READYMIX NEWS

ISSUE 24 AUGUST 2024

LOW-CARBON CONCRETE EXPLAINED

concretenz READYMIX

IN THIS ISSUE

MESSAGE FROM THE CHAIR

Kia ora readymixers,

Welcome to the latest issue of *Readymix* News. If you're anything like me, you're eager to leave winter behind and all the challenges that cold and wet weather bring to the ready mixed concrete industry.

To help tackle these difficulties, our industry has developed a wealth of best practice advice that we share with customers. By way of example, pages 8-9, feature an extract from one of Concrete NZ's *Placing in Practice* leaflets, which outlines the necessary measures for handling concrete on-site during the winter months.

Adding to the chill of winter are the latest production figures from Statistics NZ, which show that in the June 2024 quarter the actual volume of concrete produced was 977,746 m^3, down 9 percent compared with the June 2023 quarter, while in the year ended June 2024, 3.92 million m^3 of concrete was produced, down 11 percent compared with the year ended June 2023.

While production has dipped as the construction sector navigates a downturn, this period presents an opportunity for our industry to strategically prepare for recovery, and the inevitable emphasis from customers for a low-carbon product. Our decarbonisation roadmap sets a clear 2050 net-zero emissions target, which will primarily be based on the range of low-carbon concretes our members are developing. To learn more about what defines a mix as 'low-carbon,' check out the article on pages 16-19 by Concrete NZ's newly appointed Sustainability and Policy Director, Tim Kleier.

The technical content of this issue also incudes a summary of why consulting engineers do not need to specify additional testing, either on-site or at the precast yard, if the concrete is produced in accordance with NZS 3104 by a batching plant with a Certificate of Audit. This advice could be very useful when supplying your next project.

It is great to see BCITO, through its current "Hire Boldly" campaign, call for employees to foster a more inclusive industry by considering female apprenticeships. A perfect example being Daniela Powell, now a frontline manager at Firth Industries, whose story features on pages 23-24.

Through their sponsorship of the coffee cart, BCITO is once again supporting the annual Concrete NZ conference on 14 November, as well as the Learned Society hosted fib Symposium across 11-13 November – both at Te Pae Christchurch Convention Centre.

The 1-day event will feature dedicated 'readymix' content across several sessions, including a presentation from Dr Fiona Crichton, VP and Clinical Lead at Groov by Mentemia, the mental wellbeing platform co-founded by Sir John Kirwan.

Registration for the 3-day Symposium also covers the 1-day Concrete NZ conference – a fantastic opportunity for you to not only maintain your readymix knowledge, but also develop your broader concrete understanding by taking in presentations from a host of global experts.

Cover image: Waimea Community Dam. Waimea Water Ltd.

The annual Concrete NZ Conference Awards, which highlight the achievements of 'Producer' members, will be presented during the event. So, I encourage you to submit entries to help boost your company's recognition, build customer trust, improve employee morale, network with industry leaders, and benchmark to gain a competitive edge.

I'll sign-off by highlighting that having rolled-out four Joint Regional Forums in April-May as part of the Readymix Sector Group's 2024 re-set, a series of Provincial Roadshows are being organised for September-October. Taking in smaller venues, these events will offer a consistent set of presentations targeted at management, plant operators, dispatch staff, technicians, salespeople and those identified for career progression.

Keep an eye open for more details, and if I don't see you beforehand, I look forward to catching-up in Christchurch at November's fib Symposium and Concrete NZ conference.

Kerry Newton
Concrete NZ Readymix, Committee Chair

SPECIAL GUEST PRESENTER

DR. FIONA CRICHTON – GROOV BY MENTEMIA

Concrete NZ 1-Day Conference | 14 November
Te Pae | Christchurch Convention Centre

Courtesy of Higgins Concrete, Dr. Fiona Crichton, a clinical psychologist and researcher renowned for her work on stress, resilience, and the placebo effect, will speak at the Concrete NZ 1-day Conference. In conversation with Higgins Concrete GM Mike Botherway, Fiona will cover mental wellbeing, a topic central to Groov by Mentamia.

Groov is a Workplace Science Platform dedicated to making work better, using data for good to help people take proactive steps to care for themselves, care for their teams, and perform at their best. Groov combines active and passive sensing with science to provide actionable insights to support and empower individuals, managers, and organisations.

EXTENSION CHUTE RISK MANAGEMENT

The Readymix Health & Safety Committee would like to remind members of an alert it issued in late 2022 following an incident during which a ready mixed concrete truck's extension chute fell and hit a following car.

WHAT HAPPENED?

An extension chute came off a ready mixed concrete truck and struck a car which was travelling a short distance behind.

Fortunately, the chute hit the car's A pillar, which took most of the impact, before bouncing onto the roof and to the side of the road.

The driver of the car was showered with broken glass but was otherwise unharmed, and able to control the car to a safe stop.

The potential for this incident to be far more severe is easy to imagine.

INCIDENT LEARNINGS

Concrete NZ recommends that extension chutes are secured to ready mixed concrete trucks using TWO forms of restraint.

Concrete NZ suggests that NOW is the ideal time for its ready mixed concrete members to inspect their fleet and ensure that all trucks have a mechanism in place to safely secure the extension chutes, and that the mechanism is in good condition and being used all the time.

If bungee cords are used, and there is ANY sign of deterioration, they should be replaced immediately.

One method of securing extension chutes to ready mixed concrete trucks is demonstrated in this **https://vimeo.com/743242105**.

The *Incident Alert - Extension Chute Risk Management* can be downloaded from the Readymix Health & Safety page of the Concrete NZ website - **www.concretenz.org.nz/page/readymix_hs**

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Hon. Chris Bishop and Winstone Aggregates' General Manager, Amanda Croft, unveil the e-dumper at Belmont Quarry.

WINSTONE AGGREGATES INTRODUCES POWERFUL E-DUMPER AT BELMONT QUARRY

Winstone Aggregates, a subsidiary of Fletcher Building, has recently taken possession of New Zealand's largest e-dumper, which is currently being trialed at their Belmont Quarry in Wellington. The e-dumper was recently unveiled by Hon. Chris Bishop.

The fully electric SKT105E e-dumper is the future of efficient and eco-friendly hauling. This e-dumper can move up to 72 tonnes in a single load and features advanced electric drive technology to reduce emissions, as well as regenerative braking to enhance energy efficiency.

Amanda Croft, General Manager of Winstone Aggregates, says improving sustainability throughout their operations is a key focus for the business.

"Winstone Aggregates has been serving New Zealand for 160 years, and our commitment to sustainability will ensure we can continue well into the next century. Investing in initiatives like electrifying our off-road fleet, sees us reducing our carbon emissions and also supports Fletcher Building's goal of cutting emissions by 30% by 2030.

"The e-dump truck is the first trial of this technology within our business, and it will play a key role in shaping our broader sustainability strategy moving forward," Croft explains.

Belmont Quarry accounts for 40% of the Wellington region's aggregate market and 50% of high-grade aggregates, such as concrete and asphalt products.

"We chose to test the e-dumper at our Belmont Quarry because the layout is ideal for recharging. It allows us to haul material downhill, meaning the dumper can travel up empty and come back down full of rock, generating its own electricity on the

Winstone Aggregates' Belmont Quarry employees with Hon. Chris Bishop in front of the e-dumper.

way down. This downhill hauling setup is unique to Belmont, as most of our sites require hauling materials uphill from a pit.

"By using the e-dumper, we estimate it could reduce our use of diesel by approximately 30,000 litres per annum based on current hours and fuel consumption of our existing fleet," says Croft.

The acquisition of the e-dumper is made possible through co-funding from the Energy Efficiency and Conservation Authority (EECA), which is contributing 50% of the project's costs, including the installation of essential charging infrastructure.

EECA Transport General Manager Richard Briggs says the co-funding will allow Belmont to demonstrate off-road electrification opportunities to the wider industry.

"It's exciting to see how Winstone Aggregates has considered Belmont's unique terrain to integrate this innovative piece of equipment," says Briggs.

"With operations underway, the company can be an example to others of how thinking creatively can lead to solutions that will meaningfully decrease emissions from Wellington's aggregate market."

Hon. Chris Bishop rides in the e-dumper.

WINSTONE AGGREGATES

WINTER CONCRETING: DON'T GET CAUGHT COLD

Concrete NZ acknowledges that we are fortunate in New Zealand to live in a moderate temperature environment, but in many places morning frosts during winter are common and therefore precautions need to be taken when placing concrete.

In the winter months there is a range of issues to be considered when concreting. *NZS 3109 Concrete Construction* provides a definition of unfavourable cold conditions when concrete should not be placed.

These are:

- When the ground is frozen
- At temperatures below 5°C with temperature descending
- At temperatures below 2°C with temperature ascending

So, what is the reasoning behind the above temperature limitations? Let's first consider what happens to concrete at 0°C.

If concrete is frozen before it sets, the hydration of the cement is suspended, partly because the water within the mix freezes and expands, preventing the reaction from continuing. If the temperature rises, and the concrete vibrated to remove the pores created by the ice, the cement hydration should continue, producing satisfactory concrete. This only remains true however, if the concrete is re-vibrated after the ice has thawed.

If the concrete has set but not reached sufficient strength, freezing can result in internal cracking and loss of strength. If the freezing only occurs on the surface, it may result in delamination of the top surface.

After concrete has attained a strength of approximately 3.5 MPa, it is usually considered to have sufficient strength to resist a freeze thaw cycle.

The requirements of NZS 3109 give some protection against potential freezing of the concrete before it has attained sufficient strength. As a specifier or placer of concrete, what can you do to ensure a fit-for-purpose project in the cold winter months?

The best solution is to understand the fundamental principles of concreting in the cold so that the most appropriate solution can be applied to your project. The following are some general comments that are worth considering.

NEVER PLACE CONCRETE ON FROZEN GROUND

In New Zealand it should be possible to wait until the ground temperate rises before placing concrete. Alternatively, the ground can be protected overnight with straw or a similar material to prevent freezing.

USE AIR-ENTRAINED CONCRETE

The advantage of air entrainment is that it gives the concrete superior freeze/thaw resistance when it has reached sufficient strength. The concrete will still however, need to be protected from freezing until it reaches at least 3.5 MPa.

CONSIDER THE USE OF SET ACCELERATORS

These will decrease the time to final set, meaning the concrete can be finished and potentially protected earlier. When the concrete is reinforced, it is recommended that non-chloride accelerators are used. Be aware that accelerators have limited effectiveness when mix temperatures are below 5-8ºC. Also, be aware that overdosing with some set accelerators can in fact retard set, so ensure that the dose rate is that recommended by the admixture manufacturer.

There is a tendency in some areas to add set accelerators simply because it is winter rather than based on the expected temperatures during placing and finishing. It is possible to get very warm, low humidity days in winter. The indiscriminate use of accelerators can lead to problems with premature setting or plastic cracking.

HE cement could possibly be a consideration, although it is generally not stocked at ready mixed concrete plants.

PROTECT THE FRESHLY PLACED CONCRETE

In winter, there can be large changes in the ambient day and night temperatures. This can lead to restrained early thermal contraction. The use of early entry saw cuts, or tooled joints, can prevent the formation of ugly random cracking. Some winter cracking suggests that the top surface has chilled relative to the body of the concrete, resulting in surface random cracking. Although the insulation value of polythene is negligible, covering with polythene can potentially minimise the wind chill effect and prevent this type of cracking.

If freezing conditions are expected and the concrete is unlikely to have attained a strength of 3.5 MPa, insulate the concrete.

PREVENT THERMAL SHOCK

If the temperature is cold and the concrete warm, there is a risk that the removal of formwork can result in surface cracking. (A temperature differential of 20ºC or more is commonly quoted as the range across which this phenomenon can occur). Always follow the minimum formwork stripping times specified in NZS 3109.

USE WARM MATERIALS TO MAKE THE CONCRETE

The use of hot water and aggregates that have been stored in bins can mean that the concrete mix temperature is elevated, resulting in a faster setting time. Talk to your local ready mixed concrete supplier for options that are practical in your area. Never use water above 70ºC, and be aware of the safety requirements of using hot water on a construction site.

DO NOT USE UNVENTILATED HEATERS

The CO2 given off by some heaters can react with the concrete surface, producing a dusty, weak surface. Always make sure the exhaust gases are ventilated, and do not aim the burner directly at the concrete.

With some simple precautions, it is relatively easy to obtain high-quality concrete all year round.

For more information visit the Concrete NZ website - **www.concretenz.org.nz**

FIB SYMPOSIUM & CONCRETE NZ CONFERENCE – EARLY BIRD CLOSING

Concrete NZ reminds members that early bird registrations for the fib Symposium (11-13 November) and its own annual conference (14 November) at Te Pae Christchurch Convention Centre close on 16 August!

FIB SYMPOSIUM

The fib Symposium is an annual event that provides a forum to present and discuss state-of-the-art practice, recent advances and research, standards and guidelines, and future perspectives relating to durability, sustainability and resiliency in structural and civil engineering.

The Symposium's technical programme will be headlined by five outstanding construction experts who are set to share their experience and knowledge across a range of subjects, including concrete and innovative materials, structural performance and design, construction methods and management, and outstanding structures.

CONCRETE NZ CONFERENCE

The 2024 Concrete NZ Conference is taking on a twist, condensing into a power-packed 1-day event immediately following the Symposium on 14 November. Expect a diverse lineup of speakers, blending international perspectives with local insights across exemplar projects, research developments, concrete technology & materials, design trends and low-carbon initiatives.

Dr Xilin Lu
Tongji University
Shanghai, China

Dr.ir. Agnieszka Bigaj-van Vliet
Netherlands Organization for Applied Scientific Research (TNO)

Des Bull
Holmes NZ LP
Christchurch, New Zealand

Dr Steve Denton
WSP
United Kingdom

Dr Laura Lowes
University of Washington
USA

REGISTRATIONS NOW OPEN
We look forward to seeing you there!

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SYMPOSIUM
2024 ReConStruct
Resilient Concrete Structures
Christchurch, New Zealand
11–13 November 2024

Registration Type	Up to 16 Aug 2024 ($NZD incl. GST)	From 17 Aug up to 10 Nov 2024 ($NZD incl. GST)	From 11 Nov 2024 ($NZD incl. GST)
Member Full Registration*	$1100.00	$1200.00	$1595.00
Non-Member Full Registration	$1495.00	$1595.00	$1795.00
Student/Young Engineer Registraton	$695.00	$795.00	$850.00
fib 'Young Member Group' Registration*	$545.00	$645.00	$700.00
Day Registration	$600.00	$600.00	$600.00
fib Gala Dinner | 12 November 2024	$155.00	$155.00	$155.00
Concrete NZ Dinner | 13 November 2024	$155.00	$155.00	$155.00
Accompanying Person Social Function Registration	$200.00	$200.00	$200.00

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11 November</th><th>Tuesday
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14 November</th></tr>
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Invited Speakers TBC</td><td rowspan="3">Keynote session
Steve Denton</td><td colspan="2">Concrete NZ day opening & Plenary</td></tr>
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Xilin Lu
Agnieszka Bigaj-van Vliet</td><td rowspan="3">Parallel Sessions</td><td rowspan="3">Parallel Sessions</td><td rowspan="3">Readymix Session</td><td rowspan="3">Session 2B</td></tr>
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<tr><td>14.30</td><td colspan="5">Afternoon Tea</td></tr>
<tr><td>15.00</td><td rowspan="4">Parallel Sessions</td><td rowspan="4">Parallel Sessions</td><td rowspan="3">Plenary session
Invited Speakers TBC</td><td colspan="2">Plenary</td></tr>
<tr><td>15.30</td><td colspan="2" rowspan="2">Concrete NZ day closing</td></tr>
<tr><td>16.00</td></tr>
<tr><td>16.30</td><td>Symposium closing</td></tr>
<tr><td>17.00</td><td rowspan="5"></td><td colspan="2" rowspan="2">Icebreaker Reception</td><td colspan="3"></td></tr>
<tr><td>17.30</td><td rowspan="4">Young Member/ Engineer Event TBC</td><td rowspan="4">Fib Symposium Gala Dinner</td><td rowspan="4">Concrete NZ Gala Dinner & Awards</td></tr>
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AWARDS

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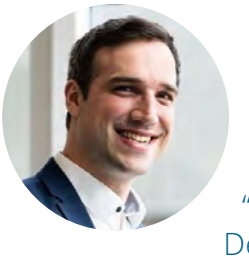


LOW-CARBON CONCRETE EXPLAINED

Tim Kleier, Concrete NZ Sustainability & Policy Director

"Low-Carbon" concrete is gaining traction in today's construction sector. Defined against independent sustainability assessment organisation's baseline data, this eco-friendly mix boasts a significantly lower Global Warming Potential compared to traditional Ordinary Portland Cement mixes.

An important part of Concrete NZ's engagement and advocacy work is communicating that industry has a clear and achievable path to become net-zero carbon by delivering "low-carbon" concrete, and explaining exactly what makes this type of new concrete "low-carbon".

2050 PATHWAY TO DECARBONISE

New Zealand's concrete industry has the ambition to reduce emissions, and in late 2023 unveiled *A Net-Zero Carbon Concrete Industry for Aotearoa New Zealand: Roadmap to 2050.*

This plan reflects a commitment to the *Climate Change Response (Zero Carbon) Amendment Act 2019* and its aim to meet the greenhouse gas (GHG) reduction targets under the Paris Agreement.

Put simply, the industry aims to achieve net-zero emissions by 2050, with the Roadmap providing a realistic pathway for all concrete stakeholders.

DECARBONISATION STRATEGIES

The chart below shows the actions ('strategies' or 'levers') that will be used to achieve net-zero GHG emissions from cement and concrete in New Zealand by 2050.

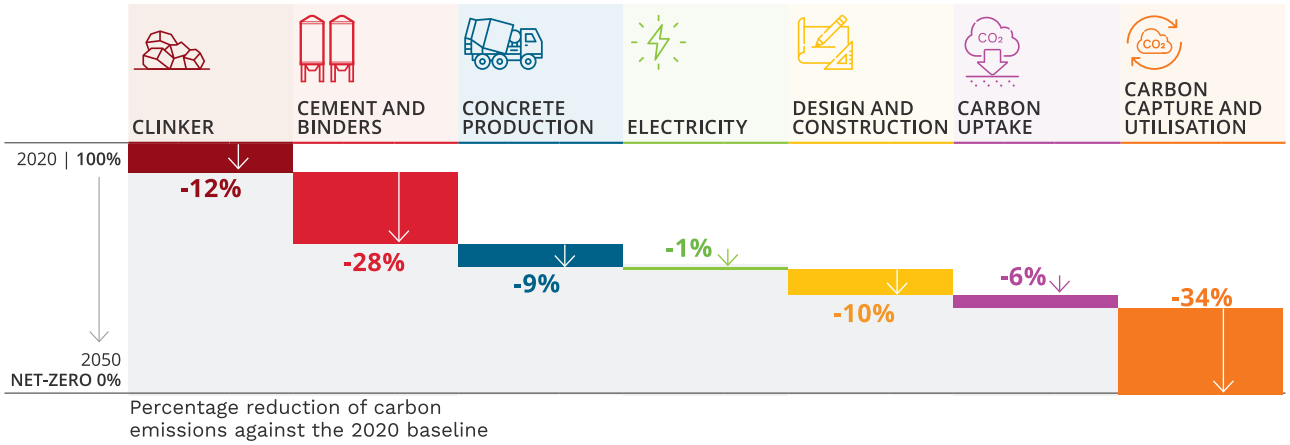
In addition to clinker factor reduction, replacing some Ordinary Portland Cement with Supplementary Cementitious Materials (SCMs), embracing carbon capture technologies, improving efficiency in concrete production as well as design and construction, and accounting for carbon uptake are expected to make the biggest differences. Industry also anticipates further small savings as the electricity grid continues to decarbonise.

Collectively, these strategies contribute to enabling low-carbon concrete. But how exactly do you measure, or rather specify, low-carbon concrete?

LOW-CARBON CONCRETE – AN EVOLVING DEFINITION

The term low-carbon concrete refers to concrete mixes with a Global Warming Potential (GWP-T) lower than a default Ordinary Portland Cement (OPC) mix of the corresponding strength class, as defined by the Infrastructure Sustainability Council (ISC) or the Australian National Life Cycle Inventory Database (AusLCI) baseline data.

This definition is evolving as the industry progresses in its decarbonisation efforts.



Images – pages 17-18: The Waimea Community Dam in Lee Valley, constructed using low-carbon concrete, is the largest dam built in New Zealand for over 20 years. Waimea Water Ltd.

UNDERSTANDING GLOBAL WARMING POTENTIAL

An initial understanding of the GWP of available concretes can be obtained by evaluating third-party verified Environmental Product Declarations (EPDs), although they do have limitations.

Various methods to reduce the GWP of a concrete mix exist, however, when specifying low-carbon concrete for a construction project, it's crucial to consistently denote a performance-oriented requirement based on the targeted reduction of GWP compared to a New Zealand concrete baseline (typically from the ISC or AusLCI).

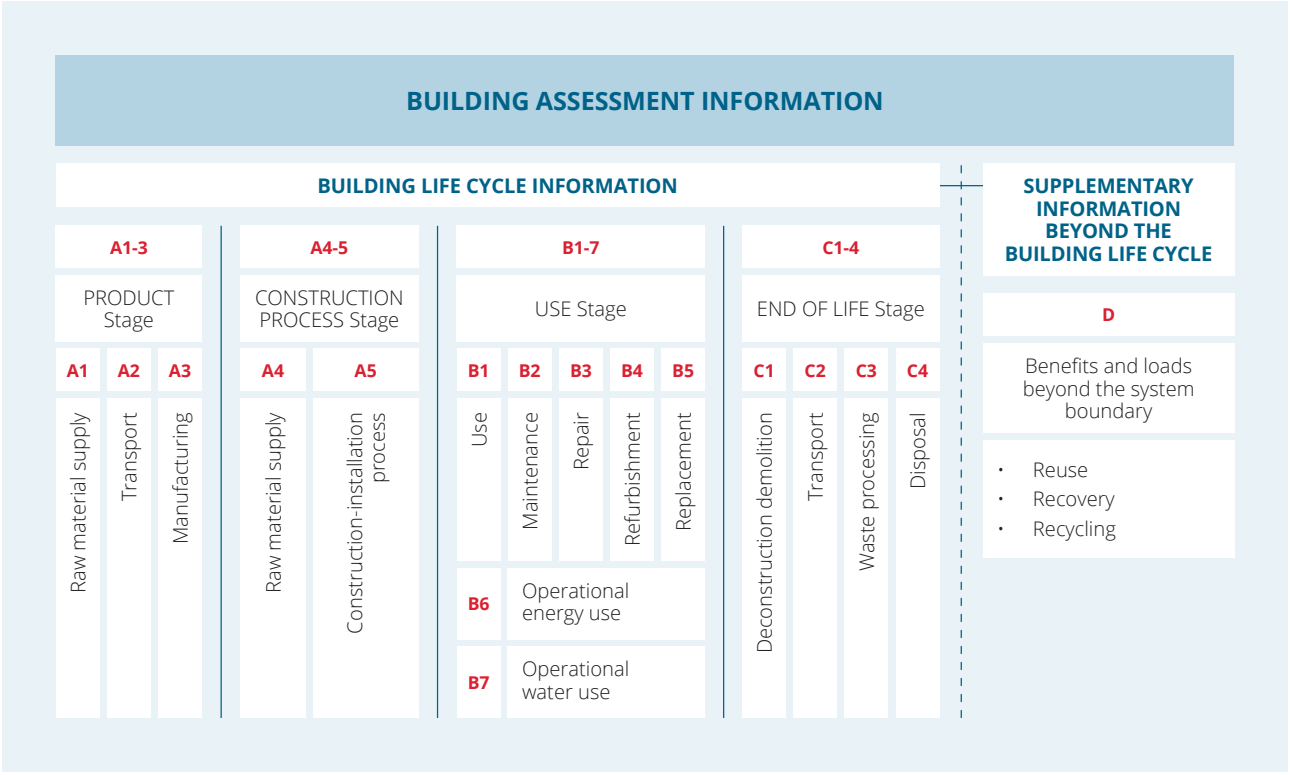
This approach allows ready mixed concrete suppliers to use the most appropriate mechanisms, such as SCMs, to achieve the end product.

OTHER CONSIDERATIONS

- **Raw Material Production and Transport:** Emissions from all ready-mixed concrete production activities, including raw material production and transport, are considered.
- **Cement Source:** The specific cement source and associated up-front carbon are included.
- **Geographical Constraints:** Locally available aggregates can affect cement demand and should be taken into account.

LIFECYCLE ASSESSMENT (LCA)

Data is organised according to several modules, which are illustrated in the following diagram:



MODULES A1-A3: RAW MATERIALS EXTRACTION & PROCESSING, TRANSPORT TO CONCRETE PLANT, MANUFACTURING OF CONCRETE

The table below provides baseline GWP in kilogram CO_2 equivalents per cubic metre of concrete for a range of common strength ratings:

	20 MPa	25 MPa	30 MPa	35 MPa	40 MPa	45 MPa	50 MPa
Embodied carbon baseline*	284	313	347	391	441	495	550

*2020 NZ concrete emissions baseline for ready mixed concrete provided by the Infrastructure Sustainability Council from their Materials Carbon Calculator NZ 2.0 taken from Firth Industries' *Low-carbon concrete: Concrete with sustainability in mind.*

Specifying a lower embodied carbon 25 MPa concrete may simply involve stating a 30% reduction in GWP from the ISC embodied carbon baseline of 313 kg CO_2e/m^3, resulting in 219 kg CO_2e/m^3.

It's recommended to liaise with the ready mixed concrete supplier to review how low-carbon mixes can be optimized while meeting performance criteria.

The majority of mix designs at the Waimea Community Dam used up to 50 percent fly ash as a replacement for cement.

MODULE B1: USE OF A CONCRETE BUILDING

Exposed surfaces of hardened concrete begin absorbing atmospheric carbon dioxide immediately, a natural process called "carbon uptake". Over time, at least 15% of the original emissions from cement production are taken up in concrete.

The Intergovernmental Panel on Climate Change (IPCC) formally recognized carbon uptake, or "recarbonation", as a CO_2 removal mechanism in its 6th Assessment Report (AR6).

MODULE B6: OPERATIONAL ENERGY

Concrete's thermal mass helps save on heating and cooling bills. Additional benefits of concrete include flood resilience, fire resistance, low vibration, acoustic separation, and a service life that can exceed 100 years.

MODULE D: REUSE, RECOVERY & RECYCLING

Beyond its end of life, concrete in buildings can be:

- **Reused:** Building elements from demolished buildings can be incorporated into new buildings.
- **Recovered:** Demolition concrete can be crushed and used as clean fill for land recontouring after quarrying or infrastructure projects.
- **Recycled:** Research in New Zealand shows that crushed demolition concrete can be recycled into new concrete.

ENVIRONMENTAL PRODUCT DECLARATIONS (EPDS)

EPDs quantify the environmental impacts of building materials following a standardised framework under EPD International. They are a type of LCA that involves third-party verification of calculation methods and input data, published by recognised EPD operators like EPD Australasia.

Many New Zealand cement and concrete companies have EPDs for their products, generally published on EPD Australasia, which is searchable.

As some published EPDs can be out-of-date, a more agile approach is to produce third-party verified LCAs. Ready mixed concrete suppliers should be able to provide customers with the latest LCA information for their products.

ADVANCING WIDER UNDERSTANDING

In short, Concrete NZ's message is that low-carbon concrete refers to mixes with a GWP lower than standard OPC mixes, as defined by independent sustainability assessment organisations.

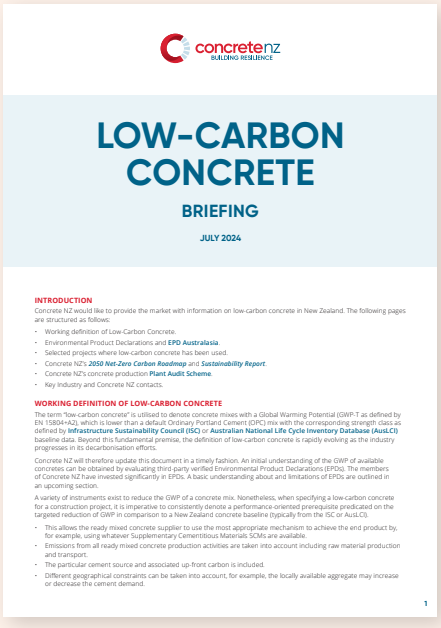
Concrete NZ also recommends that specifiers engage with local ready mixed concrete suppliers early in project planning to determine material availability and logistical capability.

LOW-CARBON CONCRETE BRIEFING

Concrete NZ has developed a *Briefing* for members, which includes the contents of this article, along with the contact details of the Concrete NZ Technical Team.

Concrete NZ offers a wealth of experience and expertise in all aspects of concrete (structural, architectural and materials) while maintaining a strong emphasis on sustainability and low-carbon developments. The Technical Team is available to assist with queries direct from members, as well as from members' clients.

The *Briefing* can be downloaded from the Concrete NZ website – www.concretenz.org.nz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LOW-CARBON CONCRETE

BRIEFING

JULY 2024

INTRODUCTION

Concrete NZ would like to provide the market with information on low-carbon concrete in New Zealand. The following pages are structured as follows:

- Working definition of Low-Carbon Concrete.
- Environmental Product Declarations and **EPD Australasia**.
- Selected projects where low-carbon concrete has been used.
- Concrete NZ's ***2050 Net-Zero Carbon Roadmap*** and ***Sustainability Report***.
- Concrete NZ's concrete production **Plant Audit Scheme**.
- Key Industry and Concrete NZ contacts.

WORKING DEFINITION OF LOW-CARBON CONCRETE

The term "low-carbon concrete" is utilised to denote concrete mixes with a Global Warming Potential (GWP-T as defined by EN 15804+A2), which is lower than a default Ordinary Portland Cement (OPC) mix with the corresponding strength class as defined by **Infrastructure Sustainability Council (ISC)** or **Australian National Life Cycle Inventory Database (AusLCI)** baseline data. Beyond this fundamental premise, the definition of low-carbon concrete is rapidly evolving as the industry progresses in its decarbonisation efforts.

Concrete NZ will therefore update this document in a timely fashion. An initial understanding of the GWP of available concretes can be obtained by evaluating third-party verified Environmental Product Declarations (EPDs). The members of Concrete NZ have invested significantly in EPDs. A basic understanding about and limitations of EPDs are outlined in an upcoming section.

A variety of instruments exist to reduce the GWP of a concrete mix. Nonetheless, when specifying a low-carbon concrete for a construction project, it is imperative to consistently denote a performance-oriented prerequisite predicated on the targeted reduction of GWP in comparison to a New Zealand concrete baseline (typically from the ISC or AusLCI).

- This allows the ready mixed concrete supplier to use the most appropriate mechanism to achieve the end product by, for example, using whatever Supplementary Cementitious Materials SCMs are available.
- Emissions from all ready mixed concrete production activities are taken into account including raw material production and transport.
- The particular cement source and associated up-front carbon is included.
- Different geographical constraints can be taken into account, for example, the locally available aggregate may increase or decrease the cement demand.

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NOW WE HAVE THE TOOLS, LET'S USE THEM

Wayne Scott, AQA Chief Executive

The Quarry Industry says a new GNS science study, showing where rock and sand resources exist in five major centres, should kick-start planning nationwide to secure these areas to support New Zealand's future development needs.

The Aggregate & Quarry Association (AQA) Chief Executive Wayne Scott says his organisation has worked with GNS and the Infrastructure Commission on the Securing Resources for Urban Growth Study which identifies potential sources of quarry materials in north and south Auckland, Bay of Plenty, Wellington and Central Otago.

Now, he says, central and local government must ensure quarry resources are available to support hundreds of billions of dollars in infrastructure and housing spend through coming decades.

Launching the study recently, Infrastructure Commission CEO Ross Copland noted that 30% of the cost of civil construction came from quarry resources and when these have to be trucked 30km, the cost doubles.

Wayne Scott says his organisation worked with GNS in Ōpōtiki in 2018 when the cost of the town's proposed harbour development doubled largely because the nearest existing quarries were 100km away. Finding local rock supplies helped make the project viable.

"Such benefits are now available in five centres around the country and other councils are starting to work with GNS to identify their own regions' viable rock and sand resources."

"I urge mayors, councillors, town planners, iwi and interested citizens in areas with already completed aggregate opportunity maps, to start using these as the basis of their future planning. Other regions should pick up the phone to GNS because much of the work has already been done."

Wayne Scott says the maps don't just identify quarry resources but looks at a whole range of factors including an area's conservation values, biodiversity impacts, local demand, proximity to existing housing, iwi and community concerns and land with high farming value, before identifying where a rock or sand resource is worth confirming for future use.

"As an industry, we want to identify and secure future potential pockets of high-value quarry resources and secure them so they aren't over-taken by urban sprawl. This study is a potential turning point in how we best plan for all our future growth."

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BUILDING PROGRESS FOR PEOPLE AND THE PLANET

BOOSTING WOMEN'S PARTICIPATION IN CONSTRUCTION – A CALL FOR EMPLOYERS TO 'HIRE BOLDLY'

BCITO has launched a new 'Hire Boldly' campaign aimed at employers in the building and construction trades, to help boost the number of women entering the industry.

The number of women in BCITO apprenticeships has grown from less than one percent in 2015, however women still only make up just over six percent of apprentices. BCITO's goal is to raise this figure to 10 percent by December 2025, through focusing on addressing ongoing misperceptions about women's ability to take on physical jobs.

Reaching this goal will clearly signal the industry is moving forward and considering people based on skills and ability for the role, not gender. In the painting industry, where 24 percent of BCITO apprentices are female, it is no longer unusual to see a woman at the business end of a spray gun, brush or roller.

"Despite the recent slowdown in resource consents and the pipeline of work for New Zealand's building industry, it's vital to ensure we have healthy numbers of new people entering the construction industry and building skills for the future. Encouraging more women into the workforce is not only a matter of equality but a strategic move to strengthen our industry's resilience. Employers play a critical role in shaping the future of construction," says Greg Durkin, Director at BCITO.

In a 2021 report for the Women in Trades Collective, part of industry initiative Trade Careers, almost half of respondents to the employer survey (48 percent) agreed that hiring and supporting women tradespeople was a challenge because it would be hard to accommodate pregnant women in the workplace. Forty-six percent also said they would find it difficult to hire women because the workplace can be physically challenging.

Greg Durkin, Director at BCITO.

Women looking for work cited receiving questions from potential employers such as "you realise there is dirt involved in this job?", or the outright statement "we're looking for a male".

"When we have examples such as the BuildHERS project in Whenuapai, a four-bedroom home project-managed and built entirely by a female crew, they demonstrate how outdated or misinformed these perceptions are. Women can do anything their male colleagues can do, and that's what we hope to educate more employers about, to help the whole sector reach a goal of 30 percent female representation by 2040," Durkin says.

Employing more women in construction brings numerous benefits. By encouraging more women to join the workforce, employers can tap into a broader talent pool. A diverse workforce also brings varied perspectives, leading to innovative solutions and improved problem-solving. Women can offer new ideas and approaches that benefit the entire industry. Companies known for their commitment to diversity and inclusion often enjoy a better reputation, which can attract top talent and improve relationships with clients and partners.

Meanwhile, more inclusive workplaces also tend to have higher employee satisfaction and retention rates.

"The women and the men bounce off each other in ways that enhance the job. It's been fabulous for us. In fact, we've become quite successful

through it," says Maria Williams, co-owner of family business Kevin Paul Painters and Decorators, which also employs daughter Lonae Paul as part of a diverse crew.

To accompany the campaign, BCITO has created videos telling the stories of fathers, uncles, grandfathers and brothers who have not just hired women in trades but have seen positive changes within their businesses. Many like Kevin and Maria also talk about why their trade is a good career for their female family members.

"We're calling on all building and construction employers to watch and share these videos, and actively participate in fostering a more inclusive trades industry by considering female apprenticeships," Durkin says.

For more information, visit **www.buildingwomen.nz**.

HOW EMPLOYERS CAN MAKE A DIFFERENCE

- **Review hiring practices:** Ensure that job advertisements and recruitment processes are inclusive and free from gender bias. Consider implementing blind recruitment practices to focus on skills and experience.
- **Create supportive work environments:** Develop policies and practices that support work-life balance and provide a safe and respectful workplace for all employees. Consider flexible working arrangements and mentorship programmes.
- **Promote training and development:** Encourage and support female employees to pursue training and career development opportunities. This not only benefits the individual but also strengthens the overall skill set of the workforce.
- **Lead by example:** Senior leaders and managers should actively promote diversity and inclusion within their teams. This includes addressing any unconscious biases and championing the benefits of a diverse workforce.

FIRTH INDUSTRIES - IT'S ALL ABOUT THE PEOPLE

Firth Industries is encouraging more employers to hire women for the person they are, gender aside. Case in point being Daniela Powell, now a frontline manager, who brings with her a can-do attitude that can't be taught.

We look for people that are curious, have the attitude of 'can do' and just ask a lot of questions. We will teach you the rest. If you turn up, you got a smile on your face and

Francis Leslie and Daniela Powell of Firth Industries.

Daniela exemplifies Firth Industries' approach to diverse recruitment.

you're willing to give it a go, you're going to go well in Firth," says Francis Leslie, Head of Asset Management and Northern Certified.

"There's a school of thought 10 years ago where this was a man's game, a man's industry. Well, that whole thing's changed now."

"We appreciate the more women we have in our workforce, the better we will be. They bring a new energy to what we do and that's all we look for," adds Francis.

"We call it a cross-section of New Zealand Society. Everybody that works in Firth is a slice of New Zealand.

"Firth wants more women and more diversity in our mix because it brings a new flavour to what we're about, that's the best thing ever. For us it's absolutely important and it's actually the right thing to do."

Daniela is in total agreement with her employer and shares the same sentiments as Francis.

"To employers that are umming and ahing about hiring women, especially in this industry, I think you're missing out on 50% of the workforce that is equally as capable and as competent," says Daniela.

"I want to see like women believing in themselves to do this, having confidence in yourself and in every call you make, is the key. I have that, I believe in myself."

"Daniela has got a unique skill of bringing everyone on board and she actually walks the talk," says Francis

"One of the key things that we encourage our people to do is be bold. Give it a go. We're going to have your back whether you're working as a driver or helping out with a customer on site pushing a wheelbarrow."

"Be bold. Put your hand up, show intent, and you're going to get far."

TESTING CONCRETE QUALITY CONTROL – CHECK THE NEED FOR ADDITIONAL TESTING!

James Mackechnie (Allied Concrete), Dave McGuigan and Paul Donoghue (Concrete NZ)

It has been observed that consulting engineers issue structural specifications with concrete testing requirements that may not be appropriate, especially when the concrete is supplied from a concrete batching plant that holds a Certificate of Audit confirming that its concrete production complies with NZS 3104:2021.

Examples of additional concrete testing requirements in structural engineering specifications that may not be appropriate for small in situ concrete pours or precast concrete manufacture include:

- Requirements to make five standard cylinders for the first 25 m^3 of concrete placed.
- Requirements to test the cylinders; which consists of breaking one at 7 days, breaking one at 14 days, breaking two at 28 days; with a spare cylinder held, and if required by the Engineer, tested at 56 days.

These testing requirements exceed the testing specified in NZS 3104:2021 and can significantly increase testing costs with no improvement in monitoring quality assurance for concrete plants that perform quality control tests in accordance with NZS 3104 and hold a Certificate of Audit. At worst, when these onerous testing requirements are applied to precast concrete manufacture, they could result in 5 cylinders per precast item, meaning 5 cylinders for every 2 or 3 m^3 of concrete.

The following sections set out guidance on how quality assurance for concrete production is typically performed in New Zealand for concrete production specified to comply with NZS 3104.

QUALITY CONTROL OF CONCRETE – AS REQUIRED BY NZS 3104

Control tests for concrete production and criteria for demonstrating compliance are specified in NZS 3104:2021, which has specific provisions for the following:

- Frequency of sampling of concrete during production.
- Target strength of different grades that is typically between 5-8 MPa above specified strength grade and results in approximately 0.5% risk of failure when analysing multiple test series.
- Controlling variability of test series to show good production control with coefficient of variation limited to typically less than 10%.
- Controlling within test variability of cylinders tested at 28 days to ensure reliable mean strengths are reported.
- Specifying early strength testing at 7 days and allowing longer term testing at 56-days when appropriate, typically for concretes with slower strength gain properties.

The standard strength testing procedures for concrete that is specified to be produced in accordance with NZS 3104 are therefore as follows:

- Plant testing during concrete production at a minimum test frequency of one test for every 75 cubic metres of concrete produced.
- Each test to typically consist of one cylinder tested at 7 days and two cylinders tested at 28 days for normal concrete. If dealing with some concretes that contain Supplementary Cementitious Materials (SCMs), such as fly ash, 56-day testing would replace 28-day testing.
- During the initial phase of a specific project some extra site testing might be undertaken to confirm concrete properties.

SITE TESTING OF CONCRETE

Specifying site testing of concrete should be done with care as this requires considerably more resources and generally provides little extra value. The commentary clause C2.15.8.1 in NZS 3104:2021 provide reasons why this form of testing is often not appropriate for compliance testing of concrete production.

In some cases, the integrity and quality of any additional testing may be compromised since technicians struggle to undertake multiple tests on sites remote from the testing laboratory or production plant.

TESTING FREQUENCY

Testing frequency is specified in NZS 3104 and NZS 3109 as being typically one test for every 75 cubic metres of concrete produced. This testing frequency means that at least one test is taken from each tanker load of Portland cement or for every truck and trailer of fine or coarse aggregate. Any significant change in raw materials is therefore captured within the testing data.

Designers and specifiers should be aware that each c. 5m^3 truck load of concrete is subject to quality control procedures regardless of whether it is tested or not. This is done by analysing batch records where all materials are accurately weighed and recorded. The final water/cement ratio of a concrete mix can be accurately used to predict the compressive strength of concrete and this also helps confirm that untested loads are consistent and comparable with tested loads.

NUMBER OF TEST SPECIMENS

Three cylinders for the test frequency outlined previously are usually sufficient for confirming strength properties:

- One cylinder provides an early estimation of strength performance (7 days).

- Two cylinders used to provide the mean strength at 28 days (three cylinders for new concrete batching plants or when the coefficient of variation of test results exceeds 4%).

Providing extra cylinders for additional strength testing is unnecessary since 14-day and 56-day strength can be accurately predicted based on 7-day and 28-day strengths. When dealing with concretes containing slower reacting materials such as fly ash, NZS 3104:2021 allows 56-day testing but this is usually done by substituting cylinder strength tests from 28 to 56 days. It would be unlikely that concrete supplied for precast concrete would require more than the standard 7-day or 28-day testing due to the rapid strength development of precast concrete mixes.

CONCLUSIONS

Quality assurance of concrete production is undertaken by a number of control tests as outlined in NZS 3104. Both batch and test records of concrete production are used to evaluate that output complies with the project specification. Specifiers who require additional testing requirements to those specified in NZS 3104 will incur significant additional costs to the project without any benefit to monitoring quality assurance if the batching plant already routinely performs quality control tests.

It is more important to specify that concrete supplied for a project, irrespective of whether it is poured at a construction site or poured at a precast manufacturing facility, is produced in accordance with NZS 3104 by a concrete batching plant with a Certificate of Audit.

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