THE COMPUTERISATION OF PREVENTIVE MAINTENANCE AT MALELANE MILL

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Abstract

Transvaalse Suikerkorporasie Beperk (TSB) has been operating a manual preventive maintenance system for the past seven years and has achieved a great deal of success particularly regarding improved mechanical efficiency. The importance of PM and the necessity to computerise is underlined. Actual and possible further advantages of the computerisation of the system are discussed. The question of self development of a system as opposed to buying a software package is dealt with and a brief analysis of available PM packages that were reviewed is covered. The present status of the computerisation of TSB's PM system is also discussed.

Introduction

Preventive maintenance (PM) is action taken to keep an item which is in operation in an operating condition by means of inspection, detection and prevention of failures.

Why Preventive Maintenance?

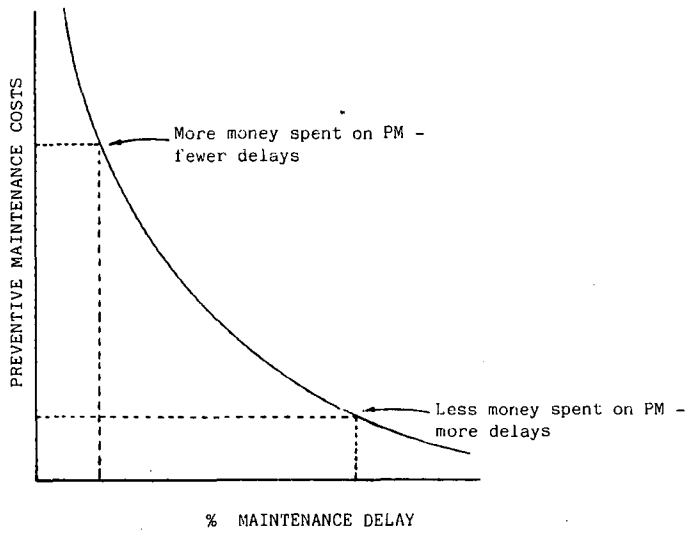

FIGURE 1 Cost vs Delay curve

Murphy's law is applicable here: equipment failure usually occurs at the worst possible time.

- A breakdown causes an interruption of production. A delay can be very costly in the competitive marketplace of today. It would have been better if the maintenance department had been able to detect a problem in the equipment and could have arranged with the production department for a convenient time to make the necessary repairs before a failure occurred. This is the ideal situation for which a company should strive but can never fully achieve.
- A second reason for PM is for safety. Proper inspections can detect unsafe conditions in time to prevent an accident, which might cause damage to the equipment or injure operating personnel.
- A third reason is reduced repair costs. When a failure occurs, it usually destroys equipment that is associated with the defective component. If the defective component is changed before the failure occurs, the related equipment will not be damaged, thus reducing repair costs for labour and material.

Purpose of Preventive Maintenance

The main purposes of PM is to increase profits by:-

- Increasing the plant availability and efficiency
- Decreasing maintenance costs per production unit
- Ensuring optimum personnel productivity
- Prolonging the effective life of capital equipment and ensuring that replacement takes place at the economic correct time with the most effective equipment.

Manual versus Computerised PM Systems

Advantages of a Computerised PM System

All above-mentioned goals can be attained by using an integrated, modular computer system. The advantages of a computerised PM system compared to a manual system are:-

- Economic replacement of equipment
- Better interaction/communication between interrelated departments
- Less and more accurate paperwork
- Instruction communication via operational documents
- Management decisions can be taken on grounds of management reports
- The control of availability, utilisation and capacity utilisation
- Increase of the effective utilisation of maintenance labour
- Monitor performance tendencies regarding:
  - Downtime
  - Cost
  - Repairable item control
  - Component/spare part life
  - Inputs (resource) usage per task
  - Labour requirements per type of equipment

Disadvantages of TSB's Manual PM System

Before computerising, TSB were operating a manual system which did not comply with today's more advanced system criteria. The effect of the manual system was:-

(1) Equipment history could not be recorded with enough detail and data manipulation was time consuming and often fairly inaccurate. Because of the amount of data that was handled, essential information could not always be supplied to the user on time.

(2) History was recorded to equipment group level for various reasons. Equipment groups can be divided, in some instances into 40 different individual pieces of equipment, with the effect that maintenance costs up to specific equipment level was not readily available.

(3) The direct effect of point No. 2 was that it was impossible to replace equipment at the correct economic time, because such considerations are based on the specific piece of equipment's maintenance history throughout its life.

(4) The upkeep of an effective equipment availability and utilisation control system was very difficult to maintain manually. The direct effect thereof was that problem areas/equipment could not always be identified soon enough.

(5) The major effect of the manual PM system was that few management decisions could be taken on grounds of information made available by the system. The system was not geared to management information at all.

Computerisation

Package vs Self Development

After detailed research and liaising with companies which had already taken decisions concerning this matter, the following main points were noted:-

- Self development would take approximately 8 man years
- Implementing time in total would take approximately 1 year for self development compared to 6 months for a package
- The service of specialists would be required
- The cost of self development would be (in current value terms) R438 000
- Full benefits of the system would only be realised after completion of the whole system
- No guarantee that a highly effective system could be developed (risk factor)
- The initial capital outlay would be much higher for the package, but a discounted cash flow analysis shows that it would be 17% more profitable.

Apart from the high costs of development, it seemed that self development was not practical judging from the experiences of companies such as SAB, ISCOR and SASOL. This was mainly because of the complexity and extent of the requirement and secondly because of the rapid technological development, mainly in the USA, in the development of programmes.

Maintenance Management Packages

Available packages were reviewed to meet the following standards:-

- Link up with present computer technology
- Link up with present computer systems
- Locally maintainable
- Make provision for future development
- Security control
- Support by an established South African organisation
- An initial satisfaction of 85% of the maintenance requirement, and the possibility of adding to or changing the system to meet the outstanding needs.
- The package should be flexible enough to adapt to TSB's needs and to the system presently in use.

The distributors of MM packages that were reviewed were:-

- IBM which markets Online Plant Maintenance system
- Groenewald and Associates which markets Cybergem
- Odyssey Computers which markets Elke 'Main/Tracker'
- Data Technologies which markets ABC Maintenance Management systems
- Comac Systems South Africa which markets Comac
- Persetel which markets Permac 2

Several companies which either have evaluated or implemented some of the above-mentioned packages were contacted, and in most cases visited. These companies were:-

- Sasol I and Sasol II
- Iscor head office
- South African Breweries
- Tongaat Huletts (Felixton)
- C. G. Smith

Evaluation of Packages

(1) Online Plant Maintenance system
The package is developed for a DL/1 database environment and because TSB has introduced an Adabas database the package was rejected.

(2) Cybergem
The package can only be used on a control data computer and TSB presently makes use of IBM technology. Another computer could not be considered and the package was thus also rejected.

(3) Elke 'Main/Tracker'
All the programmes were developed in RPG II and RPG III. Because RPG is not used at all by the DP department the package cannot be integrated with existing systems

(4) ABC Maintenance Management system
The package does not have a security module, which would mean that the DP department would have to develop a whole module for this purpose. The package meets approximately 70% of the maintenance requirements.

(5) Comac
This system runs on a micro computer and would not be able to accommodate all the terminals necessary to effectively operate a MM system. In terms of flexibility and sophistication the system had serious shortcomings.

(6) Permac 2
The package met all the prescribed standards as well as all the maintenance requirements. Permac 2 was able to offer more than was originally required.

It was thus decided to choose the Permac package, if approval could be obtained for such a vast capital outlay. For the interim period before or if Permac could be obtained, it was decided to develop some of the subsystems with the aim of transferring the information onto Permac files. The file outlays and system design was thus geared especially for the minimum problems in going over onto Permac, and to minimise the implementation phase. Because the greatest task in implementing Permac would be to get the relevant information into the system, much of the implementation time can be accounted for and thus eliminated.

Permac System Overview

The McAuto Permac system is a family of interrelated online, interactive subsystems that supply and process information on the various facets of maintenance operations. The seven subsystems in Permac are:-

- Equipment
- Preventive maintenance
- Inventory

- Work order
- Cost information
- Work package
- Downtime

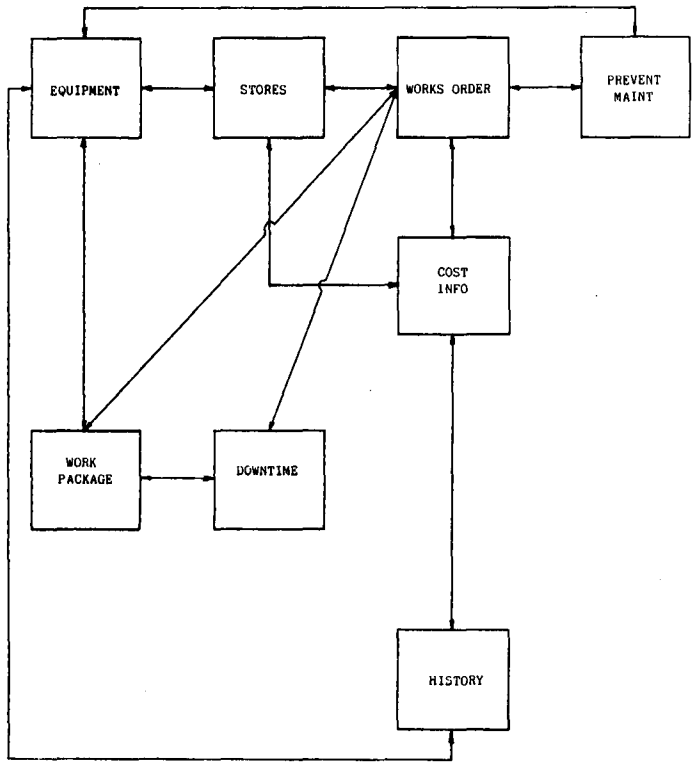

FIGURE 2 Preventive maintenance system interaction

The information provided through the use of these subsystems is immediately available through on-line video display terminals appropriately located throughout the plant.

Permac is menu driven so that relevant maintenance information can be accessed easily without extensive end-user training. Permac provides a user interface module which allows users to access programs of other systems. This transfer option is listed on the main menu like the subsystem selections.

Present Maintenance Management System Statues

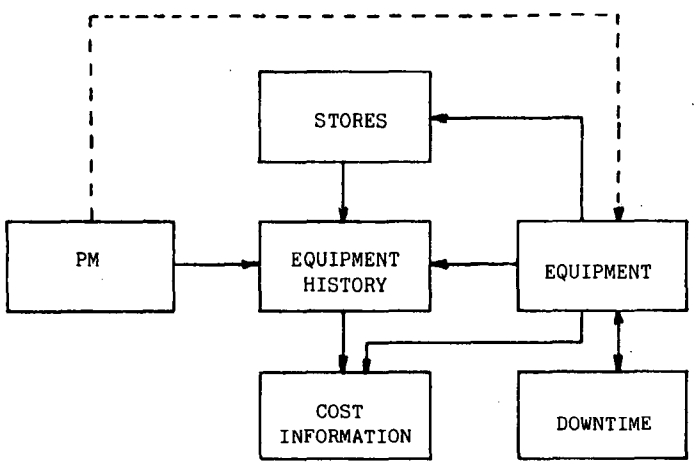

FIGURE 3 Present system status

As can be seen from Figure 3, six modules have been developed and integrated. A more detailed discussion of the already completed modules follows:-

(1) Stores

The material management is done through the Walker Material Management package which was purchased before development on a computerised MM system had started. All the relevant information concerning any stock item was thus available and only links with the necessary modules had to be established. Presently the Walker MM system is linked to the equipment, and the equipment history modules. The link with the equipment module enables a direct stock item status enquiry from the spare parts lists while the link with equipment history updates the history files.

(2) Equipment History

As already mentioned the history module is linked to the Walker system. To complete the maintenance history picture all relevant labour details from either work orders, PM schedules or inspection lists are fed into the history files. The history module is also linked to the cost information module which determines maintenance costs per equipment. With the history module one can instantly review all repairs performed on a piece of equipment, during any period.

(3) Equipment

The equipment information comprises specifications, spare parts and cross referencing. A list of spare parts for each piece of equipment helpers maintenance personnel quickly identify the part needed and enables them to quickly determine its availability through a transfer to the Walker system.

(4) Preventive Maintenance

The PM module gives complete and timely information on all preventive maintenance activities in the facility. The required activity and the frequency of the activity is identified. A hard copy work schedule or inspection list is then automatically generated for maintenance crews. The module is linked to the history module in order to update the maintenance information on each piece of equipment.

Before inputting the PM information the whole spectrum of schedules and inspection lists were reviewed in order to have a more optimised PM operation. A total of R34 642 per annum in labour costs was saved by eliminating unnecessary scheduled work.

(5) Cost information

On-line cost information gives data for effectively evaluating and controlling maintenance costs. A breakdown of all expenses charged against each piece of equipment is available. All stock items issued (with costs) that have been issued against a piece of equipment can also be displayed. Cost summaries can review the maintenance costs of every cost centre and every piece of equipment in the facility.

Areas of excessive maintenance expense can quickly be detected. The cost information module is linked to the equipment and history modules.

(6) Downtime

With the downtime subsystem, discrete segments of the facility can be identified and tracked. Downtime records are collected and entered into the downtime module. A detailed report of equipment outages/availability can be processed.

A further development would be to build and display summaries of equipment categories, equipment classes and detail equipment outages. A downtime analysis per department is development envisage and these results in turn can be compared to budgeted times/percentages per category. Equipment availability can be analysed by reasons such as maintenance, overhaul and production.

Conclusion

Although TSB has had considerable success previously in operating a more effective PM system, the introduction of the computer into the maintenance management has given much more scope. It is firmly believed that after a fully integrated system has been implemented, TSB will be much closer to running an optimal maintenance operation.