



# Lasting Performance with Composites

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In Railway Infrastructure and Rolling Stock

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# Versatile Solutions for Railway Infrastructure



Lasting mechanical performance, low weight, corrosion resistance and electrical insulation are the key benefits of composite profiles, providing for interesting application niches in the railway infrastructure.



Composite cable trays is the preferred solution where embedded systems are difficult. They are light to handle, easy to install and don't need earthing. Large projects in UK have used the Cabsys® products. In Germany, the heavy duty Cabsys Rail® is the lightest product in the market, meeting the very stringent requirements of the German Railroads. The profiles are designed to span six meters support distance subjected to heavy cable loads, and the horizontal pressure wave from high speed trains passing by.



Access structures, from small telephone platforms on difficult-to-reach locations to complete train access platforms, have been made based upon composite profiles.



Tunnel and roof lining Exel Composites solutions have been utilized in several tunnel liner and station roof projects, where the easy and fast installation, light weight and corrosion-resistance typically are key criteria.

Exel insulated rail joints have the best possible electrical insulating properties and due to design and material they are practically fail safe with respect to insulation and that is why they are the perfect choice for railway signaling systems. The mechanical strength of the fishplates is very similar to the rail and fatigue resistance is far above the fatigue resistance for metals.

Third rail covers Exel Composites supplies customer-tailored third rail covers that serve as insulators on third rails, providing safety to people working by the rails but also protecting the rails against dirt that could harm the rail and it's conductivity. Third rail covers are made of glassfibre, they are light-weight and easy to install.



Insulation rods for transmission lines Exel Composites insulating rods are used in low-, medium- and high-voltage applications in transmission lines and line posts for distribution and traction lines. Composite insulators consist of a rod from GRP as core, a housing made of silicone and 2 pressed-on fittings made of metal.



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# Composite Profiles in Rolling Stock

Pultruded composite profiles have been used in buses and coaches since mid eighties. Applications for train and tram followed in the nineties. During this period, Exel has produced hundreds of special shapes for transportation-customers across the world. In the rail market, the main applications are split in outer body panels and interior parts. Composites enable significant weight savings in rolling stock applications, they enable complex shapes in design and low maintenance costs. All these features have a great effect on energy consumption and total costs.



COMPOSITE PROFILES ARE USED IN TRAIN INTERIORS, E.G. IN CEILING AND WALL PANELS



SIDE PANEL OF TALENT TRAIN

## Outer body

Composite profiles on the outer body can be over a metre wide, with integrated design and functional elements. These parts are typically adhesively bonded to the steel frame of the train and painted together with the rest of the body. Although proper surface preparation is always a prerequisite, bonding and painting is straightforward.

## Interior parts

Based upon the previously mentioned features and superior shape capacities compared to other materials, train interior systems can be re-designed towards lower weight and lower total cost.

With composite profiles it is possible to achieve an optimum combination of large complex shape with thin enough walls for weight saving, excellent surface quality for overall appearance, and adequate fire performance for passenger safety. The thermal insulation properties also give benefits in air conditioning ducts or heating channels.

# Composites provide material features that are crucial in many railway applications

Our continuous manufacturing technologies, pultrusion, pullwinding and continuous lamination enable the most optimized structures to be designed to meet our customer needs in the best possible way. Pultruded profiles offer the possibility to integrate functions in one and the same profile, enabling new innovations in design.

Composites provide material features that are crucial in the transportation industry. Compared to traditional materials, composites are very light weight, yet having high mechanical strength and stiffness.

## Fabricating Composites

**EASY TO FABRICATE** Fast rotating diamond tipped tools are best suited for cutting, drilling and routing. Dust extraction is recommended.

**EASY TO HANDLE** The continuous pultrusion and pullwinding processes allow profiles to be produced to any required length, limiting scrap and unattractive jointing. Despite the length, composite profiles are light to handle, show excellent shape stability and do not permanently deform with rough handling.

**EASY TO BOND** Flexible polyurethane adhesives are used to bond profiles to panels. For bonding preparation solvent cleaning is in many occasions sufficient, but Exel can provide peelply moulded into the profile. After its removal it leaves a clean, roughened surface, ready for bonding.

**EASY TO PAINT** Two component polyurethane paints give excellent results, even without a primer layer and only solvent cleaning. Perfect adhesion to a non-corroding substrate makes painted composites survive the hardest weathering tests.

## Typical material properties of structural composite profiles (E23, EN 13706)

	Composites	Steel	Aluminium
Density, g/cm <sup>3</sup>	1.8	7.9	2.7
Tensile Strength, MPa	240	250	240
Elastic Modulus, GPa	23	210	70
Linear Thermal Expansion, '10 E-6/°K	10	12	24

MATERIAL PROPERTIES OF COMPOSITES WILL VARY ACCORDING TO DIFFERENT STRUCTURES.

## Characteristics comparison

	Composites	Steel	Aluminium
Complex shapes, integrated functions	yes	no	limited
Electrical insulation	yes	no	no
Thermal insulation	yes	no	no
Corrosion resistance	yes	no	average
Low maintenance	yes	no	yes
Durability	yes	average	yes

Composites can be formulated to comply to various European fire standards, e.g.

- **DIN 5510:** S3, S4, SR2, ST2
- **NFP 92 501:** M2, M1
- **NFF 16 101:** F2, F1
- **BS 476, part 7:** Class 1, Class 0

Also other classifications are possible and they will be reviewed individually. **Note:** fire specifications may influence other characteristics.

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