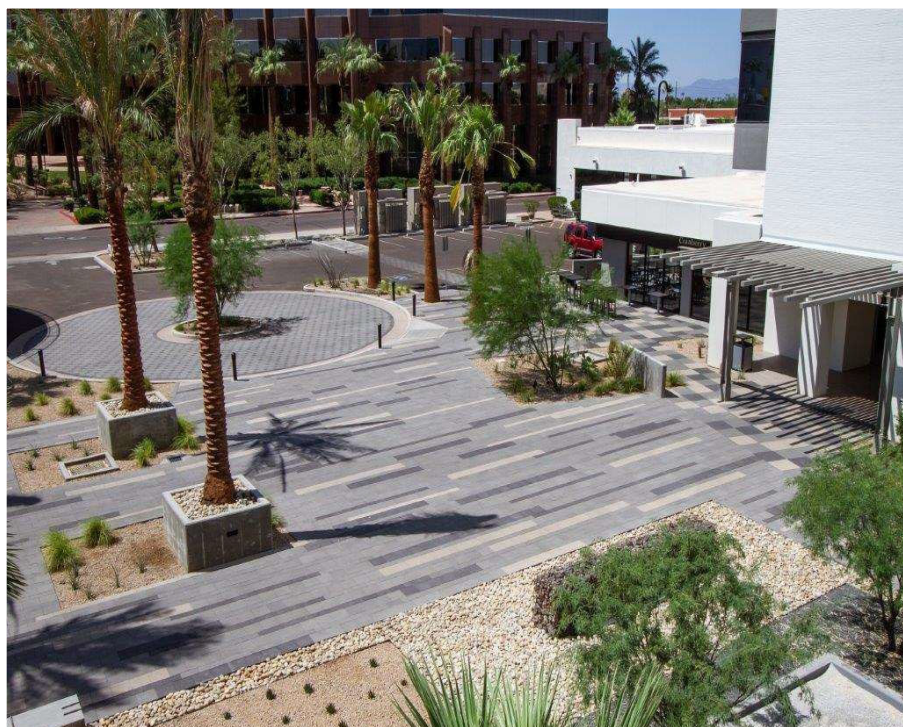


# Environmental Product Declaration (EPD) for Concrete

Superlite | Belgard Concrete Interlocking Paving Unit

**ENVIRONMENTAL PRODUCT DECLARATION VERIFICATION**



## Superlite

Since 1946, Superlite's manufacturing facilities have produced Architectural Masonry and Concrete products.

These products include the traditional and antiqued paver and wall series, concrete block, and brick. Superlite products have a long history of successful applications on thousands of residential and commercial projects throughout Arizona.

Each day, in all plants, finished products are systematically sampled and are put through comprehensive test. These tests include measuring resistance to temperature extremes, product stability, consistency of mixture and load-bearing capacity, among many other physical and chemical characteristics.


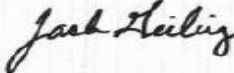

To learn more about Superlite, an Oldcastle® company visit our website: [www.superlite.com](http://www.superlite.com)



**Certified  
Environmental  
Product Declaration**  
[www.nsf.org](http://www.nsf.org)

# Environmental Product Declaration (EPD) for Concrete

## ENVIRONMENTAL PRODUCT DECLARATION VERIFICATION

EPD Information			
Program Operator		NSF Certification, LLC	
Declaration Holder		Superlite, an Oldcastle Company	
Product 60/80 mm Solid Concrete Interlocking Paving Units	Date of Issue March 27, 2020	Period of Validity 5 years	Declaration Number EPD10351
This EPD was independently verified by NSF Certification, LLC in accordance with ISO 14025 and ISO 21930:2007		 Jenny Oorbeck joorbeck@nsf.org	
<input type="checkbox"/> Internal	<input checked="" type="checkbox"/> External		
This life cycle assessment was independently verified by in accordance with ISO 14044 and the reference PCR:		 Jack Geibig Ecoform, LLC jgeibig@ecoform.com	
LCA Information			
Basis LCA		Life Cycle Assessment Manager for Concrete Interlocking Paving Units 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 Ecoform, LLC jgeibig@ecoform.com	
PCR Information			
Program Operator		NSF International	
Reference PCR		Segmental Concrete Paving Products - ASTM International	
Date of Issue		April 2015	
PCR review was conducted by:		Nicholas Santero (Chairperson) PE International (Thinkstep) ASTM International <a href="http://www.astm.org">http://www.astm.org</a>	

EPD Program Operator  
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Date of Issue: March 27, 2020  
 Period of Validity: 5 years  
 Declaration#: EPD10351

# Environmental Product Declaration (EPD) for Concrete

## LIFE CYCLE ASSESSMENT RESULTS SEGMENTAL CONCRETE PAVING PRODUCTS PER m<sup>3</sup> OF CONCRETE

Environmental Indicator	Units	Life Cycle Stage		
		A1	A2	A3
<b>TRACI 2.1 Impact Categories</b>				
Global warming potential (GWP)	kg CO <sub>2</sub> eq	3.86E+02	1.09E+01	5.39E+00
Acidification potential	kg SO <sub>2</sub> eq	1.95E+00	6.90E-02	1.50E-02
Eutrophication potential	kg N eq	4.60E-02	4.00E-03	6.52E-04
Smog creation potential	kg O <sub>3</sub> eq	2.48E+01	1.92E+00	1.32E-01
Ozone depletion potential	kg CFC-11 eq	1.42E-06	4.13E-10	-2.86E-13
<b>Total primary energy consumption</b>				
Nonrenewable fossil	MJ (HHV)	1.69E+03	1.39E+02	1.00E+02
Nonrenewable nuclear	MJ (HHV)	3.62E-04	0.00E+00	0.00E+00
Renewable (solar, wind, hydroelectric, geothermal)	MJ (HHV)	1.21E+01	0.00E+00	1.16E+01
Renewable (biomass)	MJ (HHV)	1.77E-02	0.00E+00	0.00E+00
<b>Material resource consumption</b>				
Nonrenewable material resources	kg	1.59E+03	1.38E+02	8.16E+01
Renewable material resources	kg	6.17E-04	4.54E-09	1.46E-06
Net fresh water	L	3.24E-01	0.00E+00	3.00E-02
<b>Waste generation</b>				
Non-hazardous waste generated	kg	3.46E+01	0.00E+00	2.70E-02
Hazardous waste generated	kg	1.65E-07	0.00E+00	4.34E-08

**Note:** Only EPDs prepared from cradle-to-grave life-cycle results and based on the same function, reference service life (RSL), quantified by the same functional unit, and meeting all the conditions in ISO 14025, Section 6.7.2 can be used to assist purchasers and users in making informed comparisons between products.

# Environmental Product Declaration (EPD) for Concrete

## ENVIRONMENTAL PRODUCT DECLARATION: DETAILED VERSION

### Product Description

Durable, stylish and versatile, Belgard Commercial's interlocking concrete pavers are practical for a variety of commercial paving stone applications. Our selection of durable pavers includes paving stones in multiple sizes, shapes and textures to complement traditional or contemporary styles. Our pavers are ideal for high traffic walkways, driveways, patios and terraces. Superlite Belgard Interlocking Paving Units represented by this cradle-to-gate EPD are produced at two plants in Arizona: Lone Bute (6741 W. Germann Rd #5086 Chandler, AZ 85226) and Highland (4150 W. Turney Ave Phoenix, AZ 85019) under the ASTM C-936/C936M specifications for interlocking concrete pavers. The product is used in various patios, walkways and driveway applications.



### 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<sup>3</sup> of concrete formed into segmental concrete paving products. The EPD may be presented additionally per one (1) yd<sup>3</sup> 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).



### 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 provide 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. Any

# Environmental Product Declaration (EPD) for Concrete

- allocations before reprocessing are allocated to the original product.
- 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 paving product unless the energy is exported.
  - v. Concrete recycling processes are treated as closed-loop recycling when the recycled concrete is crushed and used as a substitute for aggregate for the production of segmental concrete paving products. Only the flows and impacts associated with the recovery and crushing of the recycled concrete is taken into account and allocation is avoided since 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. Different allocation approaches and data sets that are applied 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 <sup>2</sup> )	10.76391	Square foot (ft <sup>2</sup> )
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 <sup>3</sup> )	35.31466	Cubic foot (ft <sup>3</sup> )
Meter (m)	3.281	Foot (ft)
Metric tonne (t)	1.102	Ton
M <sup>2</sup> K/W	5.6783	ft <sup>2</sup> Fhr/Btu

## 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 where data is not reasonably available is as follows:

**Mass** – a flow less than 1% of the cumulative mass of the model flows 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

# Environmental Product Declaration (EPD) for Concrete

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 accurate and representative of the production process, current technology and current measurement capability.
- 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.

## 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, CSA A231.2, ASTM C1782/C1782M, CSA A231.1 or ASTM C1319 for the represented product.

## Material Content/Base Materials

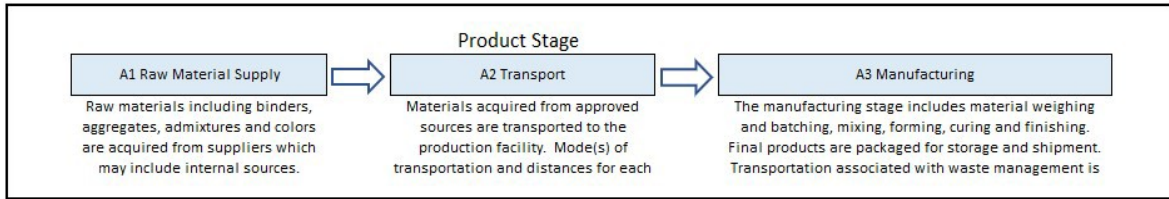
The materials for the production of one m<sup>3</sup> of concrete for segmental concrete paving products are listed here by mass (kg/m<sup>3</sup>).

Ingredient	Mass
Cement	250 – 300
Fine Aggregate	1000 - 1500
Course Aggregate	300 – 500
Water	50 - 150
MasterCast 900	0.4 – 0.7
MasterPel 240	0.3 – 0.5

## 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.


# Environmental Product Declaration (EPD) for Concrete



Main unit processes by life-cycle stage

## 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

## 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. The database used for LCA calculations was GaBi ts version 9.2.0.58



**Temporal:** The information relative to the manufacturing process is based on annual values generated within the past twelve-month period. None of the average background data is greater than ten years old.

**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 data used in this EPD are representative of current technological practices.

# Environmental Product Declaration (EPD) for Concrete

LCI	Data Base	Version	Year (Updated)	Region
Portland cement	GaBi	9.2.0.58	2016	US
Natural sand	GaBi	9.2.0.58	2014	US
Natural gravel	GaBi	9.2.0.58	2015	US
Water	GaBi	9.2.0.58	2015	US
MasterPel 240	GaBi	9.2.0.58	2018	US
MasterCast 900	GaBi	9.2.0.58	2018	US
Single unit truck, diesel	USLCI	9.2.0.58	2020	US
Train, diesel powered	USLCI	9.2.0.58	2020	US
Barge, average fuel mix	USLCI	9.2.0.58	2020	US
Electricity, at grid	USLCI	9.2.0.58	2020	US
Diesel, combusted in industrial equipment	USLCI	9.2.0.58	2020	US
Natural Gas, combusted in industrial equipment	USLCI	9.2.0.58	2016	US
Wood	GaBi	9.2.0.58	2020	US
Cardboard	GaBi	9.2.0.58	2015	US
Plastic film	GaBi	9.2.0.58	2019	Global

## 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 waste. The results presented are based on the specific product description for this EPD. This EPD is based on cradle-to-gate analysis of segmental concrete paving products using a declared unit, and the results cannot be used to compare between products. 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](http://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](http://www.iso.org) (2012)
6. GaBi Software System and Database for Life Cycle Engineering, thinkstep AG, Version 9.2.1.68.