SUSTAINABILITY REPORT

for Aotearoa New Zealand's Cement and Concrete Sectors

2023

concretenz
BUILDING RESILIENCE

Tākina – Wellington Convention and Exhibition Centre, 50 Cable Street, Wellington. Jason Mann Photography.

Cover Image: *8 Willis Street & Stewart Dawson's Corner, Wellington. Andy Spain Photography.*


TE PAPA

Bowen Campus, 40 Bowen Street, Pipitea, Wellington.
Adam Leach.

REPORT **CONTENTS**

Sustainability highlights 2023

→ Steady progress on decarbonisation:
- Direct and electricity-related emissions down 6% from 2020 baseline.
- Replacement of Portland cement with Supplementary Cementitious Materials (SCMs) increased by 48% nation-wide.
- Infrastructure in place to deliver rapid growth on SCM uptake.
- Local cement production facility increased their uptake of alternative fuels again (now 56%).
- All cement suppliers underwent intense product development to reduce their clinker factor while maintaining product quality.

→ Future-proofing focus for health and safety.

→ New: reporting on reinforcing steel processors.

FOREWORD FROM **OUR CEO**

Welcome to the second sustainability report of the New Zealand cement and concrete industry. It builds on the first report of 2021-2022 and demonstrates continuous improvement. The report also recaps the many benefits of concrete as part of a low-carbon future.

MATERIAL FOR A MORE RESILIENT FUTURE

As a critical construction material, concrete will continue to deliver resilient buildings and infrastructure, including homes, clean water, clean and renewable energy, and resilience to natural hazards, including the effects of climate change.

REDUCING OUR FOOTPRINT

I am delighted this report shows progress towards our emissions reduction targets. Despite an increase in concrete production from 2020 to 2023, absolute direct and electricity-related emissions decreased by approximately 6%.

More broadly, our 2021-2022 report provided a baseline on where the cement and concrete industry stood on indicators such as CO_2 emissions, diesel consumption, use of reticulated water, and lost-time injuries.

This second report builds on this by showing how industry is already making progress on reducing emissions, energy use, on promoting the concrete circular economy, and on how we are leading on workplace health and safety and employee wellbeing.

A TRACK RECORD

Tabling 2023 data alongside 2021-2022 data (where this is possible) starts a time series of data in Concrete NZ's sustainability reporting. Over time this will inform company strategies for improving their individual commitments to sustainability.

Concrete NZ's membership has a growing interest in sustainability reporting, evidenced by the increased contribution of data from industry compared with 2021-2022.

We are pleased to share this report and look forward to driving continuous change across industry as part of the transition to a more sustainable, resilient, and prosperous future.

Rob Gaimster
Chief Executive | Concrete NZ

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BUILDING RESILIENCE

CONCRETE BY THE NUMBERS

NZ$2.483 billion
ASSET BASE
2023 report
($1.957 billion 2021-2022 report)

NZ$1.274 billion
CONTRIBUTION TO GDP
2023 report
($1.131 billion 2021-2022 report)

11,203 FTEs
EMPLOYMENT
2023 report
(10,382 FTEs 2021-2022 report)

25.6%
MĀORI EMPLOYEES
2023 report
(23.7% 2021-2022 report)

4.136 million m³
READY MIXED CONCRETE
2023 report
(4.581 million m³ 2021-2022 report)

194 and 18
CERTIFIED READY MIXED AND PRECAST PLANTS
2023 report
(183 & 19 2021-2022 report)

11.9%
FEMALE EMPLOYEES
2023 report
(11.7% 2021-2022 report)

539
NUMBER OF APPRENTICES
October 2023
(600 2021-2022 report)

ABOUT CONCRETE NZ

Concrete New Zealand represents more than 500 corporates and individuals who contribute significantly to the construction sector. Our industry spans cement manufacturers and producers of ready mixed concrete, masonry products and precast elements, including wall panels, pipes and culverts. We also work with steel reinforcing processors.

We advocate on behalf of the cement and concrete industry for policy settings that support a diverse, efficient, and resilient construction sector.

OUR VISION

Supporting industry to position concrete as the construction material of choice for a modern and resilient New Zealand.

OUR STRATEGY AND COMMITMENTS

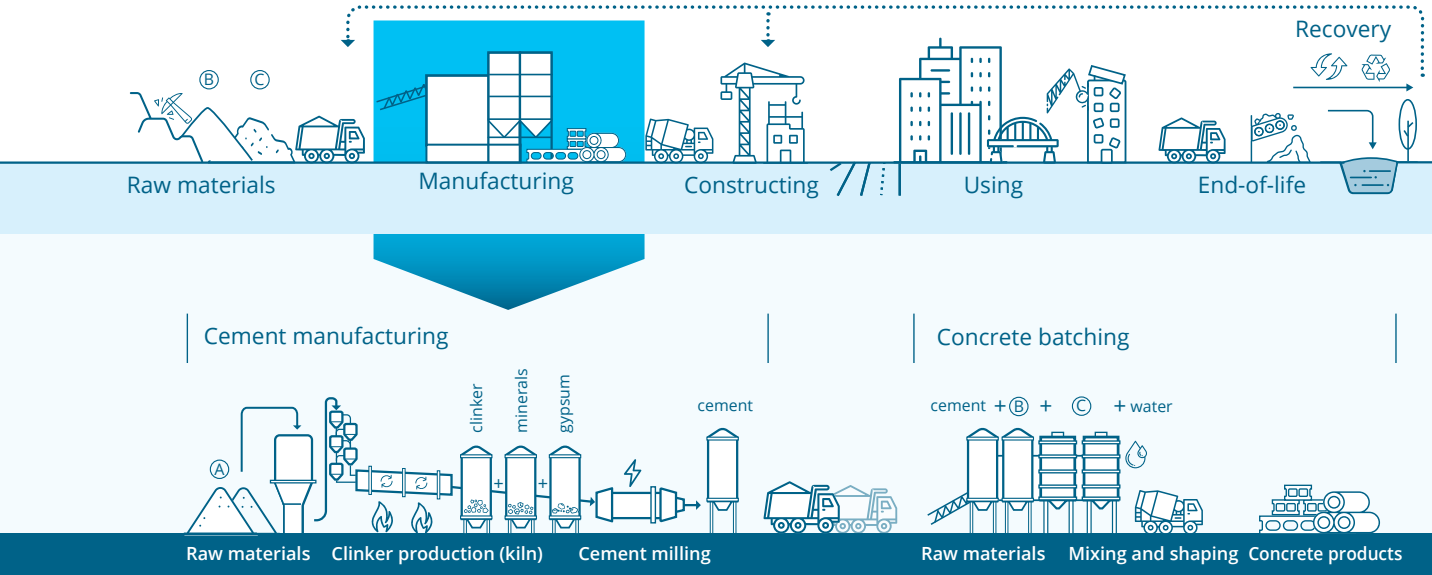
Our Strategic Charter rests on four pillars:

- consolidated voice
- raising standards
- promoting quality
- improving reputation

In pursuing these strategic priorities, we undertake a wide range of activities on behalf of our members. We fund research and development, and educate and train concrete placers, specifying architects, and engineers. We audit concrete plants, influence the development of government policy, and more. We promote the good work our industry is doing in steadily reducing the carbon footprint of concrete, and to incentivise more reuse, repurposing and recycling of concrete.

B201 Redevelopment, University of Auckland.

THE VALUE CHAIN OF CONCRETE



Ⓐ Limestone, shale and clay extraction Ⓑ Supplementary Cementitious Materials (SCMs) Ⓒ Aggregate | virgin and recycled

CONCRETE FUNDAMENTALS

CLINKER
= limestone and other minerals + 1,500°C

CEMENT
= CLINKER + gypsum (+limestone), finely crushed

CONCRETE
= CEMENT + water + crushed rock and sand (+additives)

The cement and concrete industry is diverse, and includes (but is not limited to) the following sectors:

- → **Cement** – an important binder for readymix concrete manufacture, which can be (increasingly) partially substituted by supplementary cementitious materials to produce lower-carbon concrete.
- → **Ready mixed concrete** – manufactured and supplied predominantly to construction sites, and also to the precast sector.
- → **Masonry** – concrete manufactured into standard-sized blocks, used for residential and commercial construction, retaining wall elements, pavers, and more.
- → **Precast** – off-site manufacturing of elements such as wall panels, beams, floors, as well as bridge components, pipes and culverts, which are then transported to the construction site.
- → **Reinforcing processors** – supply of cut and bent reinforcing bars, mostly to construction sites (where ready mixed concrete is then poured for foundations, floor slabs, vertical columns, etc), and also into the precast sector.

The industry value chain also includes suppliers of aggregate, reinforcing steel, admixtures, and services including handling of precast components, concrete mix designers, and placing contractors.

CASE STUDY – WILCO PRECAST LOW-CARBON PRECAST ELEMENTS

When customers started demanding low-carbon panels, Wilco Precast called their supplier, Bridgeman Concrete, to see what could be done. A challenge has always been to ensure poured concrete has enough 24-hour strength to be lifted out of a mould.

Trials started in 2023 of low-carbon supplementary cementitious materials in 40 MPa concrete mix designs, with 10% fly ash replacement of general-purpose cement supplied by HR Cement.

When local fly ash became no longer reliably available, HR Cement switched to slag, starting with 10% of the binder, raising it to 15% and then 20% as testing showed the concrete performed well in the moulds, and in next-day lifting, handling and storage.

By the time the panel is lifted from the mould, the concrete has already attained a compressive strength of 15 MPa.

Wilco Precast has supplied precast elements into Auckland buildings with a 6 Green Star rating.

MAKING PRECAST CONCRETE PANELS

- An engineer designs the panel, including steel content, and concrete properties. Panels more than 175 mm thick will require a double layer of reinforcing.
- Pacific Steel produces the steel reinforcing bar (rebar), typically 12 or 16 mm diameter, which a contractor bends and cuts to shape, and then delivers to Wilco Precast. A cage can total 1 tonne of steel for a 12 t panel (10 by 3 m, and 165 mm thick).
- A remote-controlled overhead gantry moves the rebar to a mould. This is a thick sheet of steel plate, topped with moveable aluminium or timber sides, held in place by powerful magnets.
- Bridgeman Concrete pours ready mixed concrete straight from 6-cubic metre capacity trucks into the mould, no pumping required. Workers finish the upper surface of the concrete using different-sized trowels. The concrete cures overnight.
- The following morning, a gantry operator picks up the panel, and moves it to a "toast rack", for vertical storage, to maximise exposure to air.
- After a day the panel is still warm to the touch as hydration continues, adding strength to the concrete. On reaching 25-30 MPa, the panel is ready for transport.
- A contractor delivers the panel to the building site. Wilco Precast monitors 7-day, and 28-day strength, at which time the precast panel already has reached 50 MPa.

BUILT FOR SUCCESS

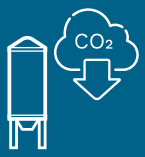
Wilco Precast moved in 1999 from Manukau into a custom-designed site the company built at Papakura for precast manufacturing:

- Employs around 65 people at Papakura.
- Uses up to 85 cubic metres of ready mixed concrete per day.
- Produces up to 25 precast concrete panels a day.

HOW THE CEMENT AND CONCRETE INDUSTRY IS BECOMING **MORE SUSTAINABLE**

ALTERNATIVE KILN FUELS

Waste wood and tyres are increasingly replacing coal in making clinker, and provide an important contribution to a circular economy.



LOW-CARBON BINDERS

Increased uptake of industrial by-products and natural supplementary cementitious materials, and mineral additions, e.g. limestone, in concrete.

LOW-CARBON CONCRETE

Improved mix design, input material properties, and operational efficiency at concrete batching plants.

IMPROVING CONCRETE TECHNOLOGY

Research and innovation are improving concrete's performance.

WATER RECYCLING

Concrete plants use rainwater and recycle grey water to reduce need for town supply.

GREENER TRANSPORT

Trials continue into electric, hybrid and hydrogen trucks.

RECYCLED INPUTS

Waste glass, chipped tyres, and aggregates can be used in ready mixed concrete and masonry.

EMPLOYEE WELLBEING

Companies are leading on improvements in health, safety, and mental health.

A MAJOR ROLE IN NEW ZEALAND'S BUILT ENVIRONMENT

Concrete is strong, long-lasting and versatile – it can be formed into almost any shape. Compared with other building materials, concrete offers better fire safety, greater noise reduction, and more efficient heating and cooling. It can be reused, repurposed and recycled at the end of life of a building or structure.

New Zealand's infrastructure pipeline is huge, and concrete will have to play a central role in delivering it. The Government has estimated that the pipeline includes $121 billion in project value over the next 30 years, with 1,356 projects each valued at more than $10 million.

Concrete is used in road and rail bridges, tunnels and other infrastructure, renewable electricity schemes, house pads, multi-storey buildings, sea and airports, industrial infrastructure, flood protection and other climate change resilience schemes, and more. In many cases, there are no economically viable alternative materials that can achieve the same performance as concrete.

CASE STUDY – HIGGINS CONCRETE COMMITTED TO SUSTAINABILITY

Higgins Concrete has been steadily reducing embodied carbon across 28 ready mixed concrete designs. The Palmerston North-based company's Environmental Product Declaration dates from December 2023, and includes its subsidiaries, Counties Ready Mix and Supacrete.

In 2022 Higgins Concrete used on average 6% fly ash in their binder. Today the figure is much higher than that, and this means it consistently achieves emissions intensity well below standard industry baselines, as can be seen clearly in the table below.

Strength	Higgins Concrete (GWP $kgCO_2/m^3$)	ISC Rating Scheme baseline
20 MPa	188	284
30 MPa	226	347
40 MPa	259	441

Besides its progress in low-carbon concrete, Higgins Concrete has also implemented industry-leading water and waste management at some of its sites.

WATER AND WASTE MANAGEMENT IN HASTINGS

Higgins Concrete has operated a site in Hastings for the last two years, which has state-of-the-art waste and water management systems. When surplus ready mixed concrete is returned to the site, it is separated into a dry "builder's mix" for making concrete in a portable mixer, and a liquid that can be repurposed into basecourse aggregates.

Other Higgins Concrete sites make concrete blocks from ready mixed concrete returns, which farmers use to build sileage bunkers. The company also crushes blocks for recycling into aggregate, either as builder's mix, or into new ready mixed concrete.

Like many concrete companies, Higgins Concrete captures all water at its sites, uses settlement ponds to reduce sediment in suspension, by way of minimising the municipal draw.

The Hastings site has a "rain smart" water management system in which rainwater is captured in subterranean plastic pods, which then trickle out water into the town stormwater drainage.

CEMENT AND CONCRETE INDUSTRY **FOCUS AREAS**

Concrete NZ's 2023 Sustainability Report covers the following key areas:

ENERGY AND EMBODIED EMISSIONS

Cement and concrete companies are reducing their CO_2 footprint.

WATER

Industry recycles water to reduce dependence on town supply.

SOCIO-ECONOMIC BENEFITS

Industry employs people in rewarding careers and produce materials that support New Zealand's prosperity.

WASTE AND CIRCULAR ECONOMY

Concrete can be reused, repurposed and recycled. Industry is seeking more sustainable inputs.

WORKPLACE HEALTH & SAFETY

Industry is focused on zero-harm workplaces, and on employees' health and wellbeing.

CONNECTING WITH THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS (SDGS)

Concrete plays a key part in pursuit of the UN's SDGs – for example:

Goal 3 – Good health and wellbeing

Concrete reduces heating and cooling bills, and protects from noise and fire.

Goal 6 – Clean water and sanitation

Concrete is essential to providing drinking water, wastewater and stormwater services.

Goal 7 – Affordable and renewable energy

Concrete is critical in generating and transmitting renewable electricity.

Goal 8 – Decent work and economic growth

The concrete industry provides rewarding jobs and contributes to the built environment which boosts economic wellbeing.

Goal 9 – Industry, innovation and infrastructure

Concrete is used to build schools, hospitals and other public buildings, roads and rail bridges.

Goal 11 – Sustainable cities and communities

Concrete supports urban growth, transport, mobility, and climate resilience as populations grow.

Goal 12 – Responsible consumption and production

Waste concrete can be recycled, reused and repurposed into aggregate, buildings, and clean fill.

Goal 13 – Climate action

Concrete provides resilience against extreme weather, wildfires and sea level rise, infrastructure for renewable energy, for a reduced carbon footprint.

According to the Global Cement and Concrete Association (GCCA) concrete contributes directly to 80 of the 169 SDG targets Association.

CASE STUDY
– CONCRETEC NZ DRIVING RURAL SUSTAINABILITY

When precast manufacturer Concretec started operations in rural South Auckland there was no sewerage or water supply. The company built a dedicated waste-water treatment plant, water storage, and sediment ponds to manage site water runoff including water quality monitoring of discharges into the local stream.

The site has thousands of native plants and trees the company has planted, so a green belt around the industrial site, says owner and director Justin Bragg. "We took pride in the site, and just started planting." Also, on the property is a small olive stand, and a vineyard producing pinot gris.

Precasting produces relatively little waste. Concretec is now progressing towards compliance with ISO14001, the internationally recognized standard for environmental management systems. Bragg describes the precasting operation as environmentally friendly, and a very clean site.

SOLAR POWER REDUCES ENERGY FOOTPRINT

Concretec uses solar for around two-thirds of its electricity requirements, and purchases the remainder from the grid, amounting to about 7 kilowatt-hours per cubic metre of precast product.

Also helping lower electricity use are 600 m^2 modern office facilities built of insulated precast concrete, using LED lighting, and skylights which improve solar load on the internal space. Concretec's main use of electricity is for eight overhead gantry cranes, as it uses ambient temperature for concrete curing.

SCMS ARE ENTERING THE MARKET

The use of supplementary cementitious materials (SCMs) is starting in precast, lowering the cement usage (and therefore emissions) in concrete. While New Zealand-made reinforcing steel is emissions intensive, this footprint will be greatly reducing over the next few years (refer to page 17 for a summary).

> ***"If anyone is talking to us about a green building, they are interested about the CO_2e side of the concrete. That's driven by the market [building owners], and the market is starting to move."*** *– JUSTIN BRAGG*

This market is influenced by clients and developers, as well as sustainability consultants, architects and engineers. Concretec recently supplied the precast components for a building for whiteware manufacturer Fisher and Paykel using low-carbon concrete, as an example.

SCMs in use today are fly ash and slag, and use of these usually requires special additives to deliver overnight strength for lifting precast elements out of moulds the morning after casting. At that stage the concrete has a compressive strength of at least 15 MPa.

Adoption of low-carbon concrete in precast elements is starting to accelerate, and as technology allows, it will continue to grow over time. This slow and steady approach allows the market to rationally adjust, Bragg says. "We are on a journey."

AGAINST THE BASELINE
OUR EFFORTS IN NUMBERS

This year's sustainability report is based on responses from businesses covering approximately 78% of the ready mixed concrete market by volume. Notably, reinforcement processors have been included for the first time.

ENERGY AND EMBODIED EMISSIONS

CO_2 EMISSIONS

In 2023, Concrete NZ launched the industry's *Roadmap to Net Zero Carbon Concrete by 2050*, which aligns with the Global Cement and Concrete Association's 2021 roadmap. The Concrete NZ roadmap identifies seven key strategies for reducing emissions: clinker production; cement and binders; concrete manufacturing; design and construction practices; electricity usage; carbon uptake; and carbon capture, utilisation, and storage (CCUS).

The industry has set ambitious targets to reduce direct and electricity-related CO_2 emissions by 44% by 2030 compared to a 2020 baseline, and to achieve net-zero carbon for cement production and concrete batching by 2050.

We are already seeing progress toward the 2030 target. Despite an increase in concrete production from 2020 to 2023, absolute direct and electricity-related emissions decreased by approximately 6%.

To support ongoing progress toward the roadmap's goals, Concrete NZ initiated a research project in August 2024 in partnership with the Ministry for Business, Innovation and Employment (MBIE) and BRANZ. This project aims to identify and establish enabling conditions across the supply chain, and to develop technological, economic, and regulatory frameworks that support concrete decarbonisation.

CEMENT EMBODIED EMISSIONS

While the roadmap outlines the primary strategies for achieving industry-wide climate targets, individual companies are already implementing various measures, fostering positive progress. A key indicator of this momentum is the ongoing reduction in embodied emissions in New Zealand's predominant binder, Portland cement.

Cement supplier	**2021-2022,** GP cement A1-A3; kg CO_2e	**2023,** GP cement A1-A3; kg CO_2e
Golden Bay	733	699
Holcim	897	862
HR Cement	811	811

INCREASING ADOPTION OF SCMS

The use of low-carbon concrete in New Zealand's construction sector is steadily increasing each year. One key factor driving this progress is the substitution of Portland cement with higher proportions of SCMs in ready mixed concrete. The share of SCMs as a percentage of total binders has increased by 48% between the first and second reporting periods:

2021-2022	2023
2.5%	3.7%

This national average conceals significant regional variations. Producers in Auckland reported an average cement substitution rate of over 15%, with some individual mixes achieving up to 65% substitution of Portland cement with SCMs. Customers nationwide are encouraged to engage with local suppliers to explore opportunities for their specific projects.

Fly ash remained the preferred SCM in New Zealand throughout 2023, although there is a growing use of ground granulated blast furnace slag (GGBFS), which is imported from overseas iron and steel mills. The commercial potential of natural volcanic ash deposits in the Central North Island is currently under investigation.

ENERGY USAGE

As of 2023, the primary energy sources for clinker manufacturing include waste wood, waste tyres, and coal. For concrete production and delivery, electricity and diesel are the main energy sources. Concrete trucks, which deliver ready mixed concrete, continue to use diesel fuel, a significant contributor to CO_2 emissions. However, specific fuel consumption from ready mixed concrete delivery has dropped by about 10%, resulting in more than 4,500 tonnes of avoided CO_2e emissions in 2023:

2021-2022	2023
4.5 L/m^3	4.1 L/m^3

Energy efficiency remains a critical focus. Some precast and masonry companies use LPG or natural gas to accelerate product curing, while electric heat pumps are being explored as an alternative energy source.

Trials of electric, hybrid, and hydrogen trucks for cement and concrete delivery are ongoing, with the challenge being to achieve emissions reductions at scale.

WASTE AND CIRCULAR ECONOMY

The industry can and is doing more to recycle, repurpose, and reuse more concrete. In 2023 Callaghan Innovation published research into the use of recycled crushed concrete in ready mixed concrete. This creates a new market for a material that is mostly used as cleanfill and roading aggregate. Precast manufacturers reprocess the small amount of waste they produce into aggregate for reuse as concrete or retaining wall blocks.

REPURPOSING CONSTRUCTION WASTE CONCRETE

When concrete trucks deliver ready mixed concrete to a construction site there can be excess that in the past was disposed of as waste. Suppliers increasingly collect concrete returns, which are poured into bins where it hardens. This material is then either used as blocks or crushed to meet roading authority specifications as a high-value basecourse aggregate.

WATER

Ready mixed concrete manufacture uses very little water, around 150 litres in each cubic metre, and a further 20 litres for washing trucks and equipment. To the extent possible, ready mixed concrete manufacturers limit their dependence on reticulated supply, and instead, use rain or bore water, and recycle used water.

WORKPLACE HEALTH AND SAFETY

The health and safety (H&S) performance of the New Zealand cement and concrete industry in 2023 reflects a strong commitment to safety and continuous improvement across its various sub-sectors. Despite some differences in specific performance indicators, the industry as a whole has made substantial progress in implementing effective safety management systems and monitoring leading indicators to enhance safety outcomes.

In 2023, most companies within the ready mixed, precast, masonry, and reinforcement processors sectors demonstrated a high degree of maturity in their health and safety practices. This was evidenced by the implementation of comprehensive safety management systems, the conduct of regular risk assessments, and the delivery of robust training programmes.

The industry's reported Lost Time Injury Frequency Rates (LTIFR) varied across sectors, with an overall average of 7.06 hours per million hours worked. This figure reflects the progress made in reducing workplace incidents and the ongoing necessity for targeted interventions in areas with higher risks.

Masonry companies reported the lowest LTIFR; however, their risk profiles differ significantly from those of other sectors:

- In the ready mixed sector, there is considerable risk associated with the delivery of products from the mixing plant to the construction site.
- In the precast and reinforcement processing sectors, the handling of steel rebar presents a significant health and safety hazard to workers.

These distinct risk profiles contribute to greater variability in LTIFR within the ready mixed, precast, and reinforcement processor sectors.

A notable strength across the industry has been the use of leading indicators to improve H&S performance. Commonly reported indicators included:

- **Workplace Hazard Assessments:** Most companies actively monitored and managed workplace hazards. Regular assessments and updates to risk registers ensured that hazards were identified and mitigated effectively.
- **Safety Training Programmes:** Training was a key focus, with most companies providing ongoing H&S training tailored to their operational needs. Programmes included driver training, hazard identification, and incident management.
- **Safety Observations and Behavioural Reporting:** Companies encouraged active participation from employees in reporting safe behaviours and potential hazards. This not only helped in identifying risks but also in promoting a culture of safety awareness and responsibility.

Across the industry, there has been a strong focus on continuous improvement. Companies have adopted various innovative practices, including the use of digital platforms for safety observations and incident reporting.

BUILDING A SUSTAINABLE FUTURE WITH **REINFORCING STEEL**

New to Concrete NZ's sustainability reporting is the reinforcing steel processing sector. Bar steel, or rebar, is important to the strength and performance of precast components, and in the direct use of ready mixed concrete in construction.

Data returned from processors surveyed have been incorporated into our reporting on health and safety.

A SWIFTLY REDUCING CARBON FOOTPRINT

Like concrete, the carbon footprint of steel in New Zealand is on a steep decline.

Conventional steel is produced either using mainly ore-based metals ('primary route') or mainly recycled steel ('secondary route'). Since iron ore must be reduced first, the primary route does consume about 24.2 GJ per tonne of crude steel in energy and lead to production emissions of about 2.33 tonnes of carbon dioxide per tonne of crude steel. The secondary route would require only about 10.24 GJ and emit about 0.7 tCO_2 per tonne of crude steel.

New Zealand Steel and the government have co-invested $300 million to install an Electric Arc Furnace (EAF) over the next 2 years at the Glenbrook mill in South Auckland. This will turn the process into a hybrid of primary and secondary steelmaking, drawing on our largely renewable grid, and increasing the share of recycled scrap steel.

Deploying the EAF is expected to reduce the embodied carbon of local steel to 1.7 t CO_2e per tonne of steel, decreasing the embodied carbon of the final steel reinforcing by over 50%. Over time the carbon footprint of New Zealand Steel will reduce further as more scrap metal is recycled compared with primary steel production.

The impact on the embodied carbon of reinforced concrete will be significant, reducing it by more than one-quarter, all other things being equal.

Alternatively, some suppliers offer imported rebar made from recycled steel already.

Nauhria Group.

Reference. *World Steel in Figures 2024.* https://worldsteel.org/steel-topics/sustainability/sustainability-indicators-2024-report/

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Simon Devitt Photographer.

THANK **YOU**

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