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

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

June 25, 2020

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

RE: **Notice of Exempt Modification**
Eversource Site # 15215
20 Barnabas Road, Newtown, CT 06470
Latitude: 41-25-39.5 N / Longitude: 73-20-37.5 W

Dear Ms. Bachman:

The Connecticut Light and Power Company doing business as Eversource Energy ("Eversource") currently maintains multiple antennas and equipment at various mounting heights on an existing 180-foot self-support tower located at 20 Barnabas Road in Newtown. See Attachment A, Parcel Map and Property Card. The tower and property are owned by Eversource. Eversource plans to install two omni-directional antennas, one bottom mounted and one inverse mounted, at 165 feet above ground level ("AGL") with a total length of 24.3 feet, and two 7/8-inch diameter coaxial cables. There will be no changes to the area of the fenced compound, the tower, or the antennas and equipment currently mounted on the tower. The tower and existing and proposed equipment on the tower are depicted on Attachment B, Construction Drawings, dated March 26, 2020 and Attachment C, Structural Analysis, dated March 26, 2020. The Connecticut Siting Council approved the self-support tower at this location in Docket No. 144 in November 1991.

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

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

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

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

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

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

By: ________________________________
Kathleen M. Shanley
Manager – Transmission Siting

cc: Honorable Daniel Rosenthal, First Selectman, Town of Newtown
George Benson, Director of Planning, Town of Newtown

Attachments

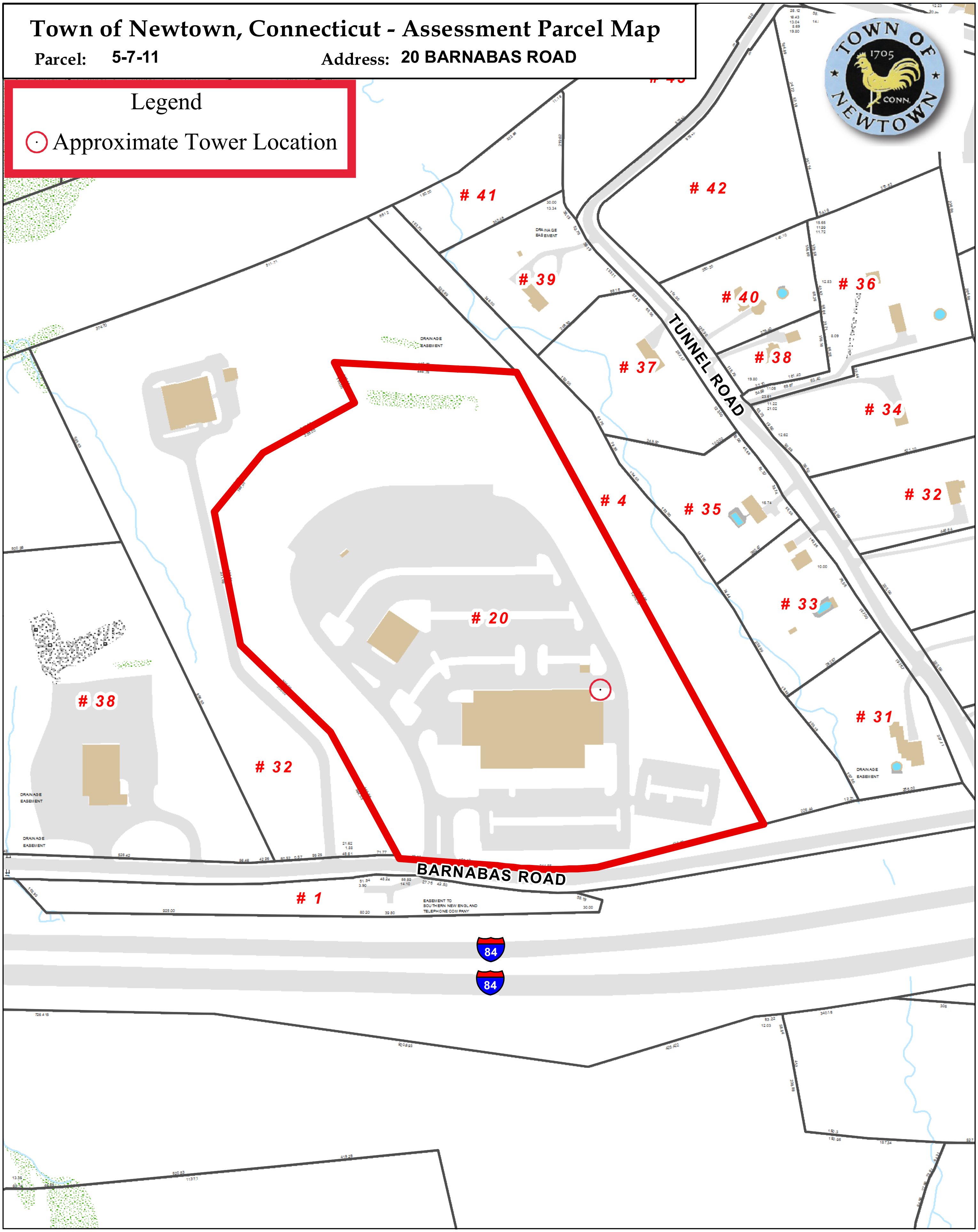
A. Parcel Map and Property Card
B. Construction Drawings
C. Structural Analysis
D. Proof of Delivery of Notice
E. Power Density Report

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

ATTACHMENT A – PARCEL MAP AND PROPERTY CARD

Town of Newtown, Connecticut - Assessment Parcel Map

Parcel: 5-7-11 Address: 20 BARNABAS ROAD



Approximate Scale:

0 75 150 225 300 Feet

N W E S

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

Map Produced Oct 2016

Town of Newtown, CT

Property Listing Report

Map Block Lot	5-7-11-1	Account	00696701

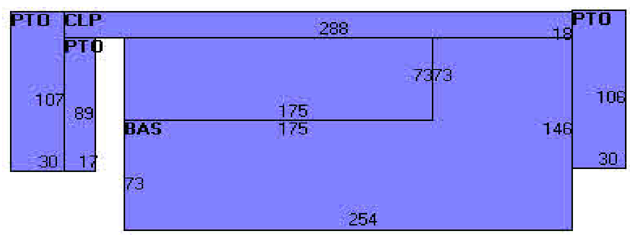
Property Information

Property Location	20 BARNABAS ROAD
Owner	BARNABAS REALTY GROUP GEN PRTSHP
Co-Owner	C/O EVERSOURCE
Mailing Address	107 SELDEN STREET BERLIN CT 06037
Land Use	3400 OFFICE
Land Class	C
Zoning Code	M-1
Census Tract	
Sub Lot	

Neighborhood	C090
Acreage	23.9
Utilities	Well,Septic
Lot Setting/Desc	
Survey Map	
TC Survey Numbers	

Photo

Sketch



Primary Construction Details

Year Built	1991	Bedrooms		Exterior Walls	Concr/CinderBk
Stories	1	Full Bathrooms		Interior Walls	Drywall/Sheet
Building Style	Office	Half Bathrooms		Heating Type	Hot Water
Building Use	Comm/Ind	Bath Style		Heating Fuel	Gas
Building Condition	B	Kitchen Style		AC Type	Central
Floors	Carpet	Roof Style	Flat	Gross Bldg Area	71702
Total Rooms		Roof Cover	Rolled Compos	Total Living Area	40066

Report Created On 3/16/2020

Town of Newtown, CT

Property Listing Report | Map Block Lot 5-7-11-1 | Account 00696701

Valuation Summary

(Assessed value = 70% of Appraised Value)

Item	Appraised	Assessed
Buildings	4870910	3409640
Extras	13200	9240
Outbuildings	300050	210030
Land	2872800	2010960
Total	8056960	5639870

Outbuilding and Extra Items

Type	Description
Fence	1600 L.F.
Fence	1600 L.F.
Tower	1 UNITS
Tower	1 UNITS
Paving	340000 S.F.
Paving	340000 S.F.
Fence	19200 L.F.
Fence	19200 L.F.
Lights	12 UNITS
Lights	12 UNITS

Sub Areas

Subarea Type	Gross Area (sq ft)	Living Area (sq ft)
Canopy	17596	0
Canopy	17596	0
Patio - Concrete	11418	0
Patio - Concrete	11418	0
Open Porch	168	0
Open Porch	168	0
First Floor	40066	40066
First Floor	40066	40066
Loading Platform	2454	0
Total Area	71702	40066

Sales History

Owner of Record	Book/ Page	Sale Date	Sale Price
BARNABAS REALTY GROUP GEN PRTSHP	423 /805	9/25/1990	0
BARNABAS REALTY GROUP GEN PRTSHP	423 /805	9/25/1990	0

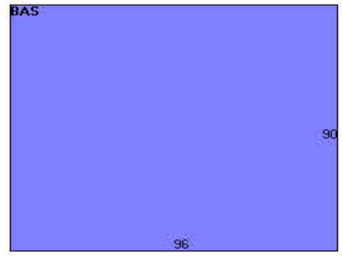
Report Created On 3/16/2020

Town of Newtown, CT

Property Listing Report | Map Block Lot 5-7-11-1 | Account 00696701

Photo

Sketch



Primary Construction Details

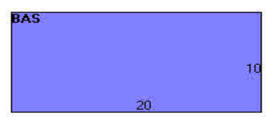
Year Built	1991	Kitchen Style	
Stories	1	Roof Style	Flat
Building Style	Light Indust	Roof Cover	Rolled Compos
Building Use	Comm/Ind	Exterior Walls	Pre-Fin Metal
Building Condition	B	Interior Walls	Drywall/Sheet
Floors	Concr-Finished	Heating Type	Susp. Space
Total Rooms		Heating Fuel	Gas
Bedrooms		AC Type	Central
Bathrooms		Gross Bldg Area	
Bath Style		Total Living Area	
Half Bath			

Sub Areas

Subarea Type	Gross Area (sq ft)	Living Area (sq ft)
First Floor	9216	9216
First Floor	9216	9216
Total Area		

Photo

Sketch



Primary Construction Details

Year Built	1995	Kitchen Style	
Stories	1	Roof Style	Flat
Building Style	Light Indust	Roof Cover	Rolled Compos
Building Use	Ind/Comm	Exterior Walls	Pre-cast Concr
Building Condition	B	Interior Walls	Minim/Masonry
Floors	Concr-Finished	Heating Type	Susp. Space
Total Rooms		Heating Fuel	Gas
Bedrooms		AC Type	Central
Bathrooms		Gross Bldg Area	
Bath Style		Total Living Area	
Half Bath			

Subarea Type	Gross Area (sq ft)	Living Area (sq ft)
First Floor	200	200
First Floor	200	200
Total Area		

Report Created On 3/16/2020

ATTACHMENT B – CONSTRUCTION DRAWINGS

EVERSOURCE ENERGY

NEWTOWN AWC
20 BARNABAS RD
NEWTOWN, CT 06470

PROJECT SUMMARY

THE GENERAL SCOPE OF WORK CONSISTS OF THE FOLLOWING:

1. INSTALL (2) NEW OMNI/WHIP ANTENNAS, (1) AT ELEVATION 180'−0"± AGL AND (1) AT ELEVATION 165'−0"± AGL
2. INSTALL (1) NEW RACK WITH NEW DMR EQUIPMENT IN EXISTING TELECOM ROOM

GOVERNING CODES

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

GENERAL NOTES

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

SITE INFORMATION

SITE NAME:	NEWTOWN AWC
SITE ID NUMBER:	#15215
SITE ADDRESS:	20 BARNABAS RD NEWTOWN, CT 06470
MAP:	5
BLOCK:	7
LOT:	11
LATITUDE:	41° 25' 39.5" N
LONGITUDE:	73° 20' 37.5" W
ELEVATION:	457'± AMSL
FEMA/FIRM DESIGNATION:	X

CONTACT INFORMATION

APPLICANTS:
EVERSOURCE ENERGY
107 SELDEN STREET
BERLIN, CT 06037

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

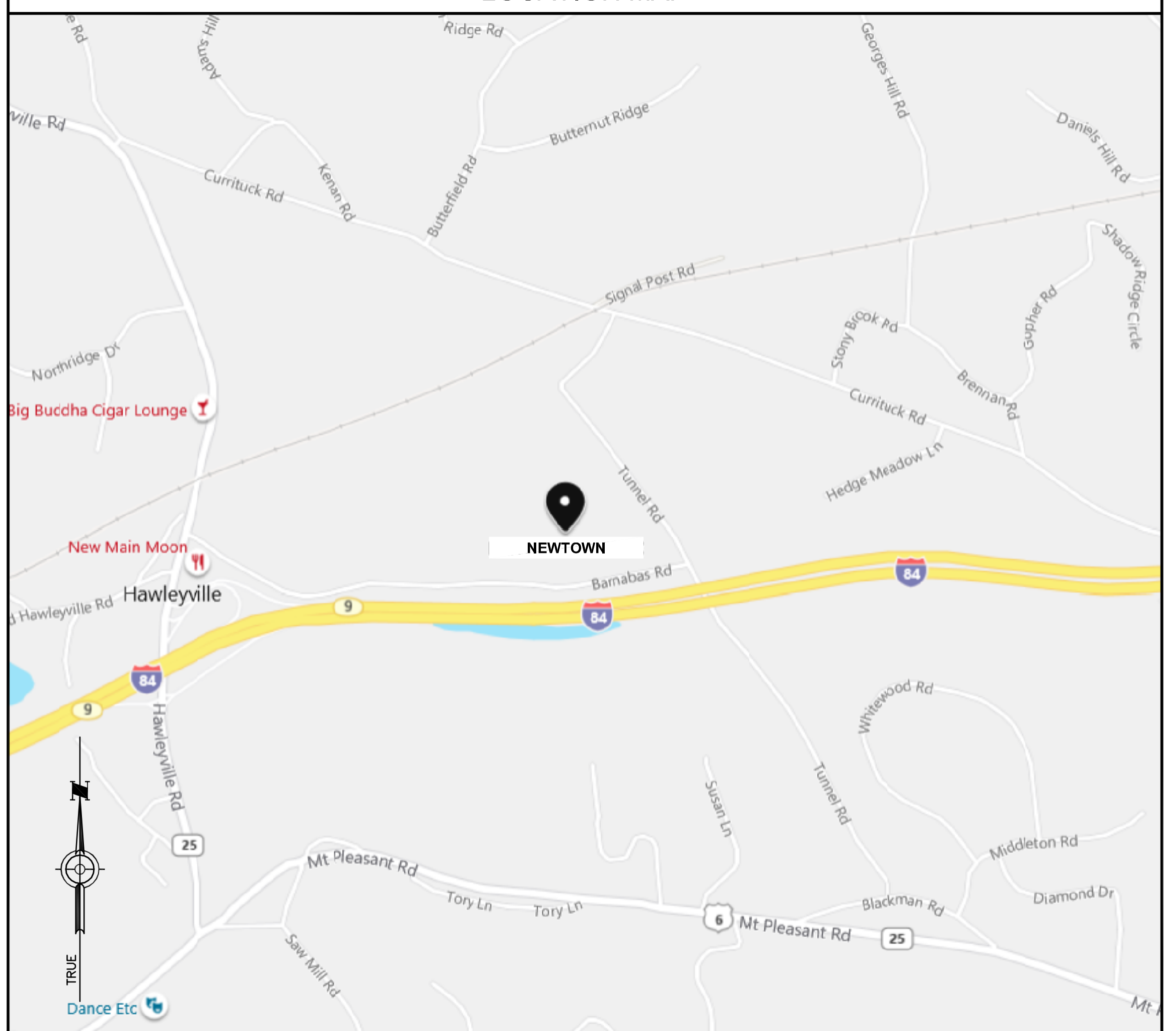
EVERSOURCE ENERGY PROJECT MANAGER:
NIKOLL PRECI
(860) 655−3079

POWER PROVIDER:
EVERSOURCE ENERGY
(800) 286−2000

TELCO PROVIDER:
FRONTIER
(800) 921−8102

CALL BEFORE YOU DIG:
(800) 922−4455

LOCATION MAP



NO SCALE

DESIGN TYPE

SITE UPGRADE
SELF−SUPPORT TOWER

DRAWING INDEX

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

DO NOT SCALE DRAWINGS

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

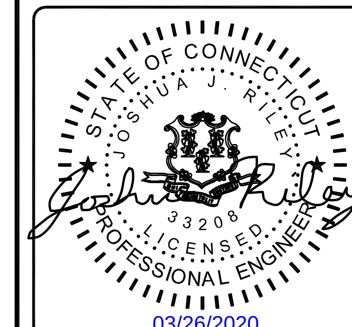
UNDERGROUND SERVICE ALERT
UTILITIES PROTECTION CENTER, INC.
811
48 HOURS BEFORE YOU DIG

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

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

PROJECT NO:	403093
DRAWN BY:	TYW
CHECKED BY:	THM

REV	DATE	DESCRIPTION
0	03/26/20	ISSUED FOR FILING

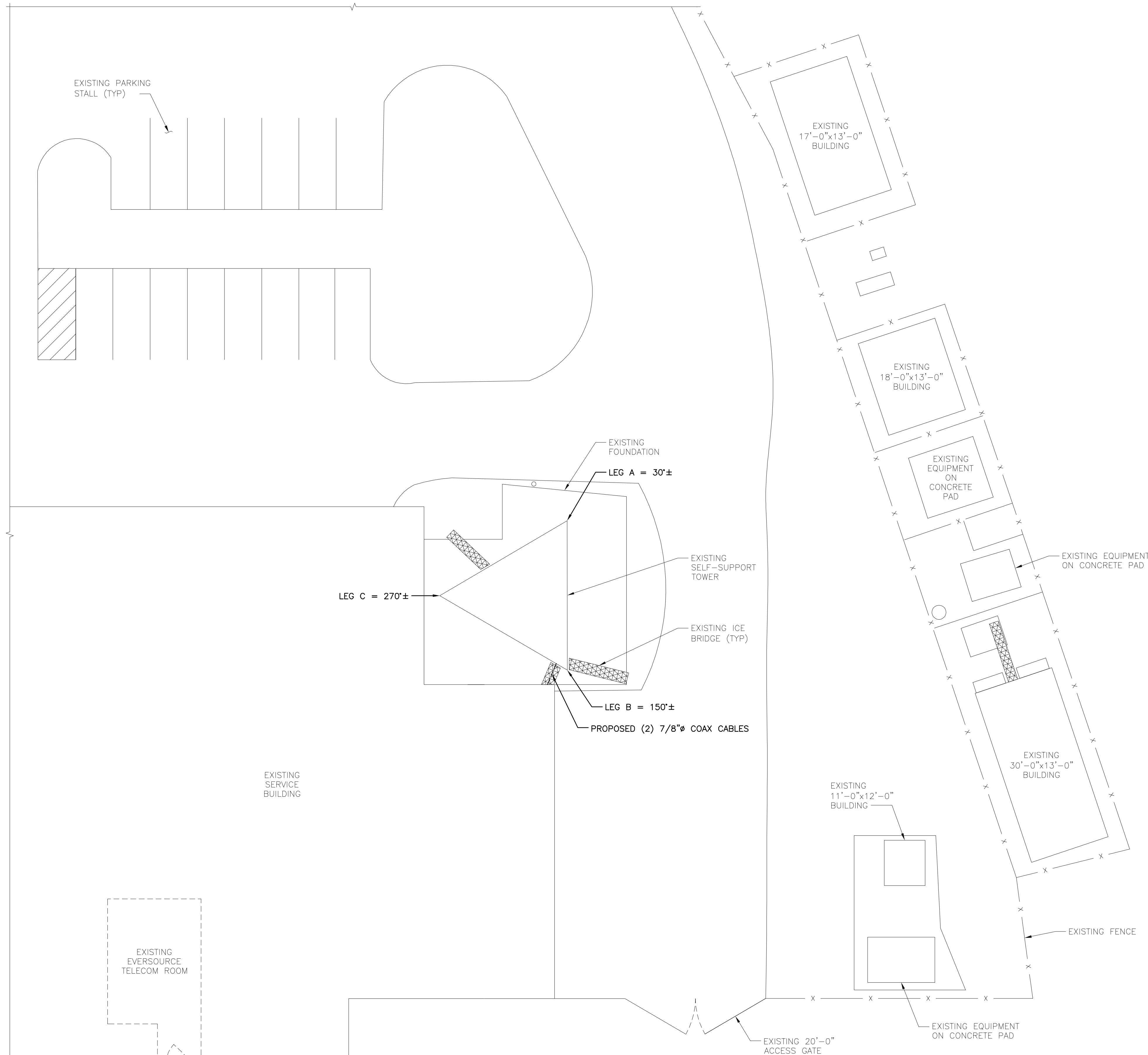


IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT.

NEWTOWN AWC
20 BARNABAS RD
NEWTOWN, CT 06470

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1



SITE PLAN

NO SCALE

EVERSOURCE ENERGY

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

BLACK & VEATCH

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

PROJECT NO:	403093
DRAWN BY:	TYW
CHECKED BY:	THM

REV	DATE	DESCRIPTION
0	03/26/20	ISSUED FOR FILING

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
PROFESSIONAL ENGINEER

03/26/2020

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

NEWTOWN AWC
20 BARNABAS RD
NEWTOWN, CT 06470

SHEET TITLE

SITE PLAN

SHEET NUMBER

C-1

TOP OF EXISTING EVERSOURCE ANTENNA
ELEVATION 199'-0"± AGL

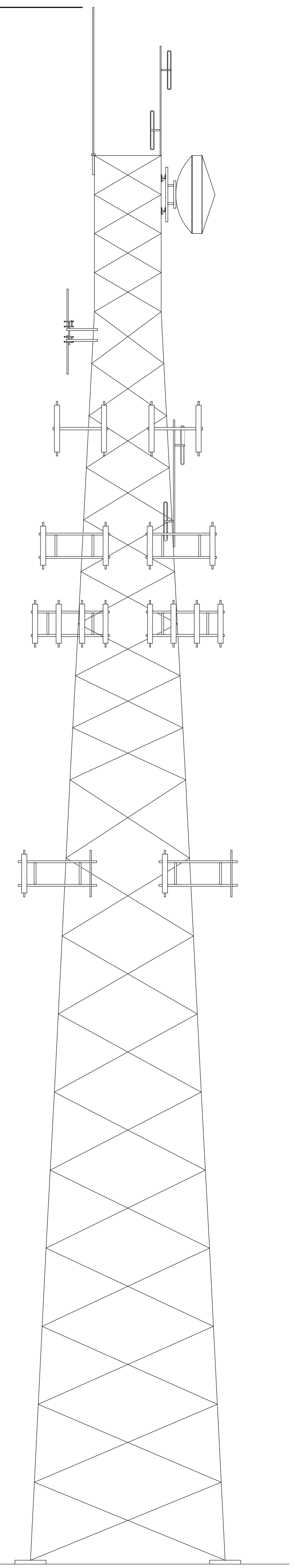
TOP OF EXISTING TOWER
ELEVATION 180'-0"± AGL

EXISTING EVERSOURCE ANTENNA
RAD CL ELEVATION 161'-0"± AGL

EXISTING EVERSOURCE ANTENNA
RAD CL ELEVATION 153'-0"± AGL

199'-0"± AGL
TOTAL HEIGHT WITH APPURTENANCES

EXISTING GRADE
ELEVATION 457'-0"± AMSL



TOP OF EXISTING ANTENNA (NON-EVERSOURCE)
ELEVATION 194'-0"± AGL

TOP OF EXISTING EVERSOURCE ANTENNA
ELEVATION 180'-0"± AGL

EXISTING ANTENNAS (NON-EVERSOURCE)
RAD CL ELEVATION 145'-0"± AGL

EXISTING ANTENNA (NON-EVERSOURCE)
RAD CL ELEVATION 138'-0"± AGL

EXISTING ANTENNAS (NON-EVERSOURCE)
RAD CL ELEVATION 130'-0"± AGL

EXISTING ANTENNAS (NON-EVERSOURCE)
RAD CL ELEVATION 120'-0"± AGL

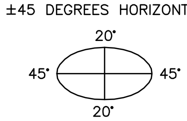
EXISTING ANTENNAS (NON-EVERSOURCE)
RAD CL ELEVATION 88'-0"± AGL

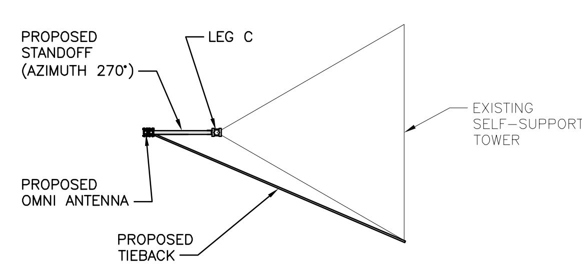
TOWER ELEVATION FACE BA
NO SCALE

NOTES

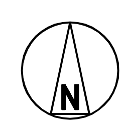
1. ATTACH TIEBACK TO FRAME MAST BETWEEN TOP AND BOTTOM HSS ARMS. ATTACH OPPOSITE END TO EITHER ADJACENT TOWER LEG. REFER TO ALLOWABLE TIEBACK ANGLE DIAGRAM.
2. TRIM TIEBACK PIPE AS REQUIRED TO MAINTAIN A 6" DISTANCE BETWEEN ENDS OF CLAMPS AND ENDS OF PIPE.

ALLOWABLE TIEBACK ANGLE
±20 DEGREES VERTICAL
±45 DEGREES HORIZONTAL





SECTION 1
NO SCALE



TOP OF EXISTING ANTENNA (NON-EVERSOURCE)
ELEVATION 194'-0"± AGL

TOP OF EXISTING EVERSOURCE ANTENNA
ELEVATION 180'-0"± AGL

EXISTING ANTENNAS (NON-EVERSOURCE)
RAD CL ELEVATION 145'-0"± AGL

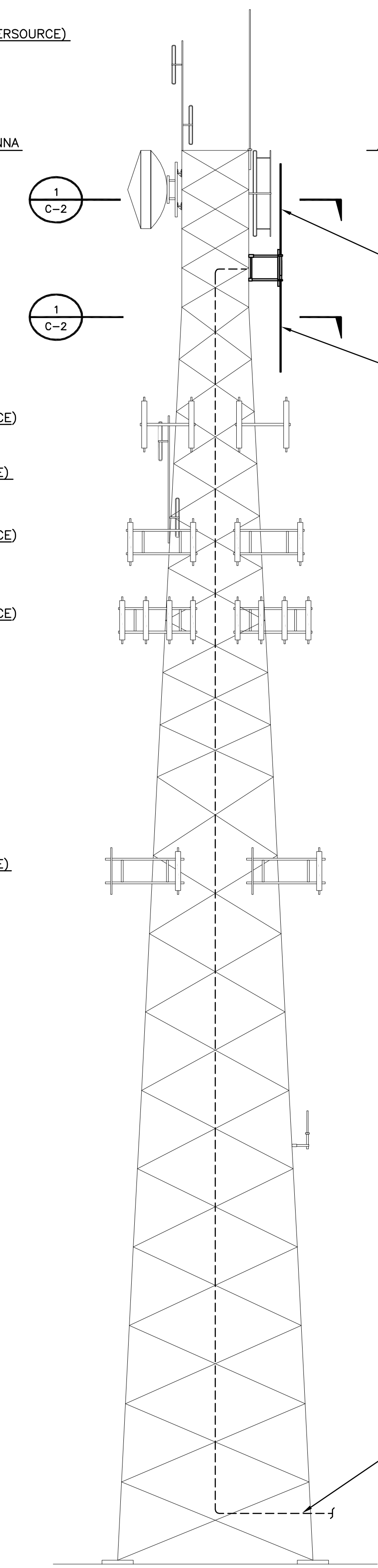
EXISTING ANTENNA (NON-EVERSOURCE)
RAD CL ELEVATION 138'-0"± AGL

EXISTING ANTENNAS (NON-EVERSOURCE)
RAD CL ELEVATION 130'-0"± AGL

EXISTING ANTENNAS (NON-EVERSOURCE)
RAD CL ELEVATION 120'-0"± AGL

EXISTING ANTENNA (NON-EVERSOURCE)
RAD CL ELEVATION 88'-0"± AGL

EXISTING GRADE
ELEVATION 457'-0"± AMSL



TOP OF EXISTING EVERSOURCE ANTENNA
ELEVATION 198'-0"± AGL

TOP OF EXISTING EVERSOURCE ANTENNA
ELEVATION 180'-0"± AGL
TOP OF EXISTING TOWER
ELEVATION 180'-0"± AGL

TOP OF PROPOSED EVERSOURCE OMNI/WHIP ANTENNA (UPRIGHT)
ELEVATION 180'-0"± AGL
RX RAD CL ELEVATION 172'-6"± AGL
(ANTENNA MECHANICAL LENGTH 14'-3")

TOP OF PROPOSED EVERSOURCE OMNI/WHIP ANTENNA (INVERTED)
ELEVATION 165'-0"± AGL
TX RAD CL ELEVATION 157'-6"± AGL
(ANTENNA MECHANICAL LENGTH 14'-3")

EXISTING ANTENNA (NON-EVERSOURCE)
RAD CL ELEVATION 56'-0"± AGL

PROPOSED (2) 7/8"ø COAX CABLES ROUTED TO PROPOSED OMNIS

TOWER ELEVATION FACE AC
NO SCALE

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

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

PROJECT NO:	403093
DRAWN BY:	TYW
CHECKED BY:	THM

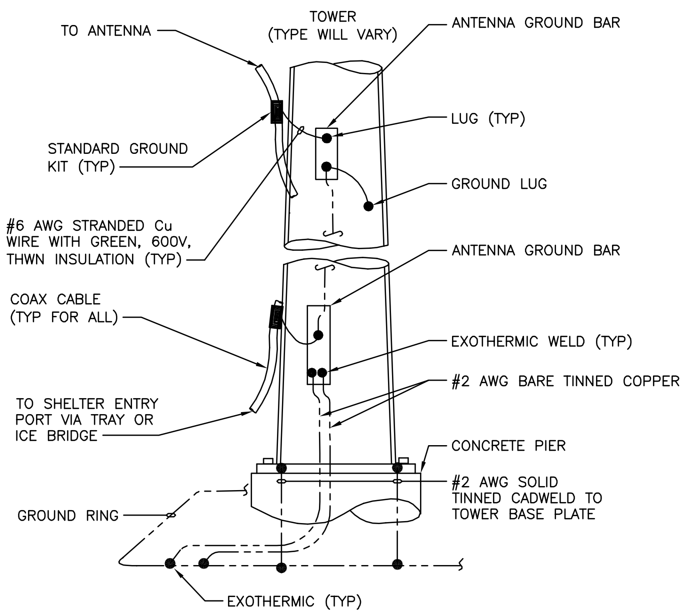
REV	DATE	DESCRIPTION
0	03/26/20	ISSUED FOR FILING

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED
PROFESSIONAL ENGINEER
03/26/2020

NEWTOWN AWC
20 BARNABAS RD
NEWTOWN, CT 06470

SHEET TITLE
TOWER ELEVATION

SHEET NUMBER
C-2

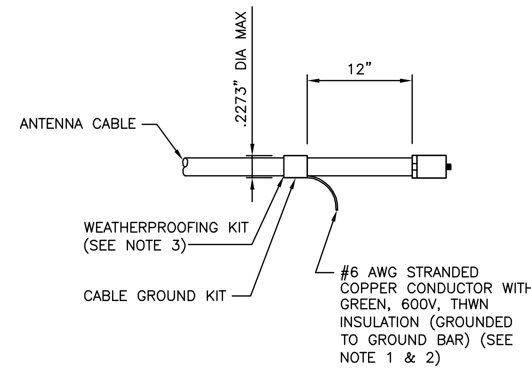


NOTE

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

ANTENNA CABLE GROUNDING

NO SCALE

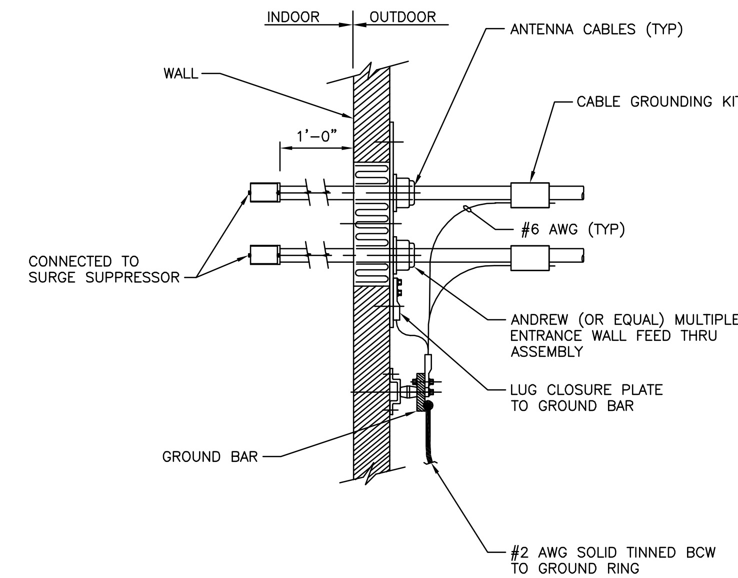


NOTES

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

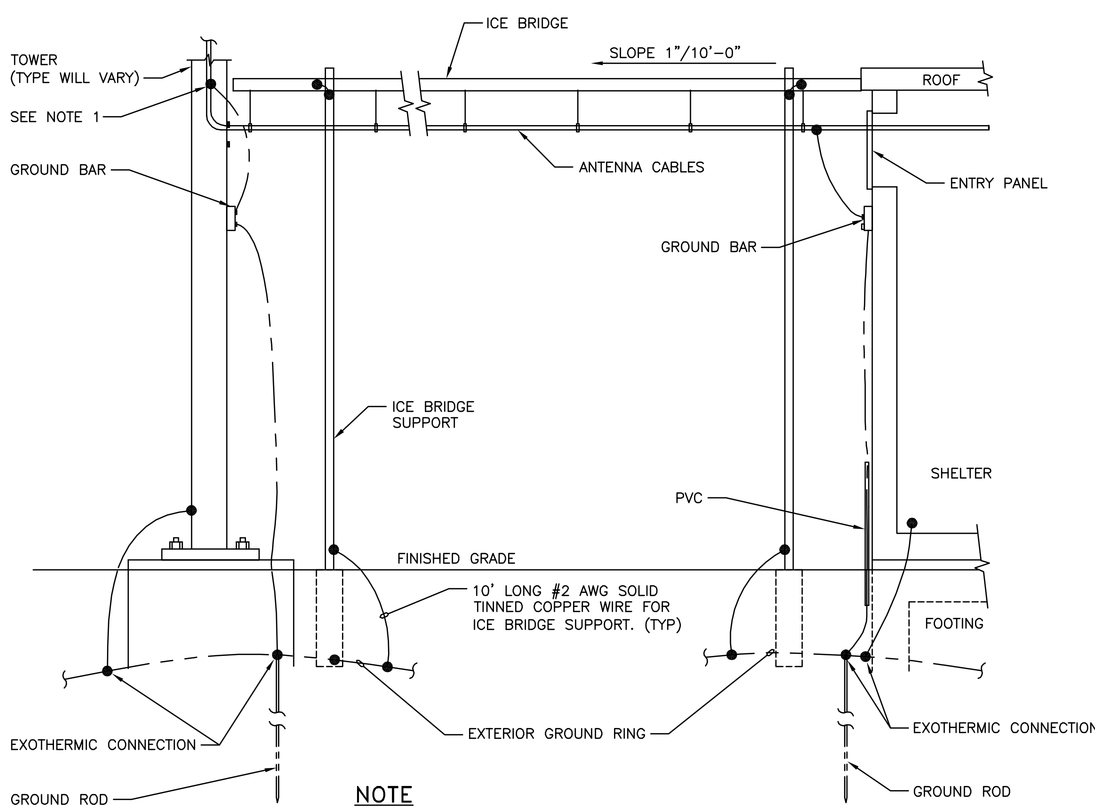
CONNECTION OF CABLE GROUND KIT TO ANTENNA CABLE

NO SCALE



CABLE INSTALLATION WITH WALL FEED THRU ASSEMBLY

NO SCALE



NOTE

1. PROVIDE GROUND KIT 6" BEFORE TURN

ICE BRIDGE AND ANTENNA CABLE DETAIL

NO SCALE

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

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

PROJECT NO:	403093
DRAWN BY:	TYW
CHECKED BY:	THM

REV	DATE	DESCRIPTION
0	03/26/20	ISSUED FOR FILING

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

03/26/2020

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

NEWTOWN AWC
20 BARNABAS RD
NEWTOWN, CT 06470

SHEET TITLE
GROUNDING DETAILS

SHEET NUMBER
G-1

DESIGN BASIS

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

GENERAL CONDITIONS

1. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL BUILDING CODES, PERMIT CONDITIONS AND SAFETY CODES DURING CONSTRUCTION.
2. THE ENGINEER IS NOT: A GUARANTOR OF THE INSTALLING CONTRACTOR'S WORK; RESPONSIBLE FOR SAFETY IN, ON OR ABOUT THE WORK SITE; IN CONTROL OF THE SAFETY OR ADEQUACY OF ANY BUILDING COMPONENT, SCAFFOLDING OR SUPERINTENDING THE WORK.
3. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL PERMITS, INSPECTIONS, TESTING AND CERTIFICATES NEEDED FOR LEGAL OCCUPANCY OF THE FINISHED PROJECT.
4. THE CONTRACTOR IS RESPONSIBLE TO REVIEW THIS COMPLETE PLAN SET AND VERIFY THE EXISTING CONDITIONS SHOWN IN THESE PLANS AS THEY RELATE TO THE WORK PRIOR TO SUBMITTING PRICE. SIGNIFICANT DEVIATIONS FROM WHAT IS SHOWN AFFECTING THE WORK SHALL BE REPORTED IMMEDIATELY TO THE CONSTRUCTION MANAGER.
5. DETAILS INCLUDED IN THIS PLAN SET ARE TYPICAL AND APPLY TO SIMILAR CONDITIONS.
6. EXISTING ELECTRICAL AND MECHANICAL FIXTURES, PIPING, WIRING, AND EQUIPMENT OBSTRUCTING THE WORK SHALL BE REMOVED AND/OR RELOCATED AS DIRECTED BY THE CONSTRUCTION MANAGER. TEMPORARY SERVICE INTERRUPTIONS MUST BE COORDINATED WITH OWNER.
7. THE CONTRACTOR SHALL DILIGENTLY PROTECT THE EXISTING BUILDING/SITE CONDITIONS AND THOSE OF ANY ADJOINING BUILDING/SITES AND RESTORE ANY DAMAGE CAUSED BY HIS ACTIVITIES TO THE PRE-CONSTRUCTION CONDITION.
8. THE CONTRACTOR SHALL SAFEGUARD AGAINST: CREATING A FIRE HAZARD, AFFECTING TENANT EGRESS OR COMPROMISING BUILDING SITE SECURITY MEASURES.
9. THE CONTRACTOR SHALL REMOVE ALL DEBRIS AND CONSTRUCTION WASTE FROM THE SITE EACH DAY. WORK AREAS SHALL BE SWEPT AND MADE CLEAN AT THE END OF EACH WORK DAY.
10. THE CONTRACTOR'S HOURS OF WORK SHALL BE IN ACCORDANCE WITH LOCAL CODES AND ORDINANCES AND BE APPROVED BY OWNER.
11. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE CONSTRUCTION MANAGER IF ASBESTOS IS ENCOUNTERED DURING THE EXECUTION OF HIS WORK. THE CONTRACTOR SHALL CEASE ALL ACTIVITIES WHERE THE ASBESTOS MATERIAL IS FOUND UNTIL NOTIFIED BY THE CONSTRUCTION MANAGER TO RESUME OPERATIONS.

THERMAL & MOISTURE PROTECTION

1. FIRE-STOP ALL PENETRATIONS FOR ELECTRICAL CONDUITS OR WAVEGUIDE CABLING THROUGH BUILDING WALLS, FLOORS, AND CEILINGS SHALL BE FIRESTOPPED WITH ACCEPTED MATERIALS TO MAINTAIN THE FIRE RATING OF THE EXISTING ASSEMBLY. ALL FILL MATERIAL SHALL BE SHAPED, FITTED, AND PERMANENTLY SECURED IN PLACE. FIRESTOPPING SHALL BE INSTALLED IN ACCORDANCE WITH ASTM E814.
2. HILTI CP620 FIRE FOAM OR 3M FIRE BARRIER FILL, VOID OR CAVITY MATERIAL OR ACCEPTED EQUAL SHALL BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND ASSOCIATED UNDERWRITERS LABORATORIES (UL) SYSTEM NUMBER.
3. FIRESTOPPING SHALL BE APPLIED AS SOON AS PRACTICABLE AFTER PENETRATIONS ARE MADE AND EQUIPMENT INSTALLED.
4. FIRESTOPPED PENETRATIONS SHALL BE LEFT EXPOSED AND MADE AVAILABLE FOR INSPECTION BEFORE CONCEALING SUCH PENETRATIONS. FIRESTOPPING MATERIAL CERTIFICATES SHALL BE MADE AVAILABLE AT THE TIME OF INSPECTION.
5. ANY BUILDING ROOF PENETRATION AND/OR RESTORATION SHALL BE PERFORMED SO THAT THE ROOF WARRANTY IN PLACE IS NOT COMPROMISED. CONTRACTOR SHALL ARRANGE FOR OWNER'S ROOFING CONTRACTOR TO PERFORM ANY AND ALL ROOFING WORK IF SO REQUIRED BY EXISTING ROOF WARRANTY. OTHERWISE, ROOF SHALL BE MADE WATERTIGHT WITH LIKE CONSTRUCTION AS SOON AS PRACTICABLE AND AT COMPLETION OF CONSTRUCTION.
6. ALL PENETRATIONS INTO AND/OR THROUGH BUILDING EXTERIOR WALLS SHALL BE SEALED WITH SILICONE SEALER.
7. WHERE CONDUIT AND CABLES PENETRATES FIRE RATED WALLS AND FLOORS, FIRE GROUT ALL PENETRATIONS IN ORDER TO MAINTAIN THE FIRE RATING USING A LISTED FIRE SEALING DEVICE OR GROUT.
8. CONTRACTOR TO REMOVE AND RE-INSTALL ALL FIRE PROOFING AS REQUIRED DURING CONSTRUCTION.

SUBMITTALS

1. CONTRACTOR TO SUBMIT SHOP DRAWINGS TO ENGINEER FOR REVIEW PRIOR TO FABRICATION.
2. CONTRACTOR TO NOTIFY ENGINEER FOR INSPECTION PRIOR TO CLOSING PENETRATIONS.
3. CONTRACTORS SHALL VERIFY ALL DIMENSIONS AND CONDITIONS IN THE FIELD PRIOR TO FABRICATION AND ERECTION OF ANY MATERIAL. THE ENGINEER SHALL BE NOTIFIED OF ANY CONDITIONS WHICH PRECLUDE COMPLETION OF THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
4. ALL STEEL MATERIAL EXPOSED TO WEATHER SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 " ZINC (HOT-DIPPED GALVANIZED) COATINGS" ON IRON AND STEEL PRODUCTS.
5. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NONCONFORMING MATERIALS OR CONDITIONS FOR REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.

STEEL

1. MATERIAL:

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

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

2. DAMAGED GALVANIZED SURFACES SHALL BE CLEANED WITH A WIRE BRUSH AND PAINTED WITH TWO COATS OF COLD ZINC, "GALVANOX", "DRY GALV", "ZINC IT", OR APPROVED EQUIVALENT, IN ACCORDANCE WITH MANUFACTURER'S GUIDELINES. TOUCH UP DAMAGED NON GALVANIZED STEEL WITH SAME PAINT IN SHOP OR FIELD.
3. DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO THE AISC "MANUAL OF STEEL CONSTRUCTION" 13TH EDITION.
4. THE STEEL STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER COMPLETION. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE AND TO INSURE THE SAFETY OF THE BUILDING AND ITS COMPONENT PARTS DURING ERECTION.
5. ALL STEEL ELEMENTS SHALL BE INSTALLED PLUMB AND LEVEL.
6. TOWER MANUFACTURER'S DESIGNS SHALL PREVAIL FOR TOWER.

SITE GENERAL

1. CONTRACTOR SHALL FOLLOW CONDITIONS OF ALL APPLICABLE PERMITS AND WORK IN ACCORDANCE WITH OSHA REGULATIONS.
2. THESE PLANS DEPICT KNOWN UNDERGROUND STRUCTURES, CONDUITS, AND/OR PIPELINES. THE LOCATIONS FOR THESE ELEMENTS ARE BASED UPON THE VARIOUS RECORD DRAWINGS AVAILABLE. THE CONTRACTOR IS HEREBY ADVISED THAT THESE DRAWINGS MAY NOT ACCURATELY DEPICT AS-BUILT LOCATIONS AND OTHER UNKNOWN STRUCTURES. THE CONTRACTOR SHALL THEREFORE DETERMINE THE EXACT LOCATION OF EXISTING UNDERGROUND ELEMENTS AND EXCAVATE WITH CARE AFTER CALLING MARKOUT SERVICE AT 1-800-272-4480 48 HOURS BEFORE DIGGING, DRILLING OR BLASTING.
3. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC, FIBER OPTIC, AND OTHER UTILITIES WHERE ENCOUNTERED, SHALL BE PROTECTED AT ALL TIMES, AND WHERE REQUIRED FOR THE PROPER EXECUTION, SHALL BE RELOCATED AS DIRECTED BY ENGINEER. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR PIER DRILLING AROUND OR NEAR UTILITIES. CONTRACTOR SHALL HAND DIG UTILITIES AS NEEDED. CONTRACTOR SHALL PROVIDE, BUT IS NOT LIMITED TO, APPROPRIATE A) FALL PROTECTION, B) CONFINED SPACE ENTRY, C) ELECTRICAL SAFETY, AND D) TRENCHING AND EXCAVATION.
4. IF NECESSARY, RUBBISH, STUMPS, DEBRIS, STICKS, STONES, AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF LEGALLY.
5. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC, FIBER OPTIC, OR OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED, AND/OR CAPPED, PLUGGED OR OTHERWISE DISCONTINUED AT THE POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, SUBJECT TO THE APPROVAL OF THE CONSTRUCTION MANAGER.
6. CONTRACTOR IS RESPONSIBLE FOR REPAIRING OR REPLACING STRUCTURES OR UTILITIES DAMAGED DURING CONSTRUCTION.
7. CONTRACTOR SHALL PROTECT EXISTING PAVED AND GRAVEL SURFACES, CURBS, LANDSCAPE AND STRUCTURES AND RESTORE SITE OR PRE-CONSTRUCTION CONDITION WITH AS GOOD, OR BETTER, MATERIALS. NEW MATERIALS SHALL MATCH EXISTING THICKNESS AND TYPE.
8. THE CONTRACTOR SHALL SHORE ALL TRENCH EXCAVATIONS GREATER THAN 5 FEET IN DEPTH OR LESS WHERE SOIL CONDITIONS ARE DEEMED UNSTABLE. ALL SHEETING AND/OR SHORING METHODS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.
9. THE CONTRACTOR IS RESPONSIBLE FOR MANAGING GROUNDWATER LEVELS IN THE VICINITY OF EXCAVATIONS TO PROTECT ADJACENT PROPERTIES AND NEW WORK. GROUNDWATER SHALL BE DRAINED IN ACCORDANCE WITH LOCAL SEDIMENTATION AND EROSION CONTROL GUIDELINES.

EVERSOURCE ENERGY

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DRAWN BY:	TYW
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STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED
PROFESSIONAL ENGINEER

03/26/2020

NEWTOWN AWC
20 BARNABAS RD
NEWTOWN, CT 06470

SHEET TITLE

NOTES & SPECIFICATIONS

SHEET NUMBER

N-1

ELECTRICAL

1. CONTRACTOR SHALL VERIFY EXISTING ELECTRIC SERVICE TYPE AND CAPACITY AND ORDER NEW ELECTRIC SERVICE FROM LOCAL ELECTRIC UTILITY, WHERE APPLICABLE.
2. ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH ALL APPLICABLE CODES, AND SHALL BE ACCEPTABLE TO ALL AUTHORITIES HAVING JURISDICTION. WHERE A CONFLICT EXISTS BETWEEN CODES, PLAN AND SPECIFICATIONS, OR AUTHORITIES HAVING JURISDICTION, THE MORE STRINGENT AUTHORITIES SHALL APPLY.
3. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, INSURANCE, EQUIPMENT, INSTALLATION, CONSTRUCTION TOOLS, TRANSPORTATION, ETC, FOR A COMPLETE AND PROPERLY OPERATIVE SYSTEM ENERGIZED THROUGHOUT AND AS INDICATED ON THE DRAWINGS AND AS SPECIFIED HEREIN AND/OR OTHERWISE REQUIRED.
4. ALL ELECTRICAL CONDUCTORS SHALL BE 100% COPPER AND SHALL HAVE TYPE THHN INSULATION UNLESS INDICATED OTHERWISE.
5. CONDUIT SHALL BE THREADED RIGID GALVANIZED STEEL OR EMT WITH ONLY COMPRESSION TYPE COUPLINGS AND CONNECTORS, ALL MADE UP WRENCH TIGHT.
6. ALL BURIED CONDUIT SHALL BE MINIMUM SCH 40 PVC UNLESS NOTED OTHERWISE, OR AS PER LOCAL CODE REQUIREMENTS.
7. PROVIDE FLEXIBLE STEEL CONDUIT OR LIQUID TIGHT FLEXIBLE STEEL CONDUIT TO ALL VIBRATING EQUIPMENT, INCLUDING HVAC UNITS, TRANSFORMERS, MOTORS, ETC, OR WHERE EQUIPMENT IS PLACED UPON A SLAB ON GRADE.
8. ALL BRANCH CIRCUITS AND FEEDERS SHALL HAVE A SEPARATE GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR BONDED TO ALL ENCLOSURES, PULLBOXES, ETC.
9. CONDUIT AND CABLE WITHIN CORRIDORS SHALL BE CONCEALED AND EXPOSED ELSEWHERE, UNLESS NOTED OTHERWISE.
10. ELECTRICAL MATERIALS INSTALLED ON ROOFTOP SHALL BE LISTED FOR NEMA 3R USE. –AND ALL WIRING WITHIN A VENTILATION DUCT SHALL BE LISTED FOR SUCH USE. IN GENERAL WIRING METHODS WITHIN A DUCT SHALL BE AN MC CABLE WITH SMOOTH OR CORRUGATED METAL JACKET AND HAVE NO OUTER COVERING OVER THE METAL JACKET. INTERLOCKED ARMOR TYPE OF MC CABLE IS NOT ACCEPTABLE FOR THIS APPLICATION. CONTRACTOR CAN ALSO USE TYPE MI CABLE IN THE VENTILATION DUCT PROVIDED IT DOES NOT HAVE ANY OUTER COVERINGS OVER THE METAL EXTERIOR.
11. WIRING DEVICES SHALL BE SPECIFICATION GRADE, AND WIRING DEVICE COVER PLATES SHALL BE PLASTIC WITH ENGRAVING AS SPECIFIED.
12. GROUNDING SYSTEM RESISTANCE SHALL BE MEASURED, RECORDED, AND DATED USING MEGGER DET14 OR SIMILAR INSTRUMENT. GROUND RESISTANCE SHALL NOT EXCEED 5 OHMS. IF THE RESISTANCE VALUE IS EXCEEDED, NOTIFY CONSTRUCTION MANAGER FOR FURTHER INSTRUCTION.
13. COORDINATE WITH BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK INVOLVING EXISTING SYSTEMS OR EQUIPMENT IN ORDER TO DETERMINE THE EFFECT, IF ANY, ON OTHER TENANTS WITHIN THE BUILDING, AND TO DETERMINE THE APPROPRIATE TIME FOR PERFORMING THIS WORK.
14. THE CONTRACTOR SHALL BE REQUIRED TO VISIT THE SITE PRIOR TO SUBMITTING BID IN ORDER TO DETERMINE THE EXTENT OF THE EXISTING CONDITIONS.
15. ALL CONDUCTOR ENDS SHALL BE TAGGED AND ELECTRICAL EQUIPMENT LABELED WITH ENGRAVED IDENTIFICATION PLATES.
16. CONTRACTOR IS RESPONSIBLE FOR ALL CONTROL WIRING AND ALARM TIE–INS.

GROUNDING

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

ANTENNA & CABLE NOTES

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

EVERSOURCE ENERGY

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CHECKED BY:	THM

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

NEWTOWN AWC
20 BARNABAS RD
NEWTOWN, CT 06470

SHEET TITLE

NOTES & SPECIFICATIONS

SHEET NUMBER

N-2

SYMBOLS

●	EXOTHERMIC CONNECTION
■	COMPRESSION CONNECTION
	5/8"øx10'-0" COPPER CLAD STEEL GROUND ROD.
	TEST GROUND ROD WITH INSPECTION SLEEVE
— - - -	GROUNDING CONDUCTOR
(A)	KEY NOTES
CHAINLINK FENCE	——— x ——— x ——— x ——— x ——— x ———
WOOD FENCE	
LEASE AREA	— — — — — — —
ICE BRIDGE	
CABLE TRAY	
GAS LINE	——— G ——— G ——— G ——— G ——— G ———
UNDERGROUND ELECTRICAL/TELCO	——— E/T ——— E/T ——— E/T ——— E/T ———
UNDERGROUND ELECTRICAL/CONTROL	——— E/C ——— E/C ——— E/C ——— E/C ———
UNDERGROUND ELECTRICAL	——— E ——— E ——— E ——— E ——— E ———
UNDERGROUND TELCO	——— T ——— T ——— T ——— T ——— T ———
PROPERTY LINE (PL)	——— — — ——— — — ——— — — ——— — — ———

ABBREVIATIONS

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

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NOTES & SPECIFICATIONS

SHEET NUMBER

N-3

REFERENCE CUTSHEETS

TELEWAVE, INC.®

216 - 225 MHz

ANT220F6

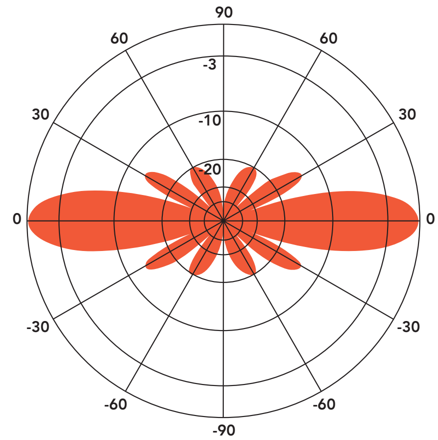
FIBERGLASS COLLINEAR ANTENNA   6 dBd

The Telewave ANT220F6 is an extremely rugged, medium-gain, fiberglass collinear antenna, designed for operation in all environmental conditions. The antenna is constructed with brass and copper elements, connected at DC ground potential for lightning impulse protection. The ANT220F6 is an excellent choice for wireless PTC systems in urban or rural areas.

All junctions are fully soldered to prevent RF intermodulation, and each antenna is completely protected within a rugged, high-tech radome to ensure survivability in the worst environments. The "Cool Blue" radome provides maximum protection from corrosive gases, ultraviolet radiation, icing, salt spray, acid rain, and wind blown abrasives.

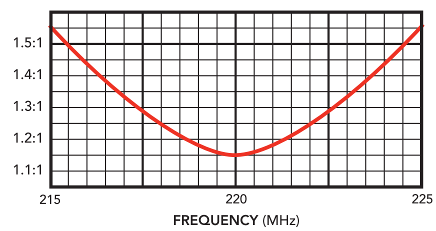
The ANT220F6 includes an ANTC482 dual clamp set for mounting to a 1.5" to 3.5" O.D. support pipe, and a 24" removable RG-213 N-Male jumper. Stand-off and top mounts are also available.

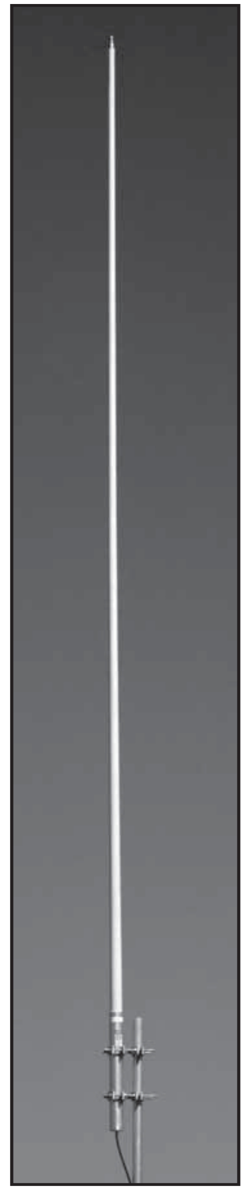
NOTE: THIS ANTENNA IS SHIPPED VIA TRUCK FREIGHT ONLY



ANT220F6 - 221 MHz
Vertical Plane
Gain = 6.11 dBd

TYPICAL VSWR RESPONSE





Mast OD

SPECIFICATIONS			
Frequency (continuous)	216-225 MHz	**Dimensions (L x base diam.) in.**	171 x 2.75
Gain	6 dBd	**Tower weight (antenna + clamps)**	35 lb.
Power rating (typ.)	500 watts	**Shipping weight**	50 lb.
Impedance	50 ohms	**Wind rating / with 0.5" ice**	150 / 125 MPH
VSWR	1.5:1 or less	**Maximum exposed area**	3.1 ft.²
Pattern	Omnidirectional	**Lateral thrust at 100 MPH**	122 lb.
Vertical beamwidth	20°	**Bending moment at top clamp**	494 ft. lb.
Termination	Recessed N Female 7-16 DIN-F opt.	**(100 MPH, 40 PSF flat plate equiv.)**	

TELEWAVE, INC.®

216 - 225 MHz

ANT220F6-I w/DIN CONNECTOR to be used for the inverted antenna.

ANT220F6

FIBERGLASS COLLINEAR ANTENNA 6 dBd

The Telewave ANT220F6 is an extremely rugged, medium-gain, fiberglass collinear antenna, designed for operation in all environmental conditions. The antenna is constructed with brass and copper elements, connected at DC ground potential for lightning impulse protection. The ANT220F6 is an excellent choice for wireless PTC systems in urban or rural areas.

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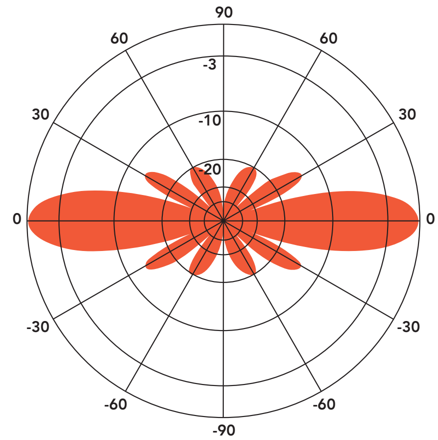
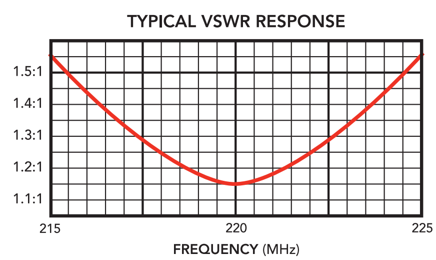
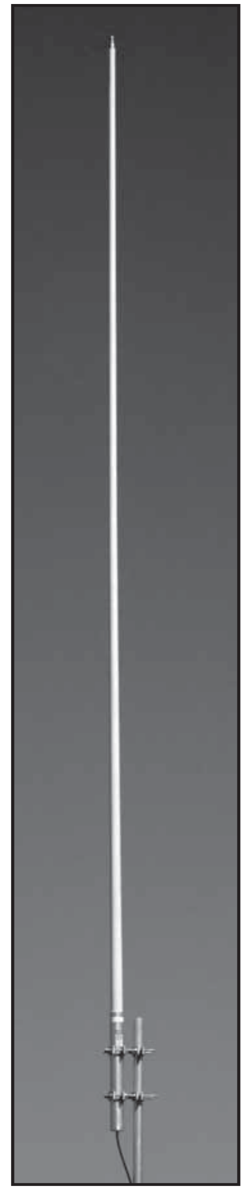


ANT220F6 - 221 MHz
Vertical Plane
Gain = 6.11 dBd





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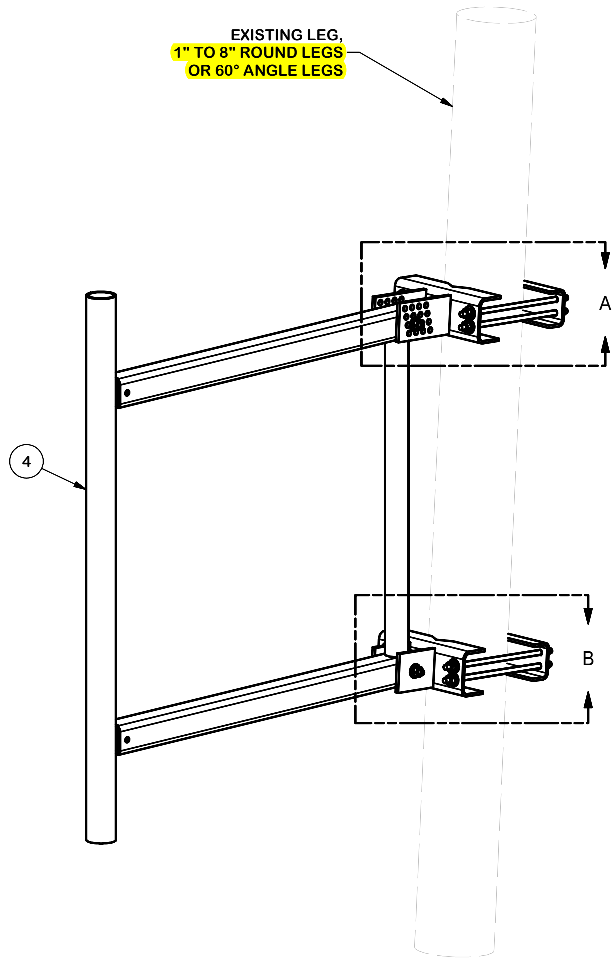
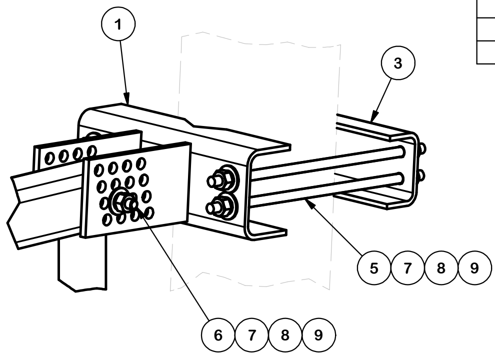
TOWER/MAST SIZE AT PROPOSED ANTENNA ATTACHMENT = 2.875" ± DIAMETER.

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





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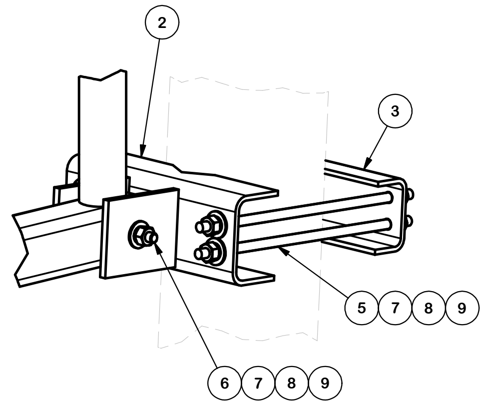

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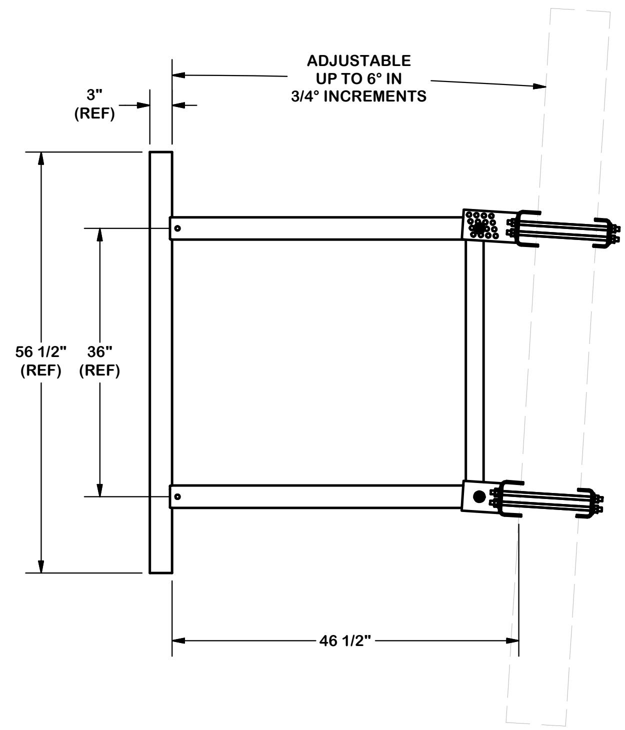

TOLERANCE NOTES

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

DESCRIPTION
48" ULTIMATE UNIVERSAL
STANDOFF FRAME

SITE PRO 1
A valmont COMPANY

Engineering Support Team:
1-888-753-7446

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

CPD NO.		DRAWN BY	ENG. APPROVAL	PART NO.	
		RCH 2/4/2011		USF-4U	
CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.	
81	01	CUSTOMER	BMC 2/16/2011	USF-4U	PAGE 1 OF 1

TIEBACK SPECIFICATIONS:
(1) SITE PRO 1 SPTB-NP
(1) SITE PRO 1 P2150 (2.375" O.D. X 12.5' LONG SCHEDULE 40 GALVANIZED PIPE)

Products (http://www.sitepro1.com/store/cart.php) > TOWER STEEL (http://www.sitepro1.com/store/cart.php?m=product_list&c=53) > Tower Components (http://www.sitepro1.com/store/cart.php?m=product_list&c=58)

2-3/8” Sliding Pipe Tie-Back Hardware, No Pipe

Qty: 1

Add to Cart

SKU: SPTB-NP
Size: See Description

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Total: $0.00

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Quick Navigation

Description

- **SPTB-NP**
- **Universal Sliding Pipe Tie-Back Assemblies**
- **2-3/8” Sliding Pipe Tie-Back Hardware, No Pipe**
- **Weight 48 lb**

- **VIEW ALL TOWER COMPONENTS (https://www.sitepro1.com/store/cart.php?m=product_list&c=58)**
- **VIEW ALL TOWER STEEL (https://www.sitepro1.com/store/cart.php?m=product_list&c=53)**
- **VIEW COMPLETE PRODUCT CATALOG (https://www.sitepro1.com/store/cart.php?m=product_list)**

Need Assistance?

Our support team is available from 8:30 AM - 8:00 PM ET to assist you.

888-438-7761 (tel:888-438-7761)
888-753-7446 (tel:888-753-7446)
SP1Support@Valmont.com (mailto:SP1Support@Valmont.com)

Go Back (https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwjXj5e3y-_nAhUK26wKHaL1A80QFjAAegQIBBAB&url=https%3A%2F

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SP1 Connection (https://www.sitepro1.com/connection/)
Equipment Platforms (https://sitepro1.com/reader/web/viewer.php?link=../../resources/pdf/Modular-

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Holiday Schedule (https://www.sitepro1.com/holiday-schedule-htm/)

ATTACHMENT C – STRUCTURAL ANALYSIS REPORT

Date: **March 26, 2020**

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

Subject:	**Structural Analysis Report**	
Eversource Designation:	**Site Number:** **Site Name:**	ES-066 NewtownAWC
Engineering Firm Designation:	**Black & Veatch Corp. Project Number:**	403093
Site Data:	**20 Barnabas Rd, Newtown, Fairfield County, CT** **Latitude *41° 25' 39.5"*, Longitude *-73° 20' 37.5"*** **180 Foot - Self Support Tower**	

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

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

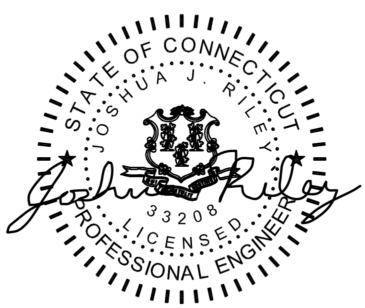
LC1: Proposed Equipment Configuration **Sufficient Capacity – 96.3%**

This analysis utilizes an ultimate 3-second gust wind speed of 130 mph as required by the 2018 Connecticut State Building Code. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

Structural analysis prepared by: Robert Hudson II / Christopher Giannotti

Respectfully submitted by:

Joshua J. Riley, P.E.
Professional Engineer



03/26/2020

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 180 ft Self Support tower designed by Rohn.

2) ANALYSIS CRITERIA

TIA-222 Revision: TIA-222-H
Risk Category: III
Wind Speed: 130 mph ultimate
Exposure Category: B
Topographic Factor: 1
Ice Thickness: 1.5 in
Wind Speed with Ice: 50 mph
Seismic Ss: 0.207
Seismic S1: 0.066
Service Wind Speed: 60 mph

Table 1 - Proposed Equipment Configuration

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
165.0	172.5	1	telewave	ANT220F6	2	7/8	-
	165.0	1	site pro 1	USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]			
	157.5	1	telewave	ANT220F6			

Table 2 - Other Considered Equipment partially shielded

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
180.0	192.5	1	antennae	10' Dipole	2 1	7/8 1/2	1
	190.5	1	antennae	15' Omni			
	189.0	1	antennae	20' Omni			
	180.0	1	mount pipes	5'x2" Mount Pipe			
		1	mount pipes	5'x4" Mount Pipe			
177.0	177.0	1	dishes	6' Microwave Dish w/ Radome	1	EW63	1
		1	miscl	8' HSS4x4x3/8 Horizontal Mount			
		1	mount pipes	6'x2" Horizontal Pipe			
		1	mount pipes	6'x4" Mount Pipe			
174.0	176.0	1	antennae	12' Dipole	1	1/2	1
	174.0	1	mount pipes	2'x2" Mount Pipe			
157.0	161.0	1	antennae	5' Omni	2	7/8	1
	157.0	1	miscl	18"x18"x6" Junction Box			
		1	tower mounts	Side Arm Mount [SO 305-1]			
	153.0	1	antennae	5' Omni			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
145.0	146.0	3	commscope	LNX-6512DS-T4M w/ Mount Pipe	12	1 5/8	1
	145.0	3	ericsson	AIR 21 B2A/B4P w/ Mount Pipe			
		3	mount pipes	5'x4" Horizontal Mount Pipe			
		3	rfscelwave	ATM1900D-1A20			
133.0	138.0	1	antennae	10' Dipole	1	7/8	1
	133.0	1	tower mounts	Side Arm Mount [SO 203-1]			
130.0	132.0	3	ericsson	RRUS 11	6 2 1	1 5/8 1 1/2 3" Conduit	1
	131.0	1	raycap	DC6-48-60-18-8F			
	130.0	3	kathrein	800 10121 w/ Mount Pipe			
		6	powerwave tech	LGP21401			
		3	powerwave tech	P65-16-XLH-RR w/ Mount Pipe			
		1	tower mounts	Sector Mount [SM 405-3]			
120.0	123.0	2	rfs celwave	DB-T1-6Z-8AB-0Z	2	1 5/8	1
	122.0	3	alcatel lucent	RRH2X40-AWS			
		3	alcatel lucent	RRH2x40 700			
	121.0	6	amphenol	BXA-171063-12CF-EDIN-X w/ Mount Pipe			
		6	amphenol	BXA-70063-6CF-EDIN-X w/ Mount Pipe			
	120.0	1	tower mounts	Pipe Mount [PM 601-3]			
		1	tower mounts	Sector Mount [SM 502-3]			
88.0	88.0	3	alcatel lucent	1900MHz RRH	3	1 1/4	1
		3	alcatel lucent	800MHz RRH			
		1	powerwave tech	P40-16-XLPP-RR w/ Mount Pipe			
		2	rfs celwave	APXVSPP18-C-A20 w/ Mount Pipe			
		1	tower mounts	Sector Mount [SM 502-3]			
56.0	56.0	1	gps	GPS_A	1	1/2	1
		1	mount pipes	3'x2" Horizontal Mount Pipe			

Notes:
1) Existing Equipment

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
GEOTECHNICAL REPORT	Dr. Clarence Welti, P.E., P.C., dated 10/19/2011	-	Eversource
TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Northeast Utilities Service Co., dated 3/01/1991	-	Eversource
TOWER STRUCTURAL MODIFICATION DRAWINGS	Centek Engineering, dated 11/18/2011	-	Eversource
TOWER STRUCTURAL MODIFICATION ANALYSIS REPORT	Centek Engineering, dated 11/29/2011	-	Eversource
TOWER STRUCTURAL MODIFICATION ANALYSIS REPORT	Centek Engineering, dated 4/09/2014	-	Eversource
TOWER STRUCTURAL MODIFICATION ANALYSIS REPORT	Centek Engineering, dated 11/10/2014	-	Eversource
TOWER STRUCTURAL ANALYSIS REPORT	AECOM, dated 2/16/2017	-	Eversource
TOWER STRUCTURAL MODIFICATION ANALYSIS REPORT	All-Points, dated 10/25/2018	-	Eversource

3.1) Analysis Method

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

3.2) Assumptions

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

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

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	180 - 160	Leg	P2.5x0.203	3	-7.40	60.05	12.3	Pass
T2	160 - 140	Leg	P2.5x.276	33	-18.95	61.44	30.8	Pass
T3	140 - 120	Leg	P3x0.216	54	-35.86	74.43	48.2	Pass
T4	120 - 100	Leg	P4x0.337	75	-62.42	167.90	37.2	Pass
T5	100 - 80	Leg	P5x0.258	96	-87.60	150.57	58.2	Pass
T6	80 - 60	Leg	P5x0.375	111	-116.45	211.28	55.1	Pass
T7	60 - 40	Leg	P5x0.375	126	-145.27	211.26	68.8	Pass
T8	40 - 20	Leg	P6x0.432	141	-174.08	318.94	54.6	Pass
T9	20 - 0	Leg	P6x0.432	155	-203.60	318.94	63.8	Pass
T1	180 - 160	Diagonal	L1 3/4x1 3/4x3/16	11	-1.91	6.88	27.7 28.8 (b)	Pass
T2	160 - 140	Diagonal	L2x2x1/8	38	-2.61	4.33	60.3	Pass
T3	140 - 120	Diagonal	L2 1/2x2 1/2x3/16	59	-4.25	9.58	44.4 64.6 (b)	Pass
T4	120 - 100	Diagonal	L2 1/2x2 1/2x1/4	80	-5.91	9.78	60.5 67.6 (b)	Pass
T5	100 - 80	Diagonal	L3x3x3/8	101	-7.77	17.04	45.6 54.3 (b)	Pass
T6	80 - 60	Diagonal	L3 1/2x3 1/2x1/4	116	-8.31	16.01	51.9 86.9 (b)	Pass
T7	60 - 40	Diagonal	L3 1/2x3 1/2x3/8	131	-8.72	19.37	45.0 61.3 (b)	Pass
T8	40 - 20	Diagonal	L4x4x3/8	144	-9.64	25.38	38.0 66.2 (b)	Pass
T9	20 - 0	Diagonal	L4x4x3/8	159	-10.58	21.97	48.2 96.3 (b)	Pass
T1	180 - 160	Top Girt	L2 1/2x2 1/2x3/16	6	-0.17	7.01	2.4	Pass
							Summary	
						Leg (T7)	68.8	Pass
						Diagonal (T9)	96.3	Pass
						Top Girt (T1)	2.4	Pass
						Bolt Checks	96.3	Pass
						Rating =	96.3	Pass

Table 5 - Tower Component Stresses vs. Capacity - LC1

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	67.5	Pass
1	Base Foundation	0	35.9	Pass
	Base Foundation Soil Interaction		78.3	Pass

Structure Rating (max from all components) =	96.3%

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity consumed.

4.1) Recommendations

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

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °	*Check**
T1	180 - 160	2.408	39	0.1092	0.02	OK
T2	160 - 140	1.948	39	0.106	0.0188	OK
T3	140 - 120	1.506	39	0.0968	0.0133	OK
T4	120 - 100	1.118	39	0.0814	0.0098	OK
T5	100 - 80	0.779	39	0.0698	0.0069	OK
T6	80 - 60	0.506	39	0.0538	0.0054	OK

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

1) Maximum Rotation = 4 Degrees

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

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

Elevation (ft)	*MW Dish*	*Tilt (°)*	*Twist (°)*	*Diameter, D (ft)*	*Frequency, α (GHz)*	*Decibel Points*	*Deformation Limit (θ)**	*Deformation Limit Exceeded?*
177	6' Microwave Dish w/ Radome	0.1089	0.02	6	10	10 dB	0.885	Not Exceeded

*Limit per TIA-222-H Annex D

Maximum Tower Deflections - Design Wind

Section No.	*Elevation ft*	*Horz. Deflection in*	*Gov. Load Comb.*	*Tilt °*	*Twist °*	*Combined Max*	*Check**
T1	180 - 160	6.672	39	0.3006	0.0566	0.306	OK
T2	160 - 140	5.408	39	0.291	0.0532	0.296	OK
T3	140 - 120	4.19	39	0.2669	0.0377	0.270	OK
T4	120 - 100	3.117	39	0.2254	0.0278	0.227	OK
T5	100 - 80	2.175	39	0.1938	0.0196	0.195	OK
T6	80 - 60	1.417	39	0.1498	0.0153	0.151	OK

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

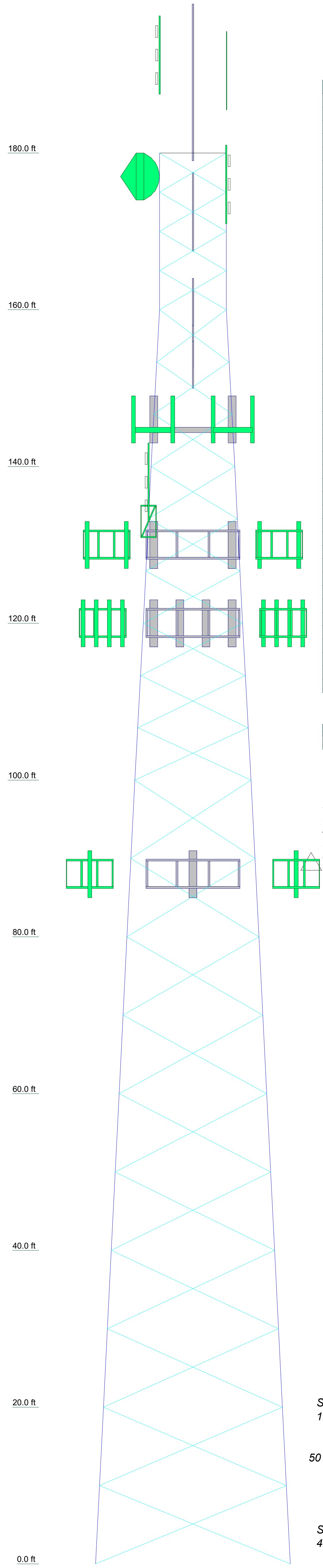
Critical Deflections of Tower at the MW Dish Elevations - Design Wind

Elevation ft	*Appurtenance*	*Gov. Load Comb.*	*Deflection in*	*Tilt °*	*Twist °*	*Radius of Curvature ft*
177	6' Microwave Dish w/ Radome	39	6.482	0.2995	0.0566	839376.000

APPENDIX A

TNXTOWER OUTPUT

Section	Legs	Leg Grade	Diagonals	Diagonal Grade	Top Girts	Face Width (ft)	# Panels @ (ft)	Weight (K)
T1	P2.5x0.203	A572-50	L1 3/4x1 3/4x3/16	A36	L2 1/2x2 1/2x3/16	8.56	4 @ 5	1.0
T2	P2.5x.276		L2x2x1/8		N.A.			0.8
T3	P3x0.216		L2 1/2x2 1/2x3/16			10.6	9 @ 6.66667	1.3
T4	P4x0.337		L2 1/2x2 1/2x1/4			12.68		2.1
T5	P5x0.258		L3x3x3/8			14.77	10 @ 10	2.6
T6	P5x0.375		L3 1/2x3 1/2x1/4			16.77		2.8
T7			L3 1/2x3 1/2x3/8			18.77		3.7
T8	P6x0.432		L4x4x3/8			20.86		4.8
T9						22.86		5.0
						24.86		24.0



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
2" Dia 20' Omni	180	2'x2" Mount Pipe	130
2" Dia 15' Omni	180	2'x2" Mount Pipe	130
5'x4" Mount Pipe	180	2'x2" Mount Pipe	130
BA40-41-DIN (4 diploes (2 bays) 11.5' dipole)	180	Sector Mount [SM 405-3]	130
5'x2" Mount Pipe	180	P65-16-XLH-RR w/ Mount Pipe	130
8' HSS4x4x3/8 Horizontal Mount	177	(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	120
6'x2" Horizontal Pipe	177	(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	120
6'x4" Mount Pipe	177	(2) BXA-171063-12CF-EDIN-X w/ Mount Pipe	120
6' Microwave Dish w/ Radome	177	(2) BXA-171063-12CF-EDIN-X w/ Mount Pipe	120
2'x2" Mount Pipe	174	(2) BXA-171063-12CF-EDIN-X w/ Mount Pipe	120
12' Dipole	174	RRH2X40-AWS	120
ANT220F6	165	RRH2X40-AWS	120
USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]	165	RRH2X40-AWS	120
		RRH2x40 700	120
ANT220F6	165	RRH2x40 700	120
2" Dia 5' Omni	157	RRH2x40 700	120
18"x18"x6" Junction Box	157	(2) DB-T1-6Z-8AB-0Z	120
Side Arm Mount [SO 305-1]	157	Sector Mount [SM 502-3]	120
2" Dia 5' Omni	157	Pipe Mount [PM 601-3]	120
LNX-6512DS-T4M_TIA w/ Mount Pipe	145	(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	120
LNX-6512DS-T4M_TIA w/ Mount Pipe	145	P40-16-XLPP-RR w/ Mount Pipe	88
AIR 21 B2A/B4P w/ Mount Pipe	145	APXVSPP18-C-A20_TIA w/ Mount Pipe	88
AIR 21 B2A/B4P w/ Mount Pipe	145	800MHZ RRH	88
AIR 21 B2A/B4P w/ Mount Pipe	145	800MHZ RRH	88
ATM1900D-1A20	145	800MHZ RRH	88
ATM1900D-1A20	145	1900MHz RRH	88
ATM1900D-1A20	145	1900MHz RRH	88
5'x4" Horizontal Mount Pipe	145	1900MHz RRH	88
5'x4" Horizontal Mount Pipe	145	Sector Mount [SM 502-3]	88
5'x4" Horizontal Mount Pipe	145	APXVSPP18-C-A20_TIA w/ Mount Pipe	88
LNX-6512DS-T4M_TIA w/ Mount Pipe	145	3'x2" Horizontal Pipe	56
Side Arm Mount [SO 203-1]	133	GPS_A	56
BA40-41-DIN (4 diploes (2 bays) 11.5' dipole)	133	L3 1/2x3 1/2x1/4	55
P65-16-XLH-RR w/ Mount Pipe	130	L3 1/2x3 1/2x1/4	55
P65-16-XLH-RR w/ Mount Pipe	130	L3 1/2x3 1/2x1/4	55
800 10121_TIA w/ Mount Pipe	130	L3 1/2x3 1/2x1/4	45
800 10121_TIA w/ Mount Pipe	130	L3 1/2x3 1/2x1/4	45
800 10121_TIA w/ Mount Pipe	130	L3 1/2x3 1/2x1/4	45
(2) LGP21401 : TMA	130	L4x4x1/4	15
(2) LGP21401 : TMA	130	L4x4x1/4	15
(2) LGP21401 : TMA	130	L4x4x1/4	15
RRUS 11	130	L4x4x1/4	5
RRUS 11	130	L4x4x1/4	5
RRUS 11	130	L4x4x1/4	5
DC6-48-60-18-8F	130		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for Exposure B to the TIA-222-H Standard.
2. Tower designed for a 130 mph basic wind in accordance with the TIA-222-H Standard.
3. Tower is also designed for a 50 mph basic wind with 1.50 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 96.3%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 211 K
SHEAR: 28 K

UPLIFT: -171 K
SHEAR: 24 K

AXIAL 143 K
SHEAR 13 K
MOMENT 1296 kip-ft
TORQUE 11 kip-ft
50 mph WIND - 1.5000 in ICE

AXIAL 51 K
SHEAR 46 K
MOMENT 4181 kip-ft
TORQUE 36 kip-ft
REACTIONS - 130 mph WIND

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Project: 403093 (NewtownAWC)	
Client: Eversource	Drawn by: Josh Riley	App'd:
Code: TIA-222-H	Date: 03/03/20	Scale: NTS
Path: C:\Users\l68982\Documentum\Checkout\ES-06 NewtownAWC Structural Analysis.eri		Dwg No. E-1

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 180.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 8.56 ft at the top and 24.86 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

1) Tower base elevation above sea level: 457.00 ft.
2) Basic wind speed of 130 mph.
3) Risk Category III.
4) Exposure Category B.
5) Simplified Topographic Factor Procedure for wind speed-up calculations is used.
6) Topographic Category: 1.
7) Crest Height: 0.00 ft.
8) Nominal ice thickness of 1.5000 in.
9) Ice thickness is considered to increase with height.
10) Ice density of 56 pcf.
11) A wind speed of 50 mph is used in combination with ice.
12) Temperature drop of 50 °F.
13) Deflections calculated using a wind speed of 60 mph.
14) Pressures are calculated at each section.
15) Stress ratio used in tower member design is 1.05.
16) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

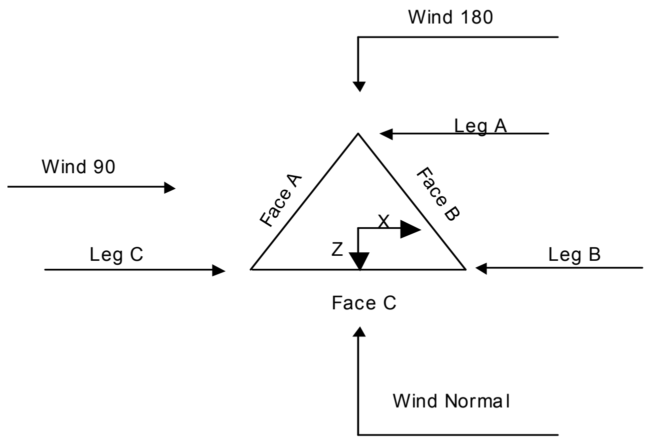
Consider Moments - Legs
Consider Moments - Horizontals
Consider Moments - Diagonals
Use Moment Magnification
Use Code Stress Ratios
√ Use Code Safety Factors - Guys
Escalate Ice
Always Use Max Kz
Use Special Wind Profile
√ Include Bolts In Member Capacity
Leg Bolts Are At Top Of Section
√ Secondary Horizontal 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	180.00-160.00			8.56	1	20.00
T2	160.00-140.00			8.56	1	20.00
T3	140.00-120.00			10.60	1	20.00
T4	120.00-100.00			12.68	1	20.00
T5	100.00-80.00			14.77	1	20.00
T6	80.00-60.00			16.77	1	20.00
T7	60.00-40.00			18.77	1	20.00
T8	40.00-20.00			20.86	1	20.00
T9	20.00-0.00			22.86	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	*Tower Elevation* *ft*	*Diagonal Spacing* *ft*	*Bracing Type*	*Has K Brace End Panels*	*Has Horizontals*	*Top Girt Offset* *in*	*Bottom Girt Offset* *in*
T1	180.00-160.00	5.00	X Brace	No	No	0.0000	0.0000
T2	160.00-140.00	6.67	X Brace	No	No	0.0000	0.0000
T3	140.00-120.00	6.67	X Brace	No	No	0.0000	0.0000
T4	120.00-100.00	6.67	X Brace	No	No	0.0000	0.0000
T5	100.00-80.00	10.00	X Brace	No	No	0.0000	0.0000
T6	80.00-60.00	10.00	X Brace	No	No	0.0000	0.0000
T7	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T8	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T9	20.00-0.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Type*	*Leg Size*	*Leg Grade*	*Diagonal Type*	*Diagonal Size*	*Diagonal Grade*
T1 180.00-160.00	Pipe	P2.5x0.203	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T2 160.00-140.00	Pipe	P2.5x.276	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T3 140.00-120.00	Pipe	P3x0.216	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T4 120.00-100.00	Pipe	P4x0.337	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x1/4	A36 (36 ksi)
T5 100.00-80.00	Pipe	P5x0.258	A572-50 (50 ksi)	Equal Angle	L3x3x3/8	A36 (36 ksi)
T6 80.00-60.00	Pipe	P5x0.375	A572-50 (50 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)
T7 60.00-40.00	Pipe	P5x0.375	A572-50 (50 ksi)	Equal Angle	L3 1/2x3 1/2x3/8	A36 (36 ksi)
T8 40.00-20.00	Pipe	P6x0.432	A572-50 (50 ksi)	Equal Angle	L4x4x3/8	A36 (36 ksi)
T9 20.00-0.00	Pipe	P6x0.432	A572-50 (50 ksi)	Equal Angle	L4x4x3/8	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Top Girt Type*	*Top Girt Size*	*Top Girt Grade*	*Bottom Girt Type*	*Bottom Girt Size*	*Bottom Girt Grade*
T1 180.00-160.00	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)	Equal Angle		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 180.00-160.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T2 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T3 140.00-120.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T4 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T5 100.00-80.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T6 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T7 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T8 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000
T9 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 180.00-160.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 160.00-140.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 140.00-120.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 120.00-100.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 100.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 40.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T9 20.00-0.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 180.00-160.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 160.00-140.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 140.00-120.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 120.00-100.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T8 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T9 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 180.00-160.00	Flange	0.6250 A325N	4	0.5000 A325N	1	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 160.00-140.00	Flange	0.7500 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 140.00-120.00	Flange	0.8750 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 120.00-100.00	Flange	1.0000 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 100.00-80.00	Flange	1.0000 A325N	4	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 80.00-60.00	Flange	1.0000 A325N	4	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T7 60.00-40.00	Flange	1.0000 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T8 40.00-20.00	Flange	1.0000 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T9 20.00-0.00	Flange	1.0000 A325N	0	0.8750 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
Feedline Ladder (Af)	B	No	No	Af (CaAa)	180.00 - 15.00	0.0000	-0.45	1	1	2.5000	2.5000		8.40
LDF5-50A(7/8)	B	No	No	Ar (CaAa)	157.00 - 0.00	0.0000	-0.46	3	3	0.5000	1.0300		0.33
LDF5-50A(7/8)	B	No	No	Ar (CaAa)	180.00 - 157.00	0.0000	-0.46	1	1	0.5000	1.0300		0.33
EW63(ELLIPTICAL)	B	No	No	Ar (CaAa)	177.00 - 0.00	0.0000	-0.43	1	1	0.5000	2.0100		0.51
LDF4-50A(1/2)	B	No	No	Ar (CaAa)	174.00 - 0.00	0.0000	-0.45	2	2	0.5000	0.6250		0.15
LDF4-50A(1/2)	B	No	No	Ar (CaAa)	180.00 - 174.00	0.0000	-0.45	1	1	0.5000	0.6250		0.15
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	133.00 - 0.00	0.0000	0.5	2	2	0.5000	1.0300		0.33
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	180.00 - 133.00	0.0000	0.5	1	1	0.5000	1.0300		0.33
*													
Feedline Ladder (Af)	A	No	No	Af (CaAa)	145.00 - 10.00	0.0000	0.45	1	1	1.5000	1.5000		8.40
LDF7-50A(1-5/8)	A	No	No	Ar (CaAa)	145.00 - 0.00	0.0000	0.45	12	6	0.5000	1.9800		0.82
*													
Feedline Ladder (Af)	C	No	No	Af (CaAa)	130.00 - 0.00	0.0000	0	1	1	3.0000	3.0000		8.40
LDF7-50A(1-5/8)	C	No	No	Ar (CaAa)	130.00 - 0.00	0.0000	0	6	3	0.5000	1.9800		0.82
3" Flexible Conduit	C	No	No	Ar (CaAa)	130.00 - 0.00	0.0000	0.03	1	1	3.0000	3.0000		0.30
MLC Hybrid 6Power/12Fiber(1 1/2)	C	No	No	Ar (CaAa)	130.00 - 0.00	0.0000	0.03	2	2	0.5000	1.5000		0.98
*													
Feedline Ladder (Af)	A	No	No	Af (CaAa)	107.00 - 0.00	0.0000	-0.45	1	1	3.0000	3.0000		8.40

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*
LDF7-50A(1-5/8) *	A	No	No	Ar (CaAa)	120.00 - 0.00	0.0000	-0.45	2	2	0.5000	1.9800		0.82
Feedline Ladder (Af)	C	No	No	Af (CaAa)	95.00 - 0.00	0.0000	-0.45	1	1	3.0000	3.0000		8.40
MLE Hybrid 3Power/6Fiber RL 2(1-1/4) *	C	No	No	Ar (CaAa)	88.00 - 0.00	0.0000	-0.45	3	3	0.5000	1.2500		0.68
LDF4-50A(1/2) **	C	No	No	Ar (CaAa)	56.00 - 0.00	0.0000	-0.46	1	1	0.5000	0.6250		0.15
Proposed** LDF5-50A(7/8)	B	No	No	Ar (CaAa)	165.00 - 0.00	0.0000	-0.4	2	2	0.5000	1.0300		0.33

Feed Line/Linear Appurtenances Section Areas

Tower Section	*Tower Elevation ft*	*Face*	*A_R ft²*	*A_F ft²*	*C_AA_A In Face ft²*	*C_AA_A Out Face ft²*	*Weight K*
T1	180.00-160.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	16.965	0.000	0.19
		C	0.000	0.000	2.060	0.000	0.01
T2	160.00-140.00	A	0.000	0.000	13.130	0.000	0.09
		B	0.000	0.000	24.535	0.000	0.22
		C	0.000	0.000	2.060	0.000	0.01
T3	140.00-120.00	A	0.000	0.000	52.520	0.000	0.36
		B	0.000	0.000	25.153	0.000	0.22
		C	0.000	0.000	26.279	0.000	0.17
T4	120.00-100.00	A	0.000	0.000	63.940	0.000	0.46
		B	0.000	0.000	25.153	0.000	0.22
		C	0.000	0.000	49.880	0.000	0.32
T5	100.00-80.00	A	0.000	0.000	70.440	0.000	0.57
		B	0.000	0.000	25.153	0.000	0.22
		C	0.000	0.000	60.380	0.000	0.47
T6	80.00-60.00	A	0.000	0.000	70.440	0.000	0.57
		B	0.000	0.000	25.153	0.000	0.22
		C	0.000	0.000	67.380	0.000	0.53
T7	60.00-40.00	A	0.000	0.000	70.440	0.000	0.57
		B	0.000	0.000	25.153	0.000	0.22
		C	0.000	0.000	68.380	0.000	0.54
T8	40.00-20.00	A	0.000	0.000	70.440	0.000	0.57
		B	0.000	0.000	25.153	0.000	0.22
		C	0.000	0.000	68.630	0.000	0.54
T9	20.00-0.00	A	0.000	0.000	67.940	0.000	0.48
		B	0.000	0.000	18.903	0.000	0.09
		C	0.000	0.000	68.630	0.000	0.54

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	*Tower Elevation ft*	*Face or Leg*	*Ice Thickness in*	*A_R ft²*	*A_F ft²*	*C_AA_A In Face ft²*	*C_AA_A Out Face ft²*	*Weight K*
T1	180.00-160.00	A	2.032	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	57.630	0.000	1.00
		C		0.000	0.000	10.189	0.000	0.16
T2	160.00-140.00	A	2.007	0.000	0.000	15.915	0.000	0.36
		B		0.000	0.000	89.419	0.000	1.30
		C		0.000	0.000	10.088	0.000	0.16

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
T3	140.00-120.00	A	1.978	0.000	0.000	63.355	0.000	1.43
		B		0.000	0.000	90.661	0.000	1.29
		C		0.000	0.000	61.502	0.000	0.99
T4	120.00-100.00	A	1.946	0.000	0.000	94.753	0.000	1.88
		B		0.000	0.000	89.713	0.000	1.27
		C		0.000	0.000	108.916	0.000	1.78
T5	100.00-80.00	A	1.907	0.000	0.000	105.477	0.000	2.14
		B		0.000	0.000	88.595	0.000	1.24
		C		0.000	0.000	130.965	0.000	2.21
T6	80.00-60.00	A	1.860	0.000	0.000	104.456	0.000	2.10
		B		0.000	0.000	87.227	0.000	1.20
		C		0.000	0.000	148.411	0.000	2.44
T7	60.00-40.00	A	1.798	0.000	0.000	103.128	0.000	2.04
		B		0.000	0.000	85.449	0.000	1.15
		C		0.000	0.000	152.714	0.000	2.45
T8	40.00-20.00	A	1.709	0.000	0.000	101.198	0.000	1.97
		B		0.000	0.000	82.864	0.000	1.09
		C		0.000	0.000	150.479	0.000	2.35
T9	20.00-0.00	A	1.531	0.000	0.000	91.809	0.000	1.66
		B		0.000	0.000	66.894	0.000	0.70
		C		0.000	0.000	142.699	0.000	2.12

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	180.00-160.00	-0.4878	-7.7217	-1.5102	-11.7519
T2	160.00-140.00	-0.5254	-17.1075	-1.4202	-20.8435
T3	140.00-120.00	-1.5798	-19.3685	-2.6834	-21.8040
T4	120.00-100.00	-5.0983	-12.9621	-7.1874	-14.6071
T5	100.00-80.00	-4.0856	-12.4519	-5.7148	-12.3438
T6	80.00-60.00	-1.8741	-11.7443	-2.7117	-11.4486
T7	60.00-40.00	-1.5875	-12.2430	-1.4102	-11.2949
T8	40.00-20.00	-1.4642	-12.1072	-1.0792	-11.4611
T9	20.00-0.00	-1.6275	-9.6518	-1.2253	-7.7627

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	Feedline Ladder (Af)	160.00 - 180.00	0.6000	0.6000
T1	3	LDF5-50A(7/8)	160.00 - 180.00	0.6000	0.6000
T1	10	EW63(ELLIPTICAL)	160.00 - 177.00	0.6000	0.6000
T1	11	LDF4-50A(1/2)	160.00 - 174.00	0.6000	0.6000
T1	12	LDF4-50A(1/2)	174.00 - 180.00	0.6000	0.6000
T1	14	LDF5-50A(7/8)	160.00 - 180.00	0.6000	0.6000
T1	32	LDF5-50A(7/8)	160.00 - 165.00	0.6000	0.6000
T2	1	Feedline Ladder (Af)	140.00 - 160.00	0.6000	0.6000

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	K_a *No Ice*	K_a *Ice*
T2	2	LDF5-50A(7/8)	140.00 - 157.00	0.6000	0.6000
T2	3	LDF5-50A(7/8)	157.00 - 160.00	0.6000	0.6000
T2	10	EW63(ELLIPTICAL)	140.00 - 160.00	0.6000	0.6000
T2	11	LDF4-50A(1/2)	140.00 - 160.00	0.6000	0.6000
T2	14	LDF5-50A(7/8)	140.00 - 160.00	0.6000	0.6000
T2	16	Feedline Ladder (Af)	140.00 - 145.00	0.6000	0.6000
T2	17	LDF7-50A(1-5/8)	140.00 - 145.00	0.6000	0.6000
T2	32	LDF5-50A(7/8)	140.00 - 160.00	0.6000	0.6000
T3	1	Feedline Ladder (Af)	120.00 - 140.00	0.6000	0.6000
T3	2	LDF5-50A(7/8)	120.00 - 140.00	0.6000	0.6000
T3	10	EW63(ELLIPTICAL)	120.00 - 140.00	0.6000	0.6000
T3	11	LDF4-50A(1/2)	120.00 - 140.00	0.6000	0.6000
T3	13	LDF5-50A(7/8)	120.00 - 133.00	0.6000	0.6000
T3	14	LDF5-50A(7/8)	133.00 - 140.00	0.6000	0.6000
T3	16	Feedline Ladder (Af)	120.00 - 140.00	0.6000	0.6000
T3	17	LDF7-50A(1-5/8)	120.00 - 140.00	0.6000	0.6000
T3	19	Feedline Ladder (Af)	120.00 - 130.00	0.6000	0.6000
T3	20	LDF7-50A(1-5/8)	120.00 - 130.00	0.6000	0.6000
T3	21	3" Flexible Conduit	120.00 - 130.00	1.0000	0.6000
T3	22	MLC Hybrid 6Power/12Fiber(1 1/2)	120.00 - 130.00	0.6000	0.6000
T3	32	LDF5-50A(7/8)	120.00 - 140.00	0.6000	0.6000
T4	1	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T4	2	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.6000
T4	10	EW63(ELLIPTICAL)	100.00 - 120.00	0.6000	0.6000
T4	11	LDF4-50A(1/2)	100.00 - 120.00	0.6000	0.6000
T4	13	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.6000
T4	16	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T4	17	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.6000
T4	19	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T4	20	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.6000
T4	21	3" Flexible Conduit	100.00 - 120.00	1.0000	0.6000
T4	22	MLC Hybrid 6Power/12Fiber(1 1/2)	100.00 - 120.00	0.6000	0.6000
T4	24	Feedline Ladder (Af)	100.00 - 107.00	0.6000	0.6000
T4	25	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T4	32	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.6000
T5	1	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T5	2	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T5	10	EW63(ELLIPTICAL)	80.00 - 100.00	0.6000	0.6000
T5	11	LDF4-50A(1/2)	80.00 - 100.00	0.6000	0.6000
T5	13	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T5	16	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T5	17	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.6000
T5	19	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T5	20	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.6000
T5	21	3" Flexible Conduit	80.00 - 100.00	0.6000	0.6000
T5	22	MLC Hybrid 6Power/12Fiber(1 1/2)	80.00 - 100.00	0.6000	0.6000
T5	24	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T5	25	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.6000
T5	27	Feedline Ladder (Af)	80.00 - 95.00	0.6000	0.6000
T5	28	MLE Hybrid 3Power/6Fiber RL 2(1-1/4)	80.00 - 88.00	0.6000	0.6000
T5	32	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T6	1	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	2	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T6	10	EW63(ELLIPTICAL)	60.00 - 80.00	0.6000	0.6000
T6	11	LDF4-50A(1/2)	60.00 - 80.00	0.6000	0.6000
T6	13	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T6	16	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	17	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.6000
T6	19	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	20	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.6000
T6	21	3" Flexible Conduit	60.00 - 80.00	0.6000	0.6000
T6	22	MLC Hybrid 6Power/12Fiber(1 1/2)	60.00 - 80.00	0.6000	0.6000
T6	24	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	25	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.6000
T6	27	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	28	MLE Hybrid 3Power/6Fiber RL 2(1-1/4)	60.00 - 80.00	0.6000	0.6000
T6	32	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T7	1	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T7	2	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T7	10	EW63(ELLIPTICAL)	40.00 - 60.00	0.6000	0.6000
T7	11	LDF4-50A(1/2)	40.00 - 60.00	0.6000	0.6000
T7	13	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T7	16	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T7	17	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T7	19	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T7	20	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T7	21	3" Flexible Conduit	40.00 - 60.00	0.6000	0.6000
T7	22	MLC Hybrid 6Power/12Fiber(1 1/2)	40.00 - 60.00	0.6000	0.6000
T7	24	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T7	25	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T7	27	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T7	28	MLE Hybrid 3Power/6Fiber RL 2(1-1/4)	40.00 - 60.00	0.6000	0.6000
T7	30	LDF4-50A(1/2)	40.00 - 56.00	0.6000	0.6000
T7	32	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T8	1	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	2	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	10	EW63(ELLIPTICAL)	20.00 - 40.00	0.6000	0.6000
T8	11	LDF4-50A(1/2)	20.00 - 40.00	0.6000	0.6000
T8	13	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	16	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	17	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T8	19	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	20	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T8	21	3" Flexible Conduit	20.00 - 40.00	0.6000	0.6000
T8	22	MLC Hybrid 6Power/12Fiber(1 1/2)	20.00 - 40.00	0.6000	0.6000
T8	24	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	25	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T8	27	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	28	MLE Hybrid 3Power/6Fiber RL 2(1-1/4)	20.00 - 40.00	0.6000	0.6000
T8	30	LDF4-50A(1/2)	20.00 - 40.00	0.6000	0.6000
T8	32	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T9	1	Feedline Ladder (Af)	15.00 - 20.00	0.6000	0.6000
T9	2	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T9	10	EW63(ELLIPTICAL)	0.00 - 20.00	0.6000	0.6000
T9	11	LDF4-50A(1/2)	0.00 - 20.00	0.6000	0.6000
T9	13	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	16	Feedline Ladder (Af)	10.00 - 20.00	0.6000	0.6000
T9	17	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T9	19	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T9	20	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T9	21	3" Flexible Conduit	0.00 - 20.00	0.6000	0.6000
T9	22	MLC Hybrid 6Power/12Fiber(1 1/2)	0.00 - 20.00	0.6000	0.6000
T9	24	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T9	25	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T9	27	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T9	28	MLE Hybrid 3Power/6Fiber RL 2(1-1/4)	0.00 - 20.00	0.6000	0.6000
T9	30	LDF4-50A(1/2)	0.00 - 20.00	0.6000	0.6000
T9	32	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert (ft, ft, ft)	Azimuth Adjustment (°)	Placement (ft)		C_AA_A Front (ft^2)	C_AA_A Side (ft^2)	Weight (K)
180									
2" Dia 20' Omni	A	From Leg	0.00	0.0000	180.00	No Ice	4.00	4.00	0.02
			0.00			1/2"	6.03	6.03	0.05
			9.00			Ice	8.07	8.07	0.10
						1" Ice	12.20	12.20	0.22
						2" Ice			
2" Dia 15' Omni	B	From Leg	0.00	0.0000	180.00	No Ice	3.00	3.00	0.02
			0.00			1/2"	4.53	4.53	0.04
			10.50			Ice	6.07	6.07	0.08
						1" Ice	9.20	9.20	0.17
						2" Ice			
5'x4" Mount Pipe	B	From Leg	0.00	0.0000	180.00	No Ice	1.45	1.45	0.05
			0.00			1/2"	2.08	2.08	0.07
			2.50			Ice	2.40	2.40	0.09
						1" Ice	3.07	3.07	0.14
						2" Ice			
BA40-41-DIN (4 diploes (2 bays) 11.5' dipole)	C	From Leg	0.00	0.0000	180.00	No Ice	5.40	5.40	0.03
			0.00			1/2"	9.24	9.24	0.04
			12.50			Ice	13.08	13.08	0.05
						1" Ice	20.76	20.76	0.07
						2" Ice			
5'x2" Mount Pipe	C	From Leg	0.00	0.0000	180.00	No Ice	1.19	1.19	0.02
			0.00			1/2"	1.50	1.50	0.03
			0.00			Ice	1.81	1.81	0.04
						1" Ice	2.46	2.46	0.08
						2" Ice			
177									
8' HSS4x4x3/8 Horizontal Mount	C	From Leg	0.00	0.0000	177.00	No Ice	2.67	0.04	0.17
			0.00			1/2"	3.37	0.59	0.22
			0.00			Ice	4.07	1.13	0.26
						1" Ice	5.47	2.23	0.35
						2" Ice			
6'x2" Horizontal Pipe	C	From Leg	0.00	0.0000	177.00	No Ice	1.43	0.01	0.02
			0.00			1/2"	1.92	0.04	0.03
			0.00			Ice	2.29	0.07	0.05

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						1" Ice	3.06	0.13	0.09
						2" Ice			
6'x4" Mount Pipe	C	From Leg	0.00	0.0000	177.00	No Ice	1.81	1.81	0.06
			0.00			1/2"	2.62	2.62	0.08
			0.00			Ice	3.00	3.00	0.11
						1" Ice	3.78	3.78	0.17
						2" Ice			
174									
12' Dipole	B	From Leg	0.00	0.0000	174.00	No Ice	2.20	2.20	0.02
			0.00			1/2"	4.62	4.62	0.02
			2.00			Ice	7.04	7.04	0.03
						1" Ice	11.88	11.88	0.04
						2" Ice			
2'x2" Mount Pipe	B	From Leg	0.00	0.0000	174.00	No Ice	0.34	0.34	0.01
			0.00			1/2"	0.47	0.47	0.01
			0.00			Ice	0.61	0.61	0.02
						1" Ice	0.92	0.92	0.03
						2" Ice			
****									
ANT220F6	A	From Leg	4.00	0.0000	165.00	No Ice	3.92	3.92	0.04
			0.00			1/2"	5.38	5.38	0.06
			7.50			Ice	6.85	6.85	0.10
						1" Ice	9.84	9.84	0.21
						2" Ice			
ANT220F6	A	From Leg	4.00	0.0000	165.00	No Ice	3.92	3.92	0.04
			0.00			1/2"	5.38	5.38	0.06
			-7.50			Ice	6.85	6.85	0.10
						1" Ice	9.84	9.84	0.21
						2" Ice			
USF-4U w/ Tieback [4' SO 203-1 + Vert. Pipe Support]	A	From Leg	2.00	0.0000	165.00	No Ice	2.96	5.64	0.18
			0.00			1/2"	3.76	6.73	0.22
			0.00			Ice	4.63	7.91	0.28
						1" Ice	6.57	10.43	0.43
						2" Ice			
157									
2" Dia 5' Omni	A	From Leg	0.00	0.0000	157.00	No Ice	1.00	1.00	0.01
			0.00			1/2"	1.51	1.51	0.01
			4.00			Ice	2.03	2.03	0.02
						1" Ice	3.06	3.06	0.04
						2" Ice			
2" Dia 5' Omni	A	From Leg	0.00	0.0000	157.00	No Ice	1.00	1.00	0.01
			0.00			1/2"	1.51	1.51	0.01
			-4.00			Ice	2.03	2.03	0.02
						1" Ice	3.06	3.06	0.04
						2" Ice			
18"x18"x6" Junction Box	A	From Leg	0.00	0.0000	157.00	No Ice	3.33	1.03	0.06
			0.00			1/2"	3.56	1.17	0.08
			0.00			Ice	3.79	1.31	0.10
						1" Ice	4.25	1.59	0.15
						2" Ice			
Side Arm Mount [SO 305-1]	A	From Leg	0.00	0.0000	157.00	No Ice	0.94	1.41	0.03
			0.00			1/2"	1.48	2.17	0.04
			0.00			Ice	2.02	2.93	0.06
						1" Ice	3.10	4.45	0.08
						2" Ice			
145									
LNX-6512DS-T4M_TIA w/ Mount Pipe	A	From Leg	0.00	0.0000	145.00	No Ice	5.33	4.53	0.05
			0.00			1/2"	5.72	5.15	0.10
			1.00			Ice	6.12	5.77	0.15
						1" Ice	6.94	7.07	0.28
						2" Ice			
LNX-6512DS-T4M_TIA w/ Mount Pipe	B	From Leg	0.00	0.0000	145.00	No Ice	5.33	4.53	0.05
			0.00			1/2"	5.72	5.15	0.10
			1.00			Ice	6.12	5.77	0.15
						1" Ice	6.94	7.07	0.28

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*
						2" Ice			
LNX-6512DS-T4M_TIA w/ Mount Pipe	C	From Leg	0.00	0.0000	145.00	No Ice	5.33	4.53	0.05
			0.00			1/2"	5.72	5.15	0.10
			1.00			Ice	6.12	5.77	0.15
						1" Ice	6.94	7.07	0.28
						2" Ice			
AIR 21 B2A/B4P w/ Mount Pipe	A	From Leg	0.00	0.0000	145.00	No Ice	6.16	5.55	0.10
			0.00			1/2"	6.60	6.30	0.16
			0.00			Ice	7.03	7.00	0.22
						1" Ice	7.92	8.44	0.37
						2" Ice			
AIR 21 B2A/B4P w/ Mount Pipe	B	From Leg	0.00	0.0000	145.00	No Ice	6.16	5.55	0.10
			0.00			1/2"	6.60	6.30	0.16
			0.00			Ice	7.03	7.00	0.22
						1" Ice	7.92	8.44	0.37
						2" Ice			
AIR 21 B2A/B4P w/ Mount Pipe	C	From Leg	0.00	0.0000	145.00	No Ice	6.16	5.55	0.10
			0.00			1/2"	6.60	6.30	0.16
			0.00			Ice	7.03	7.00	0.22
						1" Ice	7.92	8.44	0.37
						2" Ice			
ATM1900D-1A20	A	From Leg	0.00	0.0000	145.00	No Ice	0.73	0.25	0.01
			0.00			1/2"	0.84	0.32	0.01
			0.00			Ice	0.96	0.40	0.02
						1" Ice	1.21	0.58	0.04
						2" Ice			
ATM1900D-1A20	B	From Leg	0.00	0.0000	145.00	No Ice	0.73	0.25	0.01
			0.00			1/2"	0.84	0.32	0.01
			0.00			Ice	0.96	0.40	0.02
						1" Ice	1.21	0.58	0.04
						2" Ice			
ATM1900D-1A20	C	From Leg	0.00	0.0000	145.00	No Ice	0.73	0.25	0.01
			0.00			1/2"	0.84	0.32	0.01
			0.00			Ice	0.96	0.40	0.02
						1" Ice	1.21	0.58	0.04
						2" Ice			
5'x4" Horizontal Mount Pipe	A	From Leg	0.00	0.0000	145.00	No Ice	1.33	0.16	0.05
			0.00			1/2"	1.69	0.21	0.15
			0.00			Ice	2.07	0.28	0.27
						1" Ice	2.84	0.43	0.51
						2" Ice			
5'x4" Horizontal Mount Pipe	B	From Leg	0.00	0.0000	145.00	No Ice	1.33	0.16	0.05
			0.00			1/2"	1.69	0.21	0.15
			0.00			Ice	2.07	0.28	0.27
						1" Ice	2.84	0.43	0.51
						2" Ice			
5'x4" Horizontal Mount Pipe	C	From Leg	0.00	0.0000	145.00	No Ice	1.33	0.16	0.05
			0.00			1/2"	1.69	0.21	0.15
			0.00			Ice	2.07	0.28	0.27
						1" Ice	2.84	0.43	0.51
						2" Ice			
133									
BA40-41-DIN (4 diploes (2 bays) 11.5' dipole)	C	From Leg	0.00	0.0000	133.00	No Ice	5.40	5.40	0.03
			0.00			1/2"	9.24	9.24	0.04
			5.00			Ice	13.08	13.08	0.05
						1" Ice	20.76	20.76	0.07
						2" Ice			
Side Arm Mount [SO 203-1]	C	From Leg	0.00	0.0000	133.00	No Ice	2.96	3.36	0.13
			0.00			1/2"	4.10	4.68	0.15
			0.00			Ice	5.24	6.00	0.18
						1" Ice	7.52	8.64	0.24
						2" Ice			
130									
P65-16-XLH-RR w/ Mount Pipe	A	From Leg	0.00	0.0000	130.00	No Ice	8.37	6.36	0.08
			0.00				8.93	7.54	0.14

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*
			0.00			1/2"	9.46	8.43	0.22
						Ice	10.53	10.24	0.39
						1" Ice			
						2" Ice			
P65-16-XLH-RR w/ Mount	B	From Leg	0.00	0.0000	130.00	No Ice	8.37	6.36	0.08
Pipe			0.00			1/2"	8.93	7.54	0.14
			0.00			Ice	9.46	8.43	0.22
						1" Ice	10.53	10.24	0.39
						2" Ice			
P65-16-XLH-RR w/ Mount	C	From Leg	0.00	0.0000	130.00	No Ice	8.37	6.36	0.08
Pipe			0.00			1/2"	8.93	7.54	0.14
			0.00			Ice	9.46	8.43	0.22
						1" Ice	10.53	10.24	0.39
						2" Ice			
800 10121_TIA w/ Mount	A	From Leg	0.00	0.0000	130.00	No Ice	5.40	4.61	0.07
Pipe			0.00			1/2"	5.82	5.36	0.12
			0.00			Ice	6.25	6.06	0.17
						1" Ice	7.12	7.49	0.30
						2" Ice			
800 10121_TIA w/ Mount	B	From Leg	0.00	0.0000	130.00	No Ice	5.40	4.61	0.07
Pipe			0.00			1/2"	5.82	5.36	0.12
			0.00			Ice	6.25	6.06	0.17
						1" Ice	7.12	7.49	0.30
						2" Ice			
800 10121_TIA w/ Mount	C	From Leg	0.00	0.0000	130.00	No Ice	5.40	4.61	0.07
Pipe			0.00			1/2"	5.82	5.36	0.12
			0.00			Ice	6.25	6.06	0.17
						1" Ice	7.12	7.49	0.30
						2" Ice			
(2) LGP21401 : TMA	A	From Leg	0.00	0.0000	130.00	No Ice	1.10	0.35	0.01
			0.00			1/2"	1.24	0.44	0.02
			0.00			Ice	1.38	0.54	0.03
						1" Ice	1.69	0.77	0.05
						2" Ice			
(2) LGP21401 : TMA	B	From Leg	0.00	0.0000	130.00	No Ice	1.10	0.35	0.01
			0.00			1/2"	1.24	0.44	0.02
			0.00			Ice	1.38	0.54	0.03
						1" Ice	1.69	0.77	0.05
						2" Ice			
(2) LGP21401 : TMA	C	From Leg	0.00	0.0000	130.00	No Ice	1.10	0.35	0.01
			0.00			1/2"	1.24	0.44	0.02
			0.00			Ice	1.38	0.54	0.03
						1" Ice	1.69	0.77	0.05
						2" Ice			
RRUS 11	A	From Leg	0.00	0.0000	130.00	No Ice	2.78	1.19	0.05
			0.00			1/2"	2.99	1.33	0.07
			2.00			Ice	3.21	1.49	0.10
						1" Ice	3.66	1.83	0.15
						2" Ice			
RRUS 11	B	From Leg	0.00	0.0000	130.00	No Ice	2.78	1.19	0.05
			0.00			1/2"	2.99	1.33	0.07
			2.00			Ice	3.21	1.49	0.10
						1" Ice	3.66	1.83	0.15
						2" Ice			
RRUS 11	C	From Leg	0.00	0.0000	130.00	No Ice	2.78	1.19	0.05
			0.00			1/2"	2.99	1.33	0.07
			2.00			Ice	3.21	1.49	0.10
						1" Ice	3.66	1.83	0.15
						2" Ice			
DC6-48-60-18-8F	C	From Leg	0.00	0.0000	130.00	No Ice	0.92	0.92	0.02
			0.00			1/2"	1.46	1.46	0.04
			1.00			Ice	1.64	1.64	0.06
						1" Ice	2.04	2.04	0.11
						2" Ice			
2'x2" Mount Pipe	A	From Leg	0.00	0.0000	130.00	No Ice	0.34	0.34	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*
			0.00			1/2"	0.47	0.47	0.01
			2.00			Ice	0.61	0.61	0.02
						1" Ice	0.92	0.92	0.03
						2" Ice			
2'x2" Mount Pipe	B	From Leg	0.00	0.0000	130.00	No Ice	0.34	0.34	0.01
			0.00			1/2"	0.47	0.47	0.01
			2.00			Ice	0.61	0.61	0.02
						1" Ice	0.92	0.92	0.03
						2" Ice			
2'x2" Mount Pipe	C	From Leg	0.00	0.0000	130.00	No Ice	0.34	0.34	0.01
			0.00			1/2"	0.47	0.47	0.01
			2.00			Ice	0.61	0.61	0.02
						1" Ice	0.92	0.92	0.03
						2" Ice			
Sector Mount [SM 405-3]	C	None		0.0000	130.00	No Ice	18.73	18.73	0.86
						1/2"	27.19	27.19	1.26
						Ice	35.65	35.65	1.66
						1" Ice	52.57	52.57	2.47
						2" Ice			
120									
(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	A	From Leg	0.00	0.0000	120.00	No Ice	7.40	5.39	0.06
			0.00			1/2"	8.14	6.10	0.11
			1.00			Ice	8.90	6.83	0.18
						1" Ice	10.46	8.34	0.34
						2" Ice			
(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	B	From Leg	0.00	0.0000	120.00	No Ice	7.40	5.39	0.06
			0.00			1/2"	8.14	6.10	0.11
			1.00			Ice	8.90	6.83	0.18
						1" Ice	10.46	8.34	0.34
						2" Ice			
(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	C	From Leg	0.00	0.0000	120.00	No Ice	7.40	5.39	0.06
			0.00			1/2"	8.14	6.10	0.11
			1.00			Ice	8.90	6.83	0.18
						1" Ice	10.46	8.34	0.34
						2" Ice			
(2) BXA-171063-12CF-EDIN-X w/ Mount Pipe	A	From Leg	0.00	0.0000	120.00	No Ice	5.04	5.30	0.04
			0.00			1/2"	5.59	6.47	0.08
			1.00			Ice	6.11	7.36	0.14
						1" Ice	7.18	9.16	0.27
						2" Ice			
(2) BXA-171063-12CF-EDIN-X w/ Mount Pipe	B	From Leg	0.00	0.0000	120.00	No Ice	5.04	5.30	0.04
			0.00			1/2"	5.59	6.47	0.08
			1.00			Ice	6.11	7.36	0.14
						1" Ice	7.18	9.16	0.27
						2" Ice			
(2) BXA-171063-12CF-EDIN-X w/ Mount Pipe	C	From Leg	0.00	0.0000	120.00	No Ice	5.04	5.30	0.04
			0.00			1/2"	5.59	6.47	0.08
			1.00			Ice	6.11	7.36	0.14
						1" Ice	7.18	9.16	0.27
						2" Ice			
RRH2X40-AWS	A	From Leg	0.00	0.0000	120.00	No Ice	2.16	1.42	0.04
			0.00			1/2"	2.36	1.59	0.06
			2.00			Ice	2.57	1.77	0.08
						1" Ice	3.00	2.14	0.13
						2" Ice			
RRH2X40-AWS	B	From Leg	0.00	0.0000	120.00	No Ice	2.16	1.42	0.04
			0.00			1/2"	2.36	1.59	0.06
			2.00			Ice	2.57	1.77	0.08
						1" Ice	3.00	2.14	0.13
						2" Ice			
RRH2X40-AWS	C	From Leg	0.00	0.0000	120.00	No Ice	2.16	1.42	0.04
			0.00			1/2"	2.36	1.59	0.06
			2.00			Ice	2.57	1.77	0.08
						1" Ice	3.00	2.14	0.13
						2" Ice			

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
RRH2x40 700	A	From Leg	0.00 0.00 2.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.96 2.14 2.32 2.70	1.03 1.17 1.31 1.62	0.05 0.07 0.09 0.13
RRH2x40 700	B	From Leg	0.00 0.00 2.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.96 2.14 2.32 2.70	1.03 1.17 1.31 1.62	0.05 0.07 0.09 0.13
RRH2x40 700	C	From Leg	0.00 0.00 2.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.96 2.14 2.32 2.70	1.03 1.17 1.31 1.62	0.05 0.07 0.09 0.13
(2) DB-T1-6Z-8AB-0Z	C	From Leg	0.00 0.00 3.00	0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.80 5.07 5.35 5.93	2.00 2.19 2.39 2.81	0.04 0.08 0.12 0.21
Sector Mount [SM 502-3]	C	None		0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice	33.02 47.36 61.70 90.38	33.02 47.36 61.70 90.38	1.67 2.22 2.77 3.88
Pipe Mount [PM 601-3]	C	None		0.0000	120.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.39 5.48 6.57 8.75	4.39 5.48 6.57 8.75	0.20 0.24 0.28 0.36
88									
APXVSPP18-C-A20_TIA w/ Mount Pipe	A	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.26 8.82 9.35 10.42	7.47 8.66 9.56 11.39	0.10 0.17 0.24 0.43
P40-16-XLPP-RR w/ Mount Pipe	B	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.24 8.70 9.16 10.09	4.83 5.57 6.27 7.67	0.08 0.15 0.22 0.38
APXVSPP18-C-A20_TIA w/ Mount Pipe	C	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.26 8.82 9.35 10.42	7.47 8.66 9.56 11.39	0.10 0.17 0.24 0.43
800MHZ RRH	A	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.13 2.32 2.51 2.92	1.77 1.95 2.13 2.51	0.05 0.07 0.10 0.16
800MHZ RRH	B	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.13 2.32 2.51 2.92	1.77 1.95 2.13 2.51	0.05 0.07 0.10 0.16
800MHZ RRH	C	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.13 2.32 2.51 2.92	1.77 1.95 2.13 2.51	0.05 0.07 0.10 0.16
1900MHz RRH	A	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice	2.49 2.70 2.91 3.35	3.26 3.48 3.72 4.21	0.04 0.08 0.11 0.19

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft* *ft* *ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		*C_AA_A Front* *ft²*	*C_AA_A Side* *ft²*	*Weight* *K*
						2" Ice			
1900MHz RRH	B	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.49 2.70 2.91 3.35	3.26 3.48 3.72 4.21	0.04 0.08 0.11 0.19
1900MHz RRH	C	From Leg	0.00 0.00 0.00	0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.49 2.70 2.91 3.35	3.26 3.48 3.72 4.21	0.04 0.08 0.11 0.19
Sector Mount [SM 502-3]	C	None		0.0000	88.00	No Ice 1/2" Ice 1" Ice 2" Ice	33.02 47.36 61.70 90.38	33.02 47.36 61.70 90.38	1.67 2.22 2.77 3.88
56									
GPS_A	B	From Leg	0.00 0.00 0.00	0.0000	56.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.26 0.32 0.39 0.56	0.26 0.32 0.39 0.56	0.00 0.00 0.01 0.02
3'x2" Horizontal Pipe	B	From Leg	0.00 0.00 0.00	0.0000	56.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.58 0.77 0.97 1.42	0.01 0.04 0.07 0.13	0.01 0.02 0.02 0.05
Ineffective Sec Hztl									
L3 1/2x3 1/2x1/4	A	From Face	0.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.93 7.65 9.38 12.83	0.00 0.00 0.00 0.00	0.12 0.18 0.24 0.37
L3 1/2x3 1/2x1/4	B	From Face	0.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.93 7.65 9.38 12.83	0.00 0.00 0.00 0.00	0.12 0.18 0.24 0.37
L3 1/2x3 1/2x1/4	C	From Face	0.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.93 7.65 9.38 12.83	0.00 0.00 0.00 0.00	0.12 0.18 0.24 0.37
*									
L3 1/2x3 1/2x1/4	A	From Face	0.00 0.00 0.00	0.0000	45.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.93 7.65 9.38 12.83	0.00 0.00 0.00 0.00	0.12 0.18 0.24 0.37
L3 1/2x3 1/2x1/4	B	From Face	0.00 0.00 0.00	0.0000	45.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.93 7.65 9.38 12.83	0.00 0.00 0.00 0.00	0.12 0.18 0.24 0.37
L3 1/2x3 1/2x1/4	C	From Face	0.00 0.00 0.00	0.0000	45.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.93 7.65 9.38 12.83	0.00 0.00 0.00 0.00	0.12 0.18 0.24 0.37
*									
L4x4x1/4	A	From Face	0.00 0.00 0.00	0.0000	15.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.17 10.18 12.19 16.22	0.00 0.00 0.00 0.00	0.16 0.25 0.33 0.50

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
L4x4x1/4	B	From Face	0.00 0.00 0.00	0.0000	15.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.17 10.18 12.19 16.22	0.00 0.00 0.00 0.00	0.16 0.25 0.33 0.50
L4x4x1/4	C	From Face	0.00 0.00 0.00	0.0000	15.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.17 10.18 12.19 16.22	0.00 0.00 0.00 0.00	0.16 0.25 0.33 0.50
*									
L4x4x1/4	A	From Face	0.00 0.00 0.00	0.0000	5.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.17 10.18 12.19 16.22	0.00 0.00 0.00 0.00	0.16 0.25 0.33 0.50
L4x4x1/4	B	From Face	0.00 0.00 0.00	0.0000	5.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.17 10.18 12.19 16.22	0.00 0.00 0.00 0.00	0.16 0.25 0.33 0.50
L4x4x1/4	C	From Face	0.00 0.00 0.00	0.0000	5.00	No Ice 1/2" Ice 1" Ice 2" Ice	8.17 10.18 12.19 16.22	0.00 0.00 0.00 0.00	0.16 0.25 0.33 0.50

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
6' Microwave Dish w/ Radome	C	Paraboloid w/Radome	From Leg	0.00 0.00 0.00	-35.6000		177.00	6.00	No Ice 1/2" Ice 1" Ice 2" Ice	28.27 29.07 29.86 31.44	0.25 0.40 0.55 0.85

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

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	180 - 160	Leg	Max Tension	7	5.59	-0.05	0.09
			Max. Compression	2	-7.40	-0.00	0.11
			Max. Mx	4	-1.01	0.35	0.18
			Max. My	3	-0.09	0.04	-0.49
			Max. Vy	20	0.44	0.03	-0.00
			Max. Vx	2	-0.41	0.03	0.29
		Diagonal	Max Tension	5	1.87	0.00	0.00
			Max. Compression	4	-1.91	0.00	0.00
			Max. Mx	38	0.13	0.04	-0.00
			Max. My	7	-0.80	0.00	0.00
			Max. Vy	38	-0.04	0.04	-0.00
			Max. Vx	7	-0.00	0.00	0.00
		Top Girt	Max Tension	11	0.07	0.00	0.00
			Max. Compression	37	-0.17	0.00	0.00
			Max. Mx	26	-0.12	-0.16	0.00
			Max. Vy	26	0.08	0.00	0.00
T2	160 - 140	Leg	Max Tension	7	15.40	-0.24	0.02
			Max. Compression	2	-18.95	0.09	0.00
			Max. Mx	14	13.32	0.27	0.00
			Max. My	20	-1.95	-0.01	0.31
			Max. Vy	14	-0.31	-0.24	0.00
			Max. Vx	21	-0.30	-0.00	-0.16
		Diagonal	Max Tension	5	2.58	0.00	0.00
			Max. Compression	4	-2.61	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	38	0.17	0.06	-0.01
			Max. My	29	-0.84	0.06	0.01
			Max. Vy	38	0.05	0.06	-0.01
			Max. Vx	29	-0.00	0.00	0.00
T3	140 - 120	Leg	Max Tension	7	28.70	-0.41	0.03
			Max. Compression	2	-35.86	0.04	0.00
			Max. Mx	14	20.90	0.79	-0.02
			Max. My	21	-2.40	-0.03	0.75
			Max. Vy	6	-0.47	-0.43	0.03
			Max. Vx	12	-0.49	-0.01	-0.25
		Diagonal	Max Tension	4	4.21	0.00	0.00
			Max. Compression	4	-4.25	0.00	0.00
			Max. Mx	38	0.44	0.10	-0.01
			Max. My	36	0.73	0.10	-0.01
			Max. Vy	38	0.07	0.10	0.01
			Max. Vx	36	0.00	0.00	0.00
T4	120 - 100	Leg	Max Tension	7	50.13	-0.18	0.02
			Max. Compression	2	-62.42	0.22	0.03
			Max. Mx	31	-28.94	0.23	0.00
			Max. My	20	-5.04	-0.03	-0.46
			Max. Vy	6	-1.25	0.01	0.04
			Max. Vx	8	1.12	0.02	-0.19
		Diagonal	Max Tension	4	5.87	0.00	0.00
			Max. Compression	4	-5.91	0.00	0.00
			Max. Mx	38	0.68	0.13	-0.02
			Max. My	29	-1.68	0.12	0.02
			Max. Vy	38	0.08	0.13	-0.02
			Max. Vx	29	-0.00	0.00	0.00
T5	100 - 80	Leg	Max Tension	7	70.79	-0.76	0.05
			Max. Compression	2	-87.60	0.56	0.02
			Max. Mx	22	68.19	-0.78	-0.05
			Max. My	9	-6.84	-0.05	0.82
			Max. Vy	22	-0.65	-0.78	-0.05
			Max. Vx	9	0.65	-0.05	0.82
		Diagonal	Max Tension	4	7.64	0.00	0.00
			Max. Compression	4	-7.77	0.00	0.00
			Max. Mx	27	2.09	0.24	-0.03
			Max. My	35	1.32	0.23	-0.03
			Max. Vy	37	0.12	0.24	0.03
			Max. Vx	35	0.01	0.00	0.00
T6	80 - 60	Leg	Max Tension	7	94.60	-0.27	0.02
			Max. Compression	2	-116.45	0.58	0.01
			Max. Mx	33	-2.01	-0.63	-0.01
			Max. My	20	-8.80	-0.01	-0.56
			Max. Vy	33	0.13	-0.63	-0.01
			Max. Vx	21	-0.14	-0.01	-0.56
		Diagonal	Max Tension	4	8.15	0.00	0.00
			Max. Compression	4	-8.31	0.00	0.00
			Max. Mx	37	1.34	0.27	-0.03
			Max. My	30	-1.74	0.25	0.04
			Max. Vy	37	0.13	0.27	0.03
			Max. Vx	30	-0.01	0.00	0.00
T7	60 - 40	Leg	Max Tension	23	118.42	-0.40	-0.03
			Max. Compression	2	-145.27	0.59	0.01
			Max. Mx	33	-0.71	-1.17	-0.00
			Max. My	9	-10.01	-0.06	0.58
			Max. Vy	33	0.22	-1.17	-0.00
			Max. Vx	9	0.15	-0.06	0.58
		Diagonal	Max Tension	4	8.62	0.00	0.00
			Max. Compression	4	-8.72	0.00	0.00
			Max. Mx	37	1.05	0.38	-0.05
			Max. My	36	2.29	0.35	-0.05
			Max. Vy	37	0.16	0.35	0.05
			Max. Vx	36	0.01	0.00	0.00
T8	40 - 20	Leg	Max Tension	23	142.15	-0.48	-0.03
			Max. Compression	2	-174.08	0.74	0.00
			Max. Mx	37	8.01	-2.42	-0.01
			Max. My	9	-11.87	-0.06	0.77
			Max. Vy	33	0.44	-2.41	-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. Vx	9	0.17	-0.06	0.77
		Diagonal	Max Tension	4	9.31	0.00	0.00
			Max. Compression	10	-9.64	0.00	0.00
			Max. Mx	37	0.68	0.52	-0.06
			Max. My	30	3.11	0.41	0.06
			Max. Vy	37	0.19	0.52	-0.06
			Max. Vx	30	-0.01	0.00	0.00
T9	20 - 0	Leg	Max Tension	23	165.42	-0.67	-0.03
			Max. Compression	10	-203.60	0.00	-0.00
			Max. Mx	37	11.68	-2.42	-0.01
			Max. My	9	-14.48	-0.08	1.28
			Max. Vy	33	-0.49	-2.41	-0.00
			Max. Vx	9	0.25	-0.08	1.28
		Diagonal	Max Tension	4	9.92	0.00	0.00
			Max. Compression	10	-10.58	0.00	0.00
			Max. Mx	37	-0.19	0.60	-0.06
			Max. My	36	4.84	0.39	-0.07
			Max. Vy	37	0.20	0.60	-0.06
			Max. Vx	36	0.01	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	18	207.04	23.27	-14.07
	Max. H_x	18	207.04	23.27	-14.07
	Max. H_z	7	-168.05	-19.54	11.91
	Min. Vert	7	-168.05	-19.54	11.91
	Min. H_x	7	-168.05	-19.54	11.91
	Min. H_z	18	207.04	23.27	-14.07
Leg B	Max. Vert	10	211.05	-24.05	-14.54
	Max. H_x	23	-171.09	20.21	12.29
	Max. H_z	23	-171.09	20.21	12.29
	Min. Vert	23	-171.09	20.21	12.29
	Min. H_x	10	211.05	-24.05	-14.54
	Min. H_z	10	211.05	-24.05	-14.54
Leg A	Max. Vert	2	210.22	-0.30	27.52
	Max. H_x	21	13.18	4.64	1.16
	Max. H_z	2	210.22	-0.30	27.52
	Min. Vert	15	-164.84	0.28	-22.82
	Min. H_x	8	19.76	-4.68	1.72
	Min. H_z	15	-164.84	0.28	-22.82

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	42.66	-0.00	-0.00	-16.27	6.33	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	51.19	0.10	-44.95	-4158.57	-9.96	-12.42
0.9 Dead+1.0 Wind 0 deg - No Ice	38.39	0.10	-44.95	-4153.69	-11.86	-12.42
1.2 Dead+1.0 Wind 30 deg - No Ice	51.19	21.12	-36.32	-3403.07	-1969.23	-14.88
0.9 Dead+1.0 Wind 30 deg - No Ice	38.39	21.12	-36.32	-3398.19	-1971.13	-14.88
1.2 Dead+1.0 Wind 60 deg - No Ice	51.19	36.00	-20.78	-1967.29	-3361.06	-24.16

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
0.9 Dead+1.0 Wind 60 deg - No Ice	38.39	36.00	-20.78	-1962.41	-3362.96	-24.16
1.2 Dead+1.0 Wind 90 deg - No Ice	51.19	43.14	-0.22	-57.99	-3986.28	-35.87
0.9 Dead+1.0 Wind 90 deg - No Ice	38.39	43.14	-0.22	-53.11	-3988.18	-35.87
1.2 Dead+1.0 Wind 120 deg - No Ice	51.19	40.04	22.83	2041.47	-3643.95	-24.19
0.9 Dead+1.0 Wind 120 deg - No Ice	38.39	40.04	22.83	2046.35	-3645.85	-24.19
1.2 Dead+1.0 Wind 150 deg - No Ice	51.19	21.57	37.27	3381.02	-1961.90	1.14
0.9 Dead+1.0 Wind 150 deg - No Ice	38.39	21.57	37.27	3385.89	-1963.80	1.14
1.2 Dead+1.0 Wind 180 deg - No Ice	51.19	-0.10	41.56	3819.54	24.43	12.24
0.9 Dead+1.0 Wind 180 deg - No Ice	38.39	-0.10	41.56	3824.42	22.53	12.24
1.2 Dead+1.0 Wind 210 deg - No Ice	51.19	-21.04	36.15	3333.17	1970.42	14.03
0.9 Dead+1.0 Wind 210 deg - No Ice	38.39	-21.04	36.15	3338.05	1968.52	14.03
1.2 Dead+1.0 Wind 240 deg - No Ice	51.19	-38.46	22.19	2027.40	3552.39	23.09
0.9 Dead+1.0 Wind 240 deg - No Ice	38.39	-38.46	22.19	2032.28	3550.49	23.09
1.2 Dead+1.0 Wind 270 deg - No Ice	51.19	-42.92	0.04	-13.05	3963.89	34.81
0.9 Dead+1.0 Wind 270 deg - No Ice	38.39	-42.92	0.04	-8.17	3961.99	34.81
1.2 Dead+1.0 Wind 300 deg - No Ice	51.19	-37.24	-21.52	-1997.38	3423.01	23.54
0.9 Dead+1.0 Wind 300 deg - No Ice	38.39	-37.24	-21.52	-1992.50	3421.11	23.54
1.2 Dead+1.0 Wind 330 deg - No Ice	51.19	-21.64	-37.58	-3475.12	1988.49	-1.58
0.9 Dead+1.0 Wind 330 deg - No Ice	38.39	-21.64	-37.58	-3470.25	1986.59	-1.58
1.2 Dead+1.0 Ice+1.0 Temp	143.42	-0.00	-0.00	-79.62	29.90	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	143.42	0.02	-12.69	-1295.82	26.63	-3.99
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	143.42	6.20	-10.68	-1112.01	-571.24	-6.68
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	143.42	10.67	-6.15	-677.21	-1005.76	-9.97
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	143.42	12.48	-0.04	-86.30	-1173.85	-10.76
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	143.42	11.10	6.35	523.43	-1030.16	-6.25
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	143.42	6.22	10.75	947.56	-564.96	0.08
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	143.42	-0.02	12.25	1097.98	33.06	3.96
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	143.42	-6.19	10.65	947.75	628.76	6.54
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	143.42	-10.97	6.32	529.01	1085.38	9.80
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	143.42	-12.45	0.01	-78.14	1227.54	10.59
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	143.42	-10.74	-6.19	-674.24	1060.38	6.15
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	143.42	-6.23	-10.80	-1115.75	626.61	-0.16
Dead+Wind 0 deg - Service	42.66	0.02	-9.57	-897.96	2.59	-2.65
Dead+Wind 30 deg - Service	42.66	4.50	-7.74	-737.02	-414.77	-3.17
Dead+Wind 60 deg - Service	42.66	7.67	-4.43	-431.17	-711.25	-5.15
Dead+Wind 90 deg - Service	42.66	9.19	-0.05	-24.46	-844.44	-7.64
Dead+Wind 120 deg - Service	42.66	8.53	4.86	422.76	-771.52	-5.15

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+Wind 150 deg - Service	42.66	4.60	7.94	708.11	-413.21	0.24
Dead+Wind 180 deg - Service	42.66	-0.02	8.85	801.52	9.91	2.61
Dead+Wind 210 deg - Service	42.66	-4.48	7.70	697.92	424.44	2.99
Dead+Wind 240 deg - Service	42.66	-8.19	4.73	419.77	761.43	4.92
Dead+Wind 270 deg - Service	42.66	-9.14	0.01	-14.89	849.09	7.41
Dead+Wind 300 deg - Service	42.66	-7.93	-4.58	-437.58	733.87	5.02
Dead+Wind 330 deg - Service	42.66	-4.61	-8.01	-752.37	428.29	-0.34

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	-42.66	0.00	0.00	42.66	0.00	0.000%
2	0.10	-51.19	-44.95	-0.10	51.19	44.95	0.000%
3	0.10	-38.39	-44.95	-0.10	38.39	44.95	0.000%
4	21.12	-51.19	-36.32	-21.12	51.19	36.32	0.000%
5	21.12	-38.39	-36.32	-21.12	38.39	36.32	0.000%
6	36.00	-51.19	-20.78	-36.00	51.19	20.78	0.000%
7	36.00	-38.39	-20.78	-36.00	38.39	20.78	0.000%
8	43.14	-51.19	-0.22	-43.14	51.19	0.22	0.000%
9	43.14	-38.39	-0.22	-43.14	38.39	0.22	0.000%
10	40.04	-51.19	22.83	-40.04	51.19	-22.83	0.000%
11	40.04	-38.39	22.83	-40.04	38.39	-22.83	0.000%
12	21.57	-51.19	37.27	-21.57	51.19	-37.27	0.000%
13	21.57	-38.39	37.27	-21.57	38.39	-37.27	0.000%
14	-0.10	-51.19	41.56	0.10	51.19	-41.56	0.000%
15	-0.10	-38.39	41.56	0.10	38.39	-41.56	0.000%
16	-21.04	-51.19	36.15	21.04	51.19	-36.15	0.000%
17	-21.04	-38.39	36.15	21.04	38.39	-36.15	0.000%
18	-38.46	-51.19	22.19	38.46	51.19	-22.19	0.000%
19	-38.46	-38.39	22.19	38.46	38.39	-22.19	0.000%
20	-42.92	-51.19	0.04	42.92	51.19	-0.04	0.000%
21	-42.92	-38.39	0.04	42.92	38.39	-0.04	0.000%
22	-37.24	-51.19	-21.52	37.24	51.19	21.52	0.000%
23	-37.24	-38.39	-21.52	37.24	38.39	21.52	0.000%
24	-21.64	-51.19	-37.58	21.64	51.19	37.58	0.000%
25	-21.64	-38.39	-37.58	21.64	38.39	37.58	0.000%
26	0.00	-143.42	0.00	0.00	143.42	0.00	0.000%
27	0.02	-143.42	-12.69	-0.02	143.42	12.69	0.000%
28	6.20	-143.42	-10.68	-6.20	143.42	10.68	0.000%
29	10.67	-143.42	-6.15	-10.67	143.42	6.15	0.000%
30	12.48	-143.42	-0.04	-12.48	143.42	0.04	0.000%
31	11.10	-143.42	6.35	-11.10	143.42	-6.35	0.000%
32	6.22	-143.42	10.75	-6.22	143.42	-10.75	0.000%
33	-0.02	-143.42	12.25	0.02	143.42	-12.25	0.000%
34	-6.19	-143.42	10.65	6.19	143.42	-10.65	0.000%
35	-10.97	-143.42	6.32	10.97	143.42	-6.32	0.000%
36	-12.45	-143.42	0.01	12.45	143.42	-0.01	0.000%
37	-10.74	-143.42	-6.19	10.74	143.42	6.19	0.000%
38	-6.23	-143.42	-10.80	6.23	143.42	10.80	0.000%
39	0.02	-42.66	-9.57	-0.02	42.66	9.57	0.000%
40	4.50	-42.66	-7.74	-4.50	42.66	7.74	0.000%
41	7.67	-42.66	-4.43	-7.67	42.66	4.43	0.000%
42	9.19	-42.66	-0.05	-9.19	42.66	0.05	0.000%
43	8.53	-42.66	4.86	-8.53	42.66	-4.86	0.000%
44	4.60	-42.66	7.94	-4.60	42.66	-7.94	0.000%
45	-0.02	-42.66	8.85	0.02	42.66	-8.85	0.000%
46	-4.48	-42.66	7.70	4.48	42.66	-7.70	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
47	-8.19	-42.66	4.73	8.19	42.66	-4.73	0.000%
48	-9.14	-42.66	0.01	9.14	42.66	-0.01	0.000%
49	-7.93	-42.66	-4.58	7.93	42.66	4.58	0.000%
50	-4.61	-42.66	-8.01	4.61	42.66	8.01	0.000%

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 160	2.408	39	0.1092	0.0200
T2	160 - 140	1.948	39	0.1060	0.0188
T3	140 - 120	1.506	39	0.0968	0.0133
T4	120 - 100	1.118	39	0.0814	0.0098
T5	100 - 80	0.779	39	0.0698	0.0069
T6	80 - 60	0.506	39	0.0538	0.0054
T7	60 - 40	0.290	39	0.0405	0.0035
T8	40 - 20	0.138	39	0.0251	0.0022
T9	20 - 0	0.043	43	0.0130	0.0011

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	2" Dia 20' Omni	39	2.408	0.1092	0.0200	Inf
177.00	6' Microwave Dish w/ Radome	39	2.338	0.1089	0.0200	Inf
174.00	12' Dipole	39	2.269	0.1085	0.0199	Inf
165.00	ANT220F6	39	2.062	0.1071	0.0193	577387
157.00	2" Dia 5' Omni	39	1.879	0.1051	0.0182	249205
145.00	LNX-6512DS-T4M_TIA w/ Mount Pipe	39	1.612	0.0999	0.0147	87206
133.00	BA40-41-DIN (4 diploes (2 bays) 11.5' dipole)	39	1.364	0.0915	0.0118	82797
130.00	P65-16-XLH-RR w/ Mount Pipe	39	1.305	0.0891	0.0113	91054
120.00	(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	39	1.118	0.0814	0.0098	124568
88.00	APXVSPP18-C-A20_TIA w/ Mount Pipe	39	0.608	0.0603	0.0059	81196
56.00	GPS_A	39	0.254	0.0375	0.0031	69964
55.00	L3 1/2x3 1/2x1/4	39	0.246	0.0367	0.0031	70991
45.00	L3 1/2x3 1/2x1/4	39	0.170	0.0288	0.0025	83429
15.00	L4x4x1/4	43	0.029	0.0099	0.0008	100694
5.00	L4x4x1/4	43	0.008	0.0034	0.0003	302081

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 160	11.017	2	0.4958	0.0938
T2	160 - 140	8.931	2	0.4798	0.0881
T3	140 - 120	6.922	2	0.4403	0.0624
T4	120 - 100	5.151	2	0.3720	0.0461
T5	100 - 80	3.595	2	0.3201	0.0325
T6	80 - 60	2.347	11	0.2474	0.0253

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T7	60 - 40	1.350	11	0.1863	0.0163
T8	40 - 20	0.646	11	0.1159	0.0102
T9	20 - 0	0.205	11	0.0601	0.0051

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	2" Dia 20' Omni	2	11.017	0.4958	0.0938	515276
177.00	6' Microwave Dish w/ Radome	2	10.703	0.4939	0.0937	515276
174.00	12' Dipole	2	10.389	0.4920	0.0934	429399
165.00	ANT220F6	2	9.450	0.4851	0.0907	171760
157.00	2" Dia 5' Omni	2	8.621	0.4760	0.0854	61019
145.00	LNX-6512DS-T4M_TIA w/ Mount Pipe	2	7.406	0.4538	0.0691	19810
133.00	BA40-41-DIN (4 diploes (2 bays) 11.5' dipole)	2	6.275	0.4170	0.0553	18822
130.00	P65-16-XLH-RR w/ Mount Pipe	2	6.007	0.4062	0.0530	20767
120.00	(2) BXA-70063-6CF-EDIN-X w/ Mount Pipe	2	5.151	0.3720	0.0461	28708
88.00	APXVSPP18-C-A20_TIA w/ Mount Pipe	11	2.811	0.2770	0.0279	17886
56.00	GPS_A	11	1.185	0.1727	0.0148	15178
55.00	L3 1/2x3 1/2x1/4	11	1.146	0.1692	0.0144	15403
45.00	L3 1/2x3 1/2x1/4	11	0.796	0.1330	0.0115	18139
15.00	L4x4x1/4	11	0.138	0.0459	0.0038	21830
5.00	L4x4x1/4	11	0.040	0.0156	0.0013	65490

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	180	Leg	A325N	0.6250	4	1.40	20.34	0.069	1.05	Bolt Tension
		Diagonal	A325N	0.5000	1	1.87	6.20	0.302	1.05	Member Bearing
		Top Girt	A325N	0.5000	1	0.17	8.84	0.019	1.05	Bolt Shear
T2	160	Leg	A325N	0.7500	4	3.85	30.10	0.128	1.05	Bolt Tension
		Diagonal	A325N	0.5000	1	2.58	4.13	0.624	1.05	Member Bearing
T3	140	Leg	A325N	0.8750	4	7.17	41.56	0.173	1.05	Bolt Tension
		Diagonal	A325N	0.5000	1	4.21	6.20	0.678	1.05	Member Bearing
T4	120	Leg	A325N	1.0000	4	12.53	54.52	0.230	1.05	Bolt Tension
		Diagonal	A325N	0.5000	1	5.87	8.27	0.710	1.05	Member Bearing
T5	100	Leg	A325N	1.0000	4	17.70	54.52	0.325	1.05	Bolt Tension
		Diagonal	A325N	0.7500	1	7.64	13.39	0.571	1.05	Member Bearing
T6	80	Leg	A325N	1.0000	4	23.65	54.52	0.434	1.05	Bolt Tension
		Diagonal	A325N	0.7500	1	8.15	8.93	0.913	1.05	Member Bearing
T7	60	Leg	A325N	1.0000	6	19.74	54.52	0.362	1.05	Bolt Tension
		Diagonal	A325N	0.7500	1	8.62	13.39	0.644	1.05	Member Bearing
T8	40	Leg	A325N	1.0000	6	23.69	54.52	0.435	1.05	Bolt Tension
		Diagonal	A325N	0.7500	1	9.31	13.39	0.695	1.05	Member Bearing

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
T9	20	Diagonal	A325N	0.8750	1	9.92	9.81	1.011	1.05	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	P2.5x0.203	20.00	5.00	63.3 K=1.00	1.7040	-7.40	57.19	0.129 [1]
T2	160 - 140	P2.5x.276	20.03	6.68	86.7 K=1.00	2.2535	-18.95	58.51	0.324 [1]
T3	140 - 120	P3x0.216	20.04	6.68	68.9 K=1.00	2.2285	-35.86	70.89	0.506 [1]
T4	120 - 100	P4x0.337	20.04	6.68	54.3 K=1.00	4.4074	-62.42	159.90	0.390 [1]
T5	100 - 80	P5x0.258	20.03	10.02	64.0 K=1.00	4.2999	-87.60	143.40	0.611 [1]
T6	80 - 60	P5x0.375	20.03	10.02	65.4 K=1.00	6.1114	-116.45	201.22	0.579 [1]
T7	60 - 40	P5x0.375	20.04	10.02	65.4 K=1.00	6.1114	-145.27	201.20	0.722 [1]
T8	40 - 20	P6x0.432	20.03	10.02	54.8 K=1.00	8.4049	-174.08	303.75	0.573 [1]
T9	20 - 0	P6x0.432	20.03	10.02	54.8 K=1.00	8.4049	-203.60	303.75	0.670 [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	180 - 160	L1 3/4x1 3/4x3/16	9.91	4.71	164.7 K=1.00	0.6211	-1.91	6.55	0.291 [1]
T2	160 - 140	L2x2x1/8	12.24	6.07	183.4 K=1.00	0.4844	-2.61	4.12	0.633 [1]
T3	140 - 120	L2 1/2x2 1/2x3/16	14.02	6.94	168.2 K=1.00	0.9020	-4.25	9.13	0.466 [1]
T4	120 - 100	L2 1/2x2 1/2x1/4	15.89	7.83	191.3 K=1.00	1.1900	-5.91	9.31	0.635 [1]
T5	100 - 80	L3x3x3/8	19.10	9.44	192.9 K=1.00	2.1100	-7.77	16.23	0.479 [1]
T6	80 - 60	L3 1/2x3 1/2x1/4	20.83	10.30	178.1 K=1.00	1.6900	-8.31	15.25	0.545 [1]
T7	60 - 40	L3 1/2x3 1/2x3/8	22.67	11.23	196.2 K=1.00	2.4800	-8.72	18.45	0.473 [1]
T8	40 - 20	L4x4x3/8	24.50	12.08	184.0 K=1.00	2.8600	-9.64	24.17	0.399 [1]
T9	20 - 0	L4x4x3/8	26.33	12.99	197.8 K=1.00	2.8600	-10.58	20.93	0.506 [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 P_u / ϕP_n
T1	180 - 160	L2 1/2x2 1/2x3/16	8.56	8.11	196.7 K=1.00	0.9020	-0.17	6.68	0.025 [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 / ϕP_n
T1	180 - 160	P2.5x0.203	20.00	5.00	63.3	1.7040	5.61	76.68	0.073 [1]
T2	160 - 140	P2.5x.276	20.03	6.68	86.7	2.2535	15.40	101.41	0.152 [1]
T3	140 - 120	P3x0.216	20.04	6.68	68.9	2.2285	28.70	100.28	0.286 [1]
T4	120 - 100	P4x0.337	20.04	6.68	54.3	4.4074	50.13	198.34	0.253 [1]
T5	100 - 80	P5x0.258	20.03	10.02	64.0	4.2999	70.79	193.49	0.366 [1]
T6	80 - 60	P5x0.375	20.03	10.02	65.4	6.1114	94.60	275.01	0.344 [1]
T7	60 - 40	P5x0.375	20.04	10.02	65.4	6.1114	118.42	275.01	0.431 [1]
T8	40 - 20	P6x0.432	20.03	10.02	54.8	8.4049	142.15	378.22	0.376 [1]
T9	20 - 0	P6x0.432	20.03	10.02	54.8	8.4049	165.42	378.22	0.437 [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 / ϕP_n
T1	180 - 160	L1 3/4x1 3/4x3/16	9.91	4.71	107.7	0.3779	1.87	16.44	0.114 [1]
T2	160 - 140	L2x2x1/8	12.24	6.07	118.4	0.3047	2.58	13.25	0.195 [1]
T3	140 - 120	L2 1/2x2 1/2x3/16	14.02	6.94	108.6	0.5886	4.21	25.60	0.164 [1]
T4	120 - 100	L2 1/2x2 1/2x1/4	15.89	7.83	123.7	0.7753	5.87	33.73	0.174 [1]
T5	100 - 80	L3x3x3/8	19.10	9.44	125.8	1.3364	7.64	58.13	0.131 [1]
T6	80 - 60	L3 1/2x3 1/2x1/4	20.83	10.30	114.9	1.1034	8.15	48.00	0.170 [1]
T7	60 - 40	L3 1/2x3 1/2x3/8	22.67	11.23	127.5	1.6139	8.62	70.20	0.123 [1]
T8	40 - 20	L4x4x3/8	24.50	12.08	119.2	1.8989	9.31	82.60	0.113 [1]
T9	20 - 0	L4x4x3/8	26.33	12.99	128.2	1.8637	9.92	81.07	0.122 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	L2 1/2x2 1/2x3/16	8.56	8.11	128.3	0.5886	0.07	25.60	0.003 [1]

[1] P_u / ϕP_n controls

Section Capacity Table

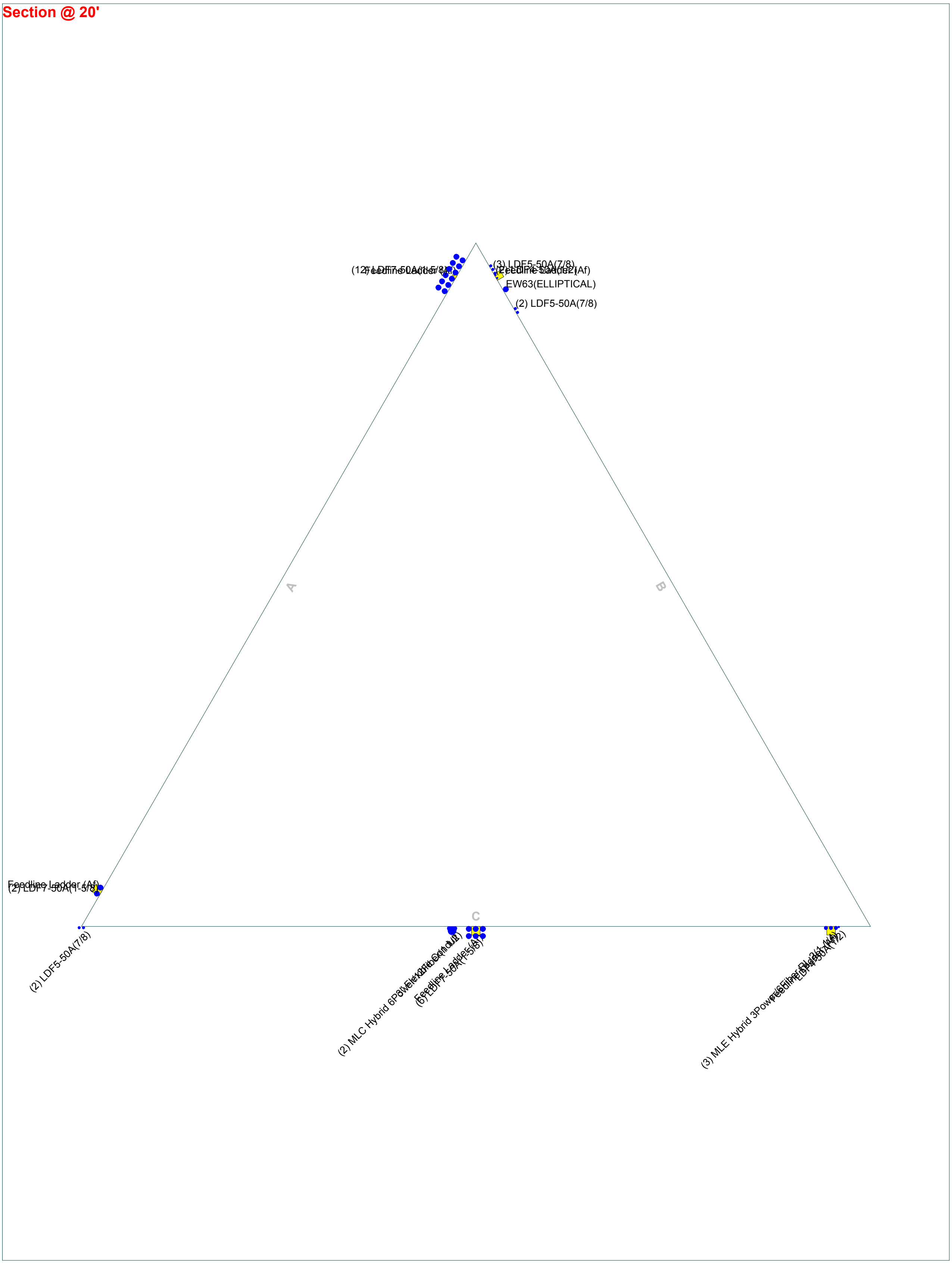
Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
T1	180 - 160	Leg	P2.5x0.203	3	-7.40	60.05	12.3	Pass
T2	160 - 140	Leg	P2.5x.276	33	-18.95	61.44	30.8	Pass
T3	140 - 120	Leg	P3x0.216	54	-35.86	74.43	48.2	Pass
T4	120 - 100	Leg	P4x0.337	75	-62.42	167.90	37.2	Pass
T5	100 - 80	Leg	P5x0.258	96	-87.60	150.57	58.2	Pass
T6	80 - 60	Leg	P5x0.375	111	-116.45	211.28	55.1	Pass
T7	60 - 40	Leg	P5x0.375	126	-145.27	211.26	68.8	Pass
T8	40 - 20	Leg	P6x0.432	141	-174.08	318.94	54.6	Pass
T9	20 - 0	Leg	P6x0.432	155	-203.60	318.94	63.8	Pass
T1	180 - 160	Diagonal	L1 3/4x1 3/4x3/16	11	-1.91	6.88	27.7 28.8 (b)	Pass
T2	160 - 140	Diagonal	L2x2x1/8	38	-2.61	4.33	60.3	Pass
T3	140 - 120	Diagonal	L2 1/2x2 1/2x3/16	59	-4.25	9.58	44.4 64.6 (b)	Pass
T4	120 - 100	Diagonal	L2 1/2x2 1/2x1/4	80	-5.91	9.78	60.5 67.6 (b)	Pass
T5	100 - 80	Diagonal	L3x3x3/8	101	-7.77	17.04	45.6 54.3 (b)	Pass
T6	80 - 60	Diagonal	L3 1/2x3 1/2x1/4	116	-8.31	16.01	51.9 86.9 (b)	Pass
T7	60 - 40	Diagonal	L3 1/2x3 1/2x3/8	131	-8.72	19.37	45.0 61.3 (b)	Pass
T8	40 - 20	Diagonal	L4x4x3/8	144	-9.64	25.38	38.0 66.2 (b)	Pass
T9	20 - 0	Diagonal	L4x4x3/8	159	-10.58	21.97	48.2 96.3 (b)	Pass
T1	180 - 160	Top Girt	L2 1/2x2 1/2x3/16	6	-0.17	7.01	2.4	Pass
							Summary	
						Leg (T7)	68.8	Pass
						Diagonal (T9)	96.3	Pass
						Top Girt (T1)	2.4	Pass
						Bolt Checks	96.3	Pass
						RATING =	**96.3**	**Pass**

APPENDIX B

BASE LEVEL DRAWING

Feed Line Plan
20'

Round — Flat — App In Face — App Out Face



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FAX:

Job: ES-066 NewtownAWC			
Project: 403093 (NewtownAWC)			
Client: Eversource	Drawn by: Preechaya Sirisuwan		App'd:
Code: TIA-222-H	Date: 02/19/20		Scale: NTS
Path:			Dwg No. E-7

APPENDIX C

ADDITIONAL CALCULATIONS

References

ANCHOR ROD ANALYSIS

Project Information

Site Name:ES-066 NewtownAWC

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

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

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

Max Leg Reactions

Compression	*Uplift*
$Axial\_C := 211 \cdot kip$	$Axial\_U := 171 \cdot kip$
$Shear\_C := 28 \cdot kip$	$Shear\_U := 24 \cdot kip$

Anchor Rod Data

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

Number of Anchor Rods: $N := 6$

Length from top of concrete to bottom of anchor rod leveling nut: $lar := 0.001 \cdot in$

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

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

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

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

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

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

Rod Ultimate Strength: $Fu = 120 \cdot ksi$

Rod Yield Strength: $Fy = 92 \cdot ksi$

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

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

Radius of Gyration:

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

Net Area of Anchor Rod:

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

TIA-222-G/H Section 4.9.6.1

Nominal Unthreaded Area of Anchor Rod:

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

Anchor Rod Design Capacities

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

$Rnt := Fu \cdot An = 72.689 \cdot kip$

$\phi t = 0.75$

$\phi Rnt := \phi t \cdot Rnt = 54.517 \cdot kip$

Design Compression Strength:

$Rnc := Fy \cdot An = 55.728 \cdot kip$

$\phi c = 1$

$\phi Rnc := \phi c \cdot Rnc = 55.728 \cdot kip$

Design Buckling Strength: TIA-222-H Section 4.5.4.2

$K_0 := 1.2$

$Fcr = 92 \cdot ksi$

$Fe = 9.581 \times 10^{9} \cdot ksi$

$Rnb := Fcr \cdot An = 55.728 \cdot kip$

$\phi c = 1$

$\phi Rnb := \phi c \cdot Rnb = 55.728 \cdot kip$

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

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

$Rnv = 47.124 \cdot kip$

$Rnvc := 0.6 \cdot Fy \cdot 0.5 \cdot An = 16.719 \cdot kip$ TIA-222-H Section 4.9.9

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

$\phi Rnv := \phi v \cdot Rnv = 35.343 \cdot kip$ $\phi Rnvc := \phi c \cdot Rnvc = 16.719 \cdot kip$

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

$Rmn := Fy \cdot Z = 10.386 \cdot kip \cdot in$

$\phi f = 0.9$

$\phi Rmn := \phi f \cdot Rmn = 9.347 \cdot kip \cdot in$

Anchor Rod Loading Demands

Tension Demand:

$$Put := \frac{Axial\_U}{N} = 28.5 \cdot kip$$

Compression Demand:

$$Puc := \frac{Axial\_C}{N} = 35.167 \cdot kip$$

Shear Demand:

$$Vut := \frac{Shear\_U}{N} = 4 \cdot kip$$

$$Vuc := \frac{Shear\_C}{N} = 4.667 \cdot kip$$

Moment Demand:

$$Mut := 0.65 \cdot lar \cdot Vut = 2.6 \times 10^{-3} \cdot kip \cdot in$$

$$Muc := 0.65 \cdot lar \cdot Vuc = 3.033 \times 10^{-3} \cdot kip \cdot in$$

Anchor Rod Interaction Check TIA-222-G Section 4.9.9

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

$$SR\_g = 0.604$$

Anchor Rod Interaction Check

TIA-222-H Section 4.9.9

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

$SR\_Pt = 0.286$

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

$SR\_Pc = 0.709$

$$SR := \begin{cases} SR\_g & \text{if } TIA = \text{"Rev-G"} \\ \max(SR\_Pt, SR\_Pc) & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"No"} \\ \frac{\max(SR\_Pt, SR\_Pc)}{1.05} & \text{if } TIA = \text{"Rev-H"} \wedge S15 = \text{"Yes"} \end{cases} = 0.675$$

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

Anchor Rod Results

Axial Tension Demand:	$Put = 28.5 \cdot kip$
Axial Tension Capacity:	$\phi Rnt = 54.517 \cdot kip$
Axial Compression Demand:	$Puc = 35.167 \cdot kip$
Axial Compression Capacity:	$\phi Rnc = 55.728 \cdot kip$
Shear Tension Demand:	$Vut = 4 \cdot kip$
Tension Shear Capacity:	$\phi Rnv = 35.343 \cdot kip$
Shear Compression Demand:	$Vuc = 4.667 \cdot kip$
Compresison Shear Capacity:	$\phi R_{nvc} = 16.719 \cdot kip$
Moment Tension Demand:	M_{ut} = "Moment Not Considered" ·kip·in
Moment Compression Demand:	M_{uc} = "Moment Not Considered" ·kip·in
Moment Capacity:	ϕR_{mn} = "Moment Not Considered" ·kip·in

Governing Stress Ratio

$SR = 67.519 \cdot \%$

$Check_{SR}$ = "Passing"

Pier and Pad Foundation

Site Name: NewtownAWC

TIA-222 Revision:	H
Tower Type:	Self Support

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

Superstructure Analysis Reactions		
Compression, P_{comp}:	211	kips
Compression Shear, Vu_comp:	28	kips
Uplift, P_{uplift}:	171	kips
Uplift Shear, V_{u_uplift}:	24	kips
Tower Height, **H**:	180	ft
Base Face Width, **BW**:	24.86	ft
BP Dist. Above Fdn, bp_{dist}:	4	in

Foundation Analysis Checks	Capacity	Demand	Rating*	Check
Uplift (kips)	207.98	171.00	**78.3%**	**Pass**
Lateral (Sliding) (kips)	75.09	24.00	**30.4%**	**Pass**
Bearing Pressure (ksf)	9.89	3.61	**34.8%**	**Pass**
*Pier Flexure (Comp.) (kip*ft)*	768.27	224.00	**27.8%**	**Pass**
*Pier Flexure (Tension) (kip*ft)*	552.10	192.00	**33.1%**	**Pass**
Pier Compression (kip)	1819.30	220.00	**11.5%**	**Pass**
*Pad Flexure (kip*ft)*	721.27	149.74	**19.8%**	**Pass**
Pad Shear - 1-way (kips)	211.65	44.59	**20.1%**	**Pass**
Pad Shear - 2-way (Comp) (ksi)	0.177	0.054	**28.9%**	**Pass**
*Flexural 2-way (Comp) (kip*ft)*	1230.68	134.40	**10.4%**	**Pass**
Pad Shear - 2-way (Uplift) (ksi)	0.177	0.067	**35.9%**	**Pass**
*Flexural 2-way (Tension) (kip*ft)*	1230.68	115.20	**8.9%**	**Pass**

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

Soil Rating*:	**78.3%**
Structural Rating*:	**35.9%**

Pier Properties		
Pier Shape:	Square	
Pier Diameter, **dpier**:	2.5	ft
Ext. Above Grade, **E**:	0.5	ft
Pier Rebar Size, **Sc**:	7	
Pier Rebar Quantity, **mc**:	24	
Pier Tie/Spiral Size, **St**:	3	
Pier Tie/Spiral Quantity, **mt**:	3	
Pier Reinforcement Type:	Tie	
Pier Clear Cover, cc_{pier}:	2	in

Pad Properties		
Depth, **D**:	9.5	ft
Pad Width, **W**:	10	ft
Pad Thickness, **T**:	2	ft
Pad Rebar Size (Bottom), **Sp**:	6	
Pad Rebar Quantity (Bottom), **mp**:	19	
Pad Clear Cover, cc_{pad}:	3	in

Material Properties		
Rebar Grade, **Fy**:	60	ksi
Concrete Compressive Strength, **F'c**:	3.5	ksi
Dry Concrete Density, δ**c**:	150	pcf

Soil Properties		
Total Soil Unit Weight, γ:	125	pcf
Ultimate Net Bearing, Qnet:	12.000	ksf
Cohesion, **Cu**:		ksf
Friction Angle, φ:	34	degrees
SPT Blow Count, N_{blows}:		
Base Friction, μ:	0.6	
Neglected Depth, **N**:	3.33	ft
Foundation Bearing on Rock?	No	
Groundwater Depth, **gw**:	N/A	ft

<--Toggle between Gross and Net

Version 3.3.0

TIA-222- H ACI : 2014

PHYSICAL PARAMETERS

Pier Height Above Water Table:	h_{pier_above} = (MIN(gw,D-T) + E)	h_{pier_above} =	8	ft
Pier Height Below Water Table:	h_{pier_below} = ((D-T) - MIN(gw,D-T))	h_{pier_below} =	0	ft
Buoyant Weight of Pier:	W_{pier} = (dpier^2) * hpier_above * δc / 1000 + (dpier^2) * hpier_below * (δc-62.4) /1000	W_{pier} =	7.50	kips
Pad Height Above Water Table:	h_{pad_above} = IF(gw<=D-T,0,IF(gw>D,T,T-(D-gw)))	h_{pad_above} =	2	ft
Pad Height Below Water Table:	h_{pad_below} = (T-IF(gw<=D-T,0,IF(gw>D,T,T-(D-gw))))	h_{pad_below} =	0	ft
Buoyant Weight of Pad:	W_{pad} = (W^2) * hpad_above * δc / 1000 + (W^2) * hpad_below * (δc-62.4) / 1000	W_{pad} =	30.00	kips
Concrete weight:	W_c = V * δc	W_c =	37.5	kips
Soil weight:	W_s = (D - T) * (W² - dpier²) * γ	W_s =	87.9	kips
EIA/TIA-222 Load Factor:	LF = 1	LF =	1.00	

UPLIFT RESISTANCE

	Soil Weight			
Soil Height Below Water Table:	h_1 = MAX((D-T) - gw , 0)	h_1 =	0	ft
Soil Height Above Water Table:	h_2 = MIN(gw,D-T)	h_2 =	7.5	ft
Soil Wedge Width 1:	W'_1 = W + 2 * (h_1 * IF(φ>25,TAN(φ*°),IF(AND(Co=0,φ>0),TAN(φ*°),0)))	W'_1 =	10.00	ft
Soil Wedge Width 2:	W'_2 = W\1 + 2 * (h_2 * IF(φ>25,TAN(φ*°),IF(AND(Co=0,φ>0),TAN(φ*°),0)))	W'_2 =	20.12	ft
Volume of Soil Truncated Pyramid 1 (Below Water Table):	V'_1 = (h_1/3)*(W^2+W*W1\+W1\^2) - ((dpier^2) * h_1))	V'_1 =	0.00	ft³
Volume of Soil Truncated Pyramid 2 (Above Water Table):	V'_2 = (h_2/3)*(W^2+W*W1\+W1\^2) - ((dpier^2) * h_2))	V'_2 =	1717.86	ft³
Soil Weight of V'_1 (Below Water Table):	$W_{s'1}$ = V'_1 * (γ-$γ_w$)	$W_{s'1}$ =	0.00	kips
Soil Weight of V'_2 (Above Water Table):	$W_{s'2}$ = V'_2 * γ	$W_{s'2}$ =	214.73	kips
Total Weight of Soil:	W_{s_uplift} = $W_{s'1}$ + $W_{s'2}$	W_{s_uplift} =	214.73	kips
	Soil Cohesion			
Pad Perimeter:	P_o = 4*W	P_o =	40	ft
Depth to Mid-Layer of Soil:	$H_{\_shear}$ = ((D - T) - N) / 2 + N	$H_{\_shear}$ =	5.42	ft
Cohesion at Mid-Layer of Soil:	S_u = 0	S_u =	0.00	ksf
Soil Shear:	$Shear_{soil}$ = (Su/2) * Po * (D-T - MIN(N,D-T))	$Shear_{soil}$ =	0.00	kips
	Skin Friction / Adhesion Applied to Pad			
Adhesion Factor:	α = 0	α =	0.00	
Soil Depth from Top of Pad to Mid. Layer (Cohesionless Soil):	$H_{cohesionless}$ = T / 2	$H_{cohesionless}$ =	1.00	ft
Beta Factor:	β = = (MIN(N_blows,15)/15)*(1.5-0.135*SQRT(H_pad))	β =	0.00	
Pad Side Area:	A_s = Po * T	A_s =	80.00	ft²
Effective Soil Unit Weight at H_{pad}:	$γ_{eff}$ = γ	$γ_{eff}$ =	0.125	kcf
Soil Depth from Grade to Mid. Layer (Silty Soil):	H_{silty} = (D-T)+T/2	H_{silty} =	8.50	ft
Cohesion at Mid-Layer of Pad:	S_{u_pad} = 0	S_{u_pad} =	0.000	ksf
Ultimate Skin Friction / Adhesion:	f_s = 0	f_s =	0.000	ksf
Skin Friction / Adhesion Resistance:	F_s = fs * As	F_s =	0.00	kips
	Uplift Resistance			
Nominal Uplift Resistance:	R_n = Wc + $W_{s'1}$ + $W_{s'2}$ + $Soil_{shear}$ + F_s	R_n =	252.23	kips
Factored Uplift Resistance:	Ra = φD * (Wc + Ws) + φsu * (Soil_shear + F_s + Ws_uplift -Ws)	Ra =	207.98	kips

Check **Ra = 207.98 kips >= P_{uplift} = 171.00 kips** **OK**

LATERAL RESISTANCE

Total Nominal Pp Resistance:	P_{p_total} = Pp_pier *Ap_pier + Pp_pad * Ap_pad	P_{p_total} = 100.12	kips
Factored Total Weight for Compression:	$P_{factored\_comp}$ = φD * (Wc + Ws + Pcomp / 1.2)	$P_{factored\_comp}$ = 271.10	kips
Factored Total Weight for Uplift:	$P_{factored\_uplift}$ = MAX(φD * (Wc + Ws) - Puplift , 0)	$P_{factored\_uplift}$ = 0.00	kips
Nominal Base Friction Resistance (Comp):	R_{s_comp} = P * μ	R_{s_comp} = 162.66	kips
Nominal Base Friction Resistance (Uplift):	R_{s_uplift} = P * μ	R_{s_uplift} = 0.00	kips
Lateral Resistance (Comp):	Va_comp = Φs * (Pp_total + Rs_comp)	Va_comp = 197.09	kips
Lateral Resistance (Uplift):	Va_uplift = Φs * (Pp_total + Rs_uplift)	Va_uplift = 75.09	kips

Check **Va_comp = 75.09 kips >= Vu_uplift = 24.00 kips** **RATING: 31.96% OK**

PIER REINFORCEMENT

Pier / Column Compression

Pier Cross-Sectional Area:	A_1 = dpier^2	A_1 = 900.00	in²
Support Area (2H:1V Slope):	A_2 = (MIN(W, dpier + 4 * T))²	A_2 = 14400.00	in²
Compressive Resistance (H/D < 3):	$ΦP_{n1}$ = 0.65*0.85 * F'c * A1 * MIN(√(A2/A1),2)	$ΦP_{n1}$ = 3480.75	kips
Rebar:	$s_{\_pier}$ = 7; $m_{\_pier}$ = 24	d_{b_pier} = 0.875 in; A_{b_pier} = 0.6 in²	
Provided area of steel:	A_{s_pier} = Ab_pier * m_pier	A_{s_pier} = 14.40	in²
Compressive Resistance (H/D >= 3):	$ΦP_{n2}$ = 0.65 * 0.8 * (0.85 * (F\c) * (A_1 - As_pier) + ((Fy) * As_pier))	$ΦP_{n2}$ = 1819.30	kips
	H/D = (D - T + E) / dpier	H/D = 3.20	
Utilized Compressive Resistance:	$ΦP_n$ = Pn2	$ΦP_n$ = 1819.30	kips
Applied Compressive Force:	P_u = Pcomp + 1.2 * Wpier	P_u = 220.00	kips

Check **$ΦP_n$ = 1819.30 kips >= P_u = 220.00 kips** **RATING: 12.09% OK**

Pier Flexure

Cross-sectional area:	A_g = dpier²	A_g = 900.00	in²
Min. area of steel (pier):	A_{smin_pier} = Ag * 0.005	A_{smin_pier} = 4.50	in²
Cage Width:	d_o = dpier - 2 * cc - 2 * tie - d_b	d_o = 24.38	in

Check **A_{s_pier} = 14.40 in^2 >= A_{smin_pier} = 4.50 in^2** **OK**

Applied Moment to DSMC (Compression):	M_{u_comp} = (D - T + E) * Vu + Mu	M_{u_comp} = 224.00	ft-kips
Pier Moment Capacity (Compression):	$ΦM_{n\_comp}$ = *from DSMC*	$ΦM_{n\_comp}$ = 768.27	ft-kips

Check **M_{u_comp} = 224.00 ft-kips >= $ΦM_{n\_comp}$ = 768.27 ft-kips** **RATING: 29.16% OK**

Applied Moment to DSMC (Tension):	$M_{u\_tension}$ = (D - T + E) * Vu + Mu	$M_{u\_tension}$ = 192.00	ft-kips
Pier Moment Capacity (Tension):	$ΦM_{n\_tension}$ = *from DSMC*	$ΦM_{n\_tension}$ = 552.10	ft-kips

Check **$M_{u\_tension}$ = 192.00 ft-kips >= $ΦM_{n\_tension}$ = 552.10 ft-kips** **RATING: 34.78% OK**

PAD REINFORCEMENT

Elastic Bearing Pressure for Soil Checks

Overturning Moment:	Mo = 0	Mo = 0.00	ft-kips	
Compressive Load for Bearing:	$P_{bearing}$ = Wc + Ws + Pcomp / 1.2	$P_{bearing}$ = 301.22	kips	
*Load Eccentricity (0.9*D LC):*	ec_0.9 = Mo / 0.9*Pbearing	ec_0.9 = 0.00	ft	e <= L/6
*Load Eccentricity (1.2*D LC):*	ec_1.2 = Mo / 1.2*Pbearing	ec_1.2 = 0.00	ft	e <= L/6
Elastic Section Modulus:	S = W³ / 6	S = 166.67	ft³	
*Positive Pressure 0.9*D LC):*	Ppos_0.9 = 0.9*Pbearing / Area + Mo / S	$P_{pos\_st\_0.9}$ = 2.71	ksf	
*Positive Pressure (1.2*D LC):*	Ppos_1.2 = 1.2*Pbearing / Area + Mo / S	$P_{pos\_st\_1.2}$ = 3.61	ksf	
*Negative Pressure (0.9*D LC):*	Pneg_0.9 = 0.9*Pbearing / Area - Mo / S Note: The resultant stress is within the kern. No adjustment is required.	$P_{neg\_st\_0.9}$ = 2.71	ksf	
*Negative Pressure (1.2*D LC):*	Pneg_1.2 = 1.2*Pbearing / Area - Mo / S Note: The resultant stress is within the kern. No adjustment is required.	$P_{neg\_st\_1.2}$ = 3.61	ksf	
*Adjusted Pressure (0.9*D LC):*	Padj_0.9 = 2*0.9*Pbearing/(3*W*(W/2-ec_0.9))	$P_{adj\_0.9}$ = 3.61	ksf	
*Adjusted Pressure (1.2*D LC):*	Padj_1.2 = 2*1.2*Pbearing/(3*W*(W/2-ec_0.9))	$P_{adj\_1.2}$ = 4.82	ksf	
*Maximum Pressure (0.9*D LC):*	$q_{u1\_0.9}$ = IF(Pneg ≥ 0, Ppos , Padj)	$q_{u\_st\_0.9}$ = 2.71	ksf	

*Maximum Pressure (1.2*D LC):*	$q_{u1\_1.2}$ = IF(Pneg ≥ 0, Ppos , Padj)	$q_{u\_st\_1.2}$ =	3.61	ksf

One-Way Shear

Rebar:	$s_{\_pad}$ = 6	*Equally spaced;*	d_{b_pad} =	0.75	in
	$m_{\_pad}$ = 19	*bottom layer in one direction*	A_{b_pad} =	0.44	in^2

Effective depth:	d_c = T - cc - 1.5 * db	d_c =	19.9	in
Distance from Edge of Pad to Column Face:	d' = W / 2 - dpier / 2	d' =	3.8	ft
Distance from Edge of Pad to dc from Column Face:	d'' = d' - d_c / 12	d'' =	2.09	ft
Distance to qs (0.9D LC):	L' _0.9 = (W / 2 - ec_0.9) * 3	L' _0.9 =	10.00	ft
Distance to qs (1.2D LC):	L' _1.2 = (W / 2 - ec_1.2) * 3	L' _1.2 =	10.00	ft
*Slope of qs (0.9*D LC):*	sqs_0.9 = IF(L' > W, (Ppos - Pneg) / W, qu / L')	sqs_0.9 =	0.00	kcf
*Slope of qs (1.2*D LC):*	sqs_1.2 = IF(L' > W, (Ppos - Pneg) / W, qu / L')	sqs_1.2 =	0.00	kcf
Nominal Shear Strength:	V_{n1} = 2 * W * √(F'c*1000) * dc	V_{n1} =	282.20	kips
Shear Reduction Factor:	$φ_{shear}$ = 0.75	$φ_{shear}$ =	0.75	
Design Shear Strength:	$φV_{n1}$ = φshear * V_{n1}	$φV_{n1}$ =	211.65	kips

Resisting Weight above Critical Section:

	Thickness (ft)	Unit Weight (kcf)	Weight (kip) (0.9*D LC)	Weight (kip) (1.2*D LC)
Soil Above Water Table:	7.5	0.125	17.67	23.55
Soil Below Water Table:	0	0.063	0.00	0.00
Pad Above Water Table:	2	0.150	5.65	7.54
Pad Below Water Table:	0	0.088	0.00	0.00
Total:			23.32	31.09

*Applied Shear (0.9*D LC):*	$V_{u1\_0.9}$ = sqs_0.9 * MIN(L'_0.9,d'') * (W / 2 - dpier / 2 - dc) * W	$V_{u1\_0.9}$ =	33.44	kips
*Applied Shear (1.2*D LC):*	$V_{u1\_1.2}$ = sqs_1.2 * MIN(L'_1.2,d'') * (W / 2 - dpier / 2 - dc) * W	$V_{u1\_1.2}$ =	44.59	kips

Check **$φV_{n1}$ = 211.65 kips >= V_{u1} = 44.59 kips** **RATING: 21.07% OK**

Two-Way Shear (Compression)

Pier Shape:	Pier Shape: Square	Pier Shape:	Square	
Pier Diameter:	d_{pier1} = d_{pier} * 12 in / ft	d_{pier1} =	30.00	in
Equivalent Square Pier Diameter:	d_{pier_sq} = dpier	d_{pier_sq} =	30.00	in
Avg. Effective Depth for Punching Shear:	d_{c_2} = T - cc_{pad} - AVERAGE(0.5 * $_{db\_pad}$, 1.5 * d_{b_pad})	d_{c_2} =	20.25	in
Area of Concrete in Shear:	A_c = (4 * (dpier1 + dc_2)) * dc_2)	A_c =	4070.25	in^2
Eq. Square Area of Concrete in Shear:	A_{c_sq} = (4*(dpier_sq+dc_2))*dc_2	A_{c_sq} =	4070.25	in^2
Factor of transfer of Moment:	Y_f = 1/(1+(2/3)*√(dpier1/dpier1))	Y_f =	0.60	
Factor of transfer of eccentricity of Shear:	Y_v = 1 - Y_f	Y_v =	0.40	
Moment applied at base of Pier:	M_v = M_{u_comp} * 12 in / ft	M_v =	2688.00	kip*in
Polar Moment of Inertia at assumed Critical Section:	J_{c_1} = (dc_2*(dpier1+dc_2)^3)/6 + ((dpier1+dc_2)*(dc_2^3))/6 + (dc_2*(dpier1+dc_2)*(dpier1+dc_2)^2)/2	J_{c_1} =	1782483.31	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	J_{c_sq} = (dc_2*(dpier_sq+dc_2)^3)/6 + ((dpier_sq+dc_2)*(dc_2^3))/6 + (dc_2*(dpier_sq+dc_2)*(dpier_sq+dc_2)^2)/2	J_{c_sq} =	1782483.31	in^4
*Net Bearing Resistance at front of Pier (1.2*D LC):*	$q_{u\_AB\_1.2}$ = MAX((qu_st_1.2 - sqs_1.2*(W/2 - (dpier1/12+dc_2/12)/2) - 1.2*(Wpad+Ws)/Area)/144,0)	$q_{u\_AB\_1.2}$ =	0.02	ksi
*Net Bearing Resistance at rear of Pier (1.2*D LC):*	$q_{u\_CD\_1.2}$ = MAX((qu_st_1.2 - sqs_1.2*(W/2 + (dpier1/12+dc_2/12)/2) - 1.2*(Wpad+Ws)/Area)/144,0)	$q_{u\_CD\_1.2}$ =	0.02	ksi
*Net Bearing Resistance at front of Pier_sq (1.2*D LC):*	$q_{u\_AB\_1.2\_sq}$ = MAX((qu_st_1.2 - sqs_1.2*(W/2 - (dpier_sq/12+MIN(dc_2,(T*12)*3)/12)/2) - 1.2*(Wpad+Ws)/Area)/144,0)	$q_{u\_AB\_1.2\_sq}$ =	0.02	ksi
*Net Bearing Resistance at rear of Pier_sq (1.2*D LC):*	$q_{u\_CD\_1.2\_sq}$ = MAX((qu_st_1.2 - sqs_1.2*(W/2 + (dpier_sq/12+dc_2/12)/2) - 1.2*(Wpad+Ws)/Area)/144,0)	$q_{u\_CD\_1.2\_sq}$ =	0.02	ksi
*Applied Shear Force (1.2*D LC):*	$V_{u\_1.2}$ = 1.2*Wpier + 1.2 * IF(OR($B$1="G",$B$1="H"), Pcomp / 1.2, Pcomp)	$V_{u\_1.2}$ =	220.00	kip
*Controlling Shear Stress (1.2*D LC):*	$v_{u\_1.2\_controlling}$ = MAX(0,IF(L_0.9 <= W/2 + dpier/2 + (dc_2/12)/2, 0, Vu_0.9/Ac + (Yv * Mv * (dpier1 + dc_2)/2) / Jc_1 - MIN(qu_AB_0.9,qu_CD_0.9)))	$v_{u\_1.2\_controlling}$ =	0.054	ksi
*Eq. Sq. Controlling Shear Stress (1.2*D LC):*	$v_{u\_1.2\_controlling\_sq}$ = MAX(0,Vu_1.2/Ac_sq + (Yv * Mv * (dpier_sq + dc_2)/2) / Jc_sq - MIN(qu_AB_1.2_sq,qu_CD_1.2_sq))	$v_{u\_1.2\_controlling\_sq}$ =	0.054	ksi

Shear Stress Capacity:	Φv_n =	φs * 4 * (√F'c*1000) / 1000	Φv_n =	0.177	ksi

Check	**Φv_n =**	**0.177**	**ksi**	**>=**	**v_{u_demand} =**	**0.054**	**ksi**	**RATING: 30.39%**	**OK**

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

Effective Pad Width:	$b_{\_pad}$ =	MIN(dpier+3*T,W)	$b_{\_pad}$ =	8.5	ft
Bar Spacing:	B_{s_pad} =	Bs_pad (see design checks below)	B_{s_pad} =	6.29	in
Fraction of Bars in Effective Width:	$m_{\_effective}$ =	IF(b_pad=W,mp,12*b_pad/Bs_pad)	$m_{\_effective}$ =	16.21	
Area of Steel in Effective Width:	$A_{s\_effective}$ =	VLOOKUP(Sp,Ref!$A$2:$C$12,3,0)*m_effective	$A_{s\_effective}$ =	7.13	in²
Depth of Equivalent Rectangular Stress Block:	$a_{\_effective}$ =	$A_{s\_effective}$ * Fy / (0.85 * F'c * $b_{\_slab}$*12)	$a_{\_effective}$ =	1.41	in
	β_{pad} =	β_{pad} (see design checks below)	β_{pad} =	0.85	
Distance from Top to Nuetral Axis:	$c_{\_effective}$ =	$a_{\_effective}$ / β_{pad}	$c_{\_effective}$ =	1.66	
Effective depth:	dc =	dc (see One-Way Shear check above)	dc =	19.875	in
Modulus of Elasticity of Steel:	E_s =	29000 ksi	E_s =	29000	ksi
Strain in Steel:	$\varepsilon_{s\_effective}$ =	0.003 * (dc-c) / c	$\varepsilon_{s\_effective}$ =	0.03293	in/in
Compression-Controlled Strain Limit::	ε_c =	F_y / E_s	ε_c =	0.00207	in/in
Tension-Controlled Strain Limit::	ε_t =	0.005	ε_t =	0.00500	in/in
Flexure Strength Reduction Factor:	$\varphi flex_{\_effective}$ =	IF(εs>=εt,0.9,IF(εs<=εc,0.65,0.65+(0.9-0.65)*((εs-εc)/(εt-εc))))	$\varphi flex_{\_effective}$ =	0.9	
Nominal Flexural Strength:	$M_{n\_effective}$ =	$A_{s\_effective}$ * (F_y) * (dc - $a_{\_effective}$ / 2) * (1/12)	$M_{n\_effective}$ =	683.71	ft-kips
Design Flexural Strength:	$\varphi M_{n\_effective}$ =	φflex_effective * Mn_effective	$\varphi M_{n\_effective}$ =	615.34	ft-kips

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

Bar Spacing:	$B_{s\_pad\_top}$ =	(W*12 - 2 * ccpad - VLOOKUP(sptop,Ref!$A$2:$C$12,2,0)) / (mptop - 1)	$B_{s\_pad\_top}$ =	8.50	in
Fraction of Bars in Effective Width:	$m_{\_effective\_top}$ =	IF(b_pad=W,mptop,12*b_pad/Bs_pad_top)	$m_{\_effective\_top}$ =	16.21	
Area of Steel in Effective Width:	$A_{s\_effective\_top}$ =	VLOOKUP(sptop,Ref!$A$2:$C$12,3,0)*m_effective_top	$A_{s\_effective\_top}$ =	7.13	in²
Depth of Equivalent Rectangular Stress Block:	$a_{\_effective\_top}$ =	$A_{s\_effective\_top}$ * Fy / (0.85 * F'c * $b_{\_slab}$*12)	$a_{\_effective\_top}$ =	1.41	in
Distance from Top to Nuetral Axis:	$c_{\_effective\_top}$ =	$a_{\_effective\_top}$ / β_{pad}	$c_{\_effective\_top}$ =	1.66	
Effective depth:	d_{c_top} =	T *12 - ccpad - 1.5 * VLOOKUP(sptop,Ref!$A$2:$C$12,2,0)	d_{c_top} =	19.875	in
Strain in Steel:	$\varepsilon_{s\_effective\_top}$ =	0.003 * (dc_top - c_effective_top) / c_effective_top	$\varepsilon_{s\_effective\_top}$ =	0.03293	in/in
Flexure Strength Reduction Factor:	$\varphi flex_{\_effective\_top}$ =	IF(εs_top>=εt,0.9,IF(εs_top<=εc,0.65,0.65+(0.9-0.65)*((εs_top-εc)/(εt-εc))))	$\varphi flex_{\_effective\_top}$ =	0.9	
Nominal Flexural Strength:	$M_{n\_effective\_top}$ =	$A_{s\_effective\_top}$ * (F_y) * (dc_top - $a_{\_effective\_top}$ / 2) * (1/12)	$M_{n\_effective\_top}$ =	683.71	ft-kips
Design Flexural Strength:	$\varphi M_{n\_effective\_top}$ =	φflex_effective * Mn_effective	$\varphi M_{n\_effective\_top}$ =	615.34	ft-kips
Applied Moment:	$Yf*M_{u\_comp}$ =	$Yf*M_{u\_comp}$	$Yf*M_{u\_comp}$ =	134.4	ft-kips

Check	**$\varphi M_{n\_effective}$ =**	**1230.68**	**ksi**	**>=**	**$Yf*M_{u\_comp}$ =**	**134.40**	**ksi**	**RATING: 10.92%**	**OK**

Two-Way Shear (Uplift)

Moment applied at base of Pier:	$M_{v\_tension}$ =	IF(T>D,E+T,(D - T + E)) * Vu_uplift * 12	$M_{v\_tension}$ =	2304.00	kip*in
Diameter of Longitudinal Rebar Cage:	$d_{\_cage}$ =	dpier*12-2*(ccpier+VLOOKUP(St,Ref!$A$2:$C$12,2,0))-VLOOKUP(Sc,Ref!$A$2:$C$12,2,0)	$d_{\_cage}$ =	24.38	in
Eq. Square Dia. of Longitudinal Rebar Cage:	$d_{\_cage\_sq}$ =	SQRT(PI())/2*d_cage	$d_{\_cage\_sq}$ =	21.60	in
Steel Embedment Length:	L_{embed} =	dc_2	L_{embed} =	20.25	in
Area of Concrete in Shear:	$A_{c\_tension}$ =	Lembed*(d_cage+Lembed)*PI()	$A_{c\_tension}$ =	2838.92	in²
Eq. Square Area of Concrete in Shear:	$A_{c\_tension\_sq}$ =	Lembed*(d_cage_sq+Lembed)*4	$A_{c\_tension\_sq}$ =	3389.99	in²
Polar Moment of Inertia at assumed Critical Section:	$J_{c\_\_tension}$ =	(Lembed*(d_cage+Lembed)^3)/6 + ((d_cage+Lembed)*(Lembed^3))/6 + (Lembed*(d_cage+Lembed)*(d_cage+Lembed)^2)/2	$J_{c\_tension}$ =	1261447.65	in^4
Eq. Square Polar Moment of Inertia at assumed Critical Section:	$J_{c\_\_tension\_sq}$ =	(Lembed*(d_cage_sq+Lembed)^3)/6 + ((d_cage_sq+Lembed)*(Lembed^3))/6 + (Lembed*(d_cage_sq+Lembed)*(d_cage_sq+Lembed)^2)/2	$J_{c\_tension\_sq}$ =	1047557.52	in^4
*Applied Shear Force (0.9*D LC):*	$V_{u\_0.9\_tension}$ =	MAX(0.9 * IF(OR($B$1="G",$B$1="H"), Puplift / 0.9, Puplift) - 0.9*Wpier,0)	$V_{u\_0.9\_tension}$ =	164.25	kip
*Controlling Shear Stress (0.9*D LC):*	$v_{u\_0.9\_controlling\_tension}$ =	Vu_0.9_tension/Ac_tension+(Yv*Mv_tension*(d_cage+Lembed)/2)/Jc_tension	$v_{u\_0.9\_controlling\_tension}$ =	0.074	ksi

*Eq. Sq. Controlling Shear Stress (0.9*D LC):*	$v_{u\_0.9\_tension\_sq}$ =	Vu_0.9_tension/Ac_tension_sq+(Yv*Mv_tension*(d_cage_sq+Lembed)/2)/Jc_tension_sq	$v_{u\_0.9\_tension\_sq}$ =	0.067	ksi
Shear Stress Capacity:	$\Phi v_{n\_tension}$ =	φs * 4 * (√F'c*1000)/1000	$\Phi v_{n\_tension}$ =	0.177	ksi

Check **Φv_n = 0.177 ksi >= v_{u_demand} = 0.067 ksi** **RATING: 37.67% OK**

Two-Way Shear (Uplift, Flexural Component)

Applied Moment:	$Yf*M_{u\_tension}$ =	$Yf*M_{u\_tension}$	$Yf*M_{u\_tension}$ =	115.2	ft-kips

Check **$\varphi M_{n\_effective}$ = 1230.68 ksi >= $Yf*M_{u\_tension}$ = 115.20 ksi** **RATING: 9.36% OK**

Pad Flexure (Net Bearing Pressure)

	β_{pad} =	IF(F'c <= 4, 0.85, IF(F'c >= 8, 0.65, 0.85 - (F'c - 4) * 0.05))	β_{pad} =	0.85	
Provided Steel:	A_{s_pad} =	A_{b_pad} * $m_{\_pad}$	A_{s_pad} =	8.36	in^2
Depth of Equivalent Rectangular Stress Block:	a =	A_{s_pad} * Fy / (0.85 * F'c * W)	a =	1.41	in
Distance from Top to Nuetral Axis:	c =	a / β_{pad}	c =	1.65	in
Modulus of Elasticity of Steel:	E_s =	29000 ksi	E_s =	29000	ksi
Strain in Steel:	ε_s =	0.003 * (dc-c) / c	ε_s =	0.03307	in/in
Compression-Controlled Strain Limit::	ε_c =	F_y / E_s	ε_c =	0.00207	in/in
Tension-Controlled Strain Limit::	ε_t =	0.005	ε_t =	0.00500	in/in
Flexure Strength Reduction Factor:	φflex =	IF(εs>=εt,0.9,IF(εs<=εc,0.65,0.65+(0.9-0.65)*((εs-εc)/(εt-εc))))	φflex =	0.9	
Nominal Flexural Strength:	M_n =	$As_{\_pad}$ * (F_y) * (dc - a / 2) * (1/12)	M_n =	801.41	ft-kips
Design Flexural Strength:	φM_n =	φflex * Mn	φM_n =	721.27	ft-kips
*Bearing Press. at Crit. Section (0.9*D LC):*	qmid_0.9 =	qu_st_0.9 - sqs_0.9 * d'	qmid_0.9 =	2.71	ksf
*Bearing Press. at Crit. Section (1.2*D LC):*	qmid_1.2 =	qu_st_1.2 - sqs_1.2 * d'	qmid_1.2 =	3.61	ksf

Resisting Weight above Critical Section:

	Thickness (ft)	Unit Weight (kcf)	Weight (kip) (0.9*D LC)	Weight (kip) (1.2*D LC)	Moment Arm (ft)	Resisting Moment (ft-kips) (0.9*D LC)	Resisting Moment (ft-kips) (1.2*D LC)
Soil Above Water Table:	7.5	0.125	31.64	42.19	1.875	59.33	79.101563
Soil Below Water Table:	0	0.063	0.00	0.00	1.875	0.00	0
Pad Above Water Table:	2	0.150	10.13	13.50	1.875	18.98	25.3125
Pad Below Water Table:	0	0.088	0.00	0.00	1.875	0.00	0
Total:			41.77	55.69		78.31	104.41

*Factored Bending Moment (0.9*D LC):*	Mu_pad_0.9 =	((0.5*(qu_0.9-qmid_0.9))*(d\^2)*(2/3)+(0.5*qmid_0.9*(d\^2))-(0.5*Wg_0.9*(d\^2)))*W	Mu_pad_0.9 =	112.31	ft-kips
*Factored Bending Moment (1.2*D LC):*	Mu_pad_1.2 =	((0.5*(qu_1.2-qmid_1.2))*(d\^2)*(2/3)+(0.5*qmid_1.2*(d\^2))-(0.5*Wg_1.2*(d\^2)))*W	Mu_pad_1.2 =	149.74	ft-kips

Check **φM_n = 721.27 ft-kips >= M_{u_pad} = 149.74 ft-kips** **RATING: 20.76% OK**

PIER DESIGN CHECKS

Minimum Steel

Min. area of steel (pier):	A_{st_c} =	Ag * 0.005	A_{st_c} =	4.50	in^2

Check **A_{s_pier} = 14.40 in² >= A_{st_c} = 4.50 in²** **RATING: 31.25% OK**

Bar Spacing

Bar separation:	B_{s_pier} =	(do * π) / m_pier - db_pier	B_{s_pier} =	2.32	in

Check **18.00 in >= B_{s_pier} = 2.32 in** **RATING: 12.86% OK**

Vertical Rebar Development Length

Reinforcement location:	α_c =	if space under bar > 12", 1.3, else use 1.0	α_c =	1.3	
Epoxy coating:	β_c =	for non- epoxy coated, use 1.0	β_c =	1.0	
Max term:	$\alpha\beta_c$ =	product of α x β not to exceed 1.7	$\alpha\beta_c$ =	1.3	
Reinforcement size:	γ_c =	if bar size is 6 or less, 0.8, else use 1.0	γ_c =	1	
Light weight concrete:	λ_c =	1.0	λ_c =	1.0	
Spacing/cover:	$c_{\_c}$ =	use smaller of half of bar spacing or concrete cover	$c_{\_c}$ =	1.6	in
Transverse bars:	k_{tr_c} =	0 in (per simplification)	k_{tr_c} =	0	in

Max term:	c_c' = MIN(2.5, (c_c + ktr_c) / db_c)	c_c' =	1.823		
Excess reinforcement:	R_c = Ast_c / As_c	R_c =	0.31		
Development (tensile):	$L_{dt}'_{\_c}$ = (3 / 40) * (Fy*1000 / √(F'c*1000)) * αβ_c * γ_c * λ_c * R_c * db_c / c_c'	$L_{dt}'_{\_c}$ =	14.83	in	
Minimum length:	L_{d_min} = 12 inches	L_{d_min} =	12.0	in	
Development length:	L_{dt_c} = MAX(Ld_min, Ldt'_c)	L_{dt_c} =	14.83	in	
Development (comp.):	$L_{dc}'_{\_c}$ = 0.02 * db_c * Fy*1000 / √(F'c*1000)	$L_{dc}'_{\_c}$ =	17.75	in	
	$L_{dc}''_{\_c}$ = 0.0003 * db_c * Fy*1000	$L_{dc}''_{\_c}$ =	15.75	in	
Development length:	L_{dc_c} = MAX(8, Ldc'_c, Ldc''_c)	L_{dc_c} =	17.75	in	
Length available in pier:	L_{vc} = D - T + E - cc	L_{vc} =	94.0	in	
Check	**L_{vc} = 94.00 in**	**>=**	**L_{dt_c} = 14.83 in**		**OK**
Check	**L_{vc} = 94.00 in**	**>=**	**L_{dc_c} = 17.75 in**		**OK**
Length available in pad:	L_{vp} = T - ccpad	L_{vp} =	21.0	in	
Check	**L_{vp} = 21.00 in**	**>=**	**L_{dt_c} = 14.83 in**		**OK**
Check	**L_{vp} = 21.00 in**	**>=**	**L_{dc_c} = 17.75 in**		**OK**

Vertical Rebar Hook Ending

Bar size & clear cover:	α_h = =if bar <= 11, and cc >= 2.5", use 0.7, else use 1.0	α_h =	1		
Epoxy coating:	β_h = for non- epoxy coated, use 1.0	β_h =	1.0		
Light weight concrete:	λ_h = 1.0	λ_h =	1.0		
Development (hook):	L_{dh}' = 0.02 * αh * βh * λh * Fy*1000 / √(F'c*1000) * db_c	L_{dh}' =	17.7	in	
Minimum length:	L_{dh_min} = the larger of: 8 * d_b or 6 in	L_{dh_min} =	7.0	in	
Development length:	L_{dh} = MAX(Ldh_min, Ldh')	L_{dh} =	17.7	in	
Check	**L_{vp} = 21.00 in**	**>=**	**L_{dh} = 17.75 in**		**OK**
Hook tail length:	L_{h_tail} = 12 * db beyond the bend radius	L_{h_tail} =	14.0	in	
Length available in pad:	L_{h_pad} = (W - dpier) / 2 + ccpier - ccpad	L_{h_pad} =	44	in	
Check	**L_{h_pad} = 44.00 in**	**>=**	**L_{dh_tail} = 14.00 in**		**OK**

Pier Ties

Minimum size: [ACI 7.10.5.1]	$s_{\_t\_min}$ =IF(s_c <= 10, 3, 4)	$s_{\_t\_min}$ =	3	
z factor:	z_seismic = 0.5 if the SDC is A, B, or C, else 1.0	z_seismic =	0.5	
Tie parameters:	$s_{\_t}$ = 3 $m_{\_t}$ = 3	d_{b_t} = 0.375 in A_{b_t} = 0.11 in^2		
Allowable tie spacing per vertical rebar:	$B_{s\_t\_max1}$ = 8 / z * db_c	$B_{s\_t\_max1}$ =	14	in
per tie size:	$B_{s\_t\_max2}$ = 24 / z * db_t	$B_{s\_t\_max2}$ =	18	in

per pier diameter:	$B_{s\_t\_max3}$ = di / (4 * z²)	$B_{s\_t\_max3}$ =	30	in
per seismic zone:	$B_{s\_t\_max4}$ = 12" in active seismic zones, else 18"	$B_{s\_t\_max4}$ =	18	in
Maximum tie spacing:	$B_{s\_t\_max}$ = MIN(Bs_t_max1, Bs_t_max2, Bs_t_max3, Bs_t_max4)	$B_{s\_t\_max}$ =	14	in
Minimum required ties:	$m_{\_t\_min}$ = (D - T + E) / Bs_t_max + 2	$m_{\_t\_min}$ =	9.00	

PAD DESIGN CHECKS

Minimum Steel Required for Shrinkage

Shrinkage:	ρ_{sh} = IF(Fy*1000 >= 60000, 0.0018, 0.002)	ρ_{sh} =	0.0018	
Min. Required Shrinkage Steel:	$A_{st\_p\_sh}$ = ρsh * W * T	$A_{st\_p\_sh}$ =	5.184	in^2

Check **A_{s_p} = 8.36 in^2 >= A_{st_p} = 5.18 in^2** **OK**

Bar Separation

Bar separation:	B_{s_pad} = (W - 2 * cc - db) / (m - 1)	B_{s_pad} =	6.29	in

Check **18" >= B_{s_p} = 6.29 in >= 2"** **OK**

Pad Development Length

Reinforcement location:	α_p = if space under bar > 12", 1.3, else use 1.0	α_p =	1.3	
Epoxy coating:	β_p = for non- epoxy coated, use 1.0	β_p =	1.0	
Max term:	$\alpha\beta_p$ = product of α x β not to exceed 1.7	$\alpha\beta_p$ =	1.3	
Reinforcement size:	γ_p = if bar size is 6 or less, 0.8, else use 1.0	γ_p =	0.8	
Light weight concrete:	λ_p = 1.0	λ_p =	1.0	
Spacing/cover:	c_p = use smaller of half of bar spacing or concrete cover	c_p =	3.38	in
Transverse bars:	k_{tr_p} = 0 in (simplification)	k_{tr_p} =	0	in
Max term:	c_p' = MIN(2.5, (c + ktr) / db)	c_p' =	2.500	
Required moment (φt = 0.9):	M_{nr} = Mu_pad / φflex	M_{nr} =	166.4	ft-kips
Steel estimate:	A_{st_p}' = Mn / (φt * Fy * dc)	A_{st_p}' =	1.860	in^2
	a_p = Ast' * Fy / (β * F'c * W)	a_p =	0.31	in
Required steel:	$A_{st\_p\_st}$ = M_{nr} / (Fy * (dc - ap / 2))	$A_{st\_p\_st}$ =	1.688	in^2
Excess reinforcement:	R_p = Ast_p / As_p	R_p =	0.62	
Development (tensile):	L_d = (3 / 40) * (Fy*1000 / √(F'c*1000)) * αβ * γ * λ * R * db / c'	L_d =	14.72	in
Minimum length:	L_{d_min} = 12 inches	L_{d_min} =	12.0	in
Development length:	L_{dp} = MAX(Ld_min, Ldp')	L_{dp} =	14.72	in
Length available in pad:	L_{pad} = W / 2 - dpier / 2 - ccpad	L_{pad} =	42.00	in

Check **L_{pad} = 42.00 in >= L_{dp} = 14.72 in** **OK**

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

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

Site Data

NewtownAWC

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

Pier Properties		
Concrete:		
Pier Diameter =	2.5	ft
Concrete Area =	706.9	in^2
Reinforcement:		
Clear Cover to **Tie**=	2.00	in
Horiz. **Tie** Bar Size=	3	
Vert. Cage Diameter =	2.03	ft
Vert. Cage Diameter =	24.38	in
Vertical Bar Size =	7	
Bar Diameter =	0.88	in
Bar Area =	0.6	in^2
Number of Bars =	24	
As Total=	14.4	in^2
A s/ Aconc, Rho:	0.0204	2.04%

ACI 10.5 , ACI 21.10.4, and IBC 1810.

Min As for Flexural, Tension Controlled, Shafts:

(3)*(Sqrt(f'c)/Fy:	0.0030
200 / Fy:	0.0033

Minimum Rho Check:

Assumed Min. Rho:	0.50%	
Provided Rho:	2.04%	OK

Ref. Shaft Max Axial Capacities, ϕ Max(Pn or Tn):		
Max Pu = (φ=0.65) Pn. Pn		
per ACI 318 (10-2)	1520.51	kips
at Mu=(ϕ=0.65)Mn=	307.36	ft-kips
Max Tu, (φ=0.9) Tn =	777.6	kips
at Mu=ϕ=(0.90)Mn=	0.00	ft-kips

Maximum Shaft Superimposed Forces		
TIA Revision:	H	
Max. Factored Shaft Mu:	224	ft-kips **(* Note)**
Max. Factored Shaft Pu:	211	kips
Max Axial Force Type:	Comp.	

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

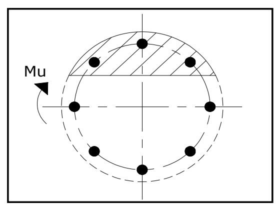
Load Factor	Shaft Factored Loads		
1.00	Mu:	224	ft-kips
1.00	Pu:	211	kips

Material Properties		
Concrete Comp. strength, f'c =	3500	psi
Reinforcement yield strength, Fy =	60	ksi
Reinforcing Modulus of Elasticity, E =	29000	ksi
Reinforcement yield strain =	0.00207	
Limiting compressive strain =	0.003	
ACI 318 Code		
Select Analysis ACI Code=	2014	

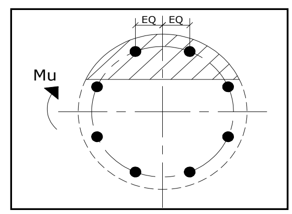
SOLVE <-- Press Upon Completing All Input

Results:

Governing Orientation Case: **1**



Case 1



Case 2

Dist. From Edge to Neutral Axis:	**9.89**	in
Extreme Steel Strain, εt:	**0.0052**	

εt > 0.0050, Tension Controlled

Reduction Factor,φ:	**0.900**	
Output Note: Negative Pu=Tension		
For Axial Compression, φ Pn = Pu:	189.90	kips
Drilled Shaft Moment Capacity, φMn:	**768.27**	ft-kips
Drilled Shaft Superimposed Mu:	**224.00**	ft-kips

(Mu/φMn, Drilled Shaft Flexure CSR:	**29.2%**

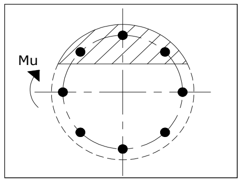
Maximum Allowable Moment of a Circular Pier

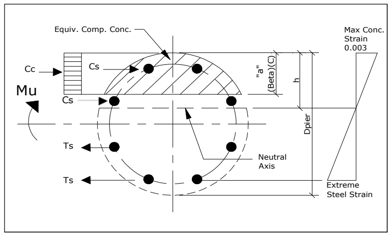
Pu: 211 kips (from Results Tab)
Axial Force type: Comp. (from Results Tab)

For Internal Calculations:
Axial Load (Negative for Compression) = -211.00 kips

	Case 1	Case 2	
Reduction factor, ϕ2002 =	0.9	0.9	<-- ϕ based on ACI 318 2002, Section 9.3.2.2 and corresponding comentaries. Transition zone equation for ties: φ=0.48+83(εt). Transition zone equation for spirals: φ=0.57+67(εt).
Reduction factor, ϕ2005 =	0.9	0.9	<-- ϕ based on ACI 318 2005, Section 9.3.2.2 and corresponding comentaries. Transition zone equation for ties: φ=0.65+((εt)-0.002)(250/3). Transition zone equation for spirals: φ=0.70+((εt)-0.002)(200/3).
Reduction factor, ϕ2014 =	0.9	0.9	<-- ϕ based on ACI 318 2014, Section 21.2 and corresponding comentaries. Transition zone equation for ties: φ=0.65+0.25((εt-εty)/(0.005-εty). Transition zone equation for spirals: φ=0.75+0.15((εt-εty)/(0.005-εty).
ACI code:	0.9	0.9	

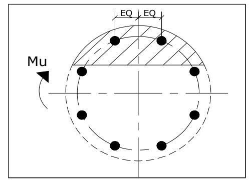
Case 1: Single Bar Near the Extreme Fiber





General Sketch (Variables) for both cases

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



Case 1

Neutral Axis

Distance from extreme edge to neutral axis, h = 9.89 in
Equivalent compression zone factor = 0.85
Distance from extreme edge to equivalent compression zone factor, a = 8.41 in
Distance from centroid to neutral axis = 5.11 in

Compression Zone

Area of steel in compression zone, Asc = 4.20 in^2
Angle from centroid of pier to intersection of equivalent compression zone and edge of pier = 63.93 deg <-- 1/2 of total angle
Area of concrete in compression, Acc = 162.26 in^2
Force in concrete = 0.85 * f`c * Acc, Fc = 482.72 kips <-- ϕ Not Involved = Concrete Pn
Total reinforcement forces, Fs = -271.72 kips <-- ϕ Not Involved = Total Steel Pn
Case 1, φ= 0.900
Axial (comp=negative), Pu = -211.00 kips <-- Pu
Balance Force in concrete, Fs+Fu = -482.72 kips
Shaft Comp. Capacity, ϕPn= **189.90** kips <--φ Pn=Pu

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

Maximum Moment

First moment of the concrete area in compression about the centoid = 1630.91 in^3
Distance between centroid of concrete in compression and centroid of pier = 10.05 in
Moment of concrete in compression = 4851.95 in-kips 404.3291 ft-kips
Total reinforcement moment = 5391.67 in-kips 449.3055 ft-kips
Nominal Moment strength of Drilled Shaft Mn = 10243.62 in-kips
Moment Capacity of Drilled Shaft, ϕMn = 9219.25 in-kips 768.2712 ft-kips

Case 1, φMn = 768.27 ft-kips

Case 2

Neutral Axis

Distance from extreme edge to neutral axis, h = 9.94 in
Equivalent compression zone factor = 0.85
Distance from extreme edge to equivalent compression zone factor, a = 8.45 in
Distance from centroid to neutral axis = 5.06 in

Compression Zone

Area of steel in compression zone, Asc = 4.80 in^2
Angle from centroid of pier to intersection of equivalent compression zone and edge of pier = 64.09 deg <-- 1/2 of total angle
Area of concrete in compression, Acc = 163.25 in^2
Force in concrete = 0.85 * f`c * Acc, Fc = 485.66 kips <-- ϕ Not Involved = Concrete Pn
Total reinforcement forces, Fs = -274.66 kips <-- ϕ Not Involved = Total Steel Pn
Case 2, φ= 0.900
Axial (comp=negative), Pu = -211.00 kips <-- Pu
Balance Force in concrete, Fs+Fu = -485.66 kips
Shaft Comp. Capacity, ϕPn= **189.90** kips <--φ Pn=Pu

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

Maximum Moment

First moment of the concrete area in compression about the centoid = 1637.42 in^3
Distance between centroid of concrete in compression and centroid of pier = 10.03 in
Moment of concrete in compression = 4871.33 in-kips 405.944 ft-kips
Total reinforcement moment = 5390.57 in-kips 449.2138 ft-kips
Nominal Moment strength of Drilled Shaft Mn = 10261.89 in-kips
Moment Capacity of Drilled Shaft, ϕMn = 9235.70 in-kips 769.642 ft-kips

Case 2, φMn = 769.64 ft-kips

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

Neutral Axis

Distance from extreme edge to neutral axis, h = 28.71 in
Equivalent compression zone factor = 0.85
Distance from extreme edge to equivalent compression zone factor, a = 24.41 in
Distance from centroid to neutral axis = -13.71 in

Compression Zone

Area of steel in compression zone, Asc = 11.40 in^2
Angle from centroid of pier to intersection of equivalent compression zone and edge of pier = 128.83 deg <-- 1/2 of total angle
Area of concrete in compression, Acc = 615.82 in^2
Force in concrete = 0.85 * f`c * Acc, Fc = 1832.06 kips <-- ϕ Not Involved = Concrete Pn
Total reinforcement forces, Fs = 507.19 kips <-- ϕ Not Involved = Total Steel Pn
φ= 0.65
Magnified, Max Axial Comp, Pn, per ACI 318 (10-2)/(ϕ=0.65)= -2339.25 kips <-- (Pn per ACI 10-2)/ϕ
Balance Force in concrete, Fs+Fu = -1832.06 kips
Shaft Comp. Capacity, (ϕ=0.65)Pn= **1520.51** kips <--φ Pn=Pu

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

Maximum Moment

First moment of the concrete area in compression about the centoid = 1063.65 in^3
Distance between centroid of concrete in compression and centroid of pier = 1.73 in
Moment of concrete in compression = 3164.36 in-kips 263.6967 ft-kips
Total reinforcement moment = 2509.99 in-kips 209.1658 ft-kips
Nominal Moment strength of Drilled Shaft Mn = 5674.35 in-kips
Moment Capacity of Drilled Shaft, (ϕ=0.65)Mn = 3688.33 in-kips 307.3606 ft-kips

Case 3, at Pmax, (φ=0.65)Mn = 307.36 ft-kips

Final Results		
Governing Orientation Case=	**1**	
phi, φ=	0.900	
Shaft ϕ*Mn=	**768.27**	ft-kips
Distance from Edge of Shaft to N.A.=	9.89	in
Shaft Beta=	0.85	
Maximum Tensile Strain=	-0.00524	<------------ εt > 0.0050, Tension Controlled
Shaft Tension Cap., φTn= (φ=0.9)*(Total As)(Fy)=	777.60	kips
Shaft Max Comp, (φ=0.65)(0.80)[0.85*f'c*(Ag-Ast)+Ast*Fy]=	1520.51	kips

TC

Individual Bars

Bar #	Angle from first bar (deg)	Distance to center of shaft (in)	Distance to neutral axis (in)	Distance to equivalent comp. zone (in)	Strain	Area of steel in compression (in^2)	Stress (ksi)	Axial force (kips)	Moment (in-kips)
1	0.00	12.19	7.08	5.60	0.00215	0.60	60.00	34.22	417.00
2	15.00	11.77	6.67	5.18	0.00202	0.60	58.61	33.38	393.00
3	30.00	10.55	5.45	3.96	0.00165	0.60	47.91	26.96	284.54
4	45.00	8.62	3.51	2.03	0.00106	0.60	30.87	16.74	144.26
5	60.00	6.09	0.99	-0.50	0.00030	0.00	8.68	5.21	31.72
6	75.00	3.15	-1.95	-3.44	-0.00059	0.00	-17.17	-10.30	-32.50
7	90.00	0.00	-5.11	-6.59	-0.00155	0.00	-44.91	-26.95	0.00
8	105.00	-3.15	-8.26	-9.75	-0.00251	0.00	-60.00	-36.00	113.56
9	120.00	-6.09	-11.20	-12.68	-0.00340	0.00	-60.00	-36.00	219.38
10	135.00	-8.62	-13.73	-15.21	-0.00416	0.00	-60.00	-36.00	310.24
11	150.00	-10.55	-15.66	-17.15	-0.00475	0.00	-60.00	-36.00	379.97
12	165.00	-11.77	-16.88	-18.36	-0.00512	0.00	-60.00	-36.00	423.80
13	180.00	-12.19	-17.29	-18.78	-0.00524	0.00	-60.00	-36.00	438.75
14	195.00	-11.77	-16.88	-18.36	-0.00512	0.00	-60.00	-36.00	423.80
15	210.00	-10.55	-15.66	-17.15	-0.00475	0.00	-60.00	-36.00	379.97
16	225.00	-8.62	-13.73	-15.21	-0.00416	0.00	-60.00	-36.00	310.24
17	240.00	-6.09	-11.20	-12.68	-0.00340	0.00	-60.00	-36.00	219.38
18	255.00	-3.15	-8.26	-9.75	-0.00251	0.00	-60.00	-36.00	113.56
19	270.00	0.00	-5.11	-6.59	-0.00155	0.00	-44.91	-26.95	0.00
20	285.00	3.15	-1.95	-3.44	-0.00059	0.00	-17.17	-10.30	-32.50
21	300.00	6.09	0.99	-0.50	0.00030	0.00	8.68	5.21	31.72
22	315.00	8.62	3.51	2.03	0.00106	0.60	30.87	16.74	144.26
23	330.00	10.55	5.45	3.96	0.00165	0.60	47.91	26.96	284.54
24	345.00	11.77	6.67	5.18	0.00202	0.60	58.61	33.38	393.00
				Min-->	-0.00524	4.20		-271.72	5391.67
									449.3055

Bar #	Angle from first bar (deg)	Distance to center of shaft (in)	Distance to neutral axis (in)	Distance to equivalent comp. zone (in)	Strain	Area of steel in compression (in^2)	Stress (ksi)	Axial force (kips)	Moment (in-kips)
1	7.50	12.08	7.02	5.53	0.00212	0.60	60.00	34.22	413.43
2	22.50	11.26	6.20	4.71	0.00187	0.60	54.25	30.77	346.41
3	37.50	9.67	4.61	3.11	0.00139	0.60	40.32	22.41	216.66
4	52.50	7.42	2.36	0.86	0.00071	0.60	20.62	10.59	78.56
5	67.50	4.66	-0.40	-1.89	-0.00012	0.00	-3.50	-2.10	-9.80
6	82.50	1.59	-3.47	-4.96	-0.00105	0.00	-30.41	-18.25	-29.03
7	97.50	-1.59	-6.65	-8.15	-0.00201	0.00	-58.27	-34.96	55.62
8	112.50	-4.66	-9.73	-11.22	-0.00294	0.00	-60.00	-36.00	167.90
9	127.50	-7.42	-12.48	-13.97	-0.00377	0.00	-60.00	-36.00	267.09
10	142.50	-9.67	-14.73	-16.22	-0.00445	0.00	-60.00	-36.00	348.08
11	157.50	-11.26	-16.32	-17.81	-0.00493	0.00	-60.00	-36.00	405.35
12	172.50	-12.08	-17.15	-18.64	-0.00518	0.00	-60.00	-36.00	435.00
13	187.50	-12.08	-17.15	-18.64	-0.00518	0.00	-60.00	-36.00	435.00
14	202.50	-11.26	-16.32	-17.81	-0.00493	0.00	-60.00	-36.00	405.35
15	217.50	-9.67	-14.73	-16.22	-0.00445	0.00	-60.00	-36.00	348.08
16	232.50	-7.42	-12.48	-13.97	-0.00377	0.00	-60.00	-36.00	267.09
17	247.50	-4.66	-9.73	-11.22	-0.00294	0.00	-60.00	-36.00	167.90
18	262.50	-1.59	-6.65	-8.15	-0.00201	0.00	-58.27	-34.96	55.62
19	277.50	1.59	-3.47	-4.96	-0.00105	0.00	-30.41	-18.25	-29.03
20	292.50	4.66	-0.40	-1.89	-0.00012	0.00	-3.50	-2.10	-9.80
21	307.50	7.42	2.36	0.86	0.00071	0.60	20.62	10.59	78.56
22	322.50	9.67	4.61	3.11	0.00139	0.60	40.32	22.41	216.66
23	337.50	11.26	6.20	4.71	0.00187	0.60	54.25	30.77	346.41
24	352.50	12.08	7.02	5.53	0.00212	0.60	60.00	34.22	413.43
				Min-->	-0.00518	4.80		-274.66	5390.57
									449.2138

Individual Bars

Bar #	Angle from first bar (deg)	Distance to center of shaft (in)	Distance to neutral axis (in)	Distance to equivalent comp. zone (in)	Strain	Area of steel in compression (in^2)	Stress (ksi)	Axial force (kips)	Moment (in-kips)
1	0.00	12.19	25.90	21.59	0.00271	0.60	60.00	34.22	417.00
2	15.00	11.77	25.48	21.18	0.00266	0.60	60.00	34.22	402.79
3	30.00	10.55	24.27	19.96	0.00254	0.60	60.00	34.22	361.13
4	45.00	8.62	22.33	18.02	0.00233	0.60	60.00	34.22	294.86
5	60.00	6.09	19.81	15.50	0.00207	0.60	60.00	34.22	208.50
6	75.00	3.15	16.87	12.56	0.00176	0.60	51.11	28.88	91.09
7	90.00	0.00	13.71	9.41	0.00143	0.60	41.55	23.14	0.00
8	105.00	-3.15	10.56	6.25	0.00110	0.60	31.99	17.41	-54.92
9	120.00	-6.09	7.62	3.31	0.00080	0.60	23.08	12.07	-73.52
10	135.00	-8.62	5.09	0.79	0.00053	0.60	15.44	7.48	-64.43
11	150.00	-10.55	3.16	-1.15	0.00033	0.00	9.57	5.74	-60.59
12	165.00	-11.77	1.94	-2.37	0.00020	0.00	5.88	3.53	-41.52
13	180.00	-12.19	1.52	-2.78	0.00016	0.00	4.62	2.77	-33.78
14	195.00	-11.77	1.94	-2.37	0.00020	0.00	5.88	3.53	-41.52
15	210.00	-10.55	3.16	-1.15	0.00033	0.00	9.57	5.74	-60.59
16	225.00	-8.62	5.09	0.79	0.00053	0.60	15.44	7.48	-64.43
17	240.00	-6.09	7.62	3.31	0.00080	0.60	23.08	12.07	-73.52
18	255.00	-3.15	10.56	6.25	0.00110	0.60	31.99	17.41	-54.92
19	270.00	0.00	13.71	9.41	0.00143	0.60	41.55	23.14	0.00
20	285.00	3.15	16.87	12.56	0.00176	0.60	51.11	28.88	91.09
21	300.00	6.09	19.81	15.50	0.00207	0.60	60.00	34.22	208.50
22	315.00	8.62	22.33	18.02	0.00233	0.60	60.00	34.22	294.86
23	330.00	10.55	24.27	19.96	0.00254	0.60	60.00	34.22	361.13
24	345.00	11.77	25.48	21.18	0.00266	0.60	60.00	34.22	402.79
				Min-->	0.00016	11.40		507.19	2509.99
									209.1658

TIA-222- H

Solve

*Highlighted cells have been modified

FACTORED LOADS

Axial Load 0.9D:	$P_{\_0.9D}$ = 0.9 * Pcomp / 1.2	$P_{\_0.9D}$ =	158.25	kip
Axial Load 1.2D:	$P_{\_1.2D}$ = 1.2 * Pcomp / 1.2	$P_{\_1.2D}$ =	211.00	kip
Shear Load:	V_u = Vu_comp	V_u =	28.00	kip
Moment:	M_u = Mu	M_u =	0.00	kip*ft

PASSIVE PRESSURE RESISTANCE (ORTHOGONAL DIRECTION)

Force of Pp Applied on Pier:	$Force_{pier}$ = MIN(Vu,Sum(Pp!M2:M7))	$Force_{pier}$ =	24.96	kip
Moment Arm of Pp on Pier:	M_{arm_pier} = D-T-Pp!O2 + T	M_{arm_pier} =	3.82	ft
Force of Pp Applied on Pad:	$Force_{pad}$ = MIN(Vu-$Force_{pier}$,SUM(Pp!M8:M13))	$Force_{pad}$ =	3.04	kip
Moment Arm of Pp on Pad:	M_{arm_pad} = D-Pp!O8	M_{arm_pad} =	0.96	ft
Unfactored Moment Resistance due to Passive Pressure:	M_{R_Pp} = $Force_{pier}$*M_{arm_pier}+$Force_{pad}$*M_{arm_pad}	M_{R_Pp} =	98.20	kip*ft
Factored Moment Resistance due to Passive Pressure:	ΦM_{R_Pp} = Φ_s*M_{R_Pp}	ΦM_{R_Pp} =	73.65	kip*ft

PLASTIC BEARING PRESSURE & OVERTURNING MOMENT (ORTHOGONAL DIRECTION)

*Compressive Load for Bearing (0.9*D LC):*	$P_{bearing\_0.9}$ = P_0.9D+0.9*(Ws+Wc)+0.75*Wwedges_0.9_bearing	$P_{bearing\_0.9}$ =	271.10	kip	
*Compressive Load for Bearing (1.2*D LC):*	$P_{bearing\_1.2}$ = P_1.2D+1.2*(Ws+Wc)+0.75*Wwedges_1.2_bearing	$P_{bearing\_1.2}$ =	361.47	kip	
Factored Overturning Moment:	$M_{overturning}$ = M_u + V_u * (MAX(T,D)+E+bp_{dist}/12)	$M_{overturning}$ =	0.00	kip*ft	
Area of Pad:	Area = W²	Area =	100.00	ft²	
Plastic Section Modulus of Pad:	Z = W³ / 4	Z =	250.00	ft³	
*Preliminary Load Eccentricity (0.9*D LC):*	$pre\_ec_{\_0.9\_p}$ = $M_{overturning}$/$P_{bearing\_0.9}$	$pre\_ec_{\_0.9\_p}$ =	0.00	ft	
*Preliminary Load Eccentricity (1.2*D LC):*	$pre\_ec_{\_1.2\_p}$ = $M_{overturning}$/$P_{bearing\_1.2}$	$pre\_ec_{\_1.2\_p}$ =	0.00	ft	
*[Goal Seek] Load Eccentricity Iteration (0.9*D LC):*	$ec_{\_0.9\_p}$ = *goal seek*	$ec_{\_0.9\_p}$ =	0.00	ft	e <= L/4
*[Goal Seek] Load Eccentricity Iteration (1.2*D LC):*	$ec_{\_1.2\_p}$ = *goal seek*	$ec_{\_1.2\_p}$ =	0.00	ft	e <= L/4
*Non-Bearing Length (0.9*D LC):*	$NBL_{\_0.9}$ = 0	$NBL_{\_0.9}$ =	0.00	ft	
*Non-Bearing Length (1.2*D LC):*	$NBL_{\_1.2}$ = 0	$NBL_{\_1.2}$ =	0.00	ft	
*Total Factored Resisting Moment due to Pp and Soil Wedges / Shear (0.9*D LC):*	$\Phi M_{Resisting\_0.9}$ = ΦM_{R_Pp} + SUM($\Phi M_{R\_wedges\_0.9}$,$\Phi M_{R\_shear\_0.9}$)	$\Phi M_{Resisting\_0.9}$ =	73.65	kip*ft	
*Total Factored Resisting Moment due to Pp and Soil Wedges / Shear (1.2*D LC):*	$\Phi M_{Resisting\_1.2}$ = ΦM_{R_Pp} + SUM($\Phi M_{R\_wedges\_1.2}$,$\Phi M_{R\_shear\_1.2}$)	$\Phi M_{Resisting\_1.2}$ =	73.65	kip*ft	
*Adjusted Overturning Moment (0.9*D LC):*	$M_{overturning\_adj\_0.9}$ = $M_{overturning}$ - $\Phi M_{Resisting\_0.9}$	$M_{overturning\_0.9}$ =	0.00	kip*ft	
*Adjusted Overturning Moment (1.2*D LC):*	$M_{overturning\_adj\_1.2}$ = $M_{overturning}$ - $\Phi M_{Resisting\_1.2}$	$M_{overturning\_1.2}$ =	0.00	kip*ft	
*Total Resistance to Overturning (0.9*D LC):*	$\Phi M_{Resisting\_qu\_0.9}$ = $P_{bearing\_0.9}$*$ec_{\_0.9\_p}$ + $\Phi M_{Resisting\_0.9}$	$\Phi M_{Resisting\_qu\_0.9}$ =	73.65	kip*ft	
*Total Resistance to Overturning (1.2*D LC):*	$\Phi M_{Resisting\_qu\_1.2}$ = $P_{bearing\_1.2}$*$ec_{\_1.2\_p}$ + $\Phi M_{Resisting\_1.2}$	$\Phi M_{Resisting\_qu\_1.2}$ =	73.65	kip*ft	
[Goal Seek] Moment Comparison Iteration (0.9D LC):	$\Delta M_{\_0.9}$ = $M_{overturning}$-$\Phi M_{Resisting\_qu\_0.9}$	$\Delta M_{\_0.9}$ =	-73.65	kip*ft	
[Goal Seek] Moment Comparison Iteration (1.2D LC):	$\Delta M_{\_1.2}$ = $M_{overturning}$-$\Phi M_{Resisting\_qu\_1.2}$	$\Delta M_{\_1.2}$ =	-73.65	kip*ft	

Bearing Pressures

*Orthogonal Bearing Pressure (0.9*D LC):*	$q_{u\_orth\_0.9}$ = MAX(Pbearing_0.9/Area + Moverturning_0.9/Z, Pbearing_0.9/Area - Moverturning_0.9/Z)	$q_{u\_orth\_0.9}$ =	2.71	ksf
*Orthogonal Bearing Pressure (1.2*D LC):*	$q_{u\_orth\_1.2}$ = MAX(Pbearing_1.2/Area + Moverturning_1.2/Z, Pbearing_1.2/Area - Moverturning_1.2/Z)	$q_{u\_orth\_1.2}$ =	3.61	ksf
Ultimate Gross Bearing Pressure:	Q_{ult} = Qult + (γ/1000) * D	Q_{ult} =	13.19	ksf
Factored Ultimate Gross Bearing Pressure:	ΦQult = φs * Qult	Qa =	9.89	ksf

Check **ΦQult = 9.89 ksf >= q_u = 3.61 ksf** **RATING: 36.55% OK**

Soil Wedges (Cohesionless Soil)

1 1 Load Resistance Utilization I

Soil (above pad) Height:	soilht = D-T	soilht =	7.50	ft
Soil (above pad & under water table) Height:	soilht_gw = MIN(soilht-gw,D-T)	soilht_gw =	0.00	ft
Soil Wedge Projection at Grade:	$Wedge_{\_proj}$ = TAN(ϕ*PI()/180)*soilht	$Wedge_{\_proj}$ =	5.06	ft
Soil Wedge Projection at Water Table:	$Wedge_{\_proj\_gw}$ = TAN(ϕ*PI()/180)*(soilht_gw)	$Wedge_{\_proj\_gw}$ =	0.00	ft

Soil Wedges (Cohesionless Soil) (0.9*D LC)

Soil	Volume (ft³)	Soil Weight (kips)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
(2) End Prisms (above Water Table)	0.00	0.00	10.00	0.00
(2) End Prisms (below Water Table)	0.00	0.00	0.00	0.00
(2) Partial Sides (above Water Table)	0.00	0.00	10.00	0.00
(2) Partial Sides (below Water Table)	0.00	0.00	10.00	0.00
(1) Rear (above Water Table)	0.00	0.00	11.69	0.00
(1) Rear (below Water Table)	0.00	0.00	0.00	0.00
Total	0.00	0.00		0.00

Eccentricity relative to W/2:

Total Moment Arm (ft) =	0.00
Soil Wedge Wt (kip)=	0.00

*Unfactored Resisting Moment of Wedges (0.9*D LC):*	$M_{R\_wedges\_0.9}$ = Total Moment Arm * Soil Wedge Wt	$M_{R\_wedges\_0.9}$ =	0.00	kip*ft
*Factored Resisting Moment of Wedges (0.9*D LC):*	$\Phi M_{R\_wedges\_0.9}$ = 0.75*MR_wedges_0.9	$\Phi M_{R\_wedges\_0.9}$ =	0.00	kip*ft

Soil Wedges (Cohesionless Soil) (1.2*D LC)

Soil	Volume (ft³)	Soil Weight (kips)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
(2) End Prisms (above Water Table)	0.00	0.00	10.00	0.00
(2) End Prisms (below Water Table)	0.00	0.00	0.00	0.00
(2) Partial Sides (above Water Table)	0.00	0.00	10.00	0.00
(2) Partial Sides (below Water Table)	0.00	0.00	10.00	0.00
(1) Rear (above Water Table)	0.00	0.00	11.69	0.00
(1) Rear (below Water Table)	0.00	0.00	0.00	0.00
Total	0.00	0.00		0.00

Eccentricity relative to W/2:

Total Moment Arm (ft) =	0.00
Soil Wedge Wt (kip)=	0.00

*Unfactored Resisting Moment of Wedges (1.2*D LC):* $M_{R\_wedges\_1.2}$ = Total Moment Arm * Soil Wedge Wt — $M_{R\_wedges\_1.2}$ = 0.00 kip*ft

*Factored Resisting Moment of Wedges (1.2*D LC):* $\Phi M_{R\_wedges\_1.2}$ = 0.75*MR_wedges_1.2 — $\Phi M_{R\_wedges\_1.2}$ = 0.00 kip*ft

Soil Shear Strength (Cohesive Soil)

Soil Shear Strength (Cohesive Soil) (0.9*D LC)

Plane	Area (ft²)	Resistance (kip)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
Rear	0.00	0.00	10.00	0.00
(2) Partial Sides	0.00	0.00	10.00	0.00
Total		0.00		0.00

Eccentricity relative to W/2:

Total Moment Arm (ft) =	0.00
Soil Shear Strength (kip)=	0.00

*Unfactored Resisting Moment of Soil Shear (0.9*D LC):* $M_{R\_shear\_0.9}$ = Total Moment Arm * Soil Shear Strength — $M_{R\_shear\_0.9}$ = 0.00 kip*ft

*Factored Resisting Moment of Soil Shear (0.9*D LC):* $\Phi M_{R\_shear\_0.9}$ = 0.75 * (Total Moment Arm * Soil Shear Strength) — $\Phi M_{R\_shear\_0.9}$ = 0.00 kip*ft

Soil Shear Strength (Cohesive Soil) (1.2*D LC)

Plane	Area (ft²)	Resistance (kip)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
Rear	0.00	0.00	10.00	0.00
(2) Partial Sides	0.00	0.00	10.00	0.00
Total		0.00		0.00

Eccentricity relative to W/2:

Total Moment Arm (ft) =	0.00
Soil Shear Strength (kip)=	0.00

*Unfactored Resisting Moment of Soil Shear (1.2*D LC):* $M_{R\_shear\_1.2}$ = Total Moment Arm * Soil Shear Strength — $M_{R\_shear\_1.2}$ = 0.00 kip*ft

*Factored Resisting Moment of Soil Shear (1.2*D LC):* $\Phi M_{R\_shear\_1.2}$ = 0.75 * (Total Moment Arm * Soil Shear Strength) — $\Phi M_{R\_shear\_1.2}$ = 0.00 kip*ft

DETERMINE MOMENT THAT WOULD CAUSE 100% OVERTURNING (ORTHOGONAL)

*Compressive Load for Bearing (0.9*D LC):*	$P_{\_100}$ = P_0.9D+0.9*(Ws+Wc)+0.75*Wwedges_100	$P_{\_100}$ =	323.21	kip
Preliminary Factored Overturning Moment:	pre_$M_{overturning_100}$ = (W/2-(P_100/ΦQult)/(2*W))*(P_100)	pre_$M_{overturning_100}$ =	1087.95	kip*ft
*Preliminary Load Eccentricity (0.9*D LC):*	pre_$ec_{_100}$ = pre_$M_{overturning_100}$ / $P_{\_100}$	pre_$ec_{_100}$ =	3.37	ft
*[Goal Seek] Load Eccentricity Iteration (0.9*D LC):*	$ec_{\_100}$ = *goal seek*	$ec_{\_100}$ =	3.14	ft
*Non-Bearing Length (0.9*D LC):*	$NBL_{\_100}$ = 2*ec_100	$NBL_{\_100}$ =	6.28	ft
*Total Factored Resisting Moment due to Pp and Soil Wedges / Shear (0.9*D LC):*	$\Phi M_{Resisting\_100}$ = ΦM_{R_Pp} + SUM($\Phi M_{R\_wedges\_100}$,$\Phi M_{R\_shear\_100}$)	$\Phi M_{Resisting\_100}$ =	316.87	kip*ft
Moment Created by Shear:	M_{shear} = V_u * (D+E+bp_{dist}/12)	M_{shear} =	289.33	kip*ft
*Adjusted Overturning Moment (0.9*D LC):*	$M_{overturning\_100}$ = $M_{u\_max\_100}$ - ΦM_{R_Pp}	$M_{overturning\_100}$ =	1331.16	kip*ft
*Total Resistance to Overturning (0.9*D LC):*	$\Phi M_{Resisting\_qu\_100}$ = $P_{\_100}$*$ec_{\_100}$ + $\Phi M_{Resisting\_100}$	$\Phi M_{Resisting\_qu\_100}$ =	1331.16	kip*ft
[Goal Seek] Moment Comparison Iteration (0.9D LC):	$\Delta M_{\_100}$ = $M_{overturning}$ - $\Phi M_{Resisting\_qu\_100}$	$\Delta M_{\_100}$ =	0.00	ft
Maximum Applied Moment from Superstructure Analysis:	$M_{u\_max\_100}$ = pre_Moverturning_100 + ΦMResisting_100	$M_{u\_max\_100}$ =	1404.81	kip*ft

L/4 < e <= L/2

Check **Mu_max_100 = 1404.81 kip*ft >= Mu = 0.00 kip*ft** **RATING: 0.00% OK**

Soil Wedges (Cohesionless Soil) (0.9*D LC)

Soil	Volume (ft³)	Soil Weight (kips)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
(2) End Prisms (above Water Table)	127.96	15.99	11.90	190.29
(2) End Prisms (below Water Table)	0.00	0.00	0.00	0.00
(2) Partial Sides (above Water Table)	238.13	29.77	6.86	204.25
(2) Partial Sides (below Water Table)	0.00	0.00	6.86	0.00
(1) Rear (above Water Table)	189.71	23.71	11.69	277.12
(1) Rear (below Water Table)	0.00	0.00	0.00	0.00
Total	555.80	69.47		671.66

Wedge Eccentricity relative to W/2:

Total Moment Arm (ft) =	4.67
Soil Wedge Wt (kip)=	69.47

*Unfactored Resisting Moment of Wedges (0.9*D LC):* $M_{R\_wedges\_100}$ = Total Moment Arm * Soil Wedge Wt — $M_{R\_wedges\_100}$ = 324.29 kip*ft

*Factored Resisting Moment of Wedges (0.9*D LC):* $\Phi M_{R\_wedges\_100}$ = 0.75*MR_wedges_100 — $\Phi M_{R\_wedges\_100}$ = 243.22 kip*ft

Soil Shear Strength (Cohesive Soil) (0.9*D LC)

Plane	Area (ft²)	Resistance (kip)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
Rear	41.70	0.00	10.00	0.00
(2) Partial Sides	52.35	0.00	6.86	0.00
Total		0.00		0.00

Wedge Eccentricity relative to W/2:

Total Moment Arm (ft) =	0.00
Soil Shear Strength (kip)=	0.00

*Unfactored Resisting Moment of Soil Shear (0.9*D LC):* $M_{R\_shear\_100}$ = Total Moment Arm * Soil Shear Strength — $M_{R\_shear\_100}$ = 0.00 kip*ft

*Factored Resisting Moment of Soil Shear (0.9*D LC):* $\Phi M_{R\_shear\_100}$ = 0.75 * (Total Moment Arm * Soil Shear Strength) — $\Phi M_{R\_shear\_100}$ = 0.00 kip*ft

PASSIVE PRESSURE RESISTANCE (DIAGONAL DIRECTION)

Force of Pp Applied on Pier:	$Force_{pier}$ = MIN(Vu,Sum(Pp!M2:M7))	$Force_{pier}$ =	24.96	kip
Moment Arm of Pp on Pier:	M_{arm_pier} = D-T-Pp!O2 + T	M_{arm_pier} =	3.82	ft
Force of Pp Applied on Pad:	$Force_{pad\_dia}$ = MIN(Vu-$Force_{pier}$,SUM(Pp!M8:M13))*(T*W*SQRT(2))/(T*W))	$Force_{pad\_dia}$ =	3.04	kip
Moment Arm of Pp on Pad:	M_{arm_pad} = D-Pp!O8	M_{arm_pad} =	0.96	ft
Unfactored Moment Resistance due to Passive Pressure:	$M_{R\_Pp\_dia}$ = $Force_{pier}$*M_{arm_pier}+$Force_{pad}$*M_{arm_pad}	$M_{R\_Pp\_dia}$ =	98.20	kip*ft
Factored Moment Resistance due to Passive Pressure:	$\Phi M_{R\_Pp\_dia}$ = Φ_s*M_{R_Pp}	$\Phi M_{R\_Pp\_dia}$ =	73.65	kip*ft

PLASTIC BEARING PRESSURE & OVERTURNING MOMENT (DIAGONAL DIRECTION)

*Compressive Load for Bearing (0.9*D LC):*	$P_{bearing\_0.9\_dia}$ = P_0.9D+0.9*(Ws+Wc)+0.75*Wwedges_0.9_bearing_dia	$P_{bearing\_0.9\_dia}$ =	271.10	kip	
*Compressive Load for Bearing (1.2*D LC):*	$P_{bearing\_1.2\_dia}$ = P_1.2D+1.2*(Ws+Wc)+0.75*Wwedges_1.2_bearing_dia	$P_{bearing\_1.2\_dia}$ =	361.47	kip	
Factored Overturning Moment:	$M_{overturning} = M_u + V_u * (D+E+bp_{dist}/12)$	$M_{overturning}$ =	0.00	kip*ft	
Area of Pad:	Area = W^2	Area =	100.00	ft^2	
Plastic Section Modulus of Pad:	$Z_{\_dia} = W^3 / (3*SQRT(2))$	$Z_{\_dia}$ =	235.70	ft^3	
*Preliminary Load Eccentricity (0.9*D LC):*	$pre\_ec_{\_0.9\_p\_dia} = M_{overturning}/P_{bearing\_0.9\_dia}$	$pre\_ec_{\_0.9\_p\_dia}$ =	0.00	ft	
*Preliminary Load Eccentricity (1.2*D LC):*	$pre\_ec_{\_1.2\_p\_dia} = M_{overturning}/P_{bearing\_1.2\_dia}$	$pre\_ec_{\_1.2\_p\_dia}$ =	0.00	ft	
*[Goal Seek] Load Eccentricity Iteration (0.9*D LC):*	$ec_{\_0.9\_p\_dia}$ = *goal seek*	$ec_{\_0.9\_p\_dia}$ =	0.00	ft	e <= (L/4)*SQRT(2)/2
*[Goal Seek] Load Eccentricity Iteration (1.2*D LC):*	$ec_{\_1.2\_p\_dia}$ = *goal seek*	$ec_{\_1.2\_p\_dia}$ =	0.00	ft	e <= (L/4)*SQRT(2)/2
*Non-Bearing Length (0.9*D LC):*	$NBL_{\_0.9\_dia}$ = 0	$NBL_{\_0.9\_dia}$ =	0.00	ft	
*Non-Bearing Length (1.2*D LC):*	$NBL_{\_1.2\_dia}$ = 0	$NBL_{\_1.2\_dia}$ =	0.00	ft	
*Total Factored Resisting Moment due to Pp and Soil Wedges / Shear (0.9*D LC):*	$\Phi M_{Resisting\_0.9} = \Phi M_{R\_Pp\_dia}$ + SUM($\Phi M_{R\_wedges\_0.9\_dia}$,$\Phi M_{R\_shear\_0.9\_dia}$)	$\Phi M_{Resisting\_0.9\_dia}$ =	73.65	kip*ft	
*Total Factored Resisting Moment due to Pp and Soil Wedges / Shear (1.2*D LC):*	$\Phi M_{Resisting\_1.2} = \Phi M_{R\_Pp\_dia}$ + SUM($\Phi M_{R\_wedges\_1.2\_dia}$,$\Phi M_{R\_shear\_1.2\_dia}$)	$\Phi M_{Resisting\_1.2\_dia}$ =	73.65	kip*ft	
*Adjusted Overturning Moment (0.9*D LC):*	$M_{overturning\_0.9\_dia} = M_{overturning} - \Phi M_{Resisting\_0.9\_dia}$	$M_{overturning\_0.9\_dia}$ =	0.00	kip*ft	
*Adjusted Overturning Moment (1.2*D LC):*	$M_{overturning\_1.2\_dia} = M_{overturning} - \Phi M_{Resisting\_1.2\_dia}$	$M_{overturning\_1.2\_dia}$ =	0.00	kip*ft	
*Total Resistance to Overturning (0.9*D LC):*	$\Phi M_{Resisting\_qu\_0.9\_dia} = P_{bearing\_0.9\_dia}*ec_{\_0.9\_p\_dia} + \Phi M_{Resisting\_0.9\_dia}$	$\Phi M_{Resisting\_qu\_0.9\_dia}$ =	73.65	kip*ft	
*Total Resistance to Overturning (1.2*D LC):*	$\Phi M_{Resisting\_qu\_1.2\_dia} = P_{bearing\_1.2\_dia}*ec_{\_1.2\_p\_dia} + \Phi M_{Resisting\_1.2\_dia}$	$\Phi M_{Resisting\_qu\_1.2\_dia}$ =	73.65	kip*ft	
[Goal Seek] Moment Comparison Iteration (0.9D LC):	$\Delta M_{\_0.9\_dia} = M_{overturning} - \Phi M_{Resisting\_qu\_0.9\_dia}$	$\Delta M_{\_0.9\_dia}$ =	-73.65	kip*ft	
[Goal Seek] Moment Comparison Iteration (1.2D LC):	$\Delta M_{\_1.2\_dia} = M_{overturning} - \Phi M_{Resisting\_qu\_1.2\_dia}$	$\Delta M_{\_1.2\_dia}$ =	-73.65	kip*ft	

Bearing Pressures

*Diagonal Bearing Pressure (0.9*D LC):*	$q_{u\_dia\_0.9}$ = Pbearing_0.9_dia/Area + Moverturning_0.9_dia / Z_dia	$q_{u\_dia\_0.9}$ =	2.71	ksf
*Diagonal Bearing Pressure (1.2*D LC):*	$q_{u\_dia\_1.2}$ = Pbearing_1.2_dia/Area + Moverturning_1.2_dia / Z_dia	$q_{u\_dia\_1.2}$ =	3.61	ksf
Ultimate Gross Bearing Pressure:	Q_{ult} = Qult + (γ/1000) * D	Q_{ult} =	13.19	ksf
Factored Ultimate Gross Bearing Pressure:	ΦQult = φs * Qult	Qa =	9.89	ksf

Check **ΦQult = 9.89 ksf >= q_u = 3.61 ksf** **RATING: 36.55% OK**

Soil Wedges (Cohesionless Soil)

1 1 Load Resistance Utilization I

Soil (above pad) Height:	soilht = D-T	soilht =	7.50	ft
Soil (above pad & under water table) Height:	soilht_gw = MIN(soilht-gw,D-T)	soilht_gw =	0.00	ft
Soil Wedge Projection at Grade:	$Wedge_{\_proj}$ = TAN(ϕ*PI()/180)*soilht	$Wedge_{\_proj}$ =	5.06	ft
Soil Wedge Projection at Water Table:	$Wedge_{\_proj\_gw}$ = TAN(ϕ*PI()/180)*(soilht_gw)	$Wedge_{\_proj\_gw}$ =	0.00	ft

Soil Wedges (Cohesionless Soil) (0.9*D LC)

Soil	Volume (ft^3)	Soil Weight (kips)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
(2) End Prisms (above Water Table)	0.00	0.00	0.00	0.00
(2) End Prisms (below Water Table)	0.00	0.00	0.00	0.00
(1) End Prism (above Water Table)	0.00	0.00	0.00	0.00
(1) End Prisms (below Water Table)	0.00	0.00	0.00	0.00
(2) Partial Sides (above Water Table)	0.00	0.00	6.18	0.00
(2) Partial Sides (below Water Table)	0.00	0.00	0.00	0.00
(2) Rear (above Water Table)	0.00	0.00	11.50	0.00
(2) Rear (below Water Table)	0.00	0.00	0.00	0.00
Total	0.00	0.00		0.00

Eccentricity relative to W/2*SQRT(2):

Total Moment Arm (ft) =	0.00
Soil Wedge Wt (kip)=	0.00

*Unfactored Resisting Moment of Wedges (0.9*D LC):*	$M_{R\_wedges\_0.9}$ = Total Moment Arm * Soil Wedge Wt	$M_{R\_wedges\_0.9\_dia}$ =	0.00	kip*ft
*Factored Resisting Moment of Wedges (0.9*D LC):*	$\Phi M_{R\_wedges\_0.9}$ = 0.75*MR_wedges_0.9_dia	$\Phi M_{R\_wedges\_0.9\_dia}$ =	0.00	kip*ft

Soil Wedges (Cohesionless Soil) (1.2*D LC)

Soil	Volume (ft^3)	Soil Weight (kips)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
(2) End Prisms (above Water Table)	0.00	0.00	0.00	0.00
(2) End Prisms (below Water Table)	0.00	0.00	0.00	0.00
(1) End Prism (above Water Table)	0.00	0.00	0.00	0.00
(1) End Prisms (below Water Table)	0.00	0.00	0.00	0.00
(2) Partial Sides (above Water Table)	0.00	0.00	6.18	0.00
(2) Partial Sides (below Water Table)	0.00	0.00	0.00	0.00
(2) Rear (above Water Table)	0.00	0.00	11.50	0.00
(2) Rear (below Water Table)	0.00	0.00	0.00	0.00
Total	0.00	0.00		0.00

Eccentricity relative to W/2*SQRT(2):

Total Moment Arm (ft) =	0.00
Soil Wedge Wt (kip)=	0.00

*Unfactored Resisting Moment of Wedges (1.2*D LC):*	$M_{R\_wedges\_1.2}$ = Total Moment Arm * Soil Wedge Wt	$M_{R\_wedges\_1.2\_dia}$ =	0.00	kip*ft
*Factored Resisting Moment of Wedges (1.2*D LC):*	$\Phi M_{R\_wedges\_1.2}$ = 0.75*MR_wedges_1.2_dia	$\Phi M_{R\_wedges\_1.2\_dia}$ =	0.00	kip*ft

Soil Shear Strength (Cohesive Soil)

Soil Shear Strength (Cohesive Soil) (0.9*D LC)

Plane	Area (ft^2)	Resistance (kip)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)
(2) Rear	0.00	0.00	10.61	0.00
(2) Partial Sides	0.00	0.00	7.07	0.00

Eccentricity relative to W/2*SQRT(2):

Total Moment Arm (ft) =	0.00

Total		0.00		0.00	Soil Shear Strength (kip)=	0.00

*Unfactored Resisting Moment of Soil Shear (0.9*D LC):* $M_{R\_shear\_0.9}$ = Total Moment Arm * Soil Shear Strength $M_{R\_shear\_0.9\_dia}$ = 0.00 kip*ft

*Factored Resisting Moment of Soil Shear (0.9*D LC):* $\Phi M_{R\_shear\_0.9}$ = 0.75 * (Total Moment Arm * Soil Shear Strength) $\Phi M_{R\_shear\_0.9\_dia}$ = 0.00 kip*ft

Soil Shear Strength (Cohesive Soil) (1.2*D LC)

Plane	Area (ft²)	Resistance (kip)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)	Eccentricity relative to W/2*SQRT(2):	
(2) Rear	0.00	0.00	10.61	0.00	Total Moment Arm (ft) =	0.00
(2) Partial Sides	0.00	0.00	7.07	0.00		
Total		0.00		0.00	Soil Shear Strength (kip)=	0.00

*Unfactored Resisting Moment of Soil Shear (1.2*D LC):* $M_{R\_shear\_1.2}$ = Total Moment Arm * Soil Shear Strength $M_{R\_shear\_1.2\_dia}$ = 0.00 kip*ft

*Factored Resisting Moment of Soil Shear (1.2*D LC):* $\Phi M_{R\_shear\_1.2}$ = 0.75 * (Total Moment Arm * Soil Shear Strength) $\Phi M_{R\_shear\_1.2\_dia}$ = 0.00 kip*ft

DETERMINE MOMENT THAT WOULD CAUSE 100% OVERTURNING (DIAGONAL)

*Compressive Load for Bearing (0.9*D LC):* $P_{\_100\_dia}$ = P_0.9D+0.9*(Ws+Wc)+0.75*Wwedges_100_dia $P_{\_100\_dia}$ = 271.10 kip

Preliminary Factored Overturning Moment: pre_$M_{overturning_100_dia}$ = (P_100_dia/(SQRT(2)))*(W-SQRT(P_100_dia/ΦQult)) pre_$M_{overturning_100_dia}$ = 913.35 kip*ft

*Preliminary Load Eccentricity (0.9*D LC):* pre_$ec_{_100_dia}$ = pre_$M_{overturning_100_dia}$/ $P_{bearing\_0.9}$ pre_$ec_{_100_dia}$ = 3.37 ft

*[Goal Seek] Load Eccentricity Iteration (0.9*D LC):* $ec_{\_100\_dia}$ = *goal seek* $ec_{\_100\_dia}$ = 3.10 ft (L/4)*SQRT(2)/2 < e <= (L/2)*SQRT(2)

*Non-Bearing Length (0.9*D LC):* $NBL_{\_100\_dia}$ = 0 $NBL_{\_100\_dia}$ = 0.00 ft

*Total Factored Resisting Moment due to Pp and Soil Wedges / Shear (0.9*D LC):* $\Phi M_{Resisting\_100\_dia}$ = $\Phi M_{R\_Pp\_dia}$ + SUM($\Phi M_{R\_wedges\_100\_dia}$,$\Phi M_{R\_shear\_100\_dia}$) $\Phi M_{Resisting\_100\_dia}$ = 73.65 kip*ft

Moment Created by Shear: M_{shear} = V_u * (D+E+bp_{dist}/12) M_{shear} = 289.33 kip*ft

*Adjusted Overturning Moment (0.9*D LC):* $M_{overturning\_100\_dia}$ = $M_{u\_max\_100\_dia}$ - $\Phi M_{R\_Pp\_dia}$ $M_{overturning\_100\_dia}$ = 913.35 kip*ft

*Total Resistance to Overturning (0.9*D LC):* $\Phi M_{Resisting\_qu\_100\_dia}$ = $P_{bearing\_0.9}$*$ec_{\_100\_dia}$ + $\Phi M_{Resisting\_100\_dia}$ $\Phi M_{Resisting\_qu\_100\_dia}$ = 913.35 kip*ft

[Goal Seek] Moment Comparison Iteration (0.9D LC): $\Delta M_{\_100\_dia}$ = $M_{overturning}$ - $\Phi M_{Resisting\_qu\_100\_dia}$ $\Delta M_{\_100\_dia}$ = 0.00 ft

Maximum Applied Moment from Superstructure Analysis: $M_{u\_max\_100\_dia}$ = pre_Moverturning_100_dia + ΦMResisting_100_dia $M_{u\_max\_100\_dia}$ = 987.00 kip*ft

Check **Mu_max_100_dia = 987.00 kip*ft >= Mu = 0.00 kip*ft RATING: 0.00% OK**

Soil Wedges (Cohesionless Soil) (0.9*D LC)

Soil	Volume (ft³)	Soil Weight (kips)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)		
(2) End Prisms (above Water Table)	0.00	0.00	0.00	0.00		
(2) End Prisms (below Water Table)	0.00	0.00	0.00	0.00		
(1) End Prism (above Water Table)	0.00	0.00	0.00	0.00		
(1) End Prisms (below Water Table)	0.00	0.00	0.00	0.00		
(2) Partial Sides (above Water Table)	0.00	0.00	6.18	0.00		
(2) Partial Sides (below Water Table)	0.00	0.00	0.00	0.00	Eccentricity relative to W/2*SQRT(2):	
(2) Rear (above Water Table)	0.00	0.00	11.50	0.00	Total Moment Arm (ft) =	0.00
(2) Rear (below Water Table)	0.00	0.00	0.00	0.00		
Total	0.00	0.00		0.00	Soil Wedge Wt (kip)=	0.00

*Unfactored Resisting Moment of Wedges (0.9*D LC):* $M_{R\_wedges\_100\_dia}$ = Total Moment Arm * Soil Wedge Wt $M_{R\_wedges\_100\_dia}$ = 0.00 kip*ft

*Factored Resisting Moment of Wedges (0.9*D LC):* $\Phi M_{R\_wedges\_100\_dia}$ = 0.75*MR_wedges_100_dia $\Phi M_{R\_wedges\_100\_dia}$ = 0.00 kip*ft

Soil Shear Strength (Cohesive Soil) (0.9*D LC)

Plane	Area (ft²)	Resistance (kip)	Moment Arm (ft)	Unfactored Resisting Moment (kip*ft)	Eccentricity relative to W/2*SQRT(2):	
(2) Rear	0.00	0.00	10.61	0.00	Total Moment Arm (ft) =	0.00
(2) Partial Sides	0.00	0.00	7.07	0.00		
Total		0.00		0.00	Soil Shear Strength (kip)=	0.00

*Unfactored Resisting Moment of Soil Shear (0.9*D LC):* $M_{R\_shear\_100\_dia}$ = Total Moment Arm * Soil Shear Strength $M_{R\_shear\_100\_dia}$ = 0.00 kip*ft

*Factored Resisting Moment of Soil Shear (0.9*D LC):* $\Phi M_{R\_shear\_100\_dia}$ = 0.75 * (Total Moment Arm * Soil Shear Strength) $\Phi M_{R\_shear\_100\_dia}$ = 0.00 kip*ft

ATTACHMENT D – PROOF OF DELIVERY OF NOTICE

Ref: CT578100-ES-066 Date: 25Jun20 SHIPPING: 0.00
Dep: BL GRAPHICS Wgt: 1.05 LBS SPECIAL: 0.00
HANDLING: 0.00
DV: 0.00 TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT
TRCK: 1714 2090 5391

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

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 25JUN20
ACTWGT: 1.05 LB MAN
CAD: 0765627/CAFE3311

BILL THIRD PARTY

565C1/C7DD/05A2

TO **GEORGE BENSON DIRECTOR OF PLANNING**
TOWN OF NEWTOWN
3 PRIMROSE STREET

NEWTOWN CT 06470
REF: CT578100-ES-066
DEPT: BL GRAPHICS

FedEx Express

E

J191219082001uv

FRI – 26 JUN 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **1714 2090 5391**

EG DXRA

06470
CT-US **SWF**

Ref: CT578100-ES-066 Date: 25Jun20 SHIPPING: 0.00
Dep: BL GRAPHICS Wgt: 1.05 LBS SPECIAL: 0.00
HANDLING: 0.00
DV: 0.00 TOTAL: 0.00

Svcs: PRIORITY OVERNIGHT
TRCK: 1714 2090 5380

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

MERIDEN, CT 06450
UNITED STATES US

SHIP DATE: 25JUN20
ACTWGT: 1.05 LB
CAD: 0765627/CAFE3311

BILL THIRD PARTY

565C1/C7DD/05A2

TO **FIRST SELECTMAN DAN ROSENTHAL**
TOWN OF NEWTOWN
3 PRIMROSE STREET

NEWTOWN CT 06470
REF: CT578100-ES-066
DEPT: BL GRAPHICS

FedEx Express

E

J191219082001uv

FRI - 26 JUN 10:30A
PRIORITY OVERNIGHT

TRK# 0201 **1714 2090 5380**

EG DXRA

06470
CT-US **SWF**

ATTACHMENT E - POWER DENSITY REPORT

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

Calculated Radio Frequency Emissions Report

EVERSOURCE ENERGY

ES-066

20 Barnabas Road

Newtown, CT 06470

April 3, 2020

Table of Contents

List of Tables

List of Figures

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed Eversource installation to be located at 20 Barnabas Road in Newtown, CT.

Eversource is proposing to install two omnidirectional antennas as part of its 220 MHz communications system – one transmit and one receive antenna.

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

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

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

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

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

3. Power Density Calculation Methods

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

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

Where:

EIRP = Effective Isotropic Radiated Power = 1.64 x ERP

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

H = Horizontal Distance from antenna

V = Vertical Distance from radiation center of antenna

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

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

4. Calculated % MPE Results

Table 1 below outlines the power density information for the site. The proposed Eversource omnidirectional antenna has a relatively narrow vertical beamwidth of 20°; therefore, the majority of the RF power is focused out towards the horizon. Please refer to Attachment C for the vertical pattern of the proposed Eversource antenna. Research of the vertical patterns of the other existing antennas also confirms varying degrees of directionality. Therefore, the calculated results in Table 1 include a nominal 3dB off-beam pattern loss for the Eversource half-wave dipole (44.34 MHz), 10 dB off-beam pattern loss for the omnidirectional and panel antennas and 30 dB off-beam pattern loss for the highly directional microwave dish to account for the lower relative gain below the antennas. As a result, there will be less RF power directed below the antennas relative to the horizon, and consequently lower power density levels around the base of the facility. Any inactive or receive-only antennas are not included in the table, as they are irrelevant in terms of the % MPE calculations.

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm^2)	Limit	%MPE
6755 MHz system		*6755*			*0.0000*	*1.0000*	*0.00%*
37.48, 37.74, 48.34, 154.46375 MHz systems					*0.0096*	*1.0000*	*0.10%*
T-Mobile	145	1900	2	953	0.0035	1.0000	0.35%
T-Mobile	145	2100	4	477	0.0036	1.0000	0.36%
Sprint	88	1900	2	693	0.0074	1.0000	0.74%
Sprint	88	850	1	390	0.0021	0.5667	0.37%
AT&T	130	850	2	419	0.0020	0.5667	0.35%
AT&T	130	850	2	885	0.0041	0.5667	0.73%
AT&T	130	850	2	553	0.0026	0.5667	0.46%
AT&T	130	1900	4	1469	0.0137	1.0000	1.37%
AT&T	130	700	2	745	0.0035	0.4667	0.75%
Verizon	121	1970	15	432	0.0176	1.0000	1.76%
Verizon	121	869	9	400	0.0098	0.5793	1.69%
Verizon	121	2145	1	1750	0.0048	1.0000	0.48%
Verizon	121	698	1	828	0.0023	0.4653	0.48%
Town of Newtown	192.5	150	1	200	0.0002	0.2000	0.10%
Eversource	190.5	44.34	1	370	0.0020	0.2000	0.98%
Eversource	189	154.46375	1	990	0.0011	0.2000	0.53%
Eversource	177	5945.2	1	9772	0.0001	1.0000	0.01%
Eversource	176	37.48	1	370	0.0005	0.2000	0.23%
Eversource	153	900	1	240	0.0004	0.6000	0.07%
Eversource	157.5	217	4	124	0.0008	0.2000	0.39%
						Total	**12.20%**

Table 1: Proposed Tower % MPE [1] [2] [3]

The CT Siting Council power density database reflects miscellaneous entries, which are assumed to be for the existing Eversource and Town of Newtown installation (based on an FCC license assigned to the Town for this location). These entries are shown as grey in the table above and should be replaced by the green shaded entries, which are based upon updated operating parameters provided by Eversource as part of this project and FCC license information for the Town of Newtown (WPQZ382). The blue entry reflects the parameters of the proposed Eversource transmit antenna. Therefore, the total % MPE calculated does not include the grey entries.

[1] The power density information for carriers other than Eversource was taken directly from the CSC database dated 12/13/2019. Please note that % MPE values listed are rounded to two decimal points and the total % MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not identically match the total value reflected in the table.

[2] The proposed and existing antenna heights listed are in reference to Black & Veatch Structural Analysis Report dated 03/26/2020.

[3] Operating parameters for the existing antennas listed for Eversource are in reference to an antenna inventory dated December 23, 2019. In cases when the transmitter and receiver antennas cannot be distinguished from each other for the same frequency, then the antenna with the lowest center line has been chosen for this analysis as the worst-case scenario.

5. Conclusion

The above analysis concludes that RF exposure at ground level with the proposed antenna installation will be below the maximum power density limits as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Using the conservative calculation methods discussed herein, the highest expected percent of Maximum Permissible Exposure at ground level with the proposed installation is **12.20% of the FCC General Population/Uncontrolled limit**.

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

6. Statement of Certification

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

Keith Vellante

April 3, 2020

Keith Vellante
Director of RF Services
C Squared Systems, LLC

Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure[4]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	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[5]

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

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

Table 2: FCC Limits for Maximum Permissible Exposure (MPE)

[4] 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

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

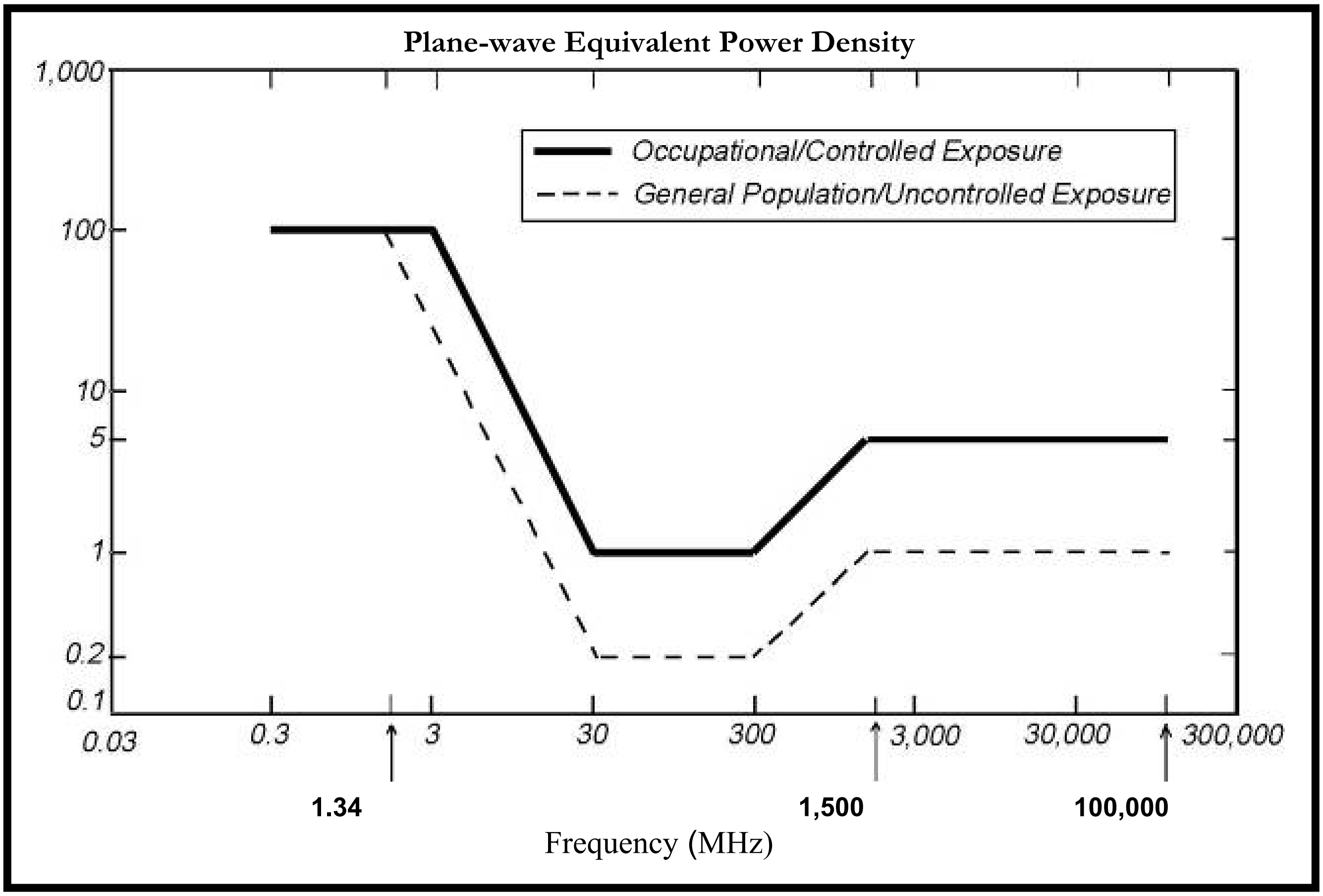


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Eversource Antenna Data Sheets and Electrical Patterns

217 MHz

Manufacturer:	Telewave
Model #:	ANT220F6
Frequency Band:	216-225 MHz
Gain:	6 dBd
Vertical Beamwidth:	20°
Horizontal Beamwidth:	360°
Polarization:	Vertical
Length:	171”