Maintenance Operations Resources Information System

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In 1986 the Pennsylvania Department of Transportation installed an updated maintenance management system. The system includes the payroll, material, and equipment cost-tracking features for each maintenance activity common to most systems. Whereas the previous software was modernized and integrated with the accounting and roadway management systems, automation of maintenance planning was probably the most innovative step in improving maintenance management systems. Department policy requires that maintenance personnel survey the roads for deficiencies that require corrective responses. Maintenance managers then prepare 4-month period plans from the surveys. Weekly plans are developed from the period plans. The final product is a completed daily payroll. The planning subsystem incorporates all this activity into one screen-driven data base. From the time that a road deficiency is inventoried through management review of the history of completed work, all planning processes can be monitored, and a complete roadway history is maintained.

In July 1986 the Pennsylvania Department of Transportation installed a new maintenance management system. The new system incorporated several stand-alone systems into one all-encompassing Maintenance and Operations Resources Information System (MORIS).

A daily payroll system, which tracked foreman cost and was similar to that of many other states, was developed in the early 1970s. Material inventory and equipment management systems were developed separately as stand-alone systems. The rewrite of these systems provided fresh software that integrated several features with the accounting and roadway management systems and included a greatly improved equipment repair work order feature in the equipment subsystem. The highway and materials inventories and equipment data bases have numerous on-line ties to each other.

The highway subsystem incorporates the standard features of a maintenance management system, including performance standards for field foremen and annual work plans. County, district, and central office managers are provided with reports that measure production, productivity, unit cost, and plan adherence. However, the function that best defines MORIS as state-of-the-art is the highway maintenance planning and scheduling module.

Before MORIS, department policy required that county maintenance managers survey their roads and record deficiencies needing maintenance. They were also to prepare 4-month "period plans" that specified the activities to be performed on the routes to be repaired. The benefits of the period plan include projecting material and specialized equipment needs and identifying efficient work flow from one route to the next. A weekly planning meeting, at which the county manager and his assistants scheduled specific workers and equipment for the following week, was also required.

It was realized that this process could be computerized and that the result of the planning could be a preprinted payroll that would feed into the existing daily payroll system.

The first step in the planning and scheduling process is to input information from the road condition survey into the road information (RI) screen (see Figure 1). With this approach the route and maintenance activity numbers that will eventually be used to document the completed work are input into the system up front. An example of a filled-out RI screen is given in Figure 2. In this case the assistant county maintenance manager has observed that cracks need to be sealed or shoulders need to be cut on a particular route.

The process continues as the assistant manager surveys the roads and builds an inventory of work to be completed. The assistant manager can either input the data on a remote mainframe terminal or have the office staff enter the data from the assistant manager's notes.

This example of RI screen entry is self-explanatory with the exception of the route. Pennsylvania has replaced stations with a state route–segment–offset location referencing scheme in roadway data bases. Each state route is divided into approximately ½-mi segments. Signs have been erected at the begin-

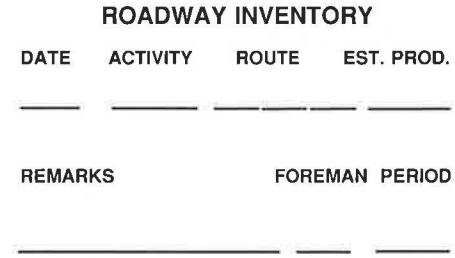


FIGURE 1 RI screen.

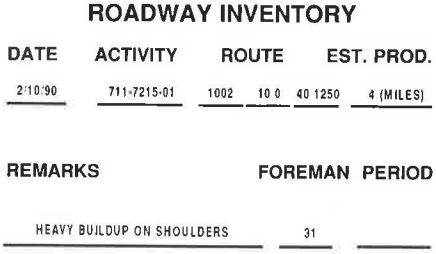


FIGURE 2 Filled-out RI screen.

Pennsylvania Department of Transportation, Transportation and Safety Building, Harrisburg, Pa. 17120.

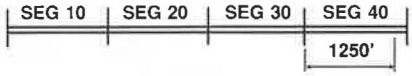
ning of each segment (see Figure 3). The RI screen sample in Figure 2 indicates that shoulder cutting needs to be done on State Route 1002 beginning at Segment 10, Offset 0 and continuing to 1,250 ft beyond the start of Segment 40. Figure 4 shows what the project would look like on a plan drawing.

The second of the four job steps is preparation of the period plan. The only step is to enter the period number on the menu of things to do on the RI screen (see Figure 5). By entering Period 3 the manager indicates an intent to complete the work during March, April, May, or June.

After indicating the work to be included in the period plan, the manager selects the print function. The system sorts the work items by activity and state route and calculates the total crew days planned for each foreman. The guideline is to include enough work on the period plan to account for at least 70 percent of the crew days available. Inclement weather and emergencies are accommodated in the remaining 30 percent of the period plan. The system automatically prints the period plan on the local printer (Figure 6).

FIGURE 3 Sign at beginning of Segment 70.

STATE ROUTE/SEGMENT/OFFSET



S.R.1002

FIGURE 4 Plan drawing of project.

ROADWAY INVENTORY

DATE	ACTIVITY	ROUTE	EST. PROD.
2/10/90	711-7215-01	1002 10 0 40 1250	4 (MILES)

REMARKS	FOREMAN	PERIOD
HEAVY BUILDUP ON SHOULDERS	31	3

FIGURE 5 Entry of Period 3 on RI screen.

FOREMAN 31

CRACK SEALING

S.R. 0364 S.R. 1004 S.R. 4022

SHOULDER CUTTING

S.R. 0322 S.R. 1004 S.R. 2032 S.R. 4032

CRACK SEALING	2.5 DAYS
SHOULDER CUTTING	3.0 DAYS
	5.5 DAYS

FIGURE 6 Period plan.

The assistant manager then has a plan for the coming 4 months. The calculation of crew days and the typing of the plan have been done by the computer. As the weeks pass the assistant manager will pick items that are listed in activity order on the period plan and organize workers and equipment for the weekly plan. A weekly planning meeting is generally held on Thursday. The assistant manager schedules a project for the next Monday by typing a 1 next to the item on the weekly plan screen, for Tuesday by typing a 2, and so forth (Figure 7). One or two activities per day are normally scheduled. The system retains the crew members and equipment assigned to the foreman for the previous week, so the manager only has to make changes where men or equipment are to change. Usually the remarks section is the only portion of the weekly plan that requires typing.

If the print option is selected again, the system will preprint a daily payroll for each day of the next week, and a weekly plan summary for each foreman will be printed. The assistant manager distributes the weekly plans and payrolls to his foremen (Figure 8). The foremen know what they are to do the

FOREMAN 31

	ROUTE		
MON.	1002	CRACK SEALING	300 GALS
TUE.	2034	SHOULDER CUTTING	4 MILES

HARPER	170 40 4066	CREW CAB	017 2024
MYERS	193 30 8486	TAR KETTLE	324 5017

REMARKS: Inclement Weather Plan Will Be Litter Pick Up

FIGURE 7 Weekly plan.

FIGURE 8 Distribution of weekly plans and payrolls to foremen.

following week and have payrolls that contain preprinted coding.

Hours worked and production units to be completed are not preprinted on the payroll. The route, accounting coding, social security numbers, names, and equipment numbers are preprinted. If one crew member is substituted for another, the foreman draws a line through that entry and writes in the correct entry. All valid social security numbers, equipment numbers, and accounting and route numbers are stored in the computer, eliminating errors on the payroll signed by the foreman.

The completed and signed payroll is taken back to the office for entry into the computer. Data entry time has been greatly reduced because there are no errors on the preprinted portion, and generally the only information left to be entered is the production hours and production units.

Figure 9 gives a flowchart that summarizes the MORIS process.

The process requires the field manager to work on a computer, whereas the old manual system did not. The process forces more planning and scheduling, which, it is believed, is an appropriate function for first-level managers.

Department crews perform a variety of maintenance functions, from litter pickup and brushing to seal coats and minor

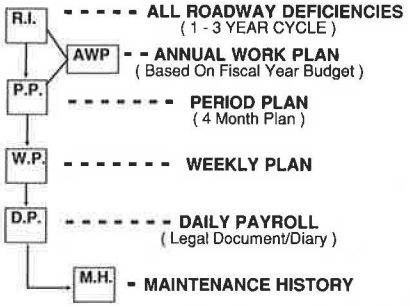


FIGURE 9 MORIS flowchart.

paving. If productivity levels are to be maintained on priority activities, good planning is critical. Management must direct the foreman to perform the priority tasks. Management has the responsibility to ensure that the foreman is supplied with adequate labor, materials, and equipment to complete the task. MORIS facilitates this process.

In summary, MORIS is probably better described as a management system than as a computer system. The formalized process supports and reinforces the correct management processes.