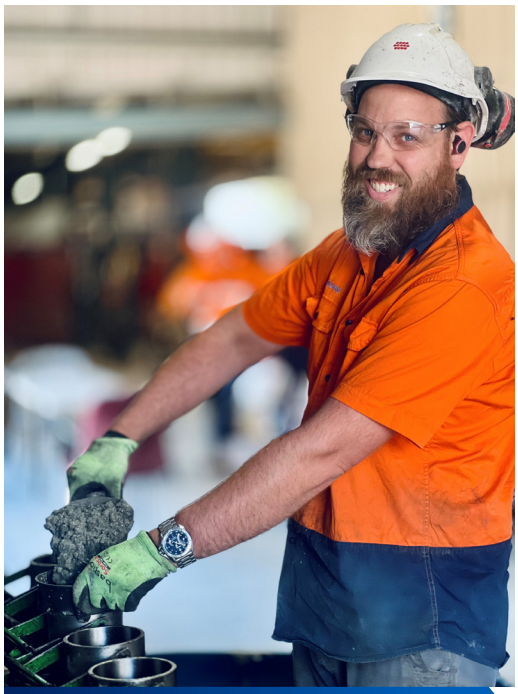
Sustainable Innovations

Reduced carbon concretes and sustainable retaining wall reinforcements

Geoquest's research and development teams here in Australia are continuing striving to provide customers with increasingly more sustainable and cost-effective options across concrete and reinforcements for mechanically stablised earth (MSE) walls. The goal is to work toward reducing costs, time and carbon footprint across projects.

Reduced carbon footprint - concrete

- Steel fibre mix development
- 50% SCM mix



Concrete testing at Geoquest Albury, NSW

Sustainable Construction: Advances in Reduced Carbon Concrete

As the engineering and construction industry seeks more sustainable solutions, reduced carbon concrete is emerging as a key innovation. Recent advancements in material science are paving the way for these low-carbon concrete alternatives that maintain strength, durability and performance while significantly reducing concrete's environmental impact.

The following carbon reduction solutions are developments pursued by Geoquest to help shape the future of more sustainable concrete:

1. Steel Fibre Mix Development: Strength Without Traditional Reinforcement

Steel reinforcement has long been a critical component of concrete structures, but the production of steel is energy-intensive and carbon-heavy. Steel fibre reinforcement presents a more sustainable alternative by replacing conventional steel mesh or rebar with dispersed fibres throughout the concrete mix.

Benefits of Steel Fibre Concrete

- Reduced Carbon Footprint – By eliminating or reducing rebar, less steel is required, lowering embodied carbon.
- Improved Durability – Steel fibres enhance crack resistance, tensile strength, and impact resistance, extending the lifespan of structures.
- Simplified Construction – Fibre-reinforced mixes eliminate the need for additional reinforcement placement, reducing labour and construction time.
- Increased Sustainability – Some steel fibres are sourced from recycled materials, further contributing to circular economy principles.

This innovation is beneficial for precast concrete, tunnel linings, industrial floors, and infrastructure projects, where durability and sustainability are key considerations.

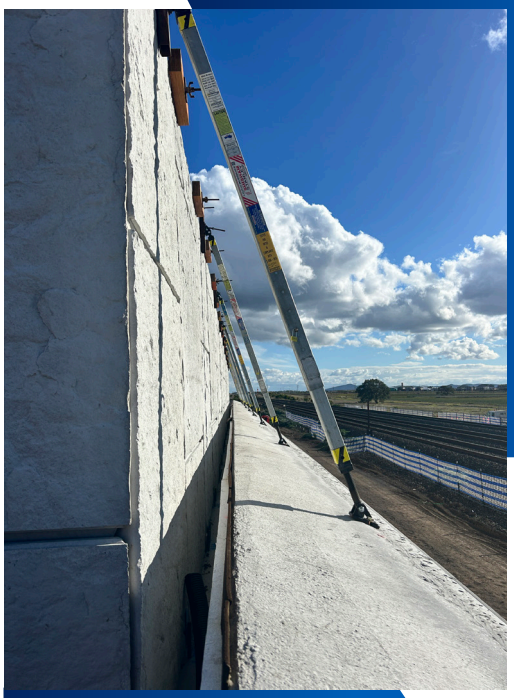
2. 50% SCM Mix: Cutting Cement Use in Half

One of the most effective ways to lower concrete's carbon footprint is by reducing cement content and replacing it with Supplementary Cementitious Materials (SCMs).

What Are SCMs?

SCMs are industrial by-products that can partially replace Portland cement in concrete mixes. Common SCMs include:

1. Fly Ash – A by-product of coal-fired power plants
2. Slag (GGBFS) – A by-product of steel manufacturing
3. Silica Fume – A by-product of silicon and ferrosilicon production



Ison Road, Victoria. 50% SCM

Advantages of a 50% SCM Mix

- Lower CO_2 Emissions – Reducing cement content by 50% significantly cuts embodied carbon.
- Enhanced Performance – SCMs improve durability, resistance to chemical attacks and offer long-term strength development.
- Better Sustainability – SCMs often result in less water demand and improved workability.
- Waste Utilisation – Industrial waste materials are repurposed instead of being landfilled.

Infrastructure and commercial projects in Australia are starting to adopt high-SCM-content concrete as part of their sustainability strategies, helping to meet carbon reduction targets without compromising performance.

At Ison Road in Victoria, all the precast bridge abutment walls were cast by Geoquest with 50% SCM concrete mix. Designed and manufactured for the Ison Road Overpass in Werribee, these bridge abutment retaining walls are a sustainable first for Victoria and Australia. The structures are the first to all be successfully cast with a 50% reduction in General Portland cement; the lowest level of cement that has been used in a concrete mix for bridge retaining walls.

This 50% reduction surpassed required project targets of 30% and demonstrates how national precast concrete suppliers can more impactfully contribute to sustainable infrastructure development.

Geoquest designed and manufactured the two (North & South) bridge abutment walls for the Ison Road Overpass project, utilising our TerraPlus® mechanically stabilised earth (MSE) walls solution with the 50% supplementary cementitious materials (SCM) concrete mix.

Other recent infrastructure developments that also incorporated 50% SCM mixes for their MSE wall panels or other precast concrete elements include the significant Warun Ponds and Diggers Rest projects, also both in Victoria.

Carbon Reduction: To achieve such a high level of SCM replacement for the project is an exciting, innovative step, which highlights the possibilities of how the precast concrete industry can reduce our carbon footprint and help to deliver more sustainable infrastructure. Geoquest is currently innovating and testing even higher SCM content mixes in our pursuit to reduce our carbon footprint. Watch this space.

Warun Ponds, Victoria, incorporated elements with 50% SCM

Final Thoughts: The Path Toward Greener Concrete

The development of steel fibre reinforcement, high-SCM mixes, and recycled plastic additives marks a positive shift towards more eco-friendly concrete solutions. These innovations not only reduce carbon emissions but also enhance performance and longevity, ensuring that sustainability does not come at the expense of quality.

As the construction industry continues to push for net-zero goals, embracing reduced carbon concrete technologies will be important for greener infrastructure, resilient cities and a sustainable future.

Cost Effective, Sustainable Reinforcements

Geoquest offers a range of steel and geosynthetic reinforcements, however it's High Adherence (HA) EcoStraps offer significant advantages on projects when it comes to cost efficiency and sustainability.

EcoStrap HA reinforcement straps

Geoquest recently introduced EcoStrap HA reinforcements to the Australian market, marking an advancement in environmentally sustainable construction. This innovative reinforcement solution enables the use of site-won materials, or even chemically aggressive materials, as backfill for mechanically stabilised earth (MSE) walls, reducing both carbon footprint and project costs

The Diggers Rest Level Crossing Removal Project in Victoria is the first Australian infrastructure project to utilise EcoStrap HA reinforcements.

The technology is designed and supplied by Geoquest to enhance sustainability by allowing recycled concrete and lime-stabilised soils to be used as select backfill—materials that traditionally present challenges due to their high pH levels.

EcoStrap HA consists of polyvinyl alcohol (PVA) tendons encased in a polyethylene sheath, making it particularly resilient in high pH environments. Additionally, its polymeric strips offer enhanced stiffness and greater resistance to elevated temperatures, ensuring long-term durability in demanding construction conditions.

Geoquest Australia supplies EcoStrap HA nationwide, supporting industry efforts to integrate more sustainable and cost-effective solutions into major infrastructure projects.

EcoStrap HA installation at Digger's Rest, Victoria

Other geosynthetic reinforcement straps offered by Geoquest

Our geosynthetic reinforcements are selected based on the characteristics of the intended backfill to be used, load factors, required service life and other considerations. Geoquest's four solutions are:

> GeoStrap™: Coated polyester (PET) strips without high-adherence edges, best for low pH backfill

> HA GeoStrap™: Coated polyester (PET) strips with high-adherence edges, best for low pH backfill

> EcoStrap™: Coated polyvinyl alcohol (PVA) strips without high-adherence edges, best for high pH backfill

> HA EcoStrap™: Coated polyvinyl alcohol (PVA) strips with high-adherence edges, best for high pH backfill

In summary, in addition to the traditional steel reinforcement straps for MSE walls, a range of geosynthetic straps are available as alternatives, including the new, innovative EcoStrap HA, which enables the use of site-won materials as backfill. The polymeric reinforcing strips are made of polyvinyl alcohol (PVA). The coated PVA strips with high-adherence edges are:

- Best for backfills with a high pH, such as those made with recycled concrete or lime-stabilised soils.
- Stiffer and can withstand higher temperatures than other options
- A cost-effective solution for reinforced soil structures
- Well suited for complex projects, including tall and heavily loaded structures

Conclusion: A Sustainable Future for Infrastructure Construction

As the engineering and construction industry shifts towards sustainability, new innovations are paving the way for more eco-friendly and high-performance infrastructure solutions. These advancements not only reduce embodied carbon but also enhance durability, efficiency and cost-effectiveness.

Geoquest remains committed to delivering cutting-edge, sustainable solutions in concrete and mechanically stabilised earth (MSE) wall reinforcements. With the introduction of EcoStrap HA and other geosynthetic reinforcements, the industry now has more opportunities to reduce carbon footprint while maintaining structural integrity.

By embracing these innovations, engineers, developers, and construction professionals can build a more sustainable future—where reduced-carbon materials become the standard, not the exception. Geoquest continues to lead the charge in responsible engineering, ensuring that sustainability and performance go hand in hand. Contact your local Geoquest Australia office for more information.