Lasting Performance with Composites

In Railway Infrastructure and Rolling Stock
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.
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.

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.

Typical material properties of structural composite profiles (E23, EN13706)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Composites</th>
<th>Steel</th>
<th>Aluminium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density, g/cm³</td>
<td>1.8</td>
<td>7.9</td>
<td>2.7</td>
</tr>
<tr>
<td>Tensile Strength, MPa</td>
<td>240</td>
<td>250</td>
<td>240</td>
</tr>
<tr>
<td>Elastic Modulus, GPa</td>
<td>23</td>
<td>210</td>
<td>70</td>
</tr>
<tr>
<td>Linear Thermal Expansion, 10 E-6/°K</td>
<td>10</td>
<td>12</td>
<td>24</td>
</tr>
</tbody>
</table>

MATERIAL PROPERTIES OF COMPOSITES WILL VARY ACCORDING TO DIFFERENT STRUCTURES.

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.

Characteristics comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>Composites</th>
<th>Steel</th>
<th>Aluminium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex shapes, integrated functions</td>
<td>yes</td>
<td>no</td>
<td>limited</td>
</tr>
<tr>
<td>Electrical insulation</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Thermal insulation</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Corrosion resistance</td>
<td>yes</td>
<td>no</td>
<td>average</td>
</tr>
<tr>
<td>Low maintenance</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Durability</td>
<td>yes</td>
<td>average</td>
<td>yes</td>
</tr>
</tbody>
</table>

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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