



DETERMINING MAINTENANCE MANPOWER REQUIREMENTS

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INTRODUCTION

1/2

- **A critical task facing maintenance managers is the allocation of worker time.**
- **From maintenance experience, even in all well managed company, only 30% of the average worker's time is spent doing "hand's on work".**

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INTRODUCTION

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The question is how to manage an organization effectively without hiring more people. This can be achieved by the following steps:

- 1. to analyze how the time is being allocated now.**
- 2. to identify activities that can be made more productive.**
- 3. managers must manage productivity in every aspect of maintenance activity.**

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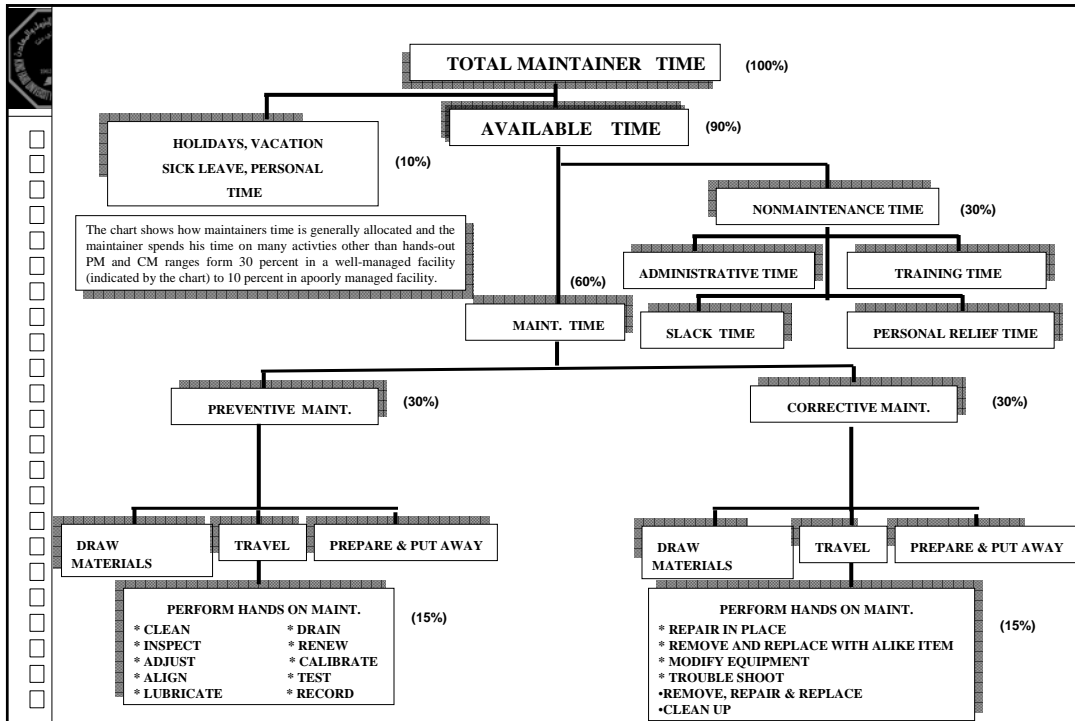
THE MAINTENANCE TIME CHART 1

- **The chart presents a breakdown of the total paid time of a maintainer in a well maintained organization.**
 - **Only 90% of the total time is available for work, because the total includes pay for holidays, vacation, sick leave, and personal time off.**
 - **One third of the 90% of the person available time is spend on non maintenance activity.**



THE MAINTENANCE TIME CHART 2/2

- **About 1% of the maintainer's total time is spent in training.**
- **4% is devoted to administrative matters such as filling out time cards, completing insurance forms and getting paid.**
- **The remaining time is spent as slack time or personal relief time.**
- **Slack time is spent by the worker waiting for an assignment or waiting between jobs.**
- **Personal relief time is spent by the worker drinking coffee, smoking going to the restroom, snacking.**



SIXTY PERCENT MAINTENANCE TIME 1/4

- After subtracting 10% for company benefit time and 30% for non-maintenance time, 60% of the worker's time remains.
- This 60% is split evenly between preventive maintenance (PM) and corrective maintenance (CM).
- Experience has shown that this 50-50 split has proven to be the most cost effective use of the maintainer's time.



SIXTY PERCENT MAINTENANCE TIME 2/4

1) Preventive Maintenance, Consists of:

- a. Service routines (cleaning and inspecting)
- b. Making small mechanical correction (adjusting and aligning).
- c. Ensuring liquids are adequate (lubricating, draining and renewing)
- d. Fine tuning (calibrating and testing)
- e. Record keeping



SIXTY PERCENT MAINTENANCE TIME 1/4

- It was found that half of the time of PM, that is 15% is spent on drawing materials, traveling to and from the equipment and putting away.
- Parallel time allocation can be seen with corrective maintenance, drawing materials, traveling, preparing and putting times compose about half of the CM hours, that is 15%.



SIXTY PERCENT MAINTENANCE TIME 1/4

- **The other 15% is spent in actual hands-on maintenance. Equipment can be repaired in place, removed and replaced with a spare, modified or removed and replaced with a different type.**
- **Troubleshooting takes a portion of the CM time in order to isolate problems, Cleanup is also a part.**



INCREASING THE PRODUCTIVE TIME 1/4

- **The manager job is to reduce nonproductive times and increase productive time.**
- **Maintenance experience indicates that there are limits on how much non productive time can be salvaged.**
The 10% for holidays, vacation can boot be touched.
Administrative and training time can not be reduced.
- **Personal relief time is essential for moral and for work efficiency.**
Personal relief time is essential for moral and for work



INCREASING THE PRODUCTIVE TIME

2/4

- **The one area that can be reduced is the slack time. Slack time appears in many forms:**
 1. **Long lunch period**
 2. **Early departure at the end of the day**
 3. **Late arrival for work**
- **To reduce these activities, managers must rely on the first line supervisor or foreman to see that policies enforced.**
- **Slack time is not only the fault of the employees, managers also share the blame for lost time.**

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INCREASING THE PRODUCTIVE TIME

3/4

- **Much of the wasted time is spent waiting for an assignment form the supervisor.**
- **Often supervisor allow slack time because they only respond to trouble calls for CM.**
- **Maintenance experience that this total reliance on CM is probably the biggest factor in lost productivity.**
- **Another way for reducing slack time and improving productivity is by projecting the total labor requirements and then balancing the maintenance labor resources with the maintenance labor hour requirements.**

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INCREASING THE PRODUCTIVE TIME

4/4

- There will be peaks and valleys in the labor hours requirements; whereas, maintenance labor resources (manpower) available are comparatively constant. Because organizations are staffed for the peaks, the valleys represent an inefficient use of manpower (slack time).
- Two other areas that could be investigated to boost productivity are the drawing of materials and travel.
 1. Drawing of materials is often an attempt by the maintainer either to guess what tools are needed or to take everything he might need.
 2. Travel time can be cut if work is assigned by location rather than by machine type.

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DEVELOPING MANPOWER MODEL 1/3

- Once the maintenance manager understands how a maintainer spends his time and how a manager can boost productivity, a maintenance manpower model can be developed.
- The model will provide a systematic method to determine how many people are needed and what skills are required.
- Most often, maintenance managers try to estimate their manpower requirement by “feeling rather than step by step analysis.”

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DEVELOPING MANPOWER MODEL 2/3

- Whenever a manager plans for a plant expansion or for a new facilities, he tried to determine precisely how many people of each skill he will need to maintain all the equipment in the plant.
- The usual method is to compare the new plant with a similar one and to make adjustments for peculiarities of the planned organization.
- This method may work but it contains the faulty assumption that the similar plant is properly manned.



DEVELOPING MANPOWER MODEL 3/3

- A better approach is to build a manpower model, using the factors known about the time spent by the maintainer. This approach which is more realistic, takes each case as a unique situation.



THE MAINTENANCE CONCEPT 1/2

- Because the manning level is truly effective only when management policy is carried out the first step must be to establish a policy on how to maintain the equipment. Such a policy is called a maintenance concept.



THE MAINTENANCE CONCEPT 2/2

The maintenance concept must address the following questions:

- How many levels of maintenance will be required?
- Where will each level be located
- How will fault isolation and testing be conducted?
- How, where and by whom will the equipment be overhauled?
- What depth of PM to be accomplished
- What support and test equipment (including tools) will be needed?
- How will spare parts be obtained?
- How will technical manuals and engineering drawings be kept up to date?
- How are priorities set and funds allocated?



INVENTORY THE EQUIPMENT FOR PM

- **After a maintenance concept is established all equipment should be inventoried according to equipment type such as:**
 - **electrical**
 - **mechanical**
 - **electronic**
- **By using:**
 - **technical manuals supplied with equipment**
 - **studying reliability and maintainability characteristics of each equipment type, or**
 - **hiring engineering consultants with maintenance management expertise.**



INVENTORY THE EQUIPMENT FOR PM

- **A determination can be made of the PM requirements for each piece of equipment.**
- **Preventive maintenance can be scheduled so that the work load is evened throughout the year.**
- **The PM can be tied to the operating hours of the equipment or to the production cycle.**



CALCULATING TOTAL PM TIME 1/2

- Every PM action for each skill must be assigned a “hands-on” time, which is the amount of time the maintainer spends in front of the equipment when he performs preventive maintenance.
- These individual “hands-on” time is summed up to obtain the total hands-on time for PM for each skill.
- The allocation of time to activities other than hands-on work will vary among plants and will depend upon plant size.



CALCULATING TOTAL PM TIME 2/2

- A good rule of thumb is that these activities consume about an equal amount of times as hands-on work. Therefore, to estimate total PM time for each skill PM maintenance hands-on time is simply double and then because a plant’s maintenance is most cost effective when CM time equals PM time, the total time is doubled to estimate total maintenance time for each skill..



COMPUTING TOTAL MAINTENANCE TIME

- **If maintenance time accounts for about 60% of the maintainer time, total labor hours for a skill can be determined by dividing the determined maintenance time by 0.6.**
- **This computation gives the total manpower requirement in hours for a particular skill. The number of full time maintainers required per skill can be determined by dividing the number of labor hours computed for the skill by 2080 (fifty-two 40 hr-weeks).**



EXAMPLE

In a large industrial operation, electrician will be needed to maintain motors, power distribution panels, and transformers. It was found that hands-on PM time for electrician totals 1543 hr. it was also calculated that mechanical PM hands-on times comes to 1991 hr.



PM time equals hands-on time for PM plus an allowance for preparing putting away, drawing materials and traveling.

Therefore:

$$\text{Electrician PM time} = 1543 \times 2 = 3086 \text{ hr.}$$

$$\text{Mechanical PM time} = 1991 \times 2 = 3982 \text{ hr.}$$

Maintenance time equals PM plus CM time, therefore:

$$\text{Electrician maintenance time} = 3086 \times 2 = 6172 \text{ hr.}$$

$$\text{Mechanical maintenance time} = 3982 \times 2 = 7964 \text{ hr.}$$



Total maintainer time equals maintenance time divided by a fraction for non-maintenance time and for time not available to management

$$\text{Total Elec. Maintainer time} = 6172 / 0.6 = 10,287 \text{ hr.}$$

$$\text{Total Mech. Maintainer time} = 7964 / 0.6 = 13,274 \text{ hr.}$$

The number of maintainers equals total maintainer time divided by hours in a work year, therefore:

$$\text{Number of Elec.} = 10,287 / 2080 \text{ hr} = 5$$

$$\text{Number of Mech.} = 13,274 \text{ hr} / 2080 \text{ hr.} = 7$$



COLLEGE OF ENVIRONMENTAL DESIGN

In this example 12 maintainers will be needed to perform all of the required PM and CM for the plant.

The approach also can serve as a test of the efficiency of an existing plant.

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Thank you !!

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