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In response to the [Independent Review of the Victorian Public Service](#), the government determined that Sustainability Victoria would be abolished. See information about [programs that have closed or transferred](#).

For current information on sustainability, energy and recycling, visit the [Department of Energy, Environment and Climate Action \(DEECA\)](#).

Recycled plastic composite railway sleepers replace timber sleepers for low speed rail applications

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Category	Details
Product	Recycled plastic composite railway sleeper
Material classification	Plastics (mixed waste plastic)
Project type	Research, development and demonstration
Research impact	Production, demonstration, testing and type approval
Research result	A new Australian Standard for 'Alternative Material Sleepers' (AS1085.22) was established paving the way for a new generation of railway infrastructure made from recycled materials. The Duratrack® sleeper has demonstrated its performance and capability as a viable timber sleeper replacement and is now type approved for use in low speed siding and yard applications in the Metro Train Melbourne (MTM) and V/Line networks.
Sector	Railway
Grant recipient	Monash Institute of Railway Technology
Project partners	Integrated Recycling
SV funding	\$299,200

The outcome

Since 2015, Monash Institute of Railway Technology (Monash IRT) has completed 2 stages of research on the application of plastic railway sleepers as an alternative to traditional sleepers made from timber, concrete and steel. This work has been delivered in partnership with Integrated Recycling, whose composite sleeper product, Duratrack® is made from 85% post-consumer plastic waste.

The most recent stage of plastic sleeper research completed in December 2021, included an in-track trial where 25 Duratrack sleepers were installed interspersed with timber sleepers in a 1 in 5 arrangement at Tottenham Junction, West Footscray in the Australian Rail Track Corporation (ARTC) network. The purpose of the stage 2 project was to assess the performance (strain, vibration and noise) of the Duratrack sleeper and support improved design procedures. The outcome of this research has previously supported other Duratrack sleeper trials. One typical example is the trial with 192 sleepers at Richmond Train Station in MTM network.

A key outcome from the project is that the Duratrack sleeper has demonstrated its suitability as a viable alternative to timber sleepers for low speed application. And it has since been approved by V/Line and MTM for low speed rail applications such as sidings and stabling yards.

Since the trial was completed, the Duratrack sleeper has been used on Level Crossing Removal projects. In 2022, it will be placed on Regional Rail Revival projects with 100 sleepers on the Shepparton Line Upgrade and 440 sleepers on the Warrnambool Line Upgrade.

Integrated Recycling has previously indicated that:

- one kilometre of Duratrack-sleepered track (approximately 1500 sleepers) diverts around 64 tonnes of recyclable plastic from landfill
- composite sleeper products have a lower carbon footprint than timber, concrete and steel sleepers made from virgin materials
- composite sleepers have a lifespan of up to 50 years and can be recycled at the end of that time.

The need

In Victoria, more than 400,000 tonnes of plastic per annum ends up in landfill. This combined with the export ban on mixed and unprocessed plastics, means that Victoria needs to find new domestic uses for recycled plastics. One potential application is via recycled plastic composite sleepers which represent the most significant volume-use opportunity for waste plastics in transport infrastructure. The Duratrack sleeper is made from agricultural plastic waste (wrap silage, twine and so on) which would have otherwise ended up in landfill.

Railway sleepers are traditionally manufactured from timber, steel or concrete, all of which are highly rigid and well accepted materials. By comparison, plastic sleepers are generally more flexible and hence have been treated with some wariness amongst the railway authorities. Building confidence in and demonstrating that plastic sleepers can perform well in mainline track is therefore a critical step to acceptance and wide scale use and was a key objective of this project.

Rigorous testing and assessment of the sleeper's capability on low speed mainline applications was needed to ensure it supports freight and passenger traffic and to compare it against conventional design models. This included testing on load transfer, track stability, strain levels, noise and vibration generation and material characterisation

The major beneficiaries from this research are the railway authorities who will have additional low carbon and cost competitive sleeper supply options for future rail infrastructure projects. The outcomes and progress on composite sleeper manufacturing demonstrates Victoria's transition to a circular economy by supporting improved recycling practices, diversion from landfill and stimulating the local manufacturing industry.

Developing the solution

Following lab testing and reaching a desired material composition for the sleeper product, Monash IRT approached its industry partner ARTC to support the trial by installing a Duratrack sleeper panel in a low speed mainline track. Monash IRT worked closely with ARTC in providing supporting documentation regarding the Duratrack product and facilitated a risk assessment workshop for the in-track sleeper trial at Tottenham Junction, West Footscray.

Monash IRT developed a rigorous monitoring and testing framework to accurately measure strains and performance of the sleepers and map the plastic sleeper behaviour in track. Regular visual inspections were carried out over a 12-month period and noise and vibration testing was carried out to make comparisons with concrete sleepers.

Laboratory testing was carried out on the Duratrack sleepers to understand key properties including elastic modulus, maximum elastic strain limit and the effects of strain rate on modulus.

A Finite Element Model of the Duratrack sleeper was developed using the measured sleeper properties. This model was then used to assess the effects of track gauge and sleeper dimensions on sleeper strains.

The partnership

Monash IRT is the premier track and vehicle railway research centre in Australia and have led this project over the past 7 years. Throughout this time researchers have applied their skills and expertise for design, lab and onsite testing to instil confidence in this innovative new product.

Integrated Recycling (IR) have been a close collaborator during this time and key manufacturer of the Duratrack plastic sleeper. This collaboration has included initial studies into Duratrack sleepers being developed by IR, small trials in Tourist and Heritage Railways through to the most recent mainline trial with ARTC in Victorian rail networks.

The success of this project can be attributed to the long-standing collaboration between IR, ARTC and Monash IRT as well as Monash IRT's domain railway knowledge.

Pathway to commercialisation

In addition to the funding the project partners received under the [SV Research, Development and Demonstration Grants](#) program, Integrated Recycling was awarded a \$1.7 million grant in 2021 under the [Circular Economy Recycling Modernisation Fund](#) to install a modular production line for the Duratrack sleepers at its Mildura Facility. This grant was co-funded equally by the Victorian and Federal Governments and will enable IR to expand its manufacturing capabilities for the current sleeper formulation approved as a timber sleeper replacement for low speed application.

To compete against concrete sleepers in high speed rail networks, a much stronger and more durable product would be required including either improved materials or stronger reinforcement. Monash IRT are taking the next step to develop such a product, with support from the Victorian Government.

Gallery



Laying Duratrack sleepers at the Richmond Station trial 2019

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