PROACTIVE MAINTENANCE

ME514

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Flow of presentation

• Introduction
• Maintenance planning
• KPIs in planning and scheduling

MAINTENANCE

Ensuring that physical assets continue to do what their users want them to do

Reliability Centered Maintenance (RCM)

A process used to determine what must be done to ensure that any physical asset continues to do whatever its users want it to do in its present operating context

RCM: Seven basic questions

1. What are the functions and associated performance standards of the asset in its present operating context?
2. In what ways does it fail to fulfill its functions?
3. What causes each functional failure?
4. What happens when each failure occurs?
5. In what way does each failure matter?
6. What can be done to predict or prevent each failure?
7. What should be done if a suitable proactive task cannot be found?

Failure Management techniques

Failure management techniques are given the answers for to the sixth and seven questions of the basic seven questions There two categories of failure management techniques

1. Proactive tasks
2. Default actions

Proactive Tasks

These are tasks undertaken before a failure occurs, in order to prevent the item from getting into a failed state.

Issues dominate proactive task selection

• The relationship between the age of the item under consideration and how likely it is to fail
• What happens once a failure has started to occur.
Proactive Tasks
These tasks further classified into,
1. Scheduled restoration
2. Scheduled discard
3. On condition maintenance

Scheduled restoration tasks
Remanufacturing component or overhauling an assembly at or before a specific age limit, regardless of its condition at the time. The frequency of a Scheduled restoration task is governed by the age at which the item or component show a rapid increase in the conditional probability of failure.

Scheduled discard tasks
Scheduled discard tasks are possible if;
- There is an identifiable age at which the item shows a rapid increase in the conditional probability of failure
- Most of the items survive to that age
- Tasks carried out restore the original resistance to failure of the item.

Scheduled discard tasks
Scheduled discard tasks are possible if;
- There is an identifiable age at which the item shows a rapid increase in the conditional probability of failure
- Most of the items survive to that age

Here the item is replaced with new one so that resistance to failure come to original condition

There two different types of life times when dealing with scheduled discard tasks
1. Safe life
   Applied to tasks meant to avoid failures which have safety consequences.
2. Economic life
   Intended to prevent failures which do not have safety consequences.
On condition maintenance

The activities are taken for identifying the failures which are occurred or are in the process of occurring. So that action can be taken to avoid the consequence.

Proactive Tasks

Proactive tasks are dealing with age of the items and these tasks are routing types tasks. So that some of planning is required to continue.

Default actions

These are deal with the failed state, and are chosen when it is not possible to identify an effective proactive task.

Default action include,

» Failure finding
» Redesigning
» Run to failure

What is Planning and Scheduling?

• Planning defines the details of WHAT and HOW, it means preparatory work which defines how a job should be done, what needed craft shall perform the task, what material and tools shall be used and in what sequence

• Scheduling defines the details of WHEN and WHO, refers to the timing of work, and when this work will be done

Why do Planning and Scheduling?

• Planning and Scheduling are dealing with control of maintenance and…
  – Cost effectiveness!
  – Quality of work!

• Priorities and organizes work to be executed in a highly efficient way
What is a typical maintenance working day…

<table>
<thead>
<tr>
<th>Work Activities</th>
<th>Without Planning and Scheduling</th>
<th>With Planning and Scheduling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving of instructions</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>Obtaining tools and maintenance requirements</td>
<td>12%</td>
<td>5%</td>
</tr>
<tr>
<td>Travel to and from job site</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Delays in coordination</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>Idle at job site</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Late starts and early quits</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Official breaks</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Excess personal time</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>65%</strong></td>
<td><strong>35%</strong></td>
</tr>
<tr>
<td>Direct actual maintenance work done</td>
<td>35%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Good Distribution of Maintenance Activities

Key Performance Indicators

- A solid, realistic and comparable base of performance measurements is needed if an organization:
  - wants to understand where the improvement opportunities lie
  - wants to capitalize on those opportunities and
  - wants to evade slipping back.

- Comparing performance indicators creates a learning challenge and gives management a tool to check up on the progress of ongoing as well as on the sustainability of completed projects.

- Its proper usage will enhance the mindset of faster learning, enabling a culture of looking forward to improving performance instead of looking back to pinpoint failures.

Key Performance Indicators (KPI)

- These are indicators which help us track whether the maintenance planning process is efficient and effectively working
  - Availability
  - Mean Time Between Failure (MTBF)
  - Plan Attainment (%)
  - PMR (%)
  - Unplanned (%)
  - Overdue (h)
  - Outstanding Work (h)
  - Overtime (%)

KPIs in Maintenance Planning

- Net Availability= \( \frac{(\text{Operating Time} + \text{Idle Time})}{\text{Calendar Time}} \) x 100%
- Gross Availability= \( \frac{\text{Operating Time}}{\text{Calendar Time}} \) x 100%
- Mean Time Between Failure= \( \frac{\text{Actual Operating Time (h)}}{\text{Failures (#)}} \)

- Unplanned=(Actual hours on completed unplanned work orders) / Actual hours on all completed work orders

- Plan Attainment=(Estimated hours completed on planned work orders) / Total Estimated Hours x 100%

- Overdue=Sum of Estimated Labor Hours on all overdue Work Orders
KPIs in Maintenance Planning

• PMR = (Actual Labor Hours on completed PMR Work Orders) x 100 / Available Labor Hours

• Outstanding Work = Sum of Estimated Labor Hours on all outstanding work orders

• Overtime (%) = Overtime Hours / (Normal available hours + actual overtime hours worked) x 100

Thanks for your attention

Question?