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PERFORMANCE ANALYSIS OF OVERHEAD CRANE CAPACITY 5 TON ON PART BOTOMO AT PT. PARAMOUNT BED INDONESIA

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ABSTRACT

Lifting machines are used to move cargo at a location or area, department, factory, construction site, storage and unloading area. In principle, the working movement of the lifting machine is to raise and lower the load. Some lifting machines can also move horizontally, rotate, move vertically, and so on. For example, cranes can lift loads, shift, hold them up when needed and carry as specified. The formulation of the problem is to find out what is the lifting speed, power consumption and performance of the Overhead Crane with Part Botomo load at PT. PARAMOUNT BED INDONESIA. the research method uses engineering research methods and theoretical research.

The purpose of this study was to determine the lifting speed, power consumption and performance generated when lifting Botomo Parts using the Overhead Crane machine at PT. PBI. In this study using 2 different rpm variations, the first uses 1000 rpm which is taken from the average value, namely the lifting speed is 6.81 m/min and the power consumption is 9.14 kW, the second uses 1,200 rpm which is taken from the average value. namely the lifting speed of 5.32 m/min and the power consumption of 6.86 kW, then this value was compared with the value of the lifting speed and power consumption in the Overhead Crane specification at PT. PBI, namely the lifting speed of 5.04 m/min and power consumption is 5.3 kW, from the results of the comparison, the performance value of the Overhead Crane engine at PT. PBI is 70%.
Keywords: Performance, Overhead Crane, and Part Botomo.

INTRODUCTION

In this era of technology that is developing very quickly, many new technologies have emerged to facilitate and assist in doing a job (Azis and Ramadhani 2021). Crane is one of the most widely used material lifting and moving aircraft. Cranes are heavy equipment that has a large shape and lifting capacity. Cranes are usually used in project work, ports, workshops, industry, and warehousing. There are several types of cranes, namely Crawler Crane, Wheel Crane, Truck Mounted Crane, Tower Crane, Overhead Crane, Gantry Crane and Portal Crane

In today's modern industrial world, the existence of Overhead Cranes as a Material Handling tool in factories and warehouses is very much needed. As a Material Handling Equipment Overhead Crane solution, it has been proven to increase productivity, profitability, and work safety. For the use of Overhead Crane itself, it is very helpful for workers who will move a machine or heavy equipment to the desired place, because humans have a limit of strength or power to lift a machine or tool that has a heavy capacity, it will definitely need a lot of people to lift it and in the world of work too will definitely limit employees according to the needs of the company.

THEORETICAL FRAMEWORK

A. Definition of Analysis

System Analysis as the decomposition of a complete information system into its component parts with a view to identifying and evaluating problems and opportunities (Azis, Pribadi, and Nurcahya 2020)

B. Aircraft Lift

Lifting plane is a set of tools used to lift, move and lower an object to another place with a limited operating range. (Jefriansyah and Ma'ruf 2018), Lifting plane is any machine tool or tool driven by mechanical power, electric power or hydraulic power which can be used as a lifting machine including rails, rail roads or other auxiliary tools (Rahmadsyah 2019), Lifting aircraft is a tool to lift or move an item from one place to another using a system (Dermawan, Sindhu, and Ruddianto 2018), Aircraft Lift and transport itself is an aircraft or tool used to move, lift cargo, either material or goods or people vertically and or horizontally within a specified distance (Bikatofani 2015).

C. Overhead traveling crane

Overhead traveling crane is included in the group of bridge-type cranes where the bridge is equipped with rubber wheels that can move on a track above ground level. These cranes are generally operated in the open field. In this study, overhead traveling cranes are operated at a sea port to lift / move pumps ± pumps to be repaired or to be moved (Imam, Amiadji, and Arief 2014). The overhead traveling crane is shown in Figure 1.

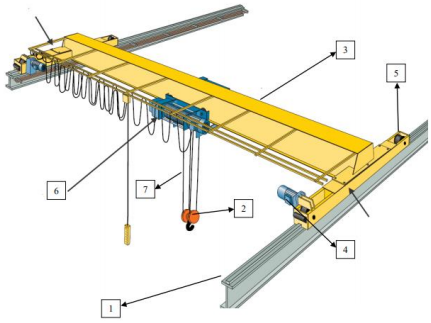

Figure 1. Overhead Crane

The components of this overhead crane include:

1. Track (runway rail)
   Functions as a path for the crane to move forward and backward(Crane 2017)
2. Drums
   Steel rope winding drum for power drive, equipped with grooves for the steel rope to be rolled regularly so that steel wear can be reduced.
3. Cross bridge
   The cross bridge serves as a trajectory for the crane to move left and right.

4. Wheel drive motor
   The wheel drive motor functions to move the wheels on the track, allowing the crane to move forward and backward.
5. Drive wheel
   The driving wheel serves as the wheel of the crane crossbar.
6. Motor drive up/down (hoist)
   Serves to raise and lower objects that are attached to the hook.
7. Steel rope
   Steel ropes are widely used in conveying machines as lifting furniture

METHOD

The research on the performance of the 5 Ton Overhead Crane was carried out at PT. PARAMOUNT BED INDONESIA which address is MM2100 Industrial Town Block M-1-1, West Cikarang, Bekasi, Gandamekar, West Cikarang sub-district, Bekasi Regency, West Java 17520. Preparation or Data Collection

Table 1 Overhead Crane Specification

Crane Type	*Overhead Crane*			
Capacity	5		Ton	
Span	18		Meter	
Lift	8		Meter	
Motion	*Speed* (m/min)	Motor (kW)	*Quantity*	*Brakes*
Hoisting	5.1	5.3	1	Magnet
Creep Hoist	0.51	0.63	1	Magnet
Cross Travel	16	0.34	1	Magnet
Long Travel	17	0.92	2	Magnet
Wire Rope	6 / 2 Falls	Ø 10 mm		
Operation	*Floor Control*	*By Push Button*		
Power Source	3 Ø	380 V	50 Hz	

Overhead Crane and Part Botomo loading material, as shown in Figure 3. below.

Figure 3. Overhead Crane

In this study, documentation was used as a complement to field notes and interviews to support the research. Research uses electronic media as tools such as cellphones, etc., which will make it easier for researchers to provide documentation that can support and strengthen the data collected by researchers. The documentation here can be in the form of photos on the Overhead Crane and Botomo Part loading material.

1. Tool Concept.
2. The concept of an Overhead Crane with an electric motor drive system that can be explained like a machine concept. In this chapter, we will explain the performance of the Overhead Crane with a capacity of 5 Tons on the loading of Part Botomo and a discussion in this way to know the working process and how the machine works.
3. Initial Parameters Seen from Overhead Crane Specifications at PT. INDONESIAN PARAMOUNT BED.

Table 2. Initial Parameters

NO	LOAD	LIFT SPEED	TOLERANCE	POWER CONSUMTION
1	RATED LOAD 5	5,04 M/MENIT	-/+ 10 %	5,3 KWH

DISCUSSION

A. Performance Parameters on Overhead Crane Based on Experiments at PT. PARAMAOUNT BED INDONESIA

In collecting data for this final table, to find the value of the lifting speed directly on the Overhead Crane by lifting the Botomo Part (Raw Material) the value is taken using a stopwatch and for the value of power consumption using a calculation with a predetermined formula

Table 3. Final Parameters of 1000 rpm

NO	ROUD TRIAL (RPM)	LIFTING DISTACE (METER)	LIFT SPEED (METER/MINUTE)	POWER CONSUMPTION (KW)	LOAD (KG)
1	1.000	0-8	7,30	5	1.000
2	1.000	0-8	6,90	9,52	2.000
3	1.000	0-8	6,24	12,9	3.000
AVERAGE			6,81	9,14	

Based on table 3 of the final parameters at 1000 rpm, in the first lifting experiment with a lifting distance of 0-8 meters with a load of 1000 kg, the lifting speed was 7.30 m/min with a power consumption value based on the calculation obtained 5 kW. in the second lifting experiment with a lifting distance of 0-8 meters with a load of 2,000 Kg, the lifting speed was 6.90 m/min with a power consumption value based on calculations that obtained a power consumption of 9.52 kW. in the third lifting experiment with a lifting distance of 0-8 meters with a load of 3,000 Kg, the lifting speed was 6.24 m/min with a power consumption value based on calculations obtained 12.9 kW. The average value in table 4.1 for the final parameter of 1000 rpm is the lifting speed of 6.81 m/min and the power consumption of 9.14 kW.

Table 3. Final Parameters of 1200 rpm

NO	ROUD TRIAL (RPM)	LIFTING DISTACE (METER)	LIFT SPEED (METER/MINUTE)	POWER CONSUMPTION (KW)	LOAD (KG)
1	1.200	0-8	6,21	4,28	1.000
2	1.200	0-8	5,38	7,3	2.000
3	1.200	0-8	4,39	9	3.000
AVERAGE			5,32	6,86	

Based on table 4. the final parameters at 1,200 rpm, in the first lifting experiment with a lifting distance of 0-8 meters with a load of 1,000 Kg the lifting speed was 6.21 m/min with a power consumption value based on the calculation obtained 4.28 kW. in the second lifting experiment with a lifting distance of 0-8 meters with a load of 2,000 kg, the lifting speed was 5.38 m/min with a power consumption value based on the calculation obtained 7.3 kW. in the third lifting experiment with a lifting distance of 0-8 meters with a load of 3,000 Kg, the lifting speed was 4.39 m/min with a power consumption value based on calculations obtained 9 kW. The average value in table 4.2 of the final parameters of 1,200 rpm is the lifting speed of 5.32 m/min and the power consumption of 6.86 kW

B. Graph of the Final Overhead Crane Experiment Table at PT. INDONESIAN PARAMOUNT BED.

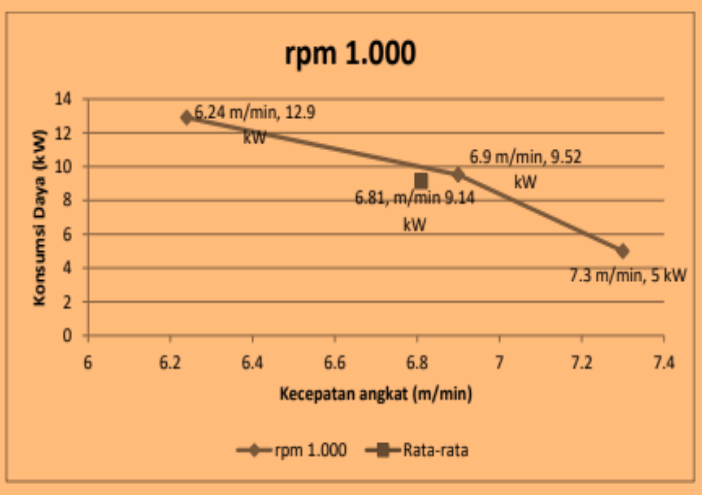

Figure 5. Final Table of 1000 rpm.

From Figure 5. the graph above is based on the data that has been obtained with 1000 rpm from each experiment. in the first experiment the results obtained lifting speed of 7.30 m/min and power consumption of 5 kW. In the second experiment, the results obtained lifting speed 6.9 m/min and power consumption 9.52 7.3 m/min, 5 kW 6.9 m/min, 9.52 kW 6.24 m/min, 12.9 kW 6.81, m/min 9.14 kW 0 2 4 6 8 10 12 14 6 6.2 6.4 6.6 6.8 7 7.2 7.4 Power Consumption (kW) Lifting speed (m/min) rpm 1,000 rpm 1,000 Average56 kW. In the third experiment, the results obtained are 6.24 m/min lifting speed and 12.9 kW power consumption. From these experiments, the average value for lifting speed is 6.81 m/min and power consumption is 9.14 kW .

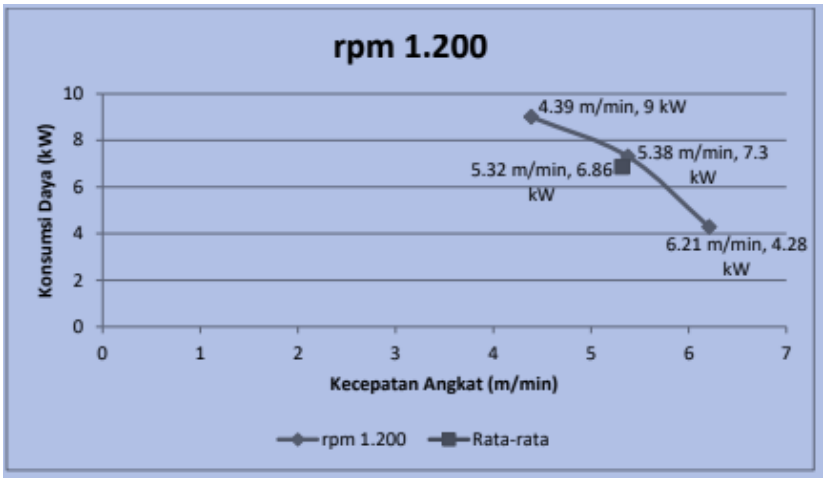

Figure 6. Graph of Final Table of 1,200 rpm rpm

From Figure 6. the graph above is based on the data that has been obtained with 1,200 rpm from each experiment. In the first experiment, the results obtained are 6.21 m/min lifting speed and 4.28 kW power consumption. In the second experiment, the results obtained were 5.38 m/min lifting speed and 7.3 kW power consumption. In the third experiment, the results obtained were 4.39 m/min lifting speed and 9 kW power consumption. From these experiments, the average value for lifting speed is 5.32 m/min and power consumption is 6.86 kW .

CONCLUSION

From the research conducted, the following conclusions are obtained:

1. The speed of the experimental results with the average value for each rotation obtained at 1000 rpm with a lifting speed of 6.81 m/min and 1200 rpm with a lifting speed of 5.32 m/min.
2. Power consumption based on calculation results with an average value at each rpm of 1000 rpm with a power consumption of 9.14 kW and 1200 rpm with a power consumption of 6.86 kW.
3. Based on the Overhead Crane engine performance parameters are:
    a. In the 1000 rpm experiment, at a load of 1,000 kg it was 56%, at a load of 2,000 kg it was 68%, at a load of 3,000 kg it was 75%.
    b. In the 1200 rpm experiment, at a load of 1,000 kg it was 74%, at a load of 2,000 kg it was 96%, at a load of 3,000 kg it was 100%.
4. The explanation is based on the hypothesis which states that as the speed value (V) of the lift increases, the driving motor power (N) will continue to increase on the 5 Ton Overhead Crane with Part Botomo load, the hypothesis is according to the experiments and calculations.

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