WOOD POLE NEWSLETTER

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Western Wood Preservers Institute

WOOD POLES: EASY TO HANDLE, INSTALL AND SAFE TO USE

Initial steps taken when designing a transmission or distribution line includes looking at and comparing the various pole materials to determine which product will be the most beneficial for use in that line. Factors which distinguish the various materials include activities from shipping to unloading of the materials, as well as the actual installation process and the significant differences among the materials when considering workability. Issues to be considered with regard to workability include ease of making equipment attachments, the types of handling practices that are necessary to avoid damaging the poles and the safety associated with working with each material.

SHIPPING AND HANDLING

Wood poles are easy to handle and can be stacked on top of one another for shipping. Manufactured poles–concrete, steel and fiberglass–often require blocking or some sort of device to provide space between the poles for shipping. Fiberglass poles may require a full-length wrap for additional protection.

Wood poles can be stacked for storage while manufactured poles often need to be spaced or blocked.

Wood poles, which are more forgiving from a handling perspective, can be moved around with chains or steel cables as slight surface marring will not affect long-term performance. The coatings on manufactured poles are vital to their performance; thus, extra care has to be exercised in their handling. Exposure of fiberglass through damage of protective coatings can lead to accelerated photodegradation. Steel pole preservative coating damage can expose raw steel and enable accelerated corrosion. To protect the coatings, steel and fiberglass products need to be handled with nylon straps. Concrete damage could potentially expose reinforcing steel thereby increasing the likelihood of accelerated corrosion as well as the original damage possibly becoming more extensive due to freeze/thaw effects in cold climates.

In addition to the lifting of the poles from the transporting vehicles, the general handling of the poles, once unloaded, varies. Of course, careful handling is always recommended, however, wood poles can be dragged along the ground, pushed with a backhoe or generally moved in any way with any available equipment. While moving to storage, manufactured poles must be protected (with nylon straps or carpet remnants if suspension lifting with forklifts). The manufactured poles cannot be dragged on the ground.

Although difficult to quantify, approximately 30% more time is required for unloading and storage of manufactured poles relative to that required for wood poles.

STORAGE

Differences in storage requirements for the various poles are similar to those for shipping. All poles should be kept off of the ground. Wood poles can be stacked on top of one another for storage while manufactured poles need to be blocked or spaced while in storage. Wood poles

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that are left for long periods of time should be rotated as they could possibly develop a bow if improperly supported and because oil-borne preservatives can migrate to lower surfaces due to the effects of gravity.

Unloading of wood structures is typically done with a self-loading type trailer which consists of a small crane mounted on the truck which lifts the poles on and off the truck. The manufactured poles typically require an additional piece of equipment depending on the pole size and weight. This equipment could range from a forklift to a crane.

For distribution and small-to-medium transmission poles, a line bed can be used to dig the foundation and lift the pole into position.

Manufactured poles require more storage space than wood poles. Given their stacking limits, it can be estimated that steel poles will require twice the amount of storage space as wood poles while concrete poles will require triple the amount of storage space.

FIELD ASSEMBLY

Most field modifications involve drilling through a pole and attaching various pieces of hardware to the pole with a through-bolt. For wood poles, simple-to-use utility drills with drill bits for wood perform this function.

Field modifications can easily be made to wood poles using simple-to-use utility drills.

Thin-walled steel poles require modification using a magnetic drill. Fiberglass poles can be field modified as well. The manufacturers recommend using carbide-tipped drill bits or carbide-tipped hole saws for larger holes. If drill bits for wood are used on fiberglass poles, drill bits will wear out in a short amount of time.

To make field modifications to concrete poles, a rotor hammer type drill, with carbide tips, must be used. The drill can bore through the spiral reinforcing; however, if one of the steel prestressing strands is encountered during the drilling, the drilling path has to be altered to avoid the stranding. Concrete poles require drilling to be performed on both sides of the pole to prevent the spalling of concrete on the concrete surface.

Linemen prefer to work with wood poles as climbing using gaffs or hooks is easier and allows better positioning on the pole.

SAFETY DURING MAINTENANCE

Wood poles enable climbing the structures using lineman gaffs or hooks. This attribute enables more flexibility from the perspective of worker positioning on a structure while performing maintenance. Manufactured poles all require steps or attachments from which ladders can be installed to support line workers performing maintenance activities and these climbing steps in wet or icy weather conditions can be hazardous.

Certainly, utility workers feel more comfortable working with a wood pole than a steel pole when performing live-line replacements.

When working on a live line, linemen prefer to work inspection or replacements with wood poles over conductive steel poles which require additional phase-to-structure insulation.

UTILITY PREFERENCE

In interviews conducted with transmission line engineers in utilities throughout the U.S., wood was cited as the best material choice in terms of:

- **Speed, ease of construction**
- **Climbability**
- **Design flexibility**

Wood Poles – Utilities' Product of Choice.

THROUGH-BORING IMPROVES PRESERVATIVE TREATMENT AND EXTENDS SERVICE LIFE

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ABSTRACT

The electric power industry faces many challenges as we are on the threshold of the twenty-first century. Utilities will become even more competitive as deregulation takes hold of us and that will drive the need for utilities to provide reliable, yet low cost power. Utilities have wood pole infrastructures that represent a large capital investment and one worth protecting. Interestingly, most utilities are confronted with either maintaining an aging system or spending an enormous amount of capital to replace that system. The latter choice is usually cost prohibitive. The days of large scale powerline construction are over and thus, the name of the game is "maintenance" and holding our replacement costs to a minimum. The best way to lower downstream wood pole repair costs is to prevent such damage by specifying the most durable pole available. Improving pretreatment design by "through-boring" is one proven technique to increase preservative treatment and extend pole service life. This article will attempt to explore Bonneville's experience and philosophies regarding through-bored poles.

HISTORY

In 1960, the Bonneville Power Administration's (BPA) Transmission Line Maintenance Group initiated a system-wide wood pole inspection program. The results of this effort were surprising. In fact, Douglas-fir poles suffered from high moisture contents, inadequate preservative treatment, and decay problems (Lindgren, 1989). These circumstances usually go hand in hand. Unfortunately, it also shortens pole service life. To correct this problem, researchers, utility engineers, and the treating industry worked together to make improvements in the pressure treatment of Douglas-fir. They also developed a method to improve the penetration and retention of the preservative treatment by boring a series of holes throughout the wood. This method is known as "through-boring" and is located near the groundline. Through-boring has been considered as a radical approach to preservative enhancement and only a handful of utilities have adopted it.

Typical boring patterns are 2 feet above groundline and 3-4 feet below.

Although, it's really a common sense approach to getting preservatives to penetrate into the otherwise non-treatable heartwood core.

SELECTION

The location and type of power system (distribution or transmission) may dictate which type of wood species/preservative will best suit the utilities needs. For example, BPA is a transmission company located in the Pacific Northwest, so naturally we can choose between Western Red Cedar and Douglas-fir. The utility person needs to have a basic understanding of wood technology and wood preservation before they are able to specify treated wood poles.

Let us start with Western Red Cedar; it has a thin sapwood that is receptive to treatment with a highly durable heartwood core. Therefore, through-boring cedar is not necessary. Cedar is a softer type wood and thus a favorite with lineman. In wet climates, cedar can be prone to shell rot if not full-length treated. However, in drier climates both butt-treated and full-length treated cedar provide excellent service life.

Douglas-fir, on the other hand, has a thicker sapwood which surrounds only a moderately durable heartwood. Douglas-fir presents other challenges during seasoning and pressure treating that must also be addressed. During air seasoning, poles can be colonized by decay fungi, but this problem can be corrected by sufficient sterilization during the treating cycle. Kiln drying or boultonizing as a means of "seasoning" can reach adequate internal temperatures to achieve sterilization (Newbill and Morrell, 1988). Our problems with Douglas-fir were directly related to drying stresses (uneven shrinkage) that occur after treatment and create vertical cracks or seasoning "checks". These checks extend beyond the original treatment and when near the groundline permit the entry of decay fungi and insects (Graham, 1973).

DECAY PREVENTION

It's far more cost effective to prevent decay through improvements in design than attempt to arrest it after the fact. In the late 1950's and early 1960's, research was conducted to improve the preservative penetration and retention by enhancing the pretreatment design. Four methods were developed; they include: kerfing, deep incising, radial boring, and through-boring (Graham, 1983). Kerfing was designed to limit check development, while other methods were designed to increase preservative treatment in the critical groundline area. Of these, only through-boring can achieve 100 % preservative penetration throughout the heartwood. In 1962, Portland General Electric (PGE) began to specify through-bored poles. BPA followed along in 1966. Both companies use a 7/16 inch diameter hole in the groundline zone. BPA's hole spacing uses a consistent geometry to achieve a uniform treatment and minimize strength impacts. BPA also specifies through-boring in the top 6 feet since we have mostly H-frame construction that requires this level of protection from field framing.

Core samples are examined to verify thorough preservative penetration in the ground-line zone.

The most frequently asked question regarding through-bored poles is, "how much strength loss results from boring all those holes?" Through the years, BPA and others have conducted full-length breaking tests (Grassel, 1969). For transmission size poles, the breaks occur well above the through-bored zone and thus we have determined this impact to be of no consequence to the strength of the structure. However, additional steps can be taken to further minimize the effects of through-boring. They include: setting a minimum edge distance of 2 inches, increase hole spacing, decrease hole diameter, and drill holes through the face of the pole so the pole can be set parallel to the conductors (which is perpendicular to the forces). However, radically altering established through-boring patterns is not recommended. In fact, efforts are underway by ANSI 05.1 to establish one standardized through-boring pattern.

PERFORMANCE

BPA's pole inspection program has been in effect since 1960. The wood pole history gathered over that time frame is essential for comparing pole types and treatments. Our reports have the advantage of sorting data and examining the performance of specific lines. The Santiam-Toledo line (near Corvallis, OR) was installed in 1959 with Douglas-fir non through-bored poles. Some 37 years later, only 47% remain in service. Remember, we discovered problems with this pole type back in the 1960's. The question is, "how many poles would be in service if not for supplemental field treatments?" Probably not many, but this is why it's hard to calculate the benefits in terms of annual savings from having a wood pole maintenance program. What about our through-bored poles? Since 1966, BPA has installed 22,620 poles and after 30 years, 98 % remain in service. This pole population is virtually free of traditional groundline decay. The poles were originally treated with creosote and pentachlorophenol and both show outstanding performance. The through-bored poles removed from service were retired due to woodpecker damage, lightning, and above ground decay. Because of the excellent report card on through-boring, we have been able to decrease our inspection cycles from 3 to 2 in the first 35 years of service. Also, we are no longer requiring remedial field treatments. These are two important side benefits that result in an estimated $175,000 annual cost savings. This data clearly demonstrates the superiority of the through-boring technique when treating Douglas-fir poles.

Full pole breaking tests were conducted on transmission poles; breakage occurred consistently well above ground-line.

SUMMARY

BPA has utilized through-bored poles to successfully solve our groundline decay problems previously experienced with Douglas-fir poles. Requiring through-boring prior to treatment has provided additional preservative protection to Douglas-fir such that their performance is now equal to or exceeds that of western red cedar. This is especially true of poles located in wet climates where cedar becomes vulnerable to shell rot and pole top problems. Thirty years of specifying, replacing, and constructing transmission lines with through-bored poles makes BPA's power system one of the most reliable in the United States. This is a tremendous success story for the treating industry and the utilities that benefit from the extended service life and have saved millions of dollars in replacement costs.

DISCLAIMER

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TRANSMISSION LINE ENGINEERS THROUGHOUT THE U.S. RATE WOOD POLES NUMBER ONE IN TERMS OF:
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We will show you why utilities across the country favor engineering with treated wood poles and crossarms because of their superior strength, durability and long life.

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