DETERMINING LINE CLEARANCE NEEDS AT WISCONSIN POWER AND LIGHT COMPANY

by Terry K. Smith

The goal of any utility company's line clearance program is to maintain a reliable system at a reasonable level of cost. The catch to this goal emerges when definitions are attempted for the words "reliable" and "reasonable." In the electric utility industry, this attempt has been a struggle for many years. Each company has its own unique line clearance problems. Far-ranging generalities cannot possibly apply to all tree maintenance programs. Differences in the percentage of urban versus rural lines, differences in the extent of agricultural lands and heavily forested areas, differences in tree species and even weather patterns force these utilities to focus mainly on their own specific tree problems.

Analyzing the line clearance needs of a single utility company is not, however, an easy task. Companies with an extensive service territory may find as much diversification internally as there is between companies hundreds of miles apart. The Wisconsin Power & Light Company has for several years been attempting such an analysis and has met many of the classic roadblocks associated with finding meaningful information. Recent strides have been made, however, in gathering data which finally begins to show the impact of the line clearance program over the past 12 years.

The most elusive characteristic of the WPL tree maintenance program has been finding a recognizable trend in the system reliability as it relates to line clearance expenditures. The entire investor-owned utility industry has been faced with this problem due to the contractor-intensive nature of these expenditures. These highly visible maintenance dollars have been used quite often as a safety valve to hedge against lean financial times. Trimming and brushing cycles, chemical brush control programs and specific line clearance plans are difficult to maintain or even establish when spending patterns are erratic. WPL is no exception to this reality. It is important to look at the changes that have occurred in the line clearance program and to point out the areas which have proven to provide meaningful information.

In the early 1970s, determining a reasonable level of line clearance expenditures was an especially difficult task. Guesswork was unfortunately a large part of this process, along with using the interruption reporting system. Definite needs were known in some specific areas of the Company, but an overall view of the Company's needs was not available. System reliability with respect to tree-caused problems was decreasing (Figure 1), and in 1976 a devastating ice storm brought WPL to its knees. Most of the customer-hour outage problems were related to the extensive quantities of brush and tree branches on the ground inhibiting restoration crews from getting to the downed lines.

The 1976 ice storm experience brought the line clearance problems of WPL into sharp focus. Information was needed to assess total Company line clearance needs. The tree maintenance budget was, therefore, increased substantially over the next few years. A utility forester was hired to gather data on line clearance and to more closely follow contract and Company tree work.

The general direction of the line clearance program through the later 1970s was toward reducing the volume of trees contacting electrical conductors. However, it was recognized that to determine the *reasonable* line clearance needs of the Company, a survey would be necessary. Thought was given to outside contractor surveys of the system. At a considerable expense, such services do exist. However, looking to in-house sources seemed the more practical approach. Existing line clearance personnel were the logical choice, as they were both experienced in line clearance techniques and were more familiar with the specific service area residents and tree problems.

To be of value, a survey system must not take too much time to complete. In addition, it must fulfill the informational needs of the Company

without providing more data than can be practically analyzed or used. In 1976, a district was chosen to serve as a survey test area. A practical survey method was to be developed that could be applied to all WPL districts. The local WPL Chief Line Clearance Technician surveyed this entire district to determine an estimate of the man-hours necessary to obtain adequate tree clearances. After completion of the survey, a line clearance budget was allocated to perform the estimated work. The work was completed with the assistance of several contract tree crews and actual expended man-hours were then compared to the estimates.

The results of this test survey and study revealed several important points. It was confirmed that WPL line clearance personnel are the best choice for predicting tree work man-hours for the various tree maintenance operations. The actual man-hour totals of tree work for this project were within 15% of the predicted hours. This availability of an in-house force for measuring the potential magnitude of tree maintenance work would be a valuable asset. The entire WPL service area could be surveyed to determine an overall picture of potential line clearance problems.

The survey system itself was not time consuming. The Company implemented the survey program in 1981 and most districts completed this survey in 2-3 weeks. All 16,000 miles of overhead distribution lines were checked. Each district utilized the WPL switch diagram map system to indicate the location of each major tree problem and noted the critical year the work should be completed (within three years). Running totals were kept of the estimated man-hours for each type of tree operation (trim, brush, or combination) by year and totaled for each map unit. The completed survey thus yielded an estimate, in man-hours, of the work necessary to maintain adequate tree clearance based on previous work done at each problem location and current tree growth conditions.

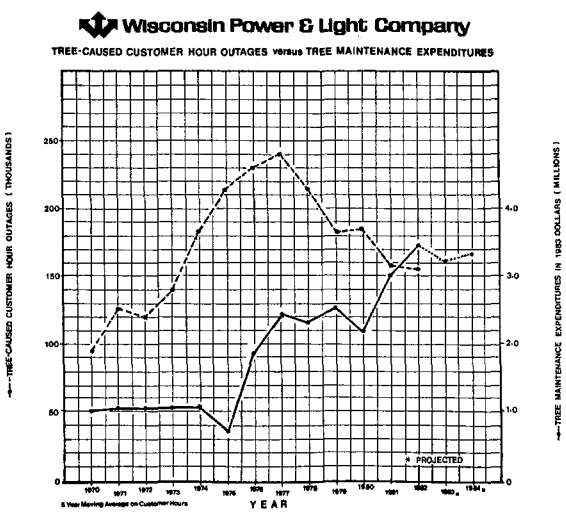

Figure 1. The 12-year customer-hour outages versus tree maintenance expenditures at Wisconsin Power and Light Company.

Using this survey method, the WPL districts and the entire Company now had the ability to estimate their present and future line clearance needs and to set priorities on critical tree problem locations by year, as well as by line clearance method. Using the man-hour totals for each year, a simple conversion could be made to show dollar amounts for budgeting purposes. These amounts would reflect the work needed to maintain integrity of the system.

This line clearance survey has greatly enhanced the planning ability of the WPL districts. With the ability to plan more effectively, the field personnel can consolidate yearly critical tree work in advance and better manage contract crew size, type and location. Crews designed for each line clearance operation, be it trimming, brushing, combination work or mechanical brushing, can be localized to reduce needless travel time. The switch map system can be further utilized to study contract crew productivity. In addition, by predicting yearly workloads, the districts can better utilize contractors over future years to help maintain key contractor personnel, a proven asset to WPL.

Several noteworthy benefits of the survey emerged after its completion. Many line clearance personnel expressed the feeling that they felt renewed interest in the Company tree program. Taking part in gathering this useful information made them feel more a part of the total Company program. Field managers and operating personnel felt more confident in expressing their line clearance needs to the Company management, now that meaningful data (on paper) were

available that supported their needed requests. Improved records now existed of the tree problem area locations. They felt a sense of accomplishment seeing their own district plans emerge in more detail. Most of all, Company management was listening more and more as these needs were brought into focus.

WPL has been able to obtain meaningful information about their current line clearance situation through surveys. This has given the Company a starting point from which to *attempt* to find a reasonable level of line clearance expenditures and a satisfactory level of reliability. The task gets harder from this point. Two ideas need to be discussed in order to put the goals of a line clearance program into perspective. These ideas are *need assessment* and *reliability.* Going hand in hand, these concepts must be dealt with in a practical common sense manner. The district has the responsibility of assessing the extent of reliability necessary for that area. The district personnel are the best qualified to address local needs, priorities of service and public acceptability of this service. With priorities thus set, assessment of needs, such as line clearance, can also be prioritized, estimated and put into dollar terms.

After each district has assessed the needs in dollar terms, the Company can total these requests and can evaluate the volume of these needs. Each district should be aware of how the Company evaluates these requests. The need, as determined by the districts, should reflect a cost-conscious level of spending. The Company must then evaluate these need requests based on the current earning picture. The reality of using maintenance dollars occasionally as a financial safety valve must be kept in mind.

The key to the success of any utility line clearance program is proving that the program can impact system reliability. Data to provide this proof are not easily obtained. The source most often used to attempt verification of this impact is the Company outage reporting system. Most utilities have such a system. A printout or report ultimately is available showing cause and duration of these outages. However, these records can only be used to a limited extent due to the large impact of storms on outage problems and the resulting cloud of doubt cast on the accuracy of the reporting system. Because of these doubts, trends in reliability, as related to line clearance expenditures, may not appear through normal analysis. Data must be qualified. Major storm data may need to be removed or various forecasting techniques used to smooth out the peaks and valleys of "bad" or "good" storm years. Line clearance expenditure figures may need to be normalized for inflation over the years. Man-hours of actual work might be a better source for analysis than expenditures.

The main point to discuss here is that each utility forester or right-of-way maintenance manager must attempt to find a way to evaluate the impact of their line clearance program. Accurate data are, of course, the best way to show this impact (negative or positive) *if it is available.* However, other sources do exist which demonstrate that a program is having an effect on a system. Verbal comments and written statements from field managers, operating personnel, or trouble and service personnel may well prove to help substantiate program results or needs.

At Wisconsin Power & Light, many of these techniques have been used to help show cause and effect. Only after many years has a meaningful trend emerged. Figure 1 graphically shows the 12-year customer-hour outage picture as compared to the line clearance expenditure picture over the same period. Some interesting observations can be made from this graph. Reliability relating to tree outages was definitely on the decrease through 1977. Even though substantial increases in the line clearance budget were made in 1976 and 1977, impact of this program was not felt until 1978. This trend supports the theory held by many WPL field offices that a large effort was needed to recover from the 1975 cutback in maintenance spending and the 1976 ice storm. It should be reiterated here that most field offices held to this theory, showing that even though they did not have supporting (written) data, the need did exist. This shows the value of accepting, at least partially, the knowledge or gut feelings of the field personnel in analyzing line clearance needs.

The last question must now be asked concerning the optimum level of line clearance expenditures. In the case of WPL, some cause and ef-

fect was finally observed in the impacting of system reliability. Our customer-hour outage picture is continuing to improve with an increasing level of tree maintenance expenditures. However, can WPL justify reducing these outage hours any further? Can we justify maintaining the current level of reliability?

Most utilities will agree that trimming all trees contacting all lines every year cannot be cost-justified. Newly developed equipment, more effective herbicides and more detailed tree trimming plans can and will aid in making line clearance programs more efficient. However, as history has shown, maintaining a consistent program can be a balancing act between good and bad financial years. The definition of an *adequate* level of line clearance spending, like that of a definition of *reliable* service, must not be too limiting. Flexibility is a necessary part of arriving at these definitions. Intangible costs may become tangible costs depending on the circumstances. Analysis must be made of *qualified* available data, keeping in mind the differences between field areas. Reassessment of need may be necessary if the actual spending picture changes.

At WPL, knowing the extent to which the line clearance program has impacted system reliability, we are now in a position to choose a direction for the program. At the current spending and reliability level, the majority of our districts feel that headways have been made in line clearance planning and in meeting their individual reliability needs. The general feeling is that WPL does not need to increase the level of spending above the current volume. Projections will now be made on future need assessment, keeping in mind possible changes in the tree growth rate, the financial picture of the Company and the district-by-district feel for reliability. Armed with this knowledge, we will strive to be responsive to the needs of the Company and the public.

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ABSTRACT

VERKADE, S.D. and D.F. HAMILTON. 1983. **Getting to the root of urban tree problems.** Am. Nurseryman 158(4): 65-66.

The distribution of roots has traditionally been thought to extend only to the vicinity of the circular "drip line" of the tree. However, root systems can extend to areas four to seven times larger than that outlined by the drip line. This is important to remember, because root distribution affects many cultural considerations for woody landscape plant growth, including those related to fertilizer applications, root loss during digging, and root damage in the landscape. About 15 percent of the total plant mass consists of large transport roots. Five percent is made up of feeder roots for nutrient and moisture uptake. The remaining 80 percent is attributed to the above-ground portions of the plant. If part of the roots are critically damaged, a proportionate section of the folar part of the tree will decline and die. Feeder roots grow upward from their point of attachment to small transport roots near the soil surface. Roots grow along the surface, because oxygen is limited in the low levels of the soil. Even the roots of plants on sloping land grow along the soil surface. Much can be done to increase the success of urban plantings if the sensitive and specific needs of roots are considered during landscape planning, installation, and maintenance. Such measures can extend the life-span of trees placed in urban environments.