

Railways Simulation and Strength Assessment



Railway simulation and strength assessments are critical processes that enable manufacturers to **optimise designs, reduce development times, and enhance material efficiency**. By utilising advanced simulation techniques and thorough strength assessments, we can create weight-optimised structures with optimal flow of forces, ensuring **compliance with global standards** and delivering **high-quality, innovative designs**.

At Applus+ Laboratories, we specialise in comprehensive simulation and strength assessment [services for the railway industry](#). Our expertise **spans the entire development phase** and continues throughout the product's lifecycle, providing you with the insights and optimisations needed to **bring your products to market faster** and with greater confidence.

We test against the **following standards**:

- FKM-Guideline
- DVS 1612 and DVS 1608
- Eurocode 3 and Eurocode 9
- DIN 743, DIN EN 12663 and DIN EN 13749
- VDV152

What Are Simulation and Strength Assessments?

Simulation uses mathematical models to evaluate product behaviour under various conditions, eliminating the need for physical experiments. This virtual testing **enables us to predict how your railway product will perform**, identify potential failure points, and optimise the design before any physical testing occurs.

What Do Strength and Simulation Assessments Involve?

Strength assessment complements simulation by [evaluating the structural integrity of components](#) and assemblies under different loading conditions. This process ensures that designs can withstand the stresses and strains they will encounter during operation, thereby **enhancing safety and reliability**.

From **comprehensive simulation tasks** in product development to **virtual test benches**, our capabilities at Applus+ Laboratories ensure a thorough analysis throughout the design process. We aim to **optimise both the manufacturing and costs** of your product as it progresses through the development stage.

What Simulation and Strength Assessments Do We Perform?

Our team of experts begins by **validating whether your products will function as intended** prior to market launch. Through virtual simulation, we study the behaviour of railway components—such as **car bodies, bogies, bogie frames, and assemblies**—under various conditions. This approach allows us to:

- **Predict performance under different operational scenarios**
- **Identify potential failure points or weaknesses**
- **Optimise designs to enhance performance and safety**
- **Reduce the need for multiple physical prototypes, saving time and costs**

By integrating **computational and experimental findings** related to operational and fatigue strength, we determine the **dynamic stresses** a construction must be able to bear. We assess how dimensions affect strength **values, analyse natural [vibration](#) and resonance behaviours**, and calculate and **assess lifespan**. Our results help you optimise your components during the development stage, ensuring they meet both your specifications and international standards.

Finite Element Analysis (FEA)

Finite Element Analysis (FEA) is a vital component of our simulation assessment services. FEA is a **computational technique** that allows engineers and designers to simulate and analyse how railway structures will perform under various conditions before they are manufactured. Key aspects of FEA include:

- **Static Analysis:**
 - **Stresses and Deformations:** Linear, materially non-linear, or geometrically non-linear analyses to determine how structures respond under load.
 - **Dents and Stability:** Evaluating the ability of components to resist dents and maintain stability under different conditions.
 - **Contact Simulation:** With or without friction, to assess how different components interact under load.
 - **Material Properties:** Analysis of isotropic, orthotropic, plastic, elastic, viscous materials, and composites.
- **Fatigue Strength Analysis:**
 - **Load Profile and Collective:** Determining temporal load profiles and load collectives to understand the operational demands.
 - **Verification:** Verification of permanent, fatigue, and operational strength following FE analysis.
- **Dynamic Analysis:**
 - **Natural Frequencies and Forms:** Identifying natural frequencies and mode shapes.
 - **Transient Processes:** Analysing how the structure behaves over time under varying loads.
 - **Harmonic Analysis:** Evaluating response to harmonic loads to ensure stability and performance.

What Are the Benefits of Simulation and Strength Assessment?

Simulation and strength assessment offer several key benefits in the development and optimisation of railway components such as car bodies, bogies, bogie frames, and other assemblies. These benefits help ensure that your products are safe, effective, and compliant with regulatory standards while streamlining the design process. Here are the main benefits:

- **Enhanced Design Accuracy:** Simulation and strength assessment provide detailed insights into product performance, allowing for precise design adjustments and refinements. This results in more reliable and effective railway components that meet stringent performance and safety standards.
- **Reduced Prototyping Costs:** By identifying design flaws and optimising the product through virtual testing, the need for multiple physical prototypes is minimised. This leads to significant cost savings and a more efficient development process.
- **Improved Safety and Reliability:** Thorough simulation and strength assessment ensures that products will operate safely and reliably in real-world conditions. This is critical in the railway industry, where any failure can have serious implications for safety and operational efficiency.
- **Accelerated Time-to-Market:** Virtual testing and optimisation speed up the design process, allowing for quicker identification and resolution of issues. This



accelerates the overall development timeline and helps bring your product to market faster.

- **Regulatory Compliance:** Comprehensive simulation and strength assessment provide the necessary evidence of a product's performance and safety, supporting regulatory submissions and ensuring that the product meets all required standards before it is approved for use.

Why Choose Applus+ Laboratories for Simulation and Strength Assessment for Railway?

Choosing [Applus+ Laboratories](#) for your simulation and strength assessment aligns you with a distinguished leader in the railway testing industry. Our services are geared towards ensuring that your railway products are structurally sound and compliant with global regulations and standards. Here's why we are the ideal partner for your needs:

- **Comprehensive Engineering Services:** We offer engineering services throughout the entire development phase and during the use of a product. Our approach considers economic requirements for shorter production development times, innovative and high-quality design, better material efficiency, and weight-optimised structures for optimal flow of forces.
- **Expertise and Experience:** Our team consists of experienced calculation engineers specialising in statics, operational strength, and dynamics. They are dedicated to optimising your product by scaling its mass and form based on FE analysis.
- **Advanced Simulation Capabilities:** We provide all-encompassing simulation tasks in product development, from virtual test benches to finite element analysis.
- **Strength Evaluations:** We base these assessments on calculated and measured stresses, adhering to relevant standards such as FKM-Guideline, DVS 1612, DVS 1608, Eurocode 3, Eurocode 9, DIN EN 12663, DIN EN 13749, VDV152, and DIN 743.
- **Cutting-Edge Technology:** Our advanced laboratories are equipped with high-performance technology to analyse the stress and reliability of components and structures. We ensure convenient data exchange via CAD and FE interfaces, facilitating seamless integration with your existing processes.

Choose Applus+ Laboratories as your trusted advisor and partner. Our high-quality services and expert guidance are designed to streamline your path to market while navigating the complexities of railway product certification with confidence and precision.