SUSTAINABILITY REPORT

for the Aotearoa New Zealand Cement and Concrete Sectors

2021/22

concretenz
BUILDING RESILIENCE


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REPORT **CONTENTS**

Sustainability highlights 2021/22

- → Kick-off for 2050 industry roadmap for net-zero carbon concrete
- → Industry initiatives to reduce emissions are now gaining traction
- → Trials of electric and hydrogen trucks are underway
- → Wellbeing initiatives are being introduced and the industry is benchmarking health and safety data.

FOREWORD FROM **OUR CEO**

Welcome to the first sustainability report of the Aotearoa New Zealand cement and concrete industry. Before we can manage our environmental and social impacts, we need to measure them. This report sets a baseline from which we can track our progress. It also calls on our industry to continue to work together to further reduce the adverse impacts and promote the many benefits of concrete.

MATERIAL FOR A MORE RESILIENT FUTURE

Concrete is the essential construction material that has shaped our modern world and it is critical to building the sustainable world of tomorrow. It will play an integral role in addressing the need for sustainable and thriving communities through the delivery of key infrastructure, homes, clean water, clean and renewable energy and by providing a more resilient built environment as our climate changes.

Concrete can be used for strong walls, breakwaters and flood protection schemes. It also forms part of wind turbines, hydroelectric schemes and geothermal plants, reducing energy-related greenhouse gas emissions to help us mitigate climate change. At the same time, concrete's carbon footprint challenges us to find ways to reduce our greenhouse gas (carbon) emissions.

WORKING TOWARDS MORE SUSTAINABLE OUTCOMES

New Zealand's producers of cement, concrete and concrete products have been working for close to two decades to reduce our industry's carbon footprint, use water more efficiently, and use recycled materials in concrete. As an industry, we promote recycling, reusing and repurposing concrete at the end of its design life. An updated independent review of our efforts shows that the sector has already reduced its carbon emissions from cement by 11% between 2005 and 2020 despite an 11% increase in production in this period.

TRACKING OUR EFFORTS

This report describes the industry's impacts across the topics that matter most to our stakeholders. These are energy and emissions, water use, waste and health and safety. We have worked with the industry to collect data that helps us to set targets that move us in the right direction. We have also looked at how we can continue to make progress and how concrete contributes to the United Nations' Sustainable Development Goals.

Our aim is to report on a biannual basis and we expect the data to become more comprehensive over time.

We are excited to share the cement and concrete industry's contribution to a more sustainable future.

Rob Gaimster
Chief Executive | Concrete NZ

ABOUT **CONCRETE NZ**

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CONCRETE BY THE NUMBERS

NZ$1.957 billion
Asset base (March 2020)

NZ$1.131 billion
Contribution to GDP (March 2021)

10,382 FTEs
Employment in industry (March 2021)

23.7%
Proportion of Māori employees (March 2021)

4.581 million m³
Readymix concrete (year to 31 March 2022)^

183 and 19
Number of certified readymix and certified precast plants

11.7%
Proportion of female employees (March 2021)

~600
Number of apprentices

^ Quality-assured concrete
Sources: Infometrics, Statistics NZ, Concrete NZ

Concrete New Zealand represents more than 500 corporates and individuals who contribute significantly to the construction sector. We advocate on behalf of the cement and concrete industry.

Our industry spans cement manufacturers and producers of ready-mixed concrete, masonry products and precast elements, including wall panels, pipes and culverts.

OUR VISION

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

OUR STRATEGY AND COMMITMENTS

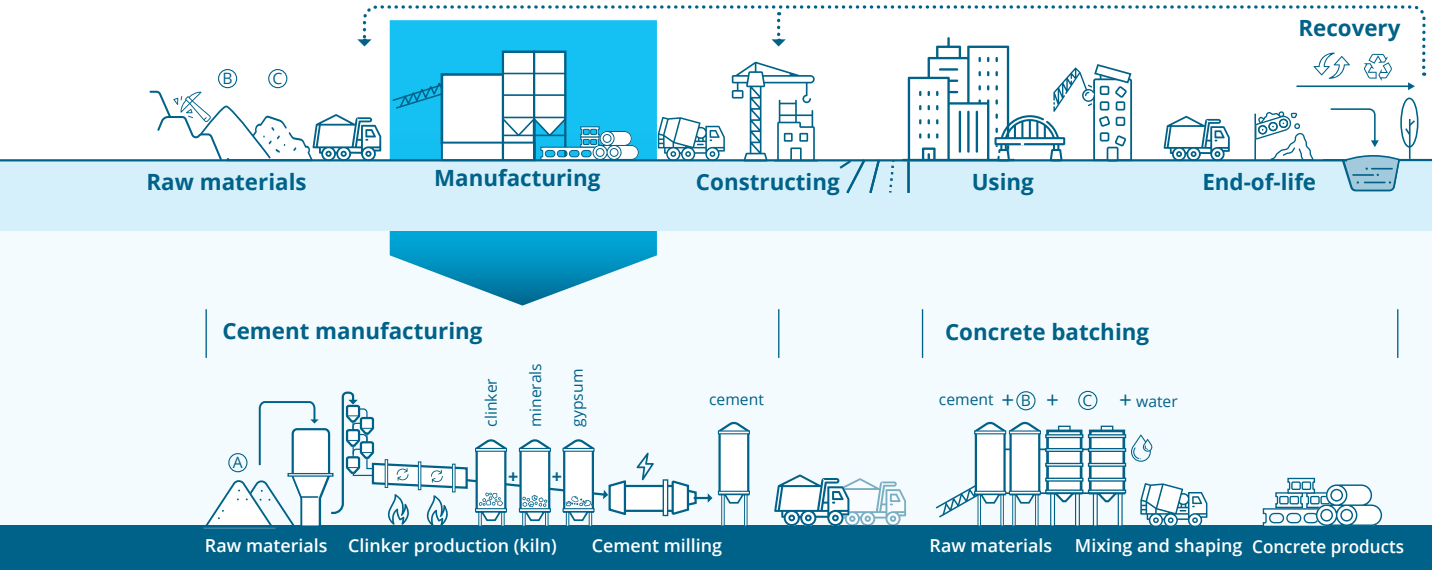
Our Strategic Charter rests on four pillars:

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

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 want to 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.

THE VALUE CHAIN OF CONCRETE



Ⓐ Limestone, Shale & Clay Extraction Ⓑ Supplementary Cementitious Materials (SCMs) Ⓒ Aggregate | virgin & 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)

LOW CARBON CONCRETES

Lower carbon concretes may contain a cement with a lower clinker factor (lower carbon cement), supplementary cementitious materials or both. These materials are referred to collectively as 'binders'.

WHAT ARE SCMs?

A big part of concrete's GHG emissions stems from the energy needed to make cement and through the chemical reaction involved.

Supplementary cementitious materials (SCMs) can partially replace the cement in concrete. They're often mineral by-products of industrial processes typically with lower embodied carbon than cement.

SCMs can either be incorporated into cement or directly into concrete.

The most common SCMs are ground granulated blast-furnace slag (GGBS) from steelmaking, fly ash from coal-fired power stations, and silica fume.

SCMs can also be manufactured, such as calcined clay. Natural SCMs, such as high-silica volcanic ash and pumice, need to be developed further so they can be used in New Zealand.

While GGBS and fly ash are the dominant SCMs in today's market, the gradual phase-out of coal-fired power stations and conventional blast furnaces for steelmaking means that these SCMs will increasingly be substituted for the other types of SCMs.

CASE STUDY – GOLDEN BAY ECOSURE CO-PROCESSES WASTE TYRES

Most of cement's carbon emissions stem from making clinker, one of its major components. The chemical process that decarbonises limestone needs kiln temperatures of 1,500°C. Golden Bay, based near Whangārei, started nearly two decades ago to substitute coal, their traditional fuel, with alternative fuels. In February 2021 New Zealand's only end-to-end cement plant completed an upgrade allowing it to also use waste tyres in its kiln.

With this system, Golden Bay's EcoSure cement contains 27% less embodied carbon than standard Portland cement. This is a remarkable achievement considering around 65% of emissions from clinker manufacture come from the chemical reaction involved in making lime (or calcium oxide). Waste tyres have been used successfully in many cement plants around the world.

	Embodied carbon (kg CO_2) per tonne	
Standard Portland cement*	952	Total decrease:
Golden Bay EcoSure cement (using waste wood and end-of-life waste tyres as fuel)	699	27 percent

*Source: ISC (2020). Infrastructure Sustainability Materials Calculator v2.0 NZ.

A SOLUTION FOR MILLIONS OF WASTE TYRES

This process allows Golden Bay to co-process half of New Zealand's annual waste tyres. The cement kiln is the ideal way to treat waste tyres as it is a clean process that does not emit smoke or air pollution. Any remaining metal and ashes are fully encapsulated in the cement and reduce demand for natural iron sands – another mineral component of clinker – by up to 7,000 tonnes a year.

up to
3.1 million
tyres kept out of landfill every year

up to
30%
coal reduced

up to
7,000 tonnes
iron sands reduced

up to
23,000 tonnes
carbon emissions reduced

For Golden Bay's parent company Fletcher Building, the tyre-derived fuel facility is part of its commitment to a verified science-based target of reducing Fletcher Building's CO_2 emissions by 30 percent by 2030.

'We are serious about transforming our business around sustainability to play our part in creating a sustainable future and reducing our carbon emissions.'

Fletcher Building CEO Ross Taylor

The $30 million project, supported by the Ministry for the Environment with a grant of $16 million from the Waste Minimisation Fund, started in December 2020.

Reducing CO_2 emissions is essential to keep the cement plant competitive and provide 150 full-time jobs. A win for Golden Bay and the local community, the project is also a win for the environment.

EcoSure is widely available in New Zealand.

HOW WE'RE BECOMING **MORE SUSTAINABLE**

The cement and concrete industry pursues sustainability through:

Alternative kiln fuels
Using alternative fuels, particularly biofuels, in the cement kiln reduces emissions from producing clinker.

Reducing emissions from cement and binders
SCMs and mineral additions (particularly limestone) in Portland cement can replace some cement.

Low-carbon cements and binders
Mineral by-products of industrial processes and naturally occurring minerals replace some cement in concrete.

Improving concrete technology
Concrete technology will improve concrete's performance over time.

Water recycling
Concrete manufacturers use rainwater and recycle grey water in ready-mixed concrete.

Reducing emissions from transport
Some members are trialling electric and hydrogen powered vehicles.

Recycled materials
Recycled aggregates and other materials, e.g. waste glass, are being used in ready-mixed concrete and masonry.

Employee wellbeing
Companies are working to improve the physical and mental health of their people.

CONCRETE AND THE BUILT ENVIRONMENT

Concrete plays a major role in New Zealand's built environment. It is strong, long-lasting and can be formed into almost any shape. Compared with most building and construction materials, concrete offers better fire safety, greater noise reduction and more efficient heating and cooling. It can also be reused and repurposed at the end of a building's life.

New Zealand will continue to use concrete for infrastructure. Rautaki Hanganga o Aotearoa – New Zealand Infrastructure Strategy 2022–2052 illustrates the scale of what this country requires:

- → New Zealand's population will grow to **6.2 million people** (or more) over 30 years
- → We will need **115,000 more homes** to fix the current housing crisis
- → **$5 billion** of council infrastructure is **exposed to sea level rise**
- → We will need **$90 billion to fix water networks**
- → We need to be able to **generate 170% more electricity**

CASE STUDY – HOLCIM BRINGS LOWER-CARBON CEMENT REPLACEMENTS TO NZ

New Zealand concrete suppliers will have easier access to lower-carbon cement replacement products from 2023. Holcim's new facility at Ports of Auckland will import and distribute ground granulated blast-furnace slag (GGBS or slag) that the construction industry can use to substitute cement.

This allows ready-mixed concrete suppliers to reduce the embodied carbon of their products. Depending on the application, slag can replace up to 75% of Portland cement in concrete.

Around 1.6 million tonnes of Portland cement are used every year in New Zealand, carrying the embodied carbon of approximately 1.3 million tonnes of CO_2. Supplementary cementitious materials (SCMs) derived from materials with lower embodied energy can significantly reduce this figure:

WHAT IS GGBS?

Ground granulated blast-furnace slag is a by-product of iron manufacture. It has significantly lower embodied energy than Portland cement, and increases the strength and durability of concrete.

Compared with Portland cement, manufacture of GGBS requires less than one-fifth the energy and produces less than one-fifteenth of the CO_2 emissions.

CO_2 up to **35%** for fly ash or other SCMs

CO_2 up to **75%** for GGBS

CO_2 up to **10%** for micro-silica

Replacing 100,000t of Portland cement with slag each year avoids 70,000t of carbon. This equates to taking 27,000 petrol-driven vehicles off the road per year.

Holcim's work in New Zealand is part of the company's worldwide commitment to producing and delivering lower-carbon cements. Headquartered in Switzerland, Holcim was the first global building materials company to sign the UN Global Compact *Business Ambition for 1.5°C initiative*. Its 2030 targets for reducing carbon emissions are validated by the Science Based Targets initiative (SBTi).

The slag from the new plant will be transported to customers using conventional tankers and stored in conventional silos. The product will be supplied either as a straight slag, or as a blended product, depending on the needs of the customer.

SHORT DISTANCES TO NEW ZEALAND'S BIGGEST MARKETS

The new facility's location in the Waitematā Port Precinct (Auckland CBD) provides easy access to the 'golden triangle' of Auckland, Tauranga and Hamilton that houses around half of New Zealand's population. This means short distances to customers in Holcim's biggest markets for housing, urban development and infrastructure.

THE MATERIAL TOPICS **WE'RE FOCUSED ON**

In April 2021 the Concrete NZ Board and executive team identified the sustainability topics (economic, social, environmental and governance) that matter to our stakeholders and our industry.

ENERGY AND CO_2 EMISSIONS

Cement and concrete companies need to reduce their carbon footprints.

FRESHWATER

Concrete producers need to use rainwater and recycled water to be less dependent on town supply.

SOCIO-ECONOMIC BENEFITS

The industry needs to continue to employ many people in rewarding careers and produce materials that benefit the economy and society.

WASTE AND CIRCULAR ECONOMY

Concrete can be reused, repurposed and recycled. The sector is looking to source more sustainable mineral inputs.

WORKPLACE HEALTH & SAFETY

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

This first sustainability report provides a baseline for our reporting.[1] We are happy to provide more information about the methodology we have used to collate our data and write this report.

[1] In some cases our environmental and social data uses different base years, as this is the best data we have been able to source. We will track changes in data against these base years. In future reports, we aim to use common years.

OUR SUSTAINABILITY FRAMEWORK: THE UNITED NATIONS' SUSTAINABLE DEVELOPMENT GOALS (SDGs)

The 17 SDGs promote an end to poverty together with environmental protection, prosperity and peace for all. In 2015 all 193 UN member states pledged their commitment. Concrete connects with many of the SDGs:

Goal 3 - Good health and wellbeing

Concrete provides thermal mass in buildings (resulting in lower heating and cooling bills) and protects from noise and fire.

Goal 6 - Clean water and sanitation

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

Goal 7 - Affordable and renewable energy

Concrete contributes to 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 10 - 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 and mobility, and climate resilience as populations grow.

Goal 12 - Responsible consumption and production

Waste concrete can be recycled, reused and repurposed in buildings, as clean fill to backfill excavations, as roading aggregate and more.

Goal 13 - Climate action

Concrete provides resilience in the face of extreme weather events and sea level rise, as well as infrastructure for renewable energy.

The Global Cement and Concrete Association has found that concrete contributes directly to 80 of the 169 SDG targets.

CASE STUDY – HR CEMENT'S ROAD TO LOW-CARBON PRODUCT

HR CEMENT limited

GGBS can replace up to **70%** of conventional cement and reduce the CO_2 emissions in the final concrete by **40 to 70%.** It also makes the lower-carbon concrete more durable.

Since setting up operations at the Port of Tauranga in Mount Maunganui in 2012, HR Cement has been developing more sustainable cement and concrete products. In 2022, the family-owned company added a second line to its facility to make the low-carbon blended cement **Eco-cem.**

HR Cement uses imported mineral waste product from steelmaking, a dryer to remove moisture from this slag, and a ball mill to produce a fine powder known as ground granulated blast-furnace slag (GGBS).

The resulting supplementary cementitious material (SCM) has been thoroughly tested and is attracting growing customer demand. HR Cement aims to sell 100,000 tonnes each year of **Eco-cem** containing its locally made GGBS.

1. Importing slag

Manufacturing iron from iron ore in a blast furnace creates a waste material made mainly of metal oxides and silicate minerals called slag.

HR Cement imports blast-furnace slag from Japan and processes it into reactive GGBS.

2. Drying it

Imported slag, with about 8% moisture content, is too wet for milling. HR Cement uses a gas-fired, rotary dryer that reduces the moisture content in slag to less than 1%. Friction during milling does the rest to thoroughly dry the product.

3. Milling it

HR Cement imported a repurposed ball mill from the US, which is made of more than 250 tonnes of kit (a lot to set up!)

Powered by national grid electricity, the mill grinds the slag to increase the surface area of the GGBS. This makes the SCM more reactive in concrete.

HR Cement uses state-of-the-art baghouse filters to capture all particulate emissions to operate more sustainably. Each filter is roughly the size of a shipping container.

RESEARCHING NATURAL SCMS IN NEW ZEALAND

HR Cement has investigated the potential of using Central North Island natural pozzolan deposits as an SCM. It has found this pumice to be highly variable in quality and to have too high a moisture content to be commercially viable at this time. 'We've got the slag moving in the New Zealand market, to create a breathing space, while keeping open the pozzolan strategy,' says HR Cement Managing Director Chris Hall.

CREATING A BASELINE – **OUR EFFORTS IN NUMBERS**

ENERGY AND CO_2 EMISSIONS

CO_2 EMISSIONS

Producing cement, the primary component of concrete, accounts for around 8% of global GHG emissions. In 2020, member companies of the GCCA committed to producing carbon-neutral concrete by 2050, in line with global climate targets.

Our targets are to reduce carbon emissions:

- → 30% by 2030
- → net-zero carbon for cement production and concrete batching by 2050.

Between 2005 and 2020 we reduced our carbon emissions by 11% while increasing the volume of ready-mixed concrete produced by 11%. This was achieved by replacing some of the coal used for manufacturing cement with woody biomass and waste tyres (see Golden Bay case study on page 8), using fuel more efficiently for transport, reducing reducing construction waste and replacing some cement with low-carbon SCMs.

	2005	2018	2020	2030 Target	2050 Target
Direct + indirect emissions (GCCA scope) (Mt CO_2e)	1.30	1.10	0.89	0.50	0.00
... equivalent per person (kg CO_2e/person)	312	223	174	92	0
...share of NZ emissions (GCCA scope)	2.27%	1.98%	1.60%		
Full life cycle emissions (EPD scope) (Mt CO_2e)	1.69	1.53	1.50	1.07	0.41
... equivalent per person (kg CO_2e/person)	406	309	294	196	66
...share of NZ emissions (EPD scope)	2.95%	2.74%	2.70%		

Source: thinkstep-anz

The three major cement producers/suppliers in New Zealand all have environmental product declarations (EPDs) and are working to reduce embodied carbon. They record embodied carbon in cement for Golden Bay of 733 kg CO_2e per tonne of cement, Holcim (897), and HR Cement (811).

SCM UPTAKE EXPECTED TO RISE

Currently, the use of SCMs in New Zealand is very low compared to other countries. It sits at 2.5% of total binders in readymix concrete manufacture. This is set to change (see Holcim case study, on page 9). In FY22 mainly fly ash was used, with a growing uptake of GGBS forecast for FY23. The choice of SCM depends on price, availability and the differing substitution rates of each SCM.

ENERGY

The sector's main sources of energy are coal, waste wood and waste tyres for manufacturing cement, and electricity and diesel for producing concrete and delivering it. Concrete trucks delivering readymix use on average 4.5 litres of diesel per cubic metre of concrete.

The drive to reduce carbon emissions is also linked to improving energy efficiency. Some precast and masonry companies use LPG (liquid petroleum gas) or natural gas to speed the curing of product. Electric heat pumps are an alternative energy source for this.

Energy	2022	2025 Target	2030 Target
Diesel consumption#	14.3 million litres	5% reduction	10% reduction

MOVE TO MORE SUSTAINABLE ENERGY SOURCES

Precast concrete manufacturer Concretec recently moved from national grid electricity to solar energy at its plant in Pōkeno, south of Auckland. Numbers of electric and hybrid light vehicles are also growing. Hydrogen trucks are being trialled (HW Richardson), as are electric trucks (Golden Bay).

Twelve respondents across industry, excluding cement manufacture. Note: a significant proportion of cement is imported. This data covers 65% of readymix, 90% of masonry, and 30% of precast (Sources: Statistics NZ; Concrete NZ)

WASTE AND CIRCULAR ECONOMY

The industry is working on solutions to recycle, repurpose and reuse more concrete. Approximately 4% of concrete and bricks ends up in landfill as construction waste. Research into using recycled crushed concrete in new readymix concrete is underway. This material is mostly used as cleanfill and roading aggregate. The industry increasingly uses returns from readymix deliveries by either pouring them into concrete blocks, e.g. for retaining walls, or allowing them to harden to be crushed and used as cleanfill or roading aggregate. Precast manufacturers produce mostly dust and seconds that cannot be sold. They crush these into aggregate for reuse as concrete or form retaining wall blocks.

A programme to inform the wider construction industry about the opportunities provided by concrete as we transition to the circular economy will be implemented in 2024. Targets for our waste and the circular economy will be introduced in the 2024 Sustainability Report.

Concrete and brick waste	2018/19
Waste to all classes of fill	432,352 tonnes ^
Readymix concrete production	10,359,480 tonnes *
Percentage of concrete/ bricks to go to landfill	4.2 %

Ministry for the Environment 2019. *Reducing waste: a more effective landfill levy* – consultation document

^ MfE calculated the percentage of concrete/bricks in construction and demolition waste at 12%

* Statistics NZ data; Conversion: 1 cubic metre of concrete = 2.4 tonnes of concrete

WATER

Manufacturing one cubic metre of concrete uses around 150 litres of water. Additionally, 20 litres is needed for activities such as washing trucks. Many readymix plants are in rural locations and source their own water, typically rain- or bore water. Most of the freshwater discharged after use, e.g. to wash plant and equipment, is then recycled for concrete production.

While the industry aims to conserve fresh water, it is challenging to measure the water that is used, discharged or recycled. The FY22 baseline reports on reticulated supply and bore water only. We made an assumption for total water use in the readymix sector, drawing on the above figures.

Water	FY 22
Readymix reticulated/bore water use	298 million litres ^
Readymix total water use	506 million litres *
Readymix ratio of reticulated / bore to total water	60%

Twelfe respondents across all sectors, excludes cement manufacture

^ Data covers 65% of the readymix sector by volume of production

* Estimate based on 170 litres of water per cubic metre of concrete produced

WORKPLACE HEALTH AND SAFETY

We are aware that we need to make our workplaces safer and healthier. Our main hazards include handling heavy materials, especially at heights, cutting tools and machinery, working with reinforcing steel, and accidents with vehicles and mobile plants. The hazards and related health and safety risks in the concrete industry vary widely between cement manufacture, ready mixed concrete production, and manufacturing precast and masonry owing to the nature of the sector and level of automation. We expect to have a more comprehensive dataset in 2024 as data from other concrete-related sectors is introduced.

Lost-time injury frequency rate, hours per million hours worked (LTIFR)	2022
Cement and readymix concrete production	3.4

Represents approximately 90% of cement and readymix concrete production in 2022.

For comparison, the Mineral Products Association's sustainability report for readymix concrete in the United Kingdom recorded an LTIFR of 3.5 in 2019.

We are increasingly focusing on mental health and wellbeing, e.g. a programme at Higgins Concrete and Firth Industries.

THANK YOU

Thanks to

- The many cement and concrete industry companies that contributed their data, information, insights and advice
- thinkstep-anz who wrote and designed this report
- Infometrics who produced the socio-economic data
- The Global Cement and Concrete Association and the UK Mineral Products Association whose reports guided this one.

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