WOOD POLE MAINTENANCE[1]

by Robert E. Birtz

Abstract. This paper deals with the various inspection and treatment methods that can be used to maintain wood poles in-place. Pole inspection has to be carried out to meet National Electric Code safety standards. Unfortunately, inspection only is an expense that leads to a lot of pole replacements. Inspection combined with present internal and external treatments will extend the life of most wood poles almost indefinitely and the savings will more than pay for the program.

Ever since poles have been used to carry power and/or communications, it has been necessary to inspect them periodically. In the late 1800's poles were made from decay resistant tree species such as chestnut, cedar and locust. Early attempts were made to extend their life by shaving off sapwood or charring with fire. In the 1890's the first pressure treated southern yellow pine poles were installed and some of these are still in service in Virginia as are some of the early chestnuts. During the first half of the 1900's, most thick sapwood species such as southern yellow pine were pressure treated with creosote and the thin sapwood species such as cedar were either butt dipped, incised or full length thermal treated with creosote. At the present time, creosote, pentachlorophenol and salt treatments such a CCA or ACA constitute the main original treatments. Southern yellow pine, western red cedar and Douglas fir are the three tree species most prominently used now for utility poles.

During the 1920's the Bell System and a few power companies began experimenting with in-place preservation. Early attempts usually called for painting or pouring creosote on the pole and the surrounding earth. This was slightly effective but probably not economical because of the limited extra life. The first economical groundline materials to show any real promise was the Osmose paste containing creosote and water borne salts that was applied to the outside of the pole and then wrapped with tar paper to keep the material up against the pole. This added about five years of life but when the tar paper disintegrated, the preservative lost its effectiveness. When polyethylene wraps came into use in the late 1940's, the effectiveness of the groundline treatment was increased greatly as this wrap did not disintegrate below ground and held the salts in the pole.

All the testing that has been done by utilities, government organizations and private industry in the United States to date has shown that, regardless of what external groundline preservative is used, it is important that the poles be wrapped with a long-lasting material. This is not necessarily true of the internal treatments.

Most emphasis has been placed on the groundline area of poles because this is by far the most critical area for decay and insects. Above ground maintenance will also be discussed later in this paper.

Wood pole timber is relatively scarce because poles are taken from some of the best timber we have. It is a waste of one of our best natural resources to allow a few cubic feet of decay, usually just below groundline, to deplete the supply of mature trees that can be used for new construction.

NEED. There are ample data available from several sources that prove that poles have to be inspected and should be treated. REA in Washington has good figures on pines and other species. Robert D. Graham and others at Oregon State University have developed excellent information on Douglas fir and the Osmose Co. has released figures on many species of poles and preservatives.

IN-PLACE INSPECTION. A fair number of utilities still have no systematic pole inspection programs; however, because of more stringent safety practices and requirements for reliable systems, the number performing the type of work has greatly

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increased over the past few years.

Over 95% of the inspections being performed today utilize one or a combination of the methods shown in Table 1 (1). Inspection without excavation is poor. Sounding and boring (Table 1, #3) is better than Sound Only but it only finds about 50% of the rejects and decayed poles and often less even when well trained and experienced men are used. Many studies have been made over the years and they consistently come up with the same results.

These types of inspections should be performed every three years.

With Partial Excavations (Table 1, #4) one or two shovels of earth are removed and the poles Sounded and Bored. This gives better results but is still below what most companies will accept. On the other hand, in the eastern part of the U.S. on southern pines and cedars the 6" to 8" Excavation (Table 1, #5) does allow for a good inspection that should find 90% or more of the rejects and most poles with decay. Some bad Douglas fir poles can be missed with this type of inspection because decay patterns are erratic and often harder to detect.

Usually little or no groundline treatment is performed with the partially excavated poles so the inspection cycle shouldn't go more than five years. If all poles found to have decay are excavated to 18" and are internally and externally treated, the inspection cycle could be extended slightly.

Most utility companies are performing the Full Excavation (Table 1, #6) combined with treatment in order to get the most reliable inspection and achieve the best economics by increasing the life of all their poles. This also means that inspections can be performed on an eight to ten year basis. Under Item 6, poles are usually visually checked above ground for defects and, if not rejected, they are excavated, cleaned off with a brush or check scraper and then Sounded and Bored. A shell indicator can also be used in bored holes to check for decay pockets. This is the method most commonly recommended by Osmose.

A relatively new instrument called a Shigometer (2) is proving highly effective in locating earlier decay than has been possible with conventional means in the past. With this instrument, it is still recommended that poles be sounded. A small

Fig. 1. External and internal decay just below groundline on a southern yellow pine pole.

Figure 2. A Shigometer. Pulsed current instrument used to locate decay in trees and poles.

hole is drilled into the pole and if the pole is badly decayed, the drilling is all that is needed. If not, the Shigometer probe is inserted into the pole and as long as there is approximately 27% moisture the meter will pick up signs of early decay. Fortunately, almost all poles with active decay have the necessary moisture present. If fumigant treatments are to be used internally, the instrument is invaluable in determining which poles should be internally treated.

Along with all pole inspections a good visual inspection should be made of crossarms and all attachments. At times it will be necessary to call for a climbing inspection to further evaluate woodpecker holes, split tops and other suspicious items. Bad crossarms are hard to evaluate from the ground. Spar arms on transmission lines have given some companies severe problems and require a good Sounding and Boring inspection.

Most utilities in the south start to inspect poles ten years of age or older and in the north fifteen years of age or older. Since they usually cannot locate poles as they come of age or economically go into each area every year, the system usually takes eight to ten years to cover. Therefore, most poles are at least fourteen to twenty years of age when first checked.

IN-PLACE TREATMENT. If poles are found to be serviceable, a groundline treatment should be applied to the outside for added protection of the outer portion of the pole that contains 90% of the strength. If internal decay is detected, the pole should receive a liquid internal or fumigant treatment. In the case of Douglas fir poles, where experience has shown internal decay to be a serious problem, all older poles should be given a fumigant treatment. The internal fumigant treatments are

Table 1. Comparison of the Types of Inspection Programs.

Type of Inspection	*Cycle*	*Approx. Cost*	*Remarks*
1. Visual & Sounding	Yearly	$.75/pole	Almost worthless. Even misses danger poles. Does nothing to maintain your plant.
2. Visual, Sonic Inspect, & Bore	2-3 Years	$2.80/pole	Finds 40-50% of the bad poles. Caution must be exercised or good poles with shake are thrown out. Should find most danger poles. Does nothing to maintain plant.
3. Visual, Sound & Bore	2-3 Years	$2.00/pole	Finds about 50-60% of the bad poles and most danger poles. Does nothing to maintain plant.
4. Visual, Partial Excavate, Sound & Bore	3-5 Years	$2-$4.00/pole	80-90% of the rejects can be located. Fair inspection but does not prolong the life of pole plant.
5. Excavate 6-8" around entire circumference, inspect and treat to 18" all poles with decay or defects.	5-6 Years	$6-$7.00/pole	90-95% of rejects can be located. Good inspection and most of the poles that would fail early are treated. Usually treat approximately 20% or more of the older poles.
6. Visual, Excavate, Sound & Bore and Groundline Treat	8-10 Yrs.	$9-$12/pole	99% of all rejects are located. Most economical in long run as the life of pole plant is extended.

exceptionally good in that they travel several feet in the pole from point of application. For more information on fumigants, Electric Power Research Institute reports of 1977 or releases from Oregon State University or the Osmose Co. can be obtained.

After inspection and treatment, poles are backfilled and usually do not have to be re-excavated for eight to ten years.

Initial in-place inspections are normally started ten to fifteen years after poles have been installed. American Wood Preservers Association (AWPA) has guidelines on when poles should be checked (3). REA (4) and A T & T also have references on how and when to inspect and treat poles. The only thing missing in most of the references is information on fumigants because they were written before this type of treatment became available commercially.

Poles set in concrete or ones that for other reasons cannot be excavated should be inspected on a shorter schedule (every three to five years) and they should also receive a fumigant treatment, because this is the best way to obtain protection below the groundline. One recommendation for very expensive poles, gas-treated poles, or poles to be set in concrete is that a groundline bandage with good penetrating ability be applied to them when the pole is set to aid the original treatment that might be weak or marginal.

The surface of a decayed pole must be prepared properly before preservatives are applied. Internal springwood decay has to be evaluated before a decision is made to reject the pole or internally treat with penta and oil or fumigants. Insect damage by termites, carpenter ants and wood borers must be located and evaluated. If enough sound wood remains, a 1% solution of chlordane in penta and oil can be injected into the pole through bored holes to eliminate these insects. Fumigants will also kill insects but right now the longevity of these treatments against insects is still being studied.

ABOVE-GROUND. Above-groundline defects like woodpecker holes can almost all be repaired with one or more materials available to pole owners. The OsmoWeld system using epoxy resin and spacer blocks and, at times, reinforcing rods is one method. PoleSplints or similar repairs can also be used on large holes. To avoid damage in the first place, wire screening using a good grade hardware cloth, wrapped tightly to poles on sections of lines showing a high incidence of attack has worked well, although it isn't 100% perfect.

Pole tops can be treated with penta and oil and a Pole Topper applied on systems where older poles have had problems in this portion of the pole. If clearance exists, pole tops can be cut off and then flooded with penta and oil before capping.

REINFORCING REJECTS. If poles are rejected at the groundline, they can be stubbed or reinforced with steel trusses. Why not get another ten to twenty years from most rejects at much less cost than replacement? Reject poles should be checked thoroughly to see that decay has not progressed so far above ground that the bands will not be effective. The poles should be treated internally to stop decay from progressing up and externally below groundline to save the good wood that remains. If proper specifications are written and followed by using professional pole inspectors and treaters, twenty additional years of life can be obtained from a reliable reinforcer. No matter how strong the stub or reinforcer is, it will not hold the wires up if the strength of the wood under the bands is not adequate. Reinforced poles should also be scheduled for inspection and retreatment with the other poles on an eight to ten year cycle.

ECONOMICS. It's important that the magnitude of plant investment be considered. Smaller companies with about 100,000 poles without a good maintenance program expect 25 to 35 years average pole life. This means at a low average replacement figure of $350.00 per pole the turnover is based on 30 years is $35,000,000 or just over $1,100,000 a year. Assuming groundline treating is not started until poles reach ten years of age and 1/10th of the plant is treated each year for twenty years at $15.00 per pole for 10,000 poles, the yearly cost would be $150,000, and, over an arbitrary twenty year period, a total of $3,000,000. When all factors such as compound interest on the money are taken into account, an expenditure of $150,000 per year will save over $1,000,000 a year. Can such savings be ignored?

QUALITY OF WORK. The most important part of an inspection and treatment program is the inspector performing the work. If this man isn't well-trained, properly motivated and constantly improving his skill, many of the benefits from the program will be lost. It takes time, training and motivation to evaluate wood property so that the best use of the supplementary preservatives can be obtained.

CONCLUSION. Wood, unlike many other materials, is not subject to fatigue and can retain its strength indefinitely. Proper pole care by qualified personnel will protect pole owners from having to raise large amounts of money now and in the future for unnecessary line replacements.

The key to getting a good inspection and also keeping expensive and often needless pole replacements to a minimum is the inspector and his supervisor. These men should be experts in their field. Millions of dollars in pole replacements are needlessly made every year by utilities when sufficiently sound poles are put up for replacement by untrained people.

References

1. *1977 Wood Pole Maintenance Workshop*, Extenson Forestry Department, North Carolina State University, Raleigh, North Carolina, "Conventional Methods for the Inspection of Poles," "Extending the Life of Poles In-place — Current Practices."
2. Alex Shigo, Walter C. Shortle and Julian Ochrymovych, "Detection of Active Decay at Groundline in Utility Poles," *Forest Service General Technical Report NE-35*, 1977.
3. American Wood Preservers Association. "Guidelines for Physical Inspection of Poles in Service." Standard M12-72.
4. U.S. Department of Agriculture, Rural Electrification Administration Bulletin No. 161-4, October, 1977.

ABSTRACTS

Barger, J.H. 1977. **Improved sanitation practice for control of Dutch elm disease.** USDA Forest Service Research Paper NE 386. 4 p.

In Detroit, Michigan, 12 plots, each containing about 600 American elm trees, *Ulmus americana* L., were subjected for 3 years to intensive and conventional sanitation treatments to control Dutch elm disease. In the intensive treatment, three disease surveys were conducted each year; each followed by tree removal within 20 working days. In the conventional treatment, one survey was conducted each year, and diseased trees were removed in late fall and winter. Results showed that the intensive sanitation treatment was significantly better than the conventional treatment each year. Arborists should consider the advantage of detecting and removing diseased elms promptly.

Campana, R.J. 1978. **Comparative aspects of Dutch elm disease in eastern North America and California.** Univ. of California Coop. Ext. California Plant Pathology 41. 6 p.

Since 1975, when Dutch elm disease was first reported in California (Pool *et al.*, 1976), elm populations in the state have been under intensive surveillance so that new cases of disease could be detected and eradicated. Comparisons between the two regions are made with respect to hosts, symptom expression, recovery survival, insect vectors, environment, and pathogen. Based on current information the Dutch elm disease in California, in contrast to the East, is likely to be more difficult to detect, slower to kill infected trees, more limited in ability to spread, and more difficult to confirm by culture. Most of the differences noted favor prospects for disease control in California after disease is detected, but others suggest difficulties in ease of detection and confirmation.