

June 7, 2017

Mr. Bruce Hart  
TCT Network  
11717 Rt. 37  
Marion, IL 62959

Re: WJFB  
260' Self Support Tower  
Lebanon, TN

Mr. Hart,

We have completed our analysis of the referenced tower. The tower consists of a 260' tall Rohn model SSVMW assembly. The tower is triangular in cross section with a base face width of 29'-11.5", tapers to a face width of 4'-6.25" at elevation 240' and remains straight to the top of the structure. The tower legs are pipe members that have been filled with grout to increase their capacity during a previous upgrade. The diagonals and horizontal members from 0' – 40' are pipe members while the bracing members above 40' are single angle members.

The purpose of the study was to determine the structural capacity relative to a proposed antenna change. The existing antenna loading was obtained during a site visit conducted on April 13, 2017. In addition, the existing top section on the tower is damaged. This analysis assumes the top section has been replaced

Per our correspondence, most of the existing antenna loading could be removed. You also requested we include a future 6' dish at elevation 150' in our analysis. Therefore, the antenna loading considered for the study is as follows:

Antennas Loading for Analysis

1. 18" dish and 12"x12" Amp with Cat 5 cable at elevation 137'.
2. DB264 w/ 1/2" line at elevation 190' – 210'.
3. 6' Dish (w/ radome) w/ EW63 at elevation 150'. (Future)
4. Replace existing Top mounted TV Antenna with a TFU-29JTH-R-04. The existing 6-1/8" line will be used for the new antenna.

The parameters of the analysis are those of the TIA-222-G code with the following as specified for Wilson County, TN:

3 Second Gust Wind Speed (No Ice) -	90 mph
Structure Class -	II
Exposure -	C
Topographic Category -	1
Crest Height -	0 ft
3 Second Gust Wind (1/2" Ice) -	30 mph
Design Ice Thickness -	3/4"

The analysis assumptions are that the tower has been properly installed and maintained, including, but not limited to the following:

1. Proper alignment and plumbness.
2. Correct bolt tightness.
3. No significant deterioration or damage to any component.

The tower was analyzed using tnxTower (version 7.0.7.0), a commercially available tower analysis program. The results of the analysis show the following areas of tower overstressing.

#### Legs

Elevation (ft)	Maximum Overstress (%)
220 – 240	20.6
200 – 220	13.6
180 – 200	1.3
140 – 160	4.4
100 - 120	1.6
80 – 100	13.9

The remaining legs, diagonals and horizontals are adequate with no overstress. The attached computer output shows the degree of member stressing for all tower members with the previously mentioned antenna loading.

To evaluate the existing foundation for the maximum reactions, the following soil parameters were assumed:

Allowable Bearing Pressure = 4000psf

Soil Unit Weight = 120 #/ft<sup>3</sup>

Internal Friction Angle = 30 degrees

Allowable Horizontal Pressure = 400 psf / ft (max = 4000psf)

Water Table Below bottom of Footing.

Using these assumptions, the existing foundations are marginally adequate.

As previously mentioned, the leg capacities have already been increased by grouting the pipe members solid. Further modifications to obtain additional capacity would be difficult. In addition, the increased wind loading associated with any modifications would most likely overstress the existing foundations.

In our opinion, replacing this tower would a better option than modifying the super structure and foundation.

If you have any questions concerning this analysis or if you need further attention, please do not hesitate to call.

Sincerely,

4SE, Inc.

A handwritten signature in blue ink, appearing to read 'G. Burbage'.

Greg Burbage, PE

320.0 ft

## DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
DB264	210 - 190	2' Std Dish	137
6' w/ Radome	150	12"x12" Amp	137

## SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	ROHN 2 X-STR (GR)	F	L1 3/4x1 3/4x1/8
B	ROHN 2.5 STD (GR)	G	L2 1/2x2 1/2x3/16
C	ROHN 3 STD (GR)	H	L3 1/2x3 1/2x1/4
D	2L2x2x3/16x3/8	I	C10x20
E	L1 1/2x1 1/2x3/16	J	L1 1/2x1 1/2x1/8

## MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A500-50	50 ksi	62 ksi	A36	36 ksi	58 ksi

## TOWER DESIGN NOTES

1. Tower is located in Wilson County, Tennessee.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 90 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 30 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. 60.00 ft TFU-29JTH-R04 (New Top Mount) is included for load transfer only.
9. Grouted pipe f<sub>c</sub> is 4 ksi
10. Weld together tower sections have flange connections.
11. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
12. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
13. Welds are fabricated with ER-70S-6 electrodes.
14. TOWER RATING: 120.6%

260.0 ft  
256.0 ft  
252.0 ft  
248.0 ft  
244.0 ft  
240.0 ft

220.0 ft

200.0 ft

180.0 ft

160.0 ft

140.0 ft

120.0 ft

100.0 ft

80.0 ft

60.0 ft

40.0 ft

20.0 ft

0.0 ft

ALL REACTIONS  
ARE FACTORED

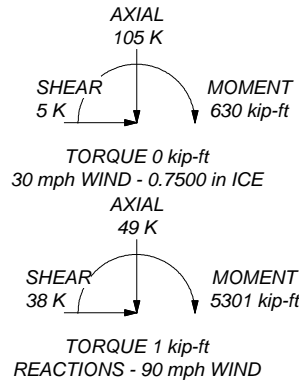
MAX. CORNER REACTIONS AT BASE:

DOWN: 221 K

SHEAR: 24 K

UPLIFT: -173 K

SHEAR: 19 K



**4SE**  
Consulting Engineers

**4SE, Inc.**  
7 Radcliffe Street, Suite 301  
Charleston, SC  
Phone: 843.722.1992  
FAX: 843.722.1211

Job: **WJFB - Proposed New Top Mount (TFU-29JTH-R-04)**

Project: **New Top Section with 6' Dish**

Client: TCT Network

Drawn by: Greg Burbage, PE

App'd:

Code: TIA-222-G

Date: 06/05/17

Scale: NTS

Path:

Dwg No. E-1

S:\Jobs\Archiver\2017\17-041 WJFB Nashville, TN\Draw Files\WJFB Lebanon, TN-New Top Section - Add 6' Dish - New Top Mount.dwg

<b><i>tnxTower</i></b>  <b>4SE, Inc.</b> 7 Radcliffe Street, Suite 301 Charleston, SC Phone: 843.722.1992 FAX: 843.722.1211	<b>Job</b>	<b>Page</b>
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	New Top Section with 6' Dish	17:34:41 06/05/17
	<b>Client</b>	<b>Designed by</b>
	TCT Network	Greg Burbage, PE

## Load Combinations

<i>Comb. No.</i>	<i>Description</i>
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
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 Tower Deflections - Service Wind

<b><i>tnxTower</i></b>  <b>4SE, Inc.</b> 7 Radcliffe Street, Suite 301 Charleston, SC Phone: 843.722.1992 FAX: 843.722.1211	<b>Job</b>	<b>Page</b>
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	<b>Client</b>	<b>Designed by</b>
	TCT Network	Greg Burbage, PE

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
Pole	320 - 260	19.149	47	0.7461	0.0037
Antenna					
T1	260 - 256	10.361	47	0.5599	0.0043
T2	256 - 252	9.896	47	0.5517	0.0043
T3	252 - 248	9.434	47	0.5402	0.0043
T4	248 - 244	8.984	47	0.5272	0.0043
T5	244 - 240	8.543	47	0.5124	0.0043
T6	240 - 220	8.118	47	0.4961	0.0043
T7	220 - 200	6.300	47	0.3730	0.0043
T8	200 - 180	4.904	47	0.2893	0.0040
T9	180 - 160	3.792	47	0.2335	0.0025
T10	160 - 140	2.878	47	0.1930	0.0014
T11	140 - 120	2.135	47	0.1536	0.0010
T12	120 - 100	1.529	47	0.1276	0.0007
T13	100 - 80	1.028	47	0.1014	0.0005
T14	80 - 60	0.644	47	0.0749	0.0004
T15	60 - 40	0.353	47	0.0560	0.0003
T16	40 - 20	0.139	47	0.0370	0.0002
T17	20 - 0	0.031	39	0.0183	0.0001

### Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
210.00	DB264	47	5.558	0.3246	0.0043	13720
205.00	DB264	47	5.221	0.3059	0.0042	15335
200.00	DB264	47	4.904	0.2893	0.0040	17242
195.00	DB264	47	4.603	0.2737	0.0037	18995
190.00	DB264	47	4.319	0.2592	0.0033	20939
150.00	6' w/ Radome	47	2.487	0.1724	0.0011	30492
137.00	2' Std Dish	47	2.036	0.1489	0.0009	36851

### Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
Pole	320 - 260	69.279	18	2.7057	0.0218
Antenna					
T1	260 - 256	37.437	18	2.0272	0.0155
T2	256 - 252	35.756	18	1.9974	0.0155
T3	252 - 248	34.084	18	1.9557	0.0155
T4	248 - 244	32.454	18	1.9083	0.0155
T5	244 - 240	30.858	18	1.8547	0.0155
T6	240 - 220	29.320	18	1.7952	0.0155
T7	220 - 200	22.747	18	1.3484	0.0156
T8	200 - 180	17.700	18	1.0451	0.0144
T9	180 - 160	13.685	18	0.8433	0.0089
T10	160 - 140	10.384	18	0.6967	0.0050
T11	140 - 120	7.704	18	0.5544	0.0034
T12	120 - 100	5.516	18	0.4605	0.0025
T13	100 - 80	3.710	18	0.3660	0.0017
T14	80 - 60	2.322	18	0.2704	0.0013
T15	60 - 40	1.271	18	0.2023	0.0010

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	TCT Network	Greg Burbage, PE

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T16	40 - 20	0.500	2	0.1338	0.0008
T17	20 - 0	0.112	3	0.0662	0.0003

### Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
210.00	DB264	18	20.065	1.1730	0.0155	3790
205.00	DB264	18	18.847	1.1053	0.0151	4237
200.00	DB264	18	17.700	1.0451	0.0144	4764
195.00	DB264	18	16.616	0.9888	0.0133	5250
190.00	DB264	18	15.589	0.9361	0.0119	5789
150.00	6' w/ Radome	18	8.973	0.6223	0.0040	8442
137.00	2' Std Dish	18	7.348	0.5374	0.0033	10210

### Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$\phi P_{allow}$ K	% Capacity	Pass Fail
T1	260 - 256	Leg	ROHN 2XX-Str	2	-27.45	84.97	32.3	Pass
		Diagonal	2L2x2x3/16x3/8	13	-5.98	25.61	23.4	Pass
		Top Girt	C10x20	7	-0.00	161.32	0.4	Pass
T2	256 - 252	Leg	ROHN 2XX-Str	14	-38.98	84.97	45.9	Pass
		Diagonal	L1 1/2x1 1/2x3/16	23	-2.04	8.20	24.8	Pass
							32.1 (b)	
T3	252 - 248	Top Girt	2L2x2x3/16x3/8	17	-2.12	25.74	8.3	Pass
		Leg	ROHN 2XX-Str	26	-43.96	84.97	51.7	Pass
		Diagonal	L1 1/2x1 1/2x3/16	32	-2.24	8.20	27.3	Pass
T4	248 - 244						35.4 (b)	
		Leg	ROHN 2XX-Str	35	-49.56	84.97	58.3	Pass
		Diagonal	L1 1/2x1 1/2x3/16	41	-2.31	8.20	28.2	Pass
T5	244 - 240						36.8 (b)	
		Leg	ROHN 2XX-Str	44	-54.76	84.97	64.5	Pass
		Diagonal	L1 1/2x1 1/2x3/16	50	-2.53	8.20	30.8	Pass
T6	240 - 220						38.7 (b)	
		Leg	ROHN 2 X-STR (GR)	53	-63.90	52.98	120.6	Fail
		Diagonal	L1 1/2x1 1/2x1/8	62	-0.72	3.50	20.5	Pass
T7	220 - 200	Top Girt	L1 1/2x1 1/2x1/8	58	-0.12	2.65	4.4	Pass
		Leg	ROHN 2.5 STD (GR)	89	-72.02	63.42	113.6	Fail
		Diagonal	L1 1/2x1 1/2x1/8	96	-1.14	2.08	55.0	Pass
T8	200 - 180	Leg	ROHN 3 STD (GR)	116	-81.66	80.59	101.3	Fail
		Diagonal	L1 3/4x1 3/4x1/8	123	-1.74	2.11	82.7	Pass
		Leg	ROHN 3 X-STR (GR)	137	-92.95	101.04	92.0	Pass
T9	180 - 160	Diagonal	L2x2x1/8	144	-2.14	2.45	87.7	Pass
		Leg	ROHN 3 X-STR (GR)	158	-105.43	101.03	104.4	Fail
		Diagonal	L2 1/2x2 1/2x3/16	165	-2.84	5.50	51.6	Pass
T10	160 - 140	Leg	ROHN 4 X-STR (GR)	179	-119.26	133.11	89.6	Pass
		Diagonal	L3x3x3/16	186	-3.85	6.60	58.4	Pass
		Leg	ROHN 4 X-STR (GR)	194	-135.20	133.11	101.6	Fail
T11	140 - 120	Diagonal	L3x3x3/16	201	-4.33	5.56	78.0	Pass
		Leg	ROHN 4 X-STR (GR)	209	-151.57	133.09	113.9	Fail
		Diagonal	L3 1/2x3 1/2x1/4	216	-4.74	9.86	48.1	Pass

<b><i>tnxTower</i></b>  <b>4SE, Inc.</b> 7 Radcliffe Street, Suite 301 Charleston, SC Phone: 843.722.1992 FAX: 843.722.1211	<b>Job</b> WJFB - Proposed New Top Mount (TFU-29JTH-R-04)	<b>Page</b> 4 of 4
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	<b>Client</b> TCT Network	<b>Designed by</b> Greg Burbage, PE

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$\phi P_{allow}$ K	% Capacity	Pass Fail	
T14	80 - 60	Leg	ROHN 5 X-STR (GR)	224	-169.28	225.19	75.2	Pass	
		Diagonal	L4x4x1/4	228	-5.72	12.86	44.5	Pass	
							52.3 (b)		
T15	60 - 40	Leg	ROHN 5 X-STR (GR)	239	-187.40	225.14	83.2	Pass	
		Diagonal	L4x4x1/4	243	-5.90	10.98	53.7	Pass	
							54.5 (b)		
T16	40 - 20	Leg	ROHN 5 X-STR (GR)	254	-192.86	225.05	85.7	Pass	
		Diagonal	ROHN 2.5 STD	263	-8.73	16.30	53.5	Pass	
		Top Girt	ROHN 2.5 STD	259	-4.80	16.00	30.0	Pass	
		Redund Horz 1	ROHN TS1.5x11 ga	261	-3.55	5.42	65.4	Pass	
		Bracing							
		Redund Diag 1	ROHN 1.5 STD	279	-3.26	4.02	81.2	Pass	
		Bracing							
		Redund Hip 1	ROHN TS1.5x11 ga	282	-0.03	5.03	0.5	Pass	
		Bracing							
		Redund Hip Diagonal	ROHN TS1.5x11 ga	281	-0.04	0.87	4.8	Pass	
		1 Bracing							
		Inner Bracing	ROHN 2 STD	286	-0.08	6.71	1.2	Pass	
T17	20 - 0	Leg	ROHN 5 X-STR (GR)	287	-208.02	225.05	92.4	Pass	
		Diagonal	ROHN 2.5 STD	296	-8.66	15.36	56.3	Pass	
		Top Girt	ROHN 2.5 STD	292	-5.13	13.17	38.9	Pass	
		Redund Horz 1	ROHN TS1.5x11 ga	311	-3.83	4.45	86.0	Pass	
		Bracing							
		Redund Diag 1	ROHN 2 STD	295	-3.29	8.10	40.6	Pass	
		Bracing							
		Redund Hip 1	ROHN TS1.5x11 ga	315	-0.03	4.15	0.6	Pass	
		Bracing							
		Redund Hip Diagonal	ROHN TS1.5x11 ga	314	-0.04	0.78	4.7	Pass	
		1 Bracing							
		Inner Bracing	ROHN 2 STD	318	-0.09	5.54	1.6	Pass	
							Summary		
							Leg (T6)	120.6	Fail ❌
							Diagonal (T9)	87.7	Pass
							Top Girt (T17)	38.9	Pass
							Redund Horz 1	86.0	Pass
							Bracing (T17)		
							Redund Diag 1	81.2	Pass
							Bracing (T16)		
							Redund Hip 1	0.6	Pass
							Bracing (T17)		
							Redund Hip Diagonal 1	4.8	Pass
							Bracing (T16)		
							Inner Bracing (T17)	1.6	Pass
							Bolt Checks	76.5	Pass
							RATING =	120.6	Fail ❌