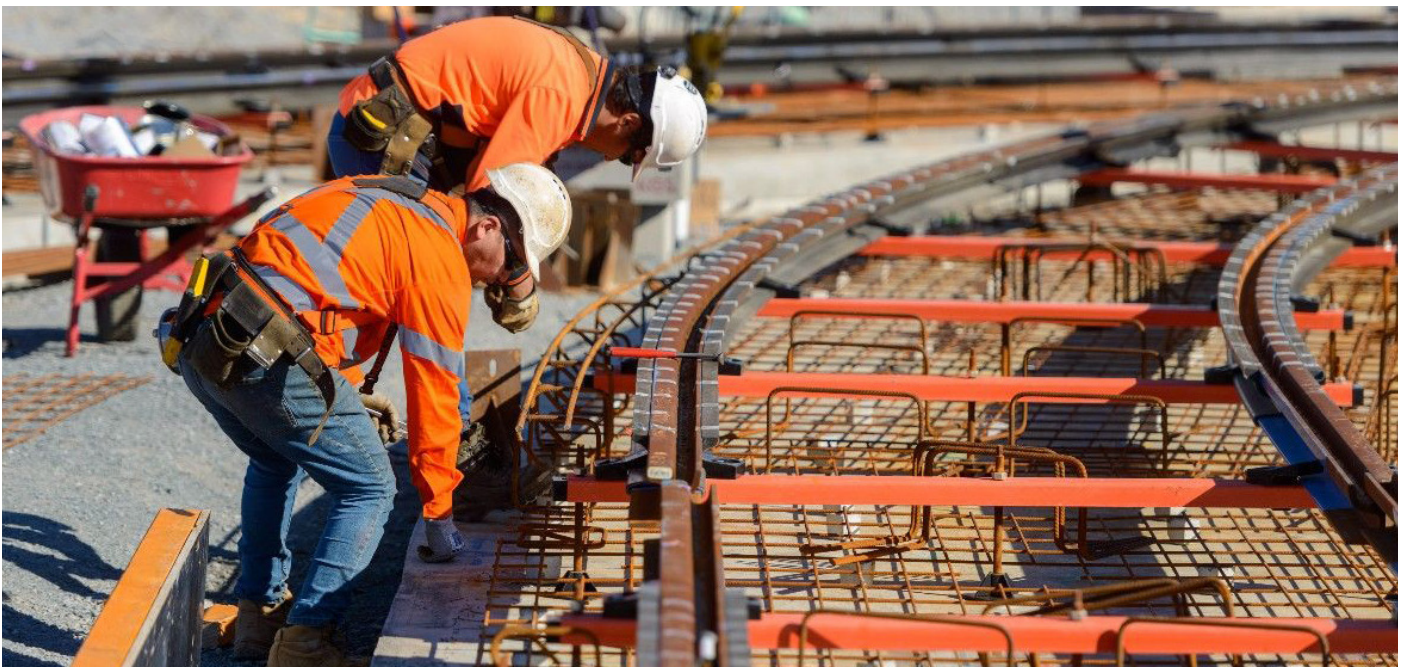


Trelleborg

Embedding the Future: How Vector is Transforming Light Rail



As light rail plays a growing role in sustainable cities, Innovation Director Dr Adam Nevin explains how Trelleborg Polyurethane Products' Vector system is helping to solve the challenges of vibration, noise and stray currents.

Light rail is a key aspect of green mobility within metropolitan areas. Providing a low-carbon alternative to cars clogging city streets, it helps ease congestion while significantly reducing emissions and improving urban accessibility. Take the Sheffield SuperTram for example – this has helped to save over 2,000 tonnes of CO2 each year, whilst transporting 280 million passengers.

There are, however, unique challenges when it comes to constructing a light rail network within a city environment. Electrification can lead to stray current leakage while rolling wheels generate noise and vibrations – issues that are magnified when this infrastructure is literally on the doorstep of hundreds, if not thousands of offices and homes.

Environmental impact assessments require network operators to mitigate stray currents and reduce noise and vibration, and the traditional solution has been floating slab tracks. These see rails fastened to a heavy concrete slab which is supported by springs or rubber to isolate the track from the ground.

While floating slab tracks can greatly reduce noise and

vibration, in light rail environments they may be cost-prohibitive, spatially constrained and maintenance-intensive, with limited impact on certain vibration frequencies and stray current mitigation. Therefore, their use is often limited to sensitive environments, like alongside hospitals, where these trade-offs are justified.

A Smarter Approach to Rail Encapsulation

At **Trelleborg** our experts have developed a next-generation solution to rail encapsulation, which provides superior vibration control and electrical isolation, whilst also enhancing the longevity.

The **Vector embedded rail system** is based on a high-performance, one-piece moulded microcellular foam polymer rail boot. This simplifies jointing and installation, while also ensuring there are no voids or cavities, which equates to improved durability and resilience.

Benefits include:

- **Versatility and ease of installation**

Highly versatile, it can be installed through a wider variety of methods than other solutions, including top down, bottom up, sacrificial beam or block sleepers.

- **Improved vibration absorption**

The boot's improved vibration absorption extends the service life of rails by reducing maintenance needs compared to traditional ballasted tracks.

- **Reduction of stray currents**

The Vector embedded rail system has the highest electrical resistivity of all systems measured. It has

been proven to achieve stray current reduction of over 50Ω, a much higher resistance than required by the majority of rail projects.

- **Tuneability**

This solution can also fine tune vibrational acoustic performance. The boot can be readily tuned to absorb frequencies as per customer demand, with track stiffness able to be dialled in without the need for any redesign.

The same boot, with the same dimensions and overall properties can be optimised to hit target requirements. Customers can choose to either lock-in density or stiffness, with either parameter able to be tuned at manufacture.

- **Stability**

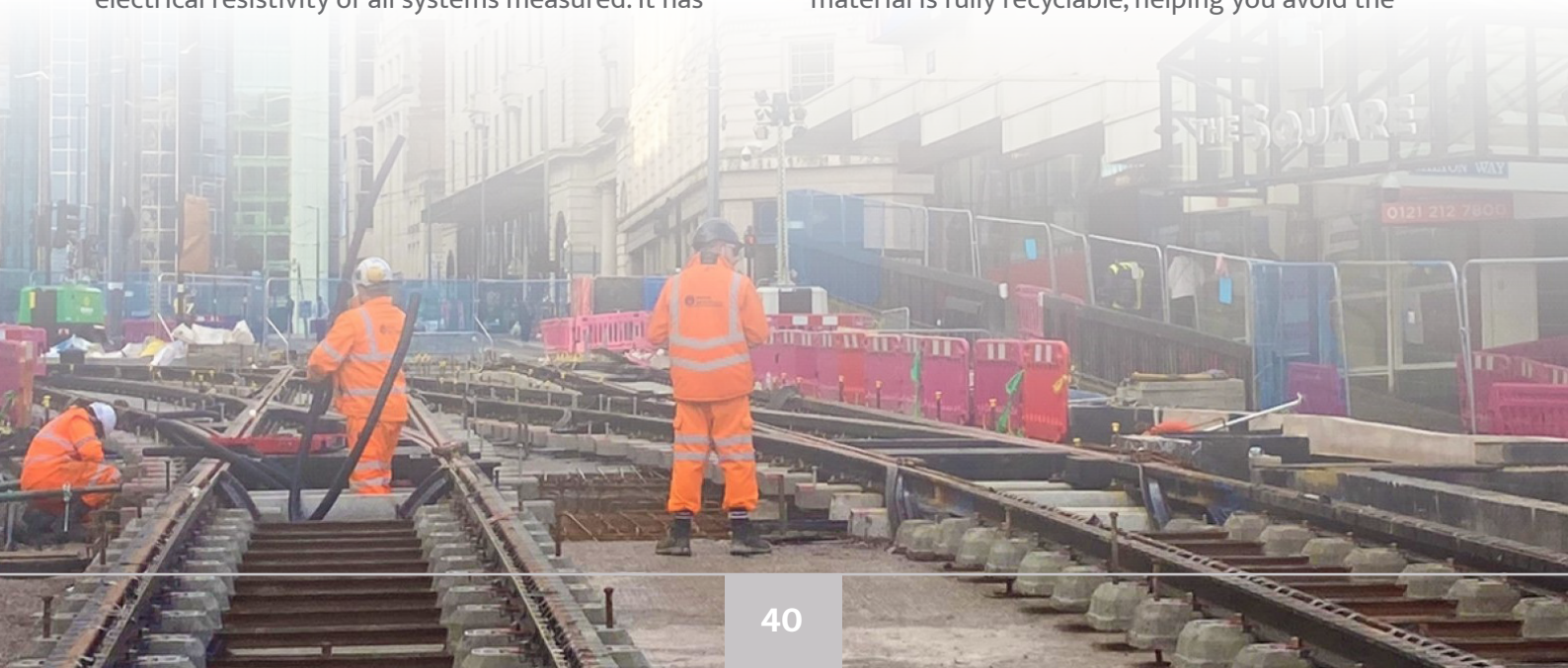
Trelleborg's solution provides improved stability and alignment of the rail during use, and the boot has been proven to be more stable than competing solutions through changes in weather.

- **Longer life**

The rail boot has excellent fatigue life under dynamic deformation, in addition to outstanding abrasion resistance, and is guaranteed to last a minimum of 30 years.

- **Recyclability**

Recyclability may not be top of mind when selecting a product designed to last 30 years, but planning for end-of-life disposal is increasingly essential. This challenge is now becoming evident in the wind turbine sector, where aging components are often consigned to landfill once they reach the end of their service life. Trelleborg offers a solution: our boot material is fully recyclable, helping you avoid the



future burden of disposing of thousands of kilometres of polymer waste.

Why Quality Matters

With growing competition in the rail sector, cheaper alternatives often tempt contractors and city planners, but what are the long-term costs? The Vector embedded rail system may not be the cheapest solution on the market, but it is by far the most cost-effective due to its ability to reduce maintenance costs while extending service life.

And with **Trelleborg** you have more than a supplier, you get a partner. Our experts are available to work with customers on the development of Vector solutions specific to each project, from R&D right through to the manufacture of your bespoke boot. We'll then provide assembly and installation training to your contractors, so you can rest assured that your rail encapsulation solution will provide the utmost benefits for the longest time.

Simply put, when you choose Trelleborg, you're choosing peace of mind. Knowledge that you've got the best solution for the project, and that it will last for the next 30+ years.

Global Adoption, Ongoing Innovation

The Vector embedded rail system is already being used by light rail networks around the world – from Europe, the Americas and Africa through to Asia and Australasia, and is part of a wider range of solutions including **rail dampers** and **pre-coated rail systems**.

Trelleborg's experts continue to work on new ways to further improve on the rail boot, but are also developing next generation rail dampers, featuring clipless designs and metamaterials for enhanced noise absorption. Other developments include constrained layer dampers, transparent acoustic barriers and flame-retardant vibration absorbers.

If you're looking for a long-term, low-maintenance rail encapsulation solution, then why not explore the Vector system in more detail? Feel free to get in touch via our **contact form** or by reaching out to Business Development Manager Peter Hardy on +44 (0)1777 712500 or via peter.hardy@trelleborg.com.

The Evolution of the Vector Rail System

Trelleborg has been perfecting its Vector Rail System for the last 30 years. Over this time, its rail boot solution has gone through three iterations, evolving to improve its capabilities and meet changing customer needs.

Generation 1

Back in 1980 Trelleborg produced its first rail encapsulation solution. This did the job, but by today's standards installation was a dirty, time-consuming affair to manufacture, and the material used was non-recyclable.

The material would be cast around the rail and then take several hours to cure. The resulting product also required shipment to site, which further added to the complexity and cost.

Generation 2 – The Vector Cast Boot

In 2000 Trelleborg engineers had developed the next generation – the Vector cast boot. This was a much cleaner solution, but still time consuming to create and non-recyclable. This solution significantly lowered the manufacturing cost and provided a better solution for customers, however they knew there was room for improvement.

Generation 3 – The Leniter Extruded Boot

By 2020 Trelleborg's experts had developed the Leniter Extruded Boot. This uses thermoplastic polyurethane, which is fully recyclable, and its extruded profile enabled instant curing. As this solution could be fitted on site, it also became easier and cheaper to ship in the form of a single continuous coil of material.

These improvements dramatically increased manufacturing efficiency and reduced costs compared to previous generations.

This brings us to the solution available today, which can be tailored to meet each customer's specific needs. From material innovation to global delivery, Trelleborg continues to push the boundaries of what embedded rail systems can achieve.

