Environmental Product Declaration

This Environmental Product Declaration (EPD) covers thirty (30) concrete mixes produced by CEMEX México, México City Business Unit at Armas Plant in México City, México.

Company

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 thirty (30) concrete mixes produced by CEMEX at the Armas Plant in Mexico City.
Declared Owner:	CEMEX México/CEMEX SAB 52(55)5626-8374 www.cemexmexico.com
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Product Category Rule:	*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) The Carbon Leadership Forum www.carbonleadershipforum.org
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Product description

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

- NMX-C-155 –ONNCCE - Industria de la Construcción – Concreto Hidráulico – Dosificado en Masa – Especificaciones y Métodos de Ensayo.

Declared unit

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

#	Mixture name	Compressive strength @ x days (kgf/cm^2)	Water/ Cement Ratio	Slump (cm)	Other Characteristics
1	**Concreto Convencional, 200**	200@28 days	0.81	14	Conventional concrete. Pumpable
2	**Concreto Convencional, 250 18 (2)**	250@28 days	0.64	18	Conventional concrete. Pumpable
3	**Concreto Convencional, 250 14 (3)**	250@28 days	0.72	14	Conventional concrete. Pumpable
4	**Concreto Convencional, 300**	300@28 days	0.64	14	Conventional concrete. Pumpable
5	**Concreto Convencional, 350**	350@28 days	0.57	14	Conventional concrete. Pumpable
6	**Concreto de Alta Resistencia, FORTIS, 450**	450@28 days	0.42	24	High Strength Concrete. Pumpable
7	**Concreto de Alta Resistencia, FORTIS, 500**	500@28 days	0.39	20	High Strength Concrete. Pumpable
8	**Concreto de Alta Resistencia, FORTIS, 650**	650@28 days	0.29	24	High Strength Concrete. Pumpable
9	**Concreto de Alta Resistencia, FORTIS, 700**	700@28 days	0.26	24	High Strength Concrete. Pumpable
10	**Concreto de Alta Resistencia, FORTIS, 750**	750@28 days	0.26	24	High Strength Concrete. Pumpable
11	**Concreto Arquitectónico, APARENTIA, 200**	200@28 days	0.70	20	Colored Architectural Concrete. Pumpable
12	**Concreto Arquitectónico, APARENTIA, 250**	250@28 days	0.72	18	Pumpable
13	**Concreto DURAMAX, 200**	200@28 days	0.60	14	Durable Concrete. Pumpable

#	Mixture name	Compressive strength @ x days (kgf/cm2)	Water/ Cement Ratio	Slump (cm)	Other Characteristics
14	**Concreto DURAMAX, 250**	250@28 days	0.61	18	Durable Concrete. Pumpable
15	**Concreto DURAMAX, 350**	350@28 days	0.44	18	Durable Concrete. Pumpable
16	**Concreto DURAMAX, 400**	400@28 days	0.37	18	Durable Concrete. Pumpable
17	**Concreto DURAMAX Autosellante, 250 44**	250@28 days	0.49	14	Durable and Self-repair Concrete. Pumpable
18	**Concreto DURAMAX Autosellante, 250 18**	250@28 days	0.50	18	Durable and Self-repair Concrete. Pumpable
19	**Concreto Estructural 200**	200@28 days	0.86	18	Structural concrete. Pumpable
20	**Concreto Estructural, 250**	250@28 days	0.73	18	Structural concrete. Pumpable
21	**Concreto Estructural, 300**	300@28 days	0.64	18	Structural concrete. Pumpable
22	**Concreto Estructural, 350**	350@28 days	0.56	18	Structural concrete. Pumpable
23	**Concreto Ultra Alta Resistencia FORTIS, 800**	800@28 days	0.27	22	Ultra High Strength Concrete. Pumpable
24	**Concreto Ligero INSULARIS, 250**	250@28 days	0.35	18	Tailgate concrete
25	**Concreto Ligero INSULARIS, 300**	300@28 days	0.40	18	Tailgate concrete
26	**Concreto Ligero, INSULARIS, 350**	350@28 days	0.30	18	Tailgate concrete
27	**Concreto Pervia, 036**	36@28 days*	0.26	0	Permeable concrete. Tailgate concrete
28	**Concreto Pervia, 040**	40@28 days*	0.25	0	Permeable concrete. Tailgate concrete
29	**Concreto STEEL DECK, 250**	250@28 days	0.58	14	Pumpable
30	**Concreto STEEL DECK, 300**	300@96 days	0.45	14	Pumpable

** Flexion strength @ 28 days (kgf/cm^2)*

Product components

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

Component	Standard	Specification for:
Portland Cement	NMX-C-414	Portland Cement
Aggregates	NMX-C-111	Concrete Aggregates (Fine and Coarse Aggregate) – Specifications and Test Methods
Lightweight Aggregates	NMX-C-299	Lightweight Aggregates - Specifications and Test Methods
Admixtures	NMX-C-255	Admixtures – Specifications and Test Methods
Water	NMX-C-122	Water - Specifications
Fibers	ASTM-C-1116	Standard Specification for Fiber-Reinforced Concrete

Life-cycle assessment

This EPD is based on a 'cradle-to-gate' life cycle assessment (LCA) of various ready mixed concrete. 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).

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 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 data are 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 readymix plant, and shows corresponding quality assessments.

Process (unit)	LCI data source	Data quality assessment
Portland Cement (kg)	• **name:** CEMEX México S.A. de C.V. (Barrientos Plant) • **database:** calculated in the tool from plant-specific data • **year:** 2015	• **technology:** very good • **time:** very good • **geography:** very good • **completeness:** very good • **reliability:** very good
Fly ash (kg)	No additional processing of fly ash necessary for use as secondary recovered material; upstream impacts solely from transportation by rail and truck.	
Crushed coarse aggregate (kg)	• **name:** Gravel, crushed • **database:** ecoinvent v3.1 • **geography:** rest of world (excluding Switzerland) • **year:** 2001	• **technology:** fair; process represents current technology (as of 2001) for gravel and sand quarry operations in Switzerland • **time:** poor; data is older than ten years • **geography:** fair; Process models production based on Swiss data and is adjusted for the rest of the world • **completeness:** very good; process is 100% representative of Swiss production • **reliability:** 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)	• **name:** Sand • **database:** ecoinvent v3.1 • **geography:** rest of world (excluding Switzerland) • **year:** 2001	
Accelerating admixture (kg)	• **name:** 300 Accelerator EPD • **reference:** [EFCA 2006a] • **geography:** Europe • **year:** 2006	• **technology:** very good; process represents manufacture of chemical admixtures for concrete • **time:** poor; data is older than 10 years • **geography:** fair; process models European production (no US data in US LCI database) • **completeness:** good; data is based on figures from four of Europe's largest admixture producers • **reliability:** fair; EPDs are not ISO-compliant
Air-entraining admixture (kg)	• **name:** 301 Air Entrainer EPD • **reference:** [EFCA 2006b] • **geography:** Europe • **Year:** 2006	
Retarding admixture (kg)	• **name:** 302 Retarder EPD • **reference:** [EFCA 2006c] • **geography:** Europe • **year:** 2006	
Plasticizing admixture (kg)	• **name:** 324 Plasticiser EPD • **reference:** [EFCA 2006d] • **geography:** Europe • **year:** 2006	
Superplasticizing admixture (kg)	• **name:** 325 Superplasticiser EPD • **reference:** [EFCA 2006e] • **geography:** Europe • **year:** 2006	

Process (unit)	LCI data source	Data quality assessment
Shredded tires (kg)	• **name:** Recycled Rubber • **reference:** Quantis 2016 • **geography:** worldwide • **year:** --	Process is a proxy that considers that the material is secondary recovered material; given the small volumes used in the products in question this approach is deemed acceptable.
Antibacterial admixture (kg)	• **name:** Other admixture • **reference:** Quantis 2016 • **geography:** worldwide • **year:** --	Process is a proxy that is based on the production of generic chemicals; given the small volumes used in the products in question this approach is deemed acceptable.
Fibers (kg)	• **name:** Fibers, polypropylene • **database:** ecoinvent v3.1 • **geography:** Europe • **year:** 2001	• **technology:** good; process covers only production of the material which is assumed to cause vast majority of environmental impacts • **time:** poor; data is older than 10 years • **geography:** fair • **completeness:** good; data set based on 28 producers • **reliability:** fair; Date is verified by ecoinvent with the following cave at: "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."
Electricity (kWh)	• **name:** supplier plant-specific electricity mix • **database:** calculated in the tool from plant-specific data • **Year:** 2015	• **technology:** very good • **time:** very good • **geography:** very good • **completeness:** very good • **reliability:** 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
Life-cycle inventory items			
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	m^3	bCW	
Concrete washing water consumption	m^3	wCW	
Total concrete water consumption	m^3	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	
Impact Categories			
Global Warming	kg CO_2-eq	GWP	TRACI 2.1
Ozone Depletion	kg CFC-11-eq	OCP	TRACI 2.1
Acidification	kg SO_2-eq	AP	TRACI 2.1
Eutrophication	kg N-eq	EP	TRACI 2.1
Photochemical ozone creation	kg O_3-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^3 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
Concreto Convencional, 200	1725.58	77.43	1803.01	0.173	0.0260	4.65	2235	0.238	0.012	0.0471	237	1E-05	0.534	0.243	12
Concreto Convencional, 250 18 (2)	1888.61	82.33	1970.94	0.175	0.0260	4.82	2251	0.250	0.012	0.0471	264	1E-05	0.574	0.269	13
Concreto Convencional, 250 14 (3)	2186.53	94.09	2280.62	0.190	0.0260	5.25	2358	0.277	0.012	0.0471	314	1E-05	0.648	0.318	14
Concreto Convencional, 300	2079.84	88.10	2167.94	0.177	0.0260	5.03	2271	0.265	0.012	0.0471	296	1E-05	0.622	0.300	14
Concreto Convencional, 350	2281.88	94.29	2376.17	0.179	0.0260	5.25	2292	0.281	0.012	0.0471	331	1E-05	0.672	0.333	15

Mix Number	nPE	rPE	tPE	bCW	wCW	tCW	nMR	rMR	hWP	nWP	GWP	ODP	AP	EP	POCP
Concreto de Alta Resistencia, FORTIS, 450	3550.62	127.55	3678.17	0.199	0.0260	6.79	2517	0.381	0.012	0.0471	546	2E-05	0.993	0.521	22
Concreto de Alta Resistencia, FORTIS, 500	3816.59	135.50	3952.09	0.197	0.0260	7.10	2566	0.402	0.012	0.0471	591	2E-05	1.060	0.563	23
Concreto de Alta Resistencia, FORTIS, 650	4880.13	171.97	5052.11	0.195	0.0260	8.15	2647	0.480	0.012	0.0471	775	2E-05	1.317	0.731	29
Concreto de Alta Resistencia, FORTIS, 700	5482.52	187.70	5670.21	0.205	0.0260	8.84	2722	0.527	0.012	0.0471	876	2E-05	1.469	0.825	32
Concreto de Alta Resistencia, FORTIS, 750	5655.11	194.58	5849.69	0.210	0.0260	8.96	2703	0.538	0.012	0.0471	908	3E-05	1.508	0.853	33
Concreto Arquitectónico, APARENTIA, 200	2122.93	88.49	2211.42	0.200	0.0260	5.09	2254	0.268	0.012	0.0471	305	1E-05	0.630	0.308	14
Concreto Arquitectónico, APARENTIA, 250	2023.78	86.89	2110.67	0.195	0.0260	4.86	2171	0.256	0.012	0.0471	290	1E-05	0.602	0.293	13
Concreto DURAMAX, 200	2226.87	93.43	2320.30	0.178	0.0260	5.39	2438	0.284	0.012	0.0471	317	1E-05	0.666	0.321	15
Concreto DURAMAX, 250	2431.16	100.10	2531.25	0.205	0.0260	5.46	2335	0.293	0.012	0.0471	355	1E-05	0.709	0.357	15
Concreto DURAMAX, 350	3171.19	121.33	3292.51	0.210	0.0260	6.25	2391	0.350	0.012	0.0471	482	2E-05	0.890	0.477	19
Concreto DURAMAX, 400	3499.14	131.43	3630.57	0.175	0.0260	6.52	2409	0.370	0.012	0.0471	543	2E-05	0.969	0.517	21
Concreto DURAMAX Autosellante, 250 44	2626.73	104.54	2731.27	0.180	0.0260	5.85	2497	0.316	0.012	0.0471	384	2E-05	0.767	0.385	17
Concreto DURAMAX Autosellante, 250 18	2944.24	112.44	3056.68	0.189	0.0260	6.14	2482	0.336	0.012	0.0471	443	2E-05	0.842	0.427	19
Concreto Estructural, 200	1796.40	81.56	1877.96	0.191	0.0260	4.84	2324	0.247	0.012	0.0471	247	1E-05	0.555	0.254	12
Concreto Estructural, 250	2026.28	88.44	2114.72	0.193	0.0260	5.09	2348	0.265	0.012	0.0471	286	1E-05	0.612	0.291	13
Concreto Estructural, 300	2253.85	95.27	2349.12	0.195	0.0260	5.33	2372	0.282	0.012	0.0471	324	1E-05	0.668	0.327	15
Concreto Estructural, 350	2525.52	103.43	2628.96	0.197	0.0260	5.63	2403	0.303	0.012	0.0471	370	1E-05	0.736	0.371	16
Concreto Ultra Alta Resistencia FORTIS, 800	5519.39	188.42	5707.81	0.211	0.0260	8.90	2739	0.530	0.012	0.0471	882	2E-05	1.479	0.830	32
Concreto Ligero, INSULARIS, 250	3835.60	138.84	3974.44	0.210	0.0260	6.48	2105	0.382	0.012	0.0471	603	2E-05	1.037	0.589	23
Concreto Ligero, INSULARIS, 300	4513.69	153.89	4667.58	0.255	0.0260	7.16	2094	0.426	0.012	0.0471	723	2E-05	1.205	0.679	26
Concreto Ligero, INSULARIS, 350	4345.11	148.66	4493.77	0.205	0.0260	7.13	2205	0.425	0.012	0.0471	685	2E-05	1.171	0.668	25
Concreto Pervia, 036	2358.61	119.17	2477.77	0.093	0.0260	4.88	2164	0.276	0.012	0.0471	358	1E-05	0.660	0.355	14
Concreto Pervia, 040	3767.60	138.10	3905.71	0.098	0.0260	5.71	2329	0.350	0.012	0.0470	471	3E-05	0.871	0.429	18
Concreto STEEL DECK, 250	2326.01	69.04	2395.05	0.175	0.0260	4.32	1447	0.241	0.012	0.0471	352	1E-05	0.662	0.339	14
Concreto STEEL DECK, 300	3063.61	119.48	3183.09	0.175	0.0260	6.13	2460	0.340	0.012	0.0471	461	2E-05	0.879	0.445	19

References

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- EFCA 2006c: Environmental Declaration: Retarding Admixtures, Sittard, The Netherlands.
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