Environmental Product Declaration (EPD) for Concrete

Interlocking Concrete Pavers and Paving Slabs

ENVIRONMENTAL PRODUCT DECLARATION VERIFICATION

Certified Environmental Product Declaration
www.nsf.org

Expocrete an Oldcastle® company

Expocrete, an Oldcastle® company is the recognized leading manufacturer and innovator of Hardscapes and Masonry products throughout Western Canada. Our products are the preferred choice among contractors, developers, builders, architects and designers alike and we are proud of our standing as one of the most admired companies in our industry.

Expocrete recognizes the role we must play in helping to develop the economic, social and environmental solutions that will meet today's demands while preserving the promise of the future. We are committed to using our resources to develop innovative technologies that drive all aspects of economic and community growth and prosperity.

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EPD Information			
Program Operator		NSF International	
Declaration Holder		Expocrete, an Oldcastle Company	
Product Interlocking Concrete Pavers and Paving Slabs	Date of Issue October 26, 2015	Period of Validity Five years	Declaration Number EPD10067
This EPD was independently verified by NSF International in accordance with ISO 14025: ☐ Internal ☒ External		 Jenny Oorbeck joorbeck@nsf.org	
This life cycle assessment was independently verified by in accordance with ISO 14044 and the reference PCR:		 Jack Geibig Ecoform jgeibig@ecoform.com	
LCA Information			
Basis LCA		Life Cycle Assessment Manager for Segmental Concrete Paving Products EPD September 2015	
LCA Preparer		David Green BASF Corporation 216-839-7803	
This life cycle assessment was critically reviewed in accordance with ISO 14044 by:		Jack Geibig jgeibig@ecoform.com	
Program Operator		NSF International	
Reference PCR		Segmental Concrete Paving Products	
Date of Issue		April 2015	
PCR review was conducted by:		Nicholas Santero PE International (Thinkstep) ASTM International http://www.astm.org	

Environmental Product Declaration for Segmental Concrete Paving Products

Declared Unit: 1 m^3 of concrete

	Expocrete Interlocking Concrete Pavers and Paving Slabs
TOTAL PRIMARY ENERGY CONSUMPTION	
Nonrenewable fossil, nuclear	6,367 MJ
Renewable (solar, wind, hydroelectric, and geothermal)	302 MJ
Renewable (biomass)	428 MJ
TOTAL MATERIAL RESOURCE CONSUMPTION	
Nonrenewable material resources	2.28E+03 kg
Renewable material resources	1.61E+01 kg
Net fresh water	1.08E+02 l
Non-hazardous generated	1.71E-01 kg
Hazardous waste generated	0 kg
LIFE CYCLE IMPACT CATEGORY INDICATOR	
Global warming potential	539 kg CO_2 eq
Acidification potential	3 kg SO_2 eq
Eutrophication potential	0.1 kg N eq
Smog creation potential	58.2 kg O_3 eq
Ozone depletion potential	4.74E-08 kg CFC-11 eq

characterization factors based on TRACI 2.1

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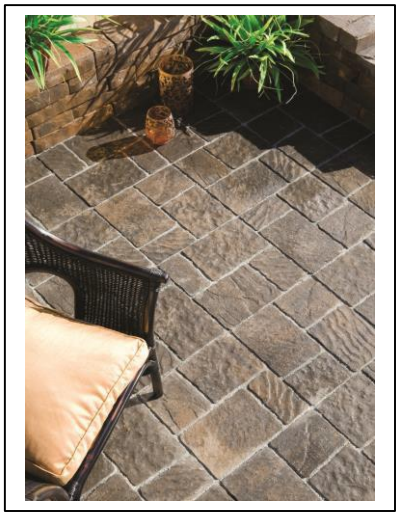
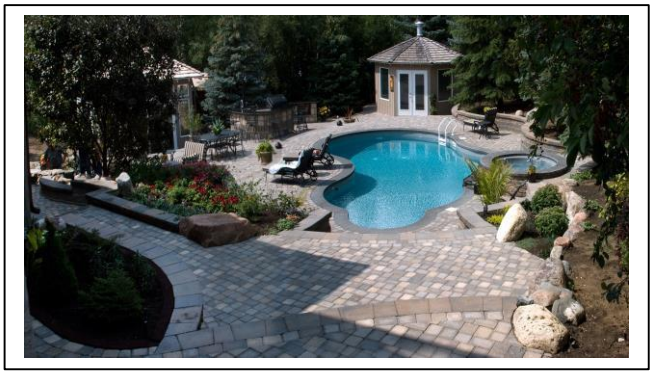
ENVIRONMENTAL PRODUCT DECLARATION: DETAILED VERSION

Product Description

The Expocrete segmental pavers and slabs represented by this cradle-to-gate EPD are produced at the Balzac plant, 260032 RR 291 Balzac, Alberta T0M 0E0 under CSA A231.1 and A231.2 specifications for interlocking concrete pavers and segmental concrete paving slabs.





Interlocking concrete pavement systems

Declared Unit

The ASTM PCR for segmental concrete paving products only covers the cradle-to-gate life-cycle stages. Therefore, the declared unit for this EPD is one (1) m^3 of concrete formed into segmental concrete paving products. The EPD may be presented additionally per one (1) yd^3 of concrete.

System Boundaries

Based on the ASTM PCR, the system boundaries are defined as the modules for raw material supply, transportation of inbound materials and the manufacturing process also known as the Product Stage. The stages include extraction and processing of raw materials (raw material supply), the average or specific transportation of raw materials from extraction site or source to the manufacturing site including empty backhauls (transportation of inbound materials) and the manufacturing of the product including the batching and mixing of the concrete, forming of the units, curing of the units and the applicable post-production finishing of the units which includes the packaging with associated transportation and waste disposal in preparing the product for shipment (manufacturing process).

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Waste Management

Hazardous and non-hazardous waste generated within the system boundaries and transported outside of the plant facility are reported in the EPD per declared unit.

Certification Other Standards/Additional Testing Requirements

Each product presented in this EPD conforms to the appropriate ASTM and/or CSA specification which provides detailed descriptions and specifications for each of the products.

Allocation Rules

A production process that generates more than one type of product may require the allocation of environmental flows from the process to the different products to get product-based inventory data. If allocation is necessary, the requirements and guidance of ISO 14044, Section 4.3.4 are followed.

i. Recycled and recovered materials are considered raw materials. Only the materials, water, energy, emissions and other elemental flows associated with reprocessing, handling, sorting and transportation from the point of the generating industrial process to their use in the production process was considered.

ii. Slag, fly ash and silica fume are considered recovered materials, not co-products.

iii. Allocation related to the transportation of materials is based on the mass of the transported material or product.

iv. Emissions from the downstream recycling or combustion of a product after the end-of-waste state is allocated to the new downstream product(s). Incineration of wastes for energy production at the primary production site are allocated to the building product unless the energy is exported.

v. Concrete that is crushed for recycling and used as a substitute for aggregate for the production of manufactured concrete and concrete masonry products is treated as closed-loop recycling. The flows and impacts associated with the recovery and crushing of the recycled concrete is taken into account and allocation is not necessary as the use of secondary material displaces the use of primary materials.

vi. A deviation of greater than 20% where different allocation options are relevant requires a sensitivity analysis. The different allocation approaches and data sets are documented within this EPD.

Units and Quantities

The standard SI unit is used for reporting results. IP units reported are converted using the following conversion factors.

Multiply	By	To convert to
Square meter (m^2)	10.76391	Square foot (ft^2)
Kilogram (kg)	2.204622	Pound (lb)
Megajoule (MJ)	947.8170	British Thermal Unit (BTU)
Degree Celsius (°C)	(°C*9/5)+32	Degree Fahrenheit (°F)
Cubic meter (m^3)	35.31466	Cubic foot (ft^3)
Meter (m)	3.281	Foot (ft)
Metric tonne (t)	1.102	Ton

Calculation Rules and Data Quality Requirements

Calculations

All inputs and outputs of a unit process for which data is reasonably available is included in the calculations. Any application of the criteria for the exclusion of inputs and outputs is documented. Data gaps that have been filled with conservative assumptions with average or generic data is documented.

The cutoff criteria for the consideration of flows is as follows:

Mass – a flow less than 1% of the cumulative mass of the unit process may be excluded if its environmental relevance is minor.

Energy – a flow less than 1% of the cumulative energy of the system model may be excluded if its environmental relevance is minor.

Environmental relevance – material and energy flows that are known or expected to have potentially relevant emissions to air, water or soil relative to the indicators noted in the PCR are included.

At least 95% of the energy usage and mass flow are included. The life cycle impact data includes at least 95% of all elementary flows that contribute to each of the declared category indicators.

Data Quality

• The data used in the generation of this EPD is representative according to the temporal, geographical and technological requirements of the PCR.
• The information representing the manufacturing process uses annual average values.
• The average background data is less than ten years for industry average data and five years for producer specific data.
• The owner of the EPD that is not the owner of all upstream processes contacted their suppliers within the system boundary for upstream data. The best available data from literature was used when upstream data was not provided. The literature based data meets the data quality requirements of the PCR.

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Product Characteristics

This EPD represents the specific environmental impacts associated with the production of segmental concrete paving products including interlocking concrete pavers, segmental concrete paving slabs and concrete grid paving units and complies with ASTM C936/C936M or CSA A231.1, CSA A231.1 and ASTM C1319.

Material Content/Base Materials

The materials for the production of a m^3 of concrete for segmental concrete paving products are listed here by mass (kg/m^3).

Ingredient	Mass
Cement	316
Fly Ash	79
Fine Aggregate	1,994
Course Aggregate	126
Water	128
MasterCast 900	4.0
MasterPel 240	3.9

Production/Manufacturing

The product manufacturing phase includes the extraction and processing of raw materials, the average or specific transportation of raw materials from extraction site or source to the manufacturing site including empty backhauls and the manufacturing of the product including the batching and mixing of the concrete, forming of the units, curing of the units and the applicable post production finishing of the units. A process diagram is shown here.

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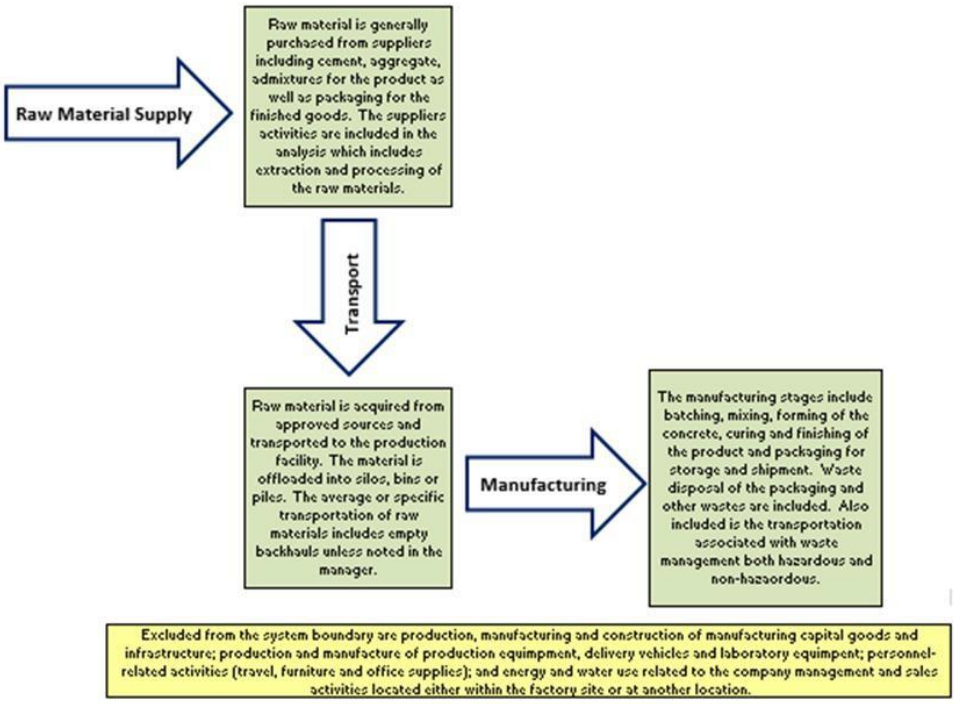

Life Cycle Assessment Stages

The life-cycle stages and individual modules included within the LCA system boundaries are shown here. The EPD that are based on this PCR include modules A1-A3. The results of these modules may be reported as one aggregated module A1-A3.

Product Stage			Construction Process Stage		Use Stage							End of Life Stage			
Raw Material Supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4

Life-cycle Stages and Modules - highlighted area is included in the EPD Manager

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Life Cycle Assessment (LCA)

The data used for the generation of EPD are representative according to temporal, geographical and technological requirements per the PCR. Additional details are provided in the EPD Project Report.

Temporal: The information obtained from the manufacturing process is based on annual values generated within the past twelve-month period. Any average background data greater than ten years old is noted in the attached table and accompanied by a statement attesting to the validity of the data.

Geographical: The geographic region for the relevant life-cycle stages included in the calculation of representative data is documented in the following table.

Technological: All of the data is representative of current technology in use.

LCI	Database	Year (Updated)	Region	Technology
Portland Cement	BEST	2015	United States	Current
Fly Ash	BEST	2014	United States	Current
Natural aggregate	BEST	2015	Canada	Current
Natural course aggregate	BEST	2015	Canada	Current
Water	BEST	2015	Canada	Current
Recycled water	BEST	2015	United States	Current
MasterPel 200 HD	BEST	2015	United States	Current
MasterPel 240	BEST	2015	United States	Current
MasterPel 240 MA	BEST	2015	United States	Current
MasterCast 630S	BEST	2015	United States	Current
MasterCast 750 HS	BEST	2015	United States	Current
MasterCast 825	BEST	2015	United States	Current
MasterCast 900	BEST	2015	United States	Current
MasterCast 900S	BEST	2015	United States	Current
Wood	BEST	2015	Canada	Current
Cardboard	BEST	2015	Canada	Current
Plastic	BEST	2014	Regional Avg	Current
Electricity	BEST	2013	Canada	Current
Diesel	BEST	2015	Canada	Current
Natural Gas	BEST	2015	Canada	Current
Truck	BEST	2015	Canada	Current
Rail	BEST	2015	Canada	Current
Sea	BEST	2014	Regional Avg.	Current

Parameters to be Declared in the EPD

The information declared in this EPD is based on the requirements of the PCR. The results are presented on page 3 of this document and include the declaration of environmental category indicators, the use of resources and the generation of wastes. The results presented are based on the specific product description for this EPD. This EPD is based on cradle-to-gate analysis. EPD that are created using different PCR may not be compatible. Additional information and explanatory materials can be requested through NSF International. In the event that this EPD represents an average performance for the products depicted, the EPD will represent an average performance.

References

1. ASTM International Product Category Rules (PCR) for Segmental Concrete Paving Products (UN CPC 3755), April 2015.
2. Saling, P., A. Kicherer, B. Dittrich-Kraemer, R. Wittlinger, W. Zombik, I. Schmidt, W. Schrott, and S. Schmidt. 2002. Eco-efficiency Analysis by BASF: The Method. Int. J. Life Cycle Assess., 7 (4): 203.
3. Shonnard, D.; Kicherer, A; and Saling, P. Industrial Applications Using BASF Eco-Efficiency Analysis: Perspectives on Green Engineering Principles. Environ. Sci. Technol. 2003, 37, 5340-5348.
4. ISO, International Organization for Standardization. Environmental Management-Life Cycle Assessment-Principles and Framework; ISO 14040:2006; ISO 14044:2006. ISO, Geneva, Switzerland, www.iso.org (2006)
5. ISO, International Organization for Standardization. Environmental Management-Eco-efficiency assessment of product systems -- Principles, requirements and guidelines; ISO 14045. ISO, Geneva, Switzerland, www.iso.org (2012)
6. Boustead Consulting Ltd UK, The Boustead Model 5.1.2600.2180 LCA database

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