


Leveraging the benefits of lighter trains and running gear

Train safety, reliability, comfort, and performance rely on well-designed:



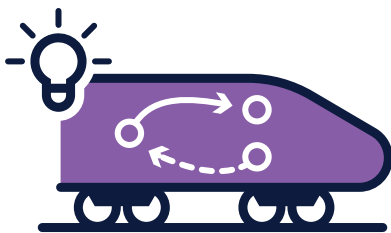
Carriages, transporting passengers, and physically linking the vehicle's elements



Running gear, the vehicle components that run passively on the rails

THE CHALLENGE

Most trains are primarily made of metals like steel and aluminium. The potential for reducing their weight is nearly exhausted. How to make further improvements without compromising safety and comfort? **Rail needs a new generation of lightweight trains.**



HOW DO WE DO THIS?

By replacing certain metals with innovative new composite materials, tried and tested in the aeronautical sector. Shift2Rail 7 Technical Demonstrators did exactly this, delivering:



1. Light structures

A new generation of lighter passenger carriage shells, unlocking energy savings and other advantages






2. Light running gear

New bogie systems, reducing wear and damage to infrastructure and wheels, increasing reliability, lowering maintenance costs



KEY LIGHT STRUCTURE SOLUTIONS

	Complete hybrid carriage shell	Full-scale hybrid carriage end modules	Full-scale hybrid underframe headstock
What it does	End walls are made of aluminium, while roof, lateral panels, and floor/main frame are made of composite materials	Two carriage end modules developed using innovative composite materials – to replace end sections in an existing design	End-structure of a metro train carriage underframe developed using composite materials – to replace aluminium headstock
Who benefits	 Railway operators	 Railway operators	 Railway operators



THE BENEFITS OF LIGHT STRUCTURES

Integrating composites and metallic parts in carriages:





- Reduces weight by around 20%
- Complies with current railway standards

Lighter passenger trains mean:

- Improved energy-efficiency
- Greater passenger comfort
- Lower impact on the track, reducing the life cycle cost of the entire railway system



KEY LIGHT RUNNING GEAR SOLUTIONS

	Lighter bogie component	Single axle gear frame for lightweight metro vehicles	Single axle independent rotating wheel (IRW) running gear	Innovative elastomer-based running gear components
What it does	Includes a primary spring and antenna beam made of composite materials	Composite running gear frame made using Carbon Fibre Reinforced Plastic and metallic inserts	Made of composite materials and high-strength steel alloys - for high-speed applications	Novel elastomer-based components, including stronger adhesives between elastomeric and metallic parts
Who benefits	 Railway operators	 Railway operators	 Railway operators	 Railway operators



THE BENEFITS OF LIGHT RUNNING GEAR

- Composite materials are a viable alternative for structural railway applications in running gears
- Elastomer formulations using nanoengineered additives can greatly improve the performance of critical components, extending running gear maintenance intervals, and significantly reducing associated life-cycle costs



Key Finding

Newly tested full-scale designs safely reduced the number of axles in running gear for metro vehicles, significantly lowering weight and complexity



Fast Fact

Using composite materials can reduce weight by:

- **20%** or more in train carriages
- **60-70%** in running gear



IMPROVING EFFICIENCY

Thanks to these advances, a new group has been tasked with defining a standardised process facilitating the integration of new materials into railway applications across the industry.

By reducing weight, increasing durability, and reducing maintenance requirements, these innovations pave the way for dramatic efficiency improvements across the railway system, from rolling stock to infrastructure.

WANT TO LEARN MORE?

rail-research.europa.eu

Solutions developed by Shift2Rail, Europe's Rail's predecessor programme

