



Comparative Study of Life Cycle Between New Bearings and Overhaul Bearings on Train Wheels at Balai Yasa Manggarai

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Abstract. Balai Yasa (BY) is a place used for major maintenance of railway facilities. This is where the Railway facilities receive semi final maintenance (SPA), final maintenance (PA) to modifications. Some parts of the facility are being maintained, such as the bogie frame, braking, upper frame, electricity and wheels. This treatment is to provide satisfaction for rail service users so that they can build trust in railroad service provider companies. Bearings on train wheels have an important role as supporting the load on the wheel axles of the Railway facilities, so proper and proper maintenance is needed so that fatal damage does not occur which can cause material, financial, and loss of life for train service users and the rail service provider. The maintenance aims to determine the comparison to damage, and the cost comparison between new bearings and overhauled bearings. This study analyzes what bearing overhaul is and what is the purpose of Balai Yasa in carrying out bearing overhaul activities. Using a comparison method by studying and analyzing an object that is carried out to find out how important the Bearing overhaul is. After the data obtained was processed using Microsoft Excel, the authors obtained results in the form of a comparison of the quality level between overhauled bearings and new bearings by calculating the amount of damage obtained (1), and about cost comparisons between overhauled bearings and new bearings based on expenses for maintenance of any damage that the bearings get (2).

Keywords: Bearing, Overhaul, Quality.

1 Introduction

A train is a rollingstock with motion, either running alone or coupled to other rollingstock. In developed countries, technology of mass transportation continues to be improved because it can be used to transport goods and passengers both long and medium distances with a relatively large number of transports^{1,2}. However, this mode of transportation must be supported by standard services and adequate supporting facilities, especially in the implementation of passenger transportation. The service is to provide satisfaction for railway service users so that they can build trust in railway service provider companies so that the company's image can be maintained. One of his efforts is to perform maintenance on the facility, the type of treatment performed is

daily check, P1, P3, P6, P12, P24, and P48³. As for some parts of the means of maintenance, such as bogie frame, breaking, roof frame, electrical, and wheels^{4,5,6}. On this occasion, the author will discuss the maintenance carried out on rollingstock wheels, especially on the bearing.

Bearings on rollingstock wheels have an important role as the fulcrum of the axle so as to minimize friction^{7,1}. To be able to produce easy and smooth movements, good and proper maintenance is needed so that things do not happen that can harm rollingstock service users and rollingstock service providers⁸. When Balai Yasa Manggarai performs bearing maintenance, based on the state of the data on the damage obtained, it can be seen that the overhaul bearing is more low cost budget than the new bearing which is then used on the train when performing maintenance at Balai Yasa Manggarai.

1.1 Bearing

Bearings are an important component in the machinery, mechanical and automotive industries. Bearings play a role in limiting the relative movement between two or more components that are connected so that they can move in the desired direction. With bearings, the rotation of the two components will be smoother, smoother and can minimize damage. Apart from that, the bearing also functions as a support for rotating objects⁹.

1.2 Bearing Components and Their Functions

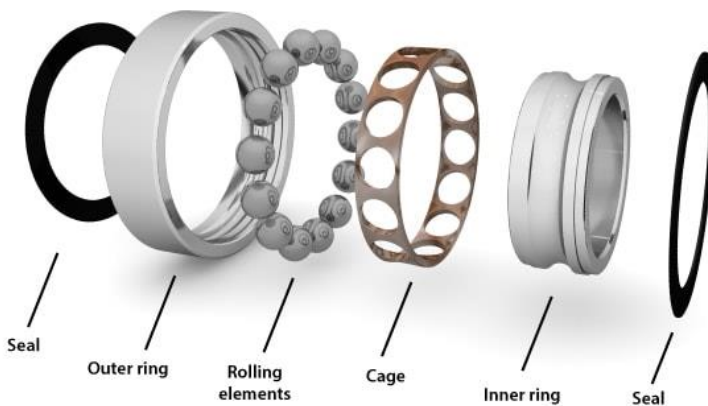


Fig. 1. Bearing Components.

a. Outer Ring and Inner Ring with raceway

As the name suggests, the outer ring is a bearing component that is located on the outermost part, while the inner ring is located on the inside of the bearing¹⁰. These two rings function to hold the ball so that it always spins in the same place. The materials often used for these two rings come from hard materials such as steel or metal with a

chromium coating, because the strength of the bearing material affects the load it will receive and the service life of the bearing itself. However, the outer ring & inner ring are also sometimes made from other lighter weight materials such as ceramic or plastic¹¹. However, the use of light materials is not suitable for placement at high temperatures and pressures, therefore you must pay attention before choosing bearings with this material.

b. Rolling Elements

In the inner bearing there is an element that can rotate. Usually this element has various shapes such as balls, rollers/cylinders, cones or hard needles. This element moves and is in direct contact with the outer ring and inner ring and will move according to the path when the shaft rotates¹².

c. Cage

The function of the cage is to maintain the distance between the balls or cylinders so that they do not collide with each other or rub against each other. So that the bearing rotation becomes smooth and smooth¹³

d. Seal

Seals or covers are not found on all bearings. There are some who don't use it. However, the seal actually has a function that is quite necessary, namely being able to prevent the inside of the bearing from getting dirty, as well as acting as a lubricant that supports the bearing's performance so that it remains smooth. So choosing a bearing with a seal is the right choice¹⁴.

2 Research Method

The method used in this study is a quantitative method. According To Abraham., et al. (2018), quantitative research is statistical analysis and the collected data rather takes a countable (numeric) form. Quantitative research there are several types of research. Quantitative research is divided into experimental, descriptive, correlational, evaluative and comparative research. This method is an approach to data processing through statistical or mathematical methods collected from secondary data. As for the method used is comparative because the author controls the independent variables directly because the existence of these variables has occurred, or because the variables can not be fundamentally manipulated. Researchers only take data that already exist in the field without manipulation or specific treatment so that both involve comparison groups, the difference is in experimental research, suspected causes, played, (manipulated).

3 Result and Analysis

3.1 Comparison of the Number of Bearing Damages

Data on the type of damage to bearings for the 2018-2021 range that occurred at the Balai Yasa Manggarai are grouped into :

- a. Damage to the temperature sticker on the bearing;
- b. Runny damage to the bearing;

- c. Broken damage to bearing;
- d. Overheat damage to bearings;
- e. Aspan damage to bearings.

After the data is obtained, the data processing is done by classifying each damage obtained by month and year, then the author can compare the amount of damage that occurs in the new bearing and bearing overhaul. Then it can be graphed to make a comparison directly. For the damage data began to be recorded from 2018 because in 2017 the two bearing data were still using new bearings.

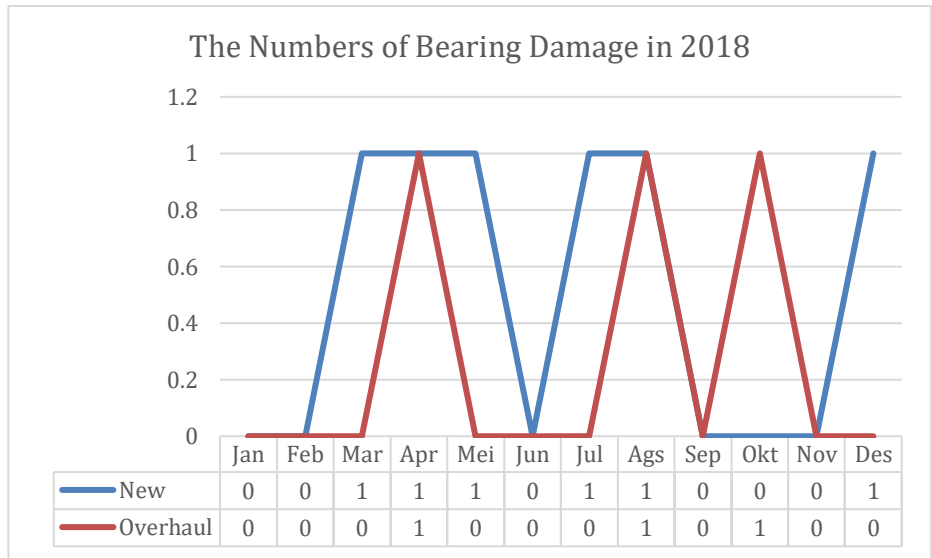


Fig. 2. Comparison chart of bearing damage in 2018.

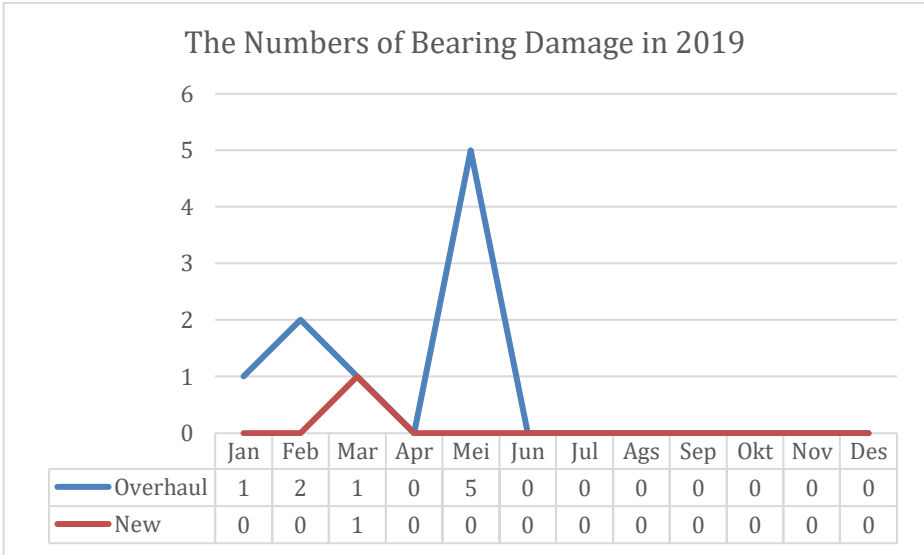


Fig. 3. Comparison chart of bearing damage in 2019.

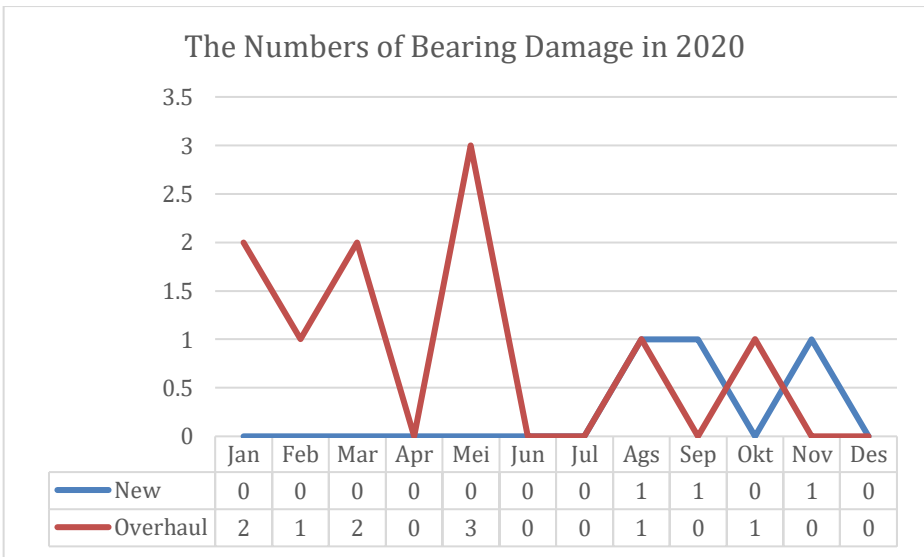


Fig. 4. Comparison chart of bearing damage in 2020.

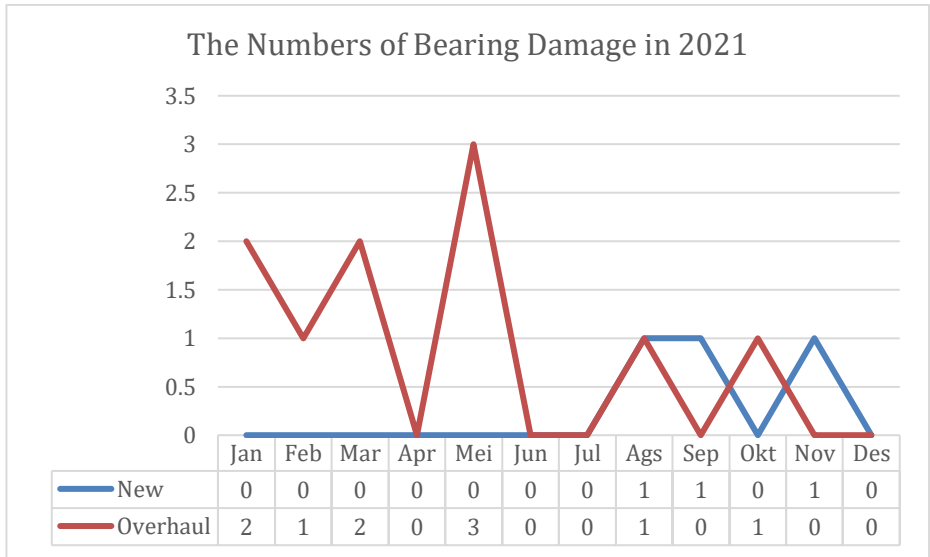


Fig. 5. Comparison chart of bearing damage in 2021.

3.2 Comparison of Repair Costs Between Overhaul Bearings and New Bearings

Data regarding bearing repair costs was obtained by conducting interviews with employees at Balai Yasa Manggarai. The price of a new bearing is IDR 3.010.597,-, while the cost of the overhaul bearing consists of the price of the grease material, which is IDR 292.500,- plus the price of the sealcup material, which is IDR 183.475,- so the total cost is IDR 475.975,-.

After getting the amount of bearing maintenance cost components, both new and overhauled, the author can create a group of maintenance costs based on the bearing damage data that was previously displayed.

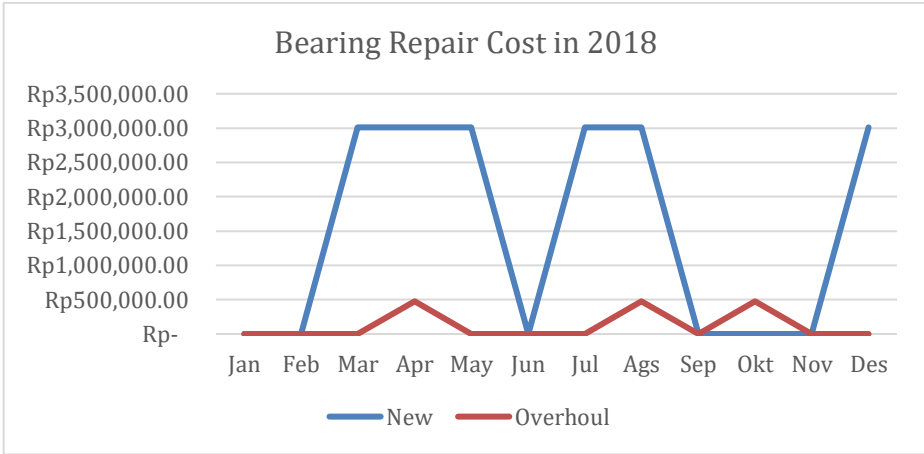


Fig. 6. Comparison chart of bearing repair cost in 2018.

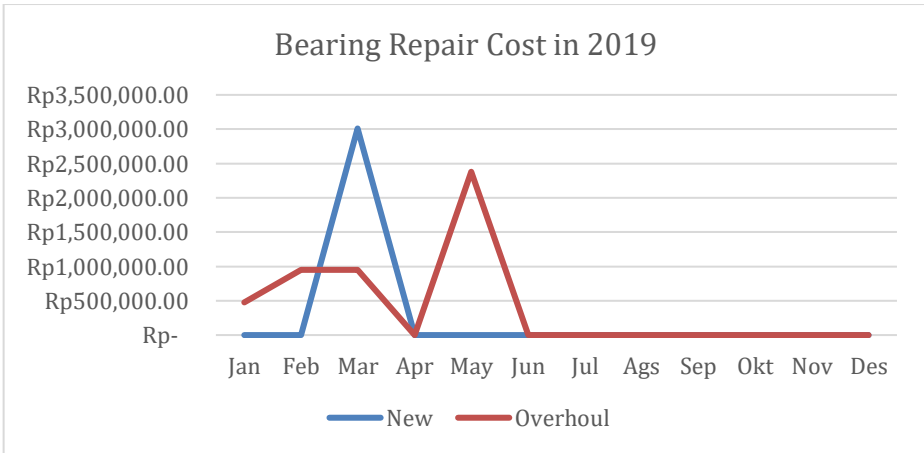


Fig. 7. Comparison chart of bearing repair cost in 2019.

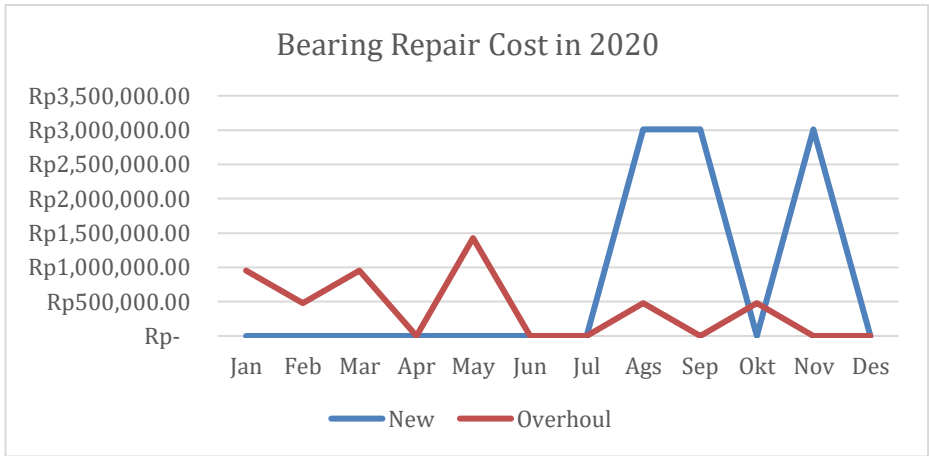


Fig. 8. Comparison chart of bearing repair cost in 2020.

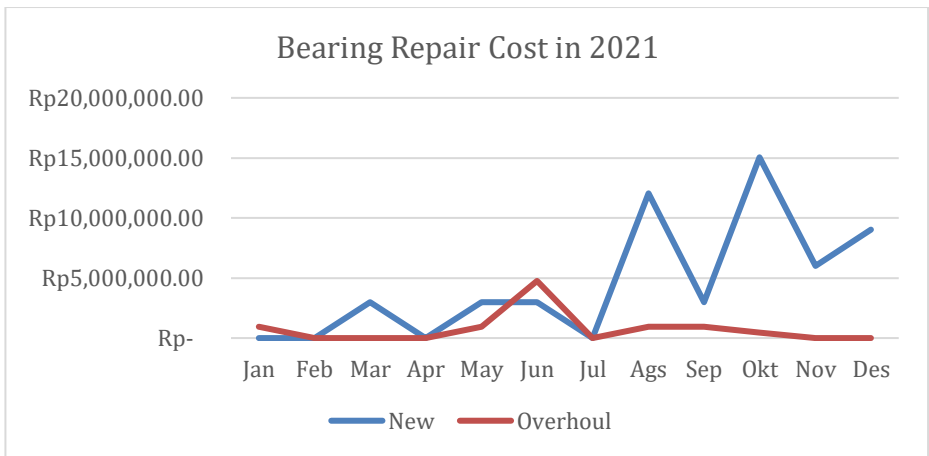


Fig. 9. Comparison chart of bearing repair cost in 2021.

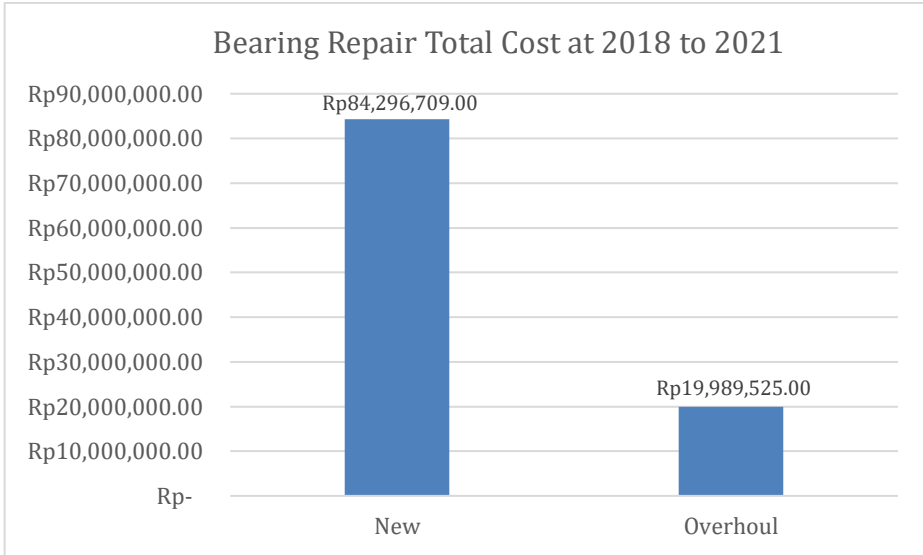


Fig. 10. Comparison chart of bearing repair total cost at 2018 to 2021.

Figure 10 shows a comparison of the total costs between new bearings and overhaul bearings for the period 2018-2021, where the costs for purchasing new bearings have a total cost of IDR 84.296.709,- and the costs for repairing overhaul bearings are IDR 19.989.525,-. When compared, the two costs between new bearings and overhaul bearings have a difference of IDR 64.307.184,-. This difference is quite large if you want to save costs.

4 Conclusion

Based on the grouped bearing damage data from 2018-2021, it can be seen that new bearings had a total of 27 sets of damage, while overhaul bearings had 42 sets. From the large number of damages, it can be concluded that the quality of new bearings is better than overhaul bearings, but overhaul bearings are still suitable for use. Based on the results of data processing regarding the comparison of costs for repairing the two types of bearings in the period between 2018-2021, it can be seen that the total cost for purchasing new bearings is IDR 84.296.709,- while the total cost for overhaul bearing repairs is IDR 19.989.525,-. From the cost comparison data, it can be seen that the cost of overhaul bearing maintenance is much smaller than the cost of purchasing new bearings, so it is hoped that this will save operational costs for bearing maintenance at Balai Yasa Manggarai.

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