

# How To Keep Your Maintenance Management System from Growing Old

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Most states now have a maintenance management information system (MMIS). Many states, including Illinois, have extensively revised or replaced their original system. Now states are facing the same dilemma with their second systems as they did with the first: how to keep their new MMIS from growing old. The new MMISs are much different from their predecessors in terms of the equipment used to support them and the experience of the managers who use them. In addition, the investment in these systems is often substantial. It is important that these systems not be allowed to grow old and require total replacement when they can remain dynamic, growing, and emerging systems that keep up with management and organizational requirements.

**T**he Illinois Department of Transportation's (IDOT's) original maintenance management information system (MMIS) dated back to the 1960s. The original system was a batch system with time cards and invoices submitted from the field to the district or state offices where data was keypunched and edited. Reports were created by a mainframe computer at the central office from information stored on magnetic tapes. The reports were then collated and mailed to the districts, which were expected to further collate and distribute them to the field engineers and team sections. Reports reaching the field contained data about activities performed 60 to 90 days before.

IDOT's new MMIS, implemented in 1987, is much different in its overall objectives and equipment support. First, the new system was developed on the basis of information managers' need to make decisions. Each area of maintenance management was explored with the managers involved. They were asked about their daily decisions

and what information they needed to make those decisions. Second, reports were designed to provide exactly the information required. Selection criteria for reports were emphasized so each requester could specify the data to be included in each report. The report requirements included not only the decision-making information required, but also the time demand (how soon) and report selection criteria (what to include or not include in the report). Therefore, the design requirements were for the MMIS to provide meaningful and timely reports for a broad range of subjects when requested by managers at all levels of the organization.

After the reports and their requirements were known, the MMIS was designed, taking into account these needs and the location of the person who needed the information. This concept is much different from the original because information is tailored to fit each manager's need and is requested and received by the managers themselves.

There is no central sourcing of the data and report generation. All information is available to all users at all times.

This system resembles the systems many states have or are moving toward today. When implemented, IDOT's MMIS addressed the three basic functions in the cycle of management:

- Work planning,
- Execution, and
- Evaluation and control.

It consisted of 44 reports pared from a total of 102 as originally designed. Users were trained to input data and, most important, how to request and use the 44 reports.

The equipment to support the MMIS now consists of 252 Digital Equipment Corporation (DEC) VT 220 and

320 terminals located in 160 highway maintenance and traffic operations headquarters, 9 district offices, and the central bureaus. The terminals are connected by dedicated telephone lines, and the data are stored on a central data base in Springfield from which uniform, quick access is guaranteed to all terminals. At least 350 employees access and use the terminals every workday. Inquiry into the data base is guaranteed within 5 sec, and most reports run within 1 hr of their request. Some reports can be requested to be run overnight at the user's option to alleviate the work load on the central processing unit during the workday. Two ad hoc report writers are now in the system to enable users to program the reports they need for specific applications or reports for which no standard report "fills the bill." Today, IDOT's MMIS provides more than 100 reports to address nearly every aspect of the functions and tasks performed in the field. These include sets of reports for needs assessment, annual work planning, budget allocation, work scheduling, expenditure tracking, performance and cost reporting, equipment management, weather forecasting, and electronic mail.

#### KEEPING THE SYSTEM FROM GROWING OLD

Many departments are now developing ways to keep their MMIS up-to-date and applicable to current situations and management needs. Because many of the systems are on-line and involve so many adept users, the new systems offer many advantages over the original systems.

The following describes how IDOT keeps its MMIS evolving and fresh.

#### Management Involvement and Support

Establishing and maintaining top management involvement, understanding, and support is not an easy or simple task. Developing an MMIS requires funding, the securing of which is often how top managers first become involved. To win the competition for funding requires the creators of the MMIS to provide top managers with the information they need to understand why an MMIS is needed.

Several factors were involved in the early development of the new MMIS at IDOT. First, the development group that created the MMIS was composed of the bureau chiefs of maintenance (now operations) of three of the nine districts. The consultant met frequently with them as a group in developing each report. Through the time invested and the reports they created, these managers became major proponents of the MMIS. Their signatures and that of the state maintenance (now operations) engineer were required at the bottom of each report as confirmation that the report had a customer and specific purpose.

Second, the department's Bureau of Information Processing was included in all meetings. The MMIS was one of the largest they had endeavored to program and install. The bureau's people understood the genesis of the MMIS, its magnitude, extent of benefits, and possibilities for future enhancements. They, too, were anxious to see the MMIS implemented.

Finally, the issue of funding became a factor when the design of report delivery required a terminal in all highway maintenance headquarters (there were 106 at the time). At a meeting of the directors, district engineers, and central bureau chiefs involved, there was considerable discussion of various options and recommendations. At the conclusion of that meeting, the decision was made to provide the funds for the required computer equipment so the MMIS could operate as designed.

The MMIS has produced the benefits expected. For example, performance and cost data on snow and ice control, flood response, and overtime are available at the close of the workday or shift on request. The documentation of costs for reimbursement meets audit requirements. The department knows what equipment is owned (\$125 million inventory), where it is located, how it is used, and how much it costs to use. Information for funds allocated, expenditures made, and account balances is available on line, at the push of a button.

Continued management support is important. At IDOT this is not only assured through the MMIS's delivery of promised benefits but also through constant updates and training. Notification of MMIS updates and enhancements are addressed to the district engineers for distribution. An overview of key reports they can use has been presented to each as a training course. Finally, results of the MMIS evaluation conducted by the central bureau at the 4-year mark, with recommendations collected from their field people, were sent to each for information and action by either the central bureau or their own staffs.

#### User Group

Illinois has found that success is best achieved through the establishment and involvement of a "user group." IDOT established a user group at the beginning of the process. The user group developed the MMIS objectives, concept, and reports. They tested and evaluated each MMIS module for a 6-month period in 20 highway maintenance headquarters they selected.

Today the user group has evolved to the point that all nine districts have at least one MMIS contact person who maintains contact with field users and provides training and system support. The contact persons form the nucleus of IDOT's ongoing user group.

In fact, there is a need for more than one user group. Equipment managers meet regularly, as they have in the past. MMIS applications, needs, and introductions of new products make up a large part of these meetings. The bridge engineers meet regularly and continue to develop enhancements in bridge inspection, maintenance repair needs, and various reports. Traffic operations personnel have unique needs that must be addressed. At their meetings time is devoted to MMIS topics. The district data processing managers and administrative services managers' work is affected by the MMIS. These groups often discuss topics that involve the MMIS in their meetings. Finally, overall user group meetings are held twice a year for any and all comers to discuss the MMIS. Discussions in the other meetings produce many of the agenda items used in the overall user group meetings. IDOT has learned that successful user group meetings include

- Updates of accomplishments,
- Introduction of new products,
- Topics suggested by members,
- Discussion of problems,
- Presentations by members of the group,
- Request for new products, and
- Establishment of priorities for enhancements.

The user meetings are consensus builders and major contributors to the success of the MMIS.

## Training

The information that MMIS gathers and produces is only valuable if it is used. Training is the major component for connecting users with the MMIS. It cannot be a one-time effort. It must be constant and incorporate everyone who is (or should be) interested in using MMIS reports.

From the beginning, the emphasis has been on what the MMIS produces and what it can do for the person being trained. The most important aspect of the training is for the user to know how to get what he or she wants or needs from the MMIS. After that, the user is more willing to learn what must be put into the MMIS to have the report or information.

A second key aspect of training is to show how the particular module fits in with the overall MMIS concept of the cycle of management. The MMIS in Illinois is totally integrated with one-time entry as a prerequisite. The same data item may appear in many reports and be accessed by many users. The MMIS itself is organized with reports and screens designed to address one (and sometimes more) of the functions of the cycle of management. After users are able to see how the particular part (report and reporting) fits into the overall schema, the interest and learning level increase. Many, if not most, field personnel want

to see improvements and are willing to make changes when they see the change as an improvement. For example, this approach enabled planning and scheduling to be introduced more successfully in locations where these concepts had not been formalized in the past.

When the MMIS was introduced, a training plan was developed to allow one trainer to work with two people for 2 hr on each module. Using three pairs of trainees full time for 6 months, IDOT staff installed the 18 modules in the system with the respective users in the districts. Users signed up for 2-hr time slots with each trainer. For each module, trainers stayed in the district as long as necessary to work with the users selected by the districts.

As new modules have been developed since that time, training has been tailored to fit the application and people involved with the module. For example, a new ad hoc program, In-Touch, was recently introduced. To train people who would use In-Touch, three separate sessions were given in Springfield with a maximum of 18 users in each. A conference room with terminals was established for the training. Each session required 4 days. The training was centralized to maintain concentration and develop a mix and support group from the sessions themselves.

On the other hand, group sessions to introduce the new radio management program are being taken to each of the nine districts. Districts may send as many as they feel necessary to this 2-hr training session because it deals with reviewing output reports, understanding their application, and becoming familiar with the brief user manual. Most of these people are already cognizant of both the MMIS and radio management.

The department also offers overview sessions for new managers and workers in the organization and for those who want to update their knowledge of the system. The newcomer sessions have been offered in the field headquarters, on request to the districts when the bureaus of traffic and maintenance were reorganized into the bureau of operations, and at the central bureau. All the courses are offered periodically, if numbers warrant, in the district or at Springfield.

Some modules are introduced using pilot or prototype installations. IDOT's new hazardous materials management software is being introduced in a volunteer district and the applications manual written as the installation is accomplished. From there, it will go to other districts as requested.

On the basis of an evaluation study conducted on site in 65 team sections, additional training programs have been developed. Update sessions, where a panel of leaders review the new modules introduced in the last 12 or 18 months and spend as much time as the group feels is warranted on each, have generated considerable interest and attendance. These are usually 1-day sessions. "Train the trainers" is another important and very useful approach. The central bureau has produced an overall train-

ing package that is complete in scope and flexible in application. All system reports and applications are included in a special manual with tabs for each application area. Helpful hints concerning shortcuts for data entry, suggested frequency of report requests, and applications are noted in the manual. Two or more trainers in each of the nine districts are trained to use the manual. In turn, the district trainers are now equipped with copies of the manual and are able to make contact with those in each of the field headquarters or with any new lead workers when necessary. Users can select training in the areas of interest to them and within their area of responsibility.

### New Applications

As evident, it is important to constantly evaluate MMIS performance with people in the field and provide enhancements and improvements when requested. New modules are continually being added to the system. This ensures that the system remains relevant to those in the field staff. The introduction of a new module often leads to the definition and request for another. Recent additions to the MMIS include electronic mail, radio equipment management, mechanistically designed pavement maintenance and monitoring, stockroom inventory, weather information, a new ad hoc program, and hazardous materials management. IDOT is currently doing additional work to tailor work planning and scheduling for the bridge crews and traffic operations, revise the stockroom inventory to handle "satellite" locations, and develop a traffic sign management module. Each new development increases user experience and broadens the knowledge of needs so the next application can be better than the last.

### Task Forces

Often requirements are presented that are unique or untried. IDOT has been successful in establishing task forces to concentrate on particular applications, develop their specifications, review the initial programs, and help install the new modules. The task force members for each application often gain self-actualization through their contributions and become some of the best salesmen for the application. For example, programs for electronic mail, word processing, and mechanistically designed pavement maintenance and monitoring were developed using the task force concept. In each case, the module was successfully completed, often in one of the task force member's areas first, where training assistance and support were available through that task force member.

### Recognition

During the original installation of the system, users who attended one of the 2-hr training sessions for any application received a certificate of completion to show they were trained in basic MMIS operation. Letters of appreciation have been sent to supervisors and members of the various task forces who assisted in developing and installing the modules. Several people involved with the MMIS have been nominated for engineer of the year or technician of the year awards for accomplishments connected with the MMIS. Recognition encourages users to be involved and continue to offer their suggestions and recommendations.

### Introduction of New Hardware or Software

Originally, IDOT's MMIS was supported by a VAX cluster consisting of two DEC VAX 8700s. This provided 5-sec response time for on-screen information inquiries and entries for the approximately 150 VT 220 terminals in the field at that time. Since then, IDOT has added a VAX 6510 to the cluster necessitated by the expansion of the system and is now installing additional VT 320s in the field. Second, IDOT has researched and selected software packages from vendors that can be integrated into the MMIS with little or no investment by department staff. For example, through Reflections software, users are able to purchase, incorporate, and use PCs instead of VT 320s in the district offices. These serve both as terminals to the MMIS and for typical PC applications. Through the use of Monarch software, users are able to produce a report from the MMIS, take the report information into a Lotus spreadsheet, manipulate it, and move it into Harvard Graphics, where graphs and charts can be produced on color laser printers. IDOT has also considered and purchased DEC graphics, the stockroom inventory system, and the hazardous materials management module from outside vendors. Last, IDOT allows the department's weather forecasters to use Kermit software to transfer the routine weather and storm warning forecasts directly into the MMIS. Therefore, the latest weather forecasts for all nine districts are available and accessible instantaneously to all 252 terminals in the system.

### Support

The system is supported by an information systems unit in the Central Bureau of Operations consisting of two civil engineers and a technical manager. The Bureau of Information Processing has devoted one programmer full-time to the system. These two elements are very important to the continued success of the system. Because of the staff assignments, IDOT is assured that enhancements

and "fixes" are handled on a timely basis in a mutually acceptable priority scheme.

The computers to support the MMIS are operational 24 hr per day, 7 days a week. When the MMIS was implemented, a telephone number for the central computer center was made available to field personnel to report and request response to hardware failures. The maintenance, traffic, and operations personnel are often called to work during emergencies and on shifts outside the normal work schedule. The computer center is staffed 24 hr per day, 5 days a week. In addition, anytime there is a problem at any terminal in the state, the operations field personnel notify the Bureau of Operations' central communications center, which is staffed at all times. Communications technicians have the pager number of the Bureau of Information Processing staff persons assigned to equipment troubleshooting and resolution. If the staff person cannot work out the problem, the central communications center can contact a district staff member using telephone or pager to work with the central person in resolving a problem any time, any day of the week.

### Increasing Scope

Although the MMIS terminals are operational and on-line around the clock, most are used about 2 hr per day for entering and retrieving reports. Therefore, time on the terminals is available for other applications. There is no reason to limit the scope of the system only to users in the bureaus of operations, maintenance, or traffic. Therefore, system applications such as electronic mail, hazardous

materials management, inventory control, vehicle preventive maintenance, and equipment inventory have been expanded for use by other bureaus. Personnel in bureaus such as construction, materials and physical research, design and environment, and administrative services need some of the same components, information, and modules first made available to those in operations. Some of the most enthusiastic users of the system are those in administrative services, because the data from the field headquarters in the system are as current as any data available. Accountants can monitor orders and expenditures for salt, aggregate, and commodities very accurately. Vehicle coordinators can find out when the last preventive maintenance was performed on any vehicle in their district or bureau. The staff industrial hygienist can offer notices about the handling of hazardous materials and transmit them and the material safety data sheets to all terminals in one action. These additions make the system vital to the department as well as to the bureau.

### CONCLUSION

Because of these accomplishments, the MMIS in Illinois will continue to expand and be exciting for users and others involved. The implementation of the MMIS and its maintenance is too great an investment to lose through obsolescence or redundancy. IDOT has successfully built momentum and interest in the system through the means described in this paper. It is important to continue to invest time and effort to keep the MMIS from growing old and to increase its longevity.