SENTINEL HOLDING
INSTITUT

SHI PRODUCT PASSPORT

Find products. Certify buildings.

SHI Product Passport No.:

15200-10-1000

SEMBLA®

Product group: Interior & Exterior masonry

Product qualities:

- SHI Product Assessment 2024
- QNG Qualitätssiegel Nachhaltiges Gebäude
- DGNB NEW CONSTRUCTION 2023
- DGNB NEW CONSTRUCTION 2018
- BNB-BN NEUBAU V2015
- EU taxonomy
- BREEAM DE NEUBAU 2018

CERTIFIED SUSTAINABLE PRODUCT
SHI PRODUCT PASSPORT
SENTINEL HOLDING INSTITUT
www.sentinel-holding.eu

Köttner

Helmut Köttner
Scientific Director
Freiburg, 02 February 2026

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

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The SHI Database is the first and only database for construction products whose comprehensive processes and data accuracy are regularly verified by the independent auditing company SGS-TÜV Saar

SENTINEL HOLDING
INSTITUT

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

SHI Product Assessment 2024

Since 2008, Sentinel Holding Institut GmbH (SHI) has been establishing a unique standard for products that support healthy indoor air. Experts carry out independent product assessments based on clear and transparent criteria. In addition, the independent testing company SGS regularly audits the processes and data accuracy.

Criteria	Product category	Assessment
SHI Product Assessment		Indoor Air Quality Certified
Valid untill: 24 October 2026		

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

QNG - Qualitätssiegel Nachhaltiges Gebäude

The Qualitätssiegel Nachhaltiges Gebäude (Quality Seal for Sustainable Buildings), developed by the German Federal Ministry for Housing, Urban Development and Building (BMWSB), defines requirements for the ecological, socio-cultural, and economic quality of buildings. The Sentinel Holding Institut evaluates construction products in accordance with QNG requirements for certification and awards the QNG ready label. Compliance with the QNG standard is a prerequisite for eligibility for the KfW funding programme. For certain product groups, the QNG currently has no specific requirements defined. Although classified as not assessment-relevant, these products remain suitable for QNG-certified projects.

Criteria	Pos. / product group	Considered substances	QNG assessment
3.1.3 Schadstoffvermeidung in Baumaterialien	not applicable	not applicable	QNG ready - Not relevant for assessment

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

DGNB New Construction 2023

The DGNB System (German Sustainable Building Council) assesses the sustainability of various types of buildings. It can be applied to both large-scale private and commercial projects as well as smaller residential buildings. The 2023 version sets high standards for ecological, economic, socio-cultural, and functional aspects throughout the entire life cycle of a building.

Criteria	Assessment
ECO1.1 Life cycle cost (*)	May positively contribute to the overall building score
Verification: EPD vom 15.02.2024	

Criteria	Assessment
ENV1.1 Climate action and energy (*)	May positively contribute to the overall building score
Verification: EPD vom 15.02.2024	

Criteria	No. / Relevant building components / construction materials / surfaces	Considered substances / aspects	Quality level
ENV 1.2 Local environmental impact, 03.05.2024 (3rd edition)			Not relevant for assessment

Criteria	Assessment
SOC1.3 Sound insulation and acoustic comfort (*)	May positively contribute to the overall building score
Verification: Datenblatt Stand 06/2024	

Criteria	Assessment
TEC1.4 Use and integration of building technology (*)	May positively contribute to the overall building score
Verification: Datenblatt Stand 06 / 2024	

Criteria	No. / Relevant building components / construction materials / surfaces	Considered substances / aspects	Quality level
ENV 1.2 Local environmental impact, 29.05.2025 (4th edition)	not applicable		Not relevant for assessment

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

DGNB New Construction 2018

The DGNB System (German Sustainable Building Council) assesses the sustainability of various types of buildings. It can be applied to both large-scale private and commercial projects as well as smaller residential buildings.

Criteria	No. / Relevant building components / construction materials / surfaces	Considered substances / aspects	Quality level
ENV 1.2 Local environmental impact			Not relevant for assessment

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

BNB-BN Neubau V2015

The Bewertungssystem Nachhaltiges Bauen (Assessment System for Sustainable Building) is a tool for evaluating public office and administrative buildings, educational facilities, laboratory buildings, and outdoor areas in Germany. The BNB was developed by the former Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and is now overseen by the Federal Ministry for Housing, Urban Development and Building (BMWSB).

Criteria	Pos. / product type	Considered substance group	Quality level
1.1.6 Risiken für die lokale Umwelt			Not relevant for assessment

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

EU taxonomy

The EU Taxonomy classifies economic activities and products according to their environmental impact. At the product level, the EU regulation defines clear requirements for harmful substances, formaldehyde and volatile organic compounds (VOCs). The Sentinel Holding Institut GmbH labels qualified products that meet this standard.

Criteria	Product type	Considered substances	Assessment
DNSH - Pollution prevention and control		Substances according to Annex C	EU taxonomy compliant
Verification: EPD vom 15.02.2024 und Herstellererklärung vom 20.02.2025			

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

BREEAM DE Neubau 2018

BREEAM (Building Research Establishment Environmental Assessment Methodology) is a UK-based building assessment system that evaluates the sustainability of new constructions, refurbishments, and conversions. Developed by the Building Research Establishment (BRE), the system aims to assess and improve the environmental, economic, and social performance of buildings.

Criteria	Product category	Considered substances	Quality level
Hea 02 Indoor Air Quality			Not relevant for assessment

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

Product labels

In the construction industry, high-quality materials are crucial for a building's indoor air quality and sustainability. Product labels and certificates offer guidance to meet these requirements. However, the evaluation criteria of these labels vary, and it is important to carefully assess them to ensure products align with the specific needs of a construction project.

Products bearing the Sentinel Holding Institute QNG-ready seal are suitable for projects aiming to achieve the "Qualitätssiegel Nachhaltiges Gebäude" (Quality Seal for Sustainable Buildings). QNG-ready products meet the requirements of QNG Appendix Document 3.1.3, "Avoidance of Harmful Substances in Building Materials." The KfW loan program Climate-Friendly New Construction with QNG may allow for additional funding.

This product is SHI Indoor Air Quality certified and recommended by Sentinel Holding Institut. Indoor-air-focused construction, renovation, and operation of buildings is made possible by transparent and verifiable criteria thanks to the Sentinel Holding concept.

Product:
SEMBLA®

SHI Product Passport no.:
15200-10-1000

Legal notices

(*) These criteria apply to the construction project as a whole. While individual products can positively contribute to the overall building score through proper planning, the evaluation is always conducted at the building level. The information was provided entirely by the manufacturer.

Find our criteria here: https://www.sentinel-holding.eu/de/Themenwelten/Pr%C3%BCfkriterien%20f%C3%BCr%20Produkte

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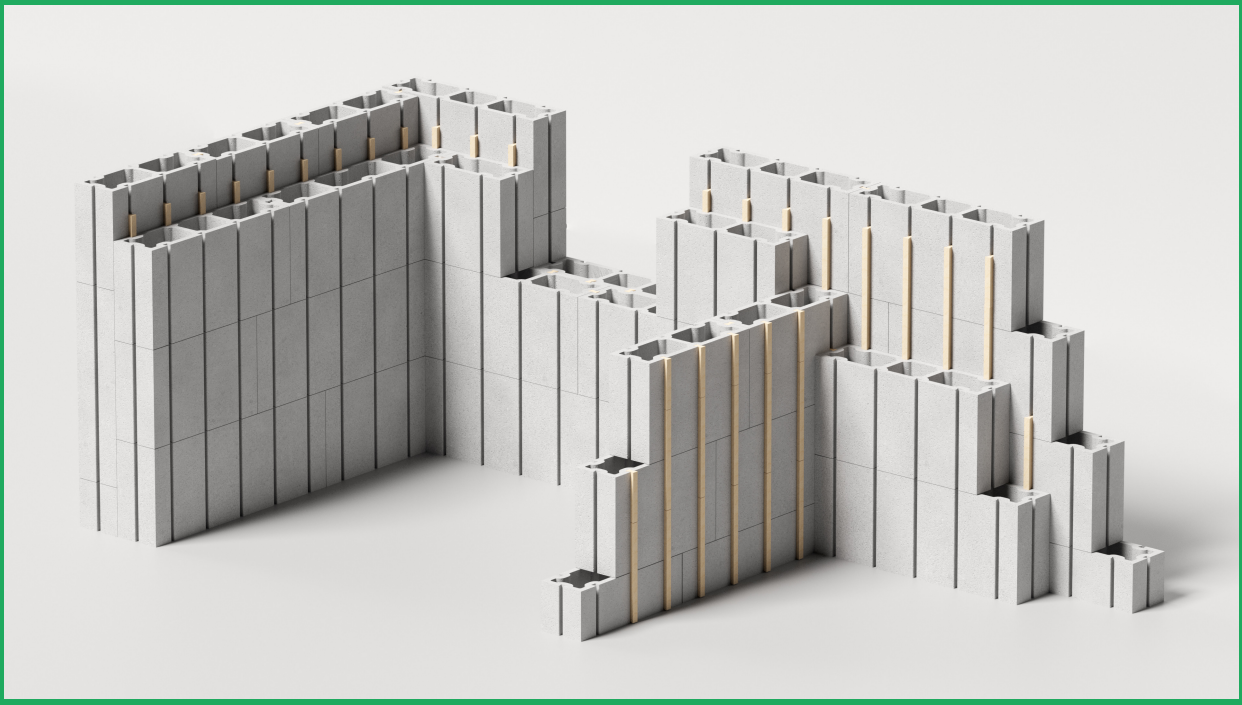
SEMBLA® | Entwickelt von Polycare

Technische Produktinformationen



Polycare Research Technology GmbH
Glasmacherstraße 11
98528 Gehlberg

Version 3.2024

SEMBLA® Mauerwerksystem

Das SEMBLA® Mauerwerksystem, entwickelt für eine nachhaltige Bauweise, ermöglicht den Bau von tragenden und nichttragenden Wänden durch ein einfaches Stecksystem, das eine zerstörungsfreie Demontage am Nutzungssende eines Gebäudes unterstützt. Dadurch wird es zum ersten wirklich kreislauffähigen Mauerwerk.

Durch die Verwendung von umweltfreundlichem Geopolymerbeton, der ohne Portland-Zement auskommt, gewährleistet SEMBLA® eine überlegene Festigkeit im Vergleich zu herkömmlichen Zementbetonen. Die Hohlblocksteine werden trocken, ohne Mörtel oder Kleber, verlegt und durch innovative Verbindungselemente fixiert. Diese Bauweise minimiert Wärmebrücken und erlaubt das Dämmen der Tragebene durch das Einbringen von Schütt- oder Einblasdämmung. SEMBLA® steht für ressourcenschonendes Bauen und ist kompatibel mit anderen rückbaubaren Bauelementen, was es zu einer vorbildlichen Wahl für zukunftsorientierte Bauprojekte macht.

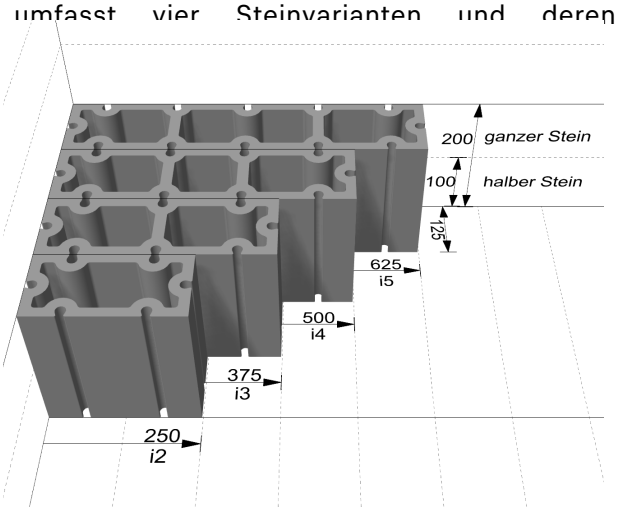
Wie wird mit SEMBLA gebaut?

Das SEMBLA® Mauerwerksystem ist optimal für den Hochbau konzipiert. Die Stärke der Rohbauwände ist variabel und abhängig von der Anzahl der verwendeten Mauerwerkschalen, mit Standardbreiten von 125 mm für einschalige, 250 mm für zweischalige und 375 mm für dreischalige Wände. Eventuelle Unebenheiten im Fundament werden zu Beginn mit einer Mörtelschicht ausgeglichen. Anschließend ermöglicht unsere Software eine maßgeschneiderte Erstellung des Verlegeplans. Die einzelnen Steine werden vertikal mit speziellen Verbindungselementen sicher verbunden, was eine solide und stabile Wandkonstruktion gewährleistet. Für die Überbrückung von Öffnungen können Stürze aus Holz oder Stahlbeton integriert werden. Nach Fertigstellung der Mauer kann eine Dämmung eingebracht werden. Der obere Wandabschluss erfolgt bei Bedarf mit einem Ringbalken oder Ringanker aus Holz oder einem anderen geeigneten Material. Bei geringer Auflast können vertikale Gewindestangen zur Vorspannung im Mauerwerk eingesetzt werden, was zusätzliche Stabilität verleiht. Die durchdachten Verbindungselemente erlauben zudem eine einfache und reversible Montage von Unterkonstruktionen für Fassaden oder Innenverkleidungen.

Zum Video mit mehr Infos zum Aufbau geht es hier.

Steintypen

Das SEMBLA® Mauerwerksystem orientiert sich am oktametrischen Maßsystem und umfasst vier Steinvarianten und deren



Maße in mm

Fundamente

Für das SEMBLA® Mauerwerksystem sind grundsätzlich alle Fundamenttypen geeignet, die auch bei herkömmlichen Bauten zum Einsatz kommen. Das reduzierte Gewicht des Systems ermöglicht aber auch den Einsatz rückbaubarer Fundamentarten wie Pfahl- oder Einschraubfundamente. Für den Aufbau des Trägerrostes eignen sich z.B. Holzbalken als auch Stahlträger, was eine flexible Anpassung an unterschiedliche bauliche Anforderungen und Präferenzen erlaubt.

Zwischendecken, Ringbalken und Dachaufbauten

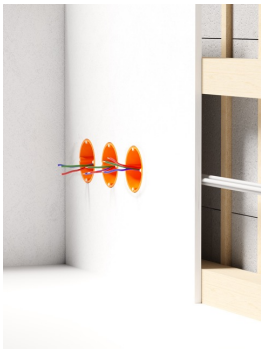
Für Geschossdecken, Ringbalken und Dachkonstruktionen sind grundsätzliche alle üblichen Bauweisen geeignet. Holzdecken jeglicher Art, Stahlbetondecken und vorgefertigte Deckenelemente sind mit dem System kompatibel. Der Ringanker kann flexibel aus Vollholz oder Stahlbeton realisiert werden, und auf diesem Fundament können Dachstrukturen aller Art errichtet werden.

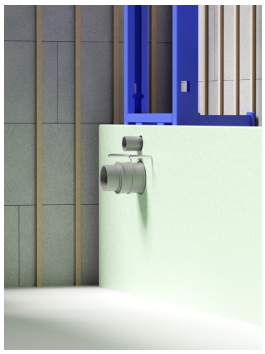
Fassaden, Wandverkleidung und Leitungsverlegung

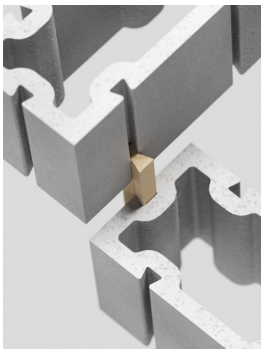
Das SEMBLA® Mauerwerksystem verwendet ein Nut- und Federsystem zur Verbindung der Steine, das auch als universelle Schnittstelle für die Montage von rückbaubaren Unterkonstruktionen für Fassaden und Innenwände dient.

Spezielle Anker- oder Holzelemente erlauben eine einfache und präzise Anbringung basierend auf dem 125-mm-Rastermaß des Systems.

Medienleitungen können somit innerhalb der dabei entstehenden variablen Installationsebene zwischen Mauerwerk und Innenwandverkleidung installiert werden. Bis zu einer Rohrgröße von DN50 ist dies prinzipiell auch innerhalb der Wand möglich.







Rückbau

Beim Rückbau ermöglicht SEMBLA® eine effiziente und nachhaltige Demontage. Sollten Gebäudeteile nicht mehr benötigt werden oder eine Grundrissänderung anstehen, lassen sich die Steine ohne Zerstörung durch einfaches Lösen der Verbindungselemente abtragen und für neue Projekte wiederverwenden. Auch bereits eingebrachte Dämmstoffe können entfernt (abgesaugt) und erneut genutzt werden.

Material

Das SEMBLA® System verwendet einen innovativen CO_2-armen Beton, der Geopolymere als Bindemittel nutzt. Diese Geopolymere bestehen aus rein mineralischen, aluminosilikathaltigen Stoffen und kommen ohne Portlandzement aus. Im Herstellungsprozess des Betons wird zudem ein bedeutender Anteil von sekundären Rohstoffen verwendet. Geopolymerbeton ist bekannt für seine hohe Festigkeit, chemische Beständigkeit und besonders niedrige CO2-Emissionen während der Produktion. Im Vergleich zu herkömmlichem Beton können die CO_2-Emissionen um bis zu 70% reduziert werden, was eine bedeutende ökologische Verbesserung darstellt.

Rücknahmegarantie

Wir meinen es ernst mit der Kreislauffähigkeit und garantieren eine Rücknahme unseres SEMBLA® Mauerwerkssystems. Wichtig dafür ist natürlich, dass die Steine nicht beschädigt wurden (zurechtgesägt, durchbohrt, etc.) Die Bedingungen der Rücknahmegarantie werden projektspezifisch vereinbart.

Technisches Datenblatt*

Produktkennwerte	Wert	Einheit	Kommentar
Rohdichteklasse	1,0	n/a	
Druckfestigkeitsklasse	10	n/a	
Steingewicht (ca.)	i2: 6,3 i3: 9,4 i4: 12,8 i5: 15,6	kg	Werte für ganze Steine sind angegeben
Abmessung	i2: 250/125/200 i3: 375/125/200 i4: 500/125/200 i5: 625/125/200	mm (L/B/H)	Werte für ganze Steine sind angegeben; halbe Steine entsprechen der halben Steinhöhe
Schalldämmaß Rw	41 49 53	dB dB dB	125 mm Wandstärke 250 mm Wandstärke 370 mm Wandstärke
U-Wert	0,53	W/(m²K)	250 mm Wandstärke mit Zellulose-Einblasdämmung
Wärmeleitfähigkeit λ	0,133	W/(mK)	Zellulose-Einblasdämmung (WLG 035)
Baustoffklasse	A	n/a	Nicht Brennbar
Feuerwiderstand	F30 F60 F120		125 mm Wandstärke 250 mm Wandstärke 370 mm Wandstärke
Global Warming Potenzial (GWP)	4,75	Kg CO_2 eq / m² Wand	125 mm Wandstärke
Richtpreis ungedämmt, inkl. Aufbau, exkl. Transport & MwSt.	125 mm: 75 250 mm: 150 370 mm: 220	€ /m² Wand	Abhängig von Umfang und Standort
Richtpreis gedämmt, inkl. Aufbau, exkl. Transport & MwSt.	125 mm: 115 250 mm: 225 370 mm: 330	€ /m² Wand	Abhängig von Umfang und Standort

* Stand Juni 2024. Alle Angaben basieren auf dem aktuellen Entwicklungsstand. Änderungen im Zuge technischer Weiterentwicklungen bleiben vorbehalten.

SEMBLA® | Entwickelt von Polycare

Polycare Research Technology GmbH
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98528 Gehlberg

Version 3.2024

Kontakt: bauen@polycare.de

PRODUCT CARBON FOOTPRINT

GWP

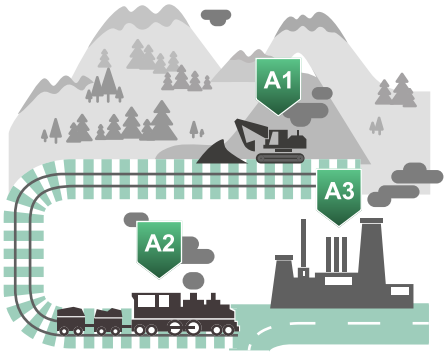
This quantifies a product's contribution towards global warming. This is referred to as carbon footprint, global warming potential and also embodied carbon.

STANDARDS

These are ISO 14021 self-declared results, calculated according to ISO 14040 and ISO 14044 standards. The results follow ISO 21930/EN 15804+A2.

SCOPE OF ASSESSMENT

The results have a cradle-to-gate scope, comprising raw materials extraction and supply (A1), transport (A2) and manufacturing (A3).



CARBON FOOTPRINT

Declared unit	**1 m3**
Mass of declared unit (kg)	**960**
GWP-fossil, A1-A3 (kg CO_2e)	**7,42E+01**
GWP-total, A1-A3 (kg CO_2e)	**6,75E+01**

MANUFACTURER AND PRODUCT

Manufacturer	Polycare Research Technology GmbH
Address	Glasmacherstraße 11, 98528 Suhl/OT Gehlbe
Website	https://polycare.de/en
Product name	SEMBLA®
Product reference	-
Place of production	Glasmacherstraße 11, 98528 Suhl/OT
Period for data	15. April -31. May 2024

PRODUCT DESCRIPTION

The circular, geopolymer-based masonry blocks SEMBLA® enable the quick and easy construction of load-bearing and non-load-bearing walls, as well as their non-destructive dismantling at the end of a buildings life cycle. SEMBLA® blocks can then be reused in new construction projects. The wall system is particularly aimed at holistically circular buildings and is therefore particularly suitable for

SYSTEM BOUNDARY

Product stage			Construction		Use stage							End of life stage				Beyond the system boundary		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
X	X	X	Modules not declared															
Raw materials	Transport to site	Manufacturing	Transport	Construction	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy	Operational water	Deconstruction	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

SEMBLA®

Polycare Research Technology GmbH

EPD HUB, HUB-1980

Published on 15.12.2024, last updated on 15.12.2024, valid until 15.06.2026.

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Polycare

GENERAL INFORMATION

MANUFACTURER

Manufacturer	Polycare Research Technology GmbH
Address	Glasmacherstraße 11, 98528 Suhl/OT Gehlberg, Germany
Contact details	bauen@polycare.de
Website	https://polycare.de/en

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804+A2:2019 and ISO 14025
PCR	EPD Hub Core PCR Version 1.1, 5 Dec 2023 EN 16757 Product Category Rules for concrete and concrete elements
Sector	Construction product
Category of EPD	Design phase EPD
Scope of the EPD	Cradle to gate with options, A4-A5, and modules C1-C4, D
EPD author	Philipp J. Scherer, Maryam Soleymani
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal verification ☑ External verification
EPD verifier	Nemanja Nedic, as an authorized verifier acting for EPD Hub Limited

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	SEMBLA®
Additional labels	-
Product reference	-
Place of production	Glasmacherstraße 11, 98528 Suhl/OT Gehlberg, Germany
Period for data	15. April -31. May 2024
Averaging in EPD	No averaging
Variation in GWP-fossil for A1-A3	- %

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 m^3
Declared unit mass	960 kg
GWP-fossil, A1-A3 ($kgCO_2e$)	7,42E+01
GWP-total, A1-A3 ($kgCO_2e$)	6,75E+01
Secondary material, inputs (%)	5.42
Secondary material, outputs (%)	96.4
Total energy use, A1-A3 (kWh)	438
Net freshwater use, A1-A3 (m^3)	1.72

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

Polycare is a European leader in the use of cement-free concretes in the building industry. Since 2010, Polycare has been developing circular and regenerative building solutions for various markets across the globe. With SEMBLA®, the first geopolymer concrete-based, circular masonry system for high-rise construction has been introduced on the German market. The business model of Polycare involves licensing the technology portfolio.
Further information can be found at: https://polycare.de/en

PRODUCT DESCRIPTION

The circular, geopolymer-based masonry blocks SEMBLA® enable quick and easy construction of load-bearing and non-load-bearing walls, as well as their non-destructive dismantling at the end of a building's life cycle. SEMBLA® blocks can then be reused in new construction projects. The wall system is designed for holistically circular buildings and is therefore particularly suitable for the combination with other deconstructable and reusable building elements. Further information about SEMBLA can be found on the product website: https://sembla.de

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass %	Material origin
Metals	0	
Minerals	99.7	Europe
Fossil materials	0.3	Europe
Bio-based materials	0	

BIOGENIC CARBON CONTENT

Product's biogenic carbon content at the factory gate

Biogenic carbon content in product, kg C	0
Biogenic carbon content in packaging, kg C	1.848

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1 m^3
Mass per declared unit	960 kg
Functional unit	-
Reference service life	-

SUBSTANCES, REACH - VERY HIGH CONCERN

The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
×	×	×	×	×	MND	MND	MND	MND	MND	MND	MND	×	×	×	×	×		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND. Modules not relevant = MNR

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

SEMBLA® block production starts by transporting the binders, activators, aggregates, and additives to the dry storage hall at the manufacturing site. From there the dry ingredients are fed into dosing units. Binder and aggregates are mixed dry. Pre-solubilized activator, water and additives are then added to the mixture, followed by wet mixing. The wet mass is filled into a mold of a concrete block paver machine and vibrated to its final shape. The blocks are then transported to a curing rack. From the curing rack, the blocks are adjusted to the right height dimensions with a masonry sawing machine. From there, they go to the packaging line, where they are taken for storage. Eventually, the finished product is packaged with plastic straps, cardboard strips, and sent to the installation site on a wooden EUR-pallet.

TRANSPORT AND INSTALLATION (A4-A5)

Transportation impacts occurred from the delivery of final products to the construction site (A4) include fuel direct exhaust emissions, environmental impacts of fuel production, as well as related infrastructure emissions.

The transportation distance is defined in accordance with the PCR guidelines. Average distance of transportation from production plant to building site is assumed as 50 km and the transportation method is assumed to be lorry. Vehicle capacity utilization is assumed to be 100 % indicating a full load. In reality, it may vary but as role of transportation emissions in total results is small, the variety in load is assumed to be negligible. Empty return trips are excluded as it is assumed that return trip is used by the transportation company to serve the needs of other clients. Transportation does not result in product losses because the items are properly packaged. Also, volume capacity utilization factor is assumed to be 100 % for the nested packaged products.

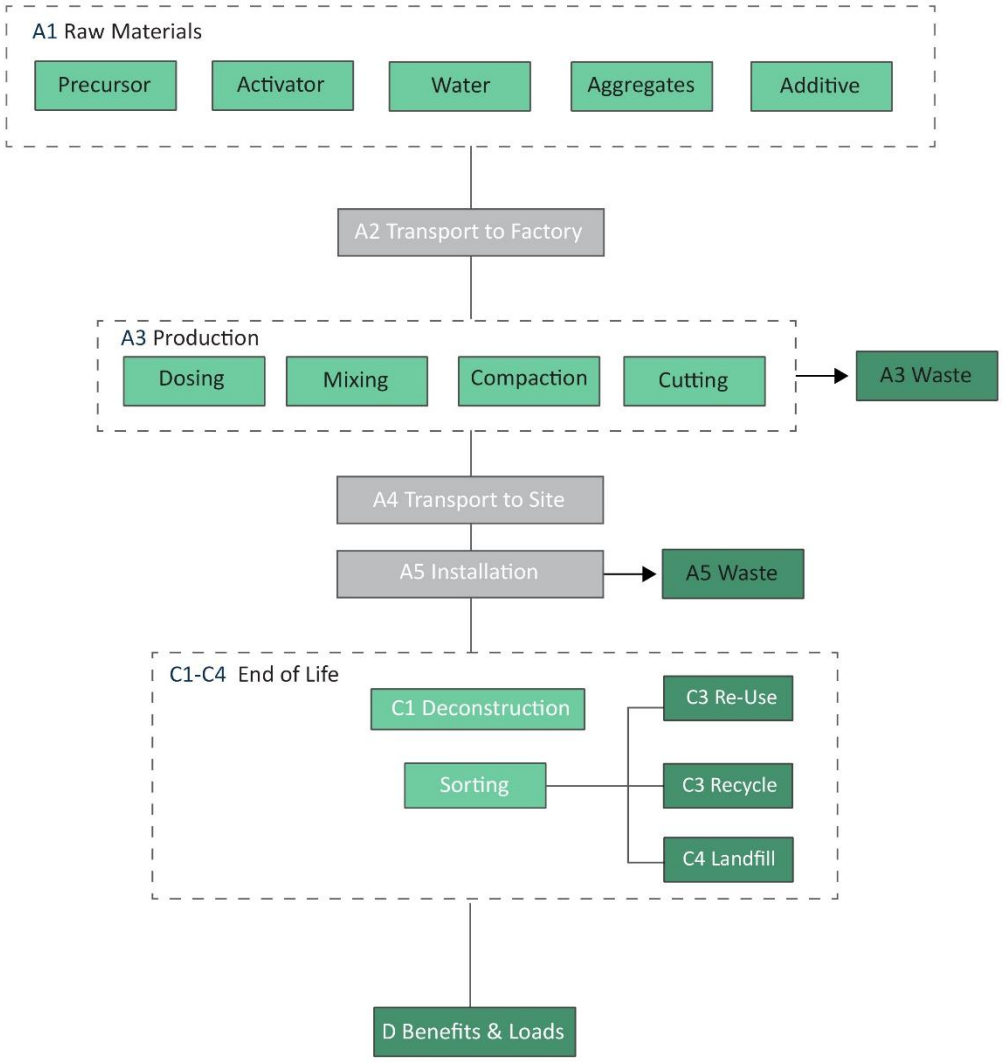
PRODUCT USE AND MAINTENANCE (B1-B7)

This EPD does not cover the use phase. Impacts on air, soil, and water during the use phase have not been analyzed.

PRODUCT END OF LIFE (C1-C4, D)

SEMBLA® being designed as a circular masonry system, the disassembly and reuse scenarios at the End-of-Life phase are key features of this product. At the end of life, the SEMBLA® wall is dismantled in a non-destructive manner (C1) and sorted. Consumption of energy and natural resources in the dismantling process is assumed to be negligible. 70% of the used SEMBLA® blocks are transported back to the manufacturing site for reuse in the next building project. 30% of the blocks are considered as waste at the end of their life cycle. It is assumed that the waste is collected separately and transported to the nearest waste concrete treatment plant. Transportation distance to treatment is assumed as 50 km and the transportation method is assumed to be lorry (C2). At the waste treatment plant, the blocks are crushed and separated. Based on data from European Environment Agency (2020), it is assumed that 88% of the blocks sent to the treatment plant are recycled. Process losses of the waste treatment plant are assumed to be negligible (C3). The remaining 12% of SEMBLA® sent to the treatment plant is assumed to be landfilled (C4). According to EN 50693:2019, the sequence of treatment operations occurring to the product shall include de-pollution, fractions separation and preparation (dismantling, crushing, shredding, sorting), as well as recycling, other material recovery, energy recovery and disposal. In this study, the default values from table G.4 of EN 50693 are used for treating materials in different waste treatment methods. Due to the material and energy recovery potential of parts in the SEMBLA® system, the end-of-life product is converted into recycled raw materials, while the energy recovered from incineration displaces electricity and heat production (Module D). The wooden pallet and other plastic packaging used during transportation incinerated for energy recovery and/or recycled. The benefits and loads of re-use, incineration and recycling are included in Module D.

MANUFACTURING PROCESS



LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes that are mandatory according to the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw materials and energy consumption. All inputs and outputs of the unit processes, for which data is available, are included in the calculation. No unit process is neglected if it accounts for more than 1% of the total mass or energy flows. The module-specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	No allocation
Packaging material	Allocated by mass or volume
Ancillary materials	Allocated by mass or volume
Manufacturing energy and waste	Allocated by mass or volume

AVERAGES AND VARIABILITY

Type of average	No averaging
Averaging method	Not applicable
Variation in GWP-fossil for A1-A3	- %

There is no average result considered in this study since this EPD refers to one specific product produced in one production plant.

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.8, Plastics Europe, Federal LCA Commons and One Click LCA databases as sources of environmental data.

ENVIRONMENTAL IMPACT DATA

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2e	5,11E+01	1,35E+01	2,88E+00	6,75E+01	4,49E+00	1,01E+01	MND	MND	MND	MND	MND	MND	MND	9,53E-01	5,47E+00	1,02E+00	1,82E-01	-1,32E+00
GWP – fossil	kg CO_2e	5,10E+01	1,35E+01	9,64E+00	7,42E+01	4,49E+00	3,28E+00	MND	MND	MND	MND	MND	MND	MND	9,53E-01	5,47E+00	1,02E+00	1,82E-01	-4,16E+01
GWP – biogenic	kg CO_2e	0,00E+00	0,00E+00	-6,77E+00	-6,77E+00	0,00E+00	6,77E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,04E+01
GWP – LULUC	kg CO_2e	6,80E-02	5,25E-03	1,81E-02	9,14E-02	1,74E-03	2,36E-03	MND	MND	MND	MND	MND	MND	MND	9,49E-05	2,20E-03	1,01E-04	1,72E-04	-6,83E-02
Ozone depletion pot.	kg $CFC\text{-}_{11}$e	7,97E-06	3,18E-06	8,68E-07	1,20E-05	1,06E-06	3,48E-07	MND	MND	MND	MND	MND	MND	MND	2,04E-07	1,24E-06	2,18E-07	7,36E-08	-5,91E-06
Acidification potential	mol H^+e	4,26E-01	4,40E-02	4,83E-02	5,18E-01	1,46E-02	1,32E-02	MND	MND	MND	MND	MND	MND	MND	9,90E-03	1,71E-02	1,06E-02	1,71E-03	-3,27E-01
EP-freshwater[2)]	kg Pe	3,07E-03	1,15E-04	4,07E-04	3,60E-03	3,80E-05	7,88E-05	MND	MND	MND	MND	MND	MND	MND	3,16E-06	4,64E-05	3,37E-06	1,91E-06	-2,46E-03
EP-marine	kg Ne	6,66E-02	9,67E-03	1,55E-02	9,18E-02	3,21E-03	3,13E-03	MND	MND	MND	MND	MND	MND	MND	4,38E-03	3,60E-03	4,68E-03	5,92E-04	-5,80E-02
EP-terrestrial	mol Ne	9,56E-01	1,07E-01	1,36E-01	1,20E+00	3,57E-02	3,44E-02	MND	MND	MND	MND	MND	MND	MND	4,81E-02	4,00E-02	5,14E-02	6,51E-03	-7,66E-01
POCP ("smog")[3)]	kg NMVOCe	1,81E-01	4,16E-02	4,59E-02	2,69E-01	1,38E-02	8,50E-03	MND	MND	MND	MND	MND	MND	MND	1,32E-02	1,53E-02	1,41E-02	1,90E-03	-1,74E-01
ADP-minerals & metals[4)]	kg Sbe	1,56E-03	3,29E-05	4,45E-05	1,63E-03	1,09E-05	3,46E-05	MND	MND	MND	MND	MND	MND	MND	4,83E-07	1,60E-05	5,17E-07	4,18E-07	-1,20E-03
ADP-fossil resources	MJ	7,36E+02	2,12E+02	1,91E+02	1,14E+03	7,03E+01	3,07E+01	MND	MND	MND	MND	MND	MND	MND	1,28E+01	8,29E+01	1,37E+01	4,99E+00	-6,26E+02
Water use[5)]	m^3e depr.	1,07E+02	9,45E-01	5,24E+00	1,13E+02	3,14E-01	2,43E+00	MND	MND	MND	MND	MND	MND	MND	3,45E-02	3,68E-01	3,68E-02	1,58E-02	-6,90E+01

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence	1,47E-05	1,54E-06	2,26E-06	1,85E-05	5,10E-07	4,30E-07	MND	MND	MND	MND	MND	MND	MND	2,65E-07	5,39E-07	2,17E-06	3,45E-08	-9,60E-06
Ionizing radiation[6)]	kBq U235e	4,82E+00	1,01E+00	7,35E-01	6,57E+00	3,37E-01	1,73E-01	MND	MND	MND	MND	MND	MND	MND	5,89E-02	3,93E-01	6,29E-02	2,26E-02	-3,72E+00
Ecotoxicity (freshwater)	CTUe	1,78E+03	1,88E+02	2,14E+02	2,18E+03	6,25E+01	5,30E+01	MND	MND	MND	MND	MND	MND	MND	7,71E+00	7,47E+01	8,23E+00	3,26E+00	-1,29E+03
Human toxicity, cancer	CTUh	3,32E-08	4,61E-09	1,15E-08	4,93E-08	1,53E-09	1,43E-09	MND	MND	MND	MND	MND	MND	MND	2,95E-10	1,95E-09	3,16E-10	8,14E-11	-6,95E-08
Human tox. non-cancer	CTUh	1,05E-06	1,81E-07	1,18E-07	1,35E-06	6,02E-08	4,02E-08	MND	MND	MND	MND	MND	MND	MND	5,57E-09	7,01E-08	5,95E-09	2,13E-09	-8,23E-07
SQP[7)]	-	4,30E+02	2,44E+02	4,93E+02	1,17E+03	8,09E+01	3,52E+01	MND	MND	MND	MND	MND	MND	MND	1,67E+00	7,93E+01	1,78E+00	1,07E+01	-3,44E+03

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy[8)]	MJ	7,43E+01	2,38E+00	4,44E+02	5,21E+02	7,91E-01	1,06E+01	MND	MND	MND	MND	MND	MND	MND	7,33E-02	9,54E-01	7,83E-02	4,33E-02	-2,84E+02
Renew. PER as material	MJ	4,82E+01	0,00E+00	5,13E+01	9,95E+01	0,00E+00	-5,93E+01	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	-3,88E+01	-1,45E+00	-2,09E+00
Total use of renew. PER	MJ	1,23E+02	2,38E+00	4,95E+02	6,20E+02	7,91E-01	-4,87E+01	MND	MND	MND	MND	MND	MND	MND	7,33E-02	9,54E-01	-3,87E+01	-1,40E+00	-2,86E+02
Non-re. PER as energy	MJ	7,16E+02	2,12E+02	1,28E+02	1,06E+03	7,03E+01	2,90E+01	MND	MND	MND	MND	MND	MND	MND	1,28E+01	8,29E+01	1,37E+01	4,99E+00	-5,72E+02
Non-re. PER as material	MJ	2,00E+01	0,00E+00	5,96E+01	7,96E+01	0,00E+00	-6,29E+01	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	-1,60E+01	-5,99E-01	8,53E+00
Total use of non-re. PER	MJ	7,36E+02	2,12E+02	1,88E+02	1,14E+03	7,03E+01	-3,39E+01	MND	MND	MND	MND	MND	MND	MND	1,28E+01	8,29E+01	-2,35E+00	4,39E+00	-5,63E+02
Secondary materials	kg	5,21E+01	5,87E-02	1,39E+00	5,35E+01	1,95E-02	1,07E+00	MND	MND	MND	MND	MND	MND	MND	5,02E-03	2,50E-02	5,36E-03	1,05E-03	-1,19E+00
Renew. secondary fuels	MJ	1,27E-02	5,92E-04	1,62E+00	1,63E+00	1,97E-04	3,27E-02	MND	MND	MND	MND	MND	MND	MND	1,64E-05	2,86E-04	1,75E-05	2,74E-05	-1,18E+01
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m^3	1,56E+00	2,73E-02	1,30E-01	1,72E+00	9,07E-03	3,87E-02	MND	MND	MND	MND	MND	MND	MND	7,79E-04	1,03E-02	8,32E-04	5,46E-03	-1,06E+00

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	2,95E+00	2,79E-01	5,42E-01	3,77E+00	9,26E-02	9,38E-02	MND	MND	MND	MND	MND	MND	MND	1,72E-02	1,14E-01	1,83E-02	0,00E+00	-2,45E+00
Non-hazardous waste	kg	9,24E+01	4,58E+00	1,06E+01	1,08E+02	1,52E+00	2,51E+01	MND	MND	MND	MND	MND	MND	MND	1,21E-01	1,84E+00	1,29E-01	3,46E+01	-7,67E+01
Radioactive waste	kg	4,97E-03	1,43E-03	4,32E-04	6,83E-03	4,74E-04	1,64E-04	MND	MND	MND	MND	MND	MND	MND	9,03E-05	5,55E-04	9,64E-05	0,00E+00	-3,46E-03

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	6,72E+02	0,00E+00	0,00E+00
Materials for recycling	kg	0,00E+00	0,00E+00	1,92E+02	1,92E+02	0,00E+00	6,40E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	2,53E+02	0,00E+00	0,00E+00
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,14E+01	MND	MND	MND	MND	MND	MND	MND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML / ISO 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO_2e	4,46E+01	1,34E+01	9,45E+00	6,74E+01	4,44E+00	3,34E+00	MND	MND	MND	MND	MND	MND	MND	9,43E-01	5,42E+00	1,01E+00	1,78E-01	-3,77E+01
Ozone depletion Pot.	kg CFC_{-11}e	7,27E-06	2,52E-06	7,12E-07	1,05E-05	8,36E-07	2,96E-07	MND	MND	MND	MND	MND	MND	MND	1,61E-07	9,82E-07	1,72E-07	5,83E-08	-5,28E-06
Acidification	kg SO_2e	3,16E-01	3,57E-02	3,79E-02	3,90E-01	1,19E-02	9,98E-03	MND	MND	MND	MND	MND	MND	MND	7,06E-03	1,39E-02	7,54E-03	1,29E-03	-2,44E-01
Eutrophication	kg PO_4^3e	8,69E-02	7,81E-03	1,69E-02	1,12E-01	2,59E-03	1,04E-02	MND	MND	MND	MND	MND	MND	MND	1,64E-03	3,05E-03	1,75E-03	2,79E-04	-7,71E-02
POCP (“smog”)	kg C_2H_4e	1,19E-02	1,65E-03	3,45E-03	1,70E-02	5,46E-04	4,83E-04	MND	MND	MND	MND	MND	MND	MND	1,54E-04	6,61E-04	1,65E-04	5,42E-05	-1,24E-02
ADP-elements	kg Sbe	1,27E-03	3,20E-05	4,26E-05	1,34E-03	1,06E-05	2,87E-05	MND	MND	MND	MND	MND	MND	MND	4,76E-07	1,56E-05	5,08E-07	4,12E-07	-1,03E-03
ADP-fossil	MJ	6,37E+02	2,12E+02	1,91E+02	1,04E+03	7,03E+01	2,87E+01	MND	MND	MND	MND	MND	MND	MND	1,28E+01	8,29E+01	1,37E+01	4,99E+00	-5,68E+02

VERIFICATION STATEMENT

VERIFICATION PROCESS FOR THIS EPD

This EPD has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliancy with reference standard, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- The Environmental Product Declaration
- The Life-Cycle Assessment used in this EPD
- The digital background data for this EPD

Why does verification transparency matter? Read more online
This EPD has been generated by One Click LCA EPD generator, which has been verified and approved by the EPD Hub.

THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Environmental Product Declaration (EPD), its LCA and project report, in terms of the data collected and used in the LCA calculations, the way the LCA-based calculations have been carried out, the presentation of environmental data in the EPD, and other additional environmental information, as present with respect to the procedural and methodological requirements in ISO 14025:2010 and reference standard.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the EPD to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification.

Nemanja Nedic, as an authorized verifier acting for EPD Hub Limited
15.12.2024

Polycare
Research & Development

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Hr. Helmut Köttner
Wissenschaftlicher Leiter
Sentinel Holding Institut GmbH
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Geopolymerbetonsteine SEMBLA® Serie - Unbedenklichkeits-Bescheinigung

Sehr geehrter Hr. Köttner,

Hiermit bestätigen wir, dass nach derzeitigem Wissensstand von uns gefertigte Geopolymerbetonsteine der Serie SEMBLA® keine Gefahr für Menschen und Umwelt darstellen.

Diese Erkenntnisse beruhen

a.) auf den aktuellen Testzertifikaten, die uns von unseren Rohstofflieferanten zur Verfügung gestellt werden.

b.) auf verschiedenen Langzeituntersuchungen an Geopolymerbetonsteinen der Serie SEMBLA®, welche bei akkreditierten Prüf-Instituten (z.B. Eco-Institut / Köln und IAB / Weimar) durchgeführt wurden.

Weder in Emissionstests (nach AgBB-Scheme 2021) noch in Auslaugtests (DIN EN 16637-2:2024-01, Ersatzbaustoff V / BBodSchV) konnten chemische Stoffe in schädlichen Konzentrationen nachgewiesen werden.

Alle ermittelten Konzentrationen befanden sich unterhalb der rechtlich erlaubten Toleranzen. Dieses gilt insbesondere für besonders kritische Substanzen wie Schwermetalle und/oder CMR-Stoffe mit ihren strengen Regulierungen.

Auf Wunsch können die Testergebnisse der im Jahre 2024 durchgeführten Langzeitunter-suchungen übermittelt werden.

Bei Rückfragen stehen wir Ihnen gerne zur Verfügung.

Mit freundlichen Grüßen,

(Erfurt, 20.2.25)

Philipp J. Scherer
Leiter Nachhaltigkeit

Anmerkung:
Die oben gemachten Aussagen erfolgen aufgrund unserer Erfahrungen nach bestem Wissen, jedoch unverbindlich.
Diese gelten nur für Baumaterialien die gänzlich unter der Kontrolle von Polycare Research Technology GmbH standen, d.h. produziert, gelagert und verbaut wurden. Für Verwendungen außerhalb unserer Kontrolle können wir keine Aussagen treffen.
Im Normalfall verändern sich unsere Baustoffe nicht. Unter besonderen Umständen (Lagerung, Bewitterung, Verbauung in Problembereichen, etc.) können sich Eigenschaften verändern. Im Zweifelsfall sind wir bei Nachuntersuchungen behilflich.

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