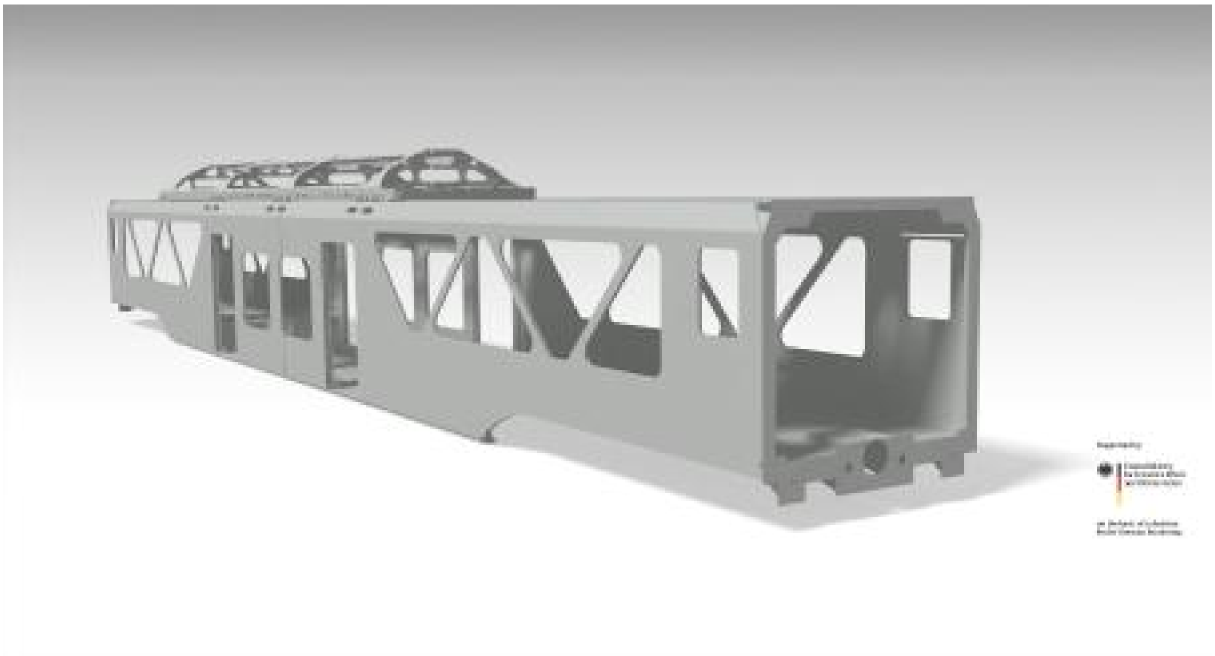
Optimised carriage bodies for alternative drives: for climate-friendly trains

About this project



AnoWaAS

Optimised carriage bodies for alternative drives: for climate-friendly trains

Markets:

Material: Thermoplastics, Aluminium, Steel, Laminates

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

Optimised carriage bodies for alternative drives: for climate-friendly trains

About this project

Context

The transport sector is one of the biggest sources of CO# emissions. While electrified railway lines already offer climate-friendly alternatives to road transport, many secondary lines are still operated with diesel, as the necessary infrastructure, such as overhead lines, is lacking and often not economically feasible.

Although alternative drive systems such as batteries or fuel cells offer a low-emission solution, they bring with them new challenges: existing vehicle structures are not optimised for the integration of these technologies. Additional batteries or hydrogen tanks either require additional installation space, increase the weight or both. As a result, the structural mass of the vehicle increases or there is less space available for payload. Both have a negative effect on efficiency: The vehicle consumes more energy per kilometre - regardless of how much is actually being transported. Without targeted adaptation of the vehicle structures, the potential for weight reduction and the advantages of lightweight construction remain largely unutilised. Targeted optimisation and lightweight construction approaches can reduce the weight or increase the installation space. This is where the AnoWaAS project comes in.

Purpose

The project team aims to develop a new generation of car bodies for rail vehicles with battery and fuel cell drives that are optimised to meet the requirements of alternative drives. Instead of simply adapting existing structures, the researchers are focusing on a complete redesign: a modular lightweight wagon body is to optimise installation space and load distribution in such a way that alternative drives and their integration into the vehicle structure can be integrated. The aim is to reduce weight, increase energy efficiency and at the same time ensure cost neutrality compared to conventional designs.

In addition to rail transport, synergies with the commercial vehicle sector are to be exploited in order to transfer the concept to other mobility applications. Sustainability plays a central role: the wagon body should be designed to conserve resources, be made from recyclable materials and be designed for a long service life. The researchers are focusing on innovative joining techniques that minimise the use of materials and production costs.

Optimised carriage bodies for alternative drives: for climate-friendly trains

About this project

Procedure

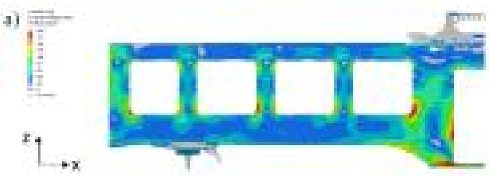
The team is looking at the entire development chain. Firstly, it is investigating various packaging approaches for battery and hydrogen systems and analysing how energy storage systems can be optimally integrated into the support structure in order to use installation space efficiently and distribute the vehicle mass evenly. To this end, the researchers are analysing theoretical topology optimisations and transferring them into practical designs in order to demonstrate the potential.

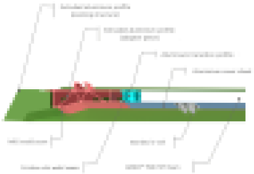
At the same time, they are developing a new type of vehicle body concept: instead of exclusively using conventional extruded aluminium profiles, lighter sandwich materials or adapted construction methods are used in accordance with the identified loads. This combines structural strength with low weight. They then validate the theoretical considerations in a complete vehicle that is ready for production and approval. Using modern joining methods such as friction stir welding, they enable a stable and at the same time material-efficient design. One focus is on the development of structural interfaces between drive components and the vehicle body.

At the end of the project, the researchers will develop a prototype that demonstrates the potential of the new construction methods. With an ecological and economic assessment, they ensure that the solutions developed are also sustainable and economically viable in practice.

Optimised carriage bodies for alternative drives: for climate-friendly trains

About this project





Funding duration:

Funding sign:	03LB2018	**Funding amount:**	EUR 2.4 million

Final report

Further websites

foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2018A - AnoWaAS in the federal funding catalogue

www.dlr.de/de/fk/forschung-transfer/projekte/fahrzeug-architekturen-und-leichtbaukonzepte/anowaas - DLR project page

Optimised carriage bodies for alternative drives: for climate-friendly trains

Project coordination

Contact:

Mr Dr.-Ing. Ben Boese

+49 05341 8736062

ben.boese@alstomgroup.com

Organisation:

Alstom

Linke-Hofmann-Busch-Str. 1
30459 Salzgitter
Lower Saxony
Germany

www.alstom.com

English (EN){{ Projektpartner }}

Optimised carriage bodies for alternative drives: for climate-friendly trains

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Materials	✓
Services & consulting Training, Testing and trials, Engineering, Prototyping, Simulation, Technology transfer, Approval	✓
Field of technology	
Design & layout Lightweight design, Hybrid structures, Lightweight construction concepts, Lightweight material construction, Others (Flat construction elements such as extruded profiles and sandwich material are combined with solid components to create a structure typical of rail vehicles.)	✓
Functional integration Material functionalisation, Others (Functional integration: connections/enclosures become part of the load-bearing structure)	✓
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), System analysis, Materials analysis, Non-destructive analysis, Others (Examination of the FSW connections and process tests in accordance with DIN EN 25239, quasi-static tests to validate the material characteristics for the simulation)	✓
Modelling and simulation Crash behaviour, Loads & stress, Optimisation, Structural mechanics, Materials	✓
Plant construction & automation Handling technology	✓
Recycling technologies Recycling	✓

Optimised carriage bodies for alternative drives: for climate-friendly trains

Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing	
Coating (surface engineering) Painting	✓
Fibre composite technology	
Forming Extrusion moulding, Deep-drawing	✓
Joining Hybrid joining, Adhesive bonding, Riveting, Screwing, Welding, Others (Friction stir welding (FSW))	✓
Material property alteration	
Primary forming Extrusion	✓
Processing and separating Turning, Milling, Sawing, Shearing/punching, Cutting	✓
Textile technology	

Optimised carriage bodies for alternative drives: for climate-friendly trains

Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Laminates	✓
Fibres	
Functional materials	
Metals Aluminium, Steel	✓
Plastics Thermoplastics	✓
Structural ceramics	
(Technical) textiles	