According to ISO 14025:2006 and ISO 21930:2017

A Regionalized Industry Average EPD for Precast Box Structures

CCPPA
Build on our strength

ASTM INTERNATIONAL

ASTM International Certified Environmental Product Declaration

This is a Canadian regionalized industry average business-to-business Type III environmental product declaration for concrete box structures as produced by CCPPA members. This declaration has been prepared in accordance with ISO 14025:2006 and ISO 21930:2017, the governing precast concrete category rules and ASTM international's EPD program operator rules.

The intent of this document is to further the development of environmentally compatible and more sustainable construction products by providing comprehensive environmental information related to potential impacts of concrete box structures available in two regions of Canada in accordance with international standards.

Environmental Product Declaration Summary

EPD Owner	
CCPPA *Build on our strength*	**Canadian Concrete Pipe and Precast Association** 447 Frederick St #2 Kitchener, ON N2H 2P4 Link (URL): www.ccppa.ca
Product Group and Name	Concrete Box Structures (UN CPC 3755)
Product Definition	Box Structures are a structural product used primarily for drainage, but versatile enough to use in a variety of configurations such as vertical access chambers or lift stations, and horizontal tunnels, pedestrian underpasses, and onsite detention systems.
Product Category Rules	NSF PCR for Precast Concrete, V3.0, May 2021. [5].
Certification Period	24.03.2023 - 24.03.2028
Declared Unit	1 metric tonne (1,000 kg) of concrete box structures
ASTM Declaration Number	EPD #434

EPD Program Operator	ASTM International
Declaration Holder	Canadian Concrete Pipe and Precast Assocation
Declaration Type A regionalized industry average "cradle-to-gate" EPD for concrete box structures as a product group manufactured by CCPPA members. Activity stages or information modules covered include production with the product ready for shipment from the point of manufacture (modules A1 to A3). The declaration is intended for use in Business-to-Business (B-to-B) communication.	
Product Applicability Concrete box structures products satisfy a wide array of building and civil engineering applications.	
Content of the Declaration This declaration follows Section 9; Content of an EPD, NSF PCR for Precast Concrete, V3.0, May 2021 [5]	
This EPD was independently verified **by ASTM in accordance with ISO 14025:** **Internal** **External** **X**	Timothy Brooke ASTM International 100 Barr Harbor Dr. West Conshohocken, PA 19428 tbrooke@astm.org
EPD Project Report Information	
EPD Project Report	A Regionalized Industry-Average Cradle-to-Gate LCA of Precast Concrete Products Produced by CCPPA Members, January 2023
Prepared by Athena Sustainable Materials Institute	Athena Sustainable Materials Institute 280 Albert St., Suite 404 Ottawa, ON, Canada K1P 5G8 info@athenasmi.org
This EPD project report was independently verified by in accordance with ISO 14025 and the reference PCR:	Thomas P. Gloria, Ph. D. Industrial Ecology Consultants 35 Bracebridge Rd. Newton, MA 02459-1728 t.gloria@industrial-ecology.com
This EPD was prepared using Athena Institute's pre-verified EPD Concrete Tool v2 (February 2022)	
PCR Information	
Program Operator	NSF and ASTM International
Reference PCR	NSF PCR for Precast Concrete, V3.0, May 2021[5]
PCR review was conducted by:	Dr. Thomas Gloria, Industrial Ecology Consultants Mr. Bill Stough, Bill Stough, LCC Dr. Michael Overcash, Environmental Clarity

1 PRODUCT IDENTIFICATION

1.1 PRODUCT DEFINITION

Precast concrete (UN CPC 3755) is a construction product produced by casting concrete in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site, and lifted into place. In contrast, standard concrete is placed into site-specific forms and cured on site. Precast concrete is primarily composed of portland cement, aggregates, and steel reinforcement materials. The applicable Canadian product standard for precast concrete products is CSA 23.4 Precast Concrete – Materials and Construction

For the purposes of this EPD the following broad descriptive definition for concrete box structures is as follows:

Box Structures: Precast boxes are a structural product used primarily for drainage, but versatile enough to use in a variety of configurations such as vertical access chambers or lift stations, and horizontal tunnels, pedestrian underpasses, and onsite detention systems.

Industry standards for box structures such as OPSS 1821 or ASTM C1433 provide a cost-effective product while ensuring a consistently high quality. Box units are designed to meet Canadian Highway Bridge Design Code requirements and can be engineered to accommodate specialized loading conditions or almost any application that an engineer or designer can imagine.

This EPD represents a baseline for the production of concrete box structures and exemplifies an average product group as an average from more than one manufacturer. Further, this EPD reports regional results as follows: ***Western Canada*** (BC, AB, SK and MN) and ***Ontario, Canada*** (ON).

2 PRODUCT APPLICATION

Concrete box structures products are engineered products satisfying a wide array of building and civil engineering applications.

3 DECLARED UNIT

The declared unit is 1 metric tonne of concrete box structures.

4 MATERIAL CONTENT

Table 1 presents the regional weighted average material content by input material for the concrete box structures product groups as derived from participating member facilities LCI data for the timeline 2021.

Table 1: Material Content for Concrete Box Structure Product Groups

Inputs	Ontario Region Ingredients (kg/tonne)	Western Region Ingredients (kg/tonne)
Cement		
Portland Cement (GU)	142.1	151.4
Aggregate		
Crushed Coarse Aggregate	339.8	363.8
Crushed Fine Aggregate	201.6	255.8
Natural Fine Aggregate	180.2	142.2
Natural Coarse Aggregate	0.0	0.0
SCMs		
Slag Cement	64.6	0.0
Fly Ash	0.0	48.3
Other Materials		
Welded Wire Reinforcement	24.4	18.8
Reinforcing bar	0.0	12.4
Steel Anchors	0.19	0.22
Cold Drawn Wire Reinforcement	0.0	0.0
Batch water (L)	69.3	48.5
Admixtures/form release agents (L)	0.2	0.2

5 PRODUCTION STAGE

Figure 1 shows the production stage system boundary for the declared product system.

PRODUCTION STAGE			CONSTRUCTION STAGE		USE STAGE							END OF LIFE STAGE			
Extraction and upstream production	Transport to Factory	Manufacturing	Transport to site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / Demolition	Transport	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

Figure 1 Production stage system boundary

The Production Stage includes the following processes [5]:

- A1 - Extraction and processing of raw materials, including fuels used in product production and transport within the manufacturing process (A3);
- A2 - Average or specific transportation of raw materials from the extraction site or source to manufacturing site, inclusive of empty backhauls (where applicable);
- A3 - Manufacturing of each precast product including all energy and materials required and all emissions and wastes produced;
- Average or specific transportation from manufacturing site to recycling/reuse/landfill for pre-consumer wastes and unutilized by-products from manufacturing, including empty backhauls (where applicable); and
- Final disposition of pre-consumer wastes inclusive of transportation.

The Production Stage excludes the following processes [5]:

- Production, manufacture, and construction of manufacturing capital goods and infrastructure;
- Formwork;
- Production and manufacture of production equipment, delivery vehicles, and laboratory equipment;
- Personnel related activities (travel, office operations and supplies); and
- Energy and water use related to company management and sales activities that may be located either within the factory site or at another location.

6 LIFE CYCLE INVENTORY

6.1 DATA COLLECTION AND REPRESENTATIVENESS

Life cycle inventory data were collected from 18 facilities within Canada for the 2021 reference year – representing more than 75% of CCPPA's membership. In total the participating facilities produced in the order of 1 million metric tonnes of precast products.

All gate-to-gate LCI flow data for energy, total water use, emissions and waste generated were averaged on the annual production basis across facilities to determine an overall per unit precast plant operations profile. These per unit gate-to-gate operational flows were used to estimate the plant production effects across all precast product groups as plants were unable to provide detailed process breakdowns for each product type but provided annual product group production figures. Hardware (lifting or connection) was included. Each plant also provided averaged formulation data for each product group they produce, and these data too were also averaged on a production weighted basis, but only across plants producing the precast product of interest; in this case concrete box structures.

6.2 SECONDARY LCI DATA SOURCES A1-A3

Flow Ref.	Materials	LCI Data Source	Year / Region	Data Quality Assessment
A1-1	GU and GUL Cement *ASTM C150, C595, C1157*	Calculated based on EPD data for specific suppliers	2021-2022 Canada	• Technology: very good • Time: very good • Geography: very good • Completeness: very good • Reliability: very good
A1-2	Fly Ash *ASTM C618*	None, no incoming burden, only transport is considered	N/A	• N/A • Recovered material
A1-3	Silica Fume *ASTM c1240*	None, no incoming burden, only transport is considered	N/A	• N/A • Recovered material
A1-4	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

Flow Ref.	Materials	LCI Data Source	Year / Region	Data Quality Assessment
A1-5	Crushed Aggregates *coarse and fine* *ASTM C33*	ecoinvent 3.4: "Gravel, crushed {RoW}| production | Cut-off, U" (2018) Modified foreground process with region-specific electricity grid.	2001 World/ Regional	• Technology: very good • Time: poor • Geography: good • Completeness: very good • Reliability: very good
A1-6	Natural Aggregates *coarse and fine* *ASTM C330*	ecoinvent 3.4: "Gravel, round {RoW}| gravel and sand quarry operation | Cut-off, U" (2018) Modified foreground process with region-specific electricity grid.	2001 World/ Regional	• Technology: very good • Time: poor • Geography: good • Completeness: very good • Reliability: very good
A1-7	Pelletized Slag	Slag Cement Association EPD of North America Slag Cement, Module A1 (2021)	2021 North America	• Technology: very good • Time: very good • Geography: very good • Completeness: very good • Reliability: very good
A1-8	Admixtures *ASTM C494*	EFCA EPDs for Air Entrainers, Plasticisers and superplasticisers, Hardening Accelerators, Set Accelerators, Water Resisting Admixtures, and Retarders (2015) [8] Non-supported LCIA indicators estimated – adjusted using TRACI equivalents	2022 EU	• Technology: very good • Time: very good • Geography: fair • Completeness: good • Reliability: very good
A1-9	Batch and Wash Water *ASTM C1602*	ecoinvent 3.4: Tap water {RoW}| market for | Cut-off, U (2018) [18] Modified foreground process with Canada average electricity grid	2011 World/ USA	• Technology: very good • Time: good • Geography: good • Completeness: very good • Reliability: very good
A1-10	Steel Plate	American Iron and Steel Institute – Life Cycle Inventories of North American Steel Products (2020) – wire and plate	2017 USA	• Technology: very good • Time: very good • Geography: good • Completeness: very good • Reliability: very good

Flow Ref.	Materials	LCI Data Source	Year / Region	Data Quality Assessment
A1-11	Rebar, Welded Wire, Steel Stressing Strand*	Concrete Reinforcing Steel Institute EPD for Steel Reinforcement Bar (2020) – *Adjusted by factor 1.10 for Steel Stressing Strand	2022 North America	• Technology: very good • Time: very good • Geography: good • Completeness: very good • Reliability: very good
A2-1	Road	USLCI 2014: Transport, combination truck, short-haul, diesel powered/tkm/RNA (2014) [13]	2010 USA	• Technology: very good • Time: good • Geography: very good • Completeness: very good • Reliability: very good
A2-2	Rail	USLCI 2014: Transport, train, diesel powered /US U (2014) [13]	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
A2-3	Ocean	USLCI 2014: Transport, ocean freighter, average fuel mix /US U (2014) [13]	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
A2-4	Barge	USLCI 2014: Transport, barge, average fuel mix /US U (2014) [13]	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
A3-1	Electricity	ecoinvent 3.4: Electricity, low voltage {XX}| market for | Cut-off, U (2018) [18] Modeled based on provincial-specific electricity grids	2015 CAN	• Technology: very good • Time: very good • Geography: very good • Completeness: very good Reliability: very good
A3-2	Natural Gas	USLCI 2014: Natural Gas, combusted in industrial boiler /US U (2014)	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
A3-3	Diesel	USLCI 2014: Diesel, combusted in industrial equipment /US U (2014) [13]	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good

Flow Ref	Process	LCI Data Source	Year / Region	Data Quality Assessment
A3-4	Gasoline	USLCI 2014: Gasoline, combusted in equipment /US U (2014) [13]	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
A3-5	Liquefied Propane Gas	USLCI 2014: Liquefied petroleum gas, combusted in industrial boiler /US U (2014) [13]	2007 USA	• Technology: very good • Time: fair • Geography: very good • Completeness: very good • Reliability: very good
A3-6	Hazardous Solid Waste,	ecoinvent 3.4: Hazardous waste, for incineration {RoW}| treatment of hazardous waste, hazardous waste incineration | Alloc Rec, U (2018) [18] Modified foreground process with Canada average electricity grid	2011 World/ USA	• Technology: very good • Time: good • Geography: good • Completeness: very good • Reliability: very good
A3-7	Non-Hazardous Solid Waste	ecoinvent 3.4: Inert waste {RoW}| treatment of, sanitary landfill | Alloc Rec, U (2018) [18] Modified foreground process with United States average electricity grid	2011 World/ USA	• Technology: very good • Time: good • Geography: good • Completeness: very good • Reliability: very good

6.3 CUT OFF RULES, ALLOCATION RULES AND DATA QUALITY REQUIREMENTS

Cut-off rules, as specified in NSF PCR for precast concrete: 2021, Section 7.1.8 were applied [5]. All input/output flow data reported by the participating member facilities were included in the LCI modeling. None of the reported flow data were excluded based on the cut-off criteria. No substances with hazardous and toxic properties that pose a concern for human health and/or the environment were identified in the framework of this EPD.

Allocation procedures observed the requirements and guidance of ISO 14044:2006, clause 4.3 and those specified in NSF PCR for precast concrete, section 7.1. The majority of the precast facility operations were dedicated to the production of one or more precast product groups. A small number of the facilities also produced other specialty precast products – a co-product - and in such instances “mass” allocation was used to allocate facility LCI environmental flows (inputs and outputs) across the co-products for those facilities prior to calculating and rolling up the weighted average LCI flows for the gate-to-gate process and individual product groups.

In addition, the following allocation rules are applied:

- Allocation related to transport is based on the mass and distance of transported inputs;
- The NSF sub-category PCR recognizes fly ash, silica fume and granulated bast furnace 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 precast concrete material input. That is, any allocations before reprocessing are allocated to the original product;
- The environmental flows related to the disposal of the manufacturing (pre-consumer) solid and liquid waste are allocated to module A3 Manufacturing.

Data quality requirements, as specified in NSF's Precast Concrete PCR: 2021, section 7.1.9, were observed [5]. This section also describes the achieved data quality relative to the ISO 14044:2006 requirements. Data quality is judged on the basis of 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).

Precision: The Canadian participating member companies through measurement and calculation collected primary data on their production of precast concrete and the various sub-group product categories. For accuracy the LCA team individually validated these plant gate-to-gate input and output data.

Completeness: All relevant, specific processes, including inputs (raw materials, energy and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent industry average precast concrete. The relevant background materials and processes were taken from the US LCI Database, ecoinvent v 3.4 LCI database for Canada, United States and/or global and modeled in Athena's pre-verified Concrete LCA Software v2 (February 2022).

Consistency: To ensure consistency, the LCI modeling of the production weighted input and output LCI data for each regional precast product used the same modeling structure across the member facilities producing these products, which consisted of input raw and ancillary material, energy flows, water resource inputs, product and co-products outputs, emissions to air, water and soil, and material recycling and pre-consumer solid and liquid waste treatment. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in CCPPA Precast Athena LCI database developed in Athena's pre-verified Concrete LCA Software v2. A high level of transparency is provided throughout the LCA background report (publicly available) as the weighted average LCI profile for each product sub-group is presented for the declared product. Key primary (manufacturer specific) and secondary (generic) LCI data sources are also summarized in the LCA background report. The provision of more detailed data to allow full external reproducibility was not possible due to reasons of confidentiality.

Representativeness: The representativeness of the data is summarized as follows.

- ***Time related coverage*** of the precast manufacturing process - primary data collected: 2021 (12 months).
- Generic data: the most appropriate LCI datasets were used as found in the US LCI (adjusted) Database, ecoinvent v.3.4 database for United States, Canada and global.
- Sector specific data: each regional concrete box structures profile is based on plant specific cement production EPDs as used at each regional precast plant.
- ***Geographical coverage***: the geographical coverage is Canada (two regions).
- ***Technological coverage***: typical or average.

7 LIFE CYCLE ASSESSMENT

7.1 RESULTS OF THE LIFE CYCLE ASSESSMENT

This section summarizes the results of the life cycle impact assessment (LCIA) based on the cradle-to-gate life cycle inventory inputs and outputs analysis. The regional results are calculated on the basis of one metric tonne (1,000 kg) of concrete box structures (Tables 2 and 3). The concrete box structures production results are delineated by information module (A1 – Raw material supply), (A2 – Raw material transport), and (A3 – precast core manufacturing). Tables 4 and 5 represent the minimum and maximum values for concrete box structures.

As per NSF PCR for precast concrete:2021, Section 7.3, the US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), version 2.1, 2012 impact categories are used as they provide a North American context for the mandatory category indicators to be included in this EPD. These are relative expressions only and do not predict category impact end-points, the exceeding of thresholds, safety margins or risks. Total primary and sub-set energy consumption was compiled using a cumulative energy demand model. Material resource consumption and generated waste reflect cumulative life cycle inventory flow information. In addition, some LCA impact categories and inventory items are still under development and can have high levels of uncertainty and demarked with an "*". To promote uniform guidance on the data collection, calculation and reporting of results, the ACLCA methodology guidance (ACLCA 2019) was used [6].

Table 2: LCA results – Concrete Box Structures, one metric ton - Western Region

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Weighted Average Total
Environmental impact Indicators					
Global warming potential (GWP)	kg CO2 eq.	175.33	19.12	47.53	241.98
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.	3.52E-06	8.03E-10	6.61E-07	4.18E-06
Eutrophication potential (EP)	kg N eq.	0.21	0.01	0.30	0.52
Acidification potential of soil and water sources (AP)	kg SO2 eq.	0.37	0.23	0.29	0.89
Formation potential of tropospheric ozone (POCP)	kg O3 eq.	7.01	5.94	1.92	14.87
Use of primary resources					
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	50.37	0.00	37.42	87.79
Renewable primary resources as material, (RPRM)*	MJ, NCV	0.00	0.00	0.00	0.00
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	1070.22	289.26	678.10	2037.58
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
Secondary Materials, (SM)*	kg	0.00	0.00	0.00	0.00
Renewable secondary fuels, (RSF)*	MJ, NCV	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)*	MJ, NCV	0.00	0.00	0.00	0.00
Recovered energy, (RE)*	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
Abiotic depletion potential for fossil resources (ADPfossil)*	MJ, LHV	174.89	272.88	609.53	1057.30
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb	0.00	0.00	0.00	0.00
Consumption of freshwater resources					
Consumption of fresh water	m3	0.53	0.00	0.11	0.64
Waste and output flows					
Hazardous waste disposed*	kg	0.05	0.00	0.20	0.25
Non-hazardous waste disposed*	kg	47.44	0.00	3.00	50.44
High-level radioactive waste*	m3	5.42E-04	0.00E+00	2.32E-09	5.42E-04
Intermediate and low-level radioactive waste*	m3	4.79E-04	0.00E+00	1.81E-08	4.79E-04
Components for reuse*	kg	0.00	0.00	0.00	0.00
Materials for recycling*	kg	0.00	0.00	0.00	0.00
Materials for energy recovery*	kg	0.00	0.00	0.00	0.00
Recovered energy exported from the product system*	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
CO_2 emissions from calcination*	kg CO2 eq.	73.20	0.00	0.00	73.20

Table 3: LCA results- Concrete Box Structures, one metric ton – Ontario Region

Impact category and inventory indicators	Unit	Module A1	Module A2	Module A3	Weighted Average Total
Environmental impact Indicators					
Global warming potential (GWP)	kg CO2 eq.	173.63	7.81	27.59	209.03
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.	4.86E-06	3.29E-10	3.20E-07	5.18E-06
Eutrophication potential (EP)	kg N eq.	0.20	0.01	0.01	0.22
Acidification potential of soil and water sources (AP)	kg SO2 eq.	0.47	0.09	0.22	0.78
Formation potential of tropospheric ozone (POCP)	kg O3 eq.	8.84	2.37	2.25	13.46
Use of primary resources					
Renewable primary energy resources as energy (fuel), (RPRE)*	MJ, NCV	55.76	0.00	30.72	86.48
Renewable primary resources as material, (RPRM)*	MJ, NCV	0.00	0.00	0.00	0.00
Non-renewable primary resources as energy (fuel), (NRPRE)*	MJ, NCV	1158.14	118.44	679.55	1956.13
Non-renewable primary resources as material (NRPRM)*	MJ, NCV	0.00	0.00	0.00	0.00
Use of secondary resources					
Secondary Materials, (SM)*	kg	0.00	0.00	0.00	0.00
Renewable secondary fuels, (RSF)*	MJ, NCV	0.00	0.00	0.00	0.00
Non-renewable secondary fuels (NRSF)*	MJ, NCV	0.00	0.00	0.00	0.00
Recovered energy, (RE)*	MJ, NCV	0.00	0.00	0.00	0.00
Abiotic depletion potential					
Abiotic depletion potential for fossil resources (ADPfossil)*	MJ, LHV	212.61	111.73	405.83	730.17
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb	0.00	0.00	0.00	0.00
Consumption of freshwater resources					
Consumption of fresh water	m3	0.95	0.00	0.29	1.24
Waste and output flows					
Hazardous waste disposed*	kg	0.04	0.00	0.20	0.24
Non-hazardous waste disposed*	kg	45.66	0.00	1.10	46.76
High-level radioactive waste*	m3	1.75E-03	0.00E+00	9.31E-07	1.75E-03
Intermediate and low-level radioactive waste*	m3	3.97E-04	0.00E+00	6.63E-07	3.97E-04
Components for reuse*	kg	0.00	0.00	0.00	0.00
Materials for recycling*	kg	0.00	0.00	0.00	0.00
Materials for energy recovery*	kg	0.00	0.00	0.00	0.00
Recovered energy exported from the product system*	kg	0.00	0.00	0.00	0.00
Additional inventory parameters for transparency					
CO_2 emissions from calcination*	kg CO2 eq.	69.95	0.00	0.00	69.95

Table 4: Maximim Values for Concrete Box structures

Impact category and inventory indicators	Unit	Ontario Box Structures	Western Canada Box Structures
Global warming potential (GWP)	kg CO2 eq.	219.95	252.32
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.	5.60E-06	4.48E-06
Eutrophication potential (EP)	kg N eq.	0.25	0.54
Acidification potential of soil and water sources (AP)	kg SO2 eq.	0.80	0.91
Formation potential of tropospheric ozone (POCP)	kg O3 eq.	14.00	15.18
Abiotic depletion potential for fossil resources (ADPfossil)*	MJ, LHV	733.50	1058.79

Table 5: Minimum Values for Concrete Box Structures

Impact category and inventory indicators	Unit	Ontario Box Structures	Western Canada Box Structures
Global warming potential (GWP)	kg CO2 eq.	198.11	231.65
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq.	4.76E-06	3.88E-06
Eutrophication potential (EP)	kg N eq.	0.19	0.50
Acidification potential of soil and water sources (AP)	kg SO2 eq.	0.77	0.88
Formation potential of tropospheric ozone (POCP)	kg O3 eq.	12.92	14.55
Abiotic depletion potential for fossil resources (ADPfossil)*	MJ, LHV	726.84	1055.81

7.2 INTERPRETATION

Across the three production information modules, module A1- raw material supply contributes the largest share of the impact category results. The upstream raw material supply (A1) also accounts for a large share of energy use; almost all of which is drawn from non-renewable energy sources. Raw material transportation (A2) proves to be a minor contributor to the burdens exhibited by concrete box structures products – generally 10% or less. Manufacturing (A3) concrete box structures products contributes in the order of 15% of all greenhouse gases and about 25% of the primary energy use.

8 ADDITIONAL ENVIRONMENTAL INFORMATION

Quality and Environmental Management Systems

In general, CCPPA member manufacturing facilities follow the ISO 14001 environmental management system, ISO 9001 quality management system or other in-house quality control systems.

9 DECLARATION TYPE AND PRODUCT AVERAGE DECLARATION

The type of EPD is defined as:

A “Cradle-to-gate” EPD of concrete box structures products covering the product stage (modules A1 to A3) and is intended for use in Business-to-Business communication.

This EPD for concrete box structures, UN CPC 3755 is an average product EPD, as an average from several CCPPA member facilities in various regions of the country.

10 DECLARATION COMPARABILITY LIMITATION STATEMENT

The following ISO statement indicates the EPD comparability limitations and intent to avoid any market distortions or misinterpretation of EPDs based on the NSF's Precast Concrete PCR: 2021:

- EPDs from different programs (using different PCR) may not be comparable.

- Declarations based on the NSF Precast Concrete PCR [5] are not comparative assertions; that is, no claim of environmental superiority may be inferred or implied.

11 EPD EXPLANATORY MATERIAL

For any explanatory material regarding this EPD, please contact the program operator.

ASTM International
Environmental Product Declarations
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West Conshohocken,
PA 19428-2959, http://www.astm.org

12 REFERENCES

1. ISO 21930: 2017 Building construction – Sustainability in building construction – Environmental declaration of building products.
2. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.
3. ISO 14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines.
4. ISO 14040: 2006 Environmental management - Life cycle assessment - Principles and framework.
5. NSF PCR for Precast Concrete, V3.0, May 2021.
6. American Center for Life-Cycle Assessment (ACLCA) 2019, ACLCA Guidance to Calculating Non-LCIA Metrics in Accordance with ISO21930:2017 https://aclca.org/aclca-iso-21930-guidance/

Appendix A – Participating Plant List

Coldstream Concrete Ltd.
402 Quaker Lane. R.R#2
Ilderton, Ontario
NOM2A0
www.coldstreamconcrete.com

locations: Ilderton, Ontario

Con Cast Pipe
299 Brock Road South
Puslinch, ON
N0B 2J0
www.concastpipe.com

locations: Oakville, Ontario and Aberfoyle, Ontario

DECAST Ltd.
8807 Simcoe County Road
Utopia, Ontario
L0M 1T0
www.decastltd.com

locations: Utopia, Ontario

Inland Pipe
7336 112 Ave NW,
Calgary, AB
T3R 1R8
www.heidelbergmaterials.us

locations: Calgary, Alberta and Winnipeg, Manitoba

Lafarge Pipe
185 Dawson Road N
Winnipeg, Manitoba
R2J 0S6
www.lafarge.ca

locations: Calgary, Alberta, Edmonton, Alberta, and Winnipeg, Manitoba

Miller Precast Ltd.
58 Cooper Road
Thunder Bay, Ontario
P7K 0E3
www.millerprecast.ca

locations: Thunder Bay, Ontario

Langley Concrete Group
41893 Cannor Rd,
Chilliwack, BC
V2R 0B6
www.langleyconcretegroup.com

locations: Chilliwack and Duncan, British Columbia

M CON Products
2150 Richardson Side Rd, Carp, ON
K0A 1L0
www.mconproducts.com

locations: Carp, Ontario

Ocean Concrete
1415 Johnston St,
Vancouver, BC
V6H 3R9
www.heidelbergmaterials.us

locations: Vancouver, British Columbia

Precon
2 CP Rail Rd, Township Rd 94
Coalhurst, AB
T0L 0V0
www.precon.ca

locations: Coalhurst, Alberta

Proform Concrete
240 Burnt Park Way, Red Deer County, AB
T4S 2L4
www.proform.ca

Rinker Pipe
5598 Power Road
Ottawa, Ontario
K1G 3N4
www.rinkerpipe.com

locations: Red Deer, Alberta

S-3 Precast
#100 – 53251 RR232
Sherwood Park, AB
T8A 4V2
www.tanks-a-lot.com

locations: Edmonton, Alberta

Tri-Kon Precast Concrete Products Ltd.
601 Patterson St W,
Cranbrook, BC V1C 6T3
www.trikonprecast.com

locations: Cranbrook, British Columbia

locations: Ottawa, Ontario and Cambridge, Ontario

Souris Valley Industries
Intersection 13 & 39 Range Road 2150 on Highway 39,
Weyburn, SK
S4H 2K3
www.sviprecast.com

locations: Weyburn, Saskatchewan