

Field Day Towers — Doing It Right

Guidelines and examples for tower and mast safety on Field Day.

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For many Field Day operations, short towers or masts are used to support Yagis or wire antennas. While easy to transport and assemble, towers can be tough to raise and lower safely in temporary installations.

Masts — push-up or multi-section — have their own challenges. For either support, it's easy to compromise safety when you're in a hurry to get on the air.

The Risk of “Temporary”

Whenever we start thinking in “temporary” terms, compromises and other challenges inevitably creep in. Questions or considerations that would be logically and cautiously addressed for a permanent installation can easily be overlooked or not thoroughly considered in the field. Problem solving sometimes takes a back seat to the immediate challenge of getting an antenna up high, in the clear and on the air.

The watchword of the day when dealing with any type of tower or mast is, of course, safety. There have been far too many instances where someone thought that a part or procedure “wasn't really necessary,” or that time could be “saved” by only installing one set of leg bolts, or that the tower was so short it did not need proper guying, or that tent stakes could be used as earth anchors and so on.

Always pay attention to where you're installing any antenna. Be particularly concerned with any power or utility lines nearby, let alone overhead. Because this is a temporary location, you may not know where the lines are, especially in sites with a lot of trees. Be mindful — should the worst thing happen and the tower fall — of the area surrounding the tower or the potential footprint of the entire setup. Do not set up a station or any other facility within that footprint!

Towers

Let's get back to that temporary installation mindset. For instance, can 40 feet (four sections) of Rohn 25 tower be “walked up” safely? Will it stay up at the Field Day site all weekend if guyed with ropes? A simple “yes” is not enough — there are always circumstances to consider in every case. Failing to assess and respond to those circumstances creates the potential for injury and damage. As always, there's no free lunch when dis-

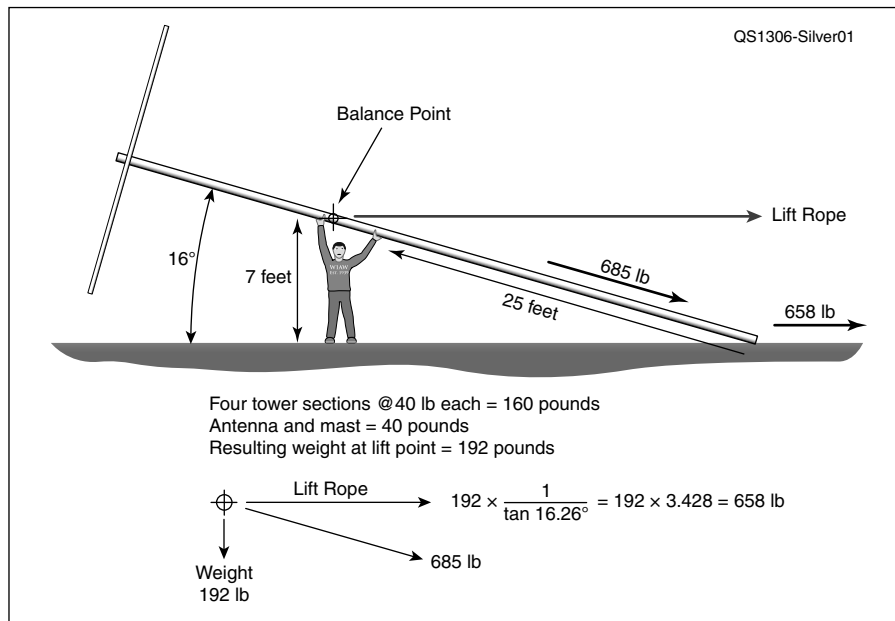


Figure 1 — Substantial force is needed to lift a tower off the ground using nearly horizontal pull rope. The same force is pushing the base of the tower horizontally, requiring the base to be securely held in place. [W1UJ, photo]

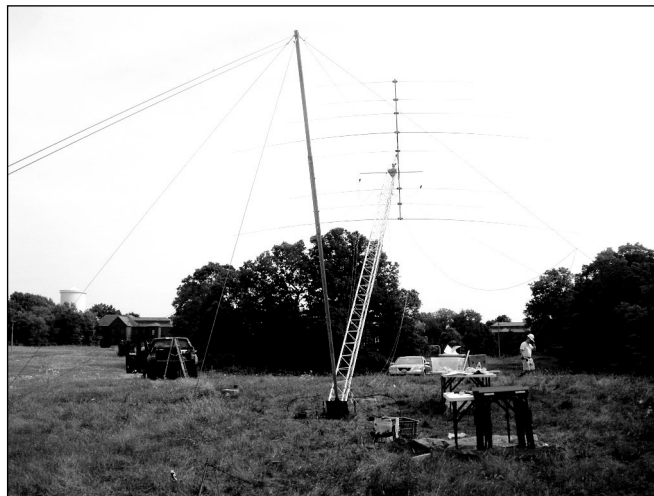


Figure 2 — The 2014 World Radiosport Team Championship stations will all use this simple and effective “falling derrick” method to erect 40 foot towers for more than fifty portable stations! [Mark Pride, K1RX, photo]

cussing, planning and executing antenna and tower installations.

Yes, it is possible for a tower to be walked up by lifting and pulling, but the base must be secured adequately or it will slip along the ground, dumping the weight abruptly onto the lifting team. Of course, walking the tower up with a beam, mast and rotator

already installed makes the task even harder.

Figure 1 illustrates the problem of walking up a tower consisting of four 40-pound sections of Rohn 25 topped with a 40-pound beam/mast/rotator. The total weight is 200 pounds balanced 25 feet from the base. Assuming your crew can lift the load to 7 feet, a horizontal pulling force of 658

pounds is required to lift the tower at its balance point and 685 pounds is compressing the tower. The same 658 pounds of force is pushing horizontally against whatever is holding the base to the ground. What do you think will happen if the base is not secured well enough?

Remember and account for this multiplication of force when walking up a ladder or other light-duty support as well. It must be adequately rated for the load during raising,

as well as holding the dead weight afterward.

What if the crew walks toward the base to raise the tower further and reduce the pulling force? That will place the balance point *behind* them, causing the tower to pivot around the crew lift point and raising the base off the ground. This is not a good combination and many a tower lifting operation has suddenly gone awry at that very moment.

The secret to tilting any tower into position is having a hinged base plate that is securely

held in place. Without a hinged base, the lift will be risky. Make certain the base is secure by driving stakes through the base plate or by having something heavy holding it in place, like a vehicle. Avoid the temptation to rely on a shallow hole as a seat for the base, or the dangerous practice of having someone stand on the base to hold it down. If the base begins to slip, you'll have a lot of unwieldy tower and aluminum that is dangerously out of control.

Over the years, hams with metalworking experience have fashioned some clever solutions to this problem. Figures 2 and 3 show the design worked up for the more than 50 2014 World Radiosport Team Championship stations (www.wrtc2014.org). This implementation of the “falling derrick” erection system is elegant and simple. By lifting from a point high above the base of the tower, you avoid the high forces that are encountered from lifting at a small angle. The same method works to lower towers safely, too.

Rick Karlquist, N6RK, has presented a detailed set of photos showing how to construct and use the falling derrick. You'll find it at www.n6rk.com/falling_derrick_gme/falling_derrick_gme.html. Rick also gives a great piece of advice: lift the tower a foot or two and check everything before proceeding.

Masts

For wire antennas and very light beams, using a mast is often a good choice. Multi-section aluminum masts such as the AB-155/U and MS-44 surplus packages are widely available and the telescopic TV antenna push-up masts are making a comeback, too. Heights of 20 through 50 feet are available. (Telescoping fiberglass masts are not strong enough to hold anything except wires and very light antennas.) Homemade masts constructed from 10 foot or longer sections of pipe or tubing are also common and can be walked up (carefully). All types of masts present challenges; don't overload them.

A mast's flexibility makes the side guys especially important since they will keep it from bending sideways under load. Masts require extra care during installation to be sure they are kept straight. Once a curve develops, a collapse can occur very quickly. Surplus “rocket launcher” AB-577 masts (www.ontariosurplus.com/ab577.htm) are much sturdier and can support a tri-band HF Yagi if erected properly.

Steel push-up masts are heavy, especially when raising the final sections that are carrying the full weight of the extended mast. A slipping section can seriously injure fingers and hands. Push-up masts can be walked up,

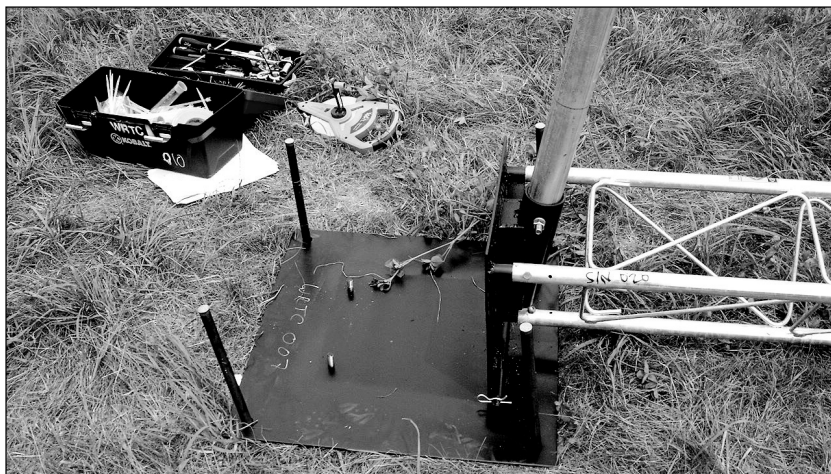


Figure 3 — A close-up of the hinged base and derrick attachment method for the 2014 World Radiosport Team Championship station towers. [Jason Corriveau, W1UJ, photo]

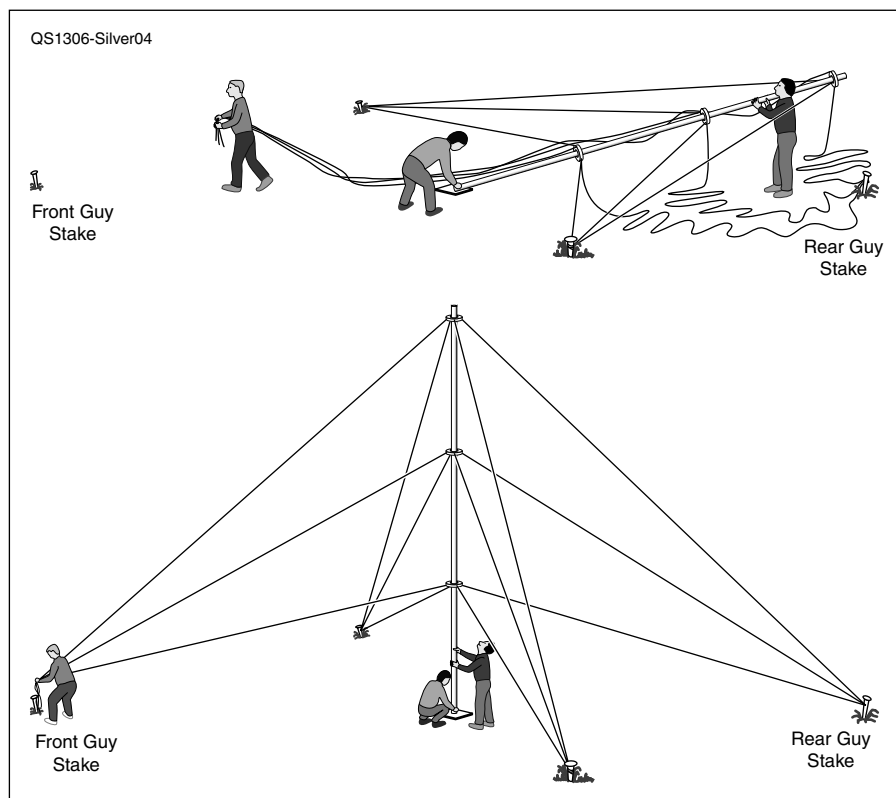


Figure 4 — By using side-guys, a multi-section mast can be walked up.

but only with the lightest of antennas attached (the top section is likely to bend if loaded and out of vertical alignment).

Guying

Use a four-way arrangement with the guys separated by 90 degrees instead of the 120 degrees typical of permanent installations. When lifting a tower or mast, use a four-way system with one set of guys aligned with or performing the lift while the two side guy sets steady the tower and stiffen a mast.

The four-way system has the advantage of allowing side guys (perpendicular to the lift) to be strung to their final length while still on the ground. This stabilizes the tower (or mast) to prevent tipping away from the plane of the lift. When the lift is finished, there will be three set of guys in place and by quickly attaching the front guys, the tower will be stabilized. Secure and adjust the guys for vertical plumb and you're all done.

A tower can be guyed with ropes, provided the load it carries is limited, no serious winds come up and no one climbs the tower. If you use rope, choose at least $\frac{3}{8}$ -inch diameter material without a lot of stretch such as Kevlar or Dacron. Do not use nylon or manila rope. Follow the manufacturer's recommendations and instructions for guying masts; it is often a more involved process than for the stiffer towers.

Guy Anchors

Make certain the guy anchors are strong enough to do their job. Use heavy pipes driven deep into the soil or screw-in earth anchors. For any temporary tower setup, the earth anchors will be the weakest link in the chain. Do not use brush or saplings as anchors. Only mature trees are safe enough to use as guy anchors and even then only attach guys near the base of the trunk. Vehicles? Forget about it!

Managing the Process

As with permanent installations, the secret to success is to have someone in charge with not only enough experience to make the proper decisions, but the ability to manage and prioritize the actual construction itself. Invariably, this person will not be able to be everywhere and do everything, so the proverbial "tailgate meeting" is mandatory. That's where the various jobs, and the process of getting them done safely, are discussed.

Finally, don't let yourself or others be talked into doing something you know isn't safe. Putting up an antenna is not a race and it's not a contest to show one's bravado. When something starts looking "iffy," or isn't going according to plan, *stop*. Return to the last safe configuration if at all possible. Take time out to determine what went wrong and correct the situation before resuming. Make sure all crew members feel comfortable asking questions and don't be shy about asking for help.

More Reading

Every situation is different, so inform yourself and your team about tools and techniques. Read the tower and antenna safety section in *The ARRL Handbook*, the more complete chapter in *The ARRL Antenna Book*, or K4ZA's *Antenna Towers for Radio Amateurs* and K7LXC's *Up The Tower*. Don't put anyone at risk by doing the job without the proper equipment or skills. You'll find that a job done safely and properly usually takes less time in the long run, avoids accidents and equipment damage, and gets you on the air reliably.

Thanks to Hank, KR7X, for the engineering review.

Ward Silver, N0AX, is the lead editor of *The ARRL Handbook* and *The ARRL Antenna Book*. He is the author of all three *ARRL License Manuals* and the *Q&A Study Guides* along with writing the monthly *QST* columns "Hands-On Radio" and "Contest Corral." The ham radio detective mystery, *Ray Tracy: Zone of Iniquity* is his most recent book. Outside of ham radio, Ward plays the mandolin, dabbles in digital photography, and enjoys camping and canoeing. You can contact Ward at 712 Jefferson St, Saint Charles, MO 63301-2740; n0ax@arrrl.net.

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