RGPVNOTES.IN

Program : **B.Tech**

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Mechanical Engineering Department
Maintenance Management – ME 8004 (3)
(UNIT – 3: Notes)

Maintenance organization

- Organizing is the process of arranging resources (people, materials, technology etc.) together to achieve the organization's strategies and goals.

- The way in which the various parts of an organization are formally arranged is referred to as the organization structure.

- It is a system involving the interaction of inputs and outputs.

- However, there is no universally accepted methodology for designing maintenance systems, i.e., no fully structured approach leading to an optimal maintenance system (i.e., organizational structure with a defined hierarchy of authority and span of control; defined maintenance procedures and policies, etc.).Identical product organizations, but different in technology advancement and production size, may apply different maintenance systems and the different systems may run successfully.

- So, maintenance systems are designed using experience and judgment supported by a number of formal decision tools and techniques.

- Maintenance managers must have the capabilities to create a division of labor for maintenance tasks to be performed and then coordinate results to achieve a common purpose.

- Solving performance problems and capitalizing on opportunities could be attained through selection of the right persons, with the appropriate capabilities, supported by continuous training and good incentive schemes, in order to achieve organization success in terms of performance effectiveness and efficiency.

Maintenance Organization Objectives and Responsibility

A maintenance organization and its position in the plant/whole organization is heavily impacted by the following elements or factors:

- Type of business, e.g., whether it is high tech, labor intensive, production or service;
- Objectives: may include profit maximization, increasing market share and other social objectives;
- Size and structure of the organization;
- Culture of the organization; and
- Range of responsibility assigned to maintenance.

Organizations seek one or several of the following objectives: profit maximization, specific quality level of service or products, minimizing costs, safe and clean environment, or human resource development. It is clear that all of these objectives are heavily impacted by maintenance and therefore the objectives of maintenance must be aligned with the objectives of the organization.

The principal responsibility of maintenance is to provide a service to enable an organization to achieve its objectives. The specific responsibilities vary from one organization to another; however they generally include the following according to Duffuaa et al. (1998):

1. Keeping assets and equipment in good condition, well configured and safe to perform their intended functions;
2. Perform all maintenance activities including preventive, predictive; corrective, overhauls, and design modification and emergency maintenance in an efficient and effective manner;
3. Conserve and control the use of spare parts and material;
4. Commission new plants and plant expansions; and
5. Operate utilities and conserve energy.

The above responsibilities and objectives impact the organization structure for maintenance as will be shown in the coming sections.

Organization of Maintenance Department:

(1) The buildings, plant and services are called by the accountant fixed assets and in many companies they form at least 50% of the money invested.
In any company, small or big, it is therefore essential that some part of the main organization should be responsible for maintaining these important assets.
(2) The section or department which preserves and looks after the upkeep of equipment, building etc., is called maintenance department.
(3) To work satisfactorily, the maintenance department has an organization structure.

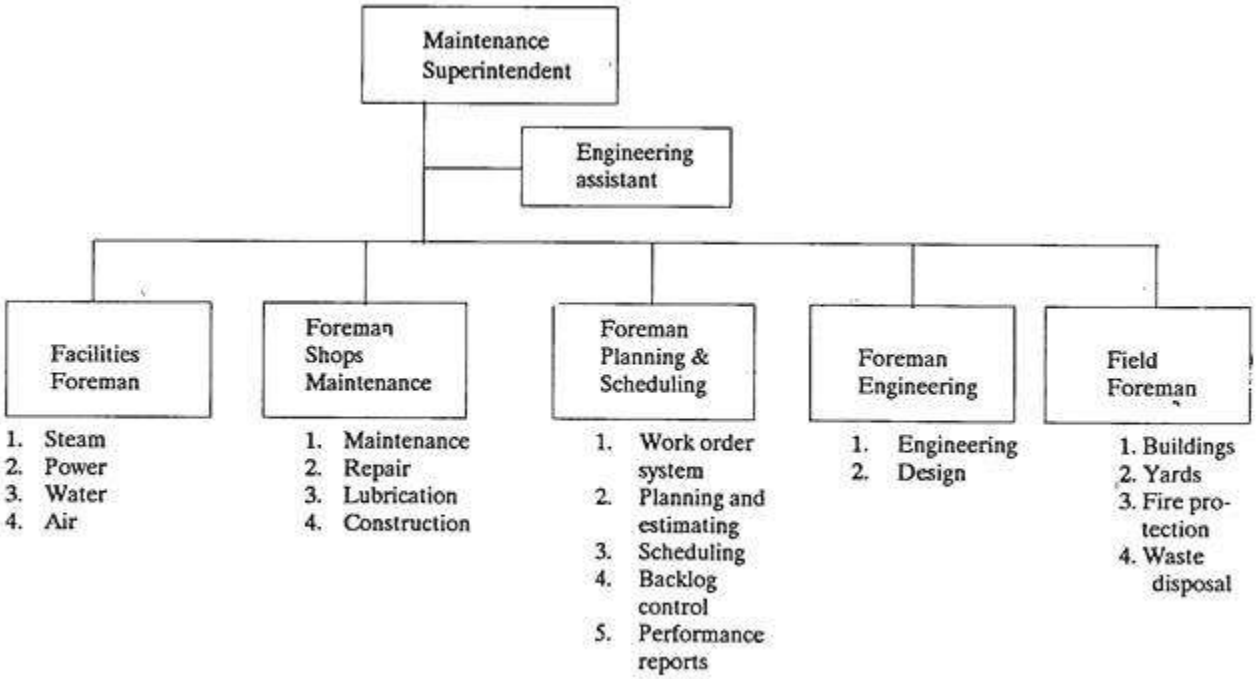


Fig. 13.1. Organization structure of maintenance department.

(4) A few basic concepts of good organizations that should be kept in mind in developing an organization are:

(a) A reasonably clear division of authority with little or no overlap.

(b) Vertical lines of authority and responsibility should be kept as short as possible. In other words, a level which simply transmits information up and instructions down should be eliminated.
(c) Keep optimum number of persons (3 to 6 is the average value) reporting to an individual.
(d) Fit the organization to the personalities involved. This means that the organization structure should be flexible and it may be revised periodically to fit changing personnel and conditions.

(5) The basic organization structure of maintenance department depends upon:

(a) Types of maintenance activities to be looked after:
The wider the maintenance field to be covered, the bigger is the organization.
(b) Continuity of operations:
The size of the maintenance force and therefore the structure of maintenance organization depend upon:
i. Whether it is a four, five or six working days week, and
ii. Whether the plant runs in one, two or three shifts.
(c) Size of the plant:
The organization structure of the maintenance department varies with the size of plant. The larger the plant the more the number of persons in the maintenance force.
(d) Compact or dispersed plant:
A plant spread in a wider area (like ECIL Hyderabad) needs decentralization and may require several parallel maintenance organizations. A compact plant may need only one such Organization.
(e) Nature of industry, i.e., whether it is primarily an electrical, electronics, chemical or a mechanical industry.
(f) State of training and reliability of work force.

(6) In establishing a maintenance organization, it is essential to recognize that:

(a) The plant is to be maintained at a level consistent with low cost and high productivity;
(b) Supervisors should be appointed according to the duties and responsibilities involved; and
(c) Modern age indicates greater need of newer engineering techniques and skills.

Duties or Functions of Maintenance Department:

(A) Inspection:

(1) Inspection is concerned with the routine schedule checks of the plant facilities to examine their condition and to check for needed repairs.
(2) Inspections ensure the safe and efficient operation of equipment and machinery.
(3) Frequency of inspections depends upon the intensity of the use of the equipment. For example, belts in a machine may be checked every week; furnace equipment every month; an over-head bridge crane every four months and so on.
(4) Inspection section makes certain that every working equipment receives proper attention.
(5) Items removed during maintenance and overhaul operations are inspected to determine the feasibility of repairs.
(6) Maintenance items received from vendors are inspected for their fitness.

(B) Engineering:

(1) Engineering involves alterations and improvements in existing equipment and building to minimize breakdowns.

(2) Maintenance department also undertakes engineering and supervision of constructional projects that will eventually become part of the plant.
(3) Engineering and consulting services to production supervision are also the responsibilities of maintenance department.

(C) Maintenance (including Preventive Maintenance):

(1) Maintenance of existing plant equipment.
(2) Maintenance of existing plant buildings, and other service facilities such as yards, central stores, roadways, sewers, etc.
(3) Engineering and execution of planned maintenance, minor installations of equipment, building and replacements.
(4) Preventive maintenance, i.e., preventing breakdown (before it occurs) by well-conceived plans of inspection, lubrication, adjustments, repair and overhaul.

(D) Repair:

(1) Maintenance department carries out corrective repairs to alleviate unsatisfactory conditions found during preventive maintenance inspection.
(2) Such a repair is an unscheduled work often of an emergency nature, and is necessary to correct breakdowns and it includes trouble calls.

(E) Overhaul:

(1) Overhaul is a planned, scheduled reconditioning of plant facilities such as machinery, etc.
(2) Overhaul involves replacement, reconditioning, reassembly, etc.

(F) Construction:

(1) In some organizations, maintenance department is provided with equipment and personnel and it takes up construction jobs also.
(2) Maintenance department handles construction of wood, brick and steel structures, cement and asphalt paving, electrical installations, etc.

(G) Salvage:

Maintenance department may also handle disposition of scrap or surplus materials.

This function involves:

i. Segregation, reclamation and disposition of production scrap, and
ii. The collection and disposition of surplus equipment, materials and supplies.

(H) Clerical Jobs:

Maintenance department keeps records:

i. Of costs,
ii. Of time progress on jobs,
iii. Pertaining to important features of buildings and production equipment; electrical installations; water, steam, air and oil lines; transportation facilities (such as elevators, conveyors, powered trucks, cranes, etc.), etc.

(I) Generation and distribution of power and other utilities.

(J) Administration and supervision of labor force (of maintenance department).
(K) Providing plant protection, including fire protection.
(L) Insurance administration.
(M) Establishing and maintaining a suitable store of maintenance materials.
(N) Janitorial service.
(O) Housekeeping.
Good housekeeping involves upkeep and cleaning of equipment, building, toilets, wash-rooms, etc.
(P) Pollution and noise abatement.

MAINTENANCE PLANNING & SCHEDULING

To achieve world class performance, organizations must plan, schedule and track maintenance activities. In the maintenance world, planning and scheduling are two different functions that work together to create a maintenance program. Planning is the process of planning, while scheduling is the process of reconfiguring workloads in a production/manufacturing process. Scheduling is used to allocate plant and machinery resources, plan human resources, plan production processes, and purchase materials.

Computerized Maintenance Management Systems (CMMS) offer the tools to plan and schedule maintenance, measure what you treasure, and act on the results. However, a successful implementation process is critical to leverage the full power of a maintenance management system. There are three main elements that are associated with a CMMS implementation journey:

1. Continuous Improvement
2. CMMS building blocks: assets, PMs, contacts, parts, work orders, and schedules
3. Asset Reliability Strategies or best practices such as ISO 55000, ISO 14224, KPIs, MRO, TPM, and RCM

"World class" manufacturing statistics, best practices and concepts set the standard for global organizations. The concept was first introduced in the automobile and steel industries, pioneered by Japanese manufacturing organizations. Organizations who strive to adopt "world class" manufacturing often experience higher productivity, lower costs and higher quality output.

In a recent poll, 32% of respondents explained that they perform planning and scheduling activities, but their processes are not formalized, and 22% said that their maintenance is performed reactively. By developing standardized processes and avoiding reactive maintenance, wrench time that is currently 20-35% direct work (not hunting for parts, information, or waiting for equipment to become available) becomes "world class" with 55% direct work, and a 57% improvement. So, the work of 20 technicians can yield the "world class" equivalent of 47 technicians with a 57% improvement.

Maintenance Planning Principle

Planning Principle #1
It is very important that the role of the planner/scheduler is identified to be independent of the other activities going on within a plant or facility. Take the planners off the tools and behind a desk in terms of the administration of the work to be done. Responsibilities of the planner/scheduler should include:

Planning emergency work
Acting as a relief supervisor
Becoming a material expeditor
Working on tools
Performing time-consuming clerical activities
Becoming a “go-fer” for maintenance / operations supervisor

Planning Principle #2
A planner must focus on arranging current and future maintenance work, as well as allocating the appropriate resources, parts, finances, costs, and reliability information for each project. The planners must also emphasize constant improvement, and use the Deming model on continuous improvement for planning, doing, checking, and acting/adjusting schedules:

Problem
Goal
Point of cause
Root causes
Counter measures
Follow-up
Standardization

Planning Principle #3
When implementing different component levels within your CMMS, take advantage of International Standards such as ISO 14224 for best practice tips and ease of compliance. Component levels are “minifies” on every piece of equipment. They include work order histories, equipment registry, parts registry and more.

Planning Principle #4
Once tasks are identified, an important principle of maintenance planning is to ensure all instructions are documented and standardized. The best planners have experience estimating time and comparing actuals of work done in bite size chunks in order to bring efficiencies into the next iteration of carrying out preventive maintenance.

Planning Principle #5
Sometimes it’s not best to reinvent the wheel for all pieces of equipment. Planners should take advantage of standard plans and enhance them. Plans will also take into account and recognize the skills of craft technicians.

Planning Principle #6
Take advantage of data from past work to properly estimate appropriate and accurate plans for the future. This will make wrench time more available and the more wrench time available, the more maintenance activity can be performed.

- Measuring how much time craft technicians actually spend on the job site versus other activities determines the effectiveness of the maintenance planning program: (Obtaining parts or tools, etc.)
- Delays are not simply part of a technician’s job and should be avoided

- Sampling wrench time can be used to measure how effective planning can be
- Use this as a metric to determine how effective your maintenance team is and look for ways to improve performance when gaps emerge

Scheduling Principle #1

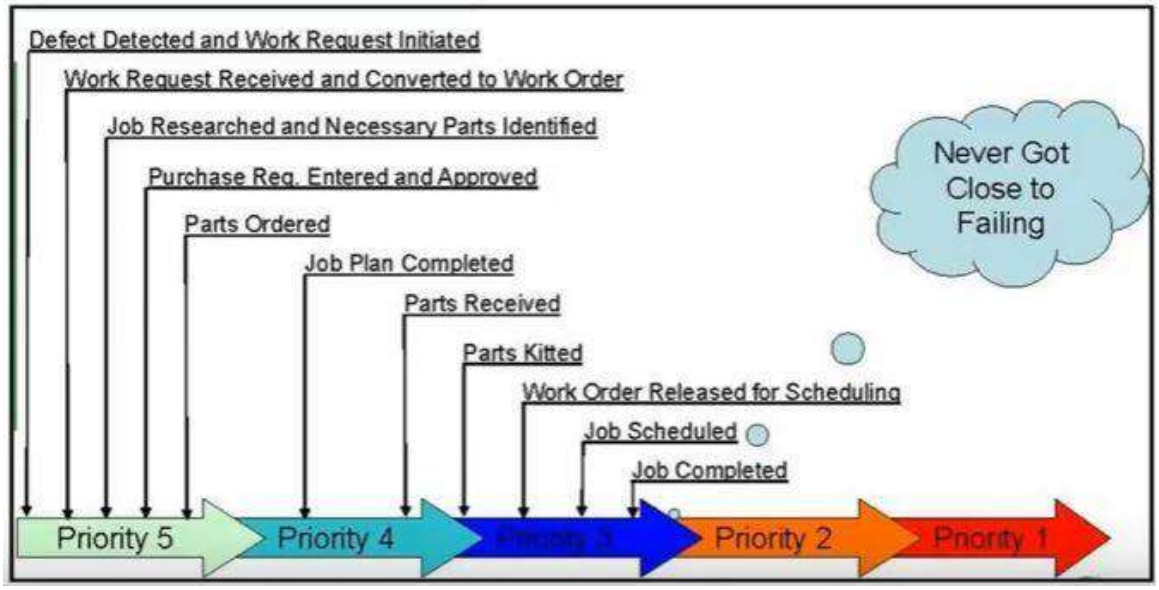
To set realistic goals and schedules, the planner/scheduler must look at the appropriate resources for the work to be performed and an estimate of the hours and effort it will require. To manage this process and avoid roadblocks, try to plan to the lowest required skill level available and work upwards.

If you work the opposite way, organizations may end up in a situation where skills are available, but the sort of work available is not appropriate for the priority level skill element. As a best practice, at the beginning of a project, identify skills for:

 # Persons
 # Work hours
#Duration of work

Scheduling Principle #2

TFor the most effective scheduling, identifying job priorities is important. The highest priority work (Priority 5) is the most urgent, and should be followed up on first. For example:



The ISO 14224 standard can help prioritize activities with the Failure-consequence Classification chart. It is useful in terms of setting up asset information, analyzing reliability information, putting P&ID or boundary drawings together, etc. It helps in terms of how to prioritize one work order over another.

Scheduling Principle #3

Scheduling from forecast of the highest skills available helps to increase productivity. If the work orders are generated 10 days in advance, then more details can be put into the scheduling, resources, availability of parts, and work to be done. Consider what jobs can be put together, what jobs can be grouped, what condition monitoring work is outstanding and can it be bundled, and any proactive work that can be done in advance.

Scheduling Principle #4
To help set up an organization's maintenance team for success, scheduling work for every hour available is a good rule of thumb, and allows for organizations to achieve practical goals.

Scheduling Principle #5
When it comes down to daily activities, the planner/scheduler should leave the granular detail of the planning and scheduling to a crew leader or technician supervisor. With proper training, these crew members can use a CMMS and take advantage of functionality to realign the resources based on their priorities for the day. This should be easy enough if the planning and scheduling is proactive, but knowing that potential emergencies and urgent activities might interrupt the day, there is still a chance that it can be done if 80-90% of the day is planned out.

Scheduling Principle #6
In order to keep employees engaged, begin measuring performance by analysis of scheduled success. This measure avoids supervisors feeling the calculation gives an unfair poorer-than-actual view of their performance, and offers the crew any benefit of any doubt.

DOCUMENTATION IN MAINTENANCE

All maintenance activities of the workforce must be documented, this includes breakdown repairs, callouts, preventive maintenance, replacement maintenance, overhauls, and Testing & Inspection work. Maintenance work by production employees must be included, whether or not the employee is listed as in maintenance. These activities can then be mined for maintenance information "gold".

List all repetitive work
One of the first things that a maintenance supervisor should be concerned with is repetitive work. Any and all repetitive work should be identified and isolated. This list can then be prioritized as to criticality to Production and plant effectiveness.

After the list has been rearranged, each task item must be analyzed to determine if the repetitive work is actually aimed at fixing a problem or fixing a symptom of a deeper problem. Fixing symptoms has the immediate effect of allowing production to rapidly resume, but does nothing for the underlying problem(s). In fact, the underlying problem may get worse.

Development of a solutions
As soon as a high priority problem has been identified and analyzed, work should begin on development of a solution to the problem. Once the solution to the problem has been developed, plans can be made for purchasing required parts and material and then scheduling the manpower and production time to implement the solution.

Maintenance planning of machine repairs

Complete documentation is absolutely essential for control of the maintenance process. How can the process of maintenance be under control if the person in charge has no complete idea of what the total maintenance activities and costs are? If needed repairs are not documented and planned for, a considerable portion of these needed repairs and modifications will be forgotten or ignored until production tries to run again.

Justify machine repair cost

Planning essential repairs and modifications requires documentation. It is easy to say that we need a modification to this particular machine and output of this line can be increased 25%. However, with no planning, six months later no work has been done on the idea. Even if the idea were actually to be somehow implemented, the output increase may not come to fruition.

If no research was carried out on the rest of the line equipment, there is no certain way of determining line and equipment capacity. How would the machine be able to increase output 25% if its current output was already 100% of the lines actual output capacity? All the costs associated with increasing the one machine's capacity would have been wasted, unless additional work was undertaken to bring the rest of the production line up to the output of the one machine.

A production line's output capacity is only as great as its least piece of equipment. That bears repeating. A production line is only as fast as its slowest piece of equipment. A chain is only as strong as its weakest link.

Prioritize your maintenance planning list

With documentation, the list of priority work problems to solve can be reduced fairly rapidly, at first. The list of easily solved problem areas will gradually be replaced by higher cost work items. Research and planning may reveal that the costs involved with eliminating some repetitive repairs are more than living with the repetitive repairs.

Compare production downtime after solution

After implementation of the solution, production downtime for that particular item can be documented and compared to pre-implementation production output. Maintenance time not spent on working on that solved problem can also be documented for the same time period. These savings can then be extrapolated for an entire year and presented to management to justify the cost of repairs.

Without documentation, research, and planning, the person in charge of making the decisions is working in the dark. With documentation, research, and planning, the Great Wall of China can be built, or the Panama Canal, or the Aswan Dam, or a world-class maintenance organization.

Maintenance Policy and Procedures is a plan to organize your maintenance department. Following the plan will cause you to document your department's activities. Other department's maintenance activities and interactions with the Maintenance Department will also be documented. With the documentation, planning can begin. For information on this article and Maintenance Policy and Procedures, see link below.

COMPUTER BASED MANAGEMENT INFORMATION SYSTEM

This relies on the computer for handling business applications. The business requires computer heavily to solve their business problems. There are different levels of information required by people at different level. People at Lower Level needs detailed information which would allow them to carry out with their tasks. People at Higher Level needs summarized information which would allow them to assess the overall progress, goals etc. This system should ensure

that people at lower level are not given access to all the data shown at the higher level. However, people at the higher level can drill down to the data at the lower when required.

Component of Computer based information System: A Computer-Based Information System (CBIS) is an information system in which the computer plays a major role. Such a system consists of the following elements:

Hardware: The term hardware refers to machinery. This category includes the computer itself, which is often referred to as the central processing unit (CPU), and all of its support equipment. Among the support equipment are input and output devices, storage devices and communications devices.

Software: The term software refers to computer programs and the manuals (if any) that support them. Computer programs are machine-readable instructions that direct the circuitry within the hardware parts of the CBIS to function in ways that produce useful information from data. Programs are generally stored on some input / output medium-often a disk or tape.

Data: Data are facts that are used by program to produce useful information. Like programs, data are generally stored in machine-readable from on disk or tape until the computer needs them.

Procedures: procedures are the policies that govern the operation of a computer system. “Procedures are to people what software is to hardware” is a common analogy that is used to illustrate the role of procedures in a CBIS.

People: Every CBIS needs people if it is to be useful. Often the most over-looked element of the CBIS is the people: probably the components that most influence the success or failure of information system.

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