

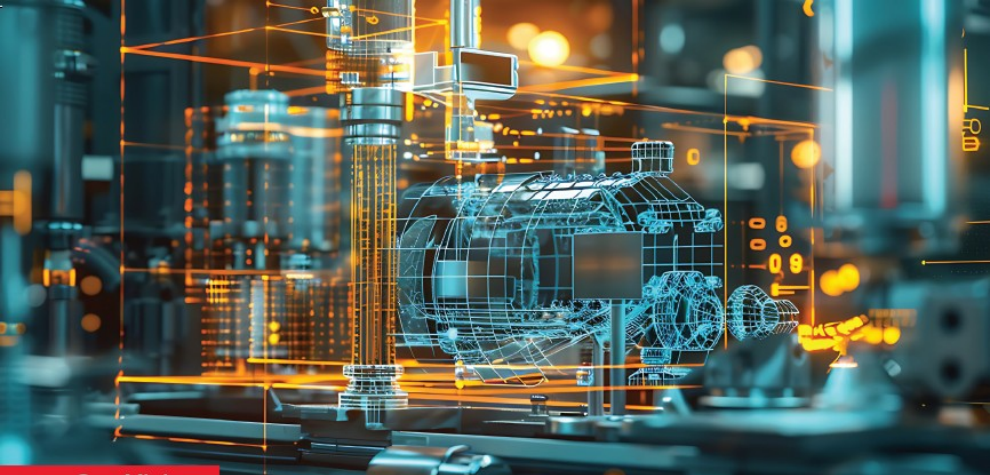
# Carbon Neutrality By Design



## ARC Training Centre for Whole Life Design of Carbon Neutral Infrastructure

The ARC Training Centre for Whole Life Design of Carbon Neutral Infrastructure (DfCO<sub>2</sub>) is designed to upskill the infrastructure workforce with the capability to design, construct, operate and dispose of infrastructure in a carbon neutral way.

We will train future leaders in the methodologies, technologies, and implementation strategies for carbon-neutral infrastructure design. In collaboration with stakeholders along the infrastructure value chain, the Centre will identify new market opportunities, reshaping Australia's infrastructure market toward low-carbon solutions. The Centre's innovations will expand sustainable infrastructure options, including low-carbon materials and maintenance strategies, and exploration of high-circularity end-of-life solutions.



## Our Vision

To transform the Australian infrastructure workforce sector with the capability to measure carbon emissions uniformly and design carbon-neutral structures throughout their lifespan.

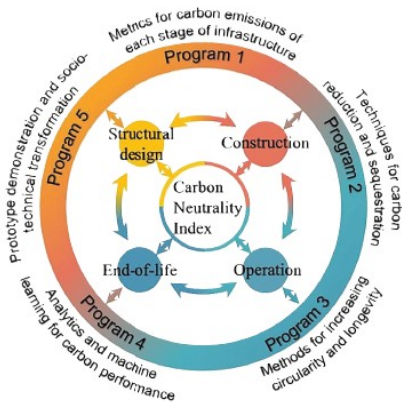
## Research Approach

Our research is focused on designing infrastructure that are carbon neutral from the outset. To achieve this, we will integrate carbon emissions as design parameters in our structural designs. Our approach covers four key stages of the infrastructure's life cycle: design, construction, operation/ maintenance, and end-of-life.

We have developed five research and training programs, based on the philosophy of carbon neutrality by design to deliver the following strategic objectives:

- Models for measuring carbon emissions and carbon neutrality in whole life.
- Techniques for carbon reduction and sequestration.
- Methods for increasing circularity and longevity.
- Analytics and machine learning for carbon performance.
- Technical manuals with digital twin tools for practical applications.

We will leverage on our industry co-designed research and training programs to develop industry-ready graduates and early-career researchers to drive advancements in reducing carbon emissions across the civil infrastructure sector.



## Our Programs

### Program 1: Metrics for carbon emissions of each stage of infrastructure

Our pioneering program supports the transition to carbon-neutral infrastructure by building capabilities to measure emissions across the entire lifecycle — from design to end-of-life. This includes using stochastic modelling and life cycle inventory databases to quantify both embodied and operational carbon emissions.

### Program 2: Techniques for Carbon Reduction and Sequestration

The program aims to advance carbon reduction and sequestration in infrastructure through industry-led projects: developing safety factors to integrate low-carbon materials into construction standards; reducing embodied carbon via advanced construction technologies such as automation, AR/VR, and IoT; and exploring novel CCUS methods to transform CO<sub>2</sub> into valuable products.

### Program 3: Methods for increasing circularity and longevity

Inclusion of circularity and longevity as essential future infrastructure design criteria to conserve natural resources and reduce carbon emissions. The program enhances infrastructure sustainability by extending the service life of infrastructure, enabling material reuse through reversible design, and assessing circular performance using digital tools like *circulytics* and material passports.

### Program 4: Analytics and machine learning for carbon performance

Using advanced analytics and machine learning to improve carbon performance across the infrastructure lifecycle. Key initiatives include federated learning with AI for data mining, processing and carbon performance modelling, developing risk-carbon-cost optimised maintenance strategies, and real-time, explainable performance monitoring—together enabling smarter, more sustainable infrastructure management.

### Program 5: Prototype demonstration and socio-technical transformation

This program focuses on real-world prototype demonstrations—such as a carbon-neutral water pipeline and road bridge—to validate tools from earlier programs. It also explores the socio-technical shifts needed for adoption, aiming to produce a design manual and boost acceptance of whole-life carbon-neutral infrastructure.

## Driving growth, productivity, and competitiveness

DfCO<sub>2</sub> will drive growth and competitiveness across the infrastructure value chain by advancing carbon-neutral design, low-carbon materials, digital technologies, and circular economy principles. These innovations will stimulate market expansion in construction, asset management, retrofitting, and waste management.

Tools such as material passports and standardized carbon neutrality indices will enhance productivity and support fair competition across the sector. A comprehensive technical design manual, integrated with digital twin technologies, will empower stakeholders to monitor key performance indicators—including carbon neutrality, safety, cost efficiency, and circularity—throughout the infrastructure lifecycle.

These outcomes will enable the emergence of new business models, attract investment, and produce industry-ready graduates, contributing to a more sustainable and resilient future for Australia's infrastructure sector.

## PhD Opportunities

Our Centre offers generous PhD scholarships with industry placements, combining academic research with real-world application. Students will receive hands-on training, mentorship, and work alongside academic and industry leaders to develop advanced skills and drive impact in their field.

## Partnering with us

There are a range of ways to collaborate with our Centre. These include:

- Partnered projects and joined grants
- Scholarships for PhD students
- Postgraduate internships and placements

## Our partners

### University Partners:

- RMIT University
- The University of Melbourne
- University of Technology Sydney
- The University of Sydney
- University of New South Wales
- University of South Australia
- The University of Adelaide

### Industry Partners:

- Melbourne Water Corporation
- South East Water Corporation
- Indesco Pty Limited
- Ortech Industries
- Sitzler Pty Ltd
- AIBUILD Pty Ltd
- Donald Macdonald Consultancy Pty Ltd
- C-Green
- Engineers Australia
- Standards Australia
- AECOM Australia Pty Ltd
- Materials and Embodied Carbon Leaders' Alliance (MECLA)
- Major Road Projects Victoria (MRPV)
- Dept of Transport & Main Roads (TMR)

## Centre Leadership

### Centre Director

Professor Chun-Qing Li  
(RMIT University)

### Deputy Director

Professor Guomin (Kevin) Zhang  
(RMIT University)

### Program Leaders

**Program 1:** Dist. Professor Mark Stewart  
(University of Technology Sydney)

**Program 2:** Professor Sujeeva Setunge  
(RMIT University)

**Program 3:** Professor Kim Rasmussen  
(The University of Sydney)

**Program 4:** Professor Flora Salim  
(University of New South Wales)

**Program 5:** Professor Chun-Qing Li  
(RMIT University)

## Contact details

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### ARC Training Centre for Whole Life Design of Carbon Neutral Infrastructure

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