Robinson+Cole

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Also admitted in Massachusetts

November 7, 2016

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

Re: **Notice of Exempt Modification – Facility Modification**
51 Daniels Avenue, Waterford, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains twelve (12) antennas at the 140-foot level of the existing 180-foot tower at 51 Daniels Avenue in Waterford, Connecticut (the "Property"). The tower is owned by SBA Communications Corporation ("SBA"). The Council approved Cellco's use of this tower in 2009. Cellco now intends to modify its facility by replacing six (6) of its antennas with three (3) model SBNHH-1D65B, 700/1900 MHz antennas and three (3) model SBNHH-1D65B, 2100 MHz antennas, all at the same level on the tower. Cellco also intends to install six (6) remote radio heads ("RRHs") and one (1) HYBRIFLEX™ antenna cable. Included in Attachment 1 are specifications for Cellco's replacement antennas, RRHs and HYBRIFLEX™ cable.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this notice is being sent to Daniel M. Steward, First Selectman for the Town of Waterford. The Town of Waterford is the owner of the property on which the tower is located. A copy of this letter is also being sent to SBA, the tower owner.

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

1. The proposed modifications will not result in an increase in the height of the existing structure. Cellco's new antennas and RRHs will be installed on its existing platform at a height of 140 feet on the 180-foot tower.

2. The proposed modifications will not involve any change to ground-mounted equipment and, therefore, will not require the extension of the site boundary.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.

4. The operation of the replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. A cumulative General Power Density table for Cellco's modified facility is included in Attachment 2.

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.

6. The tower and its foundation can support Cellco's proposed modifications. (*See* Tower Structural Analysis Report included in Attachment 3).

A copy of the Town Assessor's Parcel Map and property owner information is included in Attachment 4.

For the foregoing reasons, Cellco respectfully submits that the proposed modifications to the above-referenced telecommunications facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Daniel M. Steward, First Selectman
SBA
Tim Parks

ATTACHMENT 1

Product Specifications

COMMSCOPE®

SBNHH-1D65B

Multiband Antenna, 698–896 and 2x 1695–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.

- Interleaved dipole technology providing for attractive, low wind load mechanical package

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2200	2300–2360
Gain, dBi	14.9	14.7	17.7	18.2	18.6	18.6
Beamwidth, Horizontal, degrees	68	66	69	66	63	58
Beamwidth, Vertical, degrees	12.1	10.7	5.6	5.2	5.0	4.5
Beam Tilt, degrees	0–14	0–14	0–7	0–7	0–7	0–7
USLS (First Lobe), dB	14	13	15	15	15	13
Front-to-Back Ratio at 180°, dB	27	29	28	28	28	27
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2200	2300–2360
Gain by all Beam Tilts, average, dBi	14.5	14.3	17.4	17.9	18.2	18.3
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.8	±0.4	±0.3	±0.5	±0.3
Gain by Beam Tilt, average, dBi	0 ° | 14.6	0 ° | 14.5	0 ° | 17.4	0 ° | 17.8	0 ° | 18.1	0 ° | 18.2
	7 ° | 14.6	7 ° | 14.4	3 ° | 17.5	3 ° | 17.9	3 ° | 18.3	3 ° | 18.4
	14 ° | 14.2	14 ° | 13.6	7 ° | 17.4	7 ° | 17.9	7 ° | 18.2	7 ° | 18.4
Beamwidth, Horizontal Tolerance, degrees	±2.2	±3.4	±2	±4.6	±5.7	±4.3
Beamwidth, Vertical Tolerance, degrees	±0.8	±1	±0.3	±0.2	±0.3	±0.2
USLS, beampeak to 20° above beampeak, dB	16	14	16	16	16	15
Front-to-Back Total Power at 180° ± 30°, dB	25	26	27	26	26	26
CPR at Boresight, dB	22	23	21	20	20	22
CPR at Sector, dB	13	11	16	12	11	4

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Type	Sector with internal RET
Band	Multiband
Brand	DualPol®
Operating Frequency Band	1695 - 2360 MHz | 698 - 896 MHz
Performance Note	Outdoor usage

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground

Product Specifications

SBNHH-1D65B

Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, frontal	618.0 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Loading, lateral	197.0 N @ 150 km/h 44.3 lbf @ 150 km/h
Wind Loading, rear	728.0 N @ 150 km/h 163.7 lbf @ 150 km/h
Wind Speed, maximum	241 km/h | 150 mph

Dimensions

Depth	180.0 mm | 7.1 in
Length	1851.0 mm | 72.9 in
Width	301.0 mm | 11.9 in
Net Weight, without mounting kit	18.4 kg | 40.6 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Internal RET	High band (1) | Low band (1)
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male

Packed Dimensions

Depth	296.0 mm | 11.7 in
Length	2025.0 mm | 79.7 in
Width	390.0 mm | 15.4 in
Shipping Weight	31.0 kg | 68.3 lb

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Product Specifications

SBNHH-1D65B

Included Products

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

ALCATEL-LUCENT B13 RRH4X30-4R

Alcatel-Lucent B13 Remote Radio Head 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

Supporting 2Tx/4Tx MIMO and 4-way Rx diversity, Alcatel-Lucent B13 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the 700U band (700 MHz, 3GPP band 13), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B13 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity and up to 10MHz instantaneous bandwidth.

The Alcatel-Lucent B13 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

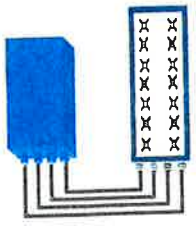
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

FEATURES

- Supporting LTE in 700 MHz band (700U, 3GPP band 13)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 10MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in 700U band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



4x30W with 4T4R
or
2x60W with 2T4R

Can be switched between modes via SW w/o site visit

Alcatel·Lucent

Features & performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R by SW)
Frequency band	U700 (C) (3GPP bands 13): DL: 746 - 756 MHz / UL: 777 - 787 MHz
Instantaneous bandwidth - #carriers	10MHz – 1 LTE carrier (in 10MHz occupied bandwidth)
LTE carrier bandwidth	10 MHz
RF output power	2x60W or 4x30W (by SW)
Noise figure – RX Diversity scheme	2 dB typ. (<2.5 dB max) – 2 or 4 way Rx diversity
Sizes (HxWxD) in mm (in.) Volume in L Weight in kg (lb) (w/o mounting HW)	550 x 305 x 230 (21.6" x 12.0" x 9") (with solar shield) 38 (with solar shield) 26 (57.2) (with solar shield)
DC voltage range DC power consumption	-40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption 550W typical @100% RF load (in 2Tx or 4TX mode)
Environmental conditions Wind load (@150km/h or 93mph)	-40°C (-40°F) /+55°C (+131°F) IP65 Frontal:<200N / Lateral :<150N
Antenna ports	4 ports 7/16 DIN female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate7, 9.8 Gbps) SFP single mode dual fiber
AISG interfaces	1 AISG2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27

ALCATEL-LUCENT B66A RRH4X45

The Alcatel-Lucent B66a Remote Radio Head 4x45 is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering. Its operational range covers beyond that of B4 (AWS) and B10 (AWS+).

Supporting 2Tx/4Tx MIMO and 2-way/4-way Rx diversity, the Alcatel-Lucent B66a RRH4x45 allows operators to have a compact radio solution to deploy LTE in the 2100 band (3GPP band 4, 10, and 66), providing them with the means to achieve high capacity, high quality, high reliability, large instantaneous bandwidth, and high coverage with minimum site requirements.

The Alcatel-Lucent B66a RRH4x45 product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x90W or 4x45W RF output power. It also supports 4-way Rx diversity at the 70 MHz instantaneous bandwidth.

The Alcatel-Lucent B66a RRH4x45 is a compact (near zero-footprint) solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

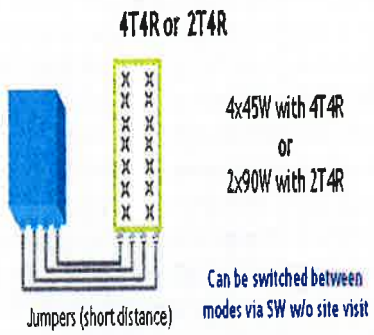
Its compactness and slim design makes the Alcatel-Lucent B66a RRH4x45 easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

FEATURES

- Supporting LTE in 2110 - 2180 MHz band/DL, 1710-1780MHz/UL (3GPP band 4, 10, and 66a)
- LTE 2Tx or 4Tx MIMO (SW selectable)
- Configuration: 2T2R/2T4R/4T4R
- Output power: Up to 2x90W or 4x45W (SW configurable)
- 70MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in AWS 1-3 band
- Selection of MIMO configuration (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through 4Tx MIMO
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



TECHNICAL SPECIFICATIONS

Features & Performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R selectable by SW)
Frequency band	AWS 1-3, B4/B66a DL: 2110-2180 MHz / UL: 1710-1780 MHz
Instantaneous bandwidth - #carriers	70 MHz – 4 LTE MIMO carriers (in 70 MHz occupied bandwidth)
LTE carrier bandwidth	5, 10, 15, 20 MHz
RF output power	2x90W or 4x45W (selectable by SW)
Noise figure – RX Diversity scheme Receiver Sensivity (FRC A1-3)	2 dB typical (<2.5 dB max) – 2 or 4 way Rx diversity -104.5 dBm maximum
Sizes (HxWxD) in mm (in.) Volume in Liters Weight in kg (lb) (w/o mounting HW)	655x299x182 (25.8x11.8x7.2) (with solar shield) 640x290x160 (25.2x11.4x6.3) (without solar shield) 35.5 (with solar shield) 29.7 (without solar shield) 25.8kg (56.8lb) (with solar shield)
DC voltage range DC power consumption	Nominal: -48V, -40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption 750W typical @100% RF load (in 2Tx or 4Tx mode); Add 58W for 2A*29V for AISG
Environmental conditions Wind load (@150km/h or 93mph)	-40°C (-40°F) /+55°C (+131°F) UL50E Type 4 Enclosure 250N (56lb) Frontal/150N (34lb) Lateral
Antenna ports	4 ports 4.3-10 female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate 7, 9.8 Gbps) SFP: SMDF (HW supports also SMSF and MMDF)
AISG interfaces	1 AISG 2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-487 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27 / FCC Part 15 / GR-3178-CORE

Alcatel·Lucent

Product Data Sheet HB158-1-08U8-S8J18

HYBRIFLEX™ RRH Hybrid Feeder Cabling Solution, 1-5/8", Single-Mode Fiber

Product Description

RFS' HYBRIFLEX Remote Radio Head (RRH) hybrid feeder cabling solution combines optical fiber and DC power for RRHs in a single lightweight aluminum corrugated cable, making it the world's most innovative solution for RRH deployments.

It was developed to reduce installation complexity and costs at Cellular sites. HYBRIFLEX allows mobile operators deploying an RRH architecture to standardize the RRH installation process and eliminate the need for and cost of cable grounding. HYBRIFLEX combines optical fiber (multi-mode or single-mode) and power in a single corrugated cable. It eliminates the need for junction boxes and can connect multiple RRHs with a single feeder. Standard RFS CELLFLEX® accessories can be used with HYBRIFLEX cable. Both pre-connectorized and on-site options are available.

Figure 1: HYBRIFLEX Series

Features/Benefits

- Aluminum corrugated armor with outstanding bending characteristics – minimizes installation time and enables mechanical protection and shielding
- Same accessories as 1 5/8" coaxial cable
- Outer conductor grounding – Eliminates typical grounding requirements and saves on installation costs
- Lightweight solution and compact design – Decreases tower loading
- Robust cabling – Eliminates need for expensive cable trays and ducts
- Installation of tight bundled fiber optic cable pairs directly to the RRH – Reduces CAPEX and wind load by eliminating need for interconnection
- Optical fiber and power cables housed in single corrugated cable – Saves CAPEX by standardizing RRH cable installation and reducing installation requirements
- Outdoor polyethylene jacket – Ensures long-lasting cable protection

Technical Specifications

Outer Conductor Armor	Corrugated Aluminum	[mm (in)]	46.5 (1.83)
Jacket	Polyethylene, PE	[mm (in)]	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Weight, Approximate		[kg/m (lb/ft)]	1.9 (1.30)
Minimum Bending Radius, Single Bending		[mm (in)]	200 (8)
Minimum Bending Radius, Repeated Bending		[mm (in)]	500 (20)
Recommended/Maximum Clamp Spacing		[m (ft)]	1.0 / 1.2 (3.25 / 4.0)
DC-Resistance Outer Conductor Armor		[Ω/km (Ω/1000ft)]	068 (0.205)
DC-Resistance Power Cable, 8.4mm² (8AWG)		[Ω/km (Ω/1000ft)]	2.1 (0.307)
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		[µm]	50/125
Primary Coating (Acrylate)		[µm]	245
Buffer Diameter, Nominal		[µm]	900
Secondary Protection, Jacket, Nominal		[mm (in)]	2.0 (0.08)
Minimum Bending Radius		[mm (in)]	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
Size (Power)		[mm² (AWG)]	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		[mm² (AWG)]	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		[mm (in)]	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-93-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Installation Temperature		[°C (°F)]	-40 to +65 (-40 to149)
Operation Temperature		[°C (°F)]	-40 to +65 (-40 to149)

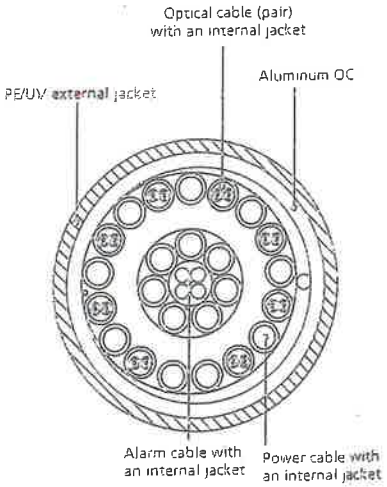


Figure 2: Construction Detail

* This data is provisional and subject to change

ATTACHMENT 2

	General	Power	Density					
Site Name: Durham								
Tower Height: 120'								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
*AT&T	**2**	1791	170	700	0.0479	0.4667	1.03%	
*AT&T	**2**	1104	170	1900	0.0295	1.0000	0.30%	
*AT&T	**2**	2203	170	2300	0.0589	1.0000	0.59%	
*AT&T	**2**	492	170	880	0.0132	0.5867	0.22%	
*AT&T	**2**	491	170	1900	0.0131	1.0000	0.13%	
*AT&T	**2**	.817	170	880	0.0218	0.5867	0.37%	
*T-Mobile	2	1649	160	2100	0.0500	1.0000	0.50%	
*T-Mobile	1	686	160	700	0.0104	0.4667	0.22%	
*T-Mobile	2	836	160	1900	0.0253	1.0000	0.25%	
*T-Mobile	2	836	160	2100	0.0253	1.0000	0.25%	
Verizon	**11**	**408**	**140**	**0.0823**	**1970**	**1.0000**	**8.23%**	
Verizon	**9**	**416**	**140**	**0.0687**	**869**	**0.5793**	**11.86%**	
Verizon	**1**	**4991**	**140**	**0.0916**	**2145**	**1.0000**	**9.16%**	
Verizon	**1**	**1663**	**140**	**0.0305**	**746**	**0.4973**	**6.13%**	
								39.2%
* Source: Siting Council								

ATTACHMENT 3

ALLPRO
CONSULTING GROUP, INC.
9221 Lyndon B. Johnson Freeway, #204, Dallas, TX 75243 ★ PHONE 972-231-8893 ★ FAX 1-866-364-8375
www.allprocgi.com ★ e-mail: info@allprocgi.com

Tower Structural Analysis Report for SBA Communications Corporation

SBA

Existing 180' Self Supported Tower

SBA Site Name: Niantic
SBA Site ID: CT09865-S-02

Carrier Name: Verizon
Carrier Site Name: Waterford South

Site Location:
Southwest School 51 Daniels Road
Waterford, CT

Latitude: 41.330264°
Longitude: -72.166672°

ACGI Job # 16-3864
Ref Previous: ACGI Job # 16-1025 dated 04/06/2016

ANALYSIS RESULTS		
Tower Components	60.8 %	**Sufficient**
Tower Base Foundation	40.3 %	**Sufficient**
Net change of stress ratio	+4.5 %	**Change from previous SA, ACGI#16-1025 dated 04/06/2016**

Prepared By:
Binod Paudel, EIT
Staff Engineer

STATE OF CONNECTICUT
JOJI M. GEORGE
No. 24444
LICENSED
PROFESSIONAL ENGINEER

10/28/2016
Approved By:
Joji M. George, P.E.
CT PE # 24444

TABLE OF CONTENTS

1. ANALYSIS SUMMARY

The purpose of this structural analysis is to determine whether the existing structure is capable of supporting additional proposed loads.

The existing 180' Self Supported Tower located in Waterford, CT was analyzed by Allpro Consulting Group, Inc (ACGI) for the existing loads and the proposed **Verizon** antennas and coaxes as authorized by SBA Communication Corp. Based on the results of the analysis, the existing tower with mentioned proposed and existing loading is found to be in compliance with *TIA -222-G, Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and IBC 2012.*

2. SCOPE & SOURCE OF INFORMATION

The purpose of this structural analysis is to determine whether the existing structure is capable of supporting additional proposed loads.

SOURCE OF INFORMATION		
Tower Data:	Tower Innovations	-Original Tower Drawings by Tower Innovations (Project Number : 5210 dated 11/05/2008)
	Allpro Consulting Group, Inc.	-Previous Structural Analysis by Allpro Consulting Group Inc., (ACGI Job # 15-4964, dated 09/09/2015)
	FDH Engineering, Inc.	-Previous Structural Analysis by FDH Engineering, Inc.(FDH Project Number 1325881400, dated 4/26/2013)
	Allpro Consulting Group, Inc.	-Previous Structural Analysis by Allpro Consulting Group Inc., (ACGI Job # 16-0431, dated 02/12/2016 -Previous Structural Analysis by Allpro Consulting Group Inc., (ACGI Job # 16-0568, dated 02/22/2016 Previous Structural Analysis by Allpro Consulting Group Inc., (ACGI Job # 16-1025, dated 04/06/2016
Foundation Data:	Tower Innovations	- Existing MAT foundation data is as per original foundation design by Tower Innovations, Project Number 5210 dated 11/5/2008

Geotechnical Report:	Dr.Clearance Welti, P.E., P.C.Geotechnical Engineering	Soil data is as per Geotechnical Report by Dr.Clearance Welti, P.E., P.C.Geotechnical Engineering (Ref: Geotechnical Study for proposed Cell Tower at Southwest School 51 Daniels Road, Waterford, CT -SBA Network Services, Inc. dated 10/23/2008)
Loading Data:	Allpro Consulting Group, Inc. SBA Communication Corp.	- Previous Structural Analysis by Allpro Consulting Group Inc., (ACGI Job # 16-1025, dated 04/06/2016 -Verizon Col. App # 24346, v3
Authorization:	SBA Communication Corp.	

3. ANALYSIS METHODS & DATA

The analysis was performed in accordance with Telecommunication Industry Association specification TIA-222-G. The tower was modeled using TNX Tower, a 3-D finite element program. TNX Tower is a general-purpose modeling, analysis, and design program created specifically for communication towers using the EIA-222-C, EIA-222-D, TIA/EIA-222-F or TIA/EIA-222-G standards. The 3-D model included the tower, with existing appurtenances and all proposed loads.

SITE DATA	
SBA Site Name:	Niantic
SBA Site Number:	CT09865-S-02
Carrier Site ID:	Waterford South
City, State:	Waterford, CT
County:	New London County
Code Wind Load Requirement:	TIA-222-G & IBC 2012 (Ultimate wind speed of 134 mph 3 sec gust equivalent to Nominal design wind speed of 104 mph basic wind speed)
Wind Load Used:	TIA-222-G Code: • Nominal design wind speed of 104 mph (3 second gust wind speed) • Structure class: II • Topographic Category: 1 • Exposure Category: C • A wind speed of 50 mph is used in combination with ice thickness 0.75 in.

TOWER DATA	
Tower Type:	Self Supported Tower
Height:	180'
Cross Section:	Triangular
Steel Strength:	Legs – 50 ksi , Braces – 36 ksi
Type of Foundation:	Mat Foundation with (3) Pedestals

TOWER HISTORY	
Tower Manufacturer / Model:	Tower Innovations
Date of Original Design:	11/05/2008
Previous Modifications:	Unknown
Original Design Code Requirements:	TIA-222-G/ 120 mph wind speed & 3/4 " ice 50 mph wind speed

4. CONCLUSIONS

RESULT SUMMARY		
MEMBER	***% Capacity***	***Results***
Legs	**60.8 %**	**Pass**
Diagonals	**54.6 %**	**Pass**
Top Girt	**4.0 %**	**Pass**
Bottom Girt	**19.9 %**	**Pass**
Bolt Checks	**54.6 %**	**Pass**
Mat Foundation (see attached MathCAD for details)	**Safety Factor against Overturning: (40.34 %)**	**Pass**
	Soil Bearing Capacity (21.04 %)	**Pass**
	Shear Capacity (37.50 %)	**Pass**
OVERALL TOWER RATING = 60.8 % (Pass)		

As per the results of the analysis, the existing tower **is in code compliance** for the proposed and existing antenna loads.

Maximum tower member stress **is less than allowable,** making **it in code compliance** under the TIA-222-G code and IBC2012 requirements.

5. DISCLAIMER

Installation procedures and related loading are not within the scope of this analysis. A contractor experienced in similar work should perform all installation work. The engineering services provided by Allpro Consulting Group, Inc. (ACGI) are limited to the computer analysis and calculations of the structure with the proposed and existing loads. This analysis is considered void if the loading mentioned in this report is changed or is different as installed. It is assumed that the existing structure is properly maintained and is in good condition free of any defects. Scope of this analysis does not include existing connections, except as noted in this report.

ACGI does not make any warranties, expressed or implied in connection with this engineering analysis report and disclaims any liability arising from deficiencies or any existing conditions of the original structure. ACGI will not be responsible for consequential or incidental damages sustained by any parties as a result of any data or conclusions included in this Report. The maximum liability of ACGI pursuant to this report shall be limited to the consulting fee received for the preparation of the report.

6. ASSUMPTIONS

This analysis was completed based on the following assumptions:

- Tower has been properly maintained.
- Tower erection was in accordance to manufacturer drawings.
- Leg flanges have been properly designed by manufacturer to not be a limiting reaction.
- Welds have been properly designed and installed by manufacturer to not be a limiting reaction.
- Foundation was constructed in accordance to manufacturer drawings.
- Foundation does not have structural damage.
- Bolts have been properly tightened according to manufacturer specifications.
- Appurtenance, mount and transmission line sizes and weights are best estimates using the tnxTower database and manufacturer information.
- It is assumed that all the radios are/will be mounted behind the antennas.

6. APPURTENANCE LISTING

EXISTING LOAD DESCRIPTION					
ELEV (ft.)	Qty.	Antenna Description	Mount Type & Qty.	TX. LINE (in)	TENANT
180'±	2	Sinclair SC488-HF2LNF Omnis	(2) SitePRO1 HM6 6' Standoffs	(2) 1-5/8"	Town of Waterford
	1	DBSpectra ATS8TMA10 TMA			
170'±	3	Powerwave 7770 antennas	(3) T-Frames	(12) 1-5/8" (4) 3/4"DC (2) 1/2" Fiber	AT&T
	3	Andrew SBNHH-1D65A antennas			
	3	KMW AM-X-CD-14-65-00T			
	6	Ericsson RRUS 11 RRUs			
	3	Ericsson RRUS 32 RRUs			
	6	TT19-08BP111-001 TMA			
	2	Raycap DC6-48-60-18-8F Surge Suppressor			
160'±	3	RFS APX16DWV-16DWVS antennas	(3) T-Frames	(18) 1-5/8" (1) 1/2" (1) 1-5/8" Fiber	T-Mobile
	3	Commscope LNX-6515DS-VTM antennas			
	3	Ericsson Double TMA 17/21			
	3	RFS ATMAA1412D-1A20			
	3	Kathrein 782 11056 Bias T's			
140'±	3	Antel BXA-80063/6CF	(3) T-Frames	(18) 1-5/8" (1) 1-5/8" Hybriflex Fiber	Verizon
	3	Antel BXA-70063/6CF			
	3	BXA 171063-12CF			
	3	BXA 171063-8CF			
	3	Alcatel Lucent RRH 2X40 – AWS RRUs			
	1	ODU Celwave DB-T1-6Z			

FINAL LOAD DESCRIPTION (VERIZON)					
ELEV (ft.)	Qty.	Antenna Description	Mount Type & Qty.	TX. LINE (in)	TENANT
140'±	3	Antel BXA-80063/6CF antennas	(3) T-Frames	(16) 1-5/8" coaxes (2) 1-5/8" fiber	Verizon
	3	Antel BXA-70063-6CF-EDIN-0 antennas			
	6	Commscope SBNHH-1D65B antennas			
	3	Alcatel Lucent B66 RRH4X45 AWS Remote Radio			
	3	Alcatel Lucent RRH 700 4X30 B13 Remote Radio			
	2	Rfs Celwave DB-T1-6Z-8AB-0Z ODU			

Notes:

1. ACGI should be notified of any discrepancies found in the data listed in this report.

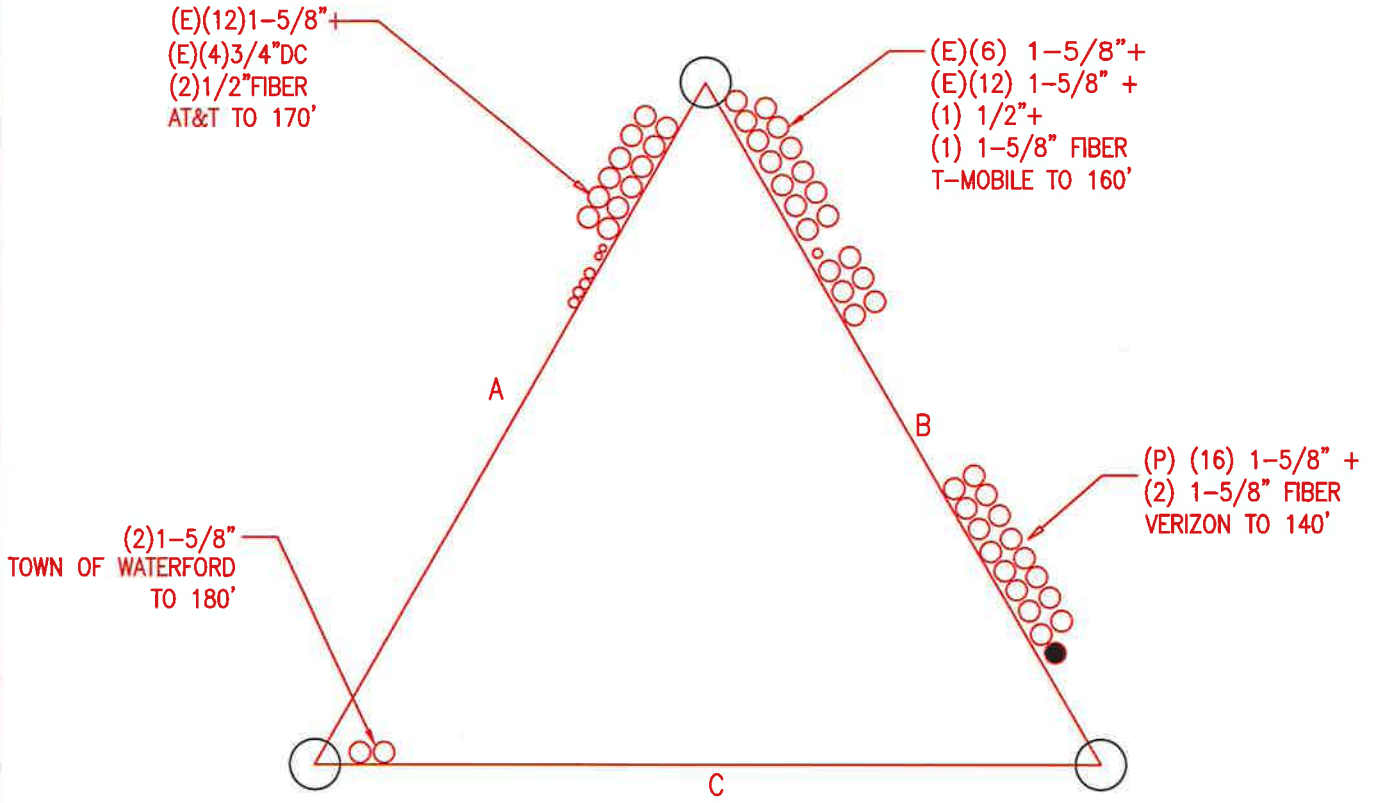
7. SUMMARY OF WORKING PERCENTAGE OF STRUCTURAL COMPONENTS

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF*P_{allow} K	% Capacity	Pass Fail
T1	180 - 160	Leg	1 3/4	3	-22.01	59.04	37.3	Pass
		Diagonal	7/8	13	-3.30	6.57	50.3	Pass
		Top Girt	7/8	6	-0.13	3.91	3.2	Pass
		Bottom Girt	7/8	7	-0.19	3.91	4.8	Pass
T2	160 - 140	Leg	2 1/2	48	-81.68	164.54	49.6	Pass
		Diagonal	1	58	-6.13	11.53	53.2	Pass
		Top Girt	1	50	-0.27	6.85	4.0	Pass
		Bottom Girt	1	52	-0.21	6.85	3.0	Pass
T3	140 - 120	Leg	3 1/2	93	-175.33	372.07	47.1	Pass
		Diagonal	1 1/8	103	-10.16	18.91	53.7	Pass
		Top Girt	1 1/8	94	-0.27	11.36	2.4	Pass
		Bottom Girt	1 1/8	98	-2.26	11.36	19.9	Pass
T4	120 - 90	Leg	4 1/4	138	-206.56	376.30	54.9	Pass
		Diagonal	L2 1/2x2 1/2x3/16	141	-3.82	10.18	37.5 40.7 (b)	Pass
T5	90 - 60	Leg	4 1/2	165	-239.83	446.66	53.7	Pass
		Diagonal	L3x3x3/16	168	-5.32	10.34	51.5 54.6 (b)	Pass
T6	60 - 30	Leg	4 3/4	192	-277.86	522.30	53.2	Pass
		Diagonal	L3 1/2x3 1/2x1/4	195	-7.03	13.68	51.4	Pass
T7	30 - 0	Leg	4 3/4	219	-317.52	522.30	60.8	Pass
		Diagonal	L4x4x5/16	222	-8.42	17.01	49.5	Pass
							Summary	
						Leg (T7)	60.8	Pass
						Diagonal (T5)	54.6	Pass
						Top Girt (T2)	4.0	Pass
						Bottom Girt (T3)	19.9	Pass
						Bolt Checks	54.6	Pass
						RATING =	**60.8**	**Pass**

APPENDIX

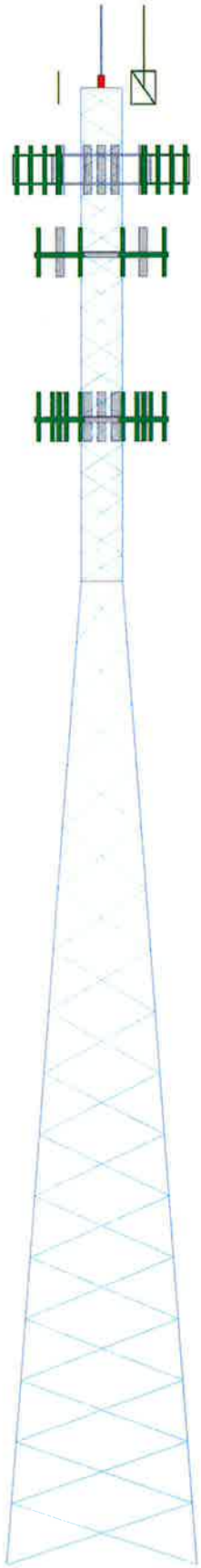
COAX LAYOUT



COAX LAYOUT
N.T.S

TOWER ELEVATION DRAWING

Section	T1	T2	T3	T4	T5	T6	T7
Legs	SR 1 3/4	SR 2 1/2	SR 3 1/2	SR 4 1/4	SR 4 1/2	SR 4 3/4	
Leg Grade	A572-50						
Diagonals	SR 7/8	SR 1	SR 1 1/8	L2 1/2x2 1/2x3/16	L3x3x3/16	L3 1/2x3 1/2x1/4	L4x4x5/16
Diagonal Grade	A572-50				A36		
Top Girts	SR 7/8	SR 1	SR 1 1/8		N.A.		
Bottom Girts	SR 7/8	SR 1	SR 1 1/8		N.A.		
Face Width (ft)	5			9.5	14	18.5	23
# Panels @ (ft)	6 @ 3.31944	6 @ 3.30556	6 @ 3.31944		16 @ 7.5		
Weight (K)	1.0	1.7	2.9	5.4	6.4	8.3	10.3



TOWER DESIGN NOTES

1. Tower is located in New London County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 104 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to Increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 60.8%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 321 K
SHEAR: 40 K

UPLIFT: -277 K
SHEAR: 34 K

AXIAL 136 K
SHEAR 15 K *MOMENT 1648 kip-ft*

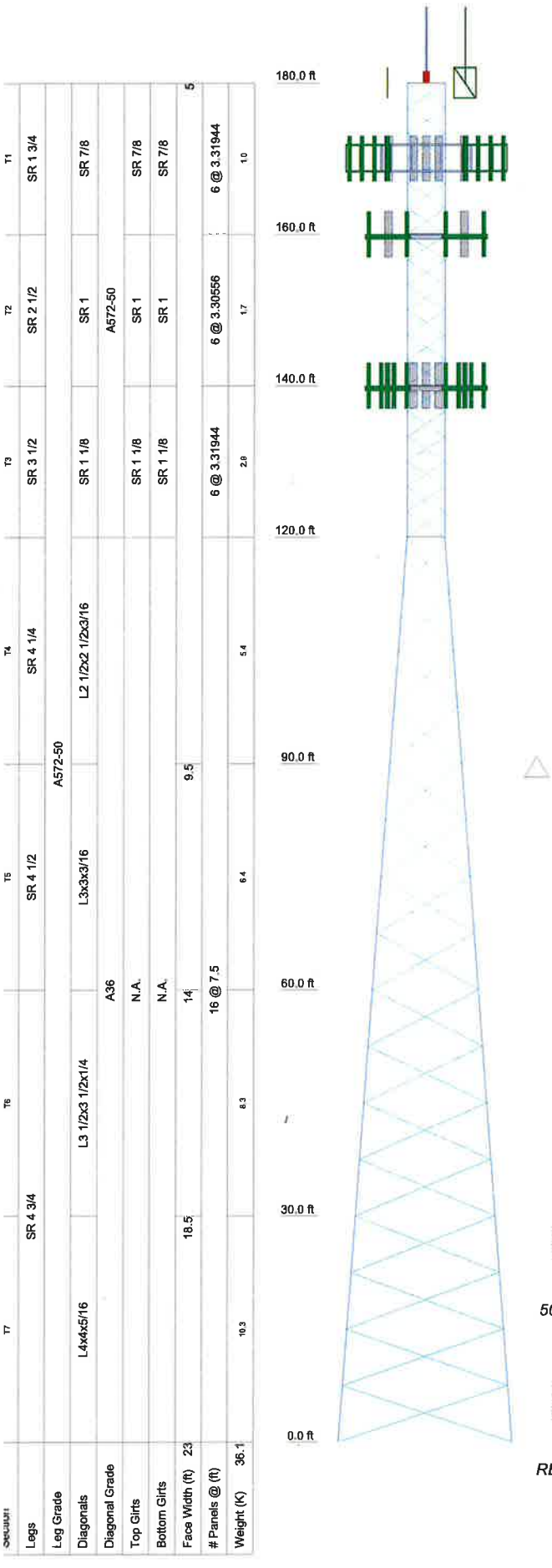
TORQUE 6 kip-ft
50 mph WIND - 0.7500 in ICE

AXIAL 63 K
SHEAR 62 K *MOMENT 5981 kip-ft*

TORQUE 29 kip-ft
REACTIONS - 104 mph WIND

ABC Consulting Engineers
ABC Engineering
1234 W. Jones St.
Smallville, PA 12345
Phone: (555) 555-1234
FAX: (555) 555-1235

Job: **16-3864 180' SST**			
Project: **CT09865-S-02_Niantic Structural**			
Client: SBA	Drawn by: bpaudel	App'd:	
Code: TIA-222-G	Date: 10/28/16	Scale: N	
Path:		Dwg No.	



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(E) Lightning Rod	180	APX16DWV-16DWVS-E-A20 (T-Mobile)	160
(E) Flash Beacon Lighting	180	LNX-6515DS-VTM (T-Mobile)	160
(E)Sinclair SC488-HF2LNF Omni (Town of Waterford)	180	LNX-6515DS-VTM (T-Mobile)	160
(E)Sinclair SC488-HF2LNF Omni (Town of Waterford)	180	(E)T-Frame (T-Mobile)	160
(E)DBSpectra ATS8TMA10 TMA (Town of Waterford)	180	(E)T-Frame (T-Mobile)	160
(E) SitePRO1 HM6 6' Stanoffs (Town of Waterford)	180	(E)T-Frame (T-Mobile)	160
(E) SitePRO1 HM6 6' Stanoffs (Town of Waterford)	180	LNX-6515DS-VTM (T-Mobile)	160
(E)Powerwave 7770.00 (ATT)	170	Double TMA 17/21 (T-Mobile)	160
SBNHH-1D65A (ATT)	170	Double TMA 17/21 (T-Mobile)	160
SBNHH-1D65A (ATT)	170	(2) (E)Antenna Pipe Mount (T-Mobile)	160
SBNHH-1D65A (ATT)	170	(2) (E)Antenna Pipe Mount (T-Mobile)	160
RRU 32 (ATT)	170	(2) (E)Antenna Pipe Mount (T-Mobile)	160
RRU 32 (ATT)	170	Double TMA 17/21 (T-Mobile)	160
RRU 32 (ATT)	170	ATMAA1412D-1A20 (T-Mobile)	160
(2) (E) RRUS 11 (ATT)	170	ATMAA1412D-1A20 (T-Mobile)	160
(2) (E) RRUS 11 (ATT)	170	ATMAA1412D-1A20 (T-Mobile)	160
(2) (E) RRUS 11 (ATT)	170	782 11056 (T-Mobile)	160
(E)Raycap DC6-48-60-18-F (ATT)	170	782 11056 (T-Mobile)	160
(E)Raycap DC6-48-60-18-F (ATT)	170	(E)Antel BXA-80063/6CF (Verizon)	140
(E)Powerwave 7770.00 (ATT)	170	(E)Antel BXA-80063/6CF (Verizon)	140
(E)Powerwave 7770.00 (ATT)	170	(E)Antel BXA-80063/6CF (Verizon)	140
(E) T-Frame (ATT)	170	(E)Antel BXA-70063/6CF (Verizon)	140
(E) T-Frame (ATT)	170	(E)Antel BXA-70063/6CF (Verizon)	140
(E) T-Frame (ATT)	170	(E)T-Frame (Verizon)	140
(3) (E)Antenna Pipe Mount (ATT)	170	(E)T-Frame (Verizon)	140
(3) (E)Antenna Pipe Mount (ATT)	170	(E)T-Frame (Verizon)	140
(3) (E)Antenna Pipe Mount (ATT)	170	(4) (E)Antenna Pipe Mount (Verizon)	140
(P)AM-X-CD-16-65-00T-RET (ATT)	170	(4) (E)Antenna Pipe Mount (Verizon)	140
(P) AM-X-CD-16-65-00T-RET (ATT)	170	(4) (E)Antenna Pipe Mount (Verizon)	140
(P)AM-X-CD-16-65-00T-RET (ATT)	170	(2) SBNHH-1D65B (Verizon)	140
(2) (P) TT19-08BP111-001 TMA (ATT)	170	(2) SBNHH-1D65B (Verizon)	140
(2) (P) TT19-08BP111-001 TMA (ATT)	170	(2) SBNHH-1D65B (Verizon)	140
(2) (P) TT19-08BP111-001 TMA (ATT)	170	B66 RRH4X45 AWS (Verizon)	140
782 11056 (T-Mobile)	160	B66 RRH4X45 AWS (Verizon)	140
APX16DWV-16DWVS-E-A20 (T-Mobile)	160	B66 RRH4X45 AWS (Verizon)	140
APX16DWV-16DWVS-E-A20 (T-Mobile)	160	RRH 700 4X30 B13 (Verizon)	140
		RRH 700 4X30 B13 (Verizon)	140
		RRH 700 4X30 B13 (Verizon)	140
		DB-T1-6Z-8AB-0Z (Verizon)	140
		DB-T1-6Z-8AB-0Z (Verizon)	140

MATERIAL STRENGTH

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

ALL RE
ARE FA

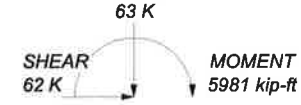
TOWER DESIGN NOTES

MAX. C
DOV
SHE
UPLIFT
SHE
A
1

1. Tower is located in New London County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 104 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 60.8%

TORQUE 6 kip-ft
50 mph WIND - 0.7500 in ICE

AXIAL
63 K



TORQUE 29 kip-ft
REACTIONS - 104 mph WIND

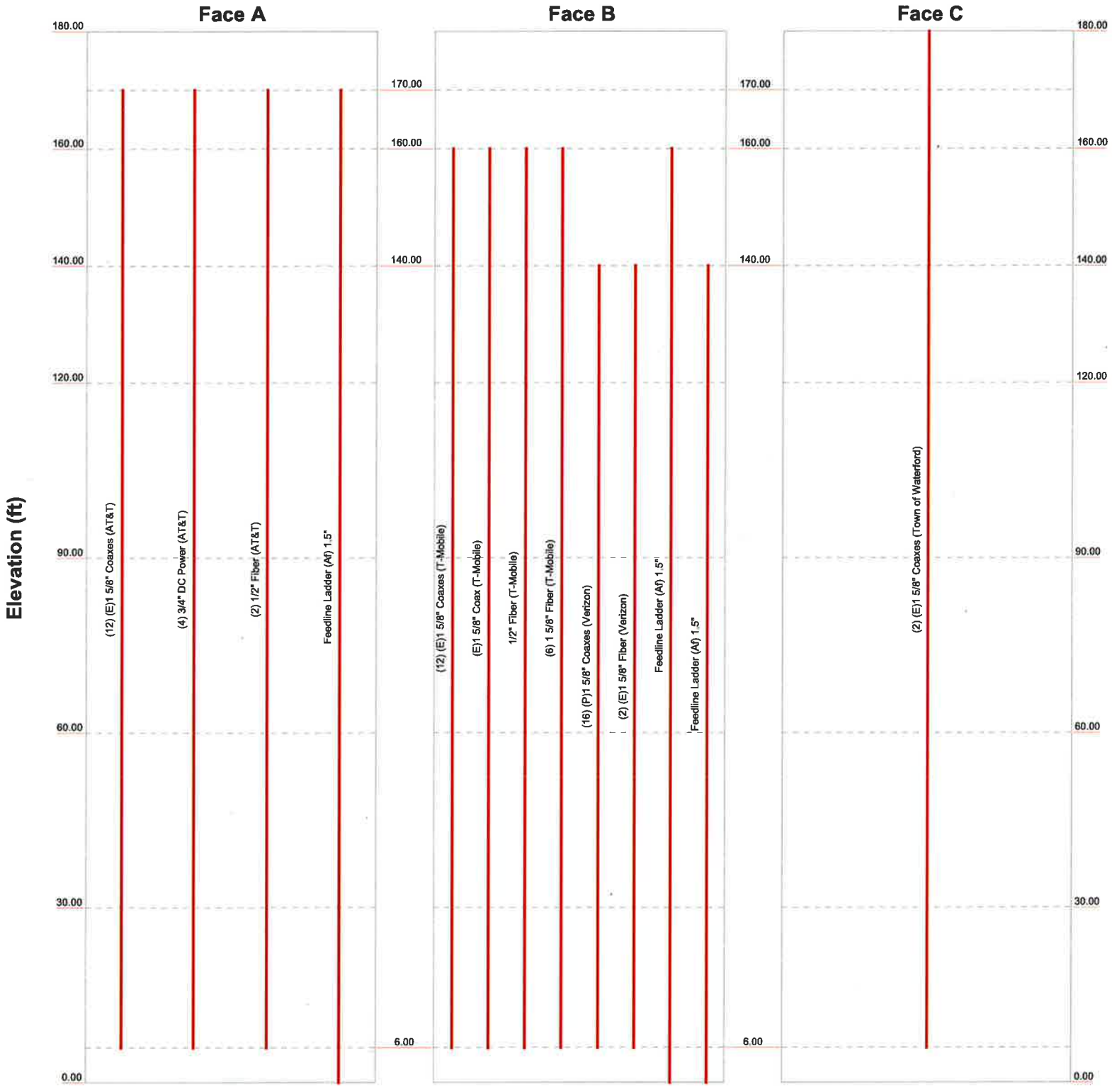
ABC Consulting Engineers
ABC Engineering
1234 W. Jones St.
Smallville, PA 12345
Phone: (555) 555-1234
FAX: (555) 555-1235

Job: 16-3864 180' SST			
Project: CT09865-S-02_Niantic Structural			
Client: SBA	Drawn by: bpaudel	App'd:	
Code: TIA-222-G	Date: 10/28/16	Scale: N	
Path:		Dwg No.	

MISCELLANEOUS PLOTS

0' - 180'

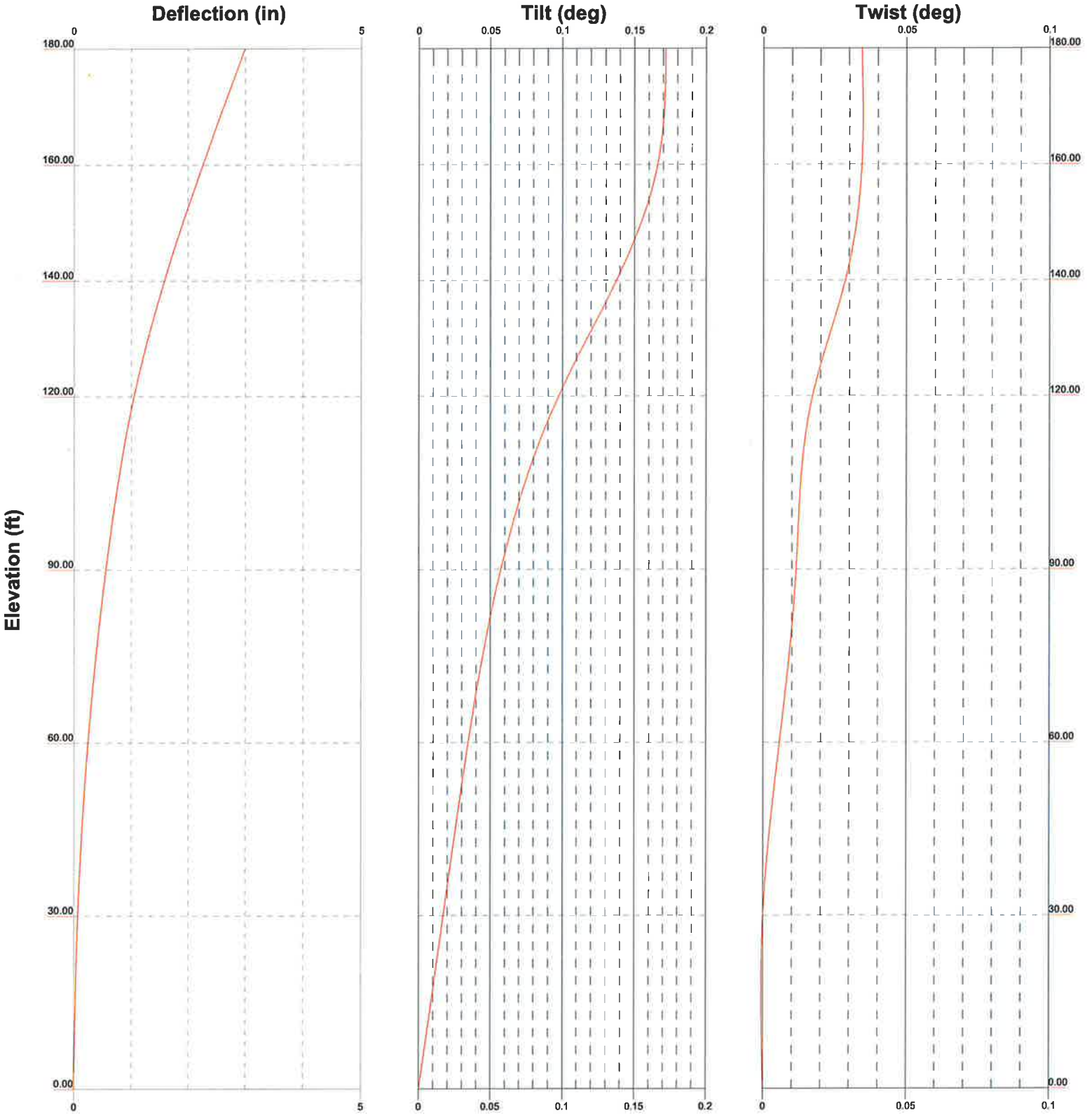
Round | Flat | App In Face | App Out Face | Truss Leg



ABC Consulting Engineers	*ABC Engineering* 1234 W. Jones St. Smallville, PA 12345 Phone: (555) 555-1234 FAX: (555) 555-1235	Job: *16-3864 180' SST*	
		Project: *CT09865-S-02_Niantic Structural*	
		Client: SBA	Drawn by: bpaudel
		Code: TIA-222-G	Date: 10/28/16
		Path:	Scale: N
			Dwg No.

TIA-222-G - Service - 60 mph

Maximum Values



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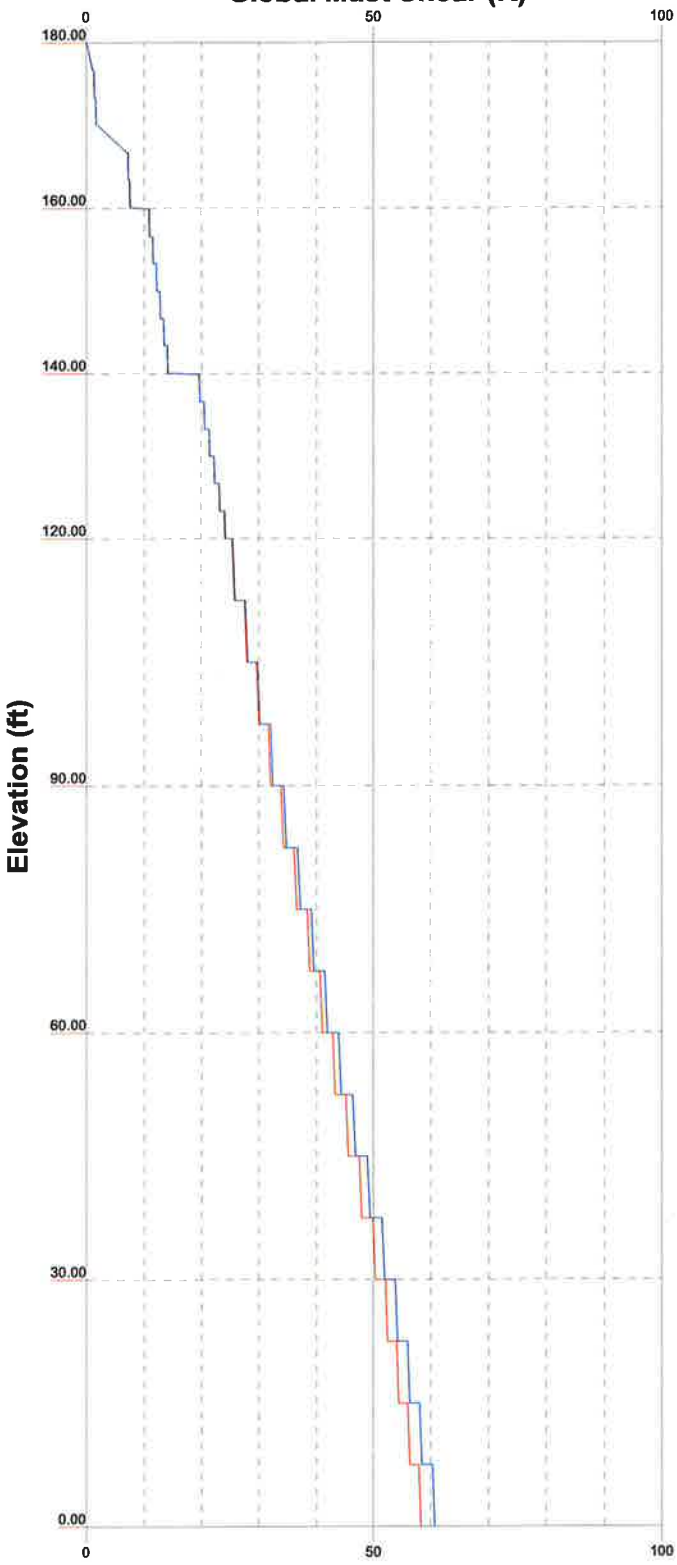
Job:	***16-3864 180' SST***		
Project:	***CT09865-S-02_Niantic Structural***		
Client: SBA		Drawn by: bpaudel	App'd:
Code: TIA-222-G		Date: 10/28/16	Scale: N
Path:			Dwg No.

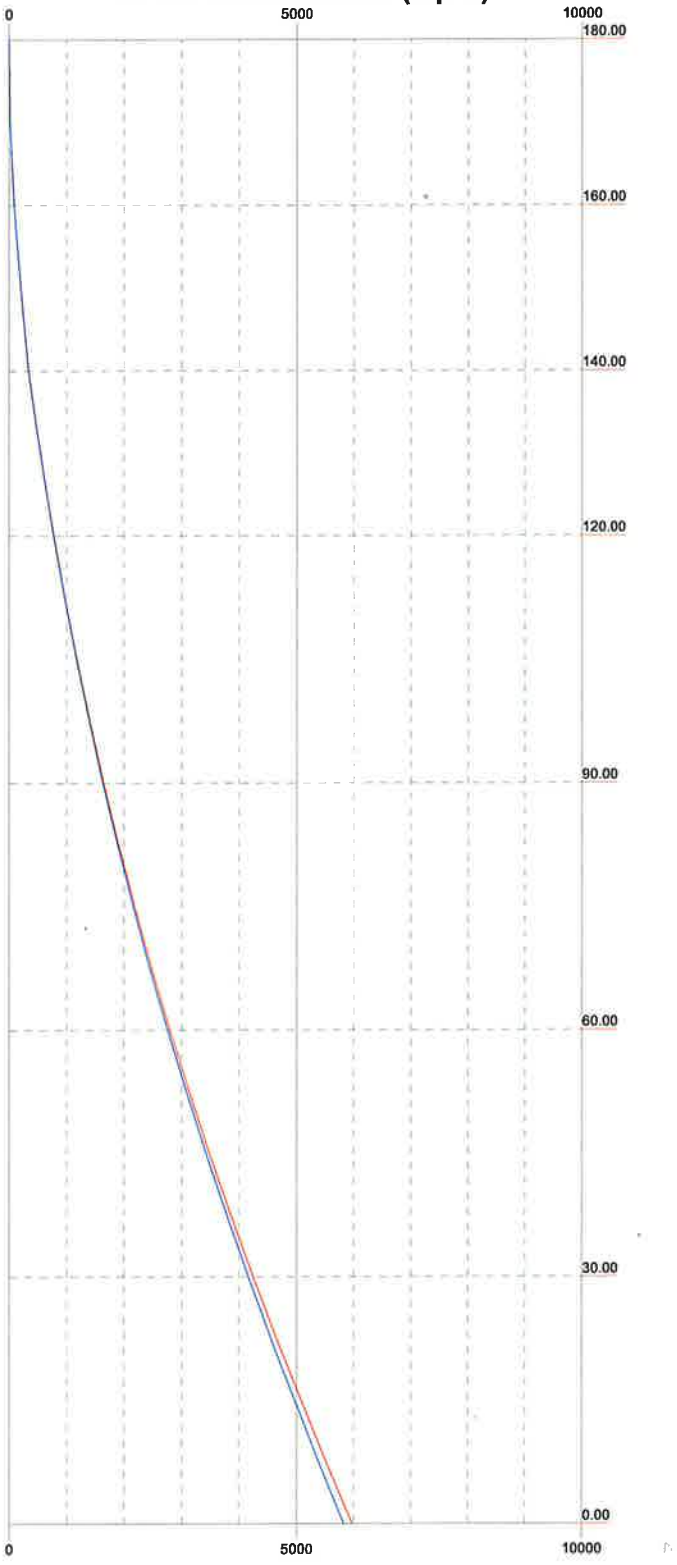
Vx Vz

Mx Mz

Global Mast Shear (K)



Global Mast Moment (kip-ft)



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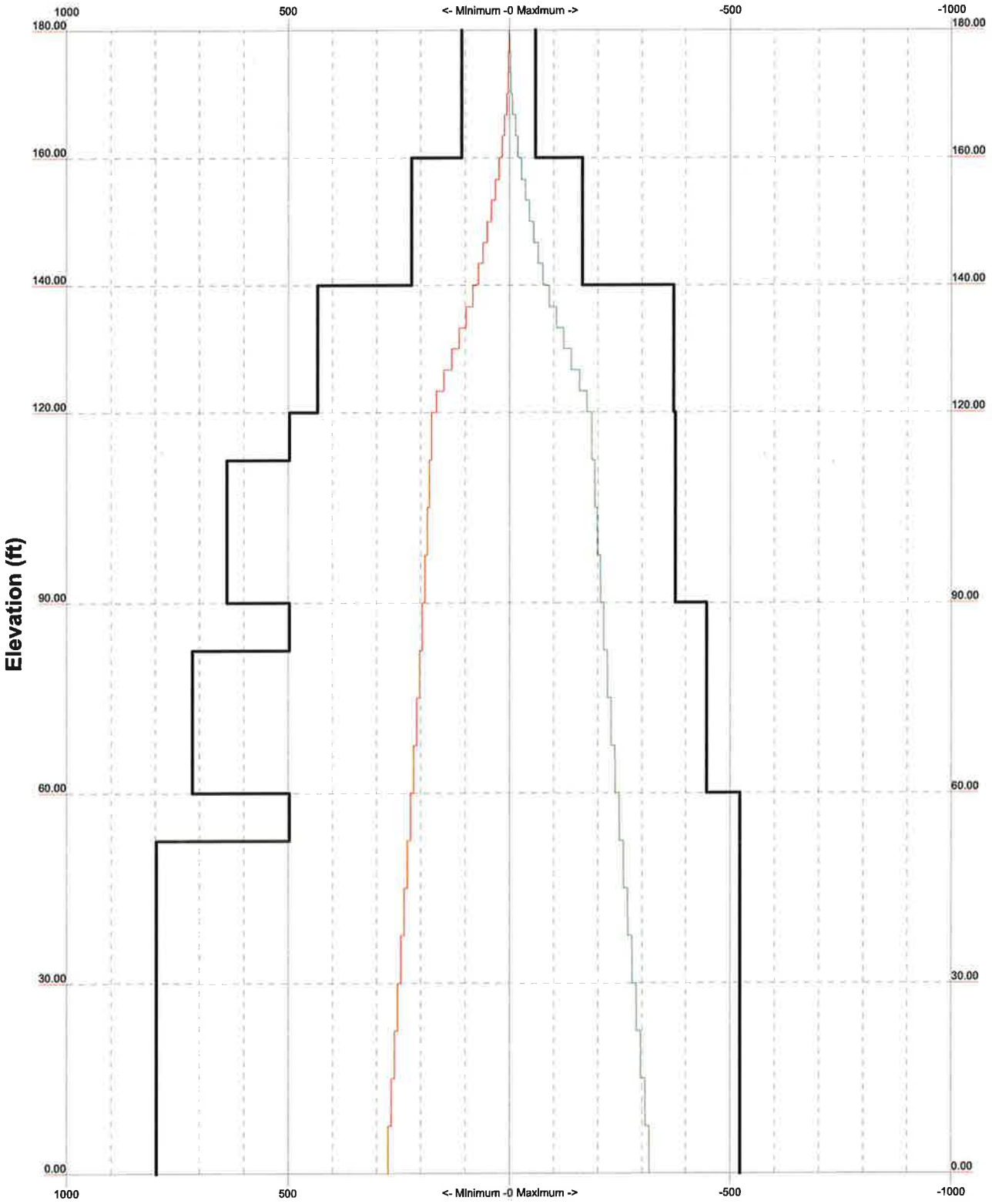
Job: *16-3864 180' SST*			
Project: *CT09865-S-02_Niantic Structural*			
Client: SBA	Drawn by: bpaudel		App'd:
Code: TIA-222-G	Date: 10/28/16		Scale: N
Path:			Dwg No.

TIA-222-G - 104 mph/50 mph 0.7500 in Ice Exposure C

Leg Capacity ——— **Leg Compression (K)**



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Job: *16-3864 180' SST*			
Project: *CT09865-S-02_Niantic Structural*			
Client: SBA	Drawn by: bpaudel		App'd:
Code: TIA-222-G	Date: 10/28/16		Scale: N
Path:			Dwg No.

CALCULATION PRINTOUT

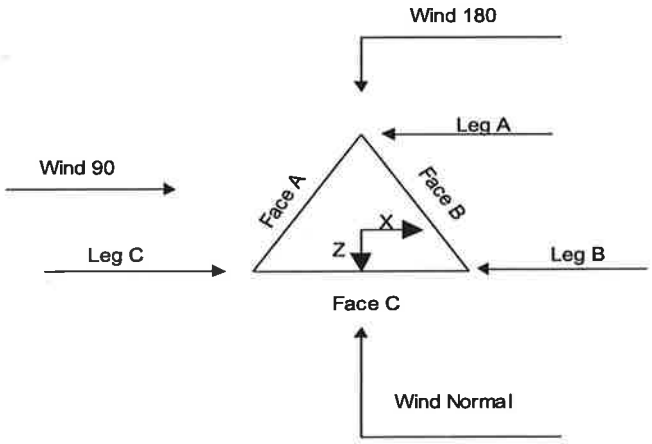
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 180.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 5.00 ft at the top and 23.00 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in New London County, Connecticut.
ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).
Basic wind speed of 104 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 0.7500 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		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-G Bracing Resist. Exemption
√	Include Bolts In Member Capacity	√	Autocalc Torque Arm Areas		Use TIA-222-G 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				



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	180.00-160.00			5.00	1	20.00
T2	160.00-140.00			5.00	1	20.00
T3	140.00-120.00			5.00	1	20.00
T4	120.00-90.00			5.00	1	30.00
T5	90.00-60.00			9.50	1	30.00
T6	60.00-30.00			14.00	1	30.00
T7	30.00-0.00			18.50	1	30.00

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T1	180.00-160.00	3.32	X Brace	No	Yes	0.0000	1.0000
T2	160.00-140.00	3.31	X Brace	No	Yes	1.0000	1.0000
T3	140.00-120.00	3.32	X Brace	No	Yes	1.0000	0.0000
T4	120.00-90.00	7.50	X Brace	No	No	0.0000	0.0000
T5	90.00-60.00	7.50	X Brace	No	No	0.0000	0.0000
T6	60.00-30.00	7.50	X Brace	No	No	0.0000	0.0000
T7	30.00-0.00	7.50	X Brace	No	No	0.0000	0.0000

Tower Section Geometry (cont'd)

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 180.00-160.00	Solid Round	1 3/4	A572-50 (50 ksi)	Solid Round	7/8	A572-50 (50 ksi)
T2 160.00-140.00	Solid Round	2 1/2	A572-50 (50 ksi)	Solid Round	1	A572-50 (50 ksi)
T3 140.00-120.00	Solid Round	3 1/2	A572-50 (50 ksi)	Solid Round	1 1/8	A572-50 (50 ksi)
T4 120.00-90.00	Solid Round	4 1/4	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 90.00-60.00	Solid Round	4 1/2	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T6 60.00-30.00	Solid Round	4 3/4	A572-50 (50 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A36 (36 ksi)
T7 30.00-0.00	Solid Round	4 3/4	A572-50 (50 ksi)	Equal Angle	L4x4x5/16	A36 (36 ksi)

Tower Section Geometry (cont'd)

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 180.00-160.00	Solid Round	7/8	A572-50 (50 ksi)	Solid Round	7/8	A570-50 (50 ksi)
T2 160.00-140.00	Solid Round	1	A572-50 (50 ksi)	Solid Round	1	A572-50 (50 ksi)
T3 140.00-120.00	Solid Round	1 1/8	A572-50 (50 ksi)	Solid Round	1 1/8	A572-50 (50 ksi)

Tower Section Geometry (cont'd)

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 180.00-160.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T2 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T3 140.00-120.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T4 120.00-90.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T5 90.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T6 60.00-30.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000

Tower Elevation ft	Gusset Area (per face) ft²	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T7 30.00-0.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000

Tower Section Geometry (cont'd)

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X	X Brace Diags Y	K Single Diags X	K Single Diags Y	Girts X	Girts Y	Horiz. X	Horiz. Y	Sec. Horiz. X	Sec. Horiz. Y	Inner Brace X	Inner Brace Y
T1	Yes	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1
180.00-160.00				1	1	1	1	1	1	1	1	1	1	1	1
T2	Yes	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1
160.00-140.00				1	1	1	1	1	1	1	1	1	1	1	1
T3	Yes	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1
140.00-120.00				1	1	1	1	1	1	1	1	1	1	1	1
T4	Yes	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1
120.00-90.00				1	1	1	1	1	1	1	1	1	1	1	1
T5	Yes	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1
90.00-60.00				1	1	1	1	1	1	1	1	1	1	1	1
T6	Yes	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1
60.00-30.00				1	1	1	1	1	1	1	1	1	1	1	1
T7 30.00-0.00	Yes	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1	1

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

Tower Section Geometry (cont'd)

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 180.00-160.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 160.00-140.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 140.00-120.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 120.00-90.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 90.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 60.00-30.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 30.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T1 180.00-160.00	Flange	0.0000 A325N	0	0.0000 A325N	0	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 160.00-140.00	Flange	1.1250 A325N	6	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 140.00-120.00	Flange	1.2500 A325N	6	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 120.00-90.00	Flange	1.2500 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 90.00-60.00	Flange	1.2500 A325N	6	0.7500 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 60.00-30.00	Flange	1.2500 A325N	6	0.8750 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T7 30.00-0.00	Flange	1.5000 A325N	0	0.8750 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
(E)1 5/8" Coaxes (Town of Waterford)	C	No	Ar (CaAa)	180.00 - 6.00	0.0000	0.45	2	2	0.5000	1.9800		1.04
(E)1 5/8" Coaxes (AT&T)	A	No	Ar (CaAa)	170.00 - 6.00	0.0000	0.35	12	6	0.5000	1.9800		1.04
3/4" DC Power (AT&T)	A	No	Ar (CaAa)	170.00 - 6.00	0.0000	0.25	4	4	0.8650	0.8650		0.15
1/2" Fiber (AT&T)	A	No	Ar (CaAa)	170.00 - 6.00	0.0000	0.25	2	2	0.5000	0.5000		0.25
*												
(E)1 5/8" Coaxes (T-Mobile)	B	No	Ar (CaAa)	160.00 - 6.00	0.0000	-0.45	12	6	0.5000	1.9800		1.04
(E)1 5/8" Coax (T-Mobile)	B	No	Ar (CaAa)	160.00 - 6.00	0.0000	-0.35	1	1	0.5000	1.9800		1.04
1/2" Fiber (T-Mobile)	B	No	Ar (CaAa)	160.00 - 6.00	0.0000	-0.3	1	1	0.5800	0.5800		0.25
1 5/8" Fiber (T-Mobile)	B	No	Ar (CaAa)	160.00 - 6.00	0.0000	-0.25	6	3	0.5000	1.9800		1.04
*												
*												
(P)1 5/8" Coaxes (Verizon)	B	No	Ar (CaAa)	140.00 - 6.00	0.0000	0.3	16	8	0.5000	1.9800		1.04
(E)1 5/8" Fiber (Verizon)	B	No	Ar (CaAa)	140.00 - 6.00	0.0000	0.3	2	1	0.5000	1.9800		1.04
Feedline	A	No	Af (CaAa)	170.00 - 0.00	0.0000	0.25	1	1	1.5000	1.5000		4.20

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
Ladder (Af) 1.5" Feedline	B	No	Af (CaAa)	160.00 - 0.00	0.0000	-0.35	1	1	1.5000	1.5000		4.20
Ladder (Af) 1.5" Feedline	B	No	Af (CaAa)	140.00 - 0.00	0.0000	0.3	1	1	1.5000	1.5000		4.20
Ladder (Af) 1.5" *******												

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C_AA_A ft^2/ft	Weight plf
* *******							

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	180.00-160.00	A	0.000	0.000	30.720	0.000	0.18
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	7.920	0.000	0.04
T2	160.00-140.00	A	0.000	0.000	61.440	0.000	0.36
		B	0.000	0.000	81.400	0.000	0.48
		C	0.000	0.000	7.920	0.000	0.04
T3	140.00-120.00	A	0.000	0.000	61.440	0.000	0.36
		B	0.000	0.000	157.680	0.000	0.94
		C	0.000	0.000	7.920	0.000	0.04
T4	120.00-90.00	A	0.000	0.000	92.160	0.000	0.53
		B	0.000	0.000	236.520	0.000	1.41
		C	0.000	0.000	11.880	0.000	0.06
T5	90.00-60.00	A	0.000	0.000	92.160	0.000	0.53
		B	0.000	0.000	236.520	0.000	1.41
		C	0.000	0.000	11.880	0.000	0.06
T6	60.00-30.00	A	0.000	0.000	92.160	0.000	0.53
		B	0.000	0.000	236.520	0.000	1.41
		C	0.000	0.000	11.880	0.000	0.06
T7	30.00-0.00	A	0.000	0.000	75.228	0.000	0.45
		B	0.000	0.000	192.216	0.000	1.18
		C	0.000	0.000	9.504	0.000	0.05

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	180.00-160.00	A	1.767	0.000	0.000	51.808	0.000	0.86

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	24.279	0.000	0.29
T2	160.00-140.00	A	1.745	0.000	0.000	103.083	0.000	1.69
		B		0.000	0.000	112.748	0.000	2.13
		C		0.000	0.000	24.127	0.000	0.28
T3	140.00-120.00	A	1.720	0.000	0.000	102.482	0.000	1.67
		B		0.000	0.000	208.229	0.000	4.01
		C		0.000	0.000	23.954	0.000	0.28
T4	120.00-90.00	A	1.684	0.000	0.000	152.402	0.000	2.47
		B		0.000	0.000	310.004	0.000	5.92
		C		0.000	0.000	35.552	0.000	0.41
T5	90.00-60.00	A	1.628	0.000	0.000	150.378	0.000	2.40
		B		0.000	0.000	306.419	0.000	5.77
		C		0.000	0.000	34.972	0.000	0.39
T6	60.00-30.00	A	1.547	0.000	0.000	147.436	0.000	2.30
		B		0.000	0.000	301.205	0.000	5.55
		C		0.000	0.000	34.127	0.000	0.37
T7	30.00-0.00	A	1.386	0.000	0.000	116.451	0.000	1.76
		B		0.000	0.000	239.020	0.000	4.23
		C		0.000	0.000	25.963	0.000	0.27

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	180.00-160.00	-2.0265	-2.7178	-0.8081	-1.4194
T2	160.00-140.00	-0.3554	-5.4313	-0.1833	-3.5503
T3	140.00-120.00	1.6622	-3.2657	1.3106	-2.3400
T4	120.00-90.00	2.2441	-4.4744	1.8443	-3.3222
T5	90.00-60.00	3.3787	-6.8264	2.8013	-5.1042
T6	60.00-30.00	4.3689	-8.8811	3.6576	-6.7128
T7	30.00-0.00	4.8386	-9.8610	4.2235	-7.8455

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	(E)1 5/8" Coaxes	160.00 - 180.00	0.6000	0.5692
T1	2	(E)1 5/8" Coaxes	160.00 - 170.00	0.6000	0.5692
T1	3	3/4" DC Power	160.00 - 170.00	0.6000	0.5692
T1	4	1/2" Fiber	160.00 - 170.00	0.6000	0.5692
T1	14	Feedline Ladder (Af) 1.5"	160.00 - 170.00	0.6000	0.5692
T2	1	(E)1 5/8" Coaxes	140.00 - 160.00	0.6000	0.5513
T2	2	(E)1 5/8" Coaxes	140.00 -	0.6000	0.5513

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T2	3	3/4" DC Power	140.00 - 160.00	0.6000	0.5513
T2	4	1/2" Fiber	140.00 - 160.00	0.6000	0.5513
T2	6	(E)1 5/8" Coaxes	140.00 - 160.00	0.6000	0.5513
T2	7	(E)1 5/8" Coax	140.00 - 160.00	0.6000	0.5513
T2	8	1/2" Fiber	140.00 - 160.00	0.6000	0.5513
T2	9	1 5/8" Fiber	140.00 - 160.00	0.6000	0.5513
T2	14	Feedline Ladder (Af) 1.5"	140.00 - 160.00	0.6000	0.5513
T2	15	Feedline Ladder (Af) 1.5"	140.00 - 160.00	0.6000	0.5513
T3	1	(E)1 5/8" Coaxes	120.00 - 140.00	0.6000	0.5292
T3	2	(E)1 5/8" Coaxes	120.00 - 140.00	0.6000	0.5292
T3	3	3/4" DC Power	120.00 - 140.00	0.6000	0.5292
T3	4	1/2" Fiber	120.00 - 140.00	0.6000	0.5292
T3	6	(E)1 5/8" Coaxes	120.00 - 140.00	0.6000	0.5292
T3	7	(E)1 5/8" Coax	120.00 - 140.00	0.6000	0.5292
T3	8	1/2" Fiber	120.00 - 140.00	0.6000	0.5292
T3	9	1 5/8" Fiber	120.00 - 140.00	0.6000	0.5292
T3	12	(P)1 5/8" Coaxes	120.00 - 140.00	0.6000	0.5292
T3	13	(E)1 5/8" Fiber	120.00 - 140.00	0.6000	0.5292
T3	14	Feedline Ladder (Af) 1.5"	120.00 - 140.00	0.6000	0.5292
T3	15	Feedline Ladder (Af) 1.5"	120.00 - 140.00	0.6000	0.5292
T3	16	Feedline Ladder (Af) 1.5"	120.00 - 140.00	0.6000	0.5292
T4	1	(E)1 5/8" Coaxes	90.00 - 120.00	0.6000	0.6000
T4	2	(E)1 5/8" Coaxes	90.00 - 120.00	0.6000	0.6000
T4	3	3/4" DC Power	90.00 - 120.00	0.6000	0.6000
T4	4	1/2" Fiber	90.00 - 120.00	0.6000	0.6000
T4	6	(E)1 5/8" Coaxes	90.00 - 120.00	0.6000	0.6000
T4	7	(E)1 5/8" Coax	90.00 - 120.00	0.6000	0.6000
T4	8	1/2" Fiber	90.00 - 120.00	0.6000	0.6000
T4	9	1 5/8" Fiber	90.00 - 120.00	0.6000	0.6000
T4	12	(P)1 5/8" Coaxes	90.00 - 120.00	0.6000	0.6000
T4	13	(E)1 5/8" Fiber	90.00 - 120.00	0.6000	0.6000
T4	14	Feedline Ladder (Af) 1.5"	90.00 - 120.00	0.6000	0.6000
T4	15	Feedline Ladder (Af) 1.5"	90.00 - 120.00	0.6000	0.6000
T4	16	Feedline Ladder (Af) 1.5"	90.00 - 120.00	0.6000	0.6000
T5	1	(E)1 5/8" Coaxes	60.00 - 90.00	0.6000	0.6000
T5	2	(E)1 5/8" Coaxes	60.00 - 90.00	0.6000	0.6000
T5	3	3/4" DC Power	60.00 - 90.00	0.6000	0.6000
T5	4	1/2" Fiber	60.00 - 90.00	0.6000	0.6000
T5	6	(E)1 5/8" Coaxes	60.00 - 90.00	0.6000	0.6000
T5	7	(E)1 5/8" Coax	60.00 - 90.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T5	8	1/2" Fiber	60.00 - 90.00	0.6000	0.6000
T5	9	1 5/8" Fiber	60.00 - 90.00	0.6000	0.6000
T5	12	(P)1 5/8" Coaxes	60.00 - 90.00	0.6000	0.6000
T5	13	(E)1 5/8" Fiber	60.00 - 90.00	0.6000	0.6000
T5	14	Feedline Ladder (Af) 1.5"	60.00 - 90.00	0.6000	0.6000
T5	15	Feedline Ladder (Af) 1.5"	60.00 - 90.00	0.6000	0.6000
T5	16	Feedline Ladder (Af) 1.5"	60.00 - 90.00	0.6000	0.6000
T6	1	(E)1 5/8" Coaxes	30.00 - 60.00	0.6000	0.6000
T6	2	(E)1 5/8" Coaxes	30.00 - 60.00	0.6000	0.6000
T6	3	3/4" DC Power	30.00 - 60.00	0.6000	0.6000
T6	4	1/2" Fiber	30.00 - 60.00	0.6000	0.6000
T6	6	(E)1 5/8" Coaxes	30.00 - 60.00	0.6000	0.6000
T6	7	(E)1 5/8" Coax	30.00 - 60.00	0.6000	0.6000
T6	8	1/2" Fiber	30.00 - 60.00	0.6000	0.6000
T6	9	1 5/8" Fiber	30.00 - 60.00	0.6000	0.6000
T6	12	(P)1 5/8" Coaxes	30.00 - 60.00	0.6000	0.6000
T6	13	(E)1 5/8" Fiber	30.00 - 60.00	0.6000	0.6000
T6	14	Feedline Ladder (Af) 1.5"	30.00 - 60.00	0.6000	0.6000
T6	15	Feedline Ladder (Af) 1.5"	30.00 - 60.00	0.6000	0.6000
T6	16	Feedline Ladder (Af) 1.5"	30.00 - 60.00	0.6000	0.6000
T7	1	(E)1 5/8" Coaxes	6.00 - 30.00	0.6000	0.6000
T7	2	(E)1 5/8" Coaxes	6.00 - 30.00	0.6000	0.6000
T7	3	3/4" DC Power	6.00 - 30.00	0.6000	0.6000
T7	4	1/2" Fiber	6.00 - 30.00	0.6000	0.6000
T7	6	(E)1 5/8" Coaxes	6.00 - 30.00	0.6000	0.6000
T7	7	(E)1 5/8" Coax	6.00 - 30.00	0.6000	0.6000
T7	8	1/2" Fiber	6.00 - 30.00	0.6000	0.6000
T7	9	1 5/8" Fiber	6.00 - 30.00	0.6000	0.6000
T7	12	(P)1 5/8" Coaxes	6.00 - 30.00	0.6000	0.6000
T7	13	(E)1 5/8" Fiber	6.00 - 30.00	0.6000	0.6000
T7	14	Feedline Ladder (Af) 1.5"	0.00 - 30.00	0.6000	0.6000
T7	15	Feedline Ladder (Af) 1.5"	0.00 - 30.00	0.6000	0.6000
T7	16	Feedline Ladder (Af) 1.5"	0.00 - 30.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(E) Lightning Rod	C	From Leg	3.00	0.0000	180.00	No Ice	0.25	0.25	0.03
			0.00			1/2" Ice	0.66	0.66	0.04
			0.00			1" Ice	0.97	0.97	0.04
(E) Flash Beacon Lighting	C	None		0.0000	180.00	No Ice	2.70	2.70	0.05
						1/2" Ice	3.10	3.10	0.07
						1" Ice	3.50	3.50	0.09
(E)Sinclair SC488-HF2LNF	A	From Leg	3.00	0.0000	180.00	No Ice	4.39	4.39	0.03
Omni			0.00			1/2" Ice	5.95	5.95	0.06
(Town of Waterford)			5.00			1" Ice	7.51	7.51	0.10
(E)Sinclair SC488-HF2LNF	B	From Leg	3.00	0.0000	180.00	No Ice	4.39	4.39	0.03
Omni			0.00			1/2" Ice	5.95	5.95	0.06
(Town of Waterford)			5.00			1" Ice	7.51	7.51	0.10

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(E)DBSpectra ATS8TMA10	C	From Leg	3.00	0.0000	180.00	No Ice	2.74	2.74	0.03
TMA			0.00			1/2" Ice	3.03	3.03	0.04
(Town of Waterford)			0.00			1" Ice	3.33	3.33	0.07
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(E)Powerwave 7770.00	A	From Leg	3.00	0.0000	170.00	No Ice	6.74	3.47	0.04
(AT&T)			0.00			1/2" Ice	7.36	3.90	0.08
			0.00			1" Ice	7.99	4.34	0.12
(E)Powerwave 7770.00	B	From Leg	3.00	0.0000	170.00	No Ice	6.74	3.47	0.04
(AT&T)			0.00			1/2" Ice	7.36	3.90	0.08
			0.00			1" Ice	7.99	4.34	0.12
(E)Powerwave 7770.00	C	From Leg	3.00	0.0000	170.00	No Ice	6.74	3.47	0.04
(AT&T)			0.00			1/2" Ice	7.36	3.90	0.08
			0.00			1" Ice	7.99	4.34	0.12
SBNHH-1D65A	A	From Leg	3.00	0.0000	170.00	No Ice	5.96	3.91	0.03
(AT&T)			0.00			1/2" Ice	6.32	4.27	0.07
			0.00			1" Ice	6.70	4.63	0.12
SBNHH-1D65A	B	From Leg	3.00	0.0000	170.00	No Ice	5.96	3.91	0.03
(AT&T)			0.00			1/2" Ice	6.32	4.27	0.07
			0.00			1" Ice	6.70	4.63	0.12
SBNHH-1D65A	C	From Leg	3.00	0.0000	170.00	No Ice	5.96	3.91	0.03
(AT&T)			0.00			1/2" Ice	6.32	4.27	0.07
			0.00			1" Ice	6.70	4.63	0.12
RRU 32	A	From Leg	3.00	0.0000	170.00	No Ice	3.46	2.42	0.08
(AT&T)			0.00			1/2" Ice	3.71	2.64	0.11
			0.00			1" Ice	3.96	2.86	0.14
RRU 32	B	From Leg	3.00	0.0000	170.00	No Ice	3.46	2.42	0.08
(AT&T)			0.00			1/2" Ice	3.71	2.64	0.11
			0.00			1" Ice	3.96	2.86	0.14
RRU 32	C	From Leg	3.00	0.0000	170.00	No Ice	3.46	2.42	0.08
(AT&T)			0.00			1/2" Ice	3.71	2.64	0.11
			0.00			1" Ice	3.96	2.86	0.14
(2) (E) RRUS 11	A	From Leg	3.00	0.0000	170.00	No Ice	2.17	1.66	0.05
(AT&T)			0.00			1/2" Ice	2.44	1.90	0.07
			0.00			1" Ice	2.71	2.15	0.08
(2) (E) RRUS 11	B	From Leg	3.00	0.0000	170.00	No Ice	2.17	1.66	0.05
(AT&T)			0.00			1/2" Ice	2.44	1.90	0.07
			0.00			1" Ice	2.71	2.15	0.08
(2) (E) RRUS 11	C	From Leg	3.00	0.0000	170.00	No Ice	2.17	1.66	0.05
(AT&T)			0.00			1/2" Ice	2.44	1.90	0.07
			0.00			1" Ice	2.71	2.15	0.08
(E)Raycap DC6-48-60-18-F	A	From Leg	3.00	0.0000	170.00	No Ice	3.34	0.73	0.03
(AT&T)			0.00			1/2" Ice	3.70	0.95	0.04
			0.00			1" Ice	4.06	1.16	0.06
(E)Raycap DC6-48-60-18-F	B	From Leg	3.00	0.0000	170.00	No Ice	3.34	0.73	0.03
(AT&T)			0.00			1/2" Ice	3.70	0.95	0.04
			0.00			1" Ice	4.06	1.16	0.06
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APX16DWV-16DWVS-E-A	A	From Leg	3.00	0.0000	160.00	No Ice	6.59	2.15	0.04
20			0.00			1/2" Ice	6.96	2.49	0.07
(T-Mobile)			0.00			1" Ice	7.34	2.84	0.11
APX16DWV-16DWVS-E-A	B	From Leg	3.00	0.0000	160.00	No Ice	6.59	2.15	0.04
20			0.00			1/2" Ice	6.96	2.49	0.07
(T-Mobile)			0.00			1" Ice	7.34	2.84	0.11
APX16DWV-16DWVS-E-A	C	From Leg	3.00	0.0000	160.00	No Ice	6.59	2.15	0.04
20			0.00			1/2" Ice	6.96	2.49	0.07
(T-Mobile)			0.00			1" Ice	7.34	2.84	0.11

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
LNX-6515DS-VTM	A	From Leg	3.00	0.0000	160.00	No Ice	11.45	7.70	0.05
(T-Mobile)			0.00			1/2" Ice	12.06	8.29	0.12
			0.00			1" Ice	12.69	8.89	0.19
LNX-6515DS-VTM	B	From Leg	3.00	0.0000	160.00	No Ice	11.45	7.70	0.05
(T-Mobile)			0.00			1/2" Ice	12.06	8.29	0.12
			0.00			1" Ice	12.69	8.89	0.19
LNX-6515DS-VTM	C	From Leg	3.00	0.0000	160.00	No Ice	11.45	7.70	0.05
(T-Mobile)			0.00			1/2" Ice	12.06	8.29	0.12
			0.00			1" Ice	12.69	8.89	0.19
Double TMA 17/21	A	From Leg	3.00	0.0000	160.00	No Ice	0.35	0.14	0.01
(T-Mobile)			0.00			1/2" Ice	0.43	0.19	0.01
			0.00			1" Ice	0.51	0.25	0.02
Double TMA 17/21	B	From Leg	3.00	0.0000	160.00	No Ice	0.35	0.14	0.01
(T-Mobile)			0.00			1/2" Ice	0.43	0.19	0.01
			0.00			1" Ice	0.51	0.25	0.02
Double TMA 17/21	C	From Leg	3.00	0.0000	160.00	No Ice	0.35	0.14	0.01
(T-Mobile)			0.00			1/2" Ice	0.43	0.19	0.01
			0.00			1" Ice	0.51	0.25	0.02
ATMAA1412D-1A20	A	From Leg	3.00	0.0000	160.00	No Ice	1.00	0.41	0.01
(T-Mobile)			0.00			1/2" Ice	1.13	0.50	0.02
			0.00			1" Ice	1.26	0.59	0.03
ATMAA1412D-1A20	B	From Leg	3.00	0.0000	160.00	No Ice	1.00	0.41	0.01
(T-Mobile)			0.00			1/2" Ice	1.13	0.50	0.02
			0.00			1" Ice	1.26	0.59	0.03
ATMAA1412D-1A20	C	From Leg	3.00	0.0000	160.00	No Ice	1.00	0.41	0.01
(T-Mobile)			0.00			1/2" Ice	1.13	0.50	0.02
			0.00			1" Ice	1.26	0.59	0.03
782 11056	A	From Leg	3.00	0.0000	160.00	No Ice	0.15	0.08	0.00
(T-Mobile)			0.00			1/2" Ice	0.20	0.13	0.00
			0.00			1" Ice	0.26	0.18	0.01
782 11056	B	From Leg	3.00	0.0000	160.00	No Ice	0.15	0.08	0.00
(T-Mobile)			0.00			1/2" Ice	0.20	0.13	0.00
			0.00			1" Ice	0.26	0.18	0.01
782 11056	C	From Leg	3.00	0.0000	160.00	No Ice	0.15	0.08	0.00
(T-Mobile)			0.00			1/2" Ice	0.20	0.13	0.00
			0.00			1" Ice	0.26	0.18	0.01
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(E) SitePRO1 HM6 6'	A	From Leg	3.00	0.0000	180.00	No Ice	2.64	4.40	0.08
Stanoffs			0.00			1/2" Ice	3.69	6.20	0.10
(Town of Waterford)			0.00			1" Ice	4.74	8.00	0.12
(E) SitePRO1 HM6 6'	B	From Leg	3.00	0.0000	180.00	No Ice	2.64	4.40	0.08
Stanoffs			0.00			1/2" Ice	3.69	6.20	0.10
(Town of Waterford)			0.00			1" Ice	4.74	8.00	0.12
(E) T-Frame	A	From Leg	3.00	0.0000	170.00	No Ice	18.81	9.20	0.30
(AT&T)			0.00			1/2" Ice	25.20	13.30	0.40
			0.00			1" Ice	31.59	17.40	0.50
(E) T-Frame	B	From Leg	3.00	0.0000	170.00	No Ice	18.81	9.20	0.30
(AT&T)			0.00			1/2" Ice	25.20	13.30	0.40
			0.00			1" Ice	31.59	17.40	0.50
(E) T-Frame	C	From Leg	3.00	0.0000	170.00	No Ice	18.81	9.20	0.30
(AT&T)			0.00			1/2" Ice	25.20	13.30	0.40
			0.00			1" Ice	31.59	17.40	0.50
(E)T-Frame	A	From Leg	3.00	0.0000	160.00	No Ice	10.60	5.00	0.26
(T-Mobile)			0.00			1/2" Ice	16.80	8.00	0.36
			0.00			1" Ice	23.00	11.00	0.46
(E)T-Frame	B	From Leg	3.00	0.0000	160.00	No Ice	10.60	5.00	0.26

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(T-Mobile)			0.00			1/2" Ice	16.80	8.00	0.36
			0.00			1" Ice	23.00	11.00	0.46
(E)T-Frame	C	From Leg	3.00	0.0000	160.00	No Ice	10.60	5.00	0.26
(T-Mobile)			0.00			1/2" Ice	16.80	8.00	0.36
			0.00			1" Ice	23.00	11.00	0.46
(E)T-Frame	A	From Leg	3.00	0.0000	140.00	No Ice	10.60	5.00	0.26
(Verizon)			0.00			1/2" Ice	16.80	8.00	0.36
			0.00			1" Ice	23.00	11.00	0.46
(E)T-Frame	B	From Leg	3.00	0.0000	140.00	No Ice	10.60	5.00	0.26
(Verizon)			0.00			1/2" Ice	16.80	8.00	0.36
			0.00			1" Ice	23.00	11.00	0.46
(E)T-Frame	C	From Leg	3.00	0.0000	140.00	No Ice	10.60	5.00	0.26
(Verizon)			0.00			1/2" Ice	16.80	8.00	0.36
			0.00			1" Ice	23.00	11.00	0.46
(3) (E)Antenna Pipe Mount	A	From Leg	3.00	0.0000	170.00	No Ice	1.32	1.32	0.04
(AT&T)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(3) (E)Antenna Pipe Mount	B	From Leg	3.00	0.0000	170.00	No Ice	1.32	1.32	0.04
(AT&T)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(3) (E)Antenna Pipe Mount	C	From Leg	3.00	0.0000	170.00	No Ice	1.32	1.32	0.04
(AT&T)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(2) (E)Antenna Pipe Mount	A	From Leg	4.00	0.0000	160.00	No Ice	1.32	1.32	0.04
(T-Mobile)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(2) (E)Antenna Pipe Mount	B	From Leg	4.00	0.0000	160.00	No Ice	1.32	1.32	0.04
(T-Mobile)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(2) (E)Antenna Pipe Mount	C	From Leg	4.00	0.0000	160.00	No Ice	1.32	1.32	0.04
(T-Mobile)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(4) (E)Antenna Pipe Mount	A	From Leg	4.00	0.0000	140.00	No Ice	1.32	1.32	0.04
(Verizon)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(4) (E)Antenna Pipe Mount	B	From Leg	4.00	0.0000	140.00	No Ice	1.32	1.32	0.04
(Verizon)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
(4) (E)Antenna Pipe Mount	C	From Leg	4.00	0.0000	140.00	No Ice	1.32	1.32	0.04
(Verizon)			0.00			1/2" Ice	1.58	1.58	0.06
			0.00			1" Ice	1.84	1.84	0.07
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(E)Antel BXA-80063/6CF	A	From Leg	3.00	0.0000	140.00	No Ice	7.74	4.17	0.02
(Verizon)			0.00			1/2" Ice	8.44	4.63	0.06
			0.00			1" Ice	9.13	5.10	0.10
(E)Antel BXA-80063/6CF	B	From Leg	3.00	0.0000	140.00	No Ice	7.74	4.17	0.02
(Verizon)			0.00			1/2" Ice	8.44	4.63	0.06
			0.00			1" Ice	9.13	5.10	0.10
(E)Antel BXA-80063/6CF	C	From Leg	3.00	0.0000	140.00	No Ice	7.74	4.17	0.02
(Verizon)			0.00			1/2" Ice	8.44	4.63	0.06
			0.00			1" Ice	9.13	5.10	0.10
(E)Antel BXA-70063/6CF	A	From Leg	3.00	0.0000	140.00	No Ice	7.74	4.17	0.02
(Verizon)			0.00			1/2" Ice	8.44	4.63	0.06
			0.00			1" Ice	9.13	5.10	0.10
(E)Antel BXA-70063/6CF	B	From Leg	3.00	0.0000	140.00	No Ice	7.74	4.17	0.02

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(Verizon)			0.00			1/2" Ice	8.44	4.63	0.06
			0.00			1" Ice	9.13	5.10	0.10
(E)Antel BXA-70063/6CF	C	From Leg	3.00	0.0000	140.00	No Ice	7.74	4.17	0.02
(Verizon)			0.00			1/2" Ice	8.44	4.63	0.06
			0.00			1" Ice	9.13	5.10	0.10
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(P)AM-X-CD-16-65-00T-RE	A	From Leg	3.00	0.0000	170.00	No Ice	5.51	2.83	0.03
T			0.00			1/2" Ice	6.01	3.22	0.06
(AT&T)			0.00			1" Ice	6.52	3.61	0.08
(P)	B	From Leg	3.00	0.0000	170.00	No Ice	5.51	2.83	0.03
AM-X-CD-16-65-00T-RET			0.00			1/2" Ice	6.01	3.22	0.06
(AT&T)			0.00			1" Ice	6.52	3.61	0.08
(P)AM-X-CD-16-65-00T-RE	C	From Leg	3.00	0.0000	170.00	No Ice	5.51	2.83	0.03
T			0.00			1/2" Ice	6.01	3.22	0.06
(AT&T)			0.00			1" Ice	6.52	3.61	0.08
(2) (P) TT19-08BP111-001	A	From Leg	2.00	0.0000	170.00	No Ice	0.64	0.52	0.02
TMA			0.00			1/2" Ice	0.76	0.62	0.02
(AT&T)			0.00			1" Ice	0.88	0.74	0.03
(2) (P) TT19-08BP111-001	B	From Leg	2.00	0.0000	170.00	No Ice	0.64	0.52	0.02
TMA			0.00			1/2" Ice	0.76	0.62	0.02
(AT&T)			0.00			1" Ice	0.88	0.74	0.03
(2) (P) TT19-08BP111-001	C	From Leg	2.00	0.0000	170.00	No Ice	0.64	0.52	0.02
TMA			0.00			1/2" Ice	0.76	0.62	0.02
(AT&T)			0.00			1" Ice	0.88	0.74	0.03
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(2) SBNHH-1D65B	A	From Leg	3.00	0.0000	140.00	No Ice	8.05	5.34	0.05
(Verizon)			0.00			1/2" Ice	8.51	5.79	0.10
			0.00			1" Ice	8.97	6.26	0.16
(2) SBNHH-1D65B	B	From Leg	3.00	0.0000	140.00	No Ice	8.05	5.34	0.05
(Verizon)			0.00			1/2" Ice	8.51	5.79	0.10
			0.00			1" Ice	8.97	6.26	0.16
(2) SBNHH-1D65B	C	From Leg	3.00	0.0000	140.00	No Ice	8.05	5.34	0.05
(Verizon)			0.00			1/2" Ice	8.51	5.79	0.10
			0.00			1" Ice	8.97	6.26	0.16
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B66 RRH4X45 AWS	A	From Leg	3.00	0.0000	140.00	No Ice	2.45	1.43	0.06
(Verizon)			0.00			1/2" Ice	2.66	1.61	0.08
			0.00			1" Ice	2.88	1.79	0.10
B66 RRH4X45 AWS	B	From Leg	3.00	0.0000	140.00	No Ice	2.45	1.43	0.06
(Verizon)			0.00			1/2" Ice	2.66	1.61	0.08
			0.00			1" Ice	2.88	1.79	0.10
B66 RRH4X45 AWS	C	From Leg	3.00	0.0000	140.00	No Ice	2.45	1.43	0.06
(Verizon)			0.00			1/2" Ice	2.66	1.61	0.08
			0.00			1" Ice	2.88	1.79	0.10
**									
RRH 700 4X30 B13	A	From Leg	3.00	0.0000	140.00	No Ice	2.16	1.62	0.06
(Verizon)			0.00			1/2" Ice	2.35	1.79	0.08
			0.00			1" Ice	2.55	1.97	0.10
RRH 700 4X30 B13	B	From Leg	3.00	0.0000	140.00	No Ice	2.16	1.62	0.06
(Verizon)			0.00			1/2" Ice	2.35	1.79	0.08
			0.00			1" Ice	2.55	1.97	0.10
RRH 700 4X30 B13	C	From Leg	3.00	0.0000	140.00	No Ice	2.16	1.62	0.06
(Verizon)			0.00			1/2" Ice	2.35	1.79	0.08

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00			1" Ice	2.55	1.97	0.10
**									
DB-T1-6Z-8AB-0Z (Verizon)	A	From Leg	3.00	0.0000	140.00	No Ice	4.80	2.00	0.04
			0.00			1/2" Ice	5.07	2.19	0.08
			0.00			1" Ice	5.35	2.39	0.12
DB-T1-6Z-8AB-0Z (Verizon)	B	From Leg	3.00	0.0000	140.00	No Ice	4.80	2.00	0.04
			0.00			1/2" Ice	5.07	2.19	0.08
			0.00			1" Ice	5.35	2.39	0.12
**									
**									

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	1.2D+1.6W (pattern 1) 0 deg - No Ice
4	1.2D+1.6W (pattern 2) 0 deg - No Ice
5	0.9 Dead+1.6 Wind 0 deg - No Ice
6	1.2 Dead+1.6 Wind 30 deg - No Ice
7	1.2D+1.6W (pattern 1) 30 deg - No Ice
8	1.2D+1.6W (pattern 2) 30 deg - No Ice
9	0.9 Dead+1.6 Wind 30 deg - No Ice
10	1.2 Dead+1.6 Wind 60 deg - No Ice
11	1.2D+1.6W (pattern 1) 60 deg - No Ice
12	1.2D+1.6W (pattern 2) 60 deg - No Ice
13	0.9 Dead+1.6 Wind 60 deg - No Ice
14	1.2 Dead+1.6 Wind 90 deg - No Ice
15	1.2D+1.6W (pattern 1) 90 deg - No Ice
16	1.2D+1.6W (pattern 2) 90 deg - No Ice
17	0.9 Dead+1.6 Wind 90 deg - No Ice
18	1.2 Dead+1.6 Wind 120 deg - No Ice
19	1.2D+1.6W (pattern 1) 120 deg - No Ice
20	1.2D+1.6W (pattern 2) 120 deg - No Ice
21	0.9 Dead+1.6 Wind 120 deg - No Ice
22	1.2 Dead+1.6 Wind 150 deg - No Ice
23	1.2D+1.6W (pattern 1) 150 deg - No Ice
24	1.2D+1.6W (pattern 2) 150 deg - No Ice
25	0.9 Dead+1.6 Wind 150 deg - No Ice
26	1.2 Dead+1.6 Wind 180 deg - No Ice
27	1.2D+1.6W (pattern 1) 180 deg - No Ice
28	1.2D+1.6W (pattern 2) 180 deg - No Ice
29	0.9 Dead+1.6 Wind 180 deg - No Ice
30	1.2 Dead+1.6 Wind 210 deg - No Ice
31	1.2D+1.6W (pattern 1) 210 deg - No Ice
32	1.2D+1.6W (pattern 2) 210 deg - No Ice
33	0.9 Dead+1.6 Wind 210 deg - No Ice
34	1.2 Dead+1.6 Wind 240 deg - No Ice
35	1.2D+1.6W (pattern 1) 240 deg - No Ice
36	1.2D+1.6W (pattern 2) 240 deg - No Ice

Comb. No.	Description
37	0.9 Dead+1.6 Wind 240 deg - No Ice
38	1.2 Dead+1.6 Wind 270 deg - No Ice
39	1.2D+1.6W (pattern 1) 270 deg - No Ice
40	1.2D+1.6W (pattern 2) 270 deg - No Ice
41	0.9 Dead+1.6 Wind 270 deg - No Ice
42	1.2 Dead+1.6 Wind 300 deg - No Ice
43	1.2D+1.6W (pattern 1) 300 deg - No Ice
44	1.2D+1.6W (pattern 2) 300 deg - No Ice
45	0.9 Dead+1.6 Wind 300 deg - No Ice
46	1.2 Dead+1.6 Wind 330 deg - No Ice
47	1.2D+1.6W (pattern 1) 330 deg - No Ice
48	1.2D+1.6W (pattern 2) 330 deg - No Ice
49	0.9 Dead+1.6 Wind 330 deg - No Ice
50	1.2 Dead+1.0 Ice+1.0 Temp
51	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
52	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
53	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
54	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
55	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
56	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
57	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
58	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
59	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
60	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
61	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
62	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
63	Dead+Wind 0 deg - Service
64	Dead+Wind 30 deg - Service
65	Dead+Wind 60 deg - Service
66	Dead+Wind 90 deg - Service
67	Dead+Wind 120 deg - Service
68	Dead+Wind 150 deg - Service
69	Dead+Wind 180 deg - Service
70	Dead+Wind 210 deg - Service
71	Dead+Wind 240 deg - Service
72	Dead+Wind 270 deg - Service
73	Dead+Wind 300 deg - Service
74	Dead+Wind 330 deg - Service

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 160	2.994	63	0.1747	0.0368
T2	160 - 140	2.261	63	0.1661	0.0324
T3	140 - 120	1.589	63	0.1375	0.0272
T4	120 - 90	1.051	63	0.0990	0.0200
T5	90 - 60	0.558	63	0.0584	0.0094
T6	60 - 30	0.251	63	0.0341	0.0047
T7	30 - 0	0.073	63	0.0161	0.0020

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	(E) Lightning Rod	63	2.994	0.1747	0.0368	327782
170.00	(E)Powerwave 7770.00	63	2.624	0.1721	0.0347	163891
160.00	APX16DWV-16DWVS-E-A20	63	2.261	0.1661	0.0324	81093
140.00	(E)T-Frame	63	1.589	0.1375	0.0272	35864

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	180 - 160	14.129	2	0.8211	0.1774
T2	160 - 140	10.680	2	0.7817	0.1563
T3	140 - 120	7.516	2	0.6473	0.1309
T4	120 - 90	4.977	2	0.4664	0.0965
T5	90 - 60	2.647	2	0.2752	0.0453
T6	60 - 30	1.195	2	0.1607	0.0228
T7	30 - 0	0.349	2	0.0759	0.0095

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
180.00	(E) Lightning Rod	2	14.129	0.8211	0.1774	70655
170.00	(E)Powerwave 7770.00	2	12.388	0.8094	0.1671	35327
160.00	APX16DWV-16DWVS-E-A20	2	10.680	0.7817	0.1563	17443
140.00	(E)T-Frame	2	7.516	0.6473	0.1309	7487

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T2	160	Leg	A325N	1.1250	6	3.23	67.10	0.048 ✔	1	Bolt Tension
T3	140	Leg	A325N	1.2500	6	12.64	82.83	0.153 ✔	1	Bolt Tension
T4	120	Leg	A325N	1.2500	6	29.23	82.83	0.353 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	3.65	8.97	0.407 ✔	1	Member Block Shear
T5	90	Leg	A325N	1.2500	6	32.73	82.83	0.395 ✔	1	Bolt Tension
		Diagonal	A325N	0.7500	1	5.16	9.46	0.546 ✔	1	Member Bearing
T6	60	Leg	A325N	1.2500	6	37.24	82.83	0.450 ✔	1	Bolt Tension
		Diagonal	A325N	0.8750	1	6.86	14.79	0.464 ✔	1	Member Bearing
T7	30	Diagonal	A325N	0.8750	1	8.23	18.49	0.445 ✔	1	Member Bearing

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	1 3/4	20.00	3.32	91.0 K=1.00	2.4053	-22.01	59.04	0.373 [1] ✔
T2	160 - 140	2 1/2	20.00	3.31	63.5 K=1.00	4.9087	-81.68	164.54	0.496 [1] ✔
T3	140 - 120	3 1/2	20.00	3.32	45.5 K=1.00	9.6211	-175.33	372.07	0.471 [1] ✔
T4	120 - 90	4 1/4	30.11	7.53	85.0 K=1.00	14.1863	-206.56	376.30	0.549 [1] ✔
T5	90 - 60	4 1/2	30.11	7.53	80.3 K=1.00	15.9043	-239.83	446.66	0.537 [1] ✔
T6	60 - 30	4 3/4	30.11	7.53	76.1 K=1.00	17.7205	-277.86	522.30	0.532 [1] ✔
T7	30 - 0	4 3/4	30.11	7.53	76.1 K=1.00	17.7205	-317.52	522.30	0.608 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	7/8	6.00	2.91	143.8 K=0.90	0.6013	-3.30	6.57	0.503 [1] ✔
T2	160 - 140	1	5.99	2.87	124.1 K=0.90	0.7854	-6.13	11.53	0.532 [1] ✔
T3	140 - 120	1 1/8	6.00	2.83	108.5 K=0.90	0.9940	-10.16	18.91	0.537 [1] ✔
T4	120 - 90	L2 1/2x2 1/2x3/16	11.67	5.84	141.5 K=1.00	0.9023	-3.82	10.18	0.375 [1] ✔
T5	90 - 60	L3x3x3/16	15.39	7.67	154.3 K=1.00	1.0898	-5.32	10.34	0.515 [1] ✔
T6	60 - 30	L3 1/2x3 1/2x1/4	19.44	9.66	167.1 K=1.00	1.6900	-7.03	13.68	0.514 [1] ✔
T7	30 - 0	L4x4x5/16	23.66	11.77	178.5	2.4000	-8.42	17.01	0.495 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
					K=1.00				✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	7/8	5.00	4.85	186.4 K=0.70	0.6013	-0.13	3.91	0.032 [1] ✔
T2	160 - 140	1	5.00	4.79	161.0 K=0.70	0.7854	-0.27	6.85	0.040 [1] ✔
T3	140 - 120	1 1/8	5.00	4.71	140.6 K=0.70	0.9940	-0.27	11.36	0.024 [1] ✔

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	7/8	5.00	4.85	186.4 K=0.70	0.6013	-0.19	3.91	0.048 [1] ✔
T2	160 - 140	1	5.00	4.79	161.0 K=0.70	0.7854	-0.21	6.85	0.030 [1] ✔
T3	140 - 120	1 1/8	5.00	4.71	140.6 K=0.70	0.9940	-2.26	11.36	0.199 [1] ✔

[1] P_u / ϕP_n controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	1 3/4	20.00	3.32	91.0	2.4053	19.41	108.24	0.179 [1] ✔
T2	160 - 140	2 1/2	20.00	3.31	63.5	4.9087	75.83	220.89	0.343 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T3	140 - 120	3 1/2	20.00	3.32	45.5	9.6211	164.84	432.95	0.381 [1]
T4	120 - 90	4 1/4	30.11	7.53	85.0	14.1863	190.44	638.38	0.298 [1]
T5	90 - 60	4 1/2	30.11	7.53	80.3	15.9043	216.36	715.69	0.302 [1]
T6	60 - 30	4 3/4	30.11	7.53	76.1	17.7205	245.24	797.42	0.308 [1]
T7	30 - 0	4 3/4	30.11	7.53	76.1	17.7205	274.12	797.42	0.344 [1]

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	7/8	6.00	2.91	159.8	0.6013	3.27	27.06	0.121 [1]
T2	160 - 140	1	5.99	2.87	137.9	0.7854	6.05	35.34	0.171 [1]
T3	140 - 120	1 1/8	6.00	2.83	120.6	0.9940	9.90	44.73	0.221 [1]
T4	120 - 90	L2 1/2x2 1/2x3/16	11.67	5.84	92.1	0.5537	3.65	24.09	0.152 [1]
T5	90 - 60	L3x3x3/16	15.39	7.67	99.7	0.6943	5.16	30.20	0.171 [1]
T6	60 - 30	L3 1/2x3 1/2x1/4	19.44	9.66	108.0	1.0800	6.86	46.98	0.146 [1]
T7	30 - 0	L4x4x5/16	23.66	11.77	115.3	1.5656	8.23	68.10	0.121 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	7/8	5.00	4.85	266.3	0.6013	0.10	27.06	0.004 [1]
T2	160 - 140	1	5.00	4.79	230.0	0.7854	0.29	35.34	0.008 [1]
T3	140 - 120	1 1/8	5.00	4.71	200.9	0.9940	0.30	44.73	0.007 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
									✔

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	180 - 160	7/8	5.00	4.85	266.3	0.6013	0.20	27.06	0.007 [1] ✔
T2	160 - 140	1	5.00	4.79	230.0	0.7854	0.22	35.34	0.006 [1] ✔
T3	140 - 120	1 1/8	5.00	4.71	200.9	0.9940	1.91	44.73	0.043 [1] ✔

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	180 - 160	Leg	1 3/4	3	-22.01	59.04	37.3	Pass
		Diagonal	7/8	13	-3.30	6.57	50.3	Pass
		Top Girt	7/8	6	-0.13	3.91	3.2	Pass
		Bottom Girt	7/8	7	-0.19	3.91	4.8	Pass
T2	160 - 140	Leg	2 1/2	48	-81.68	164.54	49.6	Pass
		Diagonal	1	58	-6.13	11.53	53.2	Pass
		Top Girt	1	50	-0.27	6.85	4.0	Pass
		Bottom Girt	1	52	-0.21	6.85	3.0	Pass
T3	140 - 120	Leg	3 1/2	93	-175.33	372.07	47.1	Pass
		Diagonal	1 1/8	103	-10.16	18.91	53.7	Pass
		Top Girt	1 1/8	94	-0.27	11.36	2.4	Pass
		Bottom Girt	1 1/8	98	-2.26	11.36	19.9	Pass
T4	120 - 90	Leg	4 1/4	138	-206.56	376.30	54.9	Pass
		Diagonal	L2 1/2x2 1/2x3/16	141	-3.82	10.18	37.5 40.7 (b)	Pass
T5	90 - 60	Leg	4 1/2	165	-239.83	446.66	53.7	Pass
		Diagonal	L3x3x3/16	168	-5.32	10.34	51.5 54.6 (b)	Pass
T6	60 - 30	Leg	4 3/4	192	-277.86	522.30	53.2	Pass
		Diagonal	L3 1/2x3 1/2x1/4	195	-7.03	13.68	51.4	Pass
T7	30 - 0	Leg	4 3/4	219	-317.52	522.30	60.8	Pass
		Diagonal	L4x4x5/16	222	-8.42	17.01	49.5	Pass
							Summary	
						Leg (T7)	60.8	Pass
						Diagonal (T5)	54.6	Pass
						Top Girt (T2)	4.0	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
						Bottom Girt (T3)	19.9	Pass
						Bolt Checks	54.6	Pass
						RATING =	**60.8**	**Pass**

Program Version 7.0.7.0 - 7/18/2016 File:P:/2016/Structural/16-3864 CT09865-S-02-Niantic Structural Analysis/TNXtower/CT09865-S-02 Niantic_AT&T_TNX_10272016.eri

MATHCAD CALCULATION PRINTOUT

Existing 180 ft. Self Supporting Tower Foundation Check

Customer Name: SBA Communications Corp
Customer Site Name: Niantic
Customer Site ID: CT09865-S-02

Carrier Name: Verizon
Carrier Site Name: Waterford South

Site Location:
Southwest School 51 Daniels Road
Waterford, CT

Latitude: 41.330264
Longitude: -72.166672

ACGI Job # 16-3864

(Previous Job ACGI Job # 16-1025)

Foundation check

-Foundation Reactions-

(As per TNX output, Factored, G Code)

Total Shear	$S := 62 \cdot kips$	Compression on Pedestal:	$P_c := 321 \cdot kips$
Moment	$M := 5981 \cdot ft\_K$	Uplift on Pedestal:	$P_{up} := 277 \cdot kips$
Down load, Tower weight	$Pv := 63kips$	Shear on Pedestal:	$Sh := 40 \cdot kips$

-Soil Properties- **Soil data as per Geotechnical Report by Dr. Clearance Welti, P.E., P.C. Geotechnical Engineering (Ref: Geotechnical Study for proposed Cell Tower at Southwest School 51 Daniels Road, Waterford, CT -SBA Network Services, Inc. dated 10/23/2008)**

Allowable Bearing Capacity	$Brg_{allw} := 4.408 \cdot ksf$	Safety Factor $SF := 2.0$	(Estimated)
Internal friction angle,	$\phi := 34deg$	$Brg_{uc} := SF \cdot Brg_{allw} = 8.816 \cdot ksf$	
Unit wt. of soil,	$\gamma_s := 0.125 \cdot kcf$		
Alowable Passive Pressure	see next page		
Cohesion of soil,	$c_u := 0 \cdot ksf$		
Friction Factor	$FF := 0.6$		(Estimated)
Depth to be neglected	$L_{neg} := 1 \cdot ft$		

-Material Parameters-

Conforming to the design requirements as in ACI 318-05

Unit wt. of concrete,	$\gamma_c := 0.150 \cdot kcf$
Concrete compressive strength,	$f_c := 3000 \cdot psi$
Rebar yield strength,	$f_y := 60000 \cdot psi$

-Factor of Safety for soil strength-

$\phi_{s\_Bear} := 0.75$	as per EIA/TIA-222-G code for bearing, 9.4.1 - for SST/MP
$\phi_{s\_friction} := 0.75$	as per EIA/TIA-222-G code for skin friction resistance, 9.4.1
$\phi_{s\_lateral} := 0.75$	as per EIA/TIA-222-G code for lateral resistance, 9.4.1
$\phi_{s\_uplift} := 0.75$	as per EIA/TIA-222-G code for lateral resistance, 9.4.1

DIMENSIONS

Tower face width $TWFW := 23.0 \cdot ft$ Tower ht. $Tw_{ht} := 180 \cdot ft$

The tower location is eccentric by $L_{pe} := 0 \cdot ft$ with respect to the mat foundation center towards the base

Type of column, col.t=0 for circular,=1 for rectangular/square $col_t := 0$

Depth of mat,	$D_f := 6.5 \cdot ft$		
Thickness of mat,	$T_f := 2.0 \cdot ft$		
Pedestal size,	$Ped_s := 3.5 \cdot ft$	No. of pedestals	$Nped := 3$
Extension above the grade,	$E_g := 0.5 \cdot ft$		
Mat Dimensions, LxB	$L := 36.0 \cdot ft$	$B := L$	$B = 36\,ft$

-(Existing Mat foundation data is as per original foundation design by Tower Innovations, Project Number 5210 dated 11/5/2008).

-Reinforcement Data-

Typical concrete cover $cc := 3in$

Vertical rebar size $d_{bar} := 8$

Tiebar size $d_{tie} := 4$

MAT SIZING CALCULATIONS

Check of mat size

$$K_p := \tan\left(45\cdot deg + \frac{\phi}{2}\right)^2 \qquad K_p = 3.537$$

$$P_{pave} := \frac{\left(D_f - T_f - L_{neg}\right)\cdot K_p\cdot\gamma_s + \left(D_f - L_{neg}\right)\cdot K_p\cdot\gamma_s}{2} = 1.99\cdot ksf$$

Safety against overturning and location of resultant on the base

Resisting Moments about mid axis parallel to base

$$Area_{ped} := if\left(col_t = 1, Ped_s^2, \frac{\pi}{4}\cdot Ped_s^2\right) \qquad Area_{ped} = 9.621\ ft^2$$

component	value, kips	lever arm, ft	resisting moment, ft-kips
1) Concrete wt.	$C_w := L\cdot B\cdot T_f\cdot\gamma_c + Area_{ped}\cdot\gamma_c\cdot\left(D_f + E_g - T_f\right)\cdot Nped$	$L_c := \frac{L}{2}$	$R_c := C_w\cdot L_c$
	$C_w = 410.448\cdot kips$	$L_c = 18\ ft$	$R_c = 7388.056\cdot ft\_K$
2) Soil wt.	$S_w := \left[L\cdot B\cdot\left(D_f - T_f\right) - Area_{ped}\cdot\left(D_f - T_f\right)\cdot Nped\right]\cdot\gamma_s$	$L_s := \frac{L}{2}$	$R_s := S_w\cdot L_s$
	$S_w = 712.764\cdot kips$	$L_s = 18\ ft$	$R_s = 12829.758\cdot ft\_K$
3) Wt. of soil wedge	$W_w := \left(D_f\right)\cdot\frac{1}{2}\cdot\left(D_f\cdot\tan(\phi)\right)\cdot B\cdot\left(\gamma_s\right)$	$L_w := \left(L + D_f\cdot\frac{\tan(\phi)}{3}\right)$	$R_w := W_w\cdot L_w$
	$W_w = 64.12\cdot kips$	$L_w = 37.461\ ft$	$R_w = 2402.045\cdot ft\_K$
4) Passive pressure	$Pe_p := T_f\cdot B\cdot P_{pave}$	$L_p := \frac{T_f}{3}$	$R_p := Pe_p\cdot L_p$
	$Pe_p = 143.254\cdot kips$	$L_p = 0.667\ ft$	$R_p = 95.503\cdot ft\_K$
5) Vertical	$Pv = 63\cdot kips$	$L_v := \frac{L}{2}$	$R_v := Pv\cdot L_v$
$S_{w1} := L\cdot B\cdot D_f\cdot\gamma_s$	$S_{w1} = 1053\cdot kips$ <--- for net calcs		
Total weight=	$T_w := C_w + S_w + W_w + Pv$ $T_w = 1250.332\cdot kips$	$L_v = 18\ ft$	$R_v = 1134\cdot ft\_K$
Total resisting Moment=	$M_r := R_c + R_s + R_w + R_p + R_v$	$M_r = 23849.361\cdot ft\_K$	

Overturning Moments

component	value, kips	lever arm, ft	Overturning Moment ft-kips
1) Moment on foundation due to eccentric location of tower	$Pv = 63 \cdot kips$	$L_{pe} = 0$	$M_{pe} := L_{pe} \cdot Pv$ $M_{pe} = 0 \cdot ft\_K$
2) Moment on foundation	-	-	$M = 5981 \cdot ft\_K$
3) Moment due to horizontal shear	$S_t := S$	$L_{hs} := D_f + E_g$ $L_{hs} = 7\ ft$	$O_{hs} := L_{hs} \cdot S_t$ $O_{hs} = 434 \cdot ft\_K$

Total Overturning Moment= $M_o := M + O_{hs} + M_{pe}$ $M_o = 6415 \cdot ft\_K$

Check Safety Factor against Overturning about mid axis parallel to base

$SF := \frac{M_r}{M_o}$ $SF = 3.718 > 1.5$ OK! Calculate eccentricity, e $e := \frac{M_o}{T_w}$ $e = 5.131\ ft$

Check location of eccentricity and determine pressure distribution under the mat

$L_{loc} := \frac{L}{6}$ $L_{loc} = 6\ ft$ For net bearing calcs $T_{w1} := S_{w1} + W_w$ $T_{w1} = 1117.12 \cdot kips$

$P_{max1} := if\left[e \le L_{loc}, \frac{T_w}{L \cdot B} \cdot \left[1 + \left(6 \cdot \frac{e}{L}\right)\right], 4 \cdot \frac{T_w}{3 \cdot B \cdot (L - 2 \cdot e)}\right]$ $P_{max1} = 1.79 \cdot ksf$

$P_{max2} := \left(\frac{T_{w1}}{L \cdot B}\right)$ $P_{max2} = 0.862 \cdot ksf$ $P_{net} := P_{max1} - P_{max2}$ $P_{max} := P_{net} = 0.928 \cdot ksf$

Net soil pressure, $P_{net} = 0.928 \cdot ksf$ < $\phi \cdot Brg_{uc} = 5.232 \cdot ksf$ **Pass!** $\frac{P_{net}}{0.75 Brg_{uc}} = 14.031 \cdot \%$

$P_{min} := if\left[e \le L_{loc}, \frac{T_w}{L \cdot B} \cdot \left[1 - \left(6 \cdot \frac{e}{L}\right)\right], 0 \cdot ksf\right]$ $P_{min} = 0.14 \cdot ksf$

Check for horizontal shear $P_{hor} := Pe_p + Pv \cdot 0.35$

$P_{hor} = 165.304 \cdot kips$ $S = 62 \cdot kips$ Since P.hor > S it is safe! $\frac{S}{P_{hor}} = 37.507 \cdot \%$

Check for uplift

Component	Down load value, kips	
1) Soil Weight	$S_{w1} := \left[L \cdot B \cdot (D_f - T_f) - Area_{ped} \cdot (D_f - T_f) \cdot Nped\right] \cdot \gamma_s$	$S_{w1} = 712.764 \cdot kips$
2) Wt. of soil wedge	$W_{w1} := (D_f) \cdot \frac{1}{2} \cdot (D_f \cdot \tan(\phi)) \cdot B \cdot (\gamma_s)$	$W_{w1} = 64.12 \cdot kips$
3) Concrete wt.	$C_{w1} := L \cdot B \cdot T_f \cdot (\gamma_c) + Area_{ped} \cdot \gamma_c \cdot (D_f + E_g - T_f) \cdot Nped$	$C_{w1} = 410.448 \cdot kips$

Total down load:

$TWT1 := S_{w1} + W_{w1} + C_{w1}$ $TWT1 = 1187.332 \cdot kips$ Total down load

$T_{down} := \phi_{s\_uplift} \cdot TWT1$ $T_{down} = 890.499 \cdot kips$ > $P_{up} = 277 \cdot kips$ $\frac{P_{up}}{T_{down}} = 31.106 \cdot \%$ **OK!**

REINFORCED CONCRETE CHECK CALCULATIONS

General Input parameters

Concrete Cover, $cc := 3.0 \cdot in$

Reduction factors as per respective ACI sections

$\phi_{shear} := 0.85$ as per ACI 9.3.2.3

$\phi_{compr} := 0.75$ as per ACI 9.3.2.2

$\phi_{axten} := 0.9$ as per ACI 9.3.2.2 a

Reinforced concrete load factor as per EIA 3.1.16 $RC_{fac} := 1.0$

(Loads already factored under TIA/EIA-222-G Code)

Check for wide beam or single shear in mat

Allowable shear stress in concrete for wide beam shear criteria =

$\nu_{wide} := 2 \cdot \phi_{shear} \cdot \sqrt{f_c \cdot psi}$ $\nu_{wide} = 93.113 \cdot psi$

Effective depth of steel $d := T_f - cc$ $d = 21 \cdot in$ $L_{eff} := if(e \le L_{loc}, L, L - 2 \cdot e)$ $L_{eff} = 36\,ft$

$$dist := if\left[Nped = 3, \left(\frac{L}{2} - \frac{1}{3} \cdot \sin(60 \cdot deg) \cdot TWFW - \frac{1}{2} \cdot Ped_s - d\right), \left(\frac{L}{2} - \frac{TWFW}{2} - \frac{1}{2} \cdot Ped_s - d\right)\right]$$

Factor load by RC $P_{maxf} := P_{max} \cdot RC_{fac}$ $P_{minf} := P_{min} \cdot RC_{fac}$

shear on the face of concrete=

$$Shear_{wide} := (dist) \cdot B \cdot \frac{\left[P_{maxf} + \left[P_{maxf} - \frac{P_{maxf} - P_{minf}}{L_{eff}} \cdot (dist)\right]\right]}{2}$$ $Shear_{wide} = 238.192 \cdot kips$

Area of concrete in shear= $A_{shear} := B \cdot d$ $A_{shear} = 9072 \cdot in^2$

Shear stress acting on concrete fa $\nu_{act} := \frac{Shear_{wide}}{A_{shear}}$ $\nu_{act} = 26.256 \cdot psi$

$\nu_{act} = 26.256 \cdot psi$ < $\nu_{wide} = 93.113 \cdot psi$ **O.K!**

Check for punching or two-way shear in mat

Calculate allowable shear stress in concrete for punching/two-way shear

$\beta := \frac{L}{B}$ $\beta = 1$ $\nu_{punch} := if\left[\left(2 + \frac{4}{\beta}\right) \cdot \phi_{shear} \cdot \sqrt{f_c \cdot psi} \le 4 \cdot \phi_{shear} \cdot \sqrt{f_c \cdot psi}, \left(2 + \frac{4}{\beta}\right) \cdot \phi_{shear} \cdot \sqrt{f_c \cdot psi}, 4 \cdot \phi_{shear} \cdot \sqrt{f_c \cdot psi}\right]$

$\nu_{punch} = 186.226 \cdot psi$ $Area_{col} := if\left[col_t = 0, \frac{\pi}{4} \cdot (Ped_s + d)^2, (Ped_s + d)^2\right]$

$P_{avg} := \frac{P_{maxf} + P_{minf}}{2}$ $Peri_{col} := if\left[col_t = 0, 2 \cdot \pi \cdot \frac{Ped_s + d}{2}, 4 \cdot (Ped_s + d)\right]$

Factor vertical load $Pvf := RC_{fac} \cdot Pv$

Shear stress acting on the concrete face= $\nu_{act} := \frac{P_c - Area_{col} \cdot P_{avg}}{Peri_{col} \cdot d \cdot 4}$

$\nu_{act} = 18.613 \cdot psi$ < $\nu_{punch} = 186.226 \cdot psi$ **O.K!**

Check of Pedestal Column

Check pedestal steel for uplift $d_i := Ped_s - 2 \cdot cc$ $d_i = 36 \cdot in$

Effective diameter/size= $D_{eff} := Ped_s - cc \cdot 2$ $D_{eff} = 36 \cdot in$ $h := Ped_s$ $h = 42 \cdot in$

$D_{pier} := Ped_s$

$M_{col} := Sh \cdot (D_f - T_f + E_g)$ $M_{col} = 200 \cdot ft\_K$ $\sigma_{bend} := 0.6 \cdot f_y$ $\sigma_{bend} = 36000 \cdot psi$

-Minimum required area of steel per ACI-

$Area_{stlmin} := 0.005 \cdot \frac{\pi}{4} \cdot D_{pier}^2$ -(ACI 10.8.4) & (ACI 10.9.1)

$Area_{stlmin} = 6.927 \cdot in^2$

-Rebar details-

Selected rebar size $d_{bar} = 8$

-Rebar details-

$No := (0 \ 1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11 \ 12 \ 13 \ 14 \ 15 \ 16 \ 17 \ 18)^T$

$d_b := (0 \ 0 \ 0 \ 0.375 \ 0.5 \ 0.625 \ 0.75 \ 0.875 \ 1.00 \ 1.125 \ 1.25 \ 1.41 \ 0 \ 0 \ 1.693 \ 0 \ 0 \ 0 \ 2.257)^T \cdot in$

$A_b := (0 \ 0 \ 0 \ 0.11 \ 0.20 \ 0.31 \ 0.44 \ 0.60 \ 0.79 \ 1.00 \ 1.27 \ 1.56 \ 0 \ 0 \ 2.25 \ 0 \ 0 \ 0 \ 4.00)^T \cdot in^2$

$B_1 := d_{bar}$ $d_{b_{B_1}} = 1 \cdot in$ Bar area= $Area_{abar} := A_{b_{B_1}}$ $Area_{abar} = 0.79 \cdot in^2$

$Lg_{dia} := d_{b_{B_1}}$

-Number of vertical rebars required-

$NRB := ceil\left(\frac{Area_{stlmin}}{Area_{abar}}\right)$ $NRB = 9$ $Area_{stluse} := Area_{abar} \cdot NRB$ $Area_{stluse} = 7.11 \cdot in^2$

Provided, $NRB := 16$

$Mn := 13000 \cdot in \cdot kips$ (From L-Pile result, attached at the end)

$0.9 \cdot Mn = 975 \cdot kips \cdot ft$ > $M_{col} = 200 \cdot kips \cdot ft$ **OK** $\frac{M_{col}}{0.9Mn} = 20.513 \cdot \%$

Provided ($NRB = 16$) $d_{bar} = 8$ vertical bars **OK**

Vertical bar spacing $S_{bar} := D_{eff} \cdot \frac{\pi}{NRB} - d_{b_{B_1}}$ $S_{bar} = 6.069 \cdot in$

Check pedestal in compression

Allowable compressive load on column ACI 10.15= $P_{comp} := \phi_{compr} \cdot 0.85 \cdot f_c \cdot Area_{ped}$ $P_{comp} = 2649.659 \cdot kips$

$P_{comp} = 2649.659 \cdot kips$ > $P_c = 321 \cdot kips$ **O.K!**

Check of mat footing

$C_{wped} := Area_{ped} \cdot \gamma_c \cdot (D_f + E_g - T_f) \cdot Nped$ Wt. of concrete pedestals

$P_{upnet} := P_{up} - \frac{C_{wped} + S_w \cdot 0.95}{Nped}$ $P_{upnet} = 44.075 \cdot kips$

Net uplift acting at mat level creating bending moment in the slab. Soil wt. reduced by 5 % to account for variation in compaction . ACI 9.3.2.2

Calculate bending moment for mat design:

$\phi_{bend} := 0.9$ $Langle := if(Nped = 3, \sin(60 \cdot deg), 1)$

$\beta_1 := if\left[f_c \le 4000 \cdot psi, 0.85, if\left[f_c \ge 8000 \cdot psi, 0.65, 0.85 - \left(\frac{f_c}{psi} - 4000\right) \cdot 0.05\right]\right]$ ACI 10.2.7.3

$B_{mo} := RC_{fac} \cdot \left[(TWFW \cdot P_{upnet}) \cdot Langle + S_t \cdot (D_f + E_g)\right]$ $B_{mo} = 1311.92 \cdot ft\_K$ (Not used, no uplift)

$B_{mo1} := \frac{P_{max} - P_{min}}{(L - 2 \cdot e) \cdot 2} \cdot \left(TWFW \cdot Langle \cdot \frac{1}{3} + \frac{Ped_s}{2}\right) \cdot \left[\left[(L - 2 \cdot e) - \left(TWFW \cdot Langle \cdot \frac{1}{3} + \frac{Ped_s}{2}\right)\right]^2 \cdot 0.5\right] \cdot B$

$W_e := TWFW \cdot Langle + Ped_s$ $W_e = 23.419\,ft$ Reinforcement middle bandwidth. $B_{mo1} = 695.766 \cdot ft \cdot kip$

required R_u $R_u := \frac{\max(B_{mo}, B_{mo1})}{\phi_{bend} \cdot B \cdot d^2}$ $R_u = 91.817 \cdot psi$ $m := \frac{f_y}{\beta_1 \cdot f_c}$ $m = 23.529$

required

$\rho := \frac{1}{m} \cdot \left[1 - \sqrt{1 - \left(\frac{2 \cdot m \cdot R_u}{f_y}\right)}\right]$ $\rho = 0.002$

required area of steel for mat=

$Ast_f := \rho \cdot B \cdot d$ $Ast_f = 14.142 \cdot in^2$

minimum area of steel required,

$Ast_{minf} := .0018 \cdot B \cdot T_f$ $Ast_{minf} = 18.662 \cdot in^2$ per ACI 10.5.3 & 7.12

$Ast_{fuse} := if(Ast_f > Ast_{minf}, Ast_f, Ast_{minf})$ $Ast_{fuse} = 18.662 \cdot in^2$

Bar size provided = $f_{bar} := 10$ $f_{dia} := \frac{f_{bar}}{8} \cdot in$ $f_{dia} = 1.25 \cdot in$

Bar area = $f_{abar} := \pi \cdot \frac{f_{dia}^2}{4}$ $f_{abar} = 1.227 \cdot in^2$

Number of bars required = $Nf_{bars} := if\left(Ast_{fuse} = Ast_{minf}, ceil\left(\frac{Ast_{fuse}}{f_{abar}}\right), ceil\left(\frac{Ast_{fuse}}{f_{abar}} \cdot \frac{L}{W_e}\right)\right)$ $Nf_{bars} = 16$

Used $Nf_{bars\_used} := 74$ > $Nf_{bars} = 16$

($Nf_{bars\_used} = 74$) # $f_{bar} = 10$ bars each way at the Top and Bottom of the mat is OK!

Foundation Check Summary

-Foundation Reactions-

Shear; $S = 62 \cdot kips$

Down load; $Pv = 63 \cdot kips$

Uplift load; $P_{up} = 277 \cdot kips$

Moment; $M = 5981 \cdot ft\_K$

Stability Calculations

Safety Factor against Overturning, $SF = 3.718$ > 1.5 OK! $\frac{1.5}{SF} = 40.347 \cdot \%$

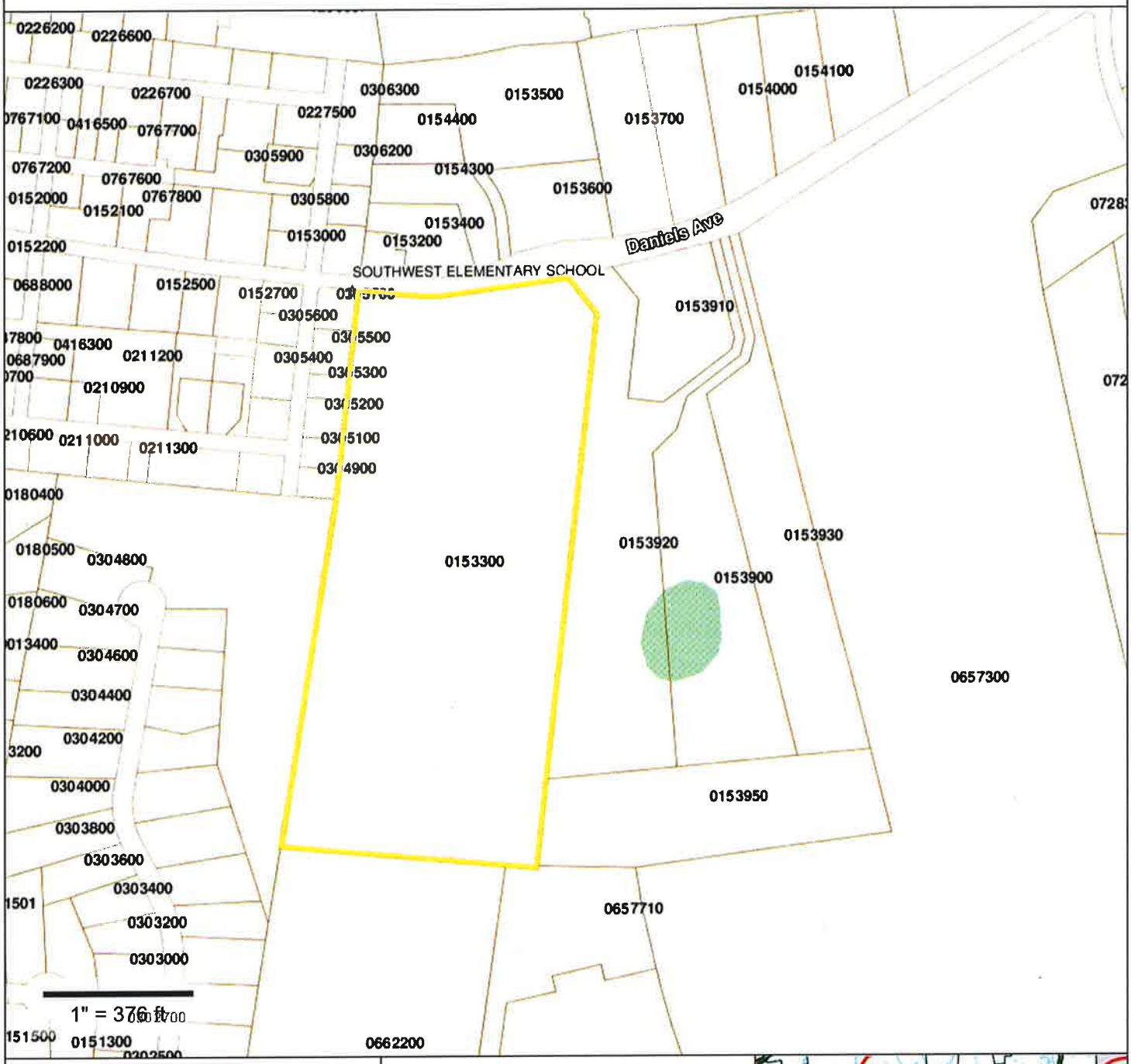
Net soil pressure, $P_{net} = 0.928 \cdot ksf$ < $Brg_{allw} = 4.408 \cdot ksf$ **OK!** $\frac{P_{net}}{Brg_{allw}} = 21.047 \cdot \%$

Check for horizontal shear, $P_{hor} = 165.304 \cdot kips$ > $S = 62 \cdot kips$ **OK!** $\frac{S}{P_{hor}} = 37.507 \cdot \%$

Check for Uplift, $T_{down} = 890.499 \cdot kips$ > $P_{up} = 277 \cdot kips$ **OK!** $\frac{P_{up}}{T_{down}} = 31.106 \cdot \%$

Steel Reinforcement Check **OK!**

ATTACHMENT 4



Property Information

Property ID 152-0153300
Location 51 DANIELS AVENUE
Owner WATERFORD TOWN OF

SCCOG Southeastern Connecticut Council of Governments Geographic Information System

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

The Town makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Parcels updated October 1, 2013

51 DANIELS AVENUE

Location	51 DANIELS AVENUE	**Assessment**	$2,782,400
Mblu	143/ / 1783/ /	**Appraisal**	$3,974,830
Acct#	00153300	**PID**	1783
		Building Count	1

Current Value

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2013	$2,294,830	$1,680,000	$3,974,830
Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2013	$1,606,400	$1,176,000	$2,782,400

Building Information

Building 1 : Section 1

Year Built: 1960
Living Area: 29626
Replacement Cost: $3,320,103
Building Percent Good: 65

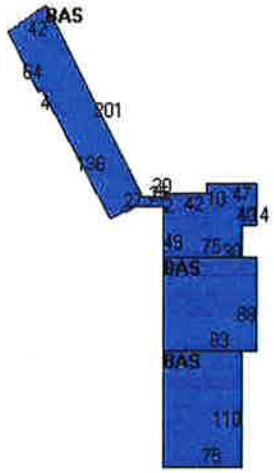
Building Attributes	
Field	**Description**
STYLE	School
MODEL	Comm/Ind
Grade	Above Ave
Stories:	1.00
Occupancy	1
Exterior Wall 1	Brick Veneer
Exterior Wall 2	
Roof Structure	Flat
Roof Cover	Rolled
Interior Wall 1	Typical
Interior Wall 2	
Interior Floor 1	Comp Tile
Interior Floor 2	
Heating Fuel	Oil

Building Photo

(http://images.vgsi.com/photos/WaterfordCTPhotos//\00\01\54

Heating Type	Hot Water
% Central Air	0
Foundation	Poured Conc
Bldg Use	Exempt Comm
Total Rooms	0
Total Bedrms	0
Total Fixtures	0
% Wet Sprinkler	
% Dry Sprinkler	
1st Floor Use	
Heat/AC	Typical
Frame Type	MASONRY
Baths/Plumbing	AVERAGE
% Finished	100
Class	C
Wall Height	10

Building Layout



Building Sub-Areas			Legend
Code	**Description**	**Gross Area**	**Living Area**
BAS	First Floor	29626	29626
		29626	29626

Extra Features

Extra Features				Legend
Code	**Description**	**Size**	**Value**	**Bldg #**
ELV1	ELEVATOR PASS	1 STOPS	$16,250	1
	RADIO TOWER	5000 UNITS	$40,630	1

Land

Land Use

Use Code	920
Description	Exempt Comm
Zone	R-40
Neighborhood	800
Alt Land Appr	No
Category	

Land Line Valuation

Size (Acres)	20
Frontage	0
Depth	0
Assessed Value	$1,176,000
Appraised Value	$1,680,000

Outbuildings

Outbuildings						Legend
Code	**Description**	**Sub Code**	**Sub Description**	**Size**	**Value**	**Bldg #**
PAV1	Paving	AS	Asphalt	42000 S.F.	$63,000	1
SHD1	Shed	FR	Frame	400 S.F.	$6,750	1
SHD1	Shed	FR	Frame	200 S.F.	$3,380	1
SHD1	Shed	FR	Frame	400 S.F.	$6,750	1

Valuation History

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2010	$0	$0	$6,099,657
2009	$0	$0	$6,055,843
2008	$0	$0	$6,039,900

Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2010	$0	$0	$4,269,760
2009	$0	$0	$4,239,090
2008	$0	$0	$4,227,930