

9. MAINTENANCE PERFORMANCE EVALUATION

1. INTRODUCTION:

1.1 Maintenance performance evaluation is an essential step to effect improvement in the maintenance planning, organizing and control.

1.2 The evaluation can be made on the following factors:-

1. Plant Availability
2. Cost of Maintenance
3. Effectiveness of Maintenance Planning
4. Frequency of break downs/MTTF
5. MTTR/Mean Time to Repair
6. MWT/Mean Waiting Time

2. ANALYSIS OF PLANT AVAILABILITY:

This is essentiality to know the overall effectiveness of the maintenance. In most of capital intensive industries, the plant availability is the most important factor as low availability means heavy down-time losses. Hence the achievement of maintenance objectives are to be reflected by the plant availability achieved.

Plant Availability can be plant-wise or major equipment wise to draw the attention of higher levels of management for maintenance decision making.

$$\text{Plant Availability} = \frac{\text{Total Available Hours} - \text{Total Down-time}}{\text{Total Available Hours}}$$

Where,

Total Available Hours = Working days x Hours per day x No. of machines.

3. ANALYSIS OF COST OF MAINTENANCE:

This analysis is helpful to assess the cost effectiveness of the maintenance system. This also helps in maintenance budgeting and cost control. Cost of maintenance as a ratio of the value of plant and equipment measured year to basis will bring out the facts whether cost control measures are required to be undertaken immediately or not. Such an analysis equipment wise will indicate whether the equipment can be replaced by a new/another equipment.

4. ANALYSIS OF EFFECTIVENESS OF PLANNING:

The effectiveness of planning is assessed by the following ratios:

$$\frac{\text{Labour Hours on Scheduled Maintenance}}{\text{Total Labour Hours on Maintenance}}$$

$$\frac{\text{or} \\ \text{Total Down Time due to scheduled Maintenance}}{\text{Total Down Time due to Maintenance}}$$

Higher the above ratio more effective is maintenance planning. But at the same time plant availability also should have been improved.

5. FREQUENCY OF BREAK-DOWNS/MTTF:

Frequency of breakdowns of mean time of failure reflects on the plant condition. Increase in the frequency of break will help the management identify the causes of the failures and take remedial measures to reduce the frequency of such failure. This is termed as design-out maintenance. This analysis, year to year basis, will indicate the effectiveness of design out maintenance action.

6. ANALYSIS OF MEAN TIME TO REPAIR(MTTR):

Mean Time To Repair or MTTR reflects on the improvements in design & modification of plant by which the time required an equipment is reduced. This also will indicate efficiency or the skill of the people who carry out the repair jobs. MTTR is computed as follows:

$$\frac{\text{Total Repair Time in Hours}}{\text{No. of break-downs}}$$

7. ANALYSIS OF MEAN WAITING TIME (MWT):

Mean Waiting Time is part of the down time indicating the mean down-time lost in waiting for materials or labour for attending to a break down. Mean waiting Time is the ratio of Total Machine Hours lost due to waiting for materials or labour to the total number of breakdowns. Increased MWT will help the management in identifying the areas for improvement such as organizing of trade force or improving the stores systems & procedures or improving the spare part control systems.

8. PRIEL'S INDICES OF MAINTENANCE EFFECTIVENESS:

So far, we have discussed only the important factors for maintenance performance evaluation. However, a comprehensive list of indices for Maintenance Effectiveness suggested by Priel given in the Annexure-1 for reference.

9. CONCLUSION:

Though there are many factors/rations suggested as a tool for maintenance performance evaluation, it is very essential to choose only such factors which are quite relevant, easy to generate necessary data and easy to interpret the results and monitor the maintenance, planning, organizing and control activities

PRIEL'S INDICES OF MAINTENANCE EFFECTIVENESS

GROUP-1 - MAINTENANCE EFFORT (INPUT)

Manpower	Manpower efficiency =		$\frac{\text{Total man-hours allowed on job}}{\text{Total man-hours worked on same jobs}}$
	Incentive coverage =		$\frac{\text{Total man-hours on bonus}}{\text{Total direct man-hours available for jobs}}$
	Craft/ Worker Utilization =		$\frac{\text{Total direct craft hours applied}}{\text{Total hours clocked all crafts}}$
	Overdue tasks =		$\frac{\text{No. of jobs one week overdue}}{\text{No. of jobs completed in same period}}$
Economy	Work-order turnover =		$\frac{\text{No. of jobs completed in period}}{\text{No. of jobs on hand at present}}$
	Cost of main hours =		$\frac{\text{Total cost of (direct + indirect) Maintenance}}{\text{Total direct maintenance hours applied}}$
	Breakdown repairs cost =		$\frac{\text{Total cost of repairs}}{\text{Total cost of direct maintenance}}$
Service Operation	Degree of scheduling =		$\frac{\text{Total direct hours on scheduled service}}{\text{Total direct hours available}}$
	Breakdown repair hours =		$\frac{\text{No. of hours spent on breakdown repairs}}{\text{Total direct production hours same period}}$

ANNEXURE - 1 Contd..

Maintenance intensity	Maintenance hours applied	=	----- Total direct maintenance hours applied ----- Total direct production hours same period
	Maintenance ratio for investment	=	----- Total direct maintenance hours applied ----- Total plant investment to date
	Maintenance cost component	=	----- Total maintenance cost for applied ----- Total Production cost for same period
Service cost	Scheduled service cost	=	----- Total cost of scheduled service ----- Total production cost for same period
	Breakdown severity	=	----- Total cost of breakdown repair ----- Total No. of breakdowns

GROUP-2 - MAINTENANCE EFFECTS (OUTPUTS)

Plant Condition	Breakdown frequency	=	----- No. of maintenance breakdown ----- Total No. of breakdown
	Visual and descriptive	=	----- Estimate of plant condition from ----- Production supervisory personnel
	Machine utilization	=	----- Total running time in hours ----- Total shift hours
Plant Performance	Length of running period	=	----- Total production output in hours ----- No. of repairs in the same period
