TOWER ANALYSIS

177" GUYED TOWER

SITE: BUENA VISTA, COLORADO

CHAFFEE COUNTY

11–12–13

COLORADO REGISTERED
LEO L. ROBERTS
31513
PROFESSIONAL ENGINEER

11-14-13

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Tower Analysis- Buena Vista, Colorado- 177' Guyed Tower
Chaffee County

Authorization:

This structural analysis was authorized by Mr. Ron Crider on 11-08-13.

Description of Tower:

The structure is a 177' guyed tower. The tower manufacturer is Rohn Tower of Peoria, Illinois. The date of installation is not known.

The tower is welded construction and has a face width of 16 3/4" center to center of leg members.

The design is triangular lattice type with single laced diagonal bracing, 7 bays per 10ft. section.

The tower has a fixed base.

There are six guy wire elevations with no torque stabilizers.

The tower has a single anchor system at 108' average radius at 120 degree intervals.

Materials of Fabrication:

Leg Members:

Elevation	Size	Material
0' – 177'	1 1/4" O.D. x 14 ga.	50 KSI

Diagonal Members:

Elevation	Size	Material
0' – 177'	S.R. 7/16"	42 KSI

Horizontal Members:

Elevation	Size	Material
0' – 177'	S.R. 7/16"	42 KS

Materials of Fabrication-continued:

Existing Guy Wire System:

Elevation	Size & Type	Ultimate Strength
30'	1/4" EHS	6.65 k
60'	1/4" EHS	6.65 k
90'	1/4" EHS	6.65 k
120'	1/4" EHS	6.65 k
150'	1/4" EHS	6.65 k
170'	1/4" EHS	6.65 k

Method of Analysis:

The tower was analyzed using "Risa Tower" computer program for lattice type guyed structures. This program is well recognized for its accuracy.

The tower was examined for conformance with ANSI/TIA-222-G for a basic wind of 90 MPH.

The wind is applied to structure and tower appurtenances in accordance to TIA standards.

Existing Loading:

Load	Qty	Elev.	Waveguide	Mount
Dragonwave 6' HP Dish	1	50'	3/8"(2)	Std
Dragonwave 2' HP Dish	1	50'	3/8"(2)	Std

Results of Analysis:

Guy Wires:

Elevation	% Capacity
30'	35.5
60'	43.0
90'	33.3
120'	38.0
150'	41.2
170'	40.9

Leg Members:

Elevation	% Capacity
0' – 177'	88.0

Diagonal Members:

Elevation	% Capacity
0' – 177'	96.4

Horizontal Members:

Elevation	% Capacity
0' – 177'	18.4

Summary and Recommendations:

The guy wires are satisfactory.

The leg members are satisfactory.

The bracing members are satisfactory.

The tower deflection is 1.00 degrees at 50' elevation.

Tower Reactions:

Base-	Down-	13.1 kips
	Horiz.-	.16 kips
Anchor-	Uplift-	5.7 kips
	Horiz.-	6.8 kips
	Result.-	8.9 kips

Conclusion:

The foundations were not analyzed due to lack of installation drawings.

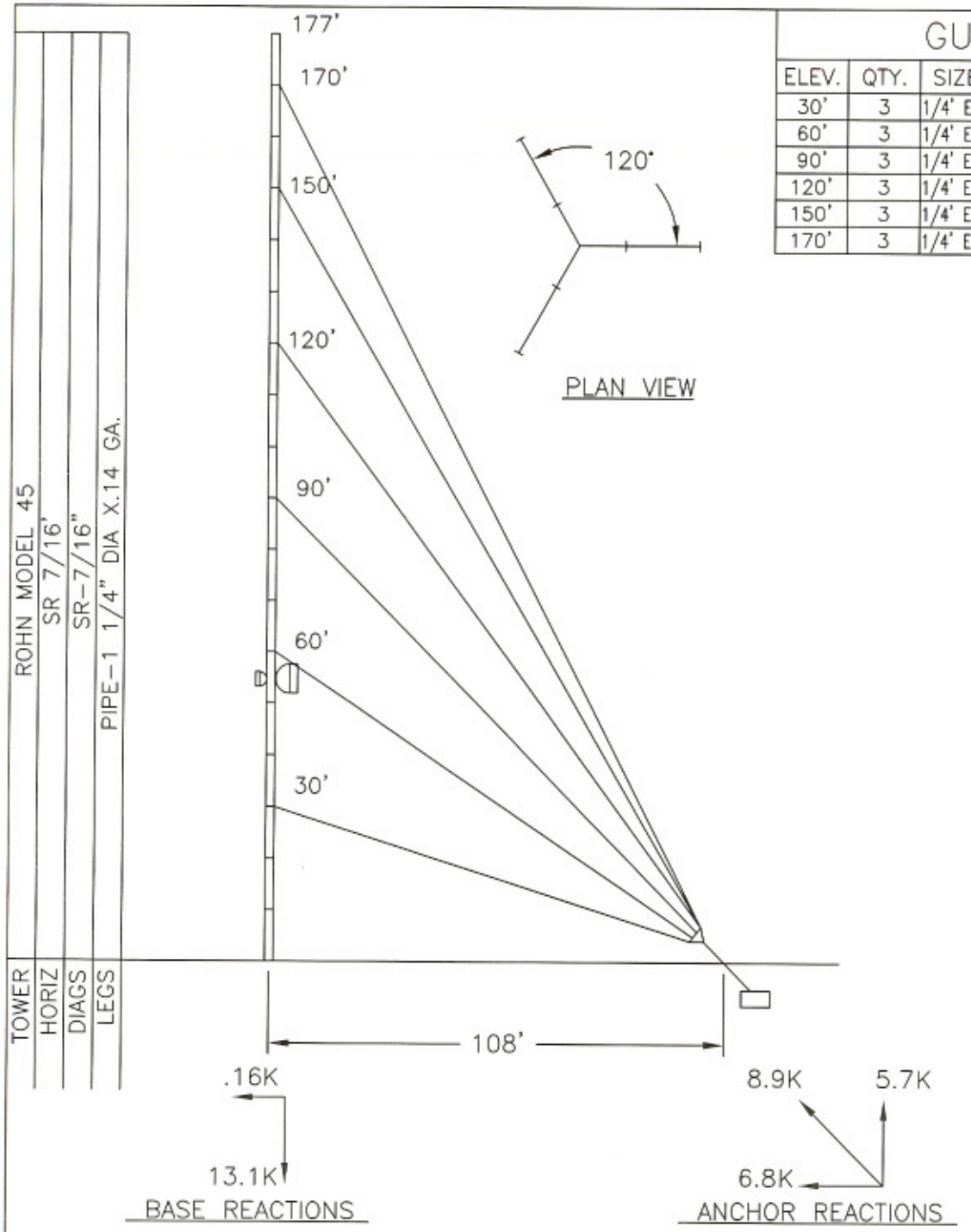
The anchor shafts- 5/8" diameter are satisfactory.

Assumptions made for this analysis include the following:

1. The fasteners will meet the strength of the relative members.
2. The tower guy wires have an initial tension of 10% of their breaking strength.
3. All leg steel is 50 ksi and bracing is 42 ksi.
4. The guy wires are standard EHS type.
5. The tower has no damage that would reduce the capacity of the members.
6. The site is relatively level.
7. The anchor shafts are 50 ksi. steel.
8. The tower is a standard Rohn-Model 45 per drawing C-630645.

The general condition of the tower must be considered anytime additional loading is considered.
Rust, corrosion, damage, etc. could cause problems.

The tower information to perform this analysis was provided by Mr. Ron Crider who furnished the tower loading and information for the tower members and geometry.



GUYWIRES

ELEV.	QTY.	SIZE	CORD LENGTH	CUT LENGTH	INITIAL TENSION
30'	3	1/4" EHS			.665
60'	3	1/4" EHS			.665
90'	3	1/4" EHS			.665
120'	3	1/4" EHS			.665
150'	3	1/4" EHS			.665
170'	3	1/4" EHS			.665

ANTENNAS

TYPE ANTENNA	QTY.	ELEV.	LINE
DRAGONWAVE 6' HP DISH	1	50'	3/8" (2)
DRAGONWAVE 2' HP DISH	1	50'	3/8" (2)

GENERAL NOTES:

1. TOWER IS LOCATED IN CHAFFEE COUNTY, COLORADO.
2. TOWER IS ANALYZED FOR 90 MPH TO THE TIA-222-G STANDARD.
3. DEFLECTIONS ARE BASED ON A 60 MPH WIND.

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BUENA VISTA, COLORADO
CHAFFEE COUNTY

DRAWN BY	DATE	JOB#
TK	11-12-13	

NO	DATE	REVISION	BY

DRAWING NO. BCO1113M

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	177 - 170	Leg	P1.25X.0785	3	-1221.48	11905.90	10.3	Pass
		Diagonal	7/16	18	-63.96	1984.14	3.2	Pass
		Horizontal	7/16	19	-44.35	3104.44	1.4	Pass
		Top Girt	7/16	5	-6.36	3293.78	0.2	Pass
		Bottom Girt	7/16	7	499.68	6764.86	7.4	Pass
		Guy A@170.5	1/4	855	1631.46	3990.00	40.9	Pass
		Guy B@170.5	1/4	854	1358.82	3990.00	34.1	Pass
		Guy C@170.5	1/4	853	1552.77	3990.00	38.9	Pass
T2	170 - 160	Leg	P1.25X.0785	39	-1592.05	11135.60	14.3	Pass
		Diagonal	7/16	84	-218.42	1866.78	11.7	Pass
		Horizontal	7/16	81	124.87	5682.48	2.2	Pass
		Top Girt	7/16	41	94.46	6764.86	1.4	Pass
		Bottom Girt	7/16	44	39.45	6764.86	0.6	Pass
T3	160 - 150	Leg	P1.25X.0785	87	-2251.82	10924.00	20.6	Pass
		Diagonal	7/16	95	-180.26	1866.78	9.7	Pass
		Horizontal	7/16	103	-85.26	3104.44	2.7	Pass
		Top Girt	7/16	89	58.35	6764.86	0.9	Pass
		Bottom Girt	7/16	91	558.10	6764.86	8.3	Pass
		Guy A@150.5	1/4	858	1645.36	3990.00	41.2	Pass
		Guy B@150.5	1/4	857	1322.70	3990.00	33.2	Pass
		Guy C@150.5	1/4	856	1554.47	3990.00	39.0	Pass
T4	150 - 140	Leg	P1.25X.0785	135	-2946.94	11097.00	26.6	Pass
		Diagonal	7/16	180	-358.07	1866.78	19.2	Pass
		Horizontal	7/16	177	207.63	5682.48	3.7	Pass
		Top Girt	7/16	137	139.36	6764.86	2.1	Pass
		Bottom Girt	7/16	141	76.74	6764.86	1.1	Pass
T5	140 - 130	Leg	P1.25X.0785	183	-2947.52	11096.90	26.6	Pass
		Diagonal	7/16	191	-336.15	1866.78	18.0	Pass
		Horizontal	7/16	194	197.58	5682.48	3.5	Pass
		Top Girt	7/16	185	70.45	6764.86	1.0	Pass
		Bottom Girt	7/16	189	137.12	6764.86	2.0	Pass
T6	130 - 120	Leg	P1.25X.0785	231	-3414.17	10941.30	31.2	Pass
		Diagonal	7/16	275	-360.53	1866.78	19.3	Pass
		Horizontal	7/16	247	-154.93	3104.44	5.0	Pass
		Top Girt	7/16	233	155.81	6764.86	2.3	Pass
		Bottom Girt	7/16	235	587.79	6764.86	8.7	Pass
		Guy A@120.5	1/4	861	1516.67	3990.00	38.0	Pass
		Guy B@120.5	1/4	860	1199.59	3990.00	30.1	Pass
		Guy C@120.5	1/4	859	1434.33	3990.00	35.9	Pass
T7	120 - 110	Leg	P1.25X.0785	279	-3414.75	10941.20	31.2	Pass
		Diagonal	7/16	324	-410.49	1866.78	22.0	Pass
		Horizontal	7/16	321	237.87	5682.48	4.2	Pass
		Top Girt	7/16	281	149.77	6764.86	2.2	Pass
		Bottom Girt	7/16	285	101.20	6764.86	1.5	Pass
T8	110 - 100	Leg	P1.25X.0785	327	-3642.94	10970.20	33.2	Pass
		Diagonal	7/16	335	-413.11	1866.78	22.1	Pass
		Horizontal	7/16	338	242.54	5682.48	4.3	Pass
		Top Girt	7/16	329	106.40	6764.86	1.6	Pass
		Bottom Girt	7/16	333	160.68	6764.86	2.4	Pass
T9	100 - 90	Leg	P1.25X.0785	375	-5317.18	11074.80	48.0	Pass
		Diagonal	7/16	419	-433.77	1866.78	23.2	Pass
		Horizontal	7/16	391	-152.41	3104.44	4.9	Pass
		Top Girt	7/16	377	179.85	6764.86	2.7	Pass
		Bottom Girt	7/16	379	626.15	6764.86	9.3	Pass
		Guy A@90.5	1/4	864	1329.71	3990.00	33.3	Pass
		Guy B@90.5	1/4	863	1041.36	3990.00	26.1	Pass
		Guy C@90.5	1/4	862	1236.78	3990.00	31.0	Pass
T10	90 - 80	Leg	P1.25X.0785	423	-5317.76	11074.80	48.0	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
		Diagonal	7/16	468	-555.20	1866.78	29.7	Pass
		Horizontal	7/16	465	325.05	5682.48	5.7	Pass
		Top Girt	7/16	426	-123.38	3293.78	3.7	Pass
		Bottom Girt	7/16	429	171.34	6764.86	2.5	Pass
T11	80 - 70	Leg	P1.25X.0785	471	-4158.22	10895.70	38.2	Pass
		Diagonal	7/16	516	-422.02	1866.78	22.6	Pass
		Horizontal	7/16	513	242.98	5682.48	4.3	Pass
		Top Girt	7/16	474	-75.00	3293.78	2.3	Pass
		Bottom Girt	7/16	476	139.03	6764.86	2.1	Pass
T12	70 - 60	Leg	P1.25X.0785	518	-4538.77	10834.40	41.9	Pass
		Diagonal	7/16	528	-642.85	1866.78	34.4	Pass
		Horizontal	7/16	529	305.28	5682.48	5.4	Pass
		Top Girt	7/16	521	155.70	6764.86	2.3	Pass
		Bottom Girt	7/16	525	917.76	6764.86	13.6	Pass
		Guy A@60.5	1/4	867	1716.39	3990.00	43.0	Pass
		Guy B@60.5	1/4	866	1103.50	3990.00	27.7	Pass
		Guy C@60.5	1/4	865	1375.03	3990.00	34.5	Pass
T13	60 - 50	Leg	P1.25X.0785	567	-9702.21	11314.00	85.8	Pass
		Diagonal	7/16	612	-1485.37	1866.78	79.6	Pass
		Horizontal	7/16	609	892.20	5682.48	15.7	Pass
		Top Girt	7/16	570	-435.99	3293.78	13.2	Pass
		Bottom Girt	7/16	573	497.85	6764.86	7.4	Pass
T14	50 - 40	Leg	P1.25X.0785	615	-9940.11	11293.50	88.0	Pass
		Diagonal	7/16	624	-1781.54	1866.78	95.4	Pass
		Horizontal	7/16	627	1045.16	5682.48	18.4	Pass
		Top Girt	7/16	618	492.95	6764.86	7.3	Pass
		Bottom Girt	7/16	620	664.24	6764.86	9.8	Pass
T15	40 - 30	Leg	P1.25X.0785	663	-6600.79	11077.50	59.6	Pass
		Diagonal	7/16	708	-1800.43	1866.78	96.4	Pass
		Horizontal	7/16	705	1016.83	5682.48	17.9	Pass
		Top Girt	7/16	666	740.03	6764.86	10.9	Pass
		Bottom Girt	7/16	669	235.76	6764.86	3.5	Pass
		Guy A@30.5	1/4	873	1415.36	3990.00	35.5	Pass
		Guy B@30.5	1/4	872	997.37	3990.00	25.0	Pass
		Guy C@30.5	1/4	868	1171.67	3990.00	29.4	Pass
		Top Guy Pull-Off@30.5	L1 3/4x1 3/4x3/16	871	974.03	22708.70	4.3	Pass
T16	30 - 20	Leg	P1.25X.0785	711	-5972.13	10967.20	54.5	Pass
		Diagonal	7/16	754	-1509.39	1866.78	80.9	Pass
		Horizontal	7/16	751	867.27	5682.48	15.3	Pass
		Top Girt	7/16	712	559.81	6764.86	8.3	Pass
		Bottom Girt	7/16	715	501.04	6764.86	7.4	Pass
T17	20 - 10	Leg	P1.25X.0785	759	-5228.99	10854.60	48.2	Pass
		Diagonal	7/16	767	-1399.06	1866.78	74.9	Pass
		Horizontal	7/16	771	815.52	5682.48	14.4	Pass
		Top Girt	7/16	760	501.83	6764.86	7.4	Pass
		Bottom Girt	7/16	764	533.55	6764.86	7.9	Pass
T18	10 - 0	Leg	P1.25X.0785	807	-6129.93	10973.70	55.9	Pass
		Diagonal	7/16	815	-1485.14	1866.78	79.6	Pass
		Horizontal	7/16	819	863.97	5682.48	15.2	Pass
		Top Girt	7/16	810	535.64	6764.86	7.9	Pass
		Bottom Girt	7/16	812	585.73	6764.86	8.7	Pass
							Summary	
						Leg (T14)	88.0	Pass
						Diagonal (T15)	96.4	Pass
						Horizontal (T14)	18.4	Pass
						Top Girt (T13)	13.2	Pass
						Bottom Girt	13.6	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
						(T12)		
						Guy A (T12)	43.0	Pass
						Guy B (T1)	34.1	Pass
						Guy C (T3)	39.0	Pass
						Top Guy Pull-Off (T15)	4.3	Pass
						Bolt Checks	3.6	Pass
						RATING =	**96.4**	**Pass**