interiors

RAILWAY INTERIORS INTERNATIONAL **2014**

UK IEP
The Hitachi-led design team opens up about the UK's new intercity trains

Tram designs
Cities from Dubai to Washington DC are embracing the tram

Get wi-fi right

Whether you want an extra source of revenue or to boost passenger loyalty, here's how to implement onboard wi-fi

Munich metro ▮ Regional SNCF trains ▮ InnoTrans preview ▮ PRM update


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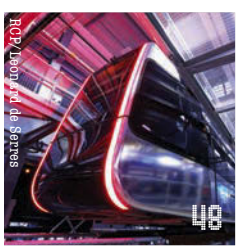

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PRODUCTS AND SERVICES

WELCOME

In July 2014, the UK government announced that more than £53m (US$90.3m) would be invested in improving wi-fi on many commuter routes in England and Wales. The plan is to offer a seamless mobile broadband service, free of charge. In this case the upgrade will be funded by fines paid by Network Rail for missing punctuality targets, so passengers could be forgiven for feeling entitled to the service. In many other cases, wi-fi is being deployed or improved to increase ridership, to make money from charging for access, or to make money from the services it supports, such as card authorization. We examine how operators can best navigate the tactical and technological hurdles in our feature on page 16.

The wi-fi boost is not the only rail improvement scheme underway in the UK. As well as setting in motion the Crossrail, Thameslink, HS2 and electrification projects, the country has ordered new rolling stock for the Intercity Express Programme. These trains will be used on routes linking London with the north and west of the UK – including Edinburgh and Cardiff. In our feature on page 6, the people from Hitachi and DCA heading up the design provide insights on the new trains.

Elsewhere in this issue, we examine how cities are making trams a part of their brand (page 48), find much to celebrate in the accessible design of Munich's new metro (page 26), see how the SNCF's new regional trains can be tailored for different areas (page 34), and gain an insight into Chinese train design, courtesy of Paul Priestman, who recently became global creative director at Chinese rolling stock manufacturer CSR Sifang (page 42). It seems that as well as more culturally specific aspects such as forward-facing seats and hot water outlets, there is another more universal expectation. I'm sure you don't need me to spell out that this is onboard wi-fi. It is truly incredible how quickly a technology can grow in public estimation into being an absolute necessity, the world over.

Izzy Kington, editor

Email your comments: railwayinteriors@ukipme.com

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RAILWAY INTERIORS INTERNATIONAL

Editor Izzy Kington
(*isabel.kington@ukipme.com*)

Production editor Alex Bradley
Chief sub editor Andrew Pickering
Deputy chief sub editor Nick Shepherd
Proofreaders Aubrey Jacobs-Tyson, Christine Velarde

Art director James Sutcliffe
Art editor Nicola Turner
Design Louise Adams, Andy Bass, Anna Davie, Andrew Locke, Craig Marshall, Julie Welby, Ben White

Head of production and logistics Ian Donovan
Deputy production manager Lewis Hopkins
Production team Carole Doran, Frank Millard, Robyn Skalsky

Publication manager Damien de Roche
(*damien.deroche@ukipme.com*)
International advertising sales John Doherty *(john.doherty@ukipme.com)*

CEO Tony Robinson
Managing director Graham Johnson
Editorial director Anthony James

Circulation and subscriptions manager Suzie Matthews
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Fax: +44 1306 742525
Editorial fax: +44 1306 887546
Email: railwayinteriors@ukipme.com

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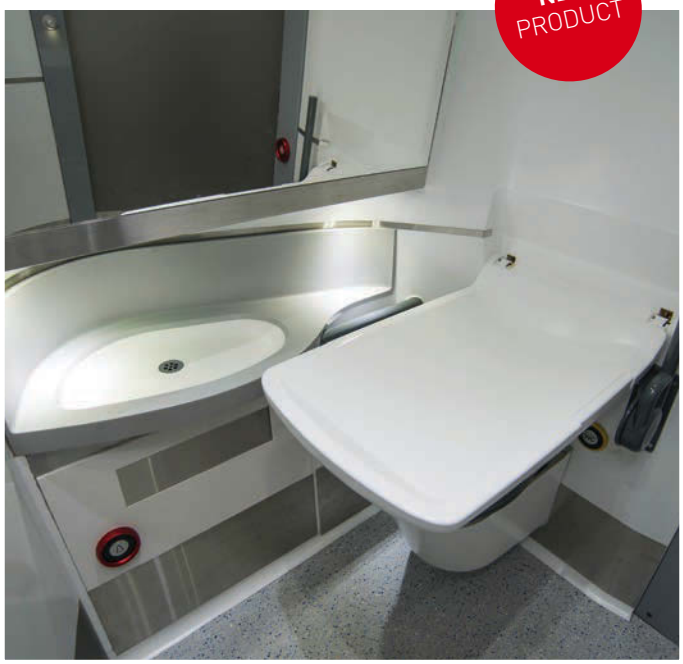


Birley Manufacturing is set to launch a new universally accessible toilet (UAT) module at InnoTrans 2014 (to be held on September 23-26 in Berlin, Germany).

The unit will be suitable for use by everyone, including persons of reduced mobility. It has been designed in line with the latest issue of Persons with Reduced Mobility Technical Specification for Interoperability (PRM TSI) regulations and the requirements of Rail Group Standards (RGS).

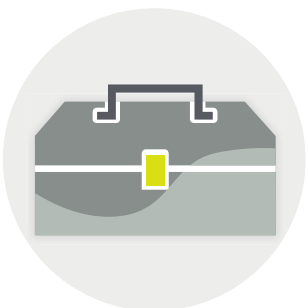
The UAT has a two-piece modular construction designed for excellent structural integrity. It is delivered pre-assembled and tested, to reduce installation time. The UAT has a sealed one-piece floor molding designed to prevent the egress of liquids and so reduce the risk of corrosion under the floor.

Inside, the unit features LED lighting, a hand cleansing system with infrared activation, a large mirror and a baby-changing unit. Birley says the modern interior can be adapted to match the style and color theme of any vehicle.

All the main equipment has been selected for its reliability, quality and advanced technology, to minimize servicing and make it as easy as possible to maintain.

Birley Manufacturing has specialized in train interior refurbishments for more than two decades. The company believes itself to be the UK's largest supplier of under-frame skirts and egress internal sliding doors.

www.birleyml.com



DESIGNERS' TOOLBOX

Exciting products and services to consider for your latest railcar interior project

Material **testing**

NEW FACILITY

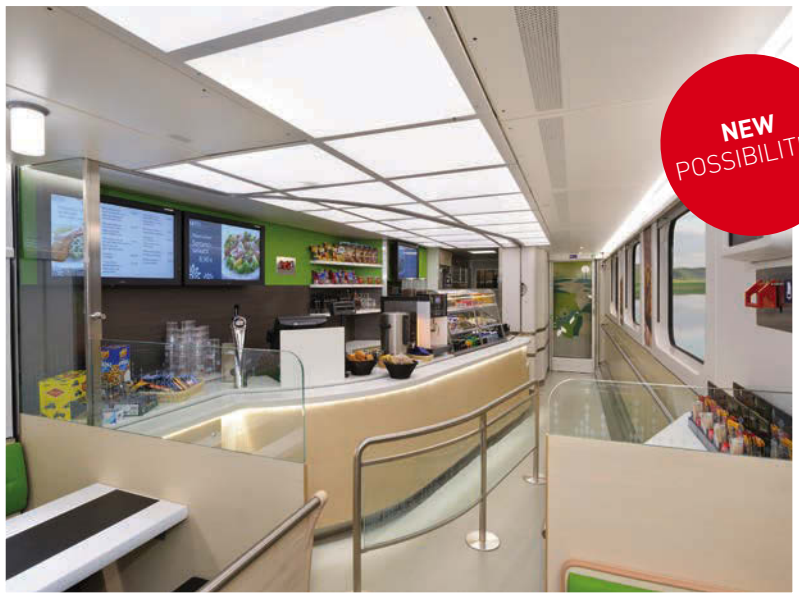
Kydex, a thermoplastics manufacturer, opened a materials testing facility called FSTLab at its site in Bloomsburg, Pennsylvania, in May 2014. The FSTLab is a space where suppliers, engineers, processors and end users collaborate with Kydex's research, development and design teams on new fire-resistant technologies and materials, and where Kydex engineers perform regulatory tests on products throughout the development cycle.

"Sourcing design-forward products that meet industry compliance can be a big challenge," says Ronn Cort, president at Kydex. "There is no initiative more important than safety. No matter how safe materials are, there is always an opportunity for improvement. The FSTLab aligns with our core commitments to the industries we serve: service, speed and superiority. Our team of engineers and chemists will be able to further reduce development time of new formulations, in our ongoing commitment to making our products lighter, safer and more sustainable."

As well as six testing laboratories, the FSTLab includes areas for collaboration. It complements Kydex's designLab, which opened in 2012. The 6,000ft² designLab is a design center including a color development laboratory, research and development labs, an exhibit space, meeting hall and collaborative working areas.

www.kydex.com

Light **panels**



Designers can use large LED light panels from Teknoware to give railcar interior ceilings a new appearance. The light panels come in various shapes and sizes. Teknoware says its expertise in electronics and optics is vital, because it ensures the light is distributed evenly on the surface of the light fixture, giving pleasant and even illumination without glare.

The light in the panels can be adjusted to create different tones, and can be dimmed as needed, either manually or through an active dimming function based on external lighting conditions.

"Adjusting the color temperature of the light increases comfort for passengers, because certain tones impact our feelings," says Sami Hukkanen, area manager at Teknoware. "On a hot summer day, a cool white light can be used to create a sense of cooler weather; while on a cold day, a warm white light can be used to create a feeling of warmth."

Teknoware's panels can offer color temperatures ranging from 3,000K (warm white) up to 7,000K (cool white) – giving considerable variation to the appearance of the interior.

The panels can also be implemented with RGB-LEDs. In an RGB-LED, components emitting red, green and blue light are contained in one LED. These components can be adjusted separately, making it possible to create nearly every color tone. Thus the RGB-LED panels enable designers to create striking and colorful effects, transforming the atmosphere of the interior.

VR (Finnish State Railways) is installing Teknoware's LED ceiling light panels on the lower levels of its new double-deck restaurant cars.

www.teknoware.eu

Multimedia **system**

The most recent upgrades to the Funtoro multimedia system, Funtoro HD, include enhanced picture quality, higher processor capacity and a multi-touch LCD panel. Together with the Android operating system, the improvements enable the latest applications and games to be implemented on board.

Each monitor has integrated FM radio (with the headphones cord playing the role of the antenna) and a built-in LED reading light with two levels of luminosity. An integrated 1.1A USB charger enables passengers to charge their personal electronic devices.

The monitors can be integrated in seatbacks and armrests. Molpir, which represents and integrates the system in Europe on behalf of MSI Corporation, says armrest integration is growing in popularity. However, this kind of integration is challenging because it means a complex kinematic solution has to be developed.

"The overall construction is much more complicated and many factors must be taken into consideration during the design, development and prototyping phases, as well as during selection of the proper technology for mass production," says Lubor Lazar, project manager at Molpir. "Factors including safety, ease of operation, robustness, stiffness, weight, price, the lifetime of key mechanical components and cables, and conformity with new, much stricter EU norms, and legislation must be taken into account, and these often contradict."

Molpir has developed prototypes for various seat brands, and these will be shown at InnoTrans 2014 (to be held on September 23-26 in Berlin, Germany). These include a mass-produced folding arm for a 10in monitor, implemented in Grammer's IC3000 seat for RegioJet.

www.funtoroeurope.com

Uniting the Kingdom

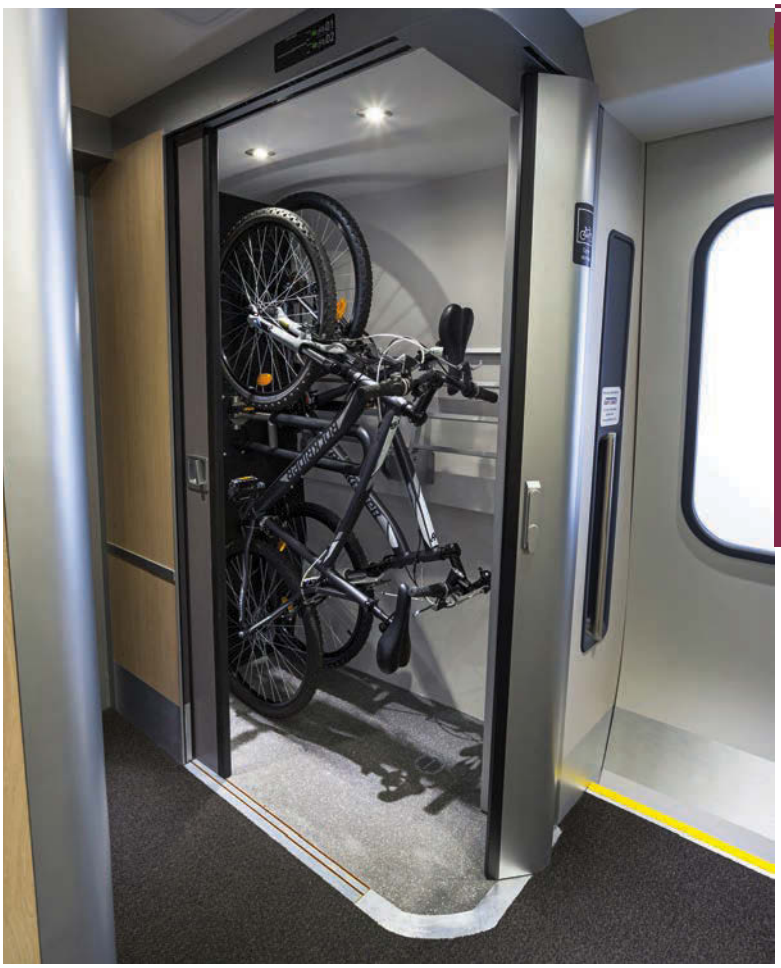
Hitachi faced a formidable design challenge with the UK's new intercity train - to create a modern but timeless interior to serve until 2050 on lines connecting major cities

MAIN AND INSET: First class on the UK's new intercity train

The UK's Intercity Express Program (IEP) involves creating a fleet of 122 trains to run on the Great Western Main Line from 2017, and the East Coast Main Line from 2018. These are long-distance routes, linking England's capital (London) with cities including the capitals of Scotland and Wales (Edinburgh and Cardiff).

Running on such vital routes, and costing £5.7bn (US$9.7bn), the project is certainly high profile. The trains are also expected to run for at least 30 years, so will have to look smart for at least that length of time. In 2012, the contract to build the trains was awarded to a consortium led by Hitachi.

Heading up the design of these 'super express' trains is Hitachi's Carl Harvey, interior



HANG YOUR BIKE

The train's solution for transporting bicycles is a self-contained compartment that enables two bikes to be hung side by side. The unit can be shut with the palm of the hand. After much experimentation with different ways of hooking up the bikes, Hitachi opted for them to be attached by the front wheel.

A padded steel arm keeps the bikes separate, to prevent, for example, a lycra-clad racer's all-carbon machine from being scratched (or worse) by a rusty old wreck. The sliding door is a masterstroke that keeps the bicycles out of passengers' way.

The decision on whether to charge for use of the space will be up to the operator. The space could also be used to store other awkward items – such as skis and tents – that don't fit into overhead storage racks easily.

Hitachi and DCA are still fine-tuning some of the details for this space, but the overall concept has been signed off.

LEFT AND RIGHT: The IEP's bike-hanging compartment, which can also be used to store big bags, skis and other items

IEP IN NUMBERS

866 carriages ordered

£5.7bn (US$9.7bn) investment in the program

30 years' expected service

26m carriage length

2 classes of travel – standard and first

£82m (US$140bn) cost for Hitachi's new rail vehicle manufacturing facility in County Durham, UK

design and mock-up manager. He was confronted with a contradictory brief that demanded a contemporary look and endurance, ruggedness and comfort, stylishness and practicality. In effect he, and contracted designers DCA Design International, had to predict what passengers will still like right up to 2050.

"We were looking for the right visual brand language that reflected what people want to see in a rail carriage," comments Harvey. "Soft or hard curves, waves or lines – everything was up for consideration."

Harvey had been in this position before. Before joining Hitachi Rail Europe in 2013, this 30-year veteran of the rail industry had headed up the ongoing Tyne & Wear metro refurbishment project contracted to Wabtec Rail. He also has broad experience in train building, refurbishment and fleet operations at Bombardier and Chiltern Railways, giving him practical insights to feed into the interior design.

Considered opinion

The design of the interiors was a long time in gestation. In 2010, the UK's Department for Transport (DfT) began proceedings by inviting the public to contribute ideas for the color scheme

CAPITAL GAINS

The new trains will be used on the UK's East Coast Main Line and Great Western Main Line, both long-distance intercity routes.

The East Coast Main Line links the English and Scottish capitals (London and Edinburgh), via several major northern cities, including Leeds, York and Newcastle.

The Great Western Main Line links London with the Welsh capital (Cardiff) and the west of England. Key destinations include Reading, Bristol and Swansea.

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LEFT AND ABOVE:
Standard class

BELOW:
The custom-designed toilet

The interior had to be a balance of compliance with the contract specification, standards, what our stakeholders want and the dictates of the space envelope

Carl Harvey, interior design and mock-up manager, Hitachi

and other elements online. Having processed the respondents' preferences, the department produced a brief. This defined the desired aesthetic as modern and timeless, and specified a palette based on blue. The department also expressly ruled out any kind of fashion statement.

Group effort

"The interior had to be a balance of compliance with the contract specification, standards, what our stakeholders want and the dictates of the space envelope," says Harvey. With the guidelines before them, the stakeholders – Hitachi, DCA, current franchise holders Great Western and East Coast, the DfT and other interested parties – organized a kind of council to meet on a regular basis. Both Hitachi and DCA welcomed this deep involvement, on the basis that all the parties will know exactly what's happening. Indeed, the group had to sign off on the final mock-up. "Throughout these meetings, the group was aiming for visual consistency," says Harvey.

Dark materials

The group was willing to experiment. As well as the recommended blues and other sober hues, it tested out some funkier combinations. "We went through a number of iterations," says Paul Rutter, DCA's head of transport design, a veteran of large-scale rail projects. Eventually, the stakeholders rejected blue in favor of gray. It will be used for the seats, carpets and walls. "We opted for a warm gray palette, a comfortable backdrop for rail travel," says Rutter.

Harvey adds that the stakeholders' group also dropped the idea of direct lighting, which was in the department's style guide, on the basis that reflected lighting produced a warmer look.

The design of the interior was heavily influenced by regulations. A complex set of EU-wide standards specifies everything from the clearances for all seats and the width of the aisle to the size of the baby-changing table in the toilet and the length of the seatback's fold-down tables.

At 26m, the carriages will be 3m longer than any others running on the UK network. This means that the sides of the carriages have to be tapered at the ends instead of being of uniform dimensions throughout. For the interior designers, the main impact of this is that elements placed at the ends of carriages, such as luggage stacks and toilets, had to be custom-designed.

All the main elements have now been agreed, although a few details are still to be finalized, such as the spaces for bicycles.

Seat information is conveyed by what Hitachi calls a comms band – a strip running below

IEP TIMELINE

November 2005	February 2009	2010	July 2012	July 2013	November 2013	March 2014	2017	2018
Project initiated by DfT	Hitachi and John Laing (the Agility Trains consortium) announced as preferred bidder to build the trains	DfT invites public feedback on interior preferences	Agility Trains contracted to build 596 carriages, an order worth £4.5bn (US$7.7bn)	A further order made for 270 more carriages, at a cost of £1.2bn (US$2.1bn)	Hitachi begins work on £82m (US$140m) rail vehicle manufacturing facility in County Durham, UK	Hitachi Rail Global relocates its headquarters from Japan to London	Trains due to begin service on the Great Western Main Line	Trains due to begin service on the East Coast Main Line

TOILET DESIGN

Because the carriages have tapered ends, Hitachi's existing toilets could not be shoehorned into the space, so bespoke designs were needed.

DCA's rail team came up with various concepts that were subjected to the inspection of around 200 groups, including one representing the interests of persons with reduced mobility (PRM).

The standard 'Space Saver' – a brightly lit and compact cubicle – fits neatly in the tapered end. Meanwhile, the separate universal access toilet – an EU recommendation as part of Brussels' determination to make travel easier for PRMs – is a particular triumph. The paneling makes it look less utilitarian and there is ample room for parents to change babies on a fold-down table, and for wheelchairs to be parked and turned.

From the outset, Hitachi and the other stakeholders agreed on the need for a higher-quality unit than before. Thus the toilet is "of hotel quality" and instead of the usual fiber glass, plastic and rubber, DCA has used wooden laminate in the cubicle to produce a more stylish aesthetic. There is even a full-length mirror.

Attention to detail extends to the door-locking system, which is activated by large levers rather than the usual buttons that users sometimes forget to push. The system is also designed to prevent miscreants pressing the lock button and then slipping out before the door closes, which can make the toilet appear occupied for the entire journey.

LEFT AND BELOW: The universal access toilet, featuring a full-length mirror

Nothing is fixed permanently; everything can be changed according to demand

Carl Harvey, interior design and mock-up manager, Hitachi

the luggage rack that tells passengers the seat number and its status, using LED lighting. A green light means the seat is free, red means booked and amber is for seats that will be occupied for part of the journey. In short – universal signage that can be read at a glance.

Shape shifting

As well as the luggage stacks at the ends of compartments, there is above-seat storage that is big enough to take an outsize suitcase, and especially generous in terms of height. Luggage racks and luggage stacks on the Great Western Main Line trains will be supplied by Lordgate Engineering (a contract for the East Coast Main Line trains is pending).

Because Hitachi and the operators are looking 30 years ahead, the carriage has a modular design that will enable extra stacks to be installed, for example in the middle of the carriage. Hitachi wants to be ready if passengers start bringing more luggage.

"The interior is modular," says Harvey. "Nothing is fixed permanently and everything can be changed according to demand." For example, the seats are mounted on pedestals fixed to rails and the internal partition panels can be shifted back and forth to reconfigure the seating.

The train's carpets produced some of the biggest challenges because of the heavy use they will have to withstand. The solution was to install hard-wearing materials in the highest-traffic areas (such as the vestibules), a lighter, textured carpet in the aisles and another heavy-duty material under the tables and seats.

Other key features of the finished interior include pull-down blinds for the windows and partitions finished in a light-oak laminate.

Draft layouts published in August 2012 detail a five-carriage train with 315 seats (45 in first class and 270 in standard class) plus space for two wheelchair users. The eight-carriage train will accommodate 539 seats (101 in first and 438 in standard) and four wheelchair spaces. Finally, a nine-carriage train can seat 627 (101 seats in first and 627 in standard) and has room for four wheelchair users.

Modern Pullman

From the outset the operators wanted extremely strong visual differentiation between first and standard class, to encourage passengers to upgrade. First-class passengers will all have tables, and the seats will be bigger, deeper and have a greater pitch. The dominant color will be a dark gray with head cushions in purple.

The designers describe the effect they were going for as "modern Pullman" – that is, an updated version of the luxury offered by Pullman trains. Luxury automobiles were another influence. Apparently, first-class passengers have grown so accustomed to the décor of their automobiles that they like the transition from road to rail transport to be aesthetically seamless.

With the modern Pullman, Harvey and his team hope they have captured the challenging 'modern and timeless' brief requested by the people that will use these trains until as far ahead as 2050. Time will tell.

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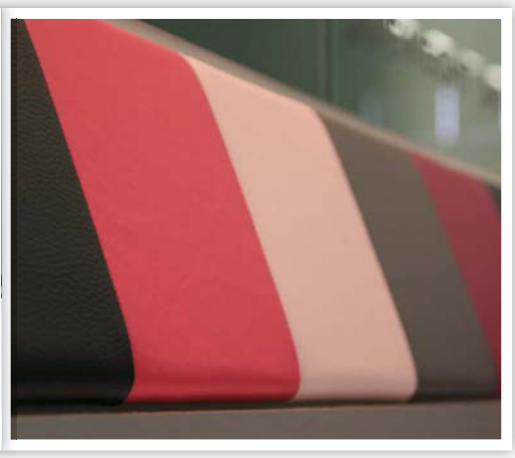

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Onboard wi-fi can transform a service in passengers' eyes. What does the implementation entail for operators?

These days, intercity and high-speed passengers don't simply want their trains to run on time, be comfortable and cost-effective. They demand a range of onboard services, too – and that includes wi-fi.

Our reliance on the internet and our expectation that we can connect to it anywhere and at any time – and our frothing outrage if we can't – is why wi-fi-enabled trains are becoming more common all over the world. Of course, passengers can use their own smartphones' network coverage during a rail journey; but, at some point on the route, that network may become unavailable. Using an on-train wi-fi system should be a more seamless experience because it hops between available networks. The speed may vary to some extent – but, crucially, the passenger will stay connected.

Intercity lifestyle

Lots of rail operators have already installed wi-fi. "The UK is fairly good at providing wi-fi," comments Thomas Drohan, senior vice president and general manager of GuestLogix's global rail division. "East Coast trains, for example, are wi-fi enabled, and Heathrow Express has a very good wireless network. In Europe, Thalys' trains have wi-fi, as do many Deutsche Bahn ICE trains; plus Eurostar's new fleet will also be wi-fi enabled."

Operators that are expected to add wi-fi soon include Poland's PKP Intercity, which in January 2014 announced one of the biggest wi-fi deployments on passenger trains in eastern Europe, with a commitment to providing its intercity customers with access to wi-fi and multimedia services.

"Essentially, with wi-fi, intercity operators are trying to differentiate their service from that

Connecting journeys

Illustration: Chris King

of short-haul carriers'," says Drohan. "They're looking for a reasonably robust system offering reasonable speeds so that passengers can browse the internet, update social media and receive emails. Many operators see this as an important part of their offer. Operators are also able to leverage their investment in wi-fi to run other value-add services, such as destination-relevant content, customer service information and online card authorization."

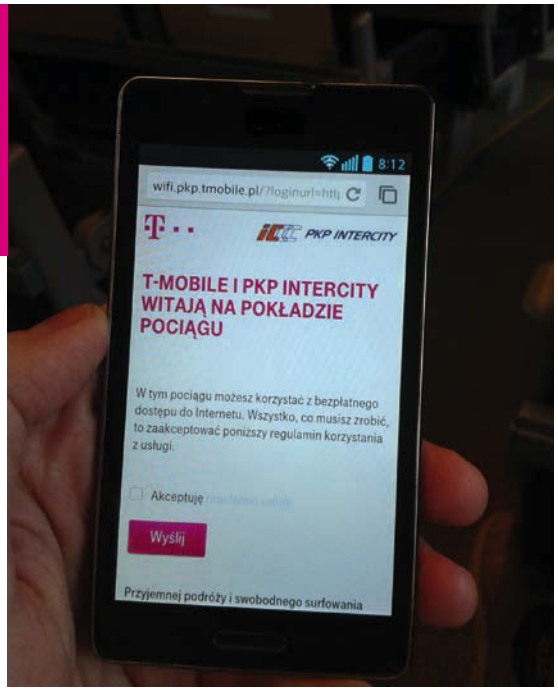
Yet wi-fi isn't the preserve of intercity trains. Moscow Metro aims to install wi-fi across its whole system, and South African commuter service operator Metrorail is rolling wi-fi out at stations, with the long-term aim of installing it in carriages.

With wi-fi, intercity operators are trying to differentiate their service from that of short-haul carriers'

Thomas Drohan, senior vice president and general manager, rail, GuestLogix

Keeping pace

The surge in demand is also putting pressure on operators that have already installed wi-fi. For example, Amtrak has announced that it is studying options to upgrade its onboard wi-fi service in the Northeast Corridor (NEC), from Boston to Washington DC, with a particular interest in constructing a dedicated, wireless trackside network to provide a high-capacity, broadband-speed internet connection. This would close existing coverage gaps along the NEC,



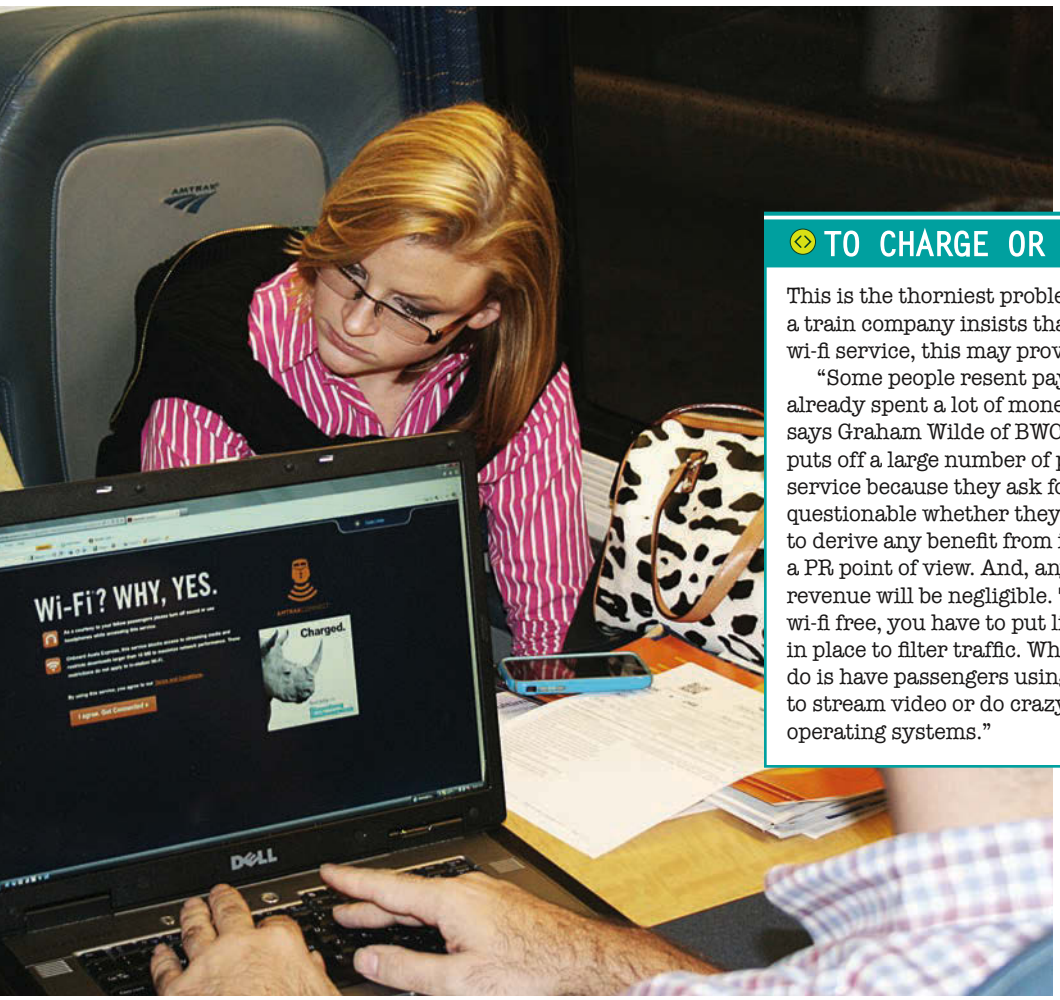
LEFT AND RIGHT: Polish operator PKP Intercity is rolling out wi-fi and multimedia services, in cooperation with T-Mobile Poland and Nomad Digital

and allow Amtrak to drop current restrictions on streaming media and large file downloads.

"We know that our customers want a consistently reliable and fast onboard wi-fi experience – something we can't guarantee today on our busiest trains when hundreds of customers want to go online at the same time – and we want to make that possible," says Matt Hardison, chief marketing and sales officer at Amtrak.

Amtrak's goal would be to increase bandwidth per train from 10Mbps to a minimum of 25Mbps. A test project is needed to determine whether it is technically and financially feasible to construct a network along the whole 457-mile corridor.

In the UK, East Coast is working with wi-fi provider Icomera to deliver a £2.2m (US$3.7m) upgrade of its on-train wi-fi. "Demand from passengers has been rising rapidly, partly because of the huge rise in the number of wi-fi-capable devices owned by our customers, including smartphones, tablets and e-readers," says Peter Williams, commercial and customer service director at East Coast. "Our system has to keep pace with this demand, and the investment we are making now is upgrading the consistency of the service, by replacing on-train servers, access points and switching equipment which together deliver wi-fi in every carriage."

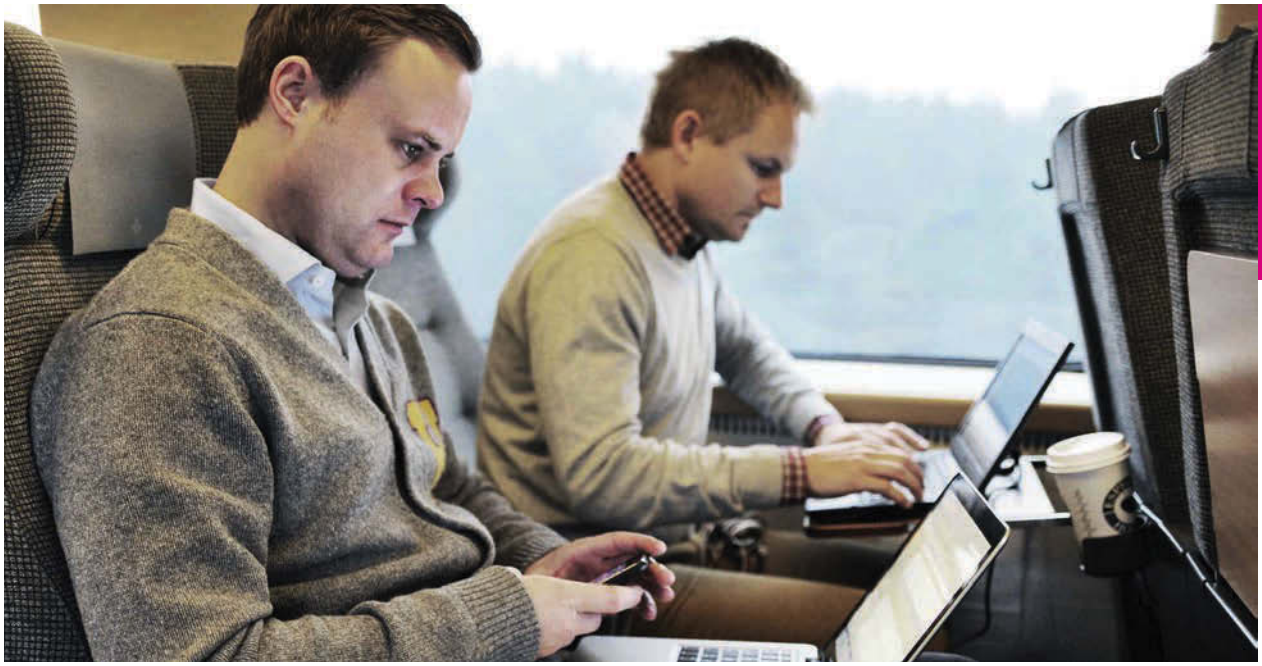


TO CHARGE OR NOT TO CHARGE?

This is the thorniest problem operators have. If a train company insists that passengers pay to use its wi-fi service, this may prove to be a PR own goal.

"Some people resent paying for wi-fi when they have already spent a lot of money paying for their ticket," says Graham Wilde of BWCS. "And if an operator puts off a large number of passengers from using the service because they ask for payment for it, then it's questionable whether they – the operators – are going to derive any benefit from it, either financially or from a PR point of view. And, anyway, if they do charge, the revenue will be negligible. Then again, if you make your wi-fi free, you have to put limits on it and have a policy in place to filter traffic. What an operator can't afford to do is have passengers using the onboard wi-fi network to stream video or do crazy things like update their operating systems."

LEFT: Amtrak is considering upgrading wi-fi on its high-speed NEC route



LEFT: Swedish operator SJ upgraded to 4G internet in first and second class on its high-speed and double-deck services (100 trains) in 2013

Peter Kingsland, sales director at Icomera UK, says that demand for wi-fi is more than a fad, pointing out that there is a wi-fi-enabled fleet on every continent and in most major rail markets. "In some cases that just means a small number of trains on a particular route," he says. "In other markets, such as Ireland, it means every train in the fleet has wi-fi. In terms of regions where there are onboard wi-fi hotspots – no pun intended – I would say the UK and Ireland, the Nordic countries and North America are where there is the greatest uptake and growing demand."

The UK and Ireland, the Nordic countries and North America are where there is the greatest uptake and growing demand

Peter Kingsland, sales director, Icomera UK

Customer loyalty

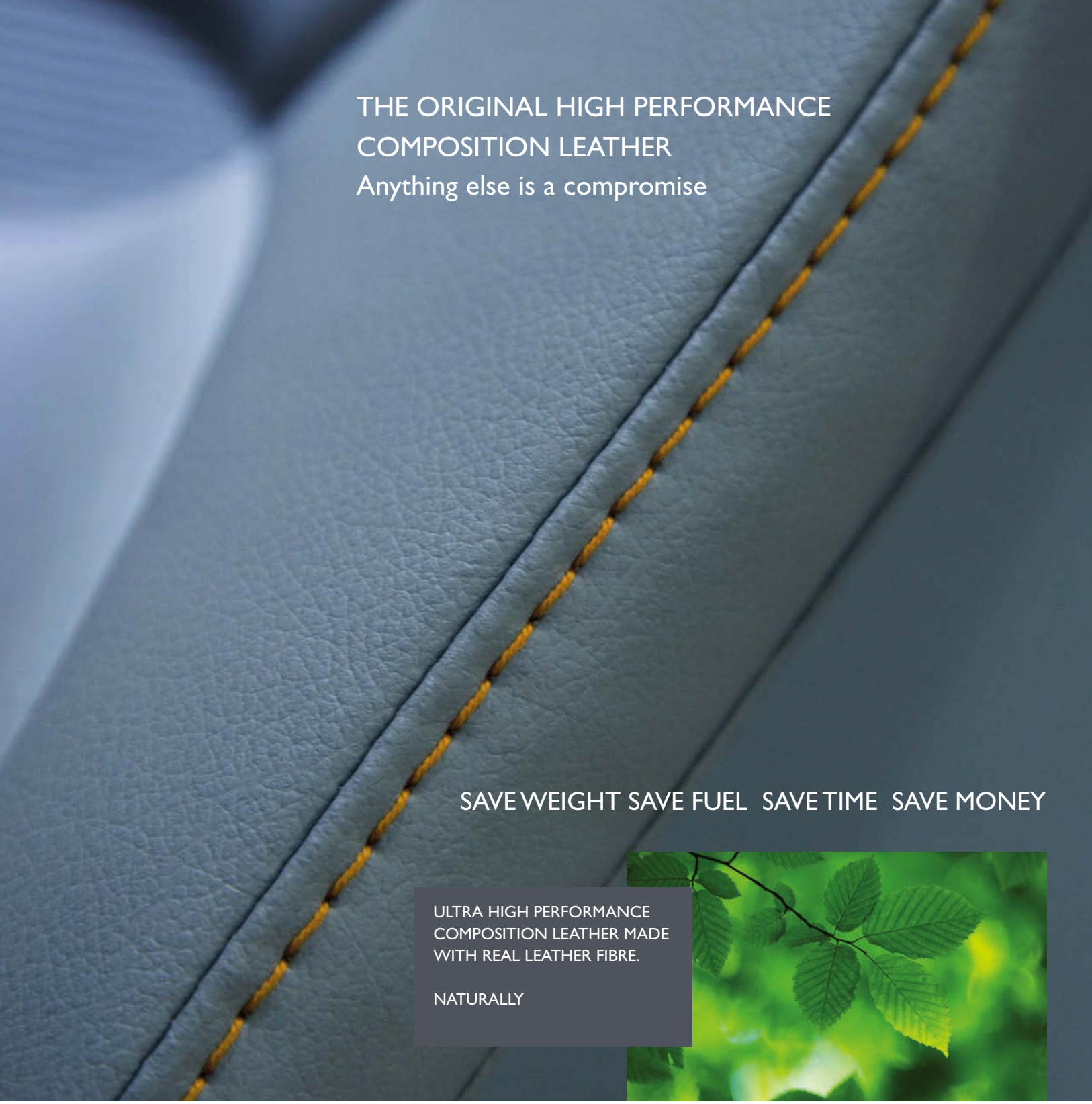
But is there a correlation between customer loyalty and provision of onboard wi-fi? On Capitol Corridor, an intercity train system (operated by Amtrak) serving 16 stations along a 170-mile corridor in eight northern California counties, the answer is yes. In 2013 it published the results of a study by Professor Patricia Mokhtarian of the Georgia Institute of Technology (Georgia Tech) about the effect of free wi-fi on the Capitol Corridor service.

BELOW: An Amtrak passenger using wi-fi on a Northeast Regional train

"Our analysis suggests that providing free wi-fi increased Capitol Corridor trips by 2.7%," said Mokhtarian. "New Capitol Corridor riders were particularly influenced by having free wi-fi. They made about 9% more trips than they would have done without free wi-fi. Those who were already riding Capitol Corridor frequently were the least affected, with only about a 1% increase in trips. Finally, those riding less frequently (only a few times per month) contributed 6% more trips than they would have made otherwise. In sum, wi-fi's impact on Capitol Corridor ridership exceeded the level needed to justify its implementation."

Multipurpose tool

Making the business case for wi-fi installation can be easier if an operator considers that a train's wi-fi network has other uses, says Graham Wilde, CEO and co-founder of BWCS, organizer of the annual Train Communications Systems conference. "If a train has an internet connection, then passenger internet access is only one of its



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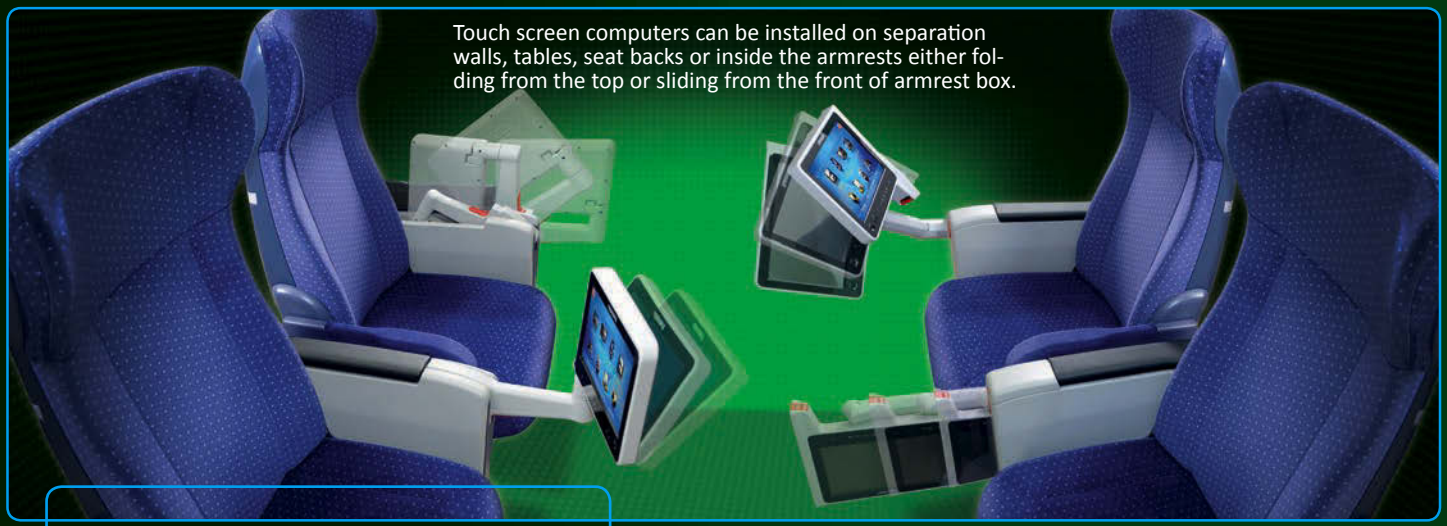

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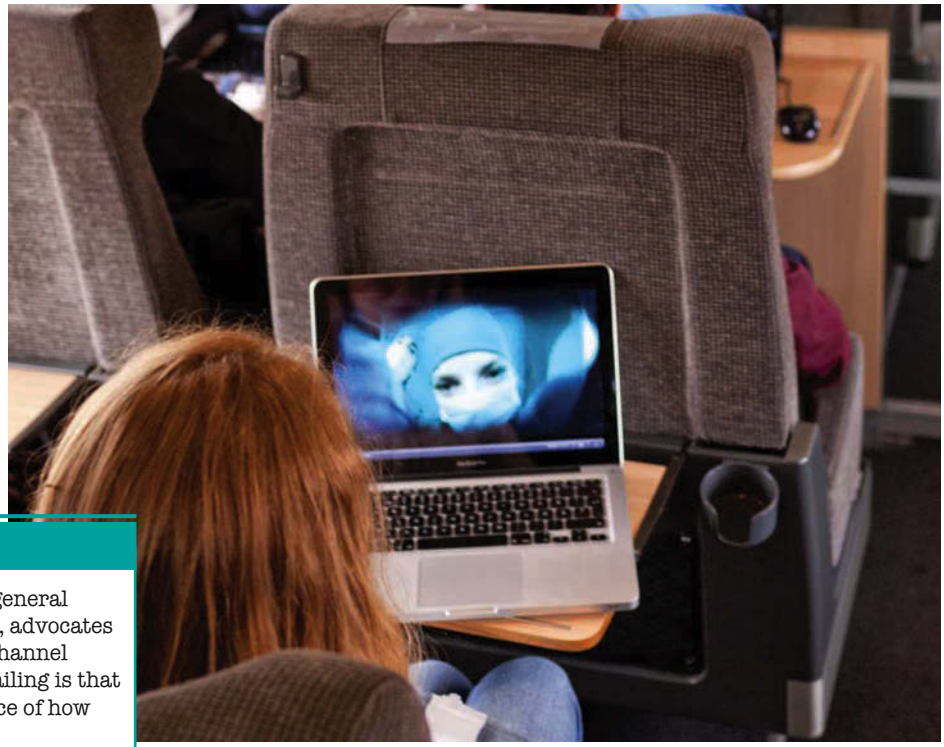
uses," says Wilde. "For example, the operator can use it for live downloads from train data recorders, monitoring aspects such as brake wear and real-time credit card authorization, which is very useful for ticket sales."

Icomera's Kingsland agrees. "Operators need to look at onboard communications as a system in itself, just as they would if they were running an office building," he says. "They need to think of it as an enabler for other systems, and view it as the foundation of their business that everything else must be able to connect to reliably and with the right quality of service."



ABOVE: SJ's internet service is offered free of charge

OMNI-CHANNEL RETAILING

Thomas Drohan, senior vice president and general manager of GuestLogix's global rail division, advocates installing wi-fi on trains, to facilitate omni-channel retailing. The principle of omni-channel retailing is that the retailer should give the customer a choice of how they obtain products and services.

"It is incumbent on retailers to provide a consistent retail environment, regardless of how their customer wishes to purchase – via a shop, website, smartphone, self-service kiosk or attendant-driven mobile sales," he says. "Wi-fi-enabled trains are critical for rail operators who want to run lucrative omni-channel retailing initiatives. The rail operator is effectively giving the passenger additional choices in how they procure products and services."

Drohan argues that the approach provides revenue opportunities while also enhancing customer service. "With on-train wi-fi, the passenger can go beyond simply going to a bar-buffet, seeking an on-train crew member, or waiting until the destination to purchase products and services," he says. "Installing wi-fi on a train opens opportunities for sales on passengers' devices, on-train digital media, seatback screens and even walled garden on-train websites. It means operators can channel passengers toward preferred products and services while also giving them important travel information."

RIGHT: Icomera's X6 Mobile Broadband Gateway, which is installed on trains to enable wi-fi service

Investment portfolio

So what kind of investment does a rail operator need to make to implement wi-fi? "Customer requirements vary but typically an operator is looking at an outlay of around £15,000 to £20,000 (US$25,541 to US$34,054) on the equipment, plus more for the installation, design and approvals," estimates Kingsland. "It depends on the installation. Obviously a nine-car train will cost considerably more than a three-car train."

Recoup on investment depends on factors such as if the operator will be running a free or paid-for service and whether or not they are connecting other real-time applications to the network. But Kingsland says that, "in some cases it can take only a couple of years".

Both a plumbing element and a networking element are necessary to install wi-fi on a train. Retrofitting wi-fi to existing rolling stock is economically viable, yet the reality is that the best way to install wi-fi is on a new vehicle. "On existing rolling stock the most cost-effective time to fit onboard networks is during a major fleet examination or refurbishment, when the train is already stripped down," says Kingsland. "Even just fitting conduit for future wires to run through can save a lot of money later on."

As well as the cabling, the key components needed for wi-fi include switches, access points, roof antennae and a multibearer router or gateway. "On every train there will be a master vehicle with a multibearer gateway and roof antennae," says Kingsland. "This master vehicle talks to the other carriages and acts as a mini hotspot; but

LEFT: UK operator East Coast is upgrading its onboard wi-fi in response to greater demand

RIGHT: PKP Intercity is installing the service in 300 passenger cars

Remote management tools are essential to ensure good customer service and support remote updates for other onboard systems

Peter Kingsland, sales director, Icomera UK

to connect the master vehicle to other carriages, Ethernet or Gigabit cabling is needed throughout. Remote management tools are also essential to ensure good customer service and support remote updates for other onboard systems."

Practicalities

Expected bandwidth varies. An on-train wi-fi system without 4G cellular connections can typically give passengers an average of 8-10Mbps. With 4G, 20Mbps or more is realistic.

Legally speaking, the key to any operator's internet service is the user license agreement – the terms and conditions that users have to agree to before they go online. On the security side, operators must ensure that firewalls are in place and that passengers' devices are blocked from peer-to-peer contact across the onboard network, to prevent the spread of viruses.

Rail operators are currently in an interesting phase with regard to wi-fi installation, maintains GuestLogix's Drohan. "Passengers want wi-fi on board, of that there's no doubt," he says. "The question for operators is how is it delivered? The answer to that question depends on an interesting timeline. Will general 3G and 4G networks become sufficiently robust so that these can be leveraged more effectively? Or is onboard wi-fi the option that more and more rail operators will need to use?"

TUNNEL VISION

Earlier in 2014, Eurotunnel completed mobile telephone and internet connections in the Channel Tunnel in time for its 20th anniversary, with the help of UK operators Vodafone, EE and O2 UK and the equipment supplier Alcatel-Lucent. "We have installed a cable running through each of the tunnels – north and south – with repeaters installed every 750m so that passengers have a continuous signal that doesn't fade in or fade out as they move between cells," says John Keefe, director of public affairs at Eurotunnel.

Services were completed in the north-running tunnel in May 2014 (the south-running tunnel was completed in 2012) with investment measured in terms of several rather than tens of millions.

The biggest challenge for Eurotunnel – apart from providing a wireless service 100m below sea level – was unreeling 100km of cable in the tunnel environment without disrupting services or interfering with existing railway communications. In addition, the south tunnel installation had to be completed in a tight timeframe of only 10 months, so it was finished in time for the 2012 Olympic Games in London.

There were specific legal issues surrounding this particular network. "Effectively, the operator's certificate had to be extended onto a foreign territory without changing the terms of that certificate," says Keefe. "Passengers on trains originating from the UK stay on the UK signal until they get to France – and vice versa. That did require some negotiation around the existing legal framework."

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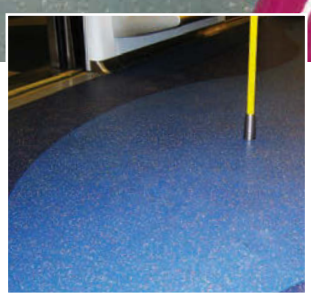

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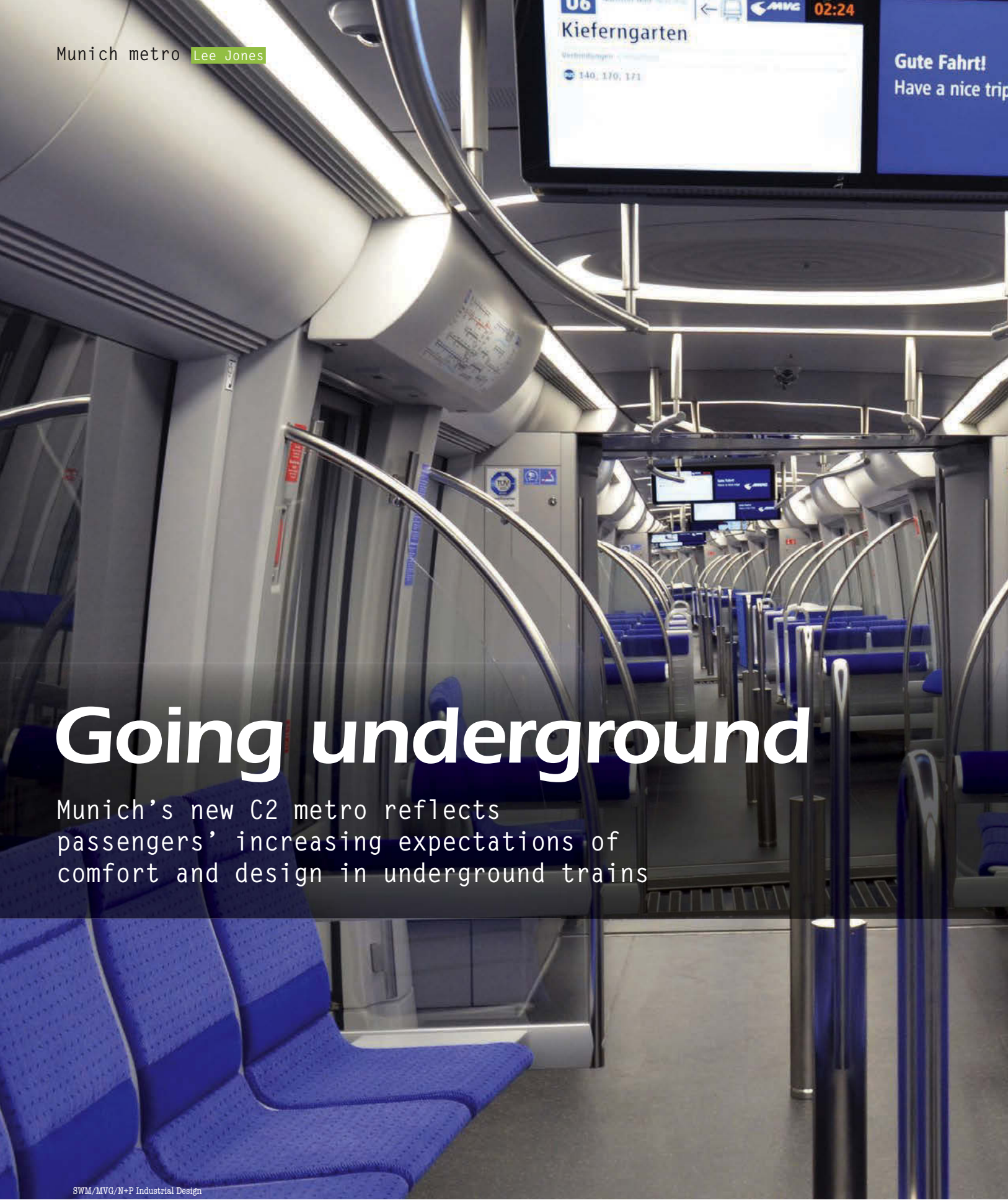


Going underground

Munich's new C2 metro reflects passengers' increasing expectations of comfort and design in underground trains

SWM/MVG/N+P Industrial Design

Munich's C2 metro, designed by N+P Industrial Design

Having worked on Munich's popular C1 metro, which entered service in 2002, N+P Industrial Design was the obvious choice to design the next generation of trains for the German city's underground – especially as the operator, Munich Public Transportation Company (MVG), was keen to use the C1 design as the foundation for the new C2s.

Following a design study by N+P, MVG ordered 126 new cars (21 six-car sets) from Siemens in 2010, at an investment of €185m (US$253m), and also placed options for a further 46 sets. If all options are exercised, the investment will total €550m (US$753m). The first of the new metros arrived in February 2014, and has been undergoing operational tests. The plan is for the C2 trains to renew the entire fleet by 2020.

"The decision makers on the operator's side still love the design of the C1 trains, yet they know that standing still means going backward," says Andreas Bergstraesser, partner and industrial designer at N+P Industrial Design. "So when the time came for a lot of vehicles to be acquired, it was clear that this new generation of trains should set new standards, not through revolution but through a modernization of the design."

C2 IN NUMBERS

126 cars ordered

€185m (US$253m) investment (firm orders only)

276 cars on option

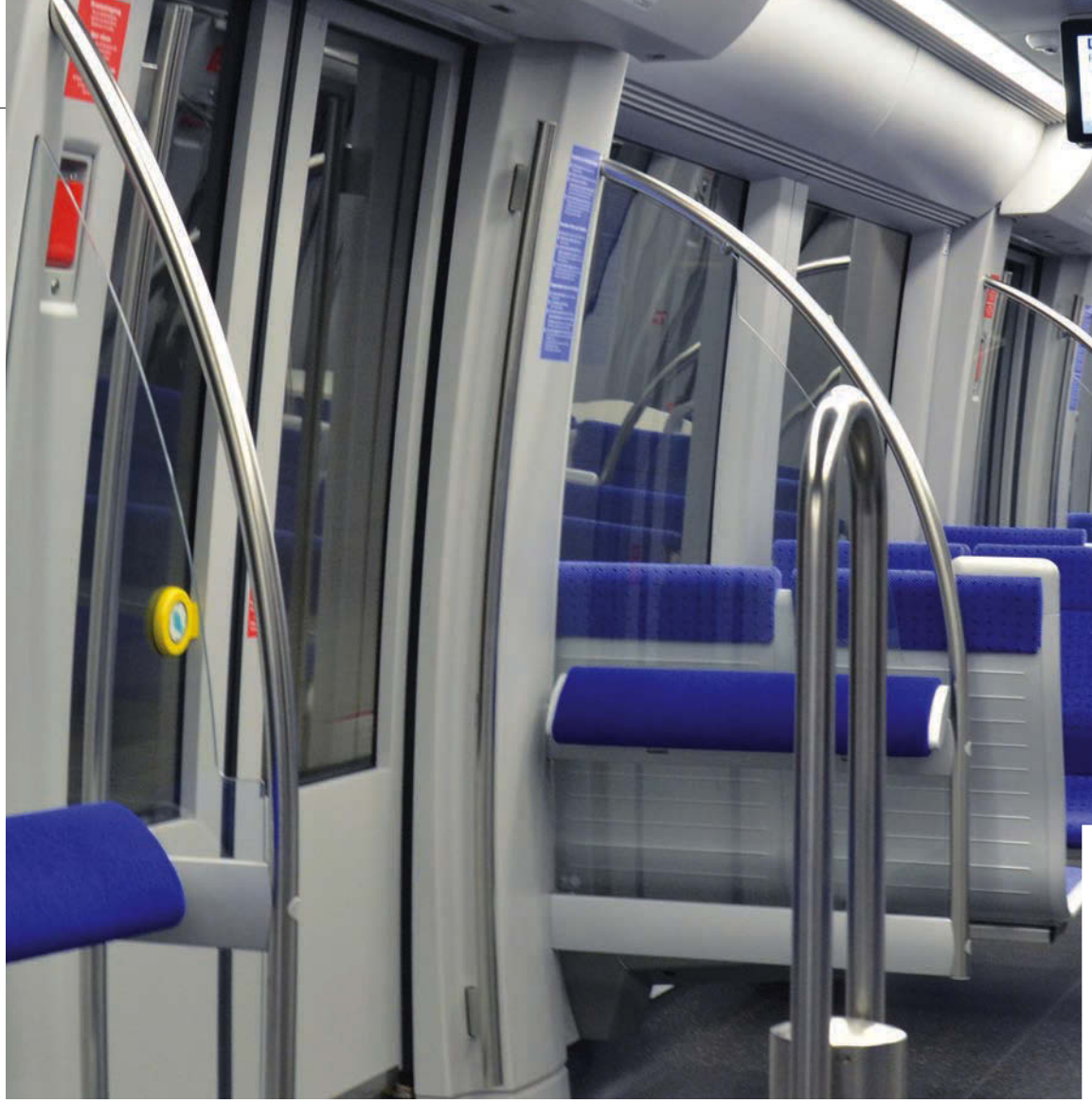
€550m (US$753m) investment if all the options are exercised

6 cars in each train set

6 passenger doors in each car

220 seats on a six-car train

720 standing places, with four people per square meter



N+P was tasked with designing the whole interior – including panels, seats and lighting – as well as the exterior profile. "Our brief was to update the successful C1 design using the latest technologies and materials, and retain a visual link," explains Bergstraesser. "The new trains had to meet a lot of requirements, such as more standing space, greater transparency between the driver and passenger compartments, and more areas for multifunctional use."

MVG's feedback showed that comfort, information and security needs were at the forefront of passengers' requirements. As a direct result, the operator opted for upholstered seats throughout, a departure from the C1, on which 50% of the seats are wooden. On the C2, there are 220 seats on each six-car train, plus 720 standing places (based on there being four people per square meter), for a total capacity of 940 passengers.

The C2's seating arrangement is new. There is a lot of standing space in the front cars, where the majority of passengers embark. This space is created by having bench-style seats positioned with backs to the side walls. Seats in the other cars face toward and against the direction of travel, providing a calmer environment for those traveling longer distances.

Well-informed decision

To ensure passengers have all the information they need, MVG specified passenger information systems that provide visual and audio information. There are eight monitors in each car,

The new trains had to have more standing space, greater transparency between the driver and passenger compartments, and more areas for multifunctional use

Andreas Bergstraesser, partner and industrial designer, N+P Industrial Design

LEFT: There are eight passenger information monitors in each C2 car

BELOW LEFT: The C2 was designed to be accessible and comfortable for all passengers, including those using wheelchairs

BELOW: The C2 cars are accessed through 55in-wide openings

BUILDING ON A PLATFORM

Munich's new C2 trains implement components from Siemens' Inspiro metro platform. Inspiro was designed for maximum flexibility in terms of its interior options. It offers a lot of choice for aspects such as seat configuration, ventilation, heating, air conditioning, lighting and passenger information systems.

"Design and comfort are gaining importance, as they are among the key factors influencing acceptance by the population," says Sandra Gott-Karlbauer, CEO of urban transport at Siemens. "Customers are becoming increasingly involved in designing vehicles that meet their individual needs. Our customers are able to put together their own personal metro trains from standardized, pre-fabricated modules. With this building block approach, Siemens can meet customers' requirements without having to develop suitable products from scratch."

With the average metro car designed to operate for 30 years, retrofitting existing stock to meet new needs is also an option. "Greater comfort can be offered to passengers through interior conversion (including reworking of interior doors, mechanical work on the floor to repair or replace carpets, assembly of new side handrails and installation of new seats modules); and system upgrades, such as new air conditioning, audio and video systems," says Gott-Karlbauer.

However, she says demand for new metro trains continues to grow worldwide. "Europe, including Russia, is investing to replace many vehicles," says Gott-Karlbauer. "For instance, Moscow said it will acquire up to 6,000 new vehicles in the next 10 years. Also, in the emerging countries, infrastructure is being developed and extended. Megacities, which are growing in number, also face a number of challenges that make it necessary to improve and extend public transportation networks."

Photos: SWM/MVG/N+P Industrial Design

providing destination and station information, complemented by loudspeakers.

For security, there is a video surveillance system, and the driver's cab features a full-height glass rear wall to give the driver a direct view into the passenger compartment at all times. The train also features new passenger counting and fire protection systems, as well as improved illumination of the tread area in the entrance.

More feedback came from MVG's maintenance team, which provided input regarding vandalism prevention and optimal cleaning conditions – one result of which was validation of the seat's floating design.

Bright idea

The development team also consulted groups representing the needs of persons of reduced mobility (PRM). One request resulting from that interaction was for the passenger doors to be made more noticeable for the visually impaired and provide enough space for wheelchair users. This led to one of the train's most recognizable design features – vertical LED strips line the doors, and change color when opening and closing. While the C1 train is lit by tube and spot lighting, the new C2 cars feature LED lighting systems throughout. Among other benefits, this enabled N+P to create eye-catching circles of light on the ceiling.

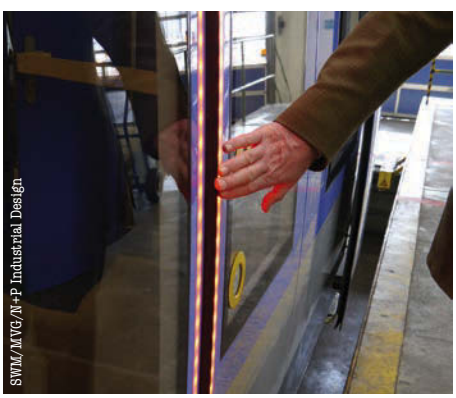
As well as their special lighting, the doors also answer the need for easy access – they slide back to give a wide 55in opening. There are three doors per car on each side; 18 per six-car train.

BELOW: Kuala Lumpur's upcoming new metro, designed by BMW Group DesignworksUSA

BOTTOM: The doors on Munich's C2 metro are lined with LED strips that change color when they open and close

Universal design

PRM passengers have also been considered in terms of handholds. "We took care to integrate details that are helpful for all users, but some of them are especially helpful for PRM passengers," says Bergstraesser. "All passengers – young, old, tall, short, traveling with a stroller, or those with reduced mobility – can access a seat, leaning aid or standing area with suitable handles. Various handles are accessible near the ceiling,



SWM/MVG/N+P Industrial Design

ANOTHER METRO BASED ON INSPIRO – IN KUALA LUMPUR, MALAYSIA

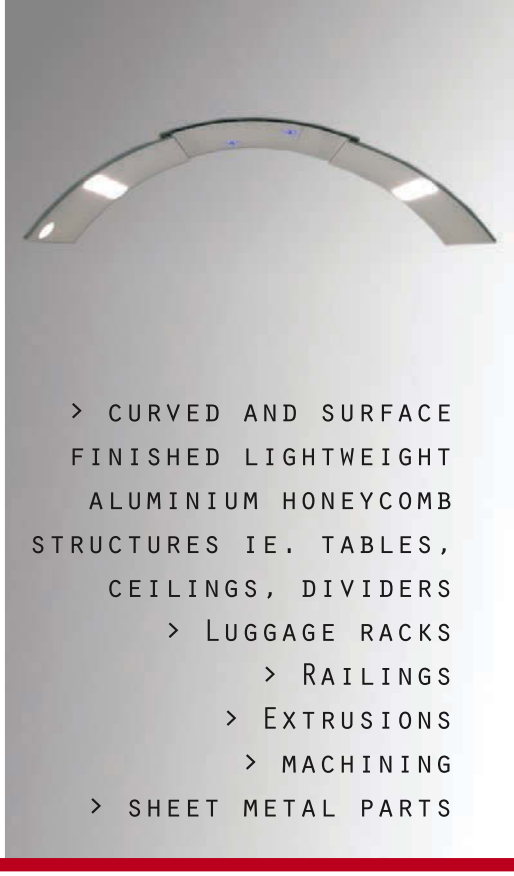
The metro being developed for Kuala Lumpur in Malaysia is also based on Siemens' Inspiro metro platform, illustrating how different Inspiro interiors can be from each other, despite their shared pedigree.

The 58 driverless metro trains are being introduced to serve the Klang Valley. Each four-car trainset will have a capacity of 1,200 passengers. The interior design is by BMW Group DesignworksUSA.

"The interior features interplay between past and future," says Laurenz Schaffer, president of BMW Group DesignworksUSA. "The lively color concept with varying shades of blue and traditional symmetrical patterns is a fresh interpretation of the vitality and cultural diversity of Kuala Lumpur.

The design also takes PRM's needs into consideration. Six areas in each train are equipped with handrails that offer sufficient space for wheelchair users. When closing or opening, the doors will emit a beeping sound and light to guide passengers. "Color contrasts in the door areas also help guide passengers and enable an easy entrance or exit," adds Schaffer.

The train features an LED lighting system. "The use of indirect light beneath the seats creates a feeling of spaciousness and safety, and enables easy maintenance of the trains," says Schaffer.



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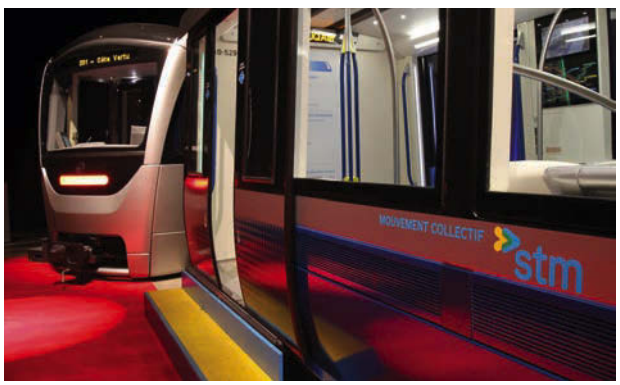
MONTREAL'S AZUR METRO

The first of Société de transport de Montréal's (STM) next-generation metro trains was delivered in April 2014. The Canadian operator ordered 468 cars from a consortium comprising Bombardier Transportation and Alstom Transport. The whole fleet should be operational by 2018.

The cars are designed to offer passengers greater comfort, a greater sense of safety, better access and optimal performance. Features include panoramic windows; indirect lighting; communicating passageways throughout the nine-car train; doors that are 27% larger to optimize passenger flow; 8% greater capacity; and new information and safety systems.

"This has to be one of the most beautiful trains in the world," said Michel Labrecque, who was chairman at STM when the train was unveiled in November 2013. "These cars will certainly be in service for 50 years. They will enable us to not only increase the reliability and quality of services offered to passengers, but also boost ridership on the metro."



ABOVE AND LEFT: Montreal's new Azur metro

The collaborative approach was the key to producing a metro that builds on the success of its predecessor

Andreas Bergstraesser, partner and industrial designer, N+P Industrial Design

at medium-height at partitions or door posts, near the seats or centrally arranged in the aisle – without visually shrinking the interior's transparent and spacious look. The small leaning supports in the entrance area are helpful for short-term travelers. The multifunctional areas near the bellows are wide open and equipped with six leaning supports each, providing more space for standing passengers, bikes, strollers, wheelchairs and wheeled walkers."

Bergstraesser reports that feedback from users and the media has been very positive. Even before the first train had left Siemens' factory in Vienna, Austria, the design had won three awards: the Red Dot Design Award 2013, the Universal Design Award 2013 and the Universal Design Consumer Favorite 2013. The German Design Award followed in 2014.

Welcome arrival

"When the first train was presented to the general public in February 2014, the enthusiasm was very evident," says Bergstraesser. "The press praised the train's modernization and many new features. For example, an important newspaper published in southern Germany ran a story headlined 'Elegance in the Underground'. This kind of feedback – as well as the four design awards – proves that the three years of intensive development have paid off."

Bergstraesser stresses that the project's success was built on teamwork. "The collaborative approach we took during the design process was the key to producing a metro that builds on the success of its predecessor and meets the needs of Munich's commuters," he concludes.

MUNICH METRO TIMELINE

1997	2002	2009	2010	2012	2013	2014	2015
N+P designs the C1 for MVG	C1 enters service	N+P begins design study for C2	Siemens wins the C2 tender, N+P begins detailed design	Siemens presents the first C2 car body to MVG	C2 wins three awards – the Universal Design Award; the Universal Design Consumer Favorite; and the Red Dot Award; the first train leaves the Vienna production plant	First C2 unveiled to the public	21 C2 trains should be in service

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Alstom's single-deck Régiolis train for SNCF

In April 2014, France's SNCF launched the first of its two new regional trains: the single-deck Régiolis, made by Alstom; and the double-deck Régio2N from Bombardier, which is scheduled to enter service in late 2014.

SNCF embarked on the renewal of France's TER regional trains in 2006. The project was necessitated by decentralization policies introduced in 2002 that included the transfer of train stock to the regions. It is a complex system whereby SNCF remains the operator and oversees railcar procurement and design, but financing comes largely from the regions.

Where both trains have gone much further than in previous designs is in their degree of personalization. They both enable each region to stamp its identity on the train, and to meet the needs of its population. The trains could be used for everything from high-density commuter services to longer rural services and intercity lines.

Alstom's single-deck Régiolis is an evolution of its Coradia Polyvalent platform, and is modular. The articulated bi-modal (electric, or electric and diesel) trains are available in a choice of lengths (56m, 72m or 110m) and configurations, providing between 162 and 354 seats, with the possibility of running up to three train sets together.

Following initial orders in 2009, the first Régiolis rolled off the assembly line in Strasbourg, France, in June 2011. It has been ordered by 12 regions, and entered service in Aquitaine, Lorraine, Picardy and Alsace in April 2014.

The design was developed by a team of transport specialists from the regions, SNCF and Alstom's Design & Styling department. The team made use of a real-time configuration visualization tool. "We have succeeded in creating an industrial but made-to-measure design – each region has its own train, but also the benefits of the whole range," says Jérôme Wallut, managing director of

Alstom trains are now based upon this idea of a tube with an interior that enables you to do what you want

Xavier Allard, director, Design & Styling division, Alstom

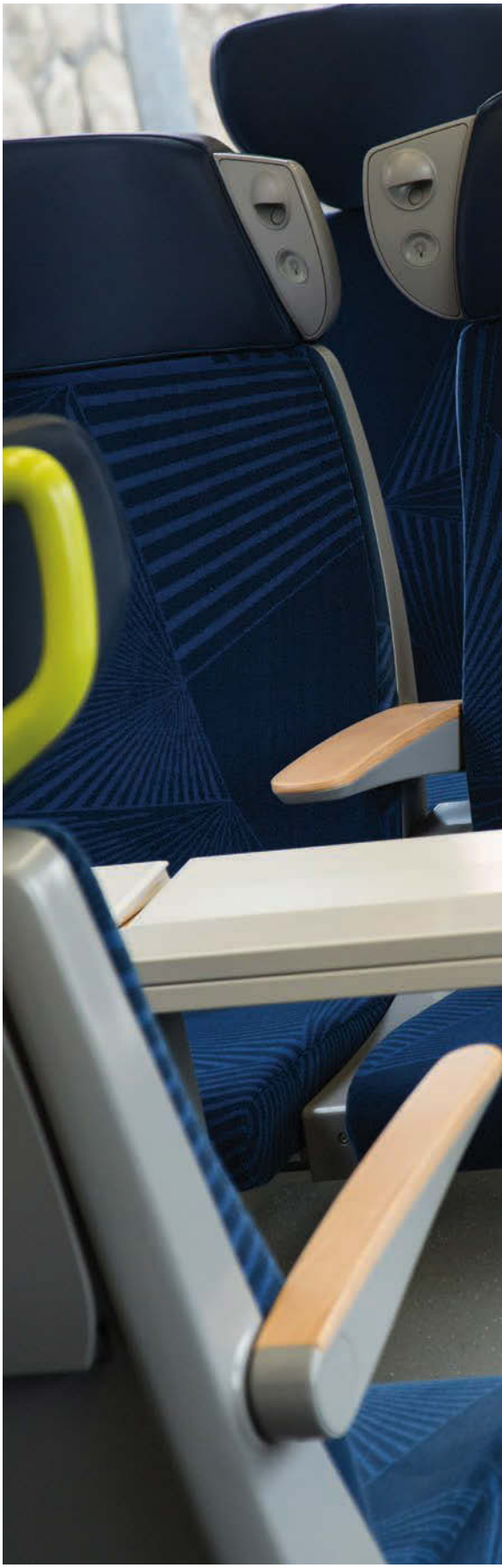
Alstom Transport France at the time of the project, and now senior vice president at Alstom Transport North America.

"Coradia is based on a very simple form, a very large glazed area and modular space," says Xavier Allard, director of Alstom's Design & Styling division. "Alstom trains are now based upon this idea of a tube with an interior that enables you to do what you want. In this case, we wanted to do something extremely simple and very clear. Even the luggage racks are very simple metal rods, but give a powerful linear appeal."

Personal effects

Around 20% of the design is customizable, offering around 150 variations. There are three possible color schemes (blue, raspberry and eggplant) for the seats. Optional features include luggage racks, bike spaces, ski racks and toilets. The design team worked on seat ergonomics to increase legroom. It aimed to improve comfort by ordering seats finished in velour with faux leather headrests. Integrated reading lights and power sockets were specified for each seat to address growing demand. Armrests and tables have a beechwood trim, with the low window ledge replacing an armrest along the window.

Bogies positioned between cars and technical equipment on the roof reduce internal noise and vibration. Large windows and an almost square cross-section, with a rounded ceiling, enhance the impression of space. Most of the technical

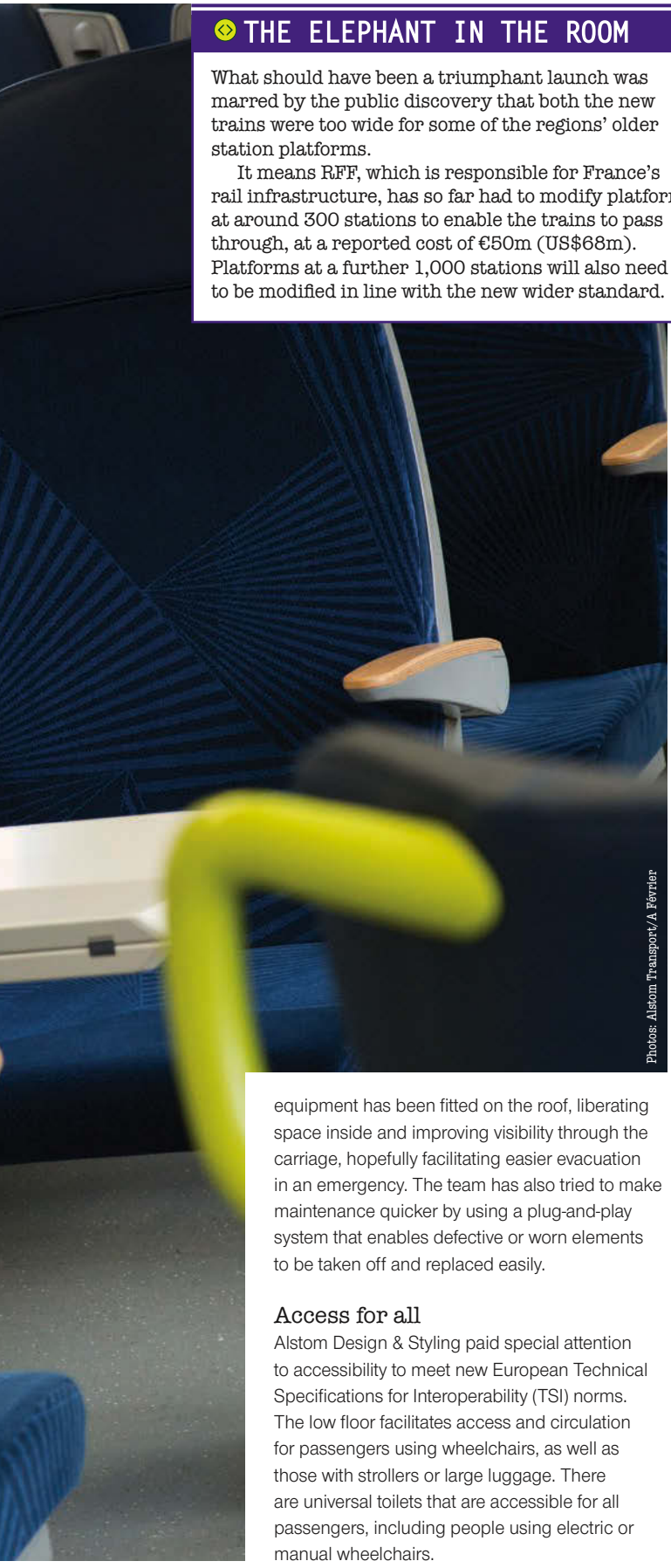


ABOVE, RIGHT AND LEFT: The Alstom Régiolis train now running in the Aquitaine region of France

THE ELEPHANT IN THE ROOM

What should have been a triumphant launch was marred by the public discovery that both the new trains were too wide for some of the regions' older station platforms.

It means RFF, which is responsible for France's rail infrastructure, has so far had to modify platforms at around 300 stations to enable the trains to pass through, at a reported cost of €50m (US$68m). Platforms at a further 1,000 stations will also need to be modified in line with the new wider standard.



Photos: Alstom Transport/A Février

equipment has been fitted on the roof, liberating space inside and improving visibility through the carriage, hopefully facilitating easier evacuation in an emergency. The team has also tried to make maintenance quicker by using a plug-and-play system that enables defective or worn elements to be taken off and replaced easily.

Access for all

Alstom Design & Styling paid special attention to accessibility to meet new European Technical Specifications for Interoperability (TSI) norms. The low floor facilitates access and circulation for passengers using wheelchairs, as well as those with strollers or large luggage. There are universal toilets that are accessible for all passengers, including people using electric or manual wheelchairs.

Alstom Transport/Design & Styling

Particular effort was made to enable people with sight impairments to use the train – as well as space for guide dogs, there is relief and braille signage in the toilets, and improved color contrasts throughout. There is also the option of a system, developed with Phitech, to help these passengers to locate the doors. When a signal is detected from a visually impaired passenger's cell phone, it triggers signals and vocal instructions, emitted by markers and loudspeakers.

Double duty

Meanwhile, the Regio2N train is based on Bombardier's Omneo model, described by the manufacturer as "the world's first articulated electric multiple unit (EMU) with alternating single- and double-deck cars". It is manufactured at Crespin in the north of France. Regio2N has been ordered by nine French regions and the first trains are due to enter service by the end of 2014.

Capacity varies from 680 (360 seats and 320 standing places) for the shortest train, to 1,320 (780 seats and 540 standing places) for the longest. The regions can choose from six layouts and around 30-40 options.

"Regio2N is the culmination of our very long collaboration with Bombardier, following the earlier TER2N, TER2N NG and AGC trains," says Stéphane Pottier, transport and product design director at MBD Design. The design agency proposed six design solutions for the project, developed in collaboration with experts from Bombardier, SNCF and the regions.

With Omneo Premium, the aim is to position against the TGV, which has the advantage of speed – our train is slower but more luxurious

Patricia Bastard, partner and director, Yellow Window

GOING THE DISTANCE

Alstom and Bombardier are already envisaging intercity versions for SNCF. Both manufacturers launched prototype designs at the Salon des Transports Publics in Paris in June 2014. These are intended to replace the 40-year-old Corail trains on intercity routes not adapted for the TGV.

The emphasis of Alstom's Coradia Liner design is on creating space and comfort for longer journeys. The modular interior proposes spacious access areas and broad corridors through which large luggage and pushchairs can be moved. Baggage storage is distributed through the train – under the seats, above seats and at entrance zones. There are also improved audio and visual information systems; reclining seats each with a coat hook, electric socket and reading light; integrated wi-fi; and options for play and relaxation areas, a bar, a restaurant and in-seat dining service. A standardized driver's cab enables potential international use, while the TrainTracer analysis system is designed to alert operators when onboard systems require maintenance.

Meanwhile, Bombardier brought in design agency Yellow Window to help create Omneo Premium – an upmarket proposition with wide reclining seats, snappy colors and dogtooth-check flooring. "The concept offers an ambience that is different and quirky, using codes, motifs and colors to evoke the interior design of a home or a restaurant, thus feelings of pleasure and well-being," says Patricia Bastard, partner and director at Yellow Window. "With Omneo Premium, the aim is to position against the TGV, which has the advantage of speed – our train is slower but more luxurious, designed for the pleasure of the journey."

ABOVE: Alstom's Coradia Liner concept for intercity travel in France

RIGHT: Bombardier and Yellow Window's Omneo Premium design

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LEFT, BELOW AND BOTTOM: Bombardier's double-deck Régio2N train for SNCF

GETTING GREENER

Bombardier has paid a lot of attention to minimizing energy consumption and waste with its Régio2N design, as part of its ECO4 program.

"The environment is a major consideration for Bombardier," says Fabien Henne at Bombardier France. "We produce an environmental statement for the product at all stages of its life: manufacture, use and end-of-life. For the manufacture, we take care to minimize waste and packaging and to use recyclable packaging. The client decides the renovation period, but the train is estimated to last for 40 years. Recyclability could reach 80% with such a train."

Before, you had one design for everybody, which means that you end up with a gray and blue color scheme that is acceptable but bland

Stéphane Pottier, transport and product design director, MBD Design

"Before, you had a consensual approach, with one design for everybody, which means that you end up with a gray and blue color scheme that is acceptable to all, but a bit bland," says Pottier. "This new approach has liberated the design enormously. The new trains are classier, more colorful and have livelier motifs. Compared with the previous generation, there is a real leap forward. For the first time we have very colorful interiors; the ambiance is more dynamic and much closer to that of the home."

The train is made up of alternate single- and double-deck cars. The single-deck cars are 3.05m wide and 10.02m long, while the double-deck cars are 2.99m wide and vary in length between 13.7-15.5m for intermediary cars and 14.3-19.2m for drivers' cars. All the train's technical equipment has been placed on the roof of the single-deck cars, reducing the number of vertical columns needed and freeing up space. As with the Régiolis, bogies are positioned between the cars to reduce internal noise and vibration.

Passengers enter the Regio2N train via 1.6m-wide entrance doors in the single-deck cars. Interior options for these single-deck cars include toilets, bike storage, a wheelchair space and a seat for an accompanying passenger, or additional tip-up seats. Apart from the space taken up by stairs, the double-deck cars feature only seats. The regions have a choice of a 2-2 layout with 58cm-wide seats and a 60cm-wide corridor; a 2-1 first-class option with 65cm-wide seats; or a 2-3 commuter layout with 49cm-wide seats and a 55cm-wide corridor.

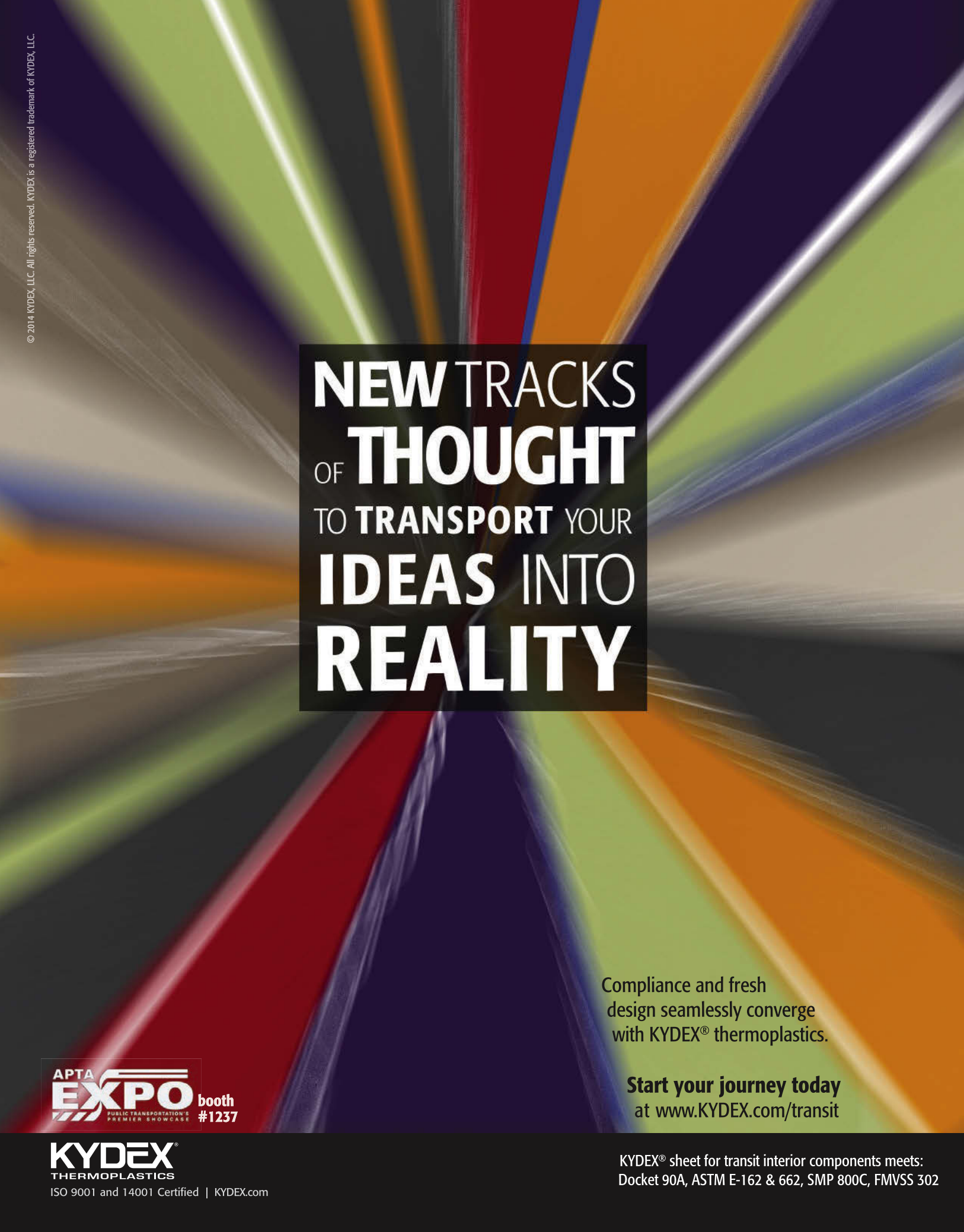
Taking five

Bombardier sales manager Fabien Henne says the majority of regions have chosen the commuter layout. "We have improved the fifth-seat option,

with greater comfort," says Pottier. The seats are rail-mounted to facilitate configuration changes.

Italian seat manufacturer Saira Seats produced prototype seats to present to the regions. The seats will be upholstered in velour with faux leather headrests. The regions have a choice of colors and patterns. MBD Design also worked with floor manufacturer Mondo to develop two patterned rubber flooring options. Each region can also choose the color of ceiling film used.

MBD Design strove to create fluidity between the two types of car. Thick glass panels are used to separate them while retaining transparency and visibility through the train. "The risk is that passengers remain in the entrance cars," explains Pottier. "Therefore the challenge was to have a very open circulation so that people move from the one-deck car to the two-deck car without realizing they have. So we used a lot of glass to make it very transparent."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Cultural exchange

Paul Priestman, global creative director of CSR Sifang, shares his thoughts on China, rail design and sustainability

In his role as a director and co-founder of Priestmangoode, Paul Priestman has traveled extensively. The London-based design agency has clients in many countries, necessitating regular visits in the course of project and relationship development. Priestman also frequently makes presentations at international conferences. This all means he has seen a lot of the world, and worked with (and designed for) people of many nationalities, which should stand him in good stead in his new additional position as global creative director of CSR Sifang, a Chinese rolling stock manufacturer. "It's an amazing appointment," says Priestman. "I'm probably one of the first Westerners to have been given that level of position within a wholly owned government company in China."

The first contact was made seven years ago, when Priestman was in China to deliver a series of talks on behalf of the UK government. The relationship was then built up slowly through a number of visits. "In China you have to visit companies several times before you can even talk about business," says Priestman. "You have to get to know companies and become friends with the leaders. Then you develop step by step, and get to really understand their requirements. I enjoy doing business in China. It's to do with trust and building up relationships. It's very different from the Western approach, which is more contractually based."

You have to get to know companies and become friends with the leaders. Then you develop step by step, and get to really understand their requirements

Paul Priestman, director and co-founder of Priestmangoode and global creative director of CSR Sifang

RIGHT: Paul Priestman

LEFT: Priestman and Gong Ming, former chief engineer and former vice general manager at Sifang

Building trust

Priestmangoode has been collaborating with CSR for several years, working with its design and engineering departments to provide input on many of the company's trains, including the high-speed CRH380A for the line connecting Beijing and Shanghai.

Priestman says that a number of projects are now under development – including intercity trains, trams and metros. Partly to help support these, in 2011 Priestmangoode established an office in China. It is staffed by a mix of locals and key people seconded from the firm's London headquarters. "In China it can be challenging to understand requests and the background to requests, mainly because of the language

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LEFT AND BELOW: The Mercury concept for high-speed train travel

difference," says Priestman. "Being able to drop around everyday to talk about ongoing projects is vital. It also shows our commitment to the contracts and to the relationship."

Talking shop

One of the key things that Priestman wants to help CSR with is creating a recognizable brand. "CSR is an absolutely brilliant manufacturer but it's fairly unknown to most people," he says. "I'm helping CSR become more accessible, to communicate its great manufacturing skill and technologies, as well as helping to give consistency to its product range in terms of design. A lot of it comes down to trust – you feel it's a safe pair of hands when you have consistent detail throughout a vehicle."

Priestman maintains a busy schedule of speechmaking around the world, and hopes CSR will benefit from representation at those events. With his experience of so many countries, he also believes he can help CSR with cultural understanding. "So if we're developing a train for a South American country, for example, we can make sure that it's culturally correct," he says.

Rapid development

Priestman's experience of working in China itself has been very positive. He says in terms of safety and fire requirements and so on, China's rail industry is at the same level as Europe and North America. "People are very quick to condemn the rapid development of China, thinking quality or safety must be suffering," he comments. "I certainly haven't seen that at all. CSR's engineers are brilliant and I have never seen such modern factories – they're immaculate, really sophisticated and produce so many trains so quickly, it's just incredible. All the leaders are immensely impressive; most come from an engineering background and they're extremely skilled people."

The design process is quite different from that in Europe and North America, where Priestmangoode is typically given a brief and asked to produce three concepts, from which one is chosen for development. "In China, the brief we're given will be very open so that we can push it in every direction possible," says Priestman. "They might require us to come up with eight concepts. Then they may develop three of these concepts in parallel. It requires a lot of manpower, but the advantage is that further down the line they have three options, which they can amalgamate or keep separate and use one for something else later. With the European method, if there's a problem you have to go back to the beginning. In China, they end up with several viable possibilities."

IN IT FOR THE LONG HAUL

For Paul Priestman, one of the great and challenging things about trains is that they last for decades – forcing designers to think ahead. He believes the Pendolino train that Priestmangoode designed for Virgin Trains, which entered service in 2002, is "only just beginning to look good, because we had to think so far ahead".

"If you design the nose of the train to look like the latest supercar, in four years' time it's going to look really out of date," he contends. "This is because the car industry wants you to buy another model, so they move the design language forward to make the old one look out of date."

Priestmangoode also tries to build modularity into its rail designs. "You have to think about which parts are going to be replaced, like the carpets and fabrics, and which bits are going to wear more quickly," he says. "If the interior is modular then that's not a problem."

ABOVE: Virgin's Pendolino train

LEFT: The design agency's Lounge Link concept

ECO-WARRIOR

Paul Priestman believes the rail industry has a vital part to play in reducing pollution and congestion. "I go to cities all over the world and there are traffic jams everywhere," he says. "The pollution can be extraordinary. People don't want to live in cities when they're like that. So what happens? Cities die. How do we solve those problems and persuade people to get out of cars?"

This aim of making public transport a more comfortable and efficient option has been played out in several Priestmangoode projects, including Moving Platforms. The concept was designed to speed up journeys for passengers (and enable greater use of existing lines) by cutting out stations completely. Passengers would transfer between trains and trams that temporarily connect while moving.

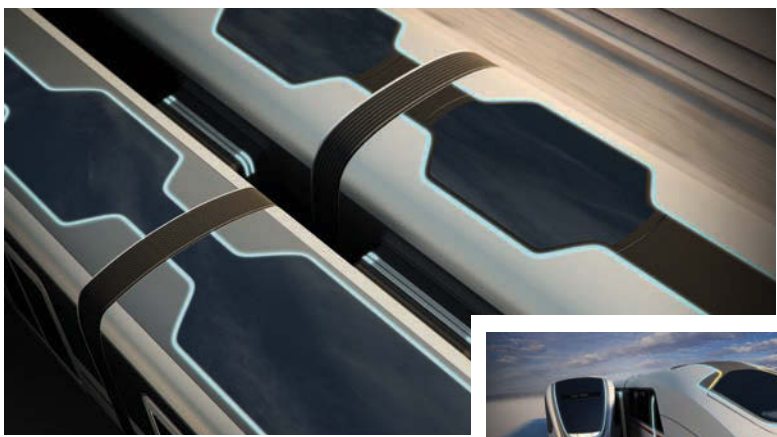
LEFT: The Walk Lines concept, designed to get people out of vehicles and ease the strain placed on public transport

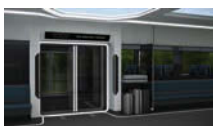
But Priestman believes rail is only part of the solution. One of his newest concepts, Walk Lines, is built like a railway line without vehicles. It would provide a clear and uninterrupted route for walkers and cyclists, separated from traffic. It's aimed at people making short journeys who might otherwise take the metro or a taxi because they don't know the way to their destination.

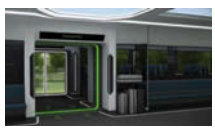
Priestman contends that as well as promoting health, it squeezes more capacity from roads that would otherwise be gridlocked. "We want to challenge the current way of thinking," he says. "You can't just think about railway infrastructure by itself; you have to think of the system holistically."

Each concept is developed to quite an advanced stage, possibly into a prototype. "Things are done so quickly," says Priestman. "We'll deliver data and they'll have made a mock-up of it in a couple of months, when typically it would take 6-12 months to get to that stage somewhere else. There's a lot to learn from their approach."

He says Priestmangoode's designers are also enjoying CSR's commitment to enriching each train with symbolism. "There's a lot more heart in it," he says. "A lot of thought goes into the narrative, which, as a designer, I find refreshing."







LEFT AND BELOW: The Moving Platforms concept

Chinese trains

When designing a train that will be used in China, Priestman says the key issue is capacity, because the number of passengers is on a different scale. "For example, across Europe there might be millions of people traveling at Christmas, whereas in China they have tens of millions traveling around their festive season, the Chinese New Year," he says. "It's incredible to see."

This is why Chinese trains are larger than they are elsewhere. The space afforded to each passenger is also generous, because all the seats have to be able to rotate to face the direction of travel. "It's not culturally acceptable to travel backward in China," explains Priestman. "Having rotating seats means you can't place them very close together. So the space has to be generous. If you're in an aisle seat you don't have to get up when the person wants to leave the window seat, for example. When people from the Sifang team visit us in the UK, they say things like 'it's so dense' and 'the trains are so small'."

To glean more legroom for Chinese seats in a way that doesn't impact the rotating function, Priestmangoode works to reduce the thickness of the seat itself. In first-class cabins, seats often recline into full-flat bed mode. Other features that are commonly expected in Chinese trains are restaurant cars, wi-fi and a hot water supply so people can make tea.

Access for all

As in Europe and North America, accessibility issues influence train design in China. Priestman believes this is only going to become more important, in line with aging populations around the world. "So many contracts now require us to deliver more than the minimum legal requirement," he says. "Inclusive design is very important. It's something we are constantly thinking about. We need to create flexible seating that everybody can use. And align the vehicle's floor to the platform to enable people to get on and off more easily."

Priestman contends that this and other innovations can be easier to implement in China, because the infrastructure is either new or still to be built. "That's one of the best things about working in China – everything's new," he says. "Culturally it's very different, but it's also very rewarding and things can happen really quickly. It's immensely exciting."

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Trams: Natasha Edwards

The new tram designed by RCP and developed for Tours, France, from Alstom's Citadis platform

City slickers

Trams are a highly visible expression of a city's brand, and often have to be extremely multifunctional – serving the city's residents and vacationers alike

RCP/Leonard de Serres

Trams are returning to service in the USA's capital city, following an absence of more than 50 years. Three Trio trams manufactured by Inekon in the Czech Republic and three trams manufactured by United Streetcars in Clackamas, Oregon, USA, are currently undergoing trials in the city.

"Most passengers will barely notice the difference between the two trams," says Ralph Burns, deputy associate director of Washington DC's District Department of Transportation (DDOT). "The layout is practically the same. The profile is crisp, the lines inside are smooth, and the next will be even more so. DC is already looking forward to the next generation, where we will be looking at wi-fi and ergonomic seats."

The DDOT has developed the design, taking care to elicit feedback from the city's residents. "The public is always involved in our studies; we always do what we can to engage them," says Burns. Thus, the layout is tailored to how people

Washington DC DDOT

will use the trams. The 2-1 layout yields just 29 seats, to make room for a lot of standing places (127). “Unlike the metro we are not bringing in passengers from long distances,” says Burns. “This is a neighborhood-to-neighborhood service. Most people just use it for one or two stops, although the seats are there if they want them.”

CCTV is installed in the cars and on the platforms, for security and to enable the operator to react to platform overcrowding with more trams.

The trams adopt the red, gold and gray scheme developed for the local bus network, and also extended to DDOT’s urban bike hire scheme. As well as providing continuity, Burns says the adoption was made because the bus service is associated with quality in terms of maintenance and reliability. It also distinguishes the trams from the city’s metro, which is separately administered.

The first trams are expected to go into service by the end of 2014 along a 2.4-mile city center route. With additional lines, the network could be extended to 22 miles and ultimately 37 miles. “We’re very excited about it,” says Burns. “Streetcars used to run in DC back in the days when they were drawn by horses.”

Scottish shuttle

Scotland’s capital city, Edinburgh, also has a new tram. The 14km line runs from the city center to Edinburgh Airport, connecting mainline train

Photos: Washington DC DDOT

Transport for Edinburgh

FAR LEFT AND BOTTOM LEFT: A 2013 showcase event for Washington DC's new Inekon tram

BELOW LEFT: Trams, buses and hire bikes offered by Washington DC's DDOT share branding

LEFT: The new tram in Edinburgh began service in May 2014

BELOW: Edinburgh's tram against the backdrop of the city's castle

stations, Princes Street and Murrayfield Stadium, as well as residential and commercial districts.

The Edinburgh Tramway ran its first passenger service on May 31, 2014. Operator Transport for Edinburgh has a new integrated transport program, which means the trams' livery (white with gray and red stripes) has also been adopted by Lothian Buses – a move similar to the one made in Washington DC.

The 43m-long Urbos trams, manufactured by CAF in Spain, can hold 250 passengers, with seats for 78, 170 standing places and two wheelchair spaces. The high-backed seats are upholstered in navy blue leather, with red piping and embroidered logo. The trams are laid out in a classic 2-2 configuration, but adapt CAF's standard tram interior specification to add the luggage space the tram needs to fulfill its role as airport shuttle. Thus, four large luggage racks are distributed along the tram.

Unlike the metro we are not bringing in passengers from long distances; this is a neighborhood-to-neighborhood service, most people just use it for one or two stops

Ralph Burns, deputy associate director, Washington DC DDOT

The 100% low floor enables level access from tram stop to tram, and the tram is wheelchair-accessible throughout. It was also designed bearing in mind the needs of people with sight impairments, and so the door buttons were conceived with an emphasis on clarity and color contrasts, there are yellow stripes on the floor around doors, and alarm signs in braille. "The interior color scheme was designed in consultation with partially sighted disability groups, so that areas where people would move


Edinburgh Trams

BUY AMERICA

Ralph Burns, deputy associate director of Washington DC's District Department of Transportation (DDOT), explains that the city's new Inekon trams were ordered in the late 1990s when no US-built trams were available. The Inekon trams had also already been adapted for the US market, to serve Portland in Oregon; and Seattle and Tacoma in Washington state.

When United Streetcars – the first modern manufacturer of trams in the USA – was founded in 2005, Washington supplemented its Inekon order with one that supported the domestic company. United Streetcars also received orders from Portland and Seattle.

The USA's Buy America Act requires authorities to favor US-made products for their mass-transit projects when the project includes federal funding.

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LEFT AND BELOW: Tours' colorful new tram, which was designed together with the line's stations and overall branding

around in and egress would have color contrasts," says a spokesperson for the City of Edinburgh Council. "The space for wheelchairs was again settled after consultation with disability groups."

One unusual feature is that sliding tinted-glass doors can be used to close-off sections of the tram during quieter evening periods.

French connection

The silvery tram that glides through Tours in France is the result of an integrated approach to transport design, the urban landscape and the city's brand identity. The entire project was entrusted to Tours-based RCP Design Concept, a design company that specializes in transport design. The company has already designed trams for cities including Paris, Angers and Le Mans in France, as well as Algiers in Algeria – using the same Alstom Citadis platform used for Tours.

Usually the creative conception of a tramway is very stratified; this was a different approach

Régine Charvet-Pello, founder, RCP

"Usually the creative conception of a tramway is very stratified; this was a different approach," says Régine Charvet-Pello, RCP's founder. "The urban landscape architects are usually appointed first to set the scene for the line. Then comes the station design; if that has not already been assigned to the architect, then the designer of the rolling stock, and finally, artists may be commissioned to produce public artwork. Tours' authorities took the decision in 2009 to confer responsibility for the creation of the line's identity, design of the rolling stock and management of the whole project to one designer-creator – guaranteeing the creative vision was maintained until entry into service."

In 2009, RCP set up a multidisciplinary creative collective to bring the project to life. As well as RCP's transport designers, the team included Daniel Buren, an artist; Roger Tallon, designer of the original TGV (France's high-speed train); Jacques Lévy and Serge Thibault, geographers and specialists in urbanization; Patrick Rimoux, a lighting sculptor; and Louis Dandrel, a sound designer.

The collective worked together to establish an identity for the 15km line and sketch out its manifesto. The tram design was considered

Photos: RCP/Leonard de Serres


RCP/Leonard de Serres

BUDDING TALENT

The Tours project has involved an unusual alliance between industry and craftsmanship, apt in a city known for its artisanal tradition and a home of the renowned Companions guild.

For each of the 21 trams, a team of local craftspeople and pupils at technical lycées were set up to create a bud (a decorative knob) to adorn the support posts at the junction of the three hold rails. The buds evoke gargoyles, monsters, fossils, temples and other diverse forms in metals including bronze, steel and tin, giving a unique identity to each tram.

alongside that of stations, the maintenance center, bridges, artworks, parking lots and the land 500m either side of the line (an area of 15km^2).

RCP conceived the tramway as the city's "fourth landscape" – after the River Loire that dominates the region, its gardens and its buildings. The tram has a deliberately fluid pared-back silhouette, sketched out by Tallon to mirror the Loire. RCP worked with Buren, one of France's leading contemporary artists, known for his striped installations, conceiving the line as a 15km-long artwork. Seven black and white stripes on the door of each tram join with those on the station platforms.

Charvet-Pello designed the tram interior in line with how it will be used. He had to consider not only commuters, but also families and groups of friends on social trips, who might welcome more informal ways of sitting and leaning. Along with conventional two-aside seats, there are convivial benches with tall wooden screens at either end and other upholstered areas surrounding a wooden table that be used for playing or writing.

RCP chose an unusual, asymmetrical color scheme. The walls and doors are a calm pale pastel blue on one side to suggest the Loire's valley gardens, and bright red on the other, recalling the red silks of Tours' historic industry and also conveying a sense of urban vivacity.

Both the tram and stations will feature high-end interior finishes and state-of-the-art media and entertainment technologies

Abudlla Yousef Al Ali, acting CEO, Dubai's Rail Agency

There are contrasts in textures, too – some of the vertical grab poles are a smooth and glossy lime green, others are a grainy and matt black.

The holistic design is rounded out by sound works by Louis Dandrel – who created a jazzy jingle and station announcements featuring a 'flutey' soprano voice – and lighting by Patrick Rimoux that is designed to sculpt the space and change with the seasons (a fresher, colder light in the summer and a warmer light in winter).

Dubai diamond

Alstom's Citadis tram was designed to be easily customizable, in line with the manufacturer's concept of "a tram, a city". Showing the Citadis in quite another light from Tours is the tram set to enter service on Al Sufouh Road, Dubai, UAE, by the end of 2014. The first tram in the region, it introduces new levels of luxury, a class system and a nose faceted like a black diamond. "It is a Citadis like the others, but the head and the interior layout is completely different," says Xavier Allard, director of Alstom Transport's Design & Styling department.

In an environment where the car dominates and passengers have to be won over to public transport, the aim for the interior was to express an upmarket image. Thus it is divided into three classes. There is one Gold (business class) cabin, which has a 1-1 layout of wide seats upholstered in leather and featuring armrests. There are five Silver (standard class) cabins, which have a 2-2 layout with blue seats. Finally there is one cabin for women and children, divided by a partial partition and featuring green seats. Women can go into all the classes, but men cannot travel in the area reserved for women and children.

"Each tram is 44m long and can transport 405 passengers," says Abudlla Yousef Al Ali, acting CEO of Dubai's Rail Agency, part of the Roads and Transport Authority (RTA). "Both the tram and stations will feature high-end interior finishes and state-of-the-art media and entertainment technologies. The tram is considered the first outside of France to be powered by a ground-based electric supply system along the track, obviating the need for overhead power cables. It is also the first to use platform screen doors in stations. These are aligned with the tram's door opening and closing mechanism, providing convenience, safety and security for passengers."

The tram has also been adapted for the area's extreme climate, where temperatures are over 50°C, and there is high humidity and sand.


RTA


Alstom Transport/TOMA – C Sasso

ABOVE: The Tours tram matches its infrastructure

FAR LEFT: Gold class on Dubai's tram

LEFT: The Dubai tram's 'diamond' nose

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Show business

InnoTrans returns to Berlin, Germany, on September 23-26, 2014. Here's a taste of some of the many railcar interior innovations you can expect to see

TEXTILE SOLUTIONS

Lantal Textiles will present its all-in-one solutions for train interiors. Every two years, Lantal produces a trendletter that forms the basis for its Conceptual Forecast collection. This is intended as a treasure trove of ideas for designers, helping them to coordinate seat cover fabrics, carpets, leathers and curtains within a balanced overall design concept. For 2014, four themes were updated.

For its largely feminine Blush theme, Lantal focused on light

reflections, mirror images, superposed colors and crystalline forms. It is a dynamic scheme designed with short-distance journeys in mind.

With the classic Framework theme, the focus was on architectural structures and three-dimensionality. It is designed to offer a calm scene for commuters working on the journey.

The checks and stripes of the Metroplexity theme were inspired by a city map. The theme is realized in luminous colors.

Finally, Sanctuary features a monochrome palette, unusual materials and subtle structures, all designed to create a demure but mysterious look for long-distance routes.

Hall 1.1, Stand 227

ENERGY-EFFICIENT TRAM

CSR will focus on its latest achievements in the development of new power systems, technologies and resources, designed to offer better, more sustainable and more efficient rolling stock.

Among these is a low-floor tram that runs solely on a supercapacitor energy storage system. Using a supercapacitor as its traction power supply, the vehicle relies on a ground-charging device at stations. A full charge takes less than 20 seconds. This eliminates the need for aerial cables.

The first of these trains will soon start trials on the Guangzhou Haizhu demonstration line in China.

Other technologies on CSR's display will include oil-electric hybrid locomotives, dual-power supply systems for intercity EMUs, permanent magnet-driven high-speed trains and other vehicle products, as well as core components like

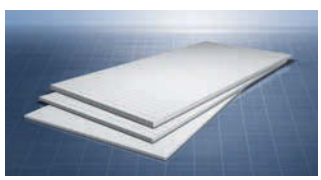
supercapacitor modules and traction converters.

CSR will also showcase its tram and high-speed products using touchscreens and augmented reality.

Hall 2.2, Stand 308

PET FOAM CORE MATERIALS

Armacell will showcase its ArmaForm PET range of structural PET foam core materials, including ArmaForm PET FR, which was developed specifically for the railway industry. The company says ArmaForm PET FR has been certified in accordance with relevant transport flame, smoke and toxicity (FST) standards, including NF F 16-101 and DIN 5510. With regard to the new European EN 45545-2 norm, Armacell explains a key benefit of ArmaForm PET is the very low smoke and toxicity level achieved when subjected to fire. According to the company, sandwich structures cored with ArmaForm PET, and with appropriate skins, achieve even HL3 classification.



The material was also designed to offer optimized strength-to-weight ratio, outstanding fatigue and corrosion resistance, and weight savings.

The combination of its light weight, 100% recyclability and excellent thermal insulation properties leads Armacell to present ArmaForm PET FR as a foam core that reduces operational costs and a train's ecological footprint.

Hall 8.2, Stand 309

REGIONAL SEAT

Borcad will showcase its Genio seat, which came to market in 2014. The company says intensive development driven by customer needs has resulted in an innovative construction. The new upholstery system is designed for greater comfort while also simplifying and speeding assembly and maintenance, particularly of the parts that are typically most frequently damaged – the seat and back cushions. Borcad says that even with a small seat pitch, its solution gives passengers more legroom. The seats can be reclined by 50mm – which Borcad contends is unusual for the regional and suburban routes this model is primarily designed for.

Many people consider the morning train journey as the beginning of their working day, and thus many operators cater for this trend by supplying wi-fi, power sockets at each seat and refreshment service. For Borcad, a high-quality table is another necessary part of the mobile office. Genio features a folding table that Borcad has designed to offer enough space and high load-bearing capacity.

Genio has already been chosen by DB Regio (pictured) of Germany.

Hall 1.1, Stand 409

SEAT LEATHERS

Boxmark will show its Xlight and Xtreme leathers. Xlight is notable for its weight of around 600g/m^2 (laminated), which Boxmark says results in energy and cost savings. Meanwhile, Xtreme was developed to be especially hard-wearing, and resistant to mold, bacteria, disinfectants, dirt, water (including chlorinated and seawater), oil and alcohol. The company says Xtreme is flame-retardant and highly resistant to stretching, tearing, breaking (even at sub-zero temperatures) and abrasions.

Xtreme has been awarded the Certificate of Material Excellence from Material ConneXion. Boxmark says both Xlight and Xtreme fulfill all international standards and are also available combined in a leather product.

Boxmark's portfolio also includes ready-made seat covers, leather for wall panels and built-in parts, ready-made wall panels and built-in parts. It can also wrap components in leather.

Hall 3.1, Stand 602

EXHIBITOR IN FOCUS

Nigel Blatherwick

global strategic marketing director, **Cytec**

What will be the highlight of your InnoTrans stand?

Cytec will showcase a range of advanced lightweight composite interior panels based on our MTM 348FR pre-preg, which was launched in late 2013. This technology enables the manufacture of thin and complex sections, including sandwich panels, which exhibit outstanding mechanical and fire performance properties, while offering weight savings over conventional materials. MTM 348FR meets the fire requirements of EN45545-2:2013 category HL2.

Can you detail a recent application?

The product is currently being evaluated for use in a number of interior applications, including the manufacture of lightweight window frames, standbacks and cantilever seats. It is still early days, but we are involved in a number of projects with carbon fiber and MTM 348FR for major structural applications in rail rolling stock. We have also produced some very interesting structures with our bio-system XMTM30 on flax, which offers the customer a completely bio-sustainable rail interior.

What do you have to bear in mind when developing products?

The key considerations for rail products – above and beyond the norm for advanced composite materials – are fire performance and cost. The customer has to see a tangible benefit if they are to move away from the conventional materials currently in use.

What challenges do you foresee?

The challenge is always going to be one of meeting total part cost aspirations and as a material supplier we need to ensure that we offer products that meet the required cost base. Apart from a competitively priced base material, the largest contribution to total part cost will be labor and in-process scrap. This means that automation and ensuring the optimum formatting of material are going to be important factors. We are excited about ongoing developments coming out of our technology center, where we are focusing a lot of resources on cost-down technologies for the serial automotive sector. I believe some of these could be adopted by the rail industry.

Meet the Cytec team on Stand 201 in Hall 5.1

CABLES AND ANTENNAS

On a joint booth with Swissrail, **Huber+Suhner's** exhibits will include new power and signal cables and products for data transmission. The company will launch a new 120Ω databus cable family and fiber-optic jumper cables, and will also be showing two new multiple input multiple output (MIMO) rooftop antennas.

Huber+Suhner will show the new thin-walled cable families Radox EN 50306 300V and Radox Tenuis-TW 600V. The company says that compared with conventional railway cables, these ones are especially space- and weight-saving, and that their electron beam cross-linked Radox insulation material ensures they retain their shape even under extremely high temperatures.

Huber+Suhner will also be offering new products for data transmission. The company will be showing two new components in its range of rooftop antennas. It says the omnidirectional Sencity Rail MIMO antenna enables system integrators and OEMs to upgrade rail vehicles to 4G/LTE standard with very little installation effort. The introduction of MIMO is intended to enable a much higher data throughput rate than with standard antennas; particularly helpful for applications that require high data rates, including internet, CCTV and repeater systems. A new low-profile MIMO antenna, particularly suitable for double-decker trains or for those

on rail routes with tunnels, will also be launched.

Huber+Suhner's expanded range of radio frequency cables will also be on show, including the Spuma 195-FR-01 and Spuma 240-FR-01 RF jumper cables. These are particularly suited to situations where a small bending radius is required. The range also includes the new Spuma 500-FR-01 feeder cable, particularly suitable for long distances. Meanwhile, the new Radox 120Ω databus cable is typically used as the control cable for multifunction vehicle bus or wire train bus applications and connects devices with the driver's cab.

Finally, Huber+Suhner will demonstrate how a gigabit backbone can be built into the train using fiber-optic cables. The company says Radox fiber-optic cables have already been used in various projects, but the market remains hesitant about the use of fiber-optic technology between carriages. Huber+Suhner will therefore be showing its project-specific jumper cables, which are designed to be resistant to vibration and shock according to the IEC 61373 standard. They have been tested over several millions of inter-vehicle movement cycles and installed for many years on operating trains. Huber+Suhner says that even under harsh environmental conditions, the data transmission performance remains extremely stable over time, proving that the technology represents a reliable option for gigabit backbones in trains.

Hall 2.2, Stand 207

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COMPOSITE SOLUTIONS

Premier Composite Technologies (PCT) will promote its services as a manufacturer of composite components.

The company has 672,000ft^2 of production space (across seven factories), in the Dubai Investment Park in the UAE. PCT's capabilities include high-accuracy tooling and stringent quality control with full material traceability – all backed by an experienced management team and dedicated production staff.

Since 2011, the company has signed six major rail contracts, delivering to manufacturers including Alstom and Downer EDI. The company worked with Downer EDI in 2012, to design and engineer a pre-preg laminate for the front-end modules of Queensland Rail's Sunlander 14 tilt train. In early 2014, a second contract was signed with Alstom to provide ceilings made from composite materials, for SNCF's 3UFC train.

Hall 1.1, Stand 607

LUMINOUS FLOORING

Tiflex has developed a method of inserting a luminous compound into its flooring as a speckle, stripe, logo, symbol or other design.

Tiflex says the material will retain its glow for a period in excess of 12 hours, after charging in both natural and artificial light. The company will display samples of high-visibility inserts combined with two straight lines, and an insert with luminous speckles. These could be used to identify exits and walkways should the lighting system fail.

The system has been tested in line with DIN 67510-1:2009. The company says DIN results are recognized by safety organizations including the Photoluminescent Safety Products Association, which also has its own classification system for signage, walkways, stair nosings, etc. The DIN test is used for ISO 17398 and BS ISO 16069.

Hall 3.1, Stand 606

EXHIBITOR IN FOCUS

Steve English,

managing director, **Birley Manufacturing**

What will you display on your stand?

Birley will be launching a new universally accessible toilet (UAT) module. The UAT has been designed to provide excellent structural integrity in a two-piece modular construction that is fully compliant to the latest issue of Persons with Reduced Mobility Technical Specification for Interoperability regulations (PRM TSI) and the requirements of Rail Group Standards (RGS). The module incorporates reliable equipment and is pre-assembled and fully tested, which reduces installation times. The other sealed one-piece floor molding prevents the egress of liquids and so reduces the risk of corrosion under the floor.

How do the challenges of the rail market shape your products?

All trains have to be PRSM-TSI compliant by 2020 and this includes toilets. There has been increased demand for a range of carriage elements, such as handrails, egress doors and toilet equipment. Other key considerations include reliability and ease of installation. Products are now expected to last at least 20 years. We have to take into consideration the number of people using the product and how it will be used, making those interfaces as robust as possible.

With rail usage expected to increase over the coming years, product durability will become even more critical. Safety and cost are other priorities; all products must be economically viable, user-friendly and safe for all passengers. We also need to consider weight and ensure the product is strong but as light as possible.

What do you think the future holds?

Developments in technology will affect how passengers and staff are able to interact with the world around them. Changes in onboard communications will mean any problems with equipment can be detected early and flagged up for repair. Controlling energy usage and conserving output will be a key challenge – the use of LEDs is one way in which we have started to address this issue. We are working toward no planned maintenance, but for now, a reduction in monitoring and maintaining equipment will assist in reducing operating costs. By improving serviceability – making it easier and faster to make repairs – costs can be kept to a minimum. Minimizing water usage using the latest EVAC technology will also be important, to reduce carriage weight.

Meet the Birley Manufacturing team on Stand 315 in Hall 6.2

THERMOPLASTIC SHEETS

Sabic has added two new Lexan sheet products to its portfolio. The company says its anti-graffiti Lexan KH6500 sheet complies with EN 45545, other European standards including the French NF F16-101 and NF P 92-501, and US rail norms for walls and ceilings. The material is designed to deliver improved chemical resistance against graffiti cleaning agents and offer excellent impact performance with high stiffness, good colorability, excellent thermoforming and low gloss retention after thermoforming.

Meanwhile, Lexan KH6200 sheet is intended for less-demanding applications such as cladding. Sabic says it complies with the German DIN 5510 norm S4/ SR2/ ST2 at 3-5mm, and that both sheets comply with French anti-graffiti norm NFF 31-112.

Two other sheets recently introduced by Sabic are Lexan H6500 and Lexan H6200. These non-chlorinated and non-brominated materials have been engineered to help meet demand for enhanced sustainability and flame-retardancy.

Lexan H6500 is an opaque, solid, low-gloss polycarbonate (PC) and acrylonitrile butadiene styrene (ABS) blend developed to deliver stiffness for sidewalls, tables and seating. The company says it can be thermoformed at a lower temperature than traditional PC materials. Its color is molded-in, so secondary painting is not needed.

Lexan H6200 is designed to deliver excellent impact performance at low temperatures (ductility down to -20°C), good colorability and thermoforming at lower temperatures than standard PC materials.

Sabic also offers an Ultem sheet solution that it says features inherent flame retardancy and low smoke emission, complying with the EN 45545 standard at the highest level for interior components across all four occupational categories at 3mm.

Hall 5.1, Stand 107

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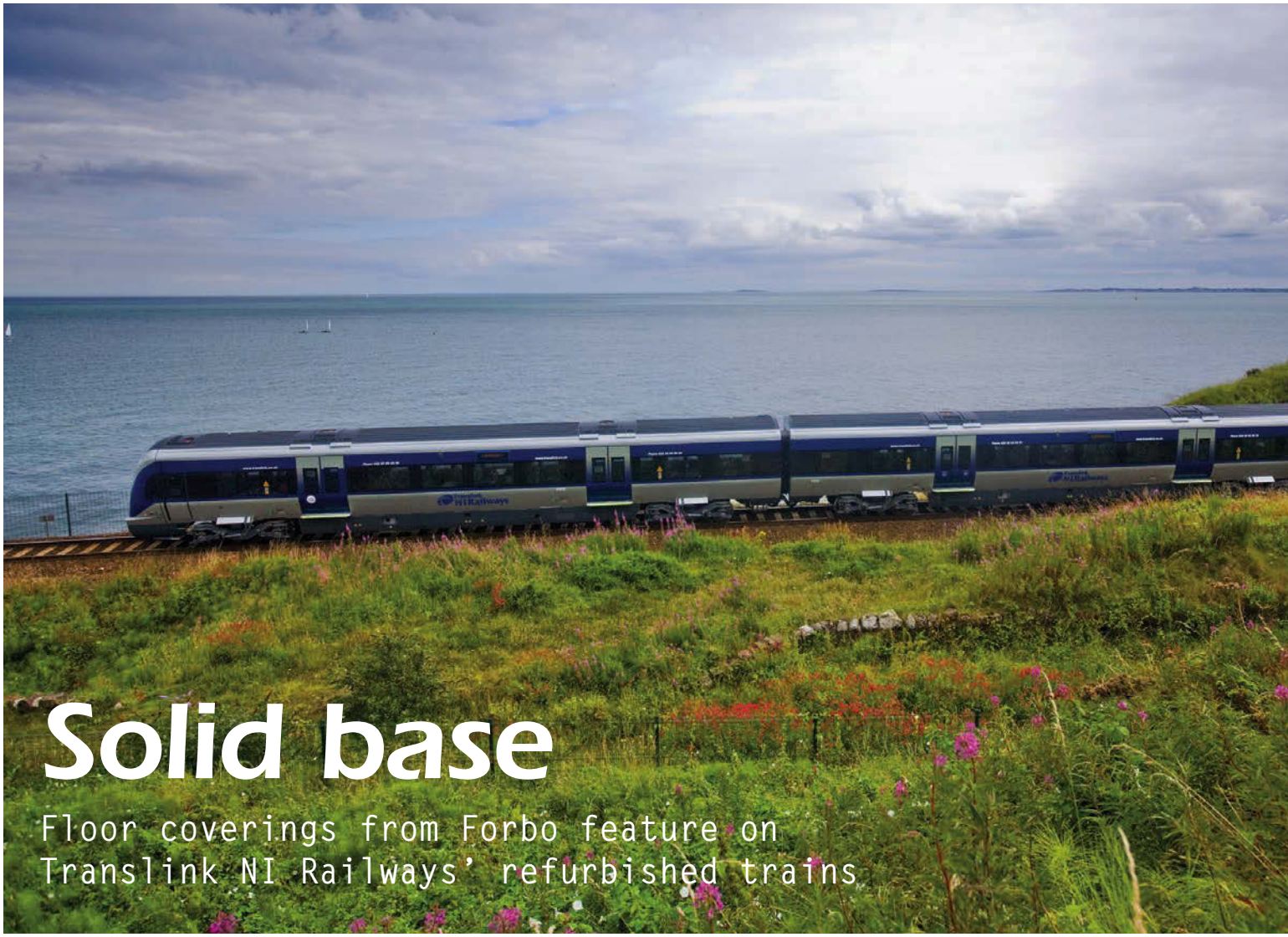


Solid base

Floor coverings from Forbo feature on Translink NI Railways' refurbished trains

Translink NI Railways, the national operator in Northern Ireland, recently upgraded its rolling stock with 20 new Class 4000 trains from CAF, one of its largest ever procurement projects. The trains entered service throughout 2011 and 2012. They feature a host of interior and exterior enhancements designed to bring the fleet up-to-date and improve the passenger experience substantially, including new floor coverings from Forbo Flooring Systems.

DCA Design – a product design and development consultancy with more than 40 years' experience in the passenger transport sector – was commissioned by CAF to redesign the interiors in close cooperation with Translink NI Railways. Operator and design consultancy alike had extensive positive experience of Forbo's floor coverings on previous projects. This led to the specification of the company's electrostatically flocked Flotex flooring for the saloons, and Coral entrance flooring for the vestibules.

"Flotex has a unique set of technical properties, which suits our client's type of operation," comments Paul Rutter, senior associate at DCA. "It provides a very practical surface that can be cleaned easily and stays looking good regardless of the wear and daily use in wet and wintery conditions. Most carpets wouldn't last long if subjected to this sort of punishment, but Flotex thrives on it. It also offers a level of underfoot comfort that is missing with alternative hard floor products."

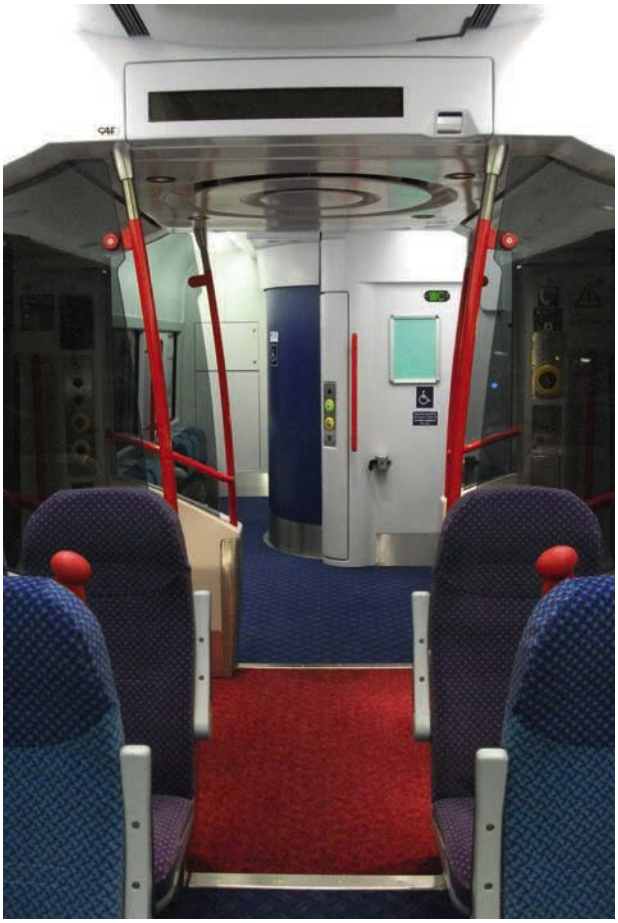
ABOVE: One of Translink NI Railways' 20 new Class 4000 trains

"We wanted to use textile floor coverings for their warmth and acoustic properties," explains James Erwin, manager of the New Trains Two program for Translink NI Railways. "However, we weren't so keen on the cleaning and maintenance requirements associated with conventional carpeting. Flotex offered the ideal alternative."

Brand designs

All the interior finishes and fittings had to be aligned with Translink NI Railways' new livery and corporate guidelines. As Flotex can be digitally printed with complete flexibility, DCA was able to create a bespoke design to its own color specifications. "This enabled us to develop a really cohesive, well-balanced interior color scheme with all elements linked together," says Rutter.

Offering a strong visual contrast to the Flotex surface, Coral Brush Activ FR was installed in vestibules to help prevent wet and dry dirt being tracked through carriages. "By far the most widely chosen vestibule matting in the UK, this textile product is renowned for its supreme durability and its ability to absorb moisture



LEFT: Forbo's wipe-off entrance flooring, Coral Brush Activ FR, was installed in the vestibules

RIGHT: Flotex was chosen for the rest of the flooring

VISUAL CONTRAST

Forbo says its flooring products have helped Translink NI Railways to comply with the latest European persons with reduced mobility (PRM) guidelines.

"We've drawn on Forbo's extensive color palettes to provide the necessary visual contrasts with fixtures and fittings throughout the carriages," says James Erwin, manager of the New Trains Two program for Translink NI Railways. "From the wide range of standard Coral FR colors, it was easy to find entrance flooring that integrated well with our other interior design products. Flotex is also very different texturally from Coral, which provides an additional navigational aid for passengers with restricted vision."

and remove soil effectively, even in the most heavily trafficked areas," says Jemma Masters, marketing manager at Forbo. "This is achieved with a unique combination of three types of yarn – capillary yarns with a large surface area to help absorb moisture, active yarns to provide scraping actions, and heavy-duty yarns to withstand heavy foot traffic."

In Rutter's view, Coral Brush Activ FR scores highly both in terms of aesthetics and performance. "We particularly like the fact that it looks more like carpet than wipe-off entry matting, yet it performs really well," he says. "Previously we've specified it for vestibules on Virgin Voyagers (now the Cross Country service) in the UK and also as the main floor covering for M6 double-deck trains in Belgium, because of its performance and carpet-like appearance. In both cases it was a complete success."

Maintenance matters

Erwin says the choice of Forbo products made sense from a maintenance standpoint. "Flotex and Coral are ideal products for passenger transport applications like ours," he explains. "They're cost-effective, affordable and work particularly well together. We installed this combination of products on our Class 3000 trains back in 2004 and 2005. Those trains are still in service with the original floor coverings, so we know how well they stand up to our punishing cleaning regimes. Nine years on and they still look great. Our cleaning staff are able to keep our carriage interiors fresh and maintain Flotex and Coral to a very high standard with a daily clean and more intensive cleaning when required."

Erwin also hints that Translink NI Railways could work with Forbo again in the future. "Forbo's floor coverings meet our expectations in terms of durability, maintainability and passenger acceptance," he says. "Right now we are looking at the possibility of installing Coral Brush on Cross Border trains that we're refurbishing over the next 28 months. All in all we see our partnership with Forbo as being very successful."

Team players

Rutter also points out the importance of effective working relationships in large-scale projects. "Working with Forbo is always rewarding," he says. "It's not just about the products; it's also about the help and support that's available, and the speed of response when timing is critical. Knowing that there's a single point of contact in the company who you can turn to is key."

These words of praise are backed up by the fact that DCA has turned to Forbo on numerous occasions. "We've specified Forbo products on all of our latest rail interior projects," says Rutter. "We believe that the visual quality and technical performance creates a winning combination at a competitive price. The flexibility to match color and pattern, and tailor unique solutions to suit our interior color schemes, means we can create high-quality, practical and visually distinctive flooring solutions that meet every design requirement."

LEFT: The Genio seat developed for ÖBB

Personal best

Operators large and small turn to Borcad for tailor-made train seats

Increasingly, clients are demanding customized solutions from Borcad. Very different looks can be achieved with the same seat model, simply by varying elements such as upholstery, armrest covers and seat head bolsters. The company recently took on such a project, in collaboration with a design studio called Descent, for a supplier of regional express trains to four self-governing regions in Poland. Although all the regions had the same seat model, four individual looks were created.

Some other operators have more challenging requirements that warrant the development of a completely new seat. For example, they might want to reduce seat pitch while also increasing comfort. "These requirements make the design and manufacture of seats a considerable challenge," says Tomáš Boruta, responsible for railway interior solutions marketing at Borcad. "The most demanding construction and design solutions for train interiors are often those intended for small series and for customers who wish to differentiate themselves from big operators. As the following examples demonstrate, Borcad is ready to handle both specialized small-series production and tailor-made seats for big operators."

Rocky Mountaineer

Rocky Mountaineer (RM) operates tourist trains linking Seattle, Vancouver and the Rocky Mountains in Canada's West. The train is among the most luxurious in the world. RM offers three classes of travel. The most prestigious, GoldLeaf Service, offers custom-made, two-level domed coaches with panoramic windows on the upper deck and a dining room on the lower deck. RM has embarked on the upgrade of all its GoldLeaf cars.

Comfort is of paramount importance in these premium-class cabins, where the journey is not a means to an end, but an integral part of the experience. Passengers expect to be able to relax and enjoy the scenery in comfort. Thus the operator partnered with Borcad to design and manufacture new seating.

The new seat that Borcad developed with RM is configured in rows of four. It is electrically controlled and features an adjustable backrest, footrest, lumbar support and heat controls.

"The project took feedback from guests and onboard staff into account," says Gord Miller, executive director at RM. One result is that the seats can be turned 180° and tables are integrated

ABOVE: Borcad developed new seats for Rocky Mountaineer's GoldLeaf cars

into armrests rather than on seatbacks to enable their use in any configuration. "The ease with which the seats can be turned gives greater flexibility to onboard staff and guests," says Miller.

Leo Express

Borcad's seat range – which serves as the basis for its customization efforts – includes regional, intercity and long-distance models. The latter category includes Excellent, a premium electrically controlled seat that is similar to an airline business-class concept. The Excellent brand was launched in 2012, following its development for the second Czech open-access operator, Leo Express. "This was an important milestone for our company in our efforts to expand into the niche market of premium travel," comments Boruta.

Russian Sapsans

Later, Borcad won a contract for Siemens' Velaro RUS EVS trains. These high-speed trains are known as Sapsans (Falcons). The contract involved the supply of Excellent seats for eight existing units and eight new units, running on the line between Moscow and St. Petersburg.

ABOVE: Seats customized for four self-governing regions in Poland

ABOVE RIGHT: The Excellent seats used for Russian Sapsan high-speed trains

The seats are for the trains' Lux class, which is in the lead car. Its spacious setup offers 23 seats, four of which are in a conference compartment. Excellent seats are placed in a 1-2 configuration and can be turned to face the direction of travel. Each seat (apart from those in the conference compartment) is equipped with a table and an LCD display, both integrated into the armrests. In addition, there is an integrated reading lamp, lumbar support, an electrical socket and a large pillow.

ÖBB regional operations

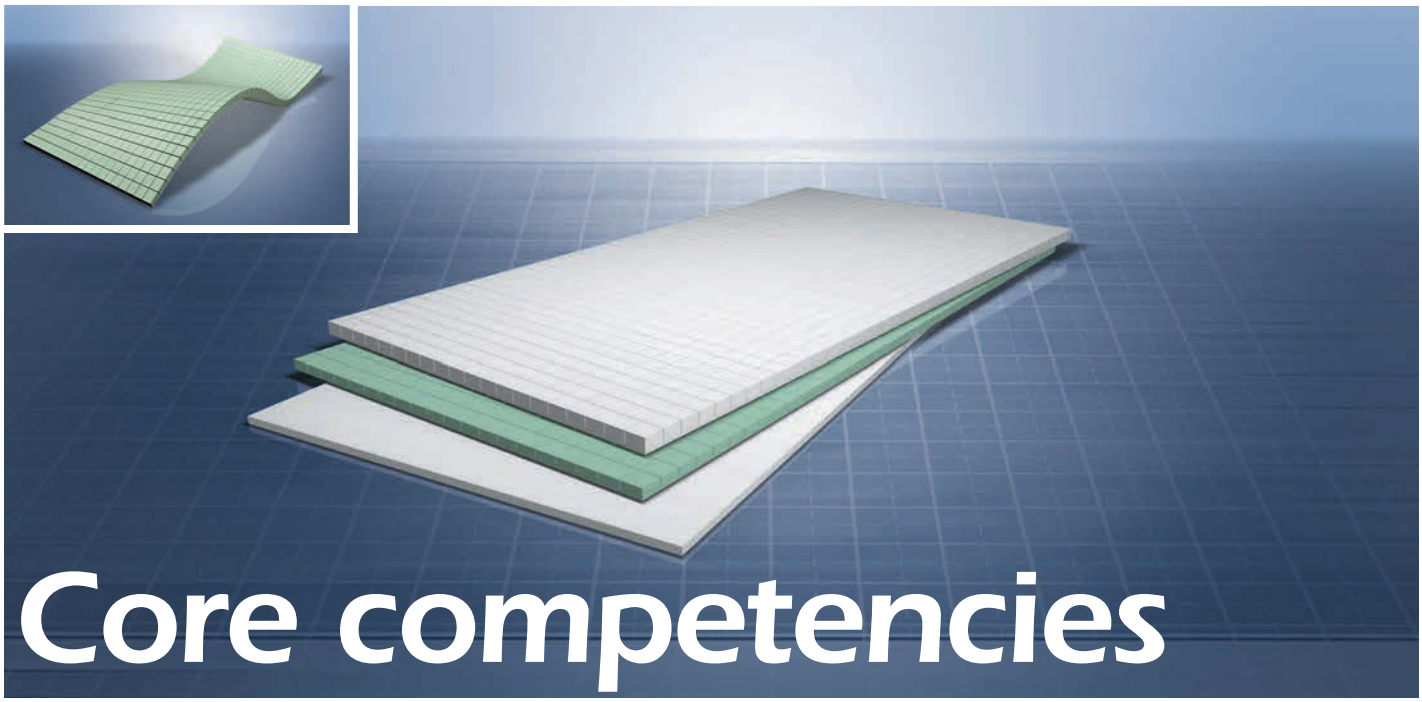
Another project involved revamping a seat designed for regional travel and marketing it under a new name – Genio. The project was initiated following a request from Siemens. Approximately 24,000 of these seats will be installed on the new Siemens Desiro ML electrical units ordered by the Austrian state operator ÖBB.

A key part of the brief was to decrease seat pitch (to enable the operator to increase passenger capacity) without affecting comfort. "Part of the solution was to reduce the depth of the seat," says Boruta. "Also, folding armrests are now attached to the rest section so as not to limit the leg space of the passenger sitting in the next row. The design of the seat and its frame thus allows for sufficient legroom, even when the seat is reclined (by 50mm)."

The customer also wanted to minimize the weight of the seat while maximizing comfort. Borcad addressed this by reducing the amount of polyurethane foam used. "The life of the seat upholstery remains unaffected," says Boruta.

For the design and color of the upholstery, Borcad cooperated with Spirit Design, which was responsible for ÖBB's brand. The upholstery was designed to give the seat a light and simple look.

The seats can be arranged in rows or facing each other, but the most efficient solution is the row setup. Borcad also developed a new headrest with a handle on the aisle side. "The headrest is shaped in such a way that it holds the head in a pleasantly relaxed position," says Boruta. "Through our efforts, traveling in regional trains has become more comfortable."



Core competencies

Thermoplastic PET foam cores offer a solution for advanced composite sandwich structures in transport applications

Over the past six years, Armacell has seen its structural polyethylene terephthalate (PET) foam cores for sandwich composites become established for applications such as wind energy rotor blades, and architectural façades and roof structures. Still, compared with most other core materials available – such as PUR, PVC, SAN and balsa wood – PET foam core is a very new material. "This also means that it is still in a period of rapid development, and its full potential is far from being reached," says Stefan Reuterlov, general manager of technical services at Armacell. "So far, its success is a combination of excellent fatigue and fire, smoke and toxicity (FST) properties. It has very good temperature stability compared with most other foam cores, and excellent compatibility with all resins and manufacturing methods."

While most other structural foam cores are produced in a batch process, Armacell's PET core – ArmaFormPET – is created using an extrusion process. Reuterlov says that means that variations in density and other properties are markedly less, and quality control procedures are easy to implement.

Sandwich composite structures are well established in train applications, but Reuterlov argues that all traditional core materials have drawbacks that prevent the sandwich constructions from achieving their full potential. "For example, with the introduction of the new European EN 45545-2 FST norm, the requirements of the core material, especially regarding smoke and toxicity, have become even more demanding," says Reuterlov.

He contends that one of the big advantages of ArmaFormPET core is the "very low" smoke and toxicity level it achieves when subjected to fire. "Even though standard PET core is not self-extinguishing, this is normally not needed anyway for sandwich structures when testing to EN 45545-2, as the skins handle the flame response," says Reuterlov. "This makes it possible, with the right skins, to have a sandwich structure that achieves HL3 classification when using standard PET foam cores that would be impossible to duplicate with PVC core, for example."

Strong reasons

Impact requirements are another important parameter for both exterior and interior panels. "Important factors to optimize the impact performance and resilience of the sandwich structure are the core materials' compression strength, ductility and adhesion to the skins," says Reuterlov. "With ArmaFormPET core, these requirements are all met, and comparative testing shows that a PET-cored sandwich structure can outperform honeycomb- and balsa-cored structures."

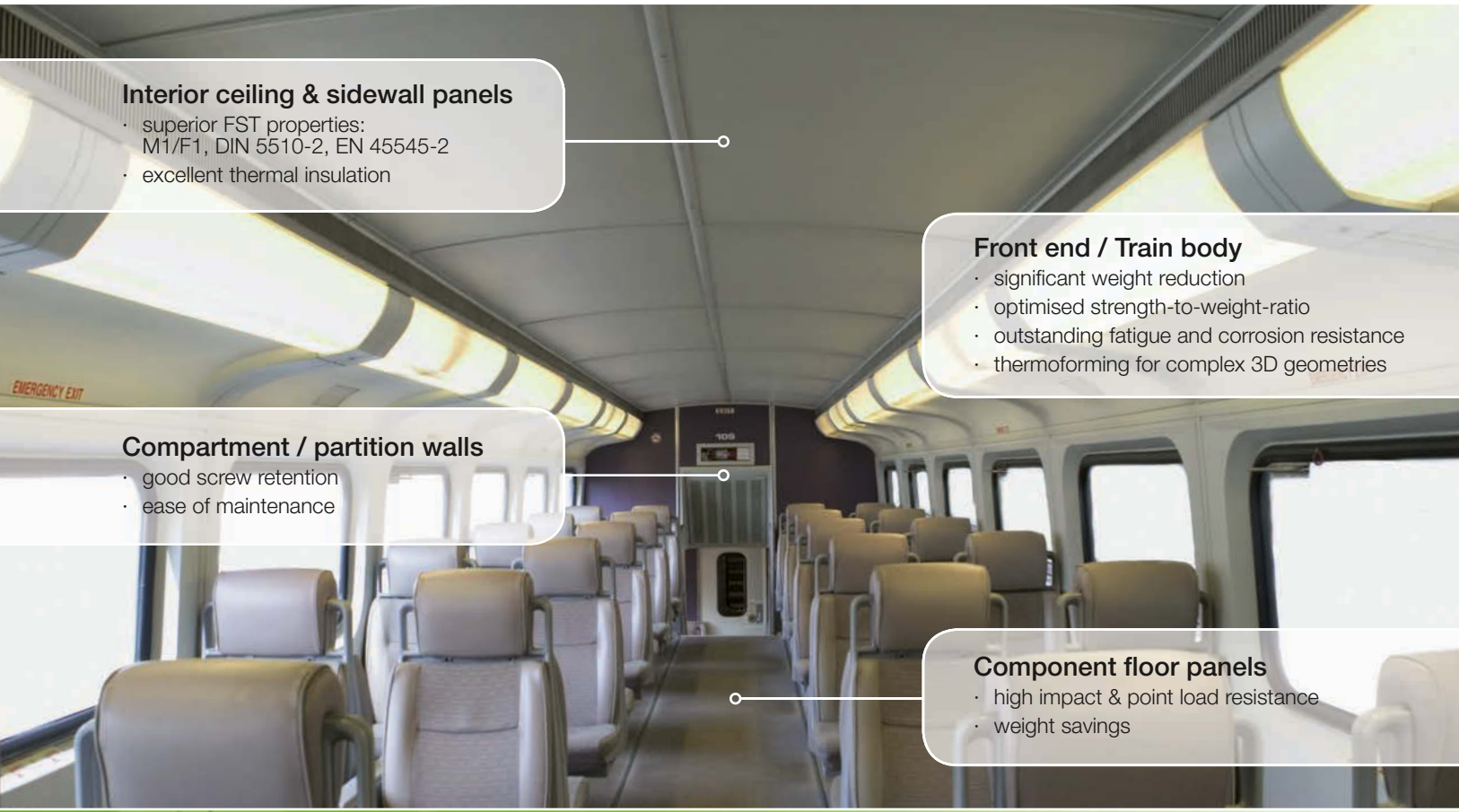
Environmental impact is also of great importance. PET is a thermoplastic polymer, which means it can be recycled. "ArmaFormPET was compared with traditional core foams in a lifetime assessment," says Reuterlov. "In all relevant categories, ArmaFormPET foam outperformed the other materials."

Armacell believes that although it is a relatively new core material, its thermoplastic ArmaFormPET foam core has proven itself a cost-effective alternative for advanced composite sandwich structures in transport applications. "Testing, including impact and FST assessment according to EN 45545-2, has shown this material can cope with the sector's design requirements," says Reuterlov.

ABOVE: ArmaFormPET foams, which can be used as a core for sandwich composites

ArmaFORM PET foam cores - the perfect match for the Railway Industry!

ArmaFORM®



Interior ceiling & sidewall panels
- superior FST properties: M1/F1, DIN 5510-2, EN 45545-2
- excellent thermal insulation

Front end / Train body
- significant weight reduction
- optimised strength-to-weight-ratio
- outstanding fatigue and corrosion resistance
- thermoforming for complex 3D geometries

Compartment / partition walls
- good screw retention
- ease of maintenance

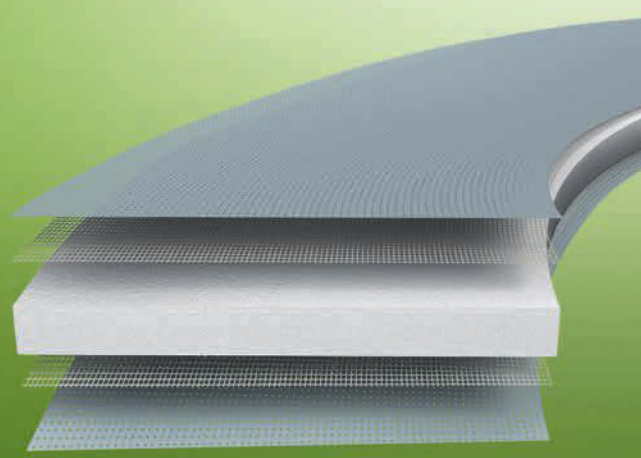
Component floor panels
- high impact & point load resistance
- weight savings

Light weight for
- improved energy efficiency in operation
- increased freight & passenger revenues

Overall cost reduction through
- reduced operational costs over its life span
- reduced installation costs and time

Safety & comfort through
- superior FST properties: M1/F1, DIN 5510-2, EN 45545-2
- excellent insulation properties for efficient heating / cooling systems

Sustainability
- less CO_2 emissions in operation
- less energy / fuel consumption in operation
- full recyclability at the end of the train's lifetime



ArmaFORM®

PET foam core for sandwich panels used in railway application

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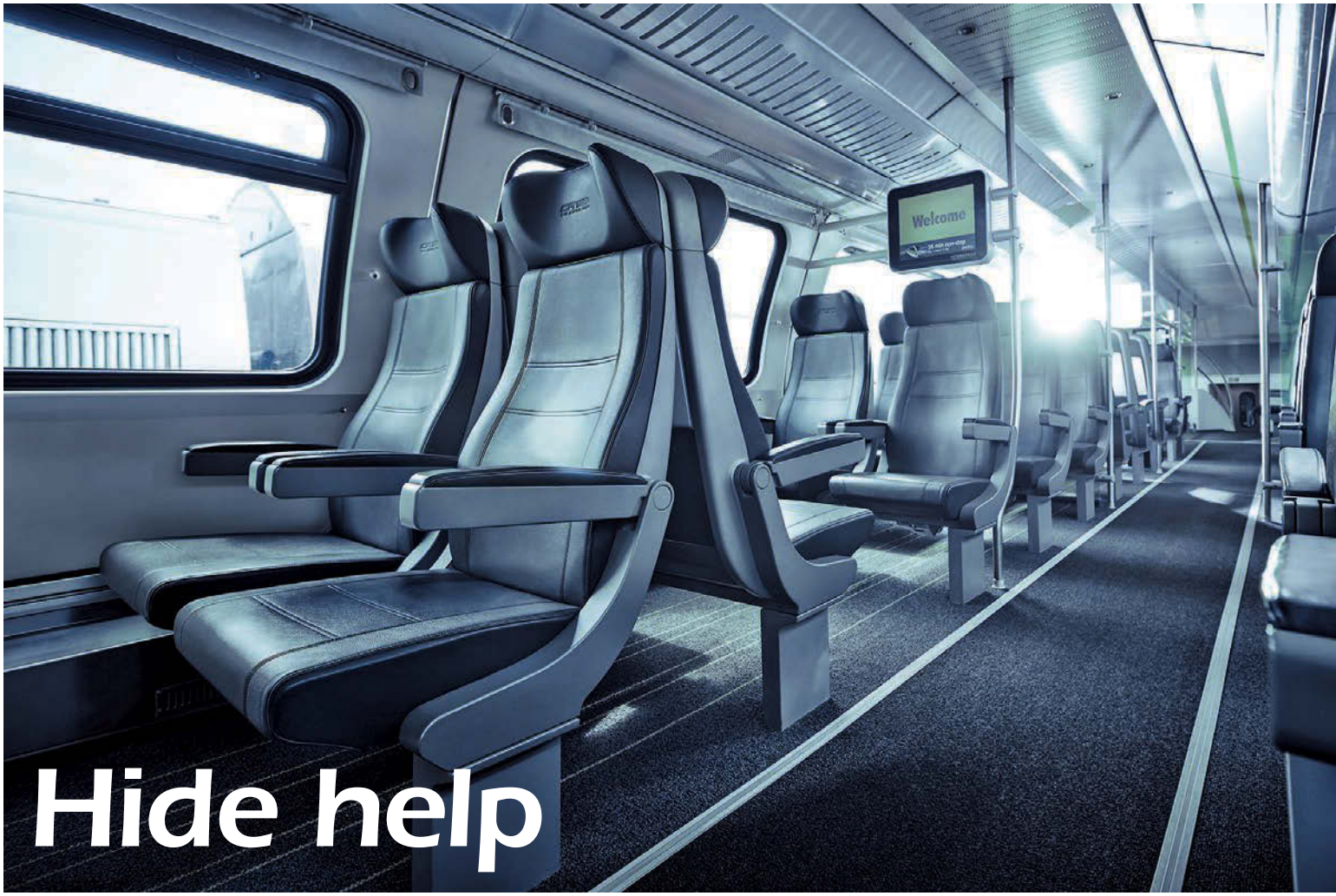


Hide help

To be able to meet customer demand for innovative and customized leather solutions, Boxmark has invested a lot in research and development

Designers' visions can be translated into customized product solutions at Boxmark in Slovenia. The research and development center develops both one-off and serial-production leather solutions.

"It is our passion to bring out the best qualities and characteristics within each piece of leather and convert it into extraordinary quality," says Marjan Trobis, managing director of Boxmark Slovenia. "This passion is visible in every product that leaves the facility. From leather hides to leather-covered components, be they prototypes, serial products or customized workpieces – each creation is a combination of master craftsmanship and industrial manufacturing technology."

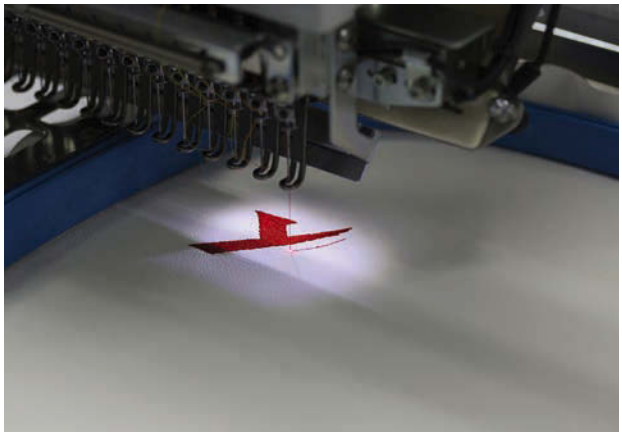
Investment

The automotive industry has been a successful market for Boxmark for decades; the company has been involved in the development and production of many automotive interiors. But in 2012, faced with increased demand from the airline, shipping, railway and furniture industries, it became necessary for the company to expand its Slovenian facility.

ABOVE: Seats on Vienna's City Airport Train, upholstered in Boxmark Leather

"Concrete results and the considerable investments made illustrate the importance that Boxmark places on research and development," comments Trobis.

In addition to the expansion of production areas and the modernization of existing machinery, many new pieces of equipment were installed at the facility. They include 3D scanners and computing systems that enable the development of virtual prototypes. The new equipment also includes CNC machines, band saws and milling machines. Boxmark is also able to create foam models, perform foam



reconstructions and add upholstery to existing seat systems and add-on components.

"Every customer requirement is unique and brings its own challenges, for which we need to find timely and customized solutions," says Alexander Mesaric, head of the engineering center at Boxmark Slovenia. "With our manufacturing facilities and machines, which were custom-made for us, we can fulfill even unusual requirements reliably and on schedule. Together with scientific institutes, we are permanently working on new machines and processing technologies so that we can continue being one of the best."

Striving for perfection

The desire for a perfect and unique final product is the starting point for all development projects carried out by Boxmark. "Our ability to understand the customer's ideas quickly, our attention to detail, creativity and the high level of qualification attained by each employee, provides the basis for a reliable realization of visions," says Trobis. "The company tackles all kinds of challenges. Be it new leather seats for vehicles; sophisticated and well-designed furnishings for aircraft, ships and trains;

LEFT: Boxmark's Slovenian facility, which was recently expanded

LEFT: Modern technology meets artisan skill in Boxmark's creations

classic seating; or trendy and stylish wall coverings and building constructions – we produce all types of interior solutions."

Rail trends

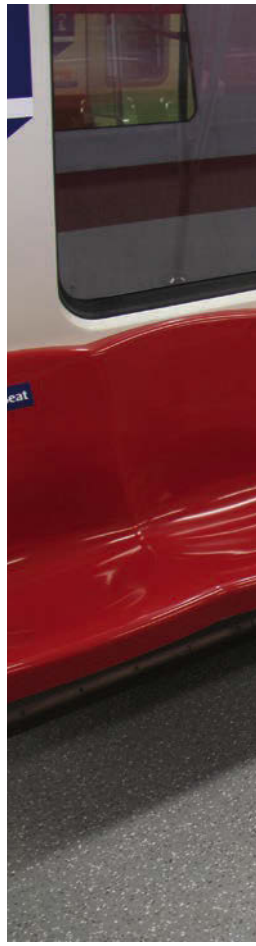
Interior fittings are currently being developed and mass-produced for several railway operators at the Slovenian facility. "The steadily increasing number of railway travelers requires the adaptation of the railway interior to today's demands and standards," says Trobis. "In doing so, importance is attached to individuality and innovation. In addition to the exclusive ambience that leather creates in any interior, this material offers extraordinarily good hygiene properties, as well as unsurpassable ease of care and resistance."

Boxmark's specialized leather products for the rail interior industry are Xlight and Xtreme. The company says the key selling point of Xlight is that it weighs 600g/m^2 including lamination. "This product can be used to minimize the total weight of the train," says Trobis. "In this way, energy can be saved, and pollutant emissions and costs can be reduced."

The company says Xtreme leather is notable for "above-average" life, high abrasion resistance and its tensile, stretching and tear properties. The leather is antibacterial and antimicrobial, and resistant to substances including disinfectants, sweat, urine, water, oil, alcohol, dirt, light, UV, mold, chlorinated water, seawater, suntan oil and mosquito repellents.

"Xlight and Xtreme fulfill all international standards and are also available combined in a leather product," says Trobis. These leather ranges are applicable to all interior components.

Boxmark's leathers are also designed to accommodate operators' aesthetic demands. Whether smooth, perforated or embossed, embroidered, printed or laser engraved, provided with contrasting or decorative stitching, Boxmark offers a full range of leather refining and processing techniques for prototypes as well as for serial products.



Higher ground

Treadmaster Flooring works closely with many design houses to develop custom floor coverings for specific projects

ABOVE LEFT: The UK's IEP train, for which DCA specified Treadmaster's TM8 and Euroflor

ABOVE: A metro featuring Treadmaster flooring

Flooring based on cork and rubber has been supplied to the transportation sector by UK-based Treadmaster Flooring since 1951. Its synthetic rubber fire-safe floor coverings are made of a colored compound with multicolored speckles of the same material. For trams, light rail and overground trains, its range includes the TM7, TM8, Euroflor and Creations brands. Creations also includes patterned versions. For overground trains, the flooring is available with added cork, under the brand name TM5. For underground trains, Treadmaster recommends TM7.

Working with customers

These ranges can be customized to meet the train interior designers' needs. This approach was recently taken to support DCA in the interior design of Hitachi trains for the UK's new Intercity Express Program (IEP). The trains will run on the Great Western Main Line and the East Coast Main Line.

The project has presented a range of challenges for the interior design team at DCA, especially in the toilets and driving cabs. As with all new train interior designs, materials had to be selected to ensure the right mix of visual attractiveness, longevity in service and technical performance.

Balancing act

"From a design perspective it is important to select materials that offer the right balance of physical attributes," says Paul Rutter, senior associate at DCA. "Flooring has to be easy to clean, hard-wearing and non-slip, with a premium look and feel to give the right visual impression. All too often materials can be selected purely because

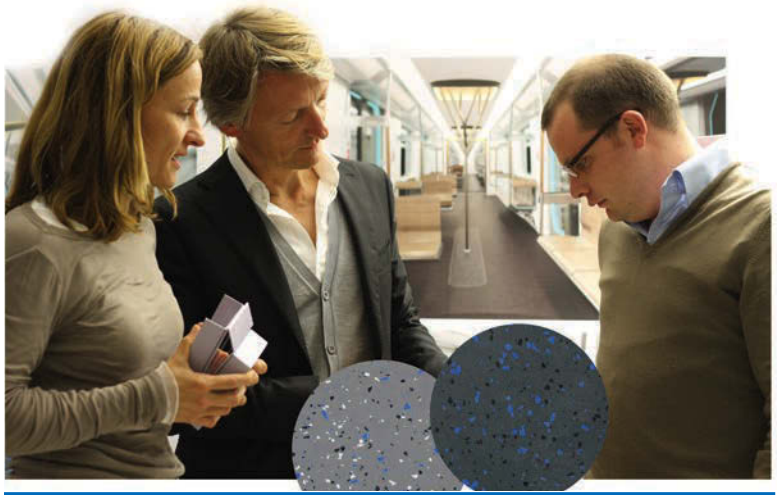
of their low price or physical performance attributes such as fire and abrasion resistance. In isolation, these features meet the technical specifications but do not create that special quality that the best designs can achieve."

For the IEP's toilets and cab, Treadmaster's TM8 and Euroflor products were selected to provide the required design flexibility and to outperform the technical requirements. "The ability to select colors that integrate with the interior schedule of finishes was a big bonus as it allowed us to customize the designs rather than use standard catalog colors and finishes," says Rutter.

Clean sheet

Treadmaster says that both floor types provide an extremely hard-wearing, non-slip surface that is fully waterproof. The trains' cleaning regimes dictated that the floors had to be inert to solvents, oils and chemicals, and allow daily washing with minimal physical intervention to keep them looking as good as new.

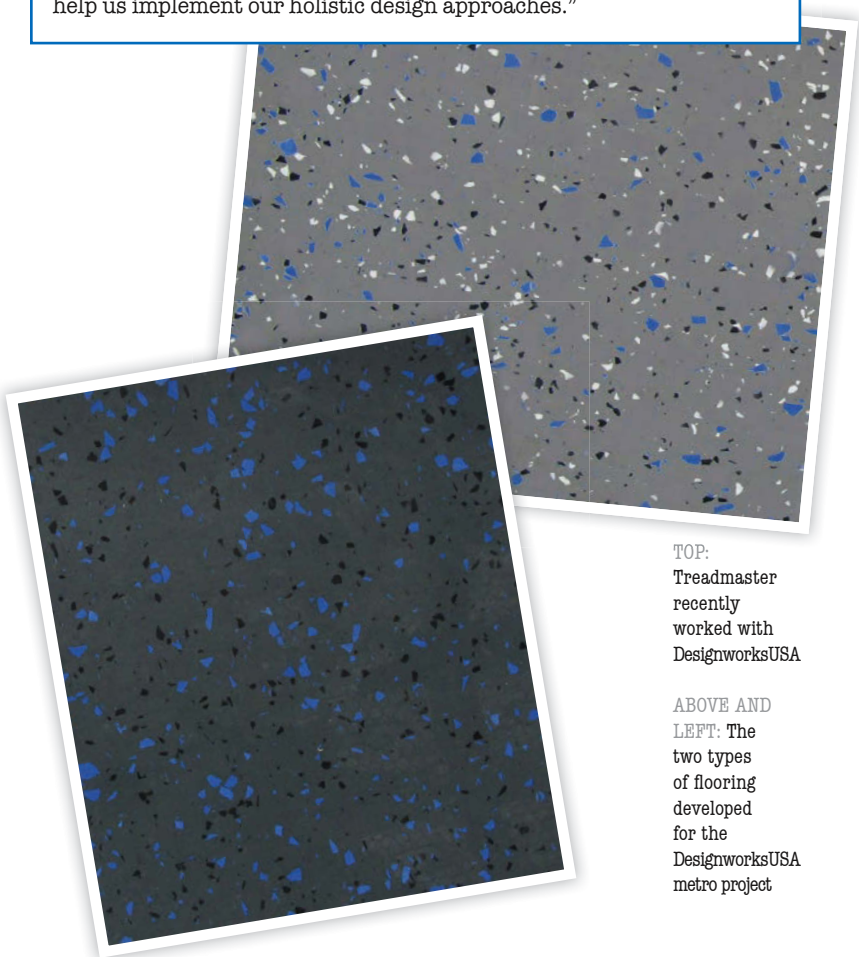
"Treadmaster worked with us to create a unique combination of finishes and surface textures to provide a practical, good-looking product that enhances the interior environment and, hopefully, will create the timeless quality that all the best designs achieve," concludes Rutter.



STRONG PARTNERSHIP FOR ASIAN METRO

In another close collaboration, Treadmaster worked with BMW Group subsidiary DesignworksUSA to create the flooring for a metro in Asia.

"Treadmaster is a valuable partner in the creation of customized solutions that stay true to the initial design intent," says Elke Weisbarth, lead designer at DesignworksUSA. "With a high degree of design understanding, profound knowledge of how to move things in bigger structures and with solutions for solid-colored floor coverings that fulfill the highest demands in the market, Treadmaster was able to help us implement our holistic design approaches."



TOP: Treadmaster recently worked with DesignworksUSA

ABOVE AND LEFT: The two types of flooring developed for the DesignworksUSA metro project

Bundle of fun

The latest version of the Funtoro entertainment system has plenty of features to keep passengers happy

The latest Multimedia On-Demand (MOD) solution from Funtoro, part of the MSI Corporation, enables each passenger to choose their own entertainment, from hundreds of movies and thousands of music files and photographs. The system is now available for trains in high definition with 10.1in touchscreens (which are integrated into seatbacks or armrests) running on an Android platform.

Molpir is the European representative and integrator for the system. Molpir collaborates with vehicle and seat manufacturers to implement the system, designing and developing installation kits and accessories for various seats. One project involved working with Grammer to integrate a 10.1in monitor into the back of Grammer's ICE3000 seat for RegioJet. This seat will be one of those shown at InnoTrans 2014, in Berlin, Germany, September 23-26.

Molpir is also responsible for the Funtoro service network in Europe, offering warranty and post-warranty service.

Crowd-pleasers

The latest version of Funtoro uses a stronger central processing unit to enable improved and new functionalities, including internet access, multichannel TV and new games.

According to Molpir, a customer satisfaction survey of 1,600 passengers, conducted by a US operator, revealed live TV to be passengers' most wanted feature on board, followed by good food and refreshments. "Funtoro MOD can answer both these requests, as it provides live TV with plenty of channels, and can be configured to enable passengers to order refreshments directly from their seats," says Lubor Lazar, project manager at Molpir.

As well as live TV (either DVB-T or satellite TV), passengers can watch images from onboard or front-facing cameras and content from other AV sources. GPS route information shows passengers the time and distance to the next stop or final destination. This can also be configured to trigger location-based travel information and advertisements. It is also possible to integrate an internet connection to enable passengers to browse the web, visit social networks and reserve tickets, hotel rooms, hire cars and taxis.

Each monitor has a 1.1A USB port for charging passengers' personal devices. Depending on the way the monitor is integrated, LED reading lights can also be installed.

Content management

Lazar says further benefits for operators include: the ability to implement commercial breaks into media content; dedicated software tools designed to make media content management easy; and cloud services for remote system diagnostics, content management and statistic gathering.

The Funtoro system and its components are also designed to be robust enough to withstand rough handling by passengers. "The cabling and integration kits are prepared for the new EN45545-2 regulation," says Lazar. "Using new types of data cables in CAT7 with POE Ethernet gives incomparable reliability and speed of connection between the monitors and the server."

ABOVE: Molpir supports European customers of Funtoro with services, including installation kit design

Clean sheet

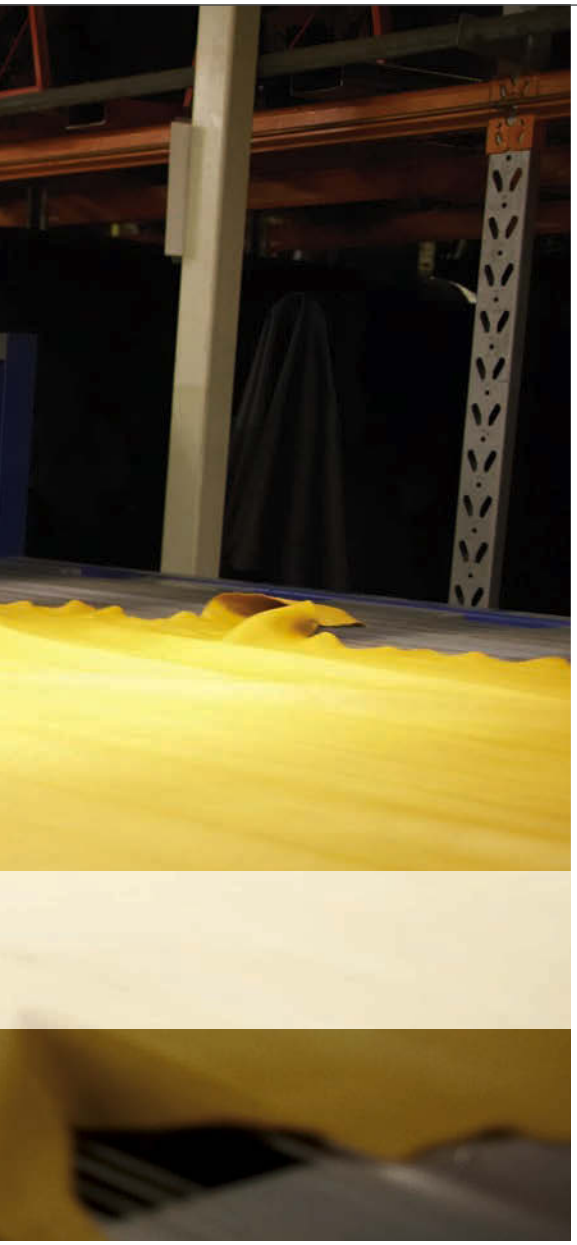
Investment in a new treatment facility at its tannery has made Elmo Leather's wastewater fit to drink

Since its foundation in 1931, Elmo has grown to become a leading manufacturer of leather for the railway, aviation, automotive and marine industries. The Swedish company develops, produces and sells leather in about 45 markets worldwide. More than 95% of its sales are abroad.

Elmo's head office in Svenljunga, Sweden, is home to the company's production, product development and sales activities. It also has regional sales offices in New Jersey and Hong Kong.

The tannery, located on Sweden's west coast, has focused on the environmental aspects of its entire production process for decades. "A tannery should not be measured just by the chemicals in its leather, but also by the chemicals in its wastewater," says Jimmy Ahlgren, company sales director. "Using groundbreaking techniques, Elmo prides itself not only on meeting existing international standards, but on taking them a step further to set a new benchmark for the industry."

ABOVE: Elmo returns clean water to this Swedish river



MAIN, LEFT AND ABOVE: Elmo's tannery in Sweden

ON THE RANGE

Elmo's leather for the rail market is marketed under the name Endurance. The leather comes from Scandinavian cattle and is treated, dyed and tested at Elmo's tannery in Sweden.

The Endurance brand includes four products. Elmotech is a soft, semi-aniline leather with a heavy structure. Elmoline is similar but thinner. Both are available in a broad range of colors. Then there is Elmo Transport, a technical leather that is available only in custom colors.

Rounding out the range is Elmocool, which is based on the TFL Cool System. Sella Cool dyes are used to color the leather, which is then finished with Roda near-infrared (NIR) transparent pigments. Elmo says the technology reflects NIR waves, preventing a build-up of heat, making a difference of up to 20°C with black leather. So far Elmocool has mostly been used in automotive applications.

BELOW: The Endurance range for rail applications

River sweep

In 2004, the company invested in a €5m (US$6.8m) cleaning facility that it says reduces its nitrogen effusions by 94%, chromium by 99.6%, biochemical oxygen demand by 99.9% and chemical oxygen demand by 99.1%.

"The water used in the tanning process is taken from the nearby river and returned cleaner than before," says Ahlgren.

Downstream, a regional cleaning facility is turning the water from the river into drinking water, supplying cities on the Swedish west coast. "We proudly see this as a proof of the minimum impact we're having on the environment," says Ahlgren. "It's a great leap toward becoming one with nature."

Natural choice

Elmo says that its products are certified to EN45545, Airbus ABD0031, IMO 652, DIN5510-2 and NF 16-101. "For operators that would like to offer their customers a unique experience on their trip, whether for short or long journeys, Elmo is a partner they can rely on," says Ahlgren. "The soft feel of the technical leather combined with its natural look and tough resistant surface enables it to live up to the demands passengers place on the interior when traveling."

Elmo's collection for the rail market is called Endurance. "The range has been developed and tested to meet rail operators' high standards regarding fire safety and durability in a demanding environment," says Ahlgren. "As well as being durable, this leather is resistant to dirt and quick and easy to clean."

Running start

It was only established in 2011, but Premier Composite Technologies' rail division has delivered some big projects

Composite materials have opened up a new world of solutions for railcars. They can be used to mold complex, fluid and creative forms and produce efficient solutions. They are even capable of simulating the look and feel of traditional materials while delivering all-important weight savings.

Premier Composite Technologies (PCT) is a leading supplier and manufacturer of advanced composite components, based in Dubai, UAE. Since establishing its rail division in 2011, the company has signed six big rail contracts, and subsequently delivered rail projects to manufacturers, including Alstom and Downer EDI. In early 2014, a second contract was signed with Alstom to provide a ceiling made from composite materials for French operator SNCF's 3UFC train.

Front ends

One of PCT's earliest projects involved the delivery of one of the first composite-based aerodynamic nose cones for German carrier Deutsche Bahn's ICE train. Then in 2012, the company was selected by Downer EDI to produce low-weight but high-resistance front-end modules for Queensland Rail's Sunlander 14 tilting train.

PCT worked with Downer EDI to design and engineer a pre-preg laminate for the front-end parts, using carbon and glass fibers combined with a toughened epoxy resin system. "The end result was a product that met vital ballistic and impact performance, while keeping panel weight to the absolute minimum," says Praveen PC, business unit manager for the rail division at PCT.

Highly accurate tooling was a key requirement on the project. PCT says the required accuracy was achieved by using its five-axis milling machine. All tooling and production parts were also supplied with comprehensive coordinate measuring machine inspection reports created using the in-house Leica laser tracking system.

The cab fronts themselves were laminated using a combination of a carbon fiber pre-preg with styrene-acrylonitrile resin foam core and glass fiber pre-preg with an aluminum core. All parts were reviewed extensively in line with the company's quality management system. Full material traceability was provided by the company's enterprise resource planning system.

Advanced composites

PCT has considerable experience working with carbon pre-preg systems, high-accuracy machine tooling and extensive quality-control systems. All parts are manufactured in a specialized,

MAIN: PCT's in-house, five-axis milling machine

LEFT: The company also has a six-axis milling machine

ABOVE: The Leica laser tracking system

FAR LEFT: A toilet module created by PCT

temperature-controlled, dedicated facility. As well as the five-axis CNC machine, the facility houses lamination, finishing, painting, assembly and packing areas.

Each project is run by experienced project management teams and dedicated production staff. The company is committed to continuous improvement, constantly investing in technology and new processes. "This foresight has helped PCT keep ahead in today's competitive business environment, while operating efficiently and effectively," says PC.

Favorable review

Recently, PCT has also gone through several rounds of extensive audits carried out by some of the leading names in the rail industry. "Audits eventually lead to higher quality, better process stability and a lower scrap rate in production," says PC. "Clearing these audits is a strong indication of our in-house capabilities in terms of facilities, technology and manpower."

PCT will be exhibiting on stand 607 in hall 1.1 at InnoTrans, to be held in Berlin, Germany, on September 23-26, 2014.

HISTORY LESSON

Premier Composite Technologies (PCT) designs and manufactures composite components for the global architectural design, marine, rail, aerospace and renewable energy markets.

The company was established in Dubai in 2006 by a team of professionals possessing more than 25 years' experience of constructing composite components. Since then, the company has seen tremendous growth. The rail division was set up in 2011.

High tech

Composites play a key role in Korba Design's new roof development

Following its composite floor development, Korba Design has created a structural roof with composite air-conditioning ducts. The key aims driving the design were to reduce weight and noise transmission, as well as to improve the efficiency of the air-conditioning system.

The composite element or panel is wrapped over aluminum extrusions, which are bonded to the underside of the composite panel. By covering the extrusions in this way, Korba Design aims to insulate them from the cold or heat outside, and provide noise insulation. The company says that because the composite is in one piece, there are no stress points and no paths for water to leak through. The assembly has a U shape, which Korba Design says makes it stiffer.

The roof's air-conditioning ducts are made entirely from a composite material, the aim being to reduce weight and improve efficiency by preventing heat transfer.

"Trials carried out in Canada in winter 2013-14 showed a huge increase in efficiency compared with insulated aluminum ducts," says Alfons Garcia, CAD design manager at Korba Design. This resulted in an operator choosing the composite ducts for a retrofit project that is set to continue over the next year.

Design freedom

Garcia says that the benefits of composites are that they offer limitless possibilities in terms of shapes, with no compromise on the structural integrity of the final product. "We are not limited to one type of resin or fiber," he explains. "The ability to use glass and carbon fiber hybrids and different resin systems is enabling the industry to push to new heights." For example, it wasn't Korba Design's original plan to start building such large components, but Garcia says that the initial prototype sections were so impressive that they had to go for it.

Because Korba Design has won a 10-year contract to supply this new roof, it is now building a new manufacturing facility in the USA that should be ready to deliver its first items in January 2015.

Clubbing together

Meanwhile, with the aim of being able to offer a more complete package, Korba Design is now working closely with Cintrafil, based in Tence, France. This cooperation has added metal working and powder coating paint capabilities to Korba Design's offering. Cintrafil has supplied stainless steel fabricated sub-assemblies to the rail market for more than 10 years.

Maurice Chastagnier, Cintrafil's production director, says the company is looking forward to expanding its range of products for the rail industry. Currently it is about to start working with Korba on the development of a lightweight folding table aimed at premium-class carriages in the high-speed sector. The aim is to come up with a sturdy, lightweight and functional table that will support the needs of today's passengers – with features such as cell phone charging pads to negate the need for power sockets.

MAIN: The roof is constructed by wrapping a composite element over aluminum extrusions

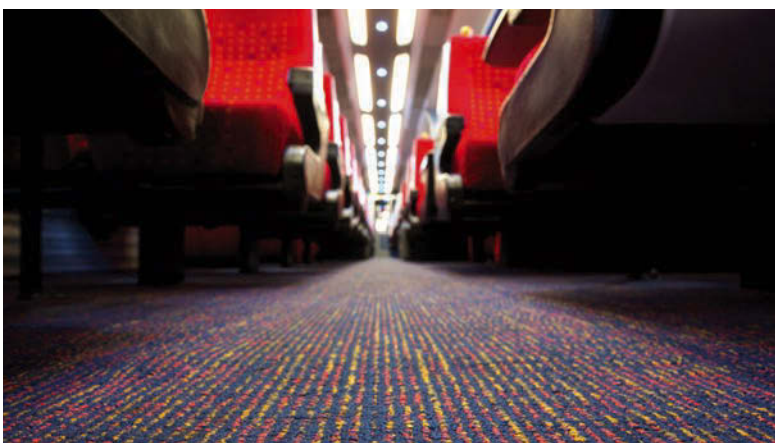
ABOVE: The air-conditioning ducts, which are made from a composite material

Take five

Five Scottish companies with complementary skills found themselves working together on a project and decided an alliance was the way forward

East Midlands Trains in the UK set about refurbishing the carriages of 27 of its Meridian 222 trains in 2010, at a cost of £6m (US$10.3m). As part of this, the operator looked to upgrade seating in both first and standard class. Working with Transcal to design, manufacture and install the new-look seating, the decision was taken to use leather from Andrew Muirhead & Son in first class and flat woven cloth from Replin Fabrics in standard class. Other key suppliers included Novograf for surface solutions and Forbo Flooring for vestibule matting. Having manufactured the dress covers, Transcal's installation team fitted them at East Midlands Trains' depot in Derby, UK. It completed each five-car train in just under five days, enabling the refurbished trains to go back into service well inside the agreed deadlines. The project was completed in February 2012, on time and within budget.

As well as offering the look and safety performance required, the interior is designed to retain its freshness. All the products provided by these companies are built to last. Replin's fabrics, for example, benefit from a patented anti-staining treatment that the company says should greatly extend their in-service life. Meanwhile, Novograf's surface solutions are designed to resist scratches, knocks and graffiti.



Coincidentally, these five companies are all based in Scotland or have a major facility there. Recognizing that efficiencies could be made through teaming up with respected local specialists in complementary disciplines, the five companies formalized their alliance by establishing Rail Interiors Solutions (RIS) with help and support from Scottish Textiles. It means that as well as continuing

KEY CAPABILITIES

Andrew Muirhead & Son's latest generation of leather is called Voyager. It is a 1mm-thick leather that was developed to have a weight of 600g/m² without compromising quality, strength or safety specifications.

Meanwhile, Forbo's rail products include the Coral FR range of entrance system products and saloon carpets; the Linoleum FR range of heavy-duty floor coverings; Flotex FR, a textile floor covering that looks and feels like a carpet but has straight fibers for ease of cleaning; and Tessera FR, a tufted carpet.

Novograf's key product is Lamigraf, a semi-flexible, self-adhesive surface solution that can be applied to sealed surfaces, such as glass, metal, plastic, melamine or pressure-sensitive laminate clad MDF and MFC panels, and powder-coated panels. It can be manufactured in any color or pattern.

Replin is the group's provider of fabric for passenger and staff seating, sleeping cubicles, curtains, blinds and vertical surfaces, such as wall panels, partitions and ceilings. In addition, the company offers anti-stain treatments.

Finally, Transcal not only designs, manufactures and installs dress covers, but it also provides complete seats for trains. The company works to ensure that the end product meets standards including BS6853:1999, GMRT 2130, EN 45545 and AVST 9001, as well as upcoming PRM TSI regulations.

TOP LEFT: The standard-class cabins refurbished for East Midlands Trains

ABOVE LEFT: East Midlands Trains' refurbished first-class cabin

LEFT: Forbo's Tessera Alignment FR carpet on a train refurbished for UK operator South West Trains

RIGHT: A dado panel and table finished with a Novograf solution

to offer their products and services individually, they can also take on new-build and refurbishment projects together.

The collaboration begins right from the specification, and continues through design, logistics, execution and certification. The group says that the primary benefit of this approach for customers is that it offers reduced costs, smoother project management, greater flexibility and a single point of contact.

The group also believes it can bring down a project's carbon footprint. It bases staff at the customer's site wherever possible, minimizing the number of journeys taken and maximizing their time on-site. As well as a reduced environmental impact, the group says this arrangement delivers fuel savings.

In addition, Andrew Muirhead & Son, as part of the Scottish Leather Group, runs its own thermal energy plant, which converts the company's waste back into energy used to operate the tannery.

Combined strength

The collaboration also brings benefits for the constituent companies. "Working as a group is driving efficiency," says Steve Harvey, Transcal's sales director. "We meet regularly and have face-to-face discussions about projects we're involved in, and new business we want to target. There's strength in numbers. As a group we have more than 300 years of experience in supplying quality solutions to the transport industry, as well as a combined turnover that goes a long way toward satisfying the procurement managers and bid teams we work with."

Archie Browning, sales director at Andrew Muirhead & Son, concurs: "Big opportunities are presenting themselves, both in the UK and internationally," he says. "In Scotland, we have a world-class, one-stop solution for interior projects."

Welcome addition

Gummiwerk Kraiburg contends that adding rubber to fiber-reinforced plastics can maximize these materials' advantages

Fiber-reinforced plastics (FRP) are in demand, largely because of their stability-to-weight ratio, according to Gummiwerk Kraiburg. "FRPs are already essential in motorsport and aviation applications, and are gaining popularity as an option for large-series production in the mass transport and automotive sectors," says Florian Plenk, team leader for composite applications at Gummiwerk Kraiburg.

However, Plenk argues that various obstacles – financial and to do with the nature of the material itself – have to be overcome before FRPs can become more widely used.

"In FRPs, forces are absorbed by the fibers, which in turn are fixed and protected by resin," says Plenk. "Although this works very well in the direction of the fiber orientation, especially in the case of carbon fibers with their very high tensile strength, in a transverse direction the fibers break down relatively quickly. If you want to use FRPs to make components that are very safe, you can, but you have to use a lot of material, an approach that brings a price and weight penalty with it."

ABOVE: CFRP pipes made with Kraibon and steel

Gummiwerk Kraiburg developed Kraibon in response to these challenges. The product consists of non-cross-linked rubber foils, which contain no fibers and can be processed as pre-impregnated composite fibers would be. "In the joint curing process they produce an excellent bond with the FRP," says Plenk.

Drop-in solution

Kraibon can be integrated directly into existing production processes, without the need for additional tools, processes or bonding agents. It is suitable for a wide range of processes (vacuum, autoclave, infusion and press), materials (CFRP, GFRP, SMC, etc) and temperatures (100-200°C).

Gummiwerk Kraiburg says Kraibon can be used to improve the acoustic properties of FRP components. "When integrated directly into the layer structure, constrained layer damping can be used to achieve excellent sound attenuation with very little additional weight," says Plenk. "Integrating 500g/m² of Kraibon into the layer structure improves acoustic damping by a factor of 10-15.

LEFT: An FRP component undergoing impact testing without (top) and with (bottom) Kraibon

BELOW: Kraibon underwent EN45545 flame testing at Exova

DECADES OF EXPERIENCE

Gummiwerk Kraiburg has been producing rubber compounds since 1947. Today the company offers compounds based on virtually all types of elastomer – including silicone and fluoroelastomers – for all common dry rubber processing technologies.

As well as products such as Kraibon, the company focuses on creating customized and tailor-made solutions. Together with its customers, it develops compounds optimized for their specific applications and processing methods.

Gummiwerk Kraiburg currently employs 400 people, of whom 10% work in research, development and quality assurance – demonstrating the company's commitment to high-quality products, service and the development of future technologies.

The weight reduction, achieved with virtually no changes to the production process, gives manufacturers, for example of panels and floor segments, a lot of potential to produce innovative products."

Impact protection

Integrating rubber into FRPs can also enable the components to withstand greater impacts. "Initial tests indicated an increase by a factor of five before any damage became visible," says Plenk.

The best results were achieved by alternating layers of the hard FRP and soft rubber materials. This design allows energy to be transferred from a thin FRP outer layer, which is still moderately flexible, to an elastomer layer. The idea is that the soft layer distributes and absorbs the energy to the extent that the underlying structure can only be damaged if subjected to considerably higher energy levels.

Although this design requires additional layers, Plenk contends that they are very lightweight – the rubber weighs approximately 1.0kg/liter and the carbon fiber-reinforced plastic (CFRP) is approximately 1.5kg/liter. "Considering the lower required safety margins, the new product offers an interesting alternative to a conventional structure, as the component's visual appearance and ability to be coated remain the same," he says.

The final benefit that Plenk highlights is Kraibon's impact on components' splintering behavior. "In a collision or similar impact, CFRP components tend to break and splinter into tiny pieces," he says. "The elastomer layer is elastic and its strong bonding helps to hold the component together, thus minimizing fragmentation."

Gummiwerk Kraiburg believes its product is a truly flexible material with huge potential, and will enable customers to explore new applications and improve their current products. "Kraibon has also been tested by a certified test institute in line with the EN45545 fire protection requirements," says Plenk.

INSIDE TRACK

John Bengough, rolling stock technical and accessibility manager at the UK's Department for Transport, gives an update on how the country is making its rail fleet accessible for persons with reduced mobility in time for its 2020 deadline

Improved accessibility is vital in enabling everyone to participate fully in society – accessing employment, leisure, health and education services. Mandatory accessibility standards for new or refurbished trains have been in force across the European Union (EU) for six years. The requirements include the provision of wheelchair spaces, audiovisual passenger information systems, priority seating, accessible toilets (if toilets are provided), accessible door controls, and handrails and seatback handholds that contrast. The document, known as the Persons with Reduced Mobility Technical Specification for Interoperability (PRM TSI), also sets accessibility requirements for stations on the Trans-European Network (TEN).

Revisions to the PRM TSI

Over the past two years, the European Rail Agency (ERA) has – in cooperation with the industry, user groups and EU member states – been revising the PRM TSI in light of experience. The revised version will come into force on January 1, 2015. Although there are few changes to the requirements for rolling stock, a notable difference will occur for stations. Instead of mandating a common standard for stations across the EU, the TSI will instead expect accessibility standards in stations to comply with the national standards of each member state. It will also apply to all stations, not just those on the TEN. In addition, ERA and the European Commission are keen to accelerate the spread of accessibility across the continent, so the future TSI also requires member states to produce National Implementation Plans (NIPs), which will set out how that country intends to roll out accessibility across its network.

Targeted compliance

In Britain, we expect our NIP to consist of two main work streams, which are already in existence – one for trains and another for stations. UK law requires all trains to meet the standards set out in the PRM TSI by January 1, 2020. This includes vehicles that are already near the end of their service life. For fleets that are more than 16 years old, we have (in consultation with stakeholders) identified the major barriers to travel for disabled and older people, which must be removed by 2020, as well as those that are minor technical non-compliances that have little or no impact and can remain unchanged. This is known as targeted compliance. This means that, although by 2020 all rail vehicles will have the key features (above) that facilitate their use by all members of society, no work will be undertaken on an older unit where, for example, a door button is currently 50mm higher than prescribed by the regulations – i.e. if the improvement gained is very limited in practice. This is saving millions of Euros in unnecessary work, while still ensuring that the whole fleet will be accessible by 2020.

Halfway point

More than 500 older vehicles have received this treatment, and contracts are in place for thousands more to undergo this work – which will improve access for all passengers, years before the legal deadline. Already, more than half the UK's train fleet has been built – or fully refurbished – to modern accessibility standards.

To complement this, the UK's government has allocated more than £450m (US$771.5m) since 2006 to provide step-free access (SFA) at stations – in addition to such work taking place as part of regular renewal and refurbishment.

We have achieved a lot in the UK, and we want to do more – for example, building on the work of Stations Made Easy, a feature on the National Rail Enquiries website that enables people to view maps of stations so they can plan their way around before and during their visit. The British Association of Train Operating Companies' estimation that the rail market for PRMs in the UK alone could equate to €360m (US$488.5m) per annum shows how much potential there is for increased ticket revenue, and for sales by suppliers of TSI-compliant products, across Europe.

THE AUTHOR: John Bengough has worked for the UK's Department for Transport for 16 years; for the past 10 years he has led on the subject of rail vehicle accessibility. During that time, Bengough has contributed to the development and introduction of pan-European access requirements, and the setting in UK law of 2020 as a deadline for all rail vehicles to be accessible

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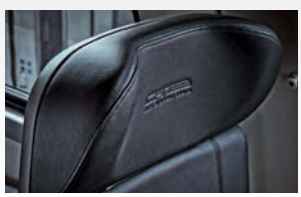

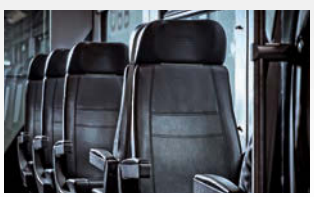


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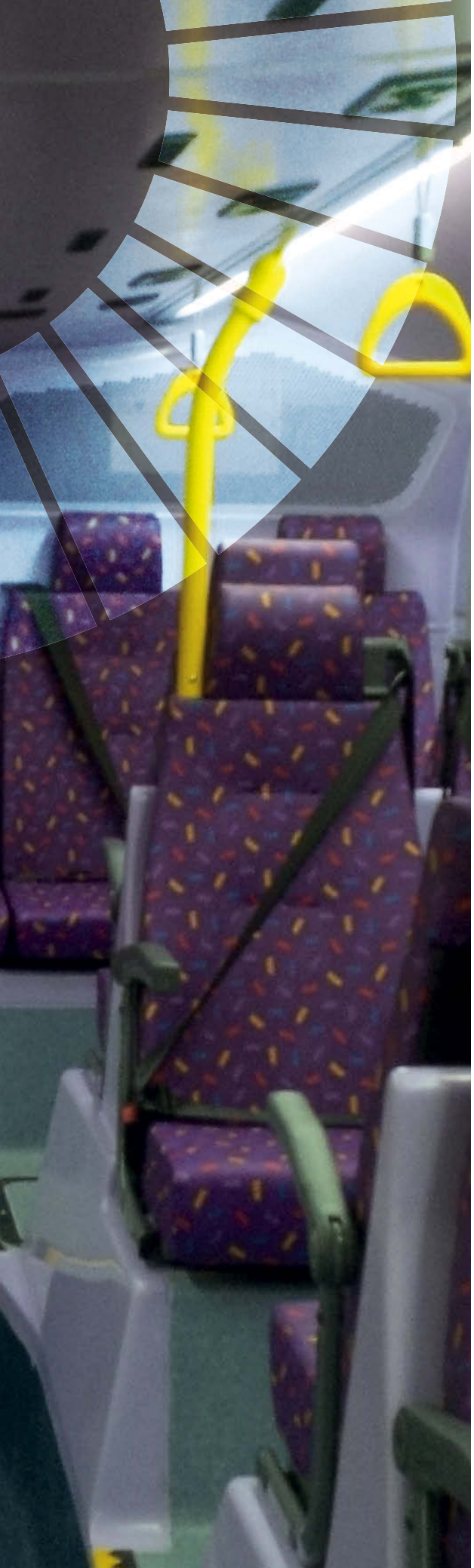

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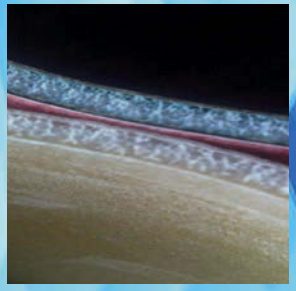

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