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APPLICATION OF THE RELIABILITY-CENTRED MAINTENANCE APPROACH ON CRITICAL RAIL WAGON COMPONENTS

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Summary: Reliability-Centered Maintenance (RCM) is a structured methodology used to optimize maintenance strategies by identifying critical failure modes and implementing preventive measures. Originally developed for the aviation industry, RCM has since been widely adopted in various specialized sectors, including the railway industry. This paper explores the application of RCM in rail freight wagons to systematically identify potential failure modes that may occur during operation, assess their impact, and develop an effective action plan to prevent failures and improve overall reliability. The study follows a structured approach, beginning with an in-depth failure mode identification process. By analysing historical maintenance data and operational conditions, the most critical failure modes are identified based on their frequency of occurrence, severity, and consequences. This analysis allows for a prioritization framework that highlights components with the highest failure risks, ensuring that maintenance efforts are directed towards the most vulnerable areas. The study also incorporates risk assessment techniques to evaluate the probability of failure and its potential impact on safety, operational efficiency, and maintenance costs. Based on these findings, a proactive maintenance action plan is developed to transition from a reactive maintenance approach to a predictive and preventive maintenance strategy. This plan includes scheduled inspections, condition-based monitoring, and the implementation of data-driven decision-making tools to minimize unplanned downtime. The benefits of this approach include improved asset reliability, reduced maintenance costs, enhanced operational efficiency, and increased safety for rail freight operations. The results demonstrate that implementing RCM in railway maintenance can significantly enhance the effectiveness of maintenance planning, ensuring longer service life for freight wagons and reducing operational disruptions. Future research will explore integrating real-time monitoring systems, such as Internet of Things (IoT)-based sensors and predictive analytics, to further refine the maintenance process and enhance wagon reliability.

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