STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
Web Site: portal.ct.gov/csc

VIA ELECTRONIC MAIL

April 18, 2023

Kenneth C. Baldwin, Esq.
Robinson & Cole LLP
280 Trumbull Street
Hartford, CT 06103
kbaldwin@rc.com

RE: **SUBPETITION NO. 1133-VER-20221221 –** Cellco Partnership d/b/a Verizon Wireless eligible facility request for modifications to an existing telecommunications facility located at 221 West Main Street, East Lyme, Connecticut.

Dear Attorney Baldwin:

The Connecticut Siting Council (Council) is in receipt of your correspondence dated April 17, 2023 regarding a change to the above-referenced Eligible Facility Request (EFR) that was approved by the Council on January 23, 2023.

Pursuant to Condition No. 1 of the Council's January 23, 2023 approval, your request to change the model of the remote radio head to RF4439d-25A due to the unavailability of the approved remote radio head model, is hereby approved.

This approval applies only to the project changes described in the April 17, 2023 correspondence.

Please be advised that deviations from the standards established by the Council in the EFR approval are enforceable under the provisions of Connecticut General Statutes §16-50u.

Thank you for your attention and cooperation.

Sincerely,

Melanie A. Bachman
Executive Director

MAB/IN/laf

c: The Honorable Kevin Seery, First Selectperson, Town of East Lyme (kseery@eltownhall.com)

laf

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KENNETH C. BALDWIN

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Also admitted in Massachusetts
and New York

April 17, 2023

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

Re: **Sub-Petition No. 1133-VER-20221221 – Cellco Partnership d/b/a Verizon Wireless – 221 West Main Street, East Lyme, Connecticut**

Dear Attorney Bachman:

On January 23, 2023 the Siting Council approved the above referenced Sub-Petition permitting the installation of a cannister antenna and remote radio head ("RRH") on an existing light pole at 221 West Main Street in East Lyme. Cellco recently learned that the RRH it intended to install at this site was no longer available. The new RRH, model number RF4439d-25A will be installed in its place.

Enclosed is a revised Structural Analysis and updated set of project plans showing the new RRH that Cellco intends to install.

Please contact me if you have any questions regarding this proposal.

Sincerely,

Kenneth C. Baldwin

Attachments

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

81-ft Light Pole

Proposed Verizon
Antenna Upgrade

Site Ref: Niantic SC6

221 West Main Street
East Lyme, CT

Centek Project No. 22105.02

~~Date: August 16, 2022~~
Rev 3: April 10, 2023

Max Stress Ratio = 59%

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

Prepared for:

Verizon Wireless
20 Alexander Drive
Wallingford, CT 06492

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Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by Verizon on the light pole (tower) located in East Lyme, CT.

The host tower is a 79.33-ft tall, three-section, round, tapered monopole, originally designed and manufactured by Musco Sport-Lighting LLC; project no. 184978, dated March 3, 2017. The tower geometry, structure member sizes and foundation system information were obtained from the original design documents.

Antenna and appurtenance information were obtained from an RFDS provided by Verizon.

The tower is made up of three (3) tapered vertical sections consisting of A595-55 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 13.73-in at the top and 24.0-in at the base.

Antenna and Appurtenance Summary

- MISCELLANEOUS. (Existing):
  Antennas: One (1) 6+5 lighting array (LSS80DEXT) mounted to the tower with an elevation of 80-ft above the existing grade.
- MISCELLANEOUS. (Existing):
  Antennas: One (1) control box mounted to the tower with an elevation of 13-ft above the existing grade.
- VERIZON (Existing to Remain):
  Coax Cables: Two (2) 7/8" ∅ coax cables running on the exterior of the existing tower.
- VERIZON (Existing to Remove):
  Antennas: One (1) Andrew NH65PS-DG-F0M antenna pipe mounted with a RAD center elevation of 87.67-ft above grade.
  Appurtenance: One (1) Nokia B66A RRH 4x45 Remote Radio Head pipe mounted with an elevation of 20-ft above grade.
- **VERIZON (Proposed):**
  Antennas: One (1) Amphenol CUUD120X06Fxyz0 antenna pipe mounted with a RAD center elevation of 87.8-ft above grade.
  Appurtenance: One (1) Samsung RF4439d-25A (B2/B66) Remote Radio Head and one (1) Commscope SDX1926Q-43 diplexer pipe mounted with an elevation of 20-ft above grade.

Primary Assumptions Used in the Analysis

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents or reinforcement drawings.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All existing coax cables to be installed as indicated in this report.

Analysis

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

The existing tower was analyzed for the controlling basic wind speed (3-second gust) with no ice and the applicable wind and ice combination to determine stresses in members as per guidelines of TIA-222-H entitled "Structural Standard for Antenna Support Structures and Antennas", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Load and Resistance Factor Design (LRFD).

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

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA-222-H, gravity loads of the tower structure and its components, and the application of 1.00" radial ice on the tower structure and its components

Load Cases:	Load Case 1; 130 mph (Ultimate – Risk Category II) wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Appendix P of the 2022 CT Building Code]*
	Load Case 2; 50 mph wind speed w/ 1.00" radial ice plus gravity load – used in calculation of tower stresses.	*[Annex B of TIA-222-H]*

[1] The 2021 International Building Code as amended by the 2022 Connecticut State Building Code (CSBC).

Mount Capacity

- Calculated stresses were found to be within allowable limits.

Component	Stress Ratio (percentage of capacity)	Result
Pipe Mast	21%	**PASS**
Connection	4%	**PASS**

Tower Capacity

- Calculated stresses were found to be within allowable limits. This tower was found to be at **58.8%** of its total capacity.

Tower Section	Elevation (AGL)	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L3)	2.00'-29.00'	58.8%	**PASS**

Foundation and Anchors

The foundation consists of an 4.0-ft diameter x 4.0-ft long reinforced concrete pier on a 14.0-ft x 2.0-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the foundation were obtained from the aforementioned original design documents.

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:

Location	Vector	Proposed Reactions
Base	Shear	7 kips
	Compression	8 kips
	Moment	372 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	TIA-222-H Section 9.4 FS(1)	Proposed Loading (FS)(1)	Result
Reinforced Concrete Pad and Pier	OTM(2)	1.0	2.88	**PASS**

Note 1: FS denotes Factor of Safety.
Note 2: OTM denotes Overturning Moment.

C o n c l u s i o n

This analysis shows that the subject tower and pipe mount are **adequate** to support the proposed modified antenna configuration.

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

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

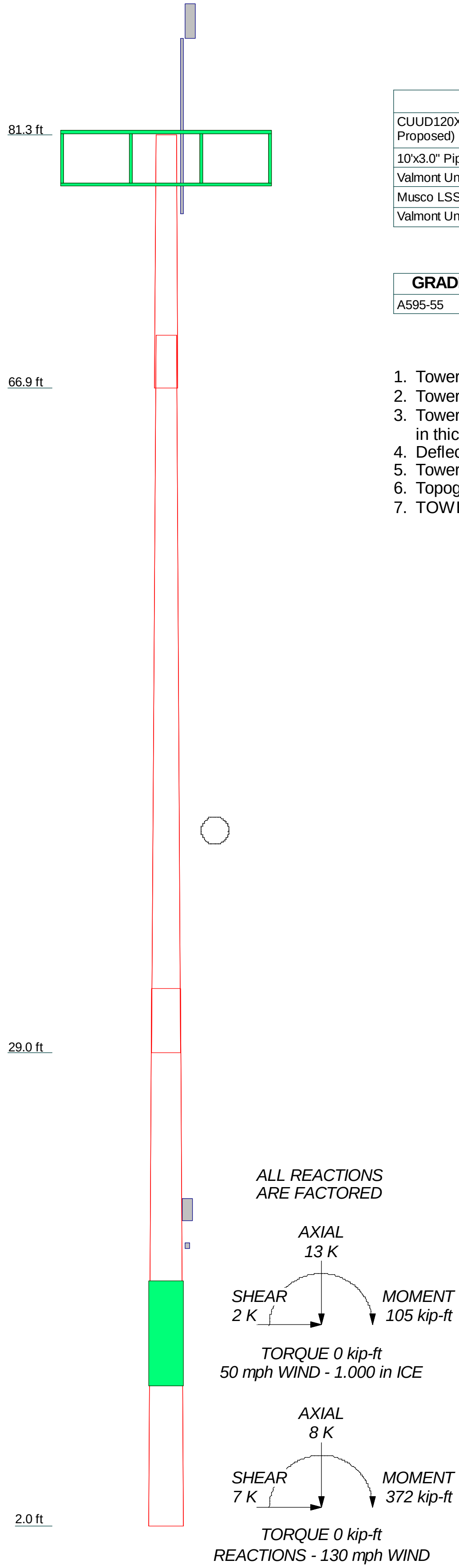
GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

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

TnxTower Features:

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

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	14.417	1	0.179	3.000	13.730	15.750	A595-55	0.4
2	40.917	1	0.239	3.670	14.972	20.700	A595-55	1.8
3	30.669	1	0.313		19.708	24.000	A595-55	2.2
								4.5



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
CUUD120X06Fxyz0 (Verizon Proposed)	87.8	RF4439d-25A (B2/B66A RRH) (Verizon Proposed)	20
10'x3.0" Pipe Mount (Verizon)	81.8	Valmont Uni-Tri Bracket (Verizon)	20
Valmont Uni-Tri Bracket (Verizon)	80.8	SDX1926Q-43 (Verizon Proposed)	18
Musco LSS80DEXT Lights (6+5)	80	Musco Light Control Box	13
Valmont Uni-Tri Bracket (Verizon)	77.3		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A595-55	55 ksi	65 ksi			

TOWER DESIGN NOTES

1. Tower designed for Exposure C 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 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category II.
6. Topographic Category 1 with Crest Height of 0.000 ft
7. TOWER RATING: 58.8%

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

Job: ***22105.02 - Niantic SC6***		
Project: ***81-ft Light Pole - East Lyme, CT***		
Client: Verizon	Drawn by: TJL	App'd:
Code: TIA-222-H	Date: 04/10/23	Scale: NTS
Path: J:\Jobs\2210500.WI\02_Niantic CT SC 6\05_Structural\Backup Documentation\Rev (3)\Calcs\ERI Files\81' Monopole _ East Lyme_CT.eri		Dwg No. E-1

Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

- Tower base elevation above sea level: 2.000 ft.
- Basic wind speed of 130 mph.
- Risk Category II.
- Exposure Category C.
- Simplified Topographic Factor Procedure for wind speed-up calculations is used.
- Topographic Category: 1.
- Crest Height: 0.000 ft.
- Nominal ice thickness of 1.000 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 50 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 60 mph.
- A non-linear (P-delta) analysis was used.
- Pressures are calculated at each section.
- Stress ratio used in pole design is 1.
- Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	*Elevation* *ft*	*Section Length* *ft*	*Splice Length* *ft*	*Number of Sides*	*Top Diameter* *in*	*Bottom Diameter* *in*	*Wall Thickness* *in*	*Bend Radius* *in*	*Pole Grade*

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	81.333-66.916	14.417	3.000	Round	13.730	15.750	0.179		A595-55 (55 ksi)
L2	66.916-28.999	40.917	3.670	Round	14.972	20.700	0.239		A595-55 (55 ksi)
L3	28.999-2.000	30.669		Round	19.708	24.000	0.313		A595-55 (55 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	13.730	7.620	174.945	4.791	6.865	25.484	349.891	3.808	0.000	0
	15.750	8.756	265.412	5.506	7.875	33.703	530.823	4.376	0.000	0
L2	15.392	11.062	300.204	5.209	7.486	40.103	600.407	5.528	0.000	0
	20.700	15.363	804.077	7.235	10.350	77.689	1608.154	7.677	0.000	0
L3	20.222	19.072	897.016	6.858	9.854	91.030	1794.033	9.530	0.000	0
	24.000	23.292	1633.843	8.375	12.000	136.154	3267.685	11.639	0.000	0

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
L1 81.333-66.916				1	1	1			
L2 66.916-28.999				1	1	1			
L3 28.999-2.000				1	1	1			

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight klf
7/8 (Verizon)	B	Yes	Surface Ar (CaAa)	81.333 - 5.000	2	2	0.000 0.000	1.110		0.001

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
1" dia. Elect. Conduit	C	No	Yes	Inside Pole	81.333 - 2.000	1	No Ice	0.000	0.003
							1/2" Ice	0.000	0.003
							1" Ice	0.000	0.003

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	81.333-66.916	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	3.201	0.000	0.016
		C	0.000	0.000	0.000	0.000	0.037
L2	66.916-28.999	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	8.418	0.000	0.041
		C	0.000	0.000	0.000	0.000	0.099
L3	28.999-2.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	5.328	0.000	0.026
		C	0.000	0.000	0.000	0.000	0.070

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	81.333-66.916	A	1.084	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	7.908	0.000	0.072
		C		0.000	0.000	0.000	0.000	0.037
L2	66.916-28.999	A	1.037	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	20.798	0.000	0.191
		C		0.000	0.000	0.000	0.000	0.099
L3	28.999-2.000	A	0.925	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	12.881	0.000	0.115
		C		0.000	0.000	0.000	0.000	0.070

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L1	2	7/8	66.92 - 81.33	1.0000	1.0000
L2	2	7/8	29.00 - 66.92	1.0000	1.0000
L3	2	7/8	5.00 - 29.00	1.0000	1.0000

Discrete Tower Loads

Description	*Face or Leg*	*Offset Type*	*Offsets: Horz Lateral Vert* *ft ft ft*	*Azimuth Adjustment* *°*	*Placement* *ft*		C_AA_A *Front* *ft²*	C_AA_A *Side* *ft²*	*Weight* *K*
Musco LSS80DEXT Lights (6+5)	C	None		0.000	80.000	No Ice	41.400	15.000	0.500
						1/2" Ice	56.000	20.000	1.200
						1" Ice	70.600	25.000	1.900
CUUD120X06Fxyz0 (Verizon Proposed)	B	From Face	1.000	0.000	87.800	No Ice	1.217	1.217	0.035
			0.000			1/2" Ice	1.896	1.896	0.060
			0.000			1" Ice	2.098	2.098	0.087
10'x3.0" Pipe Mount (Verizon)	B	From Face	0.500	0.000	81.800	No Ice	3.277	3.277	0.076
			0.000			1/2" Ice	4.537	4.537	0.101
			0.000			1" Ice	5.300	5.300	0.133
Valmont Uni-Tri Bracket (Verizon)	B	From Face	0.000	0.000	80.800	No Ice	1.750	1.750	0.290
			0.000			1/2" Ice	1.940	1.940	0.306
			0.000			1" Ice	2.130	2.130	0.323
Valmont Uni-Tri Bracket (Verizon)	B	From Face	0.000	0.000	77.300	No Ice	1.750	1.750	0.290
			0.000			1/2" Ice	1.940	1.940	0.306
			0.000			1" Ice	2.130	2.130	0.323
RF4439d-25A (B2/B66A RRH) (Verizon Proposed)	B	From Face	0.500	0.000	20.000	No Ice	1.875	1.250	0.075
			0.000			1/2" Ice	2.045	1.393	0.093
			0.000			1" Ice	2.223	1.543	0.114
Valmont Uni-Tri Bracket (Verizon)	B	From Face	0.000	0.000	20.000	No Ice	1.750	1.750	0.290
			0.000			1/2" Ice	1.940	1.940	0.306
			0.000			1" Ice	2.130	2.130	0.323
SDX1926Q-43 (Verizon Proposed)	B	From Face	0.500	0.000	18.000	No Ice	0.241	0.101	0.030
			0.000			1/2" Ice	0.306	0.144	0.032
			0.000			1" Ice	0.379	0.195	0.036
Musco Light Control Box	C	From Face	0.500	0.000	13.000	No Ice	14.667	5.867	0.550
			0.000			1/2" Ice	15.184	6.325	0.634
			0.000			1" Ice	15.708	6.790	0.726

Tower Pressures - No Ice

$G_H = 1.100$

Section Elevation *ft*	*z* *ft*	K_Z	q_z *ksf*	A_G *ft²*	*Face*	A_F *ft²*	A_R *ft²*	A_{leg} *ft²*	*Leg %*	C_AA_A *In Face* *ft²*	C_AA_A *Out Face* *ft²*
L1 81.333-66.916	73.960	1.188	0.049	17.709	A	0.000	17.709	17.709	100.00	0.000	0.000
					B	0.000	17.709		100.00	3.201	0.000
					C	0.000	17.709		100.00	0.000	0.000
L2 66.916-28.999	47.427	1.082	0.044	57.020	A	0.000	57.020	57.020	100.00	0.000	0.000
					B	0.000	57.020		100.00	8.418	0.000
					C	0.000	57.020		100.00	0.000	0.000
L3 28.999-2.000	15.115	0.85	0.035	49.748	A	0.000	49.748	49.748	100.00	0.000	0.000
					B	0.000	49.748		100.00	5.328	0.000
					C	0.000	49.748		100.00	0.000	0.000

Tower Pressure - With Ice

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

G_H = 1.100

Section Elevation *ft*	*z* *ft*	K_Z	q_z *ksf*	t_Z *in*	A_G ft^2	*Face*	A_F ft^2	A_R ft^2	A_{leg} ft^2	*Leg %*	C_AA_A *In Face* ft^2	C_AA_A *Out Face* ft^2
L1 81.333-66.916	73.960	1.188	0.007	1.084	20.314	A	0.000	20.314	20.314	100.00	0.000	0.000
						B	0.000	20.314		100.00	7.908	0.000
						C	0.000	20.314		100.00	0.000	0.000
L2 66.916-28.999	47.427	1.082	0.007	1.037	63.871	A	0.000	63.871	63.871	100.00	0.000	0.000
						B	0.000	63.871		100.00	20.798	0.000
						C	0.000	63.871		100.00	0.000	0.000
L3 28.999-2.000	15.115	0.85	0.005	0.925	54.414	A	0.000	54.414	54.414	100.00	0.000	0.000
						B	0.000	54.414		100.00	12.881	0.000
						C	0.000	54.414		100.00	0.000	0.000

Tower Pressure - Service

G_H = 1.100

Section Elevation *ft*	*z* *ft*	K_Z	q_z *ksf*	A_G ft^2	*Face*	A_F ft^2	A_R ft^2	A_{leg} ft^2	*Leg %*	C_AA_A *In Face* ft^2	C_AA_A *Out Face* ft^2
L1 81.333-66.916	73.960	1.188	0.009	17.709	A	0.000	17.709	17.709	100.00	0.000	0.000
					B	0.000	17.709		100.00	3.201	0.000
					C	0.000	17.709		100.00	0.000	0.000
L2 66.916-28.999	47.427	1.082	0.008	57.020	A	0.000	57.020	57.020	100.00	0.000	0.000
					B	0.000	57.020		100.00	8.418	0.000
					C	0.000	57.020		100.00	0.000	0.000
L3 28.999-2.000	15.115	0.85	0.007	49.748	A	0.000	49.748	49.748	100.00	0.000	0.000
					B	0.000	49.748		100.00	5.328	0.000
					C	0.000	49.748		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation *ft*	*Add Weight* *K*	*Self Weight* *K*	*Face*	*e*	C_F	q_z *ksf*	D_F	D_R	A_E ft^2	*F* *K*	*w* *klf*	*Ctrl. Face*
L1 81.333-66.916	0.053	0.402	A	1	0.6	0.049	1	1	17.709	0.571	0.040	C
			B	1	0.6		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2 66.916-28.999	0.140	1.840	A	1	0.6	0.044	1	1	57.020	1.665	0.044	C
			B	1	0.6		1	1	57.020			
			C	1	0.6		1	1	57.020			
L3 28.999-2.000	0.096	2.211	A	1	0.6	0.035	1	1	49.748	1.147	0.042	C
			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	131.722 kip-ft	3.383		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.053	0.402	A	1	0.691	0.049	1	1	17.709	0.657	0.046	A
			B	1	0.6		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2 66.916-28.999	0.140	1.840	A	1	0.641	0.044	1	1	57.020	1.779	0.047	A
			B	1	0.6		1	1	57.020			
			C	1	0.6		1	1	57.020			
L3 28.999-2.000	0.096	2.211	A	1	0.6	0.035	1	1	49.748	1.147	0.042	C
			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	143.178 kip-ft	3.584		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.053	0.402	A	1	0.6	0.049	1	1	17.709	0.571	0.040	C
			B	1	0.6		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2 66.916-28.999	0.140	1.840	A	1	0.6	0.044	1	1	57.020	1.665	0.044	C
			B	1	0.6		1	1	57.020			
			C	1	0.6		1	1	57.020			
L3 28.999-2.000	0.096	2.211	A	1	0.6	0.035	1	1	49.748	1.147	0.042	C
			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	131.722 kip-ft	3.383		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.053	0.402	A	1	0.6	0.049	1	1	17.709	0.657	0.046	B
			B	1	0.691		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2 66.916-28.999	0.140	1.840	A	1	0.6	0.044	1	1	57.020	1.779	0.047	B
			B	1	0.641		1	1	57.020			
			C	1	0.6		1	1	57.020			
L3 28.999-2.000	0.096	2.211	A	1	0.6	0.035	1	1	49.748	1.147	0.042	C
			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	143.178	3.584		

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
									kip-ft			

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.110	0.704	A	1	1.2	0.007	1	1	20.314	0.194	0.013	C
			B	1	1.2		1	1	20.314			
			C	1	1.2		1	1	20.314			
L2 66.916-28.999	0.289	2.756	A	1	1.2	0.007	1	1	63.573	0.549	0.014	C
			B	1	1.2		1	1	63.573			
			C	1	1.2		1	1	63.573			
L3 28.999-2.000	0.185	2.913	A	1	1.2	0.005	1	1	53.910	0.368	0.014	C
			B	1	1.2		1	1	53.910			
			C	1	1.2		1	1	53.910			
Sum Weight:	0.584	6.373						OTM	43.701 kip-ft	1.111		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.110	0.704	A	1	1.2	0.007	1	1	20.314	0.194	0.013	C
			B	1	1.2		1	1	20.314			
			C	1	1.2		1	1	20.314			
L2 66.916-28.999	0.289	2.756	A	1	1.2	0.007	1	1	63.573	0.549	0.014	C
			B	1	1.2		1	1	63.573			
			C	1	1.2		1	1	63.573			
L3 28.999-2.000	0.185	2.913	A	1	1.2	0.005	1	1	53.910	0.368	0.014	C
			B	1	1.2		1	1	53.910			
			C	1	1.2		1	1	53.910			
Sum Weight:	0.584	6.373						OTM	43.701 kip-ft	1.111		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	0.110	0.704	A	1	1.2	0.007	1	1	20.314	0.194	0.013	C
81.333-66.916			B	1	1.2		1	1	20.314			
			C	1	1.2		1	1	20.314			
L2	0.289	2.756	A	1	1.2	0.007	1	1	63.573	0.549	0.014	C
66.916-28.999			B	1	1.2		1	1	63.573			
			C	1	1.2		1	1	63.573			
L3	0.185	2.913	A	1	1.2	0.005	1	1	53.910	0.368	0.014	C
28.999-2.000			B	1	1.2		1	1	53.910			
			C	1	1.2		1	1	53.910			
Sum Weight:	0.584	6.373						OTM	43.701 kip-ft	1.111		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	0.110	0.704	A	1	1.2	0.007	1	1	20.314	0.194	0.013	C
81.333-66.916			B	1	1.2		1	1	20.314			
			C	1	1.2		1	1	20.314			
L2	0.289	2.756	A	1	1.2	0.007	1	1	63.573	0.549	0.014	C
66.916-28.999			B	1	1.2		1	1	63.573			
			C	1	1.2		1	1	63.573			
L3	0.185	2.913	A	1	1.2	0.005	1	1	53.910	0.368	0.014	C
28.999-2.000			B	1	1.2		1	1	53.910			
			C	1	1.2		1	1	53.910			
Sum Weight:	0.584	6.373						OTM	43.701 kip-ft	1.111		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	0.053	0.402	A	1	0.6	0.009	1	1	17.709	0.109	0.008	C
81.333-66.916			B	1	0.6		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2	0.140	1.840	A	1	0.6	0.008	1	1	57.020	0.317	0.008	C
66.916-28.999			B	1	0.6		1	1	57.020			
			C	1	0.6		1	1	57.020			
L3	0.096	2.211	A	1	0.6	0.007	1	1	49.748	0.219	0.008	C
28.999-2.000			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	25.105 kip-ft	0.645		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.053	0.402	A	1	0.691	0.009	1	1	17.709	0.125	0.009	A
			B	1	0.6		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2 66.916-28.999	0.140	1.840	A	1	0.641	0.008	1	1	57.020	0.339	0.009	A
			B	1	0.6		1	1	57.020			
			C	1	0.6		1	1	57.020			
L3 28.999-2.000	0.096	2.211	A	1	0.6	0.007	1	1	49.748	0.219	0.008	C
			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	27.289 kip-ft	0.683		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.053	0.402	A	1	0.6	0.009	1	1	17.709	0.109	0.008	C
			B	1	0.6		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2 66.916-28.999	0.140	1.840	A	1	0.6	0.008	1	1	57.020	0.317	0.008	C
			B	1	0.6		1	1	57.020			
			C	1	0.6		1	1	57.020			
L3 28.999-2.000	0.096	2.211	A	1	0.6	0.007	1	1	49.748	0.219	0.008	C
			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	25.105 kip-ft	0.645		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1 81.333-66.916	0.053	0.402	A	1	0.6	0.009	1	1	17.709	0.125	0.009	B
			B	1	0.691		1	1	17.709			
			C	1	0.6		1	1	17.709			
L2 66.916-28.999	0.140	1.840	A	1	0.6	0.008	1	1	57.020	0.339	0.009	B
			B	1	0.641		1	1	57.020			
			C	1	0.6		1	1	57.020			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z ksf	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L3 28.999-2.000	0.096	2.211	A	1	0.6	0.007	1	1	49.748	0.219	0.008	C
			B	1	0.6		1	1	49.748			
			C	1	0.6		1	1	49.748			
Sum Weight:	0.289	4.452						OTM	27.289 kip-ft	0.683		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	4.452					
Bracing Weight	0.000					
Total Member Self-Weight	4.452			0.349	-0.764	
Total Weight	6.877			0.349	-0.764	
Wind 0 deg - No Ice		0.013	-6.779	-351.112	-1.001	0.478
Wind 30 deg - No Ice		3.240	-5.877	-304.144	-174.977	0.438
Wind 45 deg - No Ice		4.574	-4.803	-248.340	-247.016	0.372
Wind 60 deg - No Ice		5.598	-3.401	-175.587	-302.273	0.280
Wind 90 deg - No Ice		6.456	-0.013	0.111	-348.779	0.048
Wind 120 deg - No Ice		5.584	3.378	175.874	-302.035	-0.197
Wind 135 deg - No Ice		4.560	4.789	249.061	-247.040	-0.304
Wind 150 deg - No Ice		3.317	6.038	314.525	-180.294	-0.390
Wind 180 deg - No Ice		-0.013	6.779	351.809	-0.527	-0.478
Wind 210 deg - No Ice		-3.240	5.877	304.841	173.449	-0.438
Wind 225 deg - No Ice		-4.574	4.803	249.037	245.487	-0.372
Wind 240 deg - No Ice		-5.598	3.401	176.284	300.744	-0.280
Wind 270 deg - No Ice		-6.456	0.013	0.586	347.251	-0.048
Wind 300 deg - No Ice		-5.584	-3.378	-175.177	300.507	0.197
Wind 315 deg - No Ice		-4.560	-4.789	-248.364	245.512	0.304
Wind 330 deg - No Ice		-3.317	-6.038	-313.828	178.766	0.390
Member Ice	1.922					
Total Weight Ice	11.054			0.431	-1.018	
Wind 0 deg - Ice		0.002	-1.912	-98.573	-1.057	0.105
Wind 30 deg - Ice		0.934	-1.657	-85.329	-50.298	0.088
Wind 45 deg - Ice		1.320	-1.354	-69.603	-70.690	0.070
Wind 60 deg - Ice		1.616	-0.958	-49.105	-86.334	0.047
Wind 90 deg - Ice		1.864	-0.002	0.391	-99.510	-0.006
Wind 120 deg - Ice		1.613	0.954	49.899	-86.295	-0.057
Wind 135 deg - Ice		1.317	1.351	70.409	-70.635	-0.078
Wind 150 deg - Ice		0.930	1.655	86.151	-50.230	-0.094
Wind 180 deg - Ice		-0.002	1.912	99.435	-0.979	-0.105
Wind 210 deg - Ice		-0.934	1.657	86.190	48.262	-0.088
Wind 225 deg - Ice		-1.320	1.354	70.465	68.654	-0.070
Wind 240 deg - Ice		-1.616	0.958	49.967	84.299	-0.047
Wind 270 deg - Ice		-1.864	0.002	0.470	97.474	0.006
Wind 300 deg - Ice		-1.613	-0.954	-49.037	84.259	0.057
Wind 315 deg - Ice		-1.317	-1.351	-69.548	68.599	0.078
Wind 330 deg - Ice		-0.930	-1.655	-85.290	48.194	0.094
Total Weight	6.877			0.349	-0.764	
Wind 0 deg - Service		0.003	-1.294	-66.824	-0.809	0.093
Wind 30 deg - Service		0.619	-1.122	-57.847	-34.061	0.085
Wind 45 deg - Service		0.874	-0.917	-47.182	-47.830	0.071

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 60 deg - Service		1.069	-0.649	-33.277	-58.391	0.053
Wind 90 deg - Service		1.233	-0.003	0.303	-67.280	0.008
Wind 120 deg - Service		1.066	0.645	33.896	-58.346	-0.040
Wind 135 deg - Service		0.871	0.914	47.883	-47.835	-0.060
Wind 150 deg - Service		0.633	1.153	60.390	-35.075	-0.077
Wind 180 deg - Service		-0.003	1.294	67.521	-0.719	-0.093
Wind 210 deg - Service		-0.619	1.122	58.544	32.533	-0.085
Wind 225 deg - Service		-0.874	0.917	47.879	46.302	-0.071
Wind 240 deg - Service		-1.069	0.649	33.974	56.863	-0.053
Wind 270 deg - Service		-1.233	0.003	0.394	65.752	-0.008
Wind 300 deg - Service		-1.066	-0.645	-33.199	56.818	0.040
Wind 315 deg - Service		-0.871	-0.914	-47.186	46.306	0.060
Wind 330 deg - Service		-0.633	-1.153	-59.693	33.546	0.077

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 45 deg - No Ice
7	0.9 Dead+1.0 Wind 45 deg - No Ice
8	1.2 Dead+1.0 Wind 60 deg - No Ice
9	0.9 Dead+1.0 Wind 60 deg - No Ice
10	1.2 Dead+1.0 Wind 90 deg - No Ice
11	0.9 Dead+1.0 Wind 90 deg - No Ice
12	1.2 Dead+1.0 Wind 120 deg - No Ice
13	0.9 Dead+1.0 Wind 120 deg - No Ice
14	1.2 Dead+1.0 Wind 135 deg - No Ice
15	0.9 Dead+1.0 Wind 135 deg - No Ice
16	1.2 Dead+1.0 Wind 150 deg - No Ice
17	0.9 Dead+1.0 Wind 150 deg - No Ice
18	1.2 Dead+1.0 Wind 180 deg - No Ice
19	0.9 Dead+1.0 Wind 180 deg - No Ice
20	1.2 Dead+1.0 Wind 210 deg - No Ice
21	0.9 Dead+1.0 Wind 210 deg - No Ice
22	1.2 Dead+1.0 Wind 225 deg - No Ice
23	0.9 Dead+1.0 Wind 225 deg - No Ice
24	1.2 Dead+1.0 Wind 240 deg - No Ice
25	0.9 Dead+1.0 Wind 240 deg - No Ice
26	1.2 Dead+1.0 Wind 270 deg - No Ice
27	0.9 Dead+1.0 Wind 270 deg - No Ice
28	1.2 Dead+1.0 Wind 300 deg - No Ice
29	0.9 Dead+1.0 Wind 300 deg - No Ice
30	1.2 Dead+1.0 Wind 315 deg - No Ice
31	0.9 Dead+1.0 Wind 315 deg - No Ice
32	1.2 Dead+1.0 Wind 330 deg - No Ice
33	0.9 Dead+1.0 Wind 330 deg - No Ice
34	1.2 Dead+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp

Comb. No.	*Description*
39	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
40	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
41	1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Temp
42	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
43	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
44	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
45	1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Temp
46	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
47	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
48	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
49	1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Temp
50	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
51	Dead+Wind 0 deg - Service
52	Dead+Wind 30 deg - Service
53	Dead+Wind 45 deg - Service
54	Dead+Wind 60 deg - Service
55	Dead+Wind 90 deg - Service
56	Dead+Wind 120 deg - Service
57	Dead+Wind 135 deg - Service
58	Dead+Wind 150 deg - Service
59	Dead+Wind 180 deg - Service
60	Dead+Wind 210 deg - Service
61	Dead+Wind 225 deg - Service
62	Dead+Wind 240 deg - Service
63	Dead+Wind 270 deg - Service
64	Dead+Wind 300 deg - Service
65	Dead+Wind 315 deg - Service
66	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*
L1	81.333 - 66.916	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	34	-3.867	-0.688	0.396
			Max. Mx	10	-1.643	-31.918	0.278
			Max. My	2	-1.643	-0.483	31.708
			Max. Vy	10	3.260	-31.918	0.278
			Max. Vx	2	-3.260	-0.483	31.708
			Max. Torque	16			0.420
L2	66.916 - 28.999	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	34	-7.228	-0.735	0.413
			Max. Mx	10	-3.952	-183.590	0.292
			Max. My	2	-3.952	-0.518	183.376
			Max. Vy	10	4.889	-183.590	0.292
			Max. Vx	2	-4.889	-0.518	183.376
			Max. Torque	16			0.420
L3	28.999 - 2	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	34	-12.598	-1.240	-0.474
			Max. Mx	10	-8.247	-357.911	-0.172
			Max. My	18	-8.247	-0.707	-360.839
			Max. Vy	10	6.462	-357.911	-0.172
			Max. Vx	18	6.785	-0.707	-360.839
			Max. Torque	16			0.556

Maximum Reactions

Location	*Condition*	*Gov. Load Comb.*	*Vertical K*	*Horizontal, X K*	*Horizontal, Z K*
Pole	Max. Vert	47	12.598	1.864	-0.002
	Max. H_x	26	8.252	6.456	-0.013
	Max. H_z	2	8.252	-0.013	6.779
	Max. M_x	2	360.017	-0.013	6.779
	Max. M_z	10	357.911	-6.456	0.013
	Max. Torsion	18	0.481	0.013	-6.779
	Min. Vert	31	6.189	4.560	4.789
	Min. H_x	10	8.252	-6.456	0.013
	Min. H_z	18	8.252	0.013	-6.779
	Min. M_x	18	-360.839	0.013	-6.779
	Min. M_z	26	-356.020	6.456	-0.013
	Min. Torsion	2	-0.481	-0.013	6.779

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	6.877	0.000	0.000	0.343	-0.778	0.000
1.2 Dead+1.0 Wind 0 deg - No Ice	8.252	0.013	-6.779	-360.017	-1.185	0.481
0.9 Dead+1.0 Wind 0 deg - No Ice	6.189	0.013	-6.779	-357.752	-0.942	0.480
1.2 Dead+1.0 Wind 30 deg - No Ice	8.252	3.240	-5.877	-311.848	-179.635	0.439
0.9 Dead+1.0 Wind 30 deg - No Ice	6.189	3.240	-5.877	-309.900	-178.212	0.438
1.2 Dead+1.0 Wind 45 deg - No Ice	8.252	4.574	-4.803	-254.619	-253.527	0.372
0.9 Dead+1.0 Wind 45 deg - No Ice	6.189	4.574	-4.803	-253.047	-251.615	0.372
1.2 Dead+1.0 Wind 60 deg - No Ice	8.252	5.598	-3.401	-180.010	-310.206	0.279
0.9 Dead+1.0 Wind 60 deg - No Ice	6.189	5.598	-3.401	-178.928	-307.918	0.280
1.2 Dead+1.0 Wind 90 deg - No Ice	8.252	6.456	-0.013	0.172	-357.911	0.044
0.9 Dead+1.0 Wind 90 deg - No Ice	6.189	6.456	-0.013	0.071	-355.307	0.046
1.2 Dead+1.0 Wind 120 deg - No Ice	8.252	5.584	3.378	180.418	-309.967	-0.202
0.9 Dead+1.0 Wind 120 deg - No Ice	6.189	5.584	3.378	179.135	-307.680	-0.201
1.2 Dead+1.0 Wind 135 deg - No Ice	8.252	4.560	4.789	255.472	-253.558	-0.309
0.9 Dead+1.0 Wind 135 deg - No Ice	6.189	4.560	4.789	253.696	-251.644	-0.307
1.2 Dead+1.0 Wind 150 deg - No Ice	8.252	3.317	6.038	322.575	-185.078	-0.395
0.9 Dead+1.0 Wind 150 deg - No Ice	6.189	3.317	6.038	320.363	-183.619	-0.393

Load Combination	*Vertical* *K*	*Shear$_x$* *K*	*Shear$_z$* *K*	*Overturning Moment, M_x* *kip-ft*	*Overturning Moment, M_z* *kip-ft*	*Torque* *kip-ft*
1.2 Dead+1.0 Wind 180 deg - No Ice	8.252	-0.013	6.779	360.839	-0.707	-0.481
0.9 Dead+1.0 Wind 180 deg - No Ice	6.189	-0.013	6.779	358.372	-0.465	-0.480
1.2 Dead+1.0 Wind 210 deg - No Ice	8.252	-3.240	5.877	312.671	177.744	-0.439
0.9 Dead+1.0 Wind 210 deg - No Ice	6.189	-3.240	5.877	310.521	176.805	-0.438
1.2 Dead+1.0 Wind 225 deg - No Ice	8.252	-4.574	4.803	255.442	251.636	-0.371
0.9 Dead+1.0 Wind 225 deg - No Ice	6.189	-4.574	4.803	253.667	250.208	-0.371
1.2 Dead+1.0 Wind 240 deg - No Ice	8.252	-5.598	3.401	180.833	308.315	-0.279
0.9 Dead+1.0 Wind 240 deg - No Ice	6.189	-5.598	3.401	179.548	306.512	-0.279
1.2 Dead+1.0 Wind 270 deg - No Ice	8.252	-6.456	0.013	0.650	356.020	-0.044
0.9 Dead+1.0 Wind 270 deg - No Ice	6.189	-6.456	0.013	0.549	353.901	-0.045
1.2 Dead+1.0 Wind 300 deg - No Ice	8.252	-5.584	-3.378	-179.596	308.076	0.202
0.9 Dead+1.0 Wind 300 deg - No Ice	6.189	-5.584	-3.378	-178.515	306.274	0.200
1.2 Dead+1.0 Wind 315 deg - No Ice	8.252	-4.560	-4.789	-254.651	251.667	0.309
0.9 Dead+1.0 Wind 315 deg - No Ice	6.189	-4.560	-4.789	-253.076	250.237	0.307
1.2 Dead+1.0 Wind 330 deg - No Ice	8.252	-3.317	-6.038	-321.753	183.186	0.394
0.9 Dead+1.0 Wind 330 deg - No Ice	6.189	-3.317	-6.038	-319.744	182.213	0.392
1.2 Dead+1.0 Ice+1.0 Temp	12.598	0.000	-0.000	0.474	-1.240	0.000
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	12.598	0.002	-1.912	-103.454	-1.291	0.109
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	12.598	0.934	-1.657	-89.550	-52.993	0.090
1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Temp	12.598	1.320	-1.354	-73.042	-74.404	0.071
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	12.598	1.616	-0.958	-51.524	-90.830	0.047
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	12.598	1.864	-0.002	0.436	-104.665	-0.009
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	12.598	1.613	0.954	52.406	-90.790	-0.062
1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Temp	12.598	1.317	1.351	73.937	-74.348	-0.083
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	12.598	0.930	1.655	90.462	-52.924	-0.099
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	12.598	-0.002	1.912	104.406	-1.212	-0.109
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	12.598	-0.934	1.657	90.502	50.490	-0.090
1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Temp	12.598	-1.320	1.354	73.993	71.901	-0.071
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	12.598	-1.616	0.958	52.475	88.327	-0.047
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	12.598	-1.864	0.002	0.516	102.161	0.009
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	12.598	-1.613	-0.954	-51.455	88.287	0.062

Load Combination	*Vertical* *K*	*Shear$_x$* *K*	*Shear$_z$* *K*	*Overturning Moment, M_x* *kip-ft*	*Overturning Moment, M_z* *kip-ft*	*Torque* *kip-ft*
1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Temp	12.598	-1.317	-1.351	-72.986	71.845	0.083
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	12.598	-0.930	-1.655	-89.510	50.421	0.099
Dead+Wind 0 deg - Service	6.877	0.003	-1.294	-68.297	-0.831	0.094
Dead+Wind 30 deg - Service	6.877	0.619	-1.122	-59.123	-34.815	0.085
Dead+Wind 45 deg - Service	6.877	0.874	-0.917	-48.225	-48.887	0.072
Dead+Wind 60 deg - Service	6.877	1.069	-0.649	-34.016	-59.681	0.053
Dead+Wind 90 deg - Service	6.877	1.233	-0.003	0.297	-68.766	0.007
Dead+Wind 120 deg - Service	6.877	1.066	0.645	34.623	-59.635	-0.041
Dead+Wind 135 deg - Service	6.877	0.871	0.914	48.916	-48.893	-0.062
Dead+Wind 150 deg - Service	6.877	0.633	1.153	61.693	-35.850	-0.078
Dead+Wind 180 deg - Service	6.877	-0.003	1.294	68.982	-0.740	-0.094
Dead+Wind 210 deg - Service	6.877	-0.619	1.122	59.809	33.244	-0.085
Dead+Wind 225 deg - Service	6.877	-0.874	0.917	48.910	47.315	-0.072
Dead+Wind 240 deg - Service	6.877	-1.069	0.649	34.702	58.109	-0.053
Dead+Wind 270 deg - Service	6.877	-1.233	0.003	0.388	67.194	-0.007
Dead+Wind 300 deg - Service	6.877	-1.066	-0.645	-33.938	58.064	0.041
Dead+Wind 315 deg - Service	6.877	-0.871	-0.914	-48.231	47.321	0.062
Dead+Wind 330 deg - Service	6.877	-0.633	-1.153	-61.008	34.279	0.078

Solution Summary

	Sum of Applied Forces			*Sum of Reactions*			
Load Comb.	*PX* *K*	*PY* *K*	*PZ* *K*	*PX* *K*	*PY* *K*	*PZ* *K*	*% Error*
1	0.000	-6.877	0.000	0.000	6.877	0.000	0.000%
2	0.013	-8.252	-6.779	-0.013	8.252	6.779	0.000%
3	0.013	-6.189	-6.779	-0.013	6.189	6.779	0.000%
4	3.240	-8.252	-5.877	-3.240	8.252	5.877	0.000%
5	3.240	-6.189	-5.877	-3.240	6.189	5.877	0.000%
6	4.574	-8.252	-4.803	-4.574	8.252	4.803	0.000%
7	4.574	-6.189	-4.803	-4.574	6.189	4.803	0.000%
8	5.598	-8.252	-3.401	-5.598	8.252	3.401	0.000%
9	5.598	-6.189	-3.401	-5.598	6.189	3.401	0.000%
10	6.456	-8.252	-0.013	-6.456	8.252	0.013	0.000%
11	6.456	-6.189	-0.013	-6.456	6.189	0.013	0.000%
12	5.584	-8.252	3.378	-5.584	8.252	-3.378	0.000%
13	5.584	-6.189	3.378	-5.584	6.189	-3.378	0.000%
14	4.560	-8.252	4.789	-4.560	8.252	-4.789	0.000%
15	4.560	-6.189	4.789	-4.560	6.189	-4.789	0.000%
16	3.317	-8.252	6.038	-3.317	8.252	-6.038	0.000%
17	3.317	-6.189	6.038	-3.317	6.189	-6.038	0.000%
18	-0.013	-8.252	6.779	0.013	8.252	-6.779	0.000%
19	-0.013	-6.189	6.779	0.013	6.189	-6.779	0.000%
20	-3.240	-8.252	5.877	3.240	8.252	-5.877	0.000%
21	-3.240	-6.189	5.877	3.240	6.189	-5.877	0.000%
22	-4.574	-8.252	4.803	4.574	8.252	-4.803	0.000%
23	-4.574	-6.189	4.803	4.574	6.189	-4.803	0.000%
24	-5.598	-8.252	3.401	5.598	8.252	-3.401	0.000%
25	-5.598	-6.189	3.401	5.598	6.189	-3.401	0.000%
26	-6.456	-8.252	0.013	6.456	8.252	-0.013	0.000%
27	-6.456	-6.189	0.013	6.456	6.189	-0.013	0.000%
28	-5.584	-8.252	-3.378	5.584	8.252	3.378	0.000%
29	-5.584	-6.189	-3.378	5.584	6.189	3.378	0.000%
30	-4.560	-8.252	-4.789	4.560	8.252	4.789	0.000%
31	-4.560	-6.189	-4.789	4.560	6.189	4.789	0.000%
32	-3.317	-8.252	-6.038	3.317	8.252	6.038	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	*PX K*	*PY K*	*PZ K*	*PX K*	*PY K*	*PZ K*	*% Error*
33	-3.317	-6.189	-6.038	3.317	6.189	6.038	0.000%
34	0.000	-12.598	0.000	-0.000	12.598	0.000	0.000%
35	0.002	-12.598	-1.912	-0.002	12.598	1.912	0.000%
36	0.934	-12.598	-1.657	-0.934	12.598	1.657	0.000%
37	1.320	-12.598	-1.354	-1.320	12.598	1.354	0.000%
38	1.616	-12.598	-0.958	-1.616	12.598	0.958	0.000%
39	1.864	-12.598	-0.002	-1.864	12.598	0.002	0.000%
40	1.613	-12.598	0.954	-1.613	12.598	-0.954	0.000%
41	1.317	-12.598	1.351	-1.317	12.598	-1.351	0.000%
42	0.930	-12.598	1.655	-0.930	12.598	-1.655	0.000%
43	-0.002	-12.598	1.912	0.002	12.598	-1.912	0.000%
44	-0.934	-12.598	1.657	0.934	12.598	-1.657	0.000%
45	-1.320	-12.598	1.354	1.320	12.598	-1.354	0.000%
46	-1.616	-12.598	0.958	1.616	12.598	-0.958	0.000%
47	-1.864	-12.598	0.002	1.864	12.598	-0.002	0.000%
48	-1.613	-12.598	-0.954	1.613	12.598	0.954	0.000%
49	-1.317	-12.598	-1.351	1.317	12.598	1.351	0.000%
50	-0.930	-12.598	-1.655	0.930	12.598	1.655	0.000%
51	0.003	-6.877	-1.294	-0.003	6.877	1.294	0.000%
52	0.619	-6.877	-1.122	-0.619	6.877	1.122	0.000%
53	0.874	-6.877	-0.917	-0.874	6.877	0.917	0.000%
54	1.069	-6.877	-0.649	-1.069	6.877	0.649	0.000%
55	1.233	-6.877	-0.003	-1.233	6.877	0.003	0.000%
56	1.066	-6.877	0.645	-1.066	6.877	-0.645	0.000%
57	0.871	-6.877	0.914	-0.871	6.877	-0.914	0.000%
58	0.633	-6.877	1.153	-0.633	6.877	-1.153	0.000%
59	-0.003	-6.877	1.294	0.003	6.877	-1.294	0.000%
60	-0.619	-6.877	1.122	0.619	6.877	-1.122	0.000%
61	-0.874	-6.877	0.917	0.874	6.877	-0.917	0.000%
62	-1.069	-6.877	0.649	1.069	6.877	-0.649	0.000%
63	-1.233	-6.877	0.003	1.233	6.877	-0.003	0.000%
64	-1.066	-6.877	-0.645	1.066	6.877	0.645	0.000%
65	-0.871	-6.877	-0.914	0.871	6.877	0.914	0.000%
66	-0.633	-6.877	-1.153	0.633	6.877	1.153	0.000%

Non-Linear Convergence Results

Load Combination	*Converged?*	*Number of Cycles*	*Displacement Tolerance*	*Force Tolerance*
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00076143
3	Yes	4	0.00000001	0.00046239
4	Yes	5	0.00000001	0.00014788
5	Yes	5	0.00000001	0.00006353
6	Yes	5	0.00000001	0.00015609
7	Yes	5	0.00000001	0.00006572
8	Yes	5	0.00000001	0.00013984
9	Yes	5	0.00000001	0.00005981
10	Yes	4	0.00000001	0.00039261
11	Yes	4	0.00000001	0.00023897
12	Yes	5	0.00000001	0.00012952
13	Yes	5	0.00000001	0.00005519
14	Yes	5	0.00000001	0.00015744
15	Yes	5	0.00000001	0.00006658
16	Yes	5	0.00000001	0.00016164
17	Yes	5	0.00000001	0.00006920

18	Yes	4	0.00000001	0.00075541
19	Yes	4	0.00000001	0.00045911
20	Yes	5	0.00000001	0.00013016
21	Yes	5	0.00000001	0.00005578
22	Yes	5	0.00000001	0.00015299
23	Yes	5	0.00000001	0.00006485
24	Yes	5	0.00000001	0.00013825
25	Yes	5	0.00000001	0.00005958
26	Yes	4	0.00000001	0.00038586
27	Yes	4	0.00000001	0.00023534
28	Yes	5	0.00000001	0.00015095
29	Yes	5	0.00000001	0.00006543
30	Yes	5	0.00000001	0.00015615
31	Yes	5	0.00000001	0.00006621
32	Yes	5	0.00000001	0.00013331
33	Yes	5	0.00000001	0.00005627
34	Yes	4	0.00000001	0.00002006
35	Yes	5	0.00000001	0.00006531
36	Yes	5	0.00000001	0.00008732
37	Yes	5	0.00000001	0.00009200
38	Yes	5	0.00000001	0.00008601
39	Yes	5	0.00000001	0.00006519
40	Yes	5	0.00000001	0.00008348
41	Yes	5	0.00000001	0.00009083
42	Yes	5	0.00000001	0.00008710
43	Yes	5	0.00000001	0.00006442
44	Yes	5	0.00000001	0.00008037
45	Yes	5	0.00000001	0.00008652
46	Yes	5	0.00000001	0.00008118
47	Yes	4	0.00000001	0.00098230
48	Yes	5	0.00000001	0.00008449
49	Yes	5	0.00000001	0.00008857
50	Yes	5	0.00000001	0.00008140
51	Yes	4	0.00000001	0.00003625
52	Yes	4	0.00000001	0.00006064
53	Yes	4	0.00000001	0.00005607
54	Yes	4	0.00000001	0.00004683
55	Yes	4	0.00000001	0.00000001
56	Yes	4	0.00000001	0.00004053
57	Yes	4	0.00000001	0.00006379
58	Yes	4	0.00000001	0.00007666
59	Yes	4	0.00000001	0.00003574
60	Yes	4	0.00000001	0.00003654
61	Yes	4	0.00000001	0.00005024
62	Yes	4	0.00000001	0.00004343
63	Yes	4	0.00000001	0.00000001
64	Yes	4	0.00000001	0.00006527
65	Yes	4	0.00000001	0.00006156
66	Yes	4	0.00000001	0.00004320

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* *°*	*Twist* *°*
L1	81.333 - 66.916	7.501	58	0.782	0.004
L2	69.916 - 28.999	5.661	58	0.742	0.003
L3	32.669 - 2	1.191	58	0.349	0.001

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* *°*	*Twist* *°*	*Radius of Curvature* *ft*
87.800	CUUD120X06Fxyz0	58	7.501	0.782	0.004	19748
81.800	10'x3.0" Pipe Mount	58	7.501	0.782	0.004	19748
80.800	Valmont Uni-Tri Bracket	58	7.414	0.781	0.004	19748
80.000	Musco LSS80DEXT Lights (6+5)	58	7.283	0.779	0.004	19748
77.300	Valmont Uni-Tri Bracket	58	6.842	0.771	0.004	19748
20.000	RF4439d-25A (B2/B66A RRH)	58	0.504	0.199	0.000	6331
18.000	SDX1926Q-43	58	0.429	0.176	0.000	7122
13.000	Musco Light Control Box	58	0.269	0.120	0.000	10359

Maximum Tower Deflections - Design Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* *°*	*Twist* *°*
L1	81.333 - 66.916	39.265	16	4.099	0.023
L2	69.916 - 28.999	29.636	16	3.891	0.015
L3	32.669 - 2	6.225	16	1.825	0.004

Critical Deflections and Radius of Curvature - Design Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* *°*	*Twist* *°*	*Radius of Curvature* *ft*
87.800	CUUD120X06Fxyz0	16	39.265	4.099	0.023	4047
81.800	10'x3.0" Pipe Mount	16	39.265	4.099	0.023	4047
80.800	Valmont Uni-Tri Bracket	16	38.809	4.092	0.022	4047
80.000	Musco LSS80DEXT Lights (6+5)	16	38.124	4.081	0.022	4047
77.300	Valmont Uni-Tri Bracket	16	35.818	4.042	0.020	4047
20.000	RF4439d-25A (B2/B66A RRH)	16	2.632	1.041	0.002	1207
18.000	SDX1926Q-43	16	2.239	0.922	0.002	1358
13.000	Musco Light Control Box	16	1.403	0.630	0.001	1975

Compression Checks

Pole Design Data

Section No.	*Elevation* *ft*	*Size*	*L* *ft*	L_u *ft*	*Kl/r*	*A* in^2	P_u *K*	ϕP_n *K*	*Ratio* $\frac{P_u}{\phi P_n}$
L1	81.333 -	TP15.75x13.73x0.179	14.417	0.000	0.0	8.520	-1.642	380.728	0.004

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
	66.916 (1)								
L2	66.916 - 28.999 (2)	TP20.7x14.972x0.239	40.917	0.000	0.0	14.977	-3.940	671.758	0.006
L3	28.999 - 2 (3)	TP24x19.708x0.313	30.669	0.000	0.0	23.292	-8.246	1073.080	0.008

Pole Bending Design Data

Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	81.333 - 66.916 (1)	TP15.75x13.73x0.179	31.995	148.349	0.216	0.000	148.349	0.000
L2	66.916 - 28.999 (2)	TP20.7x14.972x0.239	188.551	343.832	0.548	0.000	343.832	0.000
L3	28.999 - 2 (3)	TP24x19.708x0.313	371.898	641.578	0.580	0.000	641.578	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u K	ϕV_n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u kip-ft	ϕT_n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	81.333 - 66.916 (1)	TP15.75x13.73x0.179	3.260	109.426	0.030	0.000	112.122	0.000
L2	66.916 - 28.999 (2)	TP20.7x14.972x0.239	5.083	196.404	0.026	0.419	264.952	0.002
L3	28.999 - 2 (3)	TP24x19.708x0.313	6.896	345.884	0.020	0.395	565.660	0.001

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	81.333 - 66.916 (1)	0.004	0.216	0.000	0.030	0.000	0.221 ✔	1.000	4.8.2 ✔
L2	66.916 - 28.999 (2)	0.006	0.548	0.000	0.026	0.002	0.555 ✔	1.000	4.8.2 ✔
L3	28.999 - 2 (3)	0.008	0.580	0.000	0.020	0.001	0.588 ✔	1.000	4.8.2 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$øP_{allow}$ K	% Capacity	Pass Fail
L1	81.333 - 66.916	Pole	TP15.75x13.73x0.179	1	-1.642	380.728	22.1	Pass
L2	66.916 - 28.999	Pole	TP20.7x14.972x0.239	2	-3.940	671.758	55.5	Pass
L3	28.999 - 2	Pole	TP24x19.708x0.313	3	-8.246	1073.080	58.8	Pass
							Summary	
						Pole (L3)	58.8	Pass
						RATING =	**58.8**	**Pass**

Program Version 8.1.1.0 - 6/3/2021 File:J:/Jobs/2210500.WI/02_Niantic CT SC 6/05_Structural/Backup Documentation/Rev (3)/Calcs/ERI Files/81' Monopole_ East Lyme_CT.eri

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 372 \cdot ft \cdot kips$	(User Input)	
Shear Force =	$Shear := 7 \cdot kip$	(User Input)	
Axial Force =	$Axial := 8 \cdot kip$	(User Input)	
Tower Height =	$H_t := 81.33 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 6 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 4.0 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 4.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 2 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 14 \cdot ft$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f_c := 4500 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Ultimate Soil Bearing Capacity =	$q_u := 3000 \cdot psf$	(User Input)	
Allowable Soil Bearing Capacity =	$q_a := \frac{q_u}{2} = 1500 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 110 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 7$	(User Input)	
Bar Diameter =	$d_{bpier} := 0.875 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 16$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.375 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 7$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 0.875 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 14$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 7$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 0.875 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 14$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area = $$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.601 \cdot in^2$$

Pad Top Reinforcement Bar Area = $$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.601 \cdot in^2$$

Pad Bottom Reinforcement Bar Area = $$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.601 \cdot in^2$$

Coefficient of Lateral Soil Pressure = $$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

Stability of Footing:

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

Adjusted Soil Unit Weight = $\gamma_s := \text{if}(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}) = 110\cdot\text{pcf}$

Passive Pressure = $P_{pn} := K_p\cdot\gamma_s\cdot n + c\cdot 2\cdot\sqrt{K_p} = 0\cdot\text{ksf}$

$P_{pt} := K_p\cdot\gamma_s\cdot(D_f - T_f) + c\cdot 2\cdot\sqrt{K_p} = 1.32\cdot\text{ksf}$

$P_{top} := \text{if}\left[n < (D_f - T_f), P_{pt}, P_{pn}\right] = 1.32\cdot\text{ksf}$

$P_{bot} := K_p\cdot\gamma_s\cdot D_f + c\cdot 2\cdot\sqrt{K_p} = 1.98\cdot\text{ksf}$

$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.65\cdot\text{ksf}$

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

$A_p := W_f\cdot T_p = 28$

Ultimate Shear = $S_u := P_{ave}\cdot A_p = 46.2\cdot\text{kip}$

Weight of Concrete Pad = $WT_c := \left[\left(W_f^{\,2}\cdot T_f\right) + \frac{1}{4}\cdot\pi\cdot d_p^{\,2} L_p\right]\cdot\gamma_c = 66.34\cdot\text{kip}$

Weight of Soil Above Footing = $WT_{s1} := \left[\left(W_f^{\,2} - \frac{1}{4}\cdot\pi\cdot d_p^{\,2}\right)\cdot\left(\left|L_p - L_{pag} - n\right|\right)\right]\cdot\gamma_s = 80.71\cdot\text{kip}$

Weight of Soil Wedge at Back Face = $WT_{s2} := \left(\frac{D_f^{\,2}\cdot\tan(\Phi_s)}{2}\cdot W_f\right)\cdot\gamma_s = 16.004\cdot\text{kip}$

Weight of Soil Wedge at back face Corners = $WT_{s3} := 2\cdot\left[(D_f)^3\cdot\frac{\tan(\Phi_s)}{3}\right]\cdot\gamma_s = 9.145\cdot\text{kips}$

Total Weight = $WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 155.051\cdot\text{kip}$

Resisting Weight = $WT_R := 0.9\cdot WT_c + 0.75\cdot WT_{s1} + 0.75\cdot\text{Axial} = 126.239\cdot\text{kip}$

Resisting Moment = $M_r := (WT_R)\cdot\frac{W_f}{2} + 0.75\cdot S_u\cdot\frac{T_f}{3} + 0.75\cdot\left[(WT_{s2} + WT_{s3})\cdot\left(W_f + \frac{D_f\cdot\tan(\Phi_s)}{3}\right)\right] = 1193\cdot\text{kip}\cdot\text{ft}$

Overturning Moment = $M_{ot} := OM + \text{Shear}\cdot(L_p + T_f) = 414\cdot\text{kip}\cdot\text{ft}$

Factor of Safety Actual = $FS := \frac{M_r}{M_{ot}} = 2.88$

Factor of Safety Required = $FS_{req} := 1$

OverTurning_Moment_Check := if(FS ≥ FS_{req}, "Okay" , "No Good")

OverTurning_Moment_Check = "Okay"

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS_{req}} = 115.973 \cdot kips$

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

Shear_Check = "Okay"

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^2 = 196$

Section Modulus of Mat = $S := \frac{W_f^3}{6} = 457.33 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.696 \cdot ksf$

Max_Pressure_Check := if($P_{max} < .75 \cdot q_u$, "Okay", "No Good")

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.114 \cdot ksf$

Min_Pressure_Check := if[$(P_{min} \geq 0) \cdot (P_{min} < .75 \cdot q_u)$, "Okay", "No Good"]

Min_Pressure_Check = "No Good"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 4.372$

Distance to Kern = $X_k := \frac{W_f}{6} = 2.333$

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

Eccentricity = $e := \frac{\frac{M_{ot}}{1.6}}{WT_{tot}} = 1.669$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.385 \cdot ksf$

$q_{adj} := \text{if}(P_{min} < 0, P_a, P_{max}) = 1.385 \cdot ksf$

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

Pressure_Check = "Okay"

Concrete Bearing Capacity:

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

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 4.499 \times 10^3 \cdot kips$ (ACI-2008 10.14)

Bearing_Check := if(P_b > Axial, "Okay", "No Good")

Bearing_Check = "Okay"

Shear Strength of Concrete:

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

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 1.677$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$

$d_2 := d_1 - d$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$

$V_{req} := \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$

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

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

Beam_Shear_Check = "Okay"

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

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

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 25.3$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 170.7$

Guess Value = $v_u := 1\text{ksf}$ (From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := \text{Find}(v_u) = 5.2 \cdot \text{ksf}$

$V_u := v_u \cdot d \cdot W_f = 121.7 \cdot \text{kips}$

Required Shear Strength = $V_{req} := V_u = 121.7 \cdot \text{kips}$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot \text{psi}} \cdot b_o \cdot d = 982.4 \cdot \text{kip}$ (ACI-2008 11.11.2.1)

$\text{Punching\_Shear\_Check} := \text{if}(V_{req} < V_{Avail}, \text{"Okay"}, \text{"No Good"})$

$\text{Punching\_Shear\_Check} = \text{"Okay"}$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

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

$q_b := q_{adj} - d_1 \cdot \text{Slope} = 0.738 \cdot \text{ksf}$

Maximum Bending at Face of Pier = $M_n := \frac{1}{\phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^{\,2}}{3} + q_b \cdot \frac{d_1^{\,2}}{2} \right] \cdot W_f = 227.4 \cdot \text{kip} \cdot \text{ft}$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \cdot \text{psi} \le f_c \le 4000 \cdot \text{psi} \\ 0.65 & \text{if } f_c > 8000 \cdot \text{psi} \\ \left[\left[0.85 - \left[\frac{\left(\frac{f_c}{\text{psi}} - 4000\right)}{1000}\right] \cdot 0.5\right]\right] & \text{otherwise} \end{cases} = 0.6$$

(ACI-2008 10.2.7.3)

$R_n := \frac{M_n}{W_f \cdot d^2} = 40.1 \cdot \text{psi}$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}}\right) = 0.0007$

$\rho_{min} := \rho = 0.00067$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \dfrac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \dfrac{d}{2} & \text{otherwise} \end{cases} = 3.043 \cdot in^2$$

$$As_{prov.bot} := A_{bbot} \cdot NB_{bot} = 8.4 \cdot in^2$$

Pad_Reinforcement_Bot := if($As_{prov.bot} > As$, "Okay", "No Good")

Pad_Reinforcement_Bot = "Okay"

Check Temp Shrinkage Reinforcement:

$$As := \rho_{sh} \cdot (W_f \cdot T_f) = 7.3 \cdot in^2$$

$$As_{prov.top} := A_{btop} \cdot NB_{top} = 8.4 \cdot in^2$$

$$As_{prov.tot} := As_{prov.bot} + As_{prov.top} = 16.8 \cdot in^2$$

Pad_Reinforcement_Temp := if($As_{prov.tot} > As$, "Okay", "No Good")

Pad_Reinforcement_Temp = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =
$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 11.52 \cdot in$$

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

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

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \dfrac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 17.1 \cdot in$$

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

$L_{dbtCheck}$:= if($L_{dbt} \geq L_{dbmin}$, "Use L.dbt", "Use L.dbmin")

Available Length in Pad =
$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 57 \cdot in$$

Lpad_Check := if($L_{Pad} > L_{dbt}$, "Okay", "No Good")

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier = $A_p := \frac{1}{4} \cdot \pi d_p^2 = 1809.56 \cdot in^2$

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

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 9.62 \cdot in^2$

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 8.55 \cdot in$

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

Maximum Moment in Pier = $M_p := \left[OM + Shear \cdot \left(L_p\right)\right] = 4800 \cdot in \cdot kips$

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

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) := \left(d_p \cdot 12 \;\; NB_{pier} \;\; BS_{pier} \;\; \frac{Axial \cdot 1.333}{kips} \;\; \frac{M_p}{in \cdot kips}\right)$$

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) = (48 \;\; 16 \;\; 7 \;\; 10.7 \;\; 4800)$$

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := (0 \;\; 0 \;\; 0 \;\; 0)$$

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

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = (23.4 \;\; 10534.9 \;\; -60 \;\; 0)$$

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

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 45 \cdot in$

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

Tension: (ACI-2008 12.2.3)

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

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

$$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 17.12 \cdot in$$

Minimum Development Length = $L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 10.957 \cdot in$ (ACI 12.2.1)

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

$L_{db} := max(L_{dbt}, L_{dbmin})$

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

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

Compression: (ACI-2008 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 15.652 \cdot in$$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot (d_{bpier} \cdot f_y) = 15.75 \cdot in$

$L_{dbc} := if(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}) = 15.75 \cdot in$

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

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

Development of Design Heights, Exposure Coefficients, and Velocity Pressures Per TIA-222-G

Wind Speeds

Basic Wind Speed	$V := 130$	mph	(User Input - 2022 CSBC Appendix P)
Basic Wind Speed with Ice	$V_i := 50$	mph	(User Input per Annex B of TIA-222-H)

Input

Structure Type =	Structure_Type := Pole		(User Input)
Structure Category =	SC := II		(User Input)
Exposure Category =	Exp := C		(User Input)
Structure Height =	$h := 81.33$	ft	(User Input)
Height to Center of Antennas =	$z_{ant} := 87.8$	ft	(User Input)
Radial Ice Thickness =	$t_i := 1.0$	in	(User Input per Annex B of TIA-222-H)
Radial Ice Density =	$Id := 56.00$	pcf	(User Input)
Topograpic Factor =	$K_{zt} := 1.0$		(User Input)
Shielding Factor for Appurtenances =	$K_a := 1.0$		(User Input)
Ground Elevation Factor =	$K_e = 0.996$		(User Input)
Gust Response Factor =	$G_H := 1.35$		(User Input - Section 2.6.9.4 of TIA-222-H)

Output

Wind Direction Probability Factor =

$$K_d := \begin{cases} 0.95 & \text{if Structure\_Type = Pole} \\ 0.85 & \text{if Structure\_Type = Lattice} \end{cases} = 0.95$$

(Per Table 2-2 of TIA-222-H)

Importance Factors =

$$I_{ice} := \begin{cases} 0 & \text{if SC = 1} \\ 1.00 & \text{if SC = 2} \\ 1.15 & \text{if SC = 3} \\ 1.25 & \text{if SC = 4} \end{cases} = 1$$

(Per Table 2-3 of TIA-222-H)

$$K_{iz} := \left(\frac{z_{ant}}{33}\right)^{0.1} = 1.103 \qquad t_{izant} := t_i \cdot I_{ice} \cdot K_{iz} \cdot K_{zt}^{0.35} = 1.103$$

Velocity Pressure Coefficient Antennas =

$$Kz_{ant} := 2.01\left(\left(\frac{z_{ant}}{zg}\right)\right)^{\frac{2}{\alpha}} = 1.231$$

Velocity Pressure w/o Ice Antennas =

$$qz_{ant} := 0.00256 \cdot K_{zt} \cdot K_e \cdot K_d \cdot Kz_{ant} \cdot V^2 = 50.389$$

Velocity Pressure with Ice Antennas =

$$qz_{ice.ant} := 0.00256 \cdot K_{zt} \cdot K_e \cdot K_d \cdot Kz_{ant} \cdot V_i^2 = 7.454$$

Development of Wind & Ice Load on Antennas

Antenna Data:

Antenna Model =	Amphenol CUUD120X06Fxyz0		
Antenna Shape =	Flat		(User Input)
Antenna Height =	$L_{ant} := 24$	in	(User Input)
Antenna Width =	$W_{ant} := 14.6$	in	(User Input)
Antenna Thickness =	$T_{ant} := 14.6$	in	(User Input)
Antenna Weight =	$WT_{ant} := 30$	lbs	(User Input)
Number of Antennas =	$N_{ant} := 1$		(User Input)
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 1.6$		
Antenna Force Coefficient =	$Ca_{ant} = 1.2$		

Gravity Load (without ice)

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 30$	lbs

Gravity Loads (ice only)

cu in

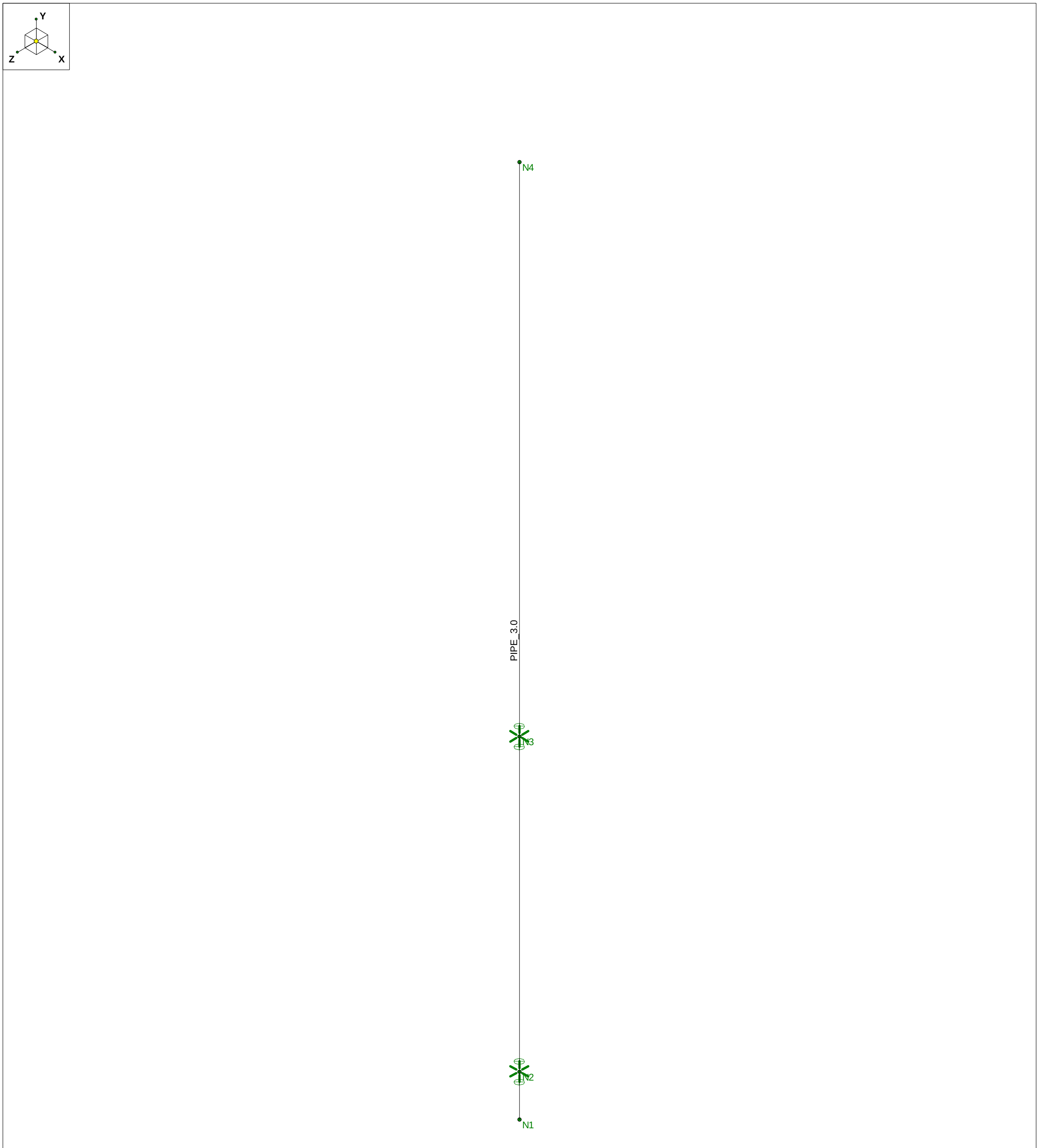
Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 5116$	cu in
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 2 \cdot t_{izant})(W_{ant} + 2 \cdot t_{izant}) \cdot (T_{ant} + 2 \cdot t_{izant}) - V_{ant} = 2285$	
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 74$	lbs
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 74$	lbs

Wind Load (with ice)

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 2 \cdot t_{izant}) \cdot (W_{ant} + 2 \cdot t_{izant})}{144} = 3.1$	sf
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 3.1$	sf
Total Antenna Wind Force w/ Ice =	$Fi_{ant} := qz_{ice.ant} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot A_{ICEant} = 37$	lbs

Wind Load (without ice)

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 2.4$	sf
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 2.4$	sf
Total Antenna Wind Force =	$F_{ant} := qz_{ant} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot A_{ant} = 199$	lbs



Envelope Only Solution

Centek		
TJL	Niantic SC6	Dec 7, 2022 at 9:48 AM
22105.02	Member Framing	Mount.r3d

(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	12
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 14th(360-10): ASD
Cold Formed Steel Code	AISI S100-10: ASD
Wood Code	AWC NDS-12: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-11
Masonry Code	ACI 530-11: ASD
Aluminum Code	AA ADM1-10: ASD - Building
Stainless Steel Code	AISC 14th(360-10): ASD
Adjust Stiffness?	Yes(Iterative)

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	ASCE 7-10
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	1
Om X	1
Cd Z	1
Cd X	1
Rho Z	1
Rho X	1
Footing Overturning Safety Factor	1
Optimize for OTM/Sliding	No
Check Concrete Bearing	No
Footing Concrete Weight (k/ft^3)	150.001
Footing Concrete f'c (ksi)	4
Footing Concrete Ec (ksi)	3644
Lambda	1
Footing Steel fy (ksi)	60
Minimum Steel	0.0018
Maximum Steel	0.0075
Footing Top Bar	#3
Footing Top Bar Cover (in)	2
Footing Bottom Bar	#3
Footing Bottom Bar Cover (in)	3.5
Pedestal Bar	#3
Pedestal Bar Cover (in)	1.5
Pedestal Ties	#3

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\...	Density[k/ft^3]	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A36 Gr.36	29000	11154	.3	.65	.49	36	1.5	58	1.2
2	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	58	1.2
3	A992	29000	11154	.3	.65	.49	50	1.1	58	1.2
4	A500 Gr.42	29000	11154	.3	.65	.49	42	1.3	58	1.1
5	A500 Gr.46	29000	11154	.3	.65	.49	46	1.2	58	1.1
6	A53 Grade B	29000	11154	.3	.65	.49	35	1.5	58	1.2

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rul...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Antenna Mast Pipe_3 S...	PIPE_3.0	Column	Wide Flange	A53 Grade B	Typical	2.07	2.85	2.85	5.69

Hot Rolled Steel Design Parameters

	Label	Shape	Length[ft]	Lbyy[ft]	Lbzz[ft]	Lcomp top[...	Lcomp bot[...	L-torq...	Kyy	Kzz	Cb	Functi...
1	M1	Antenna Mast Pipe...	10									Lateral

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(...	Section/Shape	Type	Design List	Material	Design ...
1	M1	N1	N4			Antenna Mast Pipe_3 STD	Column	Wide Flan...	A53 Grade B	Typical

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	.5	0	0	
3	N3	0	4	0	0	
4	N4	0	10	0	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N2	Reaction	Reaction	Reaction		Reaction	
2	N3	Reaction	Reaction	Reaction		Reaction	

Member Point Loads (BLC 2 : Weight of Appurtenances)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-.03	10

Member Point Loads (BLC 3 : Weight of Ice Only)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-.074	10

Member Point Loads (BLC 4 : TIA Wind with Ice)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	X	.037	10

Member Point Loads (BLC 5 : TIA Wind)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	X	.199	10

Member Distributed Loads

Member Label	Direction	Start Magnitude[k/ft,F,ksf]	End Magnitude[k/ft,F,k...	Start Location[ft...	End Location[ft,...
No Data to Print ...					

Basic Load Cases

	BLC Description	Category	X Gra...	Y Gra...	Z Gra...	Joint	Point	Distrib...	Area(...	Surfa...
1	Self Weight	None		-1						
2	Weight of Appurtenances	None					1			
3	Weight of Ice Only	None					1			
4	TIA Wind with Ice	None					1			
5	TIA Wind	None					1			

Load Combinations

	Description	So...	P...	S...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...
1	1.2D + 1.0W	Yes	Y		1	1.2	2	1.2	5	1														
2	0.9D + 1.0W	Yes	Y		1	.9	2	.9	5	1														
3	1.2D +1.0Di + 1.0Wi	Yes	Y		1	1.2	2	1.2	3	1	4	1												

Envelope Joint Reactions

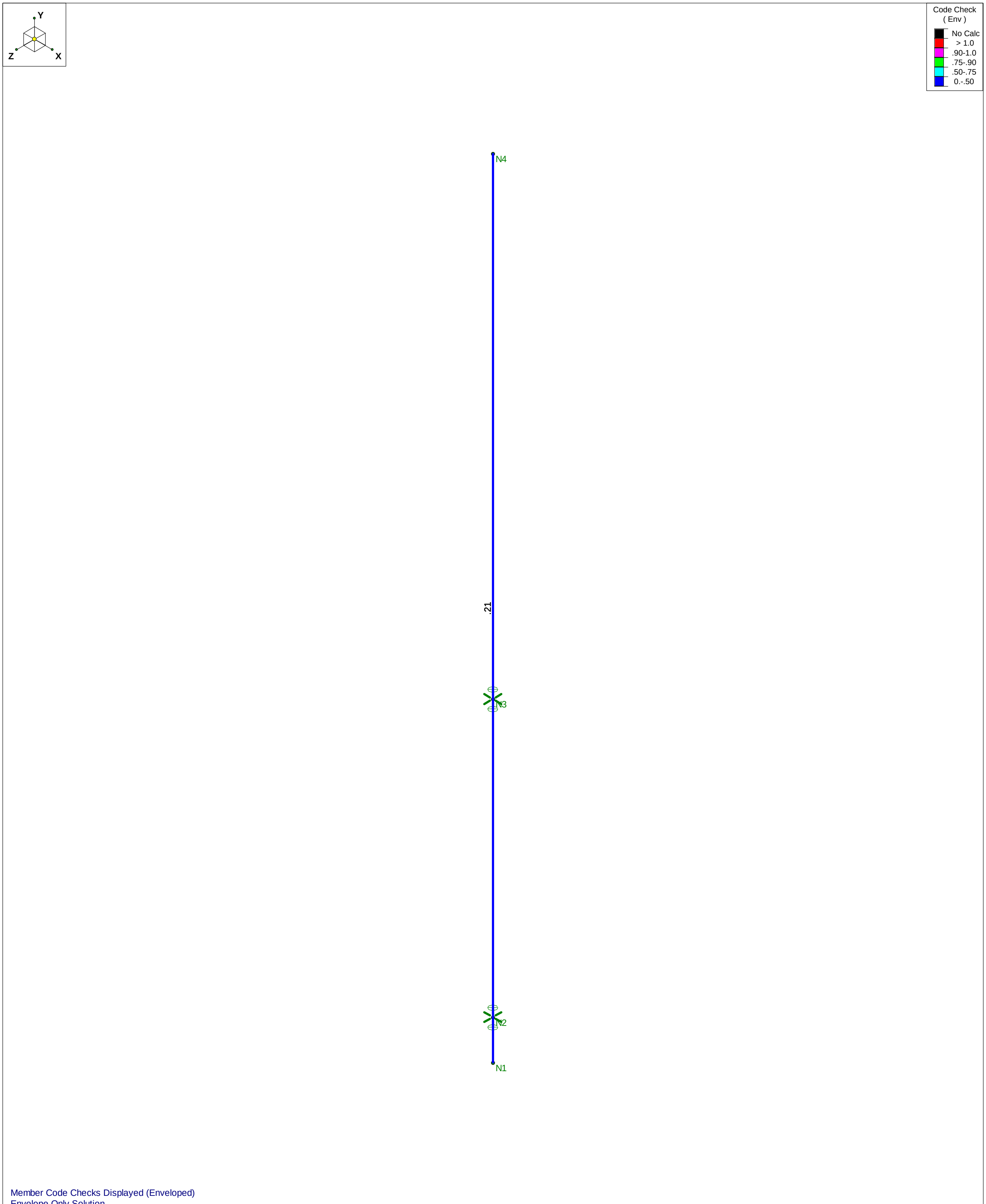
	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	N2	max	.342	1	.019	3	0	3	0	3	0	3	0	3
2		min	.064	3	.014	2	0	1	0	1	0	1	0	1
3	N3	max	-.101	3	.176	3	0	3	0	3	0	3	0	3
4		min	-.541	1	.076	2	0	1	0	1	0	1	0	1
5	Totals:	max	-.037	3	.195	3	0	3						
6		min	-.199	1	.09	2	0	1						

Envelope Joint Displacements

	Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotation [rad]	LC	Z Rotation [rad]	LC
1	N1	max	.009	1	0	2	0	3	0	3	0	3	1.493e-03	1
2		min	.002	3	0	1	0	1	0	1	0	1	2.785e-04	3
3	N2	max	0	3	0	3	0	3	0	3	0	3	1.493e-03	1
4		min	0	1	0	1	0	1	0	1	0	1	2.785e-04	3
5	N3	max	0	3	0	3	0	3	0	3	0	3	-5.724e-04	3
6		min	0	1	0	1	0	1	0	1	0	1	-3.069e-03	1
7	N4	max	.598	1	0	2	0	3	0	3	0	3	-2.031e-03	3
8		min	.111	3	0	3	0	1	0	1	0	1	-1.089e-02	1

Envelope AISC 14th(360-10): LRFD Steel Code Checks

	Memb...	Shape	Code Check	L...	LC	Sh...	L...	Dir		...phi*P...	phi*Pn...	phi*Mn y-y [k-ft]	phi*...	Cb	Eqn
1	M1	PIPE_3.0	.207	4...	1	.017	.5...		1	38.177	65.205	5.749	5.749	1....	H1...



Centek		
TJL	Niantic SC6	Dec 7, 2022 at 9:48 AM
22105.02	Unity Check	Mount.r3d

Antenna Mast Connection:

Anchor Data:

A307 Threaded Rod =		
Number of Anchor Bolts =	$N := 4$	(User Input)
Diameter of Bolts =	$D := 0.625in$	(User Input)
Bolt Spacing Horz =	$Sp_H := 6in$	(User Input)
Bolt Spacing Vertical =	$Sp_V := 6in$	(User Input)
Design Tension =	$T_n := 10.4 \cdot kips$	(User Input)
Design Shear =	$V_n := 6.23 \cdot kips$	(User Input)

Design Reactions:

Shear X =	$Shear_x := 0.54 \cdot kips$	(User Input)
Shear Y =	$Shear_y := 0.176 \cdot kips$	(User Input)
Shear Z =	$Shear_z := 0.54 \cdot kips$	(User Input)
Moment X =	$Mx := 0 \cdot ft \cdot kips$	(User Input)
Moment Y =	$My := 0 \cdot ft \cdot kips$	(User Input)
Moment Z =	$Mz := 0 \cdot ft \cdot kips$	(User Input)

Anchor Check:

Max Tension Force =

$$T_{Max} := \frac{Shear_x}{N} + \frac{My}{Sp_H \cdot \frac{N}{2}} + \frac{Mz}{Sp_V \cdot \frac{N}{2}} = 135lb$$

Max Shear Force =

$$V_{Max} := \frac{Shear_y + Shear_z}{N} + \frac{Mx}{Sp_H \cdot \frac{N}{2}} = 179lb$$

Condition 1 =

$$Condition1 := \text{if}\left(\frac{T_{Max}}{T_n} + \frac{V_{Max}}{V_n} \leq 1.0, \text{"OK"}, \text{"NG"}\right) = \text{"OK"}$$

% of Capacity =

$$\max\left[\frac{T_{Max}}{T_n}, \frac{V_{Max}}{V_n}, \frac{\left(\frac{T_{Max}}{T_n} + \frac{V_{Max}}{V_n}\right)}{1.0}\right] = 4.2 \cdot \%$$

verizon fuze | RFDS

EAST > North East > New England > New England West > NIANTIC CT SC 6 - Light Pole

RF Submit by: Stevens, Wesley - wesley.stevens@verizonwireless.com - 3/30/2023, 7:41:17 AM

EE Submit by: Driscoll, Janet - janet.driscoll@verizonwireless.com - 7/19/2022, 10:20:25 AM

Project Details

FUZE Project ID:	16774016
Project Name:	Radio Swap
Project Alt Name:	NIANTIC CT SC 6 - NENG_SC_ESNAP
Project Type:	Modification
Modification Type:	RF
Designed Sector Carrier 4G:	3
Designed Sector Carrier 5G:	N/A
Additional Sector Carrier 4G:	N/A
Additional Sector Carrier 5G:	N/A
FP Solution Type & Tech Type:	MODIFICATION;4G_PCS,4G_Radio Swap
Carrier Aggregation:	false
MPT Id:	
eCIP-0:	false
Suffix:	Rev2_20230330

Location Information

Site ID:	3288318
E-NodeB ID:	064839
PSLC:	467865
Switch Name:	Wallingford 1
Tower Owner:	
Tower Type:	Pole Utility
Site Type:	SMALL-CELL
Site Sub Type:	SPOKE
Street Address:	221 W Main St
City:	East Lyme
State:	CT
Zip Code:	06357
County:	New London
Latitude:	41.318932 / 41° 19' 8.1552" N
Longitude:	-72.237732 / 72° 14' 15.8352" W

RFDS Project Scope:

Add PCS
Swap antenna to CUUD120
Swap RRH to SS dual-band
Add diplexer for AWS/PCS

Rev2_20230330: updated RRH to ORAN
Rev1_20221215: adjusting centerline to 87.8
Rev0_20220223: initial design

Antenna Summary

Added

1900	AWS	Make	Model	Centerline	Tip Height	Azimuth	RET	4xRx	Inst. Type	Quantity	Item ID
LTE	LTE	AMPHENOL	CUUD120X06Fx0z0-T00	87.8	88.8	120(04)	false	false	PHYSICAL	1	

Removed

1900	AWS	Make	Model	Centerline	Tip Height	Azimuth	RET	4xRx	Inst. Type	Quantity	Item ID
	LTE	ANDREW	NH65PS-DG-F0M	87.33	88.5	120(04)	false	false	PHYSICAL	1	

Retained

1900	AWS	Make	Model	Centerline	Tip Height	Azimuth	RET	4xRx	Inst. Type	Quantity	Item ID

No data available.

Added: 1	**Removed:** 1	**Retained:** 0

Equipment Summary

Added

Equipment Type	Location	1900	AWS	Make	Model	Cable Length	Cable Size	Install Type	Quantity	Item ID
Kit	Tower			COMMSCOPET-001	SDX1926Q-43			PHYSICAL	1	000000001900083
Diplexer	Tower			Commscope	SDX1926Q-43			PHYSICAL	1	000000001900083
Kit	Tower			GEMINI	1600131299A			PHYSICAL	1	000000001900078
Kit	Tower			GEMINI	1600270671A			PHYSICAL	1	000000001900057
Kit	Tower			QUADELECTRIC	F113CGRS0101FLF025			PHYSICAL	2	000000001900038
Kit	Tower			QUADELECTRIC	FLI002OT010046M010			PHYSICAL	2	000000001900038
Kit	Tower			QUADELECTRIC	SAM-CBRS-BRT-NID			PHYSICAL	1	000000001900005
Kit	Tower			QUADELECTRIC	TRAT303H1B1J00F006			PHYSICAL	8	000000001900028
Kit	Tower			QUADELECTRIC	TRAT303H1B1J00F050			PHYSICAL	8	000000001900028
Kit	Tower			QUADELECTRIC	UXP-4MT-12S			PHYSICAL	8	000000001900167
Kit	Tower			QUADELECTRIC	WPS-4F			PHYSICAL	8	000000001900166
Kit	Tower			QUADELECTRIC	WPS-N-4S			PHYSICAL	8	000000001900166
Kit	Tower			QUADELELECTRIC	V3000			PHYSICAL	1	000000001900059
Other	Tower			SAMSUNGELE-001	SLS-BB1150EDEX			PHYSICAL	1	000000001900167
RRU	Tower	LTE	LTE	Samsung	B2/B66A RRH ORAN (RF4439d-25A)			PHYSICAL	1	

Removed

Equipment Type	Location	1900	AWS	Make	Model	Cable Length	Cable Size	Install Type	Quantity	Item ID
RRU	Tower		LTE	Nokia	UHIE B66A RRH 4x45			PHYSICAL	1	

Retained

Equipment Type	Location	1900	AWS	Make	Model	Cable Length	Cable Size	Install Type	Quantity	Item ID

No data available.

Service Info

1900 MHz LTE

	0002
Sector	**04**
Azimuth	120
Cell / ENode B ID	064839
Antenna Model	CUUD120X06Fx0z0-T00
Antenna Make	AMPHENOL
Antenna Centerline(Ft)	87.8
Mechanical Down-Tilt(Deg.)	0
Electrical Down-Tilt	0
Tip Height	88.8
Regulatory Power	36.26
DLEARFCN	1075
Channel Bandwidth(MHz)	15
Total ERP (W)	298.4
TMA Make	
TMA Model	
RRU Make	Samsung
RRU Model	B2/B66A RRH ORAN (RF4439d-25A)
Number of Tx, Rx Lines	4,4
Position	
Transmitter Id	12435656
Source	ATOLL_API

2100 MHz LTE

	0000	0002
Sector	**04**	**04**
Azimuth	120	120
Cell / ENode B ID	064839	064839
Antenna Model	NH65PS-DG-F0M	CUUD120X06Fx0z0-T00
Antenna Make	ANDREW	AMPHENOL
Antenna Centerline(Ft)	87.33	87.8
Mechanical Down-Tilt(Deg.)	0	0
Electrical Down-Tilt	0	0
Tip Height	88.5	88.8
Regulatory Power	55.43	28.48
DLEARFCN	2050	2050
Channel Bandwidth(MHz)	20	20
Total ERP (W)	608.14	312.46
TMA Make		
TMA Model		
RRU Make	Nokia	Samsung
RRU Model	UHIE B66A RRH 4x45	B2/B66A RRH ORAN (RF4439d-25A)
Number of Tx, Rx Lines	2,2	4,4
Position		
Transmitter Id	1958721	12435655
Source	ATOLL_API	ATOLL_API

Service Comments

Callsigns Per Antenna

Sector	Antenna Make	Antenna Model	Ant CL Height AGL	Tip Height	Azimuth (TN)	Elec Tilt	Mech Tilt	Gain	Beam Width	Regulatory Power	Callsigns						
											700	850	1900	2100	28 GHz	31 GHz	39 GHz
No data available.																	

Callsigns

Callsign	Market	Radio Code	Market Number	Block	State	County	Licensee Name	Wholly Owned	Total MHZ	Freq Range 1	Freq Range 2	Freq Range 3	Freq Range 4	Regulatory Power	Threshold (W)	POPs /Sq Mi	Status	Action	Approved for Insvc
WQDU931	*New London-Norwich, CT*	*CW*	*BTA319*	*C*	*CT*	*New London*	*Cellco Partnership*	*Yes*	*10.000*	*1900.000-1905.000*	*1980.000-1985.000*	*.000-.000*	*.000-.000*	*36.26*	*1640*	*403.90*	*Active*	*added*	*Yes*
WQEM954	*New London-Norwich, CT*	*CW*	*BTA319*	*C*	*CT*	*New London*	*Cellco Partnership*	*Yes*	*10.000*	*1895.000-1900.000*	*1975.000-1980.000*	*.000-.000*	*.000-.000*	*36.26*	*1640*	*403.90*	*Active*	*added*	*Yes*
KNLH263	*New London-Norwich, CT*	*CW*	*BTA319*	*F*	*CT*	*New London*	*Cellco Partnership*	*Yes*	*10.000*	*1890.000-1895.000*	*1970.000-1975.000*	*.000-.000*	*.000-.000*	*36.26*	*1640*	*403.90*	*Active*	*added*	*Yes*
WQGD494	*New London-Norwich, CT*	*AW*	*CMA154*	*A*	*CT*	*New London*	*Cellco Partnership*	*Yes*	*20.000*	*1710.000-1720.000*	*2110.000-2120.000*	*.000-.000*	*.000-.000*	*28.48*	*1640*	*403.90*	*Active*	*added*	*Yes*
WQGA906	*New York-No. New Jer.-Long Island, NY-NJ-CT-PA-MA-*	*AW*	*BEA010*	*B*	*CT*	*New London*	*Cellco Partnership*	*Yes*	*20.000*	*1720.000-1730.000*	*2120.000-2130.000*	*.000-.000*	*.000-.000*	*28.48*	*1640*	*403.90*	*Active*	*added*	*Yes*
WQJQ689	Northeast	WU	REA001	C	CT	New London	Cellco Partnership	Yes	22.000	746.000-757.000	776.000-787.000	.000-.000	.000-.000		1000	403.90	Active		Yes
KNKA745	New London-Norwich, CT	CL	CMA154	A	CT	New London	Cellco Partnership	Yes	25.000	824.000-835.000	869.000-880.000	845.000-846.500	890.000-891.500		400	403.90	Active		Yes
WREE835	C09011 - New London, CT	UU	C09011	L1	CT	New London	Cellco Partnership	Yes	425.000	27500.000-27925.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WREE836	C09011 - New London, CT	UU	C09011	L2	CT	New London	Cellco Partnership	Yes	425.000	27925.000-28350.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD609	New York, NY	UU	PEA001	M1	CT	New London	Cellco Partnership	Yes	100.000	37600.000-37700.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD610	New York, NY	UU	PEA001	M10	CT	New London	Cellco Partnership	Yes	100.000	38500.000-38600.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD611	New York, NY	UU	PEA001	M2	CT	New London	Cellco Partnership	Yes	100.000	37700.000-37800.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD612	New York, NY	UU	PEA001	M3	CT	New London	Cellco Partnership	Yes	100.000	37800.000-37900.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD613	New York, NY	UU	PEA001	M4	CT	New London	Cellco Partnership	Yes	100.000	37900.000-38000.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD614	New York, NY	UU	PEA001	M5	CT	New London	Cellco Partnership	Yes	100.000	38000.000-38100.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD615	New York, NY	UU	PEA001	M6	CT	New London	Cellco Partnership	Yes	100.000	38100.000-38200.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD616	New York, NY	UU	PEA001	M7	CT	New London	Cellco Partnership	Yes	100.000	38200.000-38300.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD617	New York, NY	UU	PEA001	M8	CT	New London	Cellco Partnership	Yes	100.000	38300.000-38400.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD618	New York, NY	UU	PEA001	M9	CT	New London	Cellco Partnership	Yes	100.000	38400.000-38500.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRHD619	New York, NY	UU	PEA001	N1	CT	New London	Cellco Partnership	Yes	100.000	38600.000-38700.000	.000-.000	.000-.000	.000-.000			403.90	Active		Yes
WRNE581	New York, NY	PM	PEA001	A1	CT	New London	Cellco Partnership	Yes	20.000	3700.000-3720.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		Yes

WRNE582	New York, NY	PM	PEA001	A2	CT	New London	Cellco Partnership	Yes	20.000	3720.000-3740.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		Yes
WRNE583	New York, NY	PM	PEA001	A3	CT	New London	Cellco Partnership	Yes	20.000	3740.000-3760.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		Yes
WRNE584	New York, NY	PM	PEA001	A4	CT	New London	Cellco Partnership	Yes	20.000	3760.000-3780.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		No
WRNE585	New York, NY	PM	PEA001	A5	CT	New London	Cellco Partnership	Yes	20.000	3780.000-3800.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		No
WRNE586	New York, NY	PM	PEA001	B1	CT	New London	Cellco Partnership	Yes	20.000	3800.000-3820.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		No
WRNE587	New York, NY	PM	PEA001	B2	CT	New London	Cellco Partnership	Yes	20.000	3820.000-3840.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		No
WRNE588	New York, NY	PM	PEA001	B3	CT	New London	Cellco Partnership	Yes	20.000	3840.000-3860.000	.000-.000	.000-.000	.000-.000		1640	403.90	Active		No

LEASE EXHIBIT

THIS LEASE PLAN IS DIAGRAMMATIC IN NATURE AND IS INTENDED TO PROVIDE GENERAL INFORMATION REGARDING THE LOCATION AND SIZE OF THE PROPOSED WIRELESS COMMUNICATION FACILITY. THE SITE LAYOUT WILL BE FINALIZED UPON COMPLETION OF SITE SURVEY AND FACILITY DESIGN.

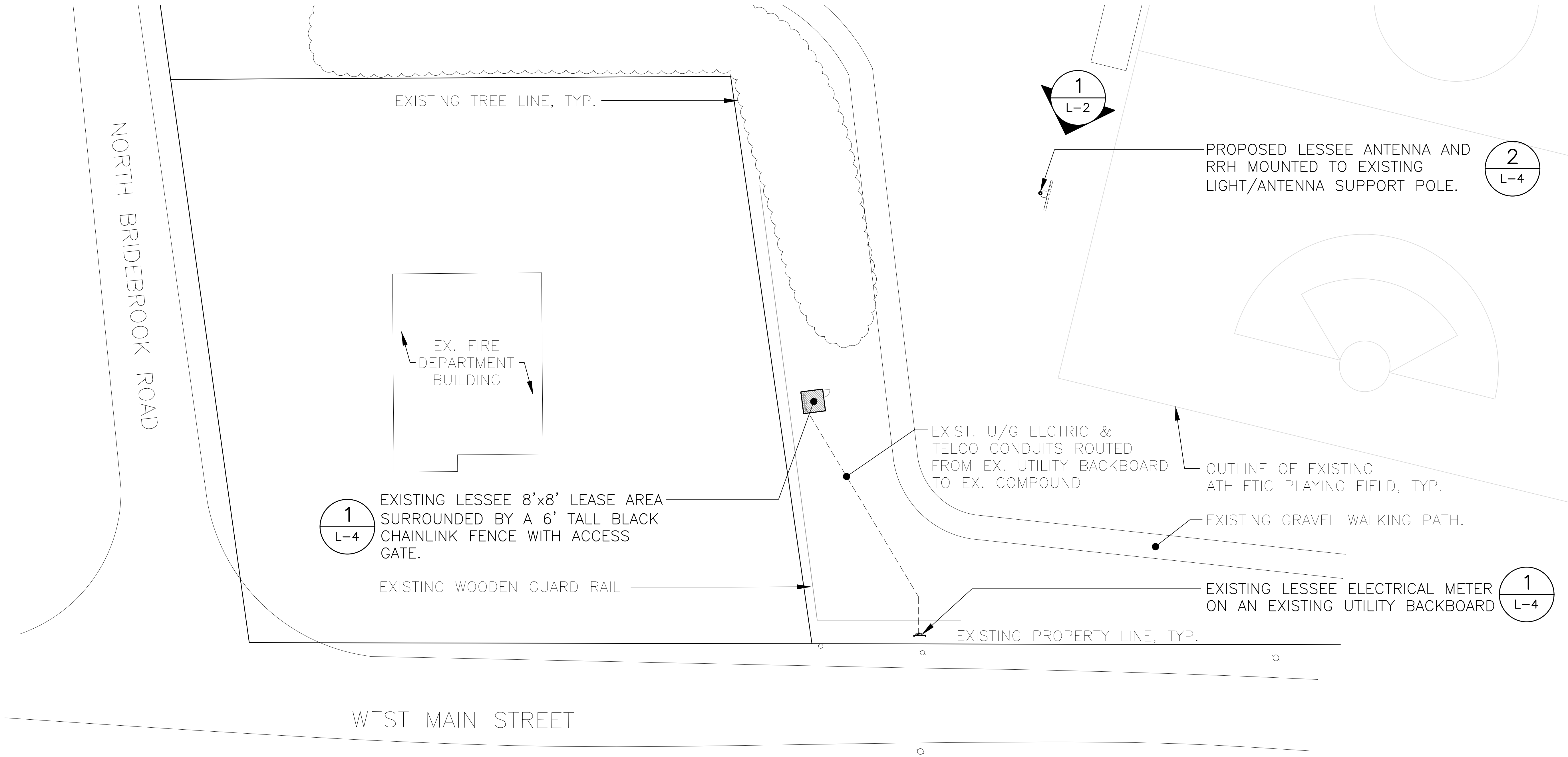
SITE COORDINATES: LAT.: 41° 19' 8.2"
LNG.: 72° 14' 15.9"

GROUND ELEVATION: 30'± A.M.S.L.

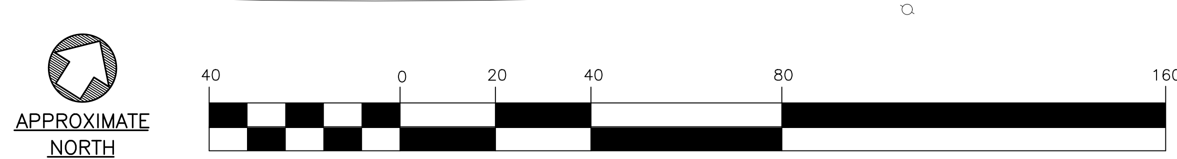
(SITE COORDINATES AND GROUND ELEVATION REFERENCED FROM GOOGLE EARTH)

WORK SCOPE NOTE:

THE PROPOSED LESSEE FACILITY UPGRADE TO CONSIST OF THE INSTALLATION OF A TOTAL OF (1) ANTENNA, (1) REMOTE RADIO HEADS (ORAN) AND (1) DIPLEXER AT THEIR RESPECTIVE EXISTING LOCATIONS.



1
L-1
PARTIAL SITE PLAN
SCALE: 1" = 40'



(IN FEET)
1 inch = 40 ft.

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
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NIANTIC CT SC6

221 WEST MAIN STREET
EAST LYME, CT 06357

DATE: 08/11/2022
SCALE: AS SHOWN
JOB NO. 22105.02

SHEET NO.
L-1

LEASE EXHIBIT

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EXISTING LESSEE ANTENNA TO BE REPLACED

EXISTING LESSEE ANTENNA MOUNT TO BE REPLACED

EXISTING COAX CABLES MOUNTED TO FACE OF STEEL POLE w/ STEEL BANDING TO BE REPLACED

EXISTING STEEL LIGHT POLE

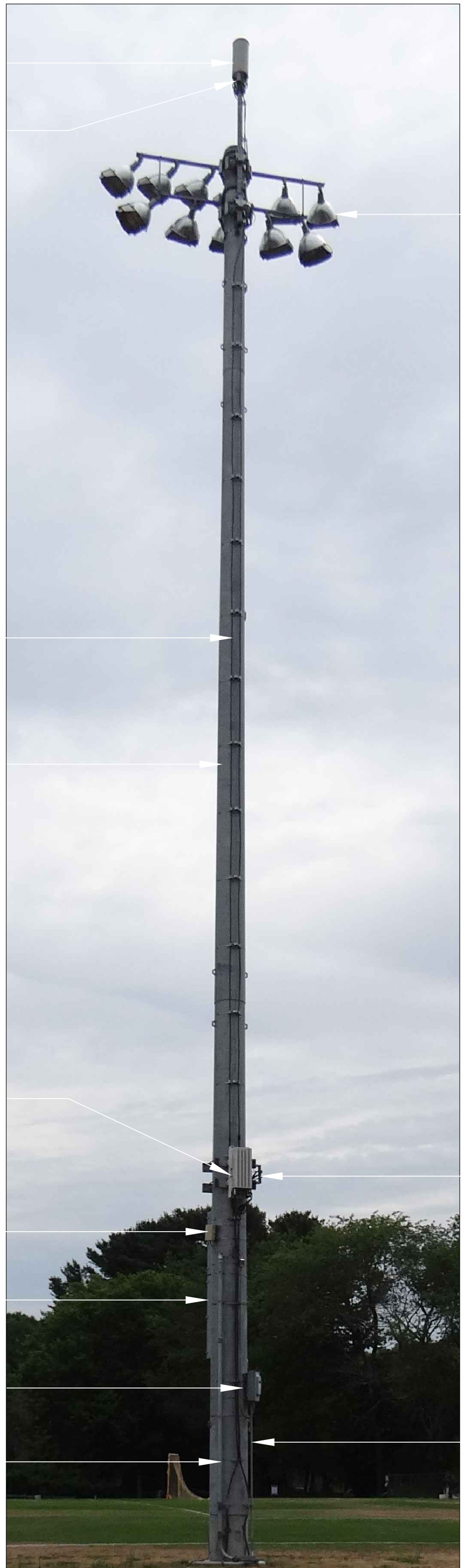
EXISTING LESSEE RADIO AND BRACKET TO BE REPLACED. EXISTING STEEL MOUNT ATTACHED TO STEEL POLE TO REMAIN

EXISTING FIBER DEMARC

EXISTING LIGHT POLE CONTROL PANELS (BEYOND)

EXISTING ELECTRIC DISCONNECT

EXISTING RISER TO LIGHT CONTROL PANELS



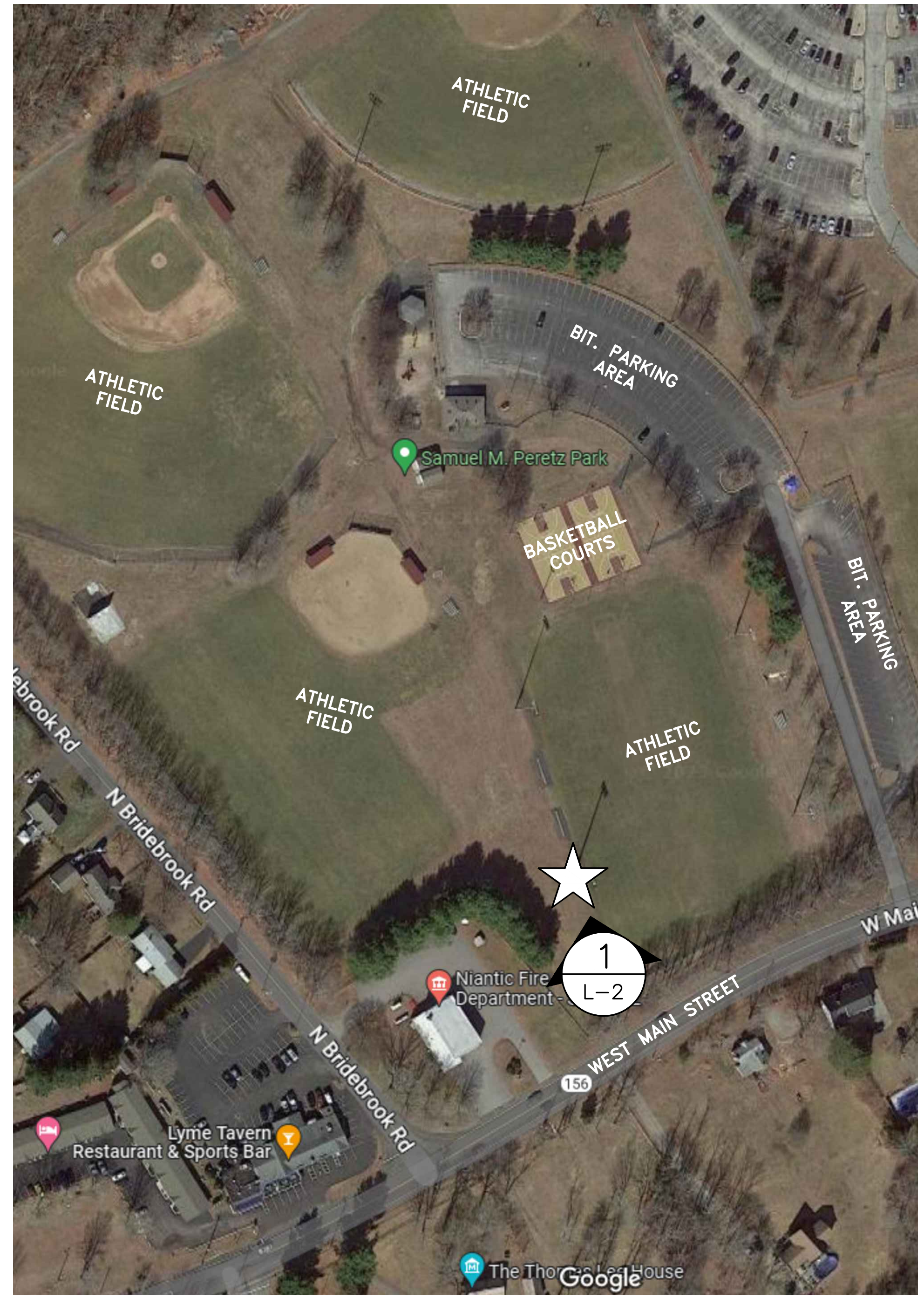
EXISTING ATHLETIC FIELD LIGHTS

EXISTING GROUND BAR TO REMAIN

EXISTING RISER TO ELECTRIC DISCONNECT

1 / L-2 **UTILITY POLE IMAGE (EXIST.)**

SCALE: 1" = 10'



2 / L-2 **LOCATION PLAN/AERIAL IMAGE**

SCALE: 1" = 200'

NORTH

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SHEET NO.
L-2

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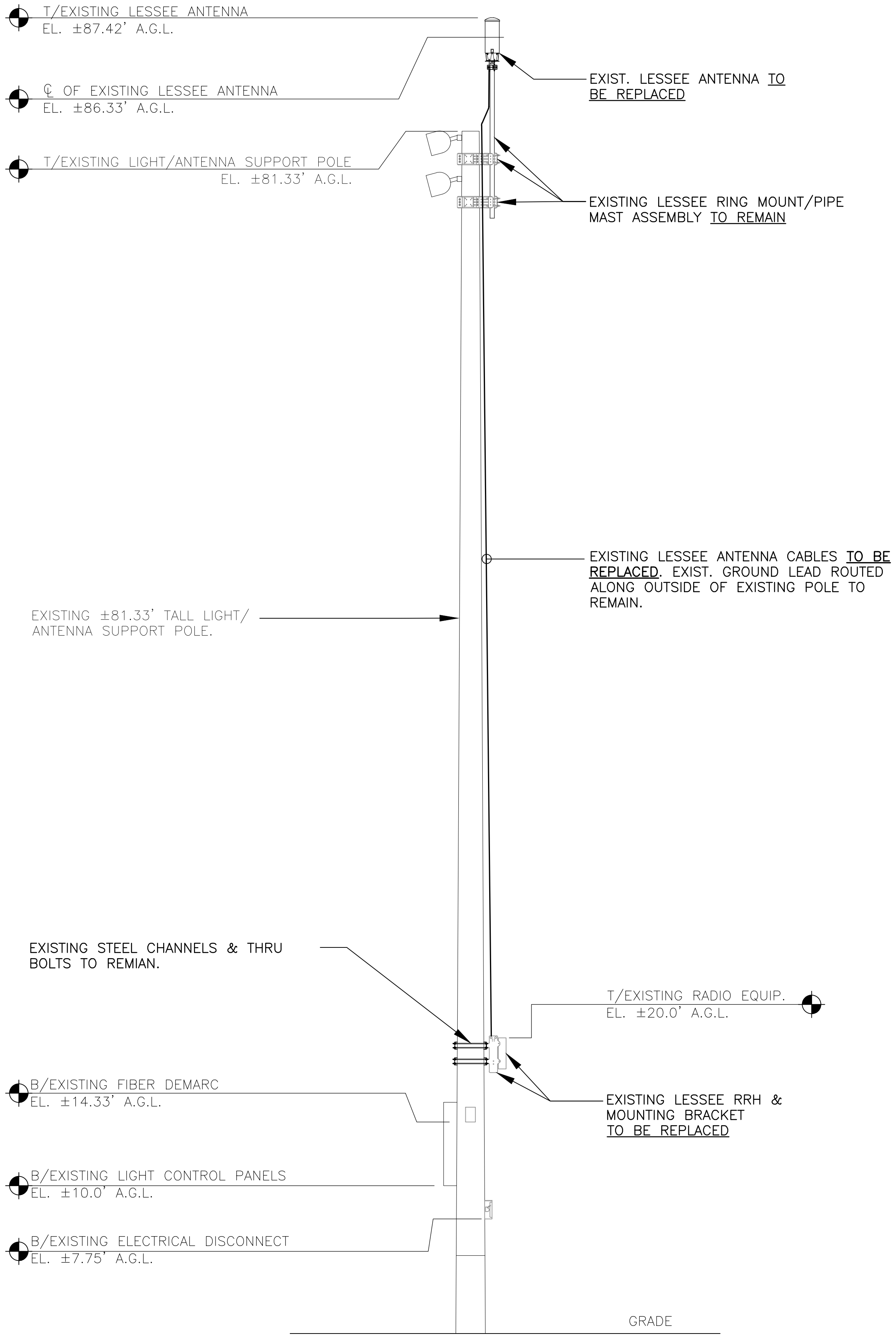
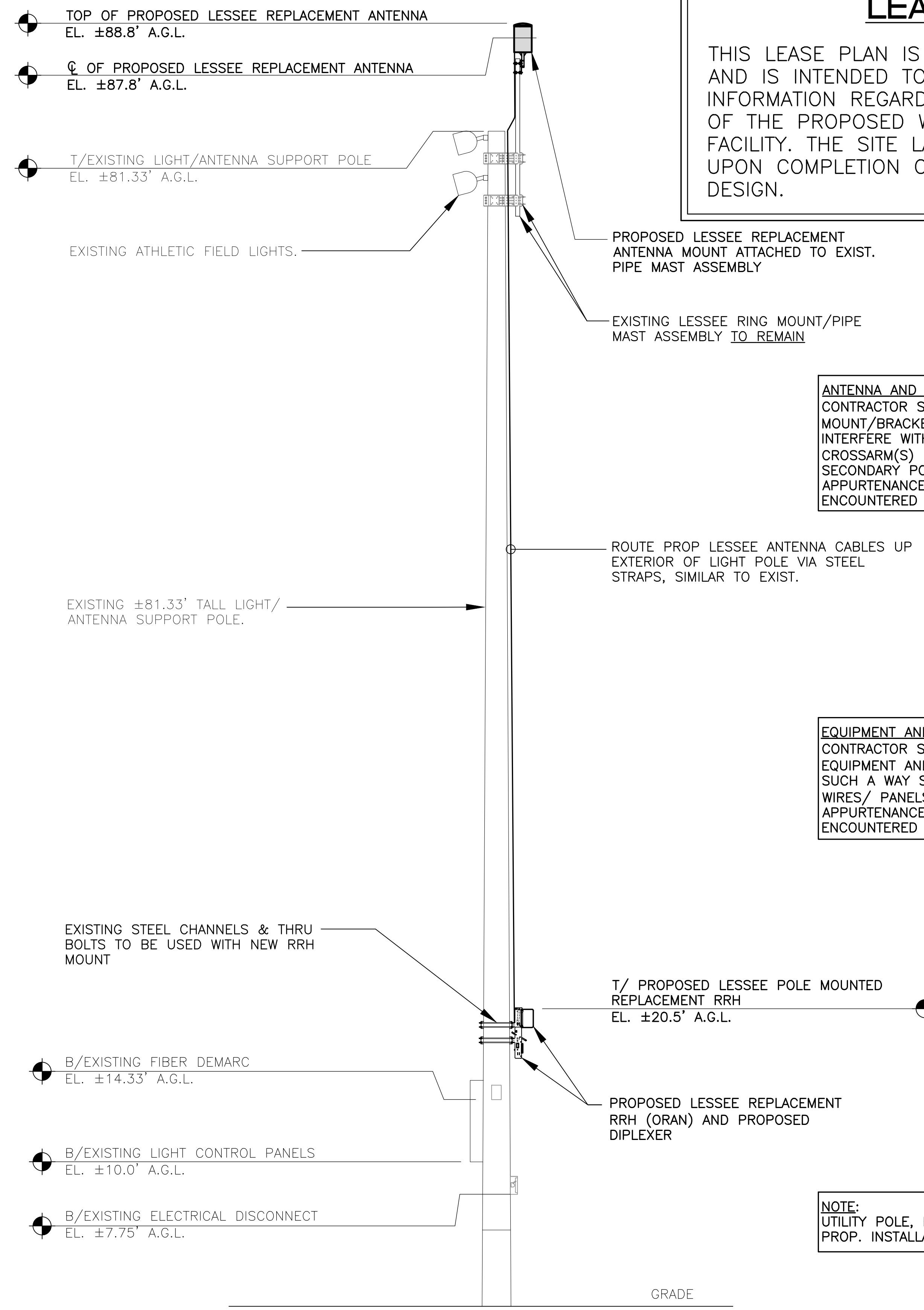


1 / L-3 EXISTING POLE ELEVATION

SCALE: 1" = 10'



2 / L-3 PROPOSED POLE ELEVATION

SCALE: 1" = 10'

ANTENNA AND MOUNT NOTE:
CONTRACTOR SHALL POSITION/ROTATE PROP. ANTENNA MOUNT/BRACKET IN SUCH A WAY SO AS TO NOT INTERFERE WITH EXIST. STREET LIGHT, PRIMARY POWER CROSSARM(S) (IF PRESENT), BRACKETS, BRACES, SECONDARY POWER SUPPORTS OR ANY OTHER MISC. APPURTENANCES AND RELATED SUPPORT BRACKETS ENCOUNTERED LOCATED ON THE EXIST. UTILITY POLE.

EQUIPMENT AND MOUNT NOTE:
CONTRACTOR SHALL POSITION/ROTATE PROP. EQUIPMENT AND ASSOCIATED MOUNT/BRACKET IN SUCH A WAY SO AS TO NOT INTERFERE WITH EXIST. WIRES/ PANELS ETC. OR ANY OTHER MISC. APPURTENANCES AND RELATED SUPPORT BRACKETS ENCOUNTERED LOCATED ON THE EXIST. UTILITY POLE.

NOTE:
UTILITY POLE, EXIST. APPURTENANCES AND DETAILS OF PROP. INSTALLATION SHOWN SCHEMATICALLY.

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SHEET NO. L-3

LEASE EXHIBIT

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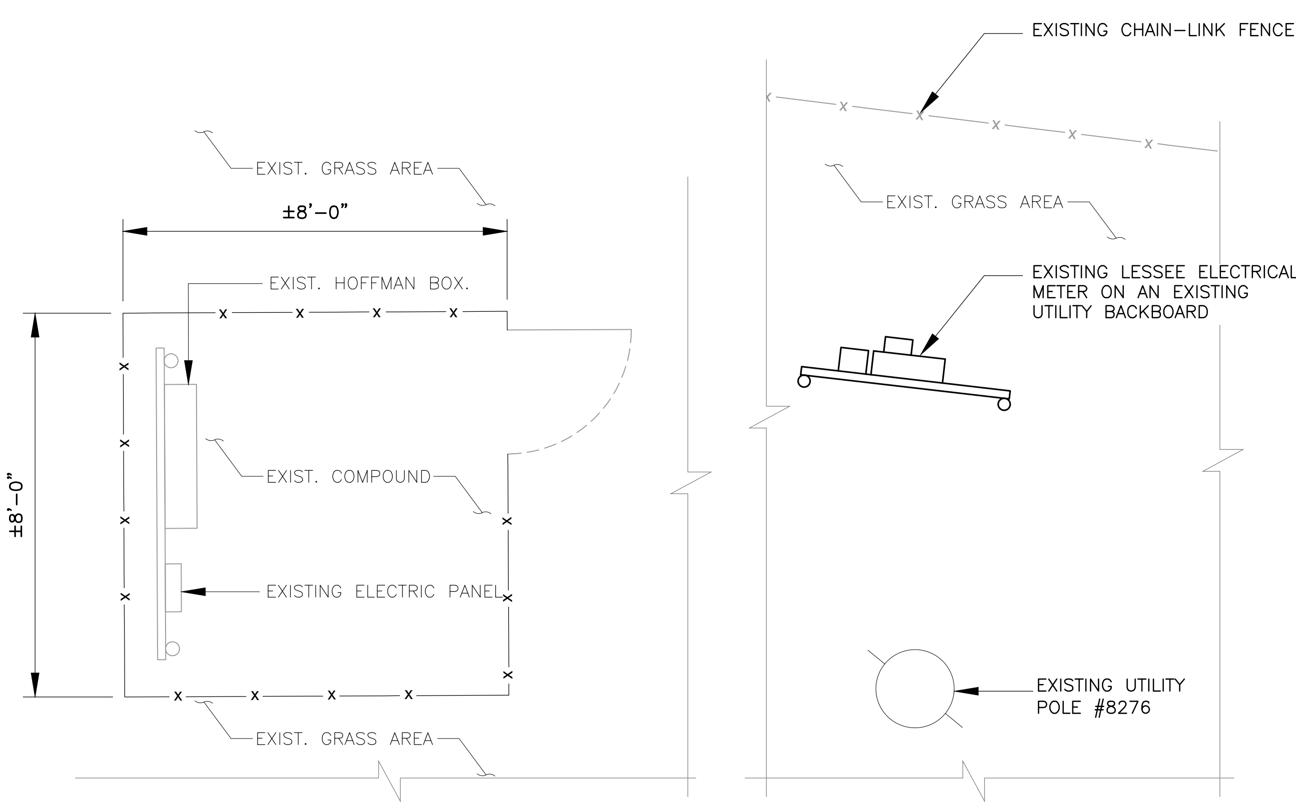
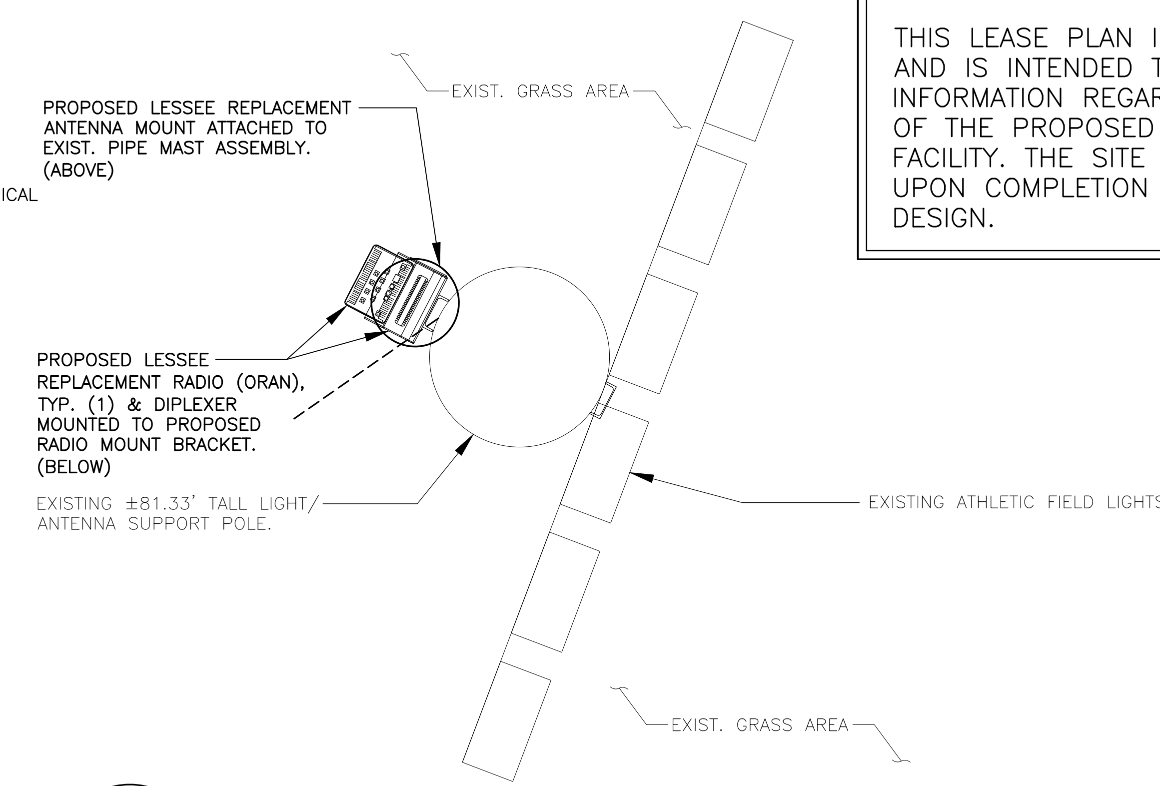


1 L–4 EXISTING GROUND EQUIP. AREAS

SCALE: 1/4" = 1'

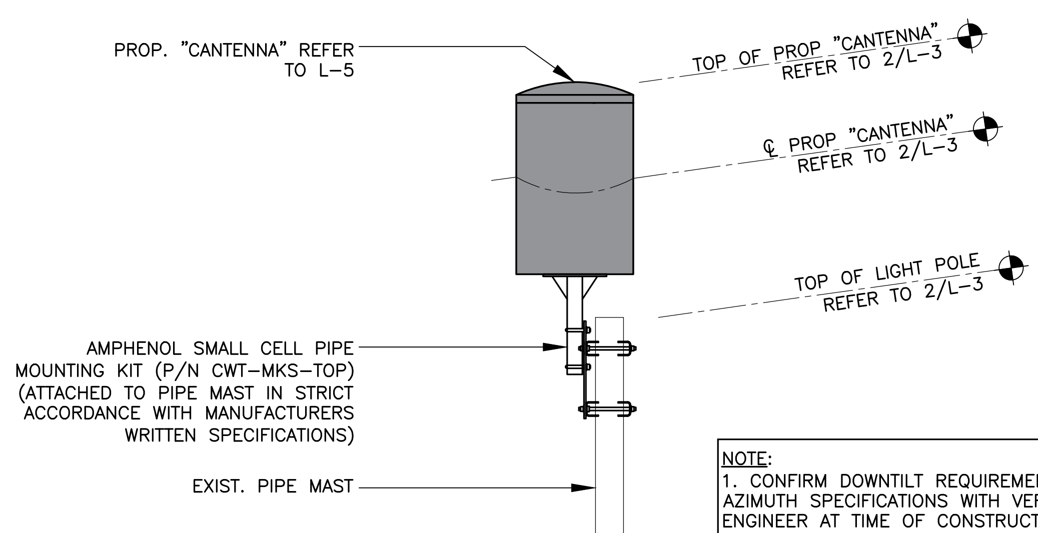
NORTH



2 L–4 PROPOSED EQUIPMENT PLAN

SCALE: 3/8" = 1'

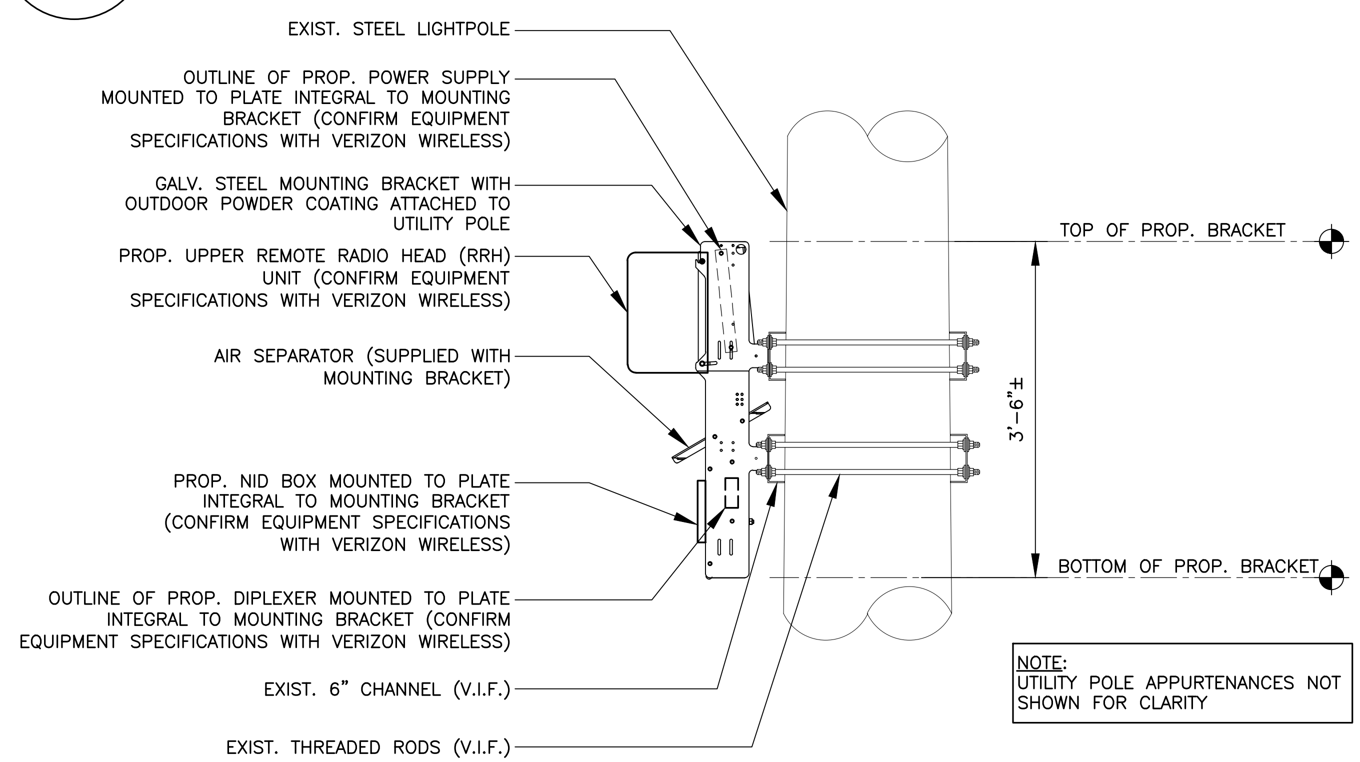
NORTH



NOTE:
1. CONFIRM DOWNTILT REQUIREMENTS (IF ANY) AND AZIMUTH SPECIFICATIONS WITH VERIZON WIRELESS RF ENGINEER AT TIME OF CONSTRUCTION.
2. MOUNT SHALL BE INSTALLED IN SUCH A WAY TO ENSURE PLUMB INSTALLATION OF "CANTANNA:.
3. LIGHT POLE APPURTENANCES NOT SHOWN FOR CLARITY

3 L–4 "CANTENNA" MOUNT DETAIL

SCALE: 1/2" = 1'



NOTE:
UTILITY POLE APPURTENANCES NOT SHOWN FOR CLARITY

4 L–4 EQUIPMENT MOUNTING BRACKET MOUNT DETAIL

SCALE: 1/2" = 1'

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SHEET NO. L–4

SMALL CELL "CANTENNA"	
DIMENSION:	14.6"±ø x 24.0"±H
WEIGHT:	28.0± LBS
QUANTITY:	TOTAL OF 1

1 L-5 TYPICAL "CANTENNA" SPEC.

SCALE: N.T.S.

DIPLEXER	
DIMENSION:	4.8"±H x 7.9"±W x 3.3"±D
WEIGHT:	7.6± LBS
QUANTITY:	TOTAL OF 1

2 L-5 TYPICAL DIPLEXER SPEC.

SCALE: N.T.S.

REMOTE RADIO HEAD UNIT (ORAN)	
DIMENSION:	14.96"±H x 14.96"±W x 10.04"±D
WEIGHT:	74.7± LBS
QUANTITY:	TOTAL OF 1

3 L-5 TYPICAL REMOTE RADIO HEAD SPEC.

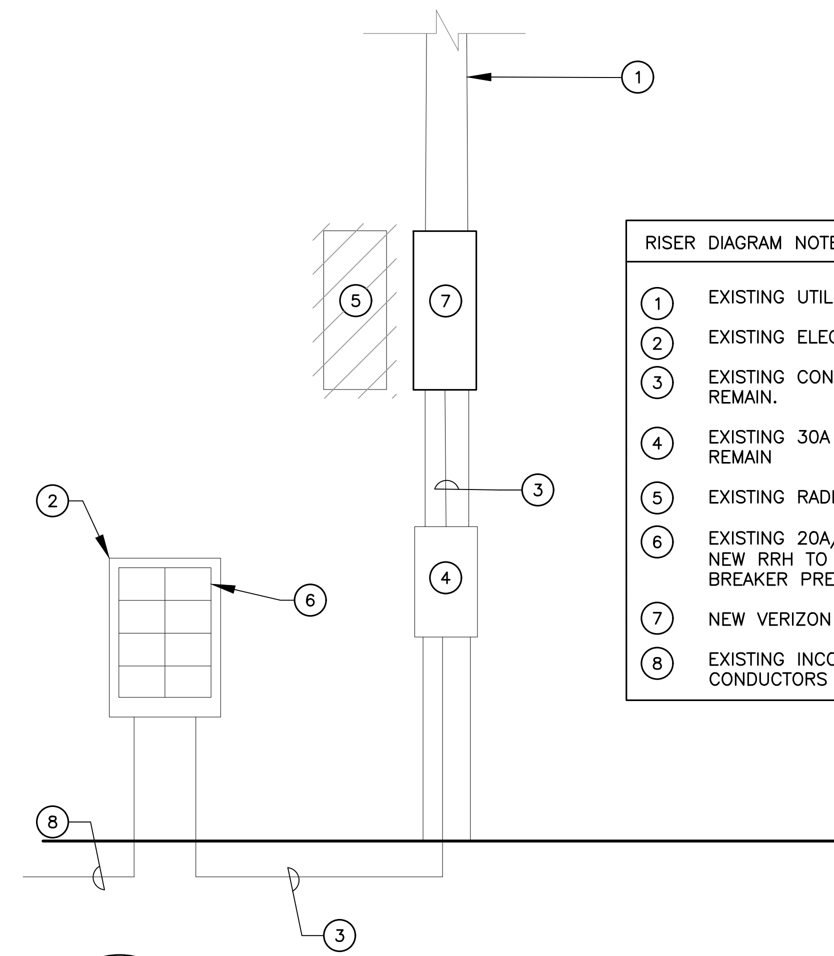
SCALE: N.T.S.

VOLTAGE:	120/240	PHASE: 1	WIRE: 3	PANEL NO.		
MAIN BUS:	100	AMPS		TOTAL WATTS, L1	0	
MAIN BREAKER:	60	A FRAME	100 A TRIP	TOTAL WATTS, L2	0	LOC: OUTSIDE
MOUNTING:	SURFACE			TOTAL WATTS	0	
NOTES:	PANEL IS EXISTING TO REMAIN					

DIRECTORY	WIRE & CONDUIT	WATTS LOAD L1	WATTS LOAD L2	CKT.	AMPS	L1 Y	L2 Y	AMPS	CKT.	WATTS LOAD L1	WATTS LOAD L2	WIRE & CONDUIT	DIRECTORY
SPARE				1				30/1P	2			ETR	SURGE SUPPRESSOR
SPARE				3				20/1P	4			ETR	TELCO GFI
SPARE				5				20/1P	6			ETR	NEW RRH
SPARE				7					8				
SPARE				9					10				
SPARE				11					12				
SPARE				13					14				
SPARE				15					16				
SPARE				17					18				
SPARE				19					20				
SPARE				21					22				
SPARE				23					24				
SUBTOTAL		0	0							0	0	SUBTOTAL	

4 L-5 ELECTRICAL PANEL SCHEDULE

SCALE: N.T.S.



RISER DIAGRAM NOTES

1. EXISTING UTILITY POLE TO REMAIN.
2. EXISTING ELECTRICAL PANEL TO REMIAN
3. EXISTING CONDUITS AND CONDUCTORS TO REMAIN.
4. EXISTING 30A NON FUSED DISCONNECT TO REMAIN
5. EXISTING RADIO EQUIPMENT TO BE REMOVED
6. EXISTING 20A/1P CIRCUIT BREAKER TO REMAIN. NEW RRH TO BE CONNECTED TO CIRCUIT BREAKER PREVIOUSLY SERVING EXISTING RRH.
7. NEW VERIZON WIRELESS RADIO EQUIPMENT.
8. EXISTING INCOMING SERVICE CONDUITS AND CONDUCTORS TO REMAIN.

5 L-5 ELECTRICAL ONE-LINE DIAGRAM

SCALE: N.T.S.

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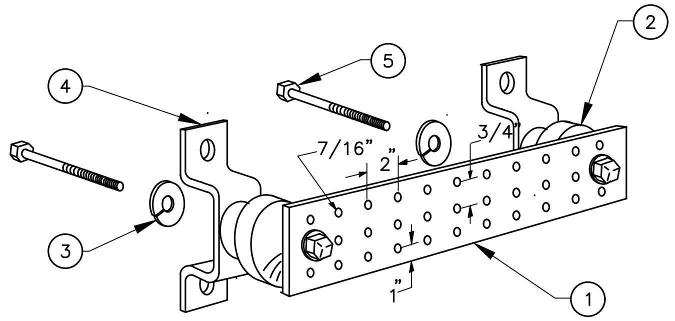
SHEET NO. L-5

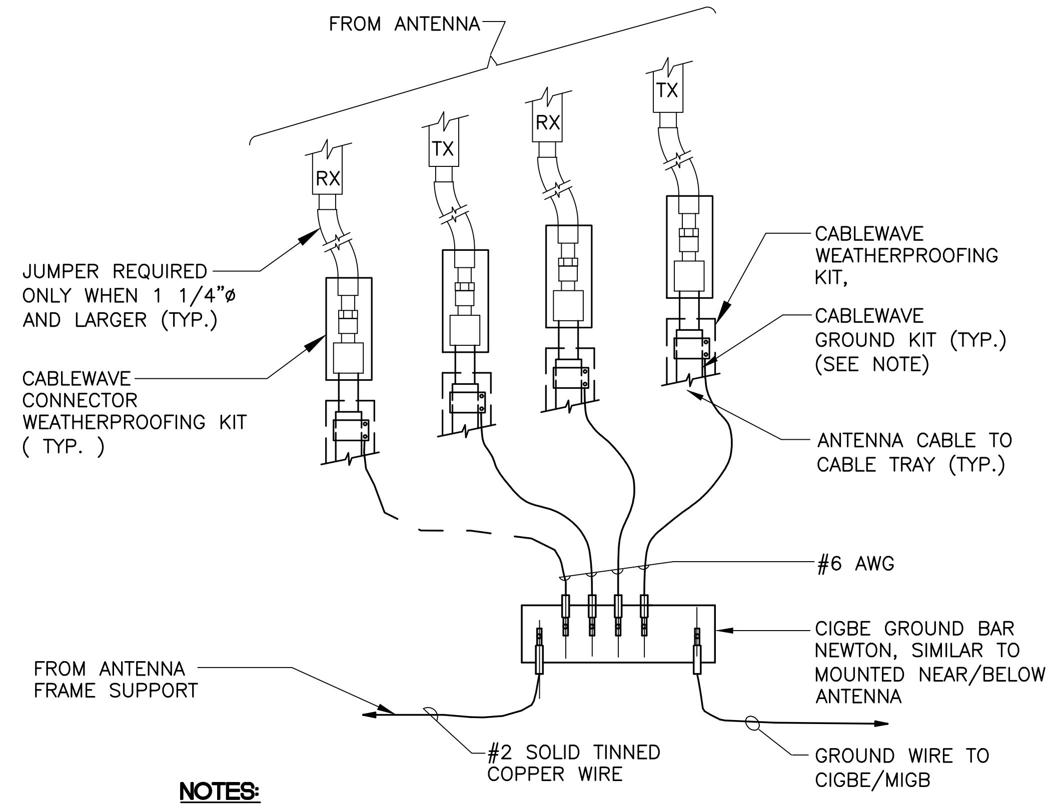


NOTES

1. TINNED COPPER GROUND BAR, 1/4" x 4" x 20", NEWTON INSTRUMENT CO. HOLE CENTERS TO MATCH NEMA DOUBLE LUG CONFIGURATION.
2. INSULATORS, NEWTON INSTRUMENT CAT. NO. 3061–4.
3. 5/8" LOCK WASHERS, NEWTON INSTRUMENT CO. CAT. NO. 3015–8.
4. WALL MOUNTING BRACKET, NEWTON INSTRUMENT CO. CAT NO. A–6056.
5. 5/8–11 x 1" STAINLESS STEEL TRUSS SPANNER MACHINE SCREWS.

1 / L–6 EQUIPMENT GROUND BAR DETAIL

SCALE: N.T.S.

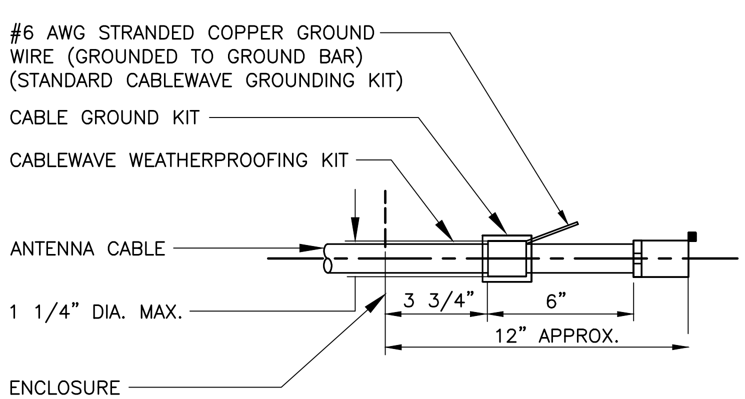


NOTES:

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO CIGBE

2 / L–6 CONNECTION OF GROUND WIRES TO GROUND BAR

SCALE: N.T.S.



NOTES:

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO GROUND BAR.

3 / L–6 ANTENNA CABLE GROUNDING DETAIL

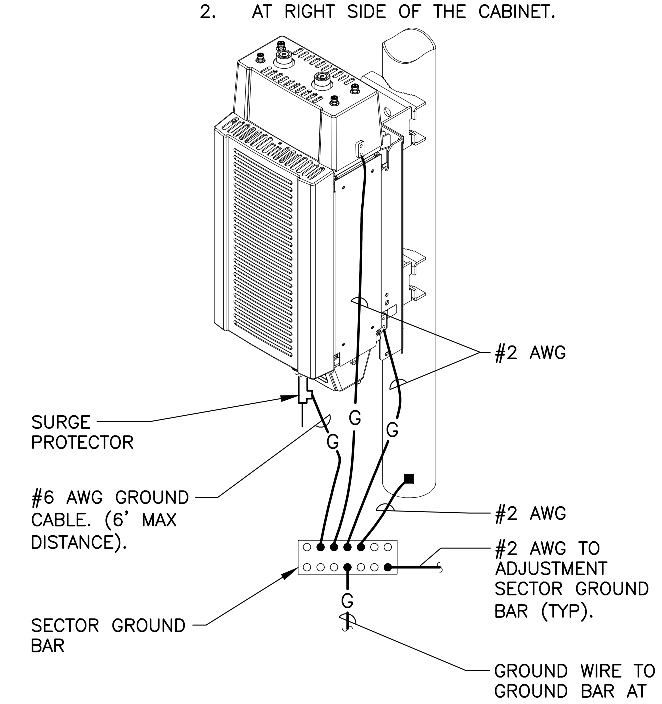
SCALE: N.T.S.

4 / L–6 TYPICAL NID BOX SPEC.

SCALE: N.T.S.

EACH RRH CABINET SHALL BE GROUNDED IN THE FOLLOWING MANNER:

1. AT TOP OF THE CABINET
2. AT RIGHT SIDE OF THE CABINET.



5 / L–6 GROUND BAR DETAIL

SCALE: N.T.S.

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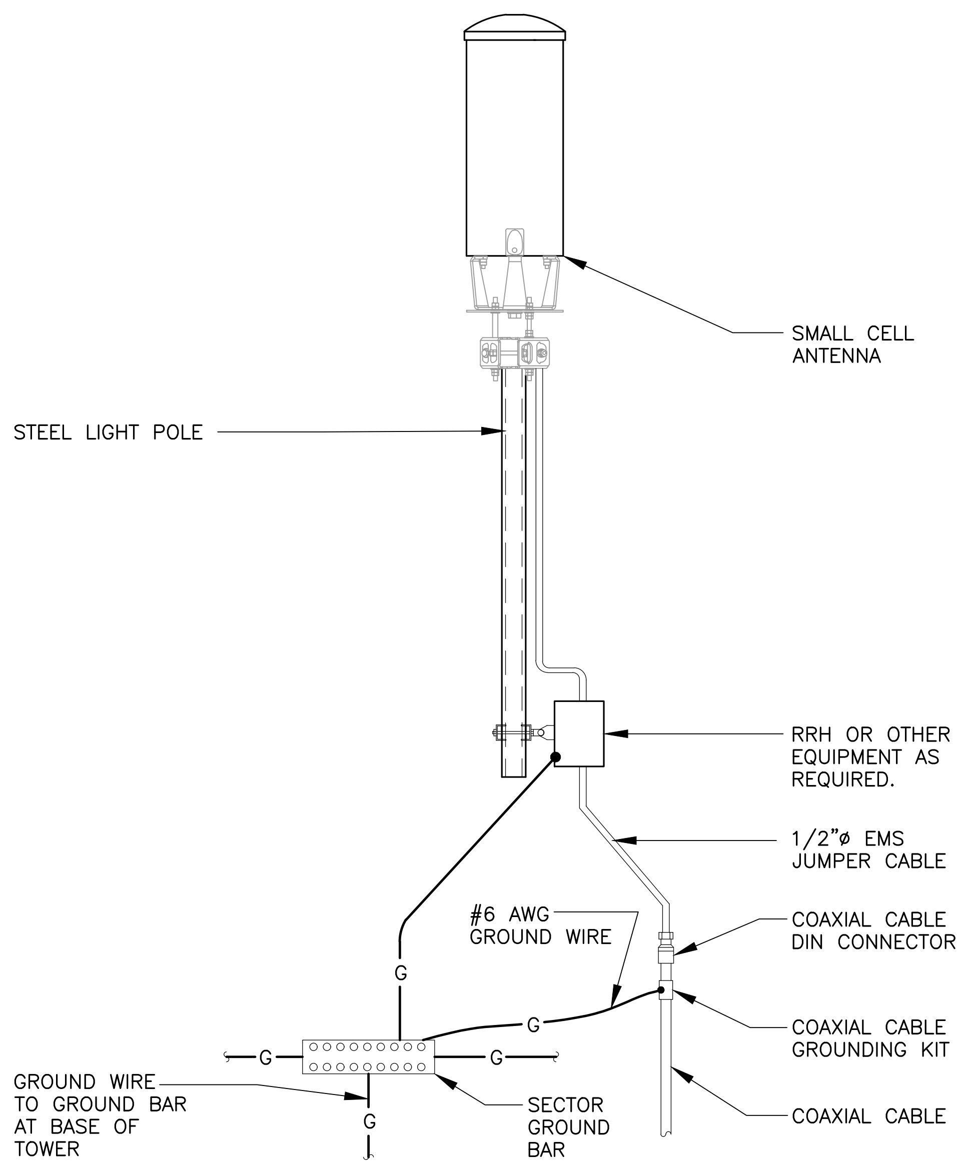

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TYPICAL ANTENNA GROUNDING DETAIL

SCALE: N.T.S.

ELECTRICAL SPECIFICATIONS

SECTION 16010

1.01. SCOPE OF WORK

A. WORK SHALL INCLUDE ALL LABOR, EQUIPMENT AND SERVICES REQUIRED TO COMPLETE (MAKE READY FOR OPERATION) ALL THE ELECTRICAL WORK INCLUDING, BUT NOT LIMITED TO, THE FOLLOWING:

1. CELLULAR GROUNDING SYSTEMS CONSISTING OF ANTENNA GROUNDING, GROUND BARS, ETC.

1.02. GENERAL REQUIREMENTS

A. THE ENTIRE ELECTRICAL INSTALLATION SHALL BE MADE IN STRICT ACCORDANCE WITH ALL LOCAL, STATE AND NATIONAL CODES AND REGULATIONS WHICH MAY APPLY AND NOTHING IN THE DRAWINGS OR SPECIFICATIONS SHALL BE INTERPRETED AS AN INFRINGEMENT OF SUCH CODES OR REGULATIONS.

B. THE ELECTRICAL CONTRACTOR IS TO BE RESPONSIBLE FOR THE COMPLETE INSTALLATION AND COORDINATION OF THE ENTIRE ELECTRICAL SERVICE. ALL ACTIVITIES TO BE COORDINATED THROUGH OWNERS REPRESENTATIVE, DESIGN ENGINEER AND OTHER AUTHORITIES HAVING JURISDICTION OF TRADES.

C. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS AND PAY ALL FEES THAT MAY BE REQUIRED FOR THE ELECTRICAL WORK AND FOR SCHEDULING OF ALL INSPECTIONS THAT MAY BE REQUIRED BY THE LOCAL AUTHORITY.

D. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION WITH THE BUILDING OWNER FOR NEW AND/OR DEMOLITION WORK INVOLVED.

E. NO MATERIAL OTHER THAN THAT CONTAINED IN THE "LATEST LIST OF ELECTRICAL FITTINGS" APPROVED BY THE UNDERWRITERS' LABORATORIES, SHALL BE USED IN ANY PART OF THE WORK. ALL MATERIAL FOR WHICH LABEL SERVICE HAS BEEN ESTABLISHED SHALL BEAR THE U.L. LABEL.

F. THE CONTRACTOR SHALL GUARANTEE ALL NEW WORK FOR A PERIOD OF ONE YEAR FROM THE ACCEPTANCE DATE BY THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING WARRANTIES FROM ALL EQUIPMENT MANUFACTURERS FOR SUBMISSION TO THE OWNER.

G. DRAWINGS INDICATE GENERAL ARRANGEMENT OF WORK INCLUDED IN CONTRACT. CONTRACTOR SHALL, WITHOUT EXTRA CHARGE, MAKE MODIFICATIONS TO THE LAYOUT OF THE WORK TO PREVENT CONFLICT WITH WORK OF OTHER TRADES AND FOR THE PROPER INSTALLATION OF WORK. CHECK ALL DRAWINGS AND VISIT JOB SITE TO VERIFY SPACE AND TYPE OF EXISTING CONDITIONS IN WHICH WORK WILL BE DONE, PRIOR TO SUBMITTAL OF BID.

H. THE ELECTRICAL CONTRACTOR SHALL SUPPLY THREE (3) COMPLETE SETS OF APPROVED DRAWINGS, ENGINEERING DATA SHEETS, MAINTENANCE AND OPERATING INSTRUCTION MANUALS FOR ALL SYSTEMS AND THEIR RESPECTIVE EQUIPMENT. THESE MANUALS SHALL BE INSERTED IN VINYL COVERED 3-RING BINDERS AND TURNED OVER TO OWNER'S REPRESENTATIVE ONE (1) WEEK PRIOR TO FINAL PUNCH LIST.

I. ALL WORK SHALL BE INSTALLED IN A NEAT AND WORKMAN LIKE MANNER AND WILL BE SUBJECT TO THE APPROVAL OF THE OWNER'S REPRESENTATIVE.

J. ALL EQUIPMENT AND MATERIALS TO BE INSTALLED SHALL BE NEW, UNLESS OTHERWISE NOTED.

K. BEFORE FINAL PAYMENT, THE CONTRACTOR SHALL PROVIDE A COMPLETE SET OF PRINTS (AS-BUILTS), LEGIBLY MARKED IN RED PENCIL TO SHOW ALL CHANGES FROM THE ORIGINAL PLANS.

L. ENTIRE ELECTRICAL INSTALLATION SHALL BE IN ACCORDANCE WITH OWNER'S SPECIFICATIONS, AND REQUIREMENTS OF ALL LOCAL AUTHORITIES HAVING JURISDICTION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH APPROPRIATE INDIVIDUALS TO OBTAIN ALL SUCH SPECIFICATIONS AND REQUIREMENTS. NOTHING CONTAINED IN, OR OMITTED FROM, THESE DOCUMENTS SHALL RELIEVE CONTRACTOR FROM THIS OBLIGATION.

SECTION 16450

1.01. GROUNDING

A. ALL NON-CURRENT CARRYING PARTS OF THE ELECTRICAL AND TELEPHONE CONDUIT SYSTEMS SHALL BE MECHANICALLY AND ELECTRICALLY CONNECTED TO PROVIDE AN INDEPENDENT RETURN PATH TO THE EQUIPMENT GROUNDING SOURCES.

B. GROUNDING SYSTEM WILL BE IN ACCORDANCE WITH THE LATEST ACCEPTABLE EDITION OF THE NATIONAL ELECTRICAL CODE AND REQUIREMENTS PER LOCAL INSPECTOR HAVING JURISDICTION.

C. EQUIPMENT GROUNDING CONDUCTOR:

1. EACH EQUIPMENT GROUND CONDUCTOR SHALL BE SIZED IN ACCORDANCE WITH THE N.E.C. ARTICLE 250-122.

2. THE MINIMUM SIZE OF EQUIPMENT GROUND CONDUCTOR SHALL BE #12 AWG COPPER.

D. CELLULAR GROUNDING SYSTEM:

PROVIDE THE CELLULAR GROUNDING SYSTEM AS SPECIFIED ON DRAWINGS, INCLUDING, BUT NOT LIMITED TO:

1. GROUND BARS
2. ANTENNA GROUND CONNECTIONS AND PLATES.

E. ALL EQUIPMENT SHALL BE BONDED TO GROUND AS REQUIRED BY N.E.C., MFG. SPECIFICATIONS, AND OWNER'S SPECIFICATIONS.

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