THE ARMY'S PAPERLESS EQUIPMENT MANAGEMENT INFORMATION SYSTEM

Milton Emory, *U.S. Army Logistic Center*

Historic problems found in maintenance reporting include illegible writing, transposition of numbers, data entry errors, and the cost of recording low cost parts.

Repair orders are the heart of all maintenance operations. Historically, this is an area vulnerable to many problems such as the interpretation of handwriting, transposition of numbers, and key in data entry. In our maintenance shop, as in most similar operations, record keeping has been a persistent source of problems. Shop mechanics have normally recorded labor hours and parts on repair orders. Understandable, clerical accuracy was not their primary skill.

Too often poor records made it hard to schedule and prioritize shop operations. Inaccurate inventories led to shortages or overstocking of parts and supplies. Preventive maintenance got off schedule and maintenance jobs were overlooked or unnecessarily duplicated.

In January 1988, Fort Lee implemented the Paperless Shop System which applies to use of bar code technology in maintenance reporting. The system made a dramatic difference.

The Paperless shop System begins with a blank sheet of paper. The computer automatically assigns sequentially generated Repair Order (RO) numbers. These RO numbers and all related RO activities are bar coded. This, provide an accurate method for building precise, fully detailed reports covering every aspect of the maintenance operation without any pre-printed forms.

Records information whether critical or something as simple a comment, has always been a clerical function and thereby subject to errors. The application of bar codes overcame this problem by enabling even the smallest detail to be recorded and extracted at any time without writing.

Bar codes provide the capability to record information in the field as well as in the maintenance shop. Each shop employee is assigned an individual bar code reader (Readers may be shared on a different shift). The portable bar code reader is used to log the individual's personal ID number. The built-in time clock automatically date/time stamps each transaction or event as they occur. This provides an ideal audit trail by using the bar code reader with pre-printed bar code work sheets. Readers track all labor transactions, whether direct or indirect, and numerous other duties as determined by management. Direct labor includes work on items such as equipment, clutch, tires, lights, engine. Indirect labor includes time spent on items such as fueling, meetings, lunch, picking up parts, etc. Bar codes are used to receive, issue, transfer and inventory parts. This eliminates the need to write at any step of the process, or from ordering until the parts have been used on a piece of equipment or vehicle.

Parts transaction can be done from a parts work station, parts room or from the mechanic's portable reader. The system can record receipt of incoming supplies and maintains inventory of parts on hand as well as a record of parts used, basic stock level, and basic re-order point. The system can generate bar codes for parts not already bar coded. When a mechanic wands a part, it automatically records the information against the mechanic, repair, charges the vehicle, and updates the parts inventory system.

When a new repair order is initiated, the associated vehicle's identification number is entered through the keyboard. This ties the vehicle number to the repair order for all future processing.

The appropriate meter reading (odometer, hubometer, hour meter, etc.) is entered through the keyboard now. This positions the data in proper perspective relative to the vehicle's history. This information is critical whether filing a warranty claim or analyzing the vehicle's performance. Each RO is automatically date/time stamped.

Down time is automatically recorded when on RO is opened and closed. Other information, such as reason for repair, repair site, repair classes, are entered at the work station with the bar code wand. All data collected through these readers are automatically charged to the appropriate RO and vehicle history file through the software.

The bar code reader contains a built in microprocessor. This places the power of a computer in the mechanic's hand. The software employed in the bar code reader is user friendly and incorporates instructions for the user. It monitors all input and will immediately screens input at the time of entry. This approach eliminates most data input errors right at their source, on the shop floor or in the field, thereby eliminating going back to the work station.

Employees may transfer from one RO to another or from a RO to indirect labor. Multiple mechanics can be

logged onto a single RO. The bar code readers are down loaded at the end of each shift or to fit the need of each operation. It is capable of recording and storing approximately 2,000 individual transactions. The standard unit has a 32K memory with provisions to increase memory to 250K.

When the readers are down loaded, all raw data is automatically edited. Any ROs with errors are printed. All completed ROs have to be viewed on the screen or printed before putting into history. At the end of the day or shift, all files such as parts inventory, PM schedules, fuel reports, labor and campaign reports, are updated.

Since the Paperless Shop System was implemented, the mechanic's efficiency has improved by 20%. Preventive maintenance records being updated daily has allowed us to keep our maintenance under control. As a result, break downs are few and duplicated maintenance has been eliminated.

Total parts inventory has decreased by 50%. The system allows the shop to anticipate what parts are needed in inventory. Remember, bar codes by themselves do nothing. It's the combination of a bar code symbol, bar code reader, computer terminal, communications network, and computer software that provides a window of opportunity to resolve age old problems and to obtain accurate and timely information about what is happening on the shop floor or in the field as it occurs on a daily basis without writing. The system has achieved a positive return on investment in one year.

You need the right tools to do the right job. We have them--the mechanics, the bar code, the future!

THE EVOLUTION OF AN ON-LINE INTEGRATED EQUIPMENT MANAGEMENT SYSTEM

Richard W. Hunter, ***Illinois Department of Transportation***

The title of this presentation--The Evolution of an On-Line Integrated Equipment Management System--contains some key words on which I would like to build. The first is evolution. The concept behind Illinois Department of Transportation's (IDOTs) Maintenance Management information (MMI) System goes back to the late 1970s. Initial development work on the system was completed in 1980 and the system was fully operational and in use, statewide, July 1987. Like most large systems, our MMI System experienced numerous problems during the development phase. In the end, the product initiated in 1987 only remotely resembled the system conceived and presented during the development in phases in the early 1980s. Today, the evolution continues. Since July 1987, numerous enhancements, improvements, additions and revisions have been made with more planned in the near future.

The second key word in this presentation is integrated. What exactly is an integrated system? When the title for this presentation was put together, integrated seemed to be the best word to describe the MMI System concept. That concept, from the early development stages, was to incorporate all facets of a comprehensive highway maintenance program.

You might be asking yourself way in an Equipment Management Workshop, am I talking about highway maintenance, as a whole. Well, before development and implementation of the MMI System, the Illinois Department of Transportation had several fragmented systems including a very limited vehicle fleet management system and no automated system for collecting management data on off-highway maintenance equipment. While improving equipment management in Illinois had been a topic of discussion for several years, it became apparent that the best opportunity to develop a solid equipment management system would involve incorporating equipment management into the total maintenance management concept. Perhaps, this can best be explained by taking a few minutes to present the overall concept and operating design of our MMI System. The MMI System is based on the classic concept of the cycle of management; that is, planning and budgeting a work program, executing the program, and reporting and evaluating the program in preparation for the next cycle.

In highway maintenance, three basic components are necessary for an effective program. These are: labor, materials, and equipment. To execute effectively the work necessary to maintain the highway system, the planning phase must identify the requirements for all three components-labor, materials, and equipment. To this end, extensive efforts have been made within the MMI System to develop realistic models which permit development of work plans based on the availability and cost of each component. Furthermore, using spreadsheet what-if programming, MMI provides the IDOT Maintenance Engineer with the ability to look at several plans with different factors in a very short time.

Incorporating equipment inventories, equipment operating costs, and equipment downtimes into these planning tools ensures that the highway work plan created by the system can be accomplished without question as to sufficient equipment to carry out the task. Your question at this point probably is, "on what basis