STAINLESS

A BUSINESS OF FDH VELOCITEL

REPORT 306918

DATE: 8/3/2017

RIGOROUS STRUCTURAL ANALYSIS

FOR A 1049' STAINLESS G-7 GUYED TOWER

NEW ORLEANS, LA

PREPARED BY: AP APPROVED: DDA

CHECKED BY: PCC

Date	Pages	Remarks

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SECTION PAGE

APPENDIX

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A. AUTHORIZATION/PURPOSE

As authorized by Tom O'Connor of WLAE, a structural analysis was performed to investigate the adequacy of a 1049' overall height Stainless G-7 guyed tower in New Orleans, Louisiana to support specified equipment

B. TOWER HISTORY

The tower was originally designed and furnished in 1983 by Stainless, Inc. It was designed in accordance with EIA Standard RS-222-C for a wind load of 65 psf and a graduated wind load in accordance with the New Orleans Building Code, to support the following equipment:

1. One (1) side-mounted ATW30H3-HSC-32 antenna at the top of the tower, fed by one (1) 6-1/8" rigid coax.
2. One (1) FMH-10BC antenna, side-mounted opposite the TV antenna at the top of the tower, fed by one (1) 5" heliax.
3. One (1) 10-bay FM antenna below the top guy level, fed by one (1) 3-1/8" rigid coax.
4. Six (6) PD-1107 antennas at the 500' level, each fed by one (1) 7/8" heliax.
5. One (1) PD-1132 antenna at the 494' level, fed by one (1) 1-5/8" heliax.
6. Six (6) PD-1107 antennas at the 487' level, each fed by one (1) 7/8" heliax.
7. One (1) 6' dish at the 450' level, fed by one (1) EW64 waveguide.
8. Six (6) PD-1107 antennas at the 400' level, each fed by one (1) 7/8" heliax.
9. Six (6) PD-1107 antennas at the 300' level, each fed by one (1) 7/8" heliax.
10. One (1) 6' dish at the 280' level, fed by one (1) EW64 waveguide.
11. One (1) 6' dish at the 250' level, fed by one (1) 7/8" heliax.
12. One (1) 6' dish at the 240' level, fed by one (1) 7/8" heliax.
13. One (1) DB-436 antenna at the 230' level, fed by one (1) 1/2" heliax.
14. One (1) 6' dish at the 100' level, fed by one (1) 7/8" heliax.
15. One (1) 6' dish at the 50' level, fed by one (1) 7/8" heliax.
16. One (1) high intensity strobe lighting system with circuits contained within one (1) 3/4" conduit for the full height of the tower.
17. One (1) ladder with cable safety device for the full height of the tower.

❖ In May 2004, the tower was modified by Stainless LLC per Report 306908. The modifications were as follows:

- Replaced Level 3 guy strands with 1-1/8"ASTM A586 Grade 2 guy strands.
- Adjusted initial tensions in all guy levels.

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- Installed additional horizontal sub-bracing at the midpoints of the following bays:

Location	No. of bays
965.0' – 958.8'	1
490.0' – 483.8'	1
302.5' – 290.0'	2
183.8' – 177.5'	1

- Replaced existing diagonal braces with new, higher capacity members at the following locations:

Location	No. of bays
758.8' – 752.5'	1
458.8' – 452.5'	1
433.8' – 427.5'	1

- Replaced existing horizontal braces with new, higher capacity members at the following locations:

Location	No. of levels
946.3'	1
458.8'	1
433.8'	1
296.3'	1
146.3'	1

C. CONDITIONS INVESTIGATED

The analysis was performed for the tower supporting the equipment listed below based on the following sources:

- Stainless Proposal P17_3069_002 dated 3/17/2017.
- Stainless LLC Report 306916 dated 9/5/2014.
- Emails from Tom O'Connor dated 5/2/2017 and 6/15/2017 with details of proposed tower loading conditions for analysis.
- Stainless TIA inspection report dated 5/25/2017.

APPURTENANCE	ELEVATION, ft.	FEED LINES
Condition 1:		
Top beacon /lightning rod	1044	--
SHPX-12AC6	976	5"/6-1/8" rigid
TFU-12DSB/VP-M-BB (Prop)	**880**	**4-1/16" rigid (Prop)**
TLP-16M (lowered from 880')	800	4-1/6" rigid
SHPX-2AC	622	4-1/6" rigid

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Ultrascan ENG	438	1/2” 1/2” control cable
Sony camera	103	(3) Cat5 in flexible conduit
***		
6' dish	406	EW63
6' grid dish	345	1-5/8”
(3) Rocket Dish 2'	270	3/8” (4) Cat5
(2) 2' Air Fiber dish	150	(3) Cat5
6' grid dish	138	7/8”
**		
FAA high intensity lighting system	To tower top	3/4” lighting conduit
Ladder with safety climb	To tower top	3/8” safety cable
Condition 2:		
As for **Condition 1** except replace proposed 4-1/16” with 6-1/8” rigid coax	880	**6-1/8” rigid**
Condition 3:		
As for **Condition 1** except replace proposed TFU-12DSB/VP-M-BB with ATC-BCH412C2-23	880	**4-1/16” rigid**
Condition 4:		
As for **Condition 3** except replace proposed 4-1/16” with 6-1/8” rigid coax	880	**6-1/8” rigid**

The tower cross section is based upon Stainless TIA inspection report dated 5/25/2017 and Stainless LLC Report 306916 dated 9/5/2014. The locations of all the transmission lines are shown on page A-2 of this report. Deviating from this appurtenance arrangement may invalidate the results presented in this report. Guy wires initial tensions for the analysis were based upon the actual measured guy intercepts in the Stainless TIA inspection report dated 5/25/2017.

D. LOADS AND STRESSES

The analysis was performed using the following design parameters in accordance with the 2012 IBC and ANSI/TIA 222-G, Structural Standard for Antenna Supporting Structures and Antennas, including Addenda 1 and 2, dated 2007 & 2009:

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- Structure Classification II
- 145 mph ultimate design wind speed with no ice
- Exposure Category C
- Topographic Category 1
- 0.10 earthquake spectral response acceleration at short periods (S_s)
- Earthquake Site Class D

Seismic effects need not be considered as the value of Ss is less than 1.0 per Section 2.7.3 of ANSI/TIA 222-G. Load and resistance factors used to evaluate the adequacy of the structure were in accordance with ANSI/TIA 222-G.

E. METHOD OF ANALYSIS

The analysis was performed using tnxTower, a computer-aided finite element program for analysis of towers subject to simultaneous transverse and axial loads.

F. RESULTS

The results of the analysis show the following ratings:

COMPONENT	SPAN	RATING %			
		C1	C2	C3	C4
Leg compression	Cantilever	53	52	53	53
	6	**150**	**152**	**137**	**139**
	5	96	98	95	97
	4	**111**	**112**	105	**107**
	3	**106**	**114**	**111**	**113**
	2	100	102	100	101
	1	77	78	77	78
Leg tension	Cantilever	25	25	25	25
	6	**107**	**112**	90	96
	5	5	5	5	5
	4	--	--	--	--
	3	--	--	--	--
	2	--	--	--	--
	1	--	--	--	--
Diagonals	Cantilever	62	62	61	61
	6	**158**	**160**	**135**	**138**
	5	**111**	**113**	**108**	**110**
	4	74	76	74	76
	3	79	80	80	81
	2	58	58	57	57
	1	53	54	53	52

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Horizontals	Cantilever	76	75	75	75
	6	**176**	**178**	**158**	**160**
	5	**127**	**129**	**122**	**125**
	4	87	89	89	90
	3	75	75	74	74
	2	78	79	77	78
	1	58	59	58	59
Guys	6	80	80	78	78
	5	91	92	89	90
	4	87	89	87	88
	3	62	63	62	63
	2	61	61	61	61
	1	52	52	52	52

The rating is defined as the percentage of the component design capacity that is used up in supporting itself and the loading from the antennas and transmission lines under the design wind and ice loading conditions. Ratings of up to 105% are considered acceptable due to tolerances in calculating the applied loads on the tower as well as component design capacities.

See discussion of the foundations in Section G.

G. CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding results, the following conclusions may be drawn:

1. The tower, supporting the equipment as specified in section C of this report, is not adequate to achieve an ultimate design wind speed of 145 mph with no ice in accordance with the 2012 IBC and ANSI/TIA 222-G with the parameters of section D for **Conditions 1 - 4**.
2. In order for the tower to achieve an ultimate design wind speed of 145 mph with no ice in accordance with the 2012 IBC and ANSI/TIA 222-G with the parameters of section D for **Condition 1**, the following modifications are required:
   a. Adjust the initial tension in all guy levels.
   b. Reinforce leg flanges at the 860', 835' and 810' flange levels.
   c. Reinforce tower legs at the following locations:

Location	No. of bays
883.8' – 833.8'	8

   d. Install additional horizontal sub-bracing at the midpoints of the following bays:

Location	No. of bays
896.3' – 883.8'	2
833.8' – 808.8'	4
496.3' – 490.0'	1
315.0' – 308.8'	1

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e. Replace existing diagonal bracing with new, higher capacity members at the following locations:

Location	No. of bays
908.8’ – 883.8’	4
796.3’ – 771.3’	4
627.5’ – 615.0’	2

f. Reinforce existing horizontal bracing with new, higher capacity members at the following locations:

Location	No. of levels
933.8’ – 896.3’	7
796.3’ – 777.5’	4
640.0’	1

g. Replace existing diagonal bracing end connection bolts with new, equal size higher capacity bolts at the following locations:

Location	No. of bays
783.8’ – 771.3’	2

3. In order for the tower to achieve an ultimate design wind speed of 145 mph with no ice in accordance with the 2012 IBC and ANSI/TIA 222-G with the parameters of section D for **Condition 2**, the modifications of **Condition 1** plus the following additional modifications are required:

   a. Install additional horizontal sub-bracing at the midpoints of the following bay:

Location	No. of bays
321.3’ – 315.0’	1

   b. Reinforce existing horizontal bracing with new, higher capacity members at the following location:

Location	No. of levels
646.3’	1

4. In order for the tower to achieve an ultimate design wind speed of 145 mph with no ice in accordance with the 2012 IBC and ANSI/TIA 222-G with the parameters of section D for **Condition 3**, the following modifications are required:

   a. Adjust the initial tension in all guy levels.

   b. Reinforce tower legs at the following locations:

Location	No. of bays
883.8’ – 833.8’	8

   c. Install additional horizontal sub-bracing at the midpoints of the following bays:

Location	No. of bays
833.8’ – 808.8’	4

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d. Replace existing diagonal bracing with new, higher capacity members at the following locations:

Location	No. of bays
908.8’ – 890.0’	3
796.3’ – 771.3’	4
627.5’ – 615.0’	2

e. Reinforce existing horizontal bracing with new, higher capacity members at the following locations:

Location	No. of levels
933.8’ – 896.3’	7
796.3’ – 777.5’	4
640.0’	1

5. In order for the tower to achieve an ultimate design wind speed of 145 mph with no ice in accordance with the 2012 IBC and ANSI/TIA 222-G with the parameters of section D for all **Condition 4**, the modifications of **Condition 3** plus the following additional modifications are required:

   a. Install additional horizontal sub-bracing at the midpoints of the following bay:

Location	No. of bays
315.0’ – 308.8’	1

6. Even though the leg flanges in Span 6.for **Conditions 3 and 4** are not overstressed, however they are almost at the limits of their capacities, so we recommend that the leg flanges at the 860’ and 835’ flange levels be reinforced as well.

7. The following chart details a comparison of the original foundation design loads, previous modification foundation loads and the current foundation loads for **Condition 2** (post recommended modifications). **Condition 2** is the most heavily loaded condition for the tower. Note that the current foundation loads are at the ultimate load level whereas the original and 306908 loads are at the service load level.

		Original design	**306908 Modification**	**Current Condition 2**
Base Foundation	Download (kips)	753.2	799.5	958.7 (120%)
	Shear (kips)	17.1	17.9	4.3 (22%)
Anchor Foundation	Uplift (kips)	293.2	307.7	367.4 (119%)
	Horizontal (kips)	290.1	306.0	335.1 (110%)

The original base and anchor foundation design was not supplied by Stainless, Inc. Stainless LLC’s report 306913 indicated that the guy anchor foundations were reinforced for the Report 306908 loads shown above. The maximum ratio of the factored to service loads is about 120%. ANSI/TIA 222-G suggests a maximum ratio of 135% when doing an initial feasibility analysis of a tower in assessing the adequacy of the foundations. Stainless is of the opinion that the foundations are adequate without remediation.

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H. PROVISIONS OF ANALYSIS

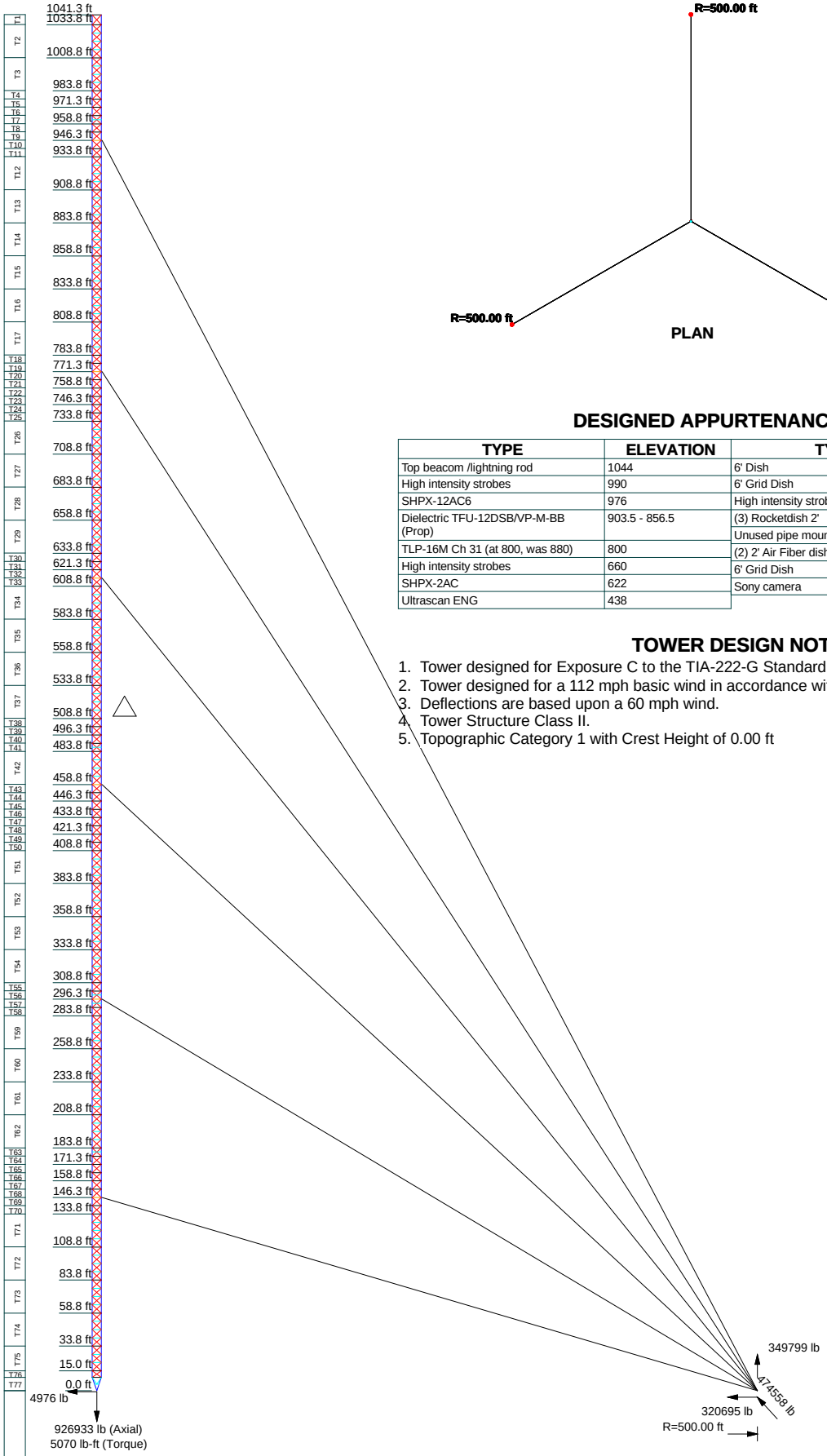
The analysis performed and the conclusions contained herein are based on the assumption that the tower has been properly installed and maintained, including, but not limited to the following:

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

Furthermore, the information and conclusions contained in this Report were determined by application of the current "state-of-the-arts" engineering and analysis procedures and formulae, and Stainless assumes no obligations to revise any of the information or conclusions contained in this Report in the event that such engineering and analysis procedures and formulae are hereafter modified or revised. In addition, under no circumstances will Stainless have any obligation or responsibility whatsoever for or on account of consequential or incidental damages sustained by any person, firm or organization as a result of any information or conclusions contained in the Report, and the maximum liability of Stainless, if any, pursuant to this Report shall be limited to the total funds actually received by Stainless for preparation of this Report.

Customer has requested Stainless to prepare and submit to Customer an engineering analysis with respect to the Subject Tower and has further requested Stainless to make appropriate recommendations regarding suggested structural modifications and changes to the Subject Tower. In making such request of Stainless, Customer has informed Stainless that Customer will make a determination as to whether or not to implement any of the changes or modifications which may be suggested by Stainless and that Customer will have any such changes or modifications made by riggers, erectors and other subcontractors of Customer's choice.

Customer hereby agrees and acknowledges that Stainless shall have no liability whatsoever to Customer or to others for any work or services performed by any persons other than Stainless in connection with the implementation of any structural changes or modifications recommended by Stainless including but not limited to any services rendered for Customer or for others by riggers, erectors or other subcontractors. Customer acknowledges and agrees that any riggers, erectors or subcontractors retained or employed by Customer shall be solely responsible to Customer and to others for the quality of work performed by them and that Stainless shall have no liability or responsibility whatsoever as a result of any negligence or breach of contract by any such rigger, erector or subcontractor.



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Top beacom /lightning rod	1044	6' Dish	406
High intensity strobes	990	6' Grid Dish	345
SHPX-12AC6	976	High intensity strobes	330
Dielectric TFU-12DSB/VP-M-BB (Prop)	903.5 - 856.5	(3) Rocketdish 2'	270
		Unused pipe mount	150
TLP-16M Ch 31 (at 800, was 880)	800	(2) 2' Air Fiber dish	150
High intensity strobes	660	6' Grid Dish	138
SHPX-2AC	622	Sony camera	103
Ultrascan ENG	438		

TOWER DESIGN NOTES

1. Tower designed for Exposure C to the TIA-222-G Standard.
2. Tower designed for a 112 mph basic wind in accordance with the TIA-222-G Standard.
3. Deflections are based upon a 60 mph wind.
4. Tower Structure Class II.
5. Topographic Category 1 with Crest Height of 0.00 ft

ALL REACTIONS ARE FACTORED

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Job:	***306918C1 New Orleans LA***		
Project:	***1049' overall height Stainless G-74 guyed towe***		
Client: WLAE-TV	Drawn by: APang	App'd:	
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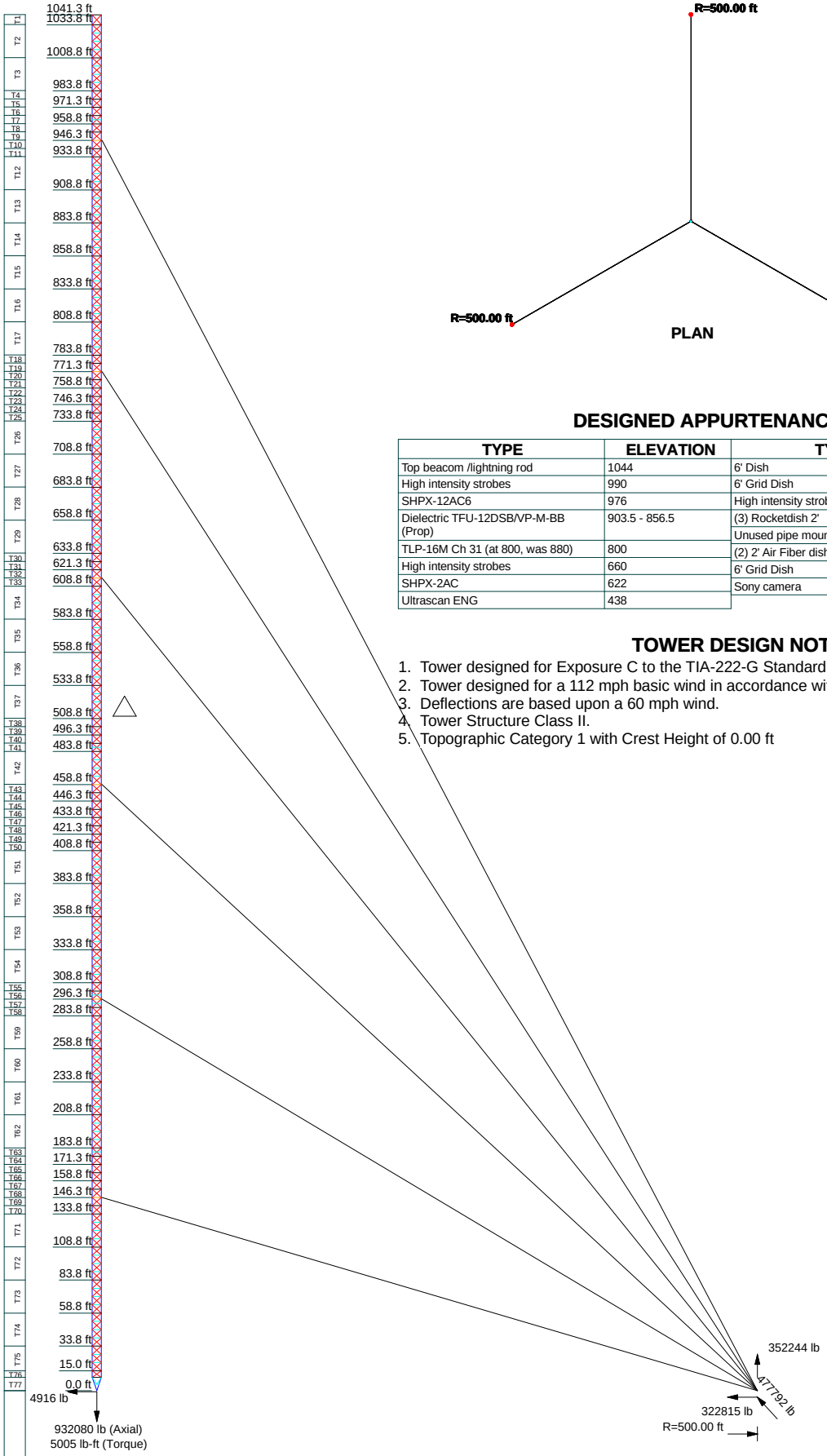

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Job: ***306918C2 New Orleans LA***			
Project: ***1049' overall height Stainless G-74 guyed towe***			
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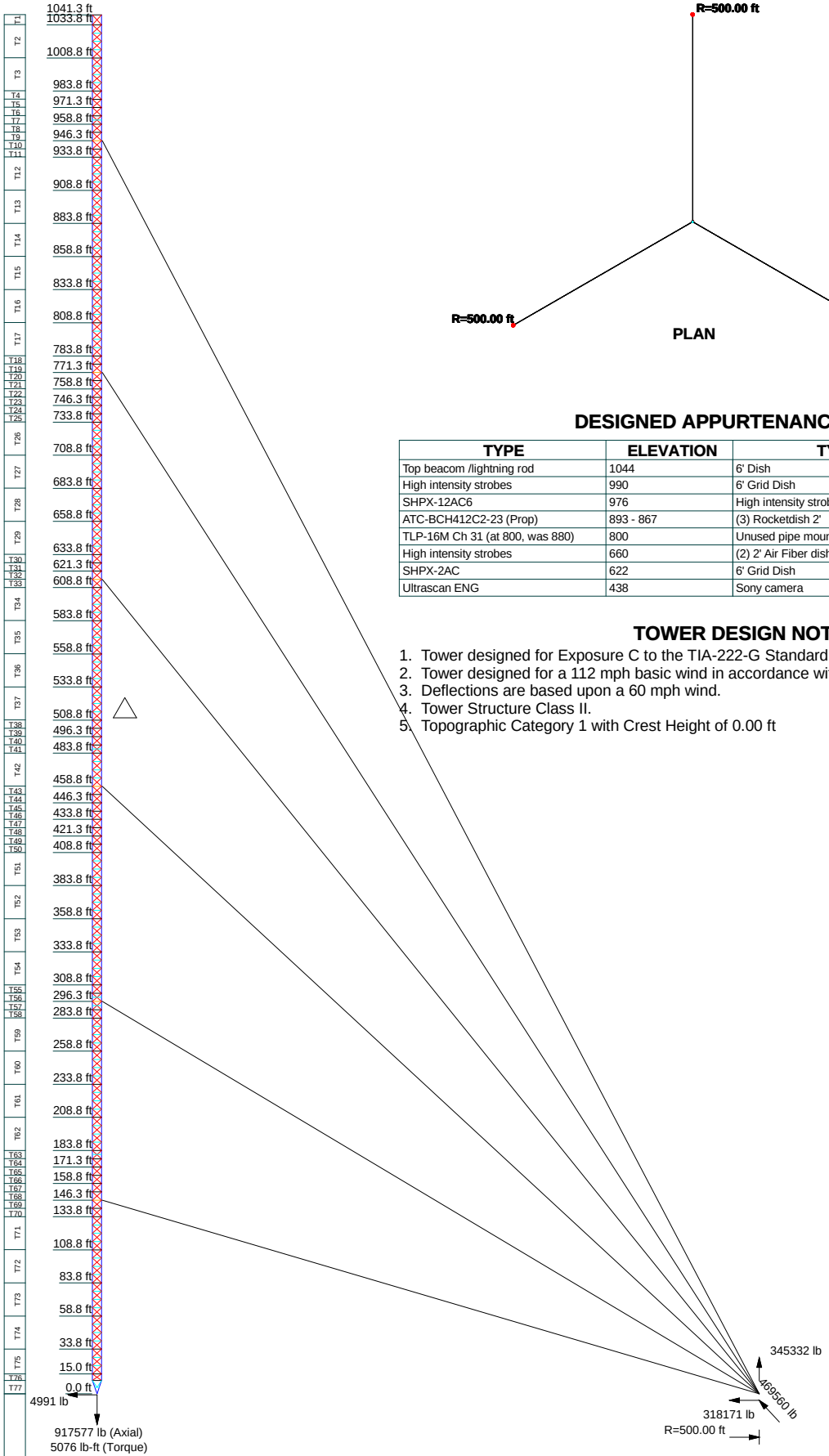

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Job:	***306918C3 New Orleans LA***		
Project:	***1049' overall height Stainless G-74 guyed towe***		
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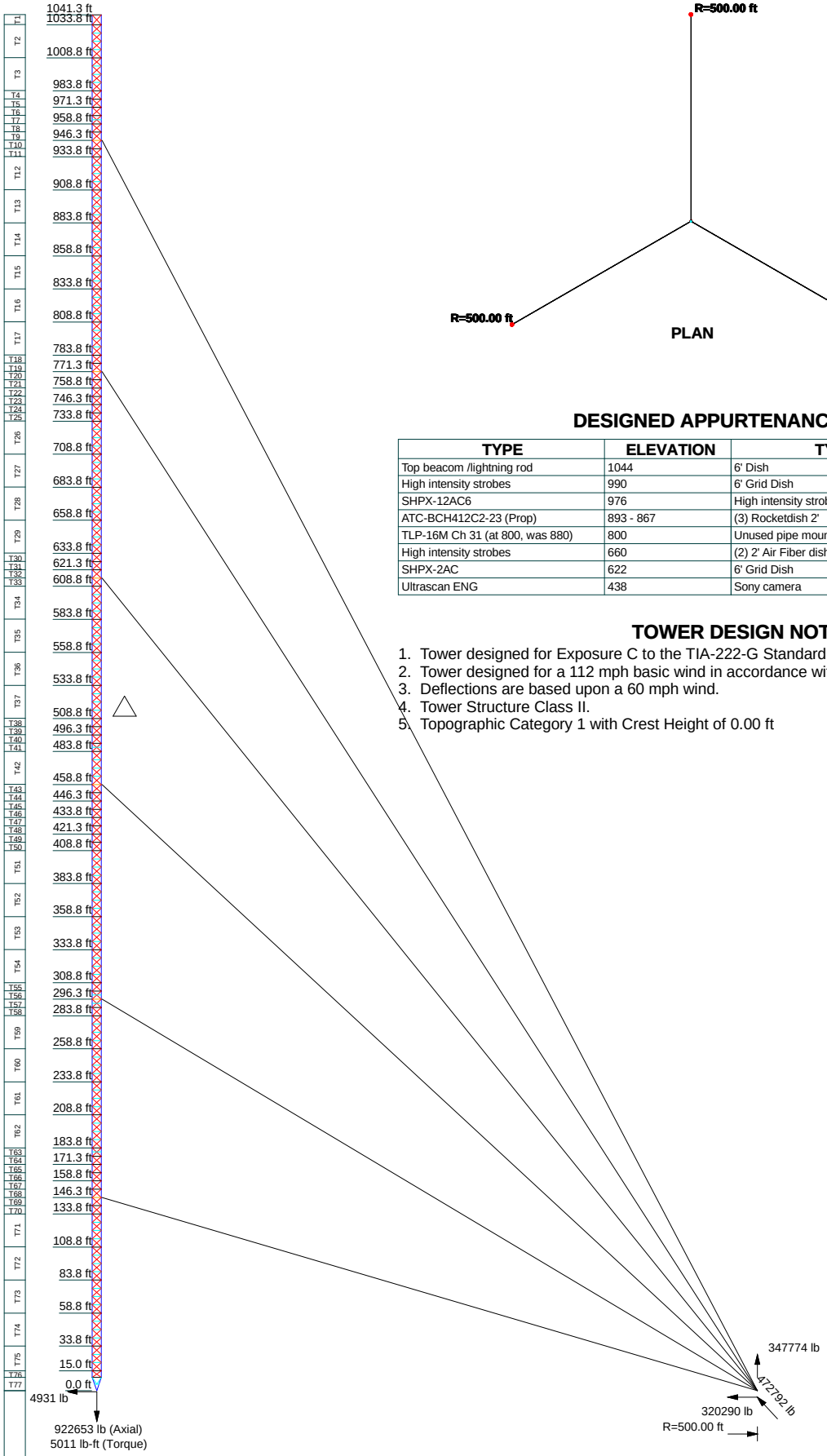

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Job: ***306918C4 New Orleans LA***			
Project: ***1049' overall height Stainless G-74 guyed towe***			
Client: WLAE-TV	Drawn by: APang	App'd:	
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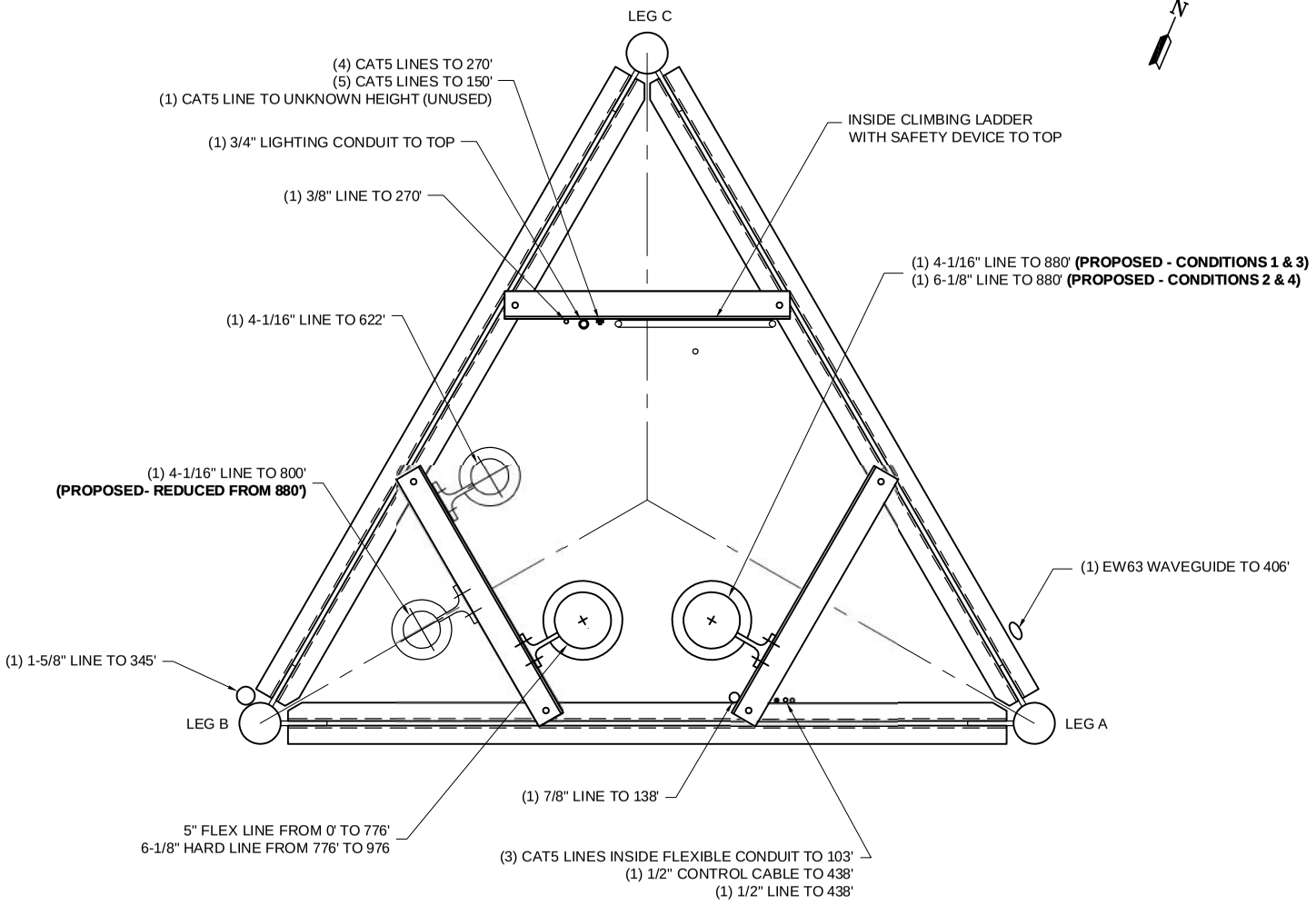

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PREPARED BY: GH 8/3/17
CHECKED BY:
ENGINEER REVIEW:
PROJECT NUMBER: 306918
DRAWING NUMBER: A-2

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LINEAR APPURTENANCES
NEW ORLEANS, LA