

So, you want to put up a tower?

Some realistic expectations:

My Experience.

Metal Bill K1ZCR

Things you need to know and research first!

- City, County ordinances, CC&R's, HOA, etc.
- Permitting and construction/ inspection process.
- How much antenna you want vs. how much you actually can put up due to tower limitations.
- Antenna propagation characteristics- How high one needs to be from the ground for adequate “Take-off” angle (Radiation).
- How much money do you have?
- A professionally constructed and installed tower could be \$25,000! (Or more!)

Where do you get a tower?

Buy one new-The best option

Buy one used- Inspect, Inspect, Inspect!

Score one free! (YOU may have to take it down)

How much antenna can you put up?

This information determines how much tower you need and what your tower limitations are.

Antenna wind loading is more important than antenna weight. It side-loads the tower and produces overturning moments as well as shear loads. It's like a huge lever that wants to be lying on the ground!

Antennas are measured in SQUARE FEET OF AREA for wind loading calculations.



HF Antenna Wind Load Reference Chart

DXE Part Number (clickable hyperlinks)	Manufacturer	Model	Wind Load (sq. ft)	Description
BNR-3X10	Benchner	3X10 Skyhawk	8.5	Tri-Band Yagi
BUT-HF5B	Butternut	HF5B Butterfly	3.0	5-Band Butterfly Beam
CMA-CHV-5X	Comet	CHV-5X	no spec	5-Band Rotatable Dipole
CMA-H-422	Comet	M-422	3.01	4-Band Trap Rotatable Dipole
CSH-A3S	Cushcraft	A3S World Ranger	4.36	Tri-Band Yagi
CSH-A3WS	Cushcraft	A3WS WARC World Ranger	4.1	2-Band WARC Yagi
CSH-A4S	Cushcraft	A4S	5.5	Tri-Band Yagi
CSH-ASL2010	Cushcraft	ASL2010 Skylog	10.1	5-Band LPDA SkyLog
CSH-D3	Cushcraft	D3 World Ranger	0.90	Rotatable Tri-Band Dipole
CSH-D3W	Cushcraft	D3W World Ranger	0.90	Rotatable Tri-Band WARC Dipole
CSH-D4	Cushcraft	D4 World Ranger	1.3	4-Band Rotatable Dipole
CSH-D40	Cushcraft	D40 World Ranger	1.3	40 M Rotatable Dipole
CSH-MA5B	Cushcraft	MA5B The Director	3.22	5-Band Yagi
CSH-TEN3	Cushcraft	TEN3	2.24	10 M Yagi
CSH-X7	Cushcraft	X7 Big Thunder	7.9	3-Band Yagi
CSH-XM240	Cushcraft	XM240 Big Thunder	5.5	40 M Yagi
DXE-HEXX-STAP-2	DX Engineering	Hexx-STAP-2	5.05	5-Band Hexx Beam
HGN-TH-3MK4	Hy-Gain	TH-3MK4 Thunderbird 3	4.6	Tri-Band Yagi
HGN-TH-5MK2	Hy-Gain	TH-5MK2 Thunderbird 5	7.4	Tri-Band Yagi
HGN-EXP-14	Hy-Gain	EXP-14	7.5	Tri-Band Yagi
HGN-LJ-103BA	Hy-Gain	LJ-103BA Long John	2.0	10 M Yagi
HGN-LJ-113	Hy-Gain	LJ-113 Long John	no spec	10/12 M Mono Band Yagi
HGN-LJ-153BA	Hy-Gain	LJ-153BA Long John	3.0	15M Yagi
HGN-LJ-203BA	Hy-Gain	LJ-203BA Long John	5.38	20 M Yagi
HGN-LJ-204BA	Hy-Gain	LJ-204BA Long John	7.27	20 M Yagi
HGN-TH11-DX	Hy-Gain	TH-11-DX Super Thunderbird	12.5	5-Band Yagi
HGN-TH3JRS	Hy-Gain	TH-3JRS Thunderbird Jr	3.35	Tri-Band Yagi
HGN-TH-7DX	Hy-Gain	TH-7DX Thunderbird Seven	9.4	Tri-Band Yagi
MFJ-1789	MFJ	MFJ-1789	1.0	4-Band Rotatable Dipole
MFJ-1775	MFJ	MFJ-1775	2.0	6-Band Rotatable Dipole
MFJ-1785	MFJ	MFJ-1775W	no spec	3-Band Rotatable Dipole
MSQ-10-15M1DX	M2 Antennae	10-15M1DX	1.1	10-15 M Rotatable Dipole
MSQ-1030LP8	M2 Antennae	1030LP8	12.5	10-30 MHz Log Periodic
MSQ-10M4DX	M2 Antennae	10M4DX	4.4	10 M Yagi
MSQ-12M4DX	M2 Antennae	12M4DX	4.9	12 M Yagi
MSQ-15M4DX	M2 Antennae	15M4DX	3.5	15 M Yagi
MSQ-17M3DX	M2 Antennae	17M3DX	4.0	17 M Yagi
MSQ-20M4DX	M2 Antennae	20M4DX	6.9	20 M Yagi
MSQ-20MSLD	M2 Antennae	20MSLD	10.0	20 M Yagi
MSQ-40M1L	M2 Antennae	40M1L	3.0	40 M Rotatable Dipole
MSQ-40M2L	M2 Antennae	40M2L	6.6	40 M Yagi
MSQ-71030LP8	M2 Antennae	71030LP8	13.0	10-30 MHz Log Periodic +40 M Dipole
MSQ-KT34M2	M2 Antennae	KT34M2	4.5	Tri-Band Yagi
MSQ-KT36XA	M2 Antennae	KT36XA	9.75	Tri-Band Yagi
TEL-143042-135	Telrex	143042-135	22.0	14-30 MHz Log Periodic
TXA-3B-8L-WRTC	2X Arrays	TX38	6.7	Tri-Band Yagi

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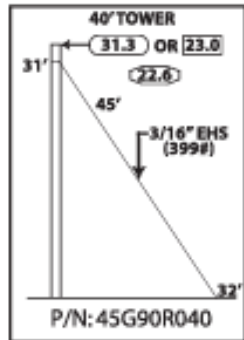
For a non-telescopic tower, there are 3
main types of installation
Free-standing, Wall bracketed, Guyed

Originally, I was going to go free-standing but ultimately decided to
guy my tower.

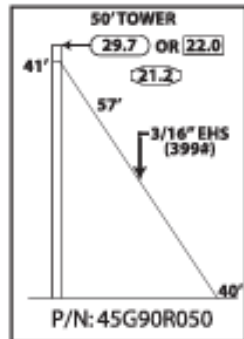
I could put more equipment on it this way.

STANDARD DESIGN - 45G

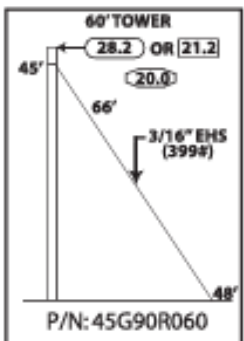
90MPH REV. G, 70MPH REV. F



TOWER PARTS INCLUDED	45G	45AG2	BPC45G	GA45GD	FDNS	
	3	1	1	1	BASE CB1G	ANCHOR AB2
GUYS & CONNECTIONS INCLUDED	3/16EHS	BG2142	5/16THH	1/2TBE&J	TBSAFETY	
	150'	6	6	3	3	
ANCHORS & GROUNDING INCLUDED	GAC3455TOP	AGK1GGX	BGK3GGX	CPC.5/.75	3/4x12PP	
	3	1	3	3	1	



TOWER PARTS INCLUDED	45G	45AG2	BPC45G	GA45GD	FDNS	
	4	1	1	1	BASE CB1G	ANCHOR AB2
GUYS & CONNECTIONS INCLUDED	3/16EHS	BG2142	5/16THH	1/2TBE&J	TBSAFETY	
	200'	6	6	3	3	
ANCHORS & GROUNDING INCLUDED	GAC3455TOP	AGK1GGX	BGK3GGX	CPC.5/.75	3/4x12PP	
	3	1	3	3	1	



TOWER PARTS INCLUDED	45G	45AG2	BPC45G	GA45GD	FDNS	
	5	1	1	1	BASE CB1G	ANCHOR AB2
GUYS & CONNECTIONS INCLUDED	3/16EHS	BG2142	5/16THH	1/2TBE&J	TBSAFETY	
	225'	6	6	3	3	
ANCHORS & GROUNDING INCLUDED	GAC3455TOP	AGK1GGX	BGK3GGX	CPC.5/.75	3/4x12PP	
	3	1	3	3	1	

From the Rohn Catalog

40' ROHN 45G

All parts shown in table are included when ordered.
Part No: 45G90R040

- This chart shows wind loading capacity for a Guyed tower.

- Rohn provides all necessary specifications. Always refer to the manufacturer and follow their guidance. Any deviation requires an engineer.

- In this example a 50 foot guyed tower in my wind zone, I'm allowed 22 square feet of wind loading surface area for anything I attach to the tower.

- Antennas, Mast, Rotator, etc.

50' ROHN 45G

All parts shown in table are included when ordered.
Part No: 45G90R050

60' ROHN 45G

All parts shown in table are included when ordered.
Part No: 45G90R060

My Option:

I located one and took it down myself (With Help)

Thanks to Silent Key W0VPH

Also scored free antennas!

And other equipment!

Here it is, Been up since 1977



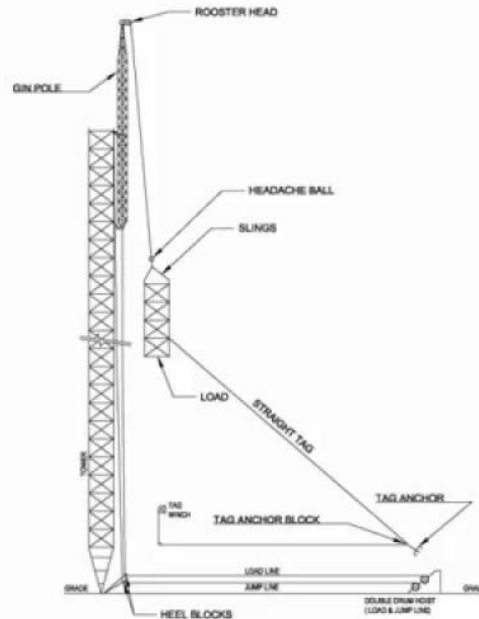
When climbing a tower, always use a fall arrest harness! I also use a positioning lanyard.



A Gin pole is used to raise and lower tower sections. A winch at the base provides lift.

Gin Poles

Many types and sizes



Gin Pole – lifting device that consists of a latticed or tubular boom or mast that allows headroom above the highest fixed point of a structure



Base Mounted Hoist

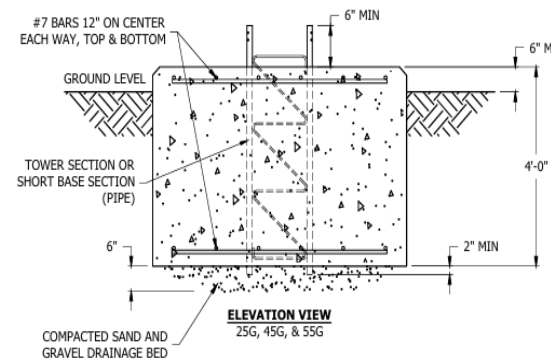
Time for a foundation!

In my case I needed a foundation 5'3" square, and 4 feet deep. I built the foundation in anticipation of a free standing tower, which is more substantial. I did wind up guying the tower.

Note the foundation has drainage! Water that gets into the tubes has a way out.

This foundation is over 4 yards of concrete and 100 feet of 7/8" rebar.

A "Bury Section" of tower is cast into the concrete, made especially for this by Rohn.



FOUNDATION DETAILS				
TOWER NUMBER	OVER-TURNING MOMENT (FT-LBS)	TOTAL SHEAR (LBS)	MAT WIDTH "W"	CONCRETE VOLUME (CU. YDS.)
25G	7000	510	4'-0"	2.4
45G	12300	1000	5'-3"	4.1
55G	22100	1600	6'-0"	5.3
65G/45GSR	53100	3500	7'-9"	8.9

GENERAL NOTES:

1. FOR 25G, 45G, 55G, 65G, AND 45GSR TOWER ASSEMBLY DRAWINGS AND MAXIMUM TOWER HEIGHTS, REFER TO DRAWING NUMBER 25GSS, 45GSS, 55GSS, 65GSS, AND 45GSR RESPECTIVELY.

Dig! Dig! Dig! About 12,000 pounds of dirt came out of that hole. All hand-dug!



Here come the OSHA inspectors!



Forming the foundation and the 7/8" rebar mats all tied and in place.



Finishing concrete

Radio operator turned Concrete finisher!



K1ZCR

Cast my call sign into the concrete foundation!

Cut out metal letters and screwed to the inside of the form board.

GROUNDING!

All 3 legs are connected with 8 gauge wire to 8 foot long ground rods, driven 6 inches below the ground surface.

The tower in the concrete, tied to the rebar, also acts as a “Ufer” ground.

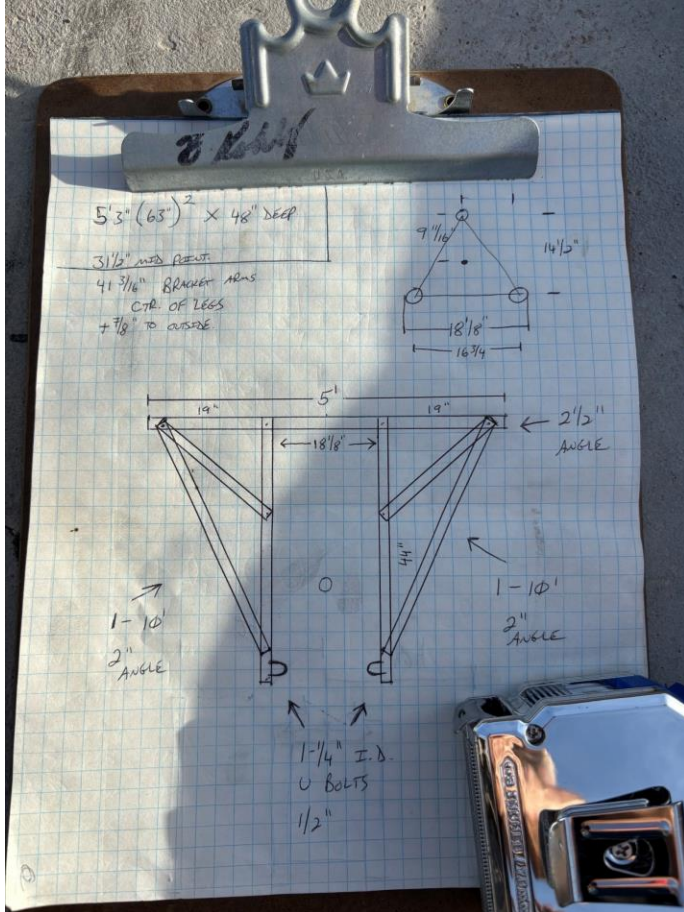


Procurement of necessary parts

Rotator and Guy bracket



I ripped off Rohn and made some of my own brackets.



While we're here, I made this mount for the Southern Hills Repeater antenna!



Finally... Going Vertical!



Stacking sections! Each one is 10 feet.

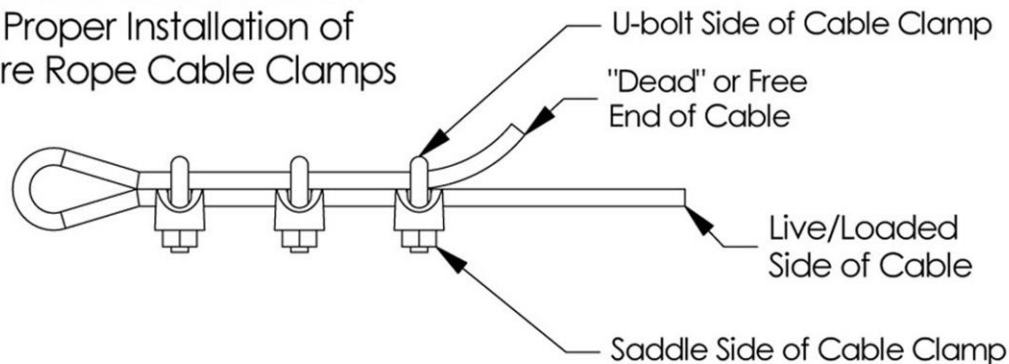


My Guy points in the front yard. Doubled up as lamp posts with address and call sign!



Cable Clamps: Never Saddle a Dead Horse!

CABLE CLAMP DETAIL:
Proper Installation of
Wire Rope Cable Clamps



- How many people know that there is a correct way to install cable clamps?
- And a proper torque!
- Clamps installed wrong can weaken and damage the critical guy cable!
- Clamp spacing is also specified.

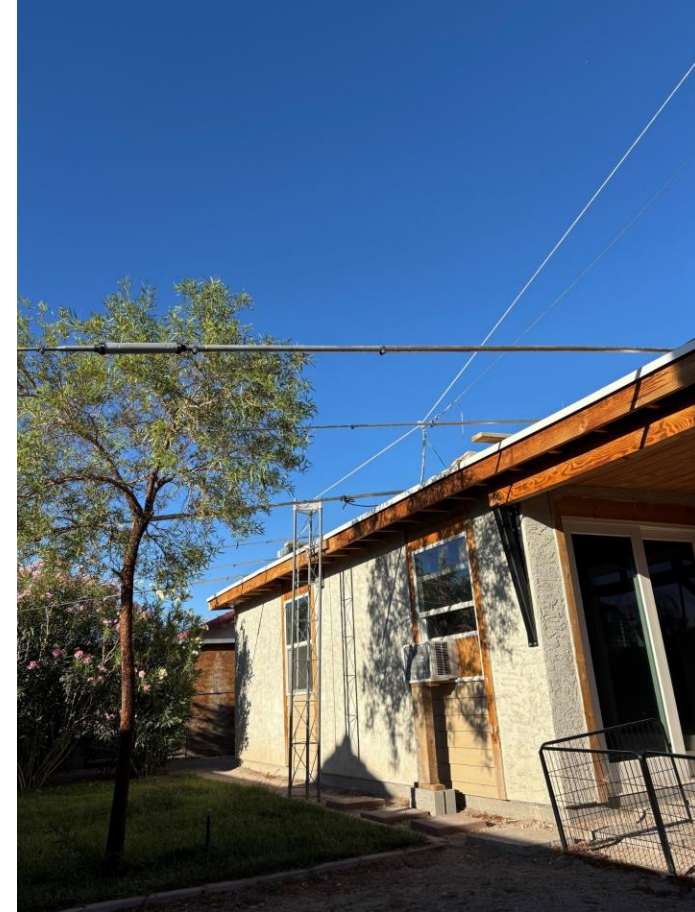
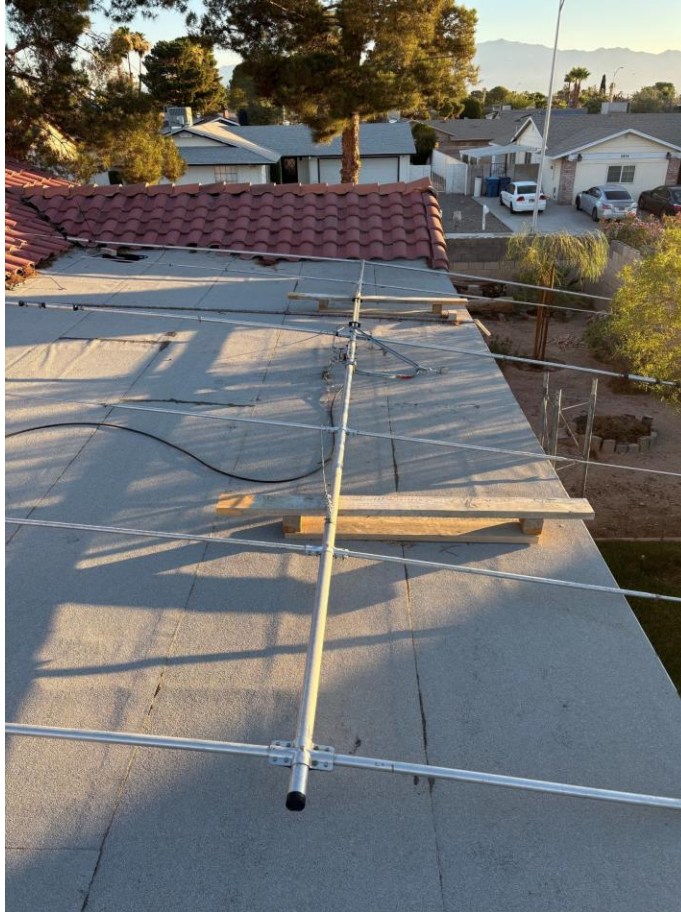
The tower itself is Up!



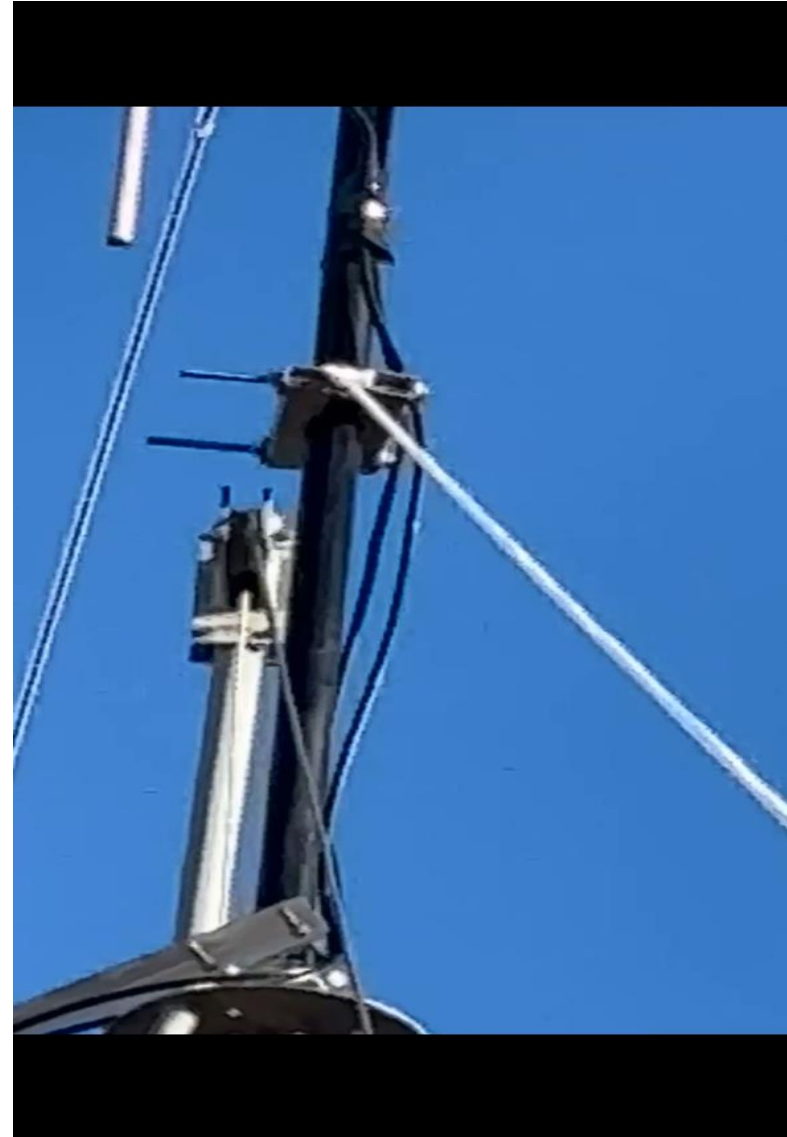
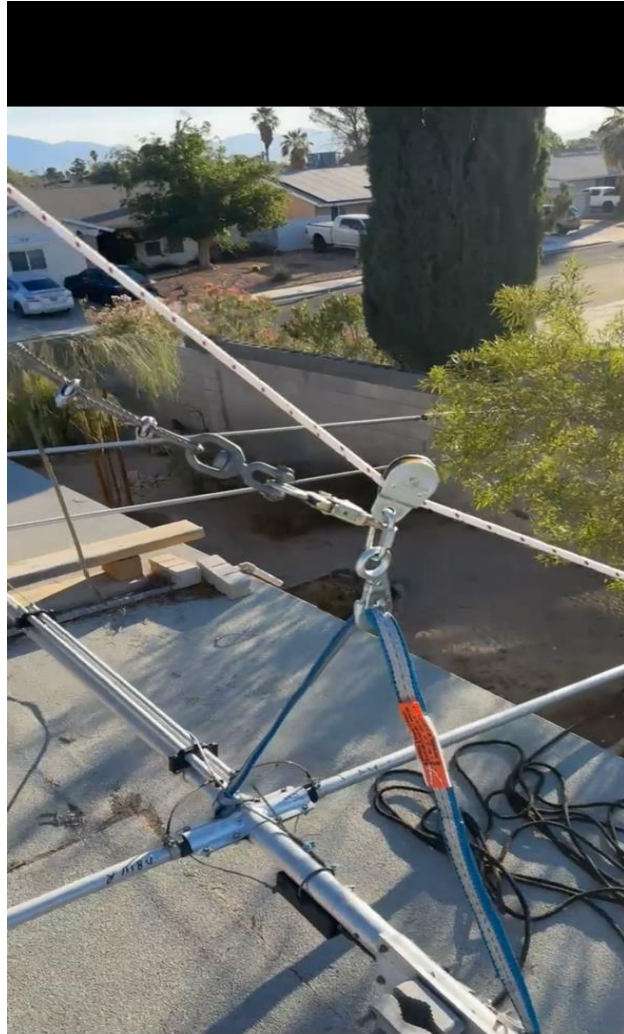
Started with Rotator, Mast, Ground plane, 2M/440 beam, and coax jumpers.



Then, time to rebuild and assemble the Tri-Bander Hy-Gain Thunderbird TH6-DXX



A tram line guides the antenna to the top.





Just got her
mounted!

There it is, in all it's glory!



Don't forget about Coax! And GOOD Coax too!

It's 100 feet down the tower to my Studio. Currently there are 3 antennas, with more to come. Right now, I have 300 feet of coax, 200 of which is Hard Line Heliax. (Super low loss). I ran separate jumpers for the lengths up to the mast due to the Rotator- It needs slack to rotate 450 degrees.

Each coax shield is grounded to the tower for lightning protection.

Heliax Hard Line has grounding kits specifically for this purpose.

There are also "PolyPhaser" inline arrestors available.

Let's talk cost

This is what it cost me for a free tower and free antennas:

Remember, I did all the labor myself, except with the help of a friend,
to move concrete into the hole, and push a button to raise tower
sections and antenna

Tower Costs Breakdown and totals:

Foundation- Concrete, rebar, forms,
etc.....1146.02

Actual tower installation- Brackets, Guy
anchors.....178.05

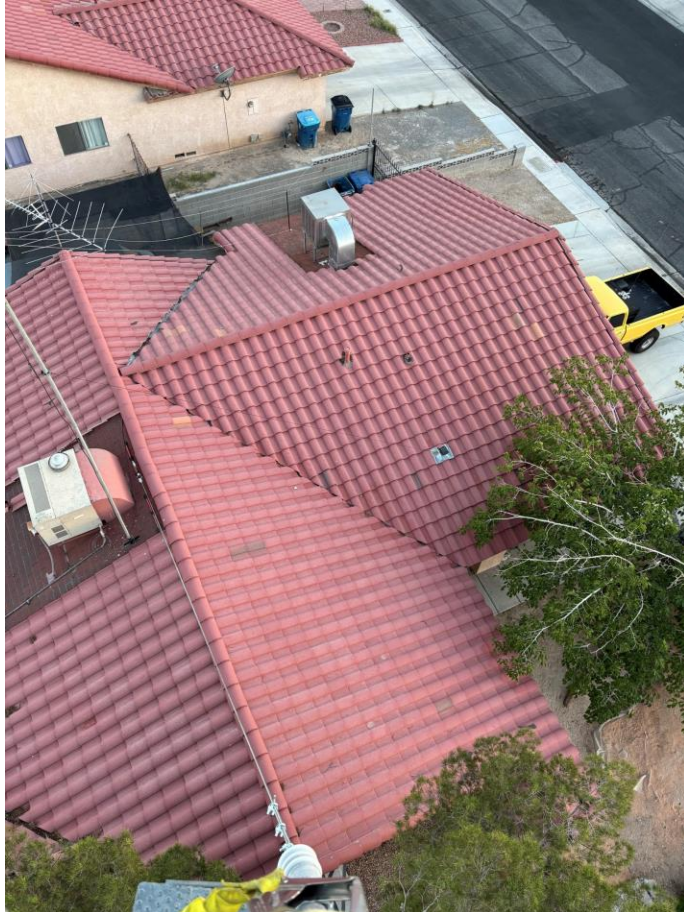
Hardware, antenna parts, rotator, thrust
bearing.....1905.27

Tooling- Wheelbarrow, Concrete vibrator,
etc.....288.30

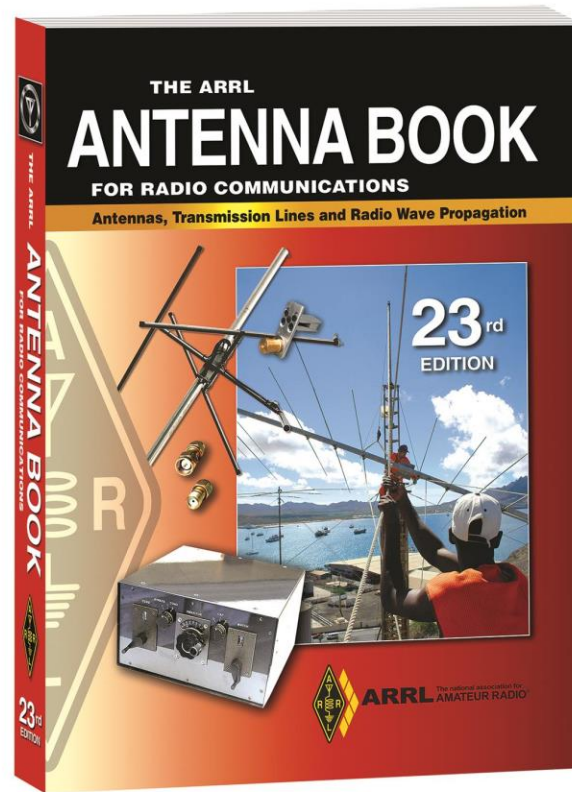
Grand
Total.....

\$3,339.59

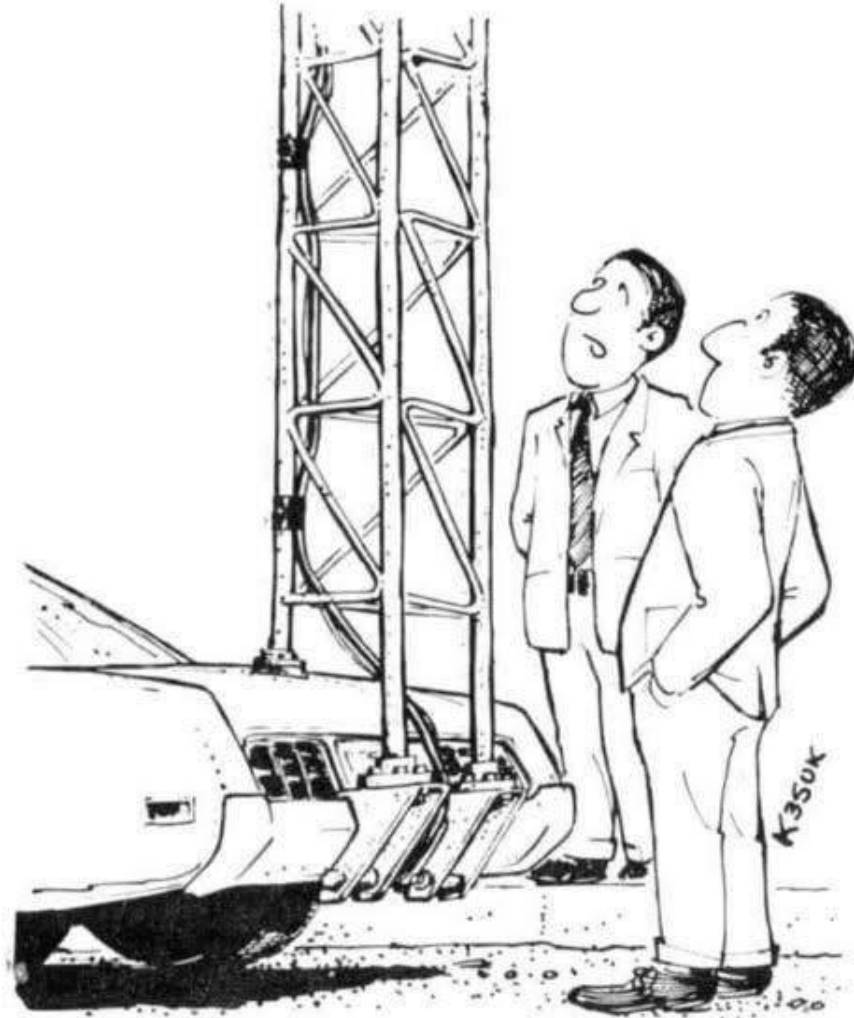
The view from the tower is awesome and the signal is above everything!



For more information see the ARRL
Antenna Book.



Thank you!
“Metal” Bill
K1ZCR
73!



"I'll betcha a steak dinner
that he's not married."