information

Style		Year Built	
Story height		Eff Year Built	
Attic		Year Remodeled	
Exterior Walls		Amenities	
Masonry Trim	x		
Color		In-law Apt	No

Basement

Basement		# Car Bsmt Gar	
FBLA Size	x	FBLA Type	
Rec Rm Size	x	Rec Rm Type	

Heating & Cooling / Fireplaces

Heat Type		Stacks	
Fuel Type		Openings	
System Type		Pre-Fab	

Room Detail

Bedrooms		Full Baths	
Family Rooms		Half Baths	
Kitchens		Extra Fixtures	
Total Rooms			
Kitchen Type		Bath Type	
Kitchen Remod		Bath Remod	

Adjustments

Int vs Ext		Unfinished Area	
Cathedral Ceiling	x	Unheated Area	

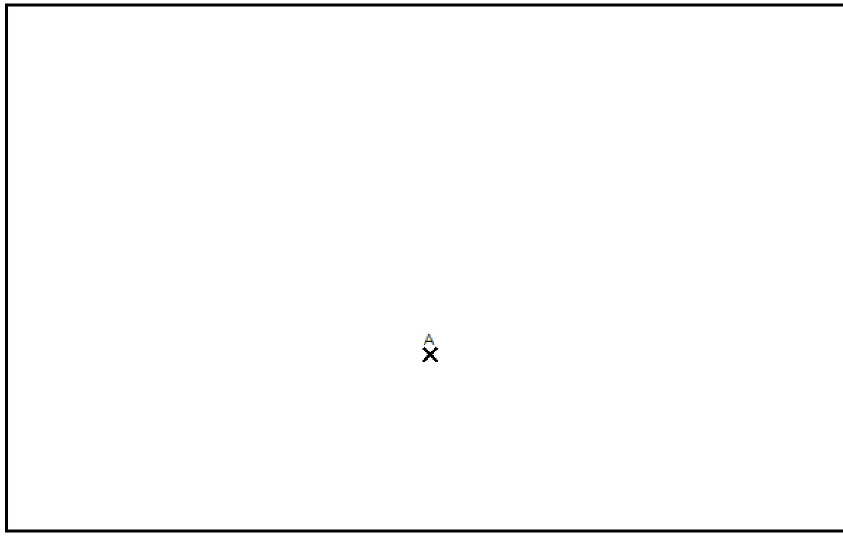
Grade & Depreciation

Grade	C	Market Adj	
Condition		Functional	
CDU	AVERAGE	Economic	
Cost & Design	0	% Good Ovr	
% Complete			

Dwelling Computations

Base Price		% Good	
Plumbing		% Good Override	
Basement		Functional	
Heating		Economic	
Attic		% Complete	
Other Features	0	C&D Factor	
		Adj Factor	
Subtotal		Additions	
Ground Floor Area			
Total Living Area		Dwelling Value	

Building Notes



ID	Code	Description	Area
A	SH1	WORKSHOP	0

Outbuilding Data

Type	Size 1	Size 2	Area	Qty	Yr Blt	Grade	Condition	Value
Wkshp	18 x	50	900	1	2000	A	3	18,210

Condominium / Mobile Home Information

Complex Name			
Condo Model			
Unit Number			
Unit Level		Unit Location	
Unit Parking		Unit View	
Model (MH)		Model Make (MH)	

Addition Details

Line #	Low	1st	2nd	3rd	Value

ATTACHMENT B – LETTER OF AUTHORIZATION

STATE OF CONNECTICUT
DEPARTMENT OF EMERGENCY SERVICES AND PUBLIC PROTECTION

April 7, 2020

Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Letter of Authorization** – Co-location on Connecticut State Police tower
Property address: Ekonk Hill Road, Sterling, CT
Latitude: 41-39-49.29" Longitude: 71-50-56.47"

To Whom It May Concern:

Eversource Energy (Eversource) has an Agreement with the Connecticut Department of Emergency Services and Public Protection (DESPP) to co-locate its communications equipment on the DESPP tower located at Ekonk Hill Road, Sterling, Connecticut.

Eversource shall be required by the terms of the agreement to seek and obtain all necessary permits and approvals. As a duly authorized representative of the DESPP, permission is hereby granted to Eversource and agents thereof, for the purpose of consummating any applications necessary to gain the required approvals from the State of Connecticut.

Any fees or charges associated with all applications or permits and any conditions placed on the applicant shall be the sole responsibility of Eversource.

Yours truly,

Brian Benito
Planning Specialist
State Of Connecticut
Department of Emergency Services and Public Protection
CTS Unit
860-685-8297
brian.benito@ct.gov

Re: Eversource - Ekonk CSP - upgrades/updates under 4RF 450 MHz project

Northgraves, Clayton <Clayton.Northgraves@ct.gov>
To Khan, Zarak

Reply | Reply All | Forward | ...

Tue 1/4/2022 8:10 PM

You replied to this message on 1/5/2022 10:54 AM.

Greetings, you may proceed, but please contact our network control center (NCC) in advance of work at this site. Or, notify me and I will notify the NCC.

Best,
Clayton

On Jan 4, 2022, at 11:54, Khan, Zarak <zarak.khan@eversource.com> wrote:

Hi Clayton,

I wanted to reach out again and request that LOA for Ekonk that was requested previously, as talks between ES and DESSP have been moving forward in the right direction in the last couple of months.

As mentioned previously Replacing the current 2 panel antenna and putting in a directional Yagi antenna. Space and loading is expected to reduce. Structural is done, but no additional space will be taken on the tower.

Please let me know if you have any questions.

Thanks,

Zarak Khan
EVERSOURCE | Telecommunications Engineering
Cell : 214-986-7861
Office : 860-665-6135

ATTACHMENT C – CONSTRUCTION DRAWINGS

EVERSOURCE

EKONK CSP STERLING

389 EKONK HILL ROAD
STERLING, CT 06354

GENERAL NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2015 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2018 CONNECTICUT SUPPLEMENT, INCLUDING THE TIA/EIA–222 REVISION "H" "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND SUPPORTING STRUCTURES." 2017 CONNECTICUT FIRE SAFETY CODE, NATIONAL ELECTRICAL CODE AND LOCAL CODES.
2. CONTRACTOR SHALL REVIEW ALL DRAWINGS AND SPECIFICATIONS IN THE CONTRACT DOCUMENT SET. CONTRACTOR SHALL COORDINATE ALL WORK SHOWN IN THE SET OF DRAWINGS. THE CONTRACTOR SHALL PROVIDE A COMPLETE SET OF DRAWINGS TO ALL SUBCONTRACTORS AND ALL RELATED PARTIES. THE SUBCONTRACTORS SHALL EXAMINE ALL THE DRAWINGS AND SPECIFICATIONS FOR THE INFORMATION THAT AFFECTS THEIR WORK.
3. CONTRACTOR SHALL PROVIDE A COMPLETE BUILD–OUT WITH ALL FINISHES, STRUCTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS AND PROVIDE ALL ITEMS AS SHOWN OR INDICATED ON THE DRAWINGS OR IN THE WRITTEN SPECIFICATIONS.
4. CONTRACTOR SHALL FURNISH ALL MATERIAL, LABOR AND EQUIPMENT TO COMPLETE THE WORK AND FURNISH A COMPLETED JOB ALL IN ACCORDANCE WITH LOCAL AND STATE GOVERNING AUTHORITIES AND OTHER AUTHORITIES HAVING LAWFUL JURISDICTION OVER THE WORK.
5. CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS AND ALL INSPECTIONS REQUIRED AND SHALL ALSO PAY FEES REQUIRED FOR THE GENERAL CONSTRUCTION, PLUMBING, ELECTRICAL, AND HVAC. PERMITS SHALL BE PAID FOR BY THE RESPECTIVE SUBCONTRACTORS.
6. CONTRACTOR SHALL MAINTAIN A CURRENT SET OF DRAWINGS AND SPECIFICATIONS ON SITE AT ALL TIMES AND INSURE DISTRIBUTION OF NEW DRAWINGS TO SUBCONTRACTORS AND OTHER RELEVANT PARTIES AS SOON AS THEY ARE MADE AVAILABLE. ALL OLD DRAWINGS SHALL BE MARKED VOID AND REMOVED FROM THE CONTRACT AREA. THE CONTRACTOR SHALL FURNISH AN 'AS–BUILT' SET OF DRAWINGS TO OWNER UPON COMPLETION OF PROJECT.
7. LOCATION OF EQUIPMENT AND WORK SUPPLIED BY OTHERS THAT IS DIAGRAMMATICALLY INDICATED ON THE DRAWINGS, SHALL BE DETERMINED BY THE CONTRACTOR. THE CONTRACTOR SHALL DETERMINE LOCATIONS AND DIMENSIONS SUBJECT TO STRUCTURAL CONDITIONS AND WORK OF THE SUBCONTRACTORS.
8. THE CONTRACTOR IS SOLELY RESPONSIBLE TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE AND TO ENSURE THE SAFETY OF THE EXISTING STRUCTURES AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, BRACING, UNDERPINNING, ETC. THAT MAY BE NECESSARY.
9. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.
10. ALL UTILITY WORK SHALL BE IN ACCORDANCE WITH LOCAL UTILITY COMPANY REQUIREMENTS AND SPECIFICATIONS.
11. ALL EQUIPMENT AND PRODUCTS PURCHASED ARE TO BE REVIEWED BY CONTRACTOR AND ALL APPLICABLE SUBCONTRACTORS FOR ANY CONDITION PER MANUFACTURER'S RECOMMENDATIONS. CONTRACTOR TO SUPPLY THESE ITEMS AT NO COST TO OWNER OR CONSTRUCTION MANAGER.
12. ANY AND ALL ERRORS, DISCREPANCIES, AND 'MISSED' ITEMS ARE TO BE BROUGHT TO THE ATTENTION OF THE EVERSOURCE CONSTRUCTION MANAGER DURING THE BIDDING PROCESS BY THE CONTRACTOR. ALL THESE ITEMS ARE TO BE INCLUDED IN THE BID. NO 'EXTRA' WILL BE ALLOWED FOR MISSED ITEMS.
13. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ON–SITE SAFETY FROM THE TIME THE JOB IS AWARDED UNTIL ALL WORK IS COMPLETE AND ACCEPTED BY THE OWNER.
14. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE CONSTRUCTION MANAGER FOR REVIEW.
15. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES AND EXISTING CONDITIONS AT THE SITE, PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA.
16. COORDINATION, LAYOUT, FURNISHING AND INSTALLATION OF CONDUITS AND ALL APPURTENANCES REQUIRED FOR PROPER INSTALLATION OF ELECTRICAL AND TELECOMMUNICATION SERVICE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
17. ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.
18. THE CONTRACTOR SHALL CONTACT 'CALL BEFORE YOU DIG' AT LEAST 48 HOURS PRIOR TO ANY EXCAVATIONS AT 1–800–922–4455. ALL UTILITIES SHALL BE IDENTIFIED AND CLEARLY MARKED. CONTRACTOR SHALL MAINTAIN AND PROTECT MARKED UTILITIES THROUGHOUT PROJECT COMPLETION.
19. CONTRACTOR SHALL COMPLY WITH THE OWNER'S ENVIRONMENTAL ENGINEER ON ALL METHODS AND PROVISIONS FOR ALL EXCAVATION ACTIVITIES INCLUDING SOIL DISPOSAL. ALL BACKFILL MATERIALS TO BE PROVIDED BY THE CONTRACTOR.

SITE DIRECTIONS

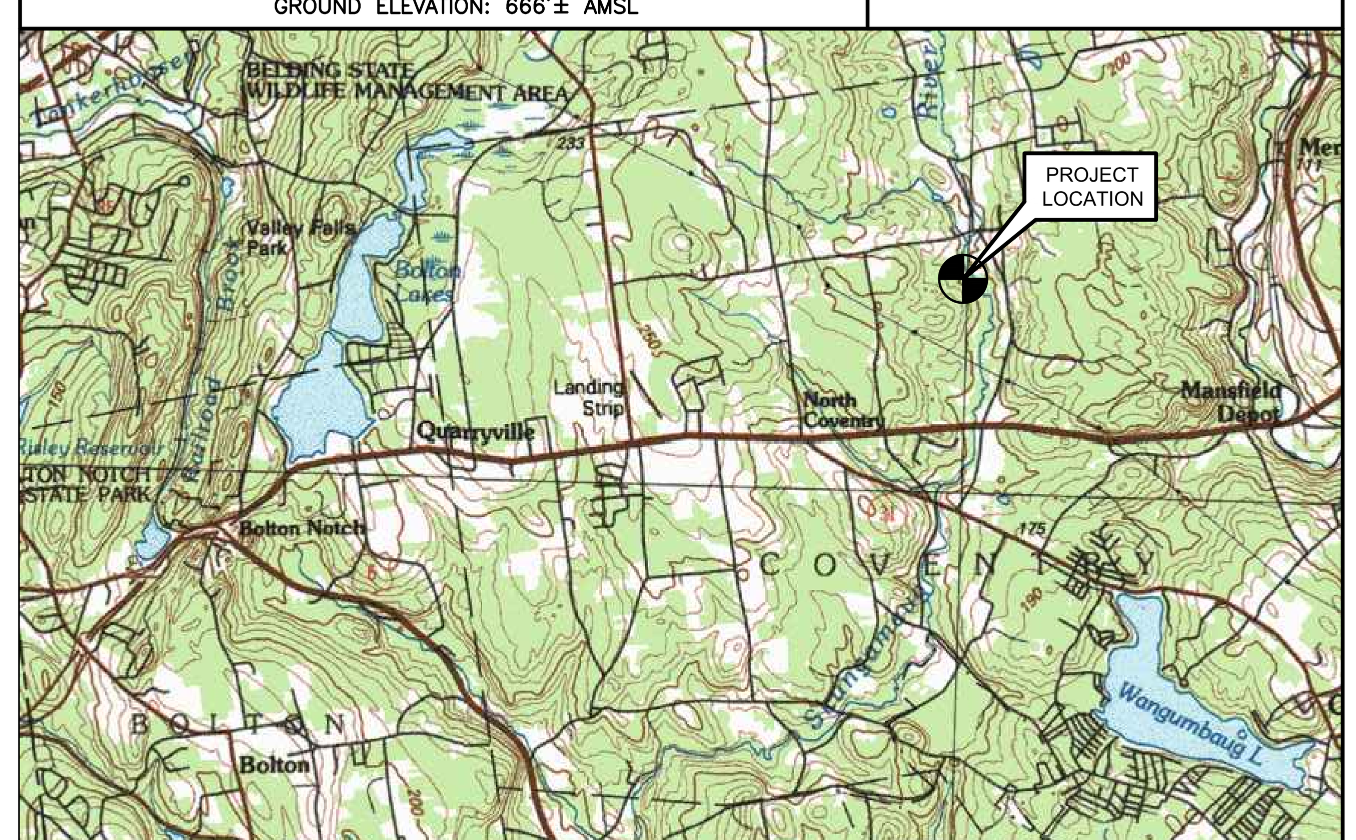
FROM: 107 SELDEN STREET
BERLIN, CT 06037

TO: 389 EKONK HILL ROAD
STERLING, CT 06354

1.	START OUT GOING SOUTH ON SELDEN ST TOWARD ELM ST.	0.40 MI.
2.	TURN LEFT ONTO DEMING RD/CT–160. CONTINUE TO FOLLOW CT–160.	2.86 MI.
3.	TURN LEFT ONTO CROMWELL AVE/CT–3. CONTINUE TO FOLLOW CT–3 N.	6.09 MI.
4.	MERGE ONTO CT–2 E TOWARD NORWICH	32.8 MI.
5.	MERGE ONTO I–395 N VIA EXIT 28 N TOWARD PROVIDENCE.	16.0 MI.
6.	TAKE THE CT–14A EXIT, EXIT 29, TOWARD PLAINFIELD/ONECO	0.19 MI.
7.	TURN RIGHT ONTO PLAINFIELD PIKE/STATE ROUTES 49 & 14A/CT–14A.	3.28 MI.
8.	TURN RIGHT ONTO STATE ROUTES 49 & 14A/EKONK HILL RD/CT–49	1.77 MI.
9.	DESTINATION IS ON THE LEFT	

SITE COORDINATES: LATITUDE: 41°–39'–49.23" N
LONGITUDE: 71°–50'–56.45" W
GROUND ELEVATION: 666'± AMSL

COORDINATES AND GROUND ELEVATION ARE REFERENCED FROM GOOGLE EARTH



VICINITY MAP

PROJECT SUMMARY

THE PROPOSED SCOPE OF WORK CONSISTS OF A MODIFICATION TO THE EXISTING UNMANNED TELECOMMUNICATIONS FACILITY INCLUDING THE FOLLOWING:

1. REMOVE (2) 12"X12" PANEL ANTENNAS (108–FT AGL + 110–FT AGL)
2. INSTALL (1) KATHREIN CL6–450B ANTENNA ON THE EXISTING PIPE–MOUNT AT 109–FT AGL. TO BE INSTALLED AT 270° AZIMUTH.
3. PROPOSED ANTENNA TO USE EXISTING 7/8" CABLE.
4. REMOVE AND REPLACE EXISTING STAND–OFF MOUNT

PROJECT INFORMATION

SITE NAME:	EKONK CSP STERLING
SITE ADDRESS:	389 EKONK HILL ROAD STERLING, CT 06354
APPLICANT:	EVERSOURCE 107 SELDEN STREET BERLIN, CT 06037
CONTACT PERSON:	ZARAK KHAN (PROJECT MANAGER) EVERSOURCE
ENGINEER OF RECORD:	CENTEK ENGINEERING, INC. 63–2 NORTH BRANFORD RD. BRANFORD, CT 06405 CARLO F. CENTORE, PE (203) 488–0580 EXT. 122
PROJECT COORDINATES:	LATITUDE: 41°–39'–49.23" N LONGITUDE: 71°–50'–56.45" W GROUND ELEVATION: 666'± AMSL SITE COORDINATES AND GROUND ELEVATION REFERENCED FROM GOOGLE EARTH.

SHEET INDEX

SHT. NO.	DESCRIPTION	REV.
T–1	TITLE SHEET	0
N–1	GENERAL NOTES AND SPECIFICATIONS	0
C–1	SITE LOCATION PLAN AND ANTENNA DETAIL	0
C–2	SITE PLAN AND ELEVATION	0
C–3	ANTENNA PLANS AND ELEVATIONS	0

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
0	10/15/21	RTS	TJR	CONSTRUCTION DRAWINGS – ISSUED FOR CONSTRUCTION

PROFESSIONAL ENGINEER SEAL

EVERSOURCE

CENTEK engineering
Centered on Solutions℠
(203) 488-0580
(203) 488-8587 Fax
63-2 North Branford Road
Branford, CT 06405
www.CentekEng.com

EVERSOURCE

EKONK CSP STERLING
389 EKONK HILL ROAD
STERLING, CT 06354

DATE: 08/27/21
SCALE: AS NOTED
JOB NO. 21082.10

TITLE SHEET

T–1

Sheet No. 1 of 5

NOTES AND SPECIFICATIONS

DESIGN BASIS:

GOVERNING CODE: 2015 INTERNATIONAL BUILDING (IBC) AS MODIFIED BY THE 2018 CONNECTICUT STATE BUILDING CODE.

1. DESIGN CRITERIA:

- RISK CATEGORY II (BASED ON IBC TABLE 1604.5)
- ULTIMATE DESIGN SPEED: 145 MPH (Vult) (EXPOSURE B/ IMPORTANCE FACTOR 1.0 BASED ON ASCE 7–10).

SITE NOTES

1. THE CONTRACTOR SHALL CALL UTILITIES PRIOR TO THE START OF CONSTRUCTION.
2. ACTIVE EXISTING UTILITIES, WHERE ENCOUNTERED IN THE WORK, SHALL BE PROTECTED AT ALL TIMES. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY, PRIOR TO PROCEEDING, SHOULD ANY UNCOVERED EXISTING UTILITY PRECLUDE COMPLETION OF THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
3. THE AREAS OF THE COMPOUND DISTURBED BY THE WORK SHALL BE RETURNED TO THEIR ORIGINAL CONDITION.
4. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING SITE DURING CONSTRUCTION. EROSION CONTROL MEASURES, SHALL BE IN CONFORMANCE WITH THE LOCAL GUIDELINES FOR EROSION AND SEDIMENT CONTROL.
5. IF ANY FIELD CONDITIONS EXIST WHICH PRECLUDE COMPLIANCE WITH THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AND SHALL PROCEED WITH AFFECTED WORK AFTER CONFLICT IS SATISFACTORILY RESOLVED.

GENERAL NOTES

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18. CONTRACTOR SHALL COMPLY WITH OWNER'S ENVIRONMENTAL ENGINEER ON ALL METHODS AND PROVISIONS FOR ALL EXCAVATION ACTIVITIES INCLUDING SOIL DISPOSAL. ALL BACKFILL MATERIALS TO BE PROVIDED BY THE CONTRACTOR.
19. THE COUNTY/CITY/TOWN WILL MAKE PERIODIC FIELD OBSERVATION AND INSPECTIONS TO MONITOR THE INSTALLATION, MATERIALS, WORKMANSHIP AND EQUIPMENT INCORPORATED INTO THE PROJECT TO ENSURE COMPLIANCE WITH THE DESIGN PLANS, SPECIFICATIONS, CONTRACT DOCUMENTS AND APPROVED SHOP DRAWINGS.
20. THE COUNTY/CITY/TOWN MUST BE NOTIFIED (2) WORKING DAYS PRIOR TO CONCEALMENT/BURIAL OF ANY SYSTEM OR MATERIAL THAT WILL PREVENT THE DIRECT INSPECTION OF MATERIALS, METHODS OR WORKMANSHIP. EXAMPLES OF THESE PROCESSES ARE BACKFILLING A GROUND RING OR TOWER FOUNDATION, POURING TOWER FOUNDATIONS, BURYING GROUND RODS, PLATES OR GRIDS, ETC. THE CONTRACTOR MAY PROCEED WITH THE SCHEDULED PROCESS (2) WORKING DAYS AFTER PROVIDING NOTICE UNLESS NOTIFIED OTHERWISE BY THE COUNTY/CITY/TOWN.

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL IS DESIGNED BY ALLOWABLE STRESS DESIGN (ASD)

   A. STRUCTURAL STEEL (W SHAPES)–––ASTM A992 (FY = 50 KSI)
   B. STRUCTURAL STEEL (OTHER SHAPES)–––ASTM A36 (FY = 36 KSI)
   C. STRUCTURAL HSS (RECTANGULAR SHAPES)–––ASTM A500 GRADE B, (FY = 46 KSI)
   D. STRUCTURAL HSS (ROUND SHAPES)–––ASTM A500 GRADE B, (FY = 42 KSI)
   E. PIPE–––ASTM A53 (FY = 35 KSI)
   F. CONNECTION BOLTS–––ASTM A325–N
   G. U–BOLTS–––ASTM A36
   H. ANCHOR RODS–––ASTM F 1554
   I. WELDING ELECTRODE–––ASTM E 70XX

2. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE ENGINEER FOR REVIEW. SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING: SECTION PROFILES, SIZES, CONNECTION ATTACHMENTS, REINFORCING, ANCHORAGE, SIZE AND TYPE OF FASTENERS AND ACCESSORIES. INCLUDE ERECTION DRAWINGS, ELEVATIONS AND DETAILS.
3. STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST PROVISIONS OF AISC MANUAL OF STEEL CONSTRUCTION.
4. PROVIDE ALL PLATES, CLIP ANGLES, CLOSURE PIECES, STRAP ANCHORS, MISCELLANEOUS PIECES AND HOLES REQUIRED TO COMPLETE THE STRUCTURE.
5. FIT AND SHOP ASSEMBLE FABRICATIONS IN THE LARGEST PRACTICAL SECTIONS FOR DELIVERY TO SITE.
6. INSTALL FABRICATIONS PLUMB AND LEVEL, ACCURATELY FITTED, AND FREE FROM DISTORTIONS OR DEFECTS.
7. AFTER ERECTION OF STRUCTURES, TOUCHUP ALL WELDS, ABRASIONS AND NON–GALVANIZED SURFACES WITH A 95% ORGANIC ZINC RICH PAINT IN ACCORDANCE WITH ASTM 780.
8. ALL STEEL MATERIAL (EXPOSED TO WEATHER) SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT DIPPED GALVANIZED) COATINGS" ON IRONS AND STEEL PRODUCTS.
9. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC COATING (HOT–DIP) ON IRON AND STEEL HARDWARE".
10. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NON CONFORMING MATERIALS OR CONDITIONS TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.
11. CONNECTION ANGLES SHALL HAVE A MINIMUM THICKNESS OF 1/4 INCHES.
12. STRUCTURAL CONNECTION BOLTS SHALL CONFORM TO ASTM A325. ALL BOLTS SHALL BE 3/4" DIAMETER MINIMUM AND SHALL HAVE A MINIMUM OF TWO BOLTS, UNLESS OTHERWISE ON THE DRAWINGS.
13. LOCK WASHER ARE NOT PERMITTED FOR A325 STEEL ASSEMBLIES.
14. SHOP CONNECTIONS SHALL BE WELDED OR HIGH STRENGTH BOLTED.
15. MILL BEARING ENDS OF COLUMNS, STIFFENERS, AND OTHER BEARING SURFACES TO TRANSFER LOAD OVER ENTIRE CROSS SECTION.
16. FABRICATE BEAMS WITH MILL CAMBER UP.
17. LEVEL AND PLUMB INDIVIDUAL MEMBERS OF THE STRUCTURE TO AN ACCURACY OF 1:500, BUT NOT TO EXCEED 1/4" IN THE FULL HEIGHT OF THE COLUMN.
18. COMMENCEMENT OF STRUCTURAL STEEL WORK WITHOUT NOTIFYING THE ENGINEER OF ANY DISCREPANCIES WILL BE CONSIDERED ACCEPTANCE OF PRECEDING WORK.
19. INSPECTION AND TESTING OF ALL WELDING AND HIGH STRENGTH BOLTING SHALL BE PERFORMED BY AN INDEPENDENT TESTING LABORATORY.
20. FOUR COPIES OF ALL INSPECTION TEST REPORTS SHALL BE SUBMITTED TO THE ENGINEER WITHIN TEN (10) WORKING DAYS OF THE DATE OF INSPECTION.

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
0	10/15/21	RTS	TJR	CONSTRUCTION DRAWINGS – ISSUED FOR CONSTRUCTION

PROFESSIONAL ENGINEER SEAL

EVERSOURCE

CENTEK engineering
Centered on Solutions™
(203) 488-0580
(203) 488-8587 Fax
63-2 North Branford Road
Branford, CT 06405
www.CentekEng.com

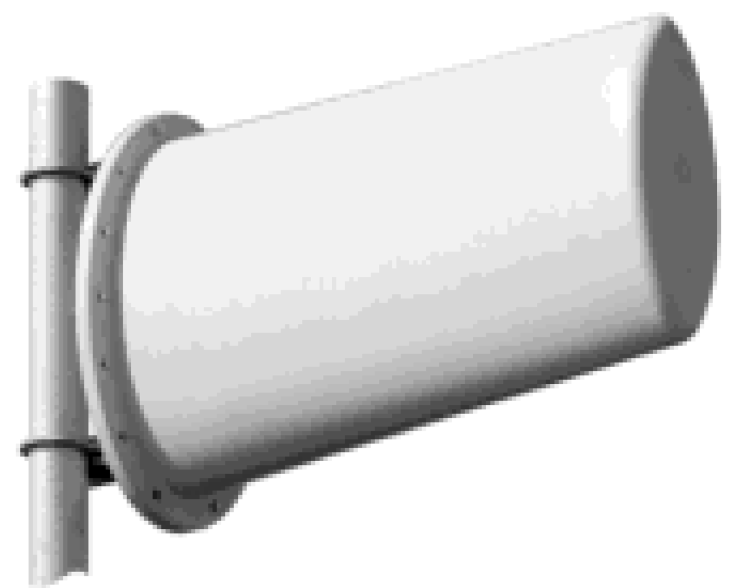
EVERSOURCE

EKONK CSP STERLING
389 EKONK HILL ROAD
STERLING, CT 06354

DATE: 08/27/21
SCALE: AS NOTED
JOB NO. 21082.10

GENERAL NOTES AND SPECIFICATIONS

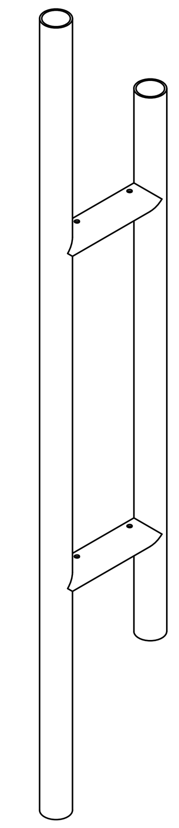
N-1



ALPHA/BETA/GAMMA ANTENNA		
EQUIPMENT	DIMENSIONS	WEIGHT
MAKE: KATHREIN MODEL: CL6-450B	26"L x 17"W	±22 LBS.

NOTES:
1. CONTRACTOR TO COORDINATE FINAL EQUIPMENT MODEL SELECTION WITH EVERSOURCE CONSTRUCTION MANAGER PRIOR TO ORDERING.

1 / C-1 **PROPOSED ANTENNA DETAIL**
SCALE: NOT TO SCALE



PARTS LIST						
ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	1	X-PM1	PM1 STANDOFF MOUNT WELDMENT	1'	43.30	43.30

2 / C-1 **1' PANEL STAND-OFF MOUNT**
SCALE: NOT TO SCALE

3 / C-1 **SITE LOCATION PLAN**
SCALE: NOT TO SCALE
TRUE NORTH

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
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STERLING, CT 06354

DATE: 08/27/21
SCALE: AS NOTED
JOB NO. 21082.10

SITE LOCATION PLAN, ANTENNA AND MOUNTING DETAIL

C-1

Sheet No. 3 of 5

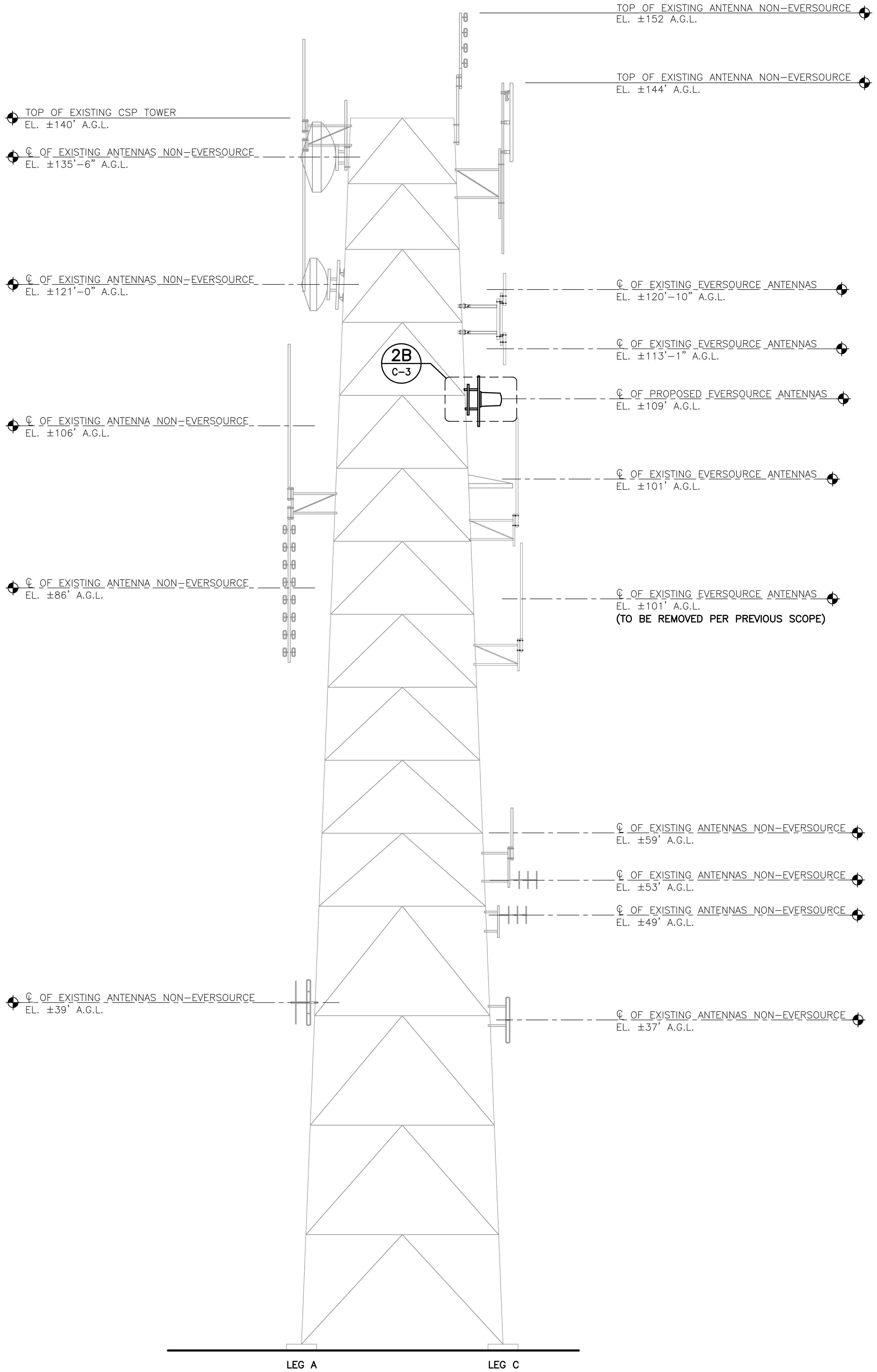
STRUCTURAL COMPLIANCE

TOWER AND TOWER FOUNDATION

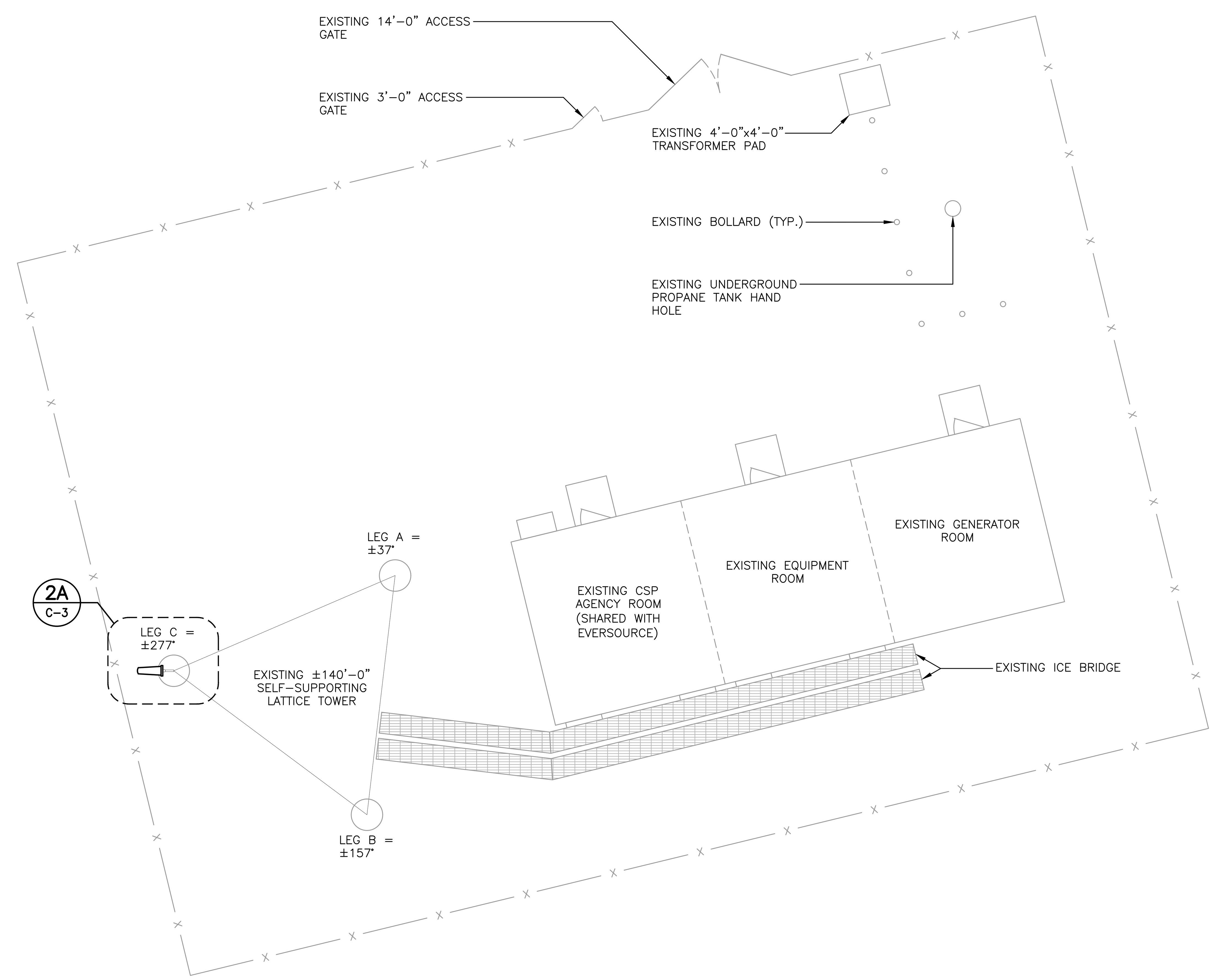
A STRUCTURAL ANALYSIS OF THE TOWER AND TOWER FOUNDATION WAS PERFORMED FOR THE PROPOSED EQUIPMENT INSTALLATION AND THEY WERE FOUND TO BE STRUCTURALLY SUFFICIENT TO ACCOMMODATE THE PROPOSED LOADING.

REFER TO THE STRUCTURAL ANALYSIS REPORT PREPARED BY CENTEK ENGINEERING (PROJECT # 21082.10) DATED 08/26/21 FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

NOTE: NO EQUIPMENT SHALL BE INSTALLED ON THE HOSTING STRUCTURE WITHOUT A PASSING STRUCTURAL ANALYSIS REPORT AND CONTRACTOR PRIOR CONFIRMATION THAT ANY AND ALL REQUISITE MODIFICATIONS HAVE BEEN COMPLETED.



1 C-2 **TOWER ELEVATION FACE AC- PROPOSED**
SCALE: 1/8" = 1'



2 C-2 **SITE PLAN - PROPOSED**
SCALE: 1/8" = 1'
TRUE NORTH

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
0	10/15/21	RTS	TJR	CONSTRUCTION DRAWINGS – ISSUED FOR CONSTRUCTION

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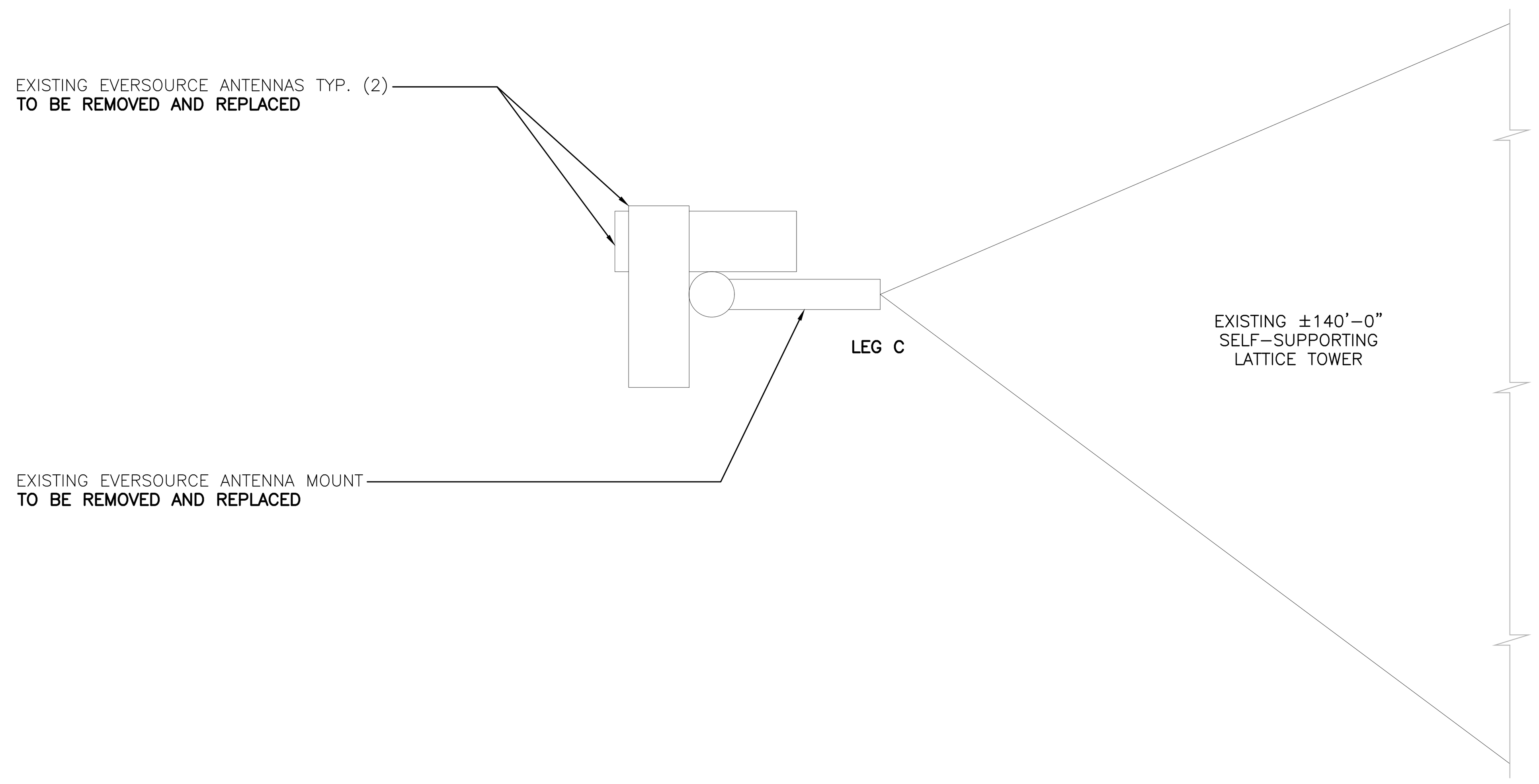
SCALE: AS NOTED
JOB NO. 21082.10

SITE PLAN AND ELEVATION

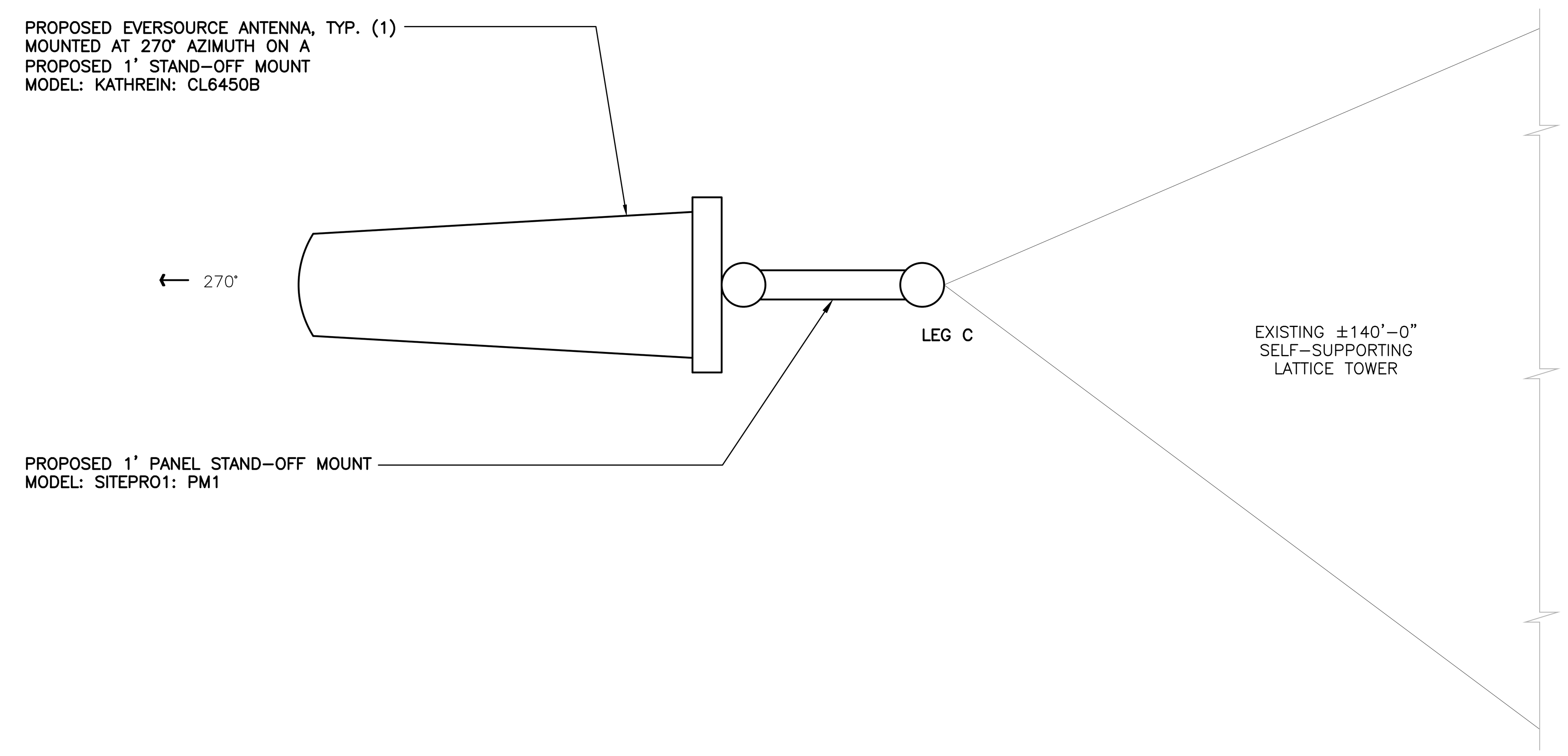
C-2

Sheet No. 4 of 5



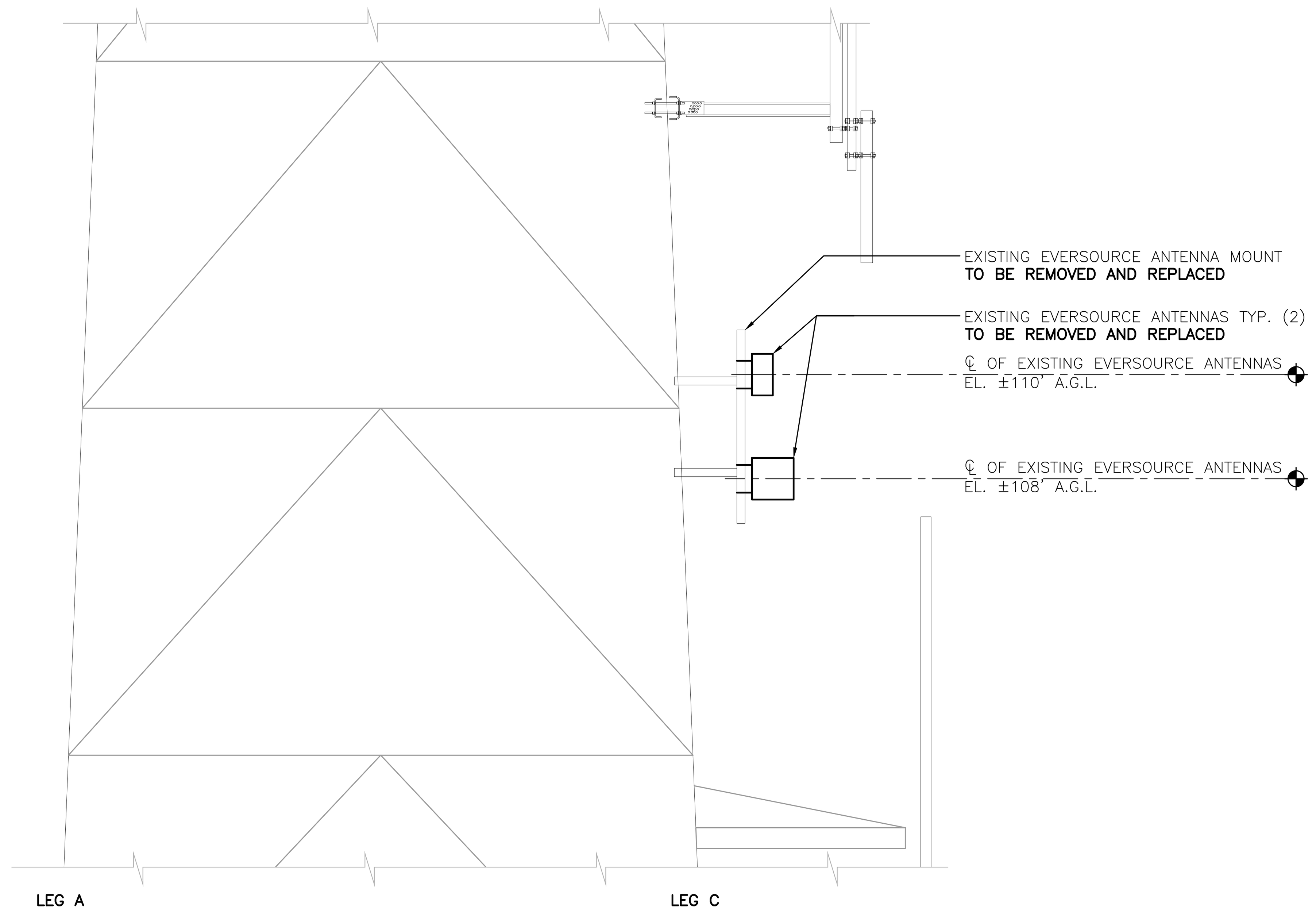
1A C-3 **ANTENNA PLAN - EXISTING** TRUE NORTH

SCALE: 1 1/2" = 1'



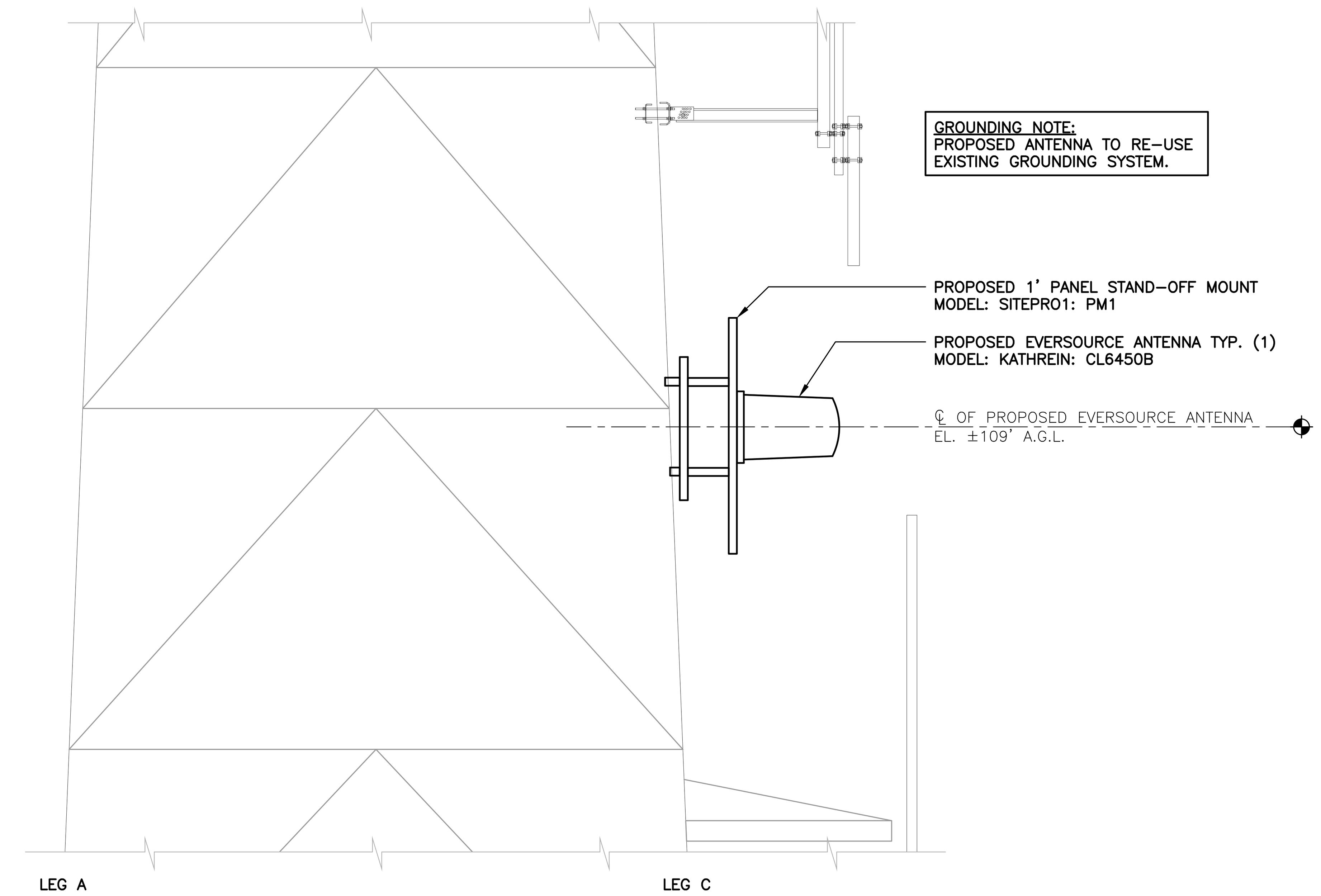
2A C-3 **ANTENNA PLAN - PROPOSED** TRUE NORTH

SCALE: 1 1/2" = 1'



1B C-3 **ANTENNA ELEVATION - EXISTING**

SCALE: 1/2" = 1'



2B C-3 **ANTENNA ELEVATION - PROPOSED**

SCALE: 1/2" = 1'

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
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DATE: 08/27/21
SCALE: AS NOTED
JOB NO. 21082.10

ANTENNA PLANS AND ELEVATIONS

C-3

Sheet No. 5 of 5

ATTACHMENT D – STRUCTURAL ANALYSIS

Centered on Solutions℠

Structural Analysis Report

140' Existing Lattice Tower

Eversource Antenna Installation

CSP Tower Ref: #49

389 Ekonk Hill Road
Sterling, CT

CENTEK Project No. 21082.10

Date: August 26, 2021

Max Stress Ratio = 99%

STATE OF CONNECTICUT
TIMOTHY J. LYNN
No. 29336
LICENSED
PROFESSIONAL ENGINEER

Prepared for:

Eversource
107 Selden Street
Berlin, CT 06037

Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation by Eversource on the existing lattice tower located in Sterling, Connecticut.

The host tower is a 140-ft, three legged, lattice tower originally designed and manufactured by Stainless Inc. project no. 358813TP dated October 24, 1995. The tower geometry, structure member sizes and foundation information were taken from a previous structural analysis report prepared by AECOM job no. EVS-011 60627154 dated November 25, 2020. The tower has been previously reinforced. All previous reinforcements are assumed to be installed. See Primary Assumptions Section below for detailed reinforcement reference reports.

Antenna and appurtenance inventory was taken from the aforementioned structural analysis and information provided by Eversource.

The tower consists of six (6) vertical sections consisting of steel pipe legs conforming to ASTM A500-50 and steel angle lateral bracing conforming to ASTM A36. The vertical tower sections are connected by bolted flange plates with the diagonal and horizontal bracing to pipe legs consisting of bolted connections. The width of the tower face is 11.8-ft at the top and 23.0-ft at the bottom.

Antenna and Appurtenance Summary

The existing and proposed loads considered in the analysis consist of the following:

- Tower:
  Antenna: One (1) lightning rod pipe mounted to the top of the tower.
- CSP:
  Antenna: One (1) 20-ft Omni-directional antenna, one (1) 3-ft panel antenna, two (2) AP14-850 panel antennas, one (1) TMA and one (1) junction box mounted on (1) 4-ft sector mount with an elevation of 137.5-ft AGL.
  Cables: Six (6) 1-5/8” ∅, two (2) 7/8” ∅ and one (1) 1/2”∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report.
- CSP:
  Antenna: One (1) AP14-850 panel antenna (inverted) mounted on (1) 6-ft side arm mount with an elevation of 137.5-ft AGL.
  Cables: Two (2) 1-5/8” ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report.
- CSP:
  Antenna: One (1) 10-ft microwave dish pipe mounted with an elevation of 135-ft AGL.
  Cables: One (1) WEP65 elliptical cable running on a leg/face of the existing tower as specified in Section 3 of this report.
- CSP:
  Antenna: One (1) 3-ft microwave dish pipe mounted with an elevation of 135-ft AGL.
  Cables: One (1) WEP65 elliptical cable running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: One (1) 20-ft dipole pipe mounted with an elevation of 134.5-ft AGL.
  Cables: One (1) 1-5/8" ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: Two (2) 20-ft Omni-directional antennas (one upright and one inverted) mounted on (1) 6-ft side arm with an elevation of 133-ft AGL.
  Cables: Two (2) 1-5/8" ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: One (1) 8-ft microwave dish pipe mounted with an elevation of 132-ft AGL.
  Cables: One (1) WEP65 elliptical cable running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: One (1) 3-ft microwave dish pipe mounted with an elevation of 125-ft AGL.
  Cables: One (1) WEP65 elliptical cable running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: One (1) 8-ft microwave dish pipe mounted with an elevation of 121-ft AGL.
  Cables: One (1) WEP65 elliptical cable running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: Three (3) 8-ft panel antennas and one (1) TMA mounted on (1) sector frame with an elevation of 121-ft AGL.
  Cables: Three (3) 7/8" ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report

- Eversource:
  Antenna: Two (2) ANT220F2 Omni-directional antennas (one upright and one inverted) mounted on (1) 4-ft side arm with an elevation of 117-ft AGL.
  Cables: Two (2) 7/8" ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: One (1) 10-ft Omni-directional antenna and one (1) 3-ft yagi mounted on (1) 6-ft sector mount with an elevation of 100-ft AGL.
  Cables: Two (2) 7/8" ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report

- CSP:
  Antenna: One (1) 20-ft Omni-directional antenna and one (1) 20-ft dipole (inverted) mounted on (1) 6-ft side arm with an elevation of 96-ft AGL.
  Cables: Two (2) 7/8" ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report.

- CSP:
  Antenna: One (1) 6-ft microwave dish pipe mounted with an elevation of 95-ft AGL.
  Cables: One (1) WEP65 elliptical cable running on a leg/face of the existing tower as specified in Section 3 of this report
- CSP:
  Antenna: One (1) 20-ft Omni-directional antenna mounted on (1) 6-ft sector mount with an elevation of 87-ft AGL.
  Cables: One (1) 7/8” ∅ cable running on a leg/face of the existing tower as specified in Section 3 of this report
- CSP:
  Antenna: One (1) single dipole antenna pipe mounted with an elevation of 83-ft AGL.
  Cables: One (1) 1/2” ∅ cable running on a leg/face of the existing tower as specified in Section 3 of this report
- CSP:
  Antenna: One (1) 7-ft Omni-directional antenna mounted on (1) 6-ft side arm with an elevation of 59-ft AGL.
  Cables: Two (2) 7/8” ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report
- CSP:
  Antenna: One (1) single dipole antenna pipe mounted with an elevation of 58-ft AGL.
  Cables: One (1) 1/2” ∅ cable running on a leg/face of the existing tower as specified in Section 3 of this report
- CSP:
  Antenna: One (1) 3-ft yagi antenna leg mounted with an elevation of 53-ft AGL.
  Cables: One (1) 1/2” ∅ cable running on a leg/face of the existing tower as specified in Section 3 of this report
- CSP:
  Antenna: One (1) single dipole antenna pipe mounted with an elevation of 52-ft AGL.
  Cables: One (1) 1/2” ∅ cable running on a leg/face of the existing tower as specified in Section 3 of this report
- Eversource (Existing To Remain):
  Cables: Two (2) 7/8” ∅ cables running on a leg/face of the existing tower as specified in Section 3 of this report to 109-ft.
- **Eversource (Existing To be Removed):**
  Antenna: Two (2) 1’x1’ panel antennas mounted with an elevation of 109-ft AGL.
- **Eversource (Proposed):**
  Antenna: One (1) Scala CL6-450B log-periodic antenna pipe mounted with an elevation of 109-ft AGL.

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All coax cables should be routed as specified in section 3 of this report.
- **All previous reinforcements per the below listed structural analysis and modification reports are assumed to be installed.**
    - **Structural report prepared by AECOM Corp for Eversource project no. EVS-011 / 60627154 dated 11/25/20.**

Analysis

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower, and the model assumes that the tower members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for the controlling basic wind speed with no ice and the applicable wind and ice combination to determine stresses in members as per guidelines of TIA-222-H entitled "Structural Standard for Antenna Support Structures, Antennas and Small Wind Turbine Support Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Load and Resistance Factor Design (LRFD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix N of the CSBC[1] and the wind speed data available in the TIA-222-H Standard.

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA-222-H, gravity loads of the tower structure and its components, and the application of 1.0" radial ice on the tower structure and its components.

Load Cases:	Load Case 1; 145 mph (Risk Cat III) wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Appendix N of the 2018 CT Building Code]*
	Load Case 2; 50 mph wind speed w/ 1.00" radial ice plus gravity load – used in calculation of tower stresses.	*[Annex B of TIA-222-H]*
	Load Case 3; 90 mph wind speed w/ 0.5" radial ice plus gravity load – used in calculation of tower twist and sway.	*[TIA-222-F used for calculation of tower twist and sway per the requirements of the CSP]*

[1] The 2015 International Building Code as amended by the 2018 Connecticut State Building Code (CSBC).

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower.

- Calculated stresses **were found to be within allowable limits**.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Leg (T4)	50.0' - 75.0'	96.4%	**PASS**
Diagonal (T5)	25.0' – 50.0'	98.9%	**PASS**
Horizontal (T6)	0.0' - 25.0'	82.9%	**PASS**

- The tower combined deflection **was found to be within allowable limits**.

Deflection Criteria	Proposed (degrees)	Allowable (degrees)	Result
Sway (Tilt)	0.409	n/a	**n/a**
Twist	0.311	n/a	**n/a**
Combined	0.72	0.75	**PASS**

TIA-222-F standard used for calculation of tower twist and sway per the requirements of the CSP.

Foundation and Anchors

The existing foundation consists of three (4) 4-ft diameter x 4.5-ft long reinforced concrete piers supported on a 36-ft square x 2-ft thick mat. The base of the tower is connected to the foundation by means of (6) 1.75"∅ anchor bolts per leg embedded into the concrete foundation structure.

- The tower reactions developed from the governing Load Case were used in the verification of the foundation and anchor bolts:

Load Effect	Proposed Tower Reactions
Leg Shear	42 kips
Leg Compression	327 kips
Leg Tension	287 kips
Base Moment	6,217 ft-kips
Base Shear	47 kips

- The anchor bolts **were found** to be within allowable limits.

Tower Section	Component	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Combined Compression and Shear	74%	**PASS**

- The foundation was found to be within allowable limits.

Foundation	Design Limit	(percentage of capacity)	Result
Reinforced Concrete Pad and Piers	Overturning	46%	**PASS**
	Bearing	26%	**PASS**

Conclusion

This analysis shows that the subject tower **is adequate** to support the proposed antenna configuration.

The analysis is based, in part, on the information provided to this office by Pyramid. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

All engineering services are performed on the basis that the information used is current and correct. This information may consist of, but is not necessarily limited to:

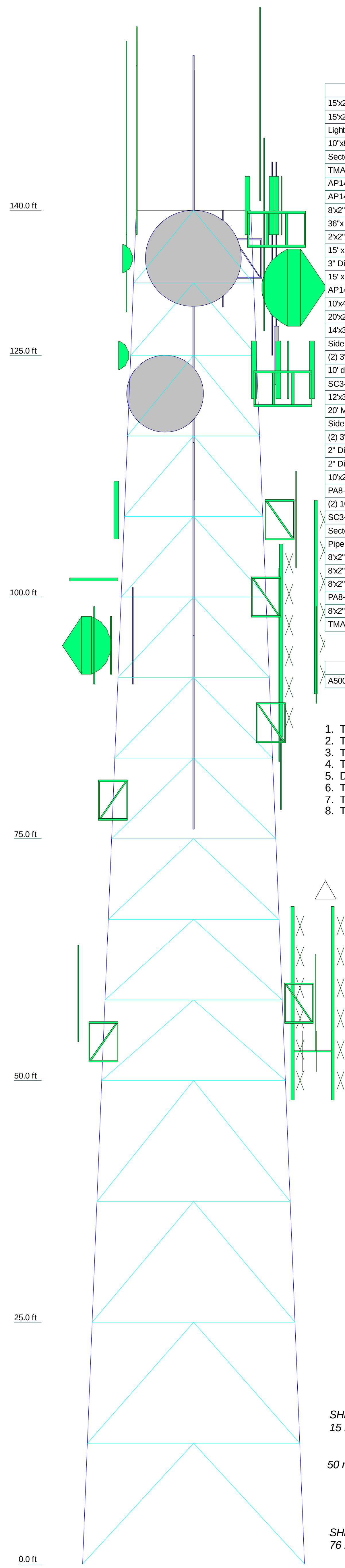
- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provided to Centek Engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. Centek Engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

tnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, tnxTower, formerly RISA Tower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

tnxTower Features:

- tnxTower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- tnxTower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.



Section	T1	T2	T3	T4	T5	T6
Legs	HSS5x0.25	HSS5x0.25	HSS5x.375	HSS5x.375	HSS7x0.25 (150deg) on HSS6.875x0.375	HSS7x0.25 (150deg) on HSS6.875x0.5
Leg Grade	A500-50	A500-50	A500-50	A500-50	A500-50	A500-50
Diagonals	2L2 1/2x2x3/16x3/8	2L3x2 1/2x1/4x3/8	2L3x2 1/2x1/4x3/8	2L3x2 1/2x1/4x3/8	2L3 1/2x3x1/4x3/8	2L4x3x5/16x3/8
Diagonal Grade	A36	A36	A36	A36	A36	A500-50
Top Girts	L3x3x1/4	N.A.	N.A.	N.A.	N.A.	N.A.
Horizontals	L3x3x1/4	L3x3x1/4	L3x4x1/4	2L3x2 1/2x1/4x3/8	L4x4x1/4	L4x4x1/4
Inner Bracing	N.A.	N.A.	N.A.	L2 1/2x2 1/2x3/16	L2 1/2x2 1/2x3/16	L2 1/2x2 1/2x3/16
Face Width (ft)	11.8 / 13	13 / 15	15 / 17	17 / 19	19 / 21	21 / 23
# Panels @ (ft)	2 @ 7.5	9 @ 8.33333	9 @ 8.33333	9 @ 8.33333	4 @ 12.5	4 @ 12.5
Weight (K)	1.5	3.5	4.2	5.0	5.9	7.5

Total Weight (K): 27.6

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
15'x2.5" Horizontal Pipe	140.5	Telewave ANT220F2 - Omni Antenna (Eversoure)	120.875
15'x2.5" Extension Pipe	140	Sitepro1 USF-4U Mount Assembly (Ca = 1.4 assumed) (Eversoure)	117
Lightning Rod 5/8"x4'	140	6' x2.5" - Sch 40 Antenna Pipe (Vertical) (CSP Reserved)	117
10"x8"x4" Junction Box (CSP)	137.5	Telewave ANT220F2 - Omni Antenna (Eversoure (inverted))	113.125
Sector Mount [SM 403-1] (CSP)	137.5	6'x2" Horizontal Pipe (Eversoure)	109
TMA (CSP)	137.5	CL6-450B (Eversoure - Proposed)	109
AP14-850/105 w/Mount Pipe (CSP)	137.5	(2) 4'x2" Horizontal Mount Pipe (CSP)	108
AP14-850/105 w/Mount Pipe (CSP)	137.5	12'x2" Horizontal Pipe (CSP)	108
8'x2" Mount Pipe (CSP)	137.5	10'x2" Horizontal Pipe	100
36"x 6"x3" panel antenna w/ Mount Pipe (CSP)	137.5	3' Yagi (CSP)	100
2'x2"x2" Vertical Tube (CSP)	137.5	(2) 3'x3"x3" Horizontal Angle (CSP)	100
15' x 4" Mount Pipe (CSP)	137.5	2" Dia 10' Omni (CSP)	100
3" Dia 20' Omni (CSP)	137.5	Side Arm Mount [SO 601-1] (CSP)	100
15' x 4" Mount Pipe (CSP)	137	Side Arm Mount [SO 601-1] (CSP)	96
AP14-850/105 w/Mount Pipe (CSP)	135	(2) 3'x3"x3" Horizontal Angle (CSP)	96
10'x4" Mount Pipe (CSP)	135	10'x4" Mount Pipe (CSP)	96
20'x2.5" Mount Pipe (CSP)	135	2" Dia 20' Omni (CSP)	96
14'x3" Mount Pipe (CSP)	135	20' Multi Array Dipole (CSP)	96
Side Arm Mount [SO 601-1] (CSP)	135	MD-S6 (for 6' MW) : Ice Shield (CSP)	95
(2) 3'x3"x3" Horizontal Angle (CSP)	135	ANT450F6 (CSP Reserved)	95
10' dish (E)	135	8'x4" Mount Pipe (CSP)	95
SC3-W100AD (CSP - Existing @ 135')	135	PA6-65 (Diversity CSP)	95
12'x3" Mount Pipe (CSP)	134.5	15' x 4" Mount Pipe (CSP)	95
20' Multi Array Dipole (CSP)	134.5	10'x2" Horizontal Pipe	92
Side Arm Mount [SO 601-1] (CSP)	133	2" Dia 20' Omni (CSP)	87
(2) 3'x3"x3" Horizontal Angle (CSP)	133	Side Arm Mount [SO 601-1] (CSP)	87
2" Dia 20' Omni (CSP)	133	12'x2" Horizontal Pipe (CSP)	83
2" Dia 20' Omni (CSP)	133	Single Bay Dipole (CSP)	83
10'x2" Horizontal Pipe	132.5	Side Arm Mount [SO 601-1] (CSP)	79
PA8-65 (E)	132	(2) 4'x2" Horizontal Mount Pipe (CSP)	58
(2) 10'x2" Horizontal Pipe	130	12'x2" Horizontal Pipe (CSP)	58
SC3-W100AD (CSP - Existing @ 125')	125	Single Dipole Antenna (CSP)	58
Sector Mount [SM 403-1] (CSP)	121	Side Arm Mount [SO 601-1] (CSP)	54
Pipe Mount [PM 602-1] (CSP)	121	7' Whip (CSP)	54
8'x2"x6" Panel Antenna w/ Mount Pipe (CSP)	121	3' Yagi (CSP)	53
8'x2"x6" Panel Antenna w/ Mount Pipe (CSP)	121	Single Bay Dipole Antenna (CSP)	52
8'x2" Mount Pipe (CSP)	121	6'x2" Mount Pipe (CSP)	52
PA8-65 (E)	121		
8'x2"x6" Panel Antenna w/ Mount Pipe (CSP)	121		
TMA (CSP)	121		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A500-50	50 ksi	62 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower is located in Windham County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 145 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Risk Category III.
7. Topographic Category 1 with Crest Height of 0.000 ft
8. TOWER RATING: 98.9%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 327 K
SHEAR: 42 K

UPLIFT: -287 K
SHEAR: 38 K

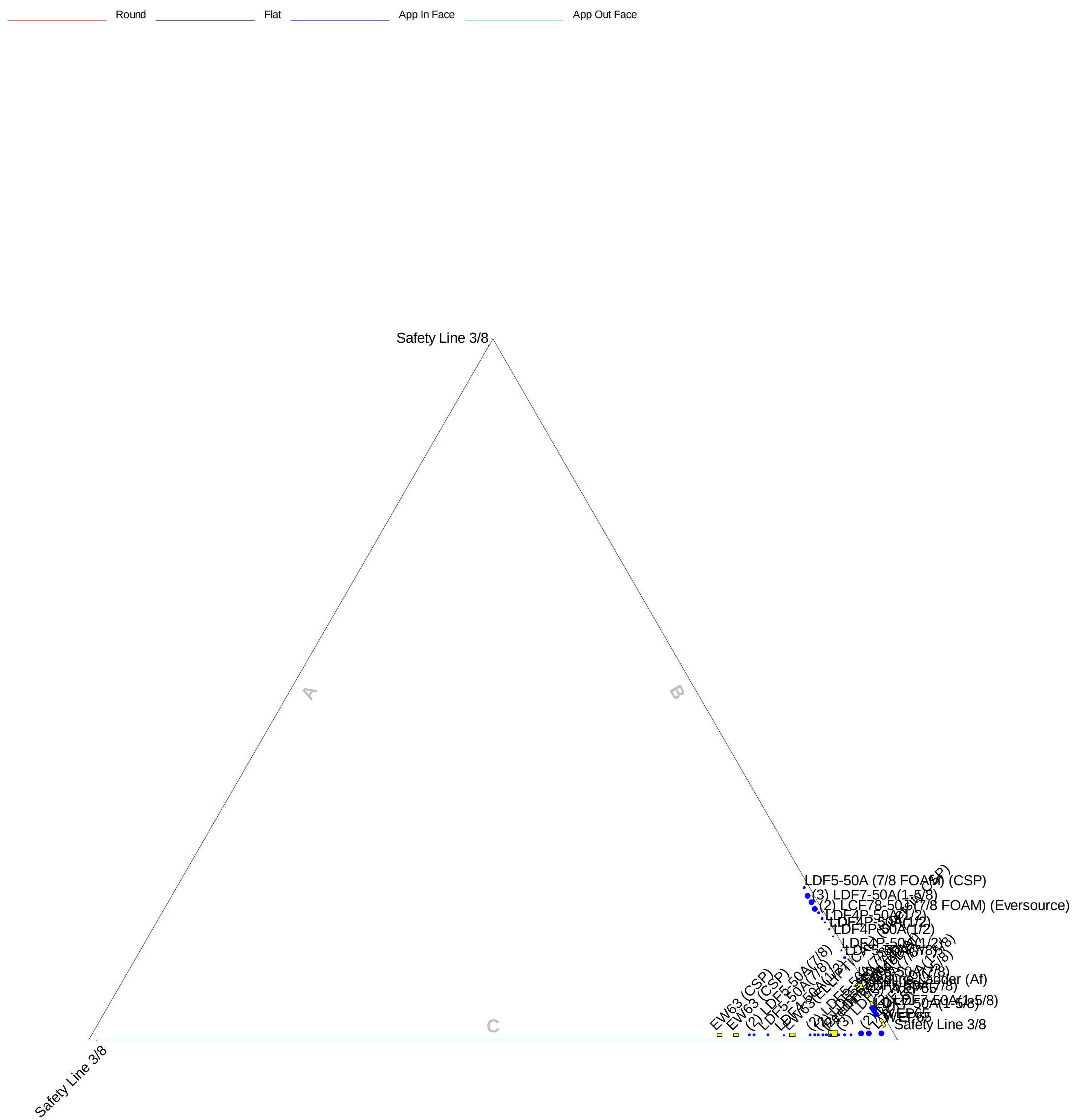
AXIAL 101 K
SHEAR 15 K
MOMENT 1429 kip-ft
TORQUE 56 kip-ft
50 mph WIND - 1.000 in ICE

AXIAL 47 K
SHEAR 76 K
MOMENT 6217 kip-ft
TORQUE 201 kip-ft
REACTIONS - 145 mph WIND

Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job: **21082.10**			
Project: **140-ft Lattice Tower #49 Sterling**			
Client: Eversource	Drawn by: TJL		App'd:
Code: TIA-222-H	Date: 08/26/21		Scale: NTS
Path:			Dwg No. E-1

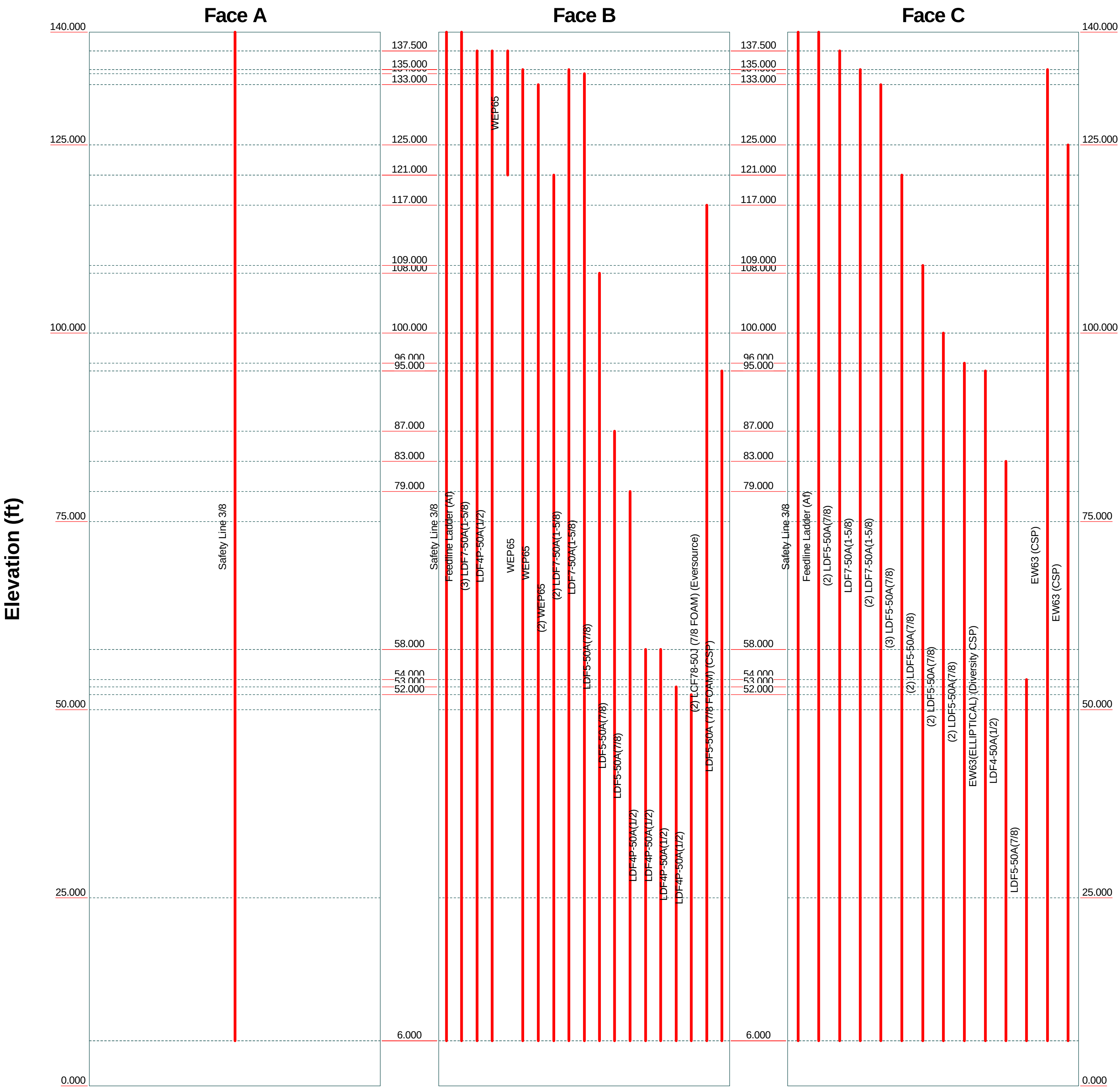
Feed Line Plan



Centek Engineering Inc.	Job: 21082.10		
63-2 North Branford Rd.	Project: 140-ft Lattice Tower #49 Sterling		
Branford, CT 06405	Client: Eversource	Drawn by: TJL	App'd:
Phone: (203) 488-0580	Code: TIA-222-H	Date: 08/26/21	Scale: NTS
FAX: (203) 488-8587	Path:		Dwg No. E-7

Feed Line Distribution Chart
0' - 140'

Round — Flat — App In Face — App Out Face — Truss Leg



Centek Engineering Inc. 63-2 North Branford Rd. Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: **21082.10**		
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	Code: TIA-222-H	Date: 08/26/21	Scale: NTS
	Path:		Dwg No. E-7

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 140.000 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 11.800 ft at the top and 23.000 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

- Tower is located in Windham County, Connecticut.
- Tower base elevation above sea level: 0.000 ft.
- Basic wind speed of 145 mph.
- Risk Category III.
- Exposure Category C.
- Simplified Topographic Factor Procedure for wind speed-up calculations is used.
- Topographic Category: 1.
- Crest Height: 0.000 ft.
- Nominal ice thickness of 1.000 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 50 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 60 mph.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in tower member design is 1.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

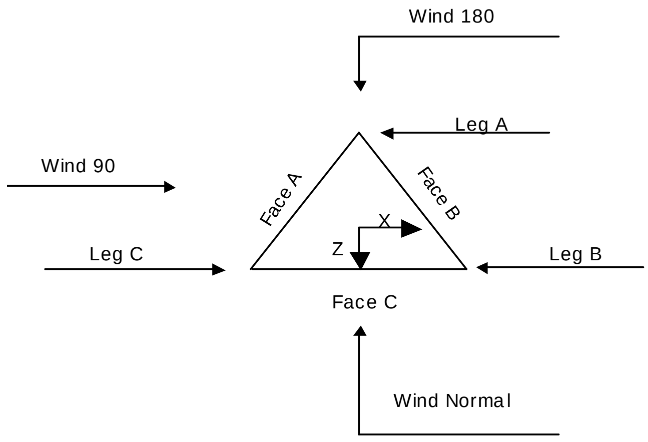
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
√ Leg Bolts Are At Top Of Section
√ Secondary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

Distribute Leg Loads As Uniform
Assume Legs Pinned
√ Assume Rigid Index Plate
√ Use Clear Spans For Wind Area
√ Use Clear Spans For KL/r
Retension Guys To Initial Tension
Bypass Mast Stability Checks
Use Azimuth Dish Coefficients
Project Wind Area of Appurt.
Autocalc Torque Arm Areas
Add IBC .6D+W Combination
√ Sort Capacity Reports By Component
√ Triangulate Diamond Inner Bracing
Treat Feed Line Bundles As Cylinder
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	140.000-125.000			11.800	1	15.000
T2	125.000-100.000			13.000	1	25.000
T3	100.000-75.000			15.000	1	25.000
T4	75.000-50.000			17.000	1	25.000
T5	50.000-25.000			19.000	1	25.000
T6	25.000-0.000			21.000	1	25.000

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	140.000-125.000	7.500	K Brace Down	No	Yes	0.000	0.000
T2	125.000-100.000	8.333	K Brace Down	No	Yes	0.000	0.000
T3	100.000-75.000	8.333	K Brace Down	No	Yes	0.000	0.000
T4	75.000-50.000	8.333	K Brace Down	No	Yes	0.000	0.000
T5	50.000-25.000	12.500	K Brace Down	No	Yes	0.000	0.000
T6	25.000-0.000	12.500	K Brace Down	No	Yes	0.000	0.000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Type*	*Leg Size*	*Leg Grade*	*Diagonal Type*	*Diagonal Size*	*Diagonal Grade*
T1 140.000-125.000	Pipe	HSS5x0.25	A500-50 (50 ksi)	Double Angle	2L2 1/2x2x3/16x3/8	A36 (36 ksi)
T2 125.000-100.000	Pipe	HSS5x0.25	A500-50 (50 ksi)	Double Angle	2L3x2 1/2x1/4x3/8	A36 (36 ksi)
T3 100.000-75.000	Pipe	HSS5x.375	A500-50 (50 ksi)	Double Angle	2L3x2 1/2x1/4x3/8	A36 (36 ksi)
T4 75.000-50.000	Pipe	HSS5x.375	A500-50 (50 ksi)	Double Angle	2L3x2 1/2x1/4x3/8	A36 (36 ksi)
T5 50.000-25.000	Arbitrary Shape	HSS7x0.25 (150deg) on HSS6.875x0.375	A500-50 (50 ksi)	Double Angle	2L3 1/2x3x1/4x3/8	A36 (36 ksi)
T6 25.000-0.000	Arbitrary Shape	HSS7x0.25 (150deg) on HSS6.875x0.5	A500-50 (50 ksi)	Double Angle	2L4x3x5/16x3/8	A500-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*No. of Mid Girts*	*Mid Girt Type*	*Mid Girt Size*	*Mid Girt Grade*	*Horizontal Type*	*Horizontal Size*	*Horizontal Grade*
T1 140.000-125.000	None	Flat Bar		A36 (36 ksi)	Single Angle	L3x3x1/4	A36 (36 ksi)
T2 125.000-100.000	None	Flat Bar		A36 (36 ksi)	Single Angle	L3x3x1/4	A36 (36 ksi)
T3 100.000-75.000	None	Flat Bar		A36 (36 ksi)	Single Angle	L3x4x1/4	A36 (36 ksi)
T4 75.000-50.000	None	Flat Bar		A36 (36 ksi)	Double Angle	2L3x2 1/2x1/4x3/8	A36 (36 ksi)
T5 50.000-25.000	None	Flat Bar		A36 (36 ksi)	Single Angle	L4x4x1/4	A36 (36 ksi)
T6 25.000-0.000	None	Flat Bar		A36 (36 ksi)	Single Angle	L4x4x1/4	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Secondary Horizontal Type*	*Secondary Horizontal Size*	*Secondary Horizontal Grade*	*Inner Bracing Type*	*Inner Bracing Size*	*Inner Bracing Grade*
T2 125.000-100.000	Equal Angle		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T3 100.000-75.000	Equal Angle		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T4 75.000-50.000	Equal Angle		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 50.000-25.000	Equal Angle		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T6 25.000-0.000	Equal Angle		A36 (36 ksi)	Single Angle	L2 1/2x2 1/2x3/16	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 140.000-125.000	0.000	0.000	A36 (36 ksi)	1	1	1	39.700	Mid-Pt	Mid-Pt
T2 125.000-100.000	0.000	0.000	A36 (36 ksi)	1	1	1	44.850	Mid-Pt	Mid-Pt
T3 100.000-75.000	0.000	0.000	A36 (36 ksi)	1	1	1	47.620	Mid-Pt	Mid-Pt
T4 75.000-50.000	0.000	0.000	A36 (36 ksi)	1	1	1	50.560	Mid-Pt	Mid-Pt
T5 50.000-25.000	0.000	0.000	A36 (36 ksi)	1.05	1	1.05	65.300	Mid-Pt	Mid-Pt
T6 25.000-0.000	0.000	0.000	A36 (36 ksi)	1.05	1	1.05	67.950	Mid-Pt	Mid-Pt

Tower Section Geometry *(cont'd)*

Tower Elevation	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
ft										
T1 140.000-125.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 125.000-100.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 100.000-75.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 75.000-50.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 50.000-25.000	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 25.000-0.000	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 140.000-125.000	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 125.000-100.000	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T3 100.000-75.000	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 75.000-50.000	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 50.000-25.000	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 25.000-0.000	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 Elevation ft	*Redundant Horizontal*		*Redundant Diagonal*		*Redundant Sub-Diagonal*		*Redundant Sub-Horizontal*		*Redundant Vertical*		*Redundant Hip*		*Redundant Hip Diagonal*	
	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 140.000-125.000	0.000	0.75	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 125.000-100.000	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T3 100.000-75.000	0.000	0.75	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 75.000-50.000	0.000	0.75	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 50.000-25.000	0.000	0.75	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 25.000-0.000	0.000	0.75	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 140.000-125.000	Flange	0.750 A325X	0	0.750 A325X	1	0.625 A325N	0	0.625 A325N	0	0.625 A325N	0	0.625 A325X	2	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 125.000-100.000	Flange	0.750 A325X	6	0.750 A325X	1	0.625 A325X	0	0.625 A325N	0	0.625 A325N	0	0.625 A325X	2	0.625 A325N	0
T3 100.000-75.000	Flange	0.750 A325X	6	0.750 A325X	1	0.625 A325X	0	0.625 A325N	0	0.625 A325N	0	0.625 A325X	2	0.625 A325N	0
T4 75.000-50.000	Flange	0.750 A325X	6	0.750 A325X	1	0.625 A325X	0	0.625 A325N	0	0.625 A325N	0	0.625 A325X	2	0.625 A325N	0
T5 50.000-25.000	Flange	1.000 A325X	6	1.000 A325X	1	0.625 A325X	0	0.625 A325N	0	0.625 A325N	0	0.625 A325X	2	0.625 A325N	0
T6 25.000-0.000	Flange	1.000 A325X	8	1.000 A325X	1	0.625 A325X	0	0.625 A325N	0	0.625 A325N	0	0.625 A325X	2	0.625 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
Safety Line 3/8	A	No	No	Ar (CaAa)	140.000 - 6.000	0.000	0.49	1	1	0.375	0.375		0.22
Safety Line 3/8	B	No	No	Ar (CaAa)	140.000 - 6.000	0.000	0.49	1	1	0.375	0.375		0.22
Safety Line 3/8	C	No	No	Ar (CaAa)	140.000 - 6.000	0.000	0.49	1	1	0.375	0.375		0.22
Feedline Ladder (Af)	B	No	No	Af (CaAa)	140.000 - 6.000	-1.000	0.42	1	1	3.000	3.000		8.40
Feedline Ladder (Af)	C	No	No	Af (CaAa)	140.000 - 6.000	-1.000	-0.42	1	1	3.000	3.000		8.40
***													
LDF7-50A(1-5/8)	B	No	No	Ar (CaAa)	137.500 - 6.000	-1.000	0.3	3	3	0.500	1.980		0.82
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	137.500 - 6.000	-1.000	-0.32	2	2	0.500	1.030		0.33
LDF4P-50A(1/2)	B	No	No	Ar (CaAa)	137.500 - 6.000	-1.000	0.33	1	1	0.500	0.630		0.15
LDF7-50A(1-5/8)	C	No	No	Ar (CaAa)	135.000 - 6.000	-1.000	-0.48	1	1	0.500	1.980		0.82
WEP65	B	No	No	Af (CaAa)	137.500 - 121.000	-1.000	0.44	1	1	1.584	1.584		0.53
WEP65	B	No	No	Af (CaAa)	135.000 - 6.000	-1.000	0.47	1	1	1.584	1.584		0.53
WEP65	B	No	No	Af (CaAa)	133.000 - 6.000	-1.000	0.475	1	1	1.584	1.584		0.53
WEP65	B	No	No	Af (CaAa)	121.000 - 6.000	-1.000	0.44	2	2	1.584	1.584		0.53
LDF7-50A(1-5/8)	B	No	No	Ar (CaAa)	135.000 - 6.000	-1.000	0.455	2	2	0.500	1.980		0.82
LDF7-50A(1-5/8)	B	No	No	Ar (CaAa)	134.500 - 6.000	-1.000	0.455	1	1	0.500	1.980		0.82
LDF7-50A(1-5/8)	C	No	No	Ar (CaAa)	133.000 - 6.000	-1.000	-0.46	2	2	0.500	1.980		0.82
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	121.000 - 6.000	-1.000	-0.435	3	3	1.030	1.030		0.33

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*
LDF5-50A(7/8)	B	No	No	Ar (CaAa)	108.000 - 6.000	-1.000	0.43	1	1	0.500	1.030		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	109.000 - 6.000	-1.000	-0.415	2	2	0.500	1.030		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	100.000 - 6.000	-1.000	-0.405	2	2	0.500	1.030		0.33
LDF5-50A(7/8)	B	No	No	Ar (CaAa)	87.000 - 6.000	-1.000	0.41	1	1	0.500	1.030		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	96.000 - 6.000	-1.000	-0.395	2	2	0.500	1.030		0.33
EW63(ELLIPTICAL) (Diversity CSP)	C	No	No	Af (CaAa)	95.000 - 6.000	-1.000	-0.37	1	1	0.500	2.010		0.51
LDF4-50A(1/2)	C	No	No	Ar (CaAa)	83.000 - 6.000	-1.000	-0.36	1	1	0.625	0.625		0.15
LDF5-50A(7/8)	B	No	No	Ar (CaAa)	79.000 - 6.000	-1.000	0.38	1	1	0.500	1.030		0.33
LDF4P-50A(1/2)	B	No	No	Ar (CaAa)	58.000 - 6.000	-1.000	0.37	1	1	0.500	0.630		0.15
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	54.000 - 6.000	-1.000	-0.34	1	1	0.500	1.030		0.33
LDF4P-50A(1/2)	B	No	No	Ar (CaAa)	58.000 - 6.000	-1.000	0.35	1	1	0.500	0.630		0.15
LDF4P-50A(1/2)	B	No	No	Ar (CaAa)	53.000 - 6.000	-1.000	0.34	1	1	0.500	0.630		0.15
LDF4P-50A(1/2)	B	No	No	Ar (CaAa)	52.000 - 6.000	-1.000	0.34	1	1	0.500	0.630		0.15
****Proposed****													
* CSP Add Dishes													
EW63 (CSP)	C	No	No	Af (CaAa)	135.000 - 6.000	-1.000	-0.3	1	1	1.574	1.574		0.51
EW63 (CSP)	C	No	No	Af (CaAa)	125.000 - 6.000	-1.000	-0.28	1	1	1.574	1.574		0.51
* EVS Proposed (2020 Inventory)													
LCF78-50J (7/8 FOAM) (Eversource)	B	No	No	Ar (CaAa)	117.000 - 6.000	-1.000	0.32	2	2	1.100	1.100		0.53
*													
LDF5-50A (7/8 FOAM) (CSP)	B	No	No	Ar (CaAa)	95.000 - 6.000	-1.000	0.28	1	1	1.090	1.090		0.33

Feed Line/Linear Appurtenances Section Areas

Tower Section	*Tower Elevation* *ft*	*Face*	A_R ft^2	A_F ft^2	C_AA_A *In Face* ft^2	C_AA_A *Out Face* ft^2	*Weight* *K*
T1	140.000-125.000	A	0.000	0.000	0.563	0.000	0.00
		B	0.000	0.000	30.166	0.000	0.20
		C	0.000	0.000	18.409	0.000	0.16

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*
T2	125.000-100.000	A	0.000	0.000	0.938	0.000	0.01
		B	0.000	0.000	74.614	0.000	0.41
		C	0.000	0.000	54.899	0.000	0.35
T3	100.000-75.000	A	0.000	0.000	0.938	0.000	0.01
		B	0.000	0.000	83.008	0.000	0.44
		C	0.000	0.000	76.107	0.000	0.40
T4	75.000-50.000	A	0.000	0.000	0.938	0.000	0.01
		B	0.000	0.000	88.378	0.000	0.46
		C	0.000	0.000	80.080	0.000	0.41
T5	50.000-25.000	A	0.000	0.000	0.938	0.000	0.01
		B	0.000	0.000	93.355	0.000	0.47
		C	0.000	0.000	82.243	0.000	0.42
T6	25.000-0.000	A	0.000	0.000	0.713	0.000	0.00
		B	0.000	0.000	70.950	0.000	0.36
		C	0.000	0.000	62.505	0.000	0.32

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	140.000-125.000	A	1.322	0.000	0.000	4.527	0.000	0.04
		B		0.000	0.000	67.804	0.000	0.84
		C		0.000	0.000	44.307	0.000	0.57
T2	125.000-100.000	A	1.300	0.000	0.000	7.438	0.000	0.07
		B		0.000	0.000	172.793	0.000	1.98
		C		0.000	0.000	139.585	0.000	1.57
T3	100.000-75.000	A	1.268	0.000	0.000	7.276	0.000	0.07
		B		0.000	0.000	198.652	0.000	2.22
		C		0.000	0.000	204.627	0.000	2.09
T4	75.000-50.000	A	1.226	0.000	0.000	7.067	0.000	0.07
		B		0.000	0.000	215.540	0.000	2.35
		C		0.000	0.000	213.806	0.000	2.13
T5	50.000-25.000	A	1.165	0.000	0.000	6.761	0.000	0.06
		B		0.000	0.000	233.545	0.000	2.44
		C		0.000	0.000	215.521	0.000	2.09
T6	25.000-0.000	A	1.044	0.000	0.000	4.678	0.000	0.04
		B		0.000	0.000	167.938	0.000	1.65
		C		0.000	0.000	155.361	0.000	1.42

Feed Line Center of Pressure

Section	*Elevation ft*	*CP_X in*	*CP_Z in*	*CP_X Ice in*	*CP_Z Ice in*
T1	140.000-125.000	17.643	10.633	22.904	13.226
T2	125.000-100.000	26.025	15.958	33.901	19.421
T3	100.000-75.000	32.508	19.354	42.716	24.213
T4	75.000-50.000	36.269	21.482	48.354	27.276
T5	50.000-25.000	31.446	19.172	48.675	27.935
T6	25.000-0.000	26.592	16.354	43.085	24.857

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	125.00 - 140.00	0.6000	0.6000
T1	2	Safety Line 3/8	125.00 - 140.00	0.6000	0.6000
T1	3	Safety Line 3/8	125.00 - 140.00	0.6000	0.6000
T1	4	Feedline Ladder (Af)	125.00 - 140.00	0.6000	0.6000
T1	5	Feedline Ladder (Af)	125.00 - 140.00	0.6000	0.6000
T1	7	LDF7-50A(1-5/8)	125.00 - 137.50	0.6000	0.6000
T1	8	LDF5-50A(7/8)	125.00 - 137.50	0.6000	0.6000
T1	9	LDF4P-50A(1/2)	125.00 - 137.50	0.6000	0.6000
T1	10	LDF7-50A(1-5/8)	125.00 - 135.00	0.6000	0.6000
T1	11	WEP65	125.00 - 137.50	0.6000	0.6000
T1	12	WEP65	125.00 - 135.00	0.6000	0.6000
T1	13	WEP65	125.00 - 133.00	0.6000	0.6000
T1	15	LDF7-50A(1-5/8)	125.00 - 135.00	0.6000	0.6000
T1	16	LDF7-50A(1-5/8)	125.00 - 134.50	0.6000	0.6000
T1	17	LDF7-50A(1-5/8)	125.00 - 133.00	0.6000	0.6000
T1	36	EW63	125.00 - 135.00	0.6000	0.6000
T2	1	Safety Line 3/8	100.00 - 125.00	0.6000	0.6000
T2	2	Safety Line 3/8	100.00 - 125.00	0.6000	0.6000
T2	3	Safety Line 3/8	100.00 - 125.00	0.6000	0.6000
T2	4	Feedline Ladder (Af)	100.00 - 125.00	0.6000	0.6000
T2	5	Feedline Ladder (Af)	100.00 - 125.00	0.6000	0.6000
T2	7	LDF7-50A(1-5/8)	100.00 - 125.00	0.6000	0.6000
T2	8	LDF5-50A(7/8)	100.00 - 125.00	0.6000	0.6000
T2	9	LDF4P-50A(1/2)	100.00 - 125.00	0.6000	0.6000
T2	10	LDF7-50A(1-5/8)	100.00 - 125.00	0.6000	0.6000
T2	11	WEP65	121.00 - 125.00	0.6000	0.6000
T2	12	WEP65	100.00 - 125.00	0.6000	0.6000
T2	13	WEP65	100.00 - 125.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T2	14	WEP65	100.00 - 121.00	0.6000	0.6000
T2	15	LDF7-50A(1-5/8)	100.00 - 125.00	0.6000	0.6000
T2	16	LDF7-50A(1-5/8)	100.00 - 125.00	0.6000	0.6000
T2	17	LDF7-50A(1-5/8)	100.00 - 125.00	0.6000	0.6000
T2	18	LDF5-50A(7/8)	100.00 - 121.00	0.6000	0.6000
T2	19	LDF5-50A(7/8)	100.00 - 108.00	0.6000	0.6000
T2	20	LDF5-50A(7/8)	100.00 - 109.00	0.6000	0.6000
T2	36	EW63	100.00 - 125.00	0.6000	0.6000
T2	37	EW63	100.00 - 125.00	0.6000	0.6000
T2	39	LCF78-50J (7/8 FOAM)	100.00 - 117.00	0.6000	0.6000
T3	1	Safety Line 3/8	75.00 - 100.00	0.6000	0.6000
T3	2	Safety Line 3/8	75.00 - 100.00	0.6000	0.6000
T3	3	Safety Line 3/8	75.00 - 100.00	0.6000	0.6000
T3	4	Feedline Ladder (Af)	75.00 - 100.00	0.6000	0.6000
T3	5	Feedline Ladder (Af)	75.00 - 100.00	0.6000	0.6000
T3	7	LDF7-50A(1-5/8)	75.00 - 100.00	0.6000	0.6000
T3	8	LDF5-50A(7/8)	75.00 - 100.00	0.6000	0.6000
T3	9	LDF4P-50A(1/2)	75.00 - 100.00	0.6000	0.6000
T3	10	LDF7-50A(1-5/8)	75.00 - 100.00	0.6000	0.6000
T3	12	WEP65	75.00 - 100.00	0.6000	0.6000
T3	13	WEP65	75.00 - 100.00	0.6000	0.6000
T3	14	WEP65	75.00 - 100.00	0.6000	0.6000
T3	15	LDF7-50A(1-5/8)	75.00 - 100.00	0.6000	0.6000
T3	16	LDF7-50A(1-5/8)	75.00 - 100.00	0.6000	0.6000
T3	17	LDF7-50A(1-5/8)	75.00 - 100.00	0.6000	0.6000
T3	18	LDF5-50A(7/8)	75.00 - 100.00	0.6000	0.6000
T3	19	LDF5-50A(7/8)	75.00 - 100.00	0.6000	0.6000
T3	20	LDF5-50A(7/8)	75.00 - 100.00	0.6000	0.6000
T3	21	LDF5-50A(7/8)	75.00 - 100.00	0.6000	0.6000
T3	22	LDF5-50A(7/8)	75.00 - 87.00	0.6000	0.6000
T3	23	LDF5-50A(7/8)	75.00 - 96.00	0.6000	0.6000
T3	24	EW63(ELLIPTICAL)	75.00 - 95.00	0.6000	0.6000
T3	25	LDF4-50A(1/2)	75.00 - 83.00	0.6000	0.6000
T3	26	LDF5-50A(7/8)	75.00 - 79.00	0.6000	0.6000
T3	36	EW63	75.00 - 100.00	0.6000	0.6000
T3	37	EW63	75.00 - 100.00	0.6000	0.6000
T3	39	LCF78-50J (7/8 FOAM)	75.00 - 100.00	0.6000	0.6000
T3	42	LDF5-50A (7/8 FOAM)	75.00 - 95.00	0.6000	0.6000
T4	1	Safety Line 3/8	50.00 - 75.00	0.6000	0.6000
T4	2	Safety Line 3/8	50.00 - 75.00	0.6000	0.6000
T4	3	Safety Line 3/8	50.00 - 75.00	0.6000	0.6000
T4	4	Feedline Ladder (Af)	50.00 - 75.00	0.6000	0.6000
T4	5	Feedline Ladder (Af)	50.00 - 75.00	0.6000	0.6000
T4	7	LDF7-50A(1-5/8)	50.00 - 75.00	0.6000	0.6000
T4	8	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	9	LDF4P-50A(1/2)	50.00 - 75.00	0.6000	0.6000
T4	10	LDF7-50A(1-5/8)	50.00 - 75.00	0.6000	0.6000
T4	12	WEP65	50.00 - 75.00	0.6000	0.6000
T4	13	WEP65	50.00 - 75.00	0.6000	0.6000
T4	14	WEP65	50.00 - 75.00	0.6000	0.6000
T4	15	LDF7-50A(1-5/8)	50.00 - 75.00	0.6000	0.6000
T4	16	LDF7-50A(1-5/8)	50.00 - 75.00	0.6000	0.6000

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	*K_a No Ice*	*K_a Ice*
T4	17	LDF7-50A(1-5/8)	50.00 - 75.00	0.6000	0.6000
T4	18	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	19	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	20	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	21	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	22	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	23	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	24	EW63(ELLIPTICAL)	50.00 - 75.00	0.6000	0.6000
T4	25	LDF4-50A(1/2)	50.00 - 75.00	0.6000	0.6000
T4	26	LDF5-50A(7/8)	50.00 - 75.00	0.6000	0.6000
T4	27	LDF4P-50A(1/2)	50.00 - 58.00	0.6000	0.6000
T4	28	LDF5-50A(7/8)	50.00 - 54.00	0.6000	0.6000
T4	29	LDF4P-50A(1/2)	50.00 - 58.00	0.6000	0.6000
T4	30	LDF4P-50A(1/2)	50.00 - 53.00	0.6000	0.6000
T4	31	LDF4P-50A(1/2)	50.00 - 52.00	0.6000	0.6000
T4	36	EW63	50.00 - 75.00	0.6000	0.6000
T4	37	EW63	50.00 - 75.00	0.6000	0.6000
T4	39	LCF78-50J (7/8 FOAM)	50.00 - 75.00	0.6000	0.6000
T4	42	LDF5-50A (7/8 FOAM)	50.00 - 75.00	0.6000	0.6000
T5	1	Safety Line 3/8	25.00 - 50.00	0.6000	0.6000
T5	2	Safety Line 3/8	25.00 - 50.00	0.6000	0.6000
T5	3	Safety Line 3/8	25.00 - 50.00	0.6000	0.6000
T5	4	Feedline Ladder (Af)	25.00 - 50.00	0.6000	0.6000
T5	5	Feedline Ladder (Af)	25.00 - 50.00	0.6000	0.6000
T5	7	LDF7-50A(1-5/8)	25.00 - 50.00	0.6000	0.6000
T5	8	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	9	LDF4P-50A(1/2)	25.00 - 50.00	0.6000	0.6000
T5	10	LDF7-50A(1-5/8)	25.00 - 50.00	0.6000	0.6000
T5	12	WEP65	25.00 - 50.00	0.6000	0.6000
T5	13	WEP65	25.00 - 50.00	0.6000	0.6000
T5	14	WEP65	25.00 - 50.00	0.6000	0.6000
T5	15	LDF7-50A(1-5/8)	25.00 - 50.00	0.6000	0.6000
T5	16	LDF7-50A(1-5/8)	25.00 - 50.00	0.6000	0.6000
T5	17	LDF7-50A(1-5/8)	25.00 - 50.00	0.6000	0.6000
T5	18	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	19	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	20	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	21	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	22	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	23	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	24	EW63(ELLIPTICAL)	25.00 - 50.00	0.6000	0.6000
T5	25	LDF4-50A(1/2)	25.00 - 50.00	0.6000	0.6000
T5	26	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	27	LDF4P-50A(1/2)	25.00 - 50.00	0.6000	0.6000
T5	28	LDF5-50A(7/8)	25.00 - 50.00	0.6000	0.6000
T5	29	LDF4P-50A(1/2)	25.00 - 50.00	0.6000	0.6000
T5	30	LDF4P-50A(1/2)	25.00 - 50.00	0.6000	0.6000
T5	31	LDF4P-50A(1/2)	25.00 - 50.00	0.6000	0.6000
T5	36	EW63	25.00 - 50.00	0.6000	0.6000
T5	37	EW63	25.00 - 50.00	0.6000	0.6000
T5	39	LCF78-50J (7/8 FOAM)	25.00 - 50.00	0.6000	0.6000
T5	42	LDF5-50A (7/8 FOAM)	25.00 - 50.00	0.6000	0.6000
T6	1	Safety Line 3/8	6.00 - 25.00	0.6000	0.6000
T6	2	Safety Line 3/8	6.00 - 25.00	0.6000	0.6000
T6	3	Safety Line 3/8	6.00 - 25.00	0.6000	0.6000
T6	4	Feedline Ladder (Af)	6.00 - 25.00	0.6000	0.6000
T6	5	Feedline Ladder (Af)	6.00 - 25.00	0.6000	0.6000
T6	7	LDF7-50A(1-5/8)	6.00 - 25.00	0.6000	0.6000
T6	8	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	9	LDF4P-50A(1/2)	6.00 - 25.00	0.6000	0.6000
T6	10	LDF7-50A(1-5/8)	6.00 - 25.00	0.6000	0.6000
T6	12	WEP65	6.00 - 25.00	0.6000	0.6000

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	K_a *No Ice*	K_a *Ice*
T6	13	WEP65	6.00 - 25.00	0.6000	0.6000
T6	14	WEP65	6.00 - 25.00	0.6000	0.6000
T6	15	LDF7-50A(1-5/8)	6.00 - 25.00	0.6000	0.6000
T6	16	LDF7-50A(1-5/8)	6.00 - 25.00	0.6000	0.6000
T6	17	LDF7-50A(1-5/8)	6.00 - 25.00	0.6000	0.6000
T6	18	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	19	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	20	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	21	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	22	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	23	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	24	EW63(ELLIPTICAL)	6.00 - 25.00	0.6000	0.6000
T6	25	LDF4-50A(1/2)	6.00 - 25.00	0.6000	0.6000
T6	26	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	27	LDF4P-50A(1/2)	6.00 - 25.00	0.6000	0.6000
T6	28	LDF5-50A(7/8)	6.00 - 25.00	0.6000	0.6000
T6	29	LDF4P-50A(1/2)	6.00 - 25.00	0.6000	0.6000
T6	30	LDF4P-50A(1/2)	6.00 - 25.00	0.6000	0.6000
T6	31	LDF4P-50A(1/2)	6.00 - 25.00	0.6000	0.6000
T6	36	EW63	6.00 - 25.00	0.6000	0.6000
T6	37	EW63	6.00 - 25.00	0.6000	0.6000
T6	39	LCF78-50J (7/8 FOAM)	6.00 - 25.00	0.6000	0.6000
T6	42	LDF5-50A (7/8 FOAM)	6.00 - 25.00	0.6000	0.6000

Discrete Tower Loads

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* ft ft ft	*Azimuth Adjustment* °	*Placement* ft		C_AA_A *Front* ft^2	C_AA_A *Side* ft^2	*Weight* K
LEG B LOADING									
3" Dia 20' Omni	B	From Leg	1.000	0.000	137.500	No Ice	4.000	4.000	0.06
(CSP)			0.000			1/2" Ice	6.000	6.000	0.10
			13.500			1" Ice	8.000	8.000	0.14
2'x2"x2" Vertical Tube	B	From Leg	1.000	0.000	137.500	No Ice	0.522	0.522	0.01
(CSP)			0.000			1/2" Ice	0.674	0.674	0.01
			4.500			1" Ice	0.833	0.833	0.02
15' x 4" Mount Pipe	B	From Leg	1.500	0.000	137.500	No Ice	4.421	4.421	0.18
(CSP)			0.000			1/2" Ice	8.296	8.296	0.23
			0.000			1" Ice	9.858	9.858	0.28
10"x8"x4" Junction Box	B	From Leg	1.500	0.000	137.500	No Ice	0.667	0.333	0.01
(CSP)			0.000			1/2" Ice	0.770	0.415	0.02
			3.500			1" Ice	0.881	0.504	0.02
Sector Mount [SM 403-1]	B	From Leg	3.000	0.000	137.500	No Ice	10.220	7.050	0.29
(CSP)			0.000			1/2" Ice	14.320	10.130	0.42
			0.500			1" Ice	18.420	13.210	0.55
TMA	B	From Leg	3.000	0.000	137.500	No Ice	0.600	0.407	0.01
(CSP)			0.000			1/2" Ice	0.704	0.497	0.02
			0.500			1" Ice	0.815	0.593	0.02
AP14-850/105 w/Mount Pipe	B	From Leg	3.000	0.000	137.500	No Ice	10.758	8.136	0.08
(CSP)			6.000			1/2" Ice	11.457	9.799	0.16
			3.000			1" Ice	12.147	11.158	0.25

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*
AP14-850/105 w/Mount Pipe	B	From Leg	3.000	0.000	137.500	No Ice	10.758	8.136	0.08
(CSP)			1.000			1/2" Ice	11.457	9.799	0.16
			3.000			1" Ice	12.147	11.158	0.25
8'x2" Mount Pipe	B	From Leg	3.000	0.000	137.500	No Ice	1.900	1.900	0.03
(CSP)			-1.000			1/2" Ice	2.728	2.728	0.04
			3.000			1" Ice	3.401	3.401	0.06
36"x 6"x3" panel antenna w/	B	From Leg	3.000	0.000	137.500	No Ice	2.250	2.041	0.03
Mount Pipe			0.000			1/2" Ice	2.541	2.511	0.06
(CSP)			3.000			1" Ice	2.842	2.998	0.09
***									
14'x3" Mount Pipe	B	From Face	3.000	0.000	135.000	No Ice	4.134	4.134	0.11
(CSP)			5.000			1/2" Ice	6.338	6.338	0.14
			0.000			1" Ice	7.792	7.792	0.18
Side Arm Mount [SO 601-1]	B	From Face	0.000	0.000	135.000	No Ice	1.220	6.300	0.16
(CSP)			5.000			1/2" Ice	1.850	8.610	0.20
			0.000			1" Ice	2.480	10.920	0.23
(2) 3'x3"x3" Horizontal Angle	B	From Face	0.000	0.000	135.000	No Ice	0.900	0.075	0.01
(CSP)			5.000			1/2" Ice	1.120	0.112	0.02
			0.000			1" Ice	1.348	0.156	0.03
20'x2.5" Mount Pipe	B	From Face	3.500	0.000	135.000	No Ice	5.750	5.750	0.12
(CSP)			5.000			1/2" Ice	7.782	7.782	0.16
			0.000			1" Ice	9.831	9.831	0.21
AP14-850/105 w/Mount Pipe	B	From Face	3.500	0.000	135.000	No Ice	10.759	8.141	0.08
(CSP)			5.000			1/2" Ice	11.457	9.799	0.16
			-10.000			1" Ice	12.147	11.158	0.25
***									
10'x4" Mount Pipe	B	From Face	0.000	0.000	135.000	No Ice	2.953	2.953	0.13
(CSP)			0.000			1/2" Ice	5.238	5.238	0.16
			0.000			1" Ice	5.846	5.846	0.19
***									
Sector Mount [SM 403-1]	B	From Leg	3.000	0.000	121.000	No Ice	10.220	7.050	0.29
(CSP)			0.000			1/2" Ice	14.320	10.130	0.42
			0.500			1" Ice	18.420	13.210	0.55
8'x2"x6" Panel Antenna w/	B	From Leg	3.000	0.000	121.000	No Ice	2.904	8.938	0.06
Mount Pipe			6.000			1/2" Ice	3.921	10.450	0.12
(CSP)			2.500			1" Ice	4.952	11.986	0.18
8'x2"x6" Panel Antenna w/	B	From Leg	3.000	0.000	121.000	No Ice	2.904	8.938	0.06
Mount Pipe			1.000			1/2" Ice	3.921	10.450	0.12
(CSP)			2.500			1" Ice	4.952	11.986	0.18
8'x2" Mount Pipe	B	From Leg	3.000	0.000	121.000	No Ice	1.900	1.900	0.03
(CSP)			-1.000			1/2" Ice	2.728	2.728	0.04
			2.500			1" Ice	3.401	3.401	0.06
8'x2"x6" Panel Antenna w/	B	From Leg	3.000	0.000	121.000	No Ice	2.904	8.938	0.06
Mount Pipe			-6.000			1/2" Ice	3.921	10.450	0.12
(CSP)			2.500			1" Ice	4.952	11.986	0.18
TMA	B	From Leg	3.000	0.000	121.000	No Ice	0.600	0.407	0.01
(CSP)			3.000			1/2" Ice	0.704	0.497	0.02
			2.500			1" Ice	0.815	0.593	0.02
***									
(2) 4'x2" Horizontal Mount	B	From Leg	2.000	0.000	108.000	No Ice	0.866	0.866	0.01
Pipe			0.000			1/2" Ice	1.111	1.111	0.02
(CSP)			0.000			1" Ice	1.365	1.365	0.03
12'x2" Horizontal Pipe	B	From Leg	4.000	0.000	108.000	No Ice	2.850	2.850	0.04
(CSP)			0.000			1/2" Ice	4.078	4.078	0.07
			0.000			1" Ice	5.323	5.323	0.09
***									
Side Arm Mount [SO 601-1]	B	From Leg	0.000	45.000	100.000	No Ice	1.220	6.300	0.16

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert*	*Azimuth Adjustment*	*Placement*		C_AA_A *Front*	C_AA_A *Side*	*Weight*
			ft ft ft	*°*	*ft*		*ft²*	*ft²*	*K*
(CSP)			0.000			1/2" Ice	1.850	8.610	0.20
			0.000			1" Ice	2.480	10.920	0.23
(2) 3'x3"x3" Horizontal Angle	B	From Leg	3.000	45.000	100.000	No Ice	0.900	0.900	0.01
(CSP)			0.000			1/2" Ice	1.120	1.120	0.02
			0.000			1" Ice	1.348	1.348	0.03
3' Yagi	B	From Leg	6.000	45.000	100.000	No Ice	2.083	2.083	0.03
(CSP)			0.000			1/2" Ice	3.787	3.787	0.05
			0.000			1" Ice	5.517	5.517	0.09
2" Dia 10' Omni	B	From Leg	6.000	0.000	100.000	No Ice	2.000	2.000	0.01
(CSP)			0.000			1/2" Ice	3.030	3.030	0.03
			-6.000			1" Ice	4.060	4.060	0.04
***									
Side Arm Mount [SO 601-1]	B	From Leg	0.000	45.000	87.000	No Ice	1.220	6.300	0.16
(CSP)			0.000			1/2" Ice	1.850	8.610	0.20
			0.000			1" Ice	2.480	10.920	0.23
2" Dia 20' Omni	B	From Leg	1.000	0.000	87.000	No Ice	4.000	4.000	0.02
(CSP)			0.000			1/2" Ice	6.025	6.025	0.05
			6.000			1" Ice	8.067	8.067	0.10
***									
12'x2" Horizontal Pipe	B	From Leg	1.000	0.000	83.000	No Ice	2.850	2.850	0.04
(CSP)			0.000			1/2" Ice	4.078	4.078	0.07
			0.000			1" Ice	5.323	5.323	0.09
Single Bay Dipole	B	From Leg	1.000	0.000	83.000	No Ice	5.400	5.400	0.03
(CSP)			0.000			1/2" Ice	9.240	9.240	0.04
			12.500			1" Ice	13.080	13.080	0.05
***									
(2) 4'x2" Horizontal Mount Pipe	B	From Leg	2.000	90.000	58.000	No Ice	0.866	0.866	0.01
			0.000			1/2" Ice	1.111	1.111	0.02
(CSP)			0.000			1" Ice	1.365	1.365	0.03
12'x2" Horizontal Pipe	B	From Leg	4.000	90.000	58.000	No Ice	2.850	2.850	0.04
(CSP)			0.000			1/2" Ice	4.078	4.078	0.07
			0.000			1" Ice	5.323	5.323	0.09
Single Dipole Antenna	B	From Leg	6.000	90.000	58.000	No Ice	5.400	5.400	0.03
(CSP)			0.000			1/2" Ice	9.240	9.240	0.04
			0.000			1" Ice	13.080	13.080	0.05
***									
3' Yagi	B	From Leg	1.000	0.000	53.000	No Ice	2.083	2.083	0.03
(CSP)			0.000			1/2" Ice	3.787	3.787	0.05
			0.000			1" Ice	5.517	5.517	0.09
***									
6'x2" Mount Pipe	B	From Leg	1.000	0.000	52.000	No Ice	1.425	1.425	0.02
(CSP)			0.000			1/2" Ice	1.925	1.925	0.03
			0.000			1" Ice	2.294	2.294	0.05
Single Bay Dipole Antenna	B	From Leg	1.000	0.000	52.000	No Ice	5.400	5.400	0.03
(CSP)			0.000			1/2" Ice	9.240	9.240	0.04
			6.000			1" Ice	13.080	13.080	0.05
***									
***									
LEG A LOADING									
15' x 4" Mount Pipe	A	From Leg	1.500	0.000	137.000	No Ice	4.422	4.422	0.18
(CSP)			0.000			1/2" Ice	8.296	8.296	0.23
			7.500			1" Ice	9.858	9.858	0.28
***									
Side Arm Mount [SO 601-1]	A	From Leg	0.000	90.000	133.000	No Ice	1.220	6.300	0.16
(CSP)			0.000			1/2" Ice	1.850	8.610	0.20
			0.000			1" Ice	2.480	10.920	0.23
(2) 3'x3"x3" Horizontal Angle	A	From Leg	3.000	90.000	133.000	No Ice	0.900	0.900	0.01

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert*	*Azimuth Adjustment*	*Placement*		*C_AA_A Front*	*C_AA_A Side*	*Weight*
			ft ft ft	*°*	*ft*		*ft²*	*ft²*	*K*
(CSP)			0.000			1/2" Ice	1.120	1.120	0.02
			0.000			1" Ice	1.348	1.348	0.03
2" Dia 20' Omni	A	From Leg	3.000	0.000	133.000	No Ice	4.000	4.000	0.02
(CSP)			0.000			1/2" Ice	6.025	6.025	0.05
			13.000			1" Ice	8.067	8.067	0.10
2" Dia 20' Omni	A	From Leg	3.000	0.000	133.000	No Ice	4.000	4.000	0.02
(CSP)			0.000			1/2" Ice	6.025	6.025	0.05
			-13.000			1" Ice	8.067	8.067	0.10
***									
Pipe Mount [PM 602-1]	A	From Leg	1.000	0.000	121.000	No Ice	5.250	5.250	0.09
(CSP)			0.000			1/2" Ice	6.500	6.500	0.12
			0.000			1" Ice	7.750	7.750	0.14
***									
Side Arm Mount [SO 601-1]	A	From Leg	0.000	90.000	96.000	No Ice	1.220	6.300	0.16
(CSP)			0.000			1/2" Ice	1.850	8.610	0.20
			0.000			1" Ice	2.480	10.920	0.23
(2) 3'x3"x3" Horizontal Angle	A	From Leg	3.000	90.000	96.000	No Ice	0.900	0.900	0.01
(CSP)			0.000			1/2" Ice	1.120	1.120	0.02
			0.000			1" Ice	1.348	1.348	0.03
2" Dia 20' Omni	A	From Leg	3.000	0.000	96.000	No Ice	4.000	4.000	0.02
(CSP)			0.000			1/2" Ice	6.025	6.025	0.05
			10.000			1" Ice	8.067	8.067	0.10
20' Multi Array Dipole	A	From Leg	3.000	0.000	96.000	No Ice	5.400	5.400	0.03
(CSP)			0.000			1/2" Ice	9.240	9.240	0.04
			-10.000			1" Ice	13.080	13.080	0.05
10'x4" Mount Pipe	A	From Face	0.000	0.000	96.000	No Ice	3.061	3.061	0.13
(CSP)			-5.000			1/2" Ice	5.238	5.238	0.16
			0.000			1" Ice	5.846	5.846	0.19
***									
***									
LEG C LOADING									
15'x2.5" Extension Pipe	C	From Leg	0.000	0.000	140.000	No Ice	4.313	4.313	0.09
			0.000			1/2" Ice	5.845	5.845	0.12
			7.500			1" Ice	7.394	7.394	0.16
Lightning Rod 5/8"x4'	C	From Leg	0.000	0.000	140.000	No Ice	0.250	0.250	0.00
			0.000			1/2" Ice	0.664	0.664	0.01
			17.000			1" Ice	0.973	0.973	0.01
***									
12'x3" Mount Pipe	C	From Leg	1.000	0.000	134.500	No Ice	3.545	3.545	0.12
(CSP)			0.000			1/2" Ice	5.438	5.438	0.15
			0.000			1" Ice	6.692	6.692	0.19
20' Multi Array Dipole	C	From Leg	1.000	0.000	134.500	No Ice	5.400	5.400	0.03
(CSP)			0.000			1/2" Ice	9.240	9.240	0.04
			13.000			1" Ice	13.080	13.080	0.05
***									
6'x2" Horizontal Pipe	C	From Leg	1.000	0.000	109.000	No Ice	1.425	0.007	0.02
(Eversoure)			0.000			1/2" Ice	1.925	0.039	0.03
			0.000			1" Ice	2.294	0.070	0.05
CL6-450B	C	From Leg	1.000	0.000	109.000	No Ice	3.683	1.700	0.03
(Eversoure - Proposed)			0.000			1/2" Ice	3.926	1.865	0.06
			0.000			1" Ice	4.176	2.037	0.09
***									
MD-S6 (for 6' MW) : Ice	C	From Leg	3.000	0.000	95.000	No Ice	1.667	0.800	0.44
Shield			0.000			1/2" Ice	2.237	1.081	0.61
(CSP)			7.000			1" Ice	2.815	1.370	0.79
8'x4" Mount Pipe	C	From Leg	1.000	0.000	95.000	No Ice	2.369	2.369	0.09
(CSP)			0.000			1/2" Ice	3.840	3.840	0.11

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft^2*	*C_AA_A Side* *ft^2*	*Weight* *K*
			0.000			1" Ice	4.333	4.333	0.14
15' x 4" Mount Pipe	C	From Leg	1.000	0.000	95.000	No Ice	4.596	4.596	0.18
(CSP)			0.000			1/2" Ice	8.296	8.296	0.23
			0.000			1" Ice	9.858	9.858	0.28
***									
Side Arm Mount [SO 601-1]	C	From Leg	0.000	0.000	79.000	No Ice	1.220	6.300	0.16
(CSP)			0.000			1/2" Ice	1.850	8.610	0.20
			0.000			1" Ice	2.480	10.920	0.23
***									
Side Arm Mount [SO 601-1]	C	From Leg	0.000	0.000	54.000	No Ice	1.220	6.300	0.16
(CSP)			0.000			1/2" Ice	1.850	8.610	0.20
			0.000			1" Ice	2.480	10.920	0.23
7' Whip	C	From Leg	3.000	0.000	54.000	No Ice	1.744	1.744	0.04
(CSP)			0.000			1/2" Ice	2.599	2.599	0.05
			5.000			1" Ice	3.294	3.294	0.08
***									
MISCL MPs inside tower*									
15'x2.5" Horizontal Pipe	B	From Leg	0.000	0.000	140.500	No Ice	4.313	0.014	0.09
			0.000			1/2" Ice	5.845	0.084	0.12
			0.000			1" Ice	7.394	0.154	0.16
10'x2" Horizontal Pipe	A	From Leg	0.000	0.000	132.500	No Ice	2.375	0.009	0.04
			0.000			1/2" Ice	3.403	0.047	0.05
			0.000			1" Ice	4.448	0.084	0.08
(2) 10'x2" Horizontal Pipe	B	From Leg	0.000	0.000	130.000	No Ice	2.375	0.009	0.04
			0.000			1/2" Ice	3.403	0.047	0.05
			0.000			1" Ice	4.448	0.084	0.08
10'x2" Horizontal Pipe	B	From Leg	0.000	0.000	100.000	No Ice	2.375	0.009	0.04
			0.000			1/2" Ice	3.403	0.047	0.05
			0.000			1" Ice	4.448	0.084	0.08
10'x2" Horizontal Pipe	B	From Leg	0.000	0.000	92.000	No Ice	2.375	0.009	0.04
			0.000			1/2" Ice	3.403	0.047	0.05
			0.000			1" Ice	4.448	0.084	0.08
Proposed									
Sitepro1 USF-4U Mount	A	From Leg	0.000	0.000	117.000	No Ice	2.483	5.145	0.17
Assembly (Ca = 1.4 assumed)			0.000			1/2" Ice	3.247	6.910	0.32
(Eversoure)			0.000			1" Ice	4.029	8.675	0.47
Telewave ANT220F2 - Omni	A	From Leg	3.000	0.000	120.875	No Ice	1.029	1.029	0.01
Antenna			0.000			1/2" Ice	1.290	1.290	0.02
(Eversoure)			0.000			1" Ice	1.560	1.560	0.03
Telewave ANT220F2 - Omni	A	From Leg	3.000	0.000	113.125	No Ice	1.029	1.029	0.01
Antenna			0.000			1/2" Ice	1.290	1.290	0.02
(Eversoure (inverted))			0.000			1" Ice	1.560	1.560	0.03
*									
ANT450F6	C	From Leg	3.000	0.000	95.000	No Ice	1.900	1.900	0.01
(CSP Reserved)			0.000			1/2" Ice	2.728	2.728	0.02
			0.000			1" Ice	3.401	3.401	0.04
6' x2.5" - Sch 40 Antenna	A	From Leg	3.000	0.000	117.000	No Ice	1.693	1.693	0.04
Pipe (Vertical)			0.000			1/2" Ice	2.088	2.088	0.05
(CSP Reserved)			0.000			1" Ice	2.460	2.460	0.06

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
PA8-65 (E)	A	Paraboloid w/Radome	From Leg	3.000 -3.000 0.000	Worst		121.000	8.000	No Ice 1/2" Ice 1" Ice	50.270 51.292 52.314	0.29 0.55 0.81
10' dish (E)	A	Paraboloid w/Radome	From Leg	2.000 0.000 0.000	Worst		135.000	10.000	No Ice 1/2" Ice 1" Ice	78.540 79.850 81.170	0.70 0.41 0.77
PA8-65 (E)	B	Paraboloid w/Radome	From Leg	1.000 0.000 0.000	Worst		132.000	8.000	No Ice 1/2" Ice 1" Ice	50.270 51.292 52.314	0.29 0.55 0.81
PA6-65 (Diversity CSP)	C	Paraboloid w/Radome	From Leg	1.000 0.000 0.000	Worst		95.000	6.000	No Ice 1/2" Ice 1" Ice	28.270 29.050 29.831	0.09 0.24 0.39
SC3-W100AD (CSP - Existing @ 135')	C	Paraboloid w/o Radome	From Leg	0.250 0.000 0.000	Worst		135.000	3.000	No Ice 1/2" Ice 1" Ice	7.070 7.470 7.860	0.04 0.08 0.12
SC3-W100AD (CSP - Existing @ 125')	C	Paraboloid w/o Radome	From Leg	0.250 0.000 0.000	Worst		125.000	3.000	No Ice 1/2" Ice 1" Ice	7.070 7.470 7.860	0.04 0.08 0.12

222-H Verification Constants

Constant	Value
K_d	0.85
Ice Thickness Importance Factor	1.15
Z_g	900
α	9.5
K_{zmin}	0.85
K_c	n/a
K_t	1
f	1
K_e	1

222-H Section Verification ArRr By Element

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft²	A_r w/Ice ft²	A_rR_r ft²	A_rR_r w/Ice ft²
T1 140.000-125.000	1	HSS5x0.25	70.012	36.904	C	0.137	0.237	6.257	9.564	2.776	5.566
	1	HSS5x0.25	70.012	36.904	A	0.137	0.237	6.257	9.564	2.776	5.566
	2	HSS5x0.25	70.012	36.904	C	0.137	0.237	6.257	9.564	2.776	5.566
	2	HSS5x0.25	70.012	36.904	B	0.137	0.237	6.257	9.564	2.776	5.566
	3	HSS5x0.25	70.012	36.904	B	0.137	0.237	6.257	9.564	2.776	5.566
	3	HSS5x0.25	70.012	36.904	A	0.137	0.237	6.257	9.564	2.776	5.566
					A		Sum:	12.513	19.128	5.551	11.133
					B			12.513	19.128	5.551	11.133
					C			12.513	19.128	5.551	11.133
T2	22	HSS5x0.25	68.817	36.07	C	0.13	0.219	10.428	15.850	4.648	9.163

Section Elevation ft	Elem. Num.	Size	C	C w/Ice	Face	e	e w/Ice	A_r ft^2	A_r w/Ice ft^2	A_rR_r ft^2	A_rR_r w/Ice ft^2
125.000-100.000											
	22	HSS5x0.25	68.817	36.07	A	0.13	0.219	10.428	15.850	4.648	9.163
	23	HSS5x0.25	68.817	36.07	C	0.13	0.219	10.428	15.850	4.648	9.163
	23	HSS5x0.25	68.817	36.07	B	0.13	0.219	10.428	15.850	4.648	9.163
	24	HSS5x0.25	68.817	36.07	B	0.13	0.219	10.428	15.850	4.648	9.163
	24	HSS5x0.25	68.817	36.07	A	0.13	0.219	10.428	15.850	4.648	9.163
					A		Sum:	20.856	31.701	9.296	18.326
					B			20.856	31.701	9.296	18.326
					C			20.856	31.701	9.296	18.326
T3 100.000-75.000	61	HSS5x.375	67.02	34.83	C	0.12	0.202	10.428	15.716	4.687	9.034
	61	HSS5x.375	67.02	34.83	A	0.12	0.202	10.428	15.716	4.687	9.034
	62	HSS5x.375	67.02	34.83	C	0.12	0.202	10.428	15.716	4.687	9.034
	62	HSS5x.375	67.02	34.83	B	0.12	0.202	10.428	15.716	4.687	9.034
	63	HSS5x.375	67.02	34.83	B	0.12	0.202	10.428	15.716	4.687	9.034
	63	HSS5x.375	67.02	34.83	A	0.12	0.202	10.428	15.716	4.687	9.034
					A		Sum:	20.856	31.432	9.375	18.069
					B			20.856	31.432	9.375	18.069
					C			20.856	31.432	9.375	18.069
T4 75.000-50.000	100	HSS5x.375	64.688	33.244	C	0.113	0.188	10.428	15.541	4.763	8.897
	100	HSS5x.375	64.688	33.244	A	0.113	0.188	10.428	15.541	4.763	8.897
	101	HSS5x.375	64.688	33.244	C	0.113	0.188	10.428	15.541	4.763	8.897
	101	HSS5x.375	64.688	33.244	B	0.113	0.188	10.428	15.541	4.763	8.897
	102	HSS5x.375	64.688	33.244	B	0.113	0.188	10.428	15.541	4.763	8.897
	102	HSS5x.375	64.688	33.244	A	0.113	0.188	10.428	15.541	4.763	8.897
					A		Sum:	20.856	31.082	9.526	17.795
					B			20.856	31.082	9.526	17.795
					C			20.856	31.082	9.526	17.795
T5 50.000-25.000					A		Sum:	0.000	0.000	0.000	0.000
					B			0.000	0.000	0.000	0.000
					C			0.000	0.000	0.000	0.000
T6 25.000-0.000					A		Sum:	0.000	0.000	0.000	0.000
					B			0.000	0.000	0.000	0.000
					C			0.000	0.000	0.000	0.000

222-H Section Verification Tables - No Ice

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
T1 140.000-125.000	132.500		1.343	1	1		61	A	0.137	5.551
								B	0.137	5.551
								C	0.137	5.551
T2 125.000-100.000	112.500		1.297	1	1		59	A	0.13	9.296
								B	0.13	9.296
								C	0.13	9.296
T3 100.000-75.000	87.500		1.231	1	1		56	A	0.12	9.375
								B	0.12	9.375
								C	0.12	9.375
T4 75.000-50.000	62.500		1.146	1	1		52	A	0.113	9.526

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft²
								B	0.113	9.526
								C	0.113	9.526
T5 50.000-25.000	37.500		1.029	1	1		47	A	0.125	0.000
								B	0.125	0.000
								C	0.125	0.000
T6 25.000-0.000	12.500		0.85	1	1		39	A	0.123	0.000
								B	0.123	0.000
								C	0.123	0.000

222-H Section Verification Tables - Ice

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft²
T1 140.000-125.000	132.500	132.500	1.343	1	1	1.322	7	A	0.237	19.003
								B	0.237	19.003
								C	0.237	19.003
T2 125.000-100.000	112.500	112.500	1.297	1	1	1.300	7	A	0.219	31.327
								B	0.219	31.327
								C	0.219	31.327
T3 100.000-75.000	87.500	87.500	1.231	1	1	1.268	7	A	0.202	31.914
								B	0.202	31.914
								C	0.202	31.914
T4 75.000-50.000	62.500	62.500	1.146	1	1	1.226	6	A	0.188	32.346
								B	0.188	32.346
								C	0.188	32.346
T5 50.000-25.000	37.500	37.500	1.029	1	1	1.165	6	A	0.175	11.138
								B	0.175	11.138
								C	0.175	11.138
T6 25.000-0.000	12.500	12.500	0.85	1	1	1.044	5	A	0.166	10.622
								B	0.166	10.622
								C	0.166	10.622

222-H Section Verification Tables - Service

Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft²
T1 140.000-125.000	132.500		1.343	1	1		11	A	0.137	7.087
								B	0.137	7.087
								C	0.137	7.087
T2 125.000-100.000	112.500		1.297	1	1		10	A	0.13	11.800
								B	0.13	11.800
								C	0.13	11.800
T3 100.000-75.000	87.500		1.231	1	1		10	A	0.12	11.787
								B	0.12	11.787
								C	0.12	11.787
T4 75.000-50.000	62.500		1.146	1	1		9	A	0.113	11.779
								B	0.113	11.779
								C	0.113	11.779
T5 50.000-25.000	37.500		1.029	1	1		8	A	0.125	0.000
								B	0.125	0.000

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Branford, CT 06405
Phone: (203) 488-0580
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Section Elevation ft	z_{wind} ft	z_{ice} ft	K_z	K_h	K_{zt}	t_z in	q_z psf	Face	e	A_rR_r ft^2
T6 25.000-0.000	12.500		0.85	1	1		7	C	0.125	0.000
								A	0.123	0.000
								B	0.123	0.000
								C	0.123	0.000

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	10.13					
Bracing Weight	17.42					
Total Member Self-Weight	27.55			21.83	-42.43	
Total Weight	38.78			21.83	-42.43	
Wind 0 deg - No Ice		0.00	-74.69	-6288.85	-42.43	174.95
Wind 30 deg - No Ice		36.24	-62.77	-5354.70	-3146.57	200.65
Wind 60 deg - No Ice		61.02	-35.23	-3020.58	-5312.04	152.70
Wind 90 deg - No Ice		70.13	0.00	21.83	-6090.79	61.10
Wind 120 deg - No Ice		63.65	36.75	3136.37	-5436.97	-31.01
Wind 150 deg - No Ice		34.49	59.74	5173.69	-3016.86	-111.19
Wind 180 deg - No Ice		0.00	69.16	6003.95	-42.43	-174.95
Wind 210 deg - No Ice		-36.24	62.77	5398.37	3061.71	-200.65
Wind 240 deg - No Ice		-65.81	38.00	3228.53	5511.73	-152.70
Wind 270 deg - No Ice		-70.13	0.00	21.83	6005.93	-61.10
Wind 300 deg - No Ice		-58.86	-33.98	-2928.42	5067.56	31.01
Wind 330 deg - No Ice		-34.49	-59.74	-5130.02	2932.00	111.19
Member Ice	28.31					
Total Weight Ice	93.46			100.78	-184.39	
Wind 0 deg - Ice		0.00	-15.20	-1175.05	-184.39	49.16
Wind 30 deg - Ice		7.45	-12.91	-992.97	-815.87	55.42
Wind 60 deg - Ice		12.64	-7.30	-521.77	-1262.67	44.11
Wind 90 deg - Ice		14.43	0.00	100.78	-1415.46	21.04
Wind 120 deg - Ice		12.76	7.37	722.74	-1261.67	-4.94
Wind 150 deg - Ice		7.20	12.47	1162.29	-797.26	-29.66
Wind 180 deg - Ice		0.00	14.57	1340.53	-184.39	-49.16
Wind 210 deg - Ice		-7.45	12.91	1194.53	447.08	-55.42
Wind 240 deg - Ice		-13.19	7.62	741.35	925.12	-44.11
Wind 270 deg - Ice		-14.43	0.00	100.78	1046.67	-21.04
Wind 300 deg - Ice		-12.21	-7.05	-503.16	861.65	4.94
Wind 330 deg - Ice		-7.20	-12.47	-960.74	428.47	29.66
Total Weight	38.78			21.83	-42.43	
Wind 0 deg - Service		0.00	-13.00	-1097.26	-9.93	29.96
Wind 30 deg - Service		6.31	-10.93	-934.61	-551.54	34.36
Wind 60 deg - Service		10.63	-6.14	-527.56	-929.71	26.15
Wind 90 deg - Service		12.21	0.00	3.48	-1065.76	10.46
Wind 120 deg - Service		11.08	6.40	546.86	-951.10	-5.31
Wind 150 deg - Service		6.01	10.41	903.10	-529.33	-19.04
Wind 180 deg - Service		0.00	12.05	1047.96	-9.93	-29.96
Wind 210 deg - Service		-6.31	10.93	941.57	531.67	-34.36
Wind 240 deg - Service		-11.45	6.61	562.64	958.57	-26.15
Wind 270 deg - Service		-12.21	0.00	3.48	1045.89	-10.46
Wind 300 deg - Service		-10.26	-5.92	-511.78	882.51	5.31
Wind 330 deg - Service		-6.01	-10.41	-896.14	509.46	19.04

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	140 - 125	Leg	Max Tension	7	3.26	-0.82	-0.06
			Max. Compression	31	-8.15	0.09	0.05
			Max. Mx	14	-0.55	3.13	0.78
			Max. My	20	-1.59	-0.04	4.56
			Max. Vy	14	2.40	-2.13	0.78
			Max. Vx	8	-3.31	-0.04	2.37
		Diagonal	Max Tension	25	10.65	0.00	0.00
			Max. Compression	24	-10.80	0.00	0.00
			Max. Mx	30	1.11	0.14	0.00
			Max. My	32	-0.36	0.00	0.01
			Max. Vy	30	0.06	0.00	0.00
			Max. Vx	32	-0.00	0.00	0.00
		Horizontal	Max Tension	14	7.51	0.03	0.02
			Max. Compression	2	-7.61	0.03	0.02
			Max. Mx	29	-0.60	0.08	0.02
			Max. My	12	-6.98	0.03	0.02
			Max. Vy	29	0.06	0.08	0.02
			Max. Vx	31	-0.00	0.00	0.00
		Top Girt	Max Tension	15	2.09	0.02	0.01
			Max. Compression	2	-2.14	0.03	0.01
			Max. Mx	29	-0.32	0.07	0.02
			Max. My	31	0.15	0.06	0.02
			Max. Vy	29	0.06	0.07	0.02
			Max. Vx	31	-0.00	0.00	0.00
T2	125 - 100	Leg	Max Tension	7	41.90	0.11	-0.29
			Max. Compression	10	-49.42	0.76	-0.06
			Max. Mx	22	9.88	2.38	-0.57
			Max. My	20	-2.96	-0.02	3.32
			Max. Vy	22	-1.06	-0.84	-0.42
			Max. Vx	10	-1.41	-0.69	1.71
		Diagonal	Max Tension	25	16.12	0.00	0.00
			Max. Compression	24	-16.38	0.00	0.00
			Max. Mx	30	2.01	0.24	0.00
			Max. My	32	-0.71	0.00	0.01
			Max. Vy	30	-0.09	0.00	0.00
			Max. Vx	32	-0.00	0.00	0.00
		Horizontal	Max Tension	24	10.87	0.04	-0.00
			Max. Compression	25	-10.75	0.03	-0.00
			Max. Mx	29	-0.38	0.11	0.00
			Max. My	18	0.52	0.02	-0.03
			Max. Vy	29	-0.07	0.11	0.00
			Max. Vx	18	0.00	0.02	-0.03
		Inner Bracing	Max Tension	17	0.01	0.00	0.00
			Max. Compression	12	-0.02	0.00	0.00
			Max. Mx	26	-0.01	-0.07	0.00
			Max. My	10	0.01	0.00	-0.00
			Max. Vy	26	-0.04	0.00	0.00
			Max. Vx	10	0.00	0.00	0.00
T3	100 - 75	Leg	Max Tension	7	92.43	-0.50	-0.20
			Max. Compression	10	-106.17	0.51	-0.06
			Max. Mx	6	55.62	1.09	-0.11
			Max. My	24	-3.65	-0.04	-1.79
			Max. Vy	6	0.71	-1.03	-0.11
			Max. Vx	12	0.92	-0.04	-1.19
		Diagonal	Max Tension	25	19.10	0.00	0.00
			Max. Compression	24	-19.44	0.00	0.00
			Max. Mx	30	3.07	0.29	0.00
			Max. My	27	0.69	0.00	-0.01
			Max. Vy	30	-0.10	0.00	0.00
			Max. Vx	27	0.00	0.00	0.00
		Horizontal	Max Tension	24	13.78	0.06	-0.00

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial K*	*Major Axis Moment kip-ft*	*Minor Axis Moment kip-ft*
			Max. Compression	3	-13.71	0.06	0.02
			Max. Mx	29	-0.71	0.16	0.01
			Max. My	18	-0.49	0.03	-0.05
			Max. Vy	29	-0.09	0.16	0.01
			Max. Vx	18	0.01	0.03	-0.05
		Inner Bracing	Max Tension	17	0.01	0.00	0.00
			Max. Compression	24	-0.02	0.00	0.00
			Max. Mx	26	-0.01	-0.09	0.00
			Max. My	2	0.01	0.00	-0.00
			Max. Vy	26	-0.05	0.00	0.00
			Max. Vx	10	0.00	0.00	0.00
T4	75 - 50	Leg	Max Tension	7	149.66	-0.53	-0.25
			Max. Compression	10	-169.02	0.73	-0.10
			Max. Mx	3	-164.82	0.74	-0.26
			Max. My	4	-11.68	-0.02	-1.13
			Max. Vy	22	-0.32	-0.52	0.06
			Max. Vx	4	-0.69	-0.01	-0.78
		Diagonal	Max Tension	3	20.66	0.00	0.00
			Max. Compression	2	-21.12	0.00	0.00
			Max. Mx	30	3.54	0.33	0.00
			Max. My	27	0.76	0.00	-0.01
			Max. Vy	30	-0.11	0.00	0.00
			Max. Vx	27	0.00	0.00	0.00
		Horizontal	Max Tension	24	15.57	-0.12	0.00
			Max. Compression	3	-15.93	-0.13	-0.02
			Max. Mx	29	-0.90	-0.27	-0.00
			Max. My	18	-2.02	-0.04	0.04
			Max. Vy	29	0.13	-0.27	-0.00
			Max. Vx	18	-0.01	-0.04	0.04
		Inner Bracing	Max Tension	17	0.01	0.00	0.00
			Max. Compression	2	-0.02	0.00	0.00
			Max. Mx	26	-0.01	-0.11	0.00
			Max. My	18	0.01	0.00	-0.00
			Max. Vy	26	-0.05	0.00	0.00
			Max. Vx	18	0.00	0.00	0.00
T5	50 - 25	Leg	Max Tension	7	198.30	-1.20	-0.43
			Max. Compression	18	-224.13	1.20	0.43
			Max. Mx	19	-188.63	1.33	0.42
			Max. My	4	-13.05	-0.03	-1.72
			Max. Vy	19	-0.33	1.33	0.42
			Max. Vx	4	0.56	-0.03	-1.72
		Diagonal	Max Tension	3	27.63	0.00	0.00
			Max. Compression	2	-28.12	0.00	0.00
			Max. Mx	32	5.33	0.55	0.00
			Max. My	27	1.21	0.00	-0.02
			Max. Vy	32	-0.13	0.00	0.00
			Max. Vx	27	0.00	0.00	0.00
		Horizontal	Max Tension	2	17.38	0.15	0.02
			Max. Compression	3	-18.35	0.13	0.02
			Max. Mx	29	-1.22	0.26	0.01
			Max. My	18	-2.30	0.03	-0.06
			Max. Vy	29	-0.12	0.26	0.01
			Max. Vx	18	0.01	0.03	-0.06
		Inner Bracing	Max Tension	17	0.01	0.00	0.00
			Max. Compression	2	-0.03	0.00	0.00
			Max. Mx	26	-0.01	-0.13	0.00
			Max. My	18	0.01	0.00	-0.00
			Max. Vy	26	0.05	0.00	0.00
			Max. Vx	18	0.00	0.00	0.00
T6	25 - 0	Leg	Max Tension	7	257.72	-1.44	-0.29
			Max. Compression	18	-293.28	-0.00	-0.00

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Axial K*	*Major Axis Moment kip-ft*	*Minor Axis Moment kip-ft*
			Max. Mx	19	-255.42	1.54	0.27
			Max. My	4	-16.08	-0.05	-1.72
			Max. Vy	19	0.35	1.54	0.27
			Max. Vx	4	-0.50	-0.05	-1.72
		Diagonal	Max Tension	3	28.87	0.00	0.00
			Max. Compression	2	-29.50	0.00	0.00
			Max. Mx	27	6.38	0.73	0.00
			Max. My	35	-1.73	0.00	-0.03
			Max. Vy	27	-0.17	0.00	0.00
			Max. Vx	35	0.01	0.00	0.00
		Horizontal	Max Tension	2	19.28	0.17	0.02
			Max. Compression	3	-20.07	0.14	0.02
			Max. Mx	29	-1.31	0.26	0.00
			Max. My	18	-2.53	0.05	-0.06
			Max. Vy	29	0.11	0.24	0.01
			Max. Vx	18	0.01	0.05	-0.06
		Inner Bracing	Max Tension	17	0.01	0.00	0.00
			Max. Compression	2	-0.03	0.00	0.00
			Max. Mx	26	-0.01	-0.15	0.00
			Max. My	18	0.00	0.00	-0.00
			Max. Vy	26	-0.05	0.00	0.00
			Max. Vx	18	0.00	0.00	0.00

Maximum Reactions

Location	*Condition*	*Gov. Load Comb.*	*Vertical K*	*Horizontal, X K*	*Horizontal, Z K*
Leg C	Max. Vert	18	327.38	38.17	-17.65
	Max. H_x	18	327.38	38.17	-17.65
	Max. H_z	5	-252.33	-29.08	16.25
	Min. Vert	7	-287.12	-34.50	15.44
	Min. H_x	7	-287.12	-34.50	15.44
	Min. H_z	18	327.38	38.17	-17.65
Leg B	Max. Vert	10	323.14	-34.80	-20.98
	Max. H_x	23	-275.12	30.97	18.79
	Max. H_z	25	-238.41	23.86	22.10
	Min. Vert	23	-275.12	30.97	18.79
	Min. H_x	10	323.14	-34.80	-20.98
	Min. H_z	12	270.71	-25.35	-22.70
Leg A	Max. Vert	2	322.77	4.35	41.20
	Max. H_x	22	158.72	8.04	19.41
	Max. H_z	2	322.77	4.35	41.20
	Min. Vert	15	-282.08	-4.44	-36.89
	Min. H_x	11	-141.66	-8.87	-19.15
	Min. H_z	15	-282.08	-4.44	-36.89

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	38.78	0.00	0.00	21.84	-42.44	0.00

Load Combination	*Vertical* *K*	*Shear$_x$* *K*	*Shear$_z$* *K*	*Overturning Moment, M_x* *kip-ft*	*Overturning Moment, M_z* *kip-ft*	*Torque* *kip-ft*
1.2 Dead+1.0 Wind 0 deg - No Ice	46.54	0.00	-74.69	-6120.11	-51.38	175.18
0.9 Dead+1.0 Wind 0 deg - No Ice	34.90	0.00	-74.69	-6124.07	-38.59	175.12
1.2 Dead+1.0 Wind 30 deg - No Ice	46.54	36.24	-62.77	-5210.11	-3074.57	200.89
0.9 Dead+1.0 Wind 30 deg - No Ice	34.90	36.24	-62.77	-5214.44	-3060.51	200.83
1.2 Dead+1.0 Wind 60 deg - No Ice	46.54	61.02	-35.23	-2938.62	-5186.63	152.90
0.9 Dead+1.0 Wind 60 deg - No Ice	34.90	61.02	-35.23	-2943.92	-5171.68	152.85
1.2 Dead+1.0 Wind 90 deg - No Ice	46.54	70.13	-0.00	26.27	-5948.75	61.19
0.9 Dead+1.0 Wind 90 deg - No Ice	34.90	70.13	-0.00	19.71	-5933.48	61.17
1.2 Dead+1.0 Wind 120 deg - No Ice	46.54	63.65	36.75	3061.34	-5308.07	-31.06
0.9 Dead+1.0 Wind 120 deg - No Ice	34.90	63.65	36.75	3053.48	-5293.09	-31.05
1.2 Dead+1.0 Wind 150 deg - No Ice	46.54	34.49	59.74	5052.02	-2952.81	-111.34
0.9 Dead+1.0 Wind 150 deg - No Ice	34.90	34.49	59.74	5043.30	-2938.82	-111.30
1.2 Dead+1.0 Wind 180 deg - No Ice	46.54	-0.00	69.16	5859.53	-51.28	-175.17
0.9 Dead+1.0 Wind 180 deg - No Ice	34.90	-0.00	69.16	5850.46	-38.52	-175.11
1.2 Dead+1.0 Wind 210 deg - No Ice	46.54	-36.24	62.77	5262.93	2971.96	-200.89
0.9 Dead+1.0 Wind 210 deg - No Ice	34.90	-36.24	62.77	5254.12	2983.45	-200.83
1.2 Dead+1.0 Wind 240 deg - No Ice	46.54	-65.81	38.00	3148.04	5355.49	-152.91
0.9 Dead+1.0 Wind 240 deg - No Ice	34.90	-65.81	38.00	3140.14	5365.99	-152.86
1.2 Dead+1.0 Wind 270 deg - No Ice	46.54	-70.13	-0.00	26.32	5846.71	-61.19
0.9 Dead+1.0 Wind 270 deg - No Ice	34.90	-70.13	-0.00	19.74	5856.99	-61.17
1.2 Dead+1.0 Wind 300 deg - No Ice	46.54	-58.86	-33.98	-2852.49	4934.80	31.05
0.9 Dead+1.0 Wind 300 deg - No Ice	34.90	-58.86	-33.98	-2857.83	4945.47	31.05
1.2 Dead+1.0 Wind 330 deg - No Ice	46.54	-34.49	-59.74	-4999.75	2850.39	111.34
0.9 Dead+1.0 Wind 330 deg - No Ice	34.90	-34.49	-59.74	-5004.17	2861.95	111.30
1.2 Dead+1.0 Ice+1.0 Temp	101.22	0.00	0.00	105.47	-193.57	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	101.22	0.00	-15.20	-1132.91	-193.78	49.30
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	101.22	7.45	-12.91	-956.46	-806.86	55.58
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	101.22	12.64	-7.30	-499.28	-1241.20	44.24
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	101.22	14.43	0.00	105.51	-1390.19	21.11
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	101.22	12.76	7.37	709.89	-1240.42	-4.96
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	101.22	7.20	12.47	1137.22	-789.27	-29.75

Load Combination	*Vertical* *K*	*Shear$_x$* *K*	*Shear$_z$* *K*	*Overturning Moment, M_x* *kip-ft*	*Overturning Moment, M_z* *kip-ft*	*Torque* *kip-ft*
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	101.22	0.00	14.57	1309.88	-193.66	-49.30
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	101.22	-7.45	12.91	1167.56	419.42	-55.58
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	101.22	-13.19	7.62	727.46	883.33	-44.25
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	101.22	-14.43	0.00	105.59	1002.78	-21.11
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	101.22	-12.21	-7.05	-481.74	823.45	4.95
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	101.22	-7.20	-12.47	-926.14	401.84	29.75
Dead+Wind 0 deg - Service	38.78	0.00	-13.00	-1050.01	-42.52	29.99
Dead+Wind 30 deg - Service	38.78	6.31	-10.93	-891.55	-569.94	34.39
Dead+Wind 60 deg - Service	38.78	10.63	-6.14	-495.53	-938.67	26.17
Dead+Wind 90 deg - Service	38.78	12.21	0.00	21.86	-1071.79	10.47
Dead+Wind 120 deg - Service	38.78	11.08	6.40	551.29	-959.49	-5.32
Dead+Wind 150 deg - Service	38.78	6.01	10.41	899.27	-549.07	-19.06
Dead+Wind 180 deg - Service	38.78	0.00	12.05	1040.11	-42.52	-29.99
Dead+Wind 210 deg - Service	38.78	-6.31	10.93	935.35	484.81	-34.39
Dead+Wind 240 deg - Service	38.78	-11.45	6.61	566.10	900.10	-26.18
Dead+Wind 270 deg - Service	38.78	-12.21	0.00	21.87	986.78	-10.48
Dead+Wind 300 deg - Service	38.78	-10.26	-5.92	-480.77	828.06	5.31
Dead+Wind 330 deg - Service	38.78	-6.01	-10.41	-855.54	464.05	19.06

Solution Summary

	Sum of Applied Forces			*Sum of Reactions*			
Load Comb.	*PX* *K*	*PY* *K*	*PZ* *K*	*PX* *K*	*PY* *K*	*PZ* *K*	*% Error*
1	0.00	-38.78	0.00	0.00	38.78	0.00	0.000%
2	0.00	-46.54	-74.69	-0.00	46.54	74.69	0.000%
3	0.00	-34.90	-74.69	-0.00	34.90	74.69	0.000%
4	36.24	-46.54	-62.77	-36.24	46.54	62.77	0.000%
5	36.24	-34.90	-62.77	-36.24	34.90	62.77	0.000%
6	61.02	-46.54	-35.23	-61.02	46.54	35.23	0.000%
7	61.02	-34.90	-35.23	-61.02	34.90	35.23	0.000%
8	70.13	-46.54	0.00	-70.13	46.54	0.00	0.000%
9	70.13	-34.90	0.00	-70.13	34.90	0.00	0.000%
10	63.65	-46.54	36.75	-63.65	46.54	-36.75	0.000%
11	63.65	-34.90	36.75	-63.65	34.90	-36.75	0.000%
12	34.49	-46.54	59.74	-34.49	46.54	-59.74	0.000%
13	34.49	-34.90	59.74	-34.49	34.90	-59.74	0.000%
14	-0.00	-46.54	69.16	0.00	46.54	-69.16	0.000%
15	-0.00	-34.90	69.16	0.00	34.90	-69.16	0.000%
16	-36.24	-46.54	62.77	36.24	46.54	-62.77	0.000%
17	-36.24	-34.90	62.77	36.24	34.90	-62.77	0.000%
18	-65.81	-46.54	38.00	65.81	46.54	-38.00	0.000%
19	-65.81	-34.90	38.00	65.81	34.90	-38.00	0.000%
20	-70.13	-46.54	0.00	70.13	46.54	0.00	0.000%
21	-70.13	-34.90	0.00	70.13	34.90	0.00	0.000%
22	-58.86	-46.54	-33.98	58.86	46.54	33.98	0.000%
23	-58.86	-34.90	-33.98	58.86	34.90	33.98	0.000%
24	-34.49	-46.54	-59.74	34.49	46.54	59.74	0.000%
25	-34.49	-34.90	-59.74	34.49	34.90	59.74	0.000%
26	0.00	-101.22	0.00	0.00	101.22	0.00	0.000%
27	0.00	-101.22	-15.20	0.00	101.22	15.20	0.000%
28	7.45	-101.22	-12.91	-7.45	101.22	12.91	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
29	12.64	-101.22	-7.30	-12.64	101.22	7.30	0.000%
30	14.43	-101.22	0.00	-14.43	101.22	0.00	0.000%
31	12.76	-101.22	7.37	-12.76	101.22	-7.37	0.000%
32	7.20	-101.22	12.47	-7.20	101.22	-12.47	0.000%
33	0.00	-101.22	14.57	0.00	101.22	-14.57	0.000%
34	-7.45	-101.22	12.91	7.45	101.22	-12.91	0.000%
35	-13.19	-101.22	7.62	13.19	101.22	-7.62	0.000%
36	-14.43	-101.22	0.00	14.43	101.22	0.00	0.000%
37	-12.21	-101.22	-7.05	12.21	101.22	7.05	0.000%
38	-7.20	-101.22	-12.47	7.20	101.22	12.47	0.000%
39	0.00	-38.78	-13.00	0.00	38.78	13.00	0.000%
40	6.31	-38.78	-10.93	-6.31	38.78	10.93	0.000%
41	10.63	-38.78	-6.14	-10.63	38.78	6.14	0.000%
42	12.21	-38.78	0.00	-12.21	38.78	0.00	0.000%
43	11.08	-38.78	6.40	-11.08	38.78	-6.40	0.000%
44	6.01	-38.78	10.41	-6.01	38.78	-10.41	0.000%
45	0.00	-38.78	12.05	0.00	38.78	-12.05	0.000%
46	-6.31	-38.78	10.93	6.31	38.78	-10.93	0.000%
47	-11.45	-38.78	6.61	11.45	38.78	-6.61	0.000%
48	-12.21	-38.78	0.00	12.21	38.78	0.00	0.000%
49	-10.26	-38.78	-5.92	10.26	38.78	5.92	0.000%
50	-6.01	-38.78	-10.41	6.01	38.78	10.41	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00000001
3	Yes	4	0.00000001	0.00000001
4	Yes	4	0.00000001	0.00000001
5	Yes	4	0.00000001	0.00000001
6	Yes	4	0.00000001	0.00000001
7	Yes	4	0.00000001	0.00000001
8	Yes	4	0.00000001	0.00000001
9	Yes	4	0.00000001	0.00000001
10	Yes	4	0.00000001	0.00000001
11	Yes	4	0.00000001	0.00000001
12	Yes	4	0.00000001	0.00000001
13	Yes	4	0.00000001	0.00000001
14	Yes	4	0.00000001	0.00000001
15	Yes	4	0.00000001	0.00000001
16	Yes	4	0.00000001	0.00000001
17	Yes	4	0.00000001	0.00000001
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00000001
20	Yes	4	0.00000001	0.00000001
21	Yes	4	0.00000001	0.00000001
22	Yes	4	0.00000001	0.00000001
23	Yes	4	0.00000001	0.00000001
24	Yes	4	0.00000001	0.00000001
25	Yes	4	0.00000001	0.00000001
26	Yes	4	0.00000001	0.00000001
27	Yes	4	0.00000001	0.00000001
28	Yes	4	0.00000001	0.00000001
29	Yes	4	0.00000001	0.00000001

30	Yes	4	0.00000001	0.00000001
31	Yes	4	0.00000001	0.00000001
32	Yes	4	0.00000001	0.00000001
33	Yes	4	0.00000001	0.00000001
34	Yes	4	0.00000001	0.00000001
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000001
37	Yes	4	0.00000001	0.00000001
38	Yes	4	0.00000001	0.00000001
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000001
41	Yes	4	0.00000001	0.00000001
42	Yes	4	0.00000001	0.00000001
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000001
45	Yes	4	0.00000001	0.00000001
46	Yes	4	0.00000001	0.00000001
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000001
49	Yes	4	0.00000001	0.00000001
50	Yes	4	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	140 - 125	1.415	43	0.080	0.048
T2	125 - 100	1.159	43	0.079	0.043
T3	100 - 75	0.755	43	0.068	0.036
T4	75 - 50	0.417	43	0.053	0.027
T5	50 - 25	0.187	43	0.029	0.018
T6	25 - 0	0.055	47	0.014	0.008

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
140.500	15'x2.5" Horizontal Pipe	43	1.415	0.080	0.048	794853
140.000	15'x2.5" Extension Pipe	43	1.415	0.080	0.048	794853
137.500	3" Dia 20' Omni	43	1.372	0.080	0.047	794853
137.000	15' x 4" Mount Pipe	43	1.363	0.080	0.047	794853
135.000	10' dish	43	1.329	0.080	0.047	794853
134.500	12'x3" Mount Pipe	43	1.320	0.080	0.047	722580
133.000	Side Arm Mount [SO 601-1]	43	1.295	0.080	0.046	567749
132.500	10'x2" Horizontal Pipe	43	1.286	0.079	0.046	529897
132.000	PA8-65	43	1.278	0.079	0.046	496779
130.000	(2) 10'x2" Horizontal Pipe	43	1.244	0.079	0.045	397423
125.000	SC3-W100AD	43	1.159	0.079	0.043	269494
121.000	PA8-65	43	1.091	0.078	0.042	223478
120.875	Telewave ANT220F2 - Omni Antenna	43	1.089	0.078	0.042	222381
117.000	Sitepro1 USF-4U Mount Assembly (Ca = 1.4 assumed)	43	1.025	0.076	0.041	193195
113.125	Telewave ANT220F2 - Omni	43	0.962	0.075	0.040	170790

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
	Antenna					
109.000	6'x2" Horizontal Pipe	43	0.895	0.073	0.039	152023
108.000	(2) 4'x2" Horizontal Mount Pipe	43	0.879	0.072	0.038	148079
100.000	Side Arm Mount [SO 601-1]	43	0.755	0.068	0.036	120683
96.000	Side Arm Mount [SO 601-1]	43	0.695	0.066	0.034	105412
95.000	PA6-65	43	0.680	0.066	0.034	101807
92.000	10'x2" Horizontal Pipe	43	0.637	0.064	0.033	92026
87.000	Side Arm Mount [SO 601-1]	43	0.567	0.061	0.031	79324
83.000	12'x2" Horizontal Pipe	43	0.514	0.059	0.030	71436
79.000	Side Arm Mount [SO 601-1]	43	0.464	0.056	0.028	64990
58.000	(2) 4'x2" Horizontal Mount Pipe	43	0.249	0.036	0.021	74439
54.000	Side Arm Mount [SO 601-1]	43	0.217	0.033	0.020	79067
53.000	3' Yagi	43	0.209	0.032	0.019	80247
52.000	6'x2" Mount Pipe	43	0.202	0.031	0.019	81338

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	140 - 125	7.721	19	0.420	0.282
T2	125 - 100	6.376	19	0.418	0.254
T3	100 - 75	4.205	19	0.369	0.208
T4	75 - 50	2.349	19	0.288	0.157
T5	50 - 25	1.074	19	0.160	0.106
T6	25 - 0	0.319	18	0.080	0.047

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
140.500	15'x2.5" Horizontal Pipe	19	7.721	0.420	0.282	281326
140.000	15'x2.5" Extension Pipe	19	7.721	0.420	0.282	281326
137.500	3" Dia 20' Omni	19	7.496	0.421	0.277	281326
137.000	15' x 4" Mount Pipe	19	7.451	0.421	0.276	281326
135.000	10' dish	19	7.272	0.421	0.273	281326
134.500	12'x3" Mount Pipe	19	7.227	0.421	0.272	255751
133.000	Side Arm Mount [SO 601-1]	19	7.092	0.421	0.269	200947
132.500	10'x2" Horizontal Pipe	19	7.048	0.421	0.268	187551
132.000	PA8-65	19	7.003	0.421	0.267	175829
130.000	(2) 10'x2" Horizontal Pipe	19	6.823	0.421	0.263	140663
125.000	SC3-W100AD	19	6.376	0.418	0.254	90126
121.000	PA8-65	19	6.019	0.414	0.246	64170
120.875	Telewave ANT220F2 - Omni Antenna	19	6.008	0.414	0.246	63548
117.000	Sitepro1 USF-4U Mount Assembly (Ca = 1.4 assumed)	19	5.665	0.408	0.240	48788
113.125	Telewave ANT220F2 - Omni Antenna	19	5.324	0.401	0.233	39589
109.000	6'x2" Horizontal Pipe	19	4.966	0.391	0.225	32971
108.000	(2) 4'x2" Horizontal Mount Pipe	19	4.880	0.389	0.223	31687

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
100.000	Side Arm Mount [SO 601-1]	19	4.205	0.369	0.208	23735
96.000	Side Arm Mount [SO 601-1]	19	3.878	0.359	0.200	20221
95.000	PA6-65	19	3.798	0.356	0.198	19444
92.000	10'x2" Horizontal Pipe	19	3.560	0.348	0.192	17432
87.000	Side Arm Mount [SO 601-1]	19	3.179	0.333	0.182	14868
83.000	12'x2" Horizontal Pipe	19	2.887	0.320	0.174	13302
79.000	Side Arm Mount [SO 601-1]	19	2.610	0.305	0.166	12038
58.000	(2) 4'x2" Horizontal Mount Pipe	19	1.420	0.200	0.123	13779
54.000	Side Arm Mount [SO 601-1]	19	1.241	0.179	0.114	14653
53.000	3' Yagi	19	1.198	0.174	0.112	14876
52.000	6'x2" Mount Pipe	19	1.156	0.169	0.110	15081

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	140	Diagonal	A325X	0.750	1	10.65	17.94	0.594 ✔	1	Member Block Shear
		Horizontal	A325X	0.625	2	3.75	10.26	0.366 ✔	1	Member Block Shear
T2	125	Leg	A325X	0.750	6	2.25	30.10	0.075 ✔	1	Bolt Tension
		Diagonal	A325X	0.750	1	16.12	25.23	0.639 ✔	1	Member Bearing
		Horizontal	A325X	0.625	2	5.44	10.26	0.530 ✔	1	Member Block Shear
T3	100	Leg	A325X	0.750	6	9.58	30.10	0.318 ✔	1	Bolt Tension
		Diagonal	A325X	0.750	1	19.10	25.23	0.757 ✔	1	Member Bearing
		Horizontal	A325X	0.625	2	6.89	10.26	0.671 ✔	1	Member Block Shear
T4	75	Leg	A325X	0.750	6	18.57	30.10	0.617 ✔	1	Bolt Tension
		Diagonal	A325X	0.750	1	20.66	25.23	0.819 ✔	1	Member Bearing
		Horizontal	A325X	0.625	2	7.79	20.53	0.379 ✔	1	Member Block Shear
T5	50	Leg	A325X	1.000	6	28.18	54.52	0.517 ✔	1	Bolt Tension
		Diagonal	A325X	1.000	1	27.63	32.54	0.849 ✔	1	Member Block Shear
		Horizontal	A325X	0.625	2	8.69	11.62	0.748 ✔	1	Member Block Shear
T6	25	Leg	A325X	1.000	8	28.50	54.52	0.523 ✔	1	Bolt Tension
		Diagonal	A325X	1.000	1	28.87	43.59	0.662 ✔	1	Member Block Shear
		Horizontal	A325X	0.625	2	9.64	11.62	0.829 ✔	1	Member Block Shear

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	140 - 125	HSS5x0.25	15.016	7.508	53.4 K=1.00	3.489	-8.15	127.48	0.064 [1] ✔
T2	125 - 100	HSS5x0.25	25.027	8.342	59.3 K=1.00	3.489	-49.42	121.40	0.407 [1] ✔
T3	100 - 75	HSS5x.375	25.027	8.342	60.7 K=1.00	5.099	-106.17	175.27	0.606 [1] ✔
T4	75 - 50	HSS5x.375	25.027	8.342	60.7 K=1.00	5.099	-169.02	175.27	0.964 [1] ✔
T5	50 - 25	HSS7x0.25 (150deg) on HSS6.875x0.375	25.027	12.513	64.9 K=1.00	10.180	-224.13	336.55	0.666 [1] ✔
T6	25 - 0	HSS7x0.25 (150deg) on HSS6.875x0.5	25.027	12.513	65.9 K=1.00	12.538	-293.28	410.59	0.714 [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	140 - 125	2L2 1/2x2x3/16x3/8	9.926	9.337	152.9 K=1.00	1.620	-10.80	18.91	0.571 [1] ✔
T2	125 - 100	2L3x2 1/2x1/4x3/8	11.213	10.631	141.3 K=1.00	2.630	-16.35	36.14	0.452 [1] ✔
T3	100 - 75	2L3x2 1/2x1/4x3/8	11.905	11.343	150.5 K=1.00	2.630	-19.44	32.03	0.607 [1] ✔
T4	75 - 50	2L3x2 1/2x1/4x3/8	12.639	12.091	160.2 K=1.00	2.630	-21.12	28.41	0.744 [1] ✔
T5	50 - 25	2L3 1/2x3x1/4x3/8	16.327	15.525	174.2 K=1.00	3.130	-28.12	28.44	0.989 [1] ✔
T6	25 - 0	2L4x3x5/16x3/8	16.988	16.209	182.8 K=1.00	4.180	-29.50	34.73	0.849 [1] ✔

[1] P_u / ϕP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	140 - 125	L3x3x1/4	12.400	5.794	118.7 K=1.01	1.440	-7.61	28.86	0.264 [1] ✔
T2	125 - 100	L3x3x1/4	14.333	6.760	133.0	1.440	-10.75	23.29	0.462 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
					K=0.97				✔
T3	100 - 75	L3x4x1/4	16.333	7.760	137.6 K=0.96	1.690	-13.71	25.55	0.537 [1] ✔
T4	75 - 50	2L3x2 1/2x1/4x3/8 2L 'a' > 44.052 in - 106	18.333	8.760	136.3 K=1.00	2.630	-15.93	38.71	0.412 [1] ✔
T5	50 - 25	L4x4x1/4	20.000	9.500	137.9 K=0.96	1.940	-18.35	29.21	0.628 [1] ✔
T6	25 - 0	L4x4x1/4	22.000	10.500	149.4 K=0.94	1.940	-20.07	24.89	0.806 [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	140 - 125	L3x3x1/4	11.800	5.692	117.7 K=1.02	1.440	-2.14	29.26	0.073 [1] ✔

[1] P_u / ϕP_n controls

Inner Bracing Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	125 - 100	L2 1/2x2 1/2x3/16	7.167	7.167	173.7 K=1.00	0.902	-0.01	8.55	0.002 [1] ✔
T3	100 - 75	L2 1/2x2 1/2x3/16	8.167	8.167	198.0 K=1.00	0.902	-0.02	6.59	0.003 [1] ✔
T4	75 - 50	L2 1/2x2 1/2x3/16	9.167	9.167	222.2 K=1.00	0.902	-0.02	5.23	0.004 [1] ✔
T5	50 - 25	L2 1/2x2 1/2x3/16	10.000	10.000	242.4 K=1.00	0.902	-0.03	4.39	0.006 [1] ✔
T6	25 - 0	L2 1/2x2 1/2x3/16 KL/R > 250 (C) - 178	11.000	11.000	266.7 K=1.00	0.902	-0.03	3.63	0.007 [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 $P_u / \phi P_n$
T1	140 - 125	HSS5x0.25	15.016	7.508	53.4	3.489	3.26	157.02	0.021 [1] ✔
T2	125 - 100	HSS5x0.25	25.027	8.342	59.3	3.489	41.90	157.02	0.267 [1] ✔
T3	100 - 75	HSS5x.375	25.027	8.342	60.7	5.099	92.43	229.47	0.403 [1] ✔
T4	75 - 50	HSS5x.375	25.027	8.342	60.7	5.099	149.66	229.47	0.652 [1] ✔
T5	50 - 25	HSS7x0.25 (150deg) on HSS6.875x0.375	25.027	12.513	64.9	10.180	198.30	458.10	0.433 [1] ✔
T6	25 - 0	HSS7x0.25 (150deg) on HSS6.875x0.5	25.027	12.513	65.9	12.538	257.72	564.21	0.457 [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 $P_u / \phi P_n$
T1	140 - 125	2L2 1/2x2x3/16x3/8	9.926	9.337	145.4	0.969	10.65	42.15	0.253 [1] ✔
T2	125 - 100	2L3x2 1/2x1/4x3/8	10.993	10.411	135.6	1.644	16.12	71.53	0.225 [1] ✔
T3	100 - 75	2L3x2 1/2x1/4x3/8	11.905	11.343	147.5	1.644	19.10	71.53	0.267 [1] ✔
T4	75 - 50	2L3x2 1/2x1/4x3/8	12.639	12.091	157.0	1.644	20.66	71.53	0.289 [1] ✔
T5	50 - 25	2L3 1/2x3x1/4x3/8	16.327	15.525	171.4	1.926	27.63	83.76	0.330 [1] ✔
T6	25 - 0	2L4x3x5/16x3/8	16.988	16.209	156.3	2.608	28.87	121.26	0.238 [1] ✔

[1] P_u / ϕP_n controls

Horizontal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $P_u / \phi P_n$
T1	140 - 125	L3x3x1/4	12.400	5.794	116.0	0.939	7.51	40.86	0.184 [1] ✔
T2	125 - 100	L3x3x1/4	14.333	6.760	89.8	0.939	10.87	40.86	0.266 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T3	100 - 75	L3x4x1/4	16.333	7.760	106.5	1.127	13.78	49.02	0.281 [1] ✔
T4	75 - 50	2L3x2 1/2x1/4x3/8	18.333	8.760	113.8	1.691	15.57	73.57	0.212 [1] ✔
T5	50 - 25	2L 'a' > 44.052 in - 106 L4x4x1/4	20.000	9.500	93.1	1.314	17.38	57.18	0.304 [1] ✔
T6	25 - 0	L4x4x1/4	22.000	10.500	102.7	1.314	19.28	57.18	0.337 [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	140 - 125	L3x3x1/4	11.800	5.692	110.2	1.440	2.09	46.66	0.045 [1] ✔

[1] P_u / ϕP_n controls

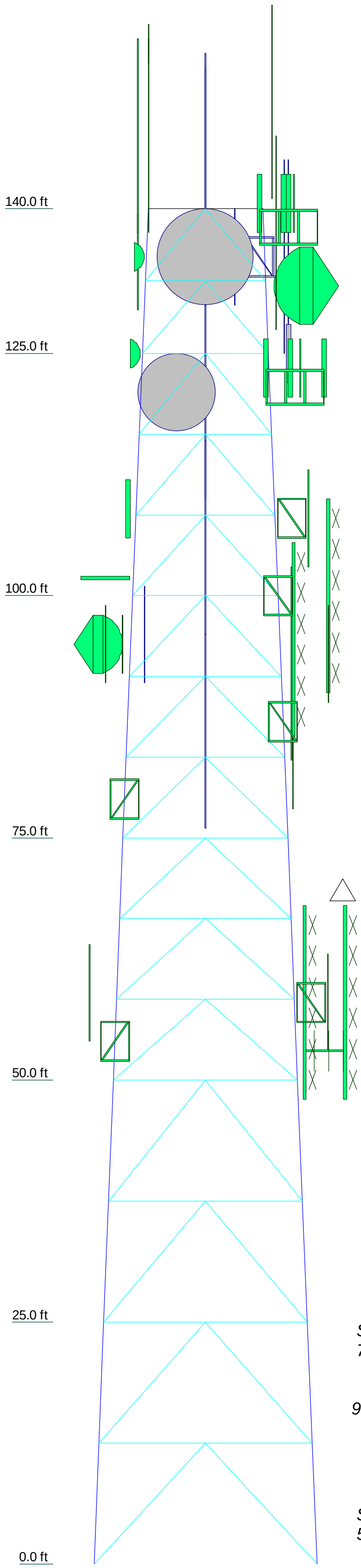
Inner Bracing Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	125 - 100	L2 1/2x2 1/2x3/16	6.833	6.833	105.4	0.902	0.01	29.22	0.000 [1] ✔
T3	100 - 75	L2 1/2x2 1/2x3/16	7.833	7.833	120.8	0.902	0.01	29.22	0.000 [1] ✔
T4	75 - 50	L2 1/2x2 1/2x3/16	8.500	8.500	131.1	0.902	0.01	29.22	0.000 [1] ✔
T5	50 - 25	L2 1/2x2 1/2x3/16	9.500	9.500	146.5	0.902	0.01	29.22	0.000 [1] ✔
T6	25 - 0	L2 1/2x2 1/2x3/16	10.500	10.500	162.0	0.902	0.01	29.22	0.000 [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	140 - 125	Leg	HSS5x0.25	3	-2.68	127.48	7.3	Pass
T2	125 - 100	Leg	HSS5x0.25	23	-49.42	121.40	40.7	Pass
T3	100 - 75	Leg	HSS5x.375	62	-106.17	175.27	60.6	Pass
T4	75 - 50	Leg	HSS5x.375	101	-169.02	175.27	96.4	Pass
T5	50 - 25	Leg	HSS7x0.25 (150deg) on HSS6.875x0.375	139	-224.13	336.55	66.6	Pass
T6	25 - 0	Leg	HSS7x0.25 (150deg) on HSS6.875x0.5	166	-293.28	410.59	71.4	Pass
T1	140 - 125	Diagonal	2L2 1/2x2x3/16x3/8	12	-10.80	18.91	57.1 59.4 (b)	Pass
T2	125 - 100	Diagonal	2L3x2 1/2x1/4x3/8	30	-16.35	36.14	45.2 63.9 (b)	Pass
T3	100 - 75	Diagonal	2L3x2 1/2x1/4x3/8	69	-19.44	32.03	60.7 75.7 (b)	Pass
T4	75 - 50	Diagonal	2L3x2 1/2x1/4x3/8	108	-21.12	28.41	74.4 81.9 (b)	Pass
T5	50 - 25	Diagonal	2L3 1/2x3x1/4x3/8	147	-28.12	28.44	98.9	Pass
T6	25 - 0	Diagonal	2L4x3x5/16x3/8	174	-29.50	34.73	84.9	Pass
T1	140 - 125	Horizontal	L3x3x1/4	10	-7.61	28.86	26.4 36.6 (b)	Pass
T2	125 - 100	Horizontal	L3x3x1/4	28	-10.75	23.29	46.2 53.0 (b)	Pass
T3	100 - 75	Horizontal	L3x4x1/4	67	-13.71	25.55	53.7 67.1 (b)	Pass
T4	75 - 50	Horizontal	2L3x2 1/2x1/4x3/8	106	-15.93	38.71	41.2	Pass
T5	50 - 25	Horizontal	L4x4x1/4	145	-18.35	29.21	62.8 74.8 (b)	Pass
T6	25 - 0	Horizontal	L4x4x1/4	172	-20.07	24.89	80.6 82.9 (b)	Pass
T1	140 - 125	Top Girt	L3x3x1/4	5	-2.14	29.26	7.3	Pass
T2	125 - 100	Inner Bracing	L2 1/2x2 1/2x3/16	35	-0.01	8.55	0.4	Pass
T3	100 - 75	Inner Bracing	L2 1/2x2 1/2x3/16	75	-0.02	6.59	0.5	Pass
T4	75 - 50	Inner Bracing	L2 1/2x2 1/2x3/16	113	-0.02	5.23	0.5	Pass
T5	50 - 25	Inner Bracing	L2 1/2x2 1/2x3/16	151	-0.03	4.39	0.6	Pass
T6	25 - 0	Inner Bracing	L2 1/2x2 1/2x3/16	178	-0.03	3.63	0.7	Pass
							Summary	
						Leg (T4)	96.4	Pass
						Diagonal (T5)	98.9	Pass
						Horizontal (T6)	82.9	Pass
						Top Girt (T1)	7.3	Pass
						Inner Bracing (T6)	0.7	Pass
						Bolt Checks	84.9	Pass
						RATING =	**98.9**	**Pass**



Section	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Horizontals	Inner Bracing	Face Width (ft)	# Panels @ (ft)	Weight (K)
T1	HSS5x0.25	A500-50	2L2 1/2x2x3/16x3/8	A36	L3x3x1/4		N.A.	11.8	2 @ 7.5	1.5
T2			2L3x2 1/2x1/4x3/8		N.A.	L3x3x1/4		13	9 @ 8.33333	3.5
T3	HSS5x.375					L3x4x1/4		15		4.2
T4						2L3x2 1/2x1/4x3/8	L2 1/2x2 1/2x3/16	17		5.0
T5	A		2L3 1/2x3x1/4x3/8			L4x4x1/4		19	4 @ 12.5	5.9
T6	HSS7x0.25 (150deg) on HSS6.875x0.5		2L4x3x5/16x3/8	A500-50				21		7.5
								23		27.6

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
15'x2.5" Horizontal Pipe	140.5	TMA (CSP)	121
15'x2.5" Extension Pipe	140	Telewave ANT220F2 - Omni Antenna (Eversoure)	120.875
Lightning Rod 5/8"x4'	140	Sitepro1 USF-4U Mount Assembly (Ca = 1.4 assumed) (Eversoure)	117
10"x8"x4" Junction Box (CSP)	137.5	6' x2.5" - Sch 40 Antenna Pipe (Vertical) (CSP Reserved)	117
Sector Mount [SM 403-1] (CSP)	137.5	Telewave ANT220F2 - Omni Antenna (Eversoure (inverted))	113.125
TMA (CSP)	137.5	6'x2" Horizontal Pipe (Eversoure)	109
AP14-850/105 w/Mount Pipe (CSP)	137.5	CL6-450B (Eversoure - Proposed)	109
AP14-850/105 w/Mount Pipe (CSP)	137.5	(2) 4'x2" Horizontal Mount Pipe (CSP)	108
8'x2" Mount Pipe (CSP)	137.5	12'x2" Horizontal Pipe (CSP)	108
36"x 6"x3" panel antenna w/ Mount Pipe (CSP)	137.5	10'x2" Horizontal Pipe	100
2'x2"x2" Vertical Tube (CSP)	137.5	3' Yagi (CSP)	100
15' x 4" Mount Pipe (CSP)	137.5	(2) 3'x3"x3" Horizontal Angle (CSP)	100
3" Dia 20' Omni (CSP)	137.5	2" Dia 10' Omni (CSP)	100
15' x 4" Mount Pipe (CSP)	137	Side Arm Mount [SO 601-1] (CSP)	100
AP14-850/105 w/Mount Pipe (CSP)	135	Side Arm Mount [SO 601-1] (CSP)	96
10'x4" Mount Pipe (CSP)	135	(2) 3'x3"x3" Horizontal Angle (CSP)	96
20'x2.5" Mount Pipe (CSP)	135	10'x4" Mount Pipe (CSP)	96
14'x3" Mount Pipe (CSP)	135	2" Dia 20' Omni (CSP)	96
Side Arm Mount [SO 601-1] (CSP)	135	20' Multi Array Dipole (CSP)	96
(2) 3'x3"x3" Horizontal Angle (CSP)	135	MD-S6 (for 6' MW) : Ice Shield (CSP)	95
10' dish (E)	135	ANT450F6 (CSP Reserved)	95
SC3-W100AD (CSP - Existing @ 135')	135	8'x4" Mount Pipe (CSP)	95
12'x3" Mount Pipe (CSP)	134.5	PA6-65 (Diversity CSP)	95
20' Multi Array Dipole (CSP)	134.5	15' x 4" Mount Pipe (CSP)	95
Side Arm Mount [SO 601-1] (CSP)	133	10'x2" Horizontal Pipe	92
(2) 3'x3"x3" Horizontal Angle (CSP)	133	2" Dia 20' Omni (CSP)	87
2" Dia 20' Omni (CSP)	133	Side Arm Mount [SO 601-1] (CSP)	87
2" Dia 20' Omni (CSP)	133	12'x2" Horizontal Pipe (CSP)	83
10'x2" Horizontal Pipe	132.5	Single Bay Dipole (CSP)	83
PA8-65 (E)	132	Side Arm Mount [SO 601-1] (CSP)	79
(2) 10'x2" Horizontal Pipe	130	(2) 4'x2" Horizontal Mount Pipe (CSP)	58
SC3-W100AD (CSP - Existing @ 125')	125	12'x2" Horizontal Pipe (CSP)	58
Sector Mount [SM 403-1] (CSP)	121	Single Dipole Antenna (CSP)	58
Pipe Mount [PM 602-1] (CSP)	121	Side Arm Mount [SO 601-1] (CSP)	54
8'x2"x6" Panel Antenna w/ Mount Pipe (CSP)	121	7' Whip (CSP)	54
8'x2"x6" Panel Antenna w/ Mount Pipe (CSP)	121	3' Yagi (CSP)	53
8'x2" Mount Pipe (CSP)	121	Single Bay Dipole Antenna (CSP)	52
PA8-65 (E)	121	6'x2" Mount Pipe (CSP)	52
8'x2"x6" Panel Antenna w/ Mount Pipe (CSP)	121		

SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	HSS7x0.25 (150deg) on HSS6.875x0.375		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A500-50	50 ksi	62 ksi	A36	36 ksi	58 ksi

SHEAR: 43 K

TOWER DESIGN NOTES

1. Tower is located in Windham County, Connecticut.
2. Tower designed for a 90 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 90 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 90 mph wind.

58 K

SHEAR 77 K — *MOMENT 6268 kip-ft*

TORQUE 231 kip-ft
90 mph WIND - 0.500 in ICE

AXIAL 39 K

SHEAR 57 K — *MOMENT 4682 kip-ft*

TORQUE 161 kip-ft
REACTIONS - 90 mph WIND

Centek Engineering Inc.
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job: 21082.10			
Project: 140-ft Lattice Tower #49 Sterling			
Client: Eversource	Drawn by: TJL	App'd:	
Code: TIA/EIA-222-F	Date: 08/26/21	Scale: NTS	
Path:		Dwg No. E-1	

Load Combinations

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

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	140 - 125	5.799	31	0.313	0.235
T2	125 - 100	4.785	31	0.311	0.215
T3	100 - 75	3.156	31	0.276	0.171
T4	75 - 50	1.765	31	0.217	0.126
T5	50 - 25	0.806	31	0.121	0.084
T6	25 - 0	0.238	31	0.060	0.037

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* *°*	*Twist* *°*	*Radius of Curvature* *ft*
140.500	15'x2.5" Horizontal Pipe	31	5.799	0.313	0.235	416517
140.000	15'x2.5" Extension Pipe	31	5.799	0.313	0.235	416517
137.500	3" Dia 20' Omni	31	5.630	0.313	0.231	416517
137.000	15' x 4" Mount Pipe	31	5.596	0.313	0.231	416517
135.000	10' dish	31	5.460	0.314	0.228	416517
134.500	12'x3" Mount Pipe	31	5.426	0.314	0.228	378651
133.000	Side Arm Mount [SO 601-1]	31	5.325	0.314	0.226	297512
132.500	10'x2" Horizontal Pipe	31	5.291	0.314	0.225	277677
132.000	PA8-65	31	5.257	0.314	0.224	260322
130.000	(2) 10'x2" Horizontal Pipe	31	5.122	0.313	0.222	208258
125.000	SC3-W100AD	31	4.785	0.311	0.215	132876
121.000	PA8-65	31	4.516	0.308	0.208	93657
120.875	Telewave ANT220F2 - Omni Antenna	31	4.508	0.308	0.208	92722
117.000	Sitepro1 USF-4U Mount Assembly (Ca = 1.4 assumed)	31	4.250	0.304	0.202	70688
113.125	Telewave ANT220F2 - Omni Antenna	31	3.995	0.299	0.195	57109
109.000	6'x2" Horizontal Pipe	31	3.726	0.292	0.188	47414
108.000	(2) 4'x2" Horizontal Mount Pipe	31	3.662	0.291	0.186	45540
100.000	Side Arm Mount [SO 601-1]	31	3.156	0.276	0.171	33737
96.000	Side Arm Mount [SO 601-1]	31	2.912	0.269	0.164	28395
95.000	PA6-65	31	2.851	0.267	0.162	27223
92.000	10'x2" Horizontal Pipe	31	2.674	0.261	0.157	24215
87.000	Side Arm Mount [SO 601-1]	31	2.388	0.250	0.147	20450
83.000	12'x2" Horizontal Pipe	31	2.169	0.240	0.140	18188
79.000	Side Arm Mount [SO 601-1]	31	1.961	0.229	0.133	16380
58.000	(2) 4'x2" Horizontal Mount Pipe	31	1.067	0.150	0.097	18500
54.000	Side Arm Mount [SO 601-1]	31	0.932	0.135	0.091	19616
53.000	3' Yagi	31	0.900	0.131	0.089	19898
52.000	6'x2" Mount Pipe	31	0.868	0.128	0.087	20156

Maximum Tower Deflections - Design Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* *°*	*Twist* *°*
T1	140 - 125	7.612	19	0.409	0.311
T2	125 - 100	6.291	19	0.406	0.287
T3	100 - 75	4.174	19	0.361	0.232
T4	75 - 50	2.353	19	0.284	0.177
T5	50 - 25	1.084	19	0.160	0.119
T6	25 - 0	0.323	19	0.080	0.054

Critical Deflections and Radius of Curvature - Design Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* *°*	*Twist* *°*	*Radius of Curvature* *ft*

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* *°*	*Twist* *°*	*Radius of Curvature* *ft*
140.500	15'x2.5" Horizontal Pipe	19	7.612	0.409	0.311	282524
140.000	15'x2.5" Extension Pipe	19	7.612	0.409	0.311	282524
137.500	3" Dia 20' Omni	19	7.391	0.409	0.307	282524
137.000	15' x 4" Mount Pipe	19	7.347	0.409	0.306	282524
135.000	10' dish	19	7.171	0.409	0.303	282524
134.500	12'x3" Mount Pipe	19	7.126	0.409	0.302	256840
133.000	Side Arm Mount [SO 601-1]	19	6.994	0.409	0.300	201803
132.500	10'x2" Horizontal Pipe	19	6.950	0.409	0.299	188349
132.000	PA8-65	19	6.906	0.409	0.298	176577
130.000	(2) 10'x2" Horizontal Pipe	19	6.730	0.409	0.295	141262
125.000	SC3-W100AD	19	6.291	0.406	0.287	92318
121.000	PA8-65	19	5.943	0.402	0.279	69076
120.875	Telewave ANT220F2 - Omni Antenna	19	5.932	0.402	0.279	68508
117.000	Sitepro1 USF-4U Mount Assembly (Ca = 1.4 assumed)	19	5.597	0.396	0.271	54550
113.125	Telewave ANT220F2 - Omni Antenna	19	5.265	0.390	0.262	45315
109.000	6'x2" Horizontal Pipe	19	4.916	0.381	0.253	38378
108.000	(2) 4'x2" Horizontal Mount Pipe	19	4.832	0.379	0.251	36960
100.000	Side Arm Mount [SO 601-1]	19	4.174	0.361	0.232	27833
96.000	Side Arm Mount [SO 601-1]	19	3.855	0.351	0.223	23121
95.000	PA6-65	19	3.777	0.349	0.221	22079
92.000	10'x2" Horizontal Pipe	19	3.544	0.341	0.214	19442
87.000	Side Arm Mount [SO 601-1]	19	3.170	0.327	0.203	16215
83.000	12'x2" Horizontal Pipe	19	2.884	0.315	0.194	14314
79.000	Side Arm Mount [SO 601-1]	19	2.611	0.301	0.186	12815
58.000	(2) 4'x2" Horizontal Mount Pipe	19	1.431	0.198	0.138	14339
54.000	Side Arm Mount [SO 601-1]	19	1.251	0.178	0.129	15183
53.000	3' Yagi	19	1.208	0.174	0.127	15395
52.000	6'x2" Mount Pipe	19	1.166	0.169	0.124	15586

Anchor Bolt Analysis:

Input Data:

Tower Reactions:

Tension Force =	$Tension := 287 \cdot kips$	(Input From tnxTower)
Compression Force =	$Compression := 327 \cdot kips$	(Input From tnxTower)
Shear Force =	$Shear := 42 \cdot kips$	(Input From tnxTower)

Anchor Bolt Data:

ASTM A36	Assumed	
Number of Anchor Bolts =	$N := 6$	(User Input)
Bolt Ultimate Strength =	$F_u := 58 \cdot ksi$	(User Input)
Bolt Yield Strength =	$F_y := 36 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 1.75 \cdot in$	(User Input)
Threads per Inch =	$n := 5$	(User Input)
Length from Top of Pier to Bottom of Leveling Nut =	$L_{ar} := 0 \cdot in$	(User Input)

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 2.405 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n}\right)^2 = 1.899 \cdot in^2$

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 1.555 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.389 \cdot in$

Elastic Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^3}{32} = 0.369 \cdot in^3$

Plastic Section Modulus of Bolt = $Z_x := \frac{D_n^3}{6} = 0.627 \cdot in^3$

Anchor Bolt Design Strength:

Resistance Factor for Flexure = $\phi_f := 0.9$

Resistance Factor for Compression = $\phi_c := 0.9$

Resistance Factor for Tension = $\phi_t := 0.75$

Resistance Factor for Shear = $\phi_v := 0.75$

Design Tensile Strength = $\Phi R_{nt} := \phi_t \cdot F_u \cdot A_n = 82.6 \cdot k$

Design Compression Strength = $\Phi R_{nc} := \phi_c \cdot F_y \cdot A_g = 77.9 \cdot k$

Design Shear Strength (Tension) = $\Phi R_{nv} := \phi_v \cdot 0.5F_u \cdot A_g = 52.3 \cdot k$

Design Shear Strength (Compression) = $\Phi R_{nvc} := \phi_c \cdot 0.6F_y \cdot A_g \cdot 0.75 = 35.1 \cdot k$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $P_{ut} := \frac{Tension}{N} = 47.8 \cdot kips$

Maximum Compressive Force = $P_{uc} := \frac{Compression}{N} = 54.5 \cdot kips$

Maximum Shear Force = $V_u := \frac{Shear}{N} = 7 \cdot kips$

Condition1 = $Condition1 := if\left[\left[\left(\frac{P_{ut}}{\Phi R_{nt}}\right)^2 + \left(\frac{V_u}{\Phi R_{nv}}\right)^2\right] \le 1.00, \text{"OK"}, \text{"Overstressed"}\right]$

Condition1 = "OK"

Condition2 = $Condition2 := if\left[\left[\left(\frac{P_{uc}}{\Phi R_{nc}}\right) + \left(\frac{V_u}{\Phi R_{nvc}}\right)^2\right] \le 1.00, \text{"OK"}, \text{"Overstressed"}\right]$

Condition2 = "OK"

Bolt % of Capacity = $\max\left[\left(\frac{P_{ut}}{\Phi R_{nt}}\right)^2 + \left(\frac{V_u}{\Phi R_{nv}}\right)^2, \left(\frac{P_{uc}}{\Phi R_{nc}}\right) + \left(\frac{V_u}{\Phi R_{nvc}}\right)^2\right] = 73.9 \cdot \%$

CENTEK engineering Centered on Solutions™ www.centekeng.com 63-2 North Branford Road P: (203) 488-0580 Branford, CT 06405 F: (203) 488-8587	Subject:	FOUNDATION ANALYSIS
	Location:	Sterling, CT
	Rev. 0: 8/26/21	Prepared by: T.J.L. Checked by: C.F.C. Job No. 21082.10

Pier and Mat Foundation Analysis:

Input Data:

Tower Data

Overturning Moment =	$OM := 6217 \cdot ft \cdot kips$	(User Input from tnxTower)
Shear Force =	$S_t := 76 \cdot kip$	(User Input from tnxTower)
Axial Force =	$WT_t := 47 \cdot kip$	(User Input from tnxTower)
Max Compression Force =	$C_t := 327 \cdot kip$	(User Input from tnxTower)
Max Uplift Force =	$U_t := 287 \cdot kip$	(User Input from tnxTower)
Tower Height =	$H_t := 140 \cdot ft$	(User Input)
Tower Width =	$W_t := 23 \cdot ft$	(User Input)
Tower Position on Foundation (1=offset, 2=centered) =	$Pos_t := 2$	(User Input)

Footing Data:

Overall Depth of Footing =	$D_f := 6 \cdot ft$	(User Input)
Length of Pier =	$L_p := 4.5 \cdot ft$	(User Input)
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)
Diameter of Pier =	$d_p := 4.0 \cdot ft$	(User Input)
Thickness of Footing =	$T_f := 2.0 \cdot ft$	(User Input)
Width of Footing =	$W_f := 36 \cdot ft$	(User Input)

Material Properties:

Concrete Compressive Strength =	$f_c := 3000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 34 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 8000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 120 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 1 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 9$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.128 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 10$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.375 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 9$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.128 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 37$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 9$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.128 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 37$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area = $$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.999 \cdot in^2$$

Pad Top Reinforcement Bar Area = $$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.999 \cdot in^2$$

Pad Bottom Reinforcement Bar Area = $$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.999 \cdot in^2$$

Coefficient of Lateral Soil Pressure = $$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3.537$$

Load Factor = $LF := 1$

Stability of Footing:

Adjusted Concrete Unit Weight = $\gamma_c := \text{if}(\text{Bouyancy} = 1, \gamma_{conc} - 62.4\text{pcf}, \gamma_{conc}) = 150\cdot\text{pcf}$

Adjusted Soil Unit Weight = $\gamma_s := \text{if}(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}) = 120\cdot\text{pcf}$

Passive Pressure = $P_{pn} := K_p\cdot\gamma_s\cdot n + c\cdot 2\cdot\sqrt{K_p} = 0.424\cdot\text{ksf}$

$P_{pt} := K_p\cdot\gamma_s\cdot(D_f - T_f) + c\cdot 2\cdot\sqrt{K_p} = 1.698\cdot\text{ksf}$

$P_{top} := \text{if}\left[n < (D_f - T_f), P_{pt}, P_{pn}\right] = 1.698\cdot\text{ksf}$

$P_{bot} := K_p\cdot\gamma_s\cdot D_f + c\cdot 2\cdot\sqrt{K_p} = 2.547\cdot\text{ksf}$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 2.122\cdot\text{ksf}$

$T_p := \text{if}\left[n < (D_f - T_f), T_f, (D_f - n)\right] = 2\cdot\text{ft}$

$A_p := W_f\cdot T_p = 72\cdot\text{ft}^2$

Ultimate Shear = $S_u := P_{ave}\cdot A_p = 152.804\cdot\text{kip}$

Weight of Concrete = $WT_c := \left[\left(W_f^2\cdot T_f\right) + (4)\cdot\left(\frac{d_p^2\cdot\pi}{4}\cdot L_p\right)\right]\cdot\gamma_c = 422.729\cdot\text{kip}$

Weight of Soil Above Footing = $WT_{s1} := \left[\left[W_f^2 - (4)\cdot\left(\frac{d_p^2\cdot\pi}{4}\right)\right]\cdot\left(\left|L_p - L_{pag} - n\right|\right)\right]\cdot\gamma_s = 373.72\cdot\text{kip}$

Weight of Soil Wedge at Back Face = $WT_{s2} := \left[\frac{(D_f - n)^2\cdot\tan(\Phi_s)}{2}\cdot W_f\right]\cdot\gamma_s = 36.423\cdot\text{kip}$

Tower Offset = $X_{t1} := \left[\frac{W_f}{2} - \frac{(W_t\cdot\cos(30\cdot\text{deg}))}{2}\right]$ $X_{t2} := \frac{W_f}{2} - \frac{(W_t\cdot\cos(30\cdot\text{deg}))}{3}$

$X_t := \text{if}(\text{Pos}_t = 1, X_{t1}, X_{t2}) = 11.36$

$X_{off1} := \frac{W_f}{2} - \left[\frac{(W_t\cdot\cos(30\cdot\text{deg}))}{3} + X_t\right] = 0$ $X_{off2} := 0$

$X_{off} := \text{if}(\text{Pos}_t = 1, X_{off1}, X_{off2})$ $X_{off} = 0\cdot\text{ft}$

Total Weight = $WT_{tot} := 0.9WT_c + 0.75WT_{s1} + WT_t = 707.7\cdot\text{kip}$

Resisting Moment = $M_r := (WT_{tot})\cdot\frac{W_f}{2} + 0.9WT_t\cdot\left(\frac{W_f}{2} - X_{off}\right) + 0.75\left(S_u\cdot\frac{T_p}{3}\right) + 0.75WT_{s2}\cdot\left[W_f + \frac{(D_f - n)\cdot\tan(\Phi_s)}{3}\right] = 14591\cdot\text{kip}\cdot\text{ft}$

Overturning Moment = $M_{ot} := OM + S_t\cdot(L_p + T_f) = 6711\cdot\text{kip}\cdot\text{ft}$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.17$

Factor of Safety Required = $FS_{req} := 1$ OverTurning_Moment_Check := if$(FS \geq FS_{req}$, "Okay", "No Good")

OverTurning_Moment_Check = "Okay"

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS_{req}} = 471.29 \cdot kips$

Shear_Check := if($S_p > S_t$, "Okay", "No Good")

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Total Load = $Load_{tot} := WT_c + WT_{s1} + WT_t = 843 \cdot kip$

Area of the Mat = $A_{mat} := W_f^{\,2} = 1.296 \times 10^3$

Section Modulus of Mat = $S := \frac{W_f^{\,3}}{6} = 7776 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{Load_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.514 \cdot ksf$

Max_Pressure_Check := if($P_{max} < 0.75q_s$, "Okay", "No Good")

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{Load_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.212 \cdot ksf$

Min_Pressure_Check := if[$(P_{min} \geq 0) \cdot (P_{min} < 0.75q_s)$, "Okay", "No Good"]

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 10.525$

Distance to Kern = $X_k := \frac{W_f}{6} = 6$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity = $e := \frac{M_{ot}}{Load_{tot}} = 7.957$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot Load_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.555 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.555 \cdot ksf$

Pressure_Check := if($q_{adj} < 0.75q_s$, "Okay", "No Good")

Pressure_Check = "Okay"

Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^{2}}{4} = 2.999 \times 10^{3} \cdot kips$ (ACI-2008 10.14)

Bearing_Check := if(P_b > LF·C_t, "Okay", "No Good")

Bearing_Check = "Okay"

Shear Strength of Concrete:

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 19.872 \cdot in$

$FL := LF \cdot \frac{C_t}{W_f^{2}} = 0.252 \cdot ksf$

$V_{req} := FL \cdot (X_t - .5 \cdot d_p - d) \cdot W_f = 69.982 \cdot kips$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d = 799 \cdot kip$ (ACI-2008 11.2.1.1)

Beam_Shear_Check := if(V_req < V_Avail, "Okay", "No Good")

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := (d_p + d) \cdot \pi = 17.8$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot (d_p + d)^{2}}{4} = 25.1$

Required Shear Strength = $V_{req} := FL \cdot (W_f^{2} - A_{bo}) = 321 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 789.1 \cdot kip$ (ACI-2008 11.11.2.1)

Punching_Shear_Check := if(V_req < V_Avail, "Okay", "No Good")

Punching_Shear_Check = "Okay"

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

Maximum Moment in Pad = $M_{max} := 1700 \cdot kip \cdot ft$ (User Input)

Design Moment = $M_n := \frac{LF \cdot M_{max}}{\phi_m} = 1.889 \times 10^3 \cdot kips \cdot ft$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \cdot psi \le f_c \le 4000 \cdot psi \\ 0.65 & \text{if } f_c > 8000 \cdot psi \\ \left[\left[0.85 - \left[\frac{\left(\frac{f_c}{psi} - 4000 \right)}{1000} \right] \cdot 0.5 \right] \right] & \text{otherwise} \end{cases} = 0.85$$

(ACI-2008 10.2.7.3)

$$b_{eff} := W_t \cdot \cos(30 \cdot deg) + d_p = 287.023 \cdot in$$

$$A_s := \frac{M_n}{(f_y \cdot d)} = 19.011 \cdot in^2$$

$$a := \frac{A_s \cdot f_y}{\beta \cdot f_c \cdot b_{eff}} = 1.558 \cdot in$$

$$A_s := \frac{M_n}{f_y \cdot \left(d - \frac{a}{2} \right)} = 19.786 \cdot in^2$$

$$\rho := \frac{A_s}{b_{eff} \cdot d} = 0.04163 \cdot in$$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \ge 60000 \cdot psi \\ .0020 & \text{otherwise} \end{cases} = 0.0018$$ (ACI -2008 7.12.2.1)

Check Bottom Bars:

$$As := \text{if}\left(\rho \ge \rho_{sh}, A_s, \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d\right) = 19.8 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 37 \cdot in^2$$

$$Pad\_Reinforcement\_Bot := \text{if}\left(As_{prov} > As, \text{"Okay"}, \text{"No Good"}\right)$$

$$Pad\_Reinforcement\_Bot = \text{"Okay"}$$

Check top Bars:

$$As := \text{if}\left(\rho \ge \rho_{sh}, A_s, \rho_{sh} \cdot \frac{b_{eff}}{2} \cdot d\right) = 19.8 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 37 \cdot in^2$$

$$Pad\_Reinforcement\_Top := \text{if}\left(As_{prov} > As, \text{"Okay"}, \text{"No Good"}\right)$$

$$Pad\_Reinforcement\_Top = \text{"Okay"}$$

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 10.67 \cdot in$$

Spacing or Cover Dimension =

$$c := \text{if}\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 3 \cdot in$$

Transverse Reinforcement Index =

$$k_{tr} := 0$$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 34.8 \cdot in$$

Minimum Development Length =

$$L_{dbmin} := 12 \cdot in$$ (ACI-2008 12.2.1)

$$L_{dbtCheck} := \text{if}\left(L_{dbt} \ge L_{dbmin}, \text{"Use L.dbt"}, \text{"Use L.dbmin"}\right) = \text{"Use L.dbt"}$$

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{W_t}{2} - Cvr_{pad} = 75 \cdot in$$

$$Lpad\_Check := \text{if}\left(L_{Pad} > L_{dbt}, \text{"Okay"}, \text{"No Good"}\right)$$

$$Lpad\_Check = \text{"Okay"}$$

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{\pi \cdot d_p^{\,2}}{4} = 1809.56 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.5 \cdot A_p = 9.05 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 9.99 \cdot in^2$

Steel_Area_Check := if$\left(A_{sprov} > A_{smin}, \text{"Okay"}, \text{"No Good"}\right)$

Steel_Area_Check = "Okay"

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 13.952 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 42 \cdot in$

Maximum Moment in Pier = $M_p := S_t \cdot \left(L_p\right) \cdot LF = 4104 \cdot in \cdot kips$

Pier Check evaluated from outside program and results are listed below;

$$\begin{pmatrix} D & N & n & P_u & M_{xu} \end{pmatrix} := \begin{pmatrix} d_p \cdot 12 & NB_{pier} & BS_{pier} & \frac{C_t \cdot 1.333}{kips} & \frac{M_p}{in \cdot kips} \end{pmatrix}$$

$$\begin{pmatrix} D & N & n & P_u & M_{xu} \end{pmatrix} = \begin{pmatrix} 48 & 10 & 9 & 435.891 & 4.104 \times 10^3 \end{pmatrix}$$

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} := \begin{pmatrix} 0 & 0 & 0 & 0 \end{pmatrix}$$

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} := \phi P'_n\left(D, N, n, P_u, M_{xu}\right)^T$$

$$\begin{pmatrix} \phi P_n & \phi M_{xn} & f_{sp} & \rho \end{pmatrix} = \begin{pmatrix} 2.075 \times 10^3 & 1.954 \times 10^4 & -45.187 & 5.526 \times 10^{-3} \end{pmatrix}$$

Axial_Load_Check := if$\left(\phi P_n \ge P_u, \text{"Okay"}, \text{"No Good"}\right)$

Axial_Load_Check = "Okay"

Bending_Check := if$\left(\phi M_{xn} \ge M_{xu}, \text{"Okay"}, \text{"No Good"}\right)$

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$$L_{pier} := L_p - Cvr_{pier} = 51 \cdot in$$

$$L_{pad} := T_f - Cvr_{pad} = 21 \cdot in$$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension = $c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 3 \cdot in$

Transverse Reinforcement = $k_{tr} := 0$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 34.85 \cdot in$$

Minimum Development Length = $L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 17.299 \cdot in$ (ACI 12.2.1)

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$$L_{db} := max\left(L_{dbt}, L_{dbmin}\right) = 34.846 \cdot in$$

$L_{tension\_Check} := if\left(L_{pier} + L_{pad} > L_{dbt}, \text{"Okay"}, \text{"No Good"}\right)$

$L_{tension\_Check} = \text{"Okay"}$

Compression: (ACI-2008 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 24.713 \cdot in$$

$$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 20.304 \cdot in$$

$$L_{dbc} := if\left(L_{dbc1} \ge L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 24.713 \cdot in$$

$L_{compression\_Check} := if\left(L_{pier} + L_{pad} > L_{dbc}, \text{"Okay"}, \text{"No Good"}\right)$

$L_{compression\_Check} = \text{"Okay"}$

ATTACHMENT E – PROOF OF DELIVERY OF NOTICE

nart
dEx carbon-neutral
velope shipping

Align top of FedEx Express® shipping label here

ORIGIN ID:EFBA (203) 562-9885
SHIPPING
JOSEPH MERRITT CO.
60 HAMILTON STREET

NEW HAVEN, CT 065115920
UNITED STATES US

SHIP DATE: 11JAN22
ACTWGT: 1.00 LB MAN
CAD: 0517347/CAFE3509

BILL THIRD PARTY

TO HONORABLE LINCOLN A. COOPER
TOWN OF STERLING
1183 PLAINFIELD PIKE

ONECO CT 06373

REF: S0422311

FedEx
Express

E

WED - 12 JAN 4:30P
PRIORITY OVERNIGHT

TRK# 0201 6437 3911 1720

00 GONA

06373
CT-US BDL

Part # 156148-434 RIT2 01/14

Align bottom of peel-and-stick airbill or pouch here.

?ef: S0422311
Dep:

Date: 11Jan22
Wgt: 1.00 LBS

DV: 100.00

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

Svcs: PRIORITY OVERNIGHT
TRCK: 6437 3911 1730

ORIGIN ID:EFBA (203) 562-9885
SHIPPING
JOSEPH MERRITT CO.
?0 HAMILTON STREET

NEW HAVEN, CT 065115920
UNITED STATES US

SHIP DATE: 11JAN22
ACTWGT: 1.00 LB MAN
CAD: 0517347/CAFE3509

BILL THIRD PARTY

MELISSA GIL
TOWN OF STERLING
1183 PLAINFIELD PIKE

ONECO CT 06373

REF: S0422311

FedEx
Express

E

WED - 12 JAN 4:30P
PRIORITY OVERNIGHT

TRK# 0201 6437 3911 1730

00 GONA

06373
CT-US BDL

Part # 156148-434 RIT2 01/14

Ref:
Dep:

Date: 11Jan22
Wgt: 1.00 LBS

DV: 100.00

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

Svcs: PRIORITY OVERNIGHT
TRCK: 6437 3911 1741

ORIGIN ID:EFBA (203) 562-9885
SHIPPING
JOSEPH MERRITT CO.
60 HAMILTON STREET

NEW HAVEN, CT 065115920
UNITED STATES US

SHIP DATE: 11JAN22
ACTWGT: 1.00 LB MAN
CAD: 0517347/CAFE3509

BILL THIRD PARTY

TO BRIAN BENITO
DEPT OF ENERGY SERV & PUBLIC PRO.
1111 COUNTRY CLUB ROAD

MIDDLETOWN CT 06457

INV:
PO: REF:
DEPT:

57AC2/81FE/6E4D

FedEx
Express

E

J211020121101uv

TRK# 0201 6437 3911 1741

WED - 12 JAN 10:30A
PRIORITY OVERNIGHT

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06457
CT-US BDL

Part # 156148-434 RIT2 01/14

Ref: S0422311
D. p.

Date: 11Jan22
Wgt: 3.00 LBS

DV: 200.00

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

Svcs: PRIORITY OVERNIGHT
TRCK: 6437 3911 1752

ORIGIN ID:EFBA (203) 562-9885
SHIPPING
JOSEPH MERRITT CO.
.. HAMILTON STREET

NEW HAVEN, CT 065115920
UNITED STATES US

SHIP DATE: 11JAN22
ACTWGT: 3.00 LB MAN
CAD: 0517347/CAFE3509

BILL THIRD PARTY

TO

CONNECTICUT SITING COUNCIL
10 FRANKLIN SQUARE

NEW BRITAIN CT 06051

REF: S0422311

FedEx
Express

E

WED - 12 JAN 10:30A
PRIORITY OVERNIGHT

TRK# 0201 6437 3911 1752

00 BDLA

06051
CT-US BDL

Part # 156148-434 RIT2 01/14

ATTACHMENT F - 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-056

389 Ekonk Hill Road

Sterling, CT 06354

October 6, 2021

Table of Contents

List of Tables

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1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed Eversource installation on the tower at 389 Ekonk Hill Road in Sterling, CT. The proposal consists in part of a directional antenna for its 450 MHz communications system.

By way of background, this office prepared a compliance report dated 12/18/2020 regarding Eversource's 220 MHz equipment (proposed at the time), which has since been installed. That analysis considered % MPE (Maximum Permissible Exposure) measurements around the existing tower to determine FCC compliance of the facility in addition to the worst-case calculated % MPE values for the (proposed at the time) 220 MHz equipment.

This report considers the results of that previous report, along with the currently proposed 450 MHz installation. Based upon a comparison of a recent structural analysis and one prepared as part of the 220 MHz installation, it is understood that no additional equipment (other than the recently installed 220 MHz equipment) has been added to the tower since the time % MPE measurements were recorded.

Site Address	389 Ekonk Hill Road
Latitude	41° 39' 49.5" N
Longitude	71° 50' 56.3" W
Site Elevation AMSL	672'
Survey Engineer	Marc Salas
Survey Date/Time	6/25/2020; 12:00 PM – 1:00 PM

Table 1: Survey Information

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

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

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

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

3. Power Density Calculation Methods

The calculated power density 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 = $1.64 \times ERP$

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. Antenna Configuration for % MPE Calculations

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

Operator	Antenna Model	TX Freq. (MHz)	Ant Gain (dBd)	Power ERP (Watts)	Number of Channels	Vertical Beamwidth	Length (ft)	Antenna Centerline Height (ft)
Eversource (recently installed)	Telewave ANT220F2	217	2.5	124	4	38°	3.67	113.1
Eversource (proposed)	Scala CL6-450B	451.625	6.5	45	1	60°	2.17	109

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

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

[2] Transmit antenna height listed for the proposed installation is based on the proposed antenna referenced in the CENTEK Engineering Structural Analysis report dated August 26, 2021 (Rev. 0).

5. Measurement Procedure

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

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

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

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

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

Manufacturer	Narda Microwave			
Probe	EA 5091, Serial# 01116			
Calibration Date	May 2020			
Calibration Interval	24 Months			
Meter	NBM550, Serial# E-1069			
Calibration Date	May 2020			
Calibration Interval	24 Months			
Probe Specifications	**Frequency Range**	**Field Measured**	**Standard**	**Measurement Range**
	300 KHz-50 GHz	Electric Field	U.S. FCC 1997 Occupational/Controlled	0.2 – 600 % of Standard

Table 3: Instrumentation Information

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

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

6. Surveyed and Calculated % MPE Results

Measured and calculated results and a description of each survey location are detailed in the table below. Measurements were recorded on June 25, 2020 between 12:00 PM and 1:00 PM. The calculated % MPE contribution from the recently installed and proposed equipment was then added to the measured % MPE values in the "Composite % MPE" column. These calculated values incorporate the antenna pattern of the antenna model specified by Eversource to determine the "Off Beam Loss" factor shown in the power density formula from Section 3. All % MPE values are in reference to the FCC Uncontrolled/General Population exposure limit.

Table 4 below lists 11 measurements recorded in the vicinity of the tower. The highest spatially averaged measurement was 9.75% (Average Uncontrolled / General Population MPE) and was recorded at Location 1 by the compound access gate. The highest composite (measured + calculated) % MPE value is calculated to be 9.85% (Average Uncontrolled / General Population) and is calculated to occur at the same location (location #1).

Meas. Location	Location Description	Latitude	Longitude	Dist. From Site (feet)	Measured % MPE (Uncontrolled / General)	Calculated % MPE (Eversource 220 MHz)	Calculated % MPE (Eversource Proposed 450 MHz)	Composite % MPE (Uncontrolled / General)
1	**Compound access gate**	**41.6638**	**-71.8489**	**32**	**9.75%**	**0.09%**	**0.01%**	**9.85%**
2	NW corner of fenced compound	41.6638	-71.8492	57	6.42%	0.08%	0.03%	6.53%
3	SW corner of fenced compound	41.6636	-71.8491	77	2.83%	0.05%	0.05%	2.93%
4	South middle of fenced compound	41.6636	-71.8489	60	< 1.00%	0.08%	0.03%	< 1.11%
5	SE corner of fenced compound	41.6636	-71.8487	82	2.60%	0.04%	0.05%	2.70%
6	Near NE corner of fenced compound	41.6639	-71.8488	81	4.02%	0.05%	0.05%	4.11%
7	Along access road	41.6641	-71.8481	272	< 1.00%	0.54%	0.05%	< 1.59%
8	Access road gate	41.6646	-71.8466	723	< 1.00%	0.15%	0.01%	< 1.16%
9	Near 419 Ekonk Hill Road mailbox	41.6624	-71.8463	880	3.34%	0.11%	0.01%	3.45%
10	Near 396 Ekonk Hill Road	41.6642	-71.8462	777	3.62%	0.13%	0.01%	3.76%
11	Southern Intersection of Still Road and Shelton Road	41.6660	-71.8469	1006	1.16%	0.09%	0.01%	1.25%

Table 4: Measured and Calculated % MPE Results [4] [5]

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

[5] Measured and calculated % MPE values listed are rounded to two decimal points and the composite % MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not identically match the total composite values reflected in the table.

Figures 2 and 3 below are aerial views[6] of the tower location and the surrounding area, along with the measurement locations listed in Table 4.

Figure 2: Measurement Points – Zoom In

Figure 3: All Measurement Points

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

7. Conclusion

A number of accessible areas around the tower at 389 Ekonk Hill Road in Sterling, CT were surveyed and found to be well within the mandated General Population/Uncontrolled limits for Maximum Permissible Exposure, as delineated in the Federal Communications Commission's Radio Frequency exposure rules published in 47 CFR 1.1307(b)(1)-(b)(3).

The highest spatially averaged % MPE measurement of all surveyed points based on the 1997 FCC standard for exposure to the general population is 9.75% MPE. This measurement was recorded at Location 1 by the compound access gate.

The highest composite (measured + calculated) power density is **9.85% of the FCC General Population MPE limit** with the recently installed 220 MHz and proposed 450 MHz Eversource equipment is calculated to also occur at Location 1 by the compound access gate.

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

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

8. 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 (signature) — October 6, 2021

Report Prepared By: Keith Vellante
Director of RF Services
C Squared Systems, LLC

Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure[7]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	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[8]

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

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

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

[7] 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

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

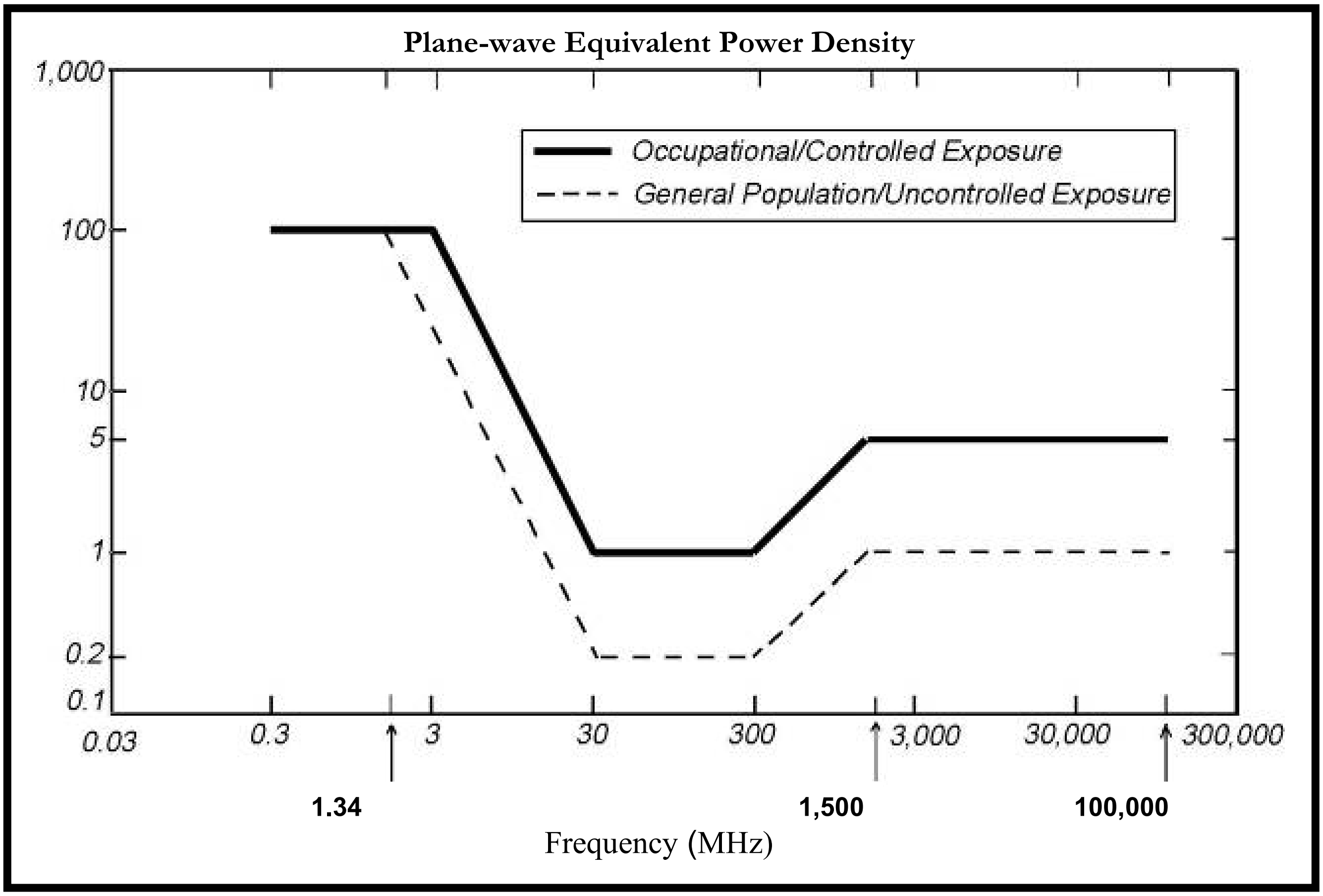
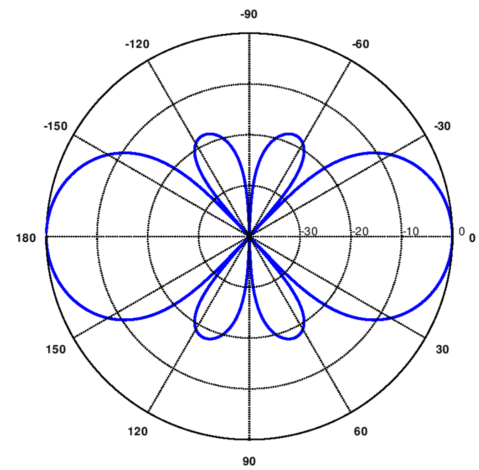


Figure 4: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Eversource Antenna Data Sheet and Electrical Patterns

217 MHz

Manufacturer:	Telewave
Model #:	ANT220F2
Frequency Band:	195 - 260 MHz
Gain:	2.5 dBd
Vertical Beamwidth:	38°
Horizontal Beamwidth:	360°
Polarization:	Vertical-Polarization
Length:	3.6’



451.625 MHz

Manufacturer:	Kathrein-Scala
Model #:	CL6-450B
Frequency Band:	400 - 512 MHz
Gain:	6.5 dBd
Vertical Beamwidth:	60°
Horizontal Beamwidth:	86°
Polarization:	Vertical-Polarization
Length:	2.17’