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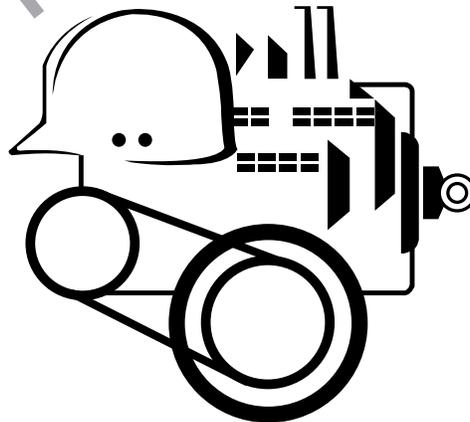
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**CONTROLLING MAINTENANCE RESOURCES**

**Lesson One**

**Measuring  
Workload**



**TPC Training Systems**

90301

**Lesson****1****Measuring Workload****TOPICS**

**What is the Workload?**  
**Categories of Workloads**  
**Techniques for Computing Workloads**

**Distributing the Workload**  
**Effects of Absenteeism, Overtime on Workloads**  
**Workloads vs. Backlog Levels**

**OBJECTIVES**

**After studying this lesson, you should be able to...**

- Define workload and explain its importance in control of maintenance work.
- List the seven workload categories.
- Compute workload measurements for each of the seven categories.
- Explain how the workload should be distributed.
- Describe the effects of absenteeism and overtime on the workload.

**KEY TECHNICAL TERMS**

**Assigned maintenance** 1.03 repetitive responsibilities carried out on a regular basis

**Scheduled maintenance** 1.03 major maintenance tasks requiring planning and scheduling

**Unscheduled repairs** 1.03 minor chores requiring a relatively short period of time for completion

**Emergency repairs** 1.03 jobs that must be undertaken immediately to avoid injury or serious loss

**Engineering project work** 1.03 nonmaintenance work performed by maintenance personnel in support of engineering

**This lesson discusses the importance of measuring the manhours needed to get the job done. Workload measurement is imperative to good labor control. Even the best labor control cannot get the job done if the workload is unreasonably large, or if the wrong crafts have been assigned.**

**In order to simplify the task of measurement, this lesson breaks the workload into categories. Techniques used for estimating manhour needs will differ according to category. The same categories will be used when discussing control of labor in subsequent lessons.**

**The balanced workload means that the right crafts are available in sufficient number to get the job done. In this lesson, you will learn the techniques for computing workloads, and for effectively distributing labor among the work categories.**

### What is the Workload?

1.01 If you, as a supervisor, aim at achieving a work crew of the right size and combination of crafts, you must first measure the workload. Workload is the number of manhours that are required to carry out essential maintenance work and, at the same time, to keep backlogs at manageable levels.

1.02 If your plant requires maintenance crews to carry out construction, equipment installation, or machine relocation chores, you must include these functions in the workload. It's also important to measure tasks and backlogs accurately and at regular intervals. This helps you to make certain that the workforce is being kept in balance with workloads. The relationship between workforce and workload is graphically illustrated in Fig. 1-1, on the following page.

### Categories of Workloads

1.03 You can divide the workload into different categories to ease the tasks of measuring and of maintaining control. Workload categories closely parallel those of labor. They include:

- *Preventive maintenance*—routine activities such as inspection, lubrication, testing, cleaning, and adjusting conducted on a regular basis.
- *Assigned maintenance*—repetitive responsibilities carried out on a regular or seasonal basis. Also work performed exclusively by the same personnel. Janitorial work,

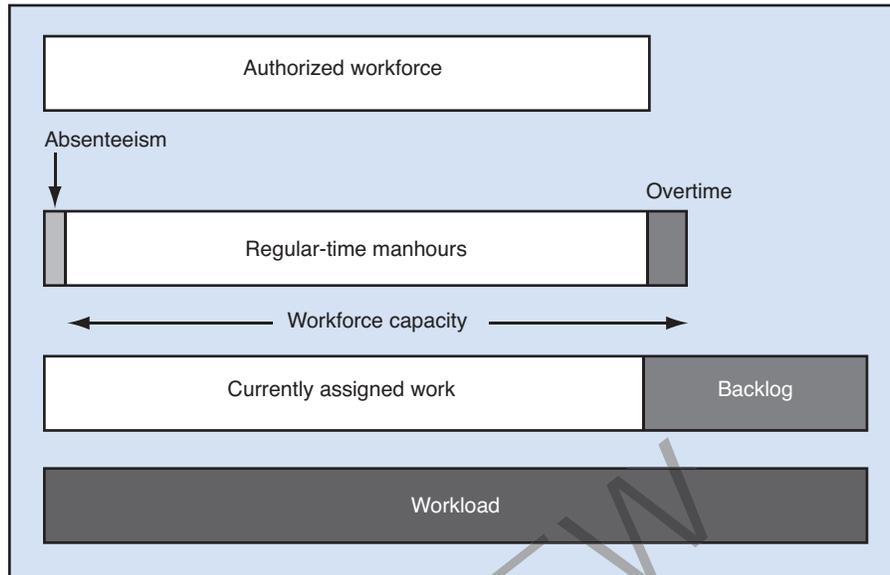
yard work, and truck driving are typical examples.

- *Scheduled maintenance*—all major maintenance tasks requiring planning and scheduling. Overhauls, component replacement, or rebuilds, are examples. This type of work involves estimation by craft as a part of planning and is included in the backlog.
- *Unscheduled repairs*—short-term chores requiring a relatively short period of time for completion.
- *Emergency repairs*—jobs that must be undertaken immediately to avoid possible injury, equipment deterioration, or serious product loss.
- *Operations support*—activities such as set-up work or tool and die repair.
- *Engineering project work*—nonmaintenance work performed in support of engineering by maintenance personnel. Work includes construction equipment relocation, etc. Because it is planned and scheduled, project work is also included in the backlog.

1.04 Each of the above work categories is measured in a specific way, and the amount of manpower each one requires is determined by these measurements. The resulting total is important to you in controlling both manpower and maintenance tasks.

1.05 The unexpected, the unwanted, the unscheduled diminish rapidly when preventive maintenance is

Fig. 1-1. Authorized workforce and the workload



conducted professionally. Some of the results you can expect are:

- work promised completed on schedule
- personnel available to work on the backlog
- overtime reduced
- costs held in line
- downtime and emergencies minimized.

1.06 Another important aspect of PM is indicated graphically in Fig. 1-2. Frequently conducted inspections discover deficiencies before costly equipment failures occur.

1.07 Before you can measure workloads accurately, two conditions must exist:

- The data used should cover a representative sample of work performed over a significant period of time—certainly no less than six months.
- The maintenance program should be one that has been in existence for a while, so that manhour requirements can be projected with fair accuracy. The likelihood of significant

and sustained surges or declines in workloads should be slight.

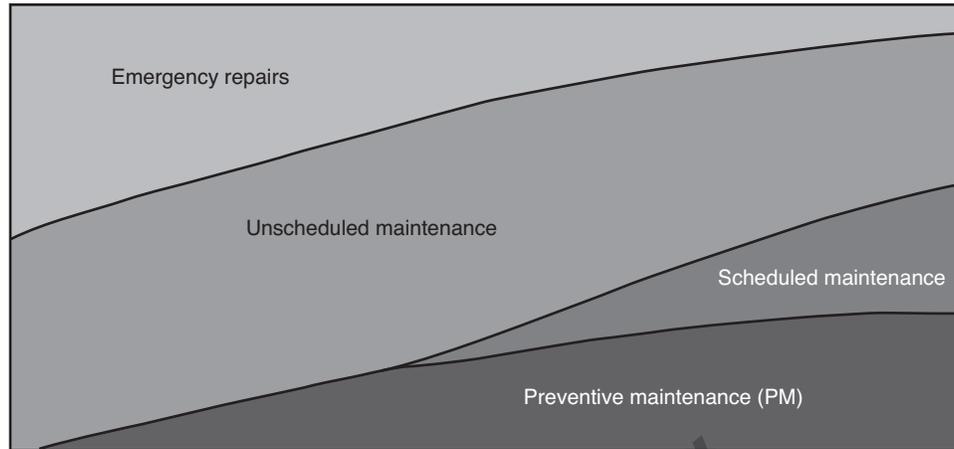
1.08 Sometimes supervisors lack essential data because they're recently promoted into the job without benefit of previous data collection, or because the PM program is relatively new. They may have to base their workload projections on the best available estimates. Regardless of how you may have to determine initial measurements, however, collect as much recorded evidence of manpower usage as possible and as quickly as possible. In that way you can compare performance data to desired workload levels and take corrective action when and where indicated.

### Techniques for Computing Workloads

1.09 Figuring workloads for each category of maintenance is time well spent. Workload projections become more accurate as historical data based on a stable operation is obtained. The workloads of new activities—new machines, new production lines—must be estimated, however. Also remember that major business events, such as strikes or management changes, can have a severe effect on schedules and plans. The following are some guidelines for computing workloads.

1.10 **Preventive maintenance.** Each activity in PM should be evaluated to determine the number of manhours required to handle it efficiently and com-

**Fig. 1-2. Effect of PM on emergency/unscheduled work**



plete it on time. Jobs will, of course, vary. But the procedures for measuring them remain relatively the same. A routine PM inspection may take an electrician four hours to complete. On the other hand, a vibration test may take a mechanic three hours. In both cases the time required to do an effective job includes:

- gathering required tools
- travel to and from the work site
- coverage of the work route itself
- performance of required services
- recording of deficiencies, measurements conducted, etc.

1.11 Table 1-1 shows computations for determining PM manpower needs. In each case, the yearly

total is the product of the number of places where the maintenance task must be performed, the time required to perform it in each place, and the number of times it must be performed each year.

1.12 The first entry in the table, for example, indicates that there are 5 places where a 2-manhour inspection and cleaning service is needed 365 days a year. In other words, 3650 manhours a year must be allocated for preventive maintenance of the equipment that requires daily inspection and cleaning. In Table 1-1, note that 8766 manhours translates into a requirement for five men. (One man works 1800 hours per year after vacations, holidays, etc.)

1.13 **Assigned maintenance.** Manpower requirements in this category are equal to the number of people handling the various activities on a full-time basis (2 janitors, for instance). Essentially, it's a head count of all people doing the same sort of work. In addition,

Service frequency	Inspection and cleaning	Lubrication	Testing
Daily (365)	$5 \times 2 \times 365 = 3650$		
Weekly (52)	$17 \times 3 \times 52 = 2652$	$6 \times 3 \times 52 = 936$	$6 \times 2 \times 52 = 624$
Monthly (12)	$12 \times 3 \times 12 = 432$	$4 \times 4 \times 12 = 192$	$3 \times 2 \times 12 = 72$
Semiannually (2)	$12 \times 5 \times 2 = 120$	$3 \times 6 \times 2 = 36$	$9 \times 2 \times 2 = 36$
Annually (1)	$2 \times 5 \times 1 = 10$	$2 \times 2 \times 1 = 4$	$1 \times 2 \times 1 = 2$
	6864	1168	734
Total manhours		8766	
Total men		5	

there must be assurances the work is necessary. As work in this category changes, of course, so does the number of maintenance personnel required. Management must reestimate the work to be done, so that the number of people on the job can be justified.

**The Programmed Exercises on the following page will tell you how well you understand the material you have just read. Before starting the exercises, remove the Reveal Key from the back of your book. Read the instructions printed on the Reveal Key. Follow these instructions as you work through the Programmed Exercises.**

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<p>1-1. To get a work crew of the right size and combination of crafts, you must _____ the workload</p>	<p>1-1. MEASURE Ref: 1.01</p>
<p>1-2. Workload is the manhours needed to perform essential maintenance work and keep the _____ at a manageable level.</p>	<p>1-2. BACKLOG Ref: 1.01</p>
<p>1-3. Short-term chores requiring a short period of time for completion are known as _____ repairs.</p>	<p>1-3. UNSCHEDULED Ref: 1.03</p>
<p>1-4. Setup work or tool and die repair falls in the category of _____ support.</p>	<p>1-4. OPERATIONS Ref: 1.03</p>
<p>1-5. Frequently conducted _____ discover deficiencies before equipment failures occur.</p>	<p>1-5. INSPECTIONS Ref: 1.06</p>
<p>1-6. The data used to measure workloads should cover no less than _____ months.</p>	<p>1-6. SIX Ref: 1.07</p>
<p>1-7. In measuring workloads for new activities, you must use _____.</p>	<p>1-7. ESTIMATES Ref: 1.09</p>
<p>1-8. Strikes cannot be allowed to affect maintenance schedules. True or False?</p>	<p>1-8. FALSE Ref: 1.09</p>

### Techniques for Computing Workloads—Continued

1.14 **Scheduled maintenance.** To allocate manpower needs for scheduled maintenance:

- plot known work to be done
- then, project it in terms of approximate time requirements.

1.15 In practice this would mean that an overhaul should be scheduled for a particular month or quarter, based on the best information available. The same holds true for repetitive chores, such as component replacements. You simply schedule them when you expect they will be needed and note them (along with the manhours required for completion) on an annual calendar called a forecast.

1.16 You should always evaluate tasks to determine craft requirements. A major overhaul, for example, might require 320 hours of mechanical craft time over a four-week period. For the same length of time you might have to allocate 160 hours of welding time. In practical terms this would mean that during the four-week overhaul, the 320 hours of mechanical time would require the skills of two men. For the 160 hours of welding, one man should be sufficient.

1.17 A thought to keep in mind when planning time for scheduled maintenance is that the time requirements for jobs involving craftsmen are already known. Previous experience is the source. For sched-

uled maintenance that has never been performed before, an estimate must be used.

1.18 When all known scheduled maintenance activities have been noted, there should be a balanced distribution of manpower for the total year. If available from previous data, the number of unexpected scheduled maintenance jobs can also be estimated and distributed evenly throughout the project. If the workload does not appear balanced (if, for instance, a major overhaul must be scheduled during a time when you can't spare the crew members needed to perform it), consider rescheduling, adding help, or using overtime.

1.19 As a general rule, scheduled maintenance should represent between 50 to 60% of the total workload. A wide variation in workloads is cause for investigation. The solution may require increased management vigilance.

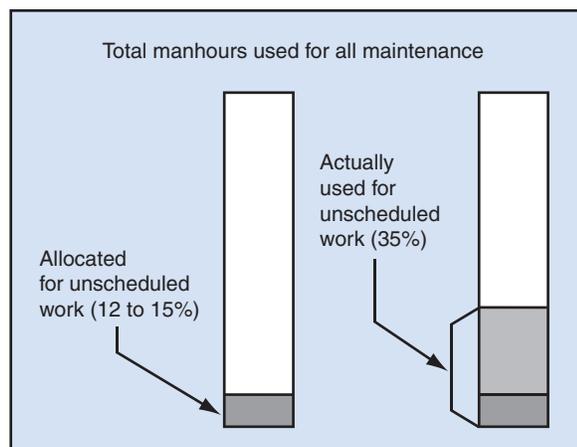
1.20 **Unscheduled repairs.** In any well-regulated program, nonscheduled repairs should not exceed 12 to 15% of total manpower expenditures. When repairs such as these seem to be getting out of hand, careful inspection of the PM program is required. Probe to find out:

- Is planning current?
- Are inspections being properly conducted on schedule?
- What controls are now in use? Are new ones indicated?
- What changes in scheduling may be necessary?
- Am I doing my share of on-the-job checking?

1.21 Projections help to determine manpower requirements. You make a workforce projection by tentatively assigning a specific percent of manpower to handle repairs. Experience will likely suggest the average number of unexpected chores that can crop up over a period of time.

1.22 To find out how closely your operations adhere to the 12 to 15% allocation, make certain there are reports you can review which detail actual total

**Fig. 1-3. Allocated vs. actual manhours for unscheduled work**



labor and the actual percent utilized in the handling of unscheduled repairs. If this information is available from previous years, your task will be greatly simplified. Check to see whether or not allocations have been exceeded. If so, a new target can be established closer to the desired allocation. Figure 1-3 suggests a method you can use.

**1.23 Emergency repairs.** When these exceed 8 to 10% of your total maintenance manpower, it's time to think about making drastic changes. Your best bet is to follow the same procedures discussed in the handling of unscheduled repairs.

**1.24 Operations support.** The number of maintenance workers who are asked to support various operations differs widely. Tool and die repair or mold replacement, as well as other related assignments, are likely to vary from facility to facility, from year to year, from season to season. Actual numbers required are usually based on head counts of personnel involved. Remember, of course, that management must estimate the work performed for the head count figure to be justified. The percent they represent of the total workforce can be developed from these figures. Figure 1-4 pictures a typical situation in which operations support plays a key role.

**1.25 Engineering projects.** As an integral part of a team responsible for keeping a plant functioning efficiently, maintenance workers are usually more than willing to lend engineering a helping hand. There is a danger, however. Be careful, for example, not to permit an engineering project to reduce your workforce so that workloads for which you're responsible cannot be achieved on schedule.

**1.26** As a general guide, an engineering project should not involve more than 12% of the total maintenance workforce at any one time. Exceptions are facilities that have production equipment designed and installed by their own personnel or new facilities where maintenance crews must rework installations constructed by outside contractors. In these cases, the percentage of maintenance personnel taking part should not exceed 21% (Fig. 1-5).

**1.27** Establishing the workload for an engineering project isn't difficult. Most of the time it is sufficient simply to follow the kind of forecast used when projecting scheduled maintenance.

**Fig. 1-4. Setup work is one aspect of operations support**

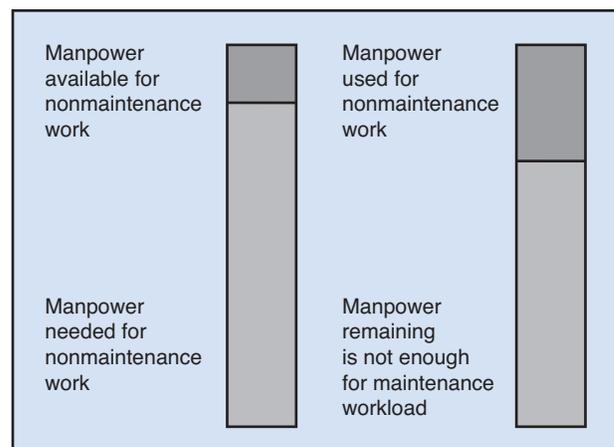


**1.28** However, engineering project work is usually unique. It is seldom repetitive, as scheduled maintenance is. Therefore, while some projects can be planned, most are not even known at the time workload data must be developed. So you should merely specify that a certain percentage of total manpower is available for engineering, rather than attempt to find out the number of manhours needed.

### Distributing the Workload

**1.29** To strike a preliminary balance, the distribution of the workload should be established.

**Fig. 1-5. Effect of excessive maintenance work**



- Controlled manpower—including PM, scheduled maintenance, and engineering projects—should be 50% or more of the total.
- Unscheduled repairs should account for 12 to 15%.
- Emergency repairs should not exceed 8 to 10%.

Harry Willis, a veteran maintenance supervisor, always projected the workload for his mobile equipment staff on the basis of 1.6 men per engine. He did this year after year, although he had no idea how the 1.6 figure was determined. He couldn't even remember the source of this rule of thumb by which he worked his team. In the meantime, he was developing a wealth of workload records that showed just how inaccurate that magic 1.6 figure was.

Why did he continue making the same mistake? A bit of probing revealed the reason. Harry simply considered it a waste of time to calculate workloads accurately. When it was pointed out to him that his own records showed how wrong he was, he became an immediate convert to workload measuring.

1.30 Manpower required for preventive maintenance can be computed and is definite—as are the head counts for assigned maintenance and production support work. A sample breakdown based on guidelines is shown in Table 1-2. Using the measurements in this table, a desirable distribution of the workforce can be developed, as indicated in Table 1-3.

1.31 When you make measurements using either the maintenance information system or a random sampling of work done, you can compare actual manpower use with your use targets as is done in Table 1-4.

1.32 Checking your performance in meeting workload requirements with manpower usage can be very revealing, especially when it is depicted graphically, as in Fig. 1-6. This can make it easier to spot trends that show where corrective action is needed.

**Effects of Absenteeism, Overtime on Workloads**

1.33 When workers don't show up to handle assigned responsibilities, it spells trouble, expense, and delay for the supervisor. Overtime can compensate for the man or woman out for a day, but it's expensive. And it's sometimes unfair to the individual performing the overtime.

1.34 The amount of absenteeism a workforce can absorb and the amount of overtime it can tolerate depend on a maintenance department's individual circumstances. But as a general rule of thumb, the number of hours of absenteeism should be about 2 to 3% less than the overtime hours.

1.35 If your department has been in business for considerable time, if realistic employee policies are in effect, and the control of work is good, the amount of overtime and absenteeism are probably predictable and controlled. On the other hand, if your maintenance operation is relatively new, lacks historical data, but is determined to control unexcused absences, a recommended target is about 3 or 4%. On average, overtime should be kept in the 6 to 9% range.

**Table 1-2. Workload breakdown**

Category	Target %	Measurements
Preventive maintenance	7	Compute
Assigned maintenance	5	Head count
Scheduled maintenance	40	Forecast
Unscheduled repairs	12	Allocate, measure
Emergency repairs	8	Allocate, measure
Operations support	12	Head count
Engineering project work	16	Forecast

**Table 1-3. Workload distribution**

Category	%	Mh/week	Workers
Preventive maintenance	7	206	5
Assigned maintenance	5	147	4
Scheduled maintenance	40	1178	29
Unscheduled repairs	12	353	9
Emergency repairs	8	237	6
Operations support	12	353	9
Project support	16	471	12
Total	100	2945	74

1.36 Overtime is frequently caused by unexpected work, such as emergencies (Fig. 1-7 on the following page). Overtime occurs in the best regulated maintenance operation. It is cause for concern only when it becomes excessive. And excess overtime can often be traced to poor or inadequate planning.

1.37 To keep absenteeism within acceptable boundaries, use the following checklist to make certain your people understand clearly where you stand.

- Stress your interest in good attendance beginning when job applicants are being interviewed.
- Require stay-aways to report absences personally to you.
- Establish a point at which frequent absentees are called to account.
- Refuse to accept feeble alibis. Insist on satisfactory explanations.
- Identify absentees who regularly extend weekends, especially long holiday weekends.
- Check lateness as well as unauthorized days off. Stay-aways are often latecomers as well.
- Watch for the problem employees: the man or woman whose absence is caused by compulsive gambling or chronic drinking.

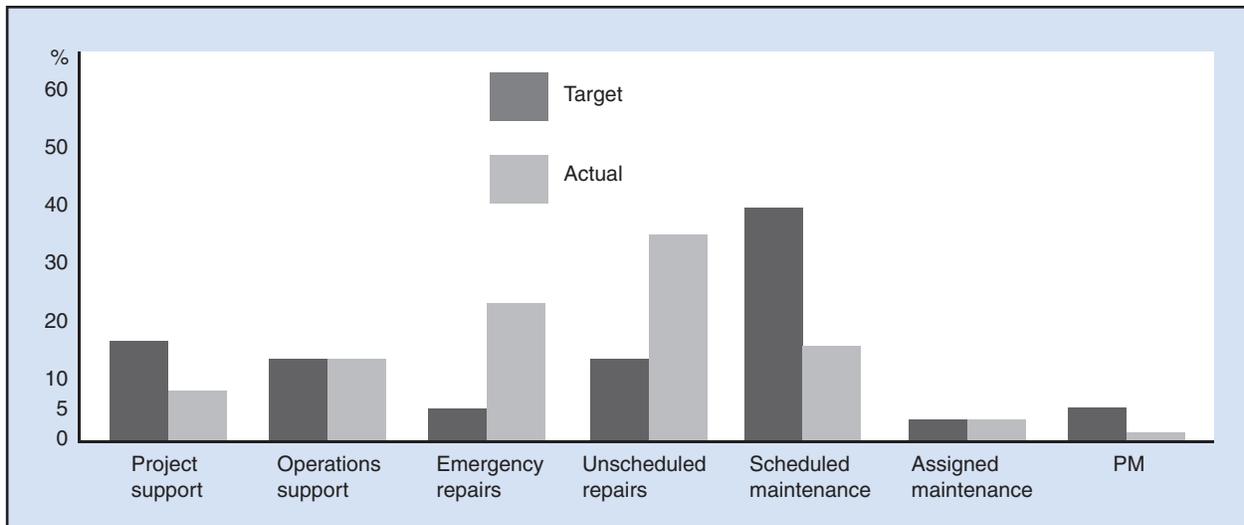
**Table 1-4. Actual vs. target manpower use**

Category	% Actual	% Target	Man-power actual	Man-power target
Preventive maintenance	1	7	1	5
Assigned maintenance	5	5	4	4
Scheduled maintenance	16	40	12	29
Unscheduled repairs	35	12	25	9
Emergency repairs	22	8	16	6
Operations support	12	12	9	9
Project support	9	16	6	11

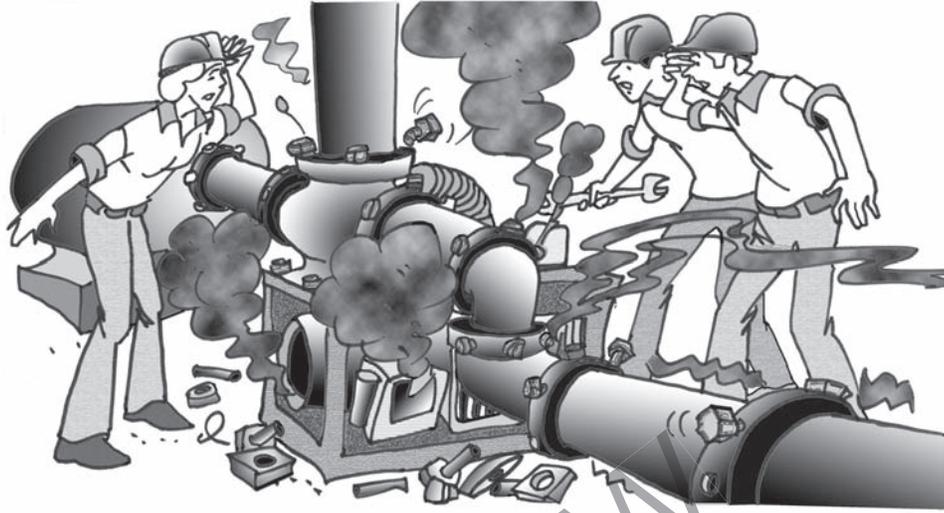
- Reward perfect attendance over extended periods in some tangible way.
- Don't hesitate to take action when circumstances warrant it—when repeated warnings have no results, for example.

It was pretty clear to maintenance supervisor Bert Miller that he had a problem on his hands. Steve Swanson still had a miserable attendance record, even after Bert had talked to him three times about it. Bert knew it wouldn't be tough to prove that Steve spent most of these "sick days" on the golf course. But he didn't want to fire the guy because Steve was an excellent worker—bright, quick, and efficient. The supervisor decided to have another heart-to-heart chat, but to take a different tack this time and encourage Steve to do most of the talking.

**Fig. 1-6. Workload targets compared to actual workload**



**Fig. 1-7. Unexpected work is a common cause of overtime**



These are the notes Bert jotted down following the interview:

“Intelligent, experienced, and bored stiff.”  
 “Wants to leave but feels he has too much seniority.” “Wants new challenge. Would like to prove himself to superiors for possible advancement. Highly ambitious.”

As Bert turned the problem over in his mind, it occurred to him that maybe part of the solution was already at hand. He needed an assistant—maybe Steve was the man. Certainly he was smart enough, but did he have the initiative? Bert decided to give it a try and find out.

The answer came soon enough. It was obvious in the new glow in Steve’s eyes, in his take-charge and follow-through attitude, in the way he made things work the way they were supposed to, and in his absence-free record. Steve became a young man with genuine growth possibilities—all because a supervisor took the time to learn the real reason behind his absenteeism.

### **Workloads vs. Backlog Levels**

1.38 Remember that backlog is defined as the number of estimated hours of planned work that has been identified but not completed. If you ignore back-

logs, you’re asking for trouble. Breakdowns and emergencies are the inevitable result.

1.39 That’s why it’s so important to make a constant effort to reduce backlogs to manageable levels. Another benefit of doing so is that you also reduce overtime and extra expense.

1.40 To maintain control of backlog, you have to plan and schedule work carefully. What happens is worth the effort. PM programs are more effective. Surprises (mostly unpleasant) are few and far between. Objectives have a better chance of achievement.

1.41 Workload measurement is essential because it is the only way you can balance the workload with a workforce of the right size and with the right craft capabilities. Once this has been done, less detailed measurements can be made that help to insure the previously computed workload remains within reasonable boundaries.

1.42 With a well-balanced workload the right crafts are available as are the correct numbers of personnel to do any job. This will help increase both productivity and work effectiveness.

1.43 Workload measurement deserves prominence. Maintenance policies should state emphatically that it should be conducted regularly with “the objective of continually matching the amount of work with the number of personnel necessary to carry it out.”

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## 16 Programmed Exercises

<p>1-9. Scheduled maintenance should represent _____ to _____% of the total workload.</p>	<p>1-9. 50 to 60% Ref: 1.19</p>
<p>1-10. When unscheduled repairs get out of hand, you should carefully review the _____.</p>	<p>1-10. PM PROGRAM Ref: 1.20</p>
<p>1-11. It's time for drastic changes when _____ repairs occupy more than 10% of your manpower.</p>	<p>1-11. EMERGENCY Ref: 1.23</p>
<p>1-12. Instead of specifying the number of manhours needed, simply indicate that a certain _____ of the workforce will be available for engineering projects.</p>	<p>1-12. PERCENTAGE Ref: 1.28</p>
<p>1-13. You should try to keep absenteeism down to _____ or _____%.</p>	<p>1-13. 3 or 4% Ref: 1.35</p>
<p>1-14. Excess overtime can often be traced to inadequate _____.</p>	<p>1-14. PLANNING Ref: 1.36</p>
<p>1-15. To control backlogs, you must plan and _____ work carefully.</p>	<p>1-15. SCHEDULE Ref: 1.40</p>
<p>1-16. With a balanced workload, you will have the right _____ available as well as sufficient personnel.</p>	<p>1-16. CRAFTS Ref: 1.42</p>

Answer the following questions by marking an "X" in the box next to the best answer.

- 1-1. Work performed exclusively by the same personnel is called
- a. assigned maintenance
  - b. operations support
  - c. regular maintenance
  - d. scheduled maintenance
- 1-2. Unscheduled repairs require
- a. a relatively short period of time
  - b. consulting a planner
  - c. immediate attention
  - d. use of unskilled labor
- 1-3. Which of the following are results of preventive maintenance?
- a. Downtime minimized
  - b. Growth of backlog
  - c. Increased cost
  - d. All of the above
- 1-4. How many hours does the average crew member work each year?
- a. 1800 hours
  - b. 2400 hours
  - c. 3600 hours
  - d. 8766 hours
- 1-5. Work is scheduled on an annual calendar called a(n)
- a. backlog
  - b. forecast
  - c. maintenance schedule
  - d. work sheet
- 1-6. As a general rule, scheduled maintenance should represent how much of the total workload?
- a. Between 20 to 25%
  - b. Between 50 to 60%
  - c. Between 70 to 80%
  - d. Exactly 35%
- 1-7. When emergency repairs take up 5% of your total maintenance manpower
- a. make drastic changes
  - b. try to get them to exceed 8 to 10%
  - c. you are doing well
  - d. your previous data was wrong
- 1-8. Overtime is frequently caused by
- a. emergency work
  - b. poor planning
  - c. unexpected work
  - d. all of the above
- 1-9. The number of estimated hours of planned work identified but not completed is called a(n)
- a. backlog
  - b. projected workload
  - c. workload
  - d. workload estimate
- 1-10. The right crafts are available in the correct number when
- a. overtime is prohibited
  - b. supervisors can do their own hiring
  - c. the number of manhours is increased
  - d. the workload is balanced

## SUMMARY

**Workload is the number of manhours needed to perform essential maintenance work and keep backlogs at manageable levels. All tasks that your maintenance team must carry out are part of its workload. A well-balanced workload means that the right crafts are available in sufficient numbers to get the job done.**

**Workload is divided into categories to simplify measurement and control. Techniques used for estimating the manhour needs for each job differ from category to category. In order to make accurate manhour estimates, you must gather data covering a representative sample of work performed over at least six months.**

**As a general rule, scheduled maintenance, PM, and engineering projects should represent 50% or**

**more of the total workload. Unscheduled repairs should not exceed 15 to 20% of the total manhour expenditure. If manhours spent on emergency repairs exceed 8 to 10% of your total maintenance manpower, your maintenance program is in trouble.**

**The number of hours of absenteeism should be about 2 to 3% less than overtime hours. Overtime is a cause for concern when it becomes excessive. Excess overtime can often be traced to poor or inadequate planning.**

**The backlog is the number of estimated hours of planned work that has been identified but not completed. Failure to control backlogs results in breakdowns and emergencies.**

## Answers to Self-Check Quiz

- |  |  |
|--|--|
| 1-1. a. Assigned maintenance. Ref: 1.03              | 1-6. b. Between 50 to 60%. Ref: 1.19         |
| 1-2. a. A relatively short period of time. Ref: 1.03 | 1-7. c. You are doing well. Ref: 1.23        |
| 1-3. a. Downtime minimized. Ref: 1.05                | 1-8. d. All of the above. Ref: 1.36          |
| 1-4. a. 1800 hours. Ref: 1.12                        | 1-9. a. Backlog. Ref: 1.38                   |
| 1-5. b. Forecast. Ref: 1.15                          | 1-10. d. The workload is balanced. Ref: 1.42 |

Contributions from the following sources are appreciated:

Figure 1-4. LINPAC Group Limited