ENVIRONMENTAL PRODUCT DECLARATION

TRENWYTH® CONCRETE MASONRY UNIT

DEFINED BY ASTM C90
Standard Specification for Loadbearing Concrete Masonry Units

Top: Insultech concrete masonry unit

Bottom: various finishes available for Trenwyth concrete masonry units

Oldcastle® Architectural

Oldcastle Architectural is North America's leading manufacturer of building products and materials and an industry leader in providing sustainable masonry solutions for architects and building owners. Oldcastle Architectural offers a complete line of masonry products and services, including sustainable solutions, through its Echelon Masonry brand. Echelon Masonry offers a number of products that may contribute to LEED v4 and other Green Building rating programs, and we continuously strive to provide our partners with valuable resources and assets to help guide sustainable design and construction practices. For more information, please visit EchelonMasonry.com.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

Oldcastle Architectural

Concrete Masonry Unit (CMU)
Defined by ASTM C1232, International Standard Specification for Concrete Masonry Unit

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds, e.g., Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	Oldcastle Architectural
DECLARATION NUMBER	4787017662.101.1
DECLARED PRODUCT	Concrete Masonry Units
REFERENCE PCR	UN CPC 3755: Product Category Rules For Preparing An Environmental Product Declaration For Manufactured Concrete And Concrete Masonry Products – ASTM International, v 1.0, December 2014
DATE OF ISSUE	June 23, 2016
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications

The PCR review was conducted by:	PCR Review Panel
	cert@astm.org
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	
	Wade Stout, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	
	Thomas Gloria, Industrial Ecology Consultants

ENVIRONMENTAL PRODUCT DECLARATION

Oldcastle Architectural

Concrete Masonry Unit (CMU)
Defined by ASTM C90, Standard Specification for Loadbearing Concrete Masonry Units

According to ISO 14025

Product Definition

Product Classification and Description

Concrete masonry units (CMUs), also known as architectural masonry blocks, are modular, concrete blocks commonly used in load-bearing walls or building foundations. They can provide the aesthetic appeal of masonry. CMUs are available in various colors, shapes, sizes and finishes. The core openings in the product are created to reduce material usage, lighten the block for improved installation efficiency, reduce transportation costs, and accommodate steel and grout fill reinforcement. Core openings can also be filled with supplemental insulation to provide improved thermal performance.

The current study represents the impacts of CMUs from Oldcastle's Astra-Glaze SW+, Verastone, Verastone Plus, Trendstone, Trendstone Plus, Mesastone, Split Face, and Insultech product lines.

Range of Applications

Trenwyth® CMU's are used in the masonry construction of complete buildings, foundations, partitions, structural footings, elevator shafts, stairway enclosures, bridge supports and numerous other construction applications.

Product Standards

The products considered in this EPD meet or exceed the following Technical Specifications:

- ASTM C90: Standard Specification for Loadbearing Concrete Masonry Units
- ASTM C129: Standard Specification for Nonloadbearing Concrete Masonry Units
- CAN/CSA-A165 SERIES - CSA Standards on Concrete Masonry Units
- ASTM C744-Standard Specification for Prefaced Concrete Masonry Units

CMU Production

Material Content

Table 1: Material content of Trenwyth® CMU

Material	Mass %
Aggregates	68%
Sand	20%
Cement	12%
Pigments	< 1%
Other materials (sealers, admixtures, vapor barrier, etc.)	< 1%

Manufacturing Stage

Figure 1 shows a simplified process flow diagram of the manufacturing of Trenwyth® CMU. The products included in this EPD are manufactured at Oldcastle's facilities in Morris, IL; Emigsville, PA; Shakopee, MN; and Phoenix, AZ.

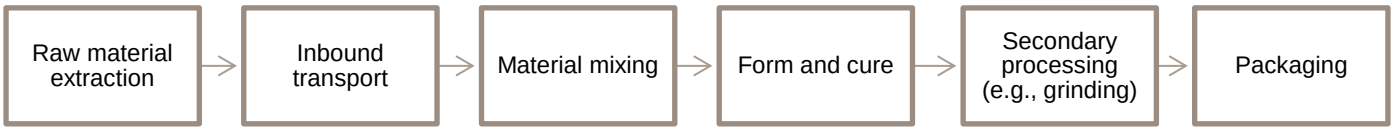

Figure 1: Process flow diagram for Trenwyth® CMU manufacturing

Downstream Stages

This is a cradle-to-gate EPD. As such, impacts associated with downstream stages, including delivery, installation, use, and disposal / recovery, are not included in this assessment.

Life Cycle Assessment

A cradle-to-gate Life Cycle Assessment has been carried out according to ISO 14025, 14040 and 14044, per "UN CPC 3755: Product Category Rules For Preparing An Environmental Product Declaration For Manufactured Concrete And Concrete Masonry Products" – ASTM International, v 1.0, December 2014.

The following life cycle stages are considered:

- Raw material supply (A1)
- Transport of raw materials to manufacturing (A2)
- CMU manufacturing (A3)

The main purpose of EPDs is for use in business-to-business communication. As all EPDs are publicly available via the Program Operator and therefore are accessible to the end consumer, they can also be used in business-to-consumer communication. EPDs of construction products may not be comparable if they do not comply with the same PCR. While the intent of the PCR is to increase comparability, there may still be differences among EPDs that comply with the same PCR (e.g., due to differences in system boundaries, background data, etc.).

An overview of the LCA Is provided below; additional information can be found in the background report.

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

Figure 2: Life cycle stages considered in this study are highlighted in blue

Declared Unit Description

Per the PCR, this EPD represents a declared unit of 1 cubic meter ($1m^3$) concrete formed into manufactured CMU. Since CMU are hollow blocks, less than 1 m^3 of concrete is required to form the declared unit of $1m^3$ of CMU. The declared unit is the same as the reference unit in this study and both pertain to the CMU product at the factory gate. As such any installation material, off-cuts etc. during the installation stage are not considered in this study.

Cut-off Criteria

No cut-off criteria are defined for this study. The system boundary was defined based on relevance to the goal of the study and for the processes within the system boundary, all available energy and material flow data have been included in the LCA model.

Allocation

The production process does not give rise to any co-products. As such, no allocation to the CMU product group was necessary.

Background Data

For life cycle modeling of the considered products, the GaBi ts Software System for Life Cycle Engineering, developed by thinkstep AG, has been used to model the product systems considered in this assessment. All relevant background datasets are taken from the GaBi 2015 software database. The datasets from the GaBi database are documented in the online documentation (GaBi ts 2015d). To ensure comparability of results in the LCA, the basic data of GaBi database were used for energy, transportation and auxiliary materials.

Data Quality

A variety of tests and checks were performed throughout the project to ensure high quality of the completed LCA. Checks included an extensive review of project-specific LCA models as well as the background data used.

Temporal Coverage

According to the PCR, the information provided regarding the manufacturing process shall be approximate annual values, preferably from the previous twelve-month period or calendar year. Average background data shall not be more than 10 years old. The results presented in this study are intended to be representative of 2014. Background datasets have reference years between 2010 and 2014.

Technological Coverage

Data on product composition and manufacturing are primary data from Oldcastle. The primary data collected from Oldcastle are considered to be representative of CMU manufacturing practice employed across the organization.

Geographical Coverage

This background LCA represents an average Oldcastle Trenwyth® CMU product produced in the United States at the four production facilities for the Trenwyth family of CMU, namely Morris, Illinois; Phoenix, Arizona; Shakopee, Minnesota; and Emigsville, Pennsylvania.

System Boundaries

The scope of the study includes raw material sourcing / extraction, transport of raw materials in/manufacturing wastes out and manufacturing. Table 2 summarizes major components considered for inclusion and exclusion from the study. Choices were shaped by the need to accurately reflect the environmental burden associated with the declared unit.

Table 2: System Boundaries

Included	Excluded
✓ Raw material production (minerals, etc.) ✓ Use of auxiliary materials, water, and energy during manufacturing ✓ Overhead (heating, lighting, warehousing) of manufacturing facilities (due to data limitations) ✓ Packaging of products ✓ Emissions to air, water, and soil during manufacturing ✓ Inbound transport of raw materials ✓ Treatment of wastes arising during manufacturing	× Construction of capital equipment × Packaging of raw materials × Maintenance and operation of support equipment × Human labor and employee commute × Internal transportation (within a manufacturing facility) × Use of product × End of life of product

LCA Results

Results for 1m^3 of Trenwyth® CMU are given below.

Overall Results

Environmental impacts

Table 3: TRACI impact assessments results for manufacture of 1m^3 of Trenwyth® CMU

Category Indicator	Unit	A1-A3
Global Warming Potential (GWP)	kg CO_2 equiv	305
Acidification Potential (AP)	kg SO_2 equiv	1.39
Eutrophication Potential (EP)	kg N equiv	0.0443
Smog Creation Potential	kg O_3 equiv	18.3
Ozone Depletion Potential	kg CFC-11 equiv	7.20E-07

Use of resources

Table 4: Resource use results for manufacture of 1m^3 of Trenwyth® CMU

Category Indicator	Unit	A1-A3
Primary energy demand, total	MJ	2,990
Primary energy demand, non-renewable	MJ	2,670
Primary energy demand, renewable	MJ	324
Non-renewable material resources	kg	1,610
Renewable material resources	kg	42,100
Net fresh water (inputs minus outputs)	L	410

Generation of waste

Table 5: Waste generation results for manufacture of 1m^3 of Trenwyth® CMU

Category Indicator	Unit	A1-A3
Non-hazardous waste generated	kg	42.2
Hazardous waste generated	kg	1.23E-03

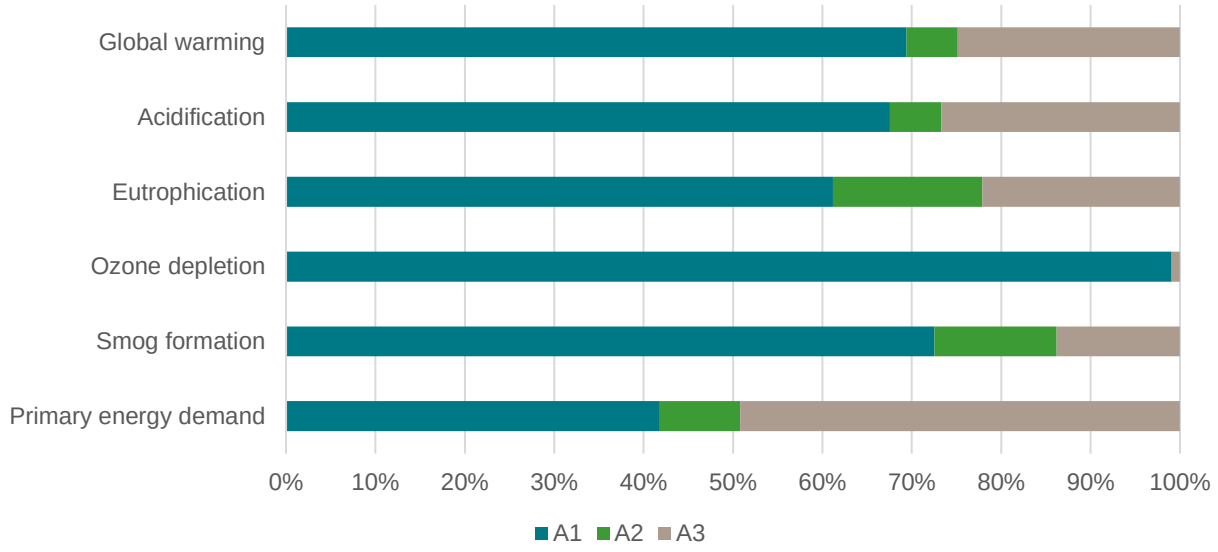

Figure 3: Overview of environmental impact results for 1m³ Trenwyth® CMU

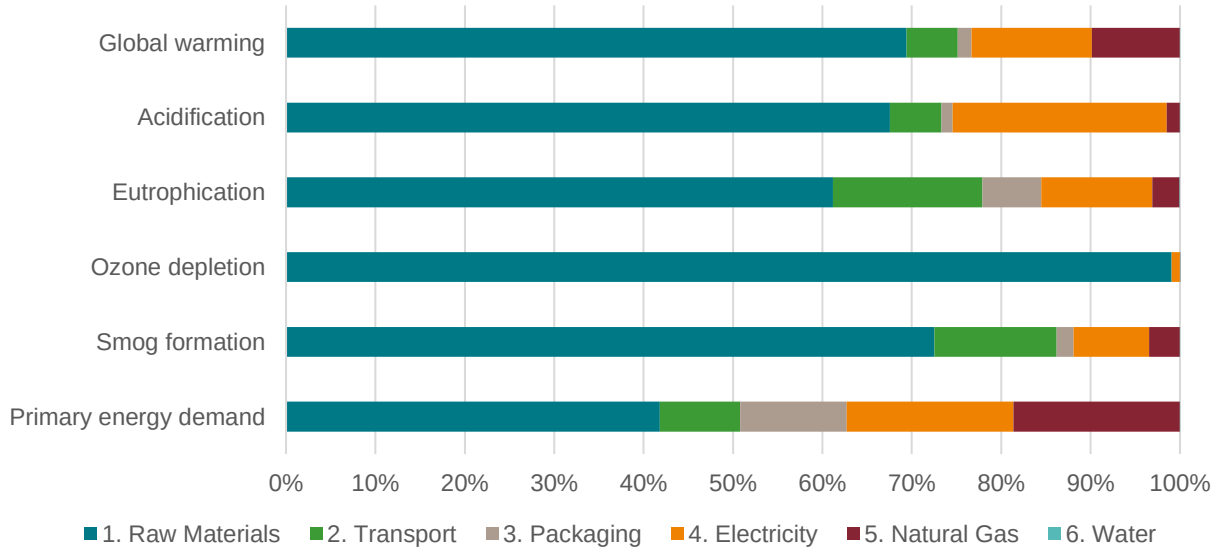

Figure 4: Detailed environmental impact results for 1m³ Trenwyth® CMU

Interpretation

As can be seen from Figures 3 and 4, raw materials and the use of energy in the manufacturing stage are the primary contributors to environmental impacts associated with 1 cubic meter of Trenwyth® CMU. For raw materials, cement production drives most of the environmental impacts associated with the production of a declared unit of Trenwyth CMU. Cement has a particularly high global warming potential primarily due to carbon dioxide emissions associated with calcination. Additionally, it drives ozone depletion due to emissions from upstream coal production. Sand and aggregates are the next major contributors to impacts across most categories. These two materials are associated with high impacts for primary energy demand due to non-renewable energy resources associated with generation of electricity also used in sand mining operations respectively. Contributions from pigments and cement admixtures, to a lesser degree, make up the remainder of significant raw material contributions.

Transport of raw materials to manufacturing is generally not a significant contributor to environmental impacts. The exceptions to this include Eutrophication Potential and Smog Formation Potential. Transportation impacts for these categories are seen to be considerably substantial contributors largely due to emissions of nitrogen oxides to air from the use of fossil-based transport fuels, and emissions of nitrogen compounds nitrates and phosphates to fresh water associated with the production of those fuels.

The consumption of electricity from the grid accounts for most of the impacts associated with manufacturing across all impact categories. In particular, electricity is a key contributor to acidification impacts, mainly due to emissions of nitrogen oxides and sulfur dioxide associated with the production of electricity from fossil sources. Impacts associated with the consumption and combustion of natural gas are generally considerably less than those associated with the consumption of electricity.

Other Environmental Information

Oldcastle® Architectural is a leading supplier of innovative and sustainable masonry and hardscape products for North America and has a published white paper, produced by a third party industry expert and LEED AP, on sustainable design and LEED v4. To see how Oldcastle Architectural products and services falling under the Echelon Masonry brand may be used as an integral part of sustainable design and contribute to LEED v4 points, please visit EchelonMasonry.com. Oldcastle Architectural is a division of Oldcastle Building Products™, a subsidiary of Oldcastle®, Inc. the North American arm of CRH, plc. To view the CRH 2014 Sustainability Report, please visit EchelonMasonry.com.

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References

ASTM PCR 2014	UN CPC 3755: Product Category Rules For Preparing An Environmental Product Declaration For Manufactured Concrete And Concrete Masonry Products – ASTM International, v 1.0, December 2014
GaBi ts 2015	thinkstep AG; GaBi ts: Software-System and Database for Life Cycle Engineering. Copyright, TM. Stuttgart, Echterdingen, 1992-2014.
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ISO 14025	ISO 14025:2011-10 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14040	ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework
ISO 14044	ISO 14044:2006-10 Environmental management - Life cycle assessment - Requirements and guidelines
UL Environment	UL Environment. StonePeak GREENGUARD Certifications. Accessed October 2015. http://productguide.ulenvironment.com/SearchResults.aspx?BrandID=600

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