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EVALUATING THE EFFICIENCY OF WHEELSET LATHE TECHNICIANS IN FREIGHT WAGON MAINTENANCE

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Summary: The maintenance of freight wagons is essential for ensuring efficient, reliable, and safe operations. Turning procedures are essential for prolonging the life cycle of wheelsets, among many maintenance tasks. They restore the worn shape of wheel profiles and remove damages, such as rolling contact fatigue, wheel flats, and cavities. Wheelset turning is typically performed at fixed lifetime intervals or using a condition-based strategy. To maximise the life cycle of a wheelset, lathe technicians should attempt to remove the minimal amount of tread diameter possible while considering the removal of all damages and restoring the wheel profiles to reliable shapes. Hence, the amount of material removed depends on the lathe technician, while there is an interaction with the lathe machine to decide which parameters of the wheel profiles should be reached by the turning process. Within this background, key research objectives are to determine which factors contribute to variability in tread diameter loss during turning and evaluate technician efficiency. To achieve these objectives, a comprehensive dataset of freight wagon wheelsets, pre- and post-turning tread diameters, and operational parameters was analysed using advanced statistical modelling and data envelopment analysis. On the one hand, a linear mixed model was applied to evaluate the impact of several factors, such as initial tread diameter, flange thickness, wheel condition, and shift type, on tread diameter loss and technician efficiency. On the other hand, models from the data envelopment analysis were used to benchmark technician efficiency against a best-practice frontier, incorporating key inputs such as tread diameter and flange thickness. After the comparison of both approaches, the models from the data envelopment analysis yield the best efficiency scores with few outliers and consistent operator rankings. Although technician performance varied, certain technicians consistently achieved higher efficiency due to better decision-making and technical skills. Results also show that there is a necessity for targeted operator training to improve maintenance outcomes and reduce variability. In conclusion, by using these insights, maintenance managers may identify underperforming technicians, provide targeted training, and use data-driven methods to maximise wheelset maintenance and efficiency. Moreover, this research work highlights the critical role of technician decisions in extending the wheelset life cycle to achieve sustainable maintenance practices in freight transportation.

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