

# Environmental Product Declaration (EPD) for Concrete



## Environmental Product Declaration Ready-Mix Concrete

(per ISO 14025 and ISO 21930)

Since the company started, UNICON decided to become the leader in the market, and with this, assumed the responsibility to differentiate themselves in the market. UNICON is committed to sustainable economic development, improving the quality of life of the society through actions that are aligned with the Sustainable Development Goals. UNICON co-creates opportunities with communities that improve their quality of life and implement responsible measures in the interaction with the environment.

### Our Priorities

At UNICON, we work to reduce our environmental impact. To this end, we concentrate on the use of clean technology in our production process and on improving the company's capacities. We also make a point of working with the community that forms part of our surrounding environment. Human capital is the starting point of our value chain, as well as supporting and extending it through our suppliers and clients.



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**Certified  
Environmental  
Product Declaration**  
[www.nsf.org](http://www.nsf.org)

EPD Information			
Program Operator		NSF Certification, LLC	
Declaration Holder		UNION DE CONCRETERAS S.A.	
Product:	Date of Issue	Period of Validity	Declaration
1210N67B	January 9, 2020	5 Years	Number EPD10328
This EPD was independently verified by NSF Certification, LLC in accordance with ISO 14025 and ISO 21930:			
Internal	<b>X</b>	External	Jenny Oorbeck joorbeck@nsf.org
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR.			
		Jack Geibig jgeibig@ecoform.com	
LCA Information			
Basis LCA		Life Cycle Assessment Manager for Concrete Environmental Product Declaration June 2017	
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This life cycle assessment was critically reviewed in accordance with ISO 14044 by:		Jack Geibig - Ecoform jgeibig@ecoform.com	

<b>North America PCR Information</b>	
Program Operator	NSF International
Reference PCR	Product Category Rules (PCR) for ISO 14025:2006 Type III Environmental Product Declarations (EPDs) of Concrete, Version 2.0.
Date of Issue	February 22, 2019
PCR review was conducted by:	Thomas P. Gloria, Ph.D, Industrial Ecology Consultants; Bill Stough, Sustainable Research Group; Dr. Michael Overcash, Environmental Clarity.
<b>EPD Software Tool</b>	
LCA Software & Version Number	GaBi ts 8.5.079
LCI Database & Version Number	GaBi ts 8.5.0.79

## ENVIRONMENTAL PRODUCT DECLARATION: DETAILED VERSION

### Product Scope



This declaration and its LCA study are relevant to concrete and concrete products manufactured by UNION DE CONCRETERAS S.A. in Lima, Peru. As the owner of the declaration UNION DE CONCRETERAS S.A. shall be liable for the underlying information and evidence; the program operator shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

### Product Description

Products covered by this Environmental Product Declaration (EPD) are for specific concrete applications for commercial and/or residential construction developed and produced by UNION DE CONCRETERAS S.A. for markets in Lima Peru. The design compressive strength is 21 mPa (3,045 psi) at 28 days.

Concrete is batched and delivered in accordance with local standards. The producer provides product that meets or exceeds the standards based on standard operating procedures. Warranties and additional information are determined by the producer's terms and conditions.

During normal use, hardened concrete is stable and inert and does not pose a significant health or environmental hazard.

Fresh, plastic concrete must be managed in accordance with local regulations. Hardened concrete is an inert product and can be recycled subject to local regulations.

This EPD reports the impacts for the concrete components made of in-situ or ready-mixed concrete. The life cycle phases covered are A1 (Raw Material Supply: Upstream Processes), A2 (Transportation from Supplier to Gate of Producer) and A3 (Concrete Production – Core Process). This EPD is based on a cradle-to-gate system boundary deemed appropriate as concrete mixtures are supplied to a variety of products and the function of the final product is not specifically determined. Reference service life is not relevant due to the cradle-to-gate boundary conditions.

Life cycle stages that are not included in this EPD are A4 (Transportation to the Construction Site), A5 (Construction and Installation Process), B1-7 (Use Phase) and C1-4 (End of Life Stage).

**Technical Data** (\* These characteristics are not relevant for ready-mix concrete)

Name	Value	Unit
Density	2,000 – 2,500	kg/m <sup>3</sup>
Thermal conductivity	*	W/(mK)
Water vapor diffusion resistance factor	*	-
Sound absorption coefficient	*	%
Compressive strength	17 - 110	N/mm <sup>2</sup>
Tensile strength	*	N/mm <sup>2</sup>
Flexural strength	*	N/mm <sup>2</sup>
Modulus of elasticity	*	N/mm <sup>2</sup>
Equilibrium moisture content	*	%

**Product Components**



The ready-mix concrete and its upstream materials covered by this Environmental Product Declaration conform to the appropriate ASTM standards as described in the NSF International PCR for Concrete, UNSPSC code 30111500, CSI Specification Section 03 30 00 or the requirements of European standard EN 206:2013, BS 8500-1:2015 and BS 8500-2:2015 based on the IBU PCR. Ready-mix concrete is generally batched at a plant, centrally mixed and then discharged into a truck mixer for delivery (central mixed) or dry-batched into the truck for mixing in the production yard, in transit or at the job site (truck mixed). Ready-mix concrete does not require packaging. The base material ranges for the defined ready-mix concrete are:

<i>Material</i>	<i>Amount</i>
Binders	10 – 15 %
Sands	40 – 45 %
Aggregates	30 - 40 %
Admixtures	< 1 %
Water	5 - 15 %

The product does not contain materials that are listed in the REACH “Candidate List of Substances of Very High Concern for Authorization”.

## Production

Health and safety measures with potential impact to human health during manufacturing are to be consistently adhered to per regional regulatory requirements. Initiatives must be undertaken to minimize or eliminate potential impacts to the environment based on the use of best practices including engineered controls. Fresh, plastic concrete must be managed in accordance with local regulations. Hardened concrete is an inert product and can be recycled subject to local regulations. If disposed under the European waste catalogue, the waste code 17-01-01 for non-hazardous concrete and 17-01-06 for concrete containing hazardous substances is applicable. Any substances with hazardous and toxic properties that may be of concern to human health and/or the environment are provided in corresponding SDS documents based on regulatory requirements.



## Declared Unit

The declared unit is 1 m<sup>3</sup> of UNION DE CONCRETERAS S.A. concrete produced for commercial applications with a specified compressive strength of 21 mPa (3,045 psi) at 28 days.



## Cut-off Criteria

All material and energy flows known or suspected to release substances into the air, water or soil in quantities that contribute significantly to any of the indicators in ISO 21930 are included. In cases where there is insufficient input data for a unit process or data gaps, the cut-off criteria used is 1% of renewable primary resources (energy), 1% of non-renewable primary resource (energy) usage, 1% of the total mass input of that unit process and 1% of environmental impacts. The total of neglected input flows per module does not exceed 5%.

## Life Cycle Assessment (LCA)



The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

A summary of the life cycle stages **included** in the EPD is as follows:

- I. Raw Material Supply (upstream processes): Extraction, handling and processing of the raw materials used in production of concrete: cement, supplementary cementitious materials, aggregate (coarse and fine), water, admixtures and other materials or chemicals used in concrete mixtures.
- II. Transportation: Transportation of these materials from supplier to the 'gate' of the concrete producer.
- III. Manufacturing (core processes): The core processes result from the energy used to store, batch, mix and distribute the concrete and operate the facility (concrete plant).
- IV. Water use in mixing and distributing concrete.

The processes **excluded** from the EPD are as follows:

- I. Production, manufacture and construction of buildings, capital goods and infrastructure with an expected lifespan of over 5 years.
- II. Production and manufacture of concrete production equipment, concrete delivery vehicles, earth-moving equipment and laboratory equipment with an expected lifespan of over 5 years.
- III. Personnel-related activities (travel, furniture, office supplies) as well as energy and water use related to company management and sales activities.

*A summary of the limitations of this EPD include:*

This EPD does not report all the environmental impacts due to manufacturing of the product, but rather reports the environmental impacts for those categories with established life cycle assessment-based methods to track and report. The product category rules for this EPD recognize fly ash, silica fume and slag as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment and transportation required to use as a concrete material input. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change and habitat destruction.

This EPD reports the results of an LCA for 'cradle to gate' analysis and is intended for business-to-business communications. Thus, declarations themselves are not comparative assertions, defined as an environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function. An EPD does not make any statements that the product covered by the EPD is better or worse than any other product.

To assess the local impacts of product manufacturing, additional analysis is required.

Life cycle impact assessment results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

*Comparability:*

EPD of concrete mixtures may not be comparable if they do not comply with this standard and data from this EPD. While an EPD can be used to compare concrete mixtures, the data cannot be used to compare between construction products or concrete mixtures used in different concrete products unless the data is integrated into a comprehensive LCA. For example, precast concrete, concrete masonry units and site cast concrete all have different manufacturing processes whose impacts are attributed to different LCA stages. This precludes direct comparison between mixtures used in these different products unless all life cycle phases are included, and a functional unit is used.

*Allocation:*

During the production of ready-mix concrete, co-products are not introduced into the mixture designs. Source-specific allocations are assigned to supplementary cementitious materials as these are considered secondary materials rather than co-products. For these secondary materials, all processing and transportation required to transform these materials to SCMs are included.

**DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)**

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE								END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential	
A1	A2	A3	A4	A%	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	



**LCA: Interpretation and Results**

The following tables provide the results of the LCA and the environmental parameters from the LCA for one (1) cubic meter of ready-mix concrete. The environmental impacts are based on the TRACI v2.1 characterization factors and NSF International PCR for Concrete.

**Note:** emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories.

- Renewable primary energy resources as energy (fuel) (PERE)
- Renewable primary resources as material (PERM)
- Non-renewable primary resources as energy (fuel) (PENRE)
- Non-renewable primary resources as material (PENRM)
- Secondary Materials (SM)
- Renewable secondary fuels (RSF)
- Non-renewable secondary fuels (NRSF)
- Recovered energy (RE)
- Abiotic depletion potential for non-fossil mineral resources (ADPelements)
- Land use related impacts, for example on biodiversity and/or soil fertility
- Toxicological aspects
- Emissions from land use change [GWP 100 (land-use change)]
- Hazardous waste disposed
- Non-hazardous waste disposed
- High-level radioactive waste
- Intermediate and low-level radioactive waste
- Components for reuse
- Materials for recycling
- Materials for energy recovery
- Recovered energy exported from the product system.

**Additional notes:** When upstream data specified in the PCR and/or used in calculating the EPD do not have data for select impact categories or inventory items, they are reported as an 'x' and not zero. Not all LCA datasets for upstream materials include these impact categories and thus results maybe incomplete. Use caution when interpreting data in these categories. This EPD was calculated using industry average cement data. Cement LCA impacts can vary depending upon manufacturing process, efficiency and fuel source by as much as 50% for some environmental impact categories. Cement accounts for as much as 80% of the impacts of the concrete mixes included in this EPD and thus manufacturer specific cement impacts could result in variation by as much as 40%.



# Environmental Product Declaration - Ready-mix Concrete 1/09/2020

**Note:** emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories.

<b>Results of the LCA - environmental impact:1 m3 Ready Mix Concrete - TRACI v 2.1</b>	A1	A2	A3
Global warming potential (GWP 100) [kg CO2 eq.]	3.61E+02	1.34E+01	5.39E+00
Ozone depletion potential (ODP) [kg CFC 11 eq.]	1.31E-06	5.04E-10	-2.86E-13
Acidification potential (AP) [kg SO2 eq.]	1.82E+00	8.40E-02	1.50E-02
Eutrophication potential (EP) [kg N eq.]	4.70E-02	4.67E-03	6.52E-04
Photochemical smog creation potential (POCP) [kg O3 eq.]	2.33E+01	2.34E+00	1.32E-01
Abiotic depletion potential for non fossil resources (ADPelements) [kg Sb eq.]	5.75E-04	5.54E-09	1.46E-06
Abiotic depletion potential for fossil resources (ADPfossil) [MJ]	1.64E+03	1.69E+02	8.16E+01

<b>Results of the LCA - resource use:1 m3 Ready Mix Concrete</b>	A1	A2	A3
Renewable primary energy as energy carrier (PERE) [MJ]	3.50E+01	0.00E+00	1.16E+01
Primary energy resources used as raw materials (PERM) [MJ]	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT) [MJ]	3.50E+01	0.00E+00	1.16E+01
Non-renewable primary energy as energy carrier (PENRE) [MJ]	1.74E+03	1.70E+02	1.00E+02
Non-renewable primary energy resources used as raw materials (PENRM) [MJ]	0.00E+00	0.00E+00	0.00E+00
Total use of non-renewable primary energy resources (PENRT) [MJ]	1.74E+03	1.70E+02	1.00E+02
Use of secondary material (SM) [kg]	x	x	x
Use of renewable secondary fuels (RSF) [MJ]	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels (NRSF) [MJ]	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water (FW) [m3]	5.73E-01	0.00E+00	3.00E-02

<b>Results of the LCA - output flows and waste categories:1 m3 Ready Mix Concrete</b>	A1	A2	A3
Hazardous waste disposed (HWD) [kg]	9.92E-07	0.00E+00	4.34E-08
Non-hazardous waste disposed (NHWD) [kg]	6.33E+01	0.00E+00	2.70E-02
Radioactive waste disposed (RWD) [kg]	5.13E-03	0.00E+00	7.28E-03
Components for reuse (CRU)	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (MER)	0.00E+00	0.00E+00	0.00E+00
Exported electrical energy (EEE) [MJ]	x	x	x
Exported thermal energy (EET) [MJ]	x	x	x

For the specific system boundaries identified for this EPD, the raw material supply (phase A1) is the primary driver for all environmental impact categories with this phase accounting for over 80% of the total results for GWP, ODP, AP, EP and POCP.

This is generally the result of the cement content in the concrete mixture as cement production requires high levels of energy for the calcining process while at the same time emitting CO<sub>2</sub> as part of the reaction from converting limestone (CaCO<sub>3</sub>) to lime (CaO). Transportation may have a larger percentage of the total impact when raw materials are transported from long distances such as trans-oceanic locations.



## Data Quality and Variability

The requirements for data quality and background data correspond with the requirements of the NSF International PCR for Concrete. The calculated data in this report is based on actual ready-mix concrete LCA compositions. Manufacturer specific data is based on average data from the past 12 months.

The time over which inputs to and outputs from the system are accounted for is 100 year from the year for which the data is deemed representative.

The technology coverage reflects the physical reality for the declared ready-mix concrete product.

Used datasets are complete according to the system boundary within the limits set by the criteria for the exclusion of inputs and outputs.

# Environmental Product Declaration - Ready-mix Concrete 1/09/2020

To calculate the life cycle of the declared ready-mix concrete products, the software solution GaBi ts 8.5.0.79 from thinkstep AG was used. Background datasets were extracted from the GaBi database. The last revision of the GaBi data is less than 3 years ago according to thinkstep AG. Altogether, the data quality is considered high.

This EPD was created using the default data noted in appendix A of the NSF International PCR for concrete.

The following table summarizes the overall quality assessments for the main inputs for ready-mix concrete.

Inputs	Data Quality					
	Technology	Time	Geography	Completeness	Reliability	Source
<b>Binders</b>						
Cement (CEM I)	good	2018	Europe	good	good	Gabi 8.5
Portland cement	good	2016	US	good	good	Gabi 8.5/PCA
Fly ash	good	2018	Regional	good	good	Gabi 8.5
Blast furnace slag	good	2018	Germany	fair	good	Gabi 8.5/ASTM
Granite	good	2016	US	good	good	Gabi 8.5
Limestone	good	2017	Europe	good	good	Gabi 8.5
Glass	good	2016	Europe	good	good	Gabi 8.5
Natural pozzolan	good	2016	Global	good	good	Gabi 8.5
Lime	good	2016	US	good	good	Gabi 8.5
Kaolin	good	2016	Germany	good	good	Gabi 8.5
Silica fume	good	2017	US	fair	good	Gabi 8.5
Titanium dioxide	good	2016	US	good	good	Gabi 8.5
Iron oxide	good	2018	Germany	good	good	Gabi 8.5
Rice husk ash	fair	2017	US	fair	good	Gabi 8.5
<b>Sands</b>						
Natural sand	good	2016	Europe	good	good	Gabi 8.5/Ecoinvent
Natural sand, washed	good	2016	Europe	good	good	Gabi 8.5
Manufactured sand	good	2016	China	good	good	Gabi 8.5
Limestone powder	good	2017	Europe	good	good	Gabi 8.5
River dredge sand	fair	2016	Global	fair	good	Gabi 8.5
<b>Aggregates</b>						
Natural aggregate	good	2016	China	good	good	Gabi 8.5/Ecoinvent
Recycled aggregate	good	2016	US	good	good	Gabi 8.5
Recycled glass	fair	2016	Europe	fair	good	Gabi 8.5
Lightweight aggregate/expanded clay	good	2016	Europe	good	good	Gabi 8.5/Ecoinvent
Recycled concrete	good	2016	US	good	good	Gabi 8.5
Recycled tires	fair	2018	US	fair	good	Gabi 8.5
Limestone	good	2017	Europe	good	good	Gabi 8.5
<b>Admixtures</b>						
MasterPozzolith (WR)	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterPozzolith (MWR)	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterPolyheed	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterPolyheed (non-chloride)	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterRheobuild	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterGlenium	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterSet AC (non-chloride)	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterSet AC	good	2018	US/Europe	good	good	GaBi 8.5/BASF
Master X-Seed	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterSet (Retarder)	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterSet DELVO	good	2018	US/Europe	good	good	GaBi 8.5/BASF

Environmental Product Declaration - Ready-mix Concrete 1/09/2020

MasterLife 300D	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterMatrix VMA	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterLife SRA	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterAir	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterSure Z 60	good	2018	US/Europe	good	good	GaBi 8.5/BASF
Mastercolor	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterKure ER	good	2018	US/Europe	good	good	GaBi 8.5/BASF
MasterLife CI	good	2018	US/Europe	good	good	GaBi 8.5/BASF
<b>Water</b>						
Water	good	2018	US/Germany	good	good	Gabi 8.5/Ecoinvent
Desalinated water	fair	2018	Middle East	fair	good	Gabi 8.5
<b>Reinforcement</b>						
Steel sections	good	2016	Global	good	good	Gabi 8.5
Reinforced steel	good	2016	Europe	good	good	Gabi 8.5
Polypropylene	good	2016	Europe	good	good	Gabi 8.5
MasterFiber MAC 2200 CB	good	2018	US	good	good	Gabi 8.5
Recycled PET	fair	2016	Europe	fair	good	Gabi 8.5
Recycled PP	fair	2016	Europe	fair	good	Gabi 8.5
<b>Energy</b>						
US Electricity grid mix	good	2016	US	good	good	Gabi 8.5/US LCI
EU-27 Electricity grid mix	good	2016	Europe	good	good	Gabi 8.5
US Natural gas	good	2016	US	good	good	Gabi 8.5/US LCI
EU-27 Natural gas	good	2016	Europe	good	good	Gabi 8.5
<b>Packaging</b>						
Pallet	good	2016	Europe	good	good	Gabi 8.5
Steel	good	2016	Global	fair	good	Gabi 8.5
Plastic	good	2016	Europe	fair	good	Gabi 8.5
<b>Transport</b>						
Truck	good	2016	Global/regional	good	good	Gabi 8.5/US LCI
Train	good	2018	Global/regional	good	good	Gabi 8.5/US LCI
Ship - river	good	2016	Global/regional	good	good	Gabi 8.5/US LCI
Ship - oceanic	good	2016	Global/regional	good	good	Gabi 8.5/US LCI

Ratings: good, fair, poor



## References

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Product Category Rule for Environmental Product Declarations, PCR for Concrete version 2.0 February 22, 2019.

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