User’s Guide for Handling, Storage, and Erection of Prestressed Concrete Poles

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Prestressed concrete poles are gaining widespread usages as structural supports for transmission and distribution electric power lines, area lighting applications, street lighting, telecommunications structures, and several other applications. Handling, storage, and erection considerations are important for the overall success of the project. This report provides guidance to the user on the appropriate procedures for handling of prestressed concrete poles under different field conditions in order to ensure safety and extend the service life of the structures. The user can be defined as the owner (e.g., public utility) or party delegated to execute the work.
1.0 INTRODUCTION

This user’s guide covers the handling, storage, and erection of spun and static cast prestressed concrete poles. The user should consider the method of hauling, storage, and erection of the concrete poles prior to procurement. The specifications for both the manufacturer and user should clearly define these responsibilities to ensure a successful project using prestressed concrete poles.

2.0 HAULING

Care should be taken in hauling concrete poles to prevent structural and cosmetic damage. The pole should not be shipped before reaching its required shipping and handling strength. In the event that pole delivery is required before reaching its handling strength, the manufacturer must provide written notification with special instructions.

Typically, poles may be hauled in a horizontal position (see Fig. 1), or in an inclined position with its tip over the tractor for longer poles (see Fig. 2). In general, no more than one-third of the length of the pole should be cantilevered during hauling. It may be necessary to reduce the unsupported length of the pole due to terrain conditions or rough roads.

The user should consider the method of hauling poles to the structure site prior to procurement. To the extent practical, concrete poles should be shipped directly to the structure site to prevent double handling of the poles. The user should clearly define the responsibilities of the manufacturer and the contractor for getting the poles to the individual structure sites.

Concrete pole manufacturers will generally deliver poles to the individual structure sites provided they are reasonably accessible. For sites where access is difficult, it may be necessary to make the contractor responsible for getting the pole to the site.

In instances where the pole cannot be hauled to the structure site, it may be necessary to drag the pole along the...
When dragging is employed, hardware should not be attached. In case of flanged or slip jointed poles, the flange or joint should not be in contact with the ground. If hardware is attached to the pole, it will be necessary to secure the pole in such a manner as to keep it from rolling about its longitudinal axis as it is dragged. Dragging should not be employed for decorative poles.

### 3.0 HANDLING

One of the most critical handling phases for any pole is lifting it clear of all supports while it is in the horizontal position. Due to the weight of concrete poles, attention must be paid to the manner in which they are lifted. Concrete poles are designed to be lifted with multiple or single pick points. A two-point pickup is recommended for handling the pole in a horizontal position (see Figs. 3 and 4). A single-point pickup may be used if approved by the manufacturer (see Fig. 5).

It is the manufacturer’s responsibility to provide the user with lifting instructions for their particular poles and it is the user’s responsibility to ensure that those instructions are relayed to the installer. The lifting locations should be marked on the pole if required by the user. The installer is responsible for the proper handling of poles. If handling instructions are not available or if the instructions are unclear, the installer is responsible for contacting the user for the necessary information.

### 4.0 STORAGE

When possible, concrete poles should be delivered to the site just prior to construction. In the event that the poles are stored in the field, special storage procedures are required.

Concrete poles should ideally be stored in a horizontal position. Cribbing for poles should be placed in intervals sufficient to prevent the pole from developing a permanent camber. For poles less than 100 ft (30.5 m) in length, at least two crib points should be installed at points approximately 25 percent of the length from the tip and 15 percent from the butt of the pole.

Poles longer than 100 ft (30.5 m)

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**Fig. 3.** Schematic showing pole handling using two-point pick.

**Fig. 4.** Pole handling using two-point pick.

**Fig. 5.** Pole handling using single-point pick.
should have at least three crib points (see Fig. 6). Cribbing should consist of hard wood dunnage on firm, level soil. Wood chocks should be installed to prevent the pole from rolling off the cribbing.

Poles may be stacked when sufficient storage area is not available (see Fig. 7). The manufacturer should be consulted to determine the number of layers and the manner in which the poles should be stacked. When stacking poles, crib points should be placed directly above each other. Special care should be taken to ensure that the soil at the storage site will support the heavy loads associated with stacking the poles.

5.0 FIELD DRILLING

Concrete poles are typically fabricated with some or all of the attachment holes already in place. However, occasionally it will be necessary to drill holes in the field. The manufacturer’s drawings should be reviewed prior to drilling to determine planes or areas that do not contain longitudinal prestressing strands. It is recommended that holes be drilled without cutting strand; however, in some cases it may be unavoidable.

If a hole must be drilled through a strand, or if a strand is inadvertently cut or nicked, the manufacturer should be consulted to verify the structural integrity of the pole. Clear distance between drilled holes should not be less than 3 in. (76 mm). Greater distances may be required for heavily loaded applications.

Drilling should be done with a rotary hammer drill and carbide tipped bit or by wet coring methods. For bolt holes, drilling of the concrete pole should be made with a drill bit \( \frac{1}{8} \) in. (3 mm) larger than the diameter of the bolt. Through holes should be drilled from the outside to the inside to prevent spalling of the concrete on the outside face of the pole.

Cutting of prestressing steel or mild steel reinforcement may require the use of a torch. Circumferential steel can be cut with a torch or drilled through with the rotary hammer or core drill. Cutting of circumferential steel (spiral reinforcement) is difficult to avoid and is typically acceptable, except when the circumferential steel is designed to resist torsion or shear. After drilling, any exposed steel should be sprayed with a zinc-rich or epoxy paint to protect the reinforcement against corrosion. Abandoned holes should be patched with epoxy grout.

6.0 FRAMING

Poles should be framed according to the user drawings. The drawings should include the type and location of all hardware (bolts, washers, locknuts, and other devices).

Concrete poles are typically framed using through bolts. Bolt lengths should be selected such that not less than \( \frac{1}{4} \) in. (6 mm) extends beyond the nut or locknut. The strength of the pole is sufficient to withstand a reasonable degree of bolt tightness.

Care should be taken not to over stress the bolts, especially near the end of a hollow pole that has not been plugged. If longitudinal cracks occur, the bolts should be loosened until the crack closes. If the cracks do not close, the installer should notify the user.

For proper tightening of bolts, the turn-of-the-nut method should be used. Torquing bolts and nuts is not recommended. The turn-of-the-nut method requires that the nut first be tightened snugly, defined as the degree of tightness caused by the first impacting of an impact wrench. Then, the nut receives an additional turn depending on bolt length as follows:

(a) For short bolts with the length less than four times the diameter, one-third turn;
(b) For medium bolts with the length between four and eight diameters, one-half turn; and
(c) For long bolts with the length greater than eight diameters, three-quarters turn.

This recommended tightening pro-
connections can be made to concrete poles using stainless or galvanized steel bands. Bands should be of sufficient strength to transfer the load from the attachment to the concrete pole. Over-tightening of the band is usually not a problem due to the inherent strength of the concrete pole in compression.

7.0 FIELD CUTTING

There may be occasions when it is necessary to shorten a pole in the field. In such cases, the manufacturer should be contacted for guidance. Shortening can be accomplished without damage to the pole by cutting with a handheld concrete saw and an abrasive blade. The blade will cut both the concrete and the steel. The pole should be marked around its circumference and carefully sawed around the mark. At the butt end, cut strands should be burned back approximately 1 in. (25 mm) and should be sealed with an epoxy grout.

8.0 ERECTION

Proper safety precautions should be followed when erecting poles in the vicinity of electrically energized lines. Most applications for prestressed concrete poles utilize single-piece concrete poles, which are erected in the same manner as steel or wood poles. A single-point pick with a choker is the common method (see Figs. 8 and 9). The choker should be placed according to the manufacturer’s recommendations.

Multiple-piece poles may be available to satisfy the need for special requirements such as length restrictions, additional height, or weight limitations. Installation and erection of these types of structures should be done in accordance with the manufacturer’s recommendations and the applicable requirements of this section. Unlike steel poles, multiple-piece concrete poles are typically erected vertically one section at a time.

Safe operations require the use of proper choker techniques. Improper use of chokers can result in the pole slipping and causing injury or property damage.
damage. Chokers must be tight around the pole. A positive stop against sliding should be provided.

One such method is by attaching the choker below a solid piece of hardware. Note that a ladder clip does not qualify as a solid hardware. The use of steel or nylon chokers for handling and erection of concrete poles is acceptable. If steel chokers are used, they should be padded to protect the surface of the pole.

Guyed poles should be initially set plumb, and the guys adjusted such that regardless of the bending and flexing that occurs during construction, the pole will remain plumb after completion of the installation. The installer should not change guy configurations without the user’s approval.

Concrete poles may be temporarily guyed when it is determined that construction loads will exceed the original allowable design loads. Temporary guys should be installed in such a manner that they do not slip or damage the pole. Use of existing holes is preferred for attaching the guy hardware. Where these holes do not exist, the pole can be drilled or the guy hardware banded to the pole. The installer should contact the user to verify that a structure can be temporarily guyed prior to application of the construction load.

Helicopters may be used in special applications to erect concrete poles. Helicopter erection is advantageous when environmental, terrain, or other considerations limit access to the structure site. Concrete poles can be flown from delivery points or erected into position at the site. Lifting limits of helicopters vary depending on the size of the helicopter but are generally limited to 23,000 lbs (10433 kg) at sea level conditions.

For higher elevations, the lifting limits are reduced. The designer, manufacturer, user, installer, contractor, and helicopter company should coordinate the project early in the design process. It is also important to select delivery or staging locations as close to the final structure location as possible to avoid excess flying time with the concrete pole.

Concrete poles are typically directly embedded in earth or rock. Holes for concrete poles are excavated by augering a hole at least 12 in. (305 mm) larger than the diameter of the pole at the butt. Setting depths may vary depending on the type of soil encountered at the site.

The foundation setting depth should not be altered without the user’s approval. After the pole is set into the hole, the annular space around the pole is backfilled and tamped with natural earth or crushed rock. For poles subjected to high sustained lateral loads, concrete is often used for backfill.

The backfill should be placed and compacted in lifts that will allow optimum compaction. Failure to adequately compact the backfill may allow the pole to lean after the load is applied. In cohesive soils, holes may be augered in advance of pole erection. In loose sandy soils, poles may be jetted into place. Casing or drilling slurry may be used to maintain the integrity of the hole. For any excavation, proper safety precautions should be followed.

9.0 CLIMBING

Concrete poles can be climbed using standard climbing ladders or step bolts. Other climbing methods are also available and may be selected by the user. When climbing concrete poles, safety rules in accordance with federal, state, local regulations, and user’s guidelines should be followed.

10.0 FIELD INSPECTIONS

Concrete poles may crack under certain conditions. However, not all cracks are necessarily detrimental to the structural integrity of the pole.

Circumferential cracks may open during construction or during severe service conditions, but will usually close once the severe loads are removed. Circumferential cracks that do not close after the pole is either properly supported on the ground or is installed should be investigated and repaired.

Due to the process of releasing the tension on the steel in prestressed poles, circumferential cracks may develop within a few inches of either end of the pole. Those at the bottom end may be ignored. Those near the top should be weatherproofed with epoxy or other coatings, if they are not closed.

Longitudinal cracks are less common. At either end, they may have been caused by the application of prestress loads. If longer longitudinal cracks occur near the bottom of the pole, most likely, they have been caused by stacking the poles. Longer longitudinal cracks near the top may be caused by overtightening of the through bolts. As long as they are only hairline cracks, they are not detrimental to the service life of the pole.

Any open cracks should be investigated for the cause and a determination should be made as to the structural adequacy of the pole. If it is decided that the pole is to remain in service, the cracks should be filled and sealed from the weather to prevent degradation of the pole.

11.0 REPAIR

It may become necessary to repair a damaged structure in the field. It is recommended that a damaged pole be reviewed by a qualified engineer or competent inspector to determine if the damage will compromise the structural integrity of the pole. The location, type, and extent of damage will be critical to determining structural adequacy. If the structure is deemed unsafe, it should be removed and replaced.

If a damaged pole is determined to be structurally sound, it may be repaired. The manufacturer should be contacted and an appropriate repair method identified. The repair may consist of an epoxy patch for large areas that have been damaged or crack injection where excessive cracking has occurred. In all instances, the manufacturer should approve the method and procedures for repair.

12.0 CONCLUSION

Proper handling, storage, and erection of prestressed concrete poles will result in extended service life of utility structures. The manufacturer should be contacted for any questions or concerns with the finished product.