COMPUTERS AND DISTRIBUTION TREE MAINTENANCE PROGRAMS [1]

by Eric Ulrich

Most utilities measure their tree maintenance programs by units of work produced. Whether the units are the number of trees trimmed, acres of right-of-way maintained, number of loads of wood chips produced, pole spans of line maintained, or a combination of these and other units, one thing is certain — somebody has to sit down, add them up, and interpret or measure the volume of work produced for the money spent.

Met-Ed had a manual system of recording work unit production starting in 1956. In 1972 we developed a small computer program to replace the manual system. The computer has allowed greater detail and evaluation using similar data to the previous manual system with simpler and less time-consuming time sheets, invoices, and divisional reports. The obvious success of the first program prompted us to develop a new larger computer program to even further simplify the field accumulation of data and expand the detail of production reports. It is an effort to better measure our work requirements and determine the most efficient methods and contractors available to complete those work requirements. The interface of these reports with disturbance reporting (tree-related reliability), line mileage reports (miles of completed tree maintenance), and budgeting (money required vs. money available) provides optimum management of our distribution tree maintenance program.

Manual system

Met-Ed started recording and reporting tree work units by the appropriate man hours of effort on a company basis in 1956 and 1957. By 1958 the system was standard and working in all divisions of our company. The work units being completed were itemized on daily time sheets by the contractor's foreman. The foreman also listed the man hours required to do those number of work units. The work units reported were the number of trees trimmed and the number of trees

removed. Most of the man hours were thus associated to those two units of production, with brushing man hours shown separately. A separate daily time sheet was required for different account numbers, i.e., distribution 593.2, transmission 571.2, and a separate account number for each capitalized or new construction work order. Composite weekly time sheets were also made from the daily time sheets for each account number. This required that a foreman submit from 6 to as many as 15 individual sheets (when doing several small work orders) to itemize the work completed by the account number charged. The contractor's invoices for the work completed were rendered weekly and with separate invoices for each account number. This normally required only one invoice weekly but occasionally required from 3 to as many as 8 or 9. Some contractors also required their crews to fill out separate contractors' time sheets to pay the men and track vehicle, equipment, and material use. The manual system was slow, required a lot of paper and bookkeeping, and was not very detailed, but it worked and provided a good analysis of production by division and contractor.

First computer system

In 1972 the manual system of work unit production logging, reporting, and analysis was put on a small computer program to simplify and expand the analysis reports. In order to make the desired changes in the analysis, we had to go back to where the process begins, the time sheet.

A new time sheet was the result of a combined effort on the part of the contractors and Met-Ed. The objectives were (1) to minimize the number of sheets of paper to be filled out by the foreman, (2) report all desired work units, (3) fix all man hours to work units or specific billing functions, (4) associate all costs to those work units or functions, (5) apportion all work to specific account

numbers, (6) pay the men, (7) track truck, equipment and materials used, and (8) record daily work locations. The result was a one-page weekly time sheet. Although admittedly crammed with information and appearing difficult and confusing, the time sheet was relatively simple, very well accepted, and surprisingly, accurately completed, by the foremen.

The next step was to have the contractors summarize the information on invoices. The multiple invoice concept was finally scrapped for a duplicate invoice system. Two invoices were submitted for a week's work with one giving the itemized man hours and costs by classification, truck, equipment, and materials as used and being billed to produce a total cost for all of the work done in a week. The second invoice, attached to the first and labeled "NOT TO BE PAID," itemized by appropriate account numbers, the man hours and all associated costs incurred to complete the itemized work units completed.

The last step before developing the program was an input document or report form. Four or five weeks of work were manually compiled by the division foresters from the invoices (upon approval as correct and to be paid) and listed as to division, work type (account), contractor, foreman, and crew type. This portion of the new system was far improved in that only 3 sheets of paper were required to provide expanded and more detailed information compared to from 7 to as many as 24 company-required time sheets and invoices necessary in the old manual system. A year's worth of work used to fill a whole file drawer per division and now occupied only 2 or 3 inches of file space.

The reports (input document) were submitted monthly by division and typed directly into the program. The program provided each division with monthly divisional reports that analyzed each crew and each contractor by all the work units completed. Total company corporate management reports compared work types, contractors, crew types, and divisions by the work units completed. Within a very short period of time, both problems and good points became quite obvious and management decisions were made to correct or expand those obvious points.

The division foresters also know which crews with what make-up of what contractors produced work for what cost.

New computer system

The new system will not substantially affect the contractor's time sheet although some minor revisions were needed to incorporate the line circuit number. The invoices likewise required very little change other than the inclusion of the detail of work unit production itemized one step further to line circuit number. The input document completed by the division forester from the invoices has been changed substantially. Instead of manually compiling totals and listing them on a report form, each account number (work type), by line circuit, foreman, and crew type is a direct entry from the invoice onto the input document. Each line entry is keypunched on an individual computer card and becomes a single entry into the program. The program thereby eliminates all manual compilation of data from the division offices and allows our division foresters more time to be out in the field supervising their crews.

Of the total number of invoices submitted to us by our contractors, about 90% are computer derived and 10% manually calculated. The larger contractors have computers available whereas the small contractors manually itemize the work units and associated costs on their invoices.

Interfacing the computer reports with the distribution program

Contractor crew efficiency is the first and most obvious benefit of the program. Each division forester can follow the efficiency of each crew of every contractor on a month-by-month basis. The divisional monthly reports are intended to help the division forester spot crews that may need closer supervision. Monthly reports only indicate areas that may need attention, while quarterly reports usually indicate a trend. Semi-annual and annual reports indicate a pattern of work productivity. It is important therefore to react to potential problems on a monthly or quarterly basis, before a pattern of poor efficiency or high cost is allowed to surface over a long period of time.

On a company-wide basis, corporate management reviews the company reports that compare contractors, work types, crew types

and divisions. Again the short-view monthly reports only indicate trends while the quarterly, semi-annual and annual reports indicate patterns.

Whether analyzing these reports on a division basis or on a company basis, it is important that the geographical, topographical and arboricultural differences within the company's operating divisions or areas be well known. Differences are obviously expected between divisions, work types and crew types and to a lesser extent between contractors. The importance of these reports is the ability to question the patterns of significant inefficiency or costly operations and make wise management decisions based on the experience of productivity.

We perform tree maintenance by line circuit on our distribution system. In so doing, we have an accurate record of the miles of lines where tree maintenance has been performed. Each quarter, the divisions report the miles of line circuits completed. The annual total miles of line completed when divided by the total miles in the division indicates the "cycle" of tree maintenance at which they are maintaining their lines. The company totals obviously reflect the Met-Ed tree maintenance cycle for any given year.

By relating the production of our tree maintenance efforts from our computer reports to the miles of line completed, we can determine the average number of tree work units that have been accomplished per average mile of line. These figures vary widely from division to division, with our rural farmland division averaging about 40 to 50 trees per mile and our heavily forested division averaging about 150 to 180 trees per mile. The company average for the last five years has been 87 trees maintained per mile.

When company budgets for tree maintenance are designed, an accurate forecast of the man-hours required to accomplish the tree work units for a desired tree maintenance cycle can be readily determined. These forecasts are thus based on our actual experience rather than a good "guestimate." Each division can likewise be given their proportionate fair share of the money based on the miles of line that each must maintain and the number of trees that can be expected to be maintained so that each division has an equal opportunity to accomplish the designed tree maintenance cycle, which at Met-Ed is set at 4 years.

Which lines get tree maintenance first? The answer to this question on Met-Ed is — the worst! Each interruption of service to customers is put on a computer program called the "Disturbance Reporting System." The cause of the disturbance is coded as to wind, vehicle, tree, ice, animal, etc. A special report of all tree-caused interruptions lists those disturbances by line circuit number. A formula that combines frequency (the number of times the line is interrupted) and severity (the number of customers affected by interrupted service) is used to determine the worst line in a division on a semi-annual and annual basis. Each division works the worst line circuit first, second worst second, and so on down the priority list of line circuits that have experienced tree-caused interruptions. This practice has leveled off an ever-increasing number of tree-caused disturbances over the past 3 to 4 years with indications for decreases expected in the near future.

The line circuit analysis report is basically built as an historical reference to accomulate the work load requirements of individual circuits. The work units and man-hours experienced over a 4-year period on a line circuit can be accurately forecast as that which may be required to complete that same circuit on the next maintenance cycle.

Summary

A computer is an excellent tool for the accumulation of tree work unit productivity. The programmed reports provide relevant information that is detailed enough to provide insight into the requirements of the distribution tree maintenance program yet is general enough to be easily understood by the supervisors and utility managers responsible for tree maintenance and line reliability. The work unit productivity from the programmed reports provides a base of experience upon which management decisions can be accurately made.

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