Maintenance Scheduling

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MAINTENANCE PLANNING AND SCHEDULING

Effective planning and scheduling contribute significantly to the following:

- Reduced maintenance cost.
- Improved utilization of the maintenance workforce by reducing delays and interruptions.
- Improved quality of maintenance work by adopting the best methods and procedures and assigning the most qualified workers for the job.

Planning and Scheduling Objectives

- Minimizing the idle time of maintenance workers.
- Maximizing the efficient use of work time, material, and equipment.
- Maintaining the operating equipment at a responsive level to the need of production in terms of delivery schedule and quality.

Classification of Maintenance Work According to Planning and Scheduling Purposes

- **Routine maintenance**: are maintenance operations of a periodic nature. They are planned and scheduled and in advance. They are covered by blanket orders.

- **Emergency or breakdown maintenance**: interrupt maintenance schedules in order to be performed. They are planned and scheduled as they happened.

- **Design modifications**: are planned and scheduled and they depend on eliminating the cause of repeated breakdowns.

- **Scheduled overhaul and shutdowns of the plant**: planned and scheduled in advanced.

- **Overhaul, general repairs, and replacement**: planned and scheduled in advanced.

- **Preventive maintenance**: planned and scheduled in advanced.

- An essential part of planning and scheduling is to forecast future work and to balance the workload between these categories.

- The maintenance management system should aim to have over 90% of the maintenance work planned and scheduled.

Planning

Planning is the process by which the elements required to perform a task are determined in advance of the job start.

Planning

- It comprises all the functions related to the preparation of:

1. The work order
2. Bill of material
3. Purchase requisition
4. Necessary drawings
5. Labor planning sheet including standard times
6. All data needed prior to scheduling and releasing the work order.

- Good planning is a prerequisite for sound scheduling.

Planning Procedures

- Determine the job content.
- Develop work plan. This entails the sequence of the activities in the job and establishing the best methods and procedures to accomplish the job.
- Establish crew size for the job.
- Plan and order parts and material.
- Check if special tools and equipment are needed and obtain them.
- Assign workers with appropriate skills.

Planning Procedures

- Review safety procedures.
- Set priorities for all maintenance work.
- Assign cost accounts.
- Complete the work order.
- Review the backlog and develop plans for controlling it.
- Predict the maintenance load using effective forecasting technique.

Basic Levels of Planning Process (Depend on The Planning Horizon)

1. Long-rang planning: it covers a period of 3 to 5 years and sets plans for future activities and long-range improvement.
2. Medium-range planning: it covers a period of 1 month to 1 year.
3. Short-rang planning: it covers a period of 1 day to 1 week. It focuses on the determination of all the elements required to perform maintenance tasks in advance.

Long and Medium-Range Planning

Needs to utilize the following:

1. Sound forecasting techniques to estimate the maintenance load.
2. Reliable job standards times to estimate staffing requirements.
3. Aggregate planning tools such as linear programming to determine resource requirements.

Long-Range Planning

sets plans for future activities and long-range improvement.

Medium-Range Planning

- Specify how the maintenance workers will operate.
- Provide details of major overhauls, construction jobs, preventive maintenance plans, and plant shutdowns.
- Balances the need for staffing over the period covered.
- Estimates required spare parts and material acquisition.

Short-Range Planning

It focuses on the determination of all the elements required to perform maintenance tasks in advance.

Scheduling

Is the process by which jobs are matched with resources and sequenced to be executed at a certain points in time.

Scheduling

- Scheduling deals with the specific time and phasing of planned jobs together with the orders to perform the work, monitoring the work, controlling it, and reporting on job progress.

- Successful planning needs a feedback from scheduling.

Reliable Schedule Must Take Into Consideration

- A job priority ranking reflecting the criticality of the job.
- The availability of all materials needed for the work order in the plant.
- The production master schedule.
- Realistic estimates and what is likely to happen.
- Flexibility in the schedule.

Elements of Sound Scheduling

Requirements for effective scheduling:

- Written work orders that are derived from a well-conceived planning process. (Work to be done, methods to be followed, crafts needed, spare parts needed, and priority).
- Time standards.
- Information about craft availability for each shift.
- Stocks of spare parts and information on restocking.

Elements of Sound Scheduling

Requirements for effective scheduling:

- Information on the availability of special equipment and tools necessary for maintenance work.
- Access to the plant production schedule and knowledge about when the facilities will be available for service without interrupting production schedule.
- Well-define priorities for maintenance work.
- Information about jobs already scheduled that are behind the schedule (backlog).

Maintenance Schedule Can be Prepared at Three Levels (Depend on The Time Horizon)

1. Long-range (master) schedule
2. Weekly schedule
3. Daily schedule

Long-Range (master) Schedule

- Covering a period of 3 months to 1 year.
- Based on existing maintenance work orders (blanket work order, backlog, PM, anticipated EM).
- Balancing long-term demand for maintenance work with available resources.
- Spare parts and material could be identified and ordered in advance.
- Subject to revision and updating to reflect changes in the plans and maintenance work.

Weekly Schedule

- Covering 1 week.
- Generated from the master schedule.
- Takes into account current operations schedules and economic considerations.
- Allow 10% to 15% of the workforce to be available for emergency work.
- The schedule prepared for the current week and the following one in order to consider the available backlog.
- The work orders scheduled in this week are sequenced based in priority.
- CPM and integer programming techniques can be used to generate a schedule.

Daily Schedule

- Covering 1 day.
- Generated from weekly schedule.
- Prepared the day before.
- Interrupted to perform EM.
- Priorities are used to schedule the jobs.

Scheduling Procedures (Steps)

- Sort backlog work orders by crafts.
- Arrange orders by priority.
- Compile a list of completed and carry over jobs.
- Consider job duration, location, travel distance, and the possibility of combining jobs in the same area.
- Schedule multi-craft jobs to start at the beginning of every shift.
- Issue a daily schedule (not for shutdown maintenance).
- Authorize a supervisor to make work assignments (dispatching).

Maintenance Job Priority System

- Priorities are established to ensure that the most critical work is scheduled first.
- It is developed under coordination with operations staff.
- It should be dynamic.
- It must be updated periodically to reflect changes in operation and maintenance strategies.
- It typically includes three to ten levels of priority.

Priorities of Maintenance Work

Code	Name	Time frame work should start	Type of work
1	Emergency	Work should start immediately	Work that has an immediate effect on safety, environment, quality, or will shut down the operation
2	Urgent	Work should start within 24 h	Work that is likely to have an impact on safety, environment, quality, or shut down the operation
3	Normal	Work should start within 48 h	Work that is likely to impact the production within a week.
4	Scheduled	As scheduled	Preventive maintenance and routine. All programmed work
5	Postponable	Work should start when resources are available or at shutdown period	Work that does not have an immediate impact on safety, health, environment, or the production operations

Scheduling Techniques

The objective of the scheduling techniques is to construct a time chart showing:

- The start and finish for each job.
- The interdependencies among jobs.
- The critical jobs that require special attention and effective monitoring.

Scheduling Techniques

Such techniques are:

- Modified Gantt chart
- CPM
- PERT
- Integer and stochastic programming.

Example

↓Activity	Days of the month (January)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A															
B															
C															
D															
E															
F															
G															

Gantt Chart