Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

Ready-Mix Concrete
G025 (10)-20-12-28-B
Cementos Bio Bio S.A.

Programme:	The International EPD® System EPD registered through the fully aligned regional program/hub: EPD Latin America
Programme operator:	EPD International AB EPD Latin America
EPD registration number:	S-P-01722
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1. General information

Programme:	The International EPD® System www.environdec.com EPD registered through the fully aligned regional program/hub: EPD Latin America www.epd-americalatina.com

Programme Operator:	EPD® International AB Box 210 60 SE-100 31 Stockholm, Sweden EPD® Latin America Chile: Alonso de Ercilla 2996, Ñuñoa, Santiago, Chile. Mexico: Av. Convento de Actopan 24 Int. 7A, Colonia Jardines de Santa Mónica, Tlalnepantla de Baz, Estado de México, México, C.P. 54050

EPD registration number: Issue date: Validity date: Revision date: Reference year of data: Geographical scope: Product group classification:	S-P-01722 2019-10-15 2024-10-15 2019-10-15 2018 Chile UN CPC 375 Concrete (CPC Version 2.1)

Product category rules (PCR): *2012:01 "Construction products and construction services", version 2.3, dated on 2018-11-15; Sub-PCR-G "Concrete and concrete elements"/EN16757:2017.*
PCR review was conducted by: *The Technical Committee of the International EPD® System. Chair: Massimo Marino; contact via* info@environdec.com The EPD is based on the WBCSD-CSI tool for clinker, cement and concrete. This tool was pre-verified by the *International EPD® System*

Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD external verification
Recognised individual verifiers: Claudia Peña, ADDERE Ltda. Approved by: The International EPD® System
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 from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

2. Company information

2.1 Owner of the EPD:

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2.2 Description of the organisation:

Cementos Bio Bio (Cbb) is a leader in the cement, lime and concrete market, with operations in Chile, Argentina and Peru. It produced 1.3 million metric tons of cement in 2018, along with 2.0 million cubic meters of concrete and 819 thousand tons of lime.

The company operates 5 cement plants and 3 lime plants. In the segment of concrete operates a set of 37 plants through its subsidiary Ready Mix, which supplies around 25% of the Chilean market of ready-mixed concrete used for building, real estate development and urban development of Chilean cities and specialty civil works for industry, mining and national infrastructure.

Ready Mix is supplying the construction of the suspension bridge over the Chacao Channel with high-strength ready-mix concrete, which is prepared on a platform located in the middle of said channel, to be pumped into the bridge's central pillar. This highly complex civil work has successfully overcome the demanding conditions of tides, currents and winds characteristic of the southern Chilean sea.

Cbb recognizes its responsibility in supporting the development needs of society in a sustainable manner. To achieve this, Cbb works in the search for concrete solutions to the challenges generated by climate change, as well as those that derive from the growth of cities:

- Guarantee the health and safety of workers, as well as the communities that are neighbours to our operations.
- Make sustainable use of raw materials, water and energy.
- Reduce direct emissions of greenhouse gases (GHG) from operations.
- Reduce air pollution that may create risks to human health and the environment.
- Reuse waste and by-products from other industries, transforming them into raw materials and alternative fuels to traditional ones.
- Develop innovative solutions to reduce the impacts of the life cycle of concrete works.
- Reduce and manage the solid waste generated during operations.
- Mitigate the impacts on biodiversity due to the extraction of raw materials.

In the lime business, the year 2018 began the process of accrediting an integrated quality assurance and operational excellence management system. The first step was to certify the transport of lime by road from the production plants of Antofagasta and Copiapo to customers, under ISO standards: 9001: 2015/14001: 2015/45001: 2018, stage already finished. Now work is being done to certify the production process in the two industrial plants and will continue with the certification of mining operations in 2021.

2.3 Name and location of production site:

Production sites correspond to the 7 largest dosed concrete plants of Ready Mix, which covered 58% of dispatches in 2018 and accounted for 19% of the productive plants. Those plants were chosen for its greater installed capacity in relation to the remaining 30 plants, as well as for its location in the Metropolitan Region, Valparaiso Region and Bio Bio Region, those with the greatest population and economic dynamism in the country.

- 5 plants are located in the Metropolitan Region: Lonquen, General Velasquez, San Bernardo, Lira and Acceso Sur.
- 1 plant in the Valparaiso Region: Concon
- 1 plant in the Bio Bio Region: Talcahuano

3. Product information

3.1 Product name:

Ready-mix concrete (RMC) represented with the nomenclature G025 (10)-20-12-28-B.

3.2 Product identification:

Concrete is a construction material used in residential, commercial and public works applications worldwide. Ready-mix concrete (RMC) products are produced in Chile in accordance with NCh148.Of68: Cement - Terminology, classification and general specifications; NCh170.Of2016: Concrete - General requirements; NCh1934.Of92: Concrete prepared in concrete mixer; NCh430.Of2008: Reinforced concrete - Design and calculation requirements.

This EPD is intended to assess the impacts for a range of concrete for structural purpose, characterized by a compressive strength between 20 MPa and 45 MPa at 28 days of age, measured in standard cylinder, differentiating the maximum aggregate size in families of 20 mm and 40 mm, with a cone settlement between 10 and 12 cm, designed to be transported and placed by concrete pumps. Because it is a structural concrete, the level of defective fraction is 10%, according to ACI 318: Building Code Requirements for Structural Concrete.

3.3 Product description:

The best-selling structural concrete in 2018 corresponded to the nomenclature G025 (10)-20-12-28-B, where:

- "G025 (10)" means specified strength of 25 MPa in normal cylinder and a defective fraction of 10%.
- "20-12-28-B" means maximum aggregate size of 20 mm, slump (cone settlement) of 12 cm, resistance measured at 28 days of age and “B” for placement by concrete pumps.

The structural concrete is controlled by its compression strength measured at 28 days of age, determined in a test cylinder of 150 mm in diameter and 300 mm in height. The compressive strength is measured in mega-pascals (MPa), equivalent to 10.2 kg per cm^2.

The defective fraction is the fraction of the total concrete batch expressed in % with resistances less than a specified value, usually 10%.

The concrete slump test measures the consistency of fresh concrete before it sets. It is performed to check the workability of freshly made concrete, and therefore the ease with which concrete flows. It can also be used as an indicator of an improperly mixed batch. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different loads of concrete under field conditions.

Its main use is for reinforced concrete with structural function, according to the high seismicity that characterizes the Chilean territory. The expected service life time is expressed in decades because it is a long-lasting building material.

3.4 UN CPC code: 375 Concrete

3.5 Geographical scope: Chile

Geographical coverage of core manufacturing process is specific to Chile.

4. LCA information

4.1 Functional unit / declared unit:

The declared unit is 1 cubic meter of unreinforced concrete, defined in accordance with the CSI EPD tool.

4.2 Reference service life: is not specified.

4.3 Time representativeness:

All material flows of the processes are based on company and site specific data gathered for the year 2018, including the 7 concrete plants and the 3 cement mills that supplied them. Regarding imported clinker (key upstream material), the data was obtained from the 2017-2018 biennium, for the different suppliers analysed. All background data originates from the Project Database of the CSI EPD tool, which is largely based on the Ecoinvent v3.3 LCI database.

4.4 Database(s) and LCA software used:

The LCA of the structural concrete produced by Ready Mix is based on the "WBCSD-CSI tool for EPD of concrete and cement", version 1.5, dated 20 April 2018, verified as compliant in accordance with the Product Category Rule (PCR) 2012:01 "Construction products and construction services", version 2.2, dated 30 May 2017, the Sub-PCR-G "Concrete and concrete elements" / EN 16757, the Sub-PCR–H "Cement and building lime" / EN 16908 and the General Programme Instructions of the International EPD® System, version 3.0, based on ISO 14025, ISO 14040, ISO 14044 and EN 15804.

The CSI EPD tool can be found at the following address: https://concrete-epd-tool.org/ and its database is largely based on the Ecoinvent LCI, version 3.3.

4.5 System diagram:

The following table shows the studied system, with the processes included in the LCA split between 4 lifecycle stages, using the terminology from the European standard EN 15804:

- A1: raw material supply (upstream processes): extraction, handling and processing of the raw materials and intermediate component products as well as fuels used in the production of concrete; processing of secondary material input.

- A2: transportation of all input materials and fuels from the supplier to the gate of the concrete plant.

- A3: manufacturing (core process): the energy used to store, move, batch and mix the concrete and operate the concrete plant as well as the transportation and processing of wastes from these core processes.

- A4: transportation of ready-mixed concrete to the construction site.

A1: Raw material supply
Extraction and processing of raw materials
Extraction and processing of primary fuels
Processing of secondary materials
Generation of electricity
Processing up to end-of-waste state
Transport of raw materials within the upstream supply chain

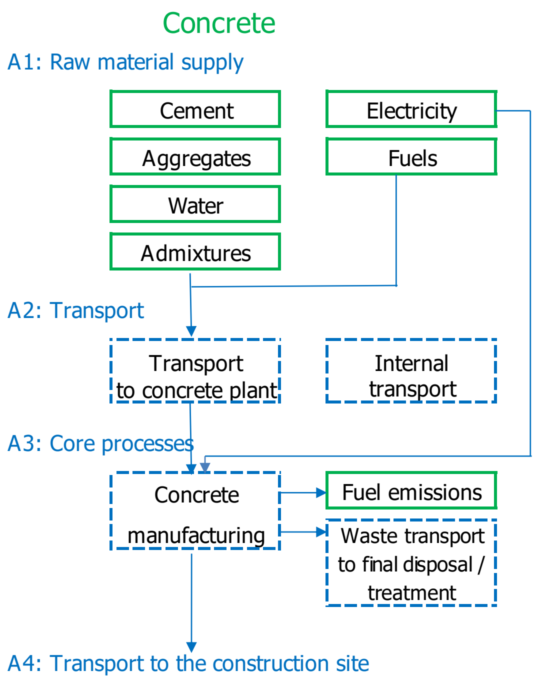
A2: Transport
Transportation of raw materials up to the factory gate
Internal transport

A3: Core processes
Concrete manufacturing
Waste transport to final disposal / treatment

A4: Transport to site
Transport of concrete to the construction site

4.6 Description of system boundaries:

The system boundaries are presented in the following figure, covering 4 lifecycle stages from "cradle to construction site":



4.7 Excluded lifecycle stages:

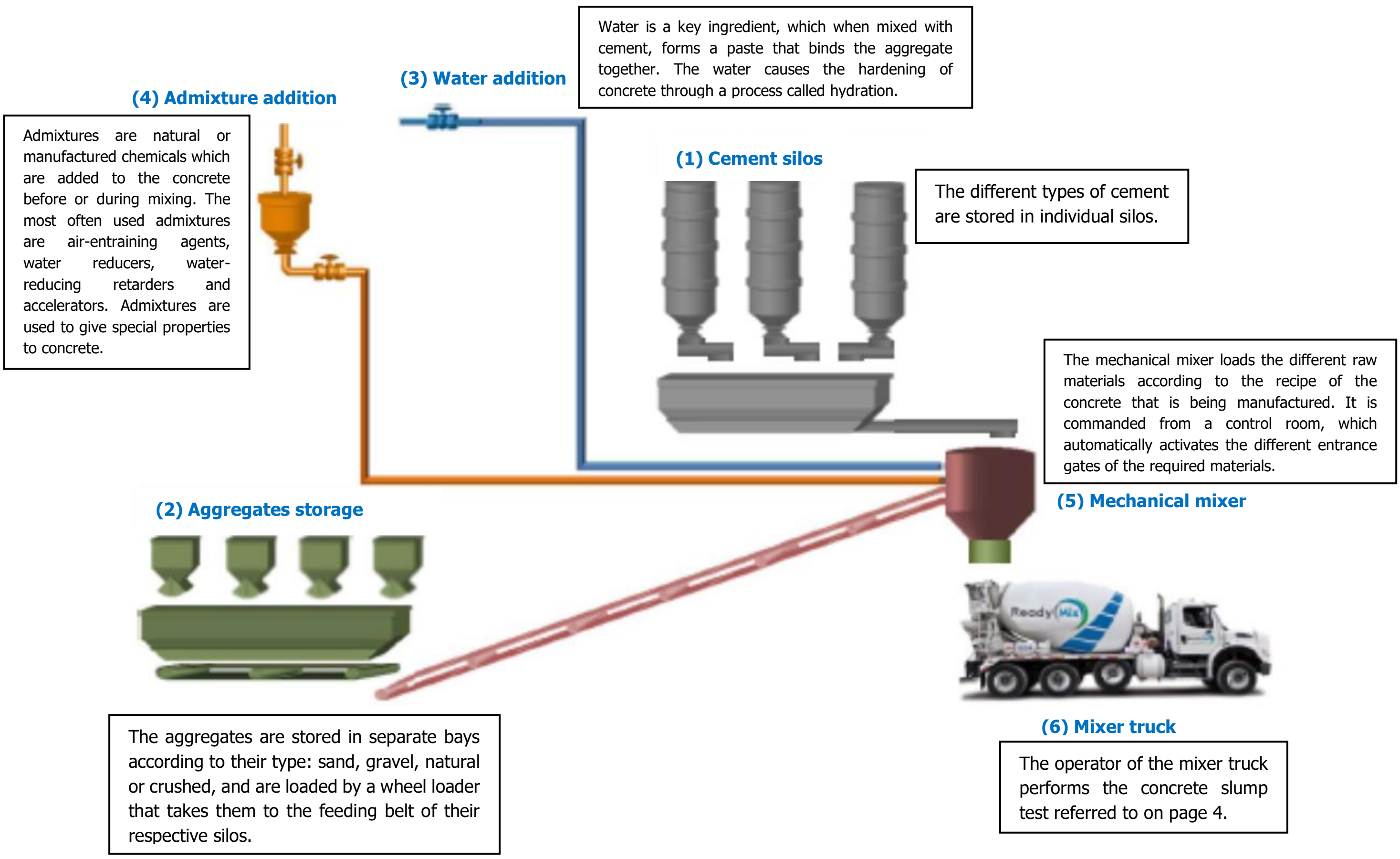
The following figure shows the building life cycle stages. Apart from A1 to A4, all other stages were excluded from the LCA study and EPD (modules A5, B1-7, and C1-4). In conformance with the PCR, the following life cycle processes are also excluded from the study:

- Production, manufacture and construction of capital goods and infrastructure that are not directly consumed in the production processes.
- Personnel-related activities, such as travel, furniture and office supplies.
- Energy and water use related to company management and sales activities.
- Water use in placement and curing of concrete.

Building Life Cycle Information Modules																
Product stage			Construction Process stage		Use stage							End-of-life 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
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4

4.8 Description of the processes units of the product system:

The following figure shows a schematic diagram of a Ready-mix concrete plant:



The main steps in ready-mix concrete production process are:

- Raw material supply and storage
- Raw material mixing
- Quality control and transport to the client

a) Raw material supply and storage:

Cement, aggregates and admixtures are received in the concrete plant, checked and placed in their respective storage sites. The aggregates, mainly sand and gravel of natural origin, both fine and coarse, are stored in bays. The cement is stored in silos located on top of the equipment that mixes the different raw materials. Water is stored in an accumulation or reserve tank and is supplied by the public network in some cases or by a well that extracts it from groundwater. Admixtures are stored in smaller ponds.

b) Raw material mixing:

In the concrete plant, each raw material is automatically weighed and feeds a mechanical mixer, which operates following the recipe of the concrete entered in its master system, for which it extracts the required weights of cement, aggregates, water and admixtures from the silos. The aggregates are the raw material of greater volume and therefore they are continuously fed to their storage silos by means of the operation of a front loader that carries them from their respective storage bay to a conveyor belt that feeds each silo. The humidity of aggregates is periodically controlled to adjust the amount of water incorporated into the mixture.

c) Quality control and transport to the client:

The concrete mixture is downloaded into the truck that is parked under the discharge hopper. The operator of the mixer truck performs the quality control of the concrete to be transported, measuring and correcting the slump of the mixture, then washes the truck to avoid the emission of dust during the transport to the construction site.

4.9 Cut-off rules:

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO14044:2006 and section 7.6 of the governing PCR. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty (e.g., cement production and clinker kiln process) are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle flow inventory.

4.10 Allocations:

As prescribed by the governing PCR, the applied allocation procedures conform ISO14044 clause 4.3.4. In any case, the allocation was made on a mass basis, following the recipes of each structural concrete, represented in the underlying LCA study by the best-selling one in 2018. This criteria was extended to the consumption at a plant level of electricity, fuels, additional process water and waste generation, which were allocated on an average basis per cubic meter of concrete, due to the lack significance to the results of this study of differentiating them by each concrete type.

4.11 Analysis of the quality of the data:

Data quality requirements, as specified in section 7.8 of the governing PCR were applied to verify the data reported in the underlying LCA study, which also describes the achieved data quality relative to the ISO 14044:2006 requirements, section 4.2.3.6. The LCA study was prepared using site specific data for the core process (concrete production and dispatch) and also for upstream processes (clinker and cement production and transport). Data variation across the 7 concrete plants can result from differences in supplier locations, transport distances, manufacturing efficiency and fuel types used. Data quality was assessed on the basis of its representativeness (technological, temporal and geographical), completeness (e.g., unreported emissions), consistency, precision and reliability.

a) Technical representativeness: core manufacturing process technology was derived from 2018 annual data covering the 7 largest plants of Cbb. These data are deemed to be reflective of typical or average technologies used within Chile in the production of ready-mixed concrete. The Project Database of the EPD Tool provided LCI data based on Ecoinvent v3.3 and also background material and process data of clinker kiln technology from the CSI statistical database.

b) Temporal representativeness: core manufacturing process data is from 2018, along with data of upstream processes.

c) Geographical representativeness: geographical coverage of core manufacturing processes is specific to Chile.

d) Completeness: core manufacturing processes are very complete and were derived from the 7 largest concrete plants of Cbb, which covered 58% of dispatches in 2018 although they represented 17% of Cbb's concrete production facilities. These data reflect annual operations inclusive of seasonal and other normal annual fluctuations in operations. All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modelled to represent the specified and declared Ready-mix concrete (RMC) products. The relevant background materials and processes were taken from the Project Database (based on Ecoinvent v3.3 LCI database) and modelled in the CSI EPD Tool software v.1.5, 2018. Efforts were made to ensure that all data used was as complete as reasonably possible.

e) Reliability: for core manufacturing processes the reliability of the information and data is deemed to be very good as these were derived from a detailed survey of the Company's largest ready-mixed concrete plants and subsequently reviewed by a Cbb's specialist for plausibility. Similarly, the data for upstream processes of own clinker and cement was gathered from the information system of Cbb based on SAP ERP software. All other LCI data have been derived from Ecoinvent database, which have been verified by Ecoinvent.

f) Precision: The Cbb's plants through measurement and calculation collected primary data on their annual production of RMC products. For accuracy one specialist validated these plant gate-to-gate input and output data.

g) Consistency: to ensure consistency, the data gathered used the same modelling structure across the production systems, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, returned concrete materials, emissions to water and soil, and waste recycling and treatment. Moreover, the EPD Tool executes on-line mass and energy balances at production plant level to maintain a high level of consistency.

h) Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in a database. A level of transparency is provided throughout the report as the specifications and material quantity makeup for the declared RMC products are presented. Key primary and secondary LCI data sources are found in the Project Database of the EPD Tool, which is subject to user license. The provision of detailed data to allow full external reproducibility is met. The data related to imported clinker were provided by their suppliers, indicated in each case in the underlying LCA study.

5. Content declaration

5.1 Ready-mix concrete: quantities to produce 1 m^3

Materials / chemical substances	kg	%	CAS number
Portland cement	272 – 319	11 - 13	65 997-15-1
Coarse aggregates (natural origin)	926 – 1 053	39 - 44	Mixture
Fine aggregates & sand	840 – 953	36 – 40	99 439-28-8 (for silica)
Batch water	192 – 207	8 – 9	7 732-18-5
Admixtures	2.0 – 2.4	0.10	Mixture

For construction product EPDs compliant with EN 15804, the content declaration shall list, as a minimum, substances contained in the products that are listed in the “Candidate List of Substances of Very High Concern for Authorisation” when their content exceeds the limits for registration with the European Chemicals Agency.

The ranges in the “kg” and “%” columns in the table above reflect the variations recorded in 2018 in the 7 concrete plants included in the underlying LCA study.

5.2 Packaging

a) Distribution packaging: Ready–mix concrete (RMC) is transported by mixer truck to the customer's site and is applied in the civil works under construction by means of discharge buckets or by pumps, given its consistency of a thick fluid, without using any packaging.

b) Consumer packaging: ditto.

5.3 Recycled material

a) Provenience of recycled materials (pre-consumer or post-consumer) in the product:

There were no recycled materials incorporated in the RMC, except for that produced in the Talcahuano plant, which was based on cement with addition of 28% of blast furnace slag in 2018, manufactured in the homonymous cement plant. Regarding recycled aggregates incorporated in the concrete mix, this is not yet possible in Chile given the stringent local norms on quality requirements of concrete, its compressive strength and defective fraction, attending to the seismic nature of Chile.

6. Environmental performance

6.1 Potential environmental impacts

PARAMETER		UNIT	TOTAL A1-A3	A4
Global warming potential (GWP)	TOTAL	kg CO_2 eq.	2.94E+02	2.73E+00
Depletion potential of the stratospheric ozone layer (ODP)		kg CFC 11 eq.	1.28E-05	5.00E-07
Acidification potential (AP)		kg SO_2 eq.	1.38E+00	1.10E-02
Eutrophication potential (EP)		kg PO_4^{3-} eq.	2.50E-01	2.47E-03
Formation potential of tropospheric ozone (POCP)		kg C_2H_4 eq.	6.23E-02	4.67E-04
Abiotic depletion potential – Elements		kg Sb eq.	2.85E-04	8.07E-06
Abiotic depletion potential – Fossil resources		MJ, net calorific value	1.64E+03	4.36E+01
Water scarcity potential		m^3 eq.	*INA*	*INA*

As stated in the governing PCR 2012:01, version 2.3, the environmental impact categories shall be calculated using characterisation factors recommended in regionally accepted impact assessment methods. CML was used as LCIA method in the underlying LCA study: CML baseline indicators, v4.7, Jan.2016, from the Institute of Environmental Sciences, Faculty of Science, University of Leiden, Netherlands. These characterisation factors are specific to Europe although CML is generally well accepted outside Europe.

The LCA results in this section 6 are presented as the weighted average of concrete dispatches in 2018 of the 7 plants included in the underlying study.

6.2 Use of resources

PARAMETER		UNIT	TOTAL A1-A3	A4
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	8.71E+01	5.13E-01
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	8.71E+01	5.13E-01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.73E+03	4.41E+01
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	1.73E+03	4.41E+01

Secondary material	kg	4.25E+01	0.00E+00
Renewable secondary fuels	MJ, net calorific value	5.25E+01	0.00E+00
Non-renewable secondary fuels	MJ, net calorific value	6.70E+01	0.00E+00
Net use of fresh water	m^3	6.33E+00	3.02E-02

6.3 Waste production and output flows

a) Waste production

PARAMETER	UNIT	TOTAL A1-A3	A4
Hazardous waste disposed	kg	1.22E-02	0.00E+00
Non-hazardous waste disposed	kg	1.03E+02	0.00E+00
Radioactive waste disposed	kg	0.00E+00	0.00E+00

b) Output flows

PARAMETER	UNIT	TOTAL A1-A3	A4
Components for reuse	kg	0.00E+00	0.00E+00
Material for recycling	kg	3.13E-02	0.00E+00
Materials for energy recovery	kg	1.93E-03	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00

6.4 Other environmental indicators

In addition to the reference indicators as per the PCR, a number of extra indicators were available in the EPD Tool, highlighting 4 toxicity indicators, which are classified in the environmental impact category: human toxicity potential, freshwater aquatic eco-toxicity potential, marine aquatic eco-toxicity pot., and terrestrial eco-toxicity potential, all of them expressed as kg p-DCB_{eq} per m^3. CML was the LCIA method used: CML v4.7.

PARAMETER	UNIT	TOTAL A1-A3	A4
Human toxicity potential, HTP	kg p-DCB_{equiv}	5.12E+01	8.87E-01
Freshwater aquatic eco-toxicity potential, FAETP	kg p-DCB_{equiv}	3.09E+01	2.30E-01
Marine aquatic eco-toxicity potential, MAETP	kg p-DCB_{equiv}	1.19E+05	8.24E+02
Terrestrial eco-toxicity potential, TETP	kg p-DCB_{equiv}	5.50E-01	3.72E-03

7. Additional information

Cbb is developing an active community engagement agenda by running social projects in 10 communes of Chile in 2018, where the Company carries out its industrial operations in lime, cement and concrete products. The detail of this social supporting agenda, as well as its activities related to the mitigation of its environmental impacts, can be found in the Integrated Report 2018 (www.cbb.cl).

The actions in the field of circular economy, on using waste and by-products from other industries, should be highlighted. Cbb uses fly ash from coal-based thermoelectric plants, slag from steel furnaces and synthetic plaster from the desulfurization of the flue gases from thermoelectric power plants as alternative raw materials. Used motor oils, very abundant in the mining regions of Chile, are used as alternative fuels to the traditional ones.

The construction sector in Chile is lagging behind in product certification, given its eminently local nature, unlike the products of various export sectors, for which certification has been a commercial imperative since decades ago. The measurement, reporting and verification of the impacts of concrete is a fundamental step for the commitments made by Chile in the signing of the Paris Agreement on climate change, because the cement sector is considered to be the third largest source worldwide of greenhouse gas emissions of anthropogenic origin.

Time is coming to reach new standards related to resources conservation, the efficient use of materials, water and energy, as well as waste management, which will mean a greater challenge for all companies that develop building projects and civil works in Chile. This scenario will go hand in hand with renewed demands for information transparency throughout the construction value chain, and its verification by third parties.

Ready-mix concretes that have an EPD with independent external verification will provide a differentiating attribute to interested parties, regarding complete and transparent information of their environmental performance. The ultimate goal is to gradually promote in the decision makers of construction industry, the selection of materials that have public information of their potential impacts and damage to health and the environment.

Last, doing a LCA has an intrinsic value. As the third decade of this century progresses, this type of analysis will be increasingly routine, although today it is almost an exception in Chile. Moreover, business transparency will require a product life cycle perspective, because the first step to make a contribution to the mitigation of global climate change is to measure, verify and report the impacts of a product throughout its life cycle, and this is the primary responsibility of a company.

8. References

General Programme Instructions of the International EPD® System. Version 3.0.

PCR 2012:01. Construction Products and Construction Services. Version 2.3

Other references:

SUB–PCR-G to PCR 2012:01, Concrete and Concrete Elements (EN 16757:2017).

SUB-PCR-H to PCR 2012:01, Cement and Building Lime (EN 16908:2017).

ISO 14025: 2006, Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

ISO 14044: 2006, Environmental management - Life cycle assessment - Requirements and guidelines.

ISO 14040: 2006, Environmental management - Life cycle assessment - Principles and framework.

EN 15804:2012+A1:2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

ISO 21930: 2007, Building construction – Sustainability in building construction – Environmental declaration of building products.

Athena Sustainable Materials Institute 2014, NRMCA LCI Data Collection Statistical Summary. Prepared for National Ready Mixed Concrete Association.

NRMCA 2014. A cradle-to-gate Life Cycle Assessment of Ready-Mixed Concrete Manufacture.

European Federation of Concrete Admixture Associations (EFCA) 2006, Environmental Declarations for Admixtures.

Weidema, B.P. and Wesnaes, M.S. 1996, Data quality management of life cycle inventories - an example of using data quality indicators. J. Cleaner Prod. Vol. 4, No. 3-1, pp.167-174.

Weidema, B.P. 1998, Multi-user test of the data quality matrix for product life cycle inventory data. Int. J. LCA3 (5), pp.259-265.

Ciroth, A., Muller, S., Weidema, B.P. 2012, Refining the pedigree matrix approach in Ecoinvent. Version 7.1.

Lloyd, S. and Ries, R. 2007, Characterizing, propagating, and analysing uncertainty in Life-Cycle Assessment: a survey of quantitative approaches. Journal of Industrial Ecology 11 (1), pp.161-179.

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