

Abridgment

Arizona Department of Transportation Highway Maintenance Management System

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The Arizona Department of Transportation has modernized its first-generation highway maintenance management system by utilizing microcomputers at the crew level. Maintenance crews now develop their own annual work plans, which results in much more realistic plans than had been prepared and imposed by the central office. In addition, management reports are available to crew supervisors on a much more timely basis. The new system, the changes made to achieve it, and the advantages obtained are outlined.

The Arizona Department of Transportation, with the assistance of Burke & Associates, Inc., has designed, developed, and implemented a series of major improvements in its first-generation highway maintenance management system, called PeCoS.

Like the initial system, the new system—PeCoS II—is used to plan, budget, and control highway maintenance operations. Some elements, such as activity performance guidelines and highway feature inventories, are the same as or similar to PeCoS, but a number of major improvements are reflected in the new system:

- The new system resides on microcomputers in each maintenance area and most crew offices, which allows field managers direct access to and control over their work programs and other work planning data.
- The responsibility for maintenance work planning and control has been decentralized. Field managers now have greater latitude in defining work needs and in developing work programs.
- The central maintenance office staff, instead of having primary responsibility for work planning, act as technical advisers to the district and area staffs.
- Planning values have become more flexible. Allowances are made for regional variations to reflect legitimate differences in material prices and in how work is performed in various parts of the state.
- The maintenance management computer programs have been rewritten to provide managers at all levels with more convenient and timely access to management information.

- Differences between “PeCoS” dollars and “real” dollars, as they appear on budgets and cost reports, have been minimized through the use of parallel costing methods and a reduction in the number of separate reporting documents. The use of statewide average rates for planning and budgeting was eliminated in favor of rates that more accurately reflect local maintenance costs.

This report provides an overview of the new system and highlights the major benefits of the new system.

OVERVIEW OF SYSTEM IMPROVEMENTS

PeCoS II represents the state of the art in maintenance work management techniques and supporting computer software. Its most significant innovation has been to place maintenance work planning in the hands of the field managers who must make the day-to-day operational decisions regarding specific work needs, priorities, and crew assignments.

System Components

Figure 1 is a schematic diagram of the major system elements. They are grouped into the following categories:

- *Work planning elements* consist of the actions needed to develop appropriate plans and budgets, including definition of service levels, resource needs, and funding requirements for each activity.
- *Work scheduling elements* include monthly work calendars and weekly crew schedules.
- *Work reporting elements* include daily work report entry, processing, and file maintenance.
- *Work control elements* consist of management reports that are available from the local microcomputer as well as the mainframe.

Figure 1 also shows the interfaces with other systems, including pavement management, payroll, equipment management, and materials inventory management.

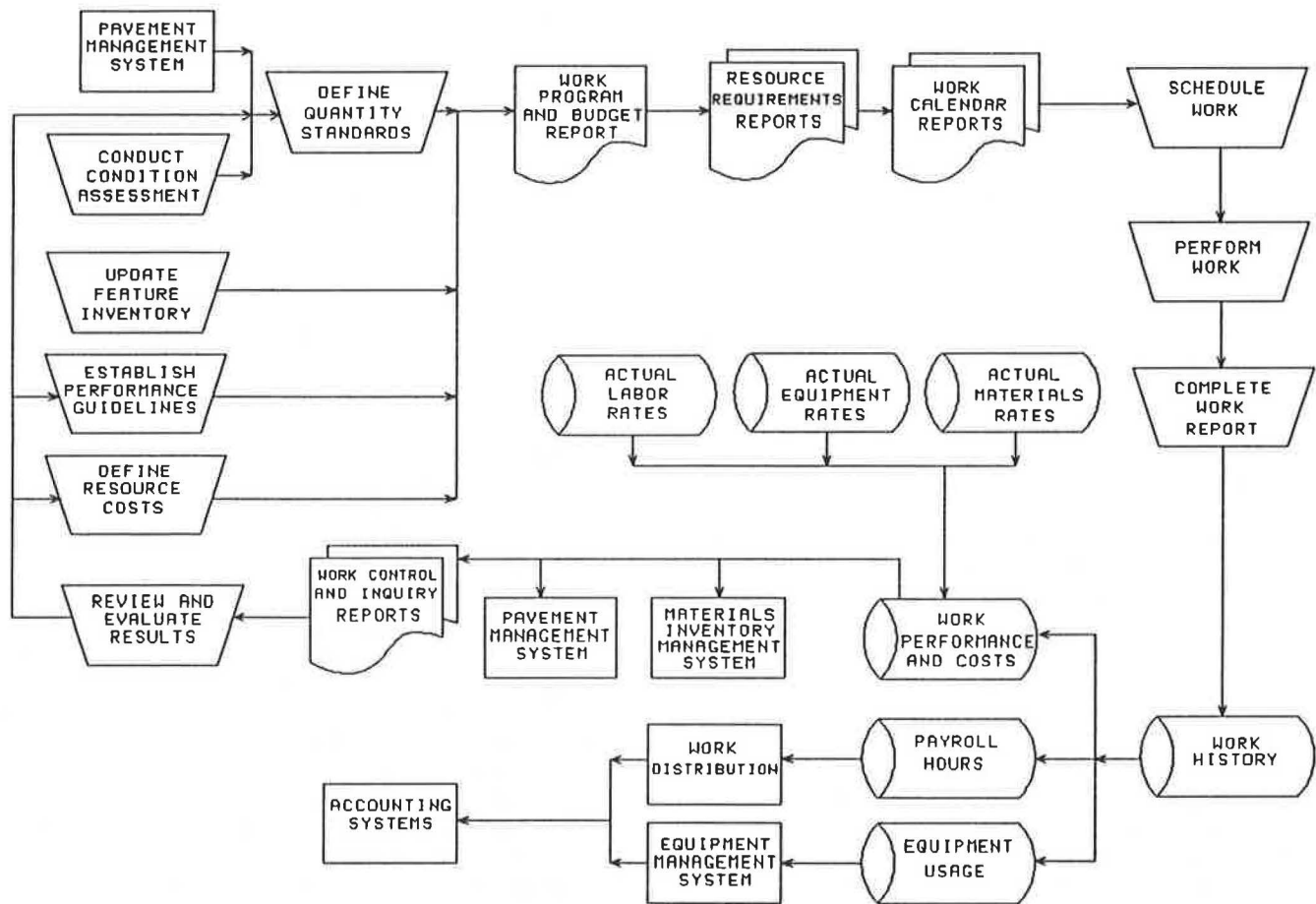


FIGURE 1 Major system elements.

Summary of Modifications

Fourteen major modifications were made to PeCoS:

1. Each area has been assigned responsibility for the development and updating of its own work programs. The central maintenance office now provides statewide maintenance management coordination and technical assistance.
2. A liaison person from the central maintenance office has been assigned to each district to provide assistance and technical support.
3. Each maintenance ORG (the lowest organization element) now has access to a microcomputer for developing and maintaining work programs, processing work reporting data, and generating reports.
4. The PeCoS computer software was rewritten in dBASE III and transferred to the microcomputers. The maintenance management system, formerly a centralized mainframe application, now operates on area-level microcomputers, and each area has its own data base. The mainframe is used for district and statewide management information storage and report generation and as a gateway to enter information to the payroll and equipment management systems.
5. The activity planning process has been modified to allow the user to enter most of the planning values for a single activity on one user-friendly, interactive screen that imme-

diately displays the impact of planning decisions on the work program and budget.

6. Crew compositions, average daily production values, and quantity standards can be refined at the area level to reflect local conditions. This reduces the disparity between actual work performance by the various areas and the standards for performance that (in the past) were established on a statewide basis without regard to legitimate regional differences.

7. The differences between PeCoS budget dollars and financial (line item) budget dollars have been reduced by increasing the number of labor, equipment, and materials rate options and adjusting the options for each area. In the past, for example, PeCoS had only two statewide labor rates for work program and budget development; now there is one rate for each employee class—a rate that accurately reflects the planned labor cost.

8. Modifications were made to the PeCoS work program and budget report to make it more readable and useful. Several versions of the report are available.

9. Under the old system, the work program and budget were annual plans; little attempt was made to extend them to a monthly basis. PeCoS II has a labor day distribution and a work calendar to allow the user to create monthly work programs from the annual plan. This ability to plan work on a monthly basis has made it considerably easier for ORG crews to manage their activities in relation to their established work programs.

10. A resource requirements report was developed to document monthly needs for each class of labor, equipment, and materials. The ability to evaluate resource needs on a monthly basis, rather than simply in terms of annual averages, has enabled maintenance field organizations to manage more effectively.

11. Crew scheduling procedures were revised. The scheduling period was reduced from 2 weeks to 1, and the scheduling form was modified to allow for more detailed work assignment planning.

12. The crew day card, which was a work authorization as well as a work reporting document, has been replaced by a new daily work report. The new work report eliminates the need to complete a separate equipment utilization report, and it will eventually eliminate the need for a separate biweekly time sheet.

13. Differences between cost data shown on PeCoS reports and those reflected on fiscal expenditure reports have been reduced by using more accurate and up-to-date rate tables and by modifying the PeCoS costing methodology to more closely resemble those of the payroll and equipment systems. Differences will remain, however, in the materials costing process. (In PeCoS II, materials are expensed as they are used over a period of time. The accounting system, however, expenses the same materials when the vendor's invoice is paid.)

14. In the past, all work control reports were generated from the mainframe. It took some time for the work report data to come in from the field and for the reports to be produced and distributed. Under PeCoS II, almost all work control reports are available from the local microcomputer as soon as the latest work reports are entered. Many of these reports are also available on the screen. This allows field managers much better access to timely activity cost and work performance information. It also is a major benefit when work programs need to be updated.

PROJECT BENEFITS

The modifications and improvements that were made to PeCoS will result in a number of significant benefits:

- **Improved work planning:** The system incorporates decentralized work planning. Both the authority and the means to do their own work planning—in the form of computer hardware and software—have been provided to area and ORG managers. Maintenance planning is far more realistic than was possible under the former centralized planning. Also, the monthly work calendars allow ORG supervisors to plan crew activities in greater detail than was possible under an annual work program. The result is maintenance work programs that are consistently employed by field crews.

- **Better management information:** The use of microcomputers with local data bases allows managers and staff at all levels a much greater access to timely and accurate management and cost information. The single source document (the new daily work report) consolidates reporting paperwork for the various management and accounting systems, thus improving the consistency of the data among these systems. The result is an enhanced ability to monitor and evaluate work performance and costs and to update work programs.

- **Reduced paperwork:** The single source document will reduce the paperwork burden on the crews and the area staffs, thus freeing their time for other work.

- **More effective resource utilization:** The improved crew scheduling procedures, as well as the new resource requirements report, allow managers to improve resource needs planning and specific labor and equipment assignments, thus making better use of limited resources.

- **Cost savings:** The more accurate and timely cost and work performance data enable the staff to better manage the work of crews and thereby to achieve greater efficiency at the job site and a more purposeful expenditure of resources and funds.