Environmental Product Declaration (EPD) for Concrete

Las Animas Concrete

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Environmental Product Declaration Ready-Mix Concrete

(per ISO 14025 and ISO 21930)

Las Animas Concrete was established in Santa Cruz in 1964, and recently expanded to Marina in 2005. In 2006 we opened Las Animas Building Materials across the street from the Santa Cruz plant.

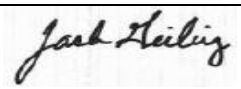
Las Animas began as a small ready mix concrete supplier with only 3 trucks and few employees. Mabel and Warren French successfully ran and expanded the company for many years before retiring in 1994. After their retirement, they passed the company on to their son, Scott, who still owns and operates it. Las Animas is still family owned and operated with Scott and his wife and all 4 of their children working together.

Las Animas started out on smaller concrete projects such as foundations and driveways but slowly worked up to bigger more complicated endeavors. We built our first bridge in 1990 and have been reaching further ever since. On December 28th, 2006, Las Animas poured the foundation for the Rittenhouse Building in downtown Santa Cruz, 1,956 yards, which is the biggest pour in Santa Cruz history.

Author of the Life Cycle Assessment:

D. Green - Master Builders Solutions US LLC

NSF Certified Environmental Product Declaration www.nsf.org

EPD Information			
Program Operator		NSF Certification, LLC	
Declaration Holder		Las Animas Concrete	
Product: 759BWS	Date of Issue August 31, 2021	Period of Validity 5 Years	Declaration Number EPD10626
This EPD was independently verified by NSF Certification, LLC in accordance with ISO 14025 and ISO 21930: Internal **X** External		 Tony Favilla afavilla@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 2019	
LCA Preparer		David Green Master Builders Solutions US LLC david.green@mbcc-group.com	
This life cycle assessment was critically reviewed in accordance with ISO 14044 by:		Jack Geibig - Ecoform jgeibig@ecoform.com	

North America PCR Information	
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.
EPD Software Tool	
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 Las Animas Concrete in Santa Cruz, California. As the owner of the declaration, Las Animas Concrete may 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

The product 759BWS covered by this Environmental Product Declaration (EPD) is for specific concrete applications for commercial construction developed and produced by Las Animas Concrete for markets in the Santa Cruz area. The design compressive strength is 4,000 psi (27.6 MPa) 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/m³
Thermal conductivity	*	W/(mK)
Water vapor diffusion resistance factor	*	-
Sound absorption coefficient	*	%
Compressive strength	25 - 50	N/mm²
Tensile strength	*	N/mm²
Flexural strength	*	N/mm²
Modulus of elasticity	*	N/mm²
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 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:

Material	***Amount***
Binders	10 – 25 %
Sands	35 – 45 %
Aggregates	30 - 40 %
Admixtures	< 1 %
Water	3 - 12 %

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^3 of Las Animas Concrete product for commercial applications with a specified compressive strength of 4,000 psi (27.6 MPa) 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. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change and habitat destruction.

This EPD was calculated using industry average cement data. Cement LCA impacts can vary depending upon manufacturing processes, efficiency and fuel sources by as much as 50% for some environmental impact categories. Cement accounts for as much as 90% of the impacts of the concrete mix(es) included in this EPD and thus manufacturer specific cement impacts could result in variation of as much as 45%.

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. 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.

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-Recycleing 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 note: not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete. Use caution when interpreting data in these categories.

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.

Results of the LCA - environmental impact:1 m3 Ready Mix Concrete - TRACI v 2.1	A1	A2	A3	Total
Global warming potential (GWP 100) [kg CO2 eq.]	3.34E+02	1.07E+01	6.70E+00	3.51E+02
Ozone depletion potential (ODP) [kg CFC 11 eq.]	1.41E-05	2.61E-06	2.21E-06	1.89E-05
Acidification potential (AP) [kg SO2 eq]	7.79E-01	4.04E-02	2.74E-02	8.47E-01
Eutrophication potential (EP) [kg N eq.]	8.46E-02	5.61E-03	6.22E-03	9.64E-02
Photochemical smog creation potential (POCP) [kg O3 eq]	1.37E+01	8.68E-01	3.85E-01	1.49E+01
Abiotic depletion potential for non fossil resources (ADPelements) [kg Sb eq]	5.97E-02	1.82E-04	2.11E-05	5.99E-02
Abiotic depletion potential for fossil resources (ADPfossil) [MJ]	1.66E+03	1.66E+02	1.83E+02	2.01E+03

Results of the LCA - resource use:1 m3 Ready Mix Concrete	A1	A2	A3	Total
Renewable primary energy as energy carrier (PERE) [MJ]	9.14E+01	1.78E+00	6.62E-01	9.38E+01
Renewable primary energy resources used as raw materials (PERM) [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total use of renewable primary energy resources (PERT) [MJ]	9.14E+01	1.78E+00	6.62E-01	9.38E+01
Non-renewable primary energy as energy carrier (PENRE) [MJ]	1.65E+03	1.67E+02	1.83E+02	2.00E+03
Non-renewable primary energy resources used as raw materials (PENRM) [MJ]	5.22E+00	0.00E+00	0.00E+00	5.22E+00
Total use of non-renewable primary energy resources (PENRT) [MJ]	1.66E+03	1.67E+02	1.83E+02	2.01E+03
Use of secondary material (SM) [kg]	4.94E-01	0.00E+00	4.65E-03	4.99E-01
Use of renewable secondary fuels (RSF) [MJ]	0.00E+00	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	0.00E+00
Recovered energy (RE) [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water (FW) [m3]	4.63E+00	3.47E-02	2.02E-02	4.68E+00

Results of the LCA - output flows and waste categories:1 m3 Ready Mix Concrete	A1	A2	A3	Total
Hazardous waste disposed (HWD) [kg]	9.03E+00	2.01E-01	1.24E+00	1.05E+01
Non-hazardous waste disposed (NHWD) [kg]	2.84E+02	1.82E+01	1.67E+01	3.19E+02
High level radioactive waste (RWD) [kg]	4.88E-05	9.57E-08	1.67E-05	6.56E-05
Intermediate and low level radioactive waste[kg]	1.37E-03	3.07E-06	2.92E-04	1.67E-03
Components for reuse (CRU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MFR)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (MER)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported electrical energy (EEE) [MJ]	x	x	x	x
Exported thermal energy (EET) [MJ]	x	x	x	x

x-data not available for this inventory item. Not all LCA datasets for upstream materials include these impact categories and thus results may be incomplete. Use caution when interpreting data in these categories.

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_2 as part of the reaction from converting limestone ($CaCO_3$) 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 compositions. Manufacturer specific data is based on average data from the past 12 months.

The period 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.

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*	*Complete*	*Reliability*	*Source*
Binders						
Portland cement	good	2019	US	good	good	Ecoinvent 3.6
GGBFS	good	2019	US	good	good	Ecoinvent 3.6
Sands						
Natural sand	good	2019	Global	good	good	Ecoinvent 3.6
Natural sand, washed	good	2018	Global	good	good	Gabi 8.5
River dredge sand	fair	2018	Global	fair	good	Gabi 8.5
Aggregates						
Natural aggregate	good	2019	Global	good	good	Ecoinvent 3.6
Recycled aggregate	good	2018	US	good	good	Gabi 8.5
Admixtures						
MasterPozzolith (WR)	good	2018	US/Europe	good	good	GaBi 8.5
MasterPozzolith (MWR)	good	2018	US/Europe	good	good	GaBi 8.5
MasterPolyheed	good	2018	US/Europe	good	good	GaBi 8.5
MasterPolyheed (non-chloride)	good	2018	US/Europe	good	good	GaBi 8.5
MasterGlenium	good	2018	US/Europe	good	good	GaBi 8.5
MasterSet DELVO	good	2018	US/Europe	good	good	GaBi 8.5
MasterAir	good	2018	US/Europe	good	good	GaBi 8.5
Water						
Water	good	2018	US/Germany	good	good	Ecoinvent 3.6
Energy						
US Electricity grid mix	good	2019	US	good	good	Ecoinvent 3.6
US Natural gas	good	2019	US	good	good	Ecoinvent 3.6
Transport						
Truck	good	2019	Global/regional	good	good	Ecoinvent 3.6
Train	good	2019	Global/regional	good	good	Ecoinvent 3.6
Ship - river	good	2019	Global/regional	good	good	Ecoinvent 3.6
Ship - oceanic	good	2019	Global/regional	good	good	Ecoinvent 3.6

Ratings: good, fair, poor

References

North American Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPD) Concrete version 1.1 December 4, 2013.

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

ISO 21930 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services, second edition 2017-07.

ISO, International Organization for Standardization, Environmental Management-Life Cycle Assessment-Principles and Framework; ISO 14040:2006; ISO 14044:2006. ISO, Geneva, Switzerland, www.iso.org (2006).

ISO, International Organization for Standardization. Environmental Management - Eco-efficiency assessment of product systems - Principles, requirements and guidelines; ISO 14045. ISO, Geneva, Switzerland, www.iso.org (2012)

ASTM C94, C94 M Standard Specification for Ready-mixed Concrete

BS 8500-1:2015, Concrete - Complementary British Standards to BS EN 206. Method of specifying and guidance for the specifier.

BS 8500-2:2015, Concrete - Complementary British Standards to BS EN 206. Specification for constituent materials and concrete.

CSI Specification Section 03 30 00 Cast-in-Place Concrete

DIN EN ISO 14025:2011: Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

EN 15804:2012, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

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GaBi ts 8.5: Software and GaBi database, LBP, University of Stuttgart and thinkstep AG, 2018

Product Category Rules for Building-Related Products and Services Part A - IBU calculation rules for the life cycle assessment and requirements on the project report.

PCR Guidance - Texts for Building-Related Products and Services Part B - IBU requirements on the EPD for Concrete components made of in-situ or ready-mixed concrete, version 1.5, 10.04.2017.

REACH Directive (EG) No. 1907/2006 of the European Parliament and of the Council dated 18 December 2006 on the registration, evaluation, approval and restriction of chemical substances (REACH), for establishing a European Agency for chemical substances, for amending Directive 1999/45/EC and for annulment of Directive (EEC) No. 793/93 of the Council, Directive (EC) No. 1488/94 of the Commission, Guideline 76/769/EEC of the Council and Guidelines 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC of the Commission.

UNSPSC Code 30111500 Concrete and Mortars