

TRANSMISSION LINE CONSTRUCTION PROCESS

INFORMATION SHEET
MINNESOTA



After a new project is approved there are several steps taken before construction begins, including detailed design and engineering, and securing easements from landowners. Siting and land rights agents will work with property owners to collect detailed information about properties prior to work beginning. The process can vary depending on the size of the line, soil conditions, terrain and other variables.

1. Soil surveys and property staking:

Before beginning easement acquisition with landowners, utilities will conduct field surveys and obtain soil information to finalize engineering and design. A soil boring is drilled at structure locations to determine the mechanical properties of the soil. Soil borings typically take place about a year before the start of construction. Right-of-way (ROW) agents request access to the property and coordinate between the soil boring contractor and the property owner. The soil boring locations are staked and existing underground utilities are located prior to borings. Once final pole locations are determined, they are staked in the field with tree clearing limits, right-of-way boundaries and other property features mapped as needed. Typically, a 150-foot wide easement will be required for 345-kV lines.

2. Construction access and tree clearing:

Construction access routes to the ROW are identified and obtained during the ROW acquisition process. The access is typically 25 to 30 feet wide and is needed so large equipment including a drill rig, concrete trucks and a crane can be delivered to the site. Tree clearing and other vegetation removal will take place on the identified access route and the area within the easement. Matting is sometimes put down in wet or soft areas to prevent compaction, minimize soil disturbance and improve site safety.

3. Mobilizing equipment and delivering material:

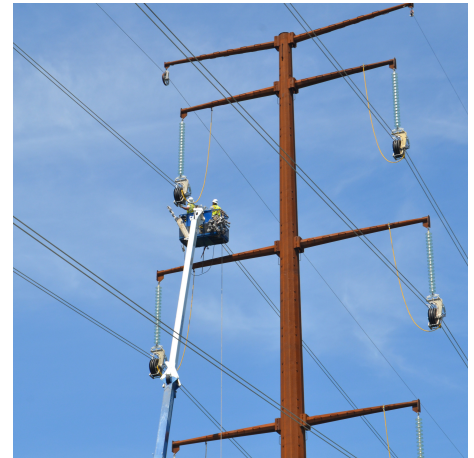
A crane, drill rig, concrete truck, boom trucks, trailers, structures, steel casing and rebar cages are some of the equipment and materials that will be moved into the site for construction.

4. Foundation construction:

Construction crews will begin drilling for structure foundations. Two types of foundations are typically used for transmission line projects, either drilled pier foundations or direct embed foundations. Concrete foundations require drilling a hole in the in the ground, placing reinforcing steel (generally a rebar cage) and anchor bolts, and then pouring concrete. Depth and diameter depends on the size and voltage of the transmission line.

5. Installing the structure:

High voltage transmission structures are usually steel poles. The poles are assembled at the foundation site and set in place with the use of cranes and other heavy equipment. A pole can be assembled and set in place in one day.



6. Stringing conductor:

After all structures are erected in an area, the next step is to install conductor (wire). Conductor is pulled from one structure to the next through a pulley system temporarily placed on the structures. After a section of conductor is pulled through a series of structures, the conductor is attached to insulators, which are attached to the structure and the pulleys are removed. Trucks, heavy equipment and sometimes helicopters are used in this process. Other equipment including bird diverters, spacers and galloping devices are also installed.

7. Land restoration:

Following construction, the ROW is cleaned up and restored. This work may include tile and fence repair, rut removal, decompaction, tilling, seeding and possible wetland restoration. If damage occurred to crops or other non-restorable property during construction, Xcel Energy will fairly reimburse the landowner for those damages.



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