



EPD for Concrete Masonry and Segmental Concrete Paving Products

Oldcastle APG, a CRH Company

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OUTDOOR LIVING



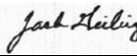
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About Amcor Masonry, an Oldcastle Company

Determined to supply the local construction market with the most sustainable building products available. Concrete Masonry Units have a lifecycle which is longer and at a lower cost than many other products available. Concrete Pavers have a lifespan of more than 50 years and can help to reduce stormwater runoff when properly designed. All Amcor concrete products can contribute to Low Impact Development, Reduced lifecycle cost, Carbon sequestration, LEED, and Green building initiatives.



EPD for Concrete Masonry and Segmental Concrete Paving Products

EPD Program and Program Operator Name, Address, and Website	NSF Certification, LLC 789 N. Dixboro Road, Ann Arbor, MI 48105 https://www.nsf.org/
General Program Instructions and Version Number	Product Category Rule Program: General Program Instructions, Version Jan 14, 2020
Manufacturer Name and Address	Oldcastle APG, a CRH Company 333 S Redwood Rd, North Salt Lake, UT 84054
Declaration Number	EPD10712
Declared Product & Declared Unit	One cubic meter (m3) of concrete formed into manufactured concrete products
Reference PCR and Version	ISO 21930:2017 serves as the core PCR along with UL Part A: Building-Related Products and Services, version 3.2. December 12, 2018; The sub-category follows UL Part B: Concrete Masonry and Segmental Concrete Paving Product EPD Requirements, November 11, 2020. V1.0.
Description of Product's Intended Application and Use	Commercial and Residential Applications for interlocking pavers
Product RSL Description (if applicable)	N/A
Markets of Applicability	North America
Date of Issue	May 26, 2022
Period of Validity	5 years
EPD Type	Manufacturer specific, Product specific
Dataset Variability	N/A
EPD Scope	Cradle to gate
Year of Reported Manufacturer Primary Data	2020
LCA Software and Version	One Click LCA
LCI Database and Version	Ecoinvent 3.6/GaBi 10.6.1.35
LCIA Methodology and Version	TRACI 2.1 v1.04
Sub-category Part B PCR review was conducted by:	Jack Geibig, Ecoform, LLC
	Terrie Boguski, Harmony Environmental, LLC
	Christine A. Subasic, P.E., LEED AP, Consulting architectural engineer
This declaration was independently verified in accordance with ISO 14025:2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v3.2 (December 2018), in conformance with ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017) <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	
	Tony Favilla afavilla@nsf.org
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	David Green
	 Master Builders Solutions US, LLC
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	
	Jack Geibig jgeibig@ecoform.com
Limitations Environmental declarations from different programs (ISO 14025) may not be comparable. <ul style="list-style-type: none"> • "Comparison of the environmental performance of Concrete Masonry and Segmental Concrete Paving Products using EPD information shall be based on the product's use and impacts at the construction works level, and therefore EPDs may not be used for comparability purposes when not considering the construction works energy use phase as instructed under this PCR". • "Full conformance with the PCR for Concrete Masonry and Segmental Concrete Paving Products allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards, use the same sub-category Part B PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences in results for the upstream and downstream life cycle stages declared. 	

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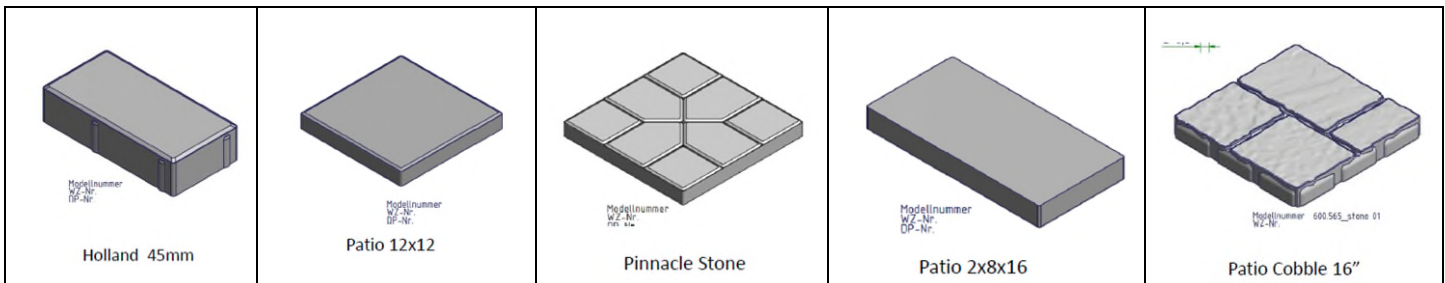
Product Scope

This declaration and its LCA study are relevant to manufactured concrete products produced by Amcor Masonry, an Oldcastle Company, in North Salt Lake, Utah for the Western US region. As the owner of the declaration, Amcor Masonry may be liable for the underlying information and evidence. The program operator shall not be liable with respect to manufacturer information, life cycle assessment data and evidence.

Product Description

This EPD includes representative products branded as Holland interlocking pavers developed from the Amcor Masonry, an Oldcastle Company portfolio of products manufactured at its facility located in North Salt Lake, Utah. This Environmental Product Declaration (EPD) covers interlocking concrete paver markets throughout the Northwest USA region. The primary audiences for interlocking concrete pavers are engineers, designers, architects, and project owners which can also include homeowners. The specific product names/identifiers associated with the EPD are presented in Appendix A with renditions shown below.

The results for this EPD are based on the full year 2020 of operational data and current raw materials and suppliers. All production is completed at the North Salt Lake facility.



Product Specification

The products evaluated for the EPD meet the technical specifications based on categories, CSI numbers and descriptions presented in the Part B PCR. Applicable UNSPSC codes and UNCPC codes are also noted in the PCR.

- ASTM C936/936M, CSA A2312

Application

Amcor Masonry, an Oldcastle Company, interlocking concrete pavers are used in various settings including but not limited to driveways, patios, pool decks, pools, steps, and walkways. Guidance on the safe and correct installation, use and disposal of the products are available from Amcor Masonry, an Oldcastle Company, or the Oldcastle APG website at:

<https://www.crhamericas.com/apg>

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Technical Data

The technical specifications from the products represented by this EPD are shown here.

Properties		
Holland		
Wet Mix Density	135	lbs/ft ³
Compressive Strength	4,000	psi
Flexural strength (slabs)	>500	MPa
Thickness (pavers, slabs and grids)	45	mm

Manufacturing

The main product components used in the manufacture of interlocking paving units are shown in table 2.

Material/Substance	Input Range
Cement	5-25%
Supplementary cementitious materials	1-5%
Fine aggregate	15-45%
Coarse aggregate	30-70%
Admixture	<1%

Table 2: Main component ranges for interlocking paving units

No substances required to be reported as hazardous are associated with the production of this product.

System Boundary

The life cycle assessment for this EPD covers the cradle-to-gate stages as shown in figure 1.

Product Stage			Construction Process Stage		Use Stage								End of Life Stage				Benefits and loads beyond the system
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction and/or demolition	Transport	Waste processing	Disposal	Reuse, recovery, recycling potential	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	

Figure 1: Life cycle stages included in the LCA

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Production Stages

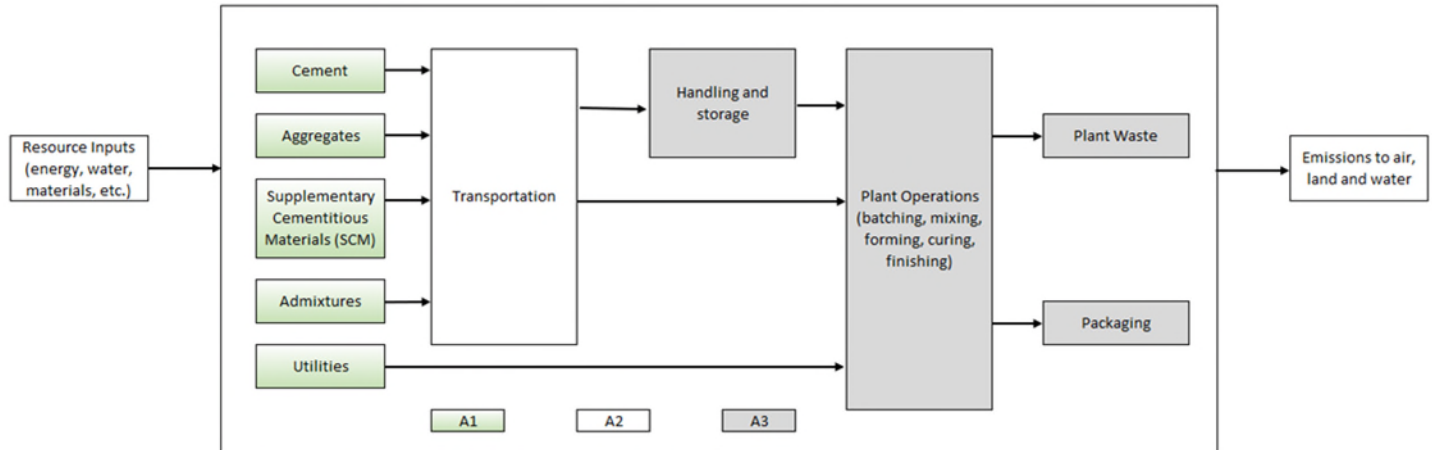


Figure 2: Cradle-to-gate concrete products flow diagram

Information relevant to the product stages not included within the system boundary (A4-C4) as required by the Part B PCR.

- Product packaging waste includes 15.9 kg wood pallet waste, 0.23 kg cardboard waste and 0.43 kg of plastic shrink wrap waste per declared unit. The end-of-life treatment for all packaging for this analysis is assumed to be landfill.
- The actual end-of-life treatment for the product is not known but may involve landfilling or crushing and re-use as recycled aggregates. The product may also be re-used prior to end of life in similar applications either through reconfiguration or relocation.

Allocation Procedure

A production process that generates more than one type of product may require the allocation of environmental flows from the process to different products to get product-based inventory data. If allocation is necessary, the requirements and guidance of the Part A PCR: Life Cycle Assessment Calculation Rules and Report Requirements, Section 3.3 are used. For this EPD, no allocation was necessary to conduct the life cycle assessment.

This EPD recognizes fly ash, silica fume and slag as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment processes and transportation required for their use as concrete material inputs.

Cut-Off Rules

All material and energy flows known or suspected to release substances in the air, water or soil in quantities that contribute significantly to any of the indicators in ISO 21930-2017 are included. In cases where there is insufficient input data for a unit process or data gaps, the cut-off criteria is 1% of renewable primary resources (energy), 1% of non-renewable primary resource usage (energy), 1% of total mass input of that unit process and 1% of environmental impacts. The total of neglected input flows per module does not exceed 5% of energy usage, mass, and environmental impacts. No known flows are deliberately excluded from this EPD.

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Interpretation

The A1 product stage (raw material supply) dominates most environmental impacts reported with cement generating the highest percentage of impacts for this stage. This EPD was calculated using manufacturer specific cement data from the cement producers EPD and represents 100% of the total cement used in this mix.

Life cycle impact assessment (LCIA) results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks (ISO 14044, ISO 14040). EPDs are comparable only if they comply with ISO 21930, 2017, 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.

Data Quality

Data Set	Data Base	Region	Year	Temporal	Technological Representativeness	Geographical	Completeness
Concrete admixture - water resisting admixtures	Ecoinvent 3.6	Europe	2019	Good	Good	Fair	Good
Concrete admixtures - Plasticisers and Superplastics, EU average	Ecoinvent 3.6	Europe	2019	Good	Good	Fair	Good
Gravel and sand quarry operation (sand)	Ecoinvent 3.6	Global	2019	Good	Good	Good	Good
Gravel and sand quarry operation (gravel)	Ecoinvent 3.6	Global	2019	Good	Good	Good	Good
Portland-limestone cement	Ecoinvent 3.6	US	2019	Good	Good	Good	Good
Market for hard coal ash	Ecoinvent 3.6	Global	2019	Good	Good	Fair	Good
Transport, freight, lorry >32 metric ton, euro5	Ecoinvent 3.6	Europe	2019	Good	Good	Fair	Good
Containerboard production, linerboard, kraftliner	Ecoinvent 3.6	Global	2019	Good	Good	Good	Good
Packaging film production, low density polyethylene	Ecoinvent 3.6	Global	2019	Good	Good	Good	Good
Eur-flat pallet production	Ecoinvent 3.6	Global	2019	Good	Good	Fair	Good
Electricity production, hard coal	Ecoinvent 3.6	USA/Utah*	2019	Good	Good	Good	Good
Natural gas production	Ecoinvent 3.6	USA	2019	Good	Good	Good	Good

*arizona, california, colorado, idaho, montana, nevada, newMexico, oregon, utah, washington, wyoming

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Declaration of Environmental Indicators Derived from LCA

Results of the LCA - environmental impact: 1 m3 of concrete formed into manufactured concrete products - TRACI v 2.1				
<i>LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.</i>				
Impact Assessment	A1	A2	A3	Total
Global warming potential (GWP 100) [kg CO ₂ eq.]	1.93E+02	1.24E+01	1.04E+01	2.16E+02
Ozone depletion potential (ODP) [kg CFC 11 eq.]	2.92E-06	3.00E-06	1.19E-06	7.11E-06
Acidification potential (AP) [kg SO ₂ eq.]	4.86E-01	4.66E-02	5.29E-02	5.85E-01
Eutrophication potential (EP) [kg N eq.]	2.71E-01	6.46E-03	9.90E-03	2.87E-01
Smog formation potential (SFP) [kg O ₃ eq.]	1.34E+01	1.00E+00	1.03E+00	1.54E+01
Abiotic depletion potential for fossil resources (ADP _{fossil}) [MJ]	7.61E+02	1.91E+02	1.81E+02	1.13E+03
<i>Note: These six impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.</i>				
Resource Use	A1	A2	A3	Total
Abiotic depletion potential for non fossil resources (ADP _{elements}) [kg Sb eq.]	4.98E-04	2.10E-04	1.66E-04	8.74E-04
Renewable primary energy as energy carrier (RPR _E) [MJ]	5.18E+01	2.05E+00	1.57E+02	2.11E+02
Renewable primary energy resources used as raw materials (RPR _M) [MJ]	0.00E+00	0.00E+00	6.10E+02	6.10E+02
Non-renewable primary energy as energy carrier (NRPR _E) [MJ]	7.92E+02	1.91E+02	1.81E+02	1.16E+03
Non-renewable primary energy resources used as raw materials (NRPR _M) [MJ]	1.59E+00	0.00E+00	7.36E-03	1.60E+00
Use of secondary material (SM) [kg]	1.08E+01	0.00E+00	3.07E-06	1.08E+01
Use of renewable secondary fuels (RSF) [MJ]	1.85E-04	0.00E+00	0.00E+00	1.85E-04
Use of non-renewable secondary fuels (NRSF) [MJ]	2.53E+02	0.00E+00	0.00E+00	2.53E+02
Recovered energy (RE) [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water (FW) [m3]	2.79E+00	3.99E-02	5.26E-02	2.88E+00
Waste and Output Flows	A1	A2	A3	Total
Hazardous waste disposed (HWD) [kg]	4.23E+01	2.31E-01	9.61E-01	4.35E+01
Non-hazardous waste disposed (NHWD) [kg]	1.51E+01	2.10E+01	2.00E+01	5.61E+01
High level radioactive waste (HLRW) [kg]	4.28E-05	3.84E-05	2.70E-05	1.08E-04
Intermediate and low level radioactive waste (ILLRW) [kg]	1.22E-03	1.24E-03	4.73E-04	2.93E-03
Components for reuse (CRU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling (MR)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (MER)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy exported from the product system (EE) [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Additional Inventory Parameters	A1	A2	A3	Total
Emissions from calcination (kg CO ₂ e)	5.935E+01	0.000E+00	0.000E+00	5.94E+01
<i>Notes: 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 these categories. Not all LCA datasets for upstream materials included these impact categories and thus results may be incomplete. Use caution when interpreting data in these categories.</i>				

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References

- 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/Amendment 2020 – Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 21930:2017 – Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL Environment (December 2018, version 3.2)
- Part B: Concrete Masonry and Segmental Concrete Paving Product EPD Requirements, UL Environment (November 2020, v1.0)

Appendix A

Products Represented by this EPD
Holland 45 mm
Patio 4 cobble 16"
Patio Square 16 x 16
Patio Square 12 x 12
Patio 2 x 8 x 16
Pinnacle stone Square 16 x 16