System quality begins with a solid foundation

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Careful preparation, proper construction techniques result in rugged antenna foundation providing years of trouble-free service. Author details installation of mat, pier structures.

Without a sturdy base, an earth station antenna won't have a leg to stand on. Great care should be taken in selecting a TVRO antenna site and constructing the antenna foundation. The installer should obtain a printout detailing azimuth and elevation of the satellite arc. The foundation heading can be determined with the aid of a compass and inclinometer.

Site examination

A preliminary examination of the site should be made to ensure the antenna will have a clear line of sight to the satellite arc. The path should be clear of trees, buildings and other man-made or natural obstructions. A site that is blocked by trees is undesirable no matter how close it is to the home. If only one or two trees are in the dish's line of sight they can be either removed or topped. Tackling a whole grove of trees however, is a discouraging proposition. The proposed site also should be as level as possible and in an area that is well drained and free of standing water. A site as close to the home as possible reduces the potential for electronic problems such as voltage drop and signal loss resulting from long cable runs.

Heading

Foundation heading is a very important aspect of antenna installation. The dish will not "see" the necessary portion of the sky with an incorrect heading. If the foundation site is chosen with the aid of a compass and inclinometer, compass readings should not be taken near mineral deposits, engines and large metal masses because they affect the reliability of compass readings. Readings always are adjusted to compensate for the difference in azimuth direction to magnetic north compared to true north (magnetic declination).

For example, the Galaxy I satellite orbits the Earth above a point where the equator and a line representing 135 degrees West longitude intersect. From Lincoln, Massachusetts, its signal can be received by an antenna pointed at 251.5 degrees azimuth (true). Yet compass readings taken at Lincoln to determine true north are inaccurate by 15 degrees because the azimuth direction to the magnetic north pole is 15 degrees further west than is the direction to true north. The difference is called "magnetic declination," and tables are published showing the correction values to be added or subtracted from compass readings throughout the country (and the world, for that matter!).

Dish orientation to receive Galaxy at Lincoln, Massachusetts—251.5 degrees—is determined by adding 15 degrees as the Lincoln, Massachusetts, correction value for the compass reading's magnetic declination. The sum—266.5 degrees—is the compass reading used to orient the dish.

Frost depth at the site is a factor for which plans must be made in advance. Regardless of the type of foundation constructed, the foundation should extend below ground at least down to the frost line. Ideally, the foundation should extend a little below the frost line. If it does not extend at least to the frost line,

the foundation possibly could be damaged when ground moisture freezes, and expansion forces the foundation upward. Frost line depth varies from five inches in the south up to 100 inches in northern areas of the country.

Mat foundation

The two types of foundations used for mounting TVRO antennas are the mat and pier structures. The mat type foundation is in the form of a full pad (see Fig. 1). To build a mat foundation, a hole is dug that is slightly smaller than the 5-foot x 5-foot outside pad dimensions. A square form made of two-inch by 12-inch boards is placed on the surface of the ground about the hole. Concrete then is poured into the form, leaving a small overhang over existing soil. The overhang eliminates the need for replanting grass or leveling soil around the foundation edges.

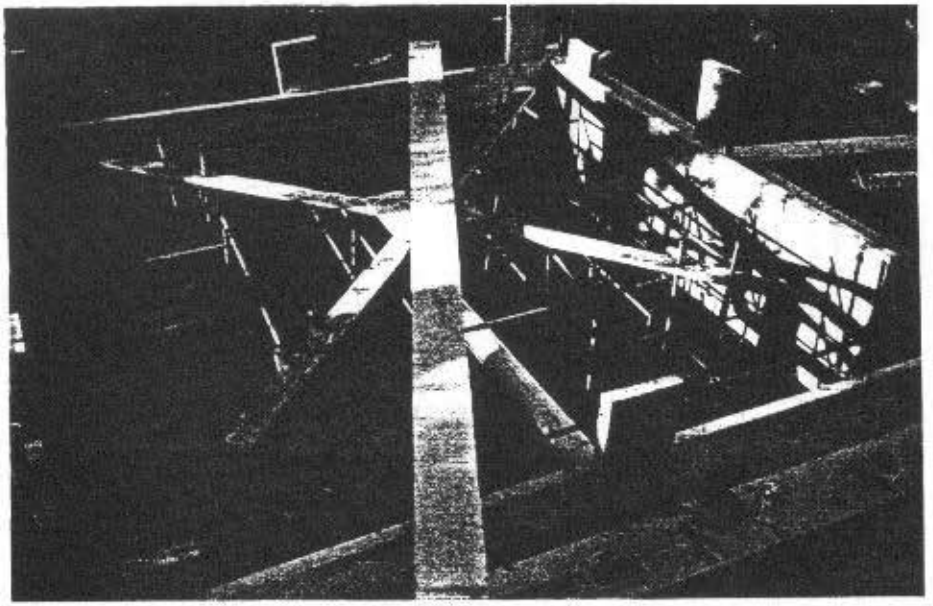


Fig. 1—The mat-type foundation is constructed in the form of a full pad. On the surface of the ground about the hole, a square form is constructed using 2-inch by 12-inch boards. Leaving a small overhang over existing soil eliminates the need for leveling soil or replanting grass after the concrete has been poured.

Pier foundation

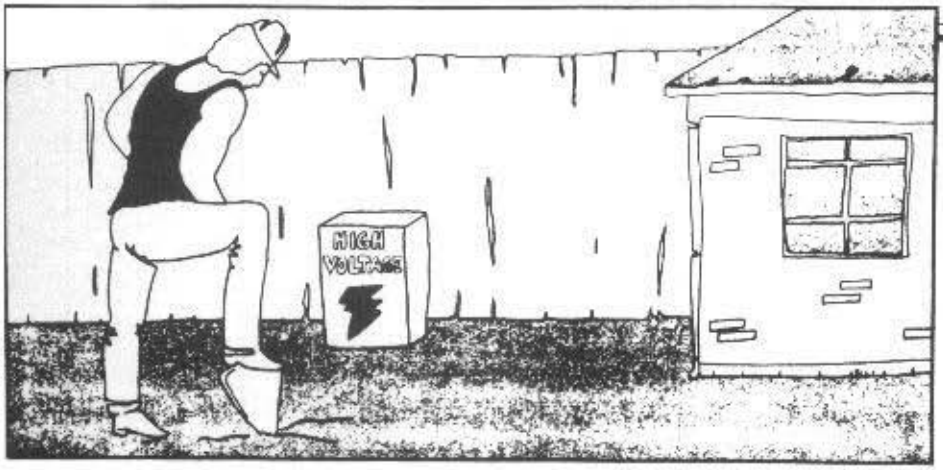
The pier foundation is constructed using an earth auger to dig three or more holes down through the frost line. Reinforcement bars are set into these holes with the bars extending above ground. Placement of number 5 reinforcement bar on 12-inch centers is recommended. Reinforcement bars are set to within 6 inches of the bottom and 3 inches of the top of the hole. The bars should be tied together at intersections with steel wire. After the piers have been poured, then it is possible to construct a "table-top" for the pad, attaching it to the rest of the structure. With a pier-type pad, far less concrete is required for construction.

It is recommended that both types of foundations be built up 12 inches above grade. This lessens the likelihood that the motorization package will burn out when called upon to move the dish during or after a heavy, wet snow. Also, the elevation decreases noise contribution from the earth's surface. The concrete pad is made level to within ⅛-inch with grouting. A "broom-finish" gives the pad a non-slip surface. As constructed, the concrete pad cannot be pulled from the soil by strong winds. To ensure the pad is secure from wind damage, the soil specification should be at least 2,500 psi and at least 2,500 psi concrete should be used. It is common to find 3,000 psi concrete readily available. For the experienced contractor, quick-drying concrete is preferable. However, for the inexperienced, quick-drying concrete prevents easy recovery from error. The concrete should be allowed to set for at least 72 hours after pouring. Seven days of curing is even better. Remember under most circumstances the removal or relocation of a foundation can cost more than the original construction.

A dry-run, or rehearsal, is recommended. A template is made that conforms to the blueprint supplied. Nuts that fit the anchor bolts are installed in the template to hold the anchor bolts in position. Placing the template over the hole after the re-bar has been installed reveals whether the anchor bolts will come into contact with the re-bar. If there is contact between the re-bar and the anchor bolts, the re-bar should be bent or cut away from the anchor bolts. Separating the anchor bolts from the re-bar prevents the bolts from moving when the concrete is poured, because the flow of concrete may cause the re-bar to shift. Anchor bolts must never be welded to the re-bar. Application of that much heat will cause the anchor bolts to become brittle and easily broken.

Anchor bolts

Anchor bolts should be made of galvanized steel, ¾" x 24" or 36" (whichever is most readily available). After installation, anchor bolts should sit three inches above the top of the pad. Greasing the



anchor bolts before pouring the concrete will avoid clogging the threads.

It is also recommended that a thick grease be applied to the bottom surface of the template as well as the anchor bolt threads for easy removal after the concrete has dried. Caution should be excercised throughout the entire installation to prevent damage to the anchor bolts.

Underground utilities

Most state laws require anyone doing excavation on public or private property to notify utility companies before digging, except in emergency situations. In some locations a minimum of 24-hours notice is required, but will vary according to the municipality.

Gas, electric, telephone and cable television companies have underground cables in areas that may not be marked clearly. Given adequate notification, utility companies will dispatch personnel to locate and mark underground cables and pipes. The small amount of time spent coordinating location of underground utilities is time well spent. The repair of most underground utilities can be very expensive depending on the amount of damage incurred.

Conclusion

Suggestions contained in this article are presented for the consideration of those involved in the planning and construction of earth station antenna foundations. The main requirement for good reception is the antenna's ability to "see" the entire satellite arc. All trees, hills, berms, fences and buildings should be to the north or east of the dish. The main requirement for a lasting antenna installation is a durable foundation. Selecting a suitable site and, using the correct construction materials and techniques will result in a sturdy foundation offering years of trouble-free service. TVRO

The author

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