

Transmission Line Construction

Construction of transmission lines involves the following activities:

- Site Preparation
- Foundation Construction
- Structure Construction
- Wire-Stringing Operations

Site Preparation

Tower locations must be cleared for construction of the tower footings.

Foundation Construction

Most structures have a concrete foundation. The size of the foundation depends on the type of structure and the terrain. Foundation construction begins with the auguring of holes for footings (four for lattice steel towers [LSTs] and one for tubular steel poles [TSPs]). For LSTs, each hole is usually 3 to 4 feet wide and 15 to 30 feet deep. TSPs require one hole that is up to 8 to 12 feet wide and 40 to 60 feet deep. Regardless of the structure type, foundations typically have a slight projection above the ground.



Foundation construction for a TSP.

After the footing holes are excavated, they are reinforced with steel and then concrete is poured into the holes. Once the concrete has cured, crews can begin the construction of the structure itself.

Structure Construction

In the most common method of construction, structures are built from the ground up. For LSTs, a lay-down area is cleared adjacent to the tower pad. The sections of the structure are assembled in the laydown area, and a crane is used to lift them into place. Crews bolt the sections together.

TSPs are either completely assembled in the laydown area and then erected at once, or are assembled in sections (see photo above). The method used is determined by terrain and available space next to the structure site.



Crews joining the sections of a TSP.

Tower erection is usually performed primarily by crane, but helicopters are used in areas that are inaccessible to large construction equipment.



An Erickson Air-Crane carries the top section of a LST for installation.

Wire-Stringing Operations

Stringing the conductors and ground wires involves the following four operations:

- **Stringing the pilot line to haul the conductor.** A light-weight sock line (pilot line) is flown from tower to tower by helicopter. Each tower has wire rollers attached to the insulators; the sock line is threaded through these rollers at every tower in the line .



The pulling phase of a wire-stringing operation. Note the reel of conductor on the right side of the photo.

- **Pulling.** The end of the sock line is attached to a conductor pulling cable, which in turn is attached to the conductor by a swiveling joint to prevent twisting and tangling as the conductor comes off of its reel. For bundle conductors (a set of two conductors separated by spacers that make up a phase), a running board is used to prevent the conductors from tangling and to allow them to feed into the wire roller smoothly. The conductors are then pulled through the length of the span by a puller machine. Another machine called a tensioner is located at the other end of the span, by the reel of conductor. The puller and tensioner work together during the pulling operation to ensure that the conductor maintains the proper ground clearance at all times. Pulling stations, where the associated pulling machinery and equipment are staged, are located at intervals along the span. Multiple lengths of conductor are usually needed for a particular span; these are connected during the pulling process by temporary splices because permanent splicing hardware cannot fit through the wire rollers.
- **Splicing, sagging, and dead-ending.** Once the conductor is pulled through the length of the line, the temporary pulling splices are removed and replaced with permanent splices. The tensioner is then used to sag the conductors to the proper tension. Conductors expand and contract with changes in temperature (they are longest at high temperatures), and they need to be installed at the proper tension such that they would not sag too low when temperatures are at a maximum. In addition, all phases (or bundle phases) between two towers must be sagged to the same tension. After splicing and sagging, conductors are fixed to dead-end towers.
- **Clipping-in, spacers.** After the conductors are dead-ended, they are “clipped in”, or attached to tangent towers. This process involves removing the rollers and replacing them with clamps and other final insulator hardware to secure the conductors to the insulators. Vibration dampeners, weights, and spacers between the conductors of a bundle phase are then installed. Once construction is complete, crews clean up work areas and restore disturbed areas.

Guard poles or guard structures are installed at transportation, flood control, utility crossings, parks, and other locations. Guard structures protect underlying areas during wire stringing operations. They intercept wire should it drop below a conventional stringing height, preventing damage to underlying structures. These guard structures are temporary and are removed after conductor installation is complete.



A guard structure being erected at a street crossing.

These guard structures are temporary and are removed after conductor installation is complete.