

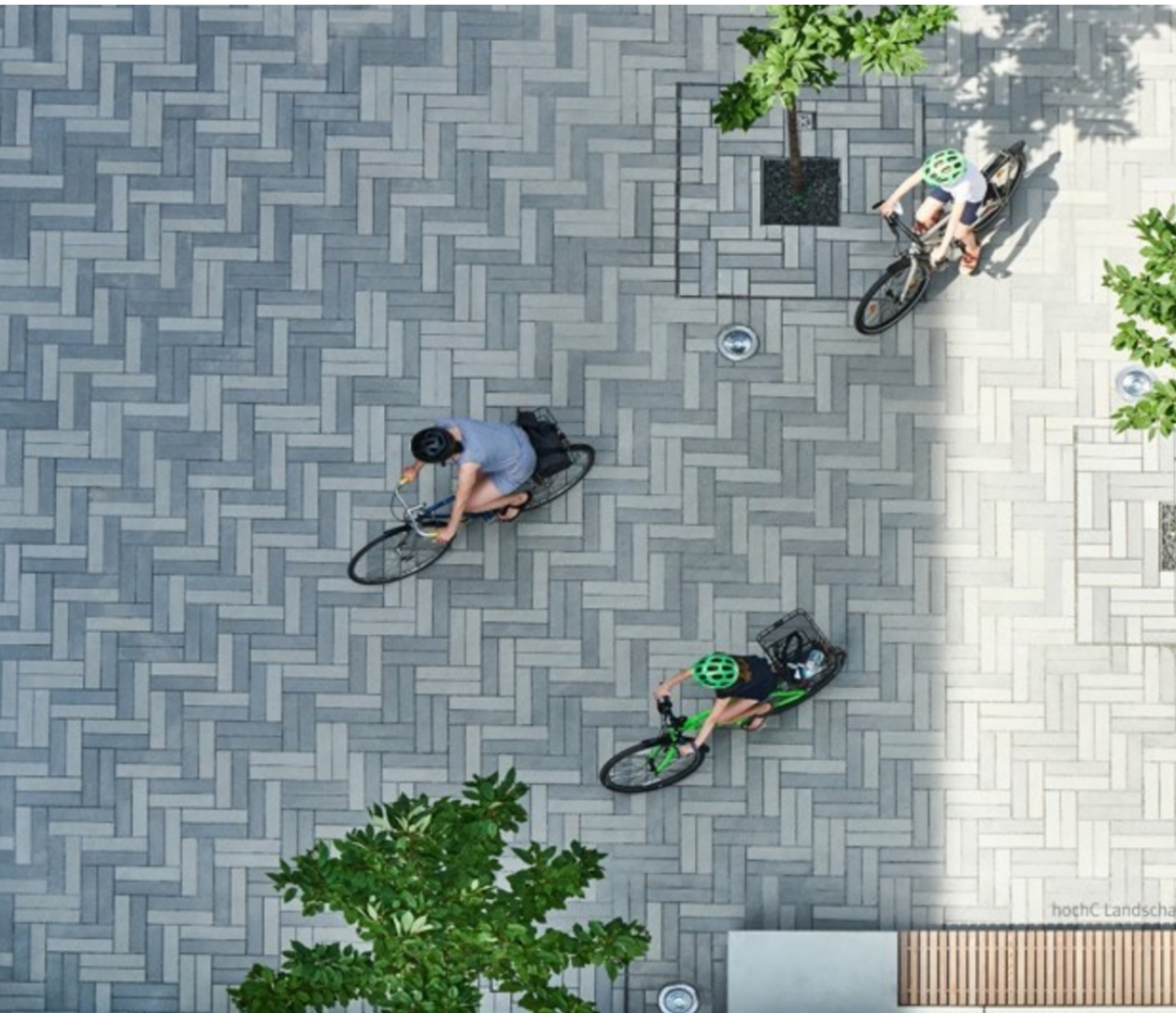
ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A2

Owner of the Declaration	GODELMANN GmbH & Co. KG
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-GDM-20240009-IBA1-EN
Issue date	19.12.2024
Valid to	18.12.2029

Concrete paving stones (50 % concrete secondary material)
GODELMANN GmbH & Co. KG

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hochC Landschaftsarchitekten PartGmbH/Marcus Witte

1. General Information

GODELMANN GmbH & Co. KG

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-GDM-20240009-IBA1-EN

This declaration is based on the product category rules:

Permanent way materials for outdoor traffic routes, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

19.12.2024

Valid to

18.12.2029



Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)



Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Concrete paving stones (50 % concrete secondary material)

Owner of the declaration

GODELMANN GmbH & Co. KG
Industriestraße 1
92269 Fensterbach
Germany

Declared product / declared unit

1 m² GODELMANN concrete paving stone (50 % concrete secondary material)

Scope:

This document refers to concrete paving stone manufactured by GODELMANN GmbH & Co. KG, manufactured in Fensterbach, Germany. The declared unit refers to 1 m² of concrete paving stone (50 % concrete secondary material). The data collection for the manufacture of the declared product was carried out on a plant-specific basis with current annual data from 2022.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR		
Independent verification of the declaration and data according to ISO 14025:2011		
☐	internally	☒ externally



Ms Jane Anderson,
(Independent verifier)

2. Product

2.1 Product description/Product definition

GODELMANN concrete paving stones are used for the holistic design of surfaces in open spaces, gardens, and landscaping. The different concrete paving stone models differ in their dimensions, shapes, surfaces and colours. The production steps and material composition are almost identical, which is why this declaration refers to an average product. Concrete paving stones are made from natural raw materials such as gravel, sand, crushed stone, water and cement/additives. For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) *Regulation (EU) No. 305/2011 (CPR)* applies. The product needs a declaration of performance taking into consideration *DIN EN 1338:2003*, Concrete paving blocks - Requirements and test methods or *DIN EN 1339:2003*, Concrete paving flags - Requirements and test methods and the CE-marking. For the application and use the respective national provisions apply.

2.2 Application

GODELMANN concrete paving stones are used in urban and road construction as well as in gardening and landscaping.

2.3 Technical Data

The data according to the declarations of performance in accordance with *EN 1338* and *EN 1339* apply.

Constructional data

Name	Value	Unit
Durability (freeze-thaw resistance) under normal conditions and / or in the presence of de-icing salts	sufficient	-
Slip resistance and slip resistance - Minimum value (Only for stones, ground surface thereof was polished or prepared so that a smooth surface is created)	≥ 45	-
Slip resistance and slip resistance (durability)	permanent	-
Water absorption	≤ 5	M.-%
Break load	≥ 250	N/mm
Compressive strength	≥ 50	N/mm ²
Gross density and open porosity	2350	kg/m ³
Deviation of the dimensions (Acceptable)	± 2	mm
Flexural strength	≥ 5	MPa
Thermal conductivity	1.56	W/(mK)
Permissible difference the two diagonals (Only for rectangular blocks with sizes of over 300 mm.)	3	mm
Weathering resistance	≤ 0,1	kg/m ²
Durability of the weather resistance	permanent	-
Splitting tensile strength (characteristic)	≥ 3,6	MPa
Splitting tensile strength (single value)	≥ 2,9	MPa
Durability of resistance	permanent	-
Reaction to fire	class A1	-
Behavior to fire from outside	sufficient 2000/553/EU	-
Abrasion resistance	≤ 20	mm
Release of asbestos	not given	-
Hazardous substances	not given	-

Performance values of the product according to the declaration of performance in relation to its essential characteristics according to *EN 1338* and *EN 1339*.

2.4 Delivery status

GODELMANN concrete paving stones are loaded onto pallets for transport for safety reasons and to prevent transport damage. The dimensions of the concrete paving stones are:

- Width = 10–60 cm
- Length = 10–120 cm
- Thickness = 6–16 cm

2.5 Base materials/Ancillary materials

GODELMANN concrete paving stones are made from natural raw materials such as gravel, sand, crushed stone, water, and cement/additives. The most important raw materials are:

- Sand: > 15 M.-%
- Gravel: < 10 M.-%
- Crushed stone: > 15 M.-%
- Internally recycled crushed stone: < 40 M.-%
- Cement: < 11 M.-%
- Additive: > 5 M.-%
- Water: < 5 M.-%

(50% internally recycled crushed stone content in the aggregates of the core concrete; total content of internally recycled crushed stone in the product: 39%)

This product/article/at least one partial article contains substances listed in the candidate list (date: 14.06.2023) exceeding 0.1 percentage by mass: no.

This product/article/at least one partial article contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: no.

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) *Ordinance on Biocide Products No. 528/2012*: no.

2.6 Manufacture

Mixing raw materials

The preliminary products for the concrete paving stones are delivered and stored temporarily in storage silos. In the mixing tower, the face and core concrete are mixed according to predefined recipes. The raw materials cement, sand, gravel, crushed stone, water, and additives are placed in a concrete mixer using a dosing scale and mixed into an earth-moist concrete. Once the mixture is ready, the concrete is transported to the mould in buckets.

Moulding

The fresh face concrete and core concrete are each transported from the buckets to the mould and poured into it. The two layers are pressed together using a vibration-pressing process to give the concrete paving stone its shape. The face concrete forms the visible surface of the paving stone and the core concrete forms the invisible part of the paving stone.

Curing and ageing

The moulding process is followed by demoulding, during which the earth-moist concrete is removed from the mould. The concrete paving stones are cured in a thermally controlled

curing hall. After 24 hours, the concrete paving stones have reached 50% of their standard strength and can be removed from storage, further processed, or subjected to surface treatment (blasting, grinding, etc.). The standard strength is reached 28 days after production.

2.7 Environment and health during manufacturing

GODELMANN is TÜV-certified as a climate-neutral company. The demand for electrical energy is covered exclusively by green electricity, with an own generation share of 30 %. All dust, fine grains, rejects, and overproduction resulting from the manufacturing process are returned 100 % to the manufacturing process in treatment plants. The sustainable water cycle collects rainwater which is fed back into the production process. No drinking water is used for concrete block production. The required process and cleaning water is recycled and returned to production as process water.

2.8 Product processing/Installation

The generally applicable installation and laying instructions for paving stones and paving slabs must be observed for the laying work. To ensure the functionality of the concrete products to be laid, it must be ensured in advance that the paved surface (well-compacted superstructure and subgrade) with its composition and workmanship corresponds to the required loads and geological conditions.

The manufacturer's installation and laying instructions in accordance with *DIN 18318*, ZTV Pflaster-StB 06 and MFP 1 must always be observed.

2.9 Packaging

GODELMANN concrete paving stones are stacked on industry pool pallets and then transported by lorry. PE shrink film and PVC strapping are used as packaging materials. Plastic packaging can be disposed under *EWK 15 01 02*.

2.10 Condition of use

GODELMANN concrete paving stones are durable building materials. The material composition does not change during their service life.

2.11 Environment and health during use

According to current knowledge, hazards to air and soil can be ruled out if the described products are used as intended. There are no known interactions between the product, the environment and health.

2.12 Reference service life

The reference service life could not be determined in accordance with *ISO 15686-1*. According to the service lives of building components for life cycle analyses in accordance with the Assessment System for Sustainable Building (*BBSR 2017*), the service life of concrete paving stones is over 50 years.

2.13 Extraordinary effects

Fire

The concrete paving stones declared here correspond to building material class A1 without testing in accordance with Commission Decision *96/603/EC*, i.e., they are non-combustible.

According to Commission Decision *2000/553/EC*, concrete pavers used for roofing, and which may be exposed to external fire comply with the fire exposure requirement without testing.

Water

No water-polluting ingredients are washed out.

Mechanical destruction

Concrete paving stones can break under mechanical impact.

2.14 Re-use phase

In undamaged form, the dismantled concrete paving stones can be reused for their original purpose.

2.15 Disposal

If the above-mentioned recycling options are not practicable, the remains of concrete paving stones and those from demolition that accumulate on the construction site can be easily disposed of under *EWK 10 13 14* (concrete waste and concrete sludge) or *EWK 17 01* (bricks, tiles and ceramics) and *EWK 17 01 01* (concrete) in accordance with local regulations (AVV) due to their mineral content.

2.16 Further information

Installation instructions, technical information and product data sheets are available for download on the GODELMANN website: www.godelmann.de.

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m² of average GODELMANN concrete paving stone.

Declared unit and mass reference

Name	Value	Unit
Declared unit	1	m ²
Grammage	175	kg/m ²
conversion factor to 1 kg	0.00571	-
Layer thickness	0.0745	m

3.2 System boundary

Type of the EPD: cradle to gate - with options

Modules A1-A3 and A5

Modules A1-A3 take into account the extraction and production

of the necessary raw materials and energies, including all corresponding upstream chains and procurement transport. In addition, the entire manufacturing phase is considered, including the treatment of production waste until the end-of-waste status (EoW) is reached.

Module A5 takes the treatment of packaging materials until EoW into account. Resulting benefits and loads are assigned to module D.

Modules C1-C4 and D

Module C1 describes the deconstruction. No processes are modelled here; therefore no loads/benefits are balanced in Module C1.

In module C2, the transports to the disposal processes are considered.

Module C3 contains the necessary processes for waste processing for recycling at the end of the product life cycle. The loads for waste treatment are included until the EoW is reached.

No processes are modelled in Module C4.
 Resulting benefits and loads are assigned to module D.
 Potentials arising in the process and avoided loads outside the system boundary are assigned to module D.

For the environmental impact, the use of green electricity was calculated taking into account the residual electricity mix for the remaining electricity. The proportion of the electricity demand covered by green electricity in the total electricity demand is 100 %.

3.3 Estimates and assumptions

For transportation to waste treatment (modules A5 and C2), 100 km by truck (50 % utilisation) was assumed.

3.4 Cut-off criteria

All inputs and outputs to the production from the data collection were modelled. Therefore, also flows contributing to less than 1 % of the mass were considered.

3.5 Background data

The LCA software *LCA for Experts* was used to model the life cycle. The manufacturing process, as well as energy consumption, were modelled on the basis of manufacturer-specific data.

Generic background datasets were used for the upstream and downstream processes. The majority of the background datasets used were taken from the current version of the *Sphera Managed LCA Content*. Only when no appropriate data set in the *Sphera Managed LCA Content* database was available, other data sources such as *ecoinvent 3.9* were used.

3.6 Data quality

The foreground data was provided by the manufacturer and has been tested for plausibility. The quality of the foreground data and the extent to which the data is representative can therefore be considered to be good.

The data quality of the background data has been rated as good with regard to the extent to which it is representative in temporal, technical and geographical terms.

With regard to the robustness of the life cycle assessment values, it can be stated that the potential impacts on the environment that have been taken into account result for the most part from the background data. Thus, the impact of background data and primary products is high compared to the environmental impacts caused by the actual production.

3.7 Period under review

Data was collected for the year 2022.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product's lifespan: Europe

3.9 Allocation

All required energies, raw materials, and supplies could be assigned to the declared product. No by-products are produced and no allocation is required.

Loads and benefits resulting from the treatment of the packaging materials (A5) and the product at its end of life (C3) are assigned to module D. The cut-off approach was applied for secondary materials.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. The background data base *Sphera Managed LCA Content* in the Content Version 2023.2 was used.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

Information on describing the biogenic carbon content at factory gate

Not relevant.

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	-	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO₂.

Assembly (A5)

Name	Value	Unit
Output substances following waste treatment on site	0.052	kg

Reference service life

Name	Value	Unit
Life Span (according to BBSR)	> 50	a

End of life (C1-C4)

Name	Value	Unit
Collected as mixed construction waste	175	kg
Reuse	-	kg
Recycling	169.7	kg
Energy recovery	-	kg
Landfilling	5.3	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Material credit	104.7	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction 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	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m2 concrete paving stone (50 % concrete secondary material)

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
GWP-total	kg CO ₂ eq	1.5E+01	1.3E-01	0	1.74E+00	4.45E-01	0	-6.79E-01
GWP-fossil	kg CO ₂ eq	1.5E+01	1.3E-01	0	1.72E+00	4.4E-01	0	-6.73E-01
GWP-biogenic	kg CO ₂ eq	4.79E-02	3.4E-05	0	5.09E-03	1.64E-03	0	-4.17E-03
GWP-luluc	kg CO ₂ eq	7.09E-03	9.07E-06	0	1.59E-02	3.37E-03	0	-2.7E-03
ODP	kg CFC11 eq	1.71E-10	4.34E-14	0	2.23E-13	7.49E-13	0	-6.24E-12
AP	mol H ⁺ eq	3.07E-02	2.19E-05	0	7.36E-03	2.34E-03	0	-1.98E-03
EP-freshwater	kg P eq	1.92E-05	1.44E-08	0	6.28E-06	1.52E-06	0	-2.32E-06
EP-marine	kg N eq	1.1E-02	6.6E-06	0	3.46E-03	1.07E-03	0	-7.15E-04
EP-terrestrial	mol N eq	1.19E-01	9.93E-05	0	3.87E-02	1.18E-02	0	-8.21E-03
POCP	kg NMVOC eq	2.95E-02	1.8E-05	0	6.68E-03	2.91E-03	0	-1.74E-03
ADPE	kg Sb eq	6.99E-07	4.16E-10	0	1.14E-07	4.79E-07	0	-7.45E-08
ADPF	MJ	6.85E+01	1.04E-01	0	2.34E+01	8.81E+00	0	-1.18E+01
WDP	m ³ world eq deprived	4.42E-01	1.23E-02	0	2.07E-02	8.71E-02	0	-3.06E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m2 concrete paving stone (50 % concrete secondary material)

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PERE	MJ	5.12E+01	2.35E-02	0	1.7E+00	8.19E-01	0	-4.51E+00
PERM	MJ	0	0	0	0	0	0	0
PERT	MJ	5.12E+01	2.35E-02	0	1.7E+00	8.19E-01	0	-4.51E+00
PENRE	MJ	6.71E+01	1.6E+00	0	2.35E+01	8.83E+00	0	-1.18E+01
PENRM	MJ	1.5E+00	-1.5E+00	0	0	0	0	0
PENRT	MJ	6.86E+01	1.05E-01	0	2.35E+01	8.83E+00	0	-1.18E+01
SM	kg	6.5E+01	0	0	0	0	0	1.05E+02
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m ³	1.88E-02	2.99E-04	0	1.86E-03	2.52E-03	0	-9.02E-03

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m2 concrete paving stone (50 % concrete secondary material)

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
HWD	kg	3.04E-08	5.23E-13	0	7.27E-11	-2.29E-11	0	4.16E-10
NHWD	kg	4.37E-01	2.4E-02	0	3.58E-03	2.32E-03	0	-6.18E-03
RWD	kg	3.03E-03	3.01E-06	0	4.39E-05	1.18E-04	0	-1.13E-03
CRU	kg	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	1.7E+02	0	0
MER	kg	0	5.21E-02	0	0	0	0	0
EEE	MJ	0	2.32E-01	0	0	0	0	0

EET	MJ	0	4.15E-01	0	0	0	0	0
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HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m2 concrete paving stone (50 % concrete secondary material)

Parameter	Unit	A1-A3	A5	C1	C2	C3	C4	D
PM	Disease incidence	ND	ND	ND	ND	ND	ND	ND
IR	kBq U235 eq	ND	ND	ND	ND	ND	ND	ND
ETP-fw	CTUe	ND	ND	ND	ND	ND	ND	ND
HTP-c	CTUh	ND	ND	ND	ND	ND	ND	ND
HTP-nc	CTUh	ND	ND	ND	ND	ND	ND	ND
SQP	SQP	ND	ND	ND	ND	ND	ND	ND

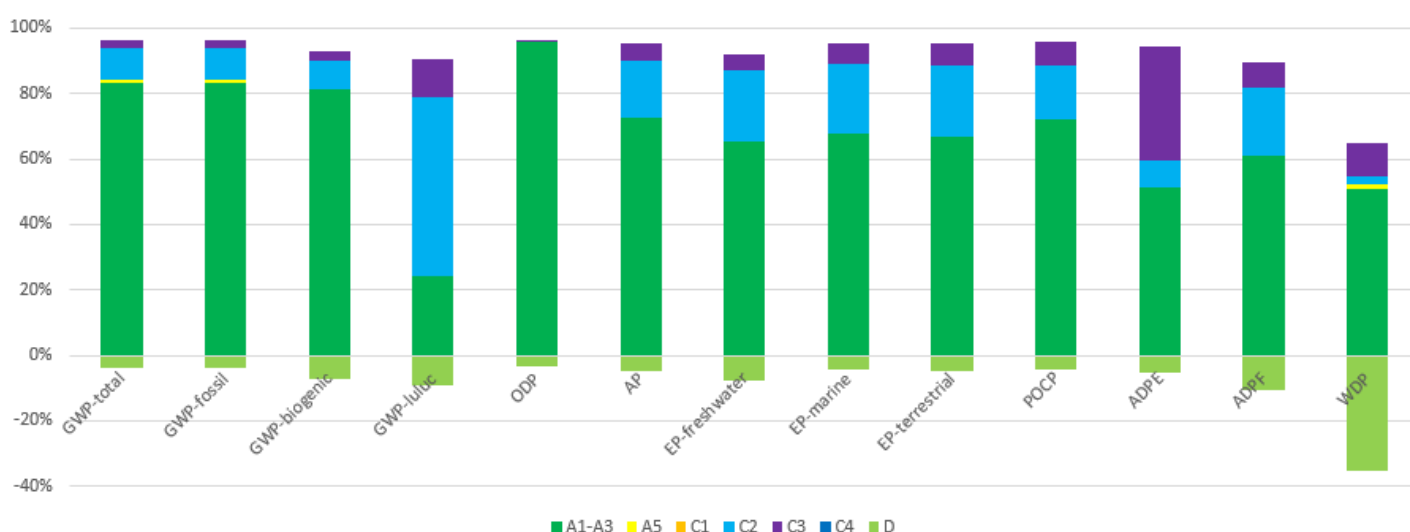
PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

Dominance analysis



The dominance analysis shows that the production phase (modules A1-A3) is dominant in most of the shown impact categories.

Within the production phase, the main impacts are with the cement and the green electricity mix. The cement contributes

to > 90 % of the global warming potential fossil (GWP-fossil) in the production phase.

For products with different dimensions the results can be scaled by weight.

7. Requisite evidence

Not relevant

8. References

Standards

DIN 18318

DIN 18318:2019-09, German construction contract procedures (VOB) - Part C: General technical specifications in construction contracts (ATV) - Sett and slab pavements, and surrounds

EN 1338

DIN EN 1338:2003-08, Concrete paving blocks - Requirements and test methods

EN 1339

DIN EN 1339:2003-08, Concrete paving flags - Requirements and test methods

EN 15804

EN 15804:2012+A2:2019 + AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products.

ISO 14025

ISO 14025:2006-07, Environmental labels and declarations - Type III environmental declarations - Principles and procedures

Further references

AVV

Waste Catalogue Ordinance (Abfallverzeichnis-Verordnung - AVV) of 10 December 2001 (Federal Law Gazette I p. 3379), last amended by Article 2 of the Ordinance of 24 July 2002 (Federal Law Gazette 2833)

CPR

Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

ECHA candidate list

Candidate List of substances of very high concern for Authorisation, from 14.06.2023, published in accordance with Article 59(10) of the REACH Regulation. Helsinki: European Chemicals Agency

EWC

European Waste Catalogue (EWC). Commission Decision on the European List of Waste (COM 2000/532/EC)

Managed LCA Content

Managed LCA Content. Content Version 2023.2. Leinfeld-Echterdingen: Sphera Solutions GmbH.

MFP 1

Merkblatt für Flächenbefestigungen mit Pflasterdecken und Plattenbelägen Teil 1 Regelbauweise (ungebundene Ausführung), Ausgabe 2003. Hrsg.: FGSV Forschungsgesellschaft für Straßen- und Verkehrswesen. Köln 2003.

PCR part A

Product Category Rules for Building-Related Products and Services. Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Version 1.3. Berlin: Institut Bauen und Umwelt e.V. (ed.), 2021.

PCR: Permanent way materials for outdoor traffic routes

PCR Guidance-Texts for Building-Related Products and Services. Part B: Requirements on the EPD for Permanent way materials for outdoor traffic routes. Berlin: Institut Bauen und Umwelt e.V. (ed.), 01.08.2021.

TÜV

Klimaneutrales Unternehmen: Certificate No. W71I C01-2023-12-21260573. TÜV Rheinland, 22.12.2023.

ZTV Pflaster-StB 06

Additional Technical Conditions of Contract and Directives for the Construction of Block or Slab Pavings and Edgings in Road Construction



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