ENVIRONMENTAL PRODUCT DECLARATION

READY MIX CONCRETE PRODUCED BY

GCP Applied Technologies

FACILITY: DOWNTOWN
476 Industrial Ave.,
Cambridge,MA 02140

MIX NAME: 300-288

STRENGTH: 5000 (28 days)

Impact Indicator		per yd3	per m3
Climate Change	kg CO2e	378.55	495.12
Ozone Depletion	kg CFC11e	1.02E-05	1.34E-05
Acidification	kg SO2e	1.07	1.40
Eutrophication	kg NE	0.51	0.66
SFP (Smog)	kg O3e	21.75	28.44
Non-renew. energy	MJ, NCV	2344.52	3066.52

1. GENERAL INFORMATION

Declared Product	Ready-mixed concrete produced by GCP Applied Technologies
EPD Number	EPD# TBD
Date of Issue	Date TBD
Period of Validity	5 years
EPD Holder	GCP Applied Technologies 476 Industrial Ave., Cambridge,MA 02140
Program Operator	**ASTM International** 100 Barr Harbor Drive,West Conshohocken, PA 19428-2959, USA
LCA and EPD Developer	**Athena Sustainable Materials Institute** 280 Albert Street, Suite 404, Ottawa, ON K1P 5G8, Canada
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 1 (February 22, 2019), 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 Timothy S. Brooke, ASTM International

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
- 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 and are based on equivalent scenarios with respect to the context of construction works.

2. METHODOLOGICAL FRAMEWORK

Declared Unit

The declared unit is 1 cubic yard of ready mixed concrete product.
Key product variables include:

- Compressive strength – Compressive strengths are represented in the various mix designs 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 higher strength non-air entrained mix designs (above 5,000psi (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 – Admixture use was specified for the different mixes that were modeled. These admixtures included an air-entraining admixture, water reducing and accelerating admixtures, and high range water reducer admixtures.

Scope of LCA

A summary of life cycle stages included in the EPD is identified in Figure 1 as follows:

- A1: Raw Material Supply (upstream processes): Extraction, handling and processing of the raw materials used in the production of concrete: cement, supplementary cementitious materials, aggregate (coarse and fine), water, admixtures and other materials or chemicals used in concrete mixtures.
- A2: Transportation: Transportation of these materials from the supplier to the 'gate' of the concrete producer.
- A3: Manufacturing (core processes): The energy used to store, batch, mix and distribute the concrete and operate the facility (concrete plant)

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

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 by WCP, Inc. that did not align with any of the admixture categories published in the 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 ISO 21930: 2017 Section 7.2.4. Specifically, the allocation criteria were applied as follows:

- Allocation was not applied any of the gate-to-gate production facilities. For facilities that manufacture additional products (i.e. aggregate), the LCI flows at the facility specific to the concrete production were reported.
- 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.

BUILDING LIFE CYCLE INFORMATION MODULES (X: Included in LCA; MND: Module Not Declared)															
Production Stage			Construction Stage		Use Stage							End-Of-Life Stage			
Extraction and Upstream 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 Waste Process. or 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

3. DATA SOURCES

This EPD is based on foreground LCI data collected from the participating company's production facilities for the calendar year 2019.

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 2019. The following Table describe each LCI data source and includes the data quality assessmnet.

Input	LCI Data Source	Year	Geography	Data Quality Assessment
Portland Cement and Limestone Cement, ASTM C595, AASHTO M 240, or CSA A3001	Portland Cement Association EPD USA Portland Cement	2016	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 (2015)	2015	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	EU	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: good, Completeness: very good, Reliability: very good
Road Transport	USLCI 2014: Transport, combination truck, short-haul, diesel powered/tkm/RNA (2014)	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: very 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.

4. ENVIRONMENTAL INDICATORS DERIVED FROM LCA

Facility: DOWNTOWN

Mix Name: 300-288

Compressive Strength: 5000 PSI @ 28 DAYS

Declared Unit: 1 cubic yard (1 cubic meter) ready mix concrete produced at GCP Applied Technologies

CALCULATED RESULTS A1-A3 PER CUBIC YARD AND CUBIC METER

Core Mandatory Impact Indicator			per yd3	per m3
Global warming potential	GWP	kg CO2e	378.55	495.12
Depletion potential of the stratospheric ozone layer	ODP	kg CFC11e	1.02E-05	1.34E-05
Acidification potential of soil and water sources	AP	kg SO2e	1.07	1.40
Eutrophication potential	EP	kg Ne	0.51	0.66
Formation potential of tropospheric ozone	SFP	kg O3e	21.75	28.44
Abiotic depletion potential for fossil resources	ADPf	MJ, NCV	2150.74	2813.06
Abiotic depletion potentialfor non-fossil mineral resources	ADPe	kg Sbe	3.40E-04	4.45E-04
Fossil fuel depletion	FFD	MJ Surplus	139.20	182.07
Use of Primary Resources				
Renewable primary energy carrier used as energy	RPRE	MJ, NCV	103.85	135.83
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	2344.52	3066.52
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	156.67	204.92
Recovered energy	RE	MJ, NCV	0.00	0.00
Mandatory Inventory Parameters				
Consumption of freshwater resources	FW	m3	3.69	4.82
Calcination and carbonation emissions	CCE	kg CO2e	161.88	211.73
Indicators Describing Waste				
Hazardous waste disposed	HWD	kg	0.00	0.00
Non-hazardous waste disposed	NHWD	kg	7.57	9.90
High-level radioactive waste, conditioned, to final repository	HLRW	m3	2.62E-08	3.43E-08
Intermediate- and low-level radioactive waste, to final repository	ILLRW	m3	3.37E-07	4.41E-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

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