
Reducing the Frequency of Rear Lamp Breakdown on the DT Coal Hauling Unit Arocs 4845 in the Mining Area of PT. Antareja Mahada Makmur Site PT Mifa Bersaudara Period (2024)

Yato, Muhammad Hanif Iswanto, Tegar Tahanuji, Agus Sutiono, Yuli Adi Gunawan
PT AMM Site Mifa Bersaudara, Indonesia
Email: hanif.iswanto@amm.id, yato@amm.id, tegar.tahanuji@amm.id

ABSTRACT

The high coal production target of PT Antareja Mahada Makmur at the PT MIFA Bersaudara jobsite demands the availability of optimal heavy equipment units. The Mercedes-Benz Arocs 4845 unit as the main means of transportation experienced a decrease in productivity due to frequent breakdowns in the rear lamps, which interfered with coal *getting* and coal hauling activities. This study aims to implement improvements to reduce the frequency and duration of breakdowns in the taillights of the DT Arocs 4845 unit. The method used was a direct experiment with several stages of technical intervention: (1) replacement of bulb lamps with more vibration-resistant LED types, (2) modification of lamp brackets with the addition of damper rubber and safety chains, and (3) repair of electrical wiring. Breakdown data before (April 2024) and after the repair (July 2024) were analyzed using Pareto charts and cost calculations. The implementation of the fix successfully eliminated the taillight breakdown incidents altogether. The frequency of breakdowns decreased from 12 times (21.18 hours lost) to 0 times, thus saving potential lost costs of IDR 31,742,518 per month. Integrated solutions for LED light replacement and bracket modification have proven to be very effective and efficient in improving unit reliability. This research provides a proactive maintenance strategy that can be replicated for similar units to support the achievement of production targets.

Keyword: Mercedes Benz, Rear lamp LED, Coal Mining, coal getting, coal hauling.

Corresponding Author: Muhammad Hanif Iswanto

E-mail: hanif.iswanto@amm.id



INTRODUCTION

Productivity is a key performance indicator crucial for achieving production and profitability for mining contractors (AYSWER et al., 2024; Gackowiec et al., 2020). One factor supporting productivity is the readiness of the unit, especially the coal hauler (Pasch & Uludag, 2018). Among the various units used to transport coal, one is the Mercedes-Benz Arocs 4845 (Karelina et al., 2022).

Field conditions indicate a decline in performance in the Arocs 4845 unit due to a high frequency of breakdowns caused by dead rear lamps (Gasmi et al., 2021). This significantly impacts coal hauling and coal *getting* production (Li et al., 2019; Mardonova & Han, 2023; Muflihhamim, 2023). This frequent rear lamp failure is caused by several factors, including poor bulb quality, a lack of security in the rear lamp bracket for the rear lamp assembly, and poor wiring and connections.

With a production target of 48 million BCM of coal and 10.2 million tons by 2024, any disruption in the hauling system directly threatens PT Antareja Mahada Makmur's ability to meet its targets. The high frequency of rear lamp failures represents an urgent operational

bottleneck that requires immediate and effective intervention to maintain continuous production flow (Colledani et al., 2018).

Previous studies have generally focused on improving truck lighting systems through the adoption of LED technology for energy efficiency and durability (Bachanek et al., 2021; Belloni et al., 2023; Pardo-Bosch et al., 2022). However, most of these studies were conducted in non-mining contexts or under less severe operating conditions (Lydia et al., 2022). Research specific to vibration management and bracket design in off-road mining environments remains limited (Altassan, 2023).

There is a lack of integrated studies that address not only the replacement of bulb-type lamps with LEDs but also the modification of mounting systems to withstand extreme mining conditions. Existing literature does not sufficiently cover the combined effect of lamp type, bracket reinforcement, and vibration damping in reducing breakdowns in heavy-duty mining trucks.

This study introduces a comprehensive approach by combining three technical interventions: replacement of bulb-type taillights with LED lights for better durability, modification of taillight brackets with rubber dampers to absorb vibrations, and addition of safety chains to prevent the lights from detaching if the rubber is damaged. This integrated solution is specifically designed for harsh mining environments and has never been documented before in the context of the Mercedes-Benz Arocs 4845.

The main objective of this study was to reduce the frequency and duration of taillight damage in the Arocs 4845 unit. The benefits obtained include: increased operational availability of transport units, reduction of lost production time and costs, increased maintenance efficiency and a proactive maintenance culture, as well as the potential for the application of similar modifications to other units in the fleet. By targeting these aspects, this research aims to provide replicable and sustainable solutions to improve the reliability of mining equipment and productivity.

METHOD

The authors' research concept involved direct experimental implementation to reduce the frequency of breakdowns caused by dead rear lamps. We identified several issues as contributing to the failure of the rear lamps. One was the poor quality of the previous bulb-type rear lamps, which frequently broke when subjected to vibrations. Therefore, we replaced the bulb-type rear lamps with better-quality LED ones.







Figure 1. Rear Lamp of a Mercedes-Benz Arocs 4845

This research began with data collection on the breakdown of an Arocs 4845 unit due to a broken rear lamp in April 2024 at the PT Antareja Mahada Makmur mining operation at the PT Mifa Bersaudara jobsite. The rear lamp was replaced from a bulb type to an LED type in June 2024, adjusting for installation opportunities. The steps taken in this research include the activities listed in the table below.

Table 1. Method Stages in Reducing Rear Lamp Breakdown

No.	Activity	Implementation	Documentation																								
1.	Conducting Problem Identification and Initial Analysis	Pareto Breakdown Rear lamp data collection	<p>Frekuensi Kerusakan DT COAL Arocs 4845 Periode April – Juni 2024</p> <table border="1"> <tr><th>Category</th><th>Frequency</th></tr> <tr><td>rear lamp off</td><td>12</td></tr> <tr><td>attachment</td><td>3</td></tr> <tr><td>air system</td><td>2</td></tr> <tr><td>hyd system</td><td>2</td></tr> <tr><td>engine</td><td>1</td></tr> </table> <p>Total Down Time Breakdown DT COAL Arocs 4845 Periode April – Juni 2024</p> <table border="1"> <tr><th>Category</th><th>Down Time</th></tr> <tr><td>rear lamp off</td><td>21.18</td></tr> <tr><td>attachment</td><td>4.20</td></tr> <tr><td>air system</td><td>11.15</td></tr> <tr><td>hyd system</td><td>0.98</td></tr> <tr><td>engine</td><td>2.82</td></tr> </table>	Category	Frequency	rear lamp off	12	attachment	3	air system	2	hyd system	2	engine	1	Category	Down Time	rear lamp off	21.18	attachment	4.20	air system	11.15	hyd system	0.98	engine	2.82
Category	Frequency																										
rear lamp off	12																										
attachment	3																										
air system	2																										
hyd system	2																										
engine	1																										
Category	Down Time																										
rear lamp off	21.18																										
attachment	4.20																										
air system	11.15																										
hyd system	0.98																										
engine	2.82																										

Reducing the frequency of rear lamp breakdown on the dt coal hauling unit arocs 4845 in the mining area of pt. Antareja mahada makmur site pt mifa bersaudara period (2024)

2.	Replacing the rear lamp bulb with LED	Replacing the rear lamp with a bulb type to an LED type to get better quality and life time.	
3.	Rear lamp bracket modification	<p>Adding rubber to the rear lamp bracket as a vibration or shock absorber.</p> <p>Adding a chain as safety when the rubber shock absorber breaks/is damaged.</p>	
4.	Rear Lamp Wiring Repair	Repair & modification of rear lamp wiring	
5.	Evaluation and Improvement	Conduct evaluations and socialize improvements to all crew to ensure consistency.	

The improvement steps that have been taken are an effort to reduce the problem of rear lamp breakdown on the Mercedes Benz Arocs 4845. The success of the experiment is expected to not only reduce the frequency and duration of unscheduled breakdowns due to the Rear lamp failure, but can also increase the operational efficiency of the DT Arocs 4845 in supporting Coal Getting and Coal Hauling activities at PT Antareja Mahada Makmur Jobsite PT MIFA Bersaudara.

RESULTS AND DISCUSSION

Pareto problem breakdown data by frequency and duration by comparing data in April 2024 (before improvement) and July 2024 (after improvement) with results as shown in the image below.

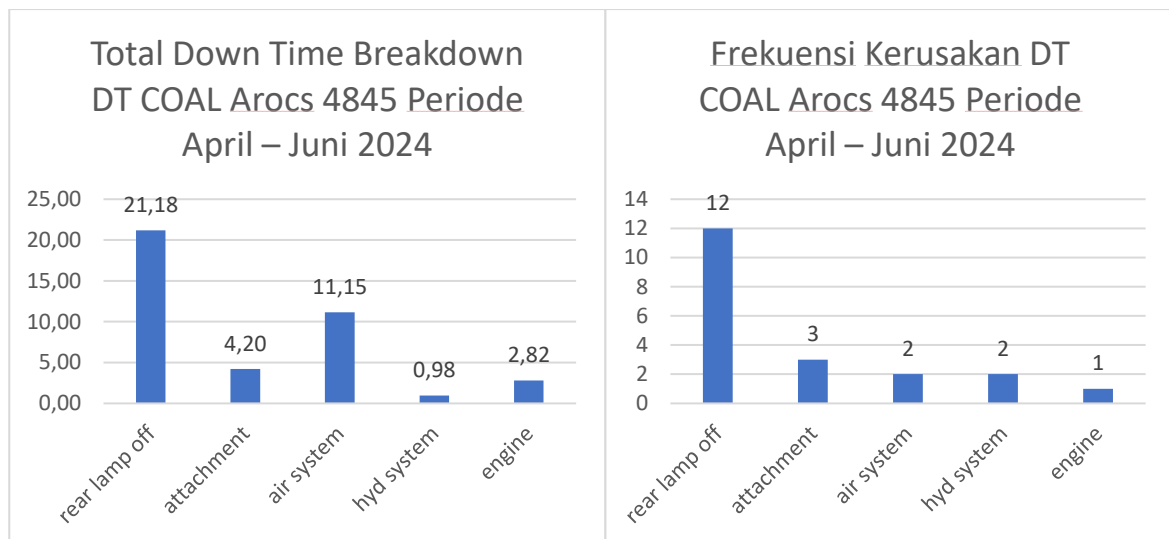


Figure 1. Pareto Achievement of Rear Lamp Breakdown Duration & Frequency (before Improvement)

In April 2024, the Arocs 4845 experienced 12 rear lamp breakdowns, with a total lost time of 21.18 hours, as shown in Figure 3. Therefore, focused improvements were required to address this issue.

Several technical steps were taken to improve the rear lamp type:

1. Changing the rear lamp type from bulb to LED.
2. Installing rubber on the rear lamp bracket to dampen vibrations/shocks.
3. Modifying the rear lamp bracket by adding a chain to protect it in case the rubber breaks/damages.
4. Replacing the bracket mounting bolts from 12mm to 14mm to strengthen the rear lamp mounting bracket.

The cost of these repairs and modifications was Rp3,833,872, covering both manpower and material costs. The results of the successful improvements are shown in the figure below.

Reducing the frequency of rear lamp breakdown on the dt coal hauling unit arocs 4845 in the mining area of pt. Antareja mahada makmur site pt mifa bersaudara period (2024)

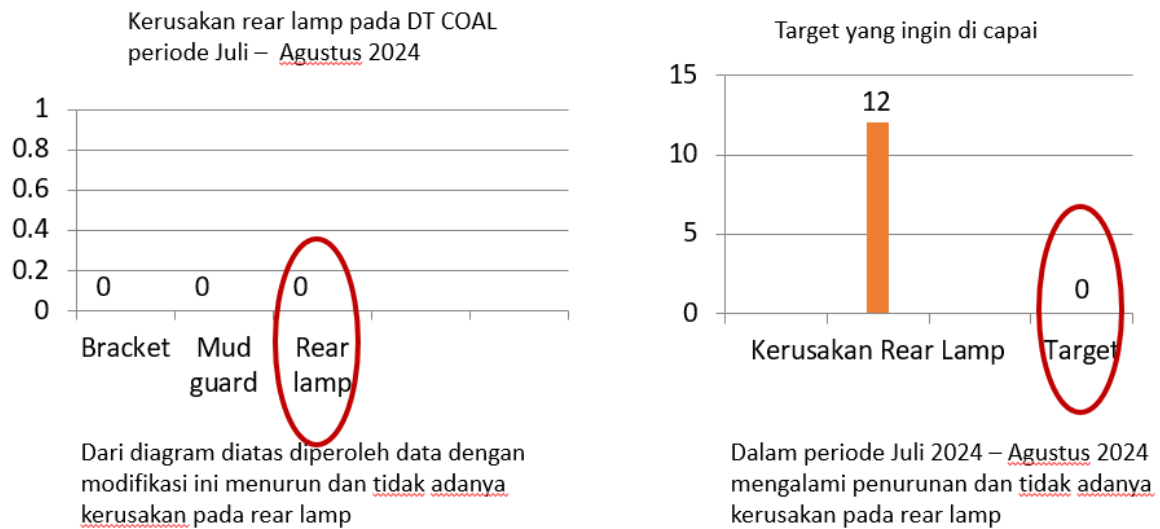


Figure 2. Breakdown Frequency Table, July 2024 (after modification)

The innovation results show that the implementation reduced breakdowns in both duration and frequency. After the July 2024 improvements, the frequency of rear lamp breakdowns even disappeared. The results of this study indicate that the implementation of replacing bulb-type rear lamps with LED ones and modifying the rear lamp brackets in the mining environment of PT Antareja Mahada Makmur, PT MIFA Bersaudara's jobsite, was very effective in reducing rear lamp breakdowns and increasing the productivity of the Mercedes-Benz Arocs 4845 unit in coal gathering and hulling activities.

The authors also calculated the potential cost savings resulting from this successful improvement by comparing the lost costs incurred in April 2024 (before improvement) with the potential cost savings in July 2024 (after improvement), as shown in the table below.

<u>Total Kerugian</u>				
Kerugian	Harga	Jumlah	Total	Satuan
Rental Unit	7.091.899	0	7.091.899	Rupiah
Man power	225.000	2	450.000	Rupiah
Produksi	24.200.619	0	24.200.619	Rupiah
Total Kerugian			31.742.518	Rupiah

Figure 3. Table of Costs Due to Rear Lamp Breakdown.

The table above shows the total lost cost due to rear lamp breakdowns amounted to Rp 31,742,518 in April 2024. The success of this improvement is demonstrated by the absence of rear lamp breakdowns on the Arocs 4845 unit in July 2024 (after the improvement), resulting in cost savings of Rp 31,742,518 in July.

CONCLUSION

Implementation of improvements in replacing the bulb-type rear lamps with LED-type lamps and modifying the rear lamp brackets on the Mercedes-Benz Arocs 4845 unit in the mining environment of PT Antareja Mahada Makmur jobsite PT *Mifa* Bersaudara has successfully increased energy efficiency and productivity. The implementation of these improvements has succeeded in reducing the frequency of breakdowns due to rear lamp failure problems from 12 times with a duration of 21.18 hours in April 2024 to 0 frequency or no breakdowns at all due to rear lamp failure in July 2024. In addition, the potential lost costs also experienced a significant decrease, with no lost costs occurring in July 2024 because there were no rear lamp failure breakdowns at all. Thus, this research is not only an effective solution in addressing existing technical challenges, but also serves as a strategy to improve the quality of proactive maintenance in the future. The authors suggest conducting an in-depth analysis of the use of LED-type rear lamps on unit performance and maintenance costs on an ongoing basis, especially on the Mercedes-Benz Arocs 4845 unit, and to add broader insight in developing a more effective heavy equipment maintenance strategy in the mining industry in Indonesia.

REFERENCES

- Altassan, A. (2023). Sustainable Integration of Solar Energy, Behavior Change, and Recycling Practices in Educational Institutions: A Holistic Framework for Environmental Conservation and Quality Education. *Sustainability*, 15(20), 15157. <https://doi.org/10.3390/su152015157>
- AYSWER, A. S., RAMASAMY, N., DEV ANAND, M., & SANTHI, N. (2024). Prioritizing Key Performance Indicators for the Mining Industry in Kerala: An AHP Approach. *Management and Production Engineering Review*. <https://doi.org/10.24425/mper.2024.151490>
- Bachanek, K. H., Tundys, B., Wiśniewski, T., Puzio, E., & Maroušková, A. (2021). Intelligent Street Lighting in a Smart City Concepts—A Direction to Energy Saving in Cities: An Overview and Case Study. *Energies*, 14(11), 3018. <https://doi.org/10.3390/en14113018>
- Belloni, E., Cotana, F., Nakamura, S., Pisello, A. L., & Villacci, D. (2023). A new smart laser photoluminescent light (LPL) technology for the optimization of the on-street lighting performance and the maximum energy saving: development of a prototype and field tests. *Sustainable Energy, Grids and Networks*, 34, 101064. <https://doi.org/10.1016/j.segan.2023.101064>
- Colledani, M., Tolio, T., & Yemane, A. (2018). Production quality improvement during manufacturing systems ramp-up. *CIRP Journal of Manufacturing Science and Technology*, 23, 197–206. <https://doi.org/10.1016/j.cirpj.2018.07.001>
- Gackowiec, P., Podobińska-Staniec, M., Brzywczy, E., Kühnbach, C., & Özver, T. (2020). Review of Key Performance Indicators for Process Monitoring in the Mining Industry. *Energies*, 13(19), 5169. <https://doi.org/10.3390/en13195169>
- Gasmi, A., Noor, S., Menzel, A., Doşa, A., Pivina, L., & Bjørklund, G. (2021). Obesity and Insulin Resistance: Associations with Chronic Inflammation, Genetic and Epigenetic Factors. *Current Medicinal Chemistry*, 28(4), 800–826. <https://doi.org/10.2174/0929867327666200824112056>
-

- Karelina, M. Y., Smirnov, P. I., & Subbotin, B. S. (2022). The Impact of Operating Conditions on the Maintenance Interval of Trucks Equipped with a Computerized Maintenance Management System. *2022 Intelligent Technologies and Electronic Devices in Vehicle and Road Transport Complex (TIRVED)*, 1–6. <https://doi.org/10.1109/TIRVED56496.2022.9965529>
- Li, Y., Chiu, Y., & Lin, T.-Y. (2019). Coal production efficiency and land destruction in China's coal mining industry. *Resources Policy*, 63, 101449. <https://doi.org/10.1016/j.resourpol.2019.101449>
- Lydia, O., Godwin, A., & Isaac, L. (2022). “We have done nothing wrong”: Youth miners’ perceptions of the environmental consequences of artisanal and small-scale mining (ASM) in Ghana. *The Extractive Industries and Society*, 12, 101179. <https://doi.org/10.1016/j.exis.2022.101179>
- Mardonova, M., & Han, Y.-S. (2023). Environmental, hydrological, and social impacts of coal and nonmetal minerals mining operations. *Journal of Environmental Management*, 332, 117387. <https://doi.org/10.1016/j.jenvman.2023.117387>
- Muflihhamim, R. (2023). Proposed Solution of Operational Strategy to Improve Coal Production: A Case Study of Sambarata Mine Operation. *International Journal of Business and Technology Management*, 4(4), 96–108. <https://doi.org/10.55057/ijbtm.2022.4.4.9>
- Pardo-Bosch, F., Blanco, A., Sesé, E., Ezcurra, F., & Pujadas, P. (2022). Sustainable strategy for the implementation of energy efficient smart public lighting in urban areas: case study in San Sebastian. *Sustainable Cities and Society*, 76, 103454. <https://doi.org/10.1016/j.scs.2021.103454>
- Pasch, O., & Uludag, S. (2018). Optimization of the load-and-haul operation at an opencast colliery. *Journal of the Southern African Institute of Mining and Metallurgy*, 118(5). <https://doi.org/10.17159/2411-9717/2018/v118n5a1>
- Zhang, M., & Kecojevic, V. (2016). Intervention strategies to eliminate truck-related fatalities in surface coal mining in West Virginia. *International Journal of Injury Control and Safety Promotion*, 23(2), 115–129. <https://doi.org/10.1080/17457300.2015.1032982>



© 2025 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>).