# WOOD POLE NEWSLETTER

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# WOOD POLES: HOW LONG DO THEY LAST?

## 30...45...60... 100 YEARS? IT MAKES A DIFFERENCE!

While initial purchase and installation costs remain a key consideration for utilities in the selection of transmission and distribution pole materials, total life cycle costs analysis is becoming a predominate decision criteria. Considering all the costs for the system, including maintenance and replacements, a "cradle to grave" approach helps assure the best decisions are made.

In doing life cycle cost analysis, no variable is more critical than the value assigned to the expected performance life of a product. As the following analysis by Andy Steward of EDM clearly demonstrates, real life data indicates the life of wood systems is significantly longer than is perceived by most utility customers. While more research efforts are needed, the Institute believes it is abundantly clear that the current perceived wood pole life of 35 ± years can be conservatively doubled to 75 ± years for use in life cycle cost analysis where appropriate inspections and maintenance programs are included in the project.

WWPI and the treated wood industry are dedicated to continuing efforts to provide the utility industry with the most reliable wood poles and crossarms possible; and to assure the best scientific information is available for use by the decisions makers.

Dennis Hayward
Executive Director

*"In general, most utilities consider wood poles to have an effective service life of 40 years; however, there is an increasing body of evidence that average service lives may extend to 80 to 150 years where poles are properly specified and maintained."*
-- Dr. J.J. Morrell, Department of Forest Products, Oregon State University, EPRI Workshop: Manufactured Distribution and Transmission Pole Structures, July 25, 1996.

**Need Information on Treated Wood Poles or Crossarms? Call WWPI 1-800-729-WOOD**

# WOOD POLE LIFE SPAN: WHAT YOU CAN EXPECT

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## INTRODUCTION

An essential variable in design and purchase decisions for overhead utility lines is the life expectancy assigned to the various structure options. It is the critical value in life cycle cost analysis. Currently, most utilities assume a 30 to 40 year life expectancy for wood poles but utility experience indicates that the actual life of properly produced and maintained wood poles is significantly longer — certainly approaching 75 or more years of service.

In most surveys, utilities indicate that the primary cause of degradation-induced pole replacement is degradation due to decay in the near-groundline zone. However, review of transmission line operation and maintenance records shows that, when a standard maintenance program is employed, significant deterioration of the condition of wood within the assumed 30-40-year life expectancy is not expected.

Several factors have contaminated life estimates for wood poles. These factors need to be reviewed and addressed before meaningful life-cycle cost analyses can be performed. One such potential contaminate is the data which has been incorporated into service life estimates. For example, life estimates often include poles that have been changed due to system modification — such as line re-routes that have little or nothing to do with line condition. Inclusion of such data in life estimates for poles, especially in urban areas, can lead to significantly under-estimated service life expectancies.

This article examines the relevant assumptions about pole life that have been generally accepted by the utility industry and wood pole manufacturers — and compares them to some real-world case histories. The question is: How long do wood poles last? Several other questions need to be addressed to assess the reliability of the projected life span assumptions:

- Do actual mortality and/or survival data support this assumption?
- Have statistics from a few isolated sources of data been inappropriately accepted as gospel?
- Have wood pole life data been contaminated by factors that do not directly relate to mortality induced by degradation?

These are important questions that should be answered in order for utilities and other users of wood poles to make informed, cost-effective material acquisition decisions.

The premise of this article is that a significant body of evidence exists that supports a significantly longer life for the average wood pole than the 35 years assumed by most utilities in conducting life-cycle economic evaluations of least-cost product alternatives for line construction. Based on the premise that wood pole life is significantly longer than the generally accepted value, it is likely that degradation mechanisms, in addition to near-groundline decay, will become limiting factors in determining pole life. Thus, in addition to examining wood pole life, this review will examine some key considerations associated with improving the life of new wood poles and extending the life of those already in service.

## ASSUMED MORTALITY RATES FOR WOOD POLES

Several utility industry surveys have been conducted in the last 15 years seeking information on the perceived performance of various structure materials used in the construction of transmission and distribution lines. Most of these have requested information on the perceived service life of wood poles. The relevant results of a representative survey are summarized in Figures 1 and 2.

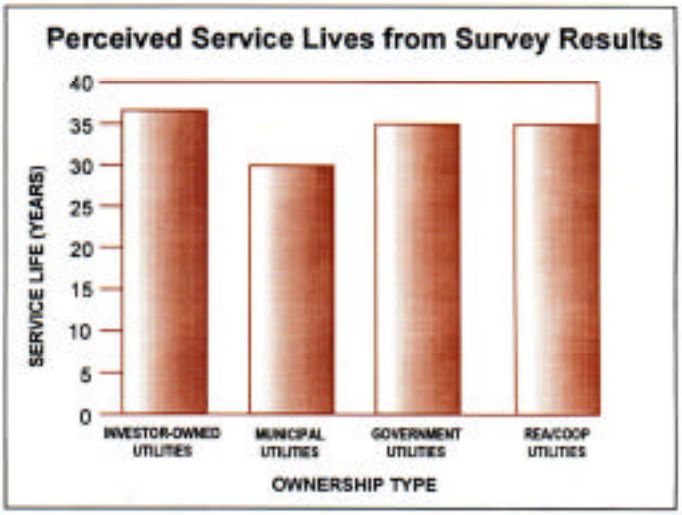


*Figure 1. Average perceived service lives of wood poles in various geographical regions of the U.S. (determined through a survey of electric utility industry personnel).*

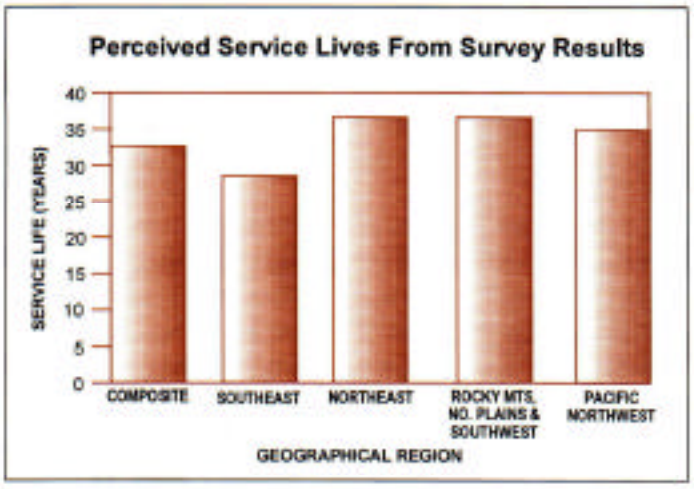


*Figure 2. Average perceived service lives of wood poles within various ownership classifications of electric utilities (determined through a survey of electric utility industry personnel).*

The results of this survey were compiled based on responses from approximately 80 investor-owned utilities, 30 municipal utilities, 15 government utilities and 25 REA cooperatives.

Examination of the results reveals an average perceived life of 33 years. When regional differences are considered, a range of average service lives from 28 to 37 years is observed. The most common reason for pole replacement was cited as "strength degradation due to groundline decay."

For comparison, the following section identifies the percentages of pole replacements that have occurred in several randomly selected wood pole lines based on current line inventory and inspection records.

## INVENTORIES AND INSPECTION RECORDS

Inventory and line inspection data for several transmission lines were randomly selected to evaluate the actual mortality rates for wood poles. The basis for and assumptions used in selecting lines for the evaluations are cited below. Only data that were readily available to the author were incorporated in the evaluation; no attempt was made to solicit additional information to corroborate the results presented herein.

### Assumptions and Justification for Line Selections

**Lines were Selected from Utilities that have Regularly Scheduled Pole Inspection and Maintenance Programs**

The ideal wood pole treatment (i.e. low cost, environmentally-benign, permanently effective treatment ) is yet to be developed. For this reason, it has long been recognized by most utilities that regularly scheduled inspection and remedial treatment of the near-groundline zone is necessary to detect and arrest the progression of decay. In the absence of such a program, decay damage may rapidly progress to the stage where pole replacement is necessitated. Since regularly scheduled programs of pole inspection and remedial treatment have become the norm rather than the exception in the utility industry, only lines that have been maintained with such a program have been included in the evaluation.

To further eliminate the possibility of negatively biasing the data, lines known to include improperly treated and/or improperly sterilized poles were excluded from the evaluation. To avoid positively biasing the data, lines constructed with poles enhanced with pretreatment manufacturing processes, such as through boring and radial drilling, were excluded from the evaluation.

### Data from Cross Country Transmission Lines were Used

It has been observed that several factors are often included in estimates of wood pole replacements and life expectancy that are totally unrelated to mortality due to degradation. This is particularly true for distribution lines and transmission lines in metropolitan areas, especially those adjacent to roadways. Factors other than "normal" degradation that contribute to replacement rates and perceived service life include:

- Utility Line Reroutes/Relocations

  Poles are often replaced due to reroutes/ relocation of lines necessitated by new building construction or road widening.

- Line Upgrades/Additions of Circuits and/or Services

  As increasing demands are placed on the existing infrastructure available for the transmission and distribution of electrical power and telecommunications, it is often necessary to place additional equipment on existing structures. In some cases, the increased structural loads imposed by added equipment cause the load limits specified by codes for particular heights and classes of poles to be exceeded. Therefore, in order to comply with code requirements, utilities will replace overloaded poles with larger class poles. Such replacements will most often have nothing to do with pole condition. Similarly, upgrades can lead to the need for replacement of existing poles with taller poles if the minimum electrical clearances specified by the controlling code cannot be maintained.

- Mechanical Damage Due to Vehicular Impacts

  It is not unusual for poles along roadways or in parking lots to be replaced due to abrasions or breaks caused by vehicular impacts. While this type of damage results in a physical failure of the product, it should not be confused with failure due to "normal" degradation (e.g. biologically-induced degradation) of poles.

**Lines in Woodpecker Prone Areas were Avoided**

Woodpecker damage is known to be a predominant cause for pole replacement in a small number of regions of North America. To avoid biasing the mortality data for the limited number of areas where woodpecker damage is the primary cause for pole replacement, inspection records for candidate lines were reviewed and lines found to contain significant woodpecker damage were excluded from further study. This approach is not meant to downplay the importance of woodpecker damage. In certain areas of North America, woodpecker attack can be very aggressive and rapidly degrade the strength of poles. However, this type of severe damage is limited to a relatively small percentage of the overall population of poles.

It is reasonable to exclude all of the aforementioned factors from estimates of wood pole mortality as these factors are anomalies that lead to premature replacements. With the exception of woodpecker damage, these same factors would contribute to premature replacements of poles manufactured from any commonly used materials. To avoid complications in interpreting and judging the reasonableness of data from various types and locations of utility lines that may have been contaminated by the aforementioned factors, only cross-country transmission lines were considered in the evaluation of pole mortality.

Five transmission lines were randomly selected from three different utilities systems in order to evaluate the percentages of poles that have been replaced since the date of line construction. Table 1 presents the statistics for each of these lines.

**Table 1. Pole Replacement Statistics for Five Transmission Lines**

| LINE NUMBER | AGE OF LINE (YEARS) | LENGTH OF LINE (MILES) | ORIGINAL POLES STILL IN SERVICE (%) | REPLACEMENT POLES (%) |
|---|---|---|---|---|
| 1 | 32 | 100 | 98.6 | 1.4 |
| 2 | 42 | 80 | 97.0 | 3.0 |
| 3* | 45 | 12 | 85.7 | 14.3 |
| 4* | 57 | 10 | 83.2 | 16.8 |
| 5* | 57 | 13 | 100 | 0 |

A groundline inspection and remedial treatment program was not implemented for these lines until approximately 10 to 15 years ago.

## DISCUSSION OF SERVICE LIFE DATA

Comparison of the perceived service lives of wood poles in Figures 1 and 2 to the actual pole replacement data presented in Table 1 reveals some very significant differences.

If the average service life for a wood pole is close to the 33 years determined from the survey, it is reasonable to expect that more than 50% of the poles in lines in excess of that age would be replacements. However, the actual line inventory data selected for the study reveals that nowhere near that quantity have been replaced. The 33-year average also conflicts with the results of the experience of many utilities that have adopted regimented programs of inspection and remedial treatment of wood poles. Most utilities that regularly inspect and remedially treat their poles on a typical 10-year cycle state that they are experiencing replacement rates ranging from 2% to 4% of the inspected poles and that this replacement rate represents a steady-state condition as long as they stick to their maintenance program.

Given that this is truly a steady-state replacement rate, how long should the average wood pole last in a utility line that is inspected and treated on a 10-year cycle, starting after the line has been in service for 20 years?

If it is assumed that the average service life is represented by the age when 50% of the poles have been replaced, then the range of average services lives is found to be from 135 to 260 years for the 4% and 2% replacement rates, respectively. While this range may seem surprisingly high, it is probably not unrealistic if groundline degradation is the only cause for pole replacement and this mechanism is controlled through remedial treatment. Unfortunately, as poles age, other degradation mechanisms will come into play that will affect their service lives. Typical inspection and maintenance programs are not currently geared toward controlling these types of degradation. Thus, maintenance practices will likely need to be modified to address secondary mechanisms of degradation.

## EXTENDING AND ENHANCING THE LIFE OF POLES

If wood pole life is significantly longer than the perceived average of 33 years, it is likely that factors other than groundline decay will come into play in limiting life. To help ensure that extended lives can be achieved, new maintenance practices will need to be developed and implemented to address degradation mechanisms including:

- Pole top decay (stove piping)
- Decay at connections
- Splitting of pole tops
- Excessive weathering

Opportunities also exist to improve the cost-effectiveness of remedial treatments currently used to control decay at groundline by extending their effectiveness and automating their application.


*Full scale tests of 62-year old 115kV H-frames at Nebraska Public Power District (conducted by Engineering Data Management, Inc. and Hughes Brothers, Inc.)*

## SUMMARY AND CONCLUSIONS

While the evidence evaluated in this study is inadequate to definitively establish how long a wood pole will last, it is adequate to raise serious questions about the prudence of the current practice of using the relatively short service life of 30 to 40 years in life-cycle cost analyses. When actual line inventories and inspection records are studied, significantly longer projected service lives are indicated.

Utilities are encouraged to carefully consider this issue and review their own data; it may not be out of line for many operating environments to use an estimated average life for wood poles of more than twice of that which is often assumed in life-cycle analyses.

More investigation is needed into actual service life experience. Manufacturers, users and researchers are encouraged to take a closer look at this issue. Objective, uncontaminated data are needed to reliably project expected service lives for wood as well as alternative material poles.

**Decisions based on perception rather than actual experience can be very costly!**