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Planning and Calculation of Cost Maintenance Machine using Reliability Engineering Method

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Abstract:- PT. XYZ implementing corrective maintenance regardless of the reliability factor of engine components production, resulting in engine damage often occurs suddenly causing the high opportunity cost. This problem can be solved by planning for the care and calculation engine maintenance costs. In this study, determined the critical components on a machine that is a component feeding roll Feeding Chain Roll, Roll On, Roll Back, Forward Roll and Roll Mill.. For critical components that have been determined, obtained an interval of replacement parts Chain Roll Feeding is 196 days with the reliability value of 0.3690, component Roll On is 179 days with the reliability value of 0.5012, the components of the Roll Back is 204 days with the value of the reliability of 0.3726, Roll Forward component is 243 days with a value of 0.3720 and component reliability Roll Mill is a 248-day reliability value of 0.5043. The results showed that the reduction in the cost of Rp. 1.190039 billion to Rp. 31.2286 million obtained from corrective maintenance into preventive maintenance. While the maintenance efficiency increased by the application of preventive maintenance is to Chain Roll Feeding components is 37.50%, component Roll On is 33.33%, the component is 20.00% Roll Back, Forward Roll components is 28.57% and components Roll Mill 33.33%

Keywords:- *Preventive Maintenance, Reliability Engineering, MTTF, MVSM.*

I. INTRODUCTION

PT. XYZ has implemented a machine maintenance system by running preventive maintenance and corrective maintenance to support the smoothness of the production process. Implementation of maintenance system with preventive maintenance done in PG is to do regular maintenance such as lubrication of machines, firming machine bolts and cleaning the inside of the machine. The application of corrective maintenance system is done after the damage to the machine is to repair or replacement of damaged machine components. Replacement of components on the corrective engine causes the engine to stop operating during the production process is in progress. This will result in losses to the company due to improper damage and lost profit opportunities. The magnitude of losses incurred in the company due to the corrective maintenance component replacement can be seen in Table 1.1. This machine component is the component of Feeding Roll machine with the longest damage frequency during the period 2014 - 2015. Feeding Roll Machine is also a machine with the longest damage frequency in that period when the turn on the machine components can be seen in Table 1.

Engine Machine	Replacement Time (Hours)
Feeding Chain Roll	8
Roll On	6
Roll Back	5
Roll Forward	7
Roll Mill	6

Table 1:- Turnover Time of Machine Component

Table 1 shows that it is known that machine damage occurs on the Feeding Chain Roll component causing the engine to stop and the production opportunity if the cane is lost. This causes the production target if the sugar cane is 50 tons is not achieved because the sugar cane can not be processed during standard working hours. To solve the problem, it is necessary to apply preventive maintenance scheduled maintenance planning to perform component replacement so that the machine is able to operate on standard working hours without any damage during production process so that the production process can run smoothly and maintenance cost arising from the scheduled treatment will can be optimized. In Eko N (2012) study in the journal "Pump Management Unit Management Unit Pump and Oil Shipping Pump" that Joint Operating Body of Pertamina-Petrochina East Java (JOB-PEJ) which often suffered sudden machine damage, component repair costs are more expensive when compared to prevention before the machine or equipment is damaged. The case succeeded in applying Reliability Engineering method to keep engine condition in optimum condition by making machine maintenance schedule based on its reliability level and minimize maintenance cost after scheduled maintenance.

II. RESEARCH METHODS

The object of research observed is the maintenance of feeding roll machine in sugar cane production process. The type of research used in this study is descriptive comparative study. This research was conducted to determine the schedule of replacement of components based on time interval data of critical engine component breakdown. The cost calculation is done to find out how much cost to the company to do scheduled maintenance machine that influenced by opportunity cost, labor cost and component price. The study was conducted by following the steps as follows:

- Initial stage of preliminary study to determine the condition of the company, supporting information required as well as literature studies on the methods of problem solving used and other supporting theories.
- The second stage is data collection. Data collected secondary data.
- The next step is secondary processing that has been collected by testing the distribution of interval data of component damage, determining Mean Time To Failure (MTTF) and preventive machine maintenance cost based on the machine component replacement schedule.
- Analysis of the results of data processing.
- Conclusions and suggestions are given for research.

III. RESULT AND DISCUSSION

Type of Feeding Roll machine in Sugar Factory PT. XYZ has the longest engine failure frequency in the period 2014-2015. The company has 5 feeding roll machines. The five units of the machine have a greater frequency of damage than other types of machinery available at the Department of Sugar Factory. Then Based on the pareto diagram with the principle of 80% -20% then got the component priority discussion with the biggest damage frequency is Feeding Chain Roll, Roll On, Roll Back, Roll Forward, Roll Mill. Damage to one component of the machine resulted in the machine can not operate and resulted in the emergence of opportunity costs. Below is the breakdown of critical components of Feeding Roll machine.

Stages performed is to test the distribution pattern of each critical component and then calculate the MTTF value (Mean Time To Failure) which becomes the replacement schedule kompoenn. The pattern of damage distribution of critical components of the machine is tested using normal, lognormal, exponential and weibull distributions. Testing the distribution pattern is done by using the interval data damage each component.

The determination of the selected distribution pattern is based on the largest Index of Fit value of the type of distribution tested. From the results obtained are the components of Feeding Chain Roll distributed weibull, normal distributed Roll On components, weibull distributed Roll Back components, Roll Forward components distributed weibull and Roll Mill components are normally distributed.

Based on the calculation of parameters with Maximum Likelihood Estimator (MLE) method manually from each selected distribution pattern, we get MTTF value for each critical component is for the component of Feeding Chain Roll is 196 days, Roll On component is 179 days, Roll Back component is 204 days, the Roll Forward component is 243 days and the Roll Mill component is 248 days. The meaning is that the machine components have to be replaced when operating for 179 days for the Feeding Chain Roll component, and subsequently for each critical component.

Companies generally make improvements rather than prevention, therefore companies often pay a high cost of care. This fee is called Cost of Failure (CoF) cost corrective maintenance that arise in the event of damage. This cost is determined by calculating labor costs, lost production costs, component costs and total repair time. Calculation of each critical component results in different cost values. The total results of corrective and preventive maintenance cost calculations can be seen in Table 2.

Component	***Corrective* Cost (IDR)**	***Preventive Cost* (IDR)**
Feeding Chain Roll	275.013.200	8.443.600
Roll On	237.947.400	3.614.600
Roll Back	226.427.400	7.381.200
Roll Forward	261.243.000	7.430.600
Roll Mill	189.408.000	4.358.600
Total	1.190.039.000	31.228.000

Table 2:- Total Comparison of Corrective and Preventive Machine Component Maintenance Costs

Based on Table 2 it is found that the corrective and preventive maintenance cost of critical components of feeding roll machine is reduced from 1,190,039,000 (IDR) to 31.228.000 (IDR).

IV. CONCLUSION

The conclusions obtained from the research results are as follows:

- The critical engine which is the priority of the research is Feeding Roll machine is the machine with the longest damage frequency during the period 2014 - 2015 with critical engine components such as Feeding Chain Roll, Roll On, Roll Back, Roll Forward, and Roll Mill.
- Schedule of machine maintenance with replacement of critical components for Feeding Chain Roll component is 196 days, Roll On component is 179 days, Roll Back

component is 204 days, Roll Forward component is 243 days and Roll Mill component is 248 days.

- The reliability value of machine components on the replacement schedule of Feeding Chain Roll component is 0.3690, Roll On component 0,5012, Roll Back component 0,3726, Roll Forward component 0,3720 and Roll Mill component 0,5043.
- Comparison of current machine maintenance costs and cost estimation of proposals result in cost savings of Rp. 1,190,039,000 to Rp. 31.228.000 to the company by applying cost of preventive than still maintain the application of cost of failure that is corrective treatment.

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