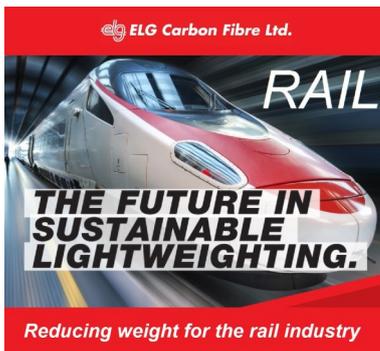


Composites reduce rail wear and fuel consumption

Rail operators seek to reduce the costs associated with track damage and reduce suspension maintenance costs. A lightweight carbon composite bogie frame, with the mechanical properties of the materials tailored to provide integrated suspension and steering functionality, results in a more flexible primary suspension that reduces the lateral forces on rail tracks by up to 40%, and also provides a 20% reduction in overall train fuel consumption.

The challenge of weight for rail operators

Track damage currently costs the UK government millions of pounds a year in track repairs and maintenance. This cost is partly offset to the rail companies by track access charges dependent on the types of train bogie running on the track, with charges proportional to the amount of wear that each bogie design causes.



RSSB supports its members and stakeholders to deliver a safer, more efficient and sustainable rail system. ELG approached Magma Structures to be the manufacturing partner in a consortium of rail industry specialists to find solutions to bogie induced track wear. Using carbon fibre, the consortium will design, manufacture and test a composite bogie frame that will significantly reduce track wear and cost for rail operators.

Carbon composite bogie benefits

Overall weight is the primary cause of track damage, especially when the train moves or dynamic forces are exerted on the rails as it enters a curved section. The bogie assembly is around 37% of total carriage weight, and so reducing bogie weight is an obvious and effective solution to reducing rail track damage.

Carbon fibre composite bogies for carriages address three main influences on track damage namely axle load, bogie primary yaw stiffness and un-sprung mass.

1. Reduce axle load by 8% through a 50% reduction of the bogie frame weight and by eliminating multiple independent suspension components.
2. Optimise bogie primary yaw stiffness to reduce horizontal loads by up to 40%
3. Reduce un-sprung mass by including suspension functionality in bogie frames.

HARNESSING THE
POTENTIAL OF
CARBON FIBRE
COMPOSITE
TECHNOLOGY

“Composite bogies can cut overall maintenance costs by reducing mechanical complexity and also by incorporating in-service structural health monitoring systems.”

Magma Structures

A global leader in carbon composite structure technology, with innovative solutions and flexible manufacturing to meet complex design challenges

Magma Structures delivers world-leading carbon composite structural engineering expertise and flexible manufacturing capabilities. We specify, design and deliver unique and complex high-performance composite assemblies to meet the most demanding structural needs

The potential of composite materials is harnessed to engineer solutions with specific performance characteristics in terms of structure strength, durability, scale and weight

A systematic and engineering led approach matches the best technology and build processes to each individual project. World-class, in-house testing facilities, robotic engineering skills and extensive experience in through-life fibre optic strain monitoring systems

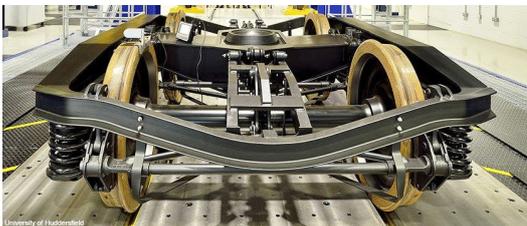
Working at the leading edge of carbon composite technology, with expertise in its applications in bespoke structures and components, all backed by a proven project delivery process

Reducing carbon fibre composite cost for railways

One of the key reasons that carbon fibre has not been adopted as widely as other types of composites is the raw material cost. ELG uses a combination of carbon fibre, typically reclaimed from the aerospace industry, together with a proven low cost manufacturing process, to produce large complex structures to a high quality and standard.

Carbon fibre composite train bogies

A consortium of RSSB, ELG Carbon Fibre, Magma Structures, Alstom UK, the University of Birmingham (Sensors and Composites Group) and the University of Huddersfield has adopted a novel approach. As the consortium represents the complete industrial supply chain, this combination is well placed to commercialise the technology developed.



The lightweight composite bogie frame tailors material mechanical properties to provide a reduction in lateral track loading combined with integrated suspension and steering functionality.

The use of carbon fibre composites results in a substantial reduction in bogie and overall train weight, with the benefit of lower operating costs, reduced maintenance, and reduced global warming potential.

The predicted weight saving will reduce track wear and tear and provide a benefit for rail operators in terms of increased residual value, reduced operating costs and track access charges, operating costs such as energy charges, and increased payload capability.

Reduced track erosion also decreases track maintenance requirements, with an accompanying cost and health and safety risk reduction benefit to rail network infrastructure owners.



The consortium will design, manufacture and test demonstrators to show the carriage bogie structures can withstand operational loading and meet design guidance requirements. An integral fibre-optic structural performance monitoring system will measure composite bogie behaviour during testing, and validate modelling techniques used in its design.



Composite train bogie benefits

- 50% reduction in train bogie weight
- 18% reduction in carriage weight
- 40% reduction in lateral track loads
- 8% reduction in vertical track loads

To discuss how carbon composites could benefit your transport project email andy.shaw@magmastructures.com

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