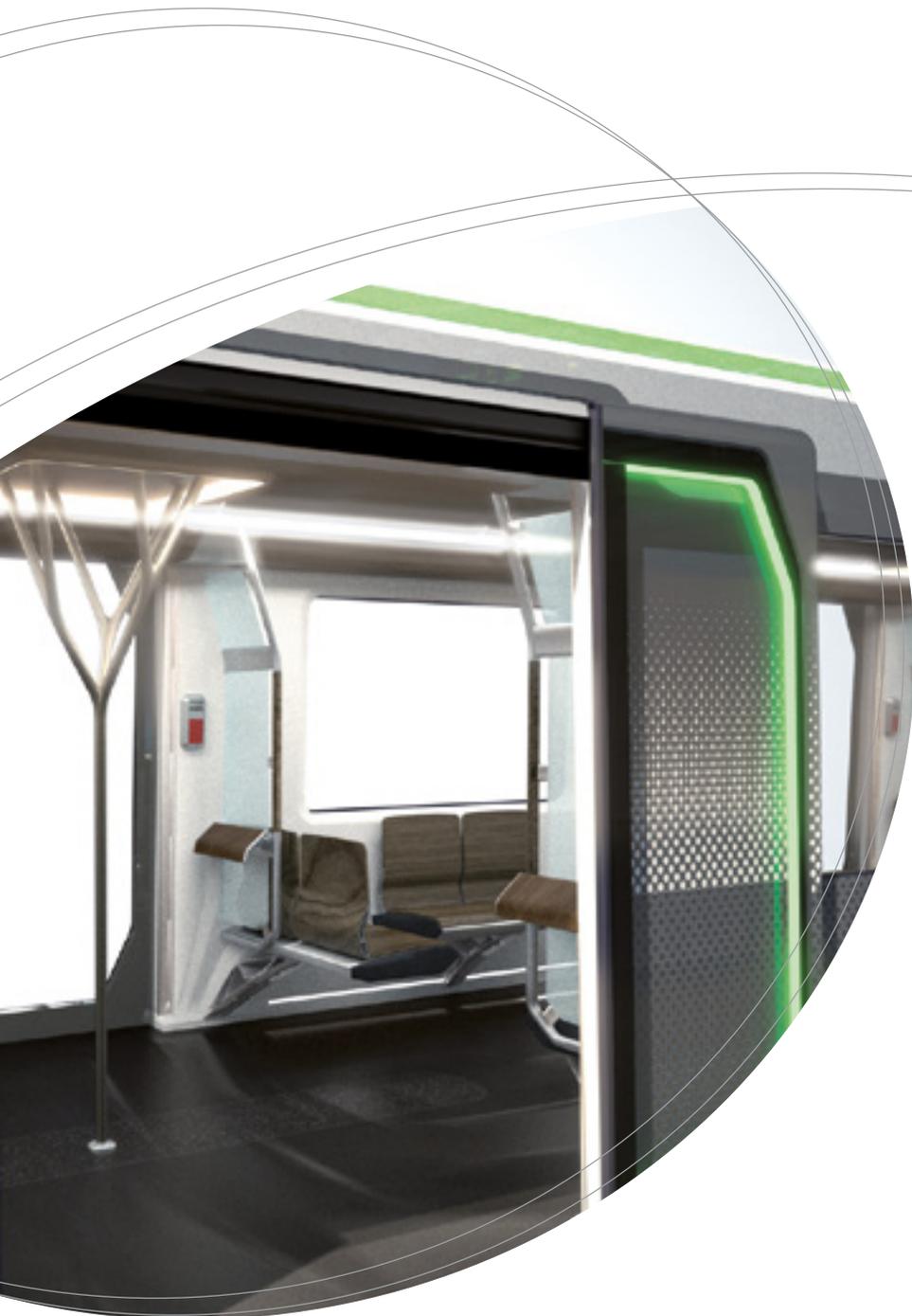


TRANSPORTATION

REINVENTING LIGHTNESS
AND COMFORT FOR THE
TRANSPORTATION INDUSTRY.



Reinventing how cork engages the world.



AMORIM

CORK COMPOSITES

LIGHTWEIGHT SOLUTIONS FOR RAILWAY AND BUS

Reducing assembly and energy cost for the transportation industry.

Lightness, anti-vibration and acoustic insulation are the leading advantages that cork brings to the transportation industry.

The innovative materials developed for train and metro carriages and buses not only optimize weight and reduce energy costs but also enable an increase in passenger acoustical and thermal comfort.

The product range available has lightweight and sustainable solutions to:

- Flooring Systems
- Panels

Advantages of cork:

- Lightweight
- Durability
- Sustainability • Comfort





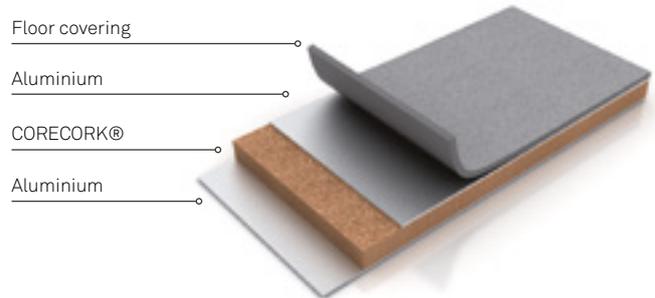
FLOOR SYSTEMS

Modular flooring system that allows 40% weight reduction.

ALUCORK is a sandwich panel made of a **CORECORK** core, in a sandwich system with aluminium skins. It is a technical panel with approximately 40% weight reduction contributing to a smaller environmental footprint when compared with similar products in the market. It uses fewer raw materials and less embodied energy on its fabrication thus decreasing the overall CO₂ emissions in its manufacturing phase and related production costs. It also uses a high percentage of renewable materials and it is 100% recyclable.

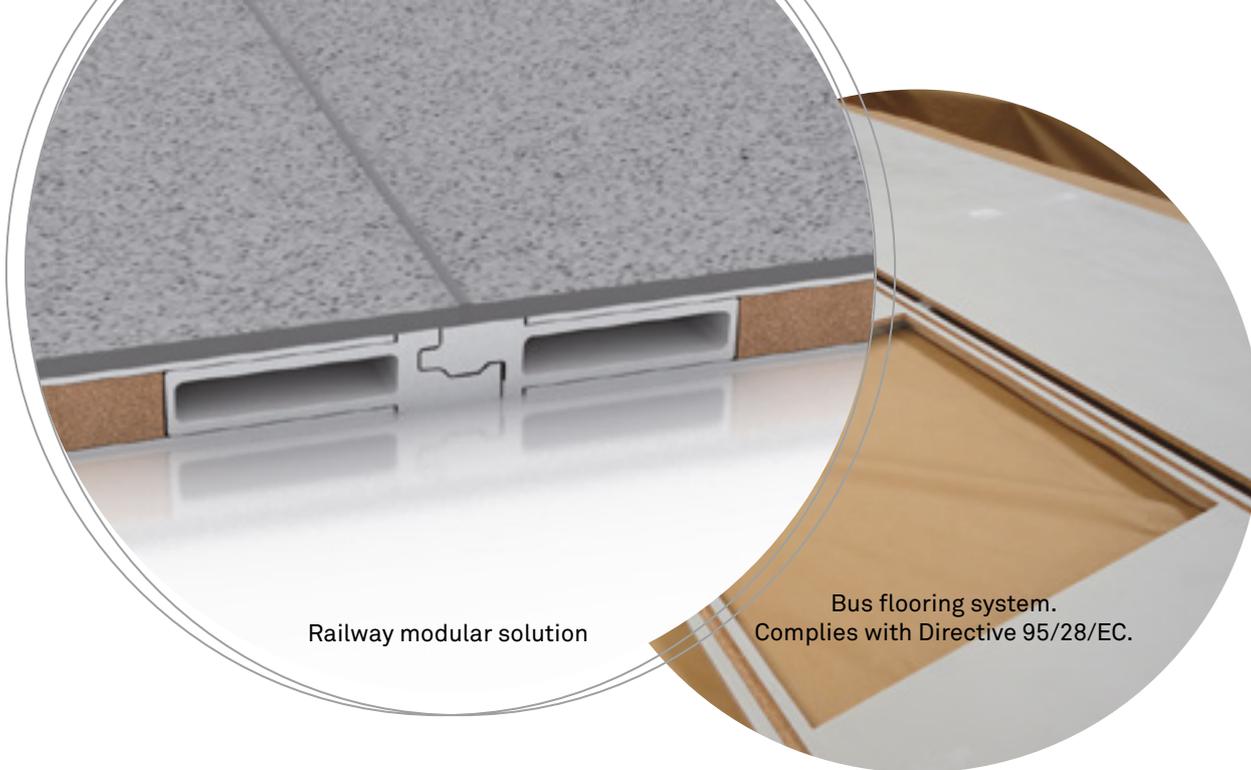
The key to the product's acoustic insulation, vibration damping and thermal insulation is the core used on the **ALUCORK** panel construction. **CORECORK** is a natural cork composite material that reduces noise transmission by 5 to 12dB, across the frequency range (up to 5KHz). As for thermal insulation, **CORECORK** provides a low thermal conductivity - $\lambda=0,040$ W/m²C - and long term durability which assures an efficient thermal insulation throughout the train car's life.

The **ALUCORK** floor panel is compliant with NF F-16-101(M1 F1), CEN/TS 45545 (HL3) and ASTM E-162/ASTM E-648.



Floor system advantages.

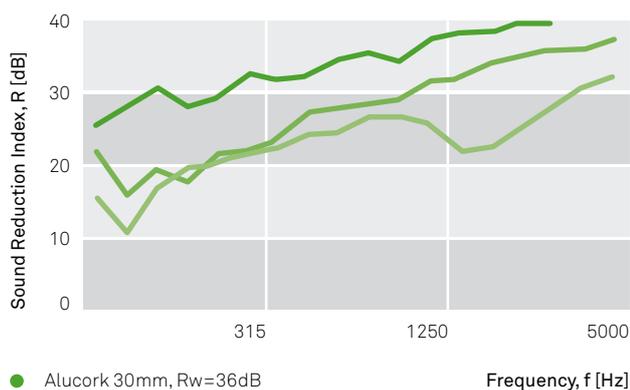
- 
20% to 25% less in weight.
- 
Reduced environmental impact during the manufacturing and service phase.
- 
Enables shorter floor assembly cycles.
- 
Thermal insulation.
- 
Noise insulation.



Railway modular solution

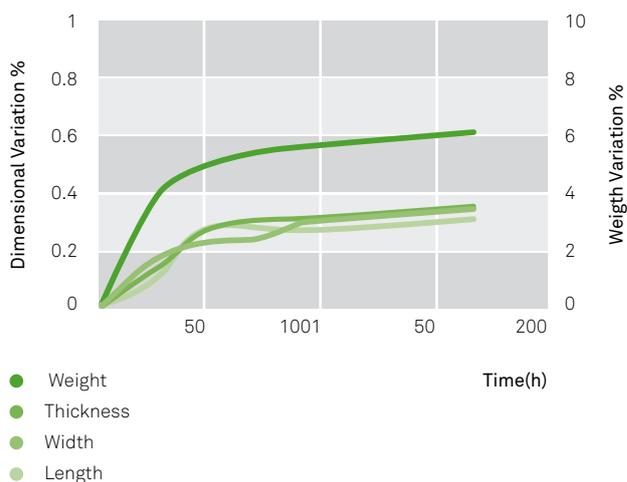
Bus flooring system.
Complies with Directive 95/28/EC.

Airborne sound insulation - EN ISO 140-3: 2005



- Alucork 30mm, $R_w=36\text{dB}$
- Alucork 20mm, $R_w=29\text{dB}$
- Plywood Okoumé 15mm, $R_w=24\text{dB}$

Influence of water absorption.



- Weight
- Thickness
- Width
- Length

Amorim Cork Composites (ACC) developed an innovative concept for Bus flooring as an alternative to plywood conventional panel flooring. The ACC new floor panel uses a composite sandwich construction with a **CORECORK** core and FRP skins. The final result is a system with optimized characteristics: lighter weight; better acoustical and thermal insulation; reduced environmental footprint; durability and reduced assembly costs.

ACC floor panel has associated properties that can be tailored to fit your specific needs: panel core thickness, varying glass fiber mat and resin quality can be specifically customized and applied to the skins to fulfill each specification regarding mechanical properties, noise reduction, vibration damping and thermal insulation of the complete system.

The use of **CORECORK** enhances the moisture proof properties of the ACC floor panel which in turn increases the durability and long term resistance in high humidity environments - **CORECORK** does not absorb water and does not rot.

Based on your technical specification, ACC can deliver a single piece installation that substantially reduces assembly time and associated costs. This single piece panel incorporates all cuts, trapdoors, corners and grooves for the seats, hand-poles, and illumination according to a specific design.

Passenger's upper deck can be supplied with a pre-applied protective/decorative mat of your choice and the luggage area floor can be supplied with an anti-slip pattern already engraved in the surface of the panel.



PANELS



Lightweight and flexible core materials.

The ACC Research & Development (R&D) strategy is based on highly skilled engineering processes coupled with a keen awareness of the rapidly changing needs and demands of the market.

The latest developments in technology and materials, as well as related processing techniques, are some of the key elements that are studied and analyzed in order to ensure innovative elements, ever-improving and high quality products.

Amorim Cork Composites is committed to the development of materials suited to the railway industry requirements.

The company is constantly observing the market to find the best solutions for specific projects and challenges in order to improve sound insulation and anti-vibration, taking advantage of the natural properties of cork:

- **Lightweight**
- **Sustainability**
- **Comfort**

Fiber glass/Resin system

CORECORK®

Fiber glass/Resin system



Sidewall and Ceiling panels.

ACC provides a railway sidewall panel and ceiling solution in FRP sandwich panels with a **CORECORK** core. A lightweight flexible core material is also available for thin sandwich panels. This new composite part is made by vacuum bagging and can also be produced by VA-RTM using FR resin systems.

The manufacturing phase of the composite panels uses less fossil resources reducing environment impacts by at least 20% (panel mfg. phase only, Eco-indicator 99 (E)V2.03). The sidewall panel improves the thermal and noise insulation and provides a good damping behaviour. It is resistant to temperature variations with no mechanical degradation and low dimensional change - retaining its dimensional stability during the entire life cycle.

The sidewall panel system complies with the fire, smoke and toxicity railway standards - NF F16-101 (M1F2) and CEN/TS 45545-2 (HL3/HL2).

Body panels.

Internal and external FRP parts, including dashboard, seater, all compartment box, roof panel, bumper, mudguard.

ACC developed a modular and easily integrated system for the FRP parts in its development, ACC uses a composite construction with a core material such as **CORECORK** providing greater durability, a lighter weight and better sound and thermal insulation.

Unique properties of **CORECORK** used as a core on FRP parts, prevents the first form of damage in laminates: matrix microcracks.

Matrix microcracks can be observed during tensile loading, during fatigue loading, during changes in temperature, and during thermocycling.

Several tests performed by our customers revealed that FRP panels using **CORECORK** present an excellent resistance to this form of damage.

Sidewall panel advantages.

	35% less in weight.
	Reduced environmental impact during the manufacturing and service phase.
	Reduced CO2 emissions.
	Anti-graffiti strength.
	Complied with fire, smoke and toxicity standards.
	Energy savings.

Body panel advantages.

	Weight savings up to 20%.
	Improved noise and thermal insulation.
	Excellent resistance to matrix microcracking.
	Impact absorber - withstanding multiple impact cycles.
	Flexible structure - withstanding multiple compression cycles without losing the elastic performance.

REINVENTING LIGHTNESS AND COMFORT FOR THE TRANSPORTATION INDUSTRY.



The data provided in this brochure represents typical values. This information is not intended to be used as a purchasing specification and does not imply suitability for use in a specific application. Failure to select the proper product may result in either product damage or personal injury. Please contact Amorim Cork Composites regarding specific application recommendations. Amorim Cork Composites expressly disclaims all warranties, including any implied warranties or merchantability or of fitness for a particular purpose. Amorim Cork Composites is not liable for any indirect, special, incidental, consequential, or punitive damages as a result of using the information listed in this brochure, any of its material specification sheets, its products or any future use or re-use of them by any person or entity.



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