



3M Science.
Applied to Life.™

**Driving improvements
in the rail industry.**

In partnership with 3M.



The challenges of a successful rail industry

Train travel has never been so popular. Investment in rolling stock has never been at higher levels. Today's train designs are lighter, faster, more aerodynamic and energy-efficient than ever before. But with that success the challenges and pressures faced by train operators have never been greater.

Pressure comes from all sides – from passengers and consumer bodies to shareholders and Governments. These challenges are both business critical and varied. How do you improve the customer experience when you're tackling ever-increasing passenger numbers? How do you reduce the high costs of train downtime? How do you introduce energy savings and sustainability benefits into your manufacturing processes without compromising on performance? 3M understands these challenges and has a proven track record, working in

partnership with leading rail operators around the globe, developing solutions that tackle many of the industry's key challenges.

Our solutions span the entire train manufacturing process, from chassis construction and assembly, through painting and finishing to maintenance and repair. They include our automated grinding and polishing solutions that help improve productivity; our structural adhesives which allow significant chassis weight savings; our personal safety products that protect

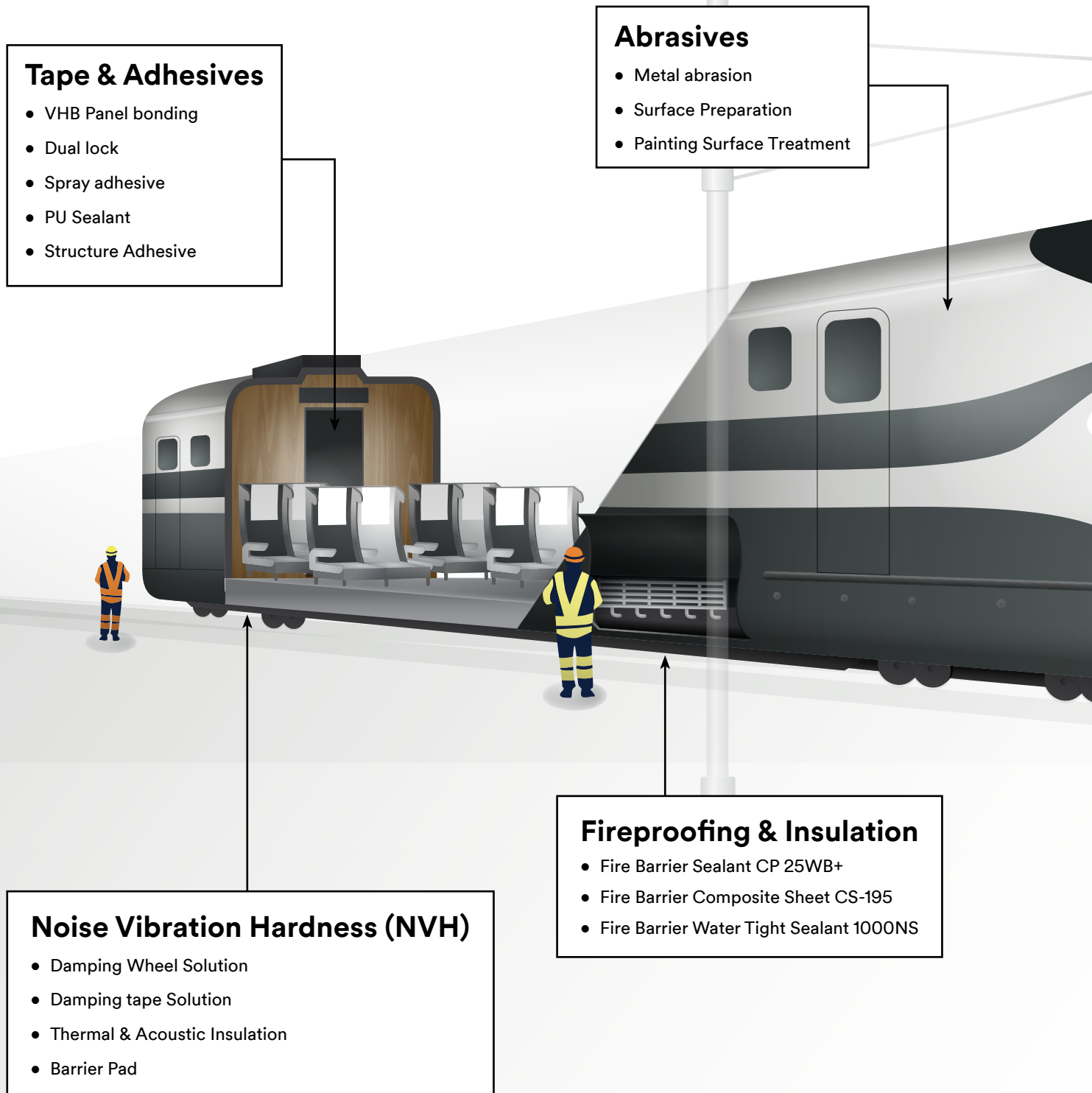
your people at work; whilst our range of decorative and windows films deliver an outstanding brand experience for passengers.

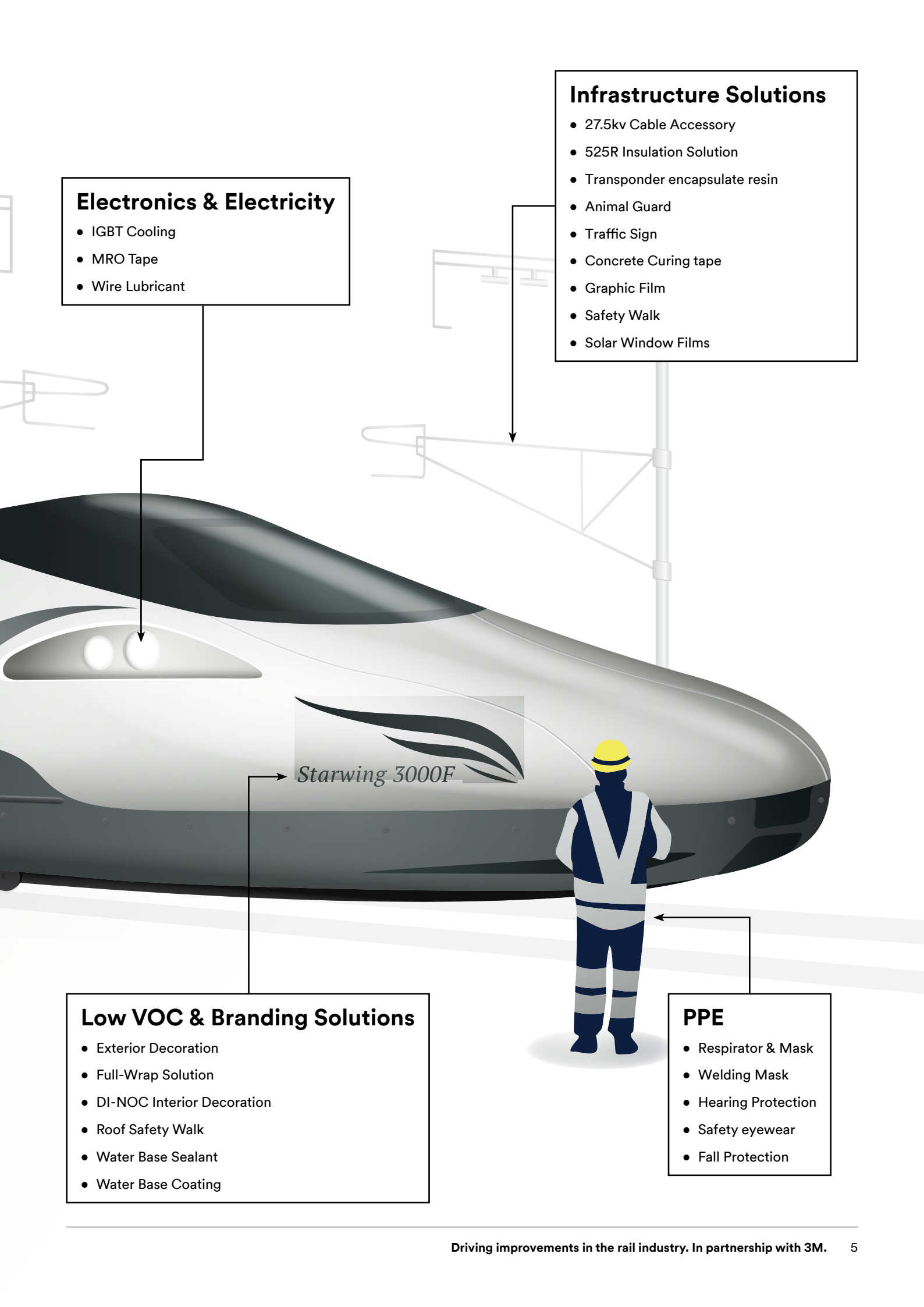
Our approach with rail operators is one of partnership. This brochure provides an introduction to how we can work together to tackle some of your industry's most pressing challenges and help build a competitive business that continues to succeed in the future.



Overview of 3M solutions to the rail industry

The following schematic shows the breadth of product solutions that 3M is able to offer the rail industry:





Electronics & Electricity

- IGBT Cooling
- MRO Tape
- Wire Lubricant

Infrastructure Solutions

- 27.5kv Cable Accessory
- 525R Insulation Solution
- Transponder encapsulate resin
- Animal Guard
- Traffic Sign
- Concrete Curing tape
- Graphic Film
- Safety Walk
- Solar Window Films

Starwing 3000F

Low VOC & Branding Solutions

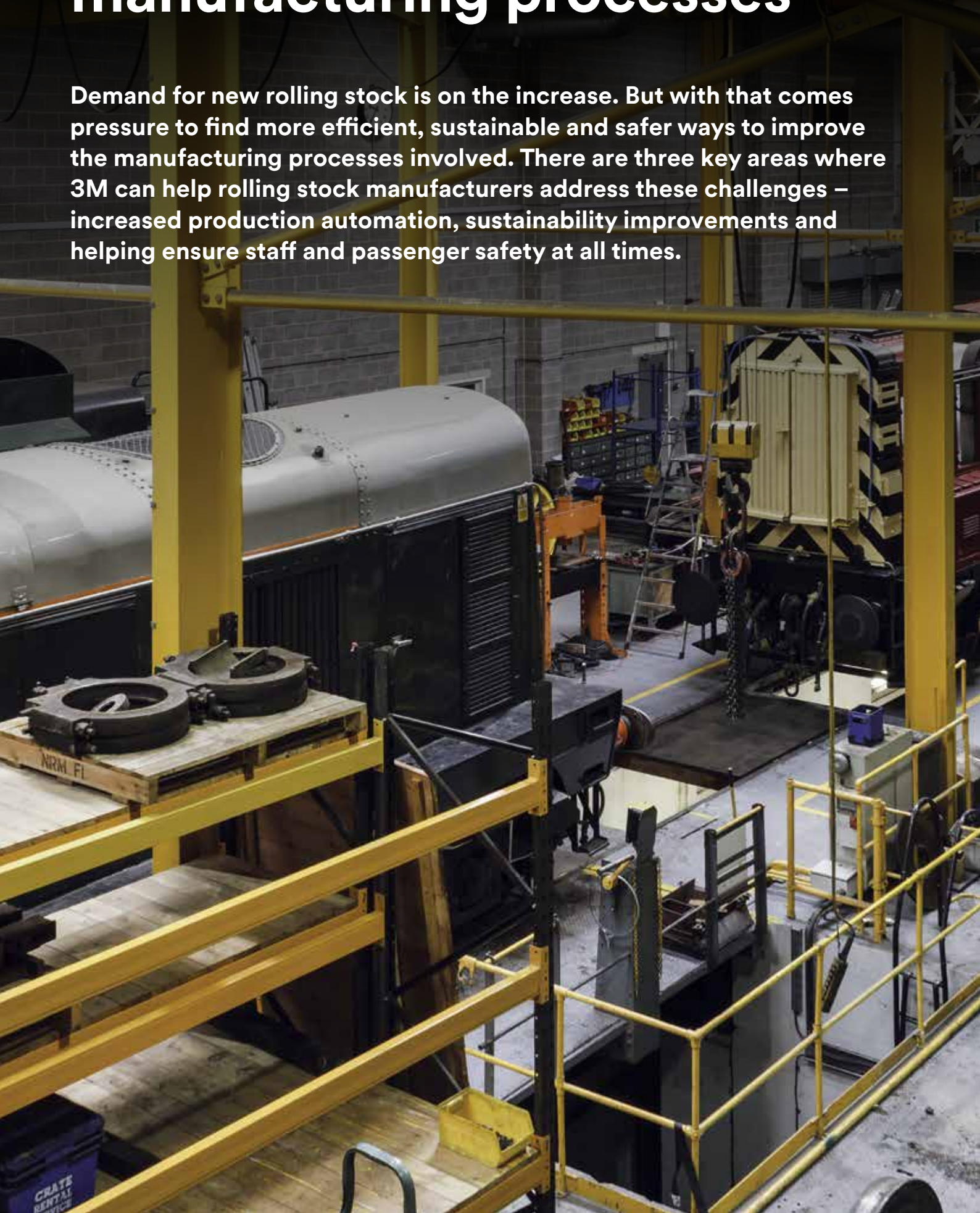
- Exterior Decoration
- Full-Wrap Solution
- DI-NOC Interior Decoration
- Roof Safety Walk
- Water Base Sealant
- Water Base Coating

PPE

- Respirator & Mask
- Welding Mask
- Hearing Protection
- Safety eyewear
- Fall Protection

Improving rail stock manufacturing processes

Demand for new rolling stock is on the increase. But with that comes pressure to find more efficient, sustainable and safer ways to improve the manufacturing processes involved. There are three key areas where 3M can help rolling stock manufacturers address these challenges – increased production automation, sustainability improvements and helping ensure staff and passenger safety at all times.



Better productivity through automation

In order to stay competitive rail manufacturers are constantly striving to find new ways to make their manufacturing processes more efficient. Automation is increasingly important, helping companies reduce costs and lead times, whilst improving productivity and performance. It's an area where 3M has proven expertise, applying its innovative thinking to help rail companies develop and integrate more effective automation systems into the manufacturing process.

Solutions from 3M:



Automatic grinding and polishing for rail car body and key components

The automated grinding and polishing of rail car bodies and key components is a key stage in the rolling stock manufacturing process. Companies are continuously exploring ways to simplify and speed their finishing processes so as to drive down costs, but without compromising on the quality of the finish. 3M has a long established reputation as experts in automated abrasive systems and works with its customers to develop and implement improved robotic grinding and finishing processes that help improve business performance.



Customised 3M™ DI-NOC™ Architectural Films speed installation of interior wall panels

3M DI-NOC Architectural Films are well known for creating appealing interior looks, quickly and inexpensively. These vinyl films realistically re-create the visual effect of natural materials and at a fraction of the cost of traditional materials. 3M is able to offer rolling stock manufacturers a customised DI-NOC film that can be applied to aluminium panels and press formed in order to mould around complex shapes (e.g. panels that include windows). This application can be undertaken quickly without the need for a skilled installer, saving time and money for the manufacturer as well as improving overall manufacturing productivity.



Helping save energy with lightweight solutions

Lightweighting is one of the key trends driving improvements in manufacturing efficiency. For the rail industry reducing carriage weight means a reduction in energy use, and that's a real benefit. The lower the weight of the carriage, the less energy is required to move it, and this delivers both cost and performance benefits as well as sustainability improvements.

Our structural adhesives can offer you significant lightweighting benefits. They allow greater design freedom over traditional mechanical fasteners - they can join composites to metal, build hard-to-bond plastics and allow the use of thinner, lighter weight materials. And to top it all, they improve the appearance of the product with invisible joints and smoother bond lines whilst offering a significant reduction in weight as well as noise.

Solutions from 3M:



Lightweighting benefits of structural adhesives

3M is an innovator in structural adhesives. Our 3M™ Scotch-Weld™ Structural Adhesives are known for their strength, durability, longevity and versatility, and trusted by industrial engineers and designers throughout the world.

Recently a major rail manufacturer teamed up with 3M and a small number of engineering and design companies. Their purpose was to explore ways to achieve a 30% weight reduction of the primary structure of an aluminium rail car, by using innovative materials such as composites, sandwich constructions and fibre-reinforced thermoplastics. In order to guarantee maximum joint performance of these new materials, structural bonding was identified as the technology of choice and 3M was selected as the sole supplier of bonding solutions for this project.

A 1:1 scale version of the lightweight rail car was built and successfully tested, proving that structural bonding (as well as 3M adhesives) offers a working solution for lightweight rail cars.



Protecting staff and passengers

The safety of both staff and passengers is paramount to the long-term success of your business. For your workforce it is essential they are both protected at all times against workplace hazards as well as being compliant with relevant regulations. For passengers it is paramount that they are protected against unforeseen dangers and risks such as a fire outbreak. 3M understands the importance of protection in the rail industry and has a range of solutions to offer its customers.

Solutions from 3M:



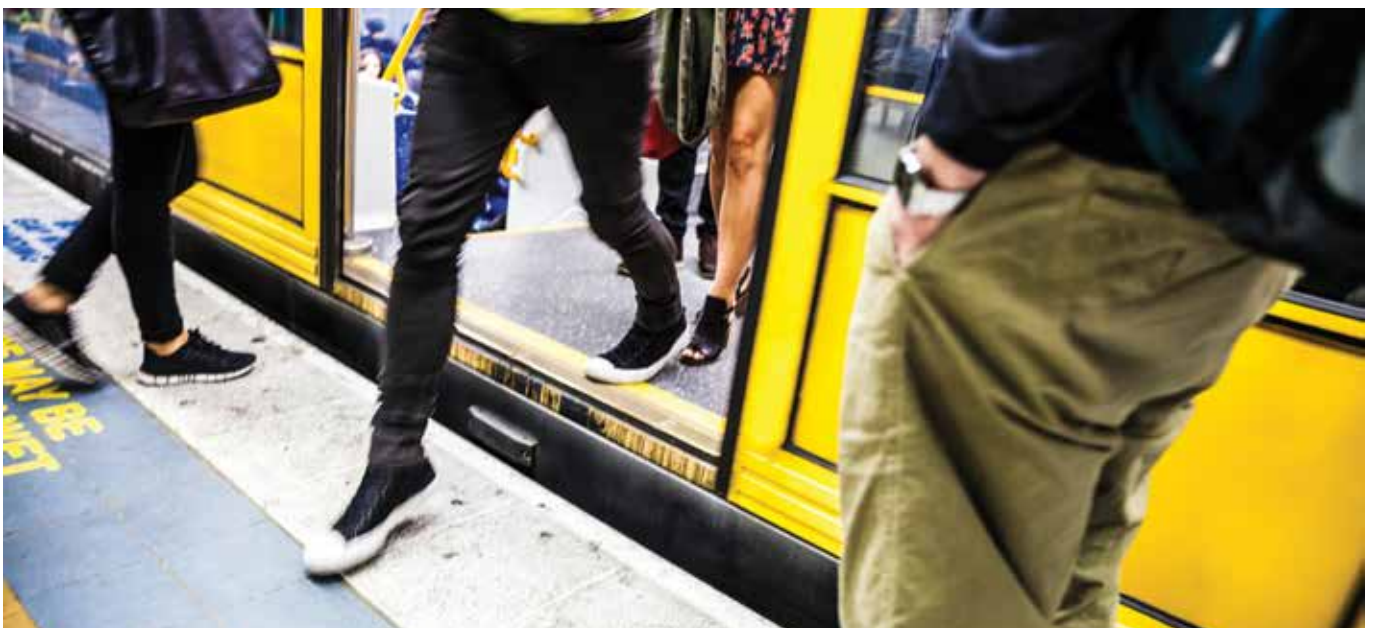
Keeping your workforce safe and compliant

At 3M we are committed to developing personal safety solutions that improve comfort whilst helping your workforce increase compliance. This means that users are not tempted to remove their mask, eyewear or hearing protection in hazardous environments, in order to feel more comfortable. We provide protection equipment for everything – from your eyes and head to your hearing and respiratory systems.



Protecting your passengers against the risk of fire

Fire stopping protection in the manufacture of rolling stock is essential to the safe protection of passengers in the case of fire. 3M has a 30 year reputation for developing market-leading fire protection products, such as 3M™ Fire Barrier Sealant CP 25WB+, an ideal fire stop for penetrations in fire-rated constructions such as metallic and insulated pipes as well as power and communication cables. We also offer technical services and training to ensure the job is done as efficiently and effectively as possible. Many of our systems are tested to the EN45545 standard.



Putting the 'wow' into the passenger experience

The long-term success of the rail industry depends upon continuous improvements in operational performance, and a key element of this is delivering an exceptional passenger experience from start to finish.

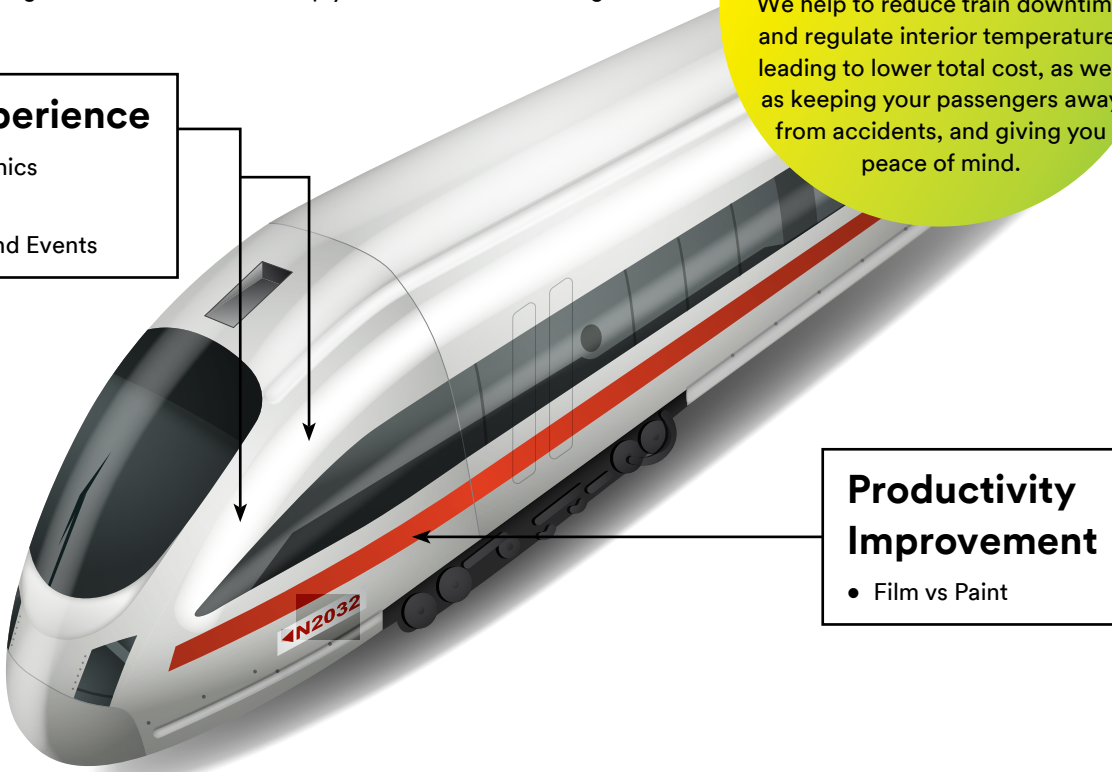


Branding and enhancing the interior and exterior surfaces of rolling stock, using high performance films and printed graphics, helps create a consistent and improved passenger experience. Rail operators recognise this and continue to make significant investments to enrich the journey. Despite this, rail operators still have to tackle the problems of vandalism including scratched and graffiti covered interiors and exteriors and unclean or broken toilets, as well as noisy and dirty carriages. At 3M we have a range of solutions that can help you tackle these challenges.

We do more than “refurbish and rebrand”.
 We help to reduce train downtime and regulate interior temperature; leading to lower total cost, as well as keeping your passengers away from accidents, and giving you peace of mind.

Brand Experience

- Exterior Graphics
- Anti Graffiti
- Promotions and Events

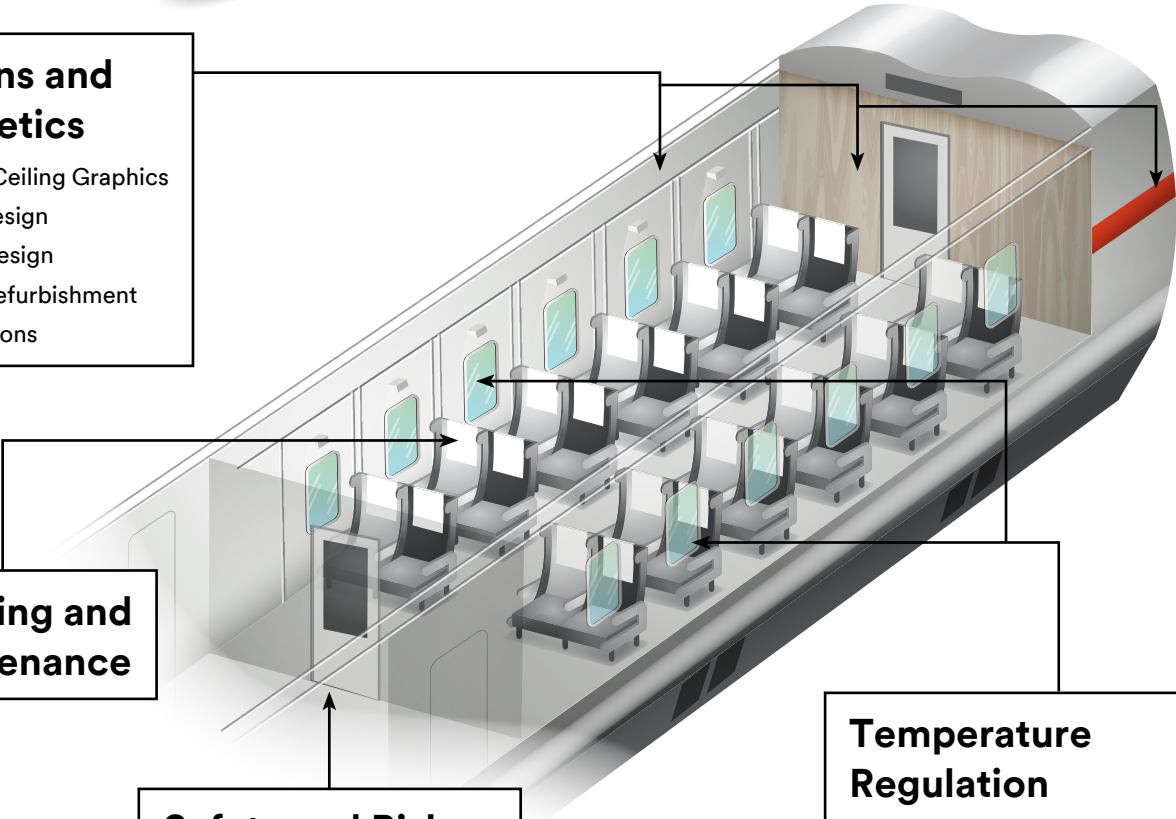


Productivity Improvement

- Film vs Paint

Designs and Aesthetics

- Wall & Ceiling Graphics
- Door Design
- Glass Design
- Toilet Refurbishment
- Promotions



Cleaning and Maintenance

Safety and Risk Mitigation

- Slip / Trip hazard prevention

Temperature Regulation

- Temperature Maintenance and Sustainability Benefits

Growing passenger numbers

Despite the recent significant investment made by rail companies, the challenge remains to persuade car drivers to switch to using rail. Rail companies have invested in new rail stock, but the perception that travelling by rail is not always a pleasurable experience remains – and this perception is exacerbated by graffiti covered interiors and exteriors, poorly maintained carriages, dirty or broken toilets - all of which limit the number of people prepared to travel by train.

3M has a range of solutions that can help tackle many of these challenges:



Image courtesy of Aura Graphics,
3M UK Authorised Rail Partner

Graphic solutions

- Design flexibility with custom colours and digital printing
- Easy maintenance and cleaning for a longer lasting solution
- Durable even at high speeds
- Industry-leading warranties



Anti-graffiti solutions

- Solutions that keep carriage interiors and exteriors fresh and inviting
- Suits all types of surfaces, including nose of train
- Cost savings on maintenance and cleaning
- Ensures protection from scratching, etching and gouging



Image courtesy of SNCF / Maxime Huriez –
RER C of railway network Ile-de-France SNCF

Glass solutions

- Easy to install and maintain with limited downtime and lower overall costs
- Collection of on-trend patterns to keep modern feel
- Appealing to passengers



Image courtesy of Aura Graphics,
3M UK Authorised Rail Partner

Architectural solutions

- Over 1000 patterns
- Fast refurbishment reduces downtime
- Can be applied to complex surfaces
- Virtually no odour after refurbishment

Keeping passengers safe

Rail operators are mindful of their responsibility to keep passengers safe and protected throughout their journey. That means keeping them safe from the risk of shattering glass, ensuring they do not slip or trip when boarding or leaving the train and protecting them at all times from hot and harmful solar rays transmitted through windows.

3M has a range of solutions that help tackle many of these challenges:



Slip resistance solutions

- Help prevent passengers from tripping
- Protects your company from litigation due to slips, trips and falls
- Increased awareness of hazards in poor visibility conditions



Matting solutions

- Easy to install, maintain and replace means limited downtime
- Help reduce risk of slipping on wet floors
- Easy to clean and maintains professional appearance over years of use



Window solutions

- Safety window films provide protection against shattered glass
- Solar control films make for more healthy travelling by reducing UV rays and help in regulating temperature.

Improving passenger comfort

Amongst the travelling public there remains a perception that train travel is an uncomfortable and unpleasant experience due to ageing carriages and poor carriage conditions, uncomfortable temperatures particularly during hot weather and rough and unclean floors.

3M has a range of solutions that help tackle many of these challenges:



Graphic solutions

- Branding and design
- Creating a peaceful and reassuring travel environment
- Pleasing brand experience to encourage passengers to travel more often



Window solutions

- Helping to maintain a healthy and pleasing temperature for passengers
- Saves on overall cost by maintaining an optimal temperature
- Metal-free window films helps to stay connected; no interference with mobile phone signals



Cleaning & maintenance

- Quality products that help maintain a high standard of cleanliness
- Products that can clean even difficult surfaces quickly and efficiently
- High performance products that save you cleaning time and costs



Architectural solutions

- Over 1000 patterns
- Virtually no odour after refurbishment
- Toilet refurbishments that provide a clean and pleasing experience

Offering more sustainable solutions

3M is committed to the sustainability of our planet and the need to work with our partners to offer solutions that deliver real benefits that help achieve our joint business and sustainability goals. Our rail partners face challenges such as the costs they have to incur for graffiti removal, washing train carriages, the level of carbon dioxide emissions in their paint shops and the cost of air conditioning in hot temperatures. These are major challenges that need addressing.

3M has a range of solutions that help tackle many of these challenges:



Graphic solutions

- Replacing paint by film can lead to less carbon dioxide emissions
- Up to 50% less cleaning required for a wrapped train compared to a painted one
- PVC-free solutions are available for printed graphics
- Savings on energy consumption from reduced weight due to film use



Window solutions

- Temperature regulating films that are metal-free
- Allows for a reduction in air conditioning usage without compromising on window appearance
- Offers a sustainability inspired solution, appreciated by passengers



Architectural solutions

- Refurbish and re-use interiors rather than replace them
- Popular solution for architects and designers due to long life, easy maintenance and removal

Better maintenance efficiency means less downtime

Running railways is an expensive business. New rolling stock is a major capital investment and taking trains out of service for maintenance and repair is costly. In addition, paint stations constitute a large investment and regular cleaning and maintenance is time consuming. How do you balance maintaining the quality and cleanliness of your rolling stock with minimising downtime of trains for essential maintenance and cleaning work?

3M has a range of solutions that help tackle many of these challenges:



Graphic solutions

- Up to 40% savings on wrapped film compared to paint*
- Less washing means less trains out of service and lower costs
- Use of film frees up paint booth capacity



Cleaning & maintenance

- High performance products that deliver long lasting results and maintain fresh and appealing appearance
- Easy removal of dirt, dust and fingerprints saves time
- Significant savings on cleaning and maintenance costs



Architectural solutions

- Productivity gains due to refurbishing and re-using interiors rather than replacing them
- Popular solution for architects and designers due to long life, easy maintenance and removal
- Costs relating to downtime reduced as a result of faster refurbishment

* Figures based upon an independent study – study available under NDA.



Image courtesy of SNCF / Maxime Huriez – RER C of railway network Ile-de-France SNCF

3M product solutions for improved operational performance

Products	Description	Challenge				
		Number of passengers	Passenger safety	Passenger comfort	Sustainability	Efficiency
Graphic solutions						
3M™ Controltac™ 180(Cv2) Series	Long-term durable and conformable 50µm coloured film that offers slideable, repositionable, pressure-activated adhesive with excellent hiding power and stability.	•		•		•
3M™ Print Wrap IJ180mC Series	Highly durable and conformable printable PVC films which provide more design flexibility for vehicle branding, fleet messaging and textured walls. Also available in versions for applications on stainless steel, on low surface energy surfaces and for short term film on film applications (easy removal).	•		•		•
3M™ Envision™ 480mC Series	50µm white PVC-free film with a pressure activated, repositionable, removable adhesive. This film has a reduced environmental impact and is ideal for long term graphic applications on compound curves, corrugations, deep channels and rivets,. Also suitable for short term wall graphics on moderately textured surfaces.	•		•	•	•
3M™ Scotchcal™ 3690 Series	This cast film can be used for a variety of applications on sand cast, moderately rough or low surface energy substrates including polyolefin.	•		•		•
3M™ Envision™ 48 Series	PVC-free film offering great versatility for indoor and outdoor signs as well as fleet graphics for promotional and middle long term applications.				•	•
Anti graffiti solutions						
3M™ Anti-Graffiti Wrap Overlaminates 8588G/8590M Series	Conformable overlaminates designed to protect graphic surfaces from stains, abrasion, UV light and graffiti.	•				•
3M™ Scotchgard™ 8991/8993/8995 Series	Easy to clean overlaminates provide superior substrate and surface protection from stains, abrasion, gouges, UV light and graffiti.	•				•
3M™ Window Film Safety 40 (Exterior) Series	For protecting glass surfaces from most forms of graffiti such as scratches, acid-etching and gouges in retail, public facilities and any street level glass applications.	•	•			•
Glass solutions						
3M™ Fasara™ Glass Decoration	Decorative glass and window films available in over 90 designs for creating privacy or appealing designs on your glass surfaces in a fast and efficient way.	•				•
Architectural solutions						
3M™ DI-NOC™ Architectural Finishes	Flexible vinyl films specifically developed for durable interior/exterior decorations and refurbishment, offering more than 1000 creative patterns.	•		•	•	•

Products	Description	Challenge				
		Number of passengers	Passenger safety	Passenger comfort	Sustainability	Efficiency
Matting solutions						
3M™ Nomad™ Aqua Series 85	High performance textile entrance mat for high traffic applications providing impressive water removal and retention properties.		●			
3M™ Safety-Walk™ Wet Area Matting Series 1500/3200	Open vinyl matting for wet areas which allows the water to run through the matting ensuring that area remains drier than the surroundings.		●			
Window solutions						
3M™ Window Film Series Safety S70	175µm PET film to protect passengers against broken and shattered glass.		●			
3M™ Prestige 40 Exterior	Metal-free window film for exterior use to optimize indoor climate that reflects UV and IR solar rays and reduces the cost for air-conditioning at 40% light transmission.		●	●	●	●
3M™ Prestige 70 (Exterior)	Metal-free window film for optimizing indoor climate that reflects UV and IR solar rays and reduces the cost for air-conditioning at 70% light transmission.		●	●	●	●
Slip resistance solutions						
3M™ Safety-Walk™ Slip-Resistance Tapes Series 510, 710, 600, 613 and 690	Slip-resistance tapes to help reduce the risk of slips, trips and falls, and avoid injuries in critical areas. Available in conformable, black/yellow and photo luminescent versions.		●			
Cleaning & maintenance						
Scotch-Brite™ Sponges & Scourers, Universal Microfibre & Multipurpose Wipes	High performance cleaning wipes that can be used to remove dust, dirt, grease and fingerprints from stainless steel, chrome, plastics, glass, paint lacquers and other finished or polished metallic surfaces, to leave a lint- and streak-free finish. Unlike conventional wipes, the ribbon-like microfibres penetrate deeply into surface irregularities where dirt, grease and micro-organisms hide.			●		●
3M™ Chemical Spill Kit DRSK-DP	For cleaning up hazardous chemical spills quickly in an emergency situation.			●		●
3M™ Stainless Steel Cleaner & Polish	For polishing and protecting all stainless steel surfaces in one step, and providing improved fingerprint resistance. HACCP certified in class SSZ (Splash or Spill Zone).			●		●

Trust in the performance of products and partners

Passenger trust and loyalty is key to running a successful rail operation and you cannot risk jeopardising that by using products (and partners) who fail to perform.

When films and printed graphics represent a key part of your passenger experience, you cannot risk colour fading, adhesion failure or hard-to-remove graffiti or films – these problems can be costly and often lead to increased downtime. That's where 3M can make a difference with its global network of approved partners and its industry leading warranties:



Image courtesy of Aura Graphics,
3M UK Authorised Rail Partner

3M™ MCS™ Warranty for Graphics

For finished graphics that use all 3M graphic products and components, 3M MCS Warranty is widely acknowledged as the best and most comprehensive in the business. Our warranty scheme, in conjunction with the 3M Performance Guarantee, offers our customers the reassurance that 3M digital graphic films have been put through extensive and rigorous proprietary tests to guarantee both their mechanical and physical properties throughout the digital printing process and for a specified period of time after application.

It's reassuring for you to know that all elements of the graphics used - from film and ink, to adhesive, tape and protective coating - will perform at their best, consistently over time, even in the harshest environments.

3M™ Window Film Warranty

Window film warranties from different manufacturers vary significantly from country to country, and this can be a real headache for customers. Cracking, adhesion, delamination and optics (for example) are often not clearly defined or even covered, and this raises problems and confusion when failures arise.

The 3M Window Film Warranty has a reputation in the market for being clear and unambiguous. It is presented in an official document when installed by authorised dealers and offers the customer the reassurance required for peace of mind.

A global network of approved partners

Trust between partners is vital in every successful business relationship. We recognise this and have built an unrivalled global network of partners to help support our rolling stock and rail operator customers. As approved partners of 3M, their product and application knowledge is always up-to-date and their skills and ability to deliver projects reliably and on time is well proven. All of this comes with the global technical resources of 3M, focused on supporting partners and customers locally.



Applying our science to tackle your issues

3M is a truly global organisation of more than 90,000 employees, with operations in over 70 countries. We have 85 R&D facilities spanning 36 countries, with 54 Customer Innovation Centres around the world. We spend approximately 6% of our revenue on research and development and have a dearly held reputation for groundbreaking innovation.

We've always worked closely with our customers to understand their business challenges and the manufacturing and operational issues they face, and have applied our science to solve them. That's how we have built our considerable track record with the rail industry.

To share just one example of this customer inspired innovation – in our discussions with a number of rail operators, they highlighted a real concern about the cost of removing graffiti from trains, including the train

nose. Traditional anti-graffiti films are non-conformable, but by applying our expertise in film manufacture, we created a flexible anti-graffiti overlaminates that is now being used by many rail operators on simple and complex curved surfaces. This is delivering significant cost saving benefits to our partners.

If you have a manufacturing or operational challenge you'd like to discuss in confidence, get in touch.

www.3m.co.uk/rail







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