

Research Challenge Brief

Calling all Innovators!

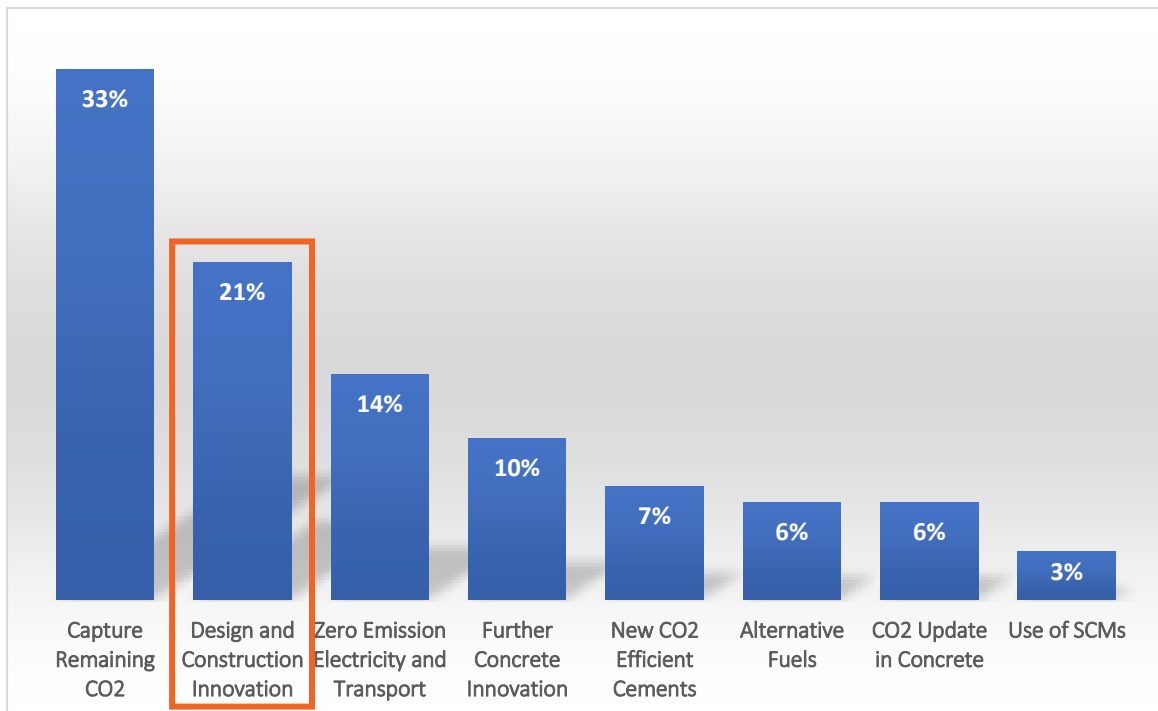
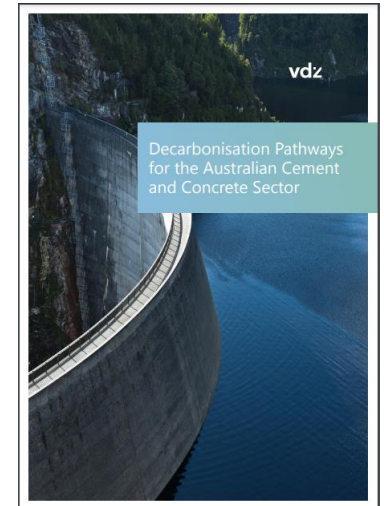
**Searching for Research Solutions to solve
challenges and barriers towards**

Decarbonised Infrastructure

Background

Significant volumes of concrete are used in Australia's infrastructure sector. This sector has ambitious targets towards a net-zero future. New engineered solutions and optimised asset management will be critical to the transition to a decarbonised Australian infrastructure sector.

SmartCrete in conjunction with other key industry associations, commissioned work to establish decarbonisation pathways for the concrete sector. View the full report [here](#).



There is a significant opportunity (over and above new cements and SCM use) to reduce carbon in the infrastructure sector through design and construction innovation where the following was highlighted:

- Promoting design of building and infrastructure that includes a clear focus on material efficiency, specifying lower carbon concrete and improved construction technologies.
- Ensuring structural optimisation that allows for lifetime extension, repair and reuse.

Decarbonising Infrastructure



SmartCrete network participants representing concrete production, architecture, design, engineering, and asset owners came together to discuss shared challenges and barriers towards achieving a decarbonised concrete construction sector.

In September 2022, SmartCrete CRC brought together industry groups who are responsible for design, construction, and management of concrete infrastructure to map out barriers and challenges towards decarbonising infrastructure and addressing the workshop vision. Participants worked through a facilitated challenge scoping session and have identified key challenges which could be solved with a research focus.

SmartCrete is now **calling for early-stage research proposals** which can demonstrate multi-disciplinary, innovative solutions to meet these industry needs.



Vision

To change and optimise the way we design and construct concrete infrastructure that enables the industry to deliver more carbon efficient structures.

The workshop uncovered the following key considerations to generate impact towards sustainability targets:

Design and Construction Innovation

Determining key considerations for decarbonisation

- Any decarbonisation action must consider interacting variables such as infrastructure design efficiency, constructability, durability, and structure performance
- Carbon performance must be considered with a full-life-cycle perspective
- Constructional demands may restrict application of sustainable solutions, for example requirements for strength at 28 days
- All participants involved with infrastructure provision must be engaged to achieve sustainability objectives
- There is a wealth of work happening around the world on achieving net-zero. Solutions must ensure they do not re-invent the wheel and maximise opportunities to collaborate and learn from existing work
- The conversations around sustainability need to happen earlier (in design and prior)
- Solutions must have a holistic focus, understanding the ownership of carbon intensity, risks and responsibilities across the asset life cycle. Solutions should aim to build consistent approaches to measurement and management of carbon.

Collaboration, Alignment and Knowledge Transfer

Learning from the past, sharing our knowledge and optimising the future

- Need a feedback loop between design and construction:
 - We keep re-learning the same mistakes
 - Lacking a post-implementation review to identify learnings after project delivery from across infrastructure provision
 - Information does not transfer well in design, construction, and asset management
- Tenders and post-tender activities are highly contractual – difficult to implement changes and innovate at this point
- Knowledge needs to be transferred to different groups:
 - Design and construction processes and their impact on project requirements for concrete materials need to be understood by sustainability professionals
 - The right information needs to go to key stakeholder groups - focus on training and education for stakeholders
- International practice:-
 - Need to be harnessed
 - Follow what has worked elsewhere around the world and consider local application perspectives

Attitudes, Paradigms and R&D

Determining what needs changing and modification

- Attitude challenges towards:-
 - Total project construction cost
 - Maintenance and asset management cost
 - Total cost of ownership
 - Carbon cost
- Australia's slow transition to renewables
- Not enough focus on what we want our structures to do (design and construction challenges)
 - Belief that materials will solely deliver outcomes (rating systems)
 - Too much focus on cement reduction
 - Avoiding a top-down approach - focusing too much on the inputs rather than the requirements of the structure/project
 - 'Greenwashing' instances of unvalidated or untested claims
- Providing incentive to change
 - We are stuck in our thinking
 - Need to "break out" and consider other options and methods of considering this issue
- Need high level thinking – R&D:
 - Issues are complex
 - The speed of R&D is critical to achieve Australia's net-zero targets
 - Need to prioritise, scale and align objectives amongst researchers, industry, government on how to address vision and goals
 - Need strategies to implement new knowledge from R&D into practice
 - Work will likely require immediate commercial priorities as well as longer term research



Challenge Themes

SmartCrete and Partners are calling for Research Proposals which can address the following 4 themes:



Ratings and Measurement



**Carbon Measurement in Use of Concrete
in Infrastructure (procurement)**



Standards and Specifications



Enhancing Engineering Design

Challenge Themes



Ratings and Measurement

To achieve improvements in carbon performance, we first need to understand existing carbon performance, and tangible pathways towards improvement (measure, monitor and learn)

We need better measurement systems for consistent and shared understanding of our carbon performance

- There is currently a lack of clarity on:
 - the total carbon cost of construction
 - the total life-cycle carbon cost
 - how the performance of the concrete infrastructure links to carbon
- Current environmental rating systems are inadequate – need improved tools
- Most measurements are Scope 1 or 2 focused, with no or limited Scope 3 accountability
- There are no or limited carbon baselines available for comparison
- We don't have adequate carbon quantification or estimation protocols
- We need to differentiate product level and enterprise level carbon measurement and reporting
- Stakeholder focus is on embodied CO₂ - should it be more holistic?
- There is no uniform and accepted embodied carbon database
- There are no tools which allow multi-variable analysis to determine what technical carbon-mitigation solution is fit for purpose for a project
- Risk and ownership of infrastructure carbon performance, durability and fit-for-purpose performance across the infrastructure life cycle is unclear (engineer, architect, construction firm, asset owner all have different perspectives)



Challenge Themes



Carbon Measurement in Use of Concrete in Infrastructure (procurement)

The procurement process is a critical pathway to instill life-cycle environmental impact targets in Australia's concrete infrastructure (shared sustainable targets)

We need shared sustainability parameters built into infrastructure procurement frameworks which drive infrastructure provision and supply chain engagement

- Procurement is hierarchical rather than collaborative. Targets can only be achieved by engaging all participants involved with infrastructure provision
- Initial phases of procurement are generally driven by construction cost. Carbon impacts are considered too late to influence design
- Competitive procurement processes often deprioritise sustainability targets in favour of traditional competitive bidding drivers
- Procurement tender documents often have conflicting requirements from a sustainability performance and durability performance perspective. Need better frameworks
- There is limited information available on the cost of sustainability. We need shared knowledge on potential cost-savings with a sustainability focused approach
- Existing sectoral payment schedules drive rigidity that can dampen innovation
- We need a cross-sectoral shared and actionable long-term vision for net-zero



Challenge Themes



Standards and Specifications

We need to have carbon measurement and sustainability considered as part of the design process

- Current lack of clarity on total cost of construction and carbon, and their interrelationship
- Historical and accepted design and quality control practices are rigid and may need to be changed (e.g. 28 day compressive strength)
- There are different requirements from various state authorities on this issue. General consistence is desired, but this requires R&D
- Need consistent processes for measurement and approach for reducing carbon on projects and structures
- We are currently limited in what we can design. Need to consider new designs, materials, and constructional techniques to lower carbon
- Engineering risk in design:
 - Managing risk and ownership of professional indemnity
 - Accountabilities for designers in managing change
- Constructional requirements for efficiency (e.g. early age concrete strength requirements) need to be assessed against carbon frameworks



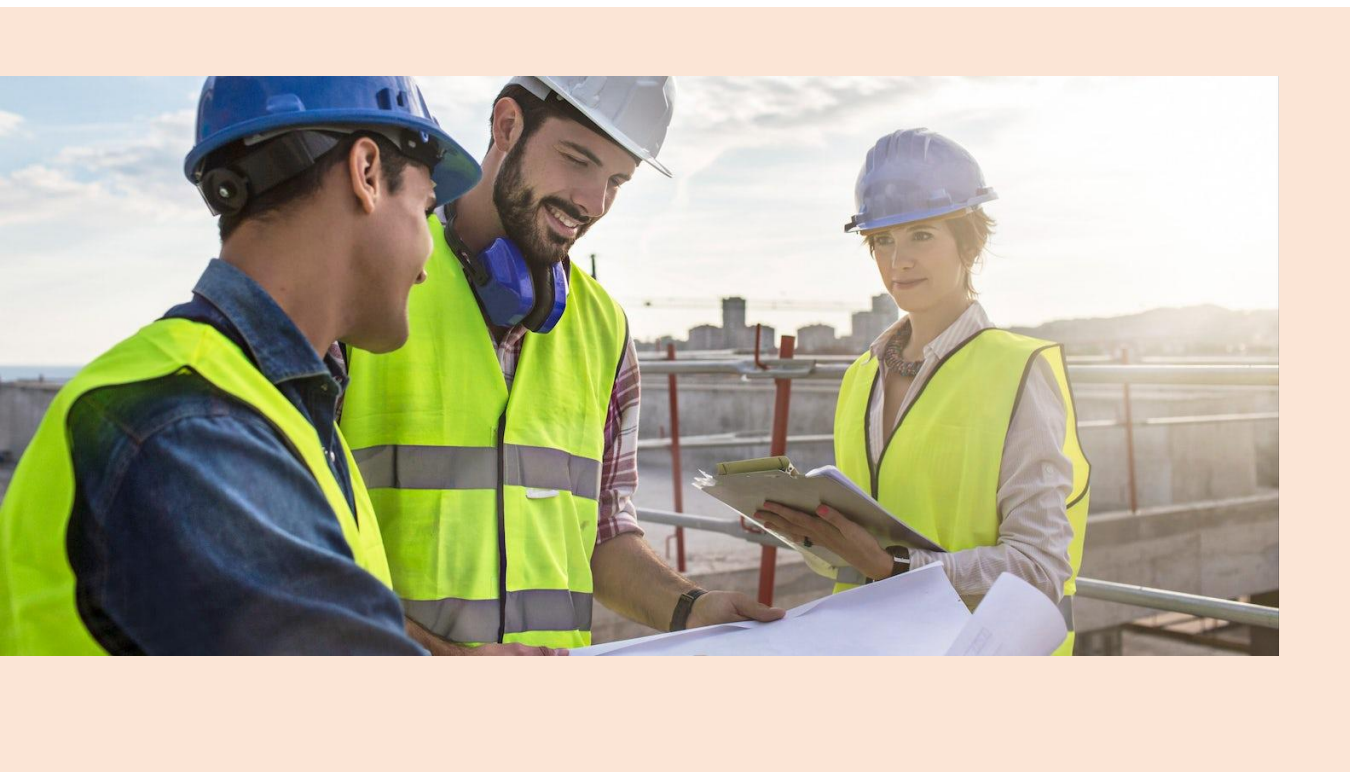
Challenge Themes



Enhancing Engineering Design

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The Collaborators



Calling for Research Solutions!

SmartCrete in collaboration with participants in the Australian cement industry ecosystem is calling for **innovative, multi-disciplinary and collaborative** research proposals to address all or part of the challenges identified towards a decarbonised infrastructure sector.

Research partners of SmartCrete CRC are asked to demonstrate your interest in this proposal through this short EOI form:

[Submit Your Research Proposal!](#)

The EOI requires only high level details of the research proposal. Upon review by the industry participants, successful research submissions will be approached to provide more information about the proposed research program and outputs.

Submissions close: 5pm Friday 16 December 2022

For more information contact
info@smartcretecrc.com.au