



**Tower Engineering Solutions**

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## Structural Analysis Report

Existing 195 ft PennSummit Monopole

Customer Name: SBA Communications Corp

Customer Site Number: NC40177-T

Customer Site Name: Mamers

Carrier Name: Sprint Nextel

Carrier Site ID / Name: RA73XC047 / RA73XC047

Site Location: 40 Raven Rock Rd.

Lillington, North Carolina

Harnett County

Latitude: 35.419249

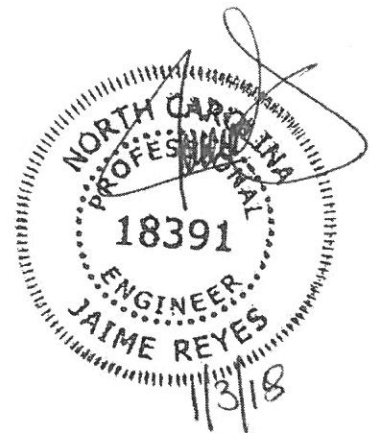
Longitude: -78.919083

**Analysis Result:**

Max Structural Usage: 39.8% [Pass]

Max Foundation Usage: 40.0% [Pass]

Report Prepared By : Tawfeeq Alajaj



## Introduction

The purpose of this report is to summarize the analysis results on the 195 ft PennSummit Monopole to support the proposed antennas and transmission lines in addition to those currently installed. Any modification listed under Sources of Information was assumed completed and was included in this analysis.

## Sources of Information

Tower Drawings	PJF. #:29205-0282.dated 10/23/2005.
Foundation Drawing	PJF. #:29205-0282.dated 10/23/2005.
Geotechnical Report	AMEC Earth & Environmental, INC#: 3-5006-0004-0001.date 05/13/2004.
Modification Drawings	N/A

## Analysis Criteria

The rigorous analysis was performed in accordance with the requirements and stipulations of the ANSI/TIA/EIA 222-G. In accordance with this standard, the structure was analyzed using **TESPoles**, a proprietary analysis software. The program considers the structure as an elastic 3-D model with second-order effects and temperature effects incorporated in the analysis. The analysis was performed using multiple wind directions.

<b>Wind Speed Used in the Analysis:</b>	94.0 mph (3-Sec. Gust)
<b>Wind Speed with Ice:</b>	30 mph (3-Sec. Gust) with 3/4" radial ice concurrent
<b>Operational Wind Speed:</b>	60 mph + 0" Radial ice
<b>Standard/Codes:</b>	ANSI/TIA/EIA 222-G / 2009 North Carolina Building Code
<b>Exposure Category:</b>	C
<b>Structure Class:</b>	II
<b>Topographic Category:</b>	1
<b>Crest Height:</b>	0 ft

This structural analysis is based upon the tower being classified as a Structure 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.

## **Analysis Results**

The results of the structural analysis, performed for the wind and ice loading and antenna equipment as defined above, are summarized as the following:

	Pole shafts	Anchor Bolts	Base Plate
Max. Usage:	<b>39.8%</b>	<b>34.4%</b>	<b>32.8%</b>
Pass/Fail	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>

## **Foundations**

	Moment (Kip-Ft)	Shear (Kips)
Original Design Reactions	5550.0	39.0
Analysis Reactions	3113.6	27.0
Factored Reactions*	7492.5	52.7
% of Design Reactions	41.6%	51.3%

\* Per section 15.5.1 of the TIA-222-G standard, factored reactions were obtained by multiplying a 1.35 factor to the original design reactions.

The foundation has been investigated using the supplied documents and soils report and was found adequate. Therefore, no modification to the foundation will be required.

## **Operational Condition (Rigidity):**

Operational characteristics of the tower are found to be within the limits prescribed by ANSI/TIA/EIA 222-G for the installed antennas. The maximum twist/sway at the elevation of the proposed equipment is 0.8669 degrees under the operational wind speed as specified in the Analysis Criteria.

## **Conclusions**

Based on the analysis results, the existing structure and its foundation were found to be adequate to safely support the existing and proposed equipment and meet the minimum requirements per the ANSI/TIA/EIA 222-G Standard under the design basic wind speed as specified in the Analysis Criteria.

## **Antenna Mount Note:**

The new proposed mount contributes 5% of additional stress to the tower structure.

## Usage Diagram - Max Ratio 39.78% at 0.0ft

**Structure:** NC40177-T-SBA  
**Site Name:** Mamers  
**Height:** 195.00 (ft)  
**Base Elev:** 0.000 (ft)

**Code:** EIA/TIA-222-G  
**Exposure:** C  
**Gh:** 1.1

1/3/2018

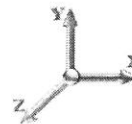
Page: 1



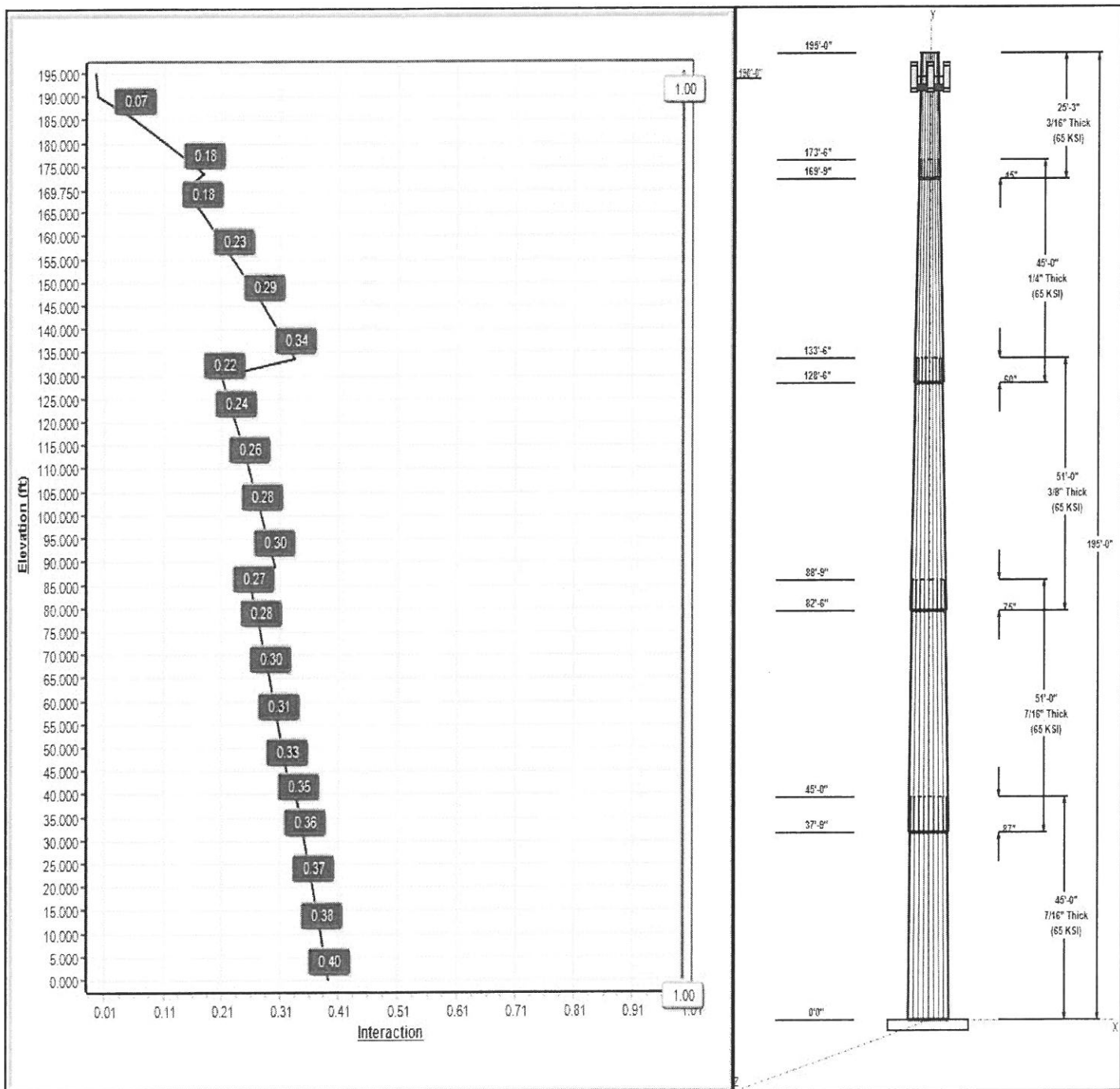
**Dead Load Factor:** 1.20  
**Wind Load Factor:** 1.60

**Iterations:** 24

**Load Case : 1.2D + 1.6W 94 mph Wind**



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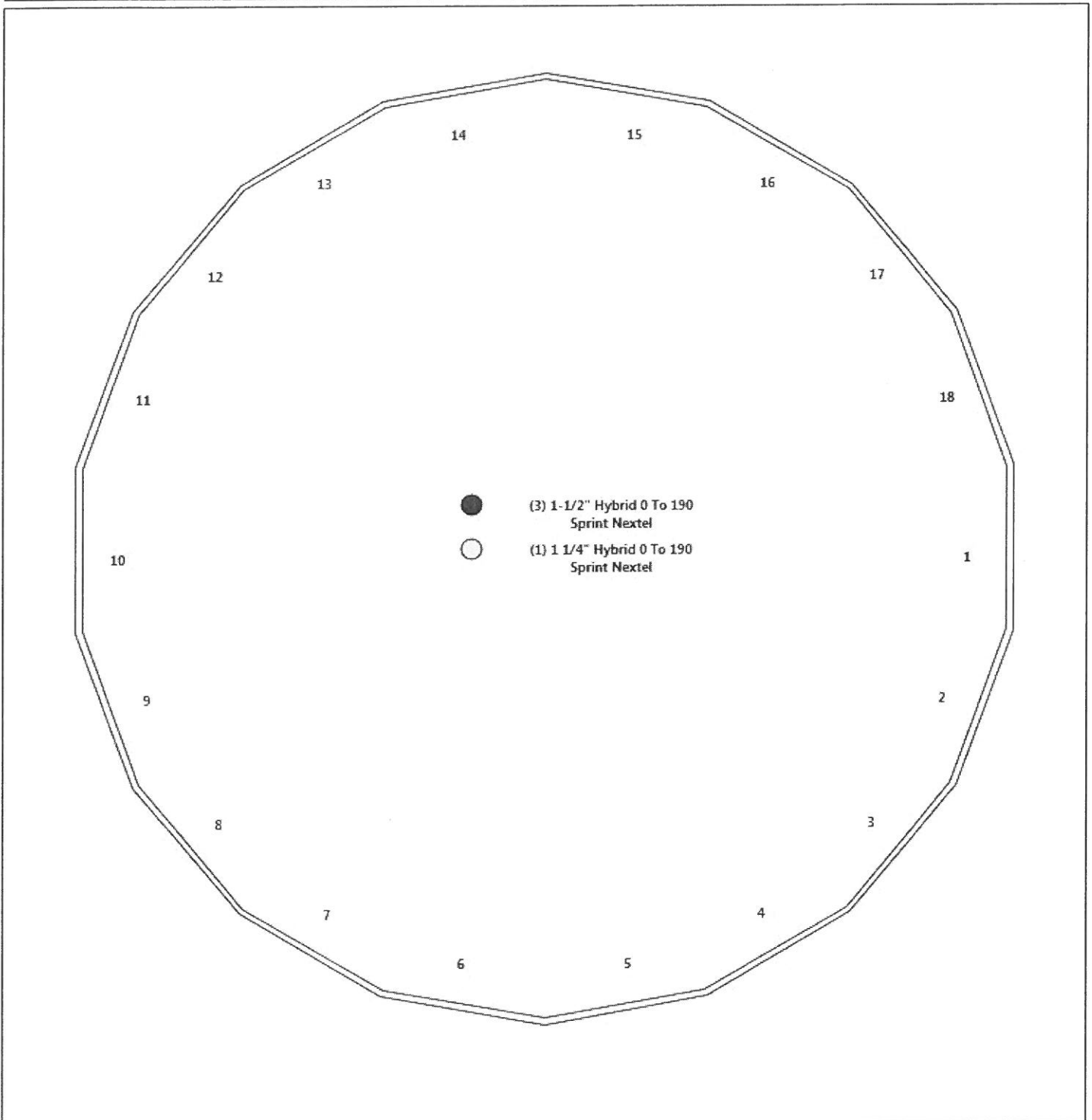


Structure: NC40177-T-SBA - Coax Line Placement

Type: Monopole  
Site Name: Mamers  
Height: 195.00 (ft)

1/3/2018

Page: 3



## Load Summary

Structure: NC40177-T-SBA	Code: EIA/TIA-222-G	1/3/2018
Site Name: Mamers	Exposure: C	
Height: 195.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 1.1	Topography: 1	Struct Class: II



Page: 5

### Discrete Appurtenances

No.	Elev (ft)	Description	Qty	No Ice			Ice			Hor. Ecc. (ft)	Vert Ecc (ft)
				Weight (lb)	CaAa (sf)	CaAa Factor	Weight (lb)	CaAa (sf)	CaAa Factor		
1	190.00	Alcatel Lucent 2500 MHz RRH	3	55.00	3.50	0.67	136.93	4.308	0.67	0.00	0.00
2	190.00	RMPQ-496	1	2600.00	56.40	1.00	6316.88	99.133	1.00	0.00	0.00
3	190.00	APXVSP18-C-A20	3	57.00	8.02	0.83	233.99	10.881	0.83	0.00	0.00
4	190.00	APXVTM14-ALU-20	3	56.20	6.34	0.77	221.24	7.482	0.77	0.00	0.00
5	190.00	Alcatel Lucent 1900MHz RRH	3	60.00	2.77	0.67	145.43	4.069	0.67	0.00	0.00
6	190.00	Alcatel Lucent 800MHZ RRH	3	53.00	2.49	0.67	128.73	3.661	0.67	0.00	0.00
<b>Totals:</b>			<b>16</b>	<b>3,443.60</b>			<b>8,915.84</b>				

### Linear Appurtenances

Bottom Elev. (ft)	Top Elev. (ft)	Description	Exposed Width	Exposed
0.00	190.00	(1) 1 1/4" Hybrid	0.00	Inside
0.00	190.00	(3) 1-1/2" Hybrid	0.00	Inside

## Wind Loading - Shaft

Structure: NC40177-T-SBA

Code: EIA/TIA-222-G

1/3/2018

Site Name: Mamers

Exposure: C

Height: 195.00 (ft)

Crest Height: 0.00

Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 1.1

Topography: 1

Struct Class: II

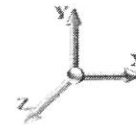
Page: 7



Load Case: 1.2D + 1.6W 94 mph Wind

Dead Load Factor 1.20

Wind Load Factor 1.60



Iterations 24

Elev (ft)	Description	Kzt	Kz	qz (psf)	qzGh (psf)	C (mph-ft)	Cf	Ice Thick (in)	Tributary (ft)	Aa (sf)	CfAa (sf)	Wind Force X (lb)	Dead Load Ice (lb)	Tot Dead Load (lb)
0.00		1.00	0.85	18.266	20.09	486.57	0.650	0.000	0.00	0.000	0.00	0.0	0.0	0.0
5.00		1.00	0.85	18.266	20.09	478.14	0.650	0.000	5.00	27.829	18.09	581.5	0.0	1852.3
10.00		1.00	0.85	18.266	20.09	469.70	0.650	0.000	5.00	27.342	17.77	571.3	0.0	1819.7
15.00		1.00	0.85	18.266	20.09	461.27	0.650	0.000	5.00	26.856	17.46	561.2	0.0	1787.1
20.00		1.00	0.90	19.381	21.32	466.45	0.650	0.000	5.00	26.369	17.14	584.7	0.0	1754.5
25.00		1.00	0.95	20.313	22.34	468.65	0.650	0.000	5.00	25.883	16.82	601.5	0.0	1721.9
30.00		1.00	0.98	21.108	23.22	468.66	0.650	0.000	5.00	25.396	16.51	613.3	0.0	1689.3
35.00		1.00	1.01	21.804	23.98	467.11	0.650	0.000	5.00	24.910	16.19	621.3	0.0	1656.7
37.75 Bot - Section 2		1.00	1.03	22.154	24.37	465.74	0.650	0.000	2.75	13.493	8.77	342.0	0.0	897.3
40.00		1.00	1.04	22.426	24.67	464.38	0.650	0.000	2.25	11.097	7.21	284.7	0.0	1464.8
45.00 Top - Section 1		1.00	1.07	22.989	25.29	460.71	0.650	0.000	5.00	24.307	15.80	639.2	0.0	3207.8
50.00		1.00	1.09	23.504	25.85	463.56	0.650	0.000	5.00	23.820	15.48	640.5	0.0	1583.7
55.00		1.00	1.12	23.981	26.38	458.57	0.650	0.000	5.00	23.334	15.17	640.1	0.0	1551.1
60.00		1.00	1.14	24.424	26.87	453.04	0.650	0.000	5.00	22.847	14.85	638.4	0.0	1518.5
65.00		1.00	1.16	24.839	27.32	447.04	0.650	0.000	5.00	22.361	14.53	635.4	0.0	1485.9
70.00		1.00	1.17	25.230	27.75	440.63	0.650	0.000	5.00	21.874	14.22	631.3	0.0	1453.3
75.00		1.00	1.19	25.599	28.16	433.86	0.650	0.000	5.00	21.387	13.90	626.3	0.0	1420.7
80.00		1.00	1.21	25.949	28.54	426.76	0.650	0.000	5.00	20.901	13.59	620.5	0.0	1388.1
82.50 Bot - Section 3		1.00	1.22	26.118	28.73	423.11	0.650	0.000	2.50	10.268	6.67	306.8	0.0	681.8
85.00		1.00	1.22	26.282	28.91	419.38	0.650	0.000	2.50	10.305	6.70	309.8	0.0	1261.0
88.75 Top - Section 2		1.00	1.23	26.522	29.17	413.67	0.650	0.000	3.75	15.229	9.90	462.1	0.0	1863.1
90.00		1.00	1.24	26.600	29.26	418.37	0.650	0.000	1.25	5.016	3.26	152.6	0.0	285.8
95.00		1.00	1.25	26.905	29.60	410.52	0.650	0.000	5.00	19.759	12.84	608.2	0.0	1125.7
100.00		1.00	1.27	27.197	29.92	402.46	0.650	0.000	5.00	19.272	12.53	599.6	0.0	1097.8
105.00		1.00	1.28	27.478	30.23	394.18	0.650	0.000	5.00	18.785	12.21	590.5	0.0	1069.8
110.00		1.00	1.29	27.748	30.52	385.72	0.650	0.000	5.00	18.299	11.89	580.9	0.0	1041.9
115.00		1.00	1.30	28.009	30.81	377.09	0.650	0.000	5.00	17.812	11.58	570.8	0.0	1013.9
120.00		1.00	1.32	28.261	31.09	368.29	0.650	0.000	5.00	17.326	11.26	560.2	0.0	986.0
125.00		1.00	1.33	28.505	31.36	359.34	0.650	0.000	5.00	16.839	10.95	549.1	0.0	958.0
128.50 Bot - Section 4		1.00	1.33	28.671	31.54	352.99	0.650	0.000	3.50	11.498	7.47	377.1	0.0	654.0
130.00		1.00	1.34	28.742	31.62	350.25	0.650	0.000	1.50	4.918	3.20	161.7	0.0	463.2
133.50 Top - Section 3		1.00	1.34	28.903	31.79	343.81	0.650	0.000	3.50	11.305	7.35	373.8	0.0	1064.5
135.00		1.00	1.35	28.971	31.87	345.64	0.650	0.000	1.50	4.772	3.10	158.2	0.0	181.5
140.00		1.00	1.36	29.193	32.11	336.31	0.650	0.000	5.00	15.591	10.13	520.7	0.0	592.9
145.00		1.00	1.37	29.410	32.35	326.85	0.650	0.000	5.00	15.104	9.82	508.2	0.0	574.3
150.00		1.00	1.38	29.621	32.58	317.28	0.650	0.000	5.00	14.618	9.50	495.3	0.0	555.7
155.00		1.00	1.39	29.826	32.81	307.60	0.650	0.000	5.00	14.131	9.19	482.2	0.0	537.0
160.00		1.00	1.40	30.026	33.03	297.82	0.650	0.000	5.00	13.645	8.87	468.7	0.0	518.4
165.00		1.00	1.41	30.221	33.24	287.94	0.650	0.000	5.00	13.158	8.55	454.9	0.0	499.8
169.75 Bot - Section 5		1.00	1.41	30.402	33.44	278.46	0.650	0.000	4.75	12.050	7.83	419.1	0.0	457.5
170.00		1.00	1.42	30.411	33.45	277.96	0.650	0.000	0.25	0.630	0.41	21.9	0.0	41.6
173.50 Top - Section 4		1.00	1.42	30.542	33.60	270.92	0.650	0.000	3.50	8.692	5.65	303.7	0.0	573.7
175.00		1.00	1.42	30.598	33.66	271.45	0.650	0.000	1.50	3.652	2.37	127.8	0.0	104.2
180.00		1.00	1.43	30.780	33.86	261.31	0.650	0.000	5.00	11.857	7.71	417.5	0.0	338.2
185.00		1.00	1.44	30.958	34.05	251.09	0.650	0.000	5.00	11.371	7.39	402.7	0.0	324.3
190.00 Appurtenance(s)		1.00	1.45	31.132	34.25	240.78	0.650	0.000	5.00	10.884	7.07	387.6	0.0	310.3
195.00		1.00	1.46	31.303	34.43	230.40	0.650	0.000	5.00	10.398	6.76	372.3	0.0	296.3

## Discrete Appurtenance Forces

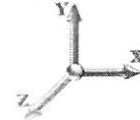
Structure: NC40177-T-SBA	Code: EIA/TIA-222-G	1/3/2018
Site Name: Mamers	Exposure: C	
Height: 195.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 1.1	Topography: 1	Struct Class: II



Page: 9

Load Case: 1.2D + 1.6W 94 mph Wind

Dead Load Factor 1.20  
Wind Load Factor 1.60



Iterations 24

No.	Elev (ft)	Description	Qty	qz (psf)	qzGh (psf)	CaAa x Ka	Ka	Total CaAa (sf)	Dead Load (lb)	Horiz Ecc (ft)	Vert Ecc (ft)	Wind FX (lb)	Mom Y (lb-ft)	Mom Z (lb-ft)
1	190.00	Alcatel Lucent 2500 MHz	3	31.132	34.245	0.54	0.80	5.63	198.00	0.000	0.000	308.37	0.00	0.00
2	190.00	RMPQ-496	1	31.132	34.245	1.00	1.00	56.40	3120.00	0.000	0.000	3090.29	0.00	0.00
3	190.00	APXVSP18-C-A20	3	31.132	34.245	0.66	0.80	15.98	205.20	0.000	0.000	875.35	0.00	0.00
4	190.00	APXVTM14-ALU-20	3	31.132	34.245	0.62	0.80	11.72	202.32	0.000	0.000	641.96	0.00	0.00
5	190.00	Alcatel Lucent 1900MHz	3	31.132	34.245	0.54	0.80	4.45	216.00	0.000	0.000	244.05	0.00	0.00
6	190.00	Alcatel Lucent 800MHZ	3	31.132	34.245	0.54	0.80	4.00	190.80	0.000	0.000	219.38	0.00	0.00
<b>Totals:</b>									<b>4,132.32</b>			<b>5,379.42</b>		



## Total Applied Force Summary

<b>Structure:</b> NC40177-T-SBA	<b>Code:</b> EIA/TIA-222-G	1/3/2018
<b>Site Name:</b> Mamers	<b>Exposure:</b> C	
<b>Height:</b> 195.00 (ft)	<b>Crest Height:</b> 0.00	
<b>Base Elev:</b> 0.000 (ft)	<b>Site Class:</b> D - Stiff Soil	
<b>Gh:</b> 1.1	<b>Topography:</b> 1	<b>Struct Class:</b> II

Page: 11



<b>Totals:</b>	<u>26,956.69</u>	<u>52,760.04</u>	<u>0.00</u>	<u>0.00</u>
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## Calculated Forces

<b>Structure:</b> NC40177-T-SBA	<b>Code:</b> EIA/TIA-222-G	1/3/2018
<b>Site Name:</b> Mamers	<b>Exposure:</b> C	
<b>Height:</b> 195.00 (ft)	<b>Crest Height:</b> 0.00	
<b>Base Elev:</b> 0.000 (ft)	<b>Site Class:</b> D - Stiff Soil	
<b>Gh:</b> 1.1	<b>Topography:</b> 1	<b>Struct Class:</b> II
		Page: 13



## Wind Loading - Shaft

<b>Structure:</b> NC40177-T-SBA	<b>Code:</b> EIA/TIA-222-G	1/3/2018
<b>Site Name:</b> Mamers	<b>Exposure:</b> C	
<b>Height:</b> 195.00 (ft)	<b>Crest Height:</b> 0.00	
<b>Base Elev:</b> 0.000 (ft)	<b>Site Class:</b> D - Stiff Soil	
<b>Gh:</b> 1.1	<b>Topography:</b> 1	<b>Struct Class:</b> II
		Page: 15



Totals: 195.00

21,577.3

35,793.6

## Total Applied Force Summary

Structure: NC40177-T-SBA

Code: EIA/TIA-222-G

1/3/2018

Site Name: Mamers

Exposure: C

Height: 195.00 (ft)

Crest Height: 0.00

Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 1.1

Topography: 1

Struct Class: II

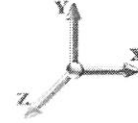
Page: 17



Load Case: 0.9D + 1.6W 94 mph Wind

Dead Load Factor 0.90

Wind Load Factor 1.60



Iterations 24

Elev (ft)	Description	Lateral FX (-) (lb)	Axial FY (-) (lb)	Torsion MY (lb-ft)	Moment MZ (lb-ft)
0.00		0.00	0.00	0.00	0.00
5.00		581.52	1407.06	0.00	0.00
10.00		571.35	1382.61	0.00	0.00
15.00		561.18	1358.16	0.00	0.00
20.00		584.65	1333.71	0.00	0.00
25.00		601.46	1309.25	0.00	0.00
30.00		613.25	1284.80	0.00	0.00
35.00		621.34	1260.35	0.00	0.00
37.75		341.97	682.77	0.00	0.00
40.00		284.69	1106.61	0.00	0.00
45.00		639.25	2423.68	0.00	0.00
50.00		640.50	1205.60	0.00	0.00
55.00		640.13	1181.15	0.00	0.00
60.00		638.37	1156.70	0.00	0.00
65.00		635.40	1132.24	0.00	0.00
70.00		631.34	1107.79	0.00	0.00
75.00		626.33	1083.34	0.00	0.00
80.00		620.46	1058.89	0.00	0.00
82.50		306.79	520.27	0.00	0.00
85.00		309.84	954.64	0.00	0.00
88.75		462.08	1410.67	0.00	0.00
90.00		152.63	218.80	0.00	0.00
95.00		608.15	862.10	0.00	0.00
100.00		599.62	841.14	0.00	0.00
105.00		590.51	820.18	0.00	0.00
110.00		580.88	799.22	0.00	0.00
115.00		570.75	778.26	0.00	0.00
120.00		560.16	757.30	0.00	0.00
125.00		549.12	736.34	0.00	0.00
128.50		377.13	502.97	0.00	0.00
130.00		161.71	352.74	0.00	0.00
133.50		373.81	810.83	0.00	0.00
135.00		158.16	141.48	0.00	0.00
140.00		520.70	462.51	0.00	0.00
145.00		508.19	448.54	0.00	0.00
150.00		495.34	434.57	0.00	0.00
155.00		482.17	420.59	0.00	0.00
160.00		468.69	406.62	0.00	0.00
165.00		454.92	392.65	0.00	0.00
169.75		419.09	360.07	0.00	0.00
170.00		21.92	32.08	0.00	0.00
173.50		303.69	442.76	0.00	0.00
175.00		127.84	83.49	0.00	0.00
180.00		417.52	271.49	0.00	0.00
185.00		402.70	261.01	0.00	0.00
190.00	(16) attachments	5767.05	3349.77	0.00	0.00
195.00		372.34	222.23	0.00	0.00

## Calculated Forces

Structure: NC40177-T-SBA

Code: EIA/TIA-222-G

1/3/2018

Site Name: Mamers

Exposure: C

Height: 195.00 (ft)

Crest Height: 0.00

Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 1.1

Topography: 1

Struct Class: II

Page: 19

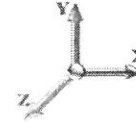


Load Case: 0.9D + 1.6W 94 mph Wind

Iterations 24

Dead Load Factor 0.90

Wind Load Factor 1.60



Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (-) (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	phi Pn (kips)	phi Vn (kips)	phi Tn (ft-kips)	phi Mn (ft-kips)	Total Deflect (in)	Rotation Sway (deg)	Rotation Twist (deg)	Stress Ratio
0.00	-39.55	-26.99	0.00	-3091.9	0.00	3091.90	5898.45	2949.22	15994.5	8009.14	0.00	0.000	0.000	0.393
5.00	-38.10	-26.46	0.00	-2956.9	0.00	2956.98	5839.66	2919.83	15556.9	7790.05	0.05	-0.086	0.000	0.386
10.00	-36.68	-25.94	0.00	-2824.6	0.00	2824.68	5779.30	2889.65	15120.9	7571.71	0.18	-0.172	0.000	0.379
15.00	-35.29	-25.43	0.00	-2694.9	0.00	2694.97	5717.37	2858.69	14686.6	7354.24	0.41	-0.259	0.000	0.373
20.00	-33.92	-24.89	0.00	-2567.8	0.00	2567.83	5653.88	2826.94	14254.2	7137.74	0.73	-0.346	0.000	0.366
25.00	-32.58	-24.33	0.00	-2443.3	0.00	2443.38	5588.82	2794.41	13824.1	6922.33	1.14	-0.435	0.000	0.359
30.00	-31.26	-23.75	0.00	-2321.7	0.00	2321.74	5522.19	2761.10	13396.3	6708.12	1.64	-0.523	0.000	0.352
35.00	-29.98	-23.16	0.00	-2202.9	0.00	2202.97	5454.00	2727.00	12971.1	6495.22	2.24	-0.613	0.000	0.345
37.75	-29.28	-22.83	0.00	-2139.3	0.00	2139.30	5415.82	2707.91	12738.5	6378.73	2.61	-0.663	0.000	0.341
40.00	-28.15	-22.56	0.00	-2087.9	0.00	2087.93	5384.24	2692.12	12548.8	6283.75	2.93	-0.704	0.000	0.338
45.00	-25.70	-21.93	0.00	-1975.1	0.00	1975.11	5367.32	2683.66	12448.3	6233.40	3.71	-0.794	0.000	0.322
50.00	-24.47	-21.31	0.00	-1865.4	0.00	1865.44	5295.62	2647.81	12029.8	6023.85	4.60	-0.885	0.000	0.314
55.00	-23.27	-20.69	0.00	-1758.8	0.00	1758.87	5222.35	2611.18	11614.6	5815.97	5.57	-0.972	0.000	0.307
60.00	-22.10	-20.07	0.00	-1655.4	0.00	1655.42	5147.51	2573.76	11203.1	5609.88	6.63	-1.059	0.000	0.299
65.00	-20.95	-19.44	0.00	-1555.1	0.00	1555.10	5071.11	2535.56	10795.3	5405.68	7.79	-1.146	0.000	0.292
70.00	-19.82	-18.82	0.00	-1457.9	0.00	1457.90	4993.14	2496.57	10391.5	5203.50	9.04	-1.234	0.000	0.284
75.00	-18.73	-18.19	0.00	-1363.8	0.00	1363.82	4913.61	2456.80	9992.03	5003.44	10.38	-1.322	0.000	0.276
80.00	-17.66	-17.57	0.00	-1272.8	0.00	1272.85	4832.50	2416.25	9596.97	4805.62	11.81	-1.410	0.000	0.269
82.50	-17.14	-17.26	0.00	-1228.9	0.00	1228.92	4791.36	2395.68	9401.19	4707.58	12.56	-1.455	0.000	0.265
85.00	-16.17	-16.94	0.00	-1185.7	0.00	1185.76	4749.83	2374.92	9206.60	4610.15	13.33	-1.499	0.000	0.261
88.75	-14.76	-16.46	0.00	-1122.2	0.00	1122.22	3879.73	1939.87	7521.93	3766.56	14.54	-1.566	0.000	0.302
90.00	-14.53	-16.31	0.00	-1101.6	0.00	1101.65	3864.08	1932.04	7445.59	3728.33	14.95	-1.589	0.000	0.299
95.00	-13.66	-15.70	0.00	-1020.0	0.00	1020.09	3800.50	1900.25	7142.09	3576.35	16.67	-1.686	0.000	0.289
100.00	-12.81	-15.10	0.00	-941.57	0.00	941.57	3735.36	1867.68	6841.77	3425.97	18.49	-1.783	0.000	0.278
105.00	-11.99	-14.50	0.00	-866.07	0.00	866.07	3668.64	1834.32	6544.87	3277.30	20.40	-1.879	0.000	0.268
110.00	-11.18	-13.92	0.00	-793.55	0.00	793.55	3600.36	1800.18	6251.60	3130.45	22.42	-1.975	0.000	0.257
115.00	-10.40	-13.33	0.00	-723.97	0.00	723.97	3530.51	1765.26	5962.19	2985.53	24.54	-2.070	0.000	0.245
120.00	-9.65	-12.76	0.00	-657.30	0.00	657.30	3459.10	1729.55	5676.86	2842.65	26.76	-2.163	0.000	0.234
125.00	-8.92	-12.20	0.00	-593.48	0.00	593.48	3386.11	1693.06	5395.84	2701.93	29.08	-2.256	0.000	0.222
128.50	-8.42	-11.81	0.00	-550.79	0.00	550.79	3334.09	1667.05	5201.80	2604.77	30.75	-2.321	0.000	0.214
130.00	-8.06	-11.64	0.00	-533.08	0.00	533.08	3311.56	1655.78	5119.34	2563.48	31.49	-2.348	0.000	0.210
133.50	-7.26	-11.24	0.00	-492.35	0.00	492.35	1921.85	960.93	2966.45	1485.43	33.23	-2.412	0.000	0.335
135.00	-7.11	-11.08	0.00	-475.49	0.00	475.49	1911.78	955.89	2923.59	1463.97	34.00	-2.439	0.000	0.329
140.00	-6.65	-10.56	0.00	-420.08	0.00	420.08	1877.18	938.59	2781.28	1392.71	36.62	-2.563	0.000	0.305
145.00	-6.20	-10.04	0.00	-367.30	0.00	367.30	1841.02	920.51	2640.02	1321.97	39.36	-2.682	0.000	0.281
150.00	-5.78	-9.54	0.00	-317.10	0.00	317.10	1803.28	901.64	2500.04	1251.88	42.24	-2.797	0.000	0.257
155.00	-5.36	-9.04	0.00	-269.42	0.00	269.42	1763.99	881.99	2361.55	1182.53	45.22	-2.905	0.000	0.231
160.00	-4.97	-8.56	0.00	-224.20	0.00	224.20	1723.12	861.56	2224.78	1114.04	48.32	-3.007	0.000	0.204
165.00	-4.59	-8.10	0.00	-181.38	0.00	181.38	1680.69	840.34	2089.96	1046.53	51.52	-3.099	0.000	0.176
169.75	-4.24	-7.66	0.00	-142.93	0.00	142.93	1638.92	819.46	1963.88	983.40	54.64	-3.178	0.000	0.148
170.00	-4.21	-7.64	0.00	-141.01	0.00	141.01	1636.69	818.34	1957.30	980.11	54.81	-3.182	0.000	0.147
173.50	-3.78	-7.31	0.00	-114.28	0.00	114.28	1094.24	547.12	1294.74	648.33	57.16	-3.233	0.000	0.180
175.00	-3.70	-7.18	0.00	-103.31	0.00	103.31	1086.92	543.46	1270.55	636.22	58.18	-3.254	0.000	0.166
180.00	-3.44	-6.75	0.00	-67.39	0.00	67.39	1061.50	530.75	1190.28	596.02	61.63	-3.324	0.000	0.116
185.00	-3.20	-6.34	0.00	-33.62	0.00	33.62	1034.52	517.26	1110.75	556.20	65.13	-3.371	0.000	0.064
190.00	-0.20	-0.38	0.00	-1.92	0.00	1.92	1005.96	502.98	1032.19	516.86	68.68	-3.390	0.000	0.004
195.00	0.00	-0.37	0.00	0.00	0.00	0.00	975.84	487.92	954.81	478.11	72.23	-3.391	0.000	0.000

## Wind Loading - Shaft

Structure: NC40177-T-SBA

Code: EIA/TIA-222-G

1/3/2018

Site Name: Mamers

Exposure: C

Height: 195.00 (ft)

Crest Height: 0.00

Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 1.1

Topography: 1

Struct Class: II

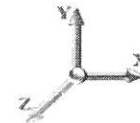
Page: 21



Load Case: 1.2D + 1.0Di + 1.0Wi 30 mph Wind

Dead Load Factor 1.20

Wind Load Factor 1.00



Iterations 23

Elev (ft)	Description	Kzt	Kz	qz (psf)	qzGh (psf)	C (mph-ft)	Cf	Ice Thick (in)	Tributary (ft)	Aa (sf)	CfAa (sf)	Wind Force X (lb)	Dead Load Ice (lb)	Tot Dead Load (lb)
0.00		1.00	0.85	1.860	2.05	0.00	1.200	0.000	0.00	0.000	0.00	0.0	0.0	0.0
5.00		1.00	0.85	1.860	2.05	0.00	1.200	1.242	5.00	28.864	34.64	70.9	517.0	2369.3
10.00		1.00	0.85	1.860	2.05	0.00	1.200	1.331	5.00	28.452	34.14	69.9	545.2	2365.0
15.00		1.00	0.85	1.860	2.05	0.00	1.200	1.386	5.00	28.011	33.61	68.8	558.3	2345.4
20.00		1.00	0.90	1.974	2.17	0.00	1.200	1.427	5.00	27.558	33.07	71.8	564.7	2319.2
25.00		1.00	0.95	2.069	2.28	0.00	1.200	1.459	5.00	27.099	32.52	74.0	567.2	2289.1
30.00		1.00	0.98	2.150	2.36	0.00	1.200	1.486	5.00	26.634	31.96	75.6	567.2	2256.5
35.00		1.00	1.01	2.221	2.44	0.00	1.200	1.509	5.00	26.167	31.40	76.7	565.3	2222.0
37.75 Bot - Section 2		1.00	1.03	2.257	2.48	0.00	1.200	1.520	2.75	14.190	17.03	42.3	310.0	1207.3
40.00		1.00	1.04	2.284	2.51	0.00	1.200	1.529	2.25	11.670	14.00	35.2	256.7	1721.5
45.00 Top - Section 1		1.00	1.07	2.342	2.58	0.00	1.200	1.547	5.00	25.596	30.72	79.1	566.2	3774.0
50.00		1.00	1.09	2.394	2.63	0.00	1.200	1.564	5.00	25.123	30.15	79.4	561.1	2144.8
55.00		1.00	1.12	2.443	2.69	0.00	1.200	1.579	5.00	24.649	29.58	79.5	555.3	2106.4
60.00		1.00	1.14	2.488	2.74	0.00	1.200	1.592	5.00	24.174	29.01	79.4	548.8	2067.3
65.00		1.00	1.16	2.530	2.78	0.00	1.200	1.605	5.00	23.698	28.44	79.1	541.8	2027.6
70.00		1.00	1.17	2.570	2.83	0.00	1.200	1.617	5.00	23.222	27.87	78.8	534.2	1987.5
75.00		1.00	1.19	2.607	2.87	0.00	1.200	1.628	5.00	22.744	27.29	78.3	526.3	1947.0
80.00		1.00	1.21	2.643	2.91	0.00	1.200	1.639	5.00	22.267	26.72	77.7	518.0	1906.1
82.50 Bot - Section 3		1.00	1.22	2.660	2.93	0.00	1.200	1.644	2.50	10.953	13.14	38.5	256.9	938.7
85.00		1.00	1.22	2.677	2.94	0.00	1.200	1.649	2.50	10.992	13.19	38.8	258.6	1519.5
88.75 Top - Section 2		1.00	1.23	2.701	2.97	0.00	1.200	1.656	3.75	16.264	19.52	58.0	382.9	2246.0
90.00		1.00	1.24	2.709	2.98	0.00	1.200	1.658	1.25	5.361	6.43	19.2	127.1	412.9
95.00		1.00	1.25	2.740	3.01	0.00	1.200	1.667	5.00	21.148	25.38	76.5	499.1	1624.8
100.00		1.00	1.27	2.770	3.05	0.00	1.200	1.676	5.00	20.669	24.80	75.6	489.7	1587.4
105.00		1.00	1.28	2.799	3.08	0.00	1.200	1.684	5.00	20.189	24.23	74.6	480.0	1549.8
110.00		1.00	1.29	2.826	3.11	0.00	1.200	1.692	5.00	19.709	23.65	73.5	470.1	1512.0
115.00		1.00	1.30	2.853	3.14	0.00	1.200	1.699	5.00	19.228	23.07	72.4	460.1	1474.0
120.00		1.00	1.32	2.879	3.17	0.00	1.200	1.707	5.00	18.748	22.50	71.2	449.8	1435.8
125.00		1.00	1.33	2.903	3.19	0.00	1.200	1.714	5.00	18.267	21.92	70.0	439.4	1397.4
128.50 Bot - Section 4		1.00	1.33	2.920	3.21	0.00	1.200	1.718	3.50	12.500	15.00	48.2	302.4	956.4
130.00		1.00	1.34	2.928	3.22	0.00	1.200	1.720	1.50	5.348	6.42	20.7	130.2	593.4
133.50 Top - Section 3		1.00	1.34	2.944	3.24	0.00	1.200	1.725	3.50	12.312	14.77	47.8	298.7	1363.1
135.00		1.00	1.35	2.951	3.25	0.00	1.200	1.727	1.50	5.204	6.24	20.3	127.0	308.5
140.00		1.00	1.36	2.974	3.27	0.00	1.200	1.733	5.00	17.035	20.44	66.9	412.5	1005.5
145.00		1.00	1.37	2.996	3.30	0.00	1.200	1.739	5.00	16.554	19.86	65.5	401.5	975.8
150.00		1.00	1.38	3.017	3.32	0.00	1.200	1.745	5.00	16.072	19.29	64.0	390.4	946.0
155.00		1.00	1.39	3.038	3.34	0.00	1.200	1.751	5.00	15.590	18.71	62.5	379.1	916.1
160.00		1.00	1.40	3.058	3.36	0.00	1.200	1.757	5.00	15.109	18.13	61.0	367.7	886.1
165.00		1.00	1.41	3.078	3.39	0.00	1.200	1.762	5.00	14.627	17.55	59.4	356.2	856.0
169.75 Bot - Section 5		1.00	1.41	3.097	3.41	0.00	1.200	1.767	4.75	13.448	16.14	55.0	327.9	785.4
170.00		1.00	1.42	3.098	3.41	0.00	1.200	1.767	0.25	0.704	0.84	2.9	17.4	59.0
173.50 Top - Section 4		1.00	1.42	3.111	3.42	0.00	1.200	1.771	3.50	9.725	11.67	39.9	238.4	812.1
175.00		1.00	1.42	3.117	3.43	0.00	1.200	1.772	1.50	4.095	4.91	16.8	101.1	205.3
180.00		1.00	1.43	3.135	3.45	0.00	1.200	1.777	5.00	13.338	16.01	55.2	325.2	663.5
185.00		1.00	1.44	3.153	3.47	0.00	1.200	1.782	5.00	12.856	15.43	53.5	313.3	637.6
190.00 Appurtenance(s)		1.00	1.45	3.171	3.49	0.00	1.200	1.787	5.00	12.373	14.85	51.8	301.3	611.6
195.00		1.00	1.46	3.188	3.51	0.00	1.200	1.792	5.00	11.891	14.27	50.0	289.3	585.6

## Discrete Appurtenance Forces

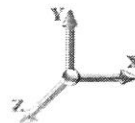
Structure: NC40177-T-SBA	Code: EIA/TIA-222-G	1/3/2018
Site Name: Mamers	Exposure: C	
Height: 195.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 1.1	Topography: 1	Struct Class: II



Page: 23

Load Case: 1.2D + 1.0Di + 1.0Wi 30 mph Wind

Dead Load Factor 1.20  
Wind Load Factor 1.00



Iterations 23

No.	Elev (ft)	Description	Qty	qz (psf)	qzGh (psf)	CaAa x Ka	Ka	Total CaAa (sf)	Dead Load (lb)	Horiz Ecc (ft)	Vert Ecc (ft)	Wind FX (lb)	Mom Y (lb-ft)	Mom Z (lb-ft)
1	190.00	Alcatel Lucent 2500 MHz	3	3.171	3.488	0.54	0.80	6.93	383.49	0.000	0.000	24.16	0.00	0.00
2	190.00	RMPQ-496	1	3.171	3.488	1.00	1.00	99.13	5936.88	0.000	0.000	345.78	0.00	0.00
3	190.00	APXVSP18-C-A20	3	3.171	3.488	0.66	0.80	21.67	587.66	0.000	0.000	75.60	0.00	0.00
4	190.00	APXVTM14-ALU-20	3	3.171	3.488	0.62	0.80	13.83	697.45	0.000	0.000	48.23	0.00	0.00
5	190.00	Alcatel Lucent 1900MHz	3	3.171	3.488	0.54	0.80	6.54	400.59	0.000	0.000	22.82	0.00	0.00
6	190.00	Alcatel Lucent 800MHZ	3	3.171	3.488	0.54	0.80	5.89	354.69	0.000	0.000	20.53	0.00	0.00
<b>Totals:</b>									<b>8,360.76</b>			<b>537.13</b>		

## Total Applied Force Summary

<b>Structure:</b> NC40177-T-SBA	<b>Code:</b> EIA/TIA-222-G	1/3/2018
<b>Site Name:</b> Mamers	<b>Exposure:</b> C	
<b>Height:</b> 195.00 (ft)	<b>Crest Height:</b> 0.00	
<b>Base Elev:</b> 0.000 (ft)	<b>Site Class:</b> D - Stiff Soil	
<b>Gh:</b> 1.1	<b>Struct Class:</b> II	Page: 25



<b>Totals:</b>	<u>3,263.22</u>	<u>75,185.04</u>	<u>0.00</u>	<u>0.00</u>
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## Calculated Forces

**Structure:** NC40177-T-SBA

**Code:** EIA/TIA-222-G

1/3/2018

**Site Name:** Mamers

**Exposure:** C

**Height:** 195.00 (ft)

**Crest Height:** 0.00

**Base Elev:** 0.000 (ft)

**Site Class:** D - Stiff Soil

**Gh:** 1.1

**Topography:** 1

**Struct Class:** II

Page: 27



## Wind Loading - Shaft

Structure: NC40177-T-SBA

Code: EIA/TIA-222-G

1/3/2018

Site Name: Mamers

Exposure: C

Height: 195.00 (ft)

Crest Height: 0.00

Base Elev: 0.000 (ft)

Site Class: D - Stiff Soil

Gh: 1.1

Topography: 1

Struct Class: II

Page: 29



Totals: 195.00

5,494.4

39,770.7

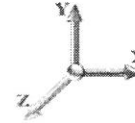
## Total Applied Force Summary

<b>Structure:</b> NC40177-T-SBA	<b>Code:</b> EIA/TIA-222-G	1/3/2018
<b>Site Name:</b> Mamers	<b>Exposure:</b> C	
<b>Height:</b> 195.00 (ft)	<b>Crest Height:</b> 0.00	
<b>Base Elev:</b> 0.000 (ft)	<b>Site Class:</b> D - Stiff Soil	
<b>Gh:</b> 1.1	<b>Topography:</b> 1	<b>Page:</b> 31
	<b>Struct Class:</b> II	



**Load Case:** 1.0D + 1.0W 60 mph Wind

**Dead Load Factor** 1.00  
**Wind Load Factor** 1.00



**Iterations** 23

Elev (ft)	Description	Lateral FX (-) (lb)	Axial FY (-) (lb)	Torsion MY (lb-ft)	Moment MZ (lb-ft)
0.00		0.00	0.00	0.00	0.00
5.00		148.08	1563.40	0.00	0.00
10.00		145.49	1536.23	0.00	0.00
15.00		142.90	1509.06	0.00	0.00
20.00		148.88	1481.90	0.00	0.00
25.00		153.16	1454.73	0.00	0.00
30.00		156.16	1427.56	0.00	0.00
35.00		158.22	1400.39	0.00	0.00
37.75		87.08	758.63	0.00	0.00
40.00		72.49	1229.57	0.00	0.00
45.00		162.78	2692.98	0.00	0.00
50.00		163.10	1339.55	0.00	0.00
55.00		163.00	1312.39	0.00	0.00
60.00		162.56	1285.22	0.00	0.00
65.00		161.80	1258.05	0.00	0.00
70.00		160.77	1230.88	0.00	0.00
75.00		159.49	1203.71	0.00	0.00
80.00		157.99	1176.54	0.00	0.00
82.50		78.12	578.08	0.00	0.00
85.00		78.90	1060.71	0.00	0.00
88.75		117.66	1567.41	0.00	0.00
90.00		38.87	243.11	0.00	0.00
95.00		154.86	957.88	0.00	0.00
100.00		152.69	934.60	0.00	0.00
105.00		150.37	911.31	0.00	0.00
110.00		147.92	888.02	0.00	0.00
115.00		145.34	864.73	0.00	0.00
120.00		142.64	841.45	0.00	0.00
125.00		139.83	818.16	0.00	0.00
128.50		96.03	558.85	0.00	0.00
130.00		41.18	391.93	0.00	0.00
133.50		95.19	900.92	0.00	0.00
135.00		40.27	157.20	0.00	0.00
140.00		132.59	513.90	0.00	0.00
145.00		129.41	498.38	0.00	0.00
150.00		126.13	482.85	0.00	0.00
155.00		122.78	467.33	0.00	0.00
160.00		119.35	451.80	0.00	0.00
165.00		115.84	436.28	0.00	0.00
169.75		106.72	400.08	0.00	0.00
170.00		5.58	35.65	0.00	0.00
173.50		77.33	491.96	0.00	0.00
175.00		32.55	92.77	0.00	0.00
180.00		106.32	301.66	0.00	0.00
185.00		102.54	290.01	0.00	0.00
190.00	(16) attachments	1468.52	3721.97	0.00	0.00
195.00		94.81	246.92	0.00	0.00

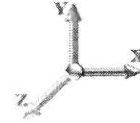
## Calculated Forces

Structure: NC40177-T-SBA	Code: EIA/TIA-222-G	1/3/2018
Site Name: Mamers	Exposure: C	
Height: 195.00 (ft)	Crest Height: 0.00	
Base Elev: 0.000 (ft)	Site Class: D - Stiff Soil	
Gh: 1.1	Topography: 1	Struct Class: II



Load Case: 1.0D + 1.0W 60 mph Wind

Dead Load Factor 1.00  
Wind Load Factor 1.00



Iterations 23

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (-) (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	phi Pn (kips)	phi Vn (kips)	phi Tn (ft-kips)	phi Mn (ft-kips)	Total Deflect (in)	Rotation Sway (deg)	Rotation Twist (deg)	Stress Ratio
0.00	-43.97	-6.87	0.00	-789.32	0.00	789.32	5898.45	2949.22	15994.5	8009.14	0.00	0.000	0.000	0.106
5.00	-42.40	-6.74	0.00	-754.97	0.00	754.97	5839.66	2919.83	15556.9	7790.05	0.01	-0.022	0.000	0.104
10.00	-40.86	-6.61	0.00	-721.27	0.00	721.27	5779.30	2889.65	15120.9	7571.71	0.05	-0.044	0.000	0.102
15.00	-39.35	-6.48	0.00	-688.23	0.00	688.23	5717.37	2858.69	14686.6	7354.24	0.10	-0.066	0.000	0.100
20.00	-37.87	-6.34	0.00	-655.83	0.00	655.83	5653.88	2826.94	14254.2	7137.74	0.19	-0.088	0.000	0.099
25.00	-36.41	-6.20	0.00	-624.11	0.00	624.11	5588.82	2794.41	13824.1	6922.33	0.29	-0.111	0.000	0.097
30.00	-34.98	-6.06	0.00	-593.10	0.00	593.10	5522.19	2761.10	13396.3	6708.12	0.42	-0.134	0.000	0.095
35.00	-33.58	-5.91	0.00	-562.81	0.00	562.81	5454.00	2727.00	12971.1	6495.22	0.57	-0.156	0.000	0.093
37.75	-32.82	-5.82	0.00	-546.57	0.00	546.57	5415.82	2707.91	12738.5	6378.73	0.67	-0.169	0.000	0.092
40.00	-31.59	-5.76	0.00	-533.47	0.00	533.47	5384.24	2692.12	12548.8	6283.75	0.75	-0.180	0.000	0.091
45.00	-28.89	-5.60	0.00	-504.69	0.00	504.69	5367.32	2683.66	12448.3	6233.40	0.95	-0.203	0.000	0.086
50.00	-27.55	-5.44	0.00	-476.71	0.00	476.71	5295.62	2647.81	12029.8	6023.85	1.17	-0.226	0.000	0.084
55.00	-26.24	-5.28	0.00	-449.51	0.00	449.51	5222.35	2611.18	11614.6	5815.97	1.42	-0.248	0.000	0.082
60.00	-24.95	-5.12	0.00	-423.11	0.00	423.11	5147.51	2573.76	11203.1	5609.88	1.69	-0.271	0.000	0.080
65.00	-23.69	-4.96	0.00	-397.50	0.00	397.50	5071.11	2535.56	10795.3	5405.68	1.99	-0.293	0.000	0.078
70.00	-22.46	-4.80	0.00	-372.68	0.00	372.68	4993.14	2496.57	10391.5	5203.50	2.31	-0.315	0.000	0.076
75.00	-21.25	-4.65	0.00	-348.66	0.00	348.66	4913.61	2456.80	9992.03	5003.44	2.65	-0.338	0.000	0.074
80.00	-20.08	-4.49	0.00	-325.42	0.00	325.42	4832.50	2416.25	9596.97	4805.62	3.02	-0.360	0.000	0.072
82.50	-19.50	-4.41	0.00	-314.21	0.00	314.21	4791.36	2395.68	9401.19	4707.58	3.21	-0.372	0.000	0.071
85.00	-18.44	-4.33	0.00	-303.18	0.00	303.18	4749.83	2374.92	9206.60	4610.15	3.41	-0.383	0.000	0.070
88.75	-16.87	-4.20	0.00	-286.95	0.00	286.95	3879.73	1939.87	7521.93	3766.56	3.71	-0.400	0.000	0.081
90.00	-16.63	-4.17	0.00	-281.70	0.00	281.70	3864.08	1932.04	7445.59	3728.33	3.82	-0.406	0.000	0.080
95.00	-15.67	-4.01	0.00	-260.86	0.00	260.86	3800.50	1900.25	7142.09	3576.35	4.26	-0.431	0.000	0.077
100.00	-14.73	-3.86	0.00	-240.80	0.00	240.80	3735.36	1867.68	6841.77	3425.97	4.72	-0.456	0.000	0.074
105.00	-13.82	-3.71	0.00	-221.51	0.00	221.51	3668.64	1834.32	6544.87	3277.30	5.21	-0.480	0.000	0.071
110.00	-12.93	-3.56	0.00	-202.97	0.00	202.97	3600.36	1800.18	6251.60	3130.45	5.73	-0.505	0.000	0.068
115.00	-12.07	-3.41	0.00	-185.19	0.00	185.19	3530.51	1765.26	5962.19	2985.53	6.27	-0.529	0.000	0.065
120.00	-11.23	-3.26	0.00	-168.14	0.00	168.14	3459.10	1729.55	5676.86	2842.65	6.84	-0.553	0.000	0.062
125.00	-10.41	-3.12	0.00	-151.83	0.00	151.83	3386.11	1693.06	5395.84	2701.93	7.43	-0.577	0.000	0.059
128.50	-9.85	-3.02	0.00	-140.91	0.00	140.91	3334.09	1667.05	5201.80	2604.77	7.86	-0.593	0.000	0.057
130.00	-9.46	-2.98	0.00	-136.39	0.00	136.39	3311.56	1655.78	5119.34	2563.48	8.05	-0.600	0.000	0.056
133.50	-8.56	-2.87	0.00	-125.97	0.00	125.97	1921.85	960.93	2966.45	1485.43	8.49	-0.616	0.000	0.089
135.00	-8.40	-2.83	0.00	-121.66	0.00	121.66	1911.78	955.89	2923.59	1463.97	8.69	-0.623	0.000	0.088
140.00	-7.89	-2.70	0.00	-107.49	0.00	107.49	1877.18	938.59	2781.28	1392.71	9.36	-0.655	0.000	0.081
145.00	-7.39	-2.57	0.00	-94.00	0.00	94.00	1841.02	920.51	2640.02	1321.97	10.06	-0.686	0.000	0.075
150.00	-6.91	-2.44	0.00	-81.15	0.00	81.15	1803.28	901.64	2500.04	1251.88	10.79	-0.715	0.000	0.069
155.00	-6.44	-2.31	0.00	-68.96	0.00	68.96	1763.99	881.99	2361.55	1182.53	11.56	-0.743	0.000	0.062
160.00	-5.99	-2.19	0.00	-57.39	0.00	57.39	1723.12	861.56	2224.78	1114.04	12.35	-0.769	0.000	0.055
165.00	-5.55	-2.07	0.00	-46.43	0.00	46.43	1680.69	840.34	2089.96	1046.53	13.17	-0.792	0.000	0.048
169.75	-5.15	-1.96	0.00	-36.59	0.00	36.59	1638.92	819.46	1963.88	983.40	13.97	-0.813	0.000	0.040
170.00	-5.12	-1.96	0.00	-36.10	0.00	36.10	1636.69	818.34	1957.30	980.11	14.01	-0.814	0.000	0.040
173.50	-4.63	-1.87	0.00	-29.25	0.00	29.25	1094.24	547.12	1294.74	648.33	14.61	-0.827	0.000	0.049
175.00	-4.53	-1.84	0.00	-26.45	0.00	26.45	1086.92	543.46	1270.55	636.22	14.87	-0.832	0.000	0.046
180.00	-4.23	-1.73	0.00	-17.25	0.00	17.25	1061.50	530.75	1190.28	596.02	15.75	-0.850	0.000	0.033
185.00	-3.94	-1.62	0.00	-8.61	0.00	8.61	1034.52	517.26	1110.75	556.20	16.65	-0.862	0.000	0.019
190.00	-0.25	-0.10	0.00	-0.49	0.00	0.49	1005.96	502.98	1032.19	516.86	17.56	-0.867	0.000	0.001
195.00	0.00	-0.09	0.00	0.00	0.00	0.00	975.84	487.92	954.81	478.11	18.47	-0.867	0.000	0.000

## Final Analysis Summary

<b>Structure:</b> NC40177-T-SBA	<b>Code:</b> EIA/TIA-222-G	1/3/2018
<b>Site Name:</b> Mamers	<b>Exposure:</b> C	
<b>Height:</b> 195.00 (ft)	<b>Crest Height:</b> 0.00	
<b>Base Elev:</b> 0.000 (ft)	<b>Site Class:</b> D - Stiff Soil	
<b>Gh:</b> 1.1	<b>Topography:</b> 1	<b>Struct Class:</b> II



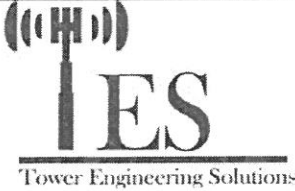
Page: 35

### Reactions

Load Case	Shear FX (kips)	Shear FZ (kips)	Axial FY (kips)	Moment MX (ft-kips)	Moment MY (ft-kips)	Moment MZ (ft-kips)
1.2D + 1.6W 94 mph Wind	27.0	0.00	52.74	0.00	0.00	3113.58
0.9D + 1.6W 94 mph Wind	27.0	0.00	39.55	0.00	0.00	3091.90
1.2D + 1.0Di + 1.0Wi 30 mph Wind	3.3	0.00	75.18	0.00	0.00	376.07
1.0D + 1.0W 60 mph Wind	6.9	0.00	43.97	0.00	0.00	789.32

### Max Stresses

Load Case	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (-) (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	phi Pn (kips)	phi Vn (kips)	phi Tn (ft-kips)	phi Mn (ft-kips)	Elev (ft)	Stress Ratio
1.2D + 1.6W 94 mph Wind	-52.74	-27.00	0.00	-3113.5	0.00	-3113.5	5898.45	2949.2	15994.5	8009.14	0.00	0.398
0.9D + 1.6W 94 mph Wind	-39.55	-26.99	0.00	-3091.9	0.00	-3091.9	5898.45	2949.2	15994.5	8009.14	0.00	0.393
1.2D + 1.0Di + 1.0Wi 30 mph Wind	-75.18	-3.27	0.00	-376.07	0.00	-376.07	5898.45	2949.2	15994.5	8009.14	0.00	0.060
1.0D + 1.0W 60 mph Wind	-43.97	-6.87	0.00	-789.32	0.00	-789.32	5898.45	2949.2	15994.5	8009.14	0.00	0.106

	<b>Pier Foundation Design For Monopole</b>			Date
				1/3/2018
	<b>Customer Name:</b>	Sprint Nextel	<b>EIA/TIA Standard:</b>	EIA-222-G
	<b>Site Name:</b>		<b>Structure Height (Ft.):</b>	195
	<b>Site Number:</b>	NC40177-T-SBA	<b>Engineer Name:</b>	T. Alajaj
<b>Engr. Number:</b>	44400	<b>Engineer Login ID:</b>		

**Foundation Info Obtained from:** Drawings/Calculations

**Structure Type:** Monopole

**Analysis or Design?** Analysis

**Base Reactions (Factored):**

Axial Load (Kips): 75.2    Shear Force (Kips): 27.0  
 Uplift Force (Kips): 0.0    Moment (Kips-ft): 3113.6

**Foundation Geometries:**

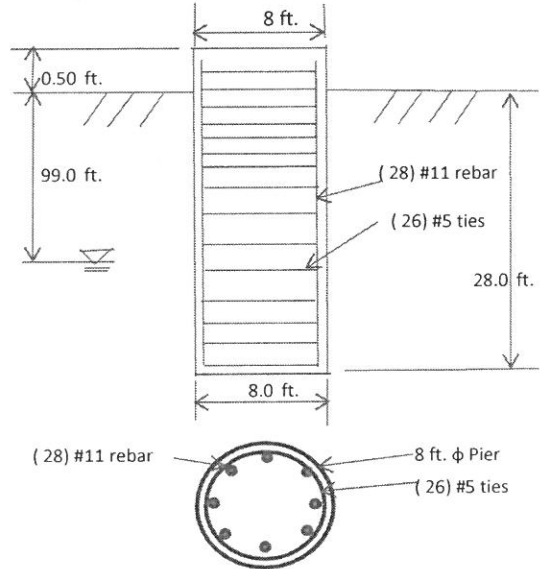
Mods required -Yes/No?: No    ft.  
 Diameter of Pier (ft.): 8.0    Depth of Base B. G. S. : 28.0 ft.  
 Pier Height A. G. (ft.): 0.50

**Material Properties and Rebar Info:**

Concrete Strength (psi): 3000    Steel Elastic Modulus: 29000 ksi  
 Vertical bar yield (ksi): 60    Tie steel yield strength: 40 ksi  
 Vertical Rebar Size #: 11    Tie / Stirrup Size #: 5  
 Qty. of Vertical Rebars: 28    Tie Spacing: 18.0 in.  
 Concrete Cover (in.): 3    Concrete unit weight: 150.0 pcf

**Soil Design Parameters:**

Water Table B.G.S. (ft): 99.0    Unit weight of water: 62.4 psf  
 Ratio of Uplift/Axial Skin Friction: 1.0    Pullout failure Angle: 30 (°)  
 Skin Frictions are to be obtained from: Soil Report



**Monopole Pier Foundation**

Depth of Layers (ft)		$\gamma_{soil}$ (pcf)	$\phi$ (°)	Cohesion (psf)	Ultimate Skin Friction (psf)	Ultimate Bearing (psf)	Soil Types					
Top	Bottom											
0.0	3.0	100	0	0	0	0						
3.0	10.0	100	25	0	0	0	Sand					
10.0	24.0	100	30	0	0	8000	Sand					
24.0	34.0	100	30	0	0	8000	Sand					
34.0	39.0											

Soil weight Increase Factor for bouyant soils (1.0 to 1.15): 1.1

**Foundation Analysis and Design:**

Uplift Strength Reduction Factor:	0.75	Soil Bearing Strength Reduction Factor:	0.75
Total Dry Soil Volume from Conical Failure (cu. Ft.):	13326	Dry Soil Weight from Conical Failure:	1162 Kips
Total Buoyant Soil Volume from Conical Failure (cu. Ft.):	0	Buoyant Soil Weight from Conical Failure (Kips):	0 Kips
Total Dry Concrete Volume (cu. Ft.):	1433	Total Dry Concrete Weight:	214.9 Kips
Total Buoyant Concrete Volume (cu. Ft.):	0.0	Total Buoyant Concrete Weight:	0.00 Kips
Total Effective Concrete Weight (Kips):	214.9	Total Effective Soil Weight:	1161.7 Kips
Total Effective Vertical Load on Base (Kips):	167.4		