Learning Objectives

By the end of this chapter, you should be able to:

• Define the need and structure of a formal organization in managing the maintenance function.
• List the three elements comprising the plant engineering function.
• List four resources that must be managed by the maintenance organization.
• Define and list your maintenance department's goals and objectives.
• List eight criteria for selecting a maintenance supervisor.
• List three methods for determining the staffing level of a maintenance organization.
• Define three concepts of area organization in maintenance.

INTRODUCTION

Driven by competitive markets and new management methods, maintenance managers face the challenge of adapting to new and better ways of doing things. The central structure for providing direction to the maintenance operation is its form of organization. An organization is the administrative and functional structure of any endeavor, whether it is a department, a business, or even an army. Each has its own purpose and objective for existing;
that is what causes the organization to come into being. The administrative and functional elements are necessary to sustain the prime purpose of the endeavor. They formulate the regulations, operating procedures, and basic guidelines for interpersonal relationships; they set controls and lines of authority. Organizations permit managers to achieve the end result of any endeavor, namely to get the job done through efficient and maximum utilization of all available resources.

Commercial businesses strive to make a reasonable profit; public and non-profit activities strive to operate in a cost-effective manner. Either way, the businesses must deliver products or services at optimum cost and on schedule in order to be judged effective. When one thinks about world class businesses, however, other factors enter the picture. Factors such as product quality, environmental obligations, energy management, and the expanding role of government and regulatory agencies in the workplace are a few of the newer topics that maintenance managers must deal with directly. The maintenance manager plays a significant and growing role in pursuing these and other issues. Still, in the final analysis, businesses must create a market for their products or services, and from this market, operating, manufacturing, and marketing costs are funded. In simplest terms, what remains is the gross profit, which is increasingly influenced by the impact of activities performed by the modern maintenance function. Increasingly, traditional organizations are giving way to new concepts of structure. Self-directed work teams, quality circles, multi-skilled technicians, cellular work groups, and similar terms are used to describe some of the changes. More and more, decision making is being pushed down to the levels where work is actually done on equipment and systems. Knowledge and training are becoming crucial to the ability of maintenance personnel to keep up with modern complex equipment and systems.

Maintenance managers, then, become essential in keeping the cost of products and services at an optimum level through effective management of the resources for which they are responsible. More than that, to effectively manage support resources, maintenance managers must not only become part of the senior management team and play an expanding role in fulfilling the objectives and strategy of the business, they must also provide ongoing leadership in implementing modern management techniques in the maintenance function itself. This may be a novel concept to some maintenance managers who have previously operated at some distance from policy-making levels or have followed traditional methods of organization and authority. However, the changing impact of the maintenance function is more evident each day. The purpose of this course, then, is to develop insights into how best to achieve this role. In this chapter we will discuss the importance of organization as an instrument for managing resources and achieving objectives, and the importance of maintenance management in controlling resources. Because people are undeniably the most important resource, the manager's role in this regard will be emphasized. We will also look at the many functional responsibilities common to both large and small organizations.
ORGANIZATION CHARTS AND REPORTING LEVELS

In structuring an organization, many factors must be taken into consideration. No single structure applies to every situation, or even to activities that are similar. Two of the factors are:

1. Organizational objectives should shape the way an organization is set up. The organization should be built around the functions that best serve the mission of the business or enterprise. But an organization is dynamic; it is made up of people. One cannot continually change boxes on an organization chart and expect productive results. Rather, the manager should develop the people, make them responsible, and gain maximum utilization. Then the manager should design the organization's functions to realize the potential of the people making up this collective activity.

2. The size of an organization dictates the need for a certain minimum number of management personnel. The distribution of functions can also change in organizations of the same size. However, regardless of size, an organization must employ the necessary management functions for control and a cost-effective operation.

Very Small and Small Organizations

Very small and small maintenance organizations have fewer people (from 2 to 30), so management systems must be streamlined to reduce work activity and paperwork. The work order is the key to all controls; consequently, a very small plant might keep all completed work orders in a file as equipment history. Engineering design might be contracted out. Typically, the individual responsible for maintenance is a supervisor (most often referred to as foreman), possibly a working supervisor. Budgeting is the responsibility of the superintendent or manager of support services. Smaller maintenance organizations typically report to the manufacturing manager, although experience suggests this is an organizational error; better results ensue when maintenance and manufacturing report to the same management level. Exhibit 1-1 shows an organization chart for a very small manufacturing plant, and Exhibit 1-2 shows a typical small manufacturing plant. A small or even very small plant should have a formal planning and scheduling function. To justify a planner/scheduler, the organization might have the individual perform other duties, such as managing stores, purchasing items for maintenance, and expediting deliveries. The maintenance superintendent and/or supervisor could carry a share of the planning and scheduling function as well. (The organization charts shown in Exhibits 1-1 through 1-4 are typical but not hard blueprints for designing an organization.)

Medium Organization

A typical medium-size manufacturing plant organization is shown in Exhibit 1-3. The maintenance group would typically have 25 to 40 people.
Exhibit 1–1
Organization Chart—Very Small Plant

- Plant Manager
  - Staff Assistant—Production, Control, etc.
  - Secretary
    - Manager of Support Services
      - Financial
      - Distribution
      - Inventory Control
      - Purchasing and Stores
      - Employee Relations
      - Office Manager
      - Marketing
      - Sales
    - Outside Support (Engineering, Construction)
      - Secretary
    - Manufacturing Superintendent
      - Budgeting
      - Safety Compliances
      - Employee Relations
      - Secretary (shared by all)
        - Production Foreman
        - Production Foreman
        - Maintenance Foreman
          - Production Employees
          - Production Employees
          - Craftsmen
Exhibit 1-2
Organization Chart—Small Plant

Plant Manager

Production Planner

Secretary

Superintendent

Production

Secretaries

Superintendent

Administrative

Support

- Purchasing and Stores
- Employee Relations
- Accounting
- Distribution
- Safety

Maintenance

Superintendent

- Engineering
- Budgeting
- Employee Relations
- Regulatory Compliance
- Training
- Safety

Secretary

(shared by all)

Department Foreman

Department Foreman

Department Foreman

Secretary

(shared by all)

Outside Contractors

- Construction
- Engineering
- Supplemental Maintenance

Foreman

- Line Organization
- Training
- Repairs
- Safety
- Records

Craftsmen

Foreman

- Line Organization
- Training
- Repairs
- Safety
- Records

Craftsmen

Staff Assistant

(one person)

- Parts Expediting
- Planning
- Scheduling
- Work Orders

Support

- Budgeting
- Records
- Safety
Exhibit 1-3
Organization Chart—Medium-size Plant
Exhibit 1-4
Organization Chart—Large Plant

Plant Manager

Assistant Plant Manager—
Administration
- Employee Relations
- Distribution
- Purchasing
- Accounting
- Safety

Assistant Plant Manager—
Maintenance and Engineering
- Superintendent
  and Staff Support
  - Engineering
  - Planning and Scheduling
  - Purchasing
  - Stores
  - Administration
  - Budgeting
  - Training

Assistant Plant Manager—
Production
  - Production Planning
  - Group
    - Materials
    - Schedules
    - Industrial
  - Engineering

Superintendent—
Area 1
  - Foremen
    - Production Employees

Superintendent—
Area 2
  - Foremen
    - Production Employees

Superintendent—
Area 3
  - Foremen
    - Production Employees

Superintendent—
Area 4
  - Foremen
    - Production Employees

Secretary

Area 1
  - Area
  - craftsmen
Area 2
  - Area
  - craftsmen
Area 3
  - Area
  - craftsmen
Area 4
  - Area
  - craftsmen

Secretary

Scheduling

Secretary

Scheduling

Secretary

Scheduling

Secretary

Scheduling

Superintendent—
Central Shops

Superintendent—
Construction

Superintendent—
Area Maintenance
In this example, the maintenance work is still centralized, but there is also a central shop. There are more personnel to manage various support functions, and the maintenance organization reports to a plant engineer, not to manufacturing. Construction and some engineering might still be contracted out. This is a practical organization because the natural affinity of engineering and maintenance is effective.

Large Organization
In much larger plants, the engineering department might be pulled out of maintenance to stand alone, and larger support activities might be administered by business-oriented managers instead of engineers. Maintenance could be a department of 100 people or more. A large plant might do all of its own maintenance work, as well as small to medium construction work and only contract out large projects to avoid building up too much internal construction capability. An organization chart for a large plant is shown in Exhibit 1-4. Clearly, large plant maintenance contains many more organizational functions, and work is typically set up along geographic or functional areas to interface with production units.

The maintenance support functions in a large plant might include engineering, purchasing, and stores. These might report to maintenance or another department depending on which activity is the chief user of the functions. In very large organizations, these services are widely used by all and are better utilized if discharged through a central organization.

MANAGERIAL OBJECTIVES
It is not enough for a manager of a department to excel technically. Because most maintenance managers are technical persons, management already assumes they excel in technical areas. A maintenance manager is also expected to increase productivity and improve the technical excellence of the organization. It takes exceptional management skills to accomplish this.

The transition from being a technical expert to a manager of a technical organization is shown in Exhibit 1-5. For a smooth transition, a manager must understand the overall objectives of the organization.

The objective should not simply be to get the job done: It should be to do a better job by knowing why the job is being done. As in technical troubleshooting, it is important to look past the effect and find the cause.

For example, top management might include the following in this year's overall company objectives:

A. Establish annual growth of 15 percent.
B. Expand market area to include Europe.
C. Introduce a new product.
D. Change corporate image (community involvement).
E. Obtain a 2 percent or smaller reportable accident level, as reported to the Occupational Safety and Health Administration (OSHA).
The transition from a purely technical responsibility to the management of that technical group, right up to a company’s top executive, is well illustrated in this exhibit. The vertical lines intersect the division of technical responsibilities and managerial responsibilities to indicate how management skills take precedence over the technical skills as a person becomes more involved in higher levels of responsibility. These vertical grids, numbered one through six, might be identified as follows:

1 Technician (or hourly mechanic). In this position there is some need to manage both work and time.

2 Engineer (accountant, nurse, and so on). Each position requires some type of technical responsibility that demands some management of time, work, and important decisions.

3 Engineering Manager (first-line manager, foreman, accounting supervisor, and floor charge nurse). Each of these positions manages a highly technical activity with a direct technical responsibility, and there is an increase in managerial requirements.

4 Functional Manager (maintenance manager, plant engineer, accounting department head, hospital head nurse, and production superintendent). The scope is increased over that of grid 3, though there is often overlapping of 3 and 4. With the increased scope comes the increased need to manage all of the resources assigned to these positions.

5 Middle Manager (plant manager, assistant controller, division manager, hospital administrator, and division, or corporate, engineering manager). The scope of responsibilities has now increased to include the responsibility of other functional organizations. The technical knowledge required includes an understanding of many technical functions. It becomes even more important to administer and make decisions affecting many areas.

6 Top Executive (has a background in one of the other disciplines). Must manage (lead) all other functions and develop the strategies of long- and short-term business planning. Like any other manager, the top executive must know how to manage the human resources who provide the input for the major decisions to be made.
Of course, many more objectives could be shown, such as quality and productivity improvements, increases in equipment uptime, facility improvement, reorganization plans, etc. And those listed above may require even more involvement to achieve their ends. For example, expanding markets to Europe may necessitate certification that the plant has implemented the provisions of ISO 9000, a standard published by the International Standards Organization, concerning manufacturing operations and materials sourcing. The maintenance function would play a major role in getting the plant certified to comply with this standard.

These sample objectives relate to key business activities and can be associated with the eight key areas for which management author Peter Drucker suggests an organization must set objectives. These are:

1. Marketing  
2. Physical resources  
3. Innovation  
4. Productivity  
5. Human resources  
6. Social responsibility  
7. Financial resources  
8. Profit requirements

These eight key areas can be matched with the five company objectives previously listed, possibly as: A=6, 7, 8; B=1, 3, 6, 7, 8; C=1, 5, 6, 7, 8; D= 2, 4; E= 2, 3, 4. Once the manager understands and identifies with the company's overall goals, true management takes shape. At this point, no matter what function is undertaken, the manager begins to run a business.

Understanding and identifying with the overall goals or objectives is not the responsibility only of the maintenance manager or other functional managers. A true test of top management is found in how effectively the organizational goals are developed and communicated to all levels of subordinate management. A company that clearly defines "where it is going" sets guidelines that can motivate all sectors of the organization. This is important because an organization doesn't just grow by itself; it grows because of people who bring it into being and who are the main reason it sustains itself.

**RESOURCES TO MANAGE**

The usual resources connected with an enterprise include:

- Human (personnel, intellectual talent)
- Financial (capital, budget, cost)
- Physical (plant, equipment, land, materials, parts, etc.)
- Information

Good management of each of these resources is vital to successfully achieving overall goals and objectives. However, the individual who successfully comprehends and manages the complexities of the human resources usually manages all of the resources well.
Human Resources

Human resources are people-complex and different from one another. They are by-and-large capable and proud and want the same respect the manager desires. They need to be clearly shown what is wanted, and they will do the job. People are generally motivated; the manager's job is to create an environment in which people can achieve and, when they do, reward them with recognition. A good manager also shows genuine concern for people, which leads to their trust and commitment to managerial decisions and leadership. Personnel at all levels have a great desire to be part of the decision-making process. This is especially true in newer types of organizations mentioned earlier in this chapter. Maintenance managers must strive to involve maintenance workers in the decision processes affecting their daily work lives. This involvement is primarily a matter of communications, but also it requires re-thinking issues of trust and respect among the various levels of the organization.

Financial Resources

A good manager is concerned with the costs of getting the job done and instills in the workforce the same concerns. To get the maximum contributions from others, a manager plans and schedules work, develops standards of measurement and productivity, and makes sure the true costs of activities are known. Financial control requires exercising effective leadership as well as developing and enforcing firm but fair discipline.

Physical Resources

The heart of the maintenance function, the reason for its existence, is the physical resources. A maintenance manager who feels responsibilities beyond day-to-day problems is more likely to achieve the major role of assuring the vitality of all physical assets. This larger role is another exciting aspect of managing an organization: it is not only more interesting than the necessary daily routine work (which managers must do well), but it gives a manager the satisfaction of contributing to the overall objectives of the organization.

Information Resources

Our entry into the information age has been accompanied by an explosion of facts, figures, and large amounts of data that may or may not assist the manager in getting the job done effectively. Information is generally regarded as helpful; however, one of the skills a modern manager must achieve is to study large amounts of information and determine which items are truly helpful in achieving the objectives of the maintenance function.

MAINTENANCE COSTS

The costs of maintenance can vary from 5 to 40 percent of the total cost of producing a product or service. The wide range derives from the nature of
the enterprise, the way costs are recognized and accumulated, and the efficiency with which work is carried out. Yet maintenance is only one of the costs associated with total costs. In a manufacturing process, for example, functional areas beyond maintenance claim portions of the total costs, including:

- Production
- Marketing and sales
- Distribution
- Plant operations
- Inventories
- Employee benefits
- Environmental issues
- Raw materials
- Administration
- Materials handling
- Research and development
- Management
- Regulatory compliance
- Obsolescence

Every unit that is produced contains a share of these costs. This is why each manager has an important responsibility to control costs. A maintenance manager is primarily concerned with controlling labor, materials, and overhead costs. In a labor-intensive industry, the overall costs of maintenance will generally be lower than in a capital-intensive industry where there is more equipment to maintain and support. Yet each situation, large or small, requires the same managerial functions within the maintenance function to keep costs under control. Another effect of maintenance on overall costs is that poor equipment reliability and poor equipment performance combine to affect product quality and rate of production. Thus, inadequate maintenance can generate production costs that are many times greater than those attributable to maintenance labor, materials, parts, and overhead.

MAINTENANCE DEPARTMENT OBJECTIVES

The objectives that govern the existence of the maintenance organization should also guide the functional activities of the department. At the same time, the maintenance department's objectives should reflect the overall goals of the business. A sample of one departmental objective might be to effectively develop and utilize available resources to preserve physical assets while safely providing continuous availability of production equipment at the most economical level.

This objective presents a challenge to any maintenance manager. It provides a guide to long-term and short-term needs, and applies to all resources—human, financial, physical, and informational. The most important part of this objective is to get the job done effectively. To successfully implement such an objective, the maintenance department must develop various functions and activities.

Additional objectives will surely include some of the more current concepts, such as continuous improvement, total quality, total productive equipment maintenance, energy and environmental upgrades, information and cost improvement, and so forth.
MAINTENANCE DEPARTMENT FUNCTIONS

Earlier, we said an organization is the administrative and functional structure of any endeavor and that it is made up of people. Within every organization there are functions and activities that are required for its successful operation. Many functions are universal to all organizations; some relate to a role that a specific organization performs (for example, maintenance production). However, a review of many well-run organizations reveals there are more universal functions than unique ones. Below is a list of typical functions for the maintenance organization:

- Repairs
- Engineering
- Preventive maintenance
- Safety
- Planning and scheduling
- Estimating
- Stores control
- Work management
- Plant operations
- Quality Assurance
- Employee relations
- Training
- Record keeping
- Energy management
- Regulatory compliance
- Data base management
- Budgeting
- Reports and analysis
- Financial planning
- Construction and remodeling

Other functions could be added to the list. The point is that many of these functions are universal to any organization. Some maintenance departments will be more involved than others in these, depending on their size and the critical nature of their responsibilities. In this list, the activities unique to maintenance are repairs, engineering, preventive maintenance, and work management. In some cases construction/remodeling is also included. These are the basic technical functions of the maintenance department. The remaining functions on the list are generally performed in any well-managed organization. Unfortunately, some maintenance organizations focus on the technical areas only.

Management activities (or tools) that support management functions, include:

- Operating procedures
- Work orders
- Management reports
- Tracking of current and future work
- Data and information retrieval
- Priority setting
- Regulations

In recent years, we have seen these activities communicated or carried out through computer-based management systems, allowing managers to spend more time in actual supervision of maintenance work, as opposed to devoting a lot of time to paperwork.
A maintenance organization, regardless of size, must to some degree develop and support all of these functions and activities if it is to be effective in achieving its objectives. The chapters that follow will discuss these prerequisites of good management in more detail.

Finding a sufficient number of people to carry out all the maintenance functions is an ongoing task. Management must agree to the principle of developing these functions and activities and apply them to the overall objectives. Then management must determine how to divide individual responsibilities among its people. The smaller the maintenance organization, the greater the share of functional responsibilities and accountability for each individual.

THE MAINTENANCE MANAGER

The maintenance manager is first a professional manager with a good technical background whose mission it is to direct the maintenance function. In small to medium-size plants, the manager might be an engineer or a technically trained person who has come up through the ranks. In most large organizations, the manager generally is a degreed engineer.

As organizations become larger and the demands of professionalism become higher, the maintenance manager title becomes interchangeable with plant engineer. Plant engineering combines the functions of engineering, maintenance, plant operations, and management. People occupying the plant engineer function are often registered professional engineers (P E.), and some strive to become designated as certified plant engineers (C.P.E.). Some professionals in this field join the American Society of Plant Engineers, which is called an umbrella society because different institutions refer to plant engineers by different titles. Hospitals use the term "hospital engineering manager"; universities typically use "facilities manager"; large corporate organizations often use titles that include the manager's engineering discipline (electrical, mechanical, maintenance, chemical). Basically, all perform the same general functions that make up plant or facilities engineering.

TIME MAINTENANCE SUPERVISOR

Maintenance supervisors (often referred to by the traditional title of "foremen") occupy one of the most important managerial functions in a maintenance organization: the day-to-day responsibility of personally directing a group of employees. The supervisor is the management's direct representative and sees that all management policies and procedures are implemented at the working level.

The supervisor's position is also the main entry level for hourly employees who want to enter management. It is essential that a good selection process be employed in filling this position. Too often, the main criterion is the individual's technical skills. Selecting people with technical skills is extremely
important, but a supervisor must also possess non-technical skills, abilities, or knowledge, including:

- Leadership skills.
- Demonstrated planning skills.
- Understanding of such systems as work orders and priorities.
- Personal communications skills (both verbal and written).
- Ability to sketch or diagram work to be done.
- Respect for peers, subordinates, and superiors.
- Ability to grasp and analyze figures.
- Innovation skills.
- Understanding of human nature and motivation.

In selecting a supervisor, it is important to make objective appraisals of the candidate. This can be done best by using the same criteria for all candidates and by including other managers within the organization in evaluating new candidates.

Some organizations occasionally appoint young or inexperienced engineers to the supervisor position in an attempt to give them some exposure and seasoning in maintenance. But before moving into the supervisor's position, the engineer should spend time in other departments to gain experience in the overall nature of the enterprise, its processes, and its people. Other organizations select supervisors from technicians or mechanics who have come up through the working ranks. Each plan offers unique opportunities for training in maintenance theory and know-how. To gain better results from the supervisor arrangement, a clearly defined job description should show the position's duties, objectives, responsibilities, authority, and relationships to other management functions.

STAFFING THE MAINTENANCE FUNCTION

There are no hard-and-fast rules for determining the number of skilled and non-skilled personnel a maintenance organization requires. Over time, most managers arrive at a mix and number of personnel who achieve maintenance objectives at an acceptable level of cost and efficiency. Historical patterns and the company's type of production (or work process) will point to which types of skills are needed. But the number of skilled personnel needed is more difficult to determine. Several methods can be utilized:

- One method is to multiply the replacement value of equipment by the factored maintenance estimate. As a general rule, total maintenance costs vary from as low as 1 percent (for a labor-intensive industry) to as much as 15 percent (for a capital-intensive industry). It must be decided by estimate or experience (sometimes arbitrary) where the facility and its equipment falls on this scale of 1 through 15 percent. Below is an example using $20
million dollars of equipment replacement value and 8 percent as the total estimated maintenance cost:

\[
\text{Capital Replacement Value} \times \text{Estimated Maintenance Cost (\%)} = \$20,000,000 \times 0.08 = \$1,600,000 \text{Total Mtce. Cost/Yr.}
\]

Next, the historical portion of labor as a percentage of the total maintenance cost is applied. If it is, say, 33.3 percent of the yearly total costs, then $533,333 labor costs can be projected ($1,600,000 divided by 3). If a weighted average skilled trades wage is $18.21 and benefits are another 22.3 percent, then 11 mechanics can be hired.

\[
\begin{align*}
\text{Labor plus fringes} \times \text{hours} & = \text{Weekly labor costs} \\
($18.21 + 4.06) \times 40 & = $890.83 \\
$890.83 \times 52 \text{ weeks} & = $46,323.33/\text{Yr.} \\
$533,333 - \text{F-} & $46,323.33 = 11.51\text{-skilled workers}
\end{align*}
\]

- Another method used to determine staffing requirements is to compare needs with another plant or organization that has substantially the same operation. Care must be taken to look for hidden differences that can affect staffing needs.
- A third method is to research the cost of maintaining similar pieces (or groups) of equipment and to infer certain cost estimates based on these data or on personal experience of the manager, supervisors, or consultants.

What is striking about these three approaches is their arbitrary or subjective nature and their imprecise basis for determining the required number of direct personnel. Over time, the true needs for keeping the equipment and facilities maintained in optimum condition emerge. As each work site is unique, and its problems and equipment are also unique, the manager must study and analyze all facets of the staffing challenge, both from a historical and from a theoretical angle. Accumulation of costs by discrete activity is essential, as is data on estimated maintenance costs for new equipment and even for planned items not yet installed.

The manager’s responsibilities do not end with determining the skills and numbers of personnel required. The manager must also manage those skilled personnel efficiently. Unfortunately, there are some managers who try to solve all problems, both technical and managerial, by simply adding more people in the maintenance work place.

PERSONNEL RATIOS

One of the questions frequently asked is: "What should the ratios be for supervisors (or other supervisory personnel) to skilled or non-skilled, hourly personnel?" Once again, the type of enterprise and equipment involved creates ratios that are unique to the case being evaluated. The ratios within a plant can vary, too. For example, a machine shop in a central location, sup-
porting the maintenance function, may have twice the number of hourly machinists for each supervisor as an electrical shop that is dispatching electricians to various parts of the plant. The obvious reason might be that all machine shop supervisors are supervised from one location, while the electricians work in many locations. Similarly, a very specialized skill, such as electronic instrumentation, might require fewer hourly employees per supervisor because of their greater technical expertise, even though their work might be performed in just one shop location.

The following ratios are for typical work situations. Each example represents one supervisor.

<table>
<thead>
<tr>
<th>Number of hourly people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrated area supervisor</td>
</tr>
<tr>
<td>Supervisor dispatching plant-wide</td>
</tr>
<tr>
<td>Machine shop supervisor</td>
</tr>
<tr>
<td>Specialty/high-tech supervisor</td>
</tr>
<tr>
<td>Average (excluding planner/estimators)</td>
</tr>
</tbody>
</table>

Planner/estimators, and planner/schedulers, although not direct supervisors, generally are responsible for 15 to 25 workers, in terms of work planned, estimated, and scheduled. The number of workers they can accommodate depends on the unique work they handle from the planning aspect. Experienced workers and their supervisor might plan, estimate, and schedule certain repetitive jobs, while more complicated jobs and projects are generally designated for separate handling by the planner/estimator/scheduler position. It should be noted that the extremely complex facilities found in many sites today cause the planner's workload to increase by a large measure. In these cases the planner probably can handle no more than 12 to 15 workers, depending on the sophistication of the technology and the resources at the planner's disposal.

For plant-wide ratios of supervisors, the two ends of the 8 to 10 average range shown above would indicate that 7 to 10 supervisors would be needed for a total of 100 workers. This range could be checked against the type of industry involved. Typically, the more complex or more capital-intensive sites require more supervisors.

To determine the ratio of management personnel to first-line supervision, a ratio of .2 manager to 1 supervisor is often used. This adds 2 managers to an organization with 10 supervisors, and 3 managers to an organization with 15 supervisors. Remember there are many variables (a scale of 1 to 15 percent of equipment replacement cost, for example) and no set rules. The staffing tables of a maintenance organization must be critically evaluated on an ongoing basis because technical requirements and priorities are constantly changing.

USE OF PRIMARY SKILLS

Frequently one hears the comment, "A multi-skilled technician is what we need." This term overlooks employee relations. The individual's primary skills should always be used to the fullest extent possible. It would be inefficient to
do otherwise. It is helpful if a worker who repairs a motor bearing can also use simple skills to remove a guard, disconnect motor leads, remove the motor from its mounting, and return it to the shop. In such a case the worker uses primary skills to actually replace the bearing.

However, use of multi-skills could be a delicate situation in some work environments, particularly in a unionized organization, because this practice might threaten the job security of other workers. Breaking the overall job into many smaller pieces, with each piece accomplished by a separate person or skill, is highly inefficient. Often this arrangement is not even a part of the established labor agreement, if there is one; many times it is merely the result of shop practices and precedent. This is but one example of why the employee relations function must be understood by both the maintenance manager and the supervisor.

A more appropriate evaluation of skills usage in modern facilities might center on the need to hire workers who possess trouble-shooting and diagnostic abilities rather than traditional craft knowledge. Newer equipment requires workers who can analyze complex problems involving a variety of technologies (e.g., computer, hydraulic, mechanical, and electronic) and direct responses from a team of varied support personnel. Straight craft work, once the backbone of most maintenance organizations, is giving way to generalists and specialists who can work together to solve problems quickly and efficiently. Modern technicians require training in recognizing modes and causes of failures; data collection and analysis; and new technologies for equipment surveillance and condition monitoring.

AREA ORGANIZATION

Many maintenance organizations have some form of area assignment.

- Line assignment. A technician is permanently assigned to maintain a specific production line (such as a product assembly or an automated "cluster area"). Generally this type of area assignment does not effectively utilize the worker; moreover, in certain cases it may overtax the worker. Furthermore, this assignment mode often leads to the creation of historical precedent under which the workers refuse to do work other than on the line to which they are assigned. Overstaffing can result.

- Area Responsibility. A single technician is given responsibility for an area of the plant or facility. If a top priority arises in that area, that person must respond immediately, whether or not engaged in other work. Area assignments are usually employed in smaller plants or within a classic area organization. Area assignments are considered superior to line assignments because they encourage dedication to a particular activity while they promote increased productivity by providing other general work assignments beyond those of the area responsibility.

- Classic Area Assignment. An organization is assigned to a physical plant or facility area. The members are responsible for the day-to-day repetitive
work, routine repairs, preventive/predictive maintenance, and some emergency work. Staffing of this type of organization should be lean, with additional support supplied as needed from central shops. Here again, there is the danger of setting precedents of overstaffing. This type of organization is usually seen in very large plants where one area may be as large as many small- to medium-size plants.

The major advantages of any area assignment are familiarity, dedication, pride in ownership, reduction in travel time from central shops, better team effort, more thorough knowledge of equipment, faster response time, and easier coordination. The main shortcoming is the potential for overstaffing, generally expressed by uncontrolled loyalty to the area or process. Priorities may be overlooked and more services provided than are economically justified. Often it is more feasible to assign area cognizance to supervisors only and let them draw on central shops for support within a solid priority system. Thus, supervisors can provide the dedication necessary to get the work done, while avoiding the establishment of an overly large permanent working group.

RULES AND REGULATIONS OF THE ORGANIZATION

Every organization has rules and regulations that govern its activities and the relationships between people, as well as certain procedures on how to operate each function. One procedure may regulate behavioral functions, another the methods by which a job is done. Rules, regulations, and procedures must be written concisely for clear understanding by all. It is important that members of an organization know what is expected of them.

To be implemented successfully, all rules and regulations must be treated as standards that apply to everyone, although some defined differences may exist in their administration. Rules for managers might vary somewhat from those that apply to hourly workers; however, the principles should be similar. For example, chronic absenteeism should be treated uniformly for all employees, and penalties should be enforced regardless of the classification of employee. On the other hand, a manager might get an afternoon off with pay to conduct personal business, partly because the manager works additional hours without pay. An hourly worker who is paid for all hours worked, including overtime, may be docked for time off to handle personal business. Similarly, if the manager or hourly employee abuses the personal business procedure, there would be potential for disciplinary actions in either case.

Besides the personal on-the-job rules and regulations governing personal conduct, there are regulations or laws with implications of a larger magnitude, and these must be rigidly enforced. Typically, these are regulations or laws promulgated by various agencies such as the Equal Employment Opportunity Commission (EEOC), Occupational Safety and Health Administration (OSHA), the Environmental Protection Administration (EPA), and various other entities. Also, a host of federal, as well as state and local, statutes govern much of what is done in maintenance. Top management and
operating managers must become familiar with these areas and implement the provisions of the rules and regulations as effectively as possible.

Moreover, systems used to manage maintenance (such as work order, priority, data retrieval, etc.) must have written procedures if they are to be universally and effectively implemented. Many routine job tasks (such as preventive maintenance, equipment shutdown, safety policies, planning, etc.) must also have procedures. For example, safe replacement of a motor might require technical procedures dealing with motor shutdown, lockout, and tagging.

Many rules and regulations apply to all functions in a plant and can be written by others; however, the day-to-day maintenance operating procedures should originate within the maintenance organization, usually with the individuals responsible for the activity or function. Some maintenance procedures affect other organizations, as well, so their input should be included. The easiest way to develop maintenance procedures is to write them down simply and attach a flow diagram, showing each step as a numbered statement. The preparer should never assume that someone else knows or understands what is being described; all essential details should be defined and described.

SUMMARY

Maintenance management is essential to facilities that wish to keep their equipment running smoothly and their costs down. Today's maintenance managers are expected to adapt to the challenges of increasing productivity and improving technical excellence, while keeping up with ever-changing markets and management methods. The key to achieving this goal, whether in small or large organizations, is to establish the appropriate organization for managing the maintenance function and for maintenance managers to become part of the senior management team: maintenance managers must understand the overall objectives of the organization.

Effective management of an organization's resources—human, financial, physical plant, and information—is also key. It is not enough for a maintenance manager to simply get the job done; he or she must motivate the work force, assure the vitality of the plant's equipment, and wisely use the information resources available today. And because maintenance costs can run from 5 to 40 percent of the total cost of producing a product or service, it is especially important for the maintenance manager to control costs. Inadequate maintenance can generate production costs that are many times greater than those attributable to labor, materials, parts, and overhead.

All of this can be achieved by setting maintenance department objectives, which should guide the functional activities of the department and reflect the overall goals of the organization. But the most important part of the objective is to get the job done effectively, to do so, the maintenance department must codify the various functions and activities typical to its organization. And, of course, it is important to select the right people, in the right numbers and with the right skills, to carry out the maintenance function—from the maintenance manager (sometimes called the plant manager) to the maintenance supervisor to the skilled and nonskilled maintenance personnel.
Review Questions

1. The four resources maintenance must manage are:
   (a) human, financial, physical, and information resources.
   (b) plant, equipment, energy, and personnel.
   (c) human, regulations, safety measures, and energy.
   (d) contractors, personnel, plant operations, and budget.

2. A manager who is effective in managing the_________resource is usually effective in managing all resources.
   (a) financial
   (b) human
   (c) planning and scheduling
   (d) skilled trades

3. The elements of a maintenance manager's primary concern with costs are:
   (a) employee benefits, administrative jobs, new equipment.
   (b) company cost and departments control.
   (c) labor, materials, and overhead costs.
   (d) safety and regulatory compliance.

4. An overall company objective is not simply getting the job done, but also:
   (a) assigning the workload properly.
   (b) designing an appropriate organization chart.
   (c) knowing why the job is being done.
   (d) none of the above.
5. To determine which skills are needed in an organization, one can evaluate and analyze the:
   (a) maintenance costs vs. projected sales growth.
   (b) type of production process and historical patterns.
   (c) lines of authority and relationship between people.
   (d) facility’s capital investment and estimated cost of labor.

6. ________ creates ratios of first-line managers to hourly employees and all other personnel unique to every organization.
   (a) The type of industry activity and equipment
   (b) The number of skilled personnel already working
   (c) The number of trainees thought to be needed
   (d) The annual budget for maintenance work

7. Assigning people responsibility for the day-to-day maintenance work of a physical plant area is called:
   (a) line assignment.
   (b) classic area organization.
   (c) area responsibility organization.
   (d) tiger team organization.

8. A(n) ________ position is the main entry to management for hourly employees.
   (a) supervisor's
   (b) superintendent's
   (c) engineer's
   (d) skilled trade person's

9. The best way to prepare organizational procedures is to:
   (a) draw a flow diagram and write statements for each numbered step.
   (b) invite input from other departments.
   (c) give the department manager authority over its preparation.
   (d) study competitor approaches and duplicate them.

10. An administrative and functional structure of an endeavor is called:
    (a) an organization.
    (b) systems and procedures.
    (c) an information pipeline.
    (d) a management hierarchy.