DISTRIBUTION LINE TREE-CAUSED DISTURBANCES[1]

by James R. Shriver

Abstract. One of the primary functions of utility arborists is the supervision of tree maintenance along distribution lines. While distribution systems vary widely from one utility company to another, the underlying reason for tree maintenance expenditures is universal throughout the industry. Trees must be controlled.

Utility arborists must continually make decisions regarding the placement of tree maintenance crews. Tree maintenance must be performed in those areas that have the highest potential for future tree-caused interruptions. Accurate identification of these high priority areas is the key to crew scheduling that will consistently make optimum use of available tree maintenance dollars.

Organized reporting and analysis of tree-caused disturbances is one means of identifying high tree maintenance priorities. The utility arborist armed with a disturbance reporting system, a measure of common sense, and a first-hand knowledge of field conditions is capable of making consistent "on target" decisions when scheduling tree maintenance crews.

Crew scheduling is one area of decision making encountered by utility arborists and foresters with greater frequency than any other. For some, it involves a daily selection of work locations that will encompass tree maintenance expenditures of thousands of dollars. In the course of one year, millions of dollars may be spent on the basis of those decisions.

Distribution line tree maintenance crew scheduling by priority has been used by the Metropolitan Edison Company since 1972. The methods developed over a period of years. During the late 1960's, emphasis was placed on tree maintenance by circuit rather than "spot maintenance." The Division Foresters were required to choose the circuits that needed tree maintenance. This determination was usually made by sampling interruption information and by evaluating conditions found in the field. Circuits with large numbers of interruptions and poor tree clearance were selected for tree maintenance first.

By 1971, the concept of tree maintenance by circuit and selection of circuits on the basis of their tree-caused disturbance history, appeared to be fairly successful. However, two problems surfaced during these initial years. First, Met-Ed had no suitable means of verifying the success or failure of this new concept. Second, there was no means of proving the accuracy of circuit priorities established by the Division Foresters. We felt that we were on the right track but had little evidence to prove it.

Questions concerning disturbances surfaced during rate relief proceedings and supporting documentation was not available. The "age of accountability" had arrived and opinions based on past experience were no longer acceptable unless supported by statistical data. A critical need had developed for detailed information regarding all types of distribution disturbances, especially those caused by trees.

In 1972 the Metropolitan Edison Company established a disturbance reporting system that now provides the information needed to answer questions about several phases of operations. This reporting system consists of steps that are performed after completion of a field investigation of each disturbance or interruption. Each disturbance receives an identification number with all pertinent information for the disturbance recorded and subsequently key-punched into the computer data base.

The Division Foresters at Met-Ed are furnished a programmed report listing all tree-caused interruptions that occurred in their operating area. The interruptions are listed chronologically for each distribution circuit that experienced one or more tree-caused disturbances during the time span requested for this report (usually a six or 12 month period). For each interruption the circuit number, disturbance number (assigned), date, start time, map coordinates, and nearest pole number are shown. Several additional columns of information follow which describe the nature and severity of each interruption.

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The column *Cause* contains a three digit code representing one of five different categories, i.e., exceptional tree growth, tree accidentally felled, tree felled by natural causes, ice weighted trees, or wind blown trees. Various codes are used to indicate the type of conductor that was involved, thus allowing comparisons between the various types of wire, voltages, etc. The *Response* column represents a brief description of the condition of the electrical equipment or facility that failed as a result of the interruption. This detail is essential for accurate recording of customer interruption time. The column *Duration* is the number of minutes the interruption lasted. The *Number Customers* column shows the number of customers interrupted. The column *Weather* contains a single digit code representing one of three weather types experienced at the time of the disturbance (normal, adverse, or disaster).

How does this detailed information relate to tree maintenance crew scheduling? Obviously, the information must be condensed into a simple format that permits comparisons between circuits. Priority circuits must be developed from the information supplied.

The Foresters at Met-Ed developed a formula for calculating a numeric index that best described the need for tree maintenance on each of the circuits within the four operating divisions. The formula reflected a realistic picture of what we knew to be true in the field. Of all the information made available by the disturbance report, two factors stood out as effective indicators of tree maintenance needs, the number of disturbances and the number of customer minutes of interruption.

Circuits frequently interrupted by trees were found to have poor tree clearance throughout and high potentials for future disturbances. Circuits with relatively few interruptions occasionally affected large numbers of customers for long periods of time.

The advantages of this crew scheduling concept are becoming apparent as Met-Ed accumulates historical information regarding tree-caused disturbances. Given stable budget levels, production efficiencies, and consistent crew scheduling techniques we can now measure the overall performance of our methods in achieving the goal of maintaining reliable service to the customer. Fluctuations in reliability will occur due to variations in weather patterns, but over a period of time the effects of weather will balance out and a normal level of reliability can be established. If this reliability level changes over a period of years, budgets, inventories, and work efficiencies can be reviewed and rational conclusions drawn as to the performance of the tree maintenance program.

Crew scheduling based on disturbance history has served in developing more equitable budgeting between operating areas. The disturbance data accumulated for each of the four operating divisions has pointed out areas where tree maintenance dollars are needed most throughout the system. Those divisions with the highest tree-caused interruption time per customer receive a larger propertion of available money as budgets are formulated.

Since all Met-Ed customers pay the same rate for electricity consumed, it seems fair that each should enjoy the same or a similar quality of service. This principle is true for customers within a division of Met-Ed as well, and here is where crew scheduling by circuit comes into play. Circuits with frequent and/or severe interruptions due to trees are scheduled for tree maintenance first, thereby reducing the potential for future disturbances. This "worst first" principle effectively prevents the occurrence of chronic tree-caused disturbances involving the same customers each time. Tree related interruption time is equalized between operating areas and individual customers.

Another advantage is the ability to monitor optimum tree maintenance cycles. Distribution circuits vary in length, tree exposure and load characteristics. Some require tree maintenance at intervals of two years while others require maintenance once every five or six years. Disturbance reporting by circuit enables the arborist to view a gradual rise of tree-caused interruptions during the time after maintenance has been completed. The time required for interruptions to return to significant levels will determine optimum maintenance cycles.

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