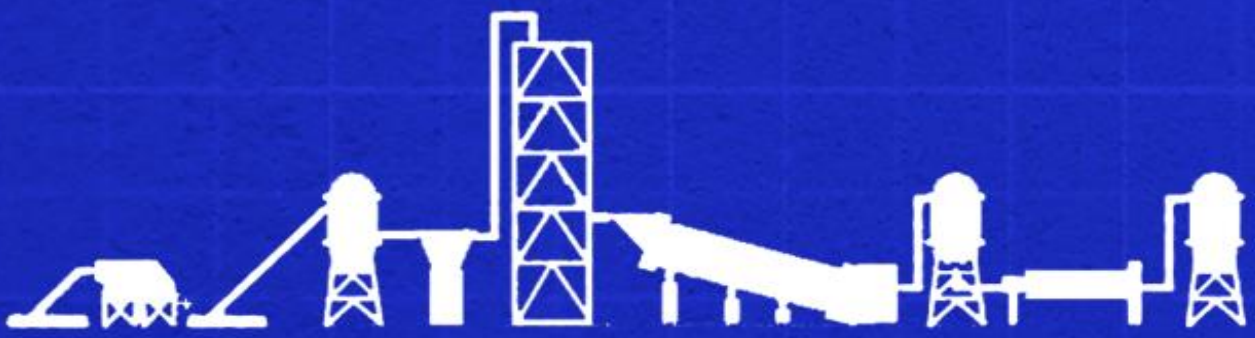
ENVIRONMENTAL PRODUCT DECLARATION



Environmental Product Declaration for cement products produced by CEMEX S.A.B. de C.V. at their Barrientos facility in Estado de México, México

FUTURE IN ACTION

ADMINISTRATIVE INFORMATION

International Certified Environmental Product Declaration

Declared Product:	This Environmental Product Declaration (EPD) covers cement products produced by CEMEX S.A.B de C.V. Declared unit: 1 tonne of cement.
Declaration Owner:	CEMEX S.A.B de C. V. 444 Av. Constitución, Col. Centro Monterrey, Nuevo León www.cemexmexico.com
Program Operator:	Labeling Sustainability Address, 11670 W Sunset Blvd. City, State, Los Angeles, CA http://labelingsustainability.com/
Product Category Rule:	Core PCR: ISO 21930:2017 Sustainability in building and civil engineering works- Core rules for environmental product declarations of construction products and services SubPCR: NSF International (March 2020). Product Category Rules (PCR) for ISO 14025 type III environmental Product Declarations (EPD) of Portland, Blended, Mansory, Mortar and Plastic (stucco) Cements. Valid through March 31, 2025 Sub PCR Program Operator: NSF International Sub-category PCR review was conducted by: Thomas P. Gloria, Ph. D. of Industrial Ecology Consultants: 35 Bracebridge, Rd., Newton, MA 02459-1728, t.gloria@industrial-ecology.com. Dr. Michael Overcash of Environmental Clarity: 2908 Chipmunk Lane, Raleigh, NC 27607-3117, mrovercash@earthlink.net. Mr. Bill Stough of Sustainable Research Group: PO Box 1684, Grand Rapids, MI 49501-1684, bstough@sustainableresearchgroup.com .
Independent LCA Reviewer and EPD Verifier:	This EPD was independently verified in accordance with ISO 14025 and ISO 21930. The life cycle assessment was independently reviewed in accordance ISO 14044 and the referenced PCR. Independent verification of the declaration, according to ISO 14025:2006 Internal ☐ ; External X Third Party Verifier Geoffrey Guest, Certified 3rd Party Verifier under the CSA group (www.csaregistries.ca), Labeling Sustainability (www.labelingsustainability.com), P3Optima (www.P3Optima.com)
Date of Issue:	15 February 2023
Period of Validity:	5 years; valid until 15 February 2028
EPD Number:	3688e939-4112-49c6-ad9e-b6f9c099cc68

TABLE OF CONTENTS

COMPANY DESCRIPTION

CEMEX is a global building materials company dedicated to building a better future through sustainable products and solutions. CEMEX is committed to achieving carbon neutrality through constant innovation and industry leadership in research and development. CEMEX is at the front of the circular economy and reduced carbon footprint within the construction value chain and promotes innovative processes with the use of advanced technologies to increase the use of waste as raw materials and alternative fuels in its operations. CEMEX provides cement, ready-mix concrete, aggregates, and urban solutions in fast-growing markets around the world, powered by a multinational workforce focused on delivering a superior customer experience, using digital technologies.

STUDY GOAL

The intended application of this life cycle assessment (LCA) is to comply with the procedures for creating a Type III environmental product declaration (EPD) and publish the EPD for public review on the website, http://labelingsustainability.com/ . This level of study is in accordance with EPD Product Category Rule (PCR) for Cement published by NSF (2020) and is a PCR in accordance with ISO 21930 for Preparing an Environmental Product Declaration for Portland, Blended Hydraulic, Masonry, Mortar, and Plastic (Stucco) Cements. EPDs for cements that follow other PCRs may not be comparable.; International Standards Organization (ISO) 14025:2006 Environmental labels and declarations, Type III environmental declarations-Principles and procedures; ISO 14044:2006 Environmental management, Life cycle assessment- Requirements and guidelines; and ISO 14040:2006 Environmental management, Life cycle assessment-Principles and framework. The performance of this study and its subsequent publishing is in alignment with the business-to-business (B2B) communication requirements for the environmental assessment of building products. The study does not intend to support comparative assertions and is intended to be disclosed to the public.

This project report was commissioned to differentiate CEMEX S.A.B. de C.V. from their competition for the following reasons: generate an advantage for the organization; offer customers information to help them make informed product decisions; improve the environmental performance of CEMEX S.A.B. de C.V. by continuously measuring, controlling, and reducing the environmental impacts of their products; help project facilitators working on Leadership in Energy and Environmental Design (LEED) projects achieve their credit goal; and to strengthen CEMEX S.A.B. de C.V. license to operate in the community. The intended audience for this LCA report is CEMEX S.A.B. de C.V. employees, their suppliers, project specifiers of their products, architects, and engineers. The EPD report is also available for policy makers, government officials interested in sustainability, academic professors, and LCA professionals. This LCA report does not include product comparisons from other facilities.

DESCRIPTION OF PRODUCT AND SCOPE

This EPD is prepared for products classified as UN CPC Group 3744-Cement or CSI MasterFormat Division 03 30 00 Cast-in-Place Concrete.

CEMEX is committed to sustainability and circularity practices. Cemex uses post-industrial material waste as inputs to its products, to save virgin raw materials as well as reducing impacts within and outside its boundaries. Some common recycled raw materials include discarded gypsum molds used to produce ceramic and metallic pieces; aggregate residues from screening, not usable by construction or concrete manufacturers due to particle size and contamination with clays prone to moulder; the by-product waste from mineral concentration by flotation; and ceramics from bathroom furniture which did not meet the manufacturer's quality standards. Other types of industrial and urban wastes are recycled as fuels inside huge clinker kilns, with energy contributions containing typically up to 30% biogenic carbon from natural non-fossil sources. The combination of both these efforts produces, first cement and later concrete, recycling and integrating materials into their production, preserving natural resources, and mitigating environmental impacts as well as climate change.

This LCA assumes the impacts from products manufactured in accordance with the standards outlined in this report. This LCA is a cradle-to-gate study, and therefore, stages extending beyond the plant gate are not included in this LCA. Excluded stages include transportation of the manufactured material to the construction site; on-site construction processes and components; building (infrastructure) use and maintenance; and "end-of-life" effects.

This subcategory PCR recognizes fly ash, silica fume, granulated blast furnace slag, cement kiln dust, flue gas desulfurization (FGD) gypsum, and post-consumer gypsum as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment and transportation required to use as a cement material input.

CEMENT DESIGN SUMMARY

The following tables provide a list of the cement products considered in this EPD along with key performance parameters.

Table 1: **Declared products considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	Resistance @3 Days (MPa)	Resistance @28 Days (MPa)
1	CPC30R	Portland Cement Composite class 30 with specified strength at 3 days.	Ordinary Portland	20	30.0
2	CPC40	Portland Composite Cement class 40.	Ordinary Portland	N/A	40.0
3	CPO30R	Ordinary Portland Cement Class 30 with specified strength at 3 days.	Ordinary Portland	20	30.0
4	Mortero	Masonry Cement	Ordinary Portland	N/A	7.8

The actual cement composition is a proprietary information; therefore, the list of materials is reported in order of greatest mass per mix.

Table 2: **Declared material ingredients in CEMEX cement**

1	Clinker
2	Limestone
3	Gypsum
4	Other Proprietary Materials

SYSTEM BOUNDARIES

The following figure depicts the cradle-to-gate system boundary considered in this study:

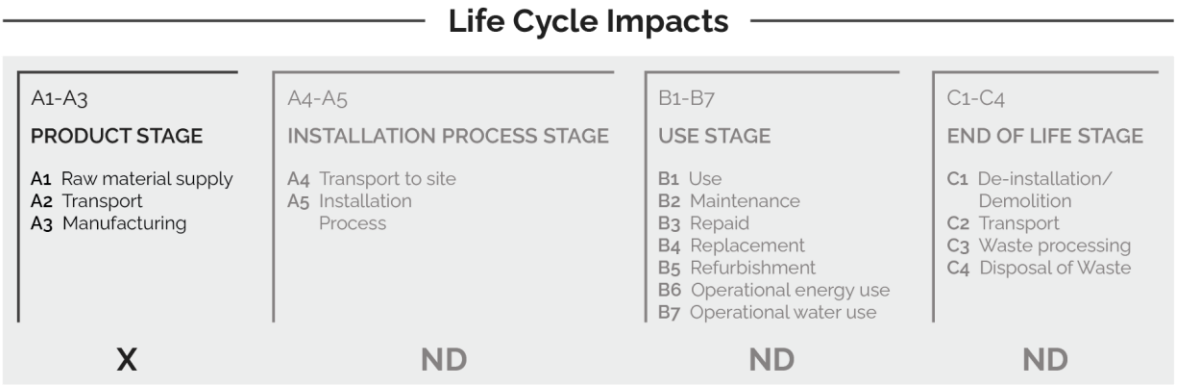


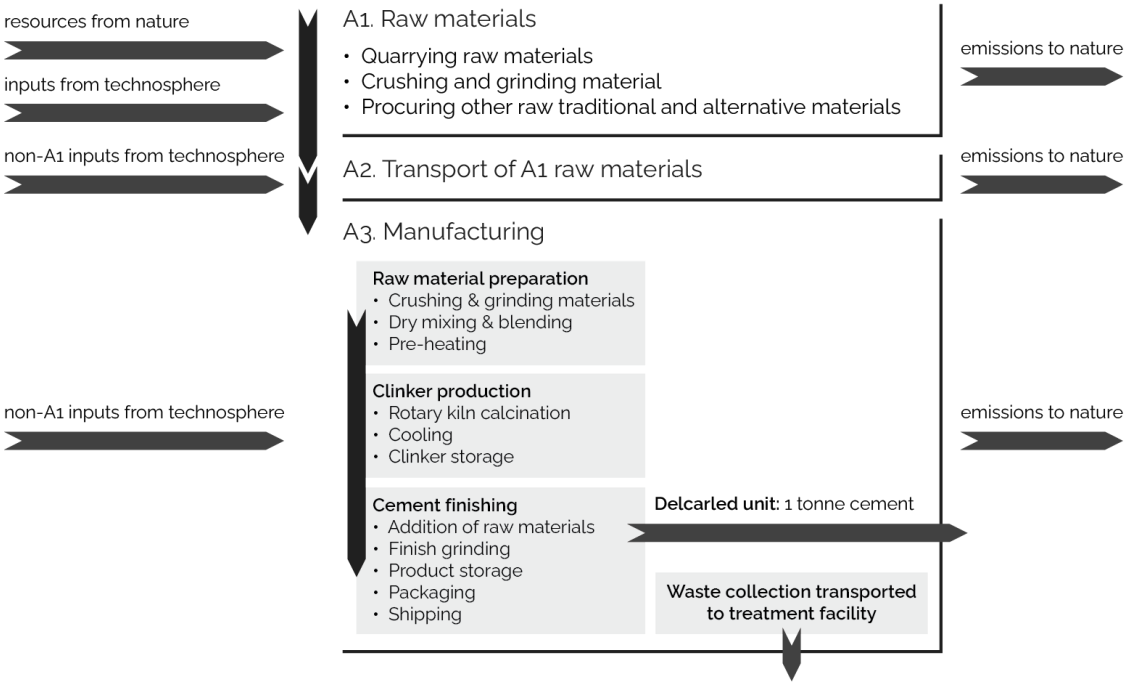
Figure 1: **General life cycle phases for consideration in a construction works system**

This is a Cradle-to-gate life cycle assessment and the following life cycle stages are included in the study:

- A1: Raw material supply (upstream processes) - Extraction, handling, and processing of the materials used in manufacturing the declared products in this LCA.
- A2: Transportation - Transportation of A1 materials from the supplier to the "gate" of the manufacturing facility (i.e., A3).
- A3: Manufacturing (core processes)- The energy and other utility inputs used to store, move, and manufacturer the declared products and to operate the facility.

As according to the PCR, Figure 2 illustrates the general activities and input requirements for producing cement products and is not necessarily exhaustive.

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**



In addition, as according to the relevant PCR, the following requirements are excluded from this study:

- Production, manufacture and construction of A3 concrete/building/capital goods and infrastructure;
- Production and manufacture of production equipment, delivery vehicles, earthmoving equipment, and laboratory equipment;
- Personnel-related activities (travel, furniture, office supplies).
- Energy use related to company management and sales activities.

All operating data for this LCA uses primary data from the manufacturing plant, owned and operated by CEMEX S.A.B. de C.V., including all energy consumption and waste generation. All inputs for this system boundary are calculated for the plant.

This life cycle inventory was organized in a spreadsheet and was then input into an RStudio environment where pre-calculated LCIA results for relevant products/activities stemming from the ecoinvent v3.8 database and a local EPD database in combination with primary data from CEMEX S.A.B. de C.V. were utilized. A broad 2% waste factor was used for all processes in this study unless otherwise noted.

CUT-OFF CRITERIA

ISO 14044:2006 and the focus PCR requires the LCA model to contain a minimum of 95% of the total inflows (mass and energy) to the upstream and core modules be included in this study. The cut-off

criteria were applied to all other processes unless otherwise noted above as follows. A 1% cut-off is considered for all renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process where the total of the neglected inputs does not exceed 5%.

DATA SOURCES AND DATA QUALITY ASSESSMENT

Raw material transport: A combination of actual mode/distance combinations were assumed for key bulk materials whereas ecoinvent default multi-modal market mix distances were assumed for other inputs where no original data could be provided.

Electricity: CEMEX Mexico purchases electricity from different electricity providers. All information on plant usage is primarily reported CEMEX information. Emission factors for independent electricity providers were directly reported from the power utility because they must report that yearly as part of Mexico's GHG emission laws. However, the exact electricity mixes are not reported or disclosed completely. Therefore, per the PCR, the national grid was used for 100% of the plant's electricity.

Process/space heating: The heating values were determined using primary CEMEX information by the approved GCCA protocol. CEMEX follows the "Cement CO2 and Energy Protocol" for all its calculations.

Fuel required for machinery: Machinery-related fuel requirements were determined from direct CEMEX calculations using the GCCA methodology. CEMEX does not own the equipment that uses diesel as fuel; therefore, that information was collected from the actual provider of the machinery and/or from CEMEX purchase history. The low heating value in GJ/t used was 45.613 with a direct emission factor of 74.1 g CO2/MJ, in "total" emissions as defined by Mexico's national environmental agency.

Waste generation: Waste generation values are directly reported from CEMEX operations.

Recovered energy: Thermal energy recovered from fuels produced from recycled materials. Is 25.84% average in Mexico's cement plants.

Recycled/reused material/components: Previously discussed in the section "Description of Product and Scope".

Module A1 material losses: Due to lack of data, default loss factors were assumed.

Direct A3 emissions accounting: This EPD uses direct plant emissions for fuels burned on-site. Consumption values and subsequent emissions were reported based on the plant's self-reported energy matrix in their annual report, "REGISTRO DE EMISIONES Y TRANSFERENCIA DE CONTAMINANTES (RETC) PARA ESTABLECIMIENTOS DE JURISDICCIÓN FEDERAL DURANTE 2021" as required by Mexico law. Direct emissions at the plant are reported for CO2, N2O, and CH4. All other emissions were derived from Ecoinvent data for the relevant process associated with the emission activity. The fuels reported are both in the furnace and outside the furnace for vehicles and other

machinery. Such emissions are reported as "total" emissions, in contrast to the lesser "gross" emissions reported in the Kyoto Protocol, EU-ETS and other international reports.

Waste transport requirements: Transportation distances are using estimated values. The waste hauler cannot guarantee the exact distances travelled due to the variation of route and actual location of disposal. Most hazardous waste suppliers are near the plant therefore the 25 km distance is a representative estimate.

The following tables depict a list of assumed life cycle inventory utilized in the LCA modeling to generate the impact results across the life cycle modules in scope. An assessment of the quality of each LCI activities utilized from various sources is also provided.

Table 3: **LCI inputs assumed for module A1 (i.e., raw material supply)**

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Natural gas (to make Clinker batch Type 1)	market for natural gas, high pressure/natural gas, high pressure/RoW/m3	ecoinvent v3.8	Estado de México	v3.8 in 2021	2	3	1	3	3
Fluorite (to make Clinker batch Type 1)	fluorspar production, 97% purity/fluorspar, 97% purity/GLO/kg	ecoinvent v3.8	San Luis Potosi	v3.8 in 2021	2	3	1	3	3
Coke (to make Clinker batch Type 1)	petroleum coke production, petroleum refinery operation/petroleum coke/RoW/kg	ecoinvent v3.8	Nuevo Leon	v3.8 in 2021	2	3	1	3	3
Iron ore (to make Clinker batch Type 1)	market for iron ore, crude ore, 63% Fe/iron ore, crude ore, 63% Fe/GLO/kg	ecoinvent v3.8	Puebla	v3.8 in 2021	1	3	0	3	3
Limestone (to make Clinker batch Type 1)	limestone production, crushed, for mill/limestone, crushed, for mill/RoW/kg; Note: modifications made (see ecoinvent activity changes table)	ecoinvent v3.8	Estado de México	v3.8 in 2021	2	3	2	3	3
Kaolin (to make Clinker	kaolin production/kaolin/RoW/kg	ecoinvent v3.8	Estado de México	v3.8 in 2021	2	3	2	3	3

batch Type 1)									
Gypsum (to make Clinker batch Type 1)	gypsum quarry operation/gypsum, mineral/RoW/kg	ecoinvent v3.8	Hidalgo	v3.8 in 2021	2	3	2	3	3
Waste Limestone (to make Clinker batch Type 1)	Waste input produced off-site	See A3 inputs	Estado de México	See A3 inputs	1	A3	1	A3	A3

DATA QUALITY ASSESSMENT

Data quality/variability requirements, as specified in the PCR, are applied. This achieved data quality is relative to the ISO 14044:2006 requirements. Data quality is judged based on its precision (measured, calculated, or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source) and representativeness (geographical, temporal, and technological).

*Labeling Sustainability has developed a proprietary tool that allows the calculation of PCR-compliant LCA results for Cement product designs. The tool auto-calculates results by scaling base-unit technosphere inputs (i.e., 1 kg sand, 1 kWh electricity, etc.) to replicate the reference flow conversions that take place in any typical LCA software like openLCA or SimaPro. The tool was tested against several LCAs performed in openLCA and the tool generated identical results to those realized in openLCA across every impact category and inventory metric (where comparisons could be readily made).

ENVIRONMENTAL INDICATORS AND INVENTORY METRICS

Per the PCR, this EPD supports the life cycle impact assessment indicators and inventory metrics. As specified in the PCR, the most recent US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), impact categories were utilized as they provide a North American context for the mandatory category indicators to be included in the EPD. The following 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

It should be noted that 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 any of the following categories.

LIMITATIONS

This EPD is a declaration of potential environmental impact and does not support or provide definitive comparisons of the environmental performance of specific products. Only EPDs prepared from cradle-to-grave life cycle results and based on the same function and reference service life and quantified by the same functional unit can be used to assist purchasers and users in making informed comparisons between products.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. Further, LCA offers a wide array of environmental impact indicators, and this EPD reports a collection of those, as specified by the PCR.

In addition to the impact results, this EPD provides several metrics related to resource consumption and waste generation. While these data may be informational in other ways, they do not provide a measure of impact on the environment.

TOTAL IMPACT SUMMARY

The following table reports the total LCA results for each product produced at the given cement facility on a per 1 tonne of cement basis.

Table 4: **Total life cycle (across modules in scope) impact results for All declared products, assuming the geometric mean point values on a per 1 tonne of cement basis.**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	**moles of H+-Eq**	**kg N**	**kg CO2-Eq**	**kg CFC-11-Eq**	**kg NOx-Eq**	**kg Sb-Eq**	**MJ, net calorific value**
Minimum	55.2	0.0765	473	3.45e-05	0.763	0.00165	3310
Maximum	100	0.159	1020	7.03e-05	1.55	0.00508	5840
Mean	83.2	0.128	814	5.69e-05	1.25	0.00407	4890
Median	88.9	0.138	881	6.14e-05	1.35	0.00478	5210
CPC30R	83.5	0.129	816	5.72e-05	1.26	0.00455	4910
CPC40	94.3	0.148	946	6.56e-05	1.44	0.00501	5510
CPO30R	100	0.159	1020	7.03e-05	1.55	0.00508	5840
Mortero	55.2	0.0765	473	3.45e-05	0.763	0.00165	3310

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NRE	NRR	RR	WDP	LFW	LFHW	bioC
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**kg**
Minimum	3570	138	3430	88.4	0.000541	0.448	16.3	0.00239	-0.0237

Maximum	6260	154	6140	151	0.00109	0.515	29	0.00411	-0.012
Mean	5250	148	5110	128	0.00088	0.49	24.6	0.00348	-0.0194
Median	5590	150	5430	136	0.000944	0.498	26.5	0.0037	-0.021
CPC30R	5270	148	5100	128	0.000896	0.491	25.2	0.00351	-0.0197
CPC40	5910	153	5760	144	0.000993	0.506	27.8	0.0039	-0.0223
CPO30R	6260	154	6140	151	0.00109	0.515	29	0.00411	-0.0237
Mortero	3570	138	3430	88.4	0.000541	0.448	16.3	0.00239	-0.012

ADDITIONAL ENVIRONMENTAL INFO

Emissions

Direct Gross and Net CO2 emissions, consider GHG emission reductions, as defined by the Global Cement and Concrete Association (GCCA) guidelines.

Table 5: **Direct Gross and Net CO2 emissions, consider GHG emission reductions, as defined by the Global Cement and Concrete Association (GCCA) guidelines.**

	Net kg CO2/t Cement	**Gross kg CO2/t Cement**
CPC30R	611.5	645.4
CPC40	721.2	761.2
CPO30R	784.0	827.5
Mortero	317.0	334.6

Renewable Energy

As an average, CEMEX Mexico cement plants use an average of 26.5% of its electricity from renewable sources.

Circularity

As a recycling method, coprocessing, is a key part in circular economy. It reduces the impacts wastes and by-products have on the environment, climate change and society.

Table 6: **The overall percent of biomass inputs to the cement kiln fuels at this plant**

Biomass	tonnes of biomass in kiln fuels]	11,809
Biomass	[% biomass in kiln fuels, mass basis]	15.36%

No regulated substances of very high concern are utilized on site.

REFERENCES

ASTM Standards:

- ASTM C150/C150M Standard Specification for Portland Cement
- ASTM C989/C989M Standard Specification for Slag Cement for Use in Concrete and Mortars
- ASTM C1157/C1157M Standard Performance Specification for Hydraulic Cement
- ASTM C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures

CSA Standards:

- CAN/CSA A3000 Cementitious Materials Compendium
- CAN/CSA G40.20/G40.21 General requirements for rolled or welded structural quality steel / Structural quality steel

ISO Standards:

- ISO 6707-1: 2014 Buildings and Civil Engineering Works - Vocabulary - Part 1: General Terms
- ISO 14021:1999 Environmental Labels and Declarations - Self-declared Environmental Claims (Type II Environmental Labeling)
- ISO 14025:2006 Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures
- ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
- ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
- ISO 14067:2018 Greenhouse Gases - Carbon Footprint of Products - Requirements and Guidelines for Quantification
- ISO 14050:2009 Environmental Management - Vocabulary
- ISO 21930:2017 Sustainability in Building Construction - Environmental Declaration of Building Products

EN Standards:

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

Other References:

- US EPA Waste Reduction Model (WARM), Fly Ash Chapter: http://epa.gov/climatechange/wycd/waste/downloads/fly-ash-chapter10-28-10.pdf
- USGBC LEED v4 for Building Design and Construction, 11 Jan 2019 available at https://www.usgbc.org/resources/pcr-committee-process-resources-part-b
- USGBC PCR Committee Process & Resources: Part B, USGBC, 7 July 2017 available at https://www.usgbc.org/resources/pcr-committee-process-resources-part-b.