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Norfolk Southern has launched a large-scale trial, laying 30 000 composite sleepers from three manufacturers.

Composite sleepers make a comeback

Norfolk Southern is among the US railroads looking afresh at the latest iteration of the composite sleeper. Greg Janson, President of supplier Triton Ties, explains how a combination of recycled plastic and glass fibre material can offer durability and environmental gains compared to using wooden or concrete sleepers.

'This is the circular economy in action', believes Greg Janson, President & CEO of Triton Ties, a St Louis, Missouri-based supplier of composite sleepers that is seeking to change the way US railways — and their international peers — invest in the permanent way.

More than 20 million sleepers are replaced every year by US railroads, and a desire to move beyond traditional wooden materials has been evident in the market for many years. Concrete is one common alternative, with steel also used at some locations, but these have proved challenging to deploy at scale while remaining cost-effective.

Janson explains that over the past decade or so, composite materials have emerged as an option that could prove more competitive on both price and durability. Yet when the first examples of plastic or synthetic products appeared on the market in the early 2010s, results in-situ proved disappointing, and the railroads quickly lost heart.

According to Janson, a critical factor in the failure of what he terms 'first generation composites' was a lack of understanding among procurement managers and track engineers of what a composite material means. In reality, most of these early products were just plastic, he says. His company is seeking to use its expertise gleaned from the plastic and recycling sectors to produce a second generation of sleepers that will prove durable and cost-effective enough over their life-cycle to challenge the hegemony of wood.

From plastic waste to trackbed

Triton Ties is one half of the Triton Group, which also includes a plastic recycling business. Janson explains that this history holds the key to the advantages he sees in Triton's newly developed material.

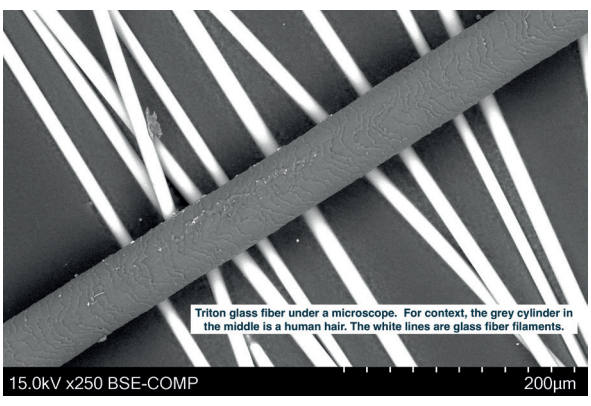
He took over at Triton Ties in 2019 after a 20-year career in the plastics sector, and says that over time, he realised 'a successful company is one that takes raw material and brings a complete finished product to market'. Other sectors had started to deploy composites successfully in areas such as road surfacing and automotive component production. Janson feels the key to this success was understanding that a true composite is one made by combining two or more distinct substances with different physical or chemical properties to produce a final product that has superior characteristics not present in the individual components.

That is the aim of Triton's product, which combines recycled plastic material with glass fibre as a reinforcing agent.

Virgin glass fibre

Janson describes early attempts at composite sleepers as 'essentially just plastic'. His product sets itself apart partly through its use of virgin glass fibres. 'Each bundle of glass fibre is about the size of a grain of rice, and each of these bundles contains over 4 400 filaments of glass fibre', he explains. There are more than 10 billion filaments in each sleeper produced.

Triton is offering three different levels of tensile strength for its sleepers, of which the strongest grade is more robust than oak, which is the standard choice for a wooden sleeper, and all the grades last longer than wood. 'A bonding process has to take place for the creation of a true composite', Janson adds. During Triton's Twin2 extrusion process, the glass fibre strands are bonded to the polymer matrix, and the load-bearing properties of the glass fibres then act to strengthen the final product. The result is a product that is stronger than oak and is claimed to offer a 50+ year lifespan.



Each composite sleeper incorporates more than 10 billion glass fibre filaments to reinforce the recycled plastics.

Sustainability

While Janson says the main driver for investing in the composite sleepers is their greater durability than wood, he believes that sustainability is also a reason for railways to adopt the material.

'Sustainability does matter', he says, 'but the product must be better too'. Triton's products use post-consumer resin, which is recycled plastic made from used consumer products, and there is no creosote in its range. But the main sustainability argument is a straightforward one: there is no need to cut down the mature oak trees that are felled to support production of wooden ties.

The latest designs of composite sleepers are stronger than most grades of wooden sleeper and are expected to have a signifcantly longer life.

The changing climate could also pave the way for a shift away from wood, as changes in the types of material available and in weather patterns is causing sharp variations in the performance and lifespan of sleepers. Janson explains this in terms of 'geographical decay zones', which is seeing parts of the US rail network experience much more rapid decay in sleeper life than others. 'Some wooden ties are only lasting four to eight years in track', he says, partly because of increasing rainfall and in some cases because of the newness of the oak being used.

In this context, composites have a clear advantage in terms of whole-life costs, but Janson acknowledges that the upfront costs of purchasing them is higher by approximately a third. Persuading railways to make the case for a return on investment over a longer timeframe remains a work in progress, he feels, with short-term planning fuelling what he sees as 'a maintenance doom loop'.

'When you run the numbers using a Net Present Value model — factoring in fewer replacements, reduced service disruptions and lower disposal costs — Triton Ties show a strong return', he insists. 'Even with an extra $100 per tie, the maths works, just not within a single budget cycle. It takes a multi-year lens. If rail tie infrastructure can be built to last 50 years, why are we budgeting like it only needs to last 10?', he asks.

Triton is targeting sales of around 500 000 sleepers per year, and Janson notes that it would be practical for railroads to install composite sleepers interspersed with those made from wood or concrete over the same stretch of line. There is no alteration to the installation process needed, he says, although the sleepers are pre-drilled before being 'spiked' into place and fastened.

Approvals

Triton's early prototypes were tested at the MxV Rail laboratories at Pueblo in Colorado in early 2022, with further trials undertaken at Penn State University. These showed that the sleepers could withstand 130 million gross tonnes in load cycles without suffering fatigue damage, Janson says.

Now, real-world installations are gaining ground. Norfolk Southern's trial of composites, which started in May this year, saw the deployment of 30 000 glass-reinforced polymer sleepers provided by three manufacturers, including Triton. These were installed with a 100% success rate, and at the same pace of installation as with conventional materials.

Janson says his company also has sleepers in use with BNSF and CSX, and installation in Union Pacific track is expected imminently, the product having received approval from the Class I's own laboratories.