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Last in a series of articles discussing the management of backlog

The first article in this series, “Essential Elements of Backlog Measurement,” defined backlog as the classification of work that, for whatever reason, has not been completed. The second article, “Measuring Backlog,” presented various methods of measuring backlog in weeks.

However, two questions remain. What does backlog mean? And, how can it be used?

There are any number of meanings, real and implied, relating to backlog. Primarily it is used as a scheduling tool for workload management and balancing. It also can be used to justify decisions concerning changes in organizational work force and budgeting.

Maintaining backlog validity

Before using backlog for any of these purposes, its validity should be ensured. Backlog requires regular maintenance to prove its validity. This maintenance includes sifting through the work to determine if jobs are feasible future work, are duplicated, require additional planning or materials, or require changes in their priority, and if the backlog provides sufficient future required work.

If work exists in the backlog that is not valid, it should either be adjusted to make it valid, such as changing the status or priority of individual jobs, or be canceled and removed from the backlog.

Determining healthy backlog

It is important to have an idea of what a healthy amount of backlog for an organization is. Opinions vary, but it is generally accepted that two to four weeks of backlog is a healthy figure of future work. This provides a good amount of scheduling capability to the organization. Also, it provides for balanced workloads as well as good facility management, where most, if not all, of the required work is completed for maintaining the facility.

If the backlog consistently falls below the two-week minimum, there is not enough work available to provide good scheduling of the labor force and leaves the organization open to running out of work to be done.

At first it might seem that this is a good thing. But if a time comes when all personnel cannot be used, money is being spent without a productive result. If this occurs often, labor resources may require adjustment.

Likewise, if the backlog is consistently above the healthy limit, the organization has more work than can be reasonably handled by the present work force. If the backlog validity is maintained, the effect of excessive backlog is higher overtime use and higher cancellation of valid or required work.

This is cause for concern on many points. First, higher overtime use generally means that the company is paying 50 percent more for those labor hours that are presumably only about 70 percent productive, due mostly to worker fatigue and decreased morale. Second, the cancellation of valid and/or required work is inherently hazardous for the facility. If an organization is so overworked that PMs go unperformed and are cancelled due to lack of resources or, in the case of a daily or weekly PM, duplication of work, then a higher possibility exists that a particular PM will not be performed for long periods, increasing the risk of breakage and subsequent corrective maintenance work.

Managing excessive backlog

There are ways to manage the backlog in this situation. One way would be to evaluate the preventive maintenance program to determine if it is excessive. It could be that too much PM is being performed and some daily work actually should be done weekly and so on. Also, evaluate job plans to determine if any changes are required to the processes involved or if duration estimates require alteration.

This contributes to validity as well. It is important to note that while this is an option to correct excessive backlog and improve validity, it should not subtract from the purpose of the PM program—to prevent a breakage.

Another avenue of managing excessive backlog involves evaluating corrective work in the backlog. As a facility ages, some corrective work will show up in patterns. If these patterns are identified, some care can be taken to more closely examine the cause of the problem and either fix/replace it directly or add it to the PM program, thereby avoiding a costly repair.

The final avenue of managing excessive backlog comes from the acquisition of additional resources. More manpower is a sure way to reduce the effects of excessive backlog. This reduces the strain on workers, budgets, and facilities by reducing the need for high overtime, reducing cancellations of required PM work, and reducing the backlog to a manageable level.

Mentioning that backlog can be used as an element to work force adjustments tends to perk up ears. There will be times when supervisors and managers will have to justify present or requested resources. Backlog, along with other contributing elements, is an important tool for the decision making process.

Any one of these techniques can produce positive results in managing excessive backlog but a combination is more likely the final answer to resolving and avoiding the problem altogether.

Elements of change

When considering a situation involving backlog work and the desire to examine work force requirements, it is important to use a wide base of data. In the example, figures are based on the prior year of data concerning patterns, averages, and summaries.

A quick and dirty method of determining labor resource requirements based on the backlog is to first decide what is an ideal amount of backlog weeks to be maintained in the organization. As stated before, two to four weeks seems to be the ideal range to maintain.

After deciding the backlog weeks, apply this figure to both the average backlog hours (3590 hr in this example) and the technician credit hour capability (34.15 hr/week). See Fig. 1 . There are 10 technicians available for work in this shop.

However, there are some key elements in addition to backlog that are required to receive a proper picture of labor resource requirements. Typically, they include workload distribution, overtime usage, cancellations, and workload projections.

Calculating work force requirements involves some of the same operations as applied in the weeks measurement calculation presented in the second article. First, identify projected preventive maintenance hours—for the next year is best.

Projecting PM hours is a simple operation and is accomplished by examining the PM schedule and taking note of frequency, frequency unit, and job plans or labor estimates. Once this information is obtained, find out how many work orders will be performed for this PM schedule.

If, for example, a monthly PM used for lighting inspections has 4 hr in estimated time attached, this PM would generate 12 work orders throughout the year that would total around 48 hr of labor time.

Once the total amount of PM work for the next year has been calculated, the annual shop credit hours capability should be determined (Fig. 2a).

Then, the projected annual workload should be figured. In this calculation, it is important to know what percentage of the expended labor hours for the prior year fit with each work type (Fig. 2b).

Next, by subtracting the annual capabilities from the projected annual workload the amount of the projected labor hours in excess of the shop's capability can be determined (Fig. 3a).

Finally, the amount of additional labor resources and their effect on the backlog can be calculated (Fig. 3b).

Now it comes to money

Why bother going through all these calculations just to figure the amount of resources a shop would require? Money.

It costs money to employ a labor force to maintain a facility. It also costs money if that facility is neglected through cancellation of required maintenance. The question with this is: what are the options and which is most cost effective?

Option 1 is to continue cancelling work that resources are not available to complete. This is not good because the health of the facility is the primary concern. Option 2 is to continue working with the present work force and absorb the excess work in overtime labor (Fig. 4).

Overtime labor is not especially productive mainly due to worker fatigue and morale compared to regular labor time. It is also very expensive compared to completing the same work with regular time employees.

Option 3 is to add labor resources to the shop. This can accomplish two things. First, the facility can be effectively maintained with less risk of corrective maintenance due to facility failures. Second, the addition of these resources accomplishes the excess work without the need for excessive overtime labor (Fig. 5).

In a world where budget cutbacks often affect a facility's support group before other "more critical" areas, facility managers are increasingly being told to do more with less. Backlog is the key to success in managing these priorities, sometimes in unconventional ways.

The subject of backlog is complicated. Coupled with other items, backlog can be a guide to operations and capabilities. It is a powerful tool for facility managers that does not give up answers easily or completely unless the manager can fully understand what it is and how it is measured, and can manage it effectively to maintain the validity of the data. **MT**

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Fig. 1. Labor resource requirements for average backlog

$$\text{Total technicians} = \frac{\text{Average backlog hours per year/ideal backlog weeks}}{\text{Technician credit hour capability} * \text{ideal backlog weeks}}$$

$$= \frac{3590/3}{34.15 * 3} = 11.6 \text{ or } 12 \text{ technicians}$$

Fig 2a Projected annual capabilities

(Current number of technicians employed by shop * technician credit hour capability) * annual wee

(10 * 34.15) * 52 = 17,758 credit hours

Fig 2b Projected annual workload

Given:

Projected preventive maintenance hours = 14,257 hours

Preventive maintenance average distribution = 51.85%

Work type calculated hours of future work =

$$\frac{(\text{Projected preventive maintenance hours} * \text{Work type average distribution}) * \text{cancellatio}}{\text{Predictive maintenance average distribution}}$$

Corrective maintenance hours =

$$\frac{(14{,}257 * 33.44\%)}{51.85\%} * -25\% = 6896 \text{ hours}$$

Projected annual workload =

Projected preventive maintenance hours + corrective maintenance hours + *Work type* av

Work type calculated hours of future work

14,257 + 6896 + 2165 + 600 = 23,918 hours

Notes:

Projected preventive maintenance hours are projected for one advance year

Preventive maintenance average distribution is evaluated for one prior year

Work type average distribution is evaluated for one prior year (substitute selected work types for this for example *corrective maintenance* hours and *corrective maintenance* average distribution)

Work type calculated hours of future work

Cancellation correction factor provides that a certain amount of labor hours will be cancelled due to n This is determined by the organization.

Fig 3a Projected excess workload

(Current backlog hours + projected annual workload) – projected annual capabilities

(3590 + 23,918) – 17,758 = 9750 hours

Fig 3b Labor resource requirements

***Labor resource requirements* =**

$$\frac{\text{Projected excess work}}{(\text{Technician credit hour capability} * \text{annual weeks})} = \frac{9750}{(34.15 * 52)} = 5.5 \text{ or } 6 \text{ technicians}$$

***Adjusted backlog weeks with additional labor resources* =**

$$\frac{\text{Current backlog hours}}{(\text{Number of current technicians} + \text{labor resource requirements}) * \text{technician credit hour capabi}}$$

$$\frac{3590}{(10 + 6) * 34.15} = 6.5 \text{ weeks}$$

Footnote 4: Overtime labor for excess work

***Calculated labor hours required to complete* =**

$$\frac{\text{Projected excess work}}{\text{Value of overtime work}} = \frac{9750}{75\%} = 13{,}000 \text{ hours}$$

***Cost of overtime labor for excess work* =**

Calculated labor hours required to complete * (mean hourly wage of technicians * overtime multip

13,000 * ($21.32 * 1.5) = $415,740

Note: Value of overtime work is determined by organization

back to article

Footnote 5

***Cost of additional labor resources* =**

(Labor resource requirement * annual regular hours for a technician) * mean hourly wage of technici

(6 * 2080) * $21.32 = $266,073.60

***Cost savings from use of additional labor* =**

Cost of overtime labor for excess work – cost of additional labor resources

$415,740 – $266,073 = **$149,667 savings**

Note: Annual regular hours for a technician was calculated previously when determining backlog in weeks

back to article