CAPABILITY STATEMENT

EARTH FRIENDLY CONCRETE

by WAGNERS

EFC

by WAGNERS

THE WORLD'S ONLY ZERO CEMENT CONCRETE THAT HAS BEEN PROVEN AT SCALE.

Some call it geopolymer concrete.

We like to call it **Earth Friendly Concrete®** or just **EFC®**.

SUPPORTING THE CIRCULAR ECONOMY

INSTEAD OF CARBON INTENSIVE ORDINARY PORTLAND CEMENT,

EARTH FRIENDLY CONCRETE®

USES THE CHEMICAL ACTIVATION OF INDUSTRIAL WASTE BY-PRODUCTS TO FORM AN ECO-FRIENDLY AND DURABLE CONCRETE SOLUTION.

TOOWOOMBA WELLCAMP AIRPORT

Constructed from EFC® geopolymer concrete, this is undoubtedly the world's greenest airport.

- Recently featured in the Catalyst program, ABC - "Building Greener Cities" episode

EFC® CARBON CREDENTIALS

REDUCING EMBODIED CARBON IN OUR BUILT ENVIRONMENT

Our built environment is a major contributor to man made global carbon emmissions[1].

A large part of this impact comes from carbon emitted through the manufacturing of construction materials and processes used in the built environment. This is embodied carbon.

Ordinary concrete is a large contributor to embodied carbon in our built environment because it is made from Ordinary Portland Cement (OPC). Global production of OPC contributes to 4 billion tonnes of CO_2 emissions every year[2]. This represents approximately 8% of the world's total man made CO_2 output.

By developing a zero cement alternative, Earth Friendly Concrete® by Wagners is a new generation building material that can reduce embodied carbon in the built environment around the world.

IN FACT, EFC® PRODUCES ONLY 32% OF CO_2 EMISSIONS COMPARED TO ORDINARY CONCRETE.

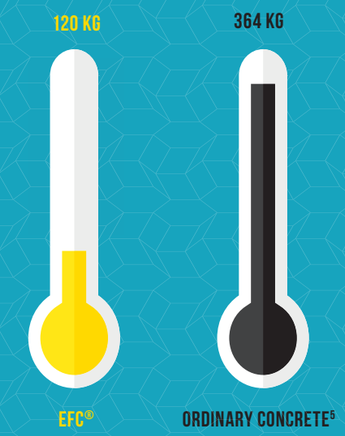
Wagners has published a detailed lifecycle study of the emissions associated with EFC® and comparable concrete products. This study was conducted in accordance with ISO 4067 and uncovered some remarkable results.

EVERY CUBIC METRE (M^3) OF EARTH FRIENDLY CONCRETE® SAVES OVER 244KG OF CO_2 EMISSIONS.

References:
1 Source: World Green Building Council. "Bringing embodied carbon upfront – coordinated action for the building and construction sector to tackle embodied carbon.
2 Source: Global Cement Report 2016-2018.
3 Source: Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2018.
4 Source: carbonneutral.com.au.
5 Australian 30% flyash mix.

"EFC® will change the built environment landscape of the future."

JOE WAGNER, COFOUNDER WAGNERS EFC®



FOR A LARGE INFRASTRUCTURE PROJECT REQUIRING 50,000M³ OF CONCRETE, EFC® WILL SAVE 12,216t CO_2 EMISSIONS, WHICH IS EQUIVALENT TO

4,500 CARS OFF THE ROAD FOR A YEAR[3]

OR

814 TREES IN A TYPICAL CARBON OFFSET PROGRAM[4]

MAJOR EFC® PROJECT CASE STUDIES

COMMERCIAL CONSTRUCTION

FINISHED GCI BUILDING FEATURES EXPOSED EFC® FLOOR PANELS

EFC® FLOOR PANELS BEING INSTALLED

"We achieved a 6-star green star rated building and that means a lot to us and our client."

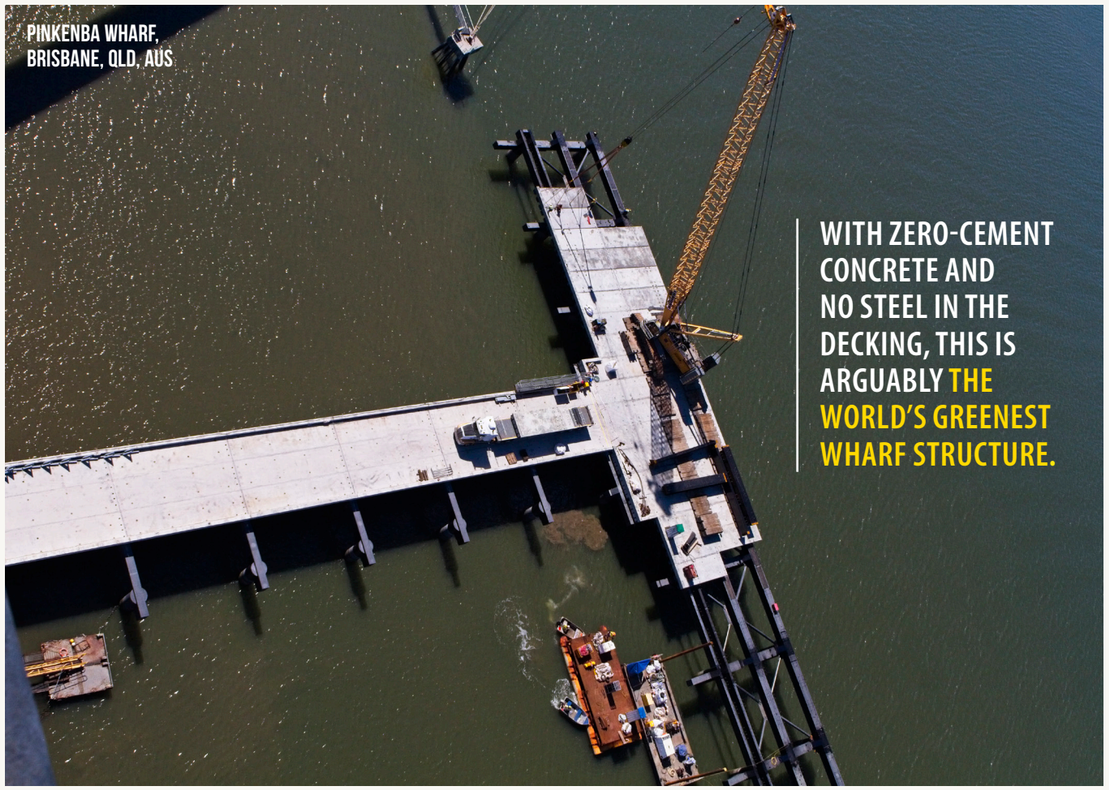
MARK JEWEL, PROJECT MANAGER, MCNAB

GLOBAL CHANGE INSTITUTE BUILDING
BRISBANE, QUEENSLAND

EFC® was used to produce 33 large floor beam/panels that form 3 suspended floor levels in the GCI building at the University of QLD's St Lucia Campus. The design brief was a sustainable building construction and operation that would serve as an outward reflection of the objectives of the organisation housed within.

This unique project marked a new era of sustainable concrete construction in QLD, and set a world benchmark as the first application of modern geopolymer concrete in the structure of a multi storey building. The GCI project remains an important milestone for market acceptance of EFC®.

WORLD'S FIRST MULTI-STORY PRECAST GEOPOLYMER CONCRETE CONSTRUCTION.



WITH ZERO-CEMENT CONCRETE AND NO STEEL IN THE DECKING, THIS IS ARGUABLY THE WORLD'S GREENEST WHARF STRUCTURE.

PINKENBA WHARF

BRISBANE, QUEENSLAND

Pinkenba wharf on the Brisbane River, Queensland was built to service the direct berthing of some of the world's largest cargo ships.

The wharf's deck construction features a new and innovative approach to building materials and delivers significant advancements in both environmental and engineering performance. The deck structure is built from 191 prefabricated hybrid panels that span between 8 and 12 metres over steel headstock beams.

Each panel consists of:

- Pultruded CFT U-Girders that provide the tensile beam spanning capacity
- EFC® geopolymer concrete engaged deck that acts as a compression flange while locking the U-Girders together
- FRP reinforcing bar in the concrete deck to form a completely non-metallic structure that is risk-free for marine exposure

The hybrid deck solution also provides vastly reduced embodied carbon emission compared to conventional steel and concrete material.

THIS CASE STUDY REPRESENTS A NEW APPROACH TO ENGINEERED STRUCTURES BY USING NEW GENERATION BUILDING MATERIALS THAT DELIVER EFFICIENCY, LOW MAINTENANCE AND LOW CO_2 EMISSIONS.

SAVED 12,216T CO^2 EMISSIONS.

TOOWOOMBA WELLCAMP AIRPORT

TOOWOOMBA, QUEENSLAND

The construction of some 50,000 m^2 of EFC® heavy duty aircraft pavements at Toowoomba Wellcamp Airport is the world's largest modern geopolymer concrete project containing absolutely NO Portland cement. The pavement thickness was 450 mm making it capable of accommodating the largest commercial airliners.

The pavement specification required 4.8 MPa flexural strength and 450 micro-strain drying shrinkage at 28 days of age. Test results of flexural beam specimens taken throughout construction returned an average of 5.8 MPa, easily exceeding the design target. The EFC® pavements were constructed using a slip form paver machine which ensured the schedule was minimised.

"The pavement design at Wellcamp allows for B747-800F aircraft (447t). The concrete has a life expectancy of 40 years of repetitive loading of heavy aircraft."

PHIL BELL, DIRECTOR, AIRPORT CONSULTANCY GROUP

SUPERIOR PRODUCT PERFORMANCE OF EFC®

QLD COAL MINE ACCESS TUNNEL-PRECAST EFC® FLOOR UNITS

HIGH STRUCTURAL PERFORMANCE

EFC® can be supplied in the full range of commercial compressive strength grades. Its material properties provide a superior structural performance compared to standard concrete in several important measures including flexural tensile strength and drying shrinkage. This is due to the geopolymer binder in EFC® that is comprised of chemically activated waste by products, slag and fly ash.

EFC® has a particular advantage in applications like heavy duty pavements where the specified performance requirements are the flexural tensile strength of the unreinforced concrete and the design of joints to control shrinkage induced cracking.

Another key performance attribute of EFC® compared to standard concrete is the very low heat of reaction.

For very thick elements like wind tower footings and wharf headstocks this is a massive advantage over Portland cement concrete that can reach internal temperatures of 80 degrees Celcius which then leads to thermal induced cracking over the subsequent cooling down period.

TESTING HAS SHOWN EFC® TO HAVE A MAXIMUM TEMPERATURE RISE OF ONLY 16 DEGREE CELCIUS ABOVE ITS INITIAL TEMPERATURE WHICH NEGATES ANY CONCERNS OVER THERMAL INDUCED CRACKING.

STRUCTURAL PERFORMANCE	DURABILITY
All commercial grades: 25 to 65 MPa compressive strength	High acid and sulphate resistance
30% higher flexural tensile strength	High Microbial Induced Corrosion (MIC) resistance
Low drying shrinkage by 40%	High chloride ingress resistance (marine)
Similar modulus and poissons ratio	Low heat of reaction
High fire resistance	

DURABILITY BENEFITS

EFC® provides greatly improved durability performance compared to Portland cement based concrete due to the different chemistry of its geopolymer binder. These performance attributes have been validated through independent testing by several leading institutions.

This means that EFC® is an ideal choice for structural applications in severe environments including:

- Wharves and marine infrastructure
- Sewer pipes, tunnels, and treatment plants
- Ground works in sulphate rich soils

NEW GENERATION BUILDING MATERIALS BY WAGNERS

Wagners' New Generation Building Materials division is the home of EFC® and Composite Fibre Technologies (CFT).

Wagners R&D innovation has lead to the development a unique hybrid structural system from these materials for use in pedestrian and road bridges. The system has been further adapted for the challenging conditions of a marine wharf deck structure.

AS5100 rated road bridges are designed and built by Wagners using CFT U-Girders integrated with an EFC® slab wearing surface. These two technologies coupled together provide a 'composite' beam section. The modules act in the following manner:

- EFC® slab acts as the top flange for the section by transferring compression stresses (under downward loads)
- The CFT U-Girder acts as the webs transferring shear and longitudinal stresses
- A GFRP flat section acts as the bottom flange to distribute longitudinal / extreme fibre stresses

EFC® IS SETTING THE STANDARD ACROSS THE WORLD

EARTH FRIENDLY CONCRETE® HAS ACHIEVED PERFORMANCE RECOGNITION IN LINE WITH INDUSTRY STANDARDS IN AUSTRALIA AND OVERSEAS.

- Performance compliance to AS3600 "Concrete Structures" verified by independent engineering report
- Standards Australia to release a design handbook for geopolymer concretes in 2020
- Queensland Department of Main Roads released a first of its kind geopolymer concrete specification
- American ASTM sub-committee to develop specifications for alternative binders including alkali activated cementitious materials
- DIBt approval for use of EFC® under the German concrete code, DIN EN 206-1

EFC® IS PRODUCED IN STANDARD BATCH PLANTS

WAGNERS CONCRETE OPERATE A NETWORK OF CONCRETE BATCH PLANTS IN SEQ WITH NEW LOCATIONS CONTINUING TO BE OPENED. EFC® CAN BE BATCHED LIKE ORDINARY CONCRETE.

EUROPEAN APPROVALS

EFC® is the world's first geopolymer technology to achieve National Technical Approval from the German Authority DIBt.

This means EFC® can be used in structural concrete applications to DIN EN 206-1. European countries with their own version on EN 206-1 can be applied on the basis of this DIBt approval.

PRECAST CONCRETE EFC® SLEEPERS MADE AT THE MAX BÖGL FACTORY, GERMANY

GLOBAL PARTNERSHIPS

Wagners EFC® have formed partnerships across the world with the likes of major Indian congolomerate, JSW group, as well as one of the UK's more innovative civil engineering groups, Keltbray.

At any point in time, we typically have a live collaboration project with an industry leader in some part of the world.

LONDON PROJECT WITH KELTBRAY AND CAPITALCONCRETE

"By offering EFC® to all our customers, we believe this is an industry-first initiative in the widespread application of carbon-reduced concrete"

TIM LOHMANN, DIRECTOR OF KELTBRAY'S SPECIALIST DESIGN CONSULTANCY, WENTWORTH HOUSE PARTNERSHIP

THE STORY OF EARTH FRIENDLY CONCRETE®

WAGNERS GROUP

Wagners was founded on innovation.

We are a pioneering Australian construction materials and services provider. Starting as a foundation as a family business over 30 years ago in Toowoomba, Wagners is now an ASX-listed operator in domestic and international markets and one of Queensland's largest construction materials and mining services companies.

In 2009, Wagners was acknowledged by the Premier of Queensland at the Smart Business Awards as the company that had made the most significant impact on regional Queensland in the state's 150 year history.

In 2018, Wagners were inducted into the Queensland Business Leaders Hall of Fame in recognition of their intrepid entrepreneurship in successfully completing highly challenging infrastructure projects nationally and internationally.

Celebrating over 30 years of operations, Wagners is constantly striving for innovative, effective and economic solutions, when supplying for the construction and mining industry both within Australia and internationally.

WAGNERS GROUP SERVICES

"Driving engineering and sustainability innovation in the built environment"

MICHAEL KEMP, EXECUTIVE GENERAL MANAGER, NEW GENERATION BUILDING MATERIALS

EFC® ZERO CEMENT CONCRETE INNOVATION

Wagners has tackled the problem of high embodied carbon in our built environment. With cement production contributing to 8 per cent of global greenhouse gas emissions, we committed ourselves to being part of the solution.

Resulting from years of focused innovation, R&D and significant investment, Earth Friendly Concrete® by Wagners, will be a significant contributor to reducing embodied carbon in the built environment.

Wagners EFC® has won multiple awards and has been recognized as an innovation construction material across the globe.

EFC® AWARDS

2011: Winner, Queensland Premier's ClimateSmart Sustainability Awards for the development of Earth Friendly Concrete® (EFC®).

2012: Winner, Brisbane City Council's Innovation Survey Awards

2013: Winner, Shell's Innovation Awards for the High-Tech Manufacturing and Design category

2014: BPN Sustainability Award

2015: Winner, Concrete Institute of Australia's Award for Excellence, representing Queensland State

2015: Winner, Concrete Institute of Australia's Award for National Sustainability Award

2016: AEEA State Award for Excellence, in the category of Infrastructure Projects

2016: Winner, American Concrete Institute Global Awards, in the Flatwork category

2019: Winner, QMCA, Innovation and Excellence Awards for the Supplier and Subcontractors category

CAPABILITY STATEMENT

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