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3rd PARTY VERIFIED

EPD

VERIFIED ENVIRONMENTAL PRODUCT DECLARATION | ISO 14025 & EN 15804



HÜBNER-LEE

TTE[®] PLAST



1. General Information

HÜBNER-LEE GmbH & Co. KG

Programme holder

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

Declaration number

EPD-HBL-20210070-IBB2-EN

This declaration is based on the product category rules:

Permanent way materials for outdoor traffic routes,
30.11.2017
(PCR checked and approved by the SVR)

Issue date

28.07.2022

Valid to

16.09.2026



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



Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.)

Sustainable and permeable pavements

Owner of the declaration

HÜBNER-LEE GmbH & Co. KG
Gewerbestr. 1
87752 Holzgünz - Germany

Declared product / declared unit

TTE®-MultiDrain^{PLUS} | ~ 27 kg/m² | 1 m² is equivalent to 3.125 grids of the product (without filling material)

Scope:

The declaration refers to the production, transport, application and end-of-life of 1 m² TTE®-MultiDrain^{PLUS} (without filling material). The declared product includes the surface finishes diamond nubs (MDP 2000) and round nubs (MDP 3000). The Life Cycle Assessment is based on data collected from the production sites in Weira (Germany) and Herstal (Belgium). A production average over the reference year 2018 was used.

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+A1*. 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



Dipl. Natw. ETH Sascha Iqbal
(Independent verifier)

2. Product

2.1 Product description/Product definition

TTE®-MultiDrain^{PLUS} is a massive plastic grid that is connected to an ecological building concept for unsealed traffic areas and pavements. It offers different design options and possibilities for combination, as it can be grassed or filled with concrete pavers and mineral filling materials. The Product is also available pregrassed or prefilled with TTE®-Pavers.

Its key function is the distribution of load on a large area, due to an innovative frictional interlocking between the single modules. This reduces the requirements on the bearing capacity and compaction of the underground (testet by "Engineering Office Siegfried Ziegler" *ibz*). Therefore the efforts and CO₂-emission for the underground preparation can be reduced. All variations provide a draining capacity, which guarantees full decentralized retention of heavy rainfall (testet by "Bayrische Landesanstalt für Weinbau und Gartenbau" *LWG*).

The raw material of TTE®-MultiDrain^{PLUS} is based on mixed recycling plastic originating from 100% post-

consumer material (PCM) from "Der Grüne Punkt" (*The Green Dot*) and other systems for waste collection and recycling. The production process of the product is injection and intrusion moulding. For the use and application of the product the respective national provisions at the place of use apply, in Germany for example the building codes of the federal states and the corresponding national specifications.

2.2 Application

TTE®-MultiDrain^{PLUS} is SLW 60 - certified for vehicle weights up to 60 t / 20 t axle load (certification via "Technical Inspection Association" *TUEV*). The static load limit of an unfilled TTE®-MultiDrain^{PLUS} grid is 147,5 kN on a 20 x 20 cm stamp, in acc. with *DIN 53 454*).

TTE®-MultiDrain^{PLUS} is suitable for various applications for permeable pavements and traffic areas, like parking lots and access roads for personal cars and heavy traffic, fire brigade access roads, residential streets, logistic areas, automobile logistics, maintenance paths,

event areas, golf paths, campsite, temporary pavements, specific solutions for tree-root protection, weak underground, modular base and drainage for sportsfields.

2.3 Technical Data

Constructional data

Name	Value	Unit
live load SLW 60 (20 t axle load), acc. to DIN 1072	approved	-
sufficient safety for fire engines areas on properties, acc. to DIN 14090	approved	-
UV-stable, acc. to DIN 4892-3	approved	-
dimensionally stable, acc. to ISO 11359 (-20 °C/+60 °C)	approved	-
environmentally neutral acc. to DIN 38415-T06 / DIN 38412 - L30 / DIN 38412 - L33	approved	-
weatherproof, acc. to DIN EN 438-2	approved	-
chemical resistance to deionised water, petrol, engine oil, caustic soda and hydrochloric acid, acc. to MUC-KSP-A 1029	approved	-
pressure stabil, acc. to DIN EN ISO 604	approved	-
compressive stress (20x20 cm stamp), acc. to DIN 53454	10	N/mm ²
compressive strength (20x20 cm stamp), acc. to DIN 53454	147.5	kN
max. compressive strength (20x20 cm stamp), acc. to DIN 53454	176.9	kN
coefficient of water permeability - kf (chambers filled with TTE®-Pavings), acc. to DIN 18915	3.28*E-2	m/s
coefficient of water permeability - kf (grassed grid), acc. to DIN 18915	3.12*E-3	m/s
tensile elastic modulus, acc. to DIN EN ISO 527	1260 ± 50	MPa
flexural elastic modulus, acc. to DIN EN ISO 178	1265 ± 49	MPa
bulk density, acc. to DIN 55 990	1.04	g/cm ³

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no harmonized CE-standards for the product exists).

2.4 Delivery status

Dimensions of the product: 80 x 40 x 6 cm (l x w x h)
 Pieces per pallet: 90 pc. (28,8 m²)
 Size of palletising: 123 x 85 x 200 cm (l x w x h)
 Weight per pallet: approx. 800 kg

2.5 Base materials/Ancillary materials

TTE®-MultiDrainPLUS is made from 100% post-consumer recycling plastics (PCM) from waste systems and recycler like "The Green Dot". Mixed recycled plastic has slight variabilities in its mixture. The material mix of the product contains in average (testet via *Cabka Innovation Center CIC*):

- Polyethylene: ~70 M. -%
- Polypropylene: ~21 M. -%
- other polymers (e.g. PET, PS): ~ 9 M. -%
- may contain residues of paper, metal -& mineral particles, etc. from post-consumer raw-material

This product/article/at least one partial article contains substances listed in *the candidate list* (date: 19.01.2021) exceeding 0.1 percentage by mass: **no**

This product/article/at least one partial article contains other 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**

Additives: A grey colour masterbatch is used as an additive to reduce colour variations in the Herstal plant. It is based on a pigment mix (Carbon Black, Titanium Dioxide) which is bonded in a polyethylene-carrier. The additive has a proportion of <1 % in the product.

The product was tested for 211 hazardous substances according to Substance of Very High Concern (SVHC) and *REACH* Annexe XVII in 2021 (test reports: *OMPG1, OMPG2*). Either the hazardous substances were not measurable or below the limits for the duty to provide information acc. to Article 33 of the *REACH* Regulation.

2.6 Manufacture

TTE®-MultiDrain^{PLUS} is produced in the following stages:

- melting of recycling material in an extruder
- forming by injection moulding or intrusion moulding, depending on the machine
- formed product cooled down active or passive, depending on the machine
- quality assurance
- palletising and packing

Quality Management System in the production sites: *ISO -9001*

2.7 Environment and health during manufacturing

TTE®-MultiDrain^{PLUS} comply with governmental standards during the manufacturing regarding emissions to air, wastewater, and waste as well as noise emissions. The production process implies no risk to the health and safety of the staff. During the manufacturing, no emissions to air must be filtered (water vapour).

The major part of plastic is processed from source material to the final product in one production process, without intermediate solidifying and remelting (granulation). This makes the manufacturing very efficient which saves energy and other resources. Also the plastified material in the moulds is mainly cooled passively without additional energy.

Energy Management System in the production sites: *ISO -50001*

2.8 Product processing/Installation

Underground preparation

The TTE®-System provides extraordinary load distribution, which demonstrably reduces the construction thickness. This reduces the requirements on the bearing capacity of the base layer starting from

EV2 ≥ 20 MPa *ibz*. Depending on the live load, TTE®-MultiDrain^{PLUS} provides 3 basic construction principles:

- 1. occasionally passengers cars and pedestrian**
- 2. passenger cars and occasionally heavy traffic** - 40t acc. to "Guidelines for the standardisation of pavement structures of traffic areas" *RStO 12 – Bk 0,3*)
- 3. heavy traffic** - 40 t (according to *RStO 12 – Bk 1,8*)

Further, the structures differ in the construction material mix. For a greened matter surface a vegetation base layer (substrate mixture, mainly consisting of gravel, topsoil and compost, 0/32 mm to 0/45 mm) is applied, for drainable paving/mineral filler drainable gravel base (e.g. 2/32 mm or 5/45 mm) ensures a high draining capacity and water storage. Corresponding to the surface type, also the bedding layer under the grid consists either of a substrate mixture or a drainable gravel.

Installation of TTE®-MultiDrain^{PLUS}

The grid can be laid on the prepared underground easily manually or mechanically (conventional paving layer machine). Depending on the situation and laying method three different bonds can be applied (stretcher/herringbone/offset-block bond). Laying manually has an estimated laying performance of 15 – 20 m²/hour per person. With a single grid weight of 8,7 kg (27 kg/m²), workers' health is improved.

TTE®-MultiDrain^{PLUS} filling

The TTE® chambers get filled up with soil substrate for a grassed purpose, or specially developed concrete pavers (TTE®-Paver), or with mineral fillers like drainable gravel/water bound covering (sand) or wood chips.

2.9 Packaging

The grids are stacked on a wooden pallet and secured by PET-strapping. The packaging material can be sorted and collected for recycling.

2.10 Condition of use

In the service life, TTE®-MultiDrain^{PLUS} provides no unusual change in material composition and condition as it is approved weatherproof, UV-stable and resistant against chemicals (deionised water, petrol, engine oil, caustic soda and hydrochloric acid) *TUEV*.

2.11 Environment and health during use

Material

The material of TTE®-MultiDrain^{PLUS} has no environmental impact in accordance with *DIN 38415-T06 | DIN 38412-L30 | DIN 38412-L33 TUEV*. In addition, the product was tested for 211 hazardous substances according to *SVHC* and *REACH* Annexe XVII in 2021 (test reports: *OMPG1, OMPG2*). The absence of hazardous substances above the limits indicates that there is no risk to the environment or people's health.

Water permeability

The TTE® construction method with water-permeable grids and low compaction of the underground enables full decentralized seepage. Usually, no additional dewatering devices are required. This relieves the canalization or water bodies and prevents from flooding *LWG*.

Soil and groundwater

An optional use of organic substrate mixtures allows a near-natural rainwater treatment through the biological degradation of pollutants. Consequently, the soil and groundwater are protected, and water reservoirs can be recharged.

2.12 Reference service life

The product is more than 27 years on the market. In the view of Huebner-Lee GmbH & Co. KG the service life of TTE®-MultiDrain^{PLUS} for its applications is up to 50 years or more. Projections of an existing building object with TTE®-MultiDrain^{PLUS} under high traffic conditions (up to 19000 vehicles per day) substantiates the conclusion of a service life of 50 years for its typical applications in traffic calmed zones like parking spaces, service road, floating root bridge and fire department access road.

2.13 Extraordinary effects

Fire

According to *DIN 4102 Part 1*, TTE®-MultiDrain^{PLUS} itself is classified as normal flammability material *DIN 4102-B2*.

Fire protection

Name	Value	Unit
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Water

TTE®-MultiDrain^{PLUS} helps to reduce flooding due to the high permeability *LWG*.

Mechanical destruction

When the product is damaged due to overload or other improper use, it can be dismantled and replaced without losing the connection.

2.14 Re-use phase

The product can be dismantled without damage and reinstalled at another place after the service time. Reference cases and the proven stability, load distribution and resistance of weathering, frost, UV, and chemicals enables in most applications a second service life.

2.15 Disposal

After the useful life of TTE®-MultiDrain^{PLUS} the grids can be removed, roughly cleaned and returned to the production plant for closed-loop recycling. Another option is to dispose the grids at a common recycling centre. Besides these recommended options it is also possible to incinerate the waste with energy recuperation or use landfills (in some countries not applicable depending on the regulations, e.g. Germany).

Waste code in acc. with the European Waste Index *EWC*:

- 17 02 wood, glass and plastic
- 17 02 03 plastic

2.16 Further information

More information about the company, its products and distribution partners is available from our website:

EN: <https://www.huebner-lee.de/en/>

DE: <https://www.huebner-lee.de>

Distribution Partner:

www.huebner-lee.de/en/international

3. LCA: Calculation rules

3.1 Declared Unit

The declaration refers to 1 m² of TTE@-MultiDrain^{PLUS}, with 27,188 kg/m². 1 m² of TTE@-MultiDrain^{PLUS} consists of 3,125 grids of the product.

Declared unit

Name	Value	Unit
Declared unit	1	m ²
Grammage	27.188	kg/m ²
Conversion factor to 1 kg (kg/m ²)	27.188	-
Layer thickness	0,06	m

Declaration type according to PCR part A:

1b) Declaration of a specific product as an average from two of the manufacturer's plants (Weira, Germany and Herstal, Belgium)

The average calculation was done according to the weighted production share of the data providing plants.

3.2 System boundary

The EPD of TTE@-MultiDrain^{PLUS}, includes the production as well as installation, use phase and the End-of-Life of the product with four different options for disposal (closed-loop recycling, re-use, incineration and landfill). It represents a "cradle-to-gate" EPD with options. The following life cycle phases are considered:

Production

A1-A3 – Raw material supply, transport and manufacturing.

Installation

A4 – Transport to building site

A5 – Installation (including packaging waste processing)

Use stage

B1 – Use / application

B2 – Maintenance

B6 – Operational energy use

B7 – Operational water use

For use stage no further effort for TTE@-MultiDrain^{PLUS} is required.

End-of-life

4 Scenarios for End-of-life:

Scenario 1: Recycling "closed loop" (C2/1, C3/1, D/1) and

Scenario 2: Re-use (C2/2, C3/2) with potential benefits for material substitution for the product TTE@-MultiDrain^{PLUS} declared in module D (D/2),

Scenario 3: Incineration with potential benefits from energy substitutions from incineration processes declared in module D (C2/3, C3/3, D/3),

Scenario 4: Landfill - in some countries not applicable depending on the regulations, e.g. Germany (C2/3, C4, D/1)

C1 – Deconstruction/ demolition

C2 – Transport to Waste processing: C2/1 Transport to Recycling, transport to Re-use C2/2, transport to incineration and to landfill C2/3

C3 – Waste processing: C3/1 Recycling "closed-loop", C3/2 Re-use, C3/3 Incineration

C4 – Landfill

Benefits and loads beyond the product system boundary

In module D the potential benefits given for energy substitution from incineration of packaging material in module A5 are declared for all scenarios.

D/1: potential benefits from energy substitutions from incineration processes of the packaging materials in A5, D/2: potential benefits from material substitution for re-use of TTE@-MultiDrain^{PLUS}, D/3 potential benefits from energy substitutions from incineration processes of the packaging materials and product.

3.3 Estimates and assumptions

TTE@-MultiDrain^{PLUS} is produced with post-consumer material (PCM). The PCM input material is modelled as a burden-free input and declared as secondary material. Consequently, no credits are issued in module D for recycling in the end of life (C3/1).

For recycling, (scenario 1) the recycled material is used to return to the production plant (Weira) for a closed-loop recycling. The transport from the building site to the production site has an estimated average distance of 450 km. For the re-use scenario (scenario 2) the transport from the building site to the next building site for re-use has an estimated average distance of 225 km.

In scenario C3/1 100% recycling "closed-loop" is assumed, in C3/2 100% re-use after removal is assumed and in C3/3 100% thermal utilisation is assumed.

3.4 Cut-off criteria

All data from the data acquisition are considered, i.e. all raw materials and their transport, water, thermal and electrical energy, packaging materials and production waste.

Machines, facilities and infrastructure required during manufacture are not taken into account.

3.5 Background data

The *GaBi ts* software was used to model the life cycle of the TTE@-MultiDrain^{PLUS} system. The data in the *GaBi* database version 8.07 is applied for energy, transport, auxiliary products and preliminary products. The database was revised in 2019.

3.6 Data quality

The foreground data collected at the two production sites are based on the volumes produced annually. Data collection was based on product and site-specific questionnaires. As a result, specific data were collected for both sites to calculate a representative average.

Overall the data quality can be described as good, as the level of completeness is very high and the collected primary data reflect current conditions (reference year 2018). To ensure consistency, all primary data are collected with the same level of detail, while all background data are sourced from the *GaBi* databases.

The LCA values can be described as robust concerning variability of the production process, geographical representativity and the influence of

background data and preliminary products compared to the environmental impacts caused by the actual production.

3.7 Period under review

The foreground data collected by the manufacturer for the production process are based on yearly production amounts and extrapolations of measurements on specific machines and plants. The production data refer to an average of the year 2018. The foreground data was collected specifically for TTE®-MultiDrain^{PLUS} by the manufacturer.

3.8 Allocation

Allocation of background data

Information about single datasets is documented in <http://database-documentation.gabi-software.com/support/gabi/>.

Allocation in the foreground data

The production process does not deliver any co-products. The applied software model does not contain any allocation.

3.9 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.

Background database *GaBi ts Service Pack 39 (GaBi ts version 8.07, 2019)* is used.

4. LCA: Scenarios and additional technical information

Characteristic product properties

Biogenic carbon

The product itself does not contain any biogenic carbon, just the product packaging (wooden pallets): 0.19 kg biogenic carbon per square meter. The biogenic carbon content of the packaging (wooden pallets) is released in **A5**.

The following information is the basis of the declared modules:

Transport from the gate to the site (A4)

Name	Value	Unit
Transport distance	450	km
Capacity utilisation (including empty runs)	90	%

Installation (A5)

The following packaging materials are considered on construction site:

Name	Value	Unit
Wooden pallets (*12 MJ/kg)	0.52	kg/m ²
PET bands (*40 MJ/kg)	0.02	kg/m ²

*Heating value (lower)

Drop-offs of the TTE®-System can be easily avoided by taking the measures of the slabs into account in the construction planning, as the tolerances of the plastic grids are very low compared to concrete products. This ensures the best stability and avoids waste. Most applications e.g. parking lots are designed in right-angled areas. Therefore the amount of drop-offs is negligible.

Use or application of the installed product (B-Modules)

No further effort for use stage required:
After installation of TTE®-MultiDrain^{PLUS} no maintenance, repair, replacement, or direct water and power consumption is required to operate the product.

Service life

The calculated service life of 50 years according to Huebner-Lee applies for the reference conditions only. The reference conditions include an outdoor installation according to the instruction guidelines of Huebner-Lee in moderate to subtropical climates.

End of life (C1-C4)

Name	Value	Unit
Collected separately	27.188	kg
Reuse (C3/2)	27.188	kg
Recycling (C3/1)	27.188	kg
Energy recovery (C3/3)	27.188	kg
Landfilling C4	27.188	kg
Transport to End of Life (Recycling): (C2/1)	450	km
Transport to End of life (Re-use): (C2/2)	225	km
Transport to End of Life (Incineration, landfill) (C2/3)	30	km
Capacity utilisation (including empty runs) (C2/1, C2/2)	90	%
Capacity utilisation (including empty runs) (C2/3)	61	%

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

In module D the potential benefits given for energy substitution from incineration of packaging material in module A5 are declared for all scenarios.

D/1: because of the burden-free input of post-consumer material in A1-A3 no credits are issued for recycling in the end of life (C3/1).

For Re-use of the TTE®-MultiDrain^{PLUS} (C3/2) credits are issued in D/2 for material substitution.

For waste incineration in a WIP (R1 > 0.6) with energy recuperation is considered. D/3: credits are issued in module D for the incineration.

5. LCA: Results

The scenario for installation (A5) contains the thermal recovery of the packaging materials.

As **End-of-Life (EoL) scenario 1: Recycling** "closed-loop" (C3/1) with no credits in D/1, **scenario 2: Re-use** (C3/2) with credits in D/2, **scenario 3: Incineration** (C3/3) with credits in D/3, **scenario 4: Landfill** (C4) is considered.

In the table "Description of the system boundary", all declared modules are indicated with an "X"; all modules that are not declared are indicated with "MND". As default the modules B3, B4, B5 are marked as MNR – module not relevant.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE 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	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 m² TTE®-MultiDrainPLUS: 27.188 kg/m² (3.125 grids)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2/1	C2/2	C2/3	C3/1	C3/2	C3/3	C4	D/1	D/2	D/3
GWP	[kg CO ₂ -Eq.]	3.79E+0	5.96E-1	9.91E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.81E-1	2.91E-1	5.04E-2	1.11E+1	0.00E+0	6.78E+1	1.86E+0	-3.36E-1	-4.63E+0	-3.59E+1
ODP	[kg CFC11-Eq.]	1.83E-13	7.66E-17	1.59E-16	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.46E-17	3.73E-17	6.46E-18	4.62E-13	0.00E+0	2.68E-14	6.52E-15	4.63E-15	1.85E-13	4.93E-13
AP	[kg SO ₂ -Eq.]	6.56E-3	4.09E-4	9.84E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.98E-4	1.99E-4	3.68E-5	1.71E-2	0.00E+0	1.60E-2	5.16E-3	5.67E-4	6.70E-3	6.05E-2
EP	[kg (PO ₄) ³ -Eq.]	1.12E-3	5.92E-5	2.03E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.75E-5	2.88E-5	5.67E-6	2.78E-3	0.00E+0	1.26E-3	5.22E-3	6.14E-5	1.09E-3	6.55E-3
POCP	[kg ethene-Eq.]	4.46E-4	1.46E-5	7.96E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.45E-5	7.24E-6	2.94E-7	1.13E-3	0.00E+0	6.15E-4	5.80E-4	4.50E-5	4.75E-4	4.80E-3
ADPE	[kg Sb-Eq.]	1.81E-6	1.63E-8	9.19E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.59E-8	7.94E-9	1.37E-9	4.62E-6	0.00E+0	4.65E-6	3.61E-7	6.06E-8	1.83E-6	6.46E-6
ADPF	[MJ]	5.15E+1	8.18E+0	1.83E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.97E+0	3.99E+0	6.90E-1	1.08E+2	0.00E+0	2.38E+1	2.85E+1	4.74E+0	5.36E+1	5.07E+2

Caption: 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

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: 1 m² TTE®-MultiDrainPLUS: 27.188 kg/m² (3.125 grids)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2/1	C2/2	C2/3	C3/1	C3/2	C3/3	C4	D/1	D/2	D/3
PERE	[MJ]	3.12E+1	2.41E+2	6.28E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.35E+2	1.17E+2	2.03E+3	7.63E+1	0.00E+0	5.19E+0	2.03E+0	-	-	-
PERM	[MJ]	6.24E+0	0.00E+0	6.24E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	3.74E+1	2.41E+2	3.79E+2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.35E+2	1.17E+2	2.03E+3	7.63E+1	0.00E+0	5.19E+0	2.03E+0	-	-	-
PENRE	[MJ]	8.01E+1	8.20E+0	1.02E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.99E+0	4.00E+0	6.92E+1	1.41E+2	0.00E+0	2.69E+1	2.95E+1	-	-	-
PENRM	[MJ]	8.00E+1	0.00E+0	8.00E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	8.09E+1	8.20E+0	2.17E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.99E+0	4.00E+0	6.92E+1	1.41E+2	0.00E+0	2.69E+1	2.95E+1	-	-	-
SM	[kg]	2.77E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.77E+1	0.00E+0
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m ³]	2.03E+2	4.45E+5	2.39E+3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.33E+5	2.17E+5	3.75E+6	4.28E+2	0.00E+0	1.68E+1	4.99E+4	-1.42E+3	-2.09E+2	-1.51E+1
Caption	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+A1: 1 m² TTE®-MultiDrainPLUS: 27.188 kg/m² (3.125 grids)

Parameter	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2/1	C2/2	C2/3	C3/1	C3/2	C3/3	C4	D/1	D/2	D/3
HWD	[kg]	7.47E-8	8.69E-10	1.78E-10	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.47E-10	4.24E-10	7.33E-11	1.10E-7	0.00E+0	1.26E-7	1.24E-7	-2.45E-9	-4.59E-8	-2.62E-7
NHWD	[kg]	7.63E-2	4.89E-5	6.97E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.77E-5	2.39E-5	4.13E-6	1.46E-1	0.00E+0	6.57E+0	2.71E+1	-2.57E-3	-7.61E-2	-2.74E-1
RWD	[kg]	1.16E-2	9.43E-6	1.36E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.19E-6	4.60E-6	7.95E-7	1.33E-2	0.00E+0	1.24E-3	3.93E-4	-4.81E-4	-1.20E-2	-5.12E-2
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.72E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.72E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.72E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	1.43E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.51E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	2.56E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.71E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Caption	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																		

6. LCA: Interpretation

The impact in the **"Production Stage"** A1-A3 (3,79 kg CO₂ equiv.) is mainly determined by the energy consumption, as the plastic raw material enters the system without burden.

The different EoL-scenarios show different result patterns:

The EoL-scenario "Closed-loop" Recycling (C3/1) shows environmental burdens for the treatment of the waste in C3/1 (11 kg CO₂ equiv.).

The end-of-life scenario "Re-use" (C3/2) has results in potential credits in D/2 (-4,63 kg CO₂ equiv.) for the re-use of the product.

The end-of-life scenario "Incineration" (C3/3) has an impact of incineration emissions of 67,8 kg CO₂

equiv. and potential benefits for energy substitution in module D (-35,9 kg CO₂ equiv.).

The end-of-life scenario "Landfill" has an environmental impact of 1,8 kg CO₂ equiv. without any potential benefits for the landfill process.

Energy substitution for the packaging material leads to a potential benefit of -0,336 kg CO₂ equivalent.

The modules B1-B7 and C1, C2 and C4 have almost no contribution to the GWP.

Within the considered modules, the electrical energy supply has the highest importance for the primary energy indicator and all impact categories.

The raw material from *"The Green Dot"* and equal systems consist of 100% secondary material (post-consumer) that enters the system without any loads.

As a consequence, the results are predominantly influenced by the electrical energy requirements of the

process and not by the pre-chain of the plastic material.

7. Requisite evidence

Not relevant

8. References

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European Chemicals Agency (ECHA) Candidate List of Substances of Very High Concern (SVHC) for Authorisation
<https://echa.europa.eu/candidate-list-table> (Status: 19.01.2021; 211 substances listed)

CIC

CABKA Innovation Center: Material Composition Testreport, dated from 5 th of May 2020

DIN 1072

DIN 1072:1985-12 Road and foot bridges; design loads

DIN 14090

DIN 14090:2003-05 Areas for the fire brigade on premises

DIN 18915

DIN 18915:2002-08 Vegetation technology in landscaping - Soil working

DIN 38412

DIN 38412-3:2010-10 German standard methods for the examination of water, waste water and sludge - Bio-assays (group L)

DIN 38415

DIN 38415-6:2003-08 German standard methods for the examination of water, waste water and sludge - Sub-animal testing (group T6)

DIN 4102

DIN 4102:1998-05 Fire behaviour of building materials and building components

DIN 4892

DIN EN ISO 4892-3:2014-02 Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps

DIN 53454

DIN 53454:1971-04 Testing of Plastics; Compression Test

DIN 55990

DIN 55990-3:1979-12 Testing of paints, varnishes and similar coating materials; powder coatings, determination of density

DIN EN 438

DIN EN 438-2:2005-04 High-pressure decorative laminates (HPL) – sheets based on thermosetting resins (usually called laminates)

DIN EN ISO 178

DIN EN ISO 178:2013-09 Plastics - Determination of

flexural properties

DIN EN ISO 527

DIN EN ISO 527-1:2012-06 Plastics - Determination of tensile properties

DIN EN ISO 604

DIN EN ISO 604:2003-12 Plastics - Determination of compressive properties

EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

EWC

The European Waste Catalogue

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GaBi ts dataset documentation for the software-system and databases, LBP, University of Stuttgart and thinkstep, Leinfelden-Echterdingen, 2017 (<http://documentation.gabi-software.com/>)

IBU 2016

IBU (2016): General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., Version 1.1 Institut Bauen und Umwelt e.V. Berlin. www.ibu-epd.de

ibz

Ingenieurbüro für Bauwesen Siegfried Ziegler: Testreport - Comparison of RStO construction and TTE pavement area with regard to load distribution through traffic, dated from 5 th of November 2012

ISO 11359

ISO 11359-2:1999-10 Plastics - Thermomechanical analysis (TMA) - Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature

ISO 14025

DIN EN ISO 14025:2011-10, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

ISO 50001

ISO 50001:2011-12 Energy management systems - Requirements with guidance for use

ISO 9001

ISO 9001:2015-11 Quality management systems - Requirements

LWG

Bayerische Landesanstalt für Weinbau und Gartenbau: Testreport - water permeability and -storage of TTE-

Systems, dated from 13 th of February 2006

MUC-KSP-A 1029

MUC-KSP-A 1029 Testing and certification of thick-walled plastic turf grids with a profile thickness > 10mm
Publication date: not available

Website: <https://www.tuvsud.com/de-de/branchen/produzierende-industrie/maschinen-geraete-ausruestung/werkstofftechnik/werkstoffpruefung-kunststoffe/pruefzeichen-muc-ksp-a-1029>
Testing for TUEV Certificate: 27.01.2014

OMPG1

Conformity acc. to Regulation (EC) 1907/2006 SVHC list and appendix XVII

Institute: OMPG Ltd.

Test Report: 21250-1138_01, dated from 02.08.2021

Product produced in Weira, Germany

OMPG2

Conformity acc. to Regulation (EC) 1907/2006 SVHC list and appendix XVII

Institute: OMPG Ltd.

Test Report: 21250-1139_01, dated from 02.08.2021

Product produced in Herstal, Belgium

Ordinance on Biocide Products

European Chemicals Agency (ECHA)

<https://echa.europa.eu/regulations/biocidal-products-regulation/understanding-bpr>

<https://echa.europa.eu/regulations/biocidal-products-regulation/legislation> (website dated from 09/2021)

PCR 2017, Part B

Institut Bauen und Umwelt e.V., Berlin (pub.): Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part B: Requirements on the EPD for permanent way materials for outdoor traffic

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REACH (EC 1907/2006) aims to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances.
https://ec.europa.eu/environment/chemicals/reach/reach_en.htm (website dated from 09/2021)

RStO 12

RStO 12: German "guidelines for the standardisation of pavement structures of traffic areas" - Edition 2012

The Green Dot

The Green Dot (Der Grüne Punkt) is providing collection of used sales packages and obtains raw materials for producers.

Homepage: <https://www.gruener-punkt.de/en> (website dated from 09/2021)

TUEV

TUEV SUEB Certificate No. 19 11 90292 001-1, dated from 07.10.2019 | valid until 11/2022 | regularly re-certified

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