Environmental Product Declaration

In accordance with ISO 14025:2006 and
EN 15804:2012+A2:2019/AC:2021 for:

45MPa Ready Mix Concrete

from

Stresscrete Formstress Precast Ltd

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
Regional programme:	EPD Australasia Ltd
EPD registration number:	EPD-IES-0017184
Publication date:	2024-11-21
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14 Construction products, version 1.3.4, 2024-04-30* *C-PCR-003 (to 2019:14) Concrete and concrete elements, version 2023-01-02*
PCR review was conducted by: *The Technical Committee of the International EPD® System.* *See www.environdec.com for a list of members.* *Most recent review chair: Claudia A. Peña, University of Concepción, Chile.* *The review panel may be contacted via the Secretariat www.environdec.com/contact*
Life Cycle Assessment (LCA)
LCA accountability: Scott Mulholland - *Stresscrete Formstress Precast Ltd.*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verification: *Jeff Vickers, thinkstep-anz* Verifier approved by: *EPD Australasia*
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Formstress Precast NZ Ltd
Contact: Scott Mulholland – +64 9 235 7257
Description of the organisation: Stresscrete Formstress Precast Ltd is primarily a precast concrete producer operating its own on-site Ready Mix Concrete batching plant
Product-related or management system-related certifications: Certified Concrete NZ Audited Plant, Plant Audit Scheme ISO 9001 Certified
Name and location of production site: Stresscrete Formstress Precast Ltd, 134 Kitchener Rd, Waiuku, Auckland

Stresscrete Formstress Precast is one of New Zealand's largest and most experienced manufacturers of precast/prestressed concrete components, with over fifty years in the precasting industry. It is our strict application of engineering principles and innovation, combined with a commitment to research and development that ensures our products are advancing in performance, quality, and durability. We have the people and technology to design and manufacture precast components for virtually all types of projects from power stations to motorway bridges, office blocks to multi story car parks, sport stadiums to your home. Stresscrete Formstress' precast concrete products have been incorporated in many of the iconic structures around New Zealand. Our projects include the Sky Tower, the Beehive, Westpac Stadium, Manapouri Tunnel, Jade Stadium, Te Papa and Auckland's Central Motorway Junction Upgrade.

Product information

Product name: 45MPa Ready Mix Concrete
Product description: Our Ready Mix Concrete combines cement, water, sand, aggregate and additives to form a workable concrete suitable for high strength applications such as precast concrete
UN CPC code: 375 Articles of concrete, cement and plaster
ANZSIC code: 20330 Concrete – ready mixed – except dry mixed
Geographical scope: New Zealand
Technical Compliance: All Ready Mix Concrete mix designs supplied by Stresscrete Formstress are certified to NZS3104

Stresscrete Formstress produces precast components in controlled conditions which enables us to manufacture units to tight tolerances, of varying shapes and with highly attractive architectural finishes. Compared with other materials, precast concrete can provide benefits such as fire resistance, durability, thermal and acoustic properties, installation time and can perform its function immediately upon arrival at site therefore eliminating on-site curing time.

This EPD is for ready mix concrete only. It is not for precast or prestressed concrete elements. No reinforcing steel or curing are included in this EPD.

Table 1: Product Content

Product components	Weight (%)	Post-consumer material, weight (%)	Biogenic material, weight (%)	CAS
General Purpose Cement	16%	0%	0%	65997-15-1
Aggregates (sand and coarse)	78%	0%	0%	14808-60-7
Water	6%	0%	0%	7732-18-5
Admixtures	<0.1%	0%	0%	9036-19-5, 68584-22-5, 1310-73-2, 13477-34-4, 540-72-7, 140-07-8, 111-42-2

LCA information

Declared unit: 1m^3 of Ready Mix Concrete
Density of declared unit: 2,440kg/m^3
Time representativeness: January 2023 to December 2023
Database(s) and LCA software used: GCCA Industry EPD Tool for Cement and Concrete (V4)
Description of system boundaries: Cradle to gate A1–A3, with modules C1-C4 and module D

The Life-Cycle Assessment (LCA) that forms the basis of this EPD will allow us to quantify the environmental impacts of our product and lay a foundation for the formulation of comprehensive sustainability goals. These goals will be implemented into Stresscrete Formstress' operations with the recognition of the role we play in paving the way towards a responsible, sustainable, and efficient construction industry. The results of the LCA will further enable us to work with our customers to choose a product that minimizes environmental impact subject to the specific needs of their project.

Table 2: Scope of EPD

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	x	x	x	ND	ND	ND	ND	ND	ND	ND	ND	ND	x	x	x	x	x
Geography	NZ	NZ	NZ										NZ	NZ	NZ	NZ	NZ
Specific data used	82%																
Variation – products	0%																
Variation - sites	0%																

X = module is covered in this EPD, ND = module not declared in this EPD

Module A1 Raw Materials

All of our ready mix concrete begins as raw materials including aggregate, sand, cement, water and admixture.
All raw materials used by Stresscrete Formstress to manufacture our concrete comply with relevant NZ standards including, but not limited to:

- **AS/NZS 3972:** General purpose and blended cements
- **NZS 3122:2009:** Specification for Portland and blended cements
- **NZS 3121:2015:** Water and aggregate for concrete
- **AS1478:** Chemical admixtures for concrete

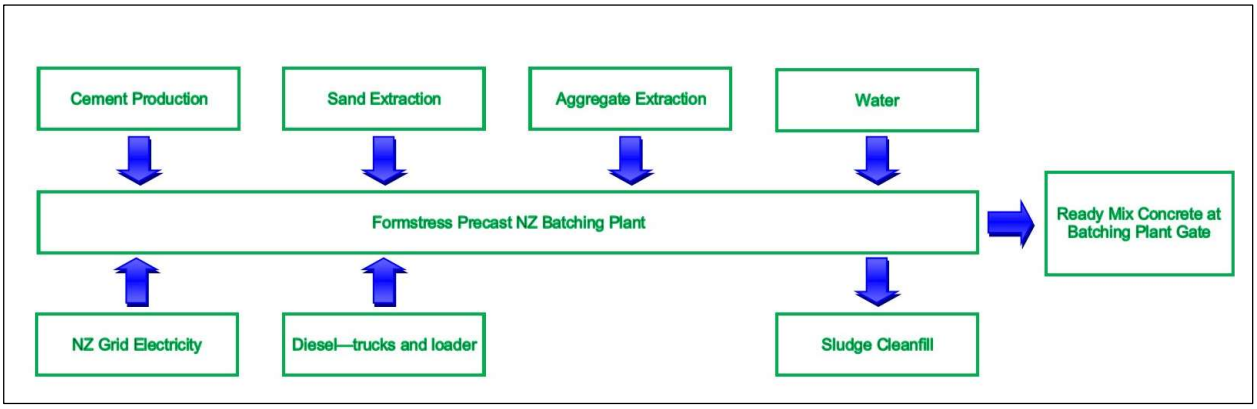
Module A2 Transportation and Module A3 Manufacturing the product

All raw materials are transported to Stresscrete Formstress' site via articulated and rigid trucks.

Stresscrete/Formstress' concrete is manufactured by combining a predetermined combination of the raw materials identified in Stage A1. The combination of these materials is done by our on-site batching plant.

The primary sources of energy used at the batching plant are NZ grid electricity for materials handling, and diesel for truck mixing.

Diagram 1: System diagram (A1-A3)



Modules C1 to C4 End of Life

100% of ready mixed concrete is assumed to be disposed of in landfill. This scenario is currently in use and represents one of the most probable alternatives.

- Module C1 includes demolition of the concrete.
- Module C2 includes transport of the concrete to landfill.
- Module C3 is zero as all concrete is assumed to go to landfill.
- Module C4 includes the activities associated with operating the landfill.

Module D Resource Recovery

Module D is zero as 100% of the concrete is assumed to go to landfill, meaning that no materials are recovered.

Key Insights into the Data:

The data compiled for this EPD was taken over 12 months from January to December 2023. The data was gathered from monthly invoices, internal manufacturing software along with physical measurements of energy inputs and waste outputs. Data for cement comes from the manufacturers EPD. Data for other raw materials comes from the GCCA EPD tool.

Cut-off Criteria:

The contribution of personnel, packaging of admixtures and office consumables is outside the scope of this LCA.

Key Assumptions:

- The composition of the mix design is provided by Stresscrete Formstress and has been accepted as is.
- Electricity has been modelled using BraveTrace, the mix is made up of coal (7%), gas (8%), hyrdo (60%), geothermal (18%), solar (0.5%) and wind (6.5%). The emission factor for the residual grid mix is calculated as 0.210kg CO2e/kWh.
- The EN 15804 reference package based on EF 3.1 is used.
- Production of capital goods and infrastructure are excluded from the LCA.

Results of the environmental performance indicators

Table 3: Mandatory impact category indicators according to EN 15804

Ready Mix Concrete – 1m^3							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	3.02E2	8.99E0	9.33E0	0	1.34E1	0
GWP-biogenic	kg CO_2 eq.	4.54E-2	1.6E-3	6.67E-3	0	8.85E-3	0
GWP-luluc	kg CO_2 eq.	1.91E-2	1.13E-3	5.42E-3	0	7.19E-3	0
GWP-total	kg CO_2 eq.	3.02E2	8.99E0	9.34E0	0	1.34E1	0
ODP	kg CFC 11 eq.	4.71E-6	1.62E-6	1.57E-6	0	4.36E-6	0
AP	mol H^+ eq.	6.14E-1	9.42E-2	5.64E-2	0	1.28E-1	0
EP-freshwater	kg P eq.	4.87E-3	4.02E-4	1.25E-3	0	1.57E-3	0
EP-marine	kg N eq.	1.72E-1	3.34E-5	9.22E-5	0	1.48E-4	0
EP-terrestrial	mol N eq.	2.57E0	4.44E-1	1.99E-1	0	4.6E-1	0
POCP	kg NMVOC eq.	5.81E-1	1.22E-1	5.77E-2	0	1.34E-1	0
ADP-minerals&metals*	kg Sb eq.	1.41E-4	2.66E-6	1.65E-5	0	1.46E-5	0
ADP-fossil*	MJ	1.33E3	1.3E2	1.39E2	0	3.73E2	0
WDP*[1]	m^3	8.47E1	7.67E-1	1.21E0	0	1.8E1	0
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption						

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

1. The 'Water deprivation potential' (WDP) indicator is characterised according to global characterisation factors in the GCCA EPD Tool. As a result, it may not accurately reflect New Zealand conditions.

Disclaimer: The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

When comparing products based on EPDs, it is preferable to include the full product life cycle (including end-of-life, i.e., modules C1-C4) rather than comparing cradle-to-gate results (i.e., modules A1-A3) only.

Table 4: Additional mandatory and voluntary impact category indicators

Ready Mix Concrete – 1m³							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	3.02E2	8.99E0	9.34E0	0	1.34E1	0

Table 5: Resource use indicators

Ready Mix Concrete – 1m³							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	4.15E2	7.59E-1	5.09E0	0	9.68E0	0
PERM	MJ	0	0	0	0	0	0
PERT	MJ	4.15E2	7.59E-1	5.09E0	0	9.68E0	0
PENRE	MJ	1.33E3	1.3E2	1.39E2	0	3.73E2	0
PENRM	MJ	0	0	0	0	0	0
PENRT	MJ	1.33E3	1.3E2	1.39E2	0	3.73E2	0
SM	kg	3.04E0	0	0	0	0	0
RSF	MJ	2.69E2	0	0	0	0	0
NRSF	MJ	2.42E-1	0	0	0	0	0
FW	m^3	3E0	1.99E-2	3.72E-2	0	4.2E-1	0
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water						

Table 6: Waste indicators

Ready Mix Concrete – 1m³							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	3.27E-9	0	0	0	0	0
Non-hazardous waste disposed	kg	2.41E1	0	0	0	2.45E3	0
Radioactive waste disposed	kg	ND	ND	ND	ND	ND	ND

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Table 7: Output flow indicators

Ready Mix Concrete – 1m^3							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	8.93E-3	0	0	0	0	0
Material for recycling	kg	0	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0	0	0

References

BraveTrace (2023). NZECS Residual Supply Mix for electricity certification. BraveTrace.

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