

Transmission Line Construction

Construction of transmission lines involves the following activities:

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

Site Preparation

Tower locations are cleared of vegetation prior to construction of the towers. Access roads may need to be upgraded or new roads constructed to accommodate construction vehicles and equipment access to each tower site.



Transmission line tower construction site.



Foundation construction for an LST.

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.

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

Generally, structures are built from the ground up. Structures are assembled in sections near the new tower location and a crane is used to lift the sections into place. Crews then bolt the sections together.

TSPs are either completely assembled near the tower location and then erected at once, or are assembled in sections. The method used is determined by terrain and available space next to the structure site.

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



A crane carrying the top section of a LST for installation.



A sky crane helicopter carrying the top section of a LST.

Wire-Stringing Operations

Wire stringing includes all activities associated with the installation of the primary conductors onto the transmission line structures. These activities include the installation of conductor, ground wire, insulators, stringing sheaves (rollers or travelers), vibration dampeners, weights, suspension and dead-end hardware assemblies for the entire length of the route. Wire stringing involves the following four operations:

- **Stringing the pilot line to install the conductor.** A light-weight sock line (pilot line) is flown from tower to tower by helicopter, threading the sock line through wire rollers attached to the insulators on each structure. A clamlock device secures the sock line in the rollers.
- **Pulling.** The sock line is attached to a conductor pulling rope/cable, which is connected to a tensioning machine on a truck. The conductors are then pulled through by a puller machine. The puller and tensioner work together during the pulling operation to ensure that the conductor maintains the proper ground clearance at all times. Wire set-up sites or pulling stations, where the associated pulling machinery and equipment are staged, are located at intervals along the span.
- **Sagging and dead-ending.** Once the conductor is pulled through the length of the line, 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), so they need to be installed at the proper tension such that they do not sag too low when temperatures are at a maximum. All phases (or bundled phases) between two towers must be sagged to the same tension.
- **Splicing.** Once the conductor is pulled in and the proper tension of the conductor is reached, mid-span splicing is performed at dead-end tower locations to connect or splice segments together. Any temporary pulling splices are removed and replaced with permanent splices. Implosive sleeves may be used for splicing, which involves placing a layer of explosives around an aluminum sleeve. The layer of explosive is designed to create the required compression of the sleeve around the conductor. After splicing and sagging, conductors are affixed to dead-end towers.



Wire-stringing operations.



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

Guard poles or guard structures may be installed at transportation, flood control, utility crossings, parks, and other sensitive locations to protect these underlying areas during wire stringing operations. The guard structures 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.

- **Clipping-in, spacers.** After the conductors are spliced and affixed to dead-end towers, 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 bundled phase are then installed. Once construction is complete, crews clean up work areas and restore disturbed areas.



A guard structure being erected at a street crossing.