



Engineers in Australia have found a way to make stronger and crack-resistant concrete with scrap carpet fibres, rolling out the red carpet for sustainability in the construction sector.

The research team is engaging with partners including Textile Recyclers Australia, Godfrey Hirst Australia and councils in Victoria to conduct field studies of on-ground slabs made of reclaimed textiles.

Lead researcher Dr Chamila Gunasekara from RMIT University said the team had developed a technique using waste carpet fibres to reduce early-age shrinkage cracking in concrete by up to 30%, while also improving the concrete's durability.

This research addresses a major challenge in the construction sector, as the annual cost of repair for cracks in reinforced concrete structures in Australia is about A\$8 billion. In the US, the cost is estimated at US\$76 billion per year.

Publishing their latest results in the Construction and Building Materials journal, the team has shown that waste carpet material can be used to improve concrete.



The research team with a pile of discarded clothes that could be used in their concrete. Credit: Will Wright, RMIT University.

With state-of-the-art textile research facilities at RMIT, the team of civil engineers and textile researchers has also been able to use other discarded textiles including clothing fabrics to make concrete stronger.

“Cracking in early-age concrete slabs is a long-standing challenge in construction projects that can cause premature corrosion, not only making a building look bad but also risking its structural integrity and safety,”

said Gunasekara, an ARC DECRA fellow from the School of Engineering.

“Scrap carpet fibres can be used to increase concrete’s strength by 40% in tension and prevent early cracking, by reducing shrinkage substantially.”

Laboratory concrete samples have been created using the various textile materials and shown to meet Australian Standards for engineering performance and environmental requirements.



PhD scholar Nayanatara Ruppegoda Gamage (left) and Dr Chamila Gunasekara with concrete samples made using textiles.
Credit: RMIT University

Addressing a big waste challenge

The disposal of carpets and other textiles including discarded fabrics poses an enormous environmental challenge, Gunasekara said.

“Australia is the second largest consumer of textiles per person in the world, after the US. The average Australian purchases 27kg of new clothing and textiles every year, and discards 23kg into landfill,” he said.

“Burning carpet waste releases various toxic gases, creating environmental concerns.”

Dr Shadi Houshyar, a textile and material scientist at RMIT, said firefighting clothes waste also posed a challenge, as the same qualities that made these materials ideal for firefighting also made them difficult to recycle.

“Up to 70% of textile waste would be suitable for conversion into usable fibres, presenting an opportunity in the materials supply chain,” said Houshyar, from the School of Engineering.

Working with industry and government to support the recycling of waste

Field trials conducted with support from industry and local government partners will help capture the unexpected conditions encountered in real-world construction projects.



Dr Chamila Gunasekara (left) and PhD scholar Nayanatara Ruppegoda Gamage with discarded firefighting clothes that could be used to make crack-resistant, stronger concrete.

Credit: Will Wright, RMIT University

The ARC Industrial Transformation Research Hub for Transformation of Reclaimed Waste Resources to Engineered Materials and Solutions for a Circular Economy (TREMS) and an early-career research grant will fund the field trials as well as computational modelling. TREMS is led by Professor Sujeeva Setunge from RMIT.

The team is collaborating with Professor Andrzej Cwirzen Luleå University of Technology in Sweden on computational modelling.

Source: Will Wright, RMIT University