Filed by:
Kri Pelletier, Property Specialist - SBA Communications
134 Flanders Rd., Suite 125, Westborough, MA 01581
508.251.0720 x 3804 - kpelletier@sbasite.com

August 30, 2018

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

Notice of Exempt Modification
81 Montevideo Road, Avon, CT
41 48 11.000 N
72 48 4.6900 W
T-Mobile #: CT11284A_L700-4x2

Dear Ms. Bachman:

T-Mobile currently maintains antennas at the 136-foot of the existing 150-foot Self-Support Tower at 81 Montevideo Road in Avon, CT. The tower is owned by MCM Acquisition 2017, LLC (an SBA entity – SBA acquired the tower previously owned by MC Towers, Inc). The property is owned by Monte LLC. T-Mobile now intends to replace (2) existing cell antennas with (2) newer technology cell antennas at the 136-foot level of the tower. The proposed full scope of work is as follows:

Remove: N/A

Remove and Replace:

- Remove: (1) Ericsson Air 32 KRD901044-1_B4A_B2P Panel Antenna
  - Replace with: (1) Ericsson AIR 32 KRD901146-1_B66A_B2A Panel Antenna
- Remove: (1) Commscope LNX-6515DS-VTM Panel Antenna
  - Replace with: (1) RFS APXVAARR24_43-U-NA20 Panel Antenna
- Remove: (1) Ericsson RRUS11
  - Replace with: (1) Ericsson 4449 B71 + B12
- Remove: (1) 1-5/8" Hybrid
  - Replace with: (2) 1-1/4" Hybrid

Install: N/A

Existing Equipment to Remain (Including entitlements):

- (1) Ericsson Air 21 KRC118023-1_B2A_B4P Panel Antenna
- (1) Ericsson KRY 112 144/2
- (1) 10.5' T-Frames (at 133.3')
- (6) 1-5/8" Coax

This facility was originally approved prior to the Council's jurisdiction, which the Council later assumed in 2001. No restrictions were placed on the tower with regard to improvements and/or upgrades. Approval for replacement of the existing 150' guyed tower with a 150' self-support structure was granted by the Council under EM-MCM-004-070824 on 10/16/07. All necessary equipment and shelters were to be placed within the compound. This modification complies with all known conditions.

Please accept this letter as notification pursuant to Regulations of Connecticut State Agencies §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 letter is being sent to the Town of Avon's Town Manager, Brandon Robertson, and Director of Planning and Community Development, Hiram Peck, as well as to the property owner, Monte, LLC. (Separate notice is not being sent to tower owner, as it belongs to SBA.)

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.
2. The proposed modification 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 emissions at the facility to a level at or above the Federal Communications Commission safety standard.
5. The proposed modification will not cause a change or alteration in the physical or environmental characteristics of the site.
6. The existing structure and its foundation can support the proposed loading.

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

Sincerely,

Kri Pelletier
Property Specialist
SBA COMMUNICATIONS CORPORATION
134 Flanders Rd., Suite 125
Westborough, MA 01581
508.251.0720 x3804 + T
508.366.2610 + F
kpelletier@sbasite.com

Attachments
cc: Brandon Robertson, Town Manager / with attachments
Avon Town Hall, 60 West Main Street, Avon, CT 06001
Hiram Peck, Director of Planning and Community Development / with attachments
Avon Town Hall, 60 West Main Street, Avon, CT 06001
Monte LLC / with attachments
40 Woodland Street, Hartford, CT 06105

POWER DENSITY

T-Mobile Site Inventory and Power Data by Antenna

Sector:	C
Antenna #:	**1**
Make / Model:	Ericsson AIR32 KRD901146-1 B66A/B2A
Gain:	15.9dBd
Height (AGL):	135 feet
Frequency Bands	1900 MHz (PCS) / 2100 MHz (AWS)
Channel Count	4
Total TX Power(W):	200
ERP (W):	7,780.90
Antenna C1 MPE%	**1.68**
Antenna #:	**2**
Make / Model:	Ericsson AIR21 KRC118023-1 B2A/B4P
Gain:	15.9 dBd
Height (AGL):	135 feet
Frequency Bands	1900 MHz (PCS) / 2100 MHz (AWS)
Channel Count	2
Total TX Power(W):	55
ERP (W):	2,139.75
Antenna C2 MPE%	**0.47**
Antenna #:	**3**
Make / Model:	RFS APXVAARR24_43-U-NA20
Gain:	12.95 / 13.35 dBd
Height (AGL):	135 feet
Frequency Bands	600 MHz / 700 MHz
Channel Count	4
Total TX Power(W):	120
ERP (W):	2,443.03
Antenna C3 MPE%	**1.25**

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile (Sector C)	**3.40 %**
Sprint	**2.67**
Site Total MPE %:	**6.07 %**

T-Mobile Max MPE Power Values (Sector C)

T-Mobile _Frequency Band / Technology (Sect	# Channe	Watts ERP (Per	Height (feet)	Total Power Densit	Frequen cy	Allowabl e MPE	Calculated %
T-Mobile PCS - 1900 MHz LTE	2	1,556.18	13	6.7	PCS - 1900 MHz	1000.00	0.67%
T-Mobile AWS - 2100 MHz LTE	2	2,334.27	13	10.0	AWS - 2100	1000.00	1.01%
T-Mobile PCS - 1900 MHz GSM	1	583.57	13	1.2	PCS - 1900 MHz	1000.00	0.13%
T-Mobile AWS - 2100 MHz	1	1,556.18	13	3.3	AWS - 2100	1000.00	0.34%
T-Mobile 600 MHz LTE	2	788.97	13	3.4	600 MHz	400.00	0.85%
T-Mobile 700 MHz LTE	2	432.54	13	1.8	700 MHz	467.00	0.40%
						Total:	3.40%

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Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com.FedEx will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery,misdelivery,or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim.Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental,consequential, or special is limited to the greater of $100 or the authorized declared value. Recovery cannot exceed actual documented loss.Maximum for items of extraordinary value is $1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our ServiceGuide. Written claims must be filed within strict time limits, see current FedEx Service Guide.

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Card 01 of 01 card — Town of Avon Residential Property Card

Property at 00081 MONTEVIDEO ROAD — Prop ID 3180081 — Printed 25-Aug-2017 8:23 AM — Design and Layout (C) Right/Angles

Administrative Information

Owner name: MONTE LLC
Second name:
Address: 40 WOODLAND STREET
City/state: HARTFORD CT Zip: 06105

Location Information

Map: 015 Clerk map: 04 104
Lot: 3180081 Neigh.: Zone: RU2A Vol: 455 Page: 057

Assessments			Exemptions			Last sale
Assmt category	Qty	Amount	Exempt	Cat	Amount	Sale date: 12-Jan-1987
Resident Land	2.00	280,000				Sale price: 460,000
Resident Excess	.50	2,630				Sale valid:
Resident Dwellng	1.00	311,360				Values
Resident Outbldg	2.00	1,020				Mkt value :
						Cost value: 850,014
Summary			Utilities			Sales ratios
Total assessments		595,010	Water	Well		Cost/sale : 1.8479
Total exemptions			Sewer	Septic		Mkt/sale :
Net assessment		595,010	Gas	None		Assmt/sale: 1.2935

Land Information

Type	Use	Acres/SqFt	Rate	Total	Infl Fact	Value	70% Value
PRIM	11	2.000	400,000	400,000		400,000	280,000
Primary Site		87,120					
RES	12	.500	7,500	3,750		3,750	2,630
Residual		21,780					
		2.500 acres		Total land value		403,750	282,630

Residential Dwelling Information

Subject	Code	Description	Condominium			
Style	02	Cape				
Exterior Walls	01	Clapboards	Story Height 1.5			
Roof Material	01	Asphalt Shingles				
Roof Type	01	Gable				
Foundation	01	Poured Concrete	Total Rooms	8	Garage cars	3
Interior Walls	02	Drywall	Bedrooms	4	Unfinished area	
Floors	01	Hardwood	Family Rooms	1	Dormer linear f	
Heating System	02	Forced Hot Air	Full Baths	3	Masonry trim sf	
Fuel	01	Oil	Half Baths	1	Finish bsmt sz	
Attic	99	None	Addtn'l fixtures	3	Rec Room Size	1,380
Grade	47	A-	Whirlpools	1	Living area	4,565
Garage	23	Attached 3 car	Saunas		# Living Units	
Area Over Gar.	03	Partial	M/F stacks			
Basement	01	Full	W/B stacks	1		
Bsmt Fin Qual	02	Rec Room w/o air	W/B openings	2		
Air Condition	01	Central Air				
Interior Cond	06	Excellent				
Exterior Cond	06	Excellent	Actual Year Built: 1955			

Building Valuation Summary

			Area	
Dwelling	Frame	1 1/2 story w/bsmt	1,671	244,200
Basement	Full			
Heating	Yes	A/C Yes		7,400
Plumbing	3 F/B	1 H/B 3 Add'l fix. 1 Wh/p	Saunas	13,600
Attic	None	Attic size:		
Additions				178,300
Other Features		WB Stks RR		28,440
Sub-Total				471,940
Grade	A-	Factor 1.4500		684,310
CDU		C&D Factor 1.00		684,310
Depreciation		35 %		444,800
		Computed cost value @ 70%		311,360

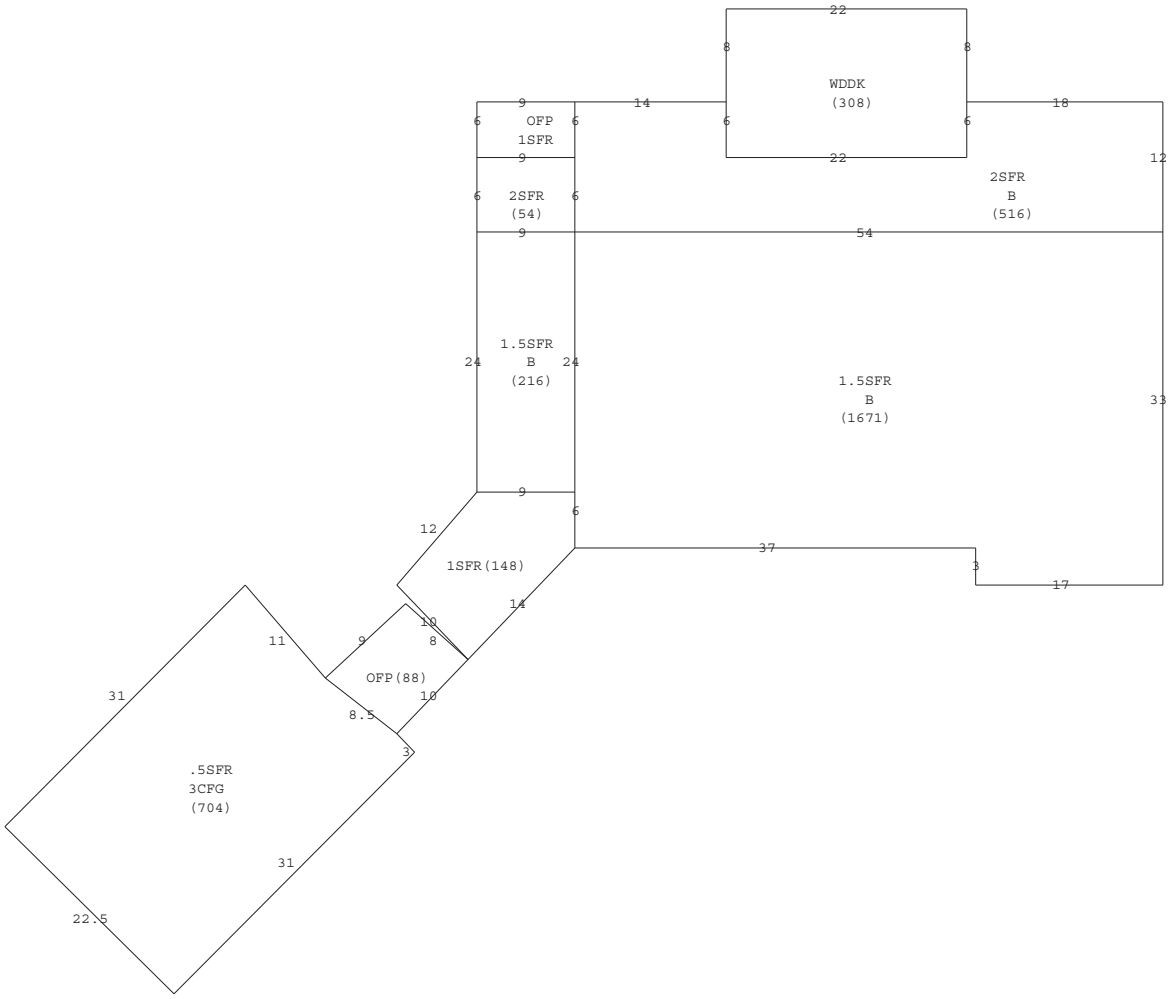
Building additions

Category		Type		Area	Value
G	Garages	FRL	Attached frame GT 65	704	22,300
L	Living Area	FATT	Full finished attic	352	9,000
L	Living Area	AIR	Air conditioning	352	800
P	Porches, Patios, Decks	FOFF	Frame open first flo	88	3,800
L	Living Area	FRFF	Frame first floor	148	12,000
L	Living Area	AIR	Air conditioning	148	300
L	Living Area	FRFF	Frame first floor	216	17,400
L	Living Area	FRUH	Frame upper half	216	7,800
L	Living Area	BSMT	Basement addition	216	2,800
L	Living Area	AIR	Air conditioning	324	700
L	Living Area	FRFF	Frame first floor	54	4,400
L	Living Area	FRUF	Frame upper full	54	3,200
L	Living Area	AIR	Air conditioning	108	200
L	Living Area	FRFF	Frame first floor	54	4,400
P	Porches, Patios, Decks	FOFF	Frame open first flo	54	2,300
L	Living Area	FRFF	Frame first floor	516	41,700
L	Living Area	FRUF	Frame upper full	516	30,500
L	Living Area	BSMT	Basement addition	516	6,700
L	Living Area	AIR	Air conditioning	1,032	2,200
P	Porches, Patios, Decks	DECK	Wood deck	308	5,800
			Total additions		178,300

Outbuilding Information

Description	Wid	Len	Area	Rate	Year	Cnd	RCN	Depr	Value
RS1 Frame	10	9	90	20.00		C	1,800	50	900
Utility Shed									
RC2 Canopy	8	9	72	15.63		C	1,125	50	560
Value at 70%			1,022			Value at 100%			1,460

Property at 00081 MONTEVIDEO ROAD | Prop ID 3180081 Card 01 | Scale: 1" = 13.73 feet



EASEMENT AGREEMENT MONTE TO MC TOWERS INC $100,000 V 708 P 268 3-31-17
AMENDMNT TO EASEMNT MONTE TO MCM ACQUISITION 710/534 6-19-17 & 711/422

EBI Consulting
environmental | engineering | due diligence

RADIO FREQUENCY EMISSIONS ANALYSIS REPORT
EVALUATION OF HUMAN EXPOSURE POTENTIAL TO NON-IONIZING EMISSIONS

T-Mobile Existing Facility

Site ID: CT11284A

Avon_1
81 Montevideo Road
Avon, CT 06001

August 14, 2018

EBI Project Number: 6218005570

Site Compliance Summary	
Compliance Status:	COMPLIANT
Site total MPE% of FCC general population allowable limit:	6.07 %

21 B Street · Burlington, MA 01803 · Tel: (781) 273.2500 · Fax: (781) 273.3311

EBI Consulting
environmental | engineering | due diligence

August 14, 2018

T-Mobile USA
Attn: Jason Overbey, RF Manager
35 Griffin Road South
Bloomfield, CT 06002

Emissions Analysis for Site: **CT11284A – Avon_1**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **81 Montevideo Road, Avon, CT**, for the purpose of determining whether the emissions from the Proposed T-Mobile Antenna Installation located on this property are within specified federal limits.

All information used in this report was analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter (μW/cm2). The number of $\mu W/cm^2$ calculated at each sample point is called the power density. The exposure limit for power density varies depending upon the frequencies being utilized. Wireless Carriers and Paging Services use different frequency bands each with different exposure limits, therefore it is necessary to report results and limits in terms of percent MPE rather than power density.

All results were compared to the FCC (Federal Communications Commission) radio frequency exposure rules, 47 CFR 1.1307(b)(1) – (b)(3), to determine compliance with the Maximum Permissible Exposure (MPE) limits for General Population/Uncontrolled environments as defined below.

General population/uncontrolled exposure limits apply to situations in which the general population may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general population would always be considered under this category when exposure is not employment related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area.

Public exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter ($\mu W/cm^2$). The general population exposure limits for the 600 MHz and 700 MHz frequency bands are approximately 400 $\mu W/cm^2$ and 467 $\mu W/cm^2$ respectively. The general population exposure limit for the 1900 MHz (PCS) and 2100 MHz (AWS) frequency bands is 1000 $\mu W/cm^2$. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Additional details can be found in FCC OET 65.

CALCULATIONS

Calculations were done for the proposed T-Mobile Wireless antenna facility located at **81 Montevideo Road, Avon, CT**, using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since T-Mobile is proposing highly focused directional panel antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB for directional panel antennas, was focused at the base of the tower. For this report the sample point is the top of a 6-foot person standing at the base of the tower.

For all calculations, all equipment was calculated using the following assumptions:

1) 1 GSM channel (PCS Band - 1900 MHz) was considered for the proposed installation. This Channels has a transmit power of 15 Watts per Channel.

2) 1 UMTS channel (AWS Band – 2100 MHz) was considered for the proposed installation. This Channels has a transmit power of 15 Watts per Channel.

3) 2 LTE channels (PCS Band - 1900 MHz) were considered the proposed installation. These Channels have a transmit power of 40 Watts per Channel.

4) 2 LTE channels (AWS Band – 2100 MHz) were considered for the proposed installation. These Channels have a transmit power of 60 Watts per Channel.

5) 2 LTE channels (600 MHz Band) were considered for the proposed installation. These Channels have a transmit power of 40 Watts per Channel.

6) 2 LTE channels (700 MHz Band) were considered for the proposed installation. These Channels have a transmit power of 20 Watts per Channel.

7) All radios at the proposed installation were considered to be running at full power and were uncombined in their RF transmissions paths per carrier prescribed configuration. Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.

8) For the following calculations the sample point was the top of a 6-foot person standing at the base of the tower. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB for directional panel antennas, was used in this direction. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

9) The antennas used in this modeling are the **Ericsson AIR32 KRD901146-1 B66A/B2A** & **Ericsson AIR21 KRC118023-1 B2A/B4P** for 1900 MHz (PCS) and 2100 MHz (AWS) channels and the **RFS APXVAARR24_43-U-NA20** for 600 MHz and 700 MHz channels. This is based on feedback from the carrier with regard to anticipated antenna selection. All Antenna gain values and associated transmit power levels are shown in the Site Inventory and Power Data table below. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB for directional panel antennas, was used for all calculations. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

10) The antenna mounting height centerline of the proposed antennas is **135 feet** above ground level (AGL).

11) Emissions values for additional carriers were taken from the Connecticut Siting Council active database. Values in this database are provided by the individual carriers themselves.

12) All calculations were done with respect to uncontrolled / general population threshold limits.

T-Mobile Site Inventory and Power Data

Sector:	C
Antenna #:	**1**
Make / Model:	Ericsson AIR32 KRD901146-1 B66A/B2A
Gain:	15.9dBd
Height (AGL):	135 feet
Frequency Bands	1900 MHz (PCS) / 2100 MHz (AWS)
Channel Count	4
Total TX Power(W):	200
ERP (W):	7,780.90
Antenna C1 MPE%	**1.68**
Antenna #:	**2**
Make / Model:	Ericsson AIR21 KRC118023-1 B2A/B4P
Gain:	15.9 dBd
Height (AGL):	135 feet
Frequency Bands	1900 MHz (PCS) / 2100 MHz (AWS)
Channel Count	2
Total TX Power(W):	55
ERP (W):	2,139.75
Antenna C2 MPE%	**0.47**
Antenna #:	**3**
Make / Model:	RFS APXVAARR24_43-U-NA20
Gain:	12.95 / 13.35 dBd
Height (AGL):	135 feet
Frequency Bands	600 MHz / 700 MHz
Channel Count	4
Total TX Power(W):	120
ERP (W):	2,443.03
Antenna C3 MPE%	**1.25**

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile (Sector C)	**3.40 %**
Sprint	**2.67**
Site Total MPE %:	**6.07 %**

T-Mobile Max MPE Power Values (Sector C)

T-Mobile _Frequency Band / Technology (Sector C)	# Channels	Watts ERP (Per Channel)	Height (feet)	Total Power Density ($\mu W/cm^2$)	Frequency (MHz)	Allowable MPE ($\mu W/cm^2$)	Calculated % MPE
T-Mobile PCS - 1900 MHz LTE	2	1,556.18	135	6.72	PCS - 1900 MHz	1000.00	0.67%
T-Mobile AWS - 2100 MHz LTE	2	2,334.27	135	10.09	AWS - 2100 MHz	1000.00	1.01%
T-Mobile PCS - 1900 MHz GSM	1	583.57	135	1.26	PCS - 1900 MHz	1000.00	0.13%
T-Mobile AWS - 2100 MHz UMTS	1	1,556.18	135	3.36	AWS - 2100 MHz	1000.00	0.34%
T-Mobile 600 MHz LTE	2	788.97	135	3.41	600 MHz	400.00	0.85%
T-Mobile 700 MHz LTE	2	432.54	135	1.87	700 MHz	467.00	0.40%
						Total:	**3.40%**

Summary

All calculations performed for this analysis yielded results that were **within** the allowable limits for general population exposure to RF Emissions.

The anticipated maximum composite contributions from the T-Mobile facility as well as the site composite emissions value with regards to compliance with FCC's allowable limits for general population exposure to RF Emissions are shown here:

T-Mobile Sector	Power Density Value (%)
Sector C:	3.40 %
T-Mobile Maximum MPE % (Sector C):	3.40 %
Site Total:	6.07 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **6.07%** of the allowable FCC established general population limit sampled at the ground level. This is based upon values listed in the Connecticut Siting Council database for existing carrier emissions.

FCC guidelines state that if a site is found to be out of compliance (over allowable thresholds), that carriers over a 5% contribution to the composite value will require measures to bring the site into compliance. For this facility, the composite values calculated were well within the allowable 100% threshold standard per the federal government.

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 Network Services, Inc.

Existing 150' Self-Support Tower
SBA Site Name: Avon (Montevideo)
SBA Site ID: CT22071-A-02
Carrier Name: T-Mobile
Carrier Site Name: CT11284A/SBA AVON/RT 177
App # 88683, v3

Site Location: 81 Montevideo Road
Avon, CT 06001
Hartford County

Latitude: 41.8031
Longitude: -72.8013

ACGI Job # 18-5261 Rev-1

ANALYSIS RESULTS		
Tower Components	98.9%	**Pass**
Tower Foundation	56.1%	**Pass**
Net change in Tower Stress Ratio	+15.9 %	**Change from previous SA by FDH Velocitel Job #17QKXZ1400 dated 08/22/17.**

Prepared By:
Brayan Andrade, EIT

08/28/2018
Approved By
Joji M. George, PE.
CT PE# 24444

TABLE OF CONTENTS

1. ANALYSIS SUMMARY

The existing 150' Self-support Tower located in Hartford, Connecticut was analyzed and designed for modifications by Allpro Consulting Group, Inc. (ACGI) for the existing and the proposed T-Mobile antennas, radios and coaxes as authorized by SBA Communication Corp. Based on the results of the analysis, the existing tower with below mentioned proposed and existing loading is found **to be in code compliance** with *TIA-222-G*, *Structural Standards for Steel Antenna Towers and Antenna Supporting Structures and the* 2016 Connecticut State Building Code (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:	Valmont Structures. FDH Velocitel	Original Tower Drawings by Valmont Structures, File No. A-123251-F1010188, date 11/29/07 Previous structural analysis by FDH Velocitel Inc., Project # 17QKXZ1400, dated 08/22/17
Foundation Data:	Valmont Structures.	Original Tower Drawings by Valmont Structures, File No. A-123251-F1010188, date 11/29/07
Geotechnical Report:	Dr. Clarence Welti	Geotechnical Evaluation by Dr. Clarence Welti Job # 36924843, dated 04/06/17
Loading Data:	FDH Velocitel SBA Communication Corp.	Previous structural analysis by FDH Velocitel Inc., Project # 17QKXZ1400, dated 08/22/17 Proposed final loading for T-Mobile as per Application ID # 88683, v3 downloaded from SBA portal.
Authorization:	SBA Communication Corp.	

3. ANALYSIS METHODS & DATA

The analysis was performed in accordance with Telecommunication Industry Association specification TIA-222-G-Addendum 2. 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-222-G standards. The 3-D model included the tower, with existing appurtenances and all proposed loads.

SITE DATA	
SBA Site Name:	Avon (Montevideo)
SBA Site Number:	CT22071-A-02
Carrier Site Name:	T-Mobile: CT11284A/ SBA Avon/Rt 177
City, State:	Avon, CT
County:	Hartford
Code Wind Load Requirement:	TIA-222-G (121 mph ultimate wind speed equal to 94 mph nominal wind speed) & 2016 Connecticut State Building Code (IBC 2012)
Wind Load Used:	TIA-222-G Code: • Nominal wind speed of 94 mph (3 second gust wind speed) • Structure Class II.* • Exposure Category B. • Topographic Category 5. • Crest Height 628 ft. • A wind speed of 50 mph is used in combination with ice. • Nominal ice thickness of 1.0 in.
Seismic Check:	Spectral Response Acceleration at Short Period (Ss) is 0.181 g which less than 1.000 g. Therefore, no seismic check is required as per TIA-222-G section 2.7.3

Note: This structural analysis is based upon the tower being classified as a class II; however, if a different classification is required subsequent to the date hereof, the tower classification will be changed to meet such requirement and a new structural analysis will be run.

TOWER DATA	
Tower Type:	3 Sided Self-support Tower
Height:	150’
Cross Section:	Triangular
Steel Strength:	Legs – 50 ksi, Braces – 36 ksi
Type of Foundation:	Mat Foundation

TOWER HISTORY	
Tower Manufacturer / Model:	Valmont Structures
Date of Original Design:	11/29/07
Previous Modifications:	N/A
Original Design Code Reqts:	TIA/EIA 222-G , 90mph + 1" ice

4. CONCLUSIONS

RESULT SUMMARY		
MEMBER	*% Capacity*	*Pass/Fail*
Leg	**88.6%**	**Pass**
Diagonal	**98.9%**	**Pass**
Top Girt	**6.5%**	**Pass**
Bottom Girt	**15.7 %**	**Pass**
Bolt Checks	**98.9%**	**Pass**
Anchor Bolt Check	**62.0%**	**Pass**
Foundation (see attached MathCAD for details)	**Overturning: 44.5%**	**Pass**
	Uplift: 56.1%	**Pass**
	Bearing: 28.4%	**Pass**
	Shear: 15.6%	**Pass**
Tower Overall Rating = 98.9 % (Pass)		

MAXIMUM TWIST AND SWAY CALCULATION FOR SERVICE WIND SPEED*			
Elev(ft)	**Dish**	**Twist (deg)**	**Sway (deg)**
76.8'	4.5' Parabolic Dish	**0.0997**	**0.1890**
73'	4.5' Parabolic Dish	**0.0873**	**0.1748**

*Note: - Allowable tilt and twist values to be reviewed by the respective carrier.

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

Maximum tower member stress is less than the allowable limit, making **it in code compliance** under the TIA-222-G code and 2016 Connecticut State Building Code (IBC 2012) requirements.

The Increase of 15.9% compared with the previous SA by FDH Velocitel Job #17QKXZ1400 dated 08/22/17, is due to the update of tnxTower version from V.7 to V.8. And, the addition of new antennas and feedlines.

5. 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

6. 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.

7. APPURTENANCE LISTING

EXISTING LOAD DESCRIPTION					
ELEV (ft.)	***Qty.***	***Antenna Description***	***Mount Type & Qty.***	***TX. LINE (in)***	***TENANT***
159.8±	1	10' Omni	Direct Mount	(1) 7/8	Unknown
147±	1	RFS APXVSPP18-C-A20 Antenna	(1) 3' Standoff @ 145.8'	(4) 1-1/4" Fiber	Sprint
147±	2	RFS APXVSPP18-C-A20 Antenna	(1) 10.5" Frame Mount @145'		
	3	RFS APXV9TM14-ALU-I20			
	3	Alcatel Lucent RRH2x20-25			
143.7±	3	Alcatel Lucent 800 MHz RRH	Direct Mount		
140.1±	3	Alcatel Lucent 1900 MHz RRH	Direct Mount		
136±	1	Ericsson AIR 21 Antenna	(1) 10.5' T-Frames @133.3'	(6) 1-5/8 Coax" (1) 1-5/8" Hybrid	T-Mobile
	1	Ericsson AIR 32 Antenna			
	1	Commscope LNX-6515DS-VTM Antenna			
	1	Ericsson KRY 112 144/2			
	1	Ericsson RRUS11			
126.8±	1	Omni 10'	(2) 5.7' StandOff @119.3' and @116.3'	(1) 1-1/4" (1) 7/8"	Unknown
	1	Omni 20'			
113.2±	1	Dipole 10'	(1) 5.7' StandOff @106.6'	(1) 7/8"	
104.5±	1	Omni 15'	(1) 5.7' StandOff @96'	(1) 7/8"	
99.8±	1	Element 6'	Direct Mount	(1) 1/2"	
76.8±	1	4.5' Parabolic Dish	(1) 1.5' Standoff @76.2'	(1) 1/4"	
73±	1	4.5' Parabolic Dish	(1) 2.8' Standoff @69.5'	(1) 1/4"	
72.4±	1	3.0"x2.5' GPS	Direct	(1) 1/2"	
67.3±	1	3.0"x1.2' GPS	Direct	(1) 1/4"	
13.9±	1	3.0"x1.5' GPS	(1) 2.2' Standoff @12.3'	(2) 1/2"	

T-MOBILE FINAL LOAD DESCRIPTION					
ELEV (ft.)	***Qty.***	***Antenna Description***	***Mount Type & Qty.***	***TX. LINE (in)***	***TENANT***
136±	1	Ericsson AIR 21 Antenna	(1) 10.5' T-Frames @133.3'	(6) 1-5/8" Coax **(2) 1-1/4" Hybrid**	T-Mobile
	1	**Ericsson AIR 32 KRD901146-1_B66A Antenna**			
	1	**RFS APXVAARR24_43-U-NA20 Antenna**			
	1	Ericsson KRY 112 144/2			
	1	**Ericsson 4449 B71 + B12**			

Notes:

1. ACGI should be notified of any discrepancies found in the data listed in this report.
2. Notify Allpro Consulting Group, Inc. of any potential physical & other interference with existing antennas for a redesign.

8. SUMMARY OF WORKING PERCENTAGE OF STRUCTURAL COMPONENTS

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	150 - 130	Leg	1 3/4	1	-22203.10	76967.90	28.8	Pass
T2	130 - 110	Leg	2	58	-68221.20	109130.00	62.5	Pass
T3	110 - 90	Leg	2 1/4	115	-128922.00	145578.00	88.6	Pass
T4	90 - 80	Leg	Pirod 195542	172	-131407.00	215254.00	61.0	Pass
T5	80 - 60	Leg	Pirod 195555	181	-157248.00	215400.00	73.0	Pass
T6	60 - 40	Leg	Pirod 195557	196	-184840.00	301490.00	61.3	Pass
T7	40 - 20	Leg	Pirod 195557	211	-211444.00	301490.00	70.1	Pass
T8	20 - 0	Leg	Pirod 195557	226	-236615.00	301490.00	78.5	Pass
T1	150 - 130	Diagonal	7/8	14	-4659.66	7581.20	61.5	Pass
T2	130 - 110	Diagonal	7/8	72	-6140.73	7658.68	80.2	Pass
T3	110 - 90	Diagonal	1	134	-7654.55	12512.20	61.2	Pass
T4	90 - 80	Diagonal	L2 1/2x2 1/2x3/16	176	-9632.91	13384.80	72.0 98.9 (b)	Pass
T5	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	188	-9182.93	10788.80	85.1 97.1 (b)	Pass
T6	60 - 40	Diagonal	L2 1/2x2 1/2x3/16	203	-8161.90	8547.93	95.5	Pass
T7	40 - 20	Diagonal	L3x3x3/16	218	-8117.00	11981.50	67.7 75.9 (b)	Pass
T8	20 - 0	Diagonal	L3x3x5/16	233	-9972.51	15430.20	64.6	Pass
T1	150 - 130	Top Girt	7/8	5	-253.39	3909.80	6.5	Pass
T2	130 - 110	Top Girt	7/8	62	-93.64	3943.57	2.4	Pass
T3	110 - 90	Top Girt	1	119	-42.67	6785.94	0.6	Pass
T1	150 - 130	Bottom Girt	7/8	8	-454.53	3909.80	11.6	Pass
T2	130 - 110	Bottom Girt	7/8	65	-477.72	3943.57	12.1	Pass
T3	110 - 90	Bottom Girt	1	122	-1068.68	6785.94	15.7	Pass
							Summary	
						Leg (T3)	88.6	Pass
						Diagonal (T4)	98.9	Pass
						Top Girt (T1)	6.5	Pass
						Bottom Girt (T3)	15.7	Pass
						Bolt Checks	98.9	Pass
						RATING =	**98.9**	**Pass**

APPENDIX

SITE DATA

⚠ This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

Hazards by Location

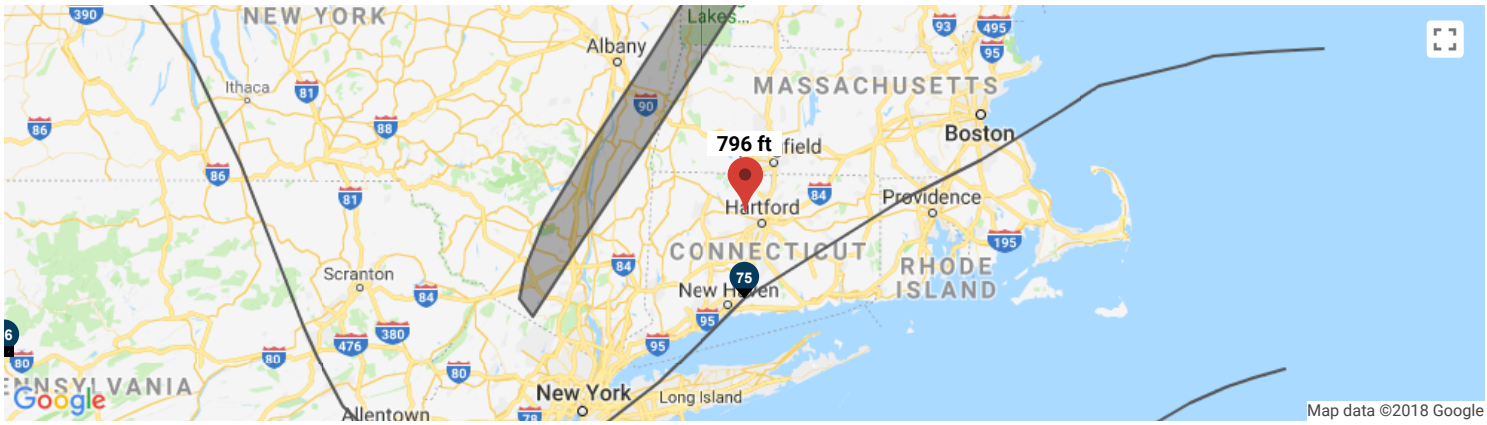
Search Information

Coordinates: 41.8031, -72.8013

Timestamp: 2018-08-07T15:07:31.724Z

Hazard Type: Wind

Map Results



Text Results

ASCE 7-16

MRI 10-Year	75 mph
MRI 25-Year	83 mph
MRI 50-Year	89 mph
MRI 100-Year	96 mph
Risk Category I	107 mph
Risk Category II	117 mph
Risk Category III	126 mph
Risk Category IV	⚠ 130 mph

You are in a wind-borne debris region if you are also within 1 mile of the coastal mean high water line.

ASCE 7-10

MRI 10-Year	76 mph
MRI 25-Year	86 mph
MRI 50-Year	92 mph
MRI 100-Year	99 mph
Risk Category I	110 mph
Risk Category II	121 mph
Risk Category III-IV	⚠ 130 mph

If the structure under consideration is a healthcare facility, you are in a wind-borne debris region. If other occupancy, use the Risk Category II basic wind speed contours to determine if you are in a wind-borne debris region.

ASCE 7-05

ASCE 7-05 Wind Speed ..... 97 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

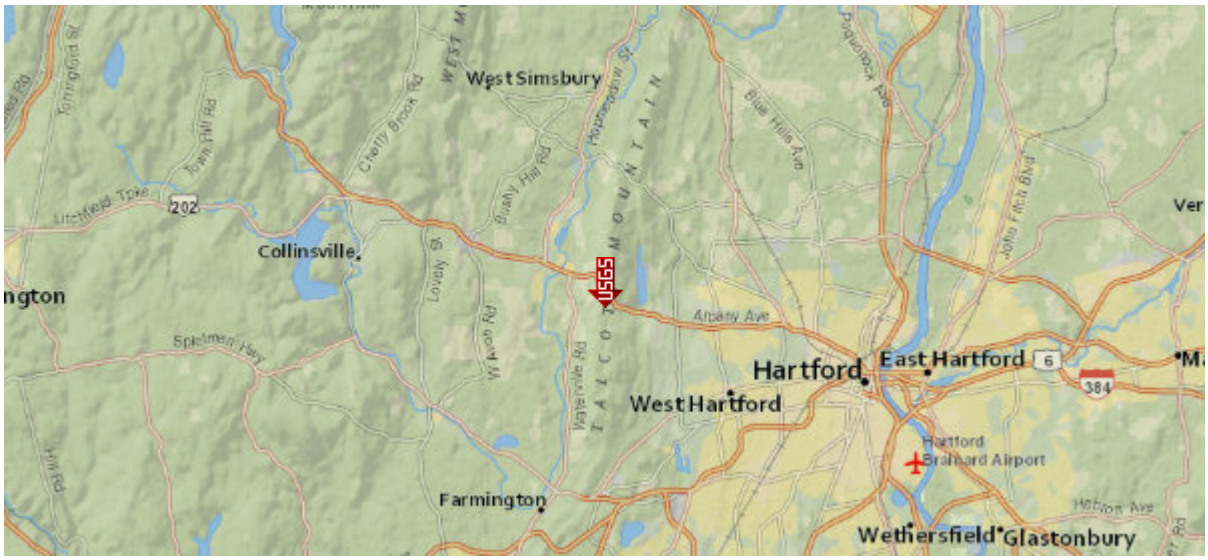
Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the report.

USGS Design Maps Summary Report

User–Specified Input

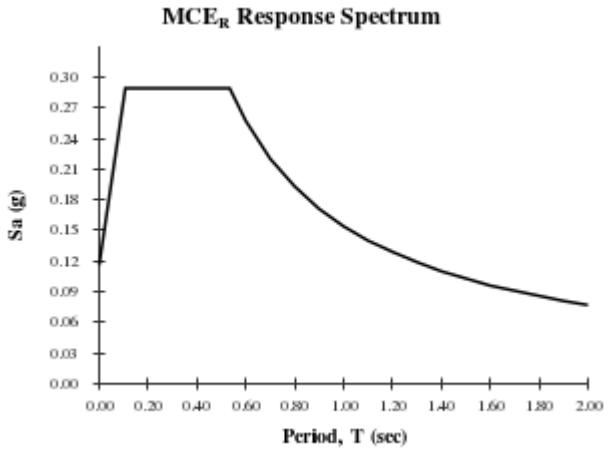
Building Code Reference Document	2012/2015 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	41.8031°N, 72.8013°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

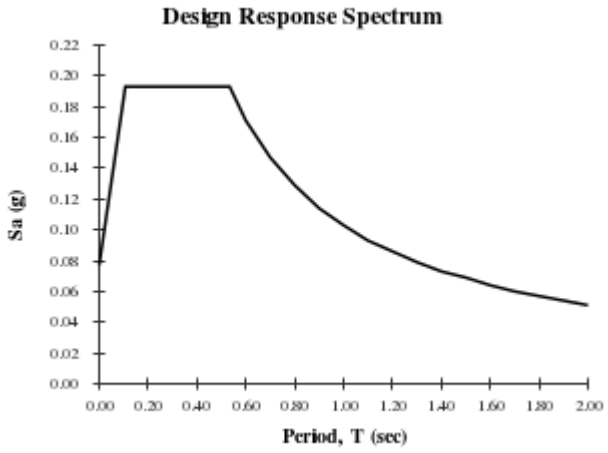


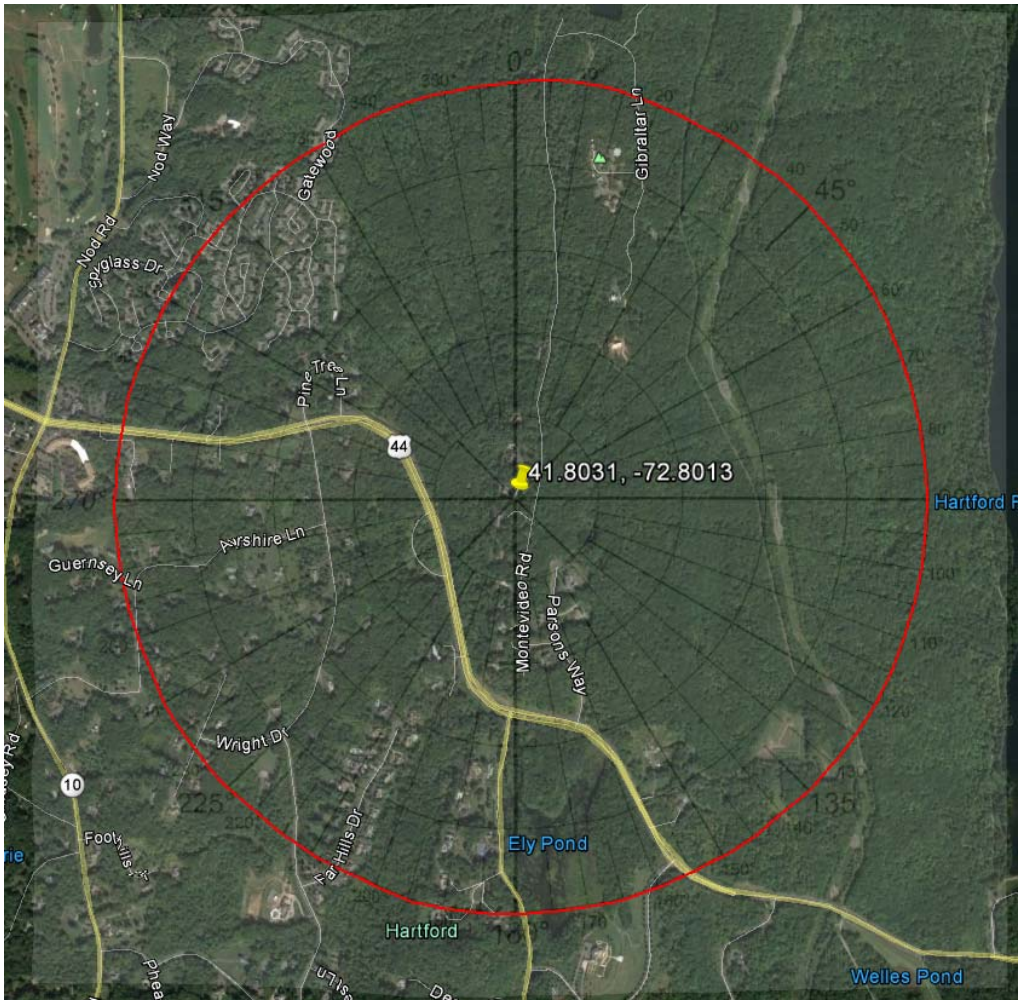
USGS–Provided Output

S_S =	0.181 g	S_{MS} =	0.289 g	S_{DS} =	0.193 g
S_1 =	0.064 g	S_{M1} =	0.154 g	S_{D1} =	0.103 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





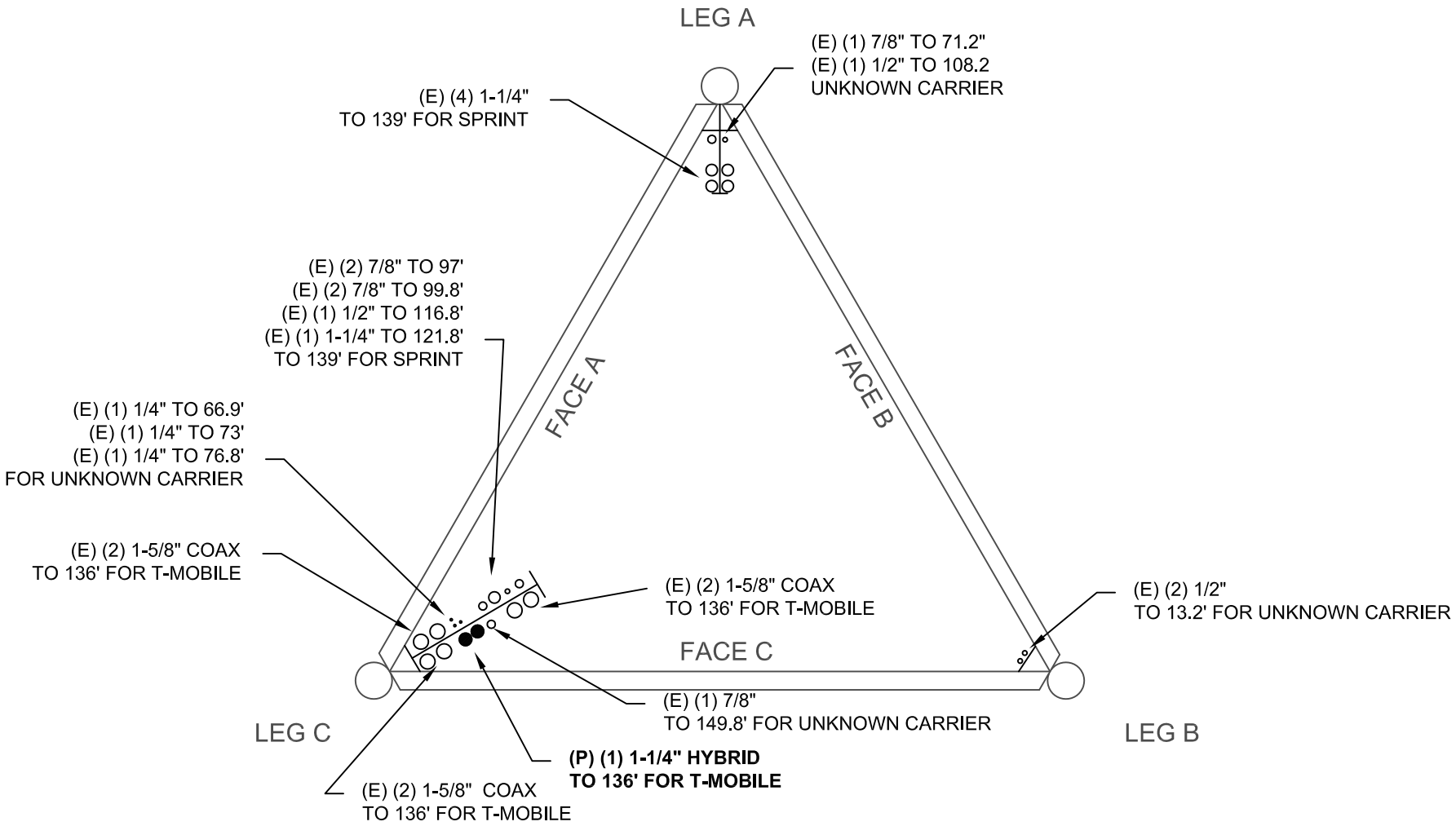


Exposure Category “B”

Topographic Category “5”

- H= 628 ft.
- L= 3194 ft.
- X= 76 ft.

COAX LAYOUT



COAX LAYOUT

N.T.S.

TOWER ELEVATION DRAWING

MATERIAL STRENGTH

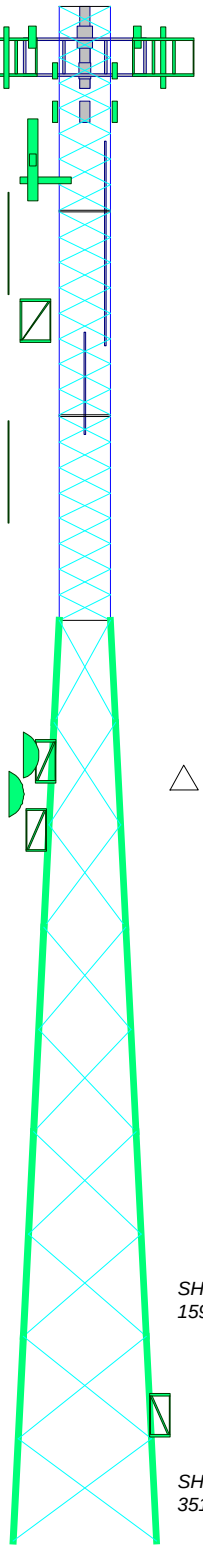
GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure B to the TIA-222-G Standard.
3. Tower designed for a 94 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 5 with Crest Height of 628.00 ft
8. TOWER RATING: 98.9%

Section	T8	T7	T6	T5	T4	T3	T2	T1
Legs		Pirod 195557		Pirod 195555	Pirod 195542	SR 2 1/4	SR 2	SR 1 3/4
Leg Grade				A572-50				
Diagonals	L3x3x5/16	L3x3x3/16		L2 1/2x2 1/2x3/16		SR 1	SR 7/8	
Diagonal Grade				A36				
Top Girts			N.A.			SR 1	SR 7/8	
Bottom Girts			N.A.			SR 1	SR 7/8	
Face Width (ft)	12	10	8	6	5			
# Panels @ (ft)	3739.1	3181.9	3007.8	2132.9	1062.1	1688.9	1313.5	1156.1
Weight (lb) 17282.2	14		9 @ 10			8 @ 2.48958	8 @ 2.47917	8 @ 2.48958

150.0 ft
130.0 ft
110.0 ft
90.0 ft
80.0 ft
60.0 ft
40.0 ft
20.0 ft
0.0 ft



ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 245519 lb
SHEAR: 24135 lb

UPLIFT: -228922 lb
SHEAR: 22692 lb

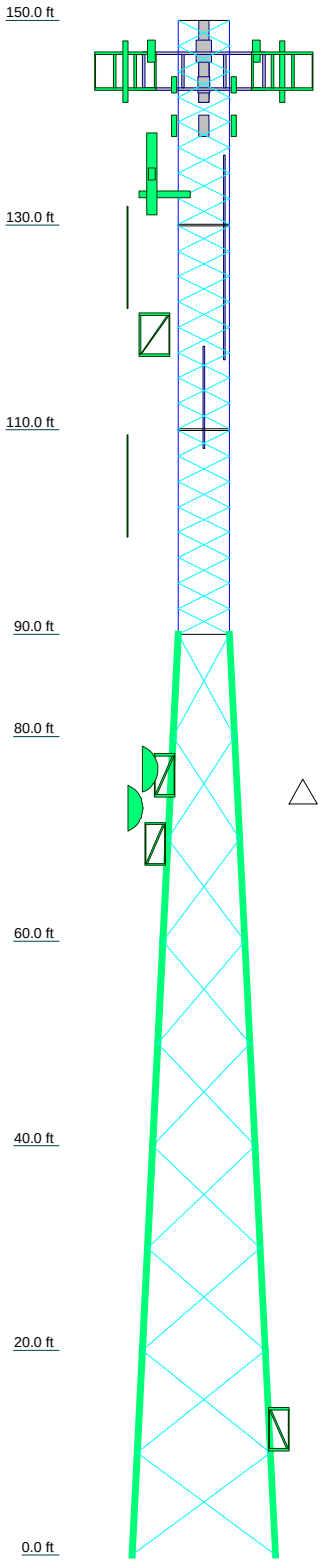
AXIAL 116337 lb
SHEAR 15901 lb *MOMENT 1452 kip-ft*
TORQUE 22 kip-ft
50 mph WIND - 1.0000 in ICE

AXIAL 25850 lb
SHEAR 35162 lb *MOMENT 2872 kip-ft*
TORQUE 47 kip-ft
REACTIONS - 94 mph WIND

Allpro consulting Group, Inc.
9221 Lyndon B Johnson Fwy
Dallas, TX 75243
Phone: 972-231-8893
FAX: 866-364-8375

Job: **18-5261**			
Project: ***CT22071-A-02 / Avon (Montevideo)***			
Client: SBA	Drawn by: Bandrade	App'd:	
Code: TIA-222-G	Date: 08/28/18	Scale: NTS	
Path:		Dwg No. E-1	

Section	T1	T2	T3	T4	T5	T6	T7	T8
Legs	SR 1 3/4	SR 2	SR 2 1/4	Pirod 195542	Pirod 195555		Pirod 195557	
Leg Grade	A572-50							
Diagonals	SR 7/8		SR 1		L2 1/2x2 1/2x3/16		L3x3x3/16	L3x3x5/16
Diagonal Grade	A36							
Top Girts	SR 7/8		SR 1		N.A.			
Bottom Girts	SR 7/8		SR 1		N.A.			
Face Width (ft) 14	5				6	8	10	12
# Panels @ (ft)	8 @ 2.48958	8 @ 2.47917	8 @ 2.48958			9 @ 10		
Weight (lb) 17282.2	1156.1	1313.5	1688.9	1062.1	2132.9	3007.8	3181.9	3739.1



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
10' Omni	149.8	KRY 112 144/2 (T-Mobile)	133.3
Lightning Rod	149	4449 B71 / B12 (T-Mobile)	133.3
APXVSPP18-C-A20 (Sprint)	145.8	10.5' Frame Mount (T-Mobile)	133.3
3' Standoff (Sprint)	145.8	10' Omni	119.3
(3) APXV9TM14-ALU-120 w/pipe mount (Sprint)	145	5.7' StandOff	119.3
		20' omni	116.3
TD-RRH8x20-25 (Sprint)	145	5.7' StandOff	116.3
TD-RRH8x20-25 (Sprint)	145	10' Omni	106.6
TD-RRH8x20-25 (Sprint)	145	5.7' StandOff	106.6
10.5 Frame Mount (Sprint)	145	6' Element	99.8
(2) APXVSPP18-C-A20 w/pipe mount (Sprint)	145	5.7' StandOff	96
		15' Omni	96
800 MHz RRH (Sprint)	143	1.5' StandOff	76.2
800 MHz RRH (Sprint)	143	4.5' Parabolic Dish	76.2
800 MHz RRH (Sprint)	143	GPS	71.2
1900 MHz RRH (Sprint)	139	3"dx1.2' GPS	69.8
1900 MHz RRH (Sprint)	139	2.8' Standoff	69.5
1900 MHz RRH (Sprint)	139	4.5' Parabolic Dish	69.5
AIR 21 (T-Mobile)	133.3	3"dx1.5' GPS	12.3
AIR 32 KRD901146-a_B66A (T-Mobile)	133.3	2.2' Standoff	12.3
APXVAARR18_43-U-NA20 (Octa) (T-Mobile)	133.3		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
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5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 5 with Crest Height of 628.00 ft

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Project: ***CT22071-A-02 / Avon (Montevideo)***			
Client: SBA	Drawn by: Bandrade	App'd:	
Code: TIA-222-G	Date: 08/28/18	Scale: NTS	
Path:		Dwg No. E-1	

MISCELLANEOUS PLOTS

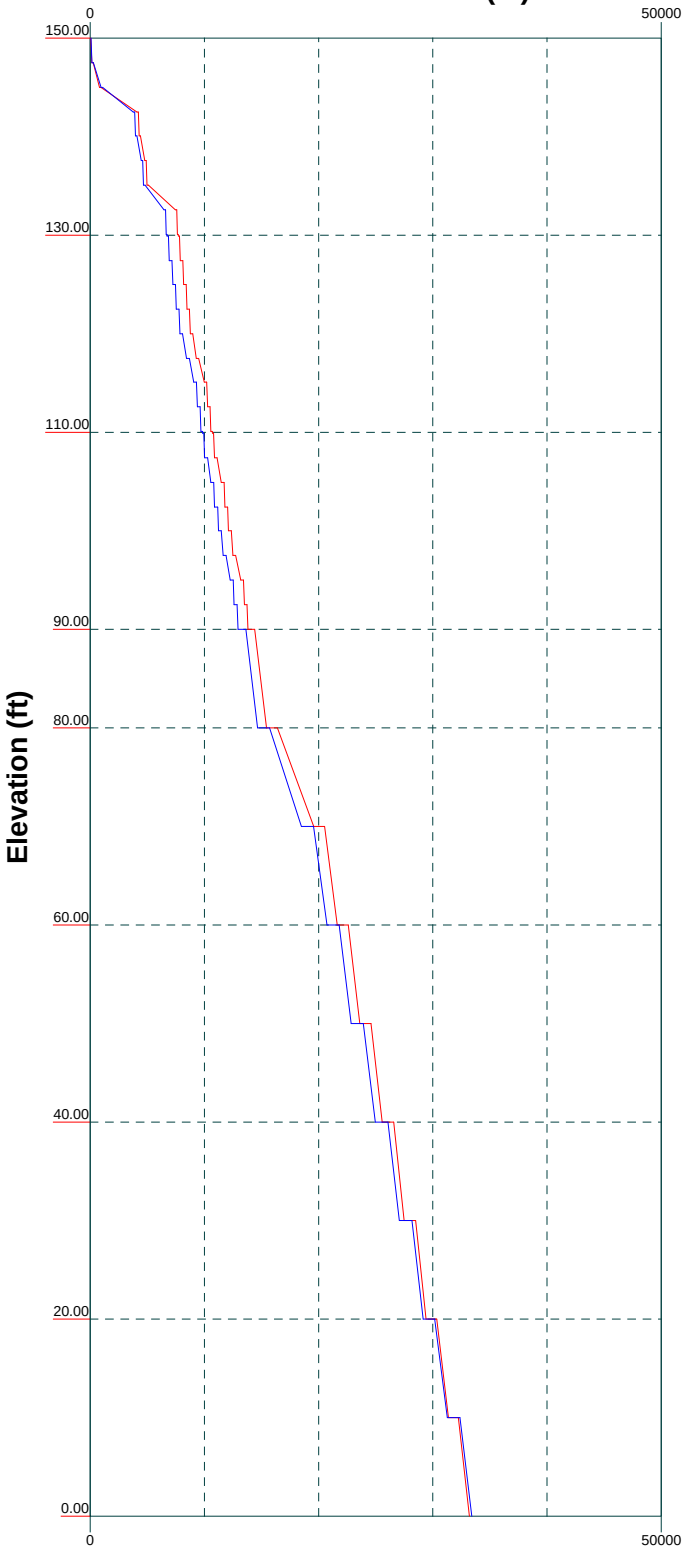
TIA-222-G - 94 mph/50 mph 1.0000 in Ice Exposure B

Vx Vz

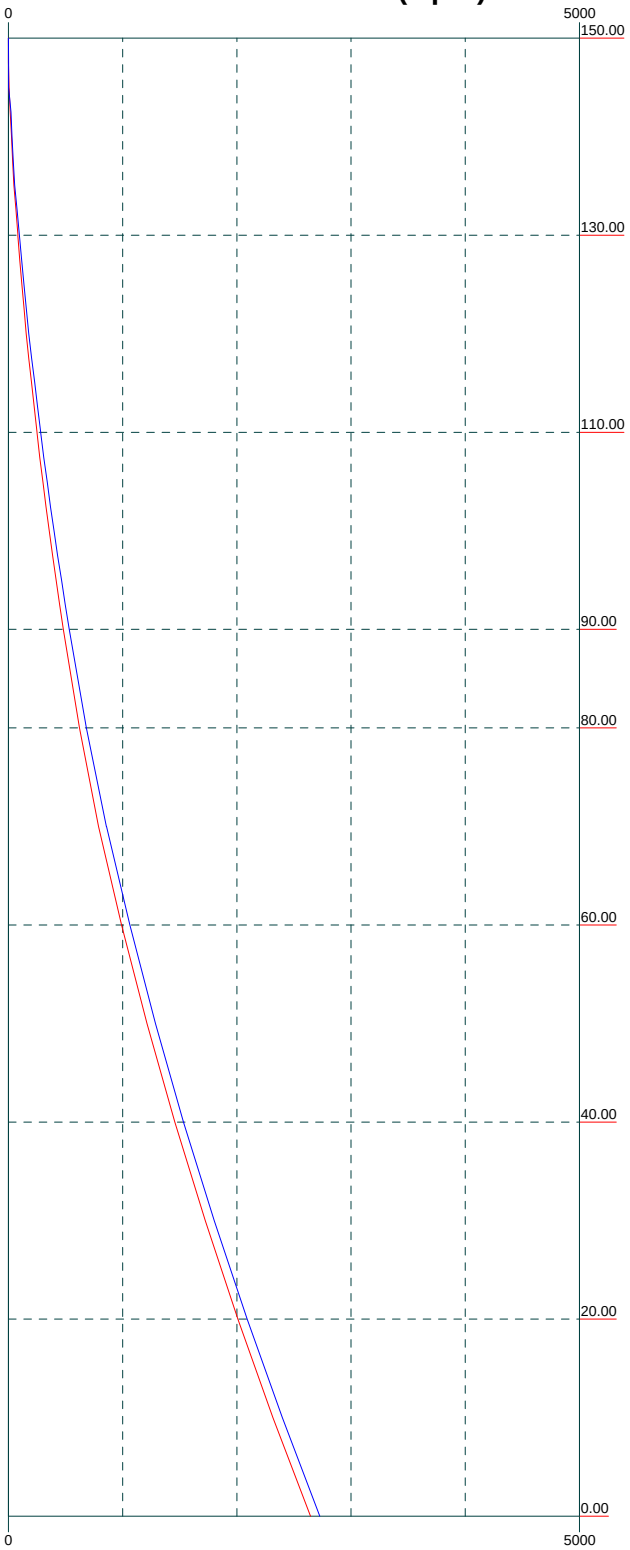
Maximum Values

Mx Mz

Global Mast Shear (lb)



Global Mast Moment (kip-ft)



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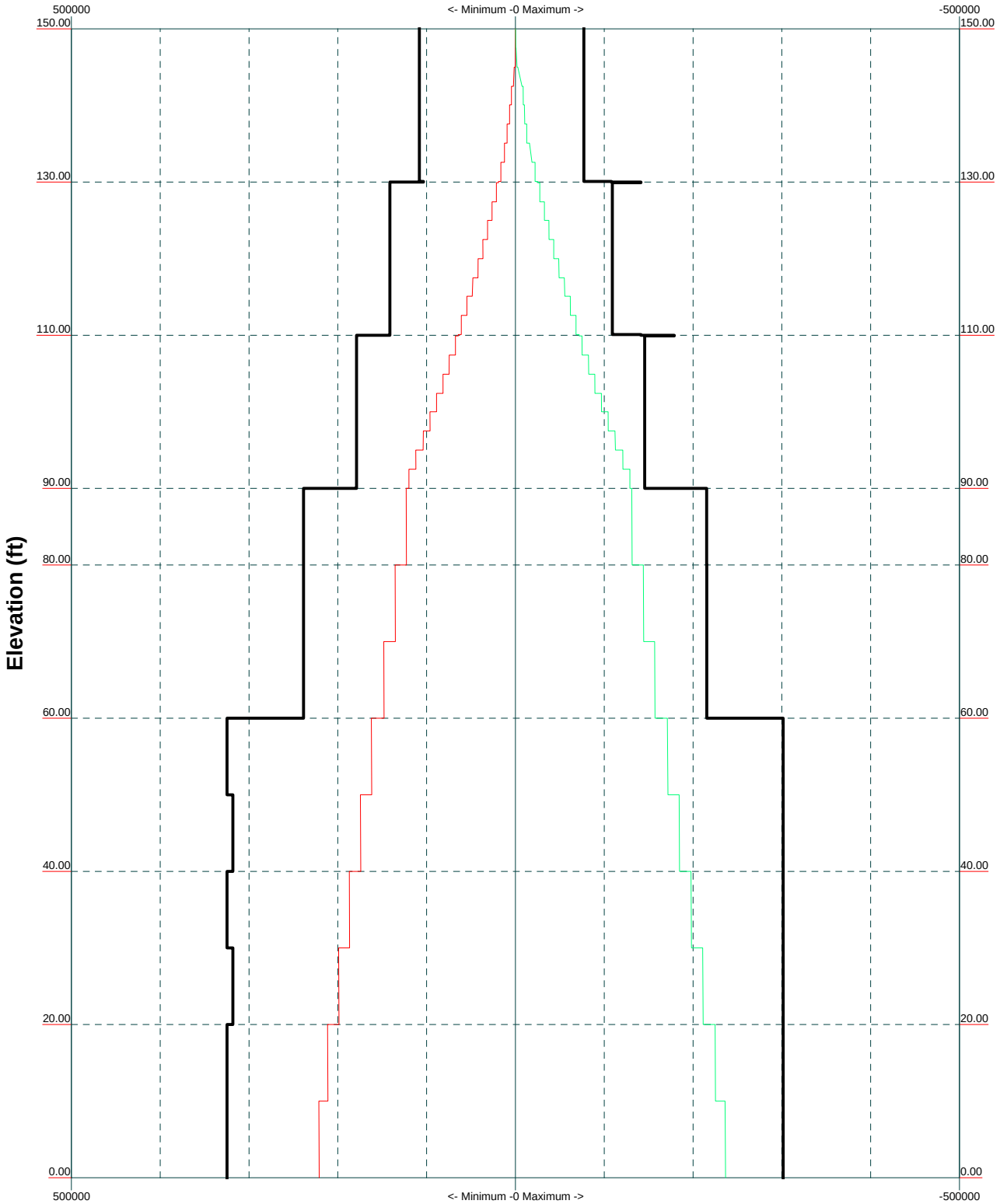
Job: ***18-5261***		
Project: ***CT22071-A-02 / Avon (Montevideo)***		
Client: SBA	Drawn by: Bandrade	App'd:
Code: TIA-222-G	Date: 08/28/18	Scale: NTS
Path:		Dwg No. E-4

TIA-222-G - 94 mph/50 mph 1.0000 in Ice Exposure B

Leg Capacity ——— **Leg Compression (lb)**



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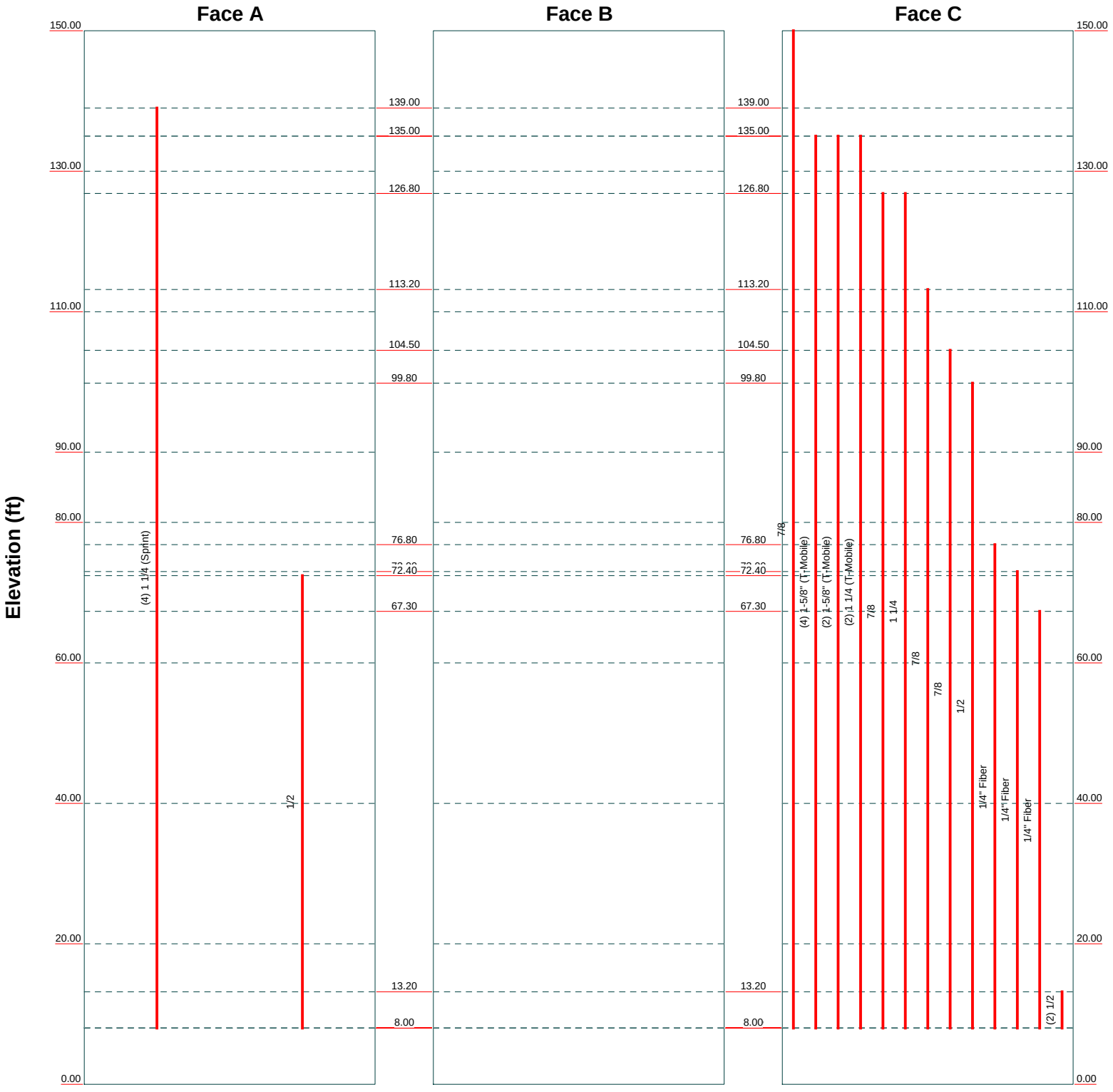
FAX: 866-364-8375

Job: ***18-5261***			
Project: ***CT22071-A-02 / Avon (Montevideo)***			
Client: SBA	Drawn by: Bandrade	App'd:	
Code: TIA-222-G	Date: 08/28/18	Scale: NTS	
Path:		Dwg No. E-3	

Feed Line Distribution Chart
0' - 150'

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



Allpro consulting Group, Inc.
9221 Lyndon B Johnson Fwy
Dallas, TX 75243
Phone: 972-231-8893
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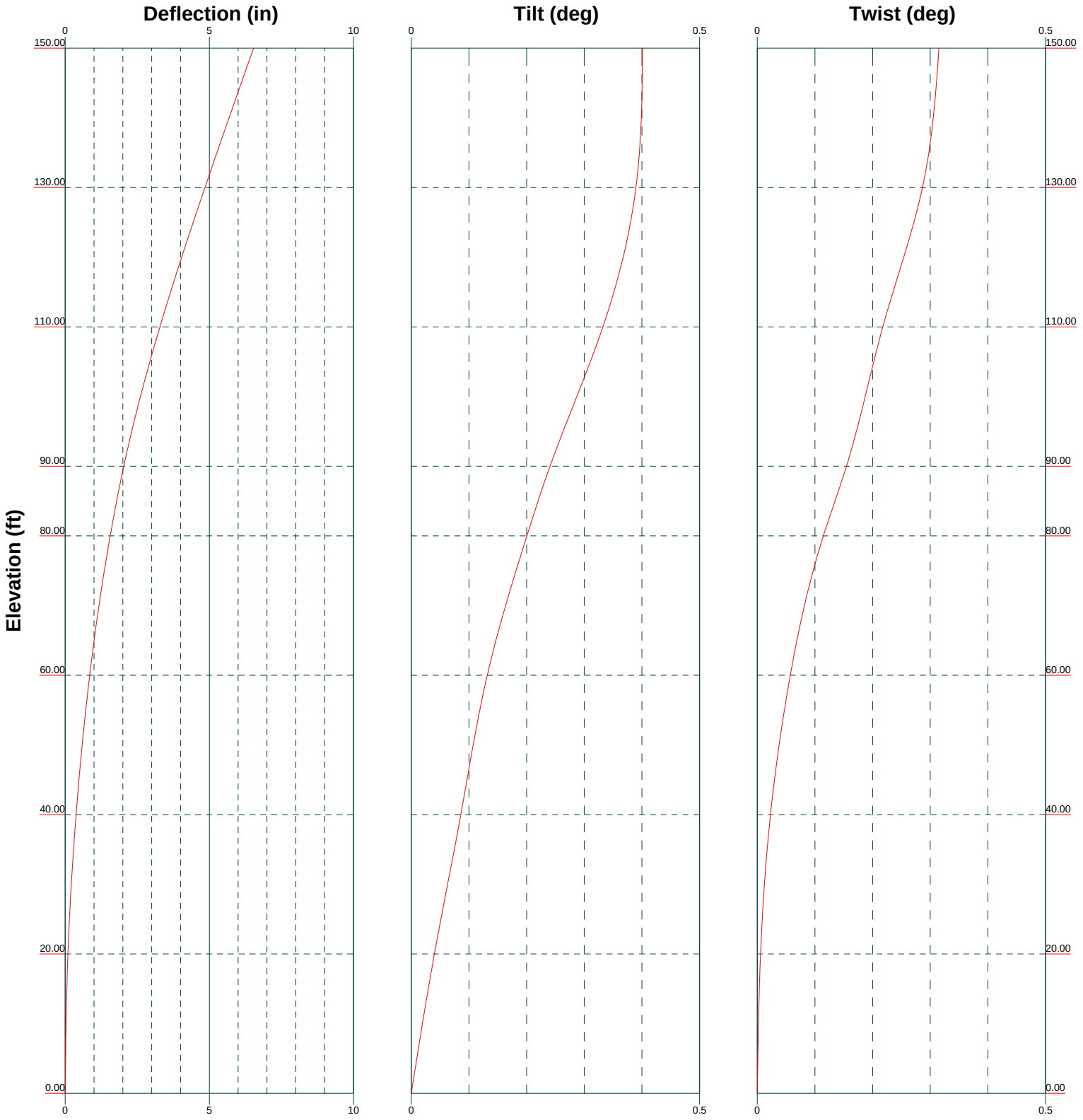
Job: **18-5261**		
Project: ***CT22071-A-02 / Avon (Montevideo)***		
Client: SBA	Drawn by: Bandrade	App'd:
Code: TIA-222-G	Date: 08/28/18	Scale: NTS
Path:		Dwg No. E-7

TIA-222-G - Service - 60 mph

Maximum Values



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Job: ***18-5261***		
Project: ***CT22071-A-02 / Avon (Montevideo)***		
Client: SBA	Drawn by: Bandrade	App'd:
Code: TIA-222-G	Date: 08/28/18	Scale: NTS
Path:		Dwg No. E-5

CALCULATION PRINTOUT

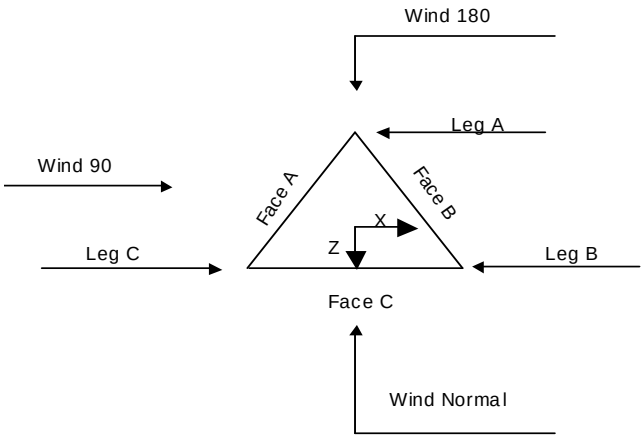
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 150.00 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 14.00 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Hartford County, Connecticut.
ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).
Basic wind speed of 94 mph.
Structure Class II.
Exposure Category B.
Topographic Category 5.
Crest Height 628.00 ft.
SEAW RSM-03 procedures for wind speed-up calculations are used.
Topographic Feature: Continuous Ridge.
Slope Distance L: 3194.00 ft.
Distance from Crest x: 76.00 ft.
Nominal ice thickness of 1.0000 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		Pole Without Linear Attachments
		Pole With Shroud Or No Appurtenances
		Outside and Inside Corner Radii Are Known



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	150.00-130.00			5.00	1	20.00
T2	130.00-110.00			5.00	1	20.00
T3	110.00-90.00			5.00	1	20.00
T4	90.00-80.00			5.00	1	10.00
T5	80.00-60.00			6.00	1	20.00
T6	60.00-40.00			8.00	1	20.00
T7	40.00-20.00			10.00	1	20.00
T8	20.00-0.00			12.00	1	20.00

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	150.00-130.00	2.49	X Brace	No	No	0.0000	1.0000
T2	130.00-110.00	2.48	X Brace	No	No	1.0000	1.0000
T3	110.00-90.00	2.49	X Brace	No	No	1.0000	0.0000
T4	90.00-80.00	10.00	X Brace	No	No	0.0000	0.0000
T5	80.00-60.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T6	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T7	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T8	20.00-0.00	10.00	X Brace	No	No	0.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 150.00-130.00	Solid Round	1 3/4	A572-50 (50 ksi)	Solid Round	7/8	A36 (36 ksi)
T2 130.00-110.00	Solid Round	2	A572-50 (50 ksi)	Solid Round	7/8	A36 (36 ksi)
T3 110.00-90.00	Solid Round	2 1/4	A572-50 (50 ksi)	Solid Round	1	A36 (36 ksi)
T4 90.00-80.00	Truss Leg	Pirod 195542	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 80.00-60.00	Truss Leg	Pirod 195555	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T6 60.00-40.00	Truss Leg	Pirod 195557	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T7 40.00-20.00	Truss Leg	Pirod 195557	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T8 20.00-0.00	Truss Leg	Pirod 195557	A572-50 (50 ksi)	Equal Angle	L3x3x5/16	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 150.00-130.00	Solid Round	7/8	A36 (36 ksi)	Solid Round	7/8	A36 (36 ksi)
T2 130.00-110.00	Solid Round	7/8	A36 (36 ksi)	Solid Round	7/8	A36 (36 ksi)
T3 110.00-90.00	Solid Round	1	A36 (36 ksi)	Solid Round	1	A36 (36 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 150.00-130.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000

Tower Elevation ft	Gusset Area (per face) 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
T2 130.00-110.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T3 110.00-90.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T4 90.00-80.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T5 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T6 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T7 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1	1	1.05	36.0000	36.0000	36.0000
T8 20.00-0.00	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 Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 150.00-130.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 130.00-110.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 110.00-90.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 90.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 40.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 20.00-0.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1

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

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Truss-Leg K Factors: Truss-Legs Used As Leg Members — Leg Panels	X Brace Diagonals	Z Brace Diagonals	Truss-Legs Used As Inner Members — Leg Panels	X Brace Diagonals	Z Brace Diagonals
T4 90.00-80.00	1	0.5	0.85	1	0.5	0.85

T5 80.00-60.00	1	0.5	0.85	1	0.5	0.85
T6 60.00-40.00	1	0.5	0.85	1	0.5	0.85
T7 40.00-20.00	1	0.5	0.85	1	0.5	0.85
T8 20.00-0.00	1	0.5	0.85	1	0.5	0.85

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 150.00-130.00	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 130.00-110.00	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 110.00-90.00	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
T4 90.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T8 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 150.00-130.00	Flange	0.6250 A325X	5	0.7500 A325X	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325N	0
T2 130.00-110.00	Flange	0.7500 A325X	5	0.6250 A325X	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325N	0
T3 110.00-90.00	Flange	1.0000 A325X	6	0.6250 A325X	0	0.0000 A325X	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325N	0
T4 90.00-80.00	Flange	1.0000 A325X	6	1.0000 A325X	1	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325N	0
T5 80.00-60.00	Flange	1.0000 A325X	6	1.0000 A325X	1	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325N	0
T6 60.00-40.00	Flange	1.0000 A325X	6	1.0000 A325X	1	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325N	0
T7 40.00-20.00	Flange	1.0000 A325X	6	1.0000 A325X	1	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325X	0	0.6250 A325N	0
T8 20.00-0.00	Flange	1.0000 A325X	0	1.0000 A325X	1	0.0000 A325N	0	0.0000 A325N	0	0.6250 A325N	0	0.6250 A325X	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 klf
7/8	C	No	Ar (CaAa)	150.00 - 8.00	-4.0000	0.42	1	1	0.5000	1.1100		0.00
1 1/4 (Sprint) ***	A	No	Ar (CaAa)	139.00 - 8.00	-5.0000	0.4	4	2	0.5000	1.5500		0.00
1-5/8" (T-Mobile)	C	No	Ar (CaAa)	135.00 - 8.00	-2.0000	0.48	4	2	0.5000	1.9800		0.00
1-5/8" (T-Mobile)	C	No	Ar (CaAa)	135.00 - 8.00	-0.7500	0.48	2	2	0.5000	1.9800		0.00
1 1/4 (T-Mobile) *********	C	No	Ar (CaAa)	135.00 - 8.00	-1.0000	0.48	2	2	0.5000	1.5500		0.00
7/8	C	No	Ar (CaAa)	126.80 - 8.00	-5.5000	0.4	1	1	0.5000	1.1100		0.00
1 1/4	C	No	Ar (CaAa)	126.80 - 8.00	-5.5000	0.38	1	1	0.5000	1.5500		0.00
7/8	C	No	Ar (CaAa)	113.20 - 8.00	-3.0000	0.48	1	1	0.5000	1.1100		0.00
7/8	C	No	Ar (CaAa)	104.50 - 8.00	-5.5000	0.4	1	1	0.5000	1.1100		0.00
1/2	C	No	Ar (CaAa)	99.80 - 8.00	-5.5000	0.41	1	1	0.5000	0.5800		0.00
1/4" Fiber	C	No	Ar (CaAa)	76.80 - 8.00	-4.5000	0.42	1	1	0.4400	0.4400		0.00
1/4" Fiber	C	No	Ar (CaAa)	73.00 - 8.00	-4.0000	0.42	1	1	0.4400	0.4400		0.00
1/2	A	No	Ar (CaAa)	72.40 - 8.00	-3.5000	0.48	1	1	0.5000	0.5800		0.00
1/4" Fiber	C	No	Ar (CaAa)	67.30 - 8.00	-4.0000	0.4	1	1	0.4400	0.4400		0.00
1/2	C	No	Ar (CaAa)	13.20 - 8.00	-2.5000	-0.48	2	2	0.5000	0.5800		0.00

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 lb
T1	150.00-130.00	A	0.000	0.000	5.580	0.000	23.76
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	9.710	0.000	42.00
T2	130.00-110.00	A	0.000	0.000	12.400	0.000	52.80
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	37.004	0.000	157.49
T3	110.00-90.00	A	0.000	0.000	12.400	0.000	52.80
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	41.898	0.000	180.68
T4	90.00-80.00	A	0.000	0.000	6.200	0.000	26.40
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	21.550	0.000	93.10
T5	80.00-60.00	A	0.000	0.000	13.119	0.000	55.90
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	44.732	0.000	189.17
T6	60.00-40.00	A	0.000	0.000	13.560	0.000	57.80
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	45.740	0.000	191.00
T7	40.00-20.00	A	0.000	0.000	13.560	0.000	57.80
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	45.740	0.000	191.00
T8	20.00-0.00	A	0.000	0.000	8.136	0.000	34.68
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	28.047	0.000	117.20

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 lb
T1	150.00-130.00	A	2.896	0.000	0.000	14.943	0.000	265.61
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	38.358	0.000	702.74
T2	130.00-110.00	A	2.873	0.000	0.000	33.042	0.000	584.59
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	137.404	0.000	2470.03
T3	110.00-90.00	A	2.842	0.000	0.000	32.826	0.000	577.22
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	168.310	0.000	3095.87
T4	90.00-80.00	A	2.813	0.000	0.000	16.309	0.000	285.07
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	88.552	0.000	1624.12
T5	80.00-60.00	A	2.775	0.000	0.000	39.952	0.000	705.29
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	197.626	0.000	3592.53
T6	60.00-40.00	A	2.705	0.000	0.000	43.835	0.000	766.75
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	207.342	0.000	3698.05
T7	40.00-20.00	A	2.592	0.000	0.000	42.580	0.000	724.29
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	200.872	0.000	3468.17
T8	20.00-0.00	A	2.342	0.000	0.000	23.888	0.000	381.07
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	117.326	0.000	1849.88

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	150.00-130.00	-4.9300	-0.0772	-2.0801	0.3281
T2	130.00-110.00	-11.4005	2.0708	-6.0174	1.6370
T3	110.00-90.00	-11.6836	2.5786	-6.9543	2.1976
T4	90.00-80.00	-8.0346	1.9164	-5.0347	1.6955
T5	80.00-60.00	-10.1751	2.4821	-10.5014	3.4906
T6	60.00-40.00	-12.6233	3.1935	-17.1057	5.8221
T7	40.00-20.00	-13.9209	3.6624	-21.2736	7.4979
T8	20.00-0.00	-9.8691	2.8207	-16.4298	6.5178

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	7/8	130.00 - 150.00	0.6000	0.3005
T1	2	1 1/4	130.00 - 139.00	0.6000	0.3005

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	5	1-5/8"	130.00 - 135.00	0.6000	0.3005
T1	6	1-5/8"	130.00 - 135.00	0.6000	0.3005
T1	7	1 1/4	130.00 - 135.00	0.6000	0.3005
T2	1	7/8	110.00 - 130.00	0.6000	0.3023
T2	2	1 1/4	110.00 - 130.00	0.6000	0.3023
T2	5	1-5/8"	110.00 - 130.00	0.6000	0.3023
T2	6	1-5/8"	110.00 - 130.00	0.6000	0.3023
T2	7	1 1/4	110.00 - 130.00	0.6000	0.3023
T2	9	7/8	110.00 - 126.80	0.6000	0.3023
T2	10	1 1/4	110.00 - 126.80	0.6000	0.3023
T2	11	7/8	110.00 - 113.20	0.6000	0.3023
T3	1	7/8	90.00 - 110.00	0.6000	0.2958
T3	2	1 1/4	90.00 - 110.00	0.6000	0.2958
T3	5	1-5/8"	90.00 - 110.00	0.6000	0.2958
T3	6	1-5/8"	90.00 - 110.00	0.6000	0.2958
T3	7	1 1/4	90.00 - 110.00	0.6000	0.2958
T3	9	7/8	90.00 - 110.00	0.6000	0.2958
T3	10	1 1/4	90.00 - 110.00	0.6000	0.2958
T3	11	7/8	90.00 - 110.00	0.6000	0.2958
T3	12	7/8	90.00 - 104.50	0.6000	0.2958
T3	13	1/2	90.00 - 99.80	0.6000	0.2958
T4	1	7/8	80.00 - 90.00	0.6000	0.2352
T4	2	1 1/4	80.00 - 90.00	0.6000	0.2352
T4	5	1-5/8"	80.00 - 90.00	0.6000	0.2352
T4	6	1-5/8"	80.00 - 90.00	0.6000	0.2352
T4	7	1 1/4	80.00 - 90.00	0.6000	0.2352
T4	9	7/8	80.00 - 90.00	0.6000	0.2352
T4	10	1 1/4	80.00 - 90.00	0.6000	0.2352
T4	11	7/8	80.00 - 90.00	0.6000	0.2352
T4	12	7/8	80.00 - 90.00	0.6000	0.2352
T4	13	1/2	80.00 - 90.00	0.6000	0.2352
T5	1	7/8	60.00 - 80.00	0.6000	0.3671
T5	2	1 1/4	60.00 - 80.00	0.6000	0.3671
T5	5	1-5/8"	60.00 - 80.00	0.6000	0.3671
T5	6	1-5/8"	60.00 - 80.00	0.6000	0.3671
T5	7	1 1/4	60.00 - 80.00	0.6000	0.3671
T5	9	7/8	60.00 - 80.00	0.6000	0.3671
T5	10	1 1/4	60.00 - 80.00	0.6000	0.3671
T5	11	7/8	60.00 - 80.00	0.6000	0.3671
T5	12	7/8	60.00 - 80.00	0.6000	0.3671
T5	13	1/2	60.00 - 80.00	0.6000	0.3671
T5	15	1/4" Fiber	60.00 - 76.80	0.6000	0.3671
T5	16	1/4" Fiber	60.00 - 73.00	0.6000	0.3671
T5	17	1/2	60.00 - 72.40	0.6000	0.3671
T5	18	1/4" Fiber	60.00 - 67.30	0.6000	0.3671
T6	1	7/8	40.00 - 60.00	0.6000	0.4942
T6	2	1 1/4	40.00 - 60.00	0.6000	0.4942
T6	5	1-5/8"	40.00 - 60.00	0.6000	0.4942
T6	6	1-5/8"	40.00 - 60.00	0.6000	0.4942
T6	7	1 1/4	40.00 - 60.00	0.6000	0.4942
T6	9	7/8	40.00 - 60.00	0.6000	0.4942

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T6	10	1 1/4	40.00 - 60.00	0.6000	0.4942
T6	11	7/8	40.00 - 60.00	0.6000	0.4942
T6	12	7/8	40.00 - 60.00	0.6000	0.4942
T6	13	1/2	40.00 - 60.00	0.6000	0.4942
T6	15	1/4" Fiber	40.00 - 60.00	0.6000	0.4942
T6	16	1/4" Fiber	40.00 - 60.00	0.6000	0.4942
T6	17	1/2	40.00 - 60.00	0.6000	0.4942
T6	18	1/4" Fiber	40.00 - 60.00	0.6000	0.4942
T7	1	7/8	20.00 - 40.00	0.6000	0.5560
T7	2	1 1/4	20.00 - 40.00	0.6000	0.5560
T7	5	1-5/8"	20.00 - 40.00	0.6000	0.5560
T7	6	1-5/8"	20.00 - 40.00	0.6000	0.5560
T7	7	1 1/4	20.00 - 40.00	0.6000	0.5560
T7	9	7/8	20.00 - 40.00	0.6000	0.5560
T7	10	1 1/4	20.00 - 40.00	0.6000	0.5560
T7	11	7/8	20.00 - 40.00	0.6000	0.5560
T7	12	7/8	20.00 - 40.00	0.6000	0.5560
T7	13	1/2	20.00 - 40.00	0.6000	0.5560
T7	15	1/4" Fiber	20.00 - 40.00	0.6000	0.5560
T7	16	1/4" Fiber	20.00 - 40.00	0.6000	0.5560
T7	17	1/2	20.00 - 40.00	0.6000	0.5560
T7	18	1/4" Fiber	20.00 - 40.00	0.6000	0.5560
T8	1	7/8	8.00 - 20.00	0.6000	0.6000
T8	2	1 1/4	8.00 - 20.00	0.6000	0.6000
T8	5	1-5/8"	8.00 - 20.00	0.6000	0.6000
T8	6	1-5/8"	8.00 - 20.00	0.6000	0.6000
T8	7	1 1/4	8.00 - 20.00	0.6000	0.6000
T8	9	7/8	8.00 - 20.00	0.6000	0.6000
T8	10	1 1/4	8.00 - 20.00	0.6000	0.6000
T8	11	7/8	8.00 - 20.00	0.6000	0.6000
T8	12	7/8	8.00 - 20.00	0.6000	0.6000
T8	13	1/2	8.00 - 20.00	0.6000	0.6000
T8	15	1/4" Fiber	8.00 - 20.00	0.6000	0.6000
T8	16	1/4" Fiber	8.00 - 20.00	0.6000	0.6000
T8	17	1/2	8.00 - 20.00	0.6000	0.6000
T8	18	1/4" Fiber	8.00 - 20.00	0.6000	0.6000
T8	19	1/2	8.00 - 13.20	0.6000	0.6000

Discrete Tower Loads

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 lb
Lightning Rod	C	From Leg	0.50 0.00 2.50	0.0000	149.00	No Ice 1/2" Ice 1" Ice	0.25 0.66 0.97	0.25 0.66 0.97	30.00 30.00 40.00
***									
10' Omni	B	From Leg	0.50 0.00 10.00	0.0000	149.80	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00
***									

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
APXVSPP18-C-A20	A	From Leg	3.00	0.0000	145.80	No Ice	8.02	5.28	80.00
(Sprint)			0.00			1/2" Ice	8.48	5.74	129.52
			1.20			1" Ice	8.94	6.20	185.12
(2) APXVSPP18-C-A20	C	From Leg	3.00	0.0000	145.00	No Ice	8.26	6.95	80.00
w/pipe mount			0.00			1/2" Ice	8.82	8.13	150.00
(Sprint)			2.00			1" Ice	9.38	9.31	220.00
(3) APXV9TM14-ALU-120	C	From Leg	3.00	0.0000	145.00	No Ice	6.42	4.93	100.00
w/pipe mount			0.00			1/2" Ice	6.82	5.60	150.00
(Sprint)			2.00			1" Ice	7.22	6.27	200.00
800 MHz RRH	A	From Leg	0.50	0.0000	143.00	No Ice	2.13	1.77	53.00
(Sprint)			0.00			1/2" Ice	2.32	1.95	74.19
			0.70			1" Ice	2.51	2.13	98.39
800 MHz RRH	B	From Leg	0.50	0.0000	143.00	No Ice	2.13	1.77	53.00
(Sprint)			0.00			1/2" Ice	2.32	1.95	74.19
			0.70			1" Ice	2.51	2.13	98.39
800 MHz RRH	C	From Leg	0.50	0.0000	143.00	No Ice	2.13	1.77	53.00
(Sprint)			0.00			1/2" Ice	2.32	1.95	74.19
			0.70			1" Ice	2.51	2.13	98.39
1900 MHz RRH	A	From Leg	0.50	0.0000	139.00	No Ice	2.31	2.38	60.00
(Sprint)			0.00			1/2" Ice	2.52	2.58	83.90
			0.70			1" Ice	2.73	2.79	111.08
1900 MHz RRH	B	From Leg	0.50	0.0000	139.00	No Ice	2.31	2.38	60.00
(Sprint)			0.00			1/2" Ice	2.52	2.58	83.90
			0.70			1" Ice	2.73	2.79	111.08
1900 MHz RRH	C	From Leg	0.50	0.0000	139.00	No Ice	2.31	2.38	60.00
(Sprint)			0.00			1/2" Ice	2.52	2.58	83.90
			0.70			1" Ice	2.73	2.79	111.08
TD-RRH8x20-25	A	From Leg	3.00	0.0000	145.00	No Ice	3.70	1.29	66.10
(Sprint)			0.00			1/2" Ice	3.95	1.46	90.04
			2.00			1" Ice	4.20	1.64	117.32
TD-RRH8x20-25	B	From Leg	3.00	0.0000	145.00	No Ice	3.70	1.29	66.10
(Sprint)			0.00			1/2" Ice	3.95	1.46	90.04
			2.00			1" Ice	4.20	1.64	117.32
TD-RRH8x20-25	C	From Leg	3.00	0.0000	145.00	No Ice	3.70	1.29	66.10
(Sprint)			0.00			1/2" Ice	3.95	1.46	90.04
			2.00			1" Ice	4.20	1.64	117.32
10.5 Frame Mount	C	From Leg	1.50	0.0000	145.00	No Ice	13.80	3.75	280.00
(Sprint)			0.00			1/2" Ice	18.42	5.95	390.00
			0.00			1" Ice	23.04	8.15	500.00
3' Standoff	A	From Leg	1.50	0.0000	145.80	No Ice	2.96	3.36	130.00
(Sprint)			0.00			1/2" Ice	4.10	4.68	150.00
			0.00			1" Ice	5.24	6.00	170.00
***									
AIR 21	C	From Leg	3.00	0.0000	133.30	No Ice	5.92	4.26	83.00
(T-Mobile)			0.00			1/2" Ice	6.43	4.71	124.22
			1.70			1" Ice	6.95	5.15	165.44
AIR 32 KRD901146-a_B66A	C	From Leg	3.00	0.0000	133.30	No Ice	6.51	4.71	132.20
(T-Mobile)			0.00			1/2" Ice	7.04	5.18	178.02
			1.70			1" Ice	7.57	5.65	223.85
APXVAARR18_43-U-NA20	C	From Leg	3.00	0.0000	133.30	No Ice	20.24	8.89	128.00
(Octa)			0.00			1/2" Ice	20.89	9.49	240.59
(T-Mobile)			1.70			1" Ice	21.54	10.09	361.72
KRY 112 144/2	C	From Leg	3.00	0.0000	133.30	No Ice	0.35	0.16	11.02
(T-Mobile)			0.00			1/2" Ice	0.47	0.25	14.12
			1.70			1" Ice	0.59	0.34	17.22
4449 B71 / B12	C	From Leg	3.00	0.0000	133.30	No Ice	1.64	1.02	74.00
(T-Mobile)			0.00			1/2" Ice	1.80	1.15	90.04

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
			1.70			1" Ice	1.97	1.28	108.70
10.5' Frame Mount (T-Mobile)	C	From Leg	1.50 0.00 0.00	0.0000	133.30	No Ice 1/2" Ice 1" Ice	13.80 18.42 23.04	3.75 5.95 8.15	280.00 390.00 500.00
****									
10' Omni	C	From Leg	5.70 0.00 7.50	0.0000	119.30	No Ice 1/2" Ice 1" Ice	2.90 4.03 5.16	2.90 4.03 5.16	20.00 40.00 60.00
5.7' StandOff	C	From Leg	2.65 0.00 0.00	0.0000	119.30	No Ice 1/2" Ice 1" Ice	0.98 1.70 2.42	2.60 4.50 6.40	50.00 70.00 90.00
***									
20' omni	A	From Leg	5.70 0.00 10.50	0.0000	116.30	No Ice 1/2" Ice 1" Ice	5.00 7.03 9.06	5.00 7.03 9.06	40.00 80.00 120.00
5.7' StandOff	A	From Leg	2.65 0.00 0.00	0.0000	116.30	No Ice 1/2" Ice 1" Ice	0.98 1.70 2.42	2.60 4.50 6.40	50.00 70.00 90.00
*****									
10' Omni	A	From Leg	5.70 0.00 6.60	0.0000	106.60	No Ice 1/2" Ice 1" Ice	2.90 4.03 5.16	2.90 4.03 5.16	20.00 40.00 60.00
5.7' StandOff	A	From Leg	2.65 0.00 0.00	0.0000	106.60	No Ice 1/2" Ice 1" Ice	0.98 1.70 2.42	2.60 4.50 6.40	50.00 70.00 90.00
***									
15' Omni	C	From Leg	5.70 0.00 8.50	0.0000	96.00	No Ice 1/2" Ice 1" Ice	4.44 6.03 7.62	4.44 6.03 7.62	20.00 50.00 80.00
5.7' StandOff	A	From Leg	2.65 0.00 0.00	0.0000	96.00	No Ice 1/2" Ice 1" Ice	0.98 1.70 2.42	2.60 4.50 6.40	50.00 70.00 90.00
***									
6' Element	C	From Leg	0.50 0.00 0.00	0.0000	99.80	No Ice 1/2" Ice 1" Ice	1.50 1.97 2.44	1.50 1.97 2.44	20.00 30.00 40.00
***									
1.5' StandOff	C	From Leg	0.75 0.00 0.00	0.0000	76.20	No Ice 1/2" Ice 1" Ice	1.00 1.39 1.78	0.90 1.42 1.94	20.00 30.00 40.00
***									
2.8' Standoff	C	From Leg	1.40 0.00 0.00	0.0000	69.50	No Ice 1/2" Ice 1" Ice	0.94 1.48 2.02	1.41 2.17 2.93	30.00 40.00 50.00
****									
GPS	A	From Leg	0.50 0.00 1.20	0.0000	71.20	No Ice 1/2" Ice 1" Ice	0.54 0.70 0.86	0.54 0.70 0.86	10.00 20.00 30.00
***									
3"dx1.2' GPS	C	From Leg	0.50 0.00 -2.50	0.0000	69.80	No Ice 1/2" Ice 1" Ice	0.22 0.30 0.38	0.22 0.30 0.38	10.00 10.00 20.00
***									
3"dx1.5' GPS	B	From Leg	2.20 0.00 1.60	0.0000	12.30	No Ice 1/2" Ice 1" Ice	0.29 0.40 0.51	0.29 0.40 0.51	10.00 10.00 20.00
****									

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 lb
2.2' Standoff	B	From Leg	1.10 0.00 0.00	0.0000	12.30	No Ice 1/2" Ice 1" Ice	0.85 1.14 1.43	1.67 2.34 3.01	70.00 80.00 90.00

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight lb
4.5' Parabolic Dish	C	Paraboloid w/o Radome	From Leg	1.50 0.00 0.60	0.0000		76.20	4.50	No Ice 1/2" Ice 1" Ice	15.90 16.50 17.10	20.00 100.00 190.00
4.5' Parabolic Dish	C	Paraboloid w/o Radome	From Leg	2.80 0.00 3.50	0.0000		69.50	4.50	No Ice 1/2" Ice 1" Ice	15.90 16.50 17.10	20.00 100.00 190.00

Truss-Leg Properties

Section Designation	Area in^2	Area Ice in^2	Self Weight lb	Ice Weight lb	Equiv. Diameter in	Equiv. Diameter Ice in	Leg Area in^2
Pirod 195542	1135.6343	3491.0383	559.89	1414.20	7.8863	24.2433	5.3014
Pirod 195555	2246.3232	6955.2381	552.48	2313.60	7.7997	24.1501	5.3014
Pirod 195557	2174.3760	6526.1840	827.62	2279.11	7.5499	22.6604	7.2158
Pirod 195557	2174.3760	6454.5484	827.62	2120.65	7.5499	22.4116	7.2158
Pirod 195557	2174.3760	6296.6510	827.62	1790.81	7.5499	21.8634	7.2158

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

Comb. No.	Description
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
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

Comb. No.	Description
74	Dead+Wind 330 deg - Service

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	150 - 130	6.534	71	0.4035	0.3176
T2	130 - 110	4.848	71	0.3882	0.2872
T3	110 - 90	3.287	71	0.3327	0.2200
T4	90 - 80	2.032	71	0.2419	0.1573
T5	80 - 60	1.562	71	0.2013	0.1122
T6	60 - 40	0.851	71	0.1314	0.0571
T7	40 - 20	0.379	71	0.0850	0.0258
T8	20 - 0	0.096	71	0.0415	0.0082

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
149.80	10' Omni	71	6.517	0.4034	0.3174	173246
149.00	Lightning Rod	71	6.449	0.4031	0.3166	173246
145.80	APXVSPP18-C-A20	71	6.176	0.4019	0.3134	173246
145.00	(2) APXVSPP18-C-A20 w/pipe mount	71	6.108	0.4015	0.3126	173246
143.00	800 MHz RRH	71	5.938	0.4006	0.3103	123747
139.00	1900 MHz RRH	71	5.600	0.3982	0.3051	78748
133.30	AIR 21	71	5.121	0.3928	0.2950	51787
119.30	10' Omni	71	3.986	0.3646	0.2525	21957
116.30	20' omni	71	3.754	0.3555	0.2417	19290
106.60	10' Omni	71	3.047	0.3185	0.2098	14120
99.80	6' Element	71	2.598	0.2872	0.1905	12139
96.00	15' Omni	71	2.366	0.2693	0.1790	11258
76.80	4.5' Parabolic Dish	71	1.430	0.1890	0.0997	16501
76.20	1.5' StandOff	71	1.406	0.1868	0.0976	16623
73.00	4.5' Parabolic Dish	71	1.282	0.1748	0.0873	17188
71.20	GPS	71	1.216	0.1682	0.0821	17517
69.80	3"dx1.2' GPS	71	1.166	0.1632	0.0784	17782
69.50	2.8' Standoff	71	1.155	0.1621	0.0776	17840
12.30	3"dx1.5' GPS	71	0.044	0.0252	0.0044	32686

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	150 - 130	24.918	34	1.5130	1.2506
T2	130 - 110	18.578	34	1.4651	1.1309
T3	110 - 90	12.656	34	1.2678	0.8666
T4	90 - 80	7.856	34	0.9276	0.6196

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T5	80 - 60	6.048	34	0.7743	0.4416
T6	60 - 40	3.304	34	0.5077	0.2246
T7	40 - 20	1.474	34	0.3291	0.1013
T8	20 - 0	0.375	34	0.1609	0.0323

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
149.80	10' Omni	34	24.854	1.5128	1.2499	56607
149.00	Lightning Rod	34	24.598	1.5120	1.2468	56607
145.80	APXVSPP18-C-A20	34	23.575	1.5087	1.2342	56607
145.00	(2) APXVSPP18-C-A20 w/pipe mount	34	23.320	1.5078	1.2308	56607
143.00	800 MHz RRH	34	22.681	1.5051	1.2220	40433
139.00	1900 MHz RRH	34	21.409	1.4977	1.2014	25730
133.30	AIR 21	34	19.610	1.4802	1.1616	16902
119.30	10' Omni	34	15.316	1.3830	0.9943	6215
116.30	20' omni	34	14.436	1.3505	0.9517	5371
106.60	10' Omni	34	11.741	1.2151	0.8262	3815
99.80	6' Element	34	10.024	1.0986	0.7505	3247
96.00	15' Omni	34	9.137	1.0310	0.7053	2998
76.80	4.5' Parabolic Dish	34	5.538	0.7276	0.3926	4349
76.20	1.5' StandOff	34	5.446	0.7189	0.3842	4380
73.00	4.5' Parabolic Dish	34	4.969	0.6733	0.3434	4519
71.20	GPS	34	4.713	0.6482	0.3231	4599
69.80	3"dx1.2' GPS	34	4.520	0.6291	0.3083	4663
69.50	2.8' Standoff	34	4.479	0.6250	0.3053	4678
12.30	3"dx1.5' GPS	34	0.172	0.0979	0.0173	8423

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load per Bolt lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	150	Leg	A325X	0.6250	5	3795.09	20708.70	0.183 ✔	1	Bolt Tension
T2	130	Leg	A325X	0.7500	5	12850.80	29820.60	0.431 ✔	1	Bolt Tension
T3	110	Leg	A325X	1.0000	6	19994.20	53014.40	0.377 ✔	1	Bolt Tension
T4	90	Leg	A325X	1.0000	6	20492.30	53014.40	0.387 ✔	1	Bolt Tension
		Diagonal	A325X	1.0000	1	9043.67	9144.14	0.989 ✔	1	Member Block Shear
T5	80	Leg	A325X	1.0000	6	24706.00	53014.40	0.466 ✔	1	Bolt Tension
		Diagonal	A325X	1.0000	1	8881.82	9144.14	0.971 ✔	1	Member Block Shear
T6	60	Leg	A325X	1.0000	6	29102.20	53014.40	0.549 ✔	1	Bolt Tension
		Diagonal	A325X	1.0000	1	8022.91	9144.14	0.877 ✔	1	Member Block Shear

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load per Bolt lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T7	40	Leg	A325X	1.0000	6	33182.70	53014.40	0.626 ✔	1	Bolt Tension
		Diagonal	A325X	1.0000	1	7714.87	10163.70	0.759 ✔	1	Member Block Shear
T8	20	Diagonal	A325X	1.0000	1	9045.29	16939.50	0.534 ✔	1	Member Block Shear

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $P_u / \phi P_n$
T1	150 - 130	1 3/4	20.00	2.49	68.3 K=1.00	2.4053	-22203.10	76967.90	0.288 [1] ✔
T2	130 - 110	2	20.00	2.48	59.5 K=1.00	3.1416	-68221.20	109130.00	0.625 [1] ✔
T3	110 - 90	2 1/4	20.00	2.49	53.1 K=1.00	3.9761	-128922.00	145578.00	0.886 [1] ✔
T4	90 - 80	Pirod 195542	10.02	10.02	37.5 K=1.00	5.3014	-131407.00	215254.00	0.610 [1] ✔
T5	80 - 60	Pirod 195555	20.03	10.02	37.4 K=1.00	5.3014	-157248.00	215400.00	0.730 [1] ✔
T6	60 - 40	Pirod 195557	20.03	10.02	31.9 K=1.00	7.2158	-184840.00	301490.00	0.613 [1] ✔
T7	40 - 20	Pirod 195557	20.03	10.02	31.9 K=1.00	7.2158	-211444.00	301490.00	0.701 [1] ✔
T8	20 - 0	Pirod 195557	20.03	10.02	31.9 K=1.00	7.2158	-236615.00	301490.00	0.785 [1] ✔

[1] $P_u / \phi P_n$ controls

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n lb	A in^2	V_u lb	ϕV_n lb	Stress Ratio
T4	90 - 80	0.4375	1.46	136.4	238565.00	0.1503	1166.04	2053.89	0.568 ✔
T5	80 - 60	0.4375	1.46	136.1	238565.00	0.1503	954.56	2066.51	0.462 ✔
T6	60 - 40	0.5	1.44	117.6	324713.00	0.1963	343.28	3624.14	0.095 ✔
T7	40 - 20	0.5	1.44	117.6	324713.00	0.1963	524.52	3624.14	0.145

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n lb	A in^2	V_u lb	ϕV_n lb	Stress Ratio
T8	20 - 0	0.5	1.44	117.6	324713.00	0.1963	1104.04	3624.14	0.305

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	150 - 130	7/8	5.59	2.71	133.9 K=0.90	0.6013	-4659.66	7581.20	0.615 [1]
T2	130 - 110	7/8	5.58	2.70	133.2 K=0.90	0.6013	-6140.73	7658.68	0.802 [1]
T3	110 - 90	1	5.59	2.69	116.1 K=0.90	0.7854	-7654.55	12512.20	0.612 [1]
T4	90 - 80	L2 1/2x2 1/2x3/16	11.42	5.02	121.8 K=1.00	0.9023	-9632.91	13384.80	0.720 [1]
T5	80 - 60	L2 1/2x2 1/2x3/16	12.50	5.67	137.5 K=1.00	0.9023	-9182.93	10788.80	0.851 [1]
T6	60 - 40	L2 1/2x2 1/2x3/16	13.80	6.37	154.4 K=1.00	0.9023	-8161.90	8547.93	0.955 [1]
T7	40 - 20	L3x3x3/16	15.24	7.12	143.3 K=1.00	1.0898	-8117.00	11981.50	0.677 [1]
T8	20 - 0	L3x3x5/16	16.80	7.92	161.4 K=1.00	1.7800	-9972.51	15430.20	0.646 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	150 - 130	7/8	5.00	4.85	186.4 K=0.70	0.6013	-253.39	3909.80	0.065 [1]
T2	130 - 110	7/8	5.00	4.83	185.6 K=0.70	0.6013	-93.64	3943.57	0.024 [1]
T3	110 - 90	1	5.00	4.81	161.7 K=0.70	0.7854	-42.67	6785.94	0.006 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	150 - 130	7/8	5.00	4.85	186.4 K=0.70	0.6013	-454.53	3909.80	0.116 [1] ✔
T2	130 - 110	7/8	5.00	4.83	185.6 K=0.70	0.6013	-477.72	3943.57	0.121 [1] ✔
T3	110 - 90	1	5.00	4.81	161.7 K=0.70	0.7854	-1068.68	6785.94	0.157 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	150 - 130	1 3/4	20.00	0.08	2.3	2.4053	18975.40	108238.00	0.175 [1] ✔
T2	130 - 110	2	20.00	0.08	2.0	3.1416	64254.00	141372.00	0.455 [1] ✔
T3	110 - 90	2 1/4	20.00	2.49	53.1	3.9761	119965.00	178924.00	0.670 [1] ✔
T4	90 - 80	Pirod 195542	10.02	10.02	37.5	5.3014	122954.00	238565.00	0.515 [1] ✔
T5	80 - 60	Pirod 195555	20.03	10.02	37.4	5.3014	148236.00	238565.00	0.621 [1] ✔
T6	60 - 40	Pirod 195557	20.03	10.02	31.9	7.2158	174613.00	324713.00	0.538 [1] ✔
T7	40 - 20	Pirod 195557	20.03	10.02	31.9	7.2158	199096.00	324713.00	0.613 [1] ✔
T8	20 - 0	Pirod 195557	20.03	10.02	31.9	7.2158	221335.00	324713.00	0.682 [1] ✔

[1] P_u / ϕP_n controls

Truss-Leg Diagonal Data

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n lb	A in^2	V_u lb	ϕV_n lb	Stress Ratio
T4	90 - 80	0.4375	1.46	136.4	238565.00	0.1503	1166.04	2053.89	0.568 ✔
T5	80 - 60	0.4375	1.46	136.1	238565.00	0.1503	954.56	2066.51	0.462 ✔
T6	60 - 40	0.5	1.44	117.6	324713.00	0.1963	343.28	3624.14	0.095 ✔

Section No.	Elevation ft	Diagonal Size	L_d ft	Kl/r	ϕP_n lb	A in^2	V_u lb	ϕV_n lb	Stress Ratio
T7	40 - 20	0.5	1.44	117.6	324713.00	0.1963	524.52	3624.14	0.145 ✔
T8	20 - 0	0.5	1.44	117.6	324713.00	0.1963	1104.04	3624.14	0.305 ✔

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	150 - 130	7/8	5.59	2.71	148.7	0.6013	4677.97	19482.80	0.240 [1] ✔
T2	130 - 110	7/8	5.58	2.70	148.0	0.6013	6091.23	19482.80	0.313 [1] ✔
T3	110 - 90	1	5.59	2.69	129.0	0.7854	7611.44	25446.90	0.299 [1] ✔
T4	90 - 80	L2 1/2x2 1/2x3/16	11.42	5.02	80.0	0.5186	9043.67	22557.10	0.401 [1] ✔
T5	80 - 60	L2 1/2x2 1/2x3/16	11.93	5.42	86.2	0.5186	8881.82	22557.10	0.394 [1] ✔
T6	60 - 40	L2 1/2x2 1/2x3/16	13.13	6.06	96.0	0.5186	8022.91	22557.10	0.356 [1] ✔
T7	40 - 20	L3x3x3/16	14.50	6.77	88.6	0.6592	7714.87	28674.30	0.269 [1] ✔
T8	20 - 0	L3x3x5/16	16.80	7.92	105.3	1.0713	9045.29	46602.80	0.194 [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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	150 - 130	7/8	5.00	4.85	266.3	0.6013	230.34	19482.80	0.012 [1] ✔
T2	130 - 110	7/8	5.00	4.83	265.1	0.6013	96.66	19482.80	0.005 [1] ✔
T3	110 - 90	1	5.00	4.81	231.0	0.7854	69.68	25446.90	0.003 [1] ✔

[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 lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	150 - 130	7/8	5.00	4.85	266.3	0.6013	456.23	19482.80	0.023 [1] ✔
T2	130 - 110	7/8	5.00	4.83	265.1	0.6013	469.91	19482.80	0.024 [1] ✔
T3	110 - 90	1	5.00	4.81	231.0	0.7854	1053.50	25446.90	0.041 [1] ✔

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	150 - 130	Leg	1 3/4	1	-22203.10	76967.90	28.8	Pass
T2	130 - 110	Leg	2	58	-68221.20	109130.00	62.5	Pass
T3	110 - 90	Leg	2 1/4	115	-128922.00	145578.00	88.6	Pass
T4	90 - 80	Leg	Pirod 195542	172	-131407.00	215254.00	61.0	Pass
T5	80 - 60	Leg	Pirod 195555	181	-157248.00	215400.00	73.0	Pass
T6	60 - 40	Leg	Pirod 195557	196	-184840.00	301490.00	61.3	Pass
T7	40 - 20	Leg	Pirod 195557	211	-211444.00	301490.00	70.1	Pass
T8	20 - 0	Leg	Pirod 195557	226	-236615.00	301490.00	78.5	Pass
T1	150 - 130	Diagonal	7/8	14	-4659.66	7581.20	61.5	Pass
T2	130 - 110	Diagonal	7/8	72	-6140.73	7658.68	80.2	Pass
T3	110 - 90	Diagonal	1	134	-7654.55	12512.20	61.2	Pass
T4	90 - 80	Diagonal	L2 1/2x2 1/2x3/16	176	-9632.91	13384.80	72.0 98.9 (b)	Pass
T5	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	188	-9182.93	10788.80	85.1 97.1 (b)	Pass
T6	60 - 40	Diagonal	L2 1/2x2 1/2x3/16	203	-8161.90	8547.93	95.5	Pass
T7	40 - 20	Diagonal	L3x3x3/16	218	-8117.00	11981.50	67.7 75.9 (b)	Pass
T8	20 - 0	Diagonal	L3x3x5/16	233	-9972.51	15430.20	64.6	Pass
T1	150 - 130	Top Girt	7/8	5	-253.39	3909.80	6.5	Pass
T2	130 - 110	Top Girt	7/8	62	-93.64	3943.57	2.4	Pass
T3	110 - 90	Top Girt	1	119	-42.67	6785.94	0.6	Pass
T1	150 - 130	Bottom Girt	7/8	8	-454.53	3909.80	11.6	Pass
T2	130 - 110	Bottom Girt	7/8	65	-477.72	3943.57	12.1	Pass
T3	110 - 90	Bottom Girt	1	122	-1068.68	6785.94	15.7	Pass
						Summary		
						Leg (T3)	88.6	Pass
						Diagonal (T4)	98.9	Pass
						Top Girt (T1)	6.5	Pass
						Bottom Girt (T3)	15.7	Pass
						Bolt Checks	98.9	Pass
						RATING =	**98.9**	**Pass**

MATHCAD CALCULATION PRINTOUT

150' SELF SUPPORTING TOWER MAT FOUNDATION

18 Montevideo Road
Avon, CT 06001

ACGI #18-5261

By:

Allpro Consulting Group, Inc.
9221 Lyndon B. Johnson Freeway, #204
Dallas, TX 75243
Phone: 972-231-8893
Fax: 866-364-8375

Foundation check

-Foundation Reactions-

(As per 150' SST drawings by Valmont Strcutures job #A-123241-F1010188 dated 11/30/07)

Total Shear	$S := 35.162 \cdot kips$	Compression on Pedestal:	$P_c := 245.519 \cdot kips$
Moment	$M := 2872 \cdot ft\_K$	Uplift on Pedestal:	$P_{up} := 228.922 \cdot kips$
Down load, Tower weight	$Pv := 25.850 \cdot kips$	Shear on Pedestal:	$Sh := 24.135 \cdot kips$

-Soil Properties- **Soil data as per Geotechnical report by DR. Clarence Welti., Project "Proposed Tower", dated 11/6/2007**

Allowable Bearing Capacity	$Brg_{allw} := 6 \cdot ksf$
Internal angle of friction for soil,	$\phi := 30 \cdot deg$
Unit wt. of soil,	$\gamma_s := 0.165 \cdot kcf$
Alowable Passive Pressure	see next page
Cohesion of soil,	$c_u := 0 \cdot ksf$
Friction Factor	$FF := 0.20$
Depth to be neglected	$L_{neg} := 3.33 \cdot ft$

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

DIMENSIONS

Tower face width $TWFW := 14 \cdot ft$ Tower ht. $Tw_{ht} := 150 \cdot ft$

The tower location is eccentric by $L_{pe} := 24.25 \cdot in$ 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,	$D_f := 6 \cdot ft$		
Thickness of mat,	$T_f := 2.5 \cdot ft$		
Pedestal size,	$Ped_s := 4 \cdot ft$	No. of pedestals	$Nped := 3$
Extension above the grade,	$E_g := 0.5 \cdot ft$		

Mat Dimensions, LxB $L := 23 \cdot ft$ x $B := L$ $B = 23\,ft$

$Brg_{allw} = 6 \cdot ksf$

-Reinforcement Data-

Typical concrete cover $cc := 3in$

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

Tiebar size $d_{tie} := 4$

MAT SIZING CALCULATIONS

Design of mat size

$K_p := \tan\left(45 \cdot deg + \frac{\phi}{2}\right)^2$ $K_p = 3$

$P_{pave} := \frac{(D_f - T_f - L_{neg}) \cdot K_p \cdot \gamma_s + (D_f - L_{neg}) \cdot K_p \cdot \gamma_s}{2}$ $P_{pave} = 0.703 \cdot ksf$

Calculate safety against overturning and location of resultant on the base

Resisting Moments about mid axis parallel to base

$Area_{ped} := if\left(col_t = 1, Ped_s^2, \frac{\pi}{4} \cdot Ped_s^2\right)$ $Area_{ped} = 12.566\,ft^2$

component	value, kips	lever arm, ft	resisting moment, ft-kips
1) Concrete wt.	$C_w := L \cdot B \cdot T_f \cdot (\gamma_c) + Area_{ped} \cdot \gamma_c \cdot (D_f + E_g - T_f) \cdot Nped$	$L_c := \frac{L}{2}$	$R_c := C_w \cdot L_c$
	$C_w = 220.994 \cdot kips$	$L_c = 11.5\,ft$	$R_c = 2541.436 \cdot ft\_K$
2) Soil wt.	$S_w := \left[L \cdot B \cdot (D_f - T_f) - Area_{ped} \cdot (D_f - T_f) \cdot Nped\right] \cdot \gamma_s$	$L_s := \frac{L}{2}$	$R_s := S_w \cdot L_s$
	$S_w = 283.726 \cdot kips$	$L_s = 11.5\,ft$	$R_s = 3262.852 \cdot ft\_K$
3) Wt. of soil wedge	$W_w := (D_f) \cdot \frac{1}{2} \cdot (D_f \cdot \tan(\phi)) \cdot B \cdot (\gamma_s)$	$L_w := \left(L + D_f \cdot \frac{\tan(\phi)}{3}\right)$	$R_w := W_w \cdot L_w$
	$W_w = 39.439 \cdot kips$	$L_w = 24.155\,ft$	$R_w = 952.632 \cdot ft\_K$
4) Passive pressure	$Pe_p := T_f \cdot B \cdot P_{pave}$	$L_p := \frac{T_f}{3}$	$R_p := Pe_p \cdot L_p$
	$Pe_p = 40.417 \cdot kips$	$L_p = 0.833\,ft$	$R_p = 33.681 \cdot ft\_K$
5) Vertical	$Pv = 25.85 \cdot kips$	$L_v := \frac{L}{2}$	$R_v := Pv \cdot L_v$
$S_{w1} := L \cdot B \cdot D_f \cdot \gamma_s$	$S_{w1} = 523.71 \cdot kips$ <--- for net calcs	$L_v = 11.5\,ft$	$R_v = 297.275 \cdot ft\_K$
Total weight	$T_w := C_w + S_w + W_w + Pv$ $T_w = 570.01 \cdot kips$		
Total resisting Moment=	$M_r := R_c + R_s + R_w + R_p + R_v$	$M_r = 7087.876 \cdot ft\_K$	

Overturning Moments

component	value, kips	lever arm, ft	Overturning Moment ft-kips
1) Moment on foundation due to eccentric location of tower	$Pv = 25.85 \cdot kips$	$L_{pe} = 2.021\,ft$	$M_{pe} := L_{pe} \cdot Pv$ $M_{pe} = 52.239 \cdot ft\_K$
2) Moment on foundation	-	-	$M = 2872 \cdot ft\_K$

3) Moment due to horizontal shear $S_t := S$ $L_{hs} := D_f + E_g$ $L_{hs} = 6.5\,ft$ $O_{hs} := L_{hs} \cdot S_t$ $O_{hs} = 228.553 \cdot ft\_K$

Total Overturning Moment= $M_o := M + O_{hs} + M_{pe}$ $M_o = 3152.792 \cdot ft\_K$

Check Safety Factor against Overturning about mid axis parallel to base $\frac{M_o}{M_r} = 44.481 \cdot \%$ OK!!

$SF := \frac{M_r}{M_o}$ $SF = 2.248$ > 1.5 **O.K!** Calculate eccentricity, e $e := \frac{M_o}{T_w}$ $e = 5.531\,ft$

Check location of eccentricity and determine pressure distribution under the mat

$L_{loc} := \frac{L}{6}$ $L_{loc} = 3.833\,ft$ For net bearing calcs $T_{w1} := S_{w1} + W_w$ $T_{w1} = 563.149 \cdot kips$

$P_{max1} := if\left[e \le L_{loc}, \frac{T_w}{L \cdot B} \cdot \left[1 + \left(6 \cdot \frac{e}{L}\right)\right], 4 \cdot \frac{T_w}{3 \cdot B \cdot (L - 2 \cdot e)}\right]$ $P_{max1} = 2.768 \cdot ksf$

$P_{max2} := \left(\frac{T_{w1}}{L \cdot B}\right)$ $P_{max2} = 1.065 \cdot ksf$ $P_{net} := P_{max1} - P_{max2}$ $P_{max} := P_{net}$

Net soil pressure, $P_{net} = 1.703 \cdot ksf$ < $Brg_{allw} = 6 \cdot ksf$ **O.K.!**

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

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

$P_{hor} = 226.117 \cdot kips$ $S = 35.162 \cdot kips$ Since P.hor > S it is safe!

Check for uplift

Component	Down load value, kips
1) Soil Weight	$S_w := \left[L \cdot B \cdot (D_f - T_f) - Area_{ped} \cdot (D_f - T_f) \cdot Nped\right] \cdot \gamma_s$ $S_w = 283.726 \cdot kips$
2) Wt. of soil wedge	$W_w := (D_f) \cdot \frac{1}{2} \cdot (D_f \cdot \tan(\phi)) \cdot B \cdot (\gamma_s)$ $W_w = 39.439 \cdot kips$
3)Concrete wt.	$C_w := L \cdot B \cdot T_f \cdot (\gamma_c) + Area_{ped} \cdot \gamma_c \cdot (D_f + E_g - T_f) \cdot Nped$ $C_w = 220.994 \cdot kips$

Total down load:

$TWT1 := S_w + W_w + C_w$ $TWT1 = 544.16 \cdot kips$ Total down load

Skin friction around footing:

$SKF := FF \cdot c_u \cdot (L + B) \cdot 2 \cdot T_f \cdot ft$ $SKF = 0 \cdot kips$

$T_{down} := \phi_{s\_uplift} \cdot (TWT1 + SKF)$ $T_{down} = 408.12 \cdot kips$ > $P_{up} = 228.922 \cdot kips$ **OK!**

REINFORCED CONCRETE ANALYSIS

$\frac{P_{up}}{T_{down}} = 0.561$

General Input parameters

Concrete Cover $cc := 3.0 \cdot in$

Reduction factors as per respective ACI sections

$\phi_{shear} := 0.75$ as per ACI 9.3.2.3

$\phi_{compr} := 0.65$ 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=

$\nu_{wide} := 2 \cdot \phi_{shear} \cdot \sqrt{f_c \cdot psi}$ $\nu_{wide} = 82.158 \cdot psi$

Effective depth of steel= $d := T_f - cc$ $d = 27 \cdot in$ $L_{eff} := if(e \le L_{loc}, L, L - 2 \cdot e)$ $L_{eff} = 11.938\,ft$

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

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

shear on the face of concrete=

$$Shear_{wide} := (dist) \cdot B \cdot \left[\frac{P_{maxf} + \left[P_{maxf} - \frac{P_{maxf} - P_{minf}}{L_{eff}} \cdot (dist)\right]}{2}\right]$$ $Shear_{wide} = 108.817 \cdot kips$

Area of concrete in shear= $A_{shear} := B \cdot d$ $A_{shear} = 7452 \cdot in^2$

Shear stress acting on concrete fa $\nu_{act} := \frac{Shear_{wide}}{A_{shear}}$ $\nu_{act} = 14.602 \cdot psi$

$\nu_{act} = 14.602 \cdot psi$ < $\nu_{wide} = 82.158 \cdot psi$ **O.K!**

Check for punching or two-way shear in mat

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

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

$\nu_{punch} = 164.317 \cdot psi$ $Area_{col} := if\left[col_t = 0, \frac{\pi}{4} \cdot (Ped_s + d)^2, (Ped_s + d)^2\right]$

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

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

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

$\nu_{act} = 8.621 \cdot psi$ < $\nu_{punch} = 164.317 \cdot psi$ **O.K!**

Analysis of Pedestal Column

Analysis pedestal steel for uplift $d_i := Ped_s - 2 \cdot cc$ $d_i = 42 \cdot in$

Effective diameter/size= $D_{eff} := Ped_s - cc \cdot 2$ $D_{eff} = 42 \cdot in$ $h := Ped_s$ $h = 48 \cdot in$

$D_{pier} := Ped_s$

$M_{col} := Sh \cdot (D_f - T_f + E_g)$ $M_{col} = 96.54 \cdot ft\_K$ $\sigma_{bend} := 0.6 \cdot f_y$ $\sigma_{bend} = 36000 \cdot psi$

-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)

$Area_{stlmin} = 9.048 \cdot in^2$

-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-

$NRB := ceil\left(\frac{Area_{stlmin}}{Area_{abar}}\right)$ $NRB = 12$ $Area_{stluse} := Area_{abar} \cdot NRB$ $Area_{stluse} = 9.48 \cdot in^2$

As per Lpile calculations, need $NRB := 12$

$Mn := 7027.430 \cdot in \cdot kips$

$0.9 \cdot Mn = 527.057 \cdot kips \cdot ft$ > $M_{col} = 96.54 \cdot kips \cdot ft$ **OK** under uplift force

Use ($NRB = 12$) $d_{bar} = 8$ vertical bars

Vertical bar spacing $S_{bar} := D_{eff} \cdot \frac{\pi}{NRB} - d_{b_{B_1}}$ $S_{bar} = 9.996 \cdot in$

Check pedestal in compression

Allowable compressive load on column ACI 10.15= $P_{comp} := \phi_{compr} \cdot 0.85 \cdot f_c \cdot Area_{ped}$ $P_{comp} = 2999.341 \cdot kips$

$P_{comp} = 2999.341 \cdot kips$ > $P_c = 245.519 \cdot kips$ **O.K!**

Analysis of mat footing

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

$P_{upnet} := P_{up} - \frac{C_{wped} + S_w \cdot 0.95}{Nped}$ $P_{upnet} = 131.536 \cdot kips$

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

$B_{mo} := RC_{fac} \cdot \left[(TWFW \cdot P_{upnet}) \cdot Langle + S_t \cdot (D_f + E_g)\right]$ $B_{mo} = 1823.337 \cdot ft\_K$

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

$W_e := TWFW \cdot Langle + Ped_s$ $W_e = 16.124\,ft$

Reinforcement middle bandwidth.

$B_{mo1} = 172338.266\,ft \cdot lb$

required R_u $R_u := \frac{B_{mo}}{\phi_{bend} \cdot B \cdot d^2}$ $R_u = 120.828 \cdot psi$ $m := \frac{f_y}{\beta_1 \cdot f_c}$ $m = 23.529$

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=

$Ast_f := \rho \cdot B \cdot d$ $Ast_f = 15.38 \cdot in^2$

minimum area of steel required,

$Ast_{minf} := .0018 \cdot B \cdot T_f$ $Ast_{minf} = 14.904 \cdot in^2$ per ACI 10.5.3 & 7.12

$Ast_{fuse} := if(Ast_f > Ast_{minf}, Ast_f, Ast_{minf})$ $Ast_{fuse} = 15.38 \cdot in^2$

Chose bar size to be u $f_{bar} := 8$ $f_{dia} := \frac{f_{bar}}{8} \cdot in$ $f_{dia} = 1 \cdot in$

Bar area= $f_{abar} := \pi \cdot \frac{f_{dia}^2}{4}$ $f_{abar} = 0.785 \cdot in^2$

Number of bars required= $Nf_{bars} := if\left(Ast_{fuse} = Ast_{minf}, \frac{Ast_{fuse}}{f_{abar}}, \frac{Ast_{fuse}}{f_{abar}} \cdot \frac{L}{W_e}\right)$ $Nf_{bars} = 27.933$

Use $Nf_{bars} := 26$

Required ($Nf_{bars} = 26$) # $f_{bar} = 8$ bars each way at the Top and Bottom of the mat

Analysis Summary

-Foundation Reactions-

Shear $S = 35.162 \cdot kips$

Down load $Pv = 25.85 \cdot kips$ (Weight)

Uplift load $P_{up} = 228.922 \cdot kips$

Moment; $M = 2872 \cdot ft\_K$

Stability Calculations

Safety Factor against Overturning $SF = 2.248 > 1.5$

$\frac{M_o}{M_r} = 44.481 \cdot \%$ OK!!

Net soil pressure, $P_{net} = 1.703 \cdot ksf < Brg_{allw} = 6 \cdot ksf$

$\frac{P_{net}}{Brg_{allw}} = 28.391 \cdot \%$ OK!!

Check for horizontal shear $P_{hor} = 226.117 \cdot kips$ $S = 35.162 \cdot kips$

$\frac{S}{P_{hor}} = 15.55 \cdot \%$ OK!!

Check for uplift $T_{down} = 408.12 \cdot kips > P_{up} = 228.922 \cdot kips$ $\frac{P_{up}}{T_{down}} = 56.092 \cdot \%$ OK!!

==========

LPile for Windows, Version 2018-10.006

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

==========

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Files Used for Analysis

Path to file locations:
\2018\Structural\18-5261 CT22071-A-02 Avon (Montevideo) SA SBA 150 SST T-Mobile\L-Pile\

Name of input data file:

CT22071-a-02 Avon ACGI#18-5261.lp10

Name of output report file:
CT22071-a-02 Avon ACGI#18-5261.lp10

Name of plot output file:
CT22071-a-02 Avon ACGI#18-5261.lp10

Name of runtime message file:
CT22071-a-02 Avon ACGI#18-5261.lp10

Date and Time of Analysis

Date: August 28, 2018 Time: 8:30:54

Problem Title

NY09965-B-02 Horton South
Job Number: 18-4661
Client:
Engineer: Bryan Andrade
Description: SA

Program Options and Settings

Computational Options:
- Compute nonlinear bending properties of pile only

Engineering Units Used for Data Input and Computations:
- US Customary System Units (pounds, feet, inches)

Output Options:
- Output files use decimal points to denote decimal symbols.
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined	=	1
Total length of pile	=	4.000 ft
Depth of ground surface below top of pile	=	0.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	48.0000
2	4.000	48.0000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

Section 1 is a round drilled shaft, bored pile, or CIDH pile

Length of section	=	4.000000 ft
Shaft Diameter	=	48.000000 in
Shear capacity of section	=	0.0000 lbs

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from input values

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Dimensions and Properties of Drilled Shaft (Bored Pile):

Length of Section	=	4.000000 ft
Shaft Diameter	=	48.000000 in
Concrete Cover Thickness (to edge of long. rebar)	=	3.000000 in
Number of Reinforcing Bars	=	12 bars
Yield Stress of Reinforcing Bars	=	60000. psi
Modulus of Elasticity of Reinforcing Bars	=	29000000. psi
Gross Area of Shaft	=	1810. sq. in.
Total Area of Reinforcing Steel	=	9.480000 sq. in.
Area Ratio of Steel Reinforcement	=	0.52 percent
Edge-to-Edge Bar Spacing	=	9.611581 in
Maximum Concrete Aggregate Size	=	0.750000 in
Ratio of Bar Spacing to Aggregate Size	=	12.82
Offset of Center of Rebar Cage from Center of Pile	=	0.0000 in

Axial Structural Capacities:

Nom. Axial Structural Capacity = 0.85 Fc Ac + Fy As = 5158.997 kips
Tensile Load for Cracking of Concrete = -683.547 kips
Nominal Axial Tensile Capacity = -568.800 kips

Reinforcing Bar Dimensions and Positions Used in Computations:

Bar Number	Bar Diam. inches	Bar Area sq. in.	X inches	Y inches
1	1.000000	0.790000	20.500000	0.00000
2	1.000000	0.790000	17.753521	10.250000
3	1.000000	0.790000	10.250000	17.753521
4	1.000000	0.790000	0.00000	20.500000
5	1.000000	0.790000	-10.250000	17.753521
6	1.000000	0.790000	-17.753521	10.250000
7	1.000000	0.790000	-20.500000	0.00000
8	1.000000	0.790000	-17.753521	-10.250000
9	1.000000	0.790000	-10.250000	-17.753521
10	1.000000	0.790000	0.00000	-20.500000
11	1.000000	0.790000	10.250000	-17.753521
12	1.000000	0.790000	17.753521	-10.250000

NOTE: The positions of the above rebars were computed by LPile

Minimum spacing between any two bars not equal to zero = 9.612 inches
between bars 7 and 8.

Ratio of bar spacing to maximum aggregate size = 12.82

Concrete Properties:

Compressive Strength of Concrete = 3000. psi
Modulus of Elasticity of Concrete = 3122019. psi
Modulus of Rupture of Concrete = -410.791918 psi
Compression Strain at Peak Stress = 0.001634
Tensile Strain at Fracture of Concrete = -0.0001160
Maximum Coarse Aggregate Size = 0.750000 in

Input Axial Thrust Forces:

Number of Axial Thrust Force Values Determined from Input Data = 2

Number	Axial Thrust Force kips
1	-228.922
2	245.519

```
Definitions of Run Messages and Notes:
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  C = concrete in section has cracked in tension.
  Y = stress in reinforcing steel has reached yield stress.
  T = ACI 318 criteria for tension-controlled section met, tensile strain in
      reinforcement exceeds 0.005 while simultaneously compressive strain in
      concrete more than 0.003. See ACI 318, Section 10.3.4.
  Z = depth of tensile zone in concrete section is less than 10 percent of
      section depth.

Bending Stiffness (EI) = Computed Bending Moment / Curvature.
Position of neutral axis is measured from edge of compression side of pile.
Compressive stresses and strains are positive in sign.
Tensile stresses and strains are negative in sign.


Axial Thrust Force =   -228.922 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens
Max Conc      Max Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain
Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in
ksi           ksi
------------ ------------ ------------ ------------ ------------ ------------ ----
--------- ------------ ---
  6.25000E-07   617.6003574
988160572.   -29.7439647   -0.00001859   -0.00004859    -0.0684364    -1.4047594
   0.00000125         1235.
988121788.    -2.9123338   -0.00000364   -0.00006364    -0.0144556    -1.8368721
   0.00000188         1852.    987968409.     6.0142824    0.00001128   -0.00007872
 0.0396346    -2.2699233
   0.00000250         2468.    987143113.    10.4693315    0.00002617   -0.00009383
 0.0931947    -2.7035735
   0.00000313         2468.    789714491.  -242.4580128    -0.0007577    -0.0009077
    0.00000   -26.3010074 C
   0.00000375         2468.    658095409.  -198.0480996    -0.0007427    -0.0009227
    0.00000   -26.7316308 C
   0.00000438         2468.    564081779.  -166.3267331    -0.0007277    -0.0009377
    0.00000   -27.1622542 C
   0.00000500         2468.    493571557.  -142.5357081    -0.0007127    -0.0009527
    0.00000   -27.5928777 C
   0.00000563         2468.    438730273.  -124.0315776    -0.0006977    -0.0009677
    0.00000   -28.0235011 C
   0.00000625         2468.    394857245.  -109.2282732    -0.0006827    -0.0009827
    0.00000   -28.4541245 C
   0.00000688         2468.    358961132.   -97.1164787    -0.0006677    -0.0009977
    0.00000   -28.8847479 C
   0.00000750         2468.    329047704.   -87.0233167    -0.0006527    -0.0010127
    0.00000   -29.3153714 C
   0.00000813         2468.    303736343.   -78.4829487    -0.0006377    -0.0010277
    0.00000   -29.7459948 C
   0.00000875         2468.    282040890.   -71.1626334    -0.0006227    -0.0010427
    0.00000   -30.1766182 C
```

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0.00000938         2468.    263238164.   -64.8183601    -0.0006077    -0.0010577
 0.00000   -30.6072418 C
0.00001000         2468.    246785778.   -59.2671209    -0.0005927    -0.0010727
 0.00000   -31.0378651 C
0.00001063         2468.    232268968.   -54.3689687    -0.0005777    -0.0010877
 0.00000   -31.4684885 C
0.00001125         2468.    219365136.   -50.0150557    -0.0005627    -0.0011027
 0.00000   -31.8991119 C
0.00001188         2468.    207819603.   -46.1194492    -0.0005477    -0.0011177
 0.00000   -32.3297353 C
0.00001250         2468.    197428623.   -42.6134035    -0.0005327    -0.0011327
 0.00000   -32.7603587 C
0.00001313         2468.    188027260.   -39.4412668    -0.0005177    -0.0011477
 0.00000   -33.1909820 C
0.00001375         2468.    179480566.   -36.5575062    -0.0005027    -0.0011627
 0.00000   -33.6216055 C
0.00001438         2468.    171677063.   -33.9245074    -0.0004877    -0.0011777
 0.00000   -34.0522290 C
0.00001500         2468.    164523852.   -31.5109252    -0.0004727    -0.0011927
 0.00000   -34.4828524 C
0.00001563         2468.    157942898.   -29.2904295    -0.0004577    -0.0012077
 0.00000   -34.9134759 C
0.00001625         2468.    151868171.   -27.2407412    -0.0004427    -0.0012227
 0.00000   -35.3440992 C
0.00001688         2468.    146243424.   -25.3428817    -0.0004277    -0.0012377
 0.00000   -35.7747226 C
0.00001750         2468.    141020445.   -23.5805835    -0.0004127    -0.0012527
 0.00000   -36.2053461 C
0.00001813         2468.    136157671.   -21.9398232    -0.0003977    -0.0012677
 0.00000   -36.6359695 C
0.00001875         2468.    131619082.   -20.4084469    -0.0003827    -0.0012827
 0.00000   -37.0665929 C
0.00001938         2468.    127373305.   -18.9758690    -0.0003677    -0.0012977
 0.00000   -37.4972164 C
0.00002000         2468.    123392889.   -17.6328273    -0.0003527    -0.0013127
 0.00000   -37.9278398 C
0.00002063         2468.    119653711.   -16.3711820    -0.0003377    -0.0013277
 0.00000   -38.3584632 C
0.00002125         2468.    116134484.   -15.1837512    -0.0003227    -0.0013427
 0.00000   -38.7890867 C
0.00002188         2468.    112816356.   -14.0641736    -0.0003077    -0.0013577
 0.00000   -39.2197100 C
0.00002250         2468.    109682568.   -13.0067947    -0.0002927    -0.0013727
 0.00000   -39.6503335 C
0.00002313         2468.    106718174.   -12.0065714    -0.0002777    -0.0013877
 0.00000   -40.0809569 C
0.00002375         2468.    103909801.   -11.0589915    -0.0002627    -0.0014027
 0.00000   -40.5115803 C
0.00002438         2468.    101245448.   -10.1600054    -0.0002477    -0.0014177
 0.00000   -40.9422037 C
0.00002563         2468.     96306645.    -8.4935921    -0.0002176    -0.0014476
 0.00000   -41.8034505 C
0.00002688         2468.     91827266.    -6.9821940    -0.0001876    -0.0014776
 0.00000   -42.6646974 C
0.00002813         2468.     87746055.    -5.6051425    -0.0001576    -0.0015076
 0.00000   -43.5259443 C
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 0.00002938         2468.     84012180.    -4.3452868    -0.0001276    -0.0015376
  0.00000   -44.3871911 C
 0.00003063         2468.     80583111.    -3.1882765   -0.00009764    -0.0015676
  0.00000   -45.2484379 C
 0.00003188         2468.     77422989.    -2.1220120   -0.00006764    -0.0015976
  0.00000   -46.1096847 C
 0.00003313         2468.     74501367.    -1.1362204   -0.00003764    -0.0016276
  0.00000   -46.9709317 C
 0.00003438         2468.     71792226.    -0.2221227   -0.00000764    -0.0016576
  0.00000   -47.8321785 C
 0.00003563         2468.     69273201.     0.6126417    0.00002183    -0.0016882
0.0485618   -48.7091146 C
 0.00003688         2468.     66924957.     1.3205170    0.00004869    -0.0017213
0.1445610   -49.6612220 C
 0.00003813         2468.     64730696.     1.9120106    0.00007290    -0.0017571
0.2295663   -50.6906832 C
 0.00003938         2468.     62675753.     2.4142644    0.00009506    -0.0017949
0.3062087   -51.7791618 C
 0.00004063         2516.     61920157.     2.8467015     0.0001156    -0.0018344
0.3763494   -52.9134797 C
 0.00004188         2652.     63336879.     3.2261516     0.0001351    -0.0018749
0.4417073   -54.0807926 C
 0.00004313         2794.     64784463.     3.5629685     0.0001537    -0.0019163
0.5032600   -55.2739123 C
 0.00004438         2941.     66266306.     3.8587326     0.0001712    -0.0019588
0.5608195   -56.4954434 C
 0.00004563         3089.     67698232.     4.1319705     0.0001885    -0.0020015
0.6167639   -57.7253365 C
 0.00004688         3241.     69135652.     4.3742110     0.0002050    -0.0020450
0.6695676   -58.9775567 C
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0.7213932   -60.0000000 CY
 0.00004938         3549.     71876199.     4.8035110     0.0002372    -0.0021328
0.7705270   -60.0000000 CY
 0.00005063         3704.     73169599.     4.9967298     0.0002530    -0.0021770
0.8192915   -60.0000000 CY
 0.00005188         3862.     74446035.     5.1702918     0.0002682    -0.0022218
0.8658547   -60.0000000 CY
 0.00005313         4009.     75466750.     5.3234824     0.0002828    -0.0022672
0.9099282   -60.0000000 CY
 0.00005438         4137.     76090108.     5.4536935     0.0002965    -0.0023135
0.9509124   -60.0000000 CY
 0.00005563         4265.     76671556.     5.5728376     0.0003100    -0.0023600
0.9906188   -60.0000000 CY
 0.00005688         4393.     77239264.     5.6821309     0.0003232    -0.0024068
1.0291557   -60.0000000 CY
 0.00005813         4488.     77205989.     5.7597040     0.0003348    -0.0024552
1.0626868   -60.0000000 CY
 0.00005938         4556.     76732763.     5.8129771     0.0003451    -0.0025049
1.0922739   -60.0000000 CY
 0.00006063         4624.     76274718.     5.8641901     0.0003555    -0.0025545
1.1216575   -60.0000000 CY
 0.00006188         4692.     75834132.     5.9136285     0.0003659    -0.0026041
1.1508656   -60.0000000 CY
 0.00006313         4760.     75409961.     5.9614002     0.0003763    -0.0026537
1.1798975   -60.0000000 CY
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1.2366521   -60.0000000 CY
 0.00006688         4965.     74237757.     6.0879728     0.0004071    -0.0028029
1.2644888   -60.0000000 CY
 0.00006813         5033.     73875266.     6.1265982     0.0004174    -0.0028526
1.2921502   -60.0000000 CY
 0.00006938         5101.     73524945.     6.1640734     0.0004276    -0.0029024
1.3196354   -60.0000000 CY
 0.00007063         5169.     73186144.     6.2004612     0.0004379    -0.0029521
1.3469436   -60.0000000 CY
 0.00007188         5237.     72858253.     6.2358202     0.0004482    -0.0030018
1.3740742   -60.0000000 CY
 0.00007313         5302.     72501642.     6.2679426     0.0004583    -0.0030517
1.4005827   -60.0000000 CY
 0.00007438         5353.     71971840.     6.2883397     0.0004677    -0.0031023
1.4247667   -60.0000000 CY
 0.00007938         5465.     68844871.     6.2948003     0.0004996    -0.0033104
1.5055567   -60.0000000 CY
 0.00008438         5569.     65999887.     6.2968318     0.0005313    -0.0035187
1.5834403   -60.0000000 CY
 0.00008938         5673.     63469677.     6.3000329     0.0005631    -0.0037269
1.6595461   -60.0000000 CY
 0.00009438         5776.     61204156.     6.3042452     0.0005950    -0.0039350
1.7338548   -60.0000000 CY
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1.8063462   -60.0000000 CY
  0.0001044         5982.     57314804.     6.3152270     0.0006592    -0.0043508
1.8769996   -60.0000000 CY
  0.0001094         6085.     55632202.     6.3218150     0.0006914    -0.0045586
1.9457939   -60.0000000 CY
  0.0001144         6187.     54092206.     6.3289002     0.0007239    -0.0047661
2.0126723   -60.0000000 CY
  0.0001194         6254.     52386754.     6.3073845     0.0007529    -0.0049771
2.0705366   -60.0000000 CY
  0.0001244         6279.     50487283.     6.2547074     0.0007779    -0.0051921
2.1185277   -60.0000000 CY
  0.0001294         6305.     48732474.     6.2064643     0.0008030    -0.0054070
2.1653377   -60.0000000 CY
  0.0001344         6330.     47107439.     6.1622991     0.0008281    -0.0056219
2.2109940   -60.0000000 CY
  0.0001394         6355.     45598202.     6.1217785     0.0008532    -0.0058368
2.2554877   -60.0000000 CY
  0.0001444         6380.     44192722.     6.0845295     0.0008785    -0.0060515
2.2988093   -60.0000000 CY
  0.0001494         6405.     42880571.     6.0502290     0.0009038    -0.0062662
2.3409495   -60.0000000 CY
  0.0001544         6430.     41652671.     6.0185959     0.0009291    -0.0064809
2.3818985   -60.0000000 CY
  0.0001594         6455.     40500512.     5.9881336     0.0009544    -0.0066956
2.4213249   -60.0000000 CY
  0.0001644         6479.     39416838.     5.9579179     0.0009793    -0.0069107
2.4590403   -60.0000000 CY
  0.0001694         6503.     38396498.     5.9299180     0.0010044    -0.0071256
2.4955951   -60.0000000 CY
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    0.0001744          6528.     37434037.     5.9039494     0.0010295    -0.0073405
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    0.0001794          6552.     36524605.     5.8798485     0.0010547    -0.0075553
  2.5651817   -60.0000000 CY
    0.0001844          6576.     35663881.     5.8574696     0.0010800    -0.0077700
  2.5981923   -60.0000000 CY
    0.0001894          6599.     34847998.     5.8366823     0.0011053    -0.0079847
  2.6300001   -60.0000000 CY
    0.0001944          6623.     34073488.     5.8173701     0.0011308    -0.0081992
  2.6605940   -60.0000000 CY
    0.0001994          6647.     33337229.     5.7994282     0.0011563    -0.0084137
  2.6899623   -60.0000000 CY
    0.0002044          6670.     32636405.     5.7827624     0.0011819    -0.0086281
  2.7180936   -60.0000000 CY
    0.0002094          6693.     31968470.     5.7672876     0.0012075    -0.0088425
  2.7449758   -60.0000000 CY
    0.0002144          6717.     31331115.     5.7529267     0.0012333    -0.0090567
  2.7705966   -60.0000000 CY
    0.0002194          6740.     30722239.     5.7396102     0.0012591    -0.0092709
  2.7949436   -60.0000000 CY
    0.0002244          6763.     30139930.     5.7272745     0.0012851    -0.0094849
  2.8180037   -60.0000000 CY
    0.0002294          6785.     29582443.     5.7158623     0.0013111    -0.0096989
  2.8397638   -60.0000000 CY
    0.0002344          6808.     29048180.     5.7053209     0.0013372    -0.0099128
  2.8602102   -60.0000000 CY
    0.0002394          6831.     28535678.     5.6956026     0.0013634    -0.0101266
  2.8793292   -60.0000000 CY
    0.0002444          6853.     28042739.     5.6864306     0.0013896    -0.0103404
  2.8970675   -60.0000000 CY
    0.0002494          6870.     27548136.     5.6722549     0.0014145    -0.0105555
  2.9125585   -60.0000000 CY
    0.0002544          6887.     27072553.     5.6589592     0.0014395    -0.0107705
  2.9268340   -60.0000000 CY
    0.0002594          6900.     26600917.     5.6423835     0.0014635    -0.0109865
  2.9393253   -60.0000000 CY
    0.0002644          6906.     26120230.     5.6188573     0.0014855    -0.0112045
  2.9497001   -60.0000000 CY
    0.0002694          6911.     25657162.     5.5964322     0.0015075    -0.0114225
  2.9591291   -60.0000000 CY
    0.0002744          6916.     25206209.     5.5736195     0.0015293    -0.0116407
  2.9674539   -60.0000000 CY
    0.0003044          6934.     22780547.     5.4366718     0.0016548    -0.0129552
  2.9969809   -60.0000000 CY
    0.0003344          6949.     20781424.     5.3231882     0.0017799    -0.0142701
  2.9899885   -60.0000000 CY
    0.0003644          6962.     19107026.     5.2343724     0.0019073    -0.0155827
  2.9976391   -60.0000000 CY
    0.0003944          6974.     17683238.     5.1647502     0.0020368    -0.0168932
  2.9944976   -60.0000000 CY
    0.0004244          6984.     16457841.     5.1094568     0.0021683    -0.0182017
  2.9946997   -60.0000000 CY
    0.0004544          6994.     15391588.     5.0656686     0.0023017    -0.0195083
2.9898121    60.0000000 CY
    0.0004844          7002.     14455413.     5.0278389     0.0024354    -0.0208146
2.9998395    60.0000000 CY
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    0.0005144         7009.     13625797.     4.9928111     0.0025682    -0.0221218
2.9853627    60.0000000 CY
    0.0005444         7015.     12886719.     4.9640400     0.0027023    -0.0234277
2.9871025    60.0000000 CY
    0.0005744         7021.     12224051.     4.9405092     0.0028377    -0.0247323
2.9985020    60.0000000 CY
    0.0006044         7027.     11626130.     4.9221405     0.0029748    -0.0260352
2.9925617    60.0000000 CY
    0.0006344         7031.     11084020.     4.9076892     0.0031133    -0.0273367
2.9772539    60.0000000 CYT
    0.0006644         7036.     10590453.     4.8960001     0.0032528    -0.0286372
2.9795934    60.0000000 CYT
    0.0006944         7040.     10139111.     4.8868149     0.0033933    -0.0299367
2.9939388    60.0000000 CYT
    0.0007244         7044.      9724721.     4.8799311     0.0035349    -0.0312351
2.9998638    60.0000000 CYT
    0.0007544         7048.      9342612.     4.8758870     0.0036782    -0.0325318
2.9889623    60.0000000 CYT
    0.0007844         7051.      8989464.     4.8732620     0.0038225    -0.0338275
2.9754573    60.0000000 CYT


Axial Thrust Force =    245.519 kips

    Bending       Bending       Bending      Depth to      Max Comp      Max Tens
Max Conc      Max Steel  Run
   Curvature      Moment       Stiffness      N Axis        Strain        Strain
Stress        Stress    Msg
    rad/in.       in-kip        kip-in2         in           in/in         in/in
ksi           ksi
------------- ------------- ------------- ------------- ------------- ------------- ----
--------- ------------- ---
  6.25000E-07   616.6815935    986690550.    81.6807350    0.00005105    0.00002105
0.1840428     1.4761133
   0.00000125         1233.    986671288.    52.8808310    0.00006610    0.00000610
0.2368172     1.9082301
   0.00000188         1850.    986581668.    43.2985442    0.00008118   -0.00000882
0.2892080     2.3413083
   0.00000250         2465.    985940656.    38.5168878    0.00009629   -0.00002371
0.3411795     2.7750744
   0.00000313         3077.    984639687.    35.6518006     0.0001114   -0.00003859
0.3926897     3.2091944
   0.00000375         3686.    982878768.    33.7435928     0.0001265   -0.00005346
0.4437196     3.6435157
   0.00000438         4291.    980813839.    32.3816216     0.0001417   -0.00006833
0.4942604     4.0779683
   0.00000500         4893.    978543259.    31.3607985     0.0001568   -0.00008320
0.5443074     4.5125158
   0.00000563         5491.    976128704.    30.5672813     0.0001719   -0.00009806
0.5938580     4.9471378
   0.00000625         6085.    973610112.    29.9328109     0.0001871    -0.0001129
0.6429106     5.3818220
   0.00000688         6085.    885100102.    24.8783856     0.0001710    -0.0001590
0.5899023     4.9122781 C
   0.00000750         6085.    811341760.    24.0571955     0.0001804    -0.0001796
0.6202256     5.1802399 C
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  0.00000813         6085.    748930856.    23.3372341     0.0001896    -0.0002004
0.6496937    -5.7546142 C
  0.00000875         6085.    695435795.    22.6975941     0.0001986    -0.0002214
0.6783413    -6.3595857 C
  0.00000938         6085.    649073408.    22.1252509     0.0002074    -0.0002426
0.7062716    -6.9694474 C
  0.00001000         6085.    608506320.    21.6099536     0.0002161    -0.0002639
0.7335701    -7.5835135 C
  0.00001063         6085.    572711831.    21.1428642     0.0002246    -0.0002854
0.7602866    -8.2014050 C
  0.00001125         6085.    540894507.    20.7172528     0.0002331    -0.0003069
0.7864748    -8.8226963 C
  0.00001188         6085.    512426375.    20.3279578     0.0002414    -0.0003286
0.8121930    -9.4469095 C
  0.00001250         6085.    486805056.    19.9694612     0.0002496    -0.0003504
 0.8374440   -10.0740703 C
  0.00001313         6085.    463623863.    19.6370232     0.0002577    -0.0003723
 0.8622194   -10.7043081 C
  0.00001375         6085.    442550051.    19.3304592     0.0002658    -0.0003942
 0.8866678   -11.3362794 C
  0.00001438         6085.    423308745.    19.0452040     0.0002738    -0.0004162
 0.9107400   -11.9704806 C
  0.00001500         6085.    405670880.    18.7782994     0.0002817    -0.0004383
 0.9344264   -12.6070398 C
  0.00001563         6085.    389444045.    18.5305419     0.0002895    -0.0004605
 0.9578734   -13.2445981 C
  0.00001625         6085.    374465428.    18.2961282     0.0002973    -0.0004827
 0.9809068   -13.8848496 C
  0.00001688         6085.    360596338.    18.0778321     0.0003051    -0.0005049
 1.0037465   -14.5257109 C
  0.00001750         6085.    347717897.    17.8710676     0.0003127    -0.0005273
 1.0262446   -15.1686332 C
  0.00001813         6085.    335727625.    17.6763243     0.0003204    -0.0005496
 1.0484949   -15.8127320 C
  0.00001875         6085.    324536704.    17.4939576     0.0003280    -0.0005720
 1.0705857   -16.4571605 C
  0.00001938         6085.    314067778.    17.3183193     0.0003355    -0.0005945
 1.0922649   -17.1044193 C
  0.00002000         6085.    304253160.    17.1539402     0.0003431    -0.0006169
 1.1138380   -17.7515146 C
  0.00002063         6085.    295033367.    16.9982807     0.0003506    -0.0006394
 1.1352142   -18.3993533 C
  0.00002125         6085.    286355915.    16.8479963     0.0003580    -0.0006620
 1.1562373   -19.0495222 C
  0.00002188         6160.    281587921.    16.7065501     0.0003655    -0.0006845
 1.1771568   -19.6995322 C
  0.00002250         6247.    277648670.    16.5732060     0.0003729    -0.0007071
 1.1979726   -20.3493830 C
  0.00002313         6333.    273875277.    16.4429036     0.0003802    -0.0007298
 1.2183962   -21.0020278 C
  0.00002375         6419.    270292562.    16.3191960     0.0003876    -0.0007524
 1.2386858   -21.6548537 C
  0.00002438         6505.    266890575.    16.2020520     0.0003949    -0.0007751
 1.2588742   -22.3075244 C
  0.00002563         6676.    260541999.    15.9817101     0.0004095    -0.0008205
 1.2986753   -23.6152417 C
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 0.00002688         6846.    254733829.    15.7781765     0.0004240    -0.0008660
1.3377452   -24.9258336 C
 0.00002813         7015.    249429780.    15.5932103     0.0004386    -0.0009114
1.3763974   -26.2360378 C
 0.00002938         7183.    244514409.    15.4178664     0.0004529    -0.0009571
1.4141149   -27.5514550 C
 0.00003063         7350.    239991450.    15.2575144     0.0004673    -0.0010027
1.4514439   -28.8662700 C
 0.00003188         7517.    235811833.    15.1099742     0.0004816    -0.0010484
1.4883479   -30.1808676 C
 0.00003313         7682.    231902065.    14.9686520     0.0004958    -0.0010942
1.5243873   -31.5001886 C
 0.00003438         7847.    228269015.    14.8382100     0.0005101    -0.0011399
1.5600445   -32.8189093 C
 0.00003563         8011.    224883501.    14.7175065     0.0005243    -0.0011857
1.5953180   -34.1370260 C
 0.00003688         8176.    221711268.    14.6039810     0.0005385    -0.0012315
1.6300621   -35.4562177 C
 0.00003813         8339.    218721317.    14.4951484     0.0005526    -0.0012774
1.6641140   -36.7784514 C
 0.00003938         8502.    215914696.    14.3937573     0.0005668    -0.0013232
1.6977881   -38.1000783 C
 0.00004063         8664.    213274441.    14.2991240     0.0005809    -0.0013691
1.7310825   -39.4210945 C
 0.00004188         8827.    210785607.    14.2106465     0.0005951    -0.0014149
1.7639958   -40.7414960 C
 0.00004313         8988.    208427858.    14.1262847     0.0006092    -0.0014608
1.7963749   -42.0631651 C
 0.00004438         9150.    206186648.    14.0449266     0.0006232    -0.0015068
1.8281461   -43.3870850 C
 0.00004563         9310.    204062697.    13.9684978     0.0006373    -0.0015527
1.8595410   -44.7103812 C
 0.00004688         9471.    202046587.    13.8966072     0.0006514    -0.0015986
1.8905580   -46.0330494 C
 0.00004813         9631.    200129876.    13.8289044     0.0006655    -0.0016445
1.9211955   -47.3550852 C
 0.00004938         9791.    198304978.    13.7650744     0.0006797    -0.0016903
1.9514517   -48.6764840 C
 0.00005063         9951.    196565055.    13.7048335     0.0006938    -0.0017362
1.9813248   -49.9972412 C
 0.00005188        10110.    194898207.    13.6463764     0.0007079    -0.0017821
2.0106438   -51.3196823 C
 0.00005313        10269.    193300783.    13.5899560     0.0007220    -0.0018280
2.0394559   -52.6432238 C
 0.00005438        10428.    191772110.    13.5365475     0.0007360    -0.0018740
2.0678887   -53.9661064 C
 0.00005563        10586.    190307520.    13.4859510     0.0007502    -0.0019198
2.0959405   -55.2883251 C
 0.00005688        10744.    188902754.    13.4379843     0.0007643    -0.0019657
2.1236095   -56.6098745 C
 0.00005813        10902.    187553919.    13.3924808     0.0007784    -0.0020116
2.1508939   -57.9307494 C
 0.00005938        11059.    186257450.    13.3492880     0.0007926    -0.0020574
2.1777920   -59.2509445 C
 0.00006063        11216.    185010075.    13.3082662     0.0008068    -0.0021032
2.2043019   -60.0000000 CY
```

```
 0.00006188        11373.    183808786.    13.2692867     0.0008210    -0.0021490
2.2304216   -60.0000000 CY
 0.00006313        11530.    182650813.    13.2322315     0.0008353    -0.0021947
2.2561494   -60.0000000 CY
 0.00006438        11686.    181533179.    13.1968304     0.0008495    -0.0022405
2.2814647   -60.0000000 CY
 0.00006563        11839.    180401490.    13.1604738     0.0008637    -0.0022863
2.3060746   -60.0000000 CY
 0.00006688        11974.    179049186.    13.1202439     0.0008774    -0.0023326
2.3296484   -60.0000000 CY
 0.00006813        12098.    177585098.    13.0783683     0.0008910    -0.0023790
2.3524518   -60.0000000 CY
 0.00006938        12221.    176160291.    13.0380901     0.0009045    -0.0024255
2.3748710   -60.0000000 CY
 0.00007063        12344.    174781900.    12.9995298     0.0009181    -0.0024719
2.3969291   -60.0000000 CY
 0.00007188        12454.    173267610.    12.9583325     0.0009314    -0.0025186
2.4181287   -60.0000000 CY
 0.00007313        12532.    171373971.    12.9085578     0.0009439    -0.0025661
2.4377884   -60.0000000 CY
 0.00007438        12598.    169381452.    12.8568156     0.0009562    -0.0026138
2.4566872   -60.0000000 CY
 0.00007938        12859.    162003794.    12.6650174     0.0010053    -0.0028047
2.5289211   -60.0000000 CY
 0.00008438        13116.    155448269.    12.4919638     0.0010540    -0.0029960
2.5955513   -60.0000000 CY
 0.00008938        13371.    149602172.    12.3414825     0.0011030    -0.0031870
2.6574595   -60.0000000 CY
 0.00009438        13601.    144112992.    12.1996384     0.0011513    -0.0033787
2.7134457   -60.0000000 CY
 0.00009938        13715.    138008084.    12.0272174     0.0011952    -0.0035748
2.7598300   -60.0000000 CY
  0.0001044        13818.    132391684.    11.8704422     0.0012390    -0.0037710
2.8020356   -60.0000000 CY
  0.0001094        13920.    127270144.    11.7279775     0.0012827    -0.0039673
2.8401638   -60.0000000 CY
  0.0001144        14018.    122562528.    11.5926187     0.0013259    -0.0041641
2.8737569   -60.0000000 CY
  0.0001194        14115.    118238953.    11.4706319     0.0013693    -0.0043607
2.9035514   -60.0000000 CY
  0.0001244        14210.    114252823.    11.3604471     0.0014130    -0.0045570
2.9294814   -60.0000000 CY
  0.0001294        14304.    110561030.    11.2591625     0.0014567    -0.0047533
2.9513830   -60.0000000 CY
  0.0001344        14394.    107120400.    11.1612953     0.0014998    -0.0049502
2.9690174   -60.0000000 CY
  0.0001394        14484.    103917659.    11.0723298     0.0015432    -0.0051468
2.9827690   -60.0000000 CY
  0.0001444        14571.    100927837.    10.9913892     0.0015869    -0.0053431
2.9925644   -60.0000000 CY
  0.0001494        14658.     98129298.    10.9177171     0.0016308    -0.0055392
2.9983272   -60.0000000 CY
  0.0001544        14743.     95501065.    10.8505304     0.0016751    -0.0057349
2.9990773   -60.0000000 CY
  0.0001594        14799.     92854377.    10.7739107     0.0017171    -0.0059329
2.9989045   -60.0000000 CY
```

```
    0.0001644        14824.     90182014.    10.6837958     0.0017561    -0.0061339
  2.9991192   -60.0000000 CY
    0.0001694        14848.     87660628.    10.6004088     0.0017954    -0.0063346
  2.9980765   -60.0000000 CY
    0.0001744        14871.     85280313.    10.5229869     0.0018349    -0.0065351
  2.9999305   -60.0000000 CY
    0.0001794        14893.     83027918.    10.4513211     0.0018747    -0.0067353
  2.9959254   -60.0000000 CY
    0.0001844        14915.     80894359.    10.3846642     0.0019147    -0.0069353
  2.9990781   -60.0000000 CY
    0.0001894        14936.     78870398.    10.3225880     0.0019548    -0.0071352
  2.9993495   -60.0000000 CY
    0.0001944        14955.     76936888.    10.2587196     0.0019940    -0.0073360
  2.9960374   -60.0000000 CY
    0.0001994        14973.     75097992.    10.1986095     0.0020333    -0.0075367
  2.9989293   -60.0000000 CY
    0.0002044        14990.     73347135.    10.1422701     0.0020728    -0.0077372
  2.9999946   -60.0000000 CY
    0.0002094        15007.     71676704.    10.0898104     0.0021126    -0.0079374
  2.9944446   -60.0000000 CY
    0.0002144        15024.     70082596.    10.0405211     0.0021524    -0.0081376
2.9975090    60.0000000 CY
    0.0002194        15040.     68559672.     9.9941648     0.0021925    -0.0083375
2.9995395    60.0000000 CY
    0.0002244        15056.     67102792.     9.9506668     0.0022327    -0.0085373
2.9985933    60.0000000 CY
    0.0002294        15072.     65707172.     9.9099897     0.0022731    -0.0087369
2.9934886    60.0000000 CY
    0.0002344        15087.     64369997.     9.8716055     0.0023137    -0.0089363
2.9970586    60.0000000 CY
    0.0002394        15101.     63086973.     9.8347538     0.0023542    -0.0091358
2.9992274    60.0000000 CY
    0.0002444        15115.     61851502.     9.7958759     0.0023939    -0.0093361
2.9999948    60.0000000 CY
    0.0002494        15128.     60663766.     9.7594577     0.0024338    -0.0095362
2.9953978    60.0000000 CY
    0.0002544        15141.     59521961.     9.7249381     0.0024738    -0.0097362
2.9935870    60.0000000 CY
    0.0002594        15154.     58423511.     9.6921759     0.0025139    -0.0099361
2.9967942    60.0000000 CY
    0.0002644        15166.     57365942.     9.6610793     0.0025541    -0.0101359
2.9989084    60.0000000 CY
    0.0002694        15178.     56346964.     9.6315632     0.0025945    -0.0103355
2.9999128    60.0000000 CY
    0.0002744        15190.     55363945.     9.6037832     0.0026350    -0.0105350
2.9971482    60.0000000 CY
    0.0003044        15259.     50132556.     9.4638792     0.0028806    -0.0117294
2.9989283    60.0000000 CY
    0.0003344        15321.     45820991.     9.3616022     0.0031303    -0.0129197
2.9991172    60.0000000 CYT
    0.0003644        15372.     42187138.     9.2794410     0.0033812    -0.0141088
2.9911326    60.0000000 CYT
    0.0003944        15410.     39073485.     9.2323199     0.0036410    -0.0152890
2.9958898    60.0000000 CYT
    0.0004244        15410.     36311295.     9.2622652     0.0039307    -0.0164393
2.9976793    60.0000000 CYT
```

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003
or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	-228.922	7027.430	0.00300000
2	245.519	15288.891	0.00300000

Note that the values of moment capacity in the table above are not
factored by a strength reduction factor (phi-factor).

In ACI 318, the value of the strength reduction factor depends on whether
the transverse reinforcing steel bars are tied hoops (0.65) or spirals (0.70).

The above values should be multiplied by the appropriate strength reduction
factor to compute ultimate moment capacity according to ACI 318, Section
9.3.2.2 or the value required by the design standard being followed.

The following table presents factored moment capacities and corresponding
bending stiffnesses computed for common resistance factor values used for
reinforced concrete sections.

Axial Load No.	Resist. Factor for Moment	Nominal Moment Cap in-kips	Ult. (Fac) Ax. Thrust kips	Ult. (Fac) Moment Cap in-kips	Bend. Stiff. at Ult Mom kip-in^2
1	0.65	7027.	-148.799300	4568.	76653305.
2	0.65	15289.	159.587350	9938.	196710158.
1	0.70	7027.	-160.245400	4919.	74488034.
2	0.70	15289.	171.863300	10702.	189272823.
1	0.75	7027.	-171.691500	5271.	72672333.
2	0.75	15289.	184.139250	11467.	183117686.

The analysis ended normally.

EXISTING 150' SELF SUPPORT TOWER ANCHOR BOLT CHECK

REACTIONS ON THE FOUNDATION

As per Tnx output (see attached)

Down load; $Pv := 245.519 \cdot kips$ Shear; $V_u := 22.692 \cdot kips$

Uplift load; $P_{up} := 228.922 \cdot kips$ Moment; $M := 0 \cdot kips \cdot ft$

Number of Anchor Rods: $N_{anchors} := 6$

Diameter of Anchors: $D_{anchors} := 1in$ $n := 8in^{-1}$

Area of anchor bolts $A_b := \frac{\pi \cdot \left(D_{anchors}^{2}\right)}{4} = 0.785 \cdot in^2$

Net Tensile Area of Anchors: $A_{net} := \frac{\pi}{4} \cdot \left(D_{anchors} - \frac{0.9743}{n}\right)^2 = 0.606 \cdot in^2$

Minimum Yield Stress $F_{Yanchors} := 105ksi$ (ASTM A687)

Ultimate Tensile Stress: $F_{Uanchors} := 150ksi$

Saftey Factor for Anchor: $\phi_t := 0.8$ (Section 4.9.9, TIA-222-G Addendum 2)

Allowable Axial Load per Anchor: $T_{cap} := \phi_t \cdot F_{Uanchors} \cdot A_{net}$

$T_{cap} = 72.689 \cdot kips$

Interaction Equation for Anchor Rods as per Section 4.9.9, TIA-222-G Addendum 1 and Figure 4.4

For detail type (C) as per Figure 4.4 $\eta := .55$

$P_u := if\left(\eta > 0.5, P_{up}, Pv\right) = 228.922 \cdot kips$

Maximum Load on Anchor: $T_{max} := \frac{P_u + \frac{V_u}{\eta}}{N_{anchors}}$

$T_{max} = 45.03 \cdot kips$

Anchor Rod Capacity: $\frac{T_{max}}{T_{cap}} = 61.949 \cdot \%$ OK!

$Anchor\_Rod\_Check := if\left(T_{max} < T_{cap}, "OK", "Not\ OK"\right)$

Anchor_Rod_Check = "OK"

Summary

-Foundation Reactions from Tower Base-

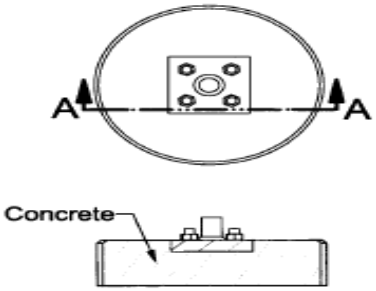
Shear	$V_u = 22.692 \cdot kips$
Down load	$Pv = 245.519 \cdot kips$
Uplift load	$P_{up} = 228.922 \cdot kips$
Moment	$M = 0 \cdot ft \cdot kip$

Anchor Rod Check $T_{max} = 45.03 \cdot kips$ < $T_{cap} = 72.689 \cdot kips$

Anchor_Rod_Check := if($T_{max} < T_{cap}$, "OK" , "Not OK")

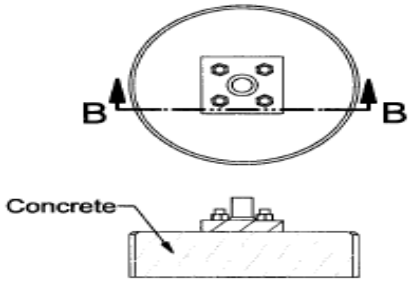
Anchor_Rod_Check = "OK"

ANSI/TIA-222-G



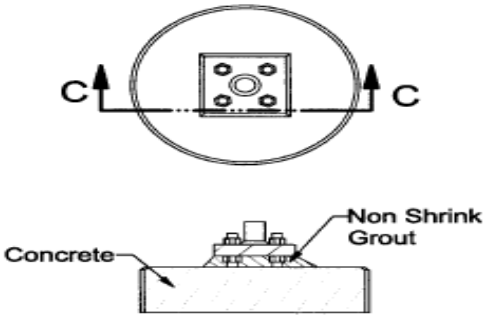
SECTION A-A

Detail Type (a)



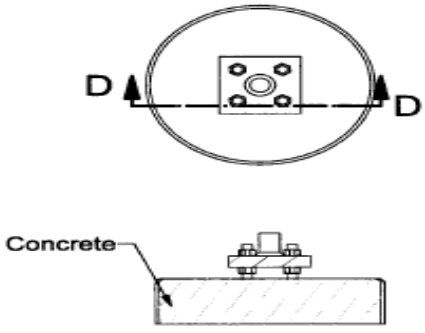
SECTION B-B

Detail Type (b)



SECTION C-C

Detail Type (c)



SECTION D-D

Detail Type (d)

(See Note 1 below)

Note:

1. When clear distance from top of concrete to the bottom face of the leveling nut exceeds 1.5 times the diameter of the anchor rod, bending of the anchor rod shall be considered (refer to 4.9.9).

Figure 4-4: Anchor Rod Detail Types

4.9.9 Anchor Rods

For anchor rods, the following interaction equation shall be satisfied:

$$\left(\frac{P_u + \frac{V_u}{\eta}}{\phi R_{nt}} \right) \leq 1$$

where:

$\phi = 0.80$

P_u = tension force for detail types (a), (b) & (c) and larger of compression or tension force for type (d) as depicted in Figure 4-4.

V_u = shear force (direct shear and torsion components) corresponding to P_u

R_{nt} = nominal tensile strength of anchor rod as per 4.9.6.1

η = 0.90 for detail type (a)
= 0.70 for detail type (b)
= 0.55 for detail type (c)
= 0.50 for detail type (d)

For detail type (d), when the clear distance from the top of concrete to the bottom leveling nut exceeds 1.0 times the diameter of the anchor rod, the following interaction equation shall also be satisfied:

$$\left(\frac{V_u}{\phi R_{nv}} \right)^2 + \left(\left| \frac{P_u}{\phi R_{nt}} \right| + \left| \frac{M_u}{\phi R_{nm}} \right| \right)^2 \leq 1$$

where:

M_u = bending moment corresponding to V_u
= 0.65 $l_{ar} V_u$

l_{ar} = length from top of concrete to bottom of anchor rod leveling nut

Addendum 1

ϕR_{nv} = design shear strength of anchor rod as per 4.9.6.3

ϕR_{nm} = design flexural strength of anchor rod in accordance with 4.7.1 using the tensile root diameter for the determination of z

d_{rt} = tensile root diameter of rod, in [mm]
= d – 0.9743/n inches
= d – 0.9382(p) mm

d = nominal rod diameter, in [mm]

n = number of threads per inch

p = pitch of threads, mm

4.9.6.3 Design Shear Strength

The design shear strength of a bolt, ϕR_{nv}, shall be taken as:

$\phi = 0.75$

(a) When threads are excluded from the shear plane:
$R_{nv} = 0.55\ F_{ub}\ A_b$

(b) When threads are included in the shear plane:
$R_{nv} = 0.45\ F_{ub}\ A_b$

where:

F_{ub} = Specified minimum tensile strength of bolt

A_b = nominal unthreaded area of bolt

4.7.1 Solid Round Members

For solid round members, M_n shall be determined as follows:

$M_n = F_y'Z$

where:

F_y' = effective yield stress as determined from 4.5.4.1

Z = plastic section modulus

4.5.4.1 Effective Yield Stress

For 60^O and 90^O angle members, the effective yield stress for axial compression, F'_y, shall be determined as follows:

$w/t \le 0.47\sqrt{\frac{E}{F_y}}$	$F'_y = F_y$
$0.47\sqrt{\frac{E}{F_y}} < w/t \le 0.85\sqrt{\frac{E}{F_y}}$	$F'_y = \left[1.677-0.677\left(\frac{w/t}{0.47\sqrt{E/F_y}}\right)\right] F_y$
$0.85\sqrt{\frac{E}{F_y}} < w/t \le 25$	$F'_y = [0.0332\ \pi^2\ E/(w/t)^2]$

The width to thickness ratio (w/t) shall not exceed 25 for angle members (refer to Figure 4-3).

For solid round members, the effective yield stress, F'_y, shall be equal to F_y.

For tubular round members, the diameter to thickness ratio (D/t) shall not exceed 400. The effective yield stress, F'_y, shall be determined as follows:

$D/t \le 0.114\ E/F_y$	$F'_y = F_y$
$0.114\ E/F_y < D/t \le 0.448\ E/F_y$	$F'_y = \left(\frac{0.0379E}{(D/t)F_y} + \frac{2}{3}\right)F_y$
$0.448\ E/F_y < D/t \le 400$	$F'_y = \frac{0.337E}{(D/t)}$

July 5, 2018

SBA Communications Corporation
134 Flanders Rd., Suite 125
Westborough, MA 01581

RE:

SBA Site ID:	CT22071-A
Site Number:	CT11284A
Site Name:	Avon_1
Site Address:	81 Montevideo Road Avon, CT 06001

To Whom It May Concern:

Hudson Design Group LLC (HDG) has been authorized by T-Mobile to perform a mount analysis on the existing T-Mobile antenna mount to determine its capability of supporting the following equipment loading:

- (1) AIR 21 KRC118023-1_B2A_B4P Antenna (55.0"x12.0"x8.0" – Wt. = 83 lbs. /each)
- (1) AIR 32 KRD901146-1_B66A_B2A Antenna (56.6"x12.9"x8.7" – Wt. = 132 lbs. /each)
- (1) KRY 112 144/2 TMA (6.9"x6.1"x2.8" – Wt. = 11 lbs. /each)
- **(1) APXVAARR24_43-U-NA20 Antennas (96.0"x24.0"x8.7" – Wt. = 128 lbs. /each)**
- **(1) RRUS 4449 B71 + B12 RRH's (13.1"x14.9"x9.2" – Wt. = 74 lbs. /each)**

**Proposed equipment shown in bold.*

No original structural design documents or fabrication drawings were available for the existing mounts. HDG's sub-consultant, ProVertic LLC, conducted a survey climb and mapping of the existing T-Mobile antenna mounts on June 27, 2018.

Based on our analysis, we have determined that the existing antenna mount **IS CAPABLE** of supporting the proposed antenna installations.

	Component	Controlling Load Case	Stress Ratio	Pass/Fail
Existing Mount Rating	1	LC1	65%	**PASS**

This analysis was conducted in accordance with EIA/TIA-222-G, Structural Standards for Steel Antenna Towers and Antenna Supporting Structures, and the International Building Code 2012 (See the attached analysis).

Reference Documents:

- Mount mapping report prepared by ProVertic LLC.

This determination was based on the following limitations and assumptions:

1. HDG is not responsible for any modifications completed prior to and hereafter which HDG was not directly involved.

2. All structural members and their connections are assumed to be in good condition and are free from defects with no deterioration to its member capacities.

3. All antennas, coax cables and waveguide cables are assumed to be properly installed and supported as per the manufacturer's requirements.

4. The existing mount has been adequately secured to the tower structure per the mount manufacturer's specifications.

5. All components pertaining to T-Mobile's mounts must be tightened and re-plumbed prior to the installation of new appurtenances.

6. HDG performed a localized analysis on the mount itself and not on the supporting tower structure.

Please feel free to contact our office should you have any questions.

Respectfully Submitted,
Hudson Design Group LLC

Michael Cabral
Structural Dept. Head

STATE OF CONNECTICUT
DANIEL HAMM
24178
LICENSED
PROFESSIONAL ENGINEER

Daniel P. Hamm, PE
Principal

FIELD PHOTOS:

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p: 413.588.8139 f: 413.517.0590 a: 116 Pleasant Street, Ste 302, Easthampton, MA 01027

HUDSON
Design Group LLC

Wind & Ice
Calculations

Date: 7/5/2018
Project Name: Avon_1
Project Number: CT11284A
Designed By: JP **Checked By**: MSC

HUDSON Design Group LLC

2.6.5.2 Velocity Pressure Coeff:

$K_z = 2.01\ (z/z_g)^{2/\alpha}$

z=	136 (ft)
z_g=	1200 (ft)
α=	7.0

K_z= 1.079

Kzmin ≤ Kz ≤ 2.01

Table 2-4

Exposure	Z_g	α	K_{zmin}	K_e
B	1200 ft	7.0	0.70	0.9
C	900 ft	9.5	0.85	1.0
D	700 ft	11.5	1.03	1.1

2.6.6.4 Topographic Factor:

Table 2-5

Topo. Category	K_t	f
2	0.43	1.25
3	0.53	2.0
4	0.72	1.5

$K_{zt} = [1+(K_e K_t/K_h)]^2$

$K_h = e^{(f*z/H)}$

K_{zt}= 1.666454916

K_h=	1.639669
K_e=	0.9 (from Table 2-4)
K_t=	0.53 (from Table 2-5)
f=	2 (from Table 2-5)
z=	136
H=	550 (Ht. of the crest above surrounding terrain)
K_{zt}=	1.67

(If Category 1 then K_{zt} =1.0)

Category= **3**

Date: 7/5/2018
Project Name: Avon_1
Project Number: CT11284A
Designed By: JP Checked By: MSC

HUDSON Design Group LLC

2.6.7 Gust Effect Factor

2.6.7.1 Self Supporting Lattice Structures

Gh = 1.0 Latticed Structures > 600 ft

Gh = 0.85 Latticed Structures 450 ft or less

Gh = 0.85 + 0.15 [h/150 - 3.0] h= ht. of structure

h=	150	Gh=	0.85
2.6.7.2 Guyed Masts		Gh=	0.85
2.6.7.3 Pole Structures		Gh=	1.1
2.6.9 Appurtenances		Gh=	1.0

2.6.7.4 Structures Supported on Other Structures
(Cantilivered tubular or latticed spines, pole, structures on buildings (ht. : width ratio > 5)

Gh=	1.35	**Gh=**	**1.00**

2.6.9.2 Design Wind Force on Appurtenances

$F = q_z * Gh * (EPA)_A$

$q_z = 0.00256 * K_z * K_{zt} * K_d * V_{max}^2 * I$

		K_z=	1.079
		K_{zt}=	1.7
q_z=	43.14	K_d=	0.85
$q_{z\,(ice)}$=	9.78	V_{max}=	105
		$V_{max\,(ice)}$=	50
		I=	1.0

Table 2-2

Structure Type	Wind Direction Probability Factor, Kd
Latticed structures with triangular, square or rectangular cross sections	0.85
Tubular pole structures, latticed structures with other cross sections, appurtenances	0.95

Date: 7/5/2018
Project Name: Avon_1
Project Number: CT11284A
Designed By: JP Checked By: MSC

HUDSON Design Group LLC

Determine Ca:

Table 2-8

Force Coefficients (Ca) for Appurtenances				
Member Type		Aspect Ratio ≤ 2.5	Aspect Ratio = 7	Aspect Ratio ≥ 25
		Ca	Ca	Ca
Flat		1.2	1.4	2.0
Round	C < 32 (Subcritical)	0.7	0.8	1.2
	32 ≤ C ≤ 64 (Transitional)	$3.76/(C^{0.485})$	$3.37/(C^{0.415})$	$38.4/(C^{1.0})$
	C > 64 (Supercritical)	0.5	0.6	0.6

Aspect Ratio is the overall length/width ratio in the plane normal to the wind direction.
(Aspect ratio is independent of the spacing between support points of a linear appurtenance, and the section length considered to have uniform wind load).

Note: Linear interpolation may be used for aspect ratios other than those shown.

Ice Thickness = 1.00 in

Appurtenances	Height	Width	Depth	Flat Area	Aspect Ratio	Ca	Force (lbs)	Force (lbs) (1" Ice)
APXVAARR24_43-U-NA20 Antenna	96.0	24.0	8.7	16.00	4.00	1.27	**874**	**219**
AIR 32 KRD901146-1_B66A_B2A Ant	56.6	12.9	8.7	5.07	4.39	1.28	**281**	**76**
AIR 21 KRC118023-1_B2A_B4P Ante	55.0	12.0	8.0	4.58	4.58	1.29	**256**	**70**
RRUS 4449 B71 + B12 RRH	13.1	14.9	9.2	1.36	0.88	1.20	**70**	**21**
KRY 112 144/2 TMA	6.9	6.1	2.8	0.29	1.13	1.20	**15**	**6**

Date: 7/5/2018
Project Name: Avon_1
Project Number: CT11284A
Designed By: JP **Checked By:** MSC

HUDSON Design Group LLC

ICE WEIGHT CALCULATIONS

Thickness of ice: 1 in.
Density of ice: 56 pcf

AIR 21 KRC118023-1_B2A_B4P Antenna

Weight of ice based on total radial SF area:

Height (in):	55.0	
Width (in):	12.0	
Depth (in):	8.0	
Total weight of ice on object:		88 lbs
Weight of object:	83 lbs	
Combined weight of ice and object:		171 lbs

AIR 32 KRD901146-1 Antenna

Weight of ice based on total radial SF area:

Height (in):	56.6	
Width (in):	12.9	
Depth (in):	8.7	
Total weight of ice on object:		97 lbs
Weight of object:	132 lbs	
Combined weight of ice and object:		229 lbs

APXVAARR24_43-U-NA20 Antenna

Weight of ice based on total radial SF area:

Height (in):	96.0	
Width (in):	24.0	
Depth (in):	8.7	
Total weight of ice on object:		234 lbs
Weight of object:	128 lbs	
Combined weight of ice and object:		362 lbs

4449 B71+B12 RRH

Weight of ice based on total radial SF area:

Height (in):	13.1	
Width (in):	14.9	
Depth (in):	9.2	
Total weight of ice on object:		34 lbs
Weight of object:	74 lbs	
Combined weight of ice and object:		108 lbs

KRY 112 144/2 TMA

Weight of ice based on total radial SF area:

Height (in):	6.9	
Width (in):	6.1	
Depth (in):	2.8	
Total weight of ice on object:		7 lbs
Weight of object:	11 lbs	
Combined weight of ice and object:		18 lbs

2" pipe

Per foot weight of ice:

diameter (in):	2.38	
Per foot weight of ice on object:		4 plf

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Mount Calculations
(Existing Conditions)

Bentley

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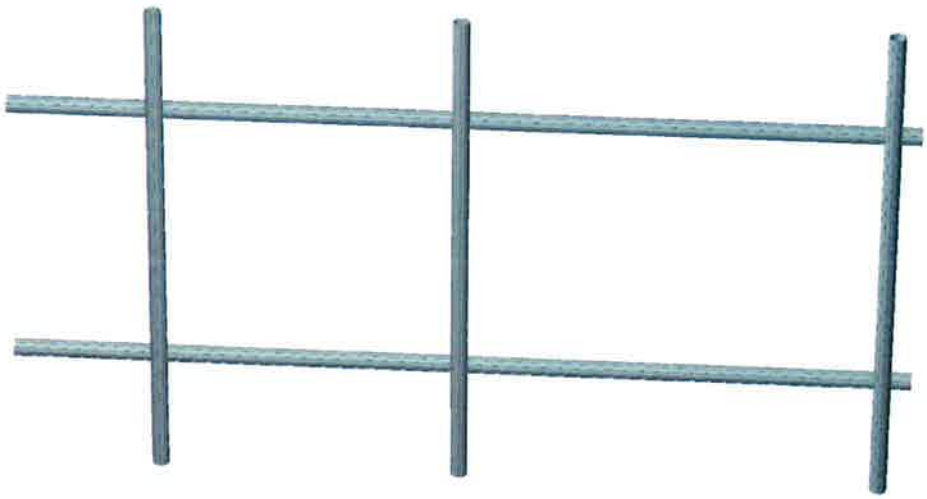

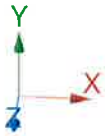

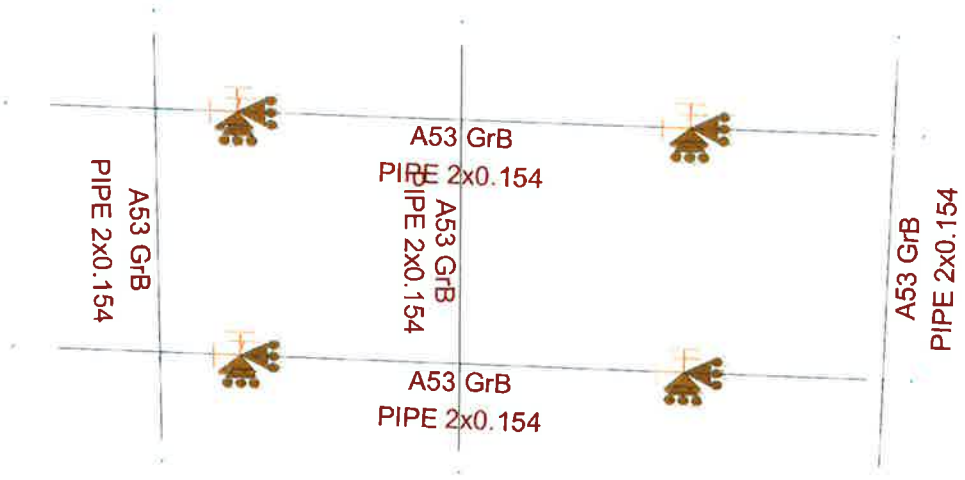
A53 GrB
PIPE 2x0.154
A53 GrB
PIPE 2x0.154
A53 GrB
PIPE 2x0.154
A53 GrB
PIPE 2x0.154
A53 GrB
PIPE 2x0.154


Y
X
Z

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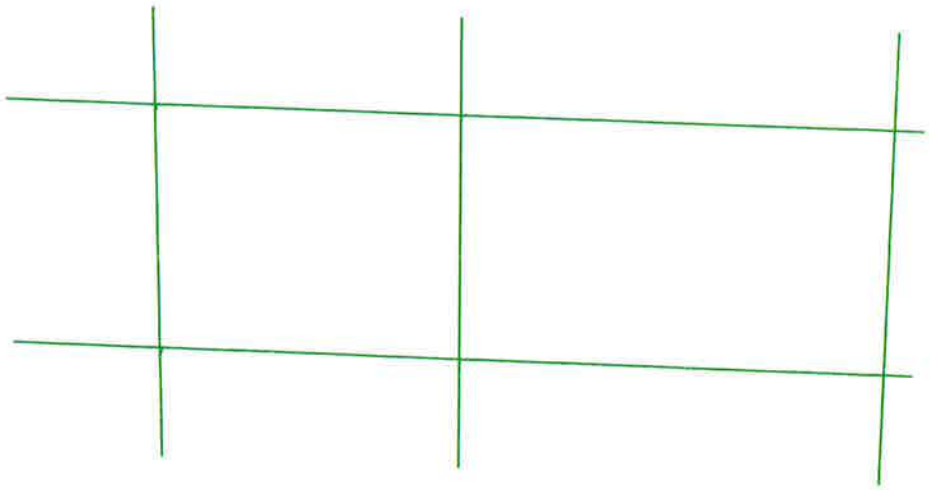
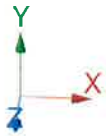
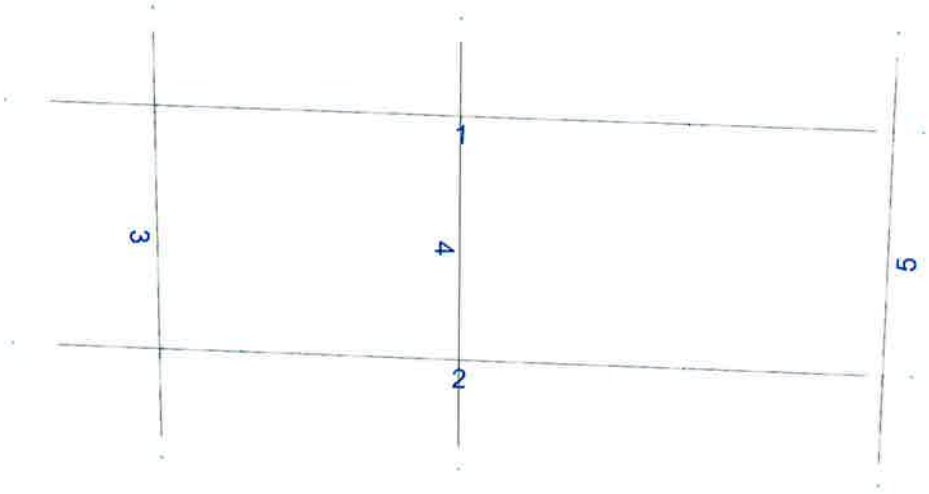
Design status

- Not designed
- Error on design
- Design O.K.
- With warnings



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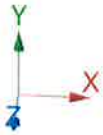
3
4
5


Y
X
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Load data

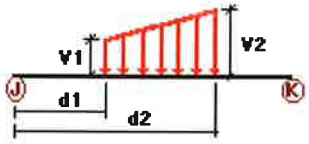
GLOSSARY

Comb : Indicates if load condition is a load combination

Load Conditions

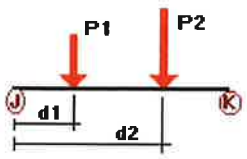
Condition	Description	Comb.	Category
DL	Dead Load	No	DL
Wo	Wind Load (No Ice)	No	WIND
Wi	Wind Load (With Ice)	No	WIND
Di	Ice Load	No	LL
LC1	1.2DL+1.6Wo	Yes	
LC2	0.9DL+1.6Wo	Yes	
LC3	1.2DL+Wi+Di	Yes	
LC4	1.2DL	Yes	
LC5	0.9DL	Yes	

Distributed force on members



Condition	Member	Dir1	Val1 [Kip/ft]	Val2 [Kip/ft]	Dist1 [ft]	%	Dist2 [ft]	%
Di	1	Y	-0.004	-0.004	0.00	Yes	100.00	Yes
	2	Y	-0.004	-0.004	0.00	Yes	100.00	Yes
	3	Y	-0.004	-0.004	0.00	Yes	100.00	Yes
	4	Y	-0.004	-0.004	0.00	Yes	100.00	Yes
	5	Y	-0.004	-0.004	0.00	Yes	100.00	Yes

Concentrated forces on members



Condition	Member	Dir1	Value1 [Kip]	Dist1 [ft]	%
DL	3	y	-0.064	1.00	No
		y	-0.064	5.00	No
		y	-0.074	3.00	No
	4	y	-0.066	1.00	No
		y	-0.066	5.00	No
	5	y	-0.042	1.00	No
		y	-0.042	5.00	No
		y	-0.011	3.00	No
Wo	3	z	-0.437	1.00	No
		z	-0.437	5.00	No
	4	z	-0.141	1.00	No
		z	-0.141	5.00	No
	5	z	-0.128	1.00	No
		z	-0.128	5.00	No
Wi	3	z	-0.11	1.00	No
		z	-0.11	5.00	No
	4	z	-0.038	1.00	No
		z	-0.038	5.00	No
	5	z	-0.035	1.00	No
		z	-0.035	5.00	No
Di	3	y	-0.117	1.00	No
		y	-0.117	5.00	No
		y	-0.034	3.00	No
	4	y	-0.049	1.00	No
		y	-0.049	5.00	No
	5	y	-0.044	1.00	No
		y	-0.044	5.00	No
		y	-0.007	3.00	No

Self weight multipliers for load conditions

Condition	Description	Self weight multiplier			
		Comb.	MultX	MultY	MultZ
DL	Dead Load	No	0.00	-1.00	0.00
Wo	Wind Load (No Ice)	No	0.00	0.00	0.00
Wi	Wind Load (With Ice)	No	0.00	0.00	0.00
Di	Ice Load	No	0.00	0.00	0.00
LC1	1.2DL+1.6Wo	Yes	0.00	0.00	0.00
LC2	0.9DL+1.6Wo	Yes	0.00	0.00	0.00
LC3	1.2DL+Wi+Di	Yes	0.00	0.00	0.00
LC4	1.2DL	Yes	0.00	0.00	0.00
LC5	0.9DL	Yes	0.00	0.00	0.00

Earthquake (Dynamic analysis only)

Condition	a/g	Ang. [Deg]	Damp. [%]
DL	0.00	0.00	0.00
Wo	0.00	0.00	0.00
Wi	0.00	0.00	0.00
Di	0.00	0.00	0.00
LC1	0.00	0.00	0.00
LC2	0.00	0.00	0.00
LC3	0.00	0.00	0.00
LC4	0.00	0.00	0.00
LC5	0.00	0.00	0.00

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Steel Code Check

Report: Summary - For all selected load conditions

Load conditions to be included in design :

LC1=1.2DL+1.6Wo
LC2=0.9DL+1.6Wo
LC3=1.2DL+Wi+Di
LC4=1.2DL
LC5=0.9DL

Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
	PIPE 2x0.154	**1**	LC1 at 25.00%	**0.65**	**OK**	Eq. H1-1b
			LC2 at 25.00%	0.63	OK	
			LC3 at 25.00%	0.25	OK	
			LC4 at 75.00%	0.10	OK	
			LC5 at 75.00%	0.08	OK	
		2	LC1 at 25.00%	0.50	OK	
			LC2 at 25.00%	**0.52**	**OK**	Eq. H1-1b
			LC3 at 75.00%	0.25	OK	
			LC4 at 75.00%	0.10	OK	
			LC5 at 75.00%	0.08	OK	
		3	LC1 at 77.08%	**0.21**	**OK**	Eq. H1-1b
			LC2 at 77.08%	0.21	OK	
			LC3 at 75.00%	0.09	OK	
			LC4 at 22.92%	0.04	OK	
			LC5 at 22.92%	0.03	OK	
		4	LC1 at 77.08%	**0.07**	**OK**	Eq. H1-1b
			LC2 at 77.08%	0.07	OK	
			LC3 at 75.00%	0.02	OK	
			LC4 at 22.92%	0.01	OK	
			LC5 at 22.92%	0.01	OK	
		5	LC1 at 75.00%	0.09	OK	Eq. H1-1b
			LC2 at 75.00%	0.08	OK	
			LC3 at 75.00%	**0.10**	**OK**	Eq. H1-1b
			LC4 at 22.92%	0.06	OK	
			LC5 at 22.92%	0.04	OK	

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Geometry data

GLOSSARY

Cb22, Cb33	: Moment gradient coefficients
Cm22, Cm33	: Coefficients applied to bending term in interaction formula
d0	: Tapered member section depth at J end of member
DJX	: Rigid end offset distance measured from J node in axis X
DJY	: Rigid end offset distance measured from J node in axis Y
DJZ	: Rigid end offset distance measured from J node in axis Z
DKX	: Rigid end offset distance measured from K node in axis X
DKY	: Rigid end offset distance measured from K node in axis Y
DKZ	: Rigid end offset distance measured from K node in axis Z
dL	: Tapered member section depth at K end of member
Ig factor	: Inertia reduction factor (Effective Inertia/Gross Inertia) for reinforced concrete members
K22	: Effective length factor about axis 2
K33	: Effective length factor about axis 3
L22	: Member length for calculation of axial capacity
L33	: Member length for calculation of axial capacity
LB pos	: Lateral unbraced length of the compression flange in the positive side of local axis 2
LB neg	: Lateral unbraced length of the compression flange in the negative side of local axis 2
RX	: Rotation about X
RY	: Rotation about Y
RZ	: Rotation about Z
TO	: 1 = Tension only member 0 = Normal member
TX	: Translation in X
TY	: Translation in Y
TZ	: Translation in Z

Nodes

Node	X [ft]	Y [ft]	Z [ft]	Rigid Floor
2	5.25	0.00	0.00	0
3	-5.25	0.00	0.00	0
5	5.25	3.25	0.00	0
6	-5.25	3.25	0.00	0
17	2.583	0.00	0.00	0
18	2.583	3.25	0.00	0
19	-2.583	0.00	0.00	0
20	-2.583	3.25	0.00	0
24	-3.50	4.625	0.20	0
25	0.00	4.625	0.20	0
26	4.917	4.625	0.20	0
27	-3.50	-1.375	0.20	0
28	0.00	-1.375	0.20	0
29	4.917	-1.375	0.20	0

Restraints

Node	TX	TY	TZ	RX	RY	RZ
17	1	1	1	1	1	1
18	1	1	1	1	1	1
19	1	1	1	1	1	1
20	1	1	1	1	1	1

Members

Member	NJ	NK	Description	Section	Material	d0 [in]	dL [in]	lg factor
1	6	5		PIPE 2x0.154	A53 GrB	0.00	0.00	0.00
2	3	2		PIPE 2x0.154	A53 GrB	0.00	0.00	0.00
3	24	27		PIPE 2x0.154	A53 GrB	0.00	0.00	0.00
4	25	28		PIPE 2x0.154	A53 GrB	0.00	0.00	0.00
5	26	29		PIPE 2x0.154	A53 GrB	0.00	0.00	0.00

SITE NAME: AVON_1

81 MONTEVIDEO ROAD
AVON, CT 06001

SITE NUMBER: CT11284A

PROJECT: T-MOBILE L600

CONFIGURATION: 67D92DB_2xAIR+1OP

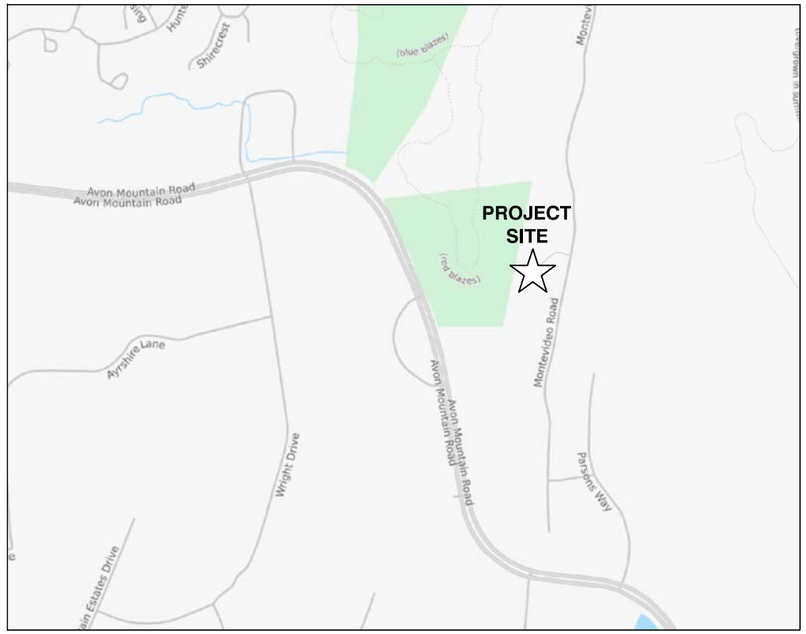
T-MOBILE TECHNICIAN SITE SAFETY NOTES	
LOCATION	SPECIAL RESTRICTIONS
ANTENNA/TMA/RRU SECTOR C:	ACCESS NOT PERMITTED
GPS/LMU:	UNRESTRICTED* (*CAUTION: OSHA-APPROVED PORTABLE 8' STEP-LADDER REQUIRED)
RADIO CABINETS:	UNRESTRICTED
PPC DISCONNECT:	UNRESTRICTED
MAIN CIRCUIT D/C:	UNRESTRICTED
NIU/T DEMARC:	UNRESTRICTED
OTHER/SPECIAL:	NONE

GENERAL NOTES

1. THIS DOCUMENT IS THE CREATION, DESIGN, PROPERTY AND COPYRIGHTED WORK OF T-MOBILE NORTHEAST, LLC. ANY DUPLICATION OR USE WITHOUT EXPRESS WRITTEN CONSENT IS STRICTLY PROHIBITED. DUPLICATION AND USE BY GOVERNMENT AGENCIES FOR THE PURPOSES OF CONDUCTING THEIR LAWFULLY AUTHORIZED REGULATORY AND ADMINISTRATIVE FUNCTIONS IS SPECIFICALLY ALLOWED.
2. THE FACILITY IS AN UNMANNED PRIVATE AND SECURED EQUIPMENT INSTALLATION. IT IS ONLY ACCESSED BY TRAINED TECHNICIANS FOR PERIODIC ROUTINE MAINTENANCE AND THEREFORE DOES NOT REQUIRE ANY WATER OR SANITARY SEWER SERVICE. THE FACILITY IS NOT GOVERNED BY REGULATIONS REQUIRING PUBLIC ACCESS PER ADA REQUIREMENTS.
3. CONTRACTOR SHALL VERIFY ALL PLANS AND EXISTING DIMENSIONS AND CONDITIONS ON THE JOB SITE AND SHALL IMMEDIATELY NOTIFY THE T-MOBILE NORTHEAST. LLC REPRESENTATIVE IN WRITING OF DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

SPECIAL CONSTRUCTION NOTES

1. TOWER OWNER SHALL PROVIDE GLOBAL STRUCTURAL STABILITY ANALYSIS OF EXISTING ANTENNA SUPPORT STRUCTURE. GENERAL CONTRACTOR SCOPE OF WORK SHALL INCLUDE ALL REQUIRED STRUCTURAL MODIFICATIONS, RE-BUNDLING OF COAXIAL CABLES OR OTHER SPECIAL MODIFICATIONS AS OUTLINED THEREIN.
2. PROTERRA DESIGN GROUP ASSUMES THAT THE MONOPOLE IS PROPERLY CONSTRUCTED AND MAINTAINED. ALL STRUCTURAL MEMBERS AND THEIR CONNECTION ARE ASSUMED TO BE IN GOOD CONDITION AND ARE FREE FROM DEFECTS WITH NO DETERIORATION TO ITS MEMBER CAPACITIES.
3. REFER TO ANTENNA MOUNT STRUCTURAL ANALYSIS (MSA) PREPARED BY HUDSON DESIGN GROUP, LLC DATED JULY 5, 2018.



PROJECT INFORMATION

SCOPE OF WORK:	UNMANNED TELECOMMUNICATIONS FACILITY T-MOBILE EQUIPMENT MODERNIZATION
ZONING JURISDICTION:	SPECIAL ZONING NOTE (ELIGIBLE FACILITY REQUEST): BASED ON INFORMATION PROVIDED BY T-MOBILE REGULATORY COMPLIANCE PROFESSIONALS AND LEGAL COUNSEL, THIS TELECOMMUNICATIONS EQUIPMENT DEPLOYMENT IS CONSIDERED AN ELIGIBLE FACILITY UNDER THE MIDDLE CLASS TAX RELIEF AND JOB CREATION ACT OF 2012, 47 USC 1455(A), SECTION 6409(A), AND IS SUBJECT TO AN ELIGIBLE FACILITY REQUEST, EXPEDITED REVIEW AND LIMITED/PARTIAL ZONING PRE-EMPTION FOR LOCAL DISCRETIONARY PERMITS (VARIANCE, SPECIAL PERMIT, SITE PLAN REVIEW OR ADMINISTRATIVE REVIEW).
T-MOBILE E911 ADDRESS:	81 MONTEVIDEO ROAD AVON, CT 06001
SBA BUSINESS ADDRESS:	81 MONTEVIDEO ROAD AVON, CT 06001
LATITUDE:	41° 48' 11.00" N (41.8031°) (FROM SBA RECORD)
LONGITUDE:	72° 48' 04.69" W (-72.8013°) (FROM SBA RECORD)
JURISDICTION:	TOWN OF AVON / CSC SITING COUNCIL
BUILDING CODE:	2016 CONNECTICUT STATE BUILDING CODE WITH AMENDMENTS (IBC 2012 BASED)
ELECTRICAL CODE:	2014 NATIONAL ELECTRICAL CODE AND AMENDMENTS
CURRENT USE:	TELECOMMUNICATIONS FACILITY
PROPOSED USE:	TELECOMMUNICATIONS FACILITY
TOWER OWNER:	MCM ACQUISITION 2017, LLC
SBA SITE ID:	CT22071-A
SBA SITE NAME:	AVON (MONTEVIDEO)
SBA REGIONAL SITE MANAGER:	STEPHEN ROTH (860) 539-4920

APPROVALS

PROJECT MANAGER	DATE
CONSTRUCTION	DATE
RF ENGINEERING	DATE
ZONING / SITE ACQ.	DATE
OPERATIONS	DATE
TOWER OWNER	DATE

DIG SAFE SYSTEM
(MA, ME, NH, RI, VT):
1-888-344-7233

CALL BEFORE YOU DIG
(CT): 1-800-922-4455

UNDERGROUND SERVICE ALERT

DRAWING INDEX

SHEET NO.	DESCRIPTION	REV.
T-1	TITLE SHEET	0
GN-1	GENERAL NOTES	0
A-1	COMPOUND & ELEVATION PLAN	0
A-2	EXISTING & PROPOSED ANTENNA PLAN	0
A-3	DETAILS	0
E-1	ONE-LINE DIAGRAM & GROUNDING DETAILS	0

T-MOBILE NORTHEAST LLC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 648-1116

SBA COMMUNICATIONS CORP.
134 FLANDERS ROAD, SUITE 125
WESTBOROUGH, MA 01581 TEL: (508) 251-0720

ProTerra DESIGN GROUP, LLC
4 Bay Road, Building A
Suite 200
Hadley, MA 01035 Ph: (413)320-4918

STATE OF CONNECTICUT
THOMAS E. JOHNSON
No. 28192
LICENSED PROFESSIONAL ENGINEER
7/24/18

CHECKED BY: JMM/TEJ

APPROVED BY: JMM/TEJ

SUBMITTALS

REV.	DATE	DESCRIPTION	BY
0	07/24/18	ISSUED FOR CONSTRUCTION	JEB

SITE NUMBER:
CT11284A
SITE NAME:
AVON_1
SITE ADDRESS:
81 MONTEVIDEO ROAD
AVON, CT 06001

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1

GROUNDING NOTES

1. THE SUBCONTRACTOR SHALL REVIEW AND INSPECT THE EXISTING FACILITY GROUNDING SYSTEM AND LIGHTNING PROTECTION SYSTEM (AS DESIGNED AND INSTALLED) FOR STRICT COMPLIANCE WITH THE NEC (AS ADOPTED BY THE AHJ), THE SITE-SPECIFIC (UL, LPI, OR NFPA) LIGHTNING PROTECTION CODE, AND GENERAL COMPLIANCE WITH TELCORDIA AND TIA GROUNDING STANDARDS. THE SUBCONTRACTOR SHALL REPORT ANY VIOLATIONS OR ADVERSE FINDINGS TO THE CONTRACTOR FOR RESOLUTION.
2. ALL GROUND ELECTRODE SYSTEMS (INCLUDING TELECOMMUNICATION, RADIO, LIGHTNING PROTECTION, AND AC POWER GES'S) SHALL BE BONDED TOGETHER, AT OR BELOW GRADE, BY TWO OR MORE COPPER BONDING CONDUCTORS IN ACCORDANCE WITH THE NEC.
3. THE SUBCONTRACTOR SHALL PERFORM IEEE FALL-OF-POTENTIAL RESISTANCE TO EARTH TESTING (PER IEEE 1100 AND 81) FOR NEW GROUND ELECTRODE SYSTEMS. THE SUBCONTRACTOR SHALL FURNISH AND INSTALL SUPPLEMENTAL GROUND ELECTRODES AS NEEDED TO ACHIEVE A TEST RESULT OF 5 OHMS OR LESS.
4. METAL RACEWAY SHALL NOT BE USED AS THE NEC REQUIRED EQUIPMENT GROUND CONDUCTOR. STRANDED COPPER CONDUCTORS WITH GREEN INSULATION, SIZED IN ACCORDANCE WITH THE NEC, SHALL BE FURNISHED AND INSTALLED WITH THE POWER SURCUITS TO BTS EQUIPMENT.
5. EACH BTS CABINET FRAME SHALL BE DIRECTLY CONNECTED TO THE MASTER GROUND BAR WITH GREEN INSULATED SUPPLEMENTAL EQUIPMENT GROUND WIRES, 6 AWG STRANDED COPPER OR LARGER FOR INDOOR BTS 2 AWG STRANDED COPPER FOR OUTDOOR BTS.
6. EXOTHERMIC WELDS SHALL BE USED FOR ALL GROUNDING CONNECTIONS BELOW GRADE.
7. APPROVED ANTIOXIDANT COATINGS (I.E., CONDUCTIVE GEL OR PASTE) SHALL BE USED ON ALL COMPRESSION AND BOLTED GROUND CONNECTIONS.
8. ICE BRIDGE BONDING CONDUCTORS SHALL BE EXOTHERMICALLY BONDED OR BOLTED TO THE BRIDGE AND THE TOWER GROUND BAR.
9. ALUMINUM CONDUCTOR OR COPPER CLAD STEEL CONDUCTOR SHALL NOT BE USED FOR GROUNDING CONNECTIONS.
10. MISCELLANEOUS ELECTRICL AND NON-ELECTRICAL METAL BOXES, FRAMES AND SUPPORTS SHALL BE BONDED TO THE GROUND RING, IN ACCORDANCE WITH THE NEC.
11. METAL CONDUIT SHALL BE MADE ELECTRICALLY CONTINUOUS WITH LISTED BONDING FITTINGS OR BY BONDING ACROSS THE DISCONTINUITY WITH 6 AWS COPPER WIRE UL APPROVED GROUNDING TYPE CONDUIT CLAMPS.
12. ALL NEW STRUCTURES WITH A FOUNDATION AND/OR FOOTING HAVING 20 FT. OR MORE OF 1/2 IN. OR GREATER ELECTRICALLY CONDUCTIVE REINFORCING STEEL MUST HAVE IT BONDED TO THE GROUND RING USING AN EXOTHERMIC WELD CONNECTION USING #2 AWG SOLID BARE TINNED COPPER GROUND WIRE, PER NEC 250.50

GENERAL NOTES

1. FOR THE PURPOSE OF CONSTRUCTION DRAWING, THE FOLLOWING DEFINITIONS SHALL APPLY:

   CONTRACTOR – SBA COMMUNICATIONS CORP.
   SUBCONTRACTOR – GENERAL CONTRACTOR (CONSTRUCTION)
   OWNER – T-MOBILE

2. PRIOR TO THE SUBMISSION OF BIDS, THE BIDDING SUBCONTRACTOR SHALL VISIT THE CELL SITE TO FAMILIARIZE WITH THE EXISTING CONDITIONS AND TO CONFIRM THAT THE WORK CAN BE ACCOMPLISHED AS SHOWN ON THE CONSTRUCTION DRAWINGS. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE ATTENTION OF CONTRACTOR.
3. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. SUBCONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK. ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
4. DRAWINGS PROVIDED HERE ARE NOT TO BE SCALED AND ARE INTENDED TO SHOW OUTLINE ONLY.
5. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
6. "KITTING LIST" SUPPLIED WITH THE BID PACKAGE IDENTIFIES ITEMS THAT WILL BE SUPPLIED BY CONTRACTOR. ITEMS NOT INCLUDED IN THE BILL OF MATERIALS AND KITTING LIST SHALL BE SUPPLIED BY THE SUBCONTRACTOR.
7. THE SUBCONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
8. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE SUBCONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION SPACE FOR APPROVAL BY THE CONTRACTOR.
9. SUBCONTRACTOR SHALL DETERMINE ACTUAL ROUTING OF CONDUIT, POWER AND T1 CABLES, GROUNDING CABLES AS SHOWN ON THE POWER, GROUNDING AND TELCO PLAN DRAWING. SUBCONTRACTOR SHALL UTILIZE EXISTING TRAYS AND/OR SHALL ADD NEW TRAYS AS NECESSARY. SUBCONTRACTOR SHALL CONFIRM THE ACTUAL ROUTING WITH THE CONTRACTOR.
10. THE SUBCONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CUR\BS, LANDSCAPING AND STRUCTURES. ANY DAMAGED PART SHALL BE REPAIRED AT SUBCONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE OWNER.
11. SUBCONTRACTOR SHALL LEGALLY AND PROPERLY DISPOSE OF ALL SCRAP MATERIALS SUCH AS COAXIAL CABLES AND OTHER ITEMS REMOVED FROM THE EXISTING FACILITY. ANTENNAS REMOVED SHALL BE RETURNED TO THE OWNER'S DESIGNATED LOCATION.
12. SUBCONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION.
13. ALL CONCRETE REPAIR WORK SHALL BE DONE IN ACCORDANCE WITH AMERICAN CONCRETE INSTITUTE (ACI) 301.
14. ANY NEW CONCRETE NEEDED FOR CONSTRUCTION SHALL BE AIR-ENTRAINED AND SHALL HAVE 4000 PSI STRENGTH AT 28 DAYS. ALL CONCRETE WORK SHALL BE DONE IN ACCORDANCE WITH ACI 318 CODE REQUIREMENTS.
15. ALL STRUCTURAL STEEL WORK SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH AISC SPECIFICATIONS. ALL STRUCTURAL STEEL SHALL BE ASTM A36 (FY = 36 KSI) UNLESS OTHERWISE NOTED. PIPES SHALL BE ASTM A53 TYPE E (FY = 35 KSI). ALL STEEL EXPOSED TO WEATHER SHALL BE HOT DIPPED GALVANIZED. TOUCHUP ALL SCRATCHES AND OTHER MARKS IN THE FIELD AFTER STEEL IS ERECTED USING A COMPATIBLE ZINC RICH PAINT.
16. CONSTRUCTION SHALL COMPLY WITH UMTS SPECIFICATIONS AND "GENERAL CONSTRUCTION SERVICES FOR CONSTRUCTION OF T-MOBILE SITES."
17. SUBCONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS PRIOR TO COMMENCING ANY WORK. ALL DIMENSIONS OF EXISTING CONSTRUCTION SHOWN ON THE DRAWINGS MUST BE VERIFIED. SUBCONTRACTOR SHALL NOTIFY THE CONTRACTOR OF ANY DISCREPANCIES PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION.
18. THE EXISTING CELL SITE IS IN FULL COMMERCIAL OPERATION. ANY CONSTRUCTION WORK BY SUBCONTRACTOR SHALL NOT DISRUPT THE EXISTING NORMAL OPERATION. ANY WORK ON EXISTING EQUIPMENT MUST BE COORDINATED WITH CONTRACTOR. ALSO, WORK SHOULD BE SCHEDULED FOR AN APPROPRIATE MAINTENANCE WINDOW USUALLY IN LOW TRAFFIC PERIODS AFTER MIDNIGHT.
19. SINCE THE CELL SITE IS ACTIVE, ALL SAFETY PRECAUTIONS MUST BE TAKEN WHEN WORKING AROUND HIGH LEVELS OF ELECTROMAGNETIC RADIATION. EQUIPMENT SHOULD BE SHUTDOWN PRIOR TO PERFORMING ANY WORK THAT COULD EXPOSE THE WORKERS TO DANGER. PERSONAL RF EXPOSURE MONITORS ARE ADVISED TO BE WORN TO ALERT OF ANY DANGEROUS EXPOSURE LEVELS.
20. APPLICABLE BUILDING CODES:
    SUBCONTRACTOR'S WORK SHALL COMPLY WITH ALL APPLICABLE NATIONAL, STATE, AND LOCAL CODES AS ADOPTED BY THE LOCAL AUTHORITY HAVING JURISDICTION (AHJ) FOR THE LOCATION. THE EDITION OF THE AHJ ADOPTED CODES AND STANDARDS IN EFFECT ON THE DATE OF CONTRACT AWARD SHALL GOVERN THE DESIGN.

    SUBCONTRACTOR'S WORK SHALL COMPLY WITH THE LATEST EDITION OF THE FOLLOWING STANDARDS:

    AMERICAN CONCRETE INSTITUTE (ACI) 318; BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE;

    AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC), STEEL CONSTRUCTION MANUAL, 14TH EDITION;

    TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA) 222-G, STRUCTURAL STANDARDS FOR STEEL

    ANTENNA TOWER AND ANTENNA SUPPORTING STRUCTURES; REFER TO ELECTRICAL DRAWINGS FOR SPECIFIC ELECTRICAL STANDARDS.

FOR ANY CONFLICTS BETWEEN SECTIONS OF LISTED CODES AND STANDARDS REGARDING MATERIAL, METHODS OF CONSTRUCTION, OR OTHER REQUIREMENTS, THE MOST RESTRICTIVE REQUIREMENT SHALL GOVERN. WHERE THERE IS CONFLICT BETWEEN A GENERAL REQUIREMENT AND A SPECIFIC REQUIREMENT, THE SPECIFIC REQUIREMENT SHALL GOVERN.

ABBREVIATIONS

AGL	ABOVE GRADE LEVEL	EQ	EQUAL	RAN	RADIO ACCESS NETWORK
AWG	AMERICAN WIRE GAUGE	G.C.	GENERAL CONTRACTOR	REF	REFERENCE
BTCW	BARE TINNED SOLID COPPER WIRE	GRC	GALVANIZED RIGID CONDUIT	REQ	REQUIRED
		MSA	MOUNT STRUCTURAL ANALYSIS	RF	RADIO FREQUENCY
BGR	BURIED GROUND RING	MGB	MASTER GROUND BAR	TBD	TO BE DETERMINED
BTS	BASE TRANSCEIVER STATION	MIN	MINIMUM	TBR	TO BE REMOVED
EXISTING	EXISTING OR (E)	PROPOSED	NEW OR (P)	TBRR	TO BE REMOVED AND REPLACED
EGB	EQUIPMENT GROUND BAR	N.T.S.	NOT TO SCALE	TYP	TYPICAL
EGR	EQUIPMENT GROUND RING	RAD	RADIATION CENTERLINE (ANTENNA)	VIF	VERIFY IN FIELD

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STATE OF CONNECTICUT
THOMAS E. JOHNSON
No. 28192
LICENSED PROFESSIONAL ENGINEER
7/24/18

CHECKED BY: JMM/TEJ

APPROVED BY: JMM/TEJ

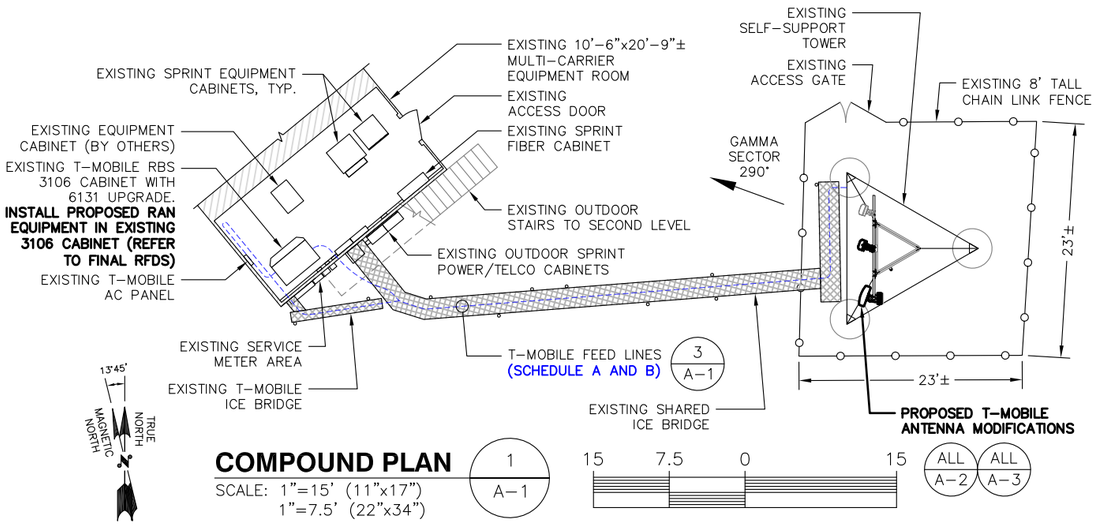
SUBMITTALS

REV.	DATE	DESCRIPTION	BY
0	07/24/18	ISSUED FOR CONSTRUCTION	JEB

SITE NUMBER:
CT11284A
SITE NAME:
AVON_1
SITE ADDRESS:
81 MONTEVIDEO ROAD
AVON, CT 06001

SHEET TITLE
GENERAL NOTES

SHEET NUMBER
GN-1



COMPOUND PLAN

1 / A-1

SCALE: 1"=15' (11"x17")
1"=7.5' (22"x34")

15 7.5 0 15

ALL A-2 / ALL A-3

SPECIAL PRE-CONSTRUCTION WORK NOTE (SBA-PROVIDED TOWER STRUCTURAL ANALYSIS SPECIAL EQUIPMENT INSTALLATION REQUIREMENTS):
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* GC SHALL FURNISH, INSTALL AND COMPLETE ALL REQUIRED STRUCTURAL MODIFICATIONS AS INDICATED IN BEFORE-MENTIONED GLOBAL AND MOUNT ANALYSIS.

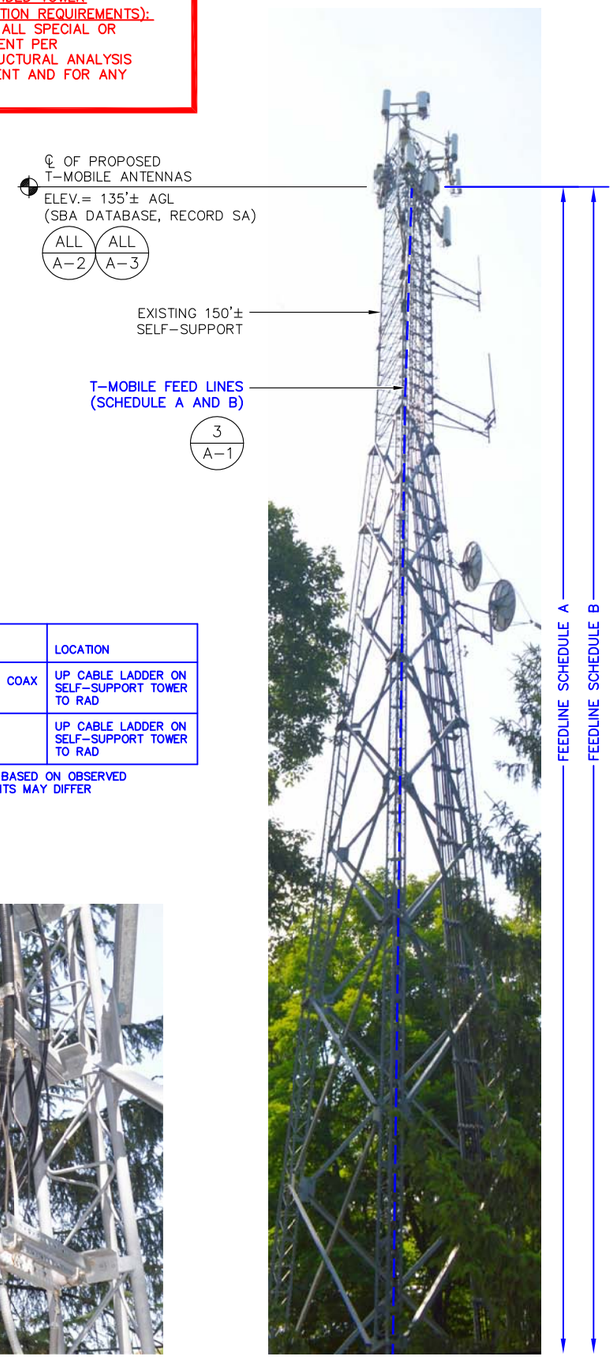

IMAGE SOURCE: PROTERRA 07/13/18

PARTIAL ELEVATION PHOTO DETAIL

4 / A-1

SCALE: N.T.S.

FEEDLINE SCHEDULE	FEEDLINE DESCRIPTION	LOCATION
A	EXISTING TO REMAIN: (2) 1⅝" COAX (ACTIVE), (3) 1⅝" COAX (INACTIVE), (1) HYBRID TO 135' RAD	UP CABLE LADDER ON SELF-SUPPORT TOWER TO RAD
B	PROPOSED: (1) 6 X 12 HYBRID TO 135' RAD	UP CABLE LADDER ON SELF-SUPPORT TOWER TO RAD

NOTE: EXISTING T-MOBILE EQUIPMENT FEEDLINE INVENTORY BASED ON OBSERVED FIELD CONDITIONS. RFDS AND FEEDLINE LEASING ENTITLEMENTS MAY DIFFER

IMAGE SOURCE: PROTERRA 07/13/18

EQUIPMENT PHOTO DETAIL

2 / A-1

SCALE: N.T.S.

IMAGE SOURCE: PROTERRA 07/13/18

FEEDLINE PHOTO DETAIL AT TOWER BASE

3 / A-1

SCALE: N.T.S.

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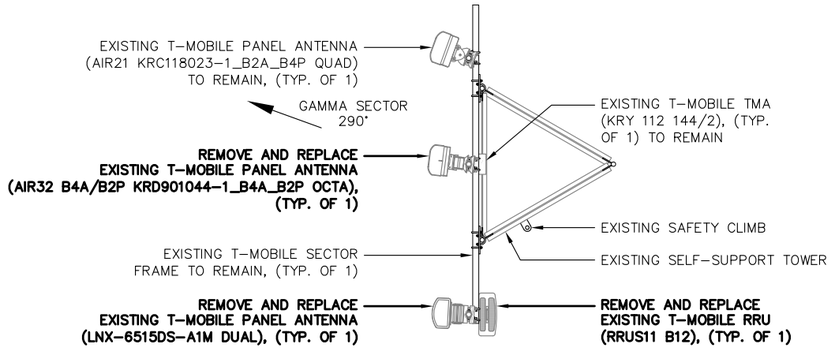
COMPOUND & ELEVATION PLAN

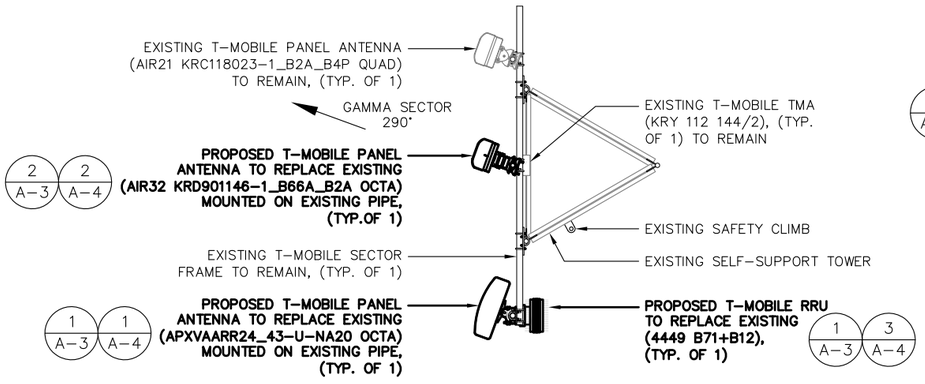
SHEET NUMBER
A-1

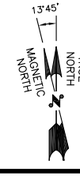


EXISTING ANTENNA PLAN

SCALE: N.T.S.

1 / A-2





PROPOSED ANTENNA PLAN

SCALE: N.T.S.

2 / A-2

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NOTE:
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

NOTE:
REFER TO THE ANTENNA MOUNT STRUCTURAL ANALYSIS (MSA) PREPARED BY HUDSON DESIGN GROUP, LLC DATED JULY 5, 2018.

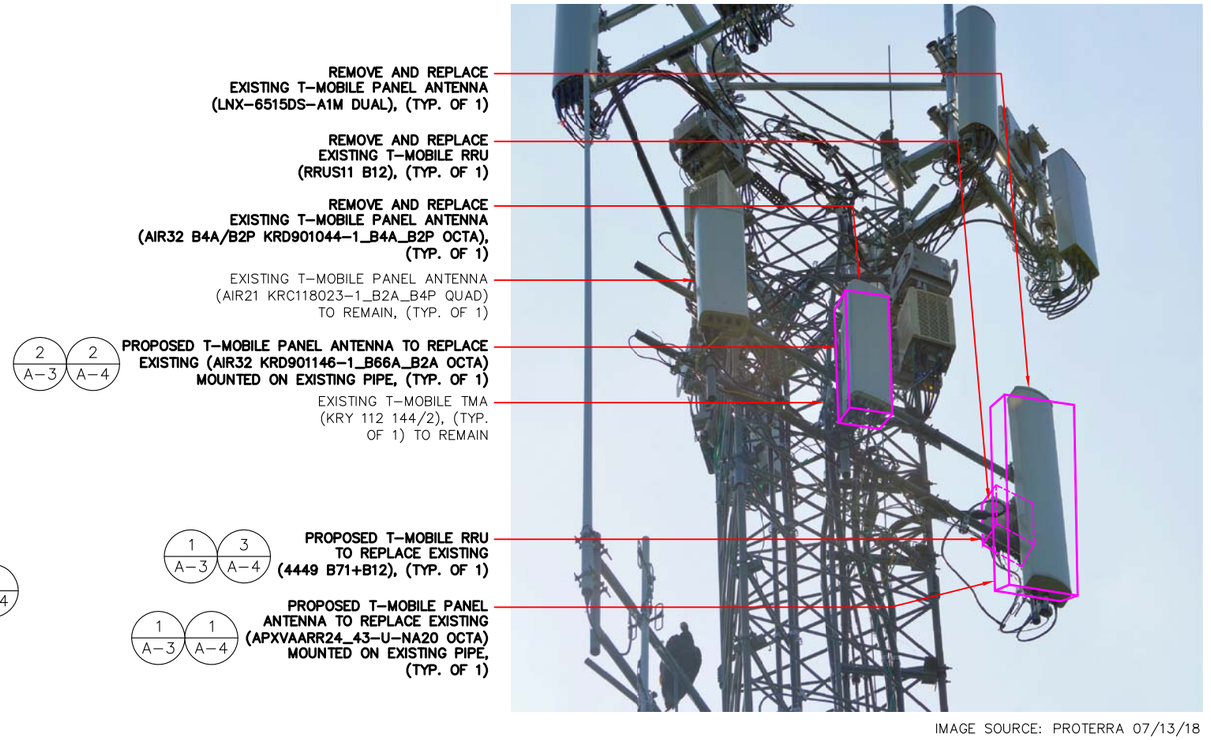

IMAGE SOURCE: PROTERRA 07/13/18

ANTENNA PHOTO DETAIL

SCALE: N.T.S.

3 / A-2

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APPROVED BY: JMM/TEJ

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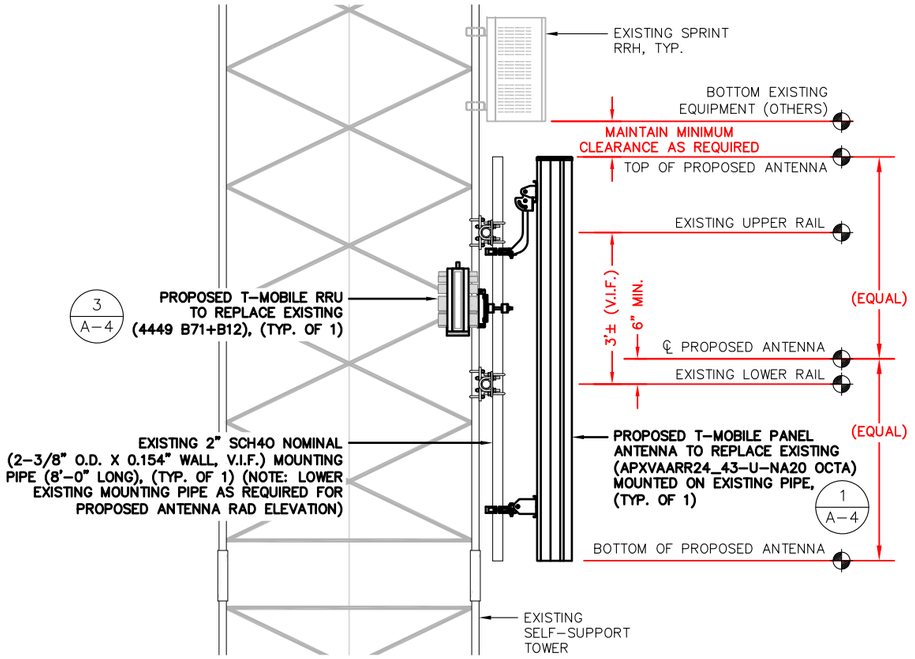
SHEET TITLE
EXISTING & PROPOSED ANTENNA PLAN

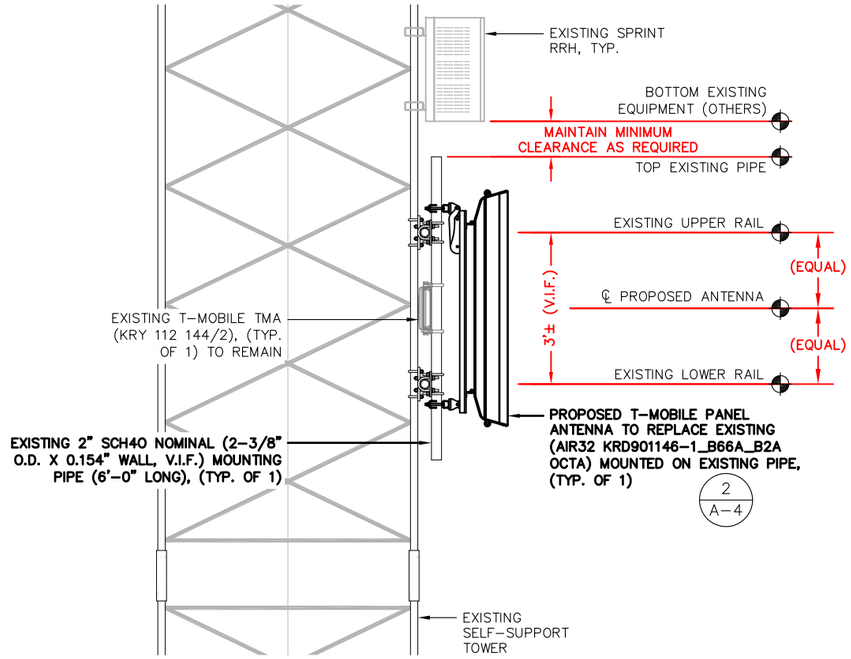
SHEET NUMBER
A-2



PROPOSED ANTENNA (APXVAARR24_43-U-NA20 OCTA) MOUNTING DETAIL

SCALE: N.T.S.

1 A-3



PROPOSED ANTENNA (AIR32 KRD901146-1_B66A_B2A OCTA) MOUNTING DETAIL

SCALE: N.T.S.

2 A-3

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NOTE:
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

NOTE:
REFER TO THE ANTENNA MOUNT STRUCTURAL ANALYSIS (MSA) PREPARED BY HUDSON DESIGN GROUP, LLC DATED JULY 5, 2018.

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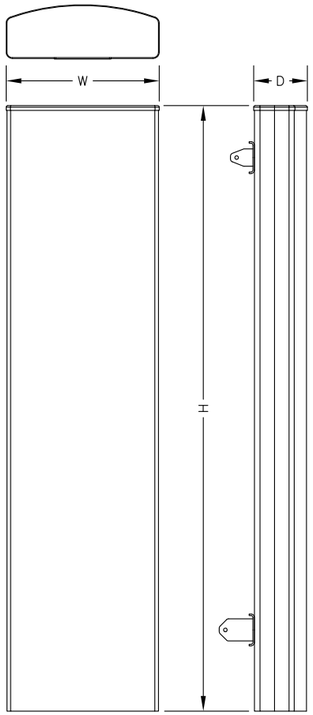
SHEET TITLE
DETAILS

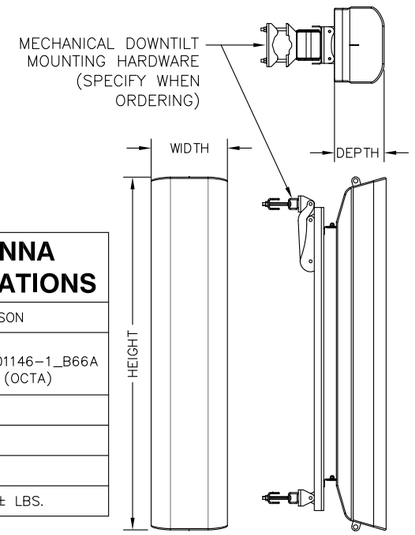
SHEET NUMBER
A-3



L600/L700 ANTENNA SPECIFICATIONS	
MANUF.	RFS
MODEL #	APXVAARR24_43-U-NA20 (OCTA)
HEIGHT	95.9"
WIDTH	24"
DEPTH	8.7"
WEIGHT	128± LBS. (ANTENNA ONLY, WITHOUT MOUNTING HARDWARE)

ANTENNA DETAIL (APXVAARR24_43-U-NA20 OCTA) — 1 / A-4

SCALE: N.T.S.

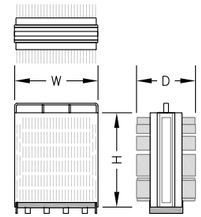


AIR ANTENNA SPECIFICATIONS	
MANUF.	ERICSSON
MODEL #	AIR32 KRD901146-1_B66A _B2A (OCTA)
HEIGHT	56.6"
WIDTH	12.9"
DEPTH	8.7"
WEIGHT	132.2± LBS.

ANTENNA DETAIL (AIR32 KRD901146-1_B66A_B2A OCTA) — 2 / A-4

SCALE: N.T.S.

RRU SPECIFICATIONS	
MANUF.	ERICSSON
MODEL #	4449 B71+B12
HEIGHT	14.9"
WIDTH	13.2"
DEPTH	9.2"
WEIGHT	74± LBS.



REMOTE RADIO UNIT (RRU) — 3 / A-4

SCALE: N.T.S.

ANTENNA CONFIGURATION

SECTOR	BAND	ANTENNA MODEL	ANTENNA RAD	AZIMUTH	RADIOS	CABLE FEED LINES
ALPHA	N/A	N/A	N/A	N/A	N/A	N/A
BETA	N/A	N/A	N/A	N/A	N/A	N/A
GAMMA	G1900, U2100	ERICSSON AIR21 KRC118023-1_B2A_B4P (QUAD)	135'±	290°	–	EXISTING (2) 1-5/8" COAX
	L1900, L2100	ERICSSON – AIR32 KRD901146-1_B66A_B2A (OCTA)	135'±	290°	EXISTING (1) KRY 112/144/2 TMA	EXISTING (1) SHARED 6X12 HYBRID CABLE TRUNK
	L600, L700	RFS – APXVAARR24_43-U-NA20 (OCTA)	135'±	290°	PROPOSED (1) 4449 B71+B12	PROPOSED (1) SHARED 6X12 HYBRID CABLE TRUNK

EXISTING (1) 1-5/8" COAX, (1) EXISTING 6X12 HYBRID CABLE TRUNK (V.I.F.) AND (1) PROPOSED 6X12 HYBRID CABLE TRUNK TO SERVE ALL SECTORS BASED ON RFDS DATED 05/08/2018. REFER TO FINAL RFDS AND FINAL COLLO-APPLICATION FOR FINAL CONFIGURATION AND QUANTITIES.

T-Mobile

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STATE OF CONNECTICUT
THOMAS E. JOHNSON
No. 28192
LICENSED PROFESSIONAL ENGINEER
7/24/18

CHECKED BY: JMM/TEJ

APPROVED BY: JMM/TEJ

SUBMITTALS

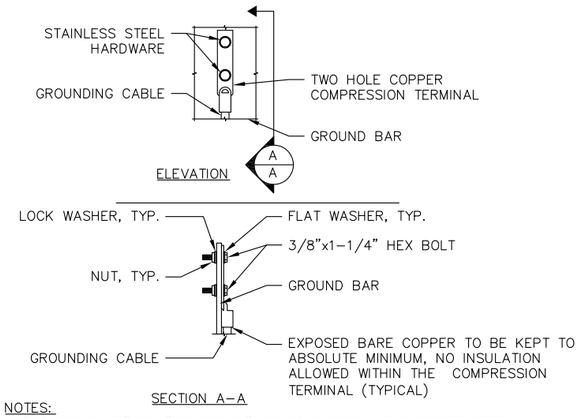
REV.	DATE	DESCRIPTION	BY
0	07/24/18	ISSUED FOR CONSTRUCTION	JEB

SITE NUMBER:
CT11284A
SITE NAME:
AVON_1

SITE ADDRESS:
81 MONTEVIDEO ROAD
AVON, CT 06001

SHEET TITLE
DETAILS

SHEET NUMBER
A-4

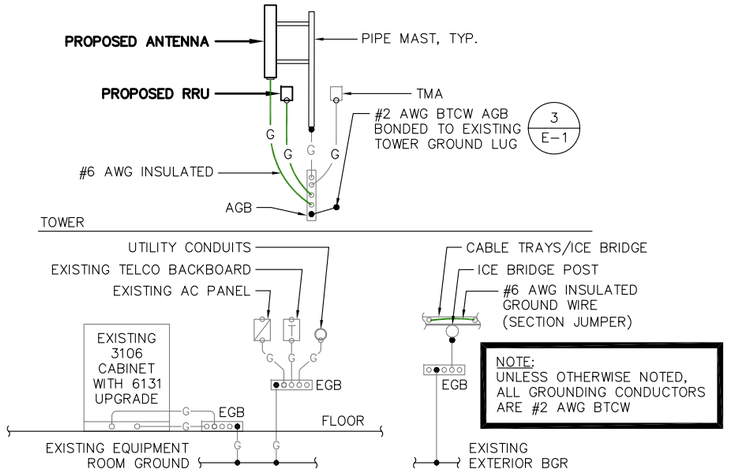


NOTES:
1. "DOUBLING UP" OR "STACKING " OF CONNECTION IS NOT PERMITTED.
2. OXIDE INHIBITING COMPOUND TO BE USED AT ALL LOCATIONS.
3. CADWELD DOWNLEADS FROM UPPER EGB, LOWER EGB, AND MGB.

TYPICAL GROUND BAR CONNECTION DETAIL

1 / E-1

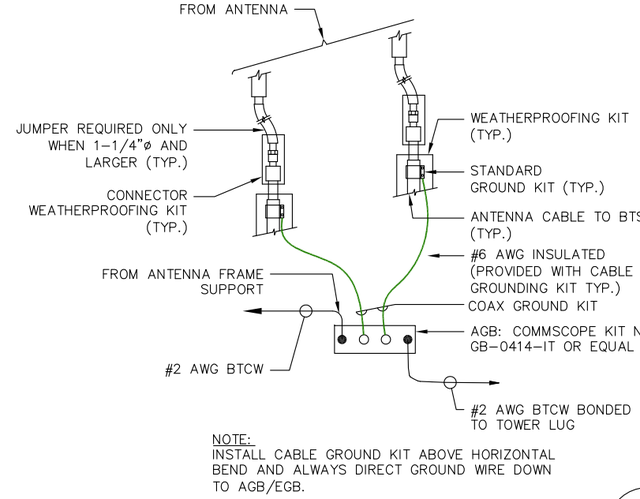
SCALE: N.T.S.



TYPICAL GROUNDING RISER DIAGRAM

2 / E-1

SCALE: N.T.S.

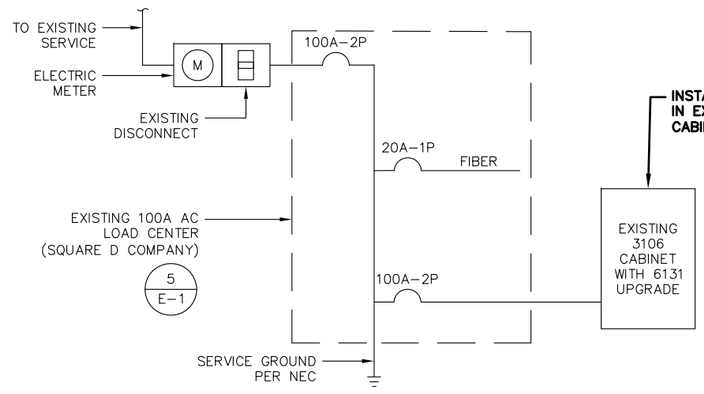


NOTE:
INSTALL CABLE GROUND KIT ABOVE HORIZONTAL BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO AGB/EGB.

TOWER TOP CABLE GROUNDING DETAIL

3 / E-1

SCALE: N.T.S.



ONE LINE POWER SCHEMATIC

4 / E-1

SCALE: N.T.S.

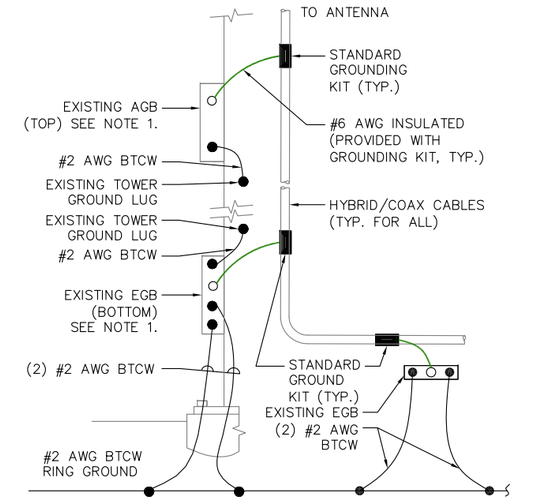
IMAGE SOURCE: PROTERRA 07/13/18

IMAGE SOURCE: PROTERRA 07/13/18

PHOTO DETAIL: PPC PANEL

5 / E-1

SCALE: N.T.S.



NOTE:
1. NUMBER OF GROUND BARS MAY VARY DEPENDING ON THE TYPE OF TOWER, ANTENNA LOCATION, AND CONNECTION ORIENTATION. PROVIDE ADDITIONAL AGB/EGB AS REQUIRED.
2. A SEPARATE GROUND BAR TO BE USED FOR GPS ANTENNA IF REQUIRED

TOWER BOTTOM CABLE GROUNDING DETAIL

6 / E-1

SCALE: N.T.S.

ELECTRICAL LEGEND

A	AMPERE
V	VOLT
KWH	KILOWATT - HOUR
C	CONDUIT
GRC	GALVANIZED RIGID CONDUIT
BTCW	BARE TINNED (SOLID) COPPER WIRE (#2 AWG, UNLESS NOTES OTHERWISE)
G	GROUND
MGB	MASTER GROUND BAR — ○ MECHANICAL CONNECTION ● CADWELD CONNECTION
AGB/EGB	EQUIPMENT GROUND BAR/ANTENNA GROUND BAR
G	GROUND COPPER WIRE, SIZE AS NOTED
	EXPOSED WIRING
	INSULATED GROUNDING CONDUCTOR (#6 AWG STRANDED, UNLESS NOTED OTHERWISE)
	5/8"x10' COPPER CLAD STAINLESS STEEL GROUND ROD
	● EXOTHERMIC (CAD WELD) OR ○ MECHANICAL (COMPRESSION TYPE) CONNECTION
PPC	POWER PROTECTION CABINET
	OMNI-DIRECTIONAL ELECTRONIC MARKER SYSTEM (EMS) BALL

CONTRACTOR NOTE:
G.C. TO VERIFY THAT THE EXISTING CONDUITS AND WIRE SIZES ARE ADEQUATE FOR THE PROPOSED LOADING IN ACCORDANCE WITH NEC AND INCLUDE ELECTRICAL UPGRADES IN THE SCOPE OF WORK AS REQUIRED.

ELECTRICAL & GROUNDING NOTES:

1. ALL ELECTRICAL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC) 2014 AS WELL AS APPLICABLE STATE AND LOCAL CODES.
2. ALL ELECTRICAL ITEMS SHALL BE U.L. APPROVED OR LISTED AND PROCURED PER SPECIFICATION REQUIREMENTS.
3. THE ELECTRICAL WORK INCLUDES ALL LABOR AND MATERIAL DESCRIBED BY DRAWINGS AND SPECIFICATIONS INCLUDING INCIDENTAL WORK TO PROVIDE COMPLETE OPERATING AND APPROVED ELECTRICAL SYSTEM.
4. GENERAL CONTRACTOR SHALL PAY FEES FOR PERMITS, AND IS RESPONSIBLE FOR OBTAINING SAID PERMITS AND COORDINATION OF INSPECTIONS.
5. ELECTRICAL AND TELCO WIRING OUTSIDE A BUILDING AND EXPOSED TO WEATHER SHALL BE IN WATER TIGHT GALVANIZED RIGID STEEL CONDUITS OR SCHEDULE 80 PVC (AS PERMITTED BY CODE) AND WHERE REQUIRED IN LIQUID TIGHT FLEXIBLE METAL OR NONMETALLIC CONDUITS.
6. RIGID STEEL CONDUITS SHALL BE GROUNDED AT BOTH ENDS.
7. ELECTRICAL WIRING SHALL BE COPPER WITH TYPE XHHW, THWN, OR THHN INSULATION AS REQUIRED BY NEC.
8. RUN ELECTRICAL CONDUIT OR CABLE BETWEEN ELECTRICAL ROOM AND PROPOSED CELL SITE POWER PEDESTAL AS INDICATED ON THIS DRAWING. PROVIDE FULL LENGTH PULL ROPE. COORDINATE INSTALLATION WITH UTILITY COMPANY.
9. RUN TELCO CONDUIT OR CABLE BETWEEN TELEPHONE UTILITY DEMARCATION POINT AND PROPOSED CELL SITE TELCO CABINET AND BTS CABINET AS INDICATED ON DRAWING A-1. PROVIDE FULL LENGTH PULL ROPE IN INSTALLED TELCO CONDUIT. PROVIDE GREENLEE CONDUIT MEASURING TAPE AT EACH END.
10. ALL EQUIPMENT LOCATED OUTSIDE SHALL HAVE NEMA 3R ENCLOSURE.
11. GROUNDING SHALL COMPLY WITH NEC ART. 250.
12. GROUND COAXIAL CABLE SHIELDS MINIMUM AT BOTH ENDS USING MANUFACTURERS COAX CABLE GROUNDING KITS SUPPLIED BY PROJECT OWNER.
13. USE #6 COPPER STRANDED WIRE WITH GREEN COLOR INSULATION FOR ABOVE GRADE GROUNDING (UNLESS OTHERWISE SPECIFIED) AND #2 SOLID TINNED BARE COPPER WIRE FOR BELOW GRADE GROUNDING AS INDICATED ON THE DRAWING.
14. ALL GROUND CONNECTIONS TO BE BURNDY HYGROUND COMPRESSION TYPE CONNECTORS OR CADWELD EXOTHERMIC WELD. DO NOT ALLOW BARE COPPER WIRE TO BE IN CONTACT WITH GALVANIZED STEEL.
15. ROUTE GROUNDING CONDUCTORS ALONG THE SHORTEST AND STRAIGHTEST PATH POSSIBLE, EXCEPT AS OTHERWISE INDICATED. GROUNDING LEADS SHOULD NEVER BE BENT AT RIGHT ANGLE. ALWAYS MAKE AT LEAST 12" RADIUS BENDS. #6 WIRE CAN BE BENT AT 6" RADIUS WHEN NECESSARY. BOND ANY METAL OBJECTS WITHIN 7 FEET OF PROPOSED EQUIPMENT OR CABINET TO MASTER GROUND BAR.
16. CONNECTIONS TO MGB SHALL BE ARRANGED IN THREE MAIN GROUPS: SURGE PRODUCERS (COAXIAL CABLE GROUND KITS, TELCO AND POWER PANEL GROUND); (GROUNDING ELECTRODE RING OR BUILDING STEEL); NON-SURGING OBJECTS (EGB GROUND IN BTS UNIT).
17. CONNECTIONS TO GROUND BARS SHALL BE MADE WITH TWO HOLE COMPRESSION TYPE COPPER LYGS. APPLY OXIDE INHIBITING COMPOUND TO ALL LOCATIONS.
18. APPLY OXIDE INHIBITING COMPOUND TO ALL COMPRESSION TYPE GROUND CONNECTIONS.
19. BOND ANTENNA MOUNTING BRACKETS, COAXIAL CABLE GROUND KITS, AND ALNA TO EGB PLACED NEAR THE ANTENNA LOCATION.
20. BOND ANTENNA EGB'S AND MGB TO WATER MAIN/GROUND RING.
21. TEST COMPLETED GROUND SYSTEM AND RECORD RESULTS FOR PROJECT CLOSE-OUT DOCUMENTATION.
22. BOND ANY METAL OBJECTS WITHIN 7 FEET OF PROPOSED EQUIPMENT OR CABINET TO MASTER GROUND BAR.
23. VERIFY PROPOSED SERVICE UPGRADE WITH LOCAL UTILITY COMPANY PRIOR TO CONSTRUCTION.

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BLOOMFIELD, CT 06002
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Hadley, MA 01035 Ph: (413)320-4918

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ONE-LINE DIAGRAM & GROUNDING DETAILS

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E-1