Alamo Concrete

EPD
ENVIRONMENTAL PRODUCT DECLARATION

READY- MIXED CONCRETE PRODUCED BY: ALAMO CONCRETE

FACILITY: Evans Rd

STRENGTH: 3000 psi @ 28 days

MIX NAME: 223037200

IMPACT INDICATOR		PER YD3	PER M3
Global Warming Potential	kg CO2e	165.40	216.34
Ozone Depletion	kg CFC11e	4.54E-06	5.94E-06
Acidification	kg SO2e	0.40	0.52
Eutrophication	kg Ne	0.22	0.29
SFP (Smog)	kg O3e	7.91	10.35
Non-renew. energy	MJ, NCV	905.49	1184.33

GENERAL INFORMATION		
Declared Product	Ready - Mixed Concrete produced by Alamo Concrete	
Date of Issue and EPD Number	August 09, 2023	
Period of Validity	5 years; 8/11/2027	
EPD Holder	Alamo Concrete 6055 W. Green Mountain Rd San Antonio, TX 78266	Alamo Concrete
Program Operator	ASTM International 100 Bar Harbor Drive West Conshohocken, PA 19428-2959, USA	ASTM INTERNATIONAL Helping our world work better
LCA and EPD Developer	WAP Sustainability Consulting 1701 Market Street Chattanooga, TN 37408 www.wapsustainability.com	WAP SUSTAINABILITY CONSULTING
Core PCR	ISO 21930:2017 Sustainability in Building Construction - Environmental Declaration of Building Products	
Sub-category PCR	NSF International Product Category Rule (PCR) for Concrete Version 2.2 (December 2022), Verified by Thomas P. Gloria, Ph.D., Industrial Ecology Consultants	
Independent LCA Reviewer and EPD Verifier	Independent verification of the declaration and data, according to ISO 21930:2017 and ISO 14025:2006	
	☐ Internal ☒ External Thomas P. Gloria, PhD Industrial Ecology Consultants	
For Additional Explanatory Material	Manufacture Representative:Michelle Ferguson (Michelle.Ferguson@buzziunicemusa.com) Software Tool: Theta by WAP Sustainability Consulting V.1.0.	

The declared product meets the following product specifications:

- ACI 211: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- ACI 318: Building Code Requirements for Structural Concrete.
- ASTM C94 Standard Specification for Ready-Mixed Concrete.
- CSA A23.1/A23.2: Concrete Materials and Methods of Concrete Construction
- CSI Masterformat Division 03-30-00: Cast-in-Place Concrete.
- UNSPSC Code 30111500: Ready Mix

Disclaimer:
EPDs are comparable only if they comply with this document, use the same sub-category PCR where applicable, include all relevant information modules, use the same functional unit and are based on equivalent scenarios with respect to the context of construction works. This EPD is intended for business-to-business communications.

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 90% of the impacts of the concrete mixes included in this EPD and thus manufacturer specific cement impacts could result in variation of as much as 45%

METHODOLOGICAL FRAMEWORK

DECLARED UNIT

The declared unit is 1 cubic meter (1 cubic yard) of ready mixed concrete product. The defined concrete mix is intended for commercial applications developed and produced by Alamo Concrete. Key product variables include:

Compressive strength - Compressive strengths are represented in the mix design and include the number of days after pouring as a part of the reference value: e.g., 3,000 psi @ 28 days; 4,000 psi @ 56 days; 6,000 psi @ 90 days; etc.

- Water to cementitious materials ratio (w/cm) – Varies but generally lower for a higher strength non-air entrained mix design (above 5,000 psi (34.5 MPa)) in accordance with ACI 211.1 recommendations.
- SCM use – various mix designs call for Portland cement displacement by incorporating fly ash (FA) and/or slag cement (SL).
- Admixtures use – Admixtures used was specified for the mix design that was modeled. These admixtures can include an air-entraining admixture, water reducing and accelerating admixtures, and high range water reducer admixtures
- No hazardous substances are present in the declared product.
- The ready mixed concrete products represented in this EPD are comprised of :
  BatchWater (ASTM C1602), Air Entrainer (ASTM C260), Crushed Coarse Aggregate (ASTM C33), Crushed Fine Aggregate (ASTM C33), Natural Fine Aggregate (ASTM C33), Water Reducer (ASTM C494), Portland Limestone Cement (ASTM C595), Fly Ash (AS

SYSTEM BOUNDARY

A summary of life cycle stages included in the EPD is identified in the figure below. This EPD covers A1-A3 life cycle stages (Cradle-to-Gate). A summary of activities excluded from the EPD is as follows:

- Production, manufacture, and construction of manufacturing capital goods and infrastructure.
- Production and manufacture of production equipment, delivery vehicles, and laboratory equipment.
- Personnel-related activities (travel, furniture, and office supplies)
- Energy and water use related to company management and sales activities.

BUILDING LIFE CYCLE INFORMATION MODULES (X: Included in LCA; MND: Module Not Declared)

Production State			Construction Stage		Use Stage							End-Of-Life Stage			
Extraction Production	Transport to Facility	Manufacturing	Transport to Site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-Construction/ Demolition	Transport to Disposal	Waste Processing	Disposal of Waste
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

CUT-OFF RULES

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. 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., portland cement and admixtures) are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.
- Proxy data was used for admixtures used that did not align with any of the admixture categories published in the European Federation of Concrete Admixtures Associations (EFCA) EPDs. In those cases, the Water Reducing Admixture data was selected as a conservative assumption as per the NSF PCR Appendix A.

ALLOCATION

The allocation of co-products or secondary flows cross the system boundary conforms with the ISO 21930: 2017 Section 7.2.4. Specifically, the allocation criteria were applied as follows:

- Allocation was not applied to any of the gate-to-gate production facilities.
- For Secondary Data sources, the NSF PCR default allocation selection (i.e., “Cut-off” or “Alloc Rec”) was applied.
- 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.
- A portion (30%) of the reported fleet energy use for truck mixing plants was allocated to the mixing facility.

CALCULATED RESULTS A1- A3

CORE MANDATORY IMPACT INDICATOR			PER YD3	PER M3
Global warming potential	GWP	kg C02e	165.40	216.34
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	4.54E-06	5.94E-0
Acidification potential of soil and water sources	AP	kg SO2e	0.40	0.52
Eutrophication potential	EP	kg Ne	0.22	0.29
Formation potential of tropospheric ozone	SFP	kg 03e	7.91	10.35
Abiotic depletion potential for fossil resources	ADPf	MJ, NCV	260.62	340.88
Abiotic depletion potential for non-fossil mineral resources *	ADPe	kg Sbe	9.91E-05	1.30E-0
Fossil fuel depletion	FFD	MJ Surplus	19.74	25.82
USE OF PRIMARY RESOURCES				
Renewable primary energy carrier used as energy*	RPRE	MJ, NCV	32.72	42.80
Renewable primary energy carrier used as material *	RPRM	MJ, NCV	0.00	0.00
Non-renewable primary energy carrier used as energy *	NRPRE	MJ, NCV	905.49	1184.33
Non-renewable primary energy carrier used as material *	NRPRM	MJ, NCV	0.00	0.00
SECONDARY MATERIAL, SECONDARY FUEL AND RECOVERED ENERGY				
Secondary material*	SM	kg	0.00	0.00
Renewable secondary fuel*	RSF	MJ, NCV	0.00	0.00
Non-renewable secondary fuel*	NRSF	MJ, NCV	84.70	110.79
Recovered energy *	RE	MJ, NCV	0.00	0.00
MANDATORY INVENTORY PARAMETERS				
Consumption of freshwater resources	FW	m3	1.46	1.91
Calcination and carbonation emissions	CCE	kg CO2e	77.73	101.66
INDICATORS DESCRIBING WASTE				
Hazardous waste disposed *	HWD	kg	0.03	0.04
Non-hazardous waste disposed *	NHWD	kg	50.16	65.60
High-level radioactive waste, conditioned, to final repository *	HLRW	m3	7.21E-04	9.43E-04
Intermediate- and low-level radioactive waste, to final repository*	ILLRW	m3	8.30E-08	1.09E-07
Components for re-use *	CRU	kg	0.00	0.00
Materials for recycling *	MR	kg	0.00	0.00
Materials for energy recovery *	MER	kg	0.00	0.00
Recovered energy exported from the product system *	EE	MJ, NCV	0.00	0.00

*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. 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.

DATA SOURCES

This EPD is based on foreground LCI data collected from the participating company's production facilities for the calendar year 2022. All upstream material, resource and energy carrier inputs have been sourced from various industry-average datasets and literature. Many of these data sets are defaulted to those specified for use in the NSF PCR 2022. The following Table describes each LCI data source and includes the data quality assessment.

MATERIALS	LCI DATA SOURCE	YEAR	GEOGRAPHY	DATA QUALITY ASSESSMENT
Portland Cement and Limestone Cement, ASTM C595, AASHTO M240, or CSA A3001	Portland Cement Association EPD of Portland Cement and Portland Limestone Cement (2021)	2021	North America	Technology: very good, Time: very good, Geography: very good, Completeness: very good, Reliability: very good
Slag Cement, ASTM C989	Slag Cement Association EPD of North America Slag Cement (2021)	2021	North America	Technology: very good, Time: very good, Geography: very good, Completeness: very good, Reliability: very good
Fly Ash, ASTM C618	None, no incoming burden, only inbound transport is considered*	N/A	N/A	N/A
Silica Fume, ASTM C1240	None, no incoming burden, only inbound transport is considered*	N/A	N/A	N/A
Crushed Aggregates, coarse and fine, ASTM C33	ecoinvent 3.4: "Gravel, crushed {RoW}| production | Cut-off, U" (2018), modified with US average electricity	2001	World/US	Technology: very good, Time: poor Geography: good, Completeness: very good, Reliability: very good
Natural Aggregates, coarse and fine, ASTM C33	ecoinvent 3.4: "Gravel, round {RoW}| gravel and sand quarry operation | Cut-off, U" (2018), modified with US average electricity	2001	World/US	Technology: very good, Time: poor, Geography: good, Completeness: very good, Reliability: very good
Manufactured Lightweight Aggregates, ASTM C330	ecoinvent 3.4: Expanded clay {RoW}| production | Cut-off, U (2018), modified with US average electricity	2000	World/US	Technology: good, Time: poor, Geography: good, Completeness: very good, Reliability: very good
Admixtures, ASTM C494	EFCA EPDs for Air Entrainers, Plasticisers and superplasticisers, Hardening Accelerators, Set Accelerators, Water Resisting Admixtures, and Retarders (2015)	2015	North America	Technology: very good, Time: very good, Geography: fair, Completeness: very good, Reliability: very good
Batch and Wash Water, ASTM C1602	ecoinvent 3.4: Tap water {RoW}| market for | Cut-off, U (2018), modified with US average electricity	2011	World/US	Technology: very good, Time: good, Geography: fair, Completeness: very good, Reliability: very good
Road Transport	USLCI 2014: Transport, combination truck, short-haul, diesel powered/tkm/RNA (2014) Adjusted for Back-hauls per NSF PCR 7.1.7.2	2010	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good
Rail Transport	USLCI 2014: Transport, train, diesel powered /US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: good, Reliability: very good
Ocean Transport	USLCI 2014: Transport, ocean freighter, average fuel mix/US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good
Electricity	ecoinvent 3.4: Electricity, low voltage {XX}| market for | Cut-off, U (2018)	2015	North America	Technology: very good, Time: very good, Geography: very good, Completeness: very good, Reliability: very good
Diesel	USLCI 2014: Diesel, combusted in industrial boiler / US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good
Gasoline	USLCI 2014: Gasoline, combusted in equipment/ US "U" (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good
Liquefied Propane Gas	USLCI 2014: Liquefied petroleum gas, combusted in industrial boiler /US U (2014)	2007	North America	Technology: very good, Time: fair, Geography: very good, Completeness: very good, Reliability: very good
Hazardous Solid Waste	ecoinvent 3.4: Hazardous waste, for incineration {RoW}| treatment of hazardous waste,hazardous waste incineration | Alloc, Rec, U 2018), modified with US electricity	2011	World/US	Technology: very good, Time: good, Geography: good, Completeness: very good, Reliability: very good
Non-Hazardous Solid Waste	ecoinvent 3.4: Inert waste {RoW}| treatment of, sanitary landfill | Alloc Rec, U (2018), modified with US average electricity	2011	World/US	Technology: very good, Time: good, Geography: good, Completeness: very good, Reliability: very good

** 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.*

REFERENCES

American Concrete Institute (2009) ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

American Concrete Institute (2008) ACI 318: Building Code Requirements for Structural Concrete.

Bare, J. (2012) Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI) v2.1.

European Federation of Concrete Admixture Associations (2015). EFCA Environmental Declarations for Admixtures.

International Organization for Standardization (2017) ISO 21930:2017 Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services.

National Renewable Energy Laboratory (2019) U.S. Life Cycle Inventory Database http://www.nrel.gov/lci/

NSF International (2022) Product Category Rule for Concrete, Version 2.2

Wernet, G., Bauer, C., Steubing, B., Reinhard, J., Moreno-Ruiz, E., & Weidema, B. (2016) The ecoinvent database version 3 (part I): overview and methodology. The International Journal of Life Cycle Assessment, 21, 1218–1230.

American Concrete Institute (2009) ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete

ASTM International (2018) ASTM C94: Standard Specification for Ready-Mixed Concrete.

Construction Specifications Institute (CSI) MasterFormat Division 03-30-00 Cast-in- Place Concrete

CSA Group (2014) CSA A23.1-09/A23.2-14 - Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.

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

ISO 14044:2006/AMD 1:2017/ AMD 2:2020 Environmental Management – Life cycle assessment – Requirements and guidelines

ISO 14040:2006 Environmental Management - Life cycle assessment - Principles and framework

ASTM International General Program Instructions (2020) v8.0