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Backlog control is an important tool for determining maintenance department resources, making budget and workforce staffing decisions, evaluating department performance, and analyzing alternatives.

Survival and competition in the marketplace have forced organizations to look for better methods of increasing their operations effectiveness. Maintenance planning and scheduling are two activities that ensure the allocation of needed resources and the sequence in which they are needed so any activity can be performed in the shortest time with the least cost.

What is a backlog?
At the heart of the planning and scheduling processes is backlog management. Backlog is the list of work generated as work order requests. Emergency work—described as any occasional and unavoidable shutdown of equipment due to unforeseen circumstances requiring repairs in an unplanned mode with high impact on safety, environmental, production loss, and/or maintenance cost—is not part of the backlog.

Backlog is usually expressed in weeks and can be calculated as:

- Hours of schedulable work/work capacity, or
- Hours of schedulable work/(Hours in a work week x number of available workers)

Other ways of measuring the backlog are number of work orders, number of craftperson hours, full-time employees or full-time equivalents, crew weeks, percentage by craft, percentage by priority, and percentage by requested completion date. Maintenance specialists usually define backlog as the amount of work that remains to be performed or the measure of the accepted risk of the remaining work. The amount of accepted risk and the dynamics of the backlog dictate the importance of its proper management.

Validating the backlog
As facility priorities change, the backlog might include jobs that are no longer valid, including work that is not required to maintain the facility's capacity.

Work orders need to be purged periodically in order to maintain the backlog as a useful management tool. Work orders that have aged beyond the requested completion date, work

that is completed but with duplicated or open work orders, and work orders that received an incorrect priority or have inaccurate or incomplete information are invalid and should be eliminated from the backlog.

Communication among the operations, maintenance, and engineering departments is important in assuring an accurate backlog. The dialog should establish a criterion for determining a requested completion date that sets the priorities for work order execution and completion.

The backlog should be reviewed regularly by representatives from the three departments. A formal review should take place every 3 months. Informal reviews should take place every month during the planning meeting and every week during the scheduling meeting.

Analyzing the backlog

The criteria used most often for analyzing the backlog include:

Backlog age. An aged backlog is an indication of the misuse of the priority system most likely caused by an inability of the maintenance department to meet the requested completion dates. An initial solution would be to establish better communication with the work order originator to negotiate a priority when a work order cannot be completed in time. A maintenance department should make any effort to keep aged work orders to less than 5 percent of the total.

Backlog size. A backlog of less than 2 weeks makes the scheduling effort difficult. This indicates difficulty in identifying work in advance and results in a high number of emergency work orders. If both the emergency rate and backlog are low, a team of representatives from the operations, engineering, maintenance, and safety departments should tour the facility to determine its condition and identify new work. If the emergency rate and backlog are consistently low, the workforce in the maintenance department may be too large and measures need to be taken to better allocate resources.

A backlog greater than 3 weeks is an indication that work is not performed in time. A temporary solution may be to use overtime or contractor work to balance the backlog. If the backlog is consistently greater than 3 weeks, the maintenance manager has a justification for an increase in the workforce to satisfy the facility's demands.

Backlog clarification. As an example, assume a facility has 36 employees in the maintenance department, about 10,000 hours of work in the backlog, and about 4000 hours of preventive maintenance (PM) and predictive maintenance (PdM) work. To calculate the backlog with this data assuming that each employee works a full 40 hr week:

Labor available = Number of employees x 40 hr/wk/employee

Adjusted labor available = Labor available x (100 percent attendance percent absenteeism)/100

Backlog = 10,000 hours/(36 employees x 40 hr/wk) = 6.9 weeks

If 30 percent of the completed work was PM and PdM, then:

0.3 x 36 = 11 employees in the PM and PdM workforce

The backlog calculation, taking out the PM and PdM work, is:

Backlog = (10,000 hr 4000 hr)/((36 employees 11 PM and PdM employees) x 40 hr/wk) = 6 weeks

The calculation of the resources needed for PM and PdM activities and the backlog size without PM and PdM work gives a more realistic picture of the labor requirements for meeting work demands. In this example, temporary measures need to be taken to supplement the existing workforce to bring the backlog to the optimum size and, if the situation persists, an additional permanent workforce needs to be made available for the maintenance department to function properly.

Statistical data analysis, performance measures indicators. There is no single indicator that gives the best picture of the potential for maintenance activities improvement. The best method is to take a look at the relationship between input and output of the number of work orders and backlog size fluctuation over time. Given this information, the rate of emergency work orders and equipment availability is an indication of opportunities in the maintenance department. Equally important is the correlation of all the above with the percentage of schedule compliance over the same period of time.

Some of the performance measures indicators often used for backlog management are:

Percent of work identification = ((Number of jobs performed with a work order)/(total number of jobs performed)) x 100

Percent of schedule compliance = ((Scheduled hours actually worked)/ (total hours scheduled)) x 100

Percent PM and PdM compliance = ((Number of PM and PdM work orders completed)/(total number of PM and PdM work orders scheduled)) x 100

Percent of planned maintenance = ((Hours spent on planned maintenance)/(total maintenance hours)) x 100

Work order estimating accuracy = ((Estimated hours of completed work)/(total actual hours work)) x 100

Percent of time scheduled = ((Scheduled hours)/(total hours available)) x 100

Percent of emergency work = ((Number of emergency work orders)/(total number of work

orders)) x 100

Percent of importance of emergency work = ((Cost of emergency work)/(total cost of maintenance)) x 100

Percent overtime = ((Overtime)/(total maintenance hours)) x 100

Percent of equipment availability = ((Equipment running time)/(equipment running time + downtime)) x 100

These indicators not only show opportunities for improvement and the effect of recent changes in activities, but also provide the foundation for the best management decisions for the future. **M T**

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