

March 30, 2017

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

Re: **Notice of Exempt Modification – Facility Modification**
175 Stafford Street, Stafford, Connecticut

Dear Ms. Bachman:

Cellco Partnership d/b/a Verizon Wireless (“Cellco”) currently maintains six (6) antennas at the 127-foot level of an existing 150-foot tower at 175 Stafford Street in Stafford, Connecticut (the “Property”). The tower is owned by Crown Castle (“Crown”). The Council approved Cellco’s use of this tower in 2013. Cellco now intends to replace its existing antennas with three (3) model SBNHH-1D65B, 700 MHz antennas and three (3) model SBNHH-1D65B, 2100 MHz antennas, all at the same level on the tower. Cellco also intends to replace six (6) remote radio heads (“RRHs”) and install two (2) HYBRIFLEX™ fiber optic antenna cables. Included in Attachment 1 are specifications for Cellco’s replacement antennas, RRHs and HYBRIFLEX™ cables.

Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Anthony Fassinelli, First Selectman for the Town of Stafford; David Palmberg, Stafford Zoning Enforcement Official; Nancy and Harry Pragl, the Property owners; and Crown, the tower owner.

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

1. The proposed modifications will not result in an increase in the height of the existing structure. Cellco’s replacement antennas and RRHs will be installed on its existing platform at the 127-foot level on the tower.


Melanie A. Bachman, Esq.
March 30, 2017
Page 2

2. The proposed modifications will not involve any change to ground-mounted equipment and, therefore, will not require the extension of the site boundary.
3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.
4. The operation of the replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. A cumulative General Power Density table for Cellco's modified facility is included in Attachment 2.
5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.
6. The tower and its foundation can support Cellco's proposed modifications. (*See Structural Analysis Report included in Attachment 3*).

A copy of the Stafford parcel map and property owner information is included in Attachment 4.

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

Sincerely,



Kenneth C. Baldwin

Enclosures

Copy to:

Anthony Fassinelli, Stafford First Selectman
David Palmberg, Stafford Zoning Enforcement Officer
Nancy and Harry Pragl
Crown Castle
Tim Parks

ATTACHMENT 1



SBNHH-1D65B

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

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

Electrical Specifications

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

Electrical Specifications, BASTA*

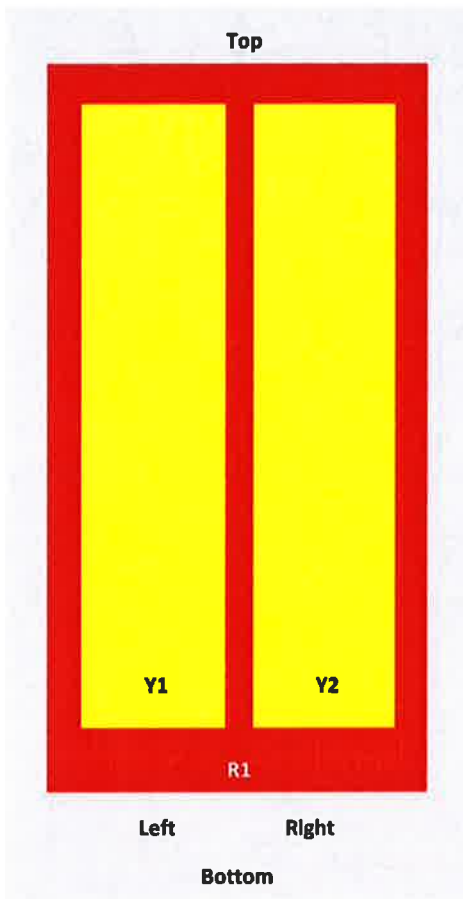
Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2200	2300–2360
Gain by all Beam Tilts, average, dBi	14.5	14.3	17.4	17.9	18.2	18.3
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.8	±0.4	±0.3	±0.5	±0.3
Gain by Beam Tilt, average, dBi	0° 14.6	0° 14.5	0° 17.4	0° 17.8	0° 18.1	0° 18.2
	7° 14.6	7°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

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

Array Layout

SBNHH-1D65B

SBNHH 65



Array	Freq (MHz)	Cones	RET (MRET)	AISG RET UID
R1	698-896	1-2	1	ANXXXXXXXXXXXXX.1
Y1	1695-2360	3-4	2	ANXXXXXXXXXXXXX.2
Y2	1695-2360	5-6		

View from the front of the antenna

(Sizes of colored boxes are not true depictions of array sizes)

General Specifications

Operating Frequency Band	1695 – 2360 MHz 698 – 896 MHz
Antenna Type	Sector
Band	Multiband
Performance Note	Outdoor usage

Mechanical Specifications

RF Connector Quantity, total	6
RF Connector Quantity, low band	2
RF Connector Quantity, high band	4
RF Connector Interface	7-16 DIN Female

SBNHH-1D65B

Color	Light gray
Grounding Type	RF connector inner conductor and body grounded to reflector and mounting bracket
Radiator Material	Aluminum Low loss circuit board
Radome Material	Fiberglass, UV resistant
Reflector Material	Aluminum
RF Connector Location	Bottom
Wind Loading, frontal	618.0 N @ 150 km/h 138.9 lbf @ 150 km/h
Wind Loading, lateral	197.0 N @ 150 km/h 44.3 lbf @ 150 km/h
Wind Loading, rear	728.0 N @ 150 km/h 163.7 lbf @ 150 km/h
Wind Speed, maximum	241 km/h 150 mph

Dimensions

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

Remote Electrical Tilt (RET) Information

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

Packed Dimensions

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

Regulatory Compliance/Certifications

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



SBNHH-1D65B

Included Products

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

* Footnotes

Performance Note Severe environmental conditions may degrade optimum performance

ALCATEL-LUCENT B13 RRH4X30-4R

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

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



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

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

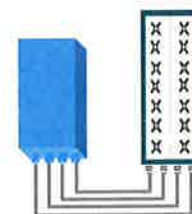
Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the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

FEATURES

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

BENEFITS

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



4x30W with 4T4R
or
2x60W with 2T4R

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

TECHNICAL SPECIFICATIONS

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

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ALCATEL-LUCENT B66A RRH4X45

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

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

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



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

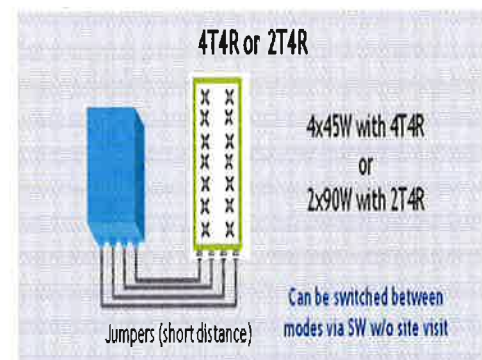
Its compactness and slim design makes the Alcatel-Lucent B66a RRH4x45 easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the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

FEATURES

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

BENEFITS

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



TECHNICAL SPECIFICATIONS

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

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

Product Description

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

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

Features/Benefits

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



Figure 1: HYBRIFLEX Series

Technical Specifications

Outer Conductor Armor	Corrugated Aluminum	(mm (in))	46.5 (1.83)
Jacket	Polyethylene, PE	(mm (in))	50.3 (1.98)
UV-Protection	Individual and External Jacket		Yes
Mechanical Properties			
Weight, Approximate		(kg/m (lb/ft))	1.9 (1.30)
Minimum Bending Radius, Single Bending		(mm (in))	200 (8)
Minimum Bending Radius, Repeated Bending		(mm (in))	500 (20)
Recommended/Maximum Clamp Spacing		(m (ft))	1.0 / 1.2 (3.25 / 4.0)
Electrical Properties			
DC-Resistance Outer Conductor Armor		(Ω/km (Ω/1000ft))	068 (0.205)
DC-Resistance Power Cable, 8.4mm ² (8AWG)		(Ω/km (Ω/1000ft))	2.1 (0.307)
Fiber Properties			
Version			Single-mode OM3
Quantity, Fiber Count			16 (8 pairs)
Core/Clad		(μm)	50/125
Primary Coating (Acrylate)		(μm)	245
Buffer Diameter, Nominal		(μm)	900
Secondary Protection, Jacket, Nominal		(mm (in))	2.0 (0.08)
Minimum Bending Radius		(mm (in))	104 (4.1)
Insertion Loss @ wavelength 850nm		dB/km	3.0
Insertion Loss @ wavelength 1310nm		dB/km	1.0
Standards (Meets or exceeds)			UL94-V0, UL1666 RoHS Compliant
DC Power Cable Properties			
Size (Power)		(mm (AWG))	8.4 (8)
Quantity, Wire Count (Power)			16 (8 pairs)
Size (Alarm)		(mm (AWG))	0.8 (18)
Quantity, Wire Count (Alarm)			4 (2 pairs)
Type			UV protected
Strands			19
Primary Jacket Diameter, Nominal		(mm (in))	6.8 (0.27)
Standards (Meets or exceeds)			NFPA 130, ICEA S-95-658 UL Type XHHW-2, UL 44 UL-LS Limited Smoke, UL VW-1 IEEE-383 (1974), IEEE1202/FT4 RoHS Compliant
Operating Conditions			
Installation Temperature		(°C (°F))	-40 to +65 (-40 to 149)
Operation Temperature		(°C (°F))	-40 to +65 (-40 to 149)

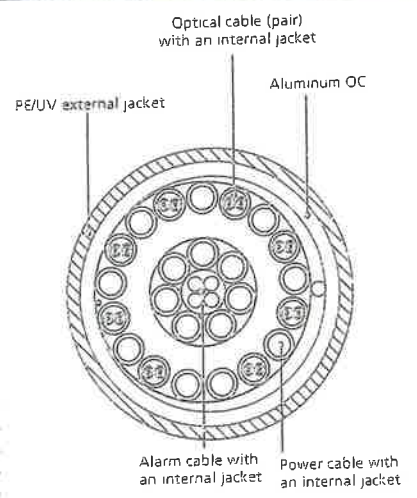


Figure 2: Construction Detail

All information contained in the present datasheet is subject to confirmation at time of ordering.

ATTACHMENT 2

Site Name: Staffordville E (Stafford) Tower Height: 150'		General		Power		Density							
CARRIER	# OF CHAN.	WATTS ERP	HEIGHT	CALC. POWER DENS	FREQ.	MAX. PERMISS. EXP.	FRACTION MPE	Total					
*AT&T	2	565	140	880	0.0226	0.5867	0.39%						
*AT&T	2	875	140	1900	0.0350	1.0000	0.35%						
*AT&T	1	283	140	880	0.0057	0.5867	0.10%						
*AT&T	4	525	140	1900	0.0421	1.0000	0.42%						
*AT&T	1	1615	140	734	0.0323	0.4893	0.66%						
*Sprint	11	287	147.5	1962.5	0.0567	1.0000	0.57%						
Verizon	0	5000	127	0.0000	1970	1.0000	0.00%						
Verizon	0	393	127	0.0000	869	0.5793	0.00%						
Verizon	1	6907	127	0.1540	2145	1.0000	15.40%						
Verizon	1	1699	127	0.0379	746	0.4973	7.62%						
													25.5%
* Source: Siting Council													

ATTACHMENT 3

Date: February 24, 2017

Charles Trask
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277
980.209.8228

Paul J. Ford and Company
250 E Broad St, Suite 600
Columbus, OH 43215
(614) 221-6679
mherbert@pjfweb.com

Subject: Structural Analysis Report

Carrier Designation: Verizon Wireless Co-Locate
Carrier Site Number: 220524
Carrier Site Name: Staffordville East, CT

Crown Castle Designation: Crown Castle BU Number: 876402
Crown Castle Site Name: STAFFORD/PRAGYL/SSUSA
Crown Castle JDE Job Number: 424711
Crown Castle Work Order Number: 1365479
Crown Castle Application Number: 378744 Rev. 0

Engineering Firm Designation: Paul J. Ford and Company Project Number: 37517-0981.001.7805

Site Data: 175 Stafford Street, STAFFORD, Tolland County, CT
Latitude 41° 59' 13.38", Longitude -72° 15' 40.78"
150 Foot - Monopole Tower

Dear Charles Trask,

Paul J. Ford and Company is pleased to submit this "Structural Analysis Report" to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 1004298, in accordance with application 378744, revision 0.

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

LC5: Existing + Proposed Equipment

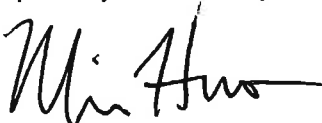
Sufficient Capacity

Note: See Table I and Table II for the proposed and existing loading, respectively.

This analysis has been performed in accordance with the 2016 Connecticut State Building Code based upon an ultimate 3-second gust wind speed of 125 mph converted to a nominal 3-second gust wind speed of 97 mph per Section 1609.3 and Appendix N as required for use in the ANSI/TIA-222-G-2005 Standard, "Structural Standard for Antenna Supporting Structures and Antennas", with ANSI/TIA-222-G-1-2007 and ANSI/TIA-222-G-2-2009 Addenda per Exception #5 of Section 1609.1.1. Risk Category II, Exposure Category C and Topographic Category 1 with a maximum Topographic Factor, Kzt, of 1.0 were used in this analysis.

We at Paul J. Ford and Company appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:



Michelle Herbert
Structural Designer



2.27.17

TABLE OF CONTENTS

1) INTRODUCTION

2) ANALYSIS CRITERIA

Table 1 - Proposed Antenna and Cable Information

Table 2 - Existing Antenna and Cable Information

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

3.1) Analysis Method

3.2) Assumptions

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Table 5 – Tower Components vs. Capacity

4.1) Recommendations

5) APPENDIX A

tnxTower Output

6) APPENDIX B

Base Level Drawing

7) APPENDIX C

Additional Calculations

1) INTRODUCTION

This tower is a 150 ft Monopole tower mapped by TEP in December of 2007. The original wind speed and design code are unknown.

2) ANALYSIS CRITERIA

This analysis has been performed in accordance with the 2016 Connecticut State Building Code based upon an ultimate 3-second gust wind speed of 125 mph converted to a nominal 3-second gust wind speed of 97 mph per Section 1609.3 and Appendix N as required for use in the ANSI/TIA-222-G-2005 Standard, "Structural Standard for Antenna Supporting Structures and Antennas", with ANSI/TIA-222-G-1-2007 and ANSI/TIA-222-G-2-2009 Addenda per Exception #5 of Section 1609.1.1. Risk Category II, Exposure Category C and Topographic Category 1 with a maximum Topographic Factor, Kzt, of 1.0 were used in this analysis.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
127.0	127.0	3	alcatel lucent	B13 RRH 4X30	2	1-5/8	--
		3	alcatel lucent	B66A RRH4X45			
		6	commscope	SBNHH-1D65B w/ MP			
		2	raycap	RXXDC-3315-PF-48			

Table 2 - Existing Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
150.0	152.0	6	decibel	980F90T2E-M w/ MP	6	1-5/8	1
	150.0	1	tower mounts	Platform Mount [LP 1201-1]			
136.0	138.0	6	powerwave	7770.00 w/ MP			
		6	powerwave	LGP21401			
		6	powerwave technologies	LGP21903			
	137.0	3	ericsson	RRUS-11			
		1	raycap	DC6-48-60-18-8F			
		1	kmw	AM-X-CD-16-65-00T-RET w/ MP			
		2	powerwave	P65-17-XLH-RR w/ MP			
136.0	1	tower mounts	T-Arm Mount [TA 602-3]				
127.0	127.0	3	alcatel lucent	RRH 2x40-700 W/SOLAR	--	--	2
		3	alcatel lucent	RRH2X40-AWS			
		3	antel	BXA-171063-12CF-EDIN-2 w/ MP			
		3	antel	BXA-70063-6CF-2 w/ MP			
		1	rfs celwave	DB-T1-6Z-8AB-0Z			
		1	tower mounts	Platform Mount [LP 303-1]			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
75.0	76.0	1	lucent	KS24019-L112A	1	1/2	1
	75.0	1	tower mounts	Side Arm Mount [SO 701-1]			

Notes:

- 1) Existing Equipment
- 2) Equipment To Be Removed

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	TEP, 131001.876402.01G, 04/12/2013	2194187	CCISITES
4-POST-MODIFICATION INSPECTION	SGS, 145336, 09/10/2014	5639214	CCISITES
4-TOWER FOUNDATION MAPPING	TEP, 072309, 02/22/2008	2208777	CCISITES
4-TOWER MANUFACTURER MAPPING	TEP, 072309, 12/02/2007	2175539	CCISITES

3.1) Analysis Method

tnxTower (version 7.0.5.1), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

- 1) Tower and structures were built in accordance with the manufacturer's specifications.
- 2) The tower and structures have been maintained in accordance with the manufacturer's specification.
- 3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
- 4) For existing modifications: monopole was modified in conformance with the referenced modification drawings.

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J. Ford and Company should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	150 - 123	Pole	TP22.69x17x0.25	1	-7.89	1288.74	26.3	Pass
L2	123 - 85	Pole	TP28.36x21.6105x0.375	2	-13.46	2423.44	50.8	Pass
L3	85 - 44	Pole	TP36.86x27.0303x0.4063	3	-21.91	3397.00	56.3	Pass
L4	44 - 0	Pole	TP42.53x35.0535x0.4375	4	-35.19	4342.59	64.0	Pass
							Summary	
						Pole (L4)	64.0	Pass
						RATING =	64.0	Pass

Table 5 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	73.9	Pass
1	Base Plate	0	93.0	Pass
1	Base Foundation Structural Steel	0	78.8	Pass
1	Base Foundation Soil Interaction	0	2.9	Pass

Structure Rating (max from all components) =	93.0%
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Notes:

- 1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

4.1) Recommendations

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

APPENDIX A
TNXTOWER OUTPUT

Tower Input Data

There is a pole section.

This tower is designed using the TIA-222-G standard.

The following design criteria apply:

- 1) Tower is located in Tolland County, Connecticut.
- 2) ASCE 7-10 Wind Data is used (wind speeds converted to nominal values).
- 3) Basic wind speed of 97 mph.
- 4) Structure Class II.
- 5) Exposure Category C.
- 6) Topographic Category 1.
- 7) Crest Height 0.00 ft.
- 8) Nominal ice thickness of 1.0000 in.
- 9) Ice thickness is considered to increase with height.
- 10) Ice density of 56 pcf.
- 11) A wind speed of 50 mph is used in combination with ice.
- 12) Temperature drop of 50 °F.
- 13) Deflections calculated using a wind speed of 60 mph.
- 14) A non-linear (P-delta) analysis was used.
- 15) Pressures are calculated at each section.
- 16) Stress ratio used in pole design is 1.
- 17) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs Consider Moments - Horizontals Consider Moments - Diagonals Use Moment Magnification ✓ Use Code Stress Ratios ✓ Use Code Safety Factors - Guys Escalate Ice Always Use Max Kz Use Special Wind Profile Include Bolts In Member Capacity Leg Bolts Are At Top Of Section Secondary Horizontal Braces Leg Use Diamond Inner Bracing (4 Sided) SR Members Have Cut Ends SR Members Are Concentric	Distribute Leg Loads As Uniform Assume Legs Pinned ✓ Assume Rigid Index Plate ✓ Use Clear Spans For Wind Area ✓ Use Clear Spans For KL/r Retension Guys To Initial Tension ✓ Bypass Mast Stability Checks ✓ Use Azimuth Dish Coefficients ✓ Project Wind Area of Appurt. Autocalc Torque Arm Areas Add IBC .6D+W Combination Sort Capacity Reports By Component Triangulate Diamond Inner Bracing Treat Feed Line Bundles As Cylinder	Use ASCE 10 X-Brace Ly Rules Calculate Redundant Bracing Forces Ignore Redundant Members in FEA SR Leg Bolts Resist Compression All Leg Panels Have Same Allowable Offset Girt At Foundation ✓ Consider Feed Line Torque Include Angle Block Shear Check Use TIA-222-G Bracing Resist. Exemption Use TIA-222-G Tension Splice Exemption <div style="text-align: center; background-color: #e0e0e0; padding: 2px;">Poles</div> ✓ Include Shear-Torsion Interaction Always Use Sub-Critical Flow Use Top Mounted Sockets
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Tapered Pole Section Geometry

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L1	150.00-123.00	27.00	2.75	18	17.0000	22.6900	0.2500	1.0000	A572-65 (65 ksi)
L2	123.00-85.00	40.75	3.50	18	21.6105	28.3600	0.3750	1.5000	A572-65 (65 ksi)
L3	85.00-44.00	44.50	4.50	18	27.0303	36.8600	0.4063	1.6250	A572-65 (65 ksi)
L4	44.00-0.00	48.50		18	35.0535	42.5300	0.4375	1.7500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in ²	I in ⁴	r in	C in	I/C in ³	J in ⁴	I/Q in ²	w in	w/t
L1	17.2623	13.2911	471.1170	5.9463	8.6360	54.5527	942.8540	6.6468	2.5520	10.208
	23.0400	17.8061	1132.7992	7.9662	11.5265	98.2776	2267.0890	8.9048	3.5534	14.214
L2	22.4064	25.2755	1439.9945	7.5386	10.9781	131.1696	2881.8839	12.6402	3.1434	8.383
	28.7975	33.3091	3295.7296	9.9347	14.4069	228.7608	6595.7958	16.6577	4.3314	11.55
L3	28.2323	34.3300	3074.3929	9.4515	13.7314	223.8953	6152.8312	17.1683	4.0423	9.95
	37.4286	47.0048	7891.5876	12.9411	18.7249	421.4493	15793.559	23.5069	5.7724	14.209
L4	36.2986	48.0686	7277.0017	12.2887	17.8072	408.6557	14563.578	24.0389	5.3994	12.342
	43.1861	58.4507	13083.881	14.9428	21.6052	605.5883	26184.978	29.2309	6.7153	15.349

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A _r	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals	Double Angle Stitch Bolt Spacing Redundants
ft	ft ²	in					in	in	in
L1 150.00-123.00				1	1	1			
L2 123.00-85.00				1	1	1			
L3 85.00-44.00				1	1	1			
L4 44.00-0.00				1	1	1			

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C _A A _A ft ² /ft	Weight plf
*** LDF7-50A(1-5/8)	C	No	Inside Pole	150.00 - 0.00	6	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.82 0.82 0.82
*** FB-L98B-002-75000(3/8)	C	No	Inside Pole	136.00 - 0.00	1	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.06 0.06 0.06
WR-VG86ST-BRD(3/4)	C	No	Inside Pole	136.00 - 0.00	2	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.58 0.58 0.58
FXL 1873 PE(1-5/8)	C	No	Inside Pole	136.00 - 0.00	12	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.67 0.67 0.67
2" (Nominal) Conduit	C	No	Inside Pole	136.00 - 0.00	1	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.72 0.72 0.72
*** HB158-1-08U8-S8J18(1-5/8)	C	No	Inside Pole	127.00 - 0.00	2	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	1.30 1.30 1.30
LDF6-50A(1-1/4)	C	No	Inside Pole	127.00 - 0.00	2	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.60 0.60 0.60
*** LDF4-50A(1/2)	C	No	Inside Pole	75.00 - 0.00	1	No Ice 1/2" Ice 1" Ice	0.00 0.00 0.00	0.15 0.15 0.15

Feed Line/Linear Appurtenances Section Areas

Tower Sectio n	Tower Elevation ft	Face	A_R ft ²	A_F ft ²	$C_A A_A$ In Face ft ²	$C_A A_A$ Out Face ft ²	Weight K
L1	150.00-123.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.28
L2	123.00-85.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.71
L3	85.00-44.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.77
L4	44.00-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.83

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Sectio n	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft ²	A_F ft ²	$C_A A_A$ In Face ft ²	$C_A A_A$ Out Face ft ²	Weight K
L1	150.00-123.00	A	2.304	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.28
L2	123.00-85.00	A	2.242	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.71
L3	85.00-44.00	A	2.137	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.77
L4	44.00-0.00	A	1.923	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.83

Feed Line Center of Pressure

Section	Elevation ft	CP_x in	CP_z in	CP_x Ice in	CP_z Ice in
L1	150.00-123.00	0.0000	0.0000	0.0000	0.0000
L2	123.00-85.00	0.0000	0.0000	0.0000	0.0000
L3	85.00-44.00	0.0000	0.0000	0.0000	0.0000
L4	44.00-0.00	0.0000	0.0000	0.0000	0.0000

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K

(2) 980F90T2E-M w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	150.00	No Ice	3.99	3.72	0.03
						1/2" Ice	4.45	4.58	0.07
						1" Ice	4.90	5.32	0.11
(2) 980F90T2E-M w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	150.00	No Ice	3.99	3.72	0.03
						1/2" Ice	4.45	4.58	0.07
						1" Ice	4.90	5.32	0.11
(2) 980F90T2E-M w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	150.00	No Ice	3.99	3.72	0.03
						1/2" Ice	4.45	4.58	0.07
						1" Ice	4.90	5.32	0.11
Platform Mount [LP 1201-1]	C	None		0.0000	150.00	No Ice	23.10	23.10	2.10
						1/2" Ice	26.80	26.80	2.50
						1" Ice	30.50	30.50	2.90
2 3/8" OD x 6 ft mount pipe	A	From Leg	4.00 0.00 0.00	0.0000	150.00	No Ice	1.43	1.43	0.00
						1/2" Ice	1.92	1.92	0.01
						1" Ice	2.29	2.29	0.03
2 3/8" OD x 6 ft mount pipe	B	From Leg	4.00 0.00 0.00	0.0000	150.00	No Ice	1.43	1.43	0.00
						1/2" Ice	1.92	1.92	0.01
						1" Ice	2.29	2.29	0.03
2 3/8" OD x 6 ft mount pipe	C	From Leg	4.00 0.00 0.00	0.0000	150.00	No Ice	1.43	1.43	0.00
						1/2" Ice	1.92	1.92	0.01
						1" Ice	2.29	2.29	0.03

(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	0.0000	136.00	No Ice	5.81	4.60	0.09
						1/2" Ice	6.27	5.51	0.14
						1" Ice	6.70	6.21	0.21
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	136.00	No Ice	5.81	4.60	0.09
						1/2" Ice	6.27	5.51	0.14
						1" Ice	6.70	6.21	0.21
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	136.00	No Ice	5.81	4.60	0.09
						1/2" Ice	6.27	5.51	0.14
						1" Ice	6.70	6.21	0.21
P65-17-XLH-RR w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	136.00	No Ice	11.82	9.06	0.09
						1/2" Ice	12.59	10.62	0.18
						1" Ice	13.38	12.21	0.28
P65-17-XLH-RR w/ Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	136.00	No Ice	11.82	9.06	0.09
						1/2" Ice	12.59	10.62	0.18
						1" Ice	13.38	12.21	0.28
AM-X-CD-16-65-00T-RET w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	136.00	No Ice	8.26	6.30	0.07
						1/2" Ice	8.82	7.48	0.14
						1" Ice	9.35	8.37	0.21
(2) LGP21401	A	From Leg	4.00 0.00 2.00	0.0000	136.00	No Ice	1.10	0.35	0.01
						1/2" Ice	1.24	0.44	0.02
						1" Ice	1.38	0.54	0.03
(2) LGP21401	B	From Leg	4.00 0.00 2.00	0.0000	136.00	No Ice	1.10	0.35	0.01
						1/2" Ice	1.24	0.44	0.02
						1" Ice	1.38	0.54	0.03
(2) LGP21401	C	From Leg	4.00 0.00 2.00	0.0000	136.00	No Ice	1.10	0.35	0.01
						1/2" Ice	1.24	0.44	0.02
						1" Ice	1.38	0.54	0.03

Description	Face or Leg	Offset Type	Offsets:		Azimuth Adjustment	Placement	C _A A _{Front}	C _A A _{Side}	Weight
			Horz Lateral	Vert					
			ft	ft	ft	ft ²	ft ²	K	
RRUS-11	A	From Leg	4.00	0.0000	136.00	1" Ice	2.79	1.19	0.05
			0.00			No Ice	3.00	1.34	0.07
			1.00			1/2" Ice	3.21	1.50	0.09
RRUS-11	B	From Leg	4.00	0.0000	136.00	1" Ice	2.79	1.19	0.05
			0.00			No Ice	3.00	1.34	0.07
			1.00			1/2" Ice	3.21	1.50	0.09
RRUS-11	C	From Leg	4.00	0.0000	136.00	1" Ice	2.79	1.19	0.05
			0.00			No Ice	3.00	1.34	0.07
			1.00			1/2" Ice	3.21	1.50	0.09
DC6-48-60-18-8F	A	From Leg	4.00	0.0000	136.00	1" Ice	0.92	0.92	0.02
			0.00			No Ice	1.46	1.46	0.04
			1.00			1/2" Ice	1.64	1.64	0.06
(2) LGP21903	A	From Leg	4.00	0.0000	136.00	1" Ice	0.23	0.16	0.01
			0.00			No Ice	0.29	0.21	0.01
			2.00			1/2" Ice	0.36	0.28	0.02
(2) LGP21903	B	From Leg	4.00	0.0000	136.00	1" Ice	0.23	0.16	0.01
			0.00			No Ice	0.29	0.21	0.01
			2.00			1/2" Ice	0.36	0.28	0.02
(2) LGP21903	C	From Leg	4.00	0.0000	136.00	1" Ice	0.23	0.16	0.01
			0.00			No Ice	0.29	0.21	0.01
			2.00			1/2" Ice	0.36	0.28	0.02
T-Arm Mount [TA 602-3]	C	None		0.0000	136.00	1" Ice	11.59	11.59	0.77
						No Ice	15.44	15.44	0.99
						1/2" Ice	19.29	19.29	1.21
						1" Ice			
*** (2) SBNHH-1D65B w/ Mount Pipe	A	From Leg	4.00	0.0000	127.00	1" Ice	8.40	7.07	0.07
			0.00			No Ice	8.96	8.26	0.14
			0.00			1/2" Ice	9.49	9.18	0.21
(2) SBNHH-1D65B w/ Mount Pipe	B	From Leg	4.00	0.0000	127.00	1" Ice	8.40	7.07	0.07
			0.00			No Ice	8.96	8.26	0.14
			0.00			1/2" Ice	9.49	9.18	0.21
(2) SBNHH-1D65B w/ Mount Pipe	C	From Leg	4.00	0.0000	127.00	1" Ice	8.40	7.07	0.07
			0.00			No Ice	8.96	8.26	0.14
			0.00			1/2" Ice	9.49	9.18	0.21
B13 RRH 4X30	A	From Leg	4.00	0.0000	127.00	1" Ice	2.06	1.32	0.06
			0.00			No Ice	2.24	1.48	0.07
			0.00			1/2" Ice	2.43	1.64	0.09
B13 RRH 4X30	B	From Leg	4.00	0.0000	127.00	1" Ice	2.06	1.32	0.06
			0.00			No Ice	2.24	1.48	0.07
			0.00			1/2" Ice	2.43	1.64	0.09
B13 RRH 4X30	C	From Leg	4.00	0.0000	127.00	1" Ice	2.06	1.32	0.06
			0.00			No Ice	2.24	1.48	0.07
			0.00			1/2" Ice	2.43	1.64	0.09
B66A RRH4X45	A	From Leg	4.00	0.0000	127.00	1" Ice	2.58	1.63	0.07
			0.00			No Ice	2.79	1.81	0.09
			0.00			1/2" Ice	3.01	2.00	0.11
B66A RRH4X45	B	From Leg	4.00	0.0000	127.00	1" Ice	2.58	1.63	0.07
			0.00			No Ice	2.79	1.81	0.09
			0.00			1/2" Ice	3.01	2.00	0.11

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment t	Placement ft		C _A A _A Front ft ²	C _A A _A Side ft ²	Weight K
B66A RRH4X45	C	From Leg	4.00 0.00 0.00	0.0000	127.00	1" Ice	2.58	1.63	0.07
						No Ice	2.79	1.81	0.09
						1/2" Ice	3.01	2.00	0.11
RXXDC-3315-PF-48	B	From Leg	4.00 0.00 0.00	0.0000	127.00	1" Ice	3.01	1.96	0.02
						No Ice	3.23	2.15	0.05
						1/2" Ice	3.46	2.35	0.08
RXXDC-3315-PF-48	C	From Leg	4.00 0.00 0.00	0.0000	127.00	1" Ice	3.01	1.96	0.02
						No Ice	3.23	2.15	0.05
						1/2" Ice	3.46	2.35	0.08
Platform Mount [LP 303-1]	C	None		0.0000	127.00	1" Ice	14.66	14.66	1.25
						No Ice	18.87	18.87	1.48
						1/2" Ice	23.08	23.08	1.71
(2) 2 3/8" OD x 6 ft mount pipe	A	From Leg	4.00 0.00 0.00	0.0000	127.00	1" Ice	1.43	1.43	0.00
						No Ice	1.92	1.92	0.01
						1/2" Ice	2.29	2.29	0.03
(2) 2 3/8" OD x 6 ft mount pipe	B	From Leg	4.00 0.00 0.00	0.0000	127.00	1" Ice	1.43	1.43	0.00
						No Ice	1.92	1.92	0.01
						1/2" Ice	2.29	2.29	0.03
(2) 2 3/8" OD x 6 ft mount pipe	C	From Leg	4.00 0.00 0.00	0.0000	127.00	1" Ice	1.43	1.43	0.00
						No Ice	1.92	1.92	0.01
						1/2" Ice	2.29	2.29	0.03

KS24019-L112A	C	From Leg	4.00 0.00 1.00	0.0000	75.00	1" Ice	0.14	0.14	0.01
						No Ice	0.20	0.20	0.01
						1/2" Ice	0.26	0.26	0.01
Side Arm Mount [SO 701-1]	C	None		0.0000	75.00	1" Ice	0.85	1.67	0.07
						No Ice	1.14	2.34	0.08
						1/2" Ice	1.43	3.01	0.09

Tower Pressures - No Ice

$G_H = 1.100$

Section Elevation ft	z ft	K _z	q _z psf	A _G ft ²	F a c e	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
L1 150.00-123.00	135.85	1.35	30.89	45.340	A	0.000	45.340	45.340	100.00	0.000	0.000
					B	0.000	45.340	100.00	0.000	0.000	
					C	0.000	45.340	100.00	0.000	0.000	
L2 123.00-85.00	103.39	1.275	29.13	81.073	A	0.000	81.073	81.073	100.00	0.000	0.000
					B	0.000	81.073	100.00	0.000	0.000	
					C	0.000	81.073	100.00	0.000	0.000	
L3 85.00-44.00	63.89	1.152	26.27	112.17	A	0.000	112.171	112.171	100.00	0.000	0.000
					1	0.000	112.171	100.00	0.000	0.000	
					B	0.000	112.171	100.00	0.000	0.000	
L4 44.00-0.00	22.26	0.922	21.10	145.72	A	0.000	145.722	145.722	100.00	0.000	0.000
					2	0.000	145.722	100.00	0.000	0.000	
					C	0.000	145.722	100.00	0.000	0.000	

Tower Pressure - With Ice

$G_H = 1.100$

Section Elevation ft	z ft	K_z	q_z psf	t_z in	A_G ft ²	F a c e	A_F ft ²	A_R ft ²	A_{leg} ft ²	Leg %	$C_A A_A$ In Face ft ²	$C_A A_A$ Out Face ft ²
L1 150.00-123.00	135.85	1.35	8.21	2.3040	55.708	A	0.000	55.708	55.708	100.00	0.000	0.000
						B	0.000	55.708	55.708	100.00	0.000	0.000
						C	0.000	55.708	55.708	100.00	0.000	0.000
L2 123.00-85.00	103.39	1.275	7.74	2.2420	95.665	A	0.000	95.665	95.665	100.00	0.000	0.000
						B	0.000	95.665	95.665	100.00	0.000	0.000
						C	0.000	95.665	95.665	100.00	0.000	0.000
L3 85.00-44.00	63.89	1.152	6.98	2.1366	127.491	A	0.000	127.491	127.491	100.00	0.000	0.000
						B	0.000	127.491	127.491	100.00	0.000	0.000
						C	0.000	127.491	127.491	100.00	0.000	0.000
L4 44.00-0.00	22.26	0.922	5.61	1.9228	161.390	A	0.000	161.390	161.390	100.00	0.000	0.000
						B	0.000	161.390	161.390	100.00	0.000	0.000
						C	0.000	161.390	161.390	100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.100$

Section Elevation ft	z ft	K_z	q_z psf	A_G ft ²	F a c e	A_F ft ²	A_R ft ²	A_{leg} ft ²	Leg %	$C_A A_A$ In Face ft ²	$C_A A_A$ Out Face ft ²
L1 150.00-123.00	135.85	1.35	10.57	45.340	A	0.000	45.340	45.340	100.00	0.000	0.000
					B	0.000	45.340	45.340	100.00	0.000	0.000
					C	0.000	45.340	45.340	100.00	0.000	0.000
L2 123.00-85.00	103.39	1.275	9.97	81.073	A	0.000	81.073	81.073	100.00	0.000	0.000
					B	0.000	81.073	81.073	100.00	0.000	0.000
					C	0.000	81.073	81.073	100.00	0.000	0.000
L3 85.00-44.00	63.89	1.152	8.99	112.17	A	0.000	112.171	112.171	100.00	0.000	0.000
					B	0.000	112.171	112.171	100.00	0.000	0.000
					C	0.000	112.171	112.171	100.00	0.000	0.000
L4 44.00-0.00	22.26	0.922	7.22	145.72	A	0.000	145.722	145.722	100.00	0.000	0.000
					B	0.000	145.722	145.722	100.00	0.000	0.000
					C	0.000	145.722	145.722	100.00	0.000	0.000

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 60 deg - No Ice
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice
15	0.9 Dead+1.6 Wind 180 deg - No Ice

Comb. No.	Description
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	150 - 123	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-24.74	0.65	0.12
			Max. Mx	20	-7.89	147.84	-0.13
			Max. My	2	-7.89	-0.13	147.92
			Max. Vy	20	-12.92	147.84	-0.13
			Max. Vx	2	-12.89	-0.13	147.92
			Max. Torque	4			0.69
L2	123 - 85	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-33.15	0.64	0.11
			Max. Mx	20	-13.47	681.31	-0.74
			Max. My	2	-13.47	-0.71	680.32
			Max. Vy	20	-15.72	681.31	-0.74
			Max. Vx	2	-15.69	-0.71	680.32
			Max. Torque	14			-0.51
L3	85 - 44	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-45.13	0.72	0.05
			Max. Mx	20	-21.91	1373.36	-1.41
			Max. My	2	-21.92	-1.32	1371.17
			Max. Vy	20	-18.85	1373.36	-1.41
			Max. Vx	2	-18.82	-1.32	1371.17
			Max. Torque	14			-0.53
L4	44 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-62.76	0.70	0.04
			Max. Mx	20	-35.19	2366.03	-2.18
			Max. My	2	-35.19	-2.09	2362.46
			Max. Vy	20	-21.83	2366.03	-2.18

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vx	2	-21.80	-2.09	2362.46
			Max. Torque	14			-0.53

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	62.76	-0.00	-0.00
	Max. H _x	20	35.21	21.79	-0.02
	Max. H _z	2	35.21	-0.02	21.76
	Max. M _x	2	2362.46	-0.02	21.76
	Max. M _z	8	2365.75	-21.79	0.02
	Max. Torsion	2	0.53	-0.02	21.76
	Min. Vert	21	26.41	21.79	-0.02
	Min. H _x	8	35.21	-21.79	0.02
	Min. H _z	14	35.21	0.02	-21.76
	Min. M _x	14	-2362.37	0.02	-21.76
	Min. M _z	20	-2366.03	21.79	-0.02
	Min. Torsion	14	-0.53	0.02	-21.76

Tower Mast Reaction Summary

Load Combination	Vertical K	Shear _x K	Shear _z K	Overturing Moment, M _x kip-ft	Overturing Moment, M _z kip-ft	Torque kip-ft
Dead Only	29.35	-0.00	0.00	-0.03	0.11	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	35.21	0.02	-21.76	-2362.46	-2.09	-0.53
0.9 Dead+1.6 Wind 0 deg - No Ice	26.41	0.02	-21.76	-2327.53	-2.09	-0.52
1.2 Dead+1.6 Wind 30 deg - No Ice	35.21	10.91	-18.86	-2047.41	-1184.94	-0.49
0.9 Dead+1.6 Wind 30 deg - No Ice	26.41	10.91	-18.86	-2017.21	-1167.50	-0.48
1.2 Dead+1.6 Wind 60 deg - No Ice	35.21	18.88	-10.90	-1183.37	-2050.25	-0.32
0.9 Dead+1.6 Wind 60 deg - No Ice	26.41	18.88	-10.90	-1165.91	-2020.05	-0.31
1.2 Dead+1.6 Wind 90 deg - No Ice	35.21	21.79	-0.02	-2.27	-2365.75	-0.06
0.9 Dead+1.6 Wind 90 deg - No Ice	26.41	21.79	-0.02	-2.22	-2330.81	-0.06
1.2 Dead+1.6 Wind 120 deg - No Ice	35.21	18.87	10.87	1179.44	-2048.04	0.21
0.9 Dead+1.6 Wind 120 deg - No Ice	26.41	18.87	10.87	1162.07	-2017.88	0.21
1.2 Dead+1.6 Wind 150 deg - No Ice	35.21	10.88	18.84	2045.12	-1181.10	0.43
0.9 Dead+1.6 Wind 150 deg - No Ice	26.41	10.88	18.84	2014.97	-1163.72	0.43
1.2 Dead+1.6 Wind 180 deg - No Ice	35.21	-0.02	21.76	2362.37	2.36	0.53
0.9 Dead+1.6 Wind 180 deg - No Ice	26.41	-0.02	21.76	2327.46	2.28	0.53
1.2 Dead+1.6 Wind 210 deg - No Ice	35.21	-10.91	18.86	2047.33	1185.21	0.48
0.9 Dead+1.6 Wind 210 deg - No Ice	26.41	-10.91	18.86	2017.15	1167.70	0.48
1.2 Dead+1.6 Wind 240 deg - No Ice	35.21	-18.88	10.90	1183.29	2050.52	0.31

Load Combination	Vertical K	Shear _x K	Shear _z K	Overturning Moment, M _x kip-ft	Overturning Moment, M _z kip-ft	Torque kip-ft
0.9 Dead+1.6 Wind 240 deg - No Ice	26.41	-18.88	10.90	1165.85	2020.25	0.31
1.2 Dead+1.6 Wind 270 deg - No Ice	35.21	-21.79	0.02	2.18	2366.03	0.06
0.9 Dead+1.6 Wind 270 deg - No Ice	26.41	-21.79	0.02	2.15	2331.02	0.06
1.2 Dead+1.6 Wind 300 deg - No Ice	35.21	-18.87	-10.87	-1179.54	2048.32	-0.21
0.9 Dead+1.6 Wind 300 deg - No Ice	26.41	-18.87	-10.87	-1162.14	2018.08	-0.21
1.2 Dead+1.6 Wind 330 deg - No Ice	35.21	-10.88	-18.84	-2045.21	1181.37	-0.43
0.9 Dead+1.6 Wind 330 deg - No Ice	26.41	-10.88	-18.84	-2015.04	1163.92	-0.42
1.2 Dead+1.0 Ice+1.0 Temp	62.76	0.00	0.00	-0.04	0.70	-0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	62.76	-0.00	-7.39	-860.82	1.04	-0.22
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	62.76	3.70	-6.40	-745.54	-430.24	-0.22
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	62.76	6.41	-3.69	-430.40	-746.00	-0.16
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	62.76	7.40	0.00	0.04	-861.50	-0.06
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	62.76	6.41	3.69	430.45	-746.12	0.05
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	62.76	3.70	6.40	745.50	-430.45	0.16
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	62.76	0.00	7.39	860.66	0.80	0.22
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	62.76	-3.70	6.40	745.38	432.09	0.22
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	62.76	-6.41	3.69	430.24	747.85	0.16
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	62.76	-7.40	-0.00	-0.20	863.35	0.06
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	62.76	-6.41	-3.69	-430.61	747.97	-0.05
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	62.76	-3.70	-6.40	-745.66	432.30	-0.16
Dead+Wind 0 deg - Service	29.35	0.00	-4.66	-501.54	-0.36	-0.11
Dead+Wind 30 deg - Service	29.35	2.33	-4.03	-434.58	-251.41	-0.11
Dead+Wind 60 deg - Service	29.35	4.04	-2.33	-251.20	-435.07	-0.07
Dead+Wind 90 deg - Service	29.35	4.66	-0.00	-0.51	-502.12	-0.01
Dead+Wind 120 deg - Service	29.35	4.04	2.33	250.30	-434.60	0.05
Dead+Wind 150 deg - Service	29.35	2.33	4.03	434.04	-250.60	0.09
Dead+Wind 180 deg - Service	29.35	-0.00	4.66	501.46	0.59	0.11
Dead+Wind 210 deg - Service	29.35	-2.33	4.03	434.51	251.64	0.11
Dead+Wind 240 deg - Service	29.35	-4.04	2.33	251.12	435.30	0.07
Dead+Wind 270 deg - Service	29.35	-4.66	0.00	0.43	502.36	0.01
Dead+Wind 300 deg - Service	29.35	-4.04	-2.33	-250.38	434.83	-0.05
Dead+Wind 330 deg - Service	29.35	-2.33	-4.03	-434.11	250.83	-0.09

Solution Summary

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.00	-29.35	0.00	0.00	29.35	0.00	0.000%

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
2	0.02	-35.21	-21.77	-0.02	35.21	21.76	0.008%
3	0.02	-26.41	-21.77	-0.02	26.41	21.76	0.012%
4	10.91	-35.21	-18.86	-10.91	35.21	18.86	0.000%
5	10.91	-26.41	-18.86	-10.91	26.41	18.86	0.000%
6	18.88	-35.21	-10.90	-18.88	35.21	10.90	0.000%
7	18.88	-26.41	-10.90	-18.88	26.41	10.90	0.000%
8	21.80	-35.21	-0.02	-21.79	35.21	0.02	0.008%
9	21.80	-26.41	-0.02	-21.79	26.41	0.02	0.012%
10	18.87	-35.21	10.87	-18.87	35.21	-10.87	0.000%
11	18.87	-26.41	10.87	-18.87	26.41	-10.87	0.000%
12	10.88	-35.21	18.84	-10.88	35.21	-18.84	0.000%
13	10.88	-26.41	18.84	-10.88	26.41	-18.84	0.000%
14	-0.02	-35.21	21.77	0.02	35.21	-21.76	0.008%
15	-0.02	-26.41	21.77	0.02	26.41	-21.76	0.012%
16	-10.91	-35.21	18.86	10.91	35.21	-18.86	0.000%
17	-10.91	-26.41	18.86	10.91	26.41	-18.86	0.000%
18	-18.88	-35.21	10.90	18.88	35.21	-10.90	0.000%
19	-18.88	-26.41	10.90	18.88	26.41	-10.90	0.000%
20	-21.80	-35.21	0.02	21.79	35.21	-0.02	0.008%
21	-21.80	-26.41	0.02	21.79	26.41	-0.02	0.012%
22	-18.87	-35.21	-10.87	18.87	35.21	10.87	0.000%
23	-18.87	-26.41	-10.87	18.87	26.41	10.87	0.000%
24	-10.88	-35.21	-18.84	10.88	35.21	18.84	0.000%
25	-10.88	-26.41	-18.84	10.88	26.41	18.84	0.000%
26	0.00	-62.76	0.00	-0.00	62.76	-0.00	0.001%
27	-0.00	-62.76	-7.39	0.00	62.76	7.39	0.003%
28	3.70	-62.76	-6.40	-3.70	62.76	6.40	0.002%
29	6.41	-62.76	-3.69	-6.41	62.76	3.69	0.002%
30	7.40	-62.76	0.00	-7.40	62.76	-0.00	0.003%
31	6.41	-62.76	3.69	-6.41	62.76	-3.69	0.002%
32	3.70	-62.76	6.40	-3.70	62.76	-6.40	0.002%
33	0.00	-62.76	7.39	-0.00	62.76	-7.39	0.003%
34	-3.70	-62.76	6.40	3.70	62.76	-6.40	0.002%
35	-6.41	-62.76	3.69	6.41	62.76	-3.69	0.002%
36	-7.40	-62.76	-0.00	7.40	62.76	0.00	0.003%
37	-6.41	-62.76	-3.69	6.41	62.76	3.69	0.002%
38	-3.70	-62.76	-6.40	3.70	62.76	6.40	0.002%
39	0.00	-29.35	-4.66	-0.00	29.35	4.66	0.004%
40	2.33	-29.35	-4.04	-2.33	29.35	4.03	0.004%
41	4.04	-29.35	-2.33	-4.04	29.35	2.33	0.004%
42	4.66	-29.35	-0.00	-4.66	29.35	0.00	0.004%
43	4.04	-29.35	2.33	-4.04	29.35	-2.33	0.004%
44	2.33	-29.35	4.03	-2.33	29.35	-4.03	0.004%
45	-0.00	-29.35	4.66	0.00	29.35	-4.66	0.004%
46	-2.33	-29.35	4.04	2.33	29.35	-4.03	0.004%
47	-4.04	-29.35	2.33	4.04	29.35	-2.33	0.004%
48	-4.66	-29.35	0.00	4.66	29.35	-0.00	0.004%
49	-4.04	-29.35	-2.33	4.04	29.35	2.33	0.004%
50	-2.33	-29.35	-4.03	2.33	29.35	4.03	0.004%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.0000001	0.0000001
2	Yes	18	0.00008554	0.00009751
3	Yes	17	0.00010241	0.00013858
4	Yes	23	0.00000001	0.00013139
5	Yes	23	0.00000001	0.00009175
6	Yes	23	0.00000001	0.00013366
7	Yes	23	0.00000001	0.00009340
8	Yes	18	0.00008552	0.00008999
9	Yes	17	0.00010239	0.00012846
10	Yes	23	0.00000001	0.00013235
11	Yes	23	0.00000001	0.00009250

12	Yes	23	0.00000001	0.00013089
13	Yes	23	0.00000001	0.00009145
14	Yes	18	0.00008554	0.00010344
15	Yes	17	0.00010241	0.00014619
16	Yes	23	0.00000001	0.00013404
17	Yes	23	0.00000001	0.00009369
18	Yes	23	0.00000001	0.00013183
19	Yes	23	0.00000001	0.00009206
20	Yes	18	0.00008552	0.00008847
21	Yes	17	0.00010239	0.00012655
22	Yes	23	0.00000001	0.00013164
23	Yes	23	0.00000001	0.00009196
24	Yes	23	0.00000001	0.00013304
25	Yes	23	0.00000001	0.00009299
26	Yes	6	0.00000001	0.00000346
27	Yes	20	0.00014289	0.00004832
28	Yes	21	0.00008455	0.00009345
29	Yes	21	0.00008454	0.00009623
30	Yes	20	0.00014285	0.00004792
31	Yes	21	0.00008454	0.00009504
32	Yes	21	0.00008454	0.00009388
33	Yes	20	0.00014287	0.00004827
34	Yes	21	0.00008455	0.00009711
35	Yes	21	0.00008456	0.00009441
36	Yes	20	0.00014289	0.00004812
37	Yes	21	0.00008456	0.00009568
38	Yes	21	0.00008456	0.00009677
39	Yes	17	0.00012716	0.00004189
40	Yes	17	0.00012699	0.00004560
41	Yes	17	0.00012698	0.00004985
42	Yes	17	0.00012715	0.00004168
43	Yes	17	0.00012698	0.00004852
44	Yes	17	0.00012698	0.00004581
45	Yes	17	0.00012715	0.00004190
46	Yes	17	0.00012699	0.00005063
47	Yes	17	0.00012699	0.00004635
48	Yes	17	0.00012716	0.00004172
49	Yes	17	0.00012699	0.00004709
50	Yes	17	0.00012699	0.00004983

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 123	25.993	47	1.4890	0.0017
L2	125.75 - 85	18.608	47	1.3875	0.0012
L3	88.5 - 44	9.120	47	0.9957	0.0005
L4	48.5 - 0	2.740	47	0.5198	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.00	(2) 980F90T2E-M w/ Mount Pipe	47	25.993	1.4890	0.0017	35013
136.00	(2) 7770.00 w/ Mount Pipe	47	21.667	1.4422	0.0014	12504
127.00	(2) SBNHH-1D65B w/ Mount Pipe	47	18.973	1.3957	0.0012	7688
75.00	KS24019-L112A	47	6.482	0.8309	0.0004	4499

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 123	122.385	20	7.0262	0.0080
L2	125.75 - 85	87.638	20	6.5467	0.0055
L3	88.5 - 44	42.976	18	4.6978	0.0024
L4	48.5 - 0	12.913	18	2.4513	0.0009

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.00	(2) 980F90T2E-M w/ Mount Pipe	20	122.385	7.0262	0.0080	7640
136.00	(2) 7770.00 w/ Mount Pipe	20	102.031	6.8049	0.0065	2726
127.00	(2) SBNHH-1D65B w/ Mount Pipe	20	89.356	6.5851	0.0057	1674
75.00	KS24019-L112A	18	30.551	3.9199	0.0017	963

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
L1	150 - 123 (1)	TP22.69x17x0.25	27.00	0.00	0.0	17.346 3	-7.89	1288.74	0.006
L2	123 - 85 (2)	TP28.36x21.6105x0.375	40.75	0.00	0.0	32.619 1	-13.46	2423.44	0.006
L3	85 - 44 (3)	TP36.86x27.0303x0.4063	44.50	0.00	0.0	45.723 1	-21.91	3397.00	0.006
L4	44 - 0 (4)	TP42.53x35.0535x0.4375	48.50	0.00	0.0	58.450 7	-35.19	4342.59	0.008

Pole Bending Design Data

Section No.	Elevation ft	Size	M _{ux} kip-ft	φM _{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M _{uy} kip-ft	φM _{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	150 - 123 (1)	TP22.69x17x0.25	148.02	577.27	0.256	0.00	577.27	0.000
L2	123 - 85 (2)	TP28.36x21.6105x0.375	681.84	1357.87	0.502	0.00	1357.87	0.000
L3	85 - 44 (3)	TP36.86x27.0303x0.4063	1374.30	2468.18	0.557	0.00	2468.18	0.000
L4	44 - 0 (4)	TP42.53x35.0535x0.4375	2367.45	3749.35	0.631	0.00	3749.35	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V _u K	φV _n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T _u kip-ft	φT _n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
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Section No.	Elevation ft	Size	Actual V_u K	ϕV_n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u kip-ft	ϕT_n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	150 - 123 (1)	TP22.69x17x0.25	12.92	644.37	0.020	0.69	1155.95	0.001
L2	123 - 85 (2)	TP28.36x21.6105x0.375	15.73	1211.72	0.013	0.31	2719.05	0.000
L3	85 - 44 (3)	TP36.86x27.0303x0.4063	18.86	1698.50	0.011	0.31	4942.39	0.000
L4	44 - 0 (4)	TP42.53x35.0535x0.4375	21.84	2171.30	0.010	0.31	7507.87	0.000

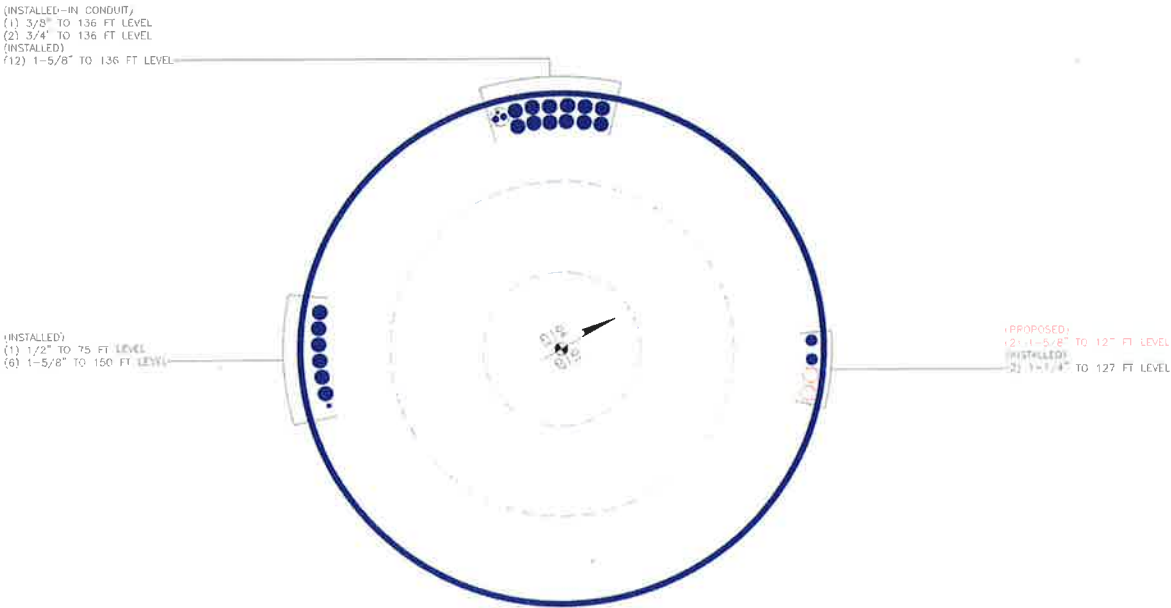
Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	150 - 123 (1)	0.006	0.256	0.000	0.020	0.001	0.263	1.000	4.8.2 ✓
L2	123 - 85 (2)	0.006	0.502	0.000	0.013	0.000	0.508	1.000	4.8.2 ✓
L3	85 - 44 (3)	0.006	0.557	0.000	0.011	0.000	0.563	1.000	4.8.2 ✓
L4	44 - 0 (4)	0.008	0.631	0.000	0.010	0.000	0.640	1.000	4.8.2 ✓

Section Capacity Table

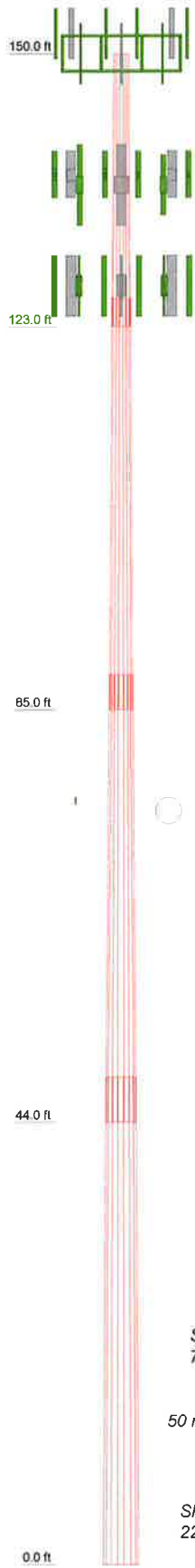
Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	150 - 123	Pole	TP22.69x17x0.25	1	-7.89	1288.74	26.3	Pass
L2	123 - 85	Pole	TP28.36x21.6105x0.375	2	-13.46	2423.44	50.8	Pass
L3	85 - 44	Pole	TP36.86x27.0303x0.4063	3	-21.91	3397.00	56.3	Pass
L4	44 - 0	Pole	TP42.53x35.0535x0.4375	4	-35.19	4342.59	64.0	Pass
Summary								
Pole (L4)							64.0	Pass
RATING =							64.0	Pass

APPENDIX B
BASE LEVEL DRAWING



APPENDIX C
ADDITIONAL CALCULATIONS

Section	Length (ft)	Number of Sides	Thickness (in)	Socket Length (ft)	Top Dia (in)	Bot Dia (in)	Grade	Weight (K)
1	27.00	18	0.2500	2.75	17.0000	22.6900	A572-65	1.4
2	40.75	18	0.3750	3.50	21.6105	28.3600	A572-65	4.1
3	44.50	18	0.4063	4.50	27.0303	36.8600	A572-65	6.2
4	48.50	18	0.4375	35.0535	42.5300		A572-65	8.8
								20.4



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
(2) 980F90T2E-M w/ Mount Pipe	150	(2) LGP21903	136
(2) 980F90T2E-M w/ Mount Pipe	150	(2) LGP21903	136
(2) 980F90T2E-M w/ Mount Pipe	150	(2) LGP21903	136
Platform Mount [LP 1201-1]	150	T-Arm Mount [TA 602-3]	136
2 3/8" OD x 6 ft mount pipe	150	(2) SBNHH-1D65B w/ Mount Pipe	127
2 3/8" OD x 6 ft mount pipe	150	(2) SBNHH-1D65B w/ Mount Pipe	127
2 3/8" OD x 6 ft mount pipe	150	(2) SBNHH-1D65B w/ Mount Pipe	127
(2) 7770.00 w/ Mount Pipe	136	B13 RRH 4X30	127
(2) 7770.00 w/ Mount Pipe	136	B13 RRH 4X30	127
(2) 7770.00 w/ Mount Pipe	136	B13 RRH 4X30	127
P65-17-XLH-RR w/ Mount Pipe	136	B66A RRH4X45	127
P65-17-XLH-RR w/ Mount Pipe	136	B66A RRH4X45	127
AM-X-CD-16-65-00T-RET w/ Mount Pipe	136	B66A RRH4X45	127
(2) LGP21401	136	RXXDC-3315-PF-48	127
(2) LGP21401	136	RXXDC-3315-PF-48	127
(2) LGP21401	136	Platform Mount [LP 303-1]	127
RRUS-11	136	(2) 2 3/8" OD x 6 ft mount pipe	127
RRUS-11	136	(2) 2 3/8" OD x 6 ft mount pipe	127
RRUS-11	136	(2) 2 3/8" OD x 6 ft mount pipe	127
DC6-48-60-18-8F	136	KS24019-L112A	75
		Side Arm Mount [SO 701-1]	75

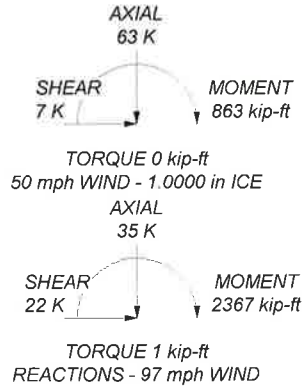
MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in Tolland County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 97 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 1 with Crest Height of 0.00 ft
8. TOWER RATING: 64%

ALL REACTIONS
ARE FACTORED



Paul J. Ford and Company
250 E Broad St, Suite 600
Columbus, OH 43215
Phone: (614) 221-6679
FAX: (555) 555-1235

Job: **150-Ft. Monopole / Stafford/Pragy/SSUSA**
Project: **37517-0981.001 / BU 876402**
Client: Crown Castle
Code: TIA-222-G
Path: \\bldg\proj\37517-0981\37517-0981.dwg
Drawn by: mherbert
Date: 02/24/17
App'd:
Scale: N
Dwg No.:

Stiffened or Unstiffened, UngROUTed, Circular Base Plate - Any Rod Material

TIA Rev G

Assumption: Clear space between bottom of leveling nut and top of concrete not exceeding (1)*(Rod Diameter)

Site Data	
BU#:	876402
Site Name:	Stafford/Pragy/SSUSA
App #:	
Pole Manufacturer:	Other

Reactions		
Mu:	2367	ft-kips
Axial, Pu:	35	kips
Shear, Vu:	22	kips
Eta Factor, η	0.5	TIA G (Fig. 4-4)

Anchor Rod Data		
Qty:	12	
Diam:	2.25	in
Rod Material:	A615-J	
Strength (Fu):	100	ksi
Yield (Fy):	75	ksi
Bolt Circle:	51.03	in

If No stiffeners, Criteria: **AISC LRFD** <-Only Applicable to Unstiffened Cases

Anchor Rod Results

Max Rod (Cu+ Vu/η): 192.1 Kips
 Allowable Axial, $\Phi * Fu * Anet$: 260.0 Kips
 Anchor Rod Stress Ratio: 73.9% **Pass**

Stiffened
AISC LRFD
$\phi * Tn$

Plate Data		
Diam:	57.53	in
Thick:	2	in
Grade:	36	ksi
Single-Rod B-eff:	11.25	in

Base Plate Results

Base Plate Stress: 30.1 ksi
 Allowable Plate Stress: 32.4 ksi
 Base Plate Stress Ratio: 93.0% **Pass**

Flexural Check

Stiffened
AISC LRFD
$\phi * Fy$
Y.L. Length:
N/A, Roark

Stiffener Data (Welding at both sides)		
Config:	1	*
Weld Type:	Both	
Groove Depth:	0.5	in **
Groove Angle:	45	degrees
Fillet H. Weld:	0.5	in
Fillet V. Weld:	0.375	in
Width:	6	in
Height:	18	in
Thick:	1	in
Notch:	0.75	in
Grade:	50	ksi
Weld str.:	80	ksi

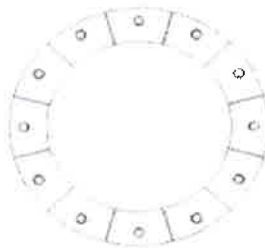
Stiffener Results

Horizontal Weld : 51.8% **Pass**
 Vertical Weld: 39.8% **Pass**
 Plate Flex+Shear, $f_b/F_b + (f_v/F_v)^2$: 14.1% **Pass**
 Plate Tension+Shear, $f_t/F_t + (f_v/F_v)^2$: 54.0% **Pass**
 Plate Comp. (AISC Bracket): 54.2% **Pass**

Pole Results

Pole Punching Shear Check: 11.7% **Pass**

Pole Data		
Diam:	42.53	in
Thick:	0.4375	in
Grade:	65	ksi
# of Sides:	18	"0" IF Round
Fu	80	ksi
Reinf. Fillet Weld	0	"0" if None



* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Factored Foundation Loads:

LC1	LC2
35	26.25 kips
22	22 kips
2367	2367 kips

Concrete Vol =
59.78 yd³

6 ft Square

LRFD Resistance and Load Factors:

φ

Soil Bearing =	0.75
Soil Weight =	0.75
Concrete Weight =	0.75

Dead Load Factors

1.2	0.9
1.2	0.9

Soil Properties:

Depth to Water Table =
99 ft

Uplift Cone from
Top of footing

Layer Thk ft	Soil Density pcf	Cohesion ksf	Friction Angle degrees	Ult Bearing ksf	Depth ft
5	116	0	45		5.00
5	130	0	45	59.4	10.00

Dimensions:

Pier Shape = Square

Pier Width = 6 ft Square

Pier Height above Grade = 0.5 ft

Depth to Bottom of Footing = 7 ft

Footing Thickness = 3 ft

Footing Width, B = 22 ft

Footing Length, L = 22 ft

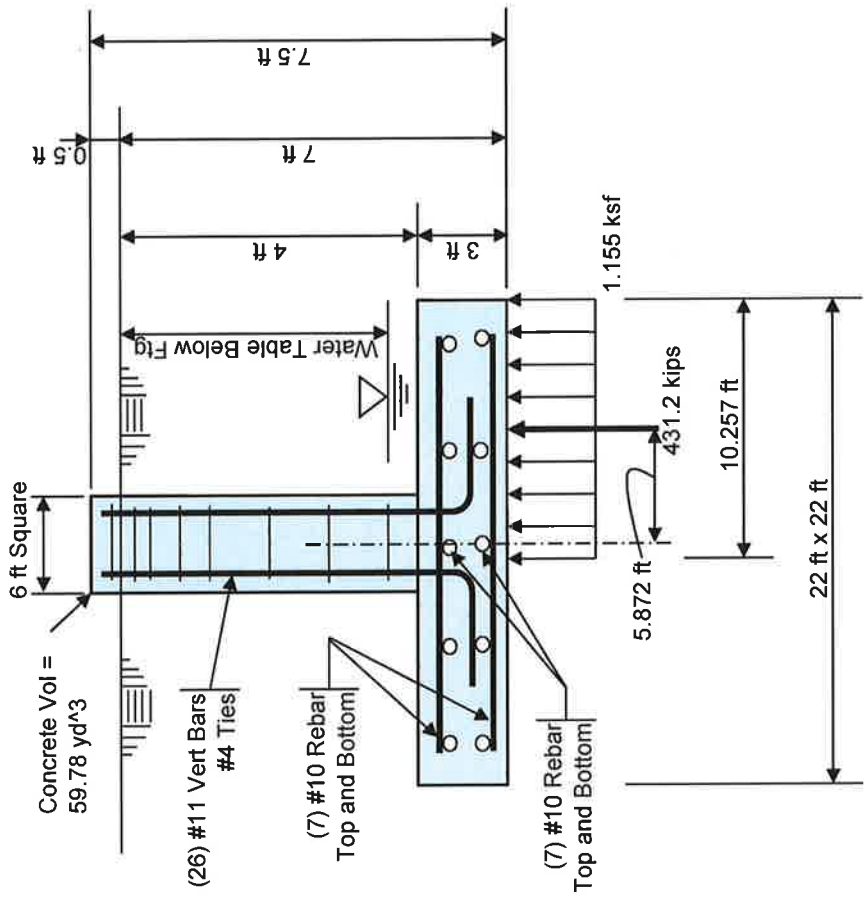
Concrete:

Concrete Strength = 3 ksi

Rebar Strength = 60 ksi

Summary Results:

	Required	Available
Maximum Net Soil Bearing =	1,287 ksf	44,550 ksf
Uplift =	0.0 kips	406.2 kips
Punching Shear Stress =	0.030 ksi	0.164 ksi
Bending Shear Stress =	152.0 kips	674.4 kips
Bending Moment =	903.81 k-ft	1228.1 k-ft
Conc Pier Reinforcing Steel =	2466.0 k-ft	3129.4 k-ft



Total Pad Reinf Stl = 17.78 in² >= 17.11 in² = Min Stl, OK

Total Pier Reinf Stl = 40.56 in² >= 25.92 in² = Min Stl, OK

Footing Thickness = 3.00 ft >= 2.05 ft = Min Fig Thk, OK

Stress Ratio = 2.9% in Soil Bearing

Stress Ratio = 0.0% in Uplift

Stress Ratio = 18.0% in Punching Shear

Stress Ratio = 22.5% in Bending Shear

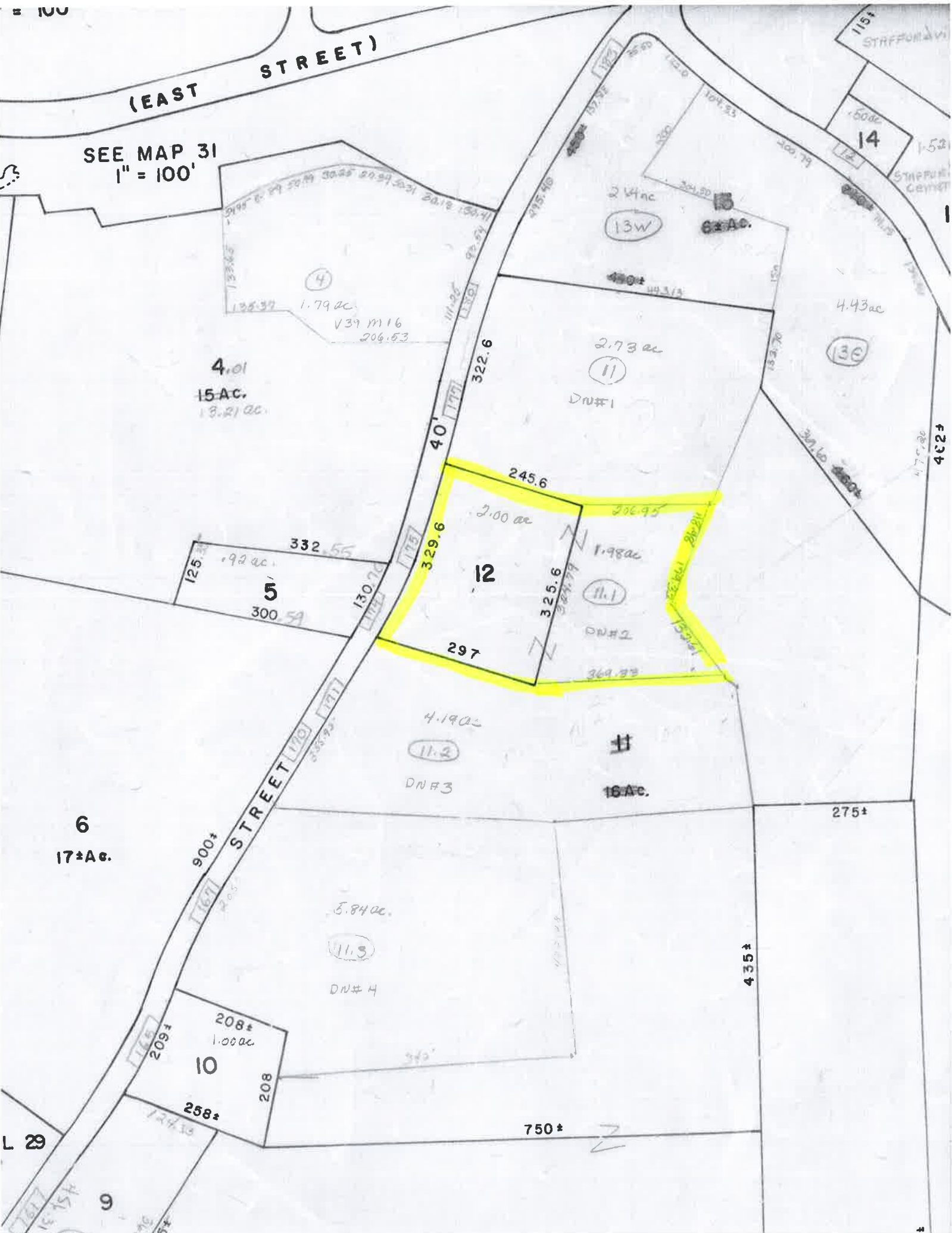
Stress Ratio = 73.6% in Bending Moment

Stress Ratio = 78.8% in Pier Rebar

ATTACHMENT 4

(EAST STREET)

SEE MAP 31
1" = 100'



175 STAFFORD ST

Location 175 STAFFORD ST

Mblu 30 / 12 / /

Acct# 00142200

Owner PRAGL HARRY J+NANCY C

Assessment \$182,420

Appraisal \$260,600

PID 1596

Building Count 1

Current Value

Appraisal			
Valuation Year	Improvements	Land	Total
2015	\$198,700	\$61,900	\$260,600

Assessment			
Valuation Year	Improvements	Land	Total
2015	\$139,090	\$43,330	\$182,420

Owner of Record

Owner PRAGL HARRY J+NANCY C
Co-Owner
Address 175 STAFFORD ST BOX 154
STAFFORDVILLE, CT 06077

Sale Price \$0
Certificate 1
Book & Page 340/ 409
Sale Date 09/03/1998

Ownership History

Ownership History				
Owner	Sale Price	Certificate	Book & Page	Sale Date
PRAGL HARRY J+NANCY C	\$0	1	340/ 409	09/03/1998

Building Information

Building 1 : Section 1

Year Built: 1972
Living Area: 2,295
Replacement Cost: \$221,292
Building Percent 83
Good:
Replacement Cost
Less Depreciation: \$183,700

Building Attributes	
Field	Description

Style	Colonial
Model	Residential
Grade:	C+
Occupancy	1
Exterior Wall 1	Aluminum Sidng
Exterior Wall 2	Brick
Roof Structure	Gambrel
Roof Cover	Asphalt
Interior Wall 1	Drywall
Interior Wall 2	
Interior Flr 1	Hardwood
Interior Flr 2	
Heat Fuel	Oil
Heat Type:	Hot Water
AC Type:	None
Total Bedrooms:	4
Full Bthrms:	1
Half Baths:	1
Extra Fixtures	0
Total Rooms:	8
Bath Style:	Average
Kitchen Style:	Average
Num Kitchens	1
Fireplaces	1
Extra Openings	
Prefab Fpl(s)	
Attic Type	None
Bsmnt Type	Full
Bsmnt Garage(s)	0
Fin Bsmnt	0
Fn. Bmt. Qual.	
Unfin Area	0

Building Photo



(<http://images.vgsi.com/photos2/StaffordCTPhotos//\00\00\94/>)

Building Layout



Building Sub-Areas (sq ft)			Legend
Code	Description	Gross Area	Living Area
BAS	First Floor	1,337	1,337
FNS	Finished 90% Story	1,064	958
BSM	Basement	1,337	0
FGR	Garage	576	0
FOP	Open Porch	39	0
		4,353	2,295

Extra Features

Extra Features	Legend
No Data for Extra Features	

Land

Land Use

Land Line Valuation

Use Code 101
Description Res Dwelling
Zone AA
Neighborhood 240
Alt Land Appr Category No

Size (Acres) 3.98
Frontage
Depth
Assessed Value \$43,330
Appraised Value \$61,900

Outbuildings

Outbuildings						Legend
Code	Description	Sub Code	Sub Description	Size	Value	Bldg #
BRN6	2S Barn w/ Bsmt			748 S.F.	\$15,000	1

Valuation History

Appraisal			
Valuation Year	Improvements	Land	Total
2016	\$198,700	\$61,900	\$260,600
2014	\$186,900	\$61,900	\$248,800
2013	\$186,900	\$61,900	\$248,800

Assessment			
Valuation Year	Improvements	Land	Total
2016	\$139,090	\$43,330	\$182,420
2014	\$130,830	\$43,330	\$174,160
2013	\$130,830	\$43,330	\$174,160

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