



Industry Challenge

Low Carbon Concrete: Accelerating the uptake of Geopolymer and Alkali Activate Binder Concrete



Department of Industry,
Science and Resources

AusIndustry
Cooperative Research
Centres Program



Industry Challenge

Overview

Using supplementary cementitious materials (SCM) such as Fly Ash, Slag and Silica Fume in concrete is not new. Fly Ash was added to lower the heat of hydration in massive concrete structures such as the Keepit Dam in the 1950's and has been used to produce pumpable concrete since the early 1970's. In the 1980's Silica Fume was introduced to make high-strength concrete, and since the 1990's SCMs have been used to improve the durability of concrete.

Being derived from lower embodied energy materials, these SCMs paved the way for the first generation of low carbon concrete (LCC) which is increasingly being used to meet Australia's ambitious sustainability targets.

Geopolymer concrete (GPC) and alkali activated binder concrete (AABC), being cement-less and having a significantly reduced carbon footprint, are often described as the next generation of LCC. Australia is leading the worldwide development and implementation of GPC and AABC, with numerous examples such as the Wellcamp Airport in Toowoomba, the University of Queensland's Global Change Institute building in Brisbane and the Cowies Creek Bridges in Geelong providing data and insights into the long-term structural performance of both concrete types. Despite research studies recognising GPC and AABC as worthy alternatives to Portland Cement Concrete (PCC) due to their environmental, technical and

economic benefits, the barriers to the widespread uptake of both LCC types in the construction industry remain.

With the imminent release of Standards Australia Technical Specification TS199 Design of geopolymer and alkali activated binder concrete structures, much-needed guidance for the design, effective use and application of both concretes will be provided.

To accelerate the adoption of GPC and AABC across Australia's buildings and construction sector, Smartcrete CRC seeks to identify and address barriers that still hinder industry to incorporate GPC and AABC into their standard concrete offering, and thus using them more broadly as a substitute for PCC.

Through a tailored program of research delivered by Australia's high-quality university network, Smartcrete CRC aims to develop and demonstrate practical solutions that overcome those barriers and support the transition of Australia's buildings and construction sector to low carbon concrete.

What? To kickstart and enable the rapid large-scale adoption of geopolymer concrete.

Why? To reduce the embodied CO₂ of Australia's concrete structures.



Image: Wellcamp Airport, Toowoomba



Image: QU Global Change Institute, Brisbane



Image: Cowies Creek Bridges in Geelong

Definition

Geopolymer Concrete (GPC)

Geopolymer concrete is a type of concrete that is made by reacting aluminate and silicate bearing materials with a caustic activator, such as fly ash or slag from iron and metal production.

GPC = Aluminosilicate by-products (precursors) + Alkali Activator + Aggregate + Water

Source: E Scholarly Community Encyclopa



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How we work

1 Theme Selection

Working with our industry participants, we identify core themes of interest which align with the mission of the CRC. We create a general overview of the theme which helps us to determine who should participate in a design workshop to uncover industry challenges which may be solved or improved through an experimental, scientific process.

2 Challenge Design

SmartCrete with the support of industry participants crafts a 'Reverse Pitch' which is shared with the entire SmartCrete research community, comprising 10 Australian Universities. The reverse pitch contains the objectives of the challenge, calling for expressions of interest from a diverse and multidisciplinary research cohort.

3 Reverse Pitch

We bring together supply chain participants in a facilitated design workshop to create a shared vision of the future for the sector and a clear set of barriers or challenges towards achieving that future. Together we determine our innovation priorities and set a notional research budget to help attract high quality research teams to undertake the research.

4 Industry Panel

Industry participants are brought back together in an industry review panel to consider curated research expressions of interest and choose which projects to invest in toward meeting the shared objectives. Once finalised, the projects are presented to SmartCrete's Investment and Impact Committee and then the Board to approve the investment.

5 Agile Delivery

All SmartCrete projects are managed through the principles of Agile Project Management. We celebrate regular showcases, fast failure and pivoting based on new knowledge to ensure projects achieve the intended impact. Our Portfolio Director works with project teams to implement agile principles into the daily project operations.



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