



## Environmental Product Declaration

**This Environmental Product Declaration (EPD) covers eight concrete mixes produced by CEMEX Panama at its Juan Diaz plant.**

### Company Profile

CEMEX is a global building materials company that provides high-quality products and reliable service to customers and communities in more than 50 countries throughout the world, and maintains trade relationships in over 100 nations. We work hard to develop and deliver the best solutions in cement, ready-mix, admixtures and aggregates...so we can transform ideas into reality

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## NRMCA Certified Environmental Product Declaration

This environmental product declaration was conducted in accordance with ISO 14025:2006

Internal Verification
  External Verification

Declared Product:	This Environmental Product Declaration (EPD) covers eight concrete mixes produce by CEMEX at its Juan Diaz plant in Panama City, Panama.	
Declared Owner:	CEMEX Panama +507 278-8800 <a href="http://www.cemexpanama.com">www.cemexpanama.com</a>	
Program Operator:	National Ready Mixed Concrete Association 900 Spring St., Silver Spring, MD 20910 <a href="http://www.nrmca.org/sustainability">www.nrmca.org/sustainability</a>  Lionel Lemay	
LCA and EPD Developer:	CEMEX through WBCSD CSI-PCA tool for concrete and cement <a href="https://concrete-epd-tool.org">https://concrete-epd-tool.org</a>	  World Business Council for Sustainable Development <b>Cement Sustainability Initiative</b>
Independent Verifiers:	Jamie Meil, Research Principal Athena Sustainable Materials Institute 119 Ross Avenue, Suite 100 Ottawa, Ontario, Canada <a href="mailto:info@athenasmi.org">info@athenasmi.org</a>	 <b>Athena Sustainable Materials Institute</b>
Product Category Rule:	<i>North American Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) for Concrete, Version 1.1, dated 12/4/2013 (including clarifications #1, #2, and #3)</i> The Carbon Leadership Forum <a href="http://www.carbonleadershipforum.org">www.carbonleadershipforum.org</a>	
Date of Issue:	September 1, 2017	
Period of Validity:	September 2017 – September 2022	
EPD Number:	NRMCAEPD:10014	



## Product description

This EPD reports the impacts for the product “ready-mix concrete” meeting the following specifications:

ASTM C94 - Standard Specification for Ready-Mixed Concrete

## Declared unit

The declared unit is 1 m<sup>3</sup> of CEMEX concrete mix, at plant, for the CEMEX mixes names given in the table below:

Mixture name	Compressive strength @ x days (psi)	Slump (cm)	Other Characteristics
6-280-3-B-28-20-1-T-235	4000@28 days	20	Extended workability
6-280-5-B-28-15-1-T-000	4000@28 days	15	Pumpable
6-350-5-B-28-15-1-T-000	5000@28 days	15	Pumpable
6-490-3-B-56-65-1-T-30K	7000@56 days	65	High Strength Concrete. Pumpable
A-490-3-B-56-20-1-T-301	7000@56 days	20	High Strength Concrete. Pumpable
A-560-3-B-56-20-1-T-301	8000@56 days	20	High Strength Concrete. Pumpable
A-630-3-B-56-20-1-T-301	9000@56 days	20	High Strength Concrete. Pumpable
A-705-3-B-56-20-1-T-301	10000@56 days	20	High Strength Concrete. Pumpable

## Product components

The components of the mixes included in this EPD meet the following standards:

Component	Standard	Specification for:
Portland Cement	ASTM C-1157	Standard Performance Specification for Hydraulic Cement
Aggregates	ASTM-C-33	Standard Specification for Concrete Aggregates
Admixtures	ASTM-C-494	Standard Specification for Chemical Admixtures for Concrete
Water	ASTM -C-1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete



## Life-cycle assessment

This EPD is based on a 'cradle-to-gate' life cycle assessment (LCA) of various ready mixed concretes. The life cycle processes included in the EPD are as follows:

- 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.
- Transportation: Transportation of these materials from supplier to the gate of the concrete producer. And from the concrete plant to a delivery of 14 kilometer ratio to the client projects.
- Manufacturing (core processes): Energy used to store, batch, mix, and distribute the concrete and operate the facility (concrete plant).
- Water use in mixing and distributing concrete.

A summary of cradle-to-gate life cycle processes excluded from the EPD is as follows:

- Production, manufacture, and construction of buildings, capital goods, and infrastructure.
- Production and manufacture of concrete production equipment, concrete delivery vehicles, earthmoving equipment, and laboratory equipment.
- Personnel-related activities (travel, furniture, office supplies).

Energy and water use related to company management and sales activities.

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

- This EPD does not report all of the environmental impacts due to manufacturing of the product, but rather environmental impacts for categories with established LCA-based methods to track and report. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change, water use in the upstream manufacturing process, and habitat destruction.
- This EPD reports the results of an LCA for 'cradle-to-gate' analysis. 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.
- In order 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.

This EPD has been developed using the Quantis 2016 (WBCSD-CSI tool for EPD of concrete and cement v1.3 - U.S. version, [concrete-epd-tool.org](http://concrete-epd-tool.org)).

## Data quality, variability, and comparability

This EPD was created using plant-specific data for upstream materials. Potential variations due to supplier locations, manufacturing processes, and efficiencies and fuel use are thus accounted for in this EPD.

EPDs of concrete mixtures may not be comparable if they do not comply with this standard and data from this EPD. While EPDs can be used to compare concrete mixes, the data cannot be used to compare between construction products or concrete mixes 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 mixes used in these different products until all life cycle phases are included.

## Data sources and quality by source

This section provides the sources of data used to compute the upstream material life-cycle inventory (LCI) in this study accompanied by qualitative data quality assessments using the five indicators outlined in the “Product Life Cycle Accounting and Reporting Standard” [GHG Protocol 2011]. Data quality is rated “very good”, “good”, “fair”, or “poor” for each indicator.

### Primary data

Quality of primary data is very good throughout all indicators as the data describe exactly the technologies, processes, and outputs analyzed in this study. All primary data refers to the full calendar year 2015.

### Secondary data

Secondary data are data provided by a trade association, from a national survey or report or industry report, or a database and is based on data from more than one supplier or from an estimation of the data.

In this study the secondary is part of the WBCSD-CSI tool for EPDs of concrete and cement (v1.2), U.S. version [Quantis 2016]. Quantis as the authors of the tool consider that the overall quality of the data in the tool is good to very good; although they use a slightly different framework for quality assessment it is considered that this ranking is equivalent to the same ranking in the framework used here.



The following table summarizes the data sources used in WBCSD-CSI tool for EPDs of concrete and cement (v1.2), U.S. version for the main inputs at the ready-mix plant, and shows corresponding quality assessments.

Process (unit)	LCI data source	Data quality assessment
Portland Cement (kg)	<b>name:</b> CEMEX Panama (Bayano Plant) <b>database:</b> calculated in the tool from plant-specific data <b>Year:</b> 2016	<b>technology:</b> very good <b>time:</b> very good <b>geography:</b> very good <b>completeness:</b> very good <b>reliability:</b> very good
Crushed coarse aggregate (kg)	<b>name:</b> Gravel, crushed <b>database:</b> ecoinvent v3.1 <b>geography:</b> rest of world (excluding Switzerland) <b>Year:</b> 2001	<b>technology:</b> fair; process represents current technology (as of 2001) for gravel and sand quarry operations in Switzerland <b>time:</b> poor; data is older than ten years <b>geography:</b> fair; Process models production based on Swiss data and is adjusted for the rest of the world <b>completeness:</b> very good; process is 100% representative of Swiss production <b>reliability:</b> fair; Date is verified by ecoinvent with the following caveat: "This is a dataset automatically generated based on a dataset transferred from ecoSpold v1 / ecoinvent database version 2. It may not in all aspects fulfill the requirements of the ecoinvent data quality guideline for version 3."
Sand (kg)	<b>name:</b> Sand <b>database:</b> ecoinvent v3.1 <b>geography:</b> rest of world (excluding Switzerland) <b>Year:</b> 2001	
Accelerating admixture (kg)	<b>name:</b> 300 Accelerator EPD <b>reference:</b> [EFCA 2006a] <b>geography:</b> Europe <b>Year:</b> 2006	<b>technology:</b> very good; process represents manufacture of chemical admixtures for concrete <b>time:</b> poor; data is older than 10 years <b>geography:</b> fair; process models European production (no US data in US LCI database) <b>completeness:</b> good; data is based on figures from four of Europe's largest admixture producers <b>reliability:</b> fair; EPDs are not ISO-compliant
Air-entraining admixture (kg)	<b>name:</b> 301 Air Entrainer EPD <b>reference:</b> [EFCA 2006b] <b>geography:</b> Europe <b>Year:</b> 2006	
Retarding admixture (kg)	<b>name:</b> 302 Retarder EPD <b>reference:</b> [EFCA 2006c] <b>geography:</b> Europe <b>Year:</b> 2006	
Plasticizing admixture (kg)	<b>name:</b> 324 Plasticiser EPD <b>reference:</b> [EFCA 2006d] <b>geography:</b> Europe <b>Year:</b> 2006	

Process (unit)	LCI data source	Data quality assessment
Superplasticizing admixture (kg)	<b>name:</b> 325 Superplasticiser EPD <b>reference:</b> [EFCA 2006e] <b>geography:</b> Europe <b>Year:</b> 2006	
Electricity (kWh)	<b>name:</b> national electricity mix from official statistics <b>database:</b> calculated in the tool from generation mix <b>Year:</b> 2016	<b>technology:</b> very good <b>time:</b> very good <b>geography:</b> very good <b>completeness:</b> very good <b>reliability:</b> very good

## Environmental impacts

This EPD covers the required set of environmental impact categories in accordance with the PCR, Section 3.2 [Carbon Leadership Forum 2013]:

Impact category	Unit	Abbreviation	Impact Assessment Method
<b>Life-cycle inventory items</b>			
Non-renewable primary energy consumption	MJ	nPE	Gross Calorific (Higher Heating)
Renewable primary energy consumption	MJ	rPE	Gross Calorific (Higher Heating)
Total primary energy consumption	MJ	tPE	Gross Calorific (Higher Heating)
Concrete batching water consumption	m3	bCW	
Concrete washing water consumption	m3	wCW	
Total concrete water consumption	m3	tCW	
Non-renewable material resource consumption	kg	nMR	
Renewable material resource consumption	kg	rMR	
Hazardous waste production	kg	hWP	
Non-hazardous waste production	kg	nWP	
<b>Impact Categories</b>			
Global Warming	kg CO2-eq	GWP	TRACI 2.1
Ozone Depletion	kg CFC-11-eq	ODP	TRACI 2.1
Acidification	kg SO2-eq	AP	TRACI 2.1
Eutrophication	kg N-eq	EP	TRACI 2.1
Photochemical ozone creation	kg O3-eq	POCP	TRACI 2.1



The calculation for computing the total primary energy consumption uses Gross Calorific Values (GCV), also known as Higher Heating Values (HHV).

The following table shows environmental impacts per m<sup>3</sup> of the CEMEX concrete mixes covered in this EPD using the abbreviations and units from the previous table.





Mix Number	nPE	rPE	tPE	bCW	wCW	tCW	nMR	rMR	hWP	nWP	GWP	ODP	AP	EP	POCP
6-280-3-B-28-20-1-T-235	2603	562	2603	0.185	0.280	5.44	2424	18.2	0	0.068	318	1.83E-05	1.07	0.296	19.9
6-280-5-B-28-15-1-T-000	2003	541	2544	0.178	0.280	5.20	2446	17.5	0	0.068	309	1.82E-05	1.04	0.283	19.4
6-350-5-B-28-15-1-T-000	2841	624	2841	0.175	0.280	5.39	2473	20.5	0	0.068	354	1.95E-05	1.16	0.321	21.4
6-490-3-B-56-65-1-T-30K	2805	756	3561	0.170	0.280	6.24	2506	25.2	0	0.068	435	2.57E-05	1.51	0.422	25.7
A-490-3-B-56-20-1-T-301	2467	706	3174	0.165	0.280	6.20	2550	23.3	0	0.068	398	2.14E-05	1.32	0.374	23.7
A-560-3-B-56-20-1-T-301	2697	792	3490	0.172	0.280	6.50	2577	26.4	0	0.068	444	2.29E-05	1.45	0.417	25.8
A-630-3-B-56-20-1-T-301	2932	898	3830	0.173	0.280	6.48	2613	30.2	0	0.068	498	2.39E-05	1.59	0.456	28.2
A-705-3-B-56-20-1-T-301	3229	982	4212	0.178	0.280	7.51	2635	33.1	0	0.068	547	2.64E-05	1.76	0.518	30.6

## References

- Carbon Leadership Forum 2013: Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) of Concrete – Version 1.1. Seattle, WA, <http://clf.be.uw.edu/clf-pcr-v1-1-2013-12-04>
- EFCA 2006a: Environmental Declaration: Accelerating Admixtures, Sittard, The Netherlands.
- EFCA 2006b: Environmental Declaration: Air Entraining Admixtures, Sittard, The Netherlands.
- EFCA 2006c: Environmental Declaration: Retarding Admixtures, Sittard, The Netherlands.
- EFCA 2006d: Environmental Declaration: Plasticising Admixtures, Sittard, The Netherlands.
- EFCA 2006e: Environmental Declaration: Superplasticising Admixtures, Sittard, The Netherlands.
- GHG Protocol 2011: Product Life Cycle Accounting and Reporting Standard, <http://www.ghgprotocol.org/standards/product-standard>
- Swiss Center for Life Cycle Inventories, ecoinvent v3.1, Zürich, Switzerland, <http://www.ecoinvent.org>
- TRACI 2.1: Tool for Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI), Washington, DC, <https://www.epa.gov/chemical-research/tool-reduction-and-assessment-chemicals-and-other-environmental-impacts-traci>
- Quantis 2016 WBCSD-CSI tool for EPD of concrete and cement v1.3 - U.S. version, concrete-epd-tool.org