

## AN ENGINEERING PERSPECTIVE ON THE GENERAL FATIGUE NORMATIVE FRAMEWORK FOR MATERIALS USED IN FREIGHT WAGONS

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**Summary:** As environmental concerns continue to shape transport policies, rail is emerging as key of a sustainable mobility strategy. With freight volumes and operating speeds expected to increase significantly in the coming decades, the railway sector must adapt to meet these growing demands efficiently. The European Green Deal sets an ambitious target of doubling the volume of goods transported by rail by 2050, reinforcing the need for advanced, high-performance freight vehicles. To achieve this goal, it is essential to develop optimized wagon designs, improve material efficiency, and integrate innovative technologies that enhance capacity, safety, and durability. Fatigue is one of the main concerns in maintaining the structural integrity of freight wagons. While an appropriate regulatory framework exists, it presents certain limitations compared to the state of the art. Given the trend toward minimizing vehicle weight to enable the transport of heavier freight loads, the application of reliable approaches for fatigue damage assessment is becoming increasingly important. Therefore, this work aims to present methodologies that can complement the applicable regulatory framework, using benchmark standards for the analysis of welded details as a reference.

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