



# A NET ZERO FUTURE:

## Delivered Through Our Infrastructure Pipeline



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# A Decade for Action

In Australia, collective action is needed to deliver low-carbon, climate-resilient infrastructure that meets community, Government, and investor requirements.

Australian state and territory Governments have committed to net zero carbon by 2050 to address climate change risks identified by the Intergovernmental Panel on Climate Change (IPCC). All have set further intermediate 2030 benchmarks to drive action over the next decade (see table one below).

Additionally, almost every jurisdiction requires the infrastructure supply chains to deliver carbon reductions measured using the Infrastructure Sustainability Council Rating Scheme (IS Rating Scheme). The IS Rating Scheme is the Australian and New Zealand rating framework to assess the sustainability of the planning, design, construction and operation phases of infrastructure programs, projects, networks, and assets. The IS Rating Scheme evaluates governance, economic, environmental and social performance and has now become standard

practice in most states and territories for any major transport project to plan and deliver carbon reductions, across a broad range of asset classes and sizes. Throughout Australia we have also started to see a range of targeted policy programs to incentivise innovation and uptake in low emissions building materials, renewable energy and the circular economy.

**Our industry is strongly placed to help enable this transition over the next decade because of its role in shaping societies and economies and through its unique position to influence emissions reductions, leverage investment, and respond to policy incentives from government, proponents, and asset owners.**

Table 1: Emissions Reduction Targets by Jurisdiction (2021) <sup>1</sup>

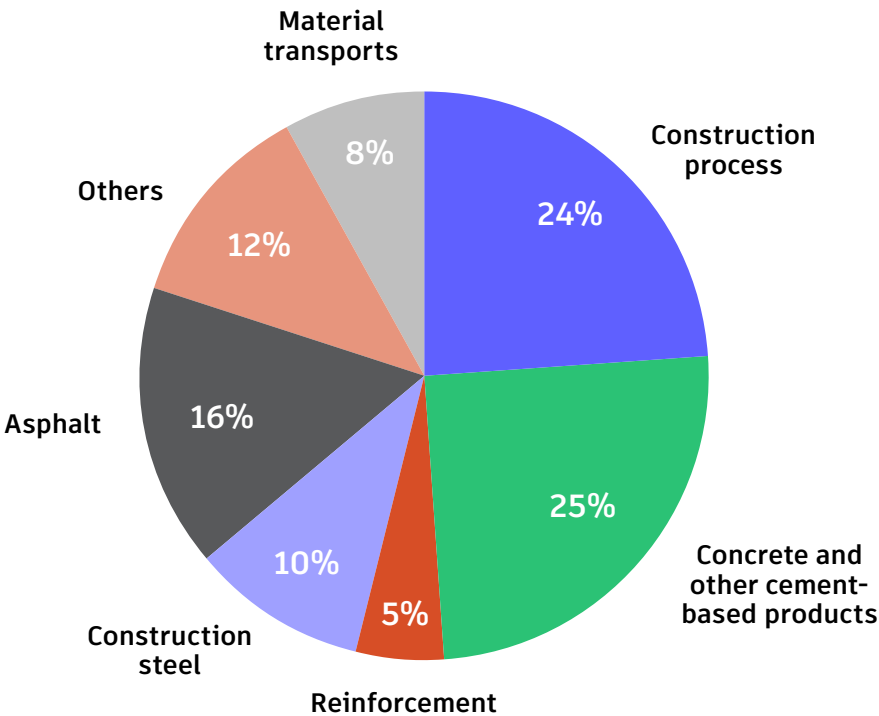
Jurisdiction	2030 target	Net-zero by 2050*
Federal	26-28%	“Prefer” to reach net zero
Victoria	45-50%	Yes
New South Wales	50%	Yes
Tasmania	Already at net zero	
Queensland	30%	Yes
Western Australia	Will match Federal government	Yes
Northern Territory	Pending	Yes
ACT	65%	Zero by 2045
South Australia	50%	Yes

\*Pre-COP26 targets

**Infrastructure and emissions**

Across Australia, it is estimated that infrastructure contributes around 70 per cent of national emissions; with around 15 per cent (or approximately 87 million tonnes of CO<sub>2</sub> per year) directly contributed through the delivery and operations of that infrastructure.<sup>2</sup> Figure 1 illustrates the emission sources of a typical infrastructure project, of which over half is from the embodied emissions in concrete, asphalt and steel<sup>3</sup>.

The infrastructure industry has already demonstrated the influence it can have on the reduction of emissions, with most recently delivered infrastructure projects being able to deliver a combined 11 per cent reduction CO<sub>2</sub> equivalent from materials across the assets lifecycle and 68 per cent reduction from energy use.<sup>4</sup>



**Figure 1: Transport infrastructure construction emissions<sup>3</sup>**

### Investment in net zero future

Over the next three years (2021 to 2024) it is expected that around \$166 billion will be spent by governments in Australia on infrastructure.<sup>5</sup> More progressive government jurisdictions are driving sustainability outcomes including climate action, resilience, and materials and resource targets. The most progressive proponents have adopted a consistent and third party assured approach to sustainability performance measurement, over \$200 billion of investment registered with the Infrastructure Sustainability Council since 2012 and implementing the IS Rating Scheme.

In July 2021, Infrastructure Australia announced the quadruple bottom line criteria **(Governance, Economic, Social and Environment)** will begin to influence investment recommendations at the federal level, providing a clear mandate to consider value beyond the traditional, often short-term focused, benefit-cost ratio. More than 70 per cent of applicable projects on Infrastructure Australia's 2021 High Priority and Priority List are expected, or are already, undertaking delivering assured performance metrics.

Australian government asset owners and proponents are not the only ones seeking to invest in sustainability, with carbon a key focus of the finance sector. Global Environmental, Social and Governance (ESG) investment assets are currently expected to reach \$53 trillion by 2025, representing more than one third of the \$140.5 trillion total assets under management.<sup>6</sup> Investors are looking to decarbonise, with less ambitious responses to climate change being seen as an additional investment and performance risk with the potential for reduced growth and risk of greater externality costs (e.g. carbon pricing).<sup>7</sup>

### Sustainable infrastructure delivers an even greater upside

The IS Rating Scheme Return on Investment (2020) Study found that infrastructure projects rated under the IS Rating Scheme will deliver up to \$2.40 in benefit for every dollar spent, This excludes aspects which are more difficult to quantify, such as social value, and workforce outcomes<sup>8</sup>.

**The Infrastructure Council Rating Scheme (IS Rating Scheme) is the Australian and New Zealand rating framework to assess the sustainability of the planning, design, construction and operation phases of infrastructure programs, projects, networks, and assets. Almost every jurisdiction requires the infrastructure supply chains to deliver carbon reductions measured using the Infrastructure Sustainability Council Rating Scheme.**

# Delivering a net zero Infrastructure Pipeline – Principles for Success

In preparing this paper, the collaborating partnership of Australian Constructors Association, Infrastructure Sustainability Council, Consult Australia and Autodesk have set out to map principles toward net zero for the design and construction of infrastructure.

The pathways are informed by industry action and global research, principle-based practical shifts are presented to deliver net zero through the infrastructure pipeline. Case studies from across the infrastructure value-chain illustrate this shift is well underway and through industry collaboration, commitment and continuous improvement progress can be accelerated and scaled through a set of systems-based enablers including technology, materials, policy and human capability.



## Principles

To achieve success, it will be critical for industry stakeholders to be working in a constructive and aligned way. Three key commitments are recommended to guide our shared responsibility and collective way of working:

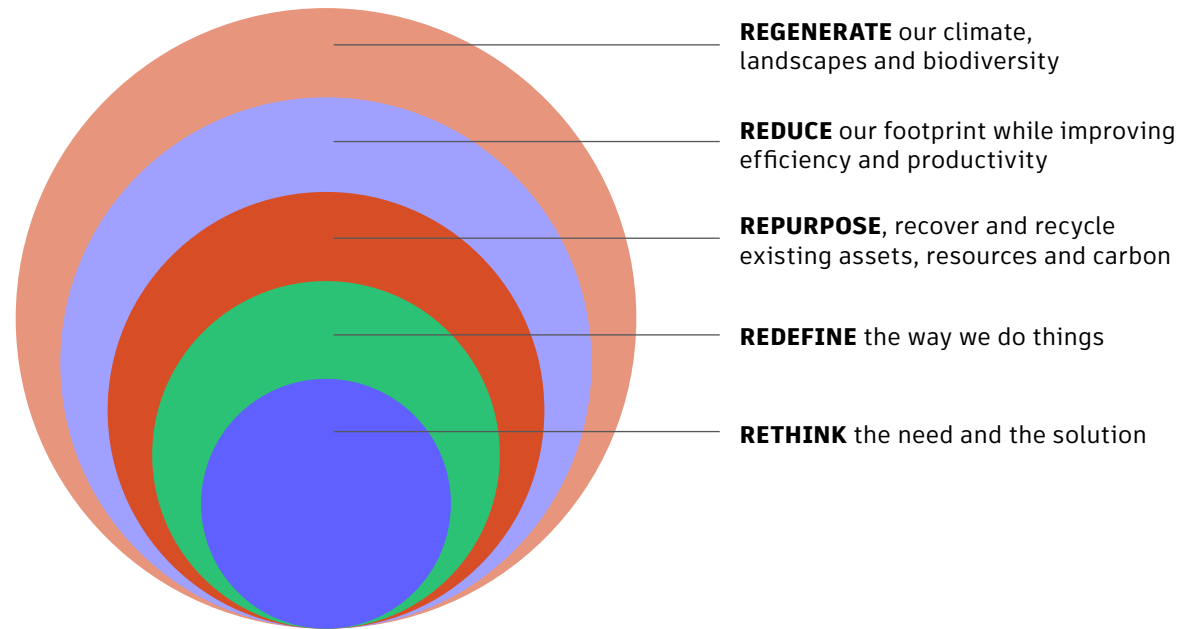
**Commitment**

**Collaboration**

**Continuous improvement**

Delivering a net zero future will require a systems-based approach which will also need to undertake at times complex and multifactorial analysis. Adapted from the PAS 2080 standard for managing the whole of carbon life in infrastructure<sup>11</sup>, the following framework for action has been developed to support industry's delivery of a net zero future through the delivery of infrastructure (see Figure 2).

The pathway to achieving net zero requires consideration of the integrated nature of infrastructure. The case studies showcased demonstrate how adopting an array of options can deliver emissions reduction and multiple additional co-benefits.



**Figure 2: Options for action on delivering net zero through the delivery of infrastructure**

### Rethink and redefine

Is new infrastructure always the answer? The sector can influence the greatest reduction in emissions through the problem identification and optioneering phases, with the desired outcome guiding assessment. Engaging early and effectively with the market and decision makers is the best way for the industry to influence planning and business-case decisions, to avoid leaving outcomes to chance.

### Repurpose, recover and recycle

With the advent of digital technologies, asset owners are now better placed to comprehensively monitor and optimise the performance of their existing assets and drive decisions on whether to opt for refurbishment or new construction. The design phase brings the opportunity to work with all stakeholders to have maximum impact on emissions and look to increasing the resilience and lifetime value of assets.

### Reduce

In the construction phase, the opportunity is to reduce emissions by using low-carbon materials, streamlining delivery approaches and minimising the consumption of resources. Manufacturers of raw materials are producing or evolving more sustainable versions of their products in the years to come. Designing in and procuring these materials will reduce emissions. Physical and digital technologies have been driving construction industry innovation over the past 20 years. New deployment methods for construction equipment will minimise the carbon emissions associated with transport fuel, with the potential to increase productivity and efficiency in construction. Models that are being created include improved equipment management for better availability, centralised fleet management, improved utilisation and equipment leasing to distribute capacity more efficiently across the industry. While these activities can and do reduce

carbon emissions through efficiencies, it is anticipated that electrification and the use of emerging low emission fuels will substantially accelerate progress. Impacts on climate and ecology should be directly reduced as much as possible with offsets used as a last-resort strategy to compensate for residual impacts.

### Regenerate

Regeneration refers to the broad concept of leaving a net-positive environmental legacy. This might include investment in renewable production that produces more than the requirements of the asset and thus available for other uses; above compliance rehabilitation of ecosystems or landscapes such as habitats, waterways or soils; or investment in registered carbon offsets or sequestration that goes beyond offsetting the carbon footprint of the asset.

Practical implementation

Emission reduction opportunities are possible at each project phase. Key professionals include policy makers, regulators, planners, engineers, contractors and asset managers.

A review of eight major global infrastructure projects<sup>11</sup> found that considerable carbon reductions may be achieved within existing budgets, and in most cases will even reduce cost. Measures such as optimisation of construction, minimised transport, reuse of excavated material and cement clinker replacement, were found to be cost efficient and could have been undertaken in a normal design and construction optimisation process. It is believed an increased focus on carbon may contribute to finding even more innovations.

Table 2 outlines practical activities being deployed as business-as-usual on major infrastructure projects.

Table 2: Practical activities from planning, design and construction<sup>2</sup>

Planning and Design Phase	Construction Phase
<ul style="list-style-type: none"><li>• Choice of location of transport infrastructure;</li><li>• Minimising number of structures;</li><li>• Value engineering ground reinforcement (steel and concrete piles);</li><li>• Optimisation of mass balance and need of transport work;</li><li>• Optimisation of construction design to use less material;</li><li>• Choice of technical systems;</li><li>• Optimisation of energy and material use over lifecycle;</li><li>• Focus on the embodied energy in materials, and use of alternative construction material, e.g. wood or composites.</li></ul>	<ul style="list-style-type: none"><li>• Cement clinker replacement in concrete (e.g. fly-ash, GGBS3 etc.)</li><li>• Choice of production method for construction (e.g. on-site, off-site, 3D-printing etc.)</li><li>• Low-temperature technique and/or renewable fuel in manufacturing and asphalt plants</li><li>• Choosing low-carbon alternatives in procurement e.g., steel based on Environmental Product Declarations</li><li>• Effective use of materials and resources within and between projects</li><li>• Minimising vehicular trips through optimised logistics</li><li>• Use of biofuels for construction equipment and vehicles</li><li>• Use of renewable energy on site</li><li>• Minimising waste through effective modelling, coordinator and procurement.</li></ul>

Embodied Emissions from Materials

Studies indicate emissions from materials and construction (embodied emissions) could be nearly halved by using current best-available technologies and methods (BAT<sup>10</sup>). The most significant current reductions identified are from fuel switching

and manufacturing. The most significant future reductions expected to result from alternative concrete products and improved efficiency in upstream manufacturing processes. Case studies indicate that emissions reduction is already underway in Australian infrastructure delivery.

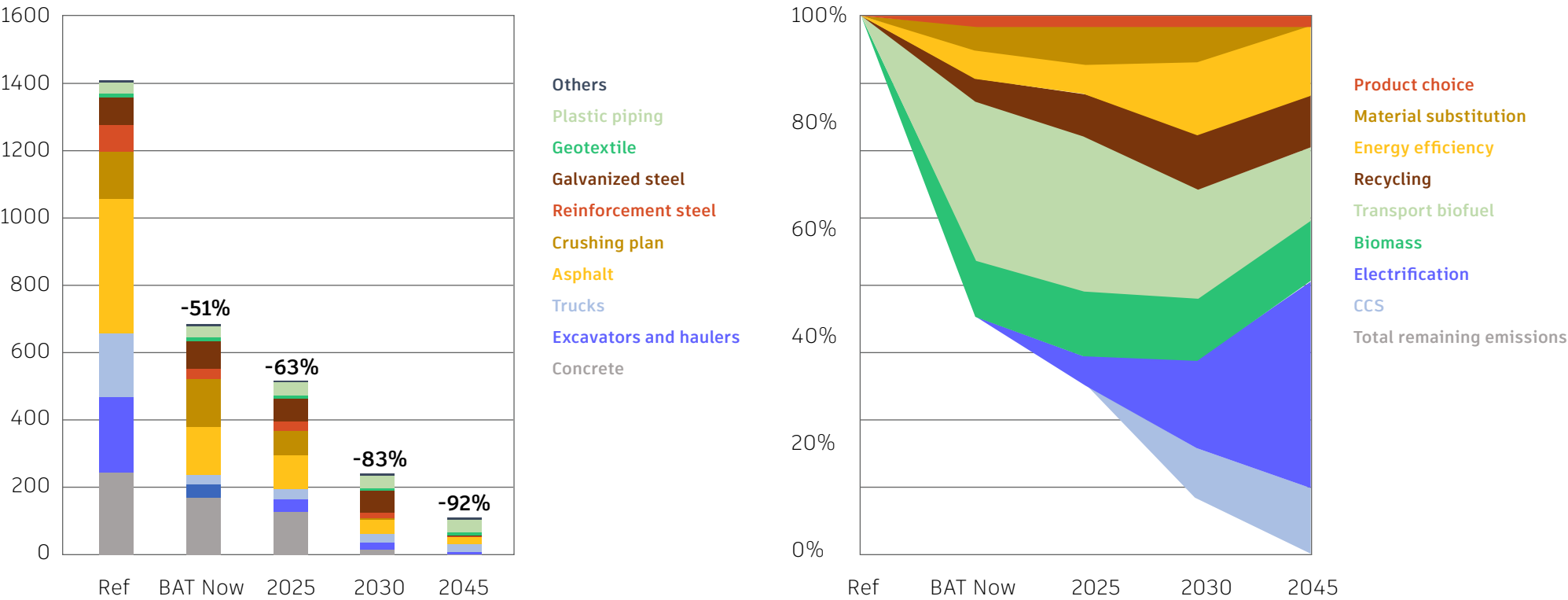


Figure 3: Modelled emission reductions from embodied emissions for road construction from best-available and transitional technologies<sup>11</sup>

## Design and Construction Technologies

Advancements in digital design methods, standards and technologies provide platforms for practically implementing a net zero vision. Many of the included case studies illustrate the market demand for emission management being incorporated into digital design processes.

**Table 3: Practical use of digital technology to achieve net zero emission**

Asset Introduction and Finance	Engineer, Procure and Construct
<ul style="list-style-type: none"> <li>• Conceive and deliver projects considering the full lifecycle impacts, using standards-based data frameworks and digital design methods that incorporate emission factors;</li> <li>• Digitise collaboration on a single platform from conception for improved decision making;</li> <li>• Build investment cases on lifetime value driven using digital simulations that consider net-zero related impact and cost implications.</li> </ul>	<ul style="list-style-type: none"> <li>• Build a culture of coordination, cooperation and collaboration across disciplines, and work on a connected design model, to achieve a low-emissions design intent;</li> <li>• Incorporate life-cycle assessments of materials;</li> <li>• Procure the digital and physical asset, incorporating emission-related data, under the same contract;</li> <li>• Engage in subscription-style supply and maintenance of physical and digital assets;</li> <li>• Incorporate real-time data (smart sensors, drones, wearables) through construction.</li> </ul>
Operations and Maintenance	Demolition and Decommissioning
<ul style="list-style-type: none"> <li>• Track and monitor materials and asset emission performance through predictive maintenance, automated procurement, supply chain alignment.</li> <li>• Perform maintenance concurrently on digital and physical assets updating with improved materials and technologies.</li> </ul>	<ul style="list-style-type: none"> <li>• Realise lower end-of-life costs and risks as the identification of reusable and hazardous materials, and demolition/construction implications are known and managed through the project lifecycle.</li> </ul>

## Enablers

Achieving these outcomes requires the infrastructure construction industry to enable change across various aspects of project delivery as outlined in the following table and demonstrated through best-in-class case studies examples.

Enablers	Description	Lifecycle stage
Policy	Harmonised decarbonisation policy for public infrastructure; Align investment decision-making with stakeholder expectations; Embed sustainability and emissions-reduction in business-case development.	Planning, Decommissioning
Procurement	Focus procurement reform on productivity, and maximises long-term social, economic and environmental value.	Planning, Construction
Technology	Accelerate investment and uptake of new technology with incentives to catalyse innovation, productivity and holistic value delivery. This can include improved; data and insights, automation, efficiencies across the value chain, design and modelling outcomes, resilience and futureproofing of assets.	Planning, Design, Construction, Operations and Maintenance, Decommissioning
Capability	Improve industries culture, capability and capacity to lead the step-change. This can include training and upskilling, implementing the culture standard, adopting principles-based engineering, valuing collaboration over competition, and measureing and rewarding delivery of sustainale outcomes.	Planning, Design, Construction, Operations and Maintenance, Decommissioning
Materials	Rapidly innovate and adopt substitute or alternative low emission products particularly with high materiality (e.g. steel concrete and asphalt). Maximise resources by adopting circular economy practices.	Design, Construction, Operations and Maintenance, Decommissioning
Methodologies	Identify and implement low emission methodologies for key processes (e.g. heavy transport, excavation etc.); Harmonise national standards and guidelines for low emission methodologies across design, construction, and maintenance.	Design, Construction, Operations and Maintenance, Decommissioning
Supply chain	Build capability, embed responsibility, incentivise innovation and fairly allocated risk. Encourage and reward collaboration and sustainable outcomes.	Design, Construction
Data and measurement	Adopt consistent sustainability and emissions targets, metrics and indicators across the asset lifecycle. Leverage technology for transparent monitoring and reporting across the quadruple bottom line.	Planning, Design, Construction, Operations and Maintenance, Decommissioning

A Net-zero Future Delivered Through Our Infrastructure Pipeline

# Case Studies



# South Eastern Program Alliance (SEPA)

Aiming for a net zero carbon construction site

## Activity driving emissions reduction

Hallam Road Level Crossing Removal Project pursued and embedded several greenhouse gas abatement projects with the aim to achieve a net zero carbon construction site. This included:

### SEPA Image 1: Eco-site and solar sheds for crib sheds



## Temporary works stage

- Solar powered crib sheds for site security
- Eco-site and Solar Sheds for crib sheds for construction workers

\*No need for an external grid connection to power crib sheds

## Construction stage

- Temporary compound lighting connected to an external grid to minimise diesel use in mobile light towers
- B5 biodiesel used in plant machinery rather than standard diesel liquid
- Linklite temporary station platform lighting
- Biodiesel fuel used in back-up generators rather than using standard diesel generators
- Continual use of solar shed & eco-site satellite offices
- Electricity consumption powered by a green energy product to achieve carbon neutral certification

From the implementation of the above greenhouse gas abatement projects within the site compound footprint, the Hallam Road Level Crossing Removal Project saved ~72% of CO2 against the baseline carbon footprint.

### SEPA Image 2: Semi-permanent compound lighting set up to minimise diesel use.



## Achievements and lessons learned

The team's commitment to mitigating emissions meant they worked collaboratively to identify opportunities for implementation on the project. Following this, they adopted a reverse base case approach where the savings from the emissions were quantified against business as usual. These initiatives and their respective savings are in line with Laing O'Rourke's mission to become Net Carbon, for scope 1 and 2 emissions, by 2030.

The outcomes achieved were a true team effort by the project team and supply chain partners, with collective efforts from;

- Jarrod Lowe, Dan Zeng, Darren Bloom – Early Works Site Establishment with Solar Shed and Eco-Site Caravans
- Claudia Casanova – Semi Permanent Compound Lighting
- Anthony Flynn and Sam Levett – B5 supply replacing diesel
- Gareth Phillips – Site Solutions Compound & Solar Array Proposal
- Heath Kee & Anthony Flynn – Solar Shed & Eco-Site (Rimfire Road set up)
- Tess David – Carbon Neutral Elec Plan

'The lengths that the Hallam Road Level Crossing Removal Project delivery team have gone to minimise the project's temporary site impact over the course of the project to-date, has been nothing short of inspiring.

I can confidently attribute this to the outstanding culture embedded by both Ed Griffiths and Salam Al-Mulla, and the project team's drive to deliver innovative outcomes'

–Tess David, Sustainability Advisor, Hallam Road Level Crossing Removal

### Other organisations involved:

- LXP
- Laing O'Rourke
- Jacobs, MTM
- Select

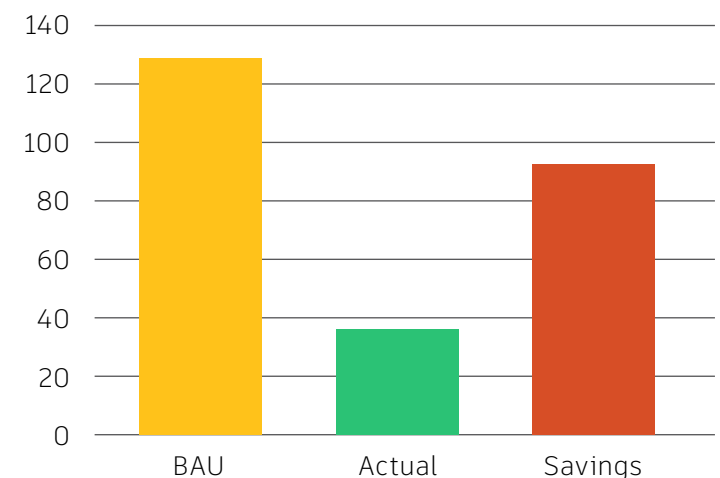
### Project phase:

Construction

### Stakeholders involved:

- Asset Owners
- Designers
- Contractors
- Asset Managers
- Supply chain
- Industry bodies

**Hallam Road Level Crossing Removal Project:  
Site Compound Emissions To-Date(tCO<sub>2e</sub>)**



# Watercare & Mott MacDonald

## Carbon Baseline and Moata Carbon Portal deployment

### Activity driving emissions reduction

Mott MacDonald developed the first programme-wide capital carbon baseline in Australasia for Watercare's 9-year infrastructure, NZD 2.4 billion programmes of works. Through identifying the capital carbon hotspots across their portfolio, we enabled Watercare to take their first steps in their carbon reduction journey through embedding low-carbon thinking with an emphasis on challenging project requirements, innovative design, and efficient construction.

Watercare were able to use this knowledge to set a point of reference as well as identify key hot spots to achieve their enterprise goal of 40% capital carbon reduction and associated 20% reduction in capital expenditure by 2024. The baseline provided a detailed breakdown of their assets carbon footprint to target effort where the greatest reduction opportunities lay using the PAS 2080 Carbon management in infrastructure standard principles.

To ensure that Watercare attained their carbon reduction target, we provided their entire value chain the Moata Carbon Portal – a digital tool that enables effective and efficient calculation of carbon and identification of carbon hotspots throughout the design process, encouraging low-carbon optioneering even at very early stages. The Moata Carbon Portal continues to be used on a daily basis by enterprise team, covering suppliers, designers, contractors and Watercare staff.

“Thank you for bringing your skills and expertise to the table to support our desired carbon reduction outcomes at Watercare and the flow on effect this can have in the industry. The opportunities are enormous and as they always say, what gets measured gets managed, so your support in baselining and tools for optioneering has been critical. We look forward to reduced carbon emissions being normalised as a currency in providing value through infrastructure.”

–Chris Thurston, Head of Sustainability, Watercare Services Limited

## Achievements and lessons learned

Building upon the work previously delivered in the UK combined with the local domain expertise, we developed a well-crafted approach for Watercare to embark on their decarbonisation journey. Our international carbon experts attended workshops, data gathering exercises and presentations to transfer carbon management strategies and knowledge to the New Zealand team and Watercare.

Working closely with the planners and project managers at Watercare to scope each project and the associated business-as-usual construction practices to quantify the carbon impact of each asset and process. The carbon baseline will form the basis of Watercare's capital carbon management programme for years to come and encourage the right carbon reduction behaviours in the supply chain.

This knowledge and tools helped form relationships within New Zealand to leverage the carbon assets in Moata Carbon Portal to understand, quantify and ultimately reduce carbon with other organisations such as Auckland Council. This foundational work continues to benefit the wider water sector in New Zealand to accelerate their carbon journey and share innovation using a platform approach.

## Project completion date

January 2020 (Baseline), ongoing (Moata Carbon Portal)

## Other organisations on project, where relevant:

Watercare  
Mott MacDonald

## Project phase

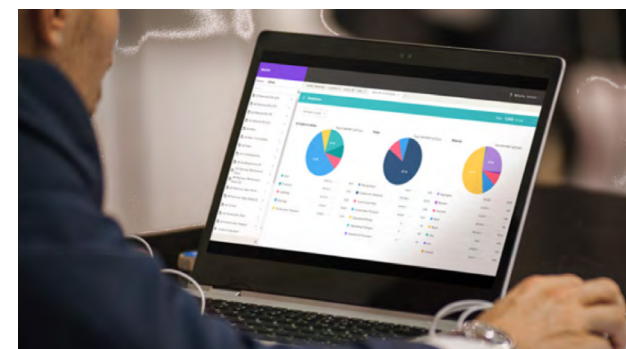
Business case / Planning / Design

## Stakeholders involved

- Asset Owners
- Designers
- Contractors
- Supply chain
- Industry bodies

## Relevant links

[Water New Zealand Paper on emission calculation tools](#)



# ACCIONA

## Vehicle Management Technology and Decarbonisation

### Activity driving emissions reduction

As a carbon neutral business, ACCIONA has a strong history of supporting innovations that assist in the reduction of our carbon footprint while maintaining strong operational performance. As a business with a large construction fleet of earthmoving equipment, diesel consumption has materially contributed to ACCIONA's global carbon footprint. With limited hybrid/electric/hydrogen alternatives currently available in the market, a key focus of our decarbonisation strategy is to reduce fuel consumption through elevated monitoring and management of our fleet. ACCIONA is advancing the use of fleet management technology across 12 projects in three countries (Spain, New Zealand and Australia) to monitor the productivity of our machinery to minimise idling time, inefficient activities, assess driver behaviour, and avoid unnecessary fuel-burn. Through the installation of GPS enabled equipment and vehicle telemetry

monitoring, we are able to assess in real time the efficiency of our operations and make adjustments as required. Early indications suggest that insight provided by the use of this technology has resulted in a 5-7% reduction in project carbon emissions associated with fuel use when compared to projects that don't apply this technology.



### Achievements and lessons learned

The largest reductions in fuel-burn, and hence carbon emissions, has been attributed to fleet planning and the ability to quickly reduce the fleet size or reprioritise workflows in areas where inefficiencies are identified. We also have the ability to identify how hard each piece of machinery is working so we can select the optimal plant size to suit the workload.

The application of fleet management technology has demonstrated that emissions reductions are achievable through a better understanding of how the fleet operates and the ability to make quick and informed changes to workflows.

Minimising our existing carbon footprint through efficient operations is the first step of ACCIONA's decarbonisation strategy. Over the next 5 years, in line with our Sustainability Master Plan 2025, we will be looking for opportunities to leverage off advancements in hybrid, electric and hydrogen technology as they become available in the market. As an example, we have already started to supplement our light vehicle fleet with a hybrid vehicle alternative where appropriate, and plan to save approximately 3,700T of CO<sub>2</sub> over the next 5 years.

This technology is readily available and can be easily applied to almost any piece of equipment to maximise its performance and minimise unnecessary fuel-burn.



# Laing O'Rourke

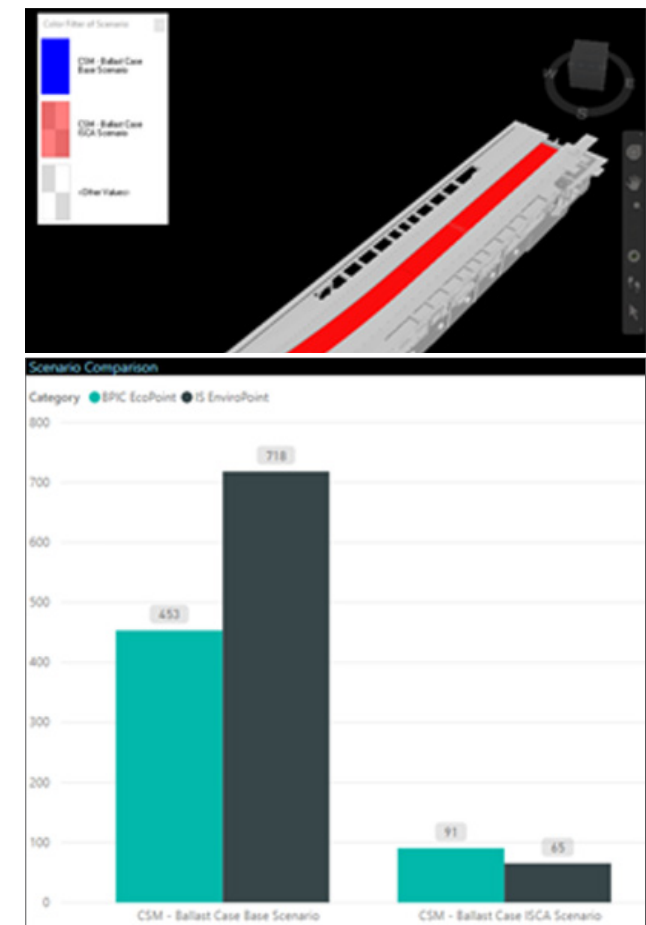
## A Digital Approach to Carbon Measurement and Reduction

### Activity driving emissions reduction

Laing O'Rourke has developed an innovative approach to measure the carbon impact of the construction materials used across our projects. Our forward-thinking team on the Central Station Metro (CSM) project developed a process that links Digital Design models to lifecycle carbon analysis data (i.e. the [ISC materials lifecycle calculator](#)) to measure the lifecycle carbon footprint for the materials utilised to deliver a project. The process is tested and developed through the design stages and a baseline is established. After the baseline is determined, our teams seek to achieve reductions in the size of our carbon footprint by altering design and material scenarios.

Our commitment to knowledge sharing has ensured that other projects, both in Australia and the United Kingdom, have had the opportunity to learn from the CSM team and then further refine and adopt this process, helping to measure carbon impacts and influence decision making to reduce carbon impacts on a global scale. For example, this digital enabled approach was utilised on the Timber Square Building located in London whereby the project team was able to demonstrate approximately 30% reduction in embodied carbon by proposed alternative material selections and design options in the model.

**Laing O'Rourke Image 1:  
Ballast material comparison**



## Achievements and lessons learned

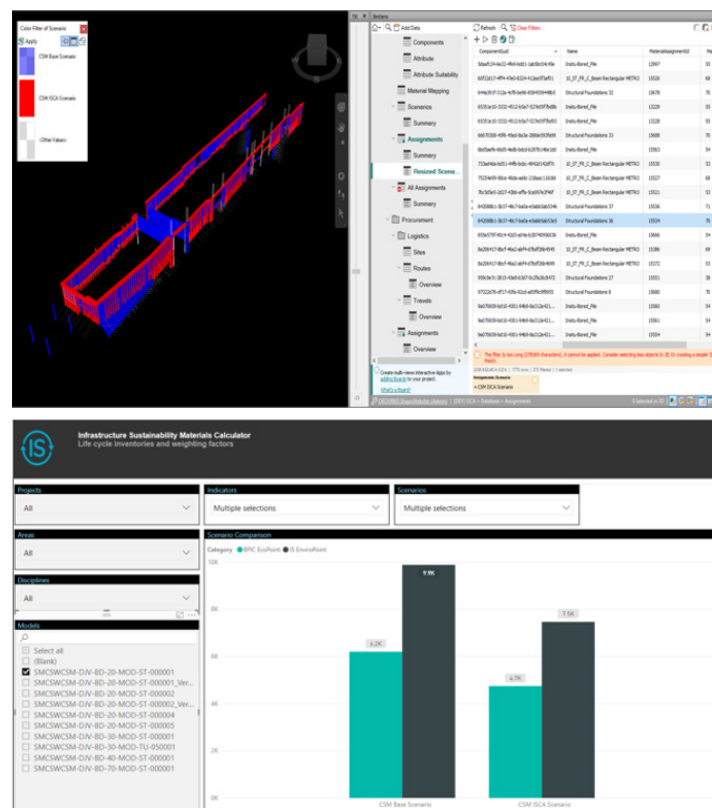
The Digital Engineering and Sustainability teams used the power of their collective experience to collaboratively bring this development to life, integrating the digital models with lifecycle carbon analysis data to enable the project team to develop the project carbon footprints. The approach uses [Navisworks](#) and [BIMsens](#) to generate different footprint scenarios based off a combination of material types entered by users. The users can develop a base case scenario and then run modifications on the scenario where materials can be reduced or substituted. The output of the different scenarios is then analysed in a PowerBI dashboard, allowing for rapid analysis of carbon impacts to the different project scenarios. An example of this is provided in the alternative ballast material scenarios whereby the project proposed different design solutions to optimise the quantity of ballast required which saved 465m<sup>3</sup> concrete which is being replaced by ballast materials.

A Global Digital Engineering taskforce has been established within Laing O'Rourke to take the tool into further applications of use to support sustainable outcomes across our global operations.

“Applying this digital approach to measuring carbon impacts makes it simple for the user to identify some big impact decisions that can be made to optimise environmental, cost and performance outcomes”

–Shaun Webster, Digital Engineer Lead

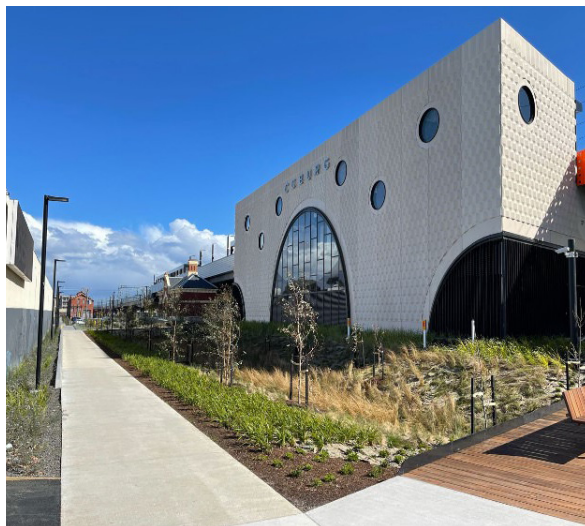
**Laing O'Rourke Image 2: Progressive As built of the works showing reduction during construction**



# Fibercon

## Bell To Moreland Level Crossing Removal Project (B2M LXP)

The Bell To Moreland Level Crossing Removal Project comprised the removal of four level crossings by elevating the rail line onto a continuous rail bridge. Additionally, new stations at Coburg and Moreland, with 2.5km of open space created, including extensive landscaping, shared use paths and community areas underneath the rail line.



### Activity driving emissions reduction

Mesh 100% recycled Macro Synthetic Fibre, made in Ballarat, packaged by NDIS workers, was proposed to replace steel mesh reinforcement in the concrete SUP and footpaths by NWPAs for B2M LXP. Reductions in CO<sub>2</sub> and PO<sub>4</sub> emissions (over 90%), reduced water and fossil fuel consumption (over 90%) and NDIS employment created (200 hrs) by replacing steel mesh with [eMesh](#), encouraged a deeper examination of the associated benefits, indirect savings and efficiencies of eMesh by NWPAs. Areas examined included site activities and compliance, which outlined reduced safety risks onsite to workers, time lost due to co-ordinating, moving, unloading steel mesh deliveries, and reduced pre-pour engineering inspection requirement for eMesh reinforced concrete (no steel mesh to inspect). The savings across the many areas, which are complemented by site efficiencies and time reduction in construction, provided



a clear positive outcome for the decision to adopt the use of eMesh and adoption by MRPV and RPV for future works with potential for greater improvements across many of the BIG Build projects. The potential emission reductions and reuse of waste plastic across future projects, since successful implementation at B2M, is extensive and will provide long term repurposing of a waste stream.

## Achievements and lessons learned

The process to have eMesh approved for use on the B2M project began in late 2019 and early 2020, where after consultation, design checks, environmental assessment and inspection of existing SUP at Skeleton Creek (Hobsons Bay constructed in 2017) a decision was made by NWPAA to present a proposal to MTM and LXRA for use of eMesh. The proposal was accepted and implemented into the project. Throughout the approval process, which took over 6 months and then implementation, the learnings gained provided clear lessons that to introduce a product that is non-standard the assessment process needs to be clear and concise, backed by evidence and published research.

“The inclusion of EMesh for the linear parkland paths at Bell to Moreland LXR has proven to be a very positive step change made by NWPAA during the design delivery phase. Benefits have been seen through design, construction, and asset owner operation & maintenance spaces. NWPAA are now treating eMesh as the ‘BAU’ for our upcoming level crossing removal projects”

–Addison Kaye (NWPAA Deputy Design Director)

The practical implementation also requires engagement with all levels down to the subcontractor on site. A clear knowledge sharing of how to use, design with and assess environmentally is a key part of new product success, and B2M showed us this needs to be a strong focus. For future projects the engagement of all parties from concrete suppliers to contractors placing the concrete is paramount to continued improvement and achieving quality outcomes. Lessons learned are already being implemented across many LXR, MRPV and RPV projects, and will continue to be shared to create continued improvements and quality outcomes.

## Project completion date

July 2021

## Key organisations

North Western Program Alliance (NWPAA)

The Alliance comprises

- Kellogg Brown & Root (KBR) as the principal designer
- John Holland Group (JHG) as the principal contractor
- Metro Trains Melbourne (MTM) as the network operator

## Project phase

Target Outturn Phase (TOC) This is so that LXR are clear with The State on what is included in the Alliances proposal and so that the Alliance is able to communicate with key stakeholders our design solution.

## Stakeholders involved

Stakeholders involved in the decision making on eMesh for B2M were:

- Moreland City Council (all relevant departments)
- Metro Trains Melbourne (LXRG and Infrastructure departments)
- LXR (Client)

## Relevant links

[www.emesh.com.au](http://www.emesh.com.au)

# Novo Rail Alliance

## Activity Driving emission reduction

Supplying energy to off-grid temporary site accommodation with diesel generators is a significant contributor to greenhouse gas emissions. The Redfern Station Upgrade project has an annual diesel fuel requirement upwards of 52,000L for site accommodation power alone. The generator sets for site accommodation are typically sized to match the expected peak demand which is rarely experienced but can be an order of magnitude higher than the baseline load of operating ceiling lights and hot water.

An underutilised generator running for prolonged periods of time is both inefficient and at risk of damage from cylinder glazing. By sizing the generator based on measured energy consumption data, coupling it with an industrial battery pack, and using B5 biodiesel blends as the generator fuel source, the project is now consuming less than 400L of fuel each week. Annually, we estimate the project's site accommodation fuel consumption to reduce by 60%, directly reducing CO2 emissions equivalent to 80 tonnes of CO2.

“It is a very simple, smart and easy to use solution for the project and I can't imagine going back the traditional style of generators”.

—Marijan Harris, Construction Manager



### Achievements and lessons learned

Working with our supply chain partners; Select Plant Hire and Green Power Solutions, we identified the opportunity to reduce the size of our generator by 60% based on data from energy metering and to optimise the load and running time by coupling it with GPS' PowerCube; a robust purpose-built industrial battery. The hybrid system cycles between the generator operating at optimal capacity until the battery is charged, then turning off while the power demand is met by the capacity of the discharging battery until a set point triggers the generator to restart.

This optimised generator and hybrid battery system is estimated to reduce fuel consumption by ~31,200L annually, and by using a B5 biodiesel blend as the generator fuel source we realise additional reduction in CO2 emissions when compared against a non-hybrid diesel fuel generator.

Other benefits include improved whole of life outcomes for the generator and remote access to the power management systems that enable us to monitor and find better ways to manage the energy requirements of our site accommodation. The benefits of the real time energy data stream validates Laing O'Rourke's goal to integrate energy sub-metering into all temporary project facilities nationwide to support our goal to become net zero for scope 1 and 2 emissions by 2030.

"We can configure the system to meet the requirements of our clients, in this case we are optimising for fuel consumption."

**–Jim Stefanis Green Power Solutions Business Development Manager**

"It's uplifting to see genuine leadership and commitment by our project teams and supply chain partners to deliver greenhouse gas abatement projects. It's helping drive positive change in the construction industry and support our decarbonisation plan."

**–Sam Donaldson, National Sustainability Manager**

**Project completion date**

July 2022

**Other organisations on project, where relevant:**

- Select Plant Hire
- Green Power Solutions

**Project phase**

Construction

**Stakeholders involved**

- Select Plant Hire
- Greenpower Solutions
- Novo Rail Alliance

**Relevant links**[www.transport.nsw.gov.au](http://www.transport.nsw.gov.au)[www.greenpowersolutions.com.au](http://www.greenpowersolutions.com.au)[www.laingorourke.com](http://www.laingorourke.com)

“We support our clients in striving for innovation and excellence wherever possible, it’s a joint success to take action on our sustainability ambitions”

–Joel Thompson, Select Plant  
Australia Operations Leader

**Innovation & Sustainability****Redfern Station Energy Profile**

8/20/2021 9/15/2021

1,015 Estimated Fuel Saving (L)	2,962 Estimated CO2 abatement (kg)	634 Total Run Time (h)
4,157 Total Generator Output kWh	3,722 Total Site Consumption kWh	

1. Data from Shindaiwa DGA37C fuel curve.

2. B5 diesel GHG emissions = 2.565kgCO2 per L.

3. CO2 abatement calculated against a diesel fuel generator

**Hybrid Genset Insights**

*Theoretical calculation for  
original non-hybrid generator*

114  
Run Time (h) < 25% Load

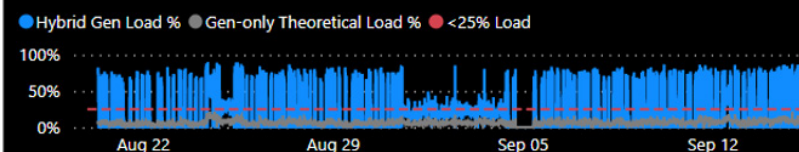
606  
Run Time (h) < 25% Load

35  
Run Time (h) > 75% Load

(Blank)  
Run Time (h) > 75% Load

1,648  
Estimated Fuel Use (L)

2,663  
Fuel Use (L)



# Jacobs

## Waratah and Wyee Stations Upgrade

Delivered in partnership with Gartner Rose for the NSW Government as part of the Transport Access Program (TAP), the Waratah and Wyee Stations Upgrade projects were great examples of how even small projects can deliver significant sustainability outcomes and contribute to a more climate positive future.

### Achievements and lessons learned

The projects were awarded the first 'Leading' As Built rating under TAP, achieving numerous positive outcomes for the local environment and community.

The project reduced the ongoing energy needs of the two stations by up to 31% and reduced its carbon emissions by 32% (4,367 tCO<sub>2</sub>e). This was driven by design initiatives including reconfiguring the cooling systems and undertaking cost

benefit assessments and market analysis to specify high efficiency cooling systems for station equipment and service rooms. They also achieved a 9% reduction in materials footprint through material saving initiatives and implemented an increase of more than 50% in biodiversity offset requirements across both sites, providing enhanced ecological benefits. Planting was concentrated in the under-utilised space at the front of the stations and, in time, will contribute to cooling the surrounding urban environment. The use of drought-resilient native planting was one of a number of choices made throughout the design process to reduce the future water needs of the stations and deliver a 43% reduction in water use over the lifetime of the asset.

For many organisations, decarbonising their assets and operations can seem like a daunting and complex task. To help clients navigate the challenge, we recently launched our Net Zero Lab, a collaborative

and interactive program where we work with clients to understand their carbon footprint, set emission reduction targets, develop and operationalise decarbonisation strategies and manage performance to bring about lasting change.

### Relevant links

[www.jacobs.com](http://www.jacobs.com)

[www.gartnerrose.com](http://www.gartnerrose.com)



# Boral

## Forrestfield Airport Link: ENVISIA track slab concrete supply

### Activities driving emissions

The Forrestfield-Airport Link is a new rail service to the eastern suburbs of Perth, WA through twin-bored tunnels. Three train stations will also be built. Salini Impregilo NRW JV (SINRW) was awarded the design and construct contract by the WA Government in 2016.

Boral commenced concrete supply to the project in late 2016, including tunnel segment concrete. In collaboration with SINRW Boral commenced track slab concrete trials in late 2019, this was before SINRW had established the placement methodology and appointed a subcontractor (subsequently Martinus Rail was appointed).

For this project, the client was looking for a high performance concrete to meet its requirement for the track slab within the tunnel.

- The specification required low shrinkage and high durability concrete to meet the 120 year design life.
- The client specification called for strict maximum crack width requirements.
- Placement methodology played a significant role and changed during the trial period from underground transit vehicles to pumping the concrete (>1km).

Boral was able to meet these requirements with its ENVISIA lower carbon concrete product. The mixes developed for this project achieved a 50 per cent Portland cement reduction compared against the relevant reference case. ENVISIA® is an AS 1379 compliant concrete that offers significant reductions in embodied carbon whilst maintaining high early-age strength.

**Activities driving emissions**

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Boral commenced concrete supply to the project in late 2016, including tunnel segment concrete. In collaboration with SINRW Boral commenced track slab concrete trials in late 2019, this was before SINRW had established the placement methodology and appointed a subcontractor (subsequently Martinus Rail was appointed).

**Project completion date**

2021 for concrete supply

**Project phase**

Construction

**Stakeholders involved**

- Constructors (Client): Salini Impregilo NRW JV (SINRWJV)

**Relevant links**

[www.boral.com.au/lower-carbon-concrete](http://www.boral.com.au/lower-carbon-concrete)



## Contributors

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## References

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- [2] [ISCA, ClimateWorks. Australia and ASBEC \(2020\) Issues Paper: Reshaping Infrastructure for a net zero emissions future](#)
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- [4] [ISCA, 2020](#)
- [5] [IPA, 2021](#)
- [6] [Diab & Martin Adams, 2020, "ESG assets may hit \\$53 trillion by 2025, a third of global AUM", Bloomberg Intelligence](#)
- [7] [Kehoe, 2021](#)
- [8] [ISCA IS Rating Scheme: Return on Investment Study](#)
- [9] [BSI, UK Green Construction Board, 2016](#)
- [10] [Construction Climate Challenge, 2019](#)
- [11] [Ida Karlsson, Chalmers University of Technology, Decarbonization of construction supply chains, 2020](#)





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### A net zero future

Net zero is a shared responsibility. Australian Constructors Association, Consult Australia and ISC, in partnership with Autodesk are committed to collaborate with members to drive the continuous improvement required to achieve this shared outcome.

[www.autodesk.com](http://www.autodesk.com)  
[iscouncil.org](http://iscouncil.org)  
[constructors.com.au](http://constructors.com.au)  
[consultaustalia.com.au](http://consultaustalia.com.au)

