

ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804+A2

Owner of the Declaration	Schöck Bauteile GmbH
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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Valid to	25.03.2031

Schöck Bole® (V) type O and type U Schöck Bauteile GmbH

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1. General Information

Schöck Bauteile GmbH

Programme holder

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

Declaration number

EPD-SBG-20250655-IBC1-EN

This declaration is based on the product category rules:

Reinforcing Steel, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

26.03.2026

Valid to

25.03.2031



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



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

Schöck Bole® (V) type O and type U

Owner of the declaration

Schöck Bauteile GmbH
Schöckstraße 1
76534 Baden-Baden
Germany

Declared product / declared unit

1 kg Schöck Bole® (V) typ O or U

Scope:

The average EPD refers to one kilogram of Schöck Bole® (V) type O or U punching shear reinforcement manufactured by Schöck Bauteile GmbH. A total of 280 variants were considered, and a weighted average was calculated based on their sales volumes. Production of Schöck Bole® (V) Issue date type O or U takes place at the Schöck plants in Baden-Baden (Germany) and Pillis (Hungary).

The results of the average EPD for the weighted average Schöck Bole® (V) type O or U are applicable to all variants of this Bole®. 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 evidence.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard is abbreviated 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	
<input type="checkbox"/>	internal
<input checked="" type="checkbox"/>	external



Dr. Martina Bender,
(Independent verifier)

2. Product

2.1 Product description/Product definition

The Schöck Bole® is a punching shear and shear reinforcement system which increases the load-bearing capacity in flat slabs and foundations in the vicinity of walls and columns. The Schöck Bole® consists of at least two double-headed bolts, which are welded to spacer bars and thus joined to form a linear element. The spacer bars ensure the stability of the element during installation and maintain the specified spacing between the double-headed bolts.

The double-headed bolts and spacer bars are made of B500B reinforcing steel in accordance with *EN DIN EN 1992-1-1:2011-01*, Eurocode 2: Design and construction of reinforced and prestressed concrete structures – Part 1-1: General design rules and rules for building construction, Annex C and *DIN 488-1:2009-08*, Reinforcing steel – Part 1: Steel grades, properties, marking. The heads of the bolts are produced by hot forming the reinforcing steel bars.

Properties of B500B reinforcing steel:

Name	Value
Tensile strength	≥ 540 N/mm ²
Yield strength	≥ 500 N/mm ²
Diameter of double-headed bolt	10,12,14,16,20,25 mm
Diameter of spacer rods	6, 8 mm

This Environmental Product Declaration covers the following variants of Schöck Bole®:

- **Bole® type O** – punching shear reinforcement for installation from above after the slab reinforcement has been laid
- **Bole® type U** – punching shear reinforcement for installation from below prior to the laying of the slab reinforcement
- **Bole® V type O** – shear reinforcement for installation from above after the slab reinforcement has been laid
- **Bole® V type U** – shear reinforcement for installation from below prior to the laying of the slab reinforcement

Schöck Bole® types O and U have been subject to a *European Technical Assessment (ETA) 13/0076* in accordance with *EAD 160003-00-0301*. Regulation (EU/EFTA) No 305/2011 (CPR) applies to the placing on the market of the construction product. The corresponding CE marking is affixed to the product, and all essential characteristics are published in the Declaration of Performance *DOP_BO_ETA_13-0076* in its currently valid version.

The design and essential characteristics of the Schöck Bole® V type O and U are specified in the General Building Approval *Z-15.1-260*. The corresponding approval mark is affixed to the product.

2.2 Application

The Schöck Bole® is used in flat slabs, floor slabs and foundations to increase the shear capacity in the vicinity of columns, walls or concentrated loads. It can be installed in both in-situ concrete and precast elements.

The design and arrangement of the Bole® as punching shear reinforcement in the vicinity of point load applications is carried out in accordance with the technical report *EOTA TR 060* in conjunction with standard *EN 1992-1-1* and the relevant

national annex.

The design and arrangement of Bole® V as shear reinforcement in the vicinity of linear supports and loads is carried out in accordance with approval *Z-15.1-260* in conjunction with standard *EN 1992-1-1* and the relevant national annex.

2.3 Technical data

The following table takes into account the material properties of the raw material and the key characteristics in accordance with *ETA-13/0076* and the general building approval *Z-15.1-260*.

Structural data

Name	Value	Unit
Tensile strength	≥ 540	N/mm ²
Type of steel (bar, ring, welded mesh, truss)	Bar	-
Production route (EAF or BOF)	EAF	-
Weldability	≤ 0,52	Ceq
Yield strength	≥ 500	N/mm ²
Elongation (Agt)	≥ 5	%
Recycled content	> 89	%
Increase factor for punching shear resistance for flat slabs kpu,sl	1.96	-
Increase factor for punching shear resistance for floor slabs kpu,fo	1.50	-
Characteristic fatigue strength for N = 2.0E+6 load cycles	70	MPa

Product performance values in accordance with the Declaration of Performance regarding its essential characteristics in accordance with *ETA-13/0076*, 14.07.2022, Schöck Bole® punching shear reinforcement.

2.4 Delivery status

When ordering, the following details are required for each Schöck Bole® punching shear element:

- Type of Bole® (V) type O or U
- Diameter of double-headed bolts 10, 12, 14, 16, 20, 25 mm
- Height of the double-headed bolts
- Number of bolts per strip 2 to 15
- Bolt spacing and total length of the strip

The punching shear elements are manufactured to order in accordance with the order specifications. The products are supplied ready for installation. The bolts are factory-welded onto the spacer bars. All product information and the CE mark are printed on a label attached to the first bolt. For type U, the supplied spacers must be fitted onto the spacer bars prior to installation.

2.5 Base materials/auxiliary materials

Name	Value	Unit
Reinforcing steel B500B	100	M.-%

Other components are:

- Polyethylene (PE) label
- Spacer made of polypropylene (PP)
- Weld metal made from material No. 1.5130

These other components were not taken into account and were excluded in accordance with the exclusion rule, as they account for less than 0.2% by mass.

The product/article/at least one sub-article contains substances from the ECHA list of Substances of Very High Concern (SVHC) eligible for authorisation (25.06.2025) in concentrations exceeding 0.1% by weight: **no**.

The product/article/at least one component contains other CMR substances of category 1A or 1B that are not on the *Candidate List*, in concentrations exceeding 0.1% by weight in at least one component: **no**.

Biocidal products have been added to this construction product or it has been treated with biocidal products (it is therefore a treated article within the meaning of the *Biocidal Products Regulation* (EU) No 528/2012): **no**.

2.6 Manufacture

The Schöck Bole® is manufactured in the following steps:

- Cutting the bars for the double-headed bolts
- Hot forming of the bar ends into heads by means of electrical heating and pressing
- Cutting the spacer bars for each Bole® element
- Welding (MAG) the spacer bars to the bolts

Any offcuts and production residues are collected separately and disposed of or recycled by certified companies. A shielding gas and welding wire (G4Si1) are used when welding the bolts to the spacer bars.

Quality assurance in production is regularly audited by a notified third-party auditor and confirmed in the form of an annual declaration of conformity.

Quality management in manufacturing:

The company has been certified to *ISO 9001* by DEKRA Certification GmbH since 2006.

2.7 Environment and health during manufacturing

The criteria for environmental and energy management, as well as the requirements regarding health and safety at work, are complied with in accordance with the certifications.

Occupational health and safety in manufacturing:

Occupational health and safety management in accordance with *ISO 45001* since 2018.

Environmental protection in manufacturing:

Environmental management in accordance with *ISO 14001* since 2013.

Energy management in accordance with *ISO 50001* since 2014.

All certifications are carried out by DEKRA Certification GmbH.

All types of waste, such as reinforcing steel, wood (wooden pallets and wooden fittings) and packaging film, which are generated during the manufacture of the product or remain as surplus material, are separated, stored and disposed of or recycled by specialist companies.

2.8 Product processing/Installation

Schöck Bole® (V) type O is inserted from above into the previously laid slab reinforcement and placed on the top layer using the spacer bars. The spacer bars of the Bole® strip are secured to the top layer of the slab reinforcement with wire.

Schöck Bole® (V) type U is placed on the formwork of the flat slab or the screed layer for foundations using spacers. The slab reinforcement is then laid.

The exact installation location of the individual punching shear elements is specified in the drawings for the respective construction project. No special environmental protection measures are required during the installation of Schöck Bole®.

2.9 Packaging

Schöck Bole® elements are stacked on wooden pallets and wrapped with polypropylene (PP) strapping. For smaller quantities, the elements are wrapped in cardboard strips and secured with polypropylene (PP) strapping. The wooden pallets and cardboard packaging can be returned to authorised waste disposal companies via the Interseroh system.

2.10 Condition of use

The material composition of the Schöck Bole® does not change during its service life. The product is durable as it is encased in concrete throughout its service life.

2.11 Environment and health during use

Provided that planning and installation comply with standards, the environment and health during use are not adversely affected according to current state of knowledge. No special measures are required during processing to protect the environment and health.

2.12 Reference service life

A reference service life in accordance with *ISO 15686* cannot be declared. The *BBSR table (2025)* 'Service lives of building components for life cycle analysis according to BNB' specifies a service life of at least 50 years for steel components. This is subject to correct planning, use and installation in accordance with the manufacturer's specifications.

Provided that installation and planning are carried out correctly, all components of the Schöck Bole® are protected from external influences by sufficient concrete cover. Under these conditions, the product is not expected to age due to corrosion or changes in mechanical properties.

2.13 Extraordinary effects

Fire

The Schöck Bole® (V) type O and U consist of 100% reinforcing steel, which is classified as non-combustible (A1) in accordance with European Commission Decision 96/603/EC.

Fire-protection

Name	Value
Building material class	A1

Water

When installed, the Schöck Bole® is completely encased in concrete. Therefore, no contact with water is to be expected. Should the concrete component be in constant contact with water, this must be taken into account in the concrete cover or by means of a waterproofing system on the surface. In the event of short-term occurrences such as flooding, the protection provided by the concrete is sufficient.

Mechanical destruction

Not relevant.

2.14 Re-use phase

Recovery of the construction product is possible through demolition or dismantling of the building. Subsequently, the concrete and reinforcing steel must be separated. Reuse of the removed Schöck Bole® is not possible. Instead, the entire product can be recycled as steel.

2.15 Disposal

The Schöck Bole® can be disposed of or recycled using the following waste code in accordance with the European Waste Catalogue (EWC):

- 17 04 05 Iron and steel

2.16 Further information

For further information about the product, please visit www.schoeck.com.

3. LCA: Calculation rules

3.1 Declared unit

The declared unit is one kilogram (1 kg) of average Schöck Bole® (V) type O and type U (plus packaging). The declaration type is a manufacturer's declaration. The EPD variant is a volume-weighted average EPD.

Depending on customer requirements, a Schöck Bole® consists of several bolts welded to two distribution bars. In 2024, 280 different variants of the Bole® were manufactured to customer order. The various variants differ in terms of the length and diameter of the bolts and distribution bars, as well as the number of bolts. Each variant of the Bole® therefore has a specific product weight.

Declared unit and mass reference

Name	Value	Unit
Declared unit	1	kg

3.2 System boundary

EPD type b) from cradle to factory gate with options, modules C1–C4 and module D (A1–A3 + C + D and additional modules A4 and A5) is declared.

Module A1–A3

The product phase comprises the provision of reinforcing steel and packaging materials, as well as the associated transport to the production site. In addition, the electrical energy required for the manufacturing process is taken into account. For double-headed bolts, transport from the Pilis production site (Hungary) to Baden-Baden (Germany) is also taken into account.

Due to its low economic value, the steel scrap leaves the system without allocation (cut-off). Therefore, all impacts are attributed to the production of the declared unit.

The cut-off method is applied for the use of secondary materials. Consequently, secondary materials enter the system under consideration without any environmental impacts. The value for GWP-fossil for the electricity mix used in modules A1–A3 is 0.364 kg CO₂eq./kWh.

Module A4

Module A4 examines transport to the construction site based on the average distances to customers, taking into account the respective sales volumes.

Module A5

Module A5 covers the treatment of packaging materials until they reach the end-of-waste status. For cardboard packaging, recycling is modelled and it is assumed that the end-of-waste status is achieved after transport to the recycling plant. The substitution potentials from cardboard recycling are specified in Module D.

For pallets and polypropylene packaging, incineration with energy recovery is modelled. It is assumed that the end-of-

waste status is achieved after incineration. The substitution potentials from the electrical and thermal energy recovered are specified in Module D.

It is assumed that the impacts associated with installation are negligible, as the Schöck Bole® is delivered ready-to-fit and no cutting or welding is required.

Module C1-C4

Module C1 describes the costs incurred after the end of the product's service life for the dismantling or demolition of the reinforced concrete.

Module C2 takes into account transport to the disposal processes. A 100 km lorry journey to the waste sorting plant was modelled.

Module C3 contains the necessary processes for waste treatment at the end of the product life cycle. Reinforcing steel must be mechanically separated from the surrounding concrete prior to recycling. The costs for waste sorting are allocated to Module C3. The end-of-waste status for steel scrap is assumed to be reached following transport to and sorting at a recycling plant. The sorted steel has attained end-of-waste status as it exhibits functional equivalence to the primary material it replaces. The resulting substitution potentials for a subsequent product system are taken into account in Module D.

Module C4 describes the costs of disposing of the product. A collection rate of 95% is assumed for the recycling of the product. This assumes 5% collection losses, which are not recycled but disposed of in a landfill.

Module D

The output streams or secondary raw materials/fuels resulting from waste treatment in A5 and C3, which can potentially serve as energy input (energy recovery) or material input (recycling) for another product system are specified in Module D.

For steel, only net flows are taken into account to ensure consistency with the cut-off method. Therefore, the output flows are compared with the input flows of secondary raw materials. The difference between the input and output flows gives the resulting net flow, the impact of which is calculated in Module D. For the environmental impacts, the use of green electricity was calculated, taking into account the residual electricity mix and a CHP plant for the remaining electricity. The proportion of total electricity demand covered by green electricity is 0.1%.

3.3 Estimates and assumptions

Costs for demolition/dismantling in Module C1:

In accordance with an assumption by the German Federal Environment Agency (UBA), it was assumed that 60% of the reinforced concrete would be demolished using a cable excavator and a wrecking ball (diesel consumption of the excavator: 60.8 litres/hour; output approx. 15 m³/h) and 40% of the reinforced concrete will be collected using a hydraulic excavator and grapple (diesel consumption of excavator and grapple: 36.1 litres/hour; output approx. 20 m³/h). The ratio of

reinforcing steel to concrete is 4.8%, which corresponds to 120 kg of reinforcing steel per m³ of reinforced concrete.

Packaging materials for transport in modules A1–A3
 Reusable packaging is used for the internal transport of bolts from Pils to Baden-Baden (1,050 km). Due to the multiple use of the materials and the small quantity, the costs for this packaging are set at '0'.

For the environmental impacts, the use of green electricity was calculated, taking into account the residual electricity mix for the remaining electricity. The proportion of the total electricity demand covered by green electricity is 0.1%.

3.4 Cut-off criteria

The polyethylene labels, the weld material (material no. 1.5130) and the polypropylene spacers used exclusively for the Schöck Bole® type U were not taken into account and were excluded. For pallet production, only one data set for wood was used. The further process steps involved in pallet production were not considered and were excluded.

Any process steps that may be necessary for the recycling of cardboard packaging (sorting, shredding, etc.) have not been included in the assessment and were excluded.

Otherwise, all specific data collected were taken into account. It can be assumed that the exclusion criteria for the consideration of primary energy consumption and mass in accordance with EN 15804+A2 (< 1% each, < 5% in total per declared module) were met. Furthermore, no substances or processes with high environmental relevance were excluded.

3.5 Background data

The Sphera *LCA for Experts* (formerly GaBi) software system, version 10.9, was used for the life cycle assessment model, utilising the background datasets from the *Sphera Managed LCA Content* databases (Service Pack 2024.2).

3.6 Data quality

The collected data was checked for plausibility and consistency. It can be assumed that the representativeness is good to very good. The data quality of the selected background datasets is assessed as very good overall. The background data used covers the years 2020 to 2024.

This is an EPD for multiple products based on average results. It is a weighted average based on production volume by mass. Firstly, the results for individual products may deviate from the declared average product due to the varying weights of the bolts and distribution bars. The declared unit of 1 kilogram of

Schöck Bole® may contain between 0.15 and 5.5 bolts. The more bolts contained in a declared unit, the higher the energy consumption during manufacture, the amount of off-cuts and the packaging requirements. Furthermore, the deviations result from the two production sites with their different raw material and energy suppliers and production processes.

3.7 Period under review

The specific data collected for the production processes is from the year 2024. Annual total values were collected and extrapolated to the declared unit. This ensures the calculation of production-weighted average values.

3.8 Geographic representativeness

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

3.9 Allocation

The heat generated at the CHP plant in Baden-Baden cannot be attributed to any specific product. For this reason, a conservative approach was adopted and, in addition to the costs for the electricity generated, the costs for the proportion of heat generated were also allocated to the manufacture of the declared unit.

The waste treatment of material flows is considered until the status of end-of-waste is reached. The costs for waste treatment are taken into account in the module in which the waste is generated (A1–A3, A5, C3 and C4); the substitution potentials from energy recovery and recycling (A5 and C3) are allocated to Module D.

To determine the net flows of secondary material for calculating the substitution potentials at the end of the life cycle, the primary material inputs are deducted before the credit for recycled material is applied in Module D. This ensures that credits are only granted for the proportion of primary material.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all data sets to be compared were created according to EN 15804 and the building context and product-specific performance characteristics are taken into account. The software *LCA for Experts* (version 10.9) and the background database *Managed LCA Content* (Service Pack 2024.2) from Sphera were used to create the EPD.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	-	kg C
Biogenic carbon content in accompanying packaging	0.028	kg C

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

The following technical information forms the basis for the declared modules or can be used to develop specific scenarios in the context of a building assessment where modules are not declared (MND).

Transport from the manufacturer to the place of use (A4)

Name	Value	Unit
Litres of fuel	2	l/100tkm
Transport distance	374	km
Capacity utilisation (including empty runs)	55	%

Assembly (A5)

Module A5 covers the treatment of packaging materials until they reach the end-of-waste status.

Name	Value	Unit
Output substances following waste treatment on site	0.053	kg

A reference service life could not be specified in accordance with ISO 15686. The service life is taken from Table BNB Service Life of Building Components 2025.

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	1	kg
Recycling	0.95	kg
Landfilling	0.05	kg

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

Name	Value	Unit
Thermal utilisation of wood (Module A5)	0.053	kg
Thermal recovery of polypropylene (Module A5)	0.001	kg
Recycling of cardboard (Module A5)	0.001	kg

Due to the high proportion of secondary materials in the product, the net steel scrap quantity is negative and there is no substitution potential for this in Module D.

5. LCA: Results

The following results for the impact categories relate to the potential environmental impacts over an analysis period of 100 years. Long-term emissions (> 100 years) are not taken into account in the impact assessment. The results of the impact categories are only relative statements that do not make any statements about endpoints of the impact categories, exceedances of threshold values, safety margins or risks.

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	X	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 kg Bole

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO ₂ eq	1.02E+00	4.75E-02	3.01E-02	8.54E-04	1.07E-02	2.59E-03	7.55E-04	6.16E-02
GWP-fossil	kg CO ₂ eq	1.03E+00	4.66E-02	2.54E-03	7.77E-04	1.05E-02	2.55E-03	7.48E-04	6.18E-02
GWP-biogenic	kg CO ₂ eq	-2.22E-02	1.49E-04	2.75E-02	1.22E-05	3.24E-05	9.52E-06	2.38E-06	-1.4E-04
GWP-luluc	kg CO ₂ eq	2.59E-03	7.9E-04	9.8E-06	6.47E-05	1.71E-04	3.44E-05	4.49E-06	9.64E-06
ODP	kg CFC11 eq	1.3E-08	6.93E-15	9.58E-15	5.67E-16	1.5E-15	4.6E-15	2.02E-15	-3.44E-13
AP	mol H ⁺ eq	3.55E-03	3.36E-04	1.53E-05	3.33E-06	4.34E-05	1.27E-05	5.31E-06	1.86E-04
EP-freshwater	kg P eq	1.24E-04	2.01E-07	4.72E-09	1.64E-08	4.35E-08	9.91E-09	1.7E-09	-2.21E-08
EP-marine	kg N eq	1.16E-03	1.66E-04	4.58E-06	9.72E-07	2.06E-05	5.87E-06	1.37E-06	2.61E-05
EP-terrestrial	mol N eq	1.19E-02	1.83E-03	6.45E-05	1.19E-05	2.3E-04	6.49E-05	1.51E-05	2.19E-04
POCP	kg NMVOC eq	3.52E-03	3.24E-04	1.25E-05	3.4E-06	4.12E-05	1.62E-05	4.19E-06	1.16E-04
ADPE	kg Sb eq	2.29E-06	4.1E-09	1.48E-10	3.35E-10	8.88E-10	2.67E-09	4.85E-11	4.9E-07
ADPF	MJ	1.55E+01	6.19E-01	2.8E-02	5.07E-02	1.34E-01	4.77E-02	9.87E-03	4.15E-01
WDP	m ³ world eq deprived	1.99E-01	7.28E-04	9.47E-03	5.96E-05	1.58E-04	4.87E-04	8.56E-05	3.08E-03

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 kg Bole

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	3.74E+00	5.34E-02	-8.93E-01	4.37E-03	1.16E-02	5.08E-03	1.72E-03	-1.86E-01
PERM	MJ	-9E-01	0	9E-01	0	0	0	0	0
PERT	MJ	2.84E+00	5.34E-02	6.53E-03	4.37E-03	1.16E-02	5.08E-03	1.72E-03	-1.86E-01
PENRE	MJ	1.55E+01	6.19E-01	2.1E-02	5.07E-02	1.34E-01	4.77E-02	9.87E-03	4.15E-01
PENRM	MJ	-7E-03	0	7E-03	0	0	0	0	0
PENRT	MJ	1.55E+01	6.19E-01	2.8E-02	5.07E-02	1.34E-01	4.77E-02	9.87E-03	4.15E-01
SM	kg	1.12E+00	0	0	0	0	0	0	1.18E-04
RSF	MJ	7.97E-02	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m ³	1.53E-02	5.94E-05	2.23E-04	4.87E-06	1.29E-05	1.42E-05	2.62E-06	8.67E-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 kg Bole

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	2.84E-03	2.37E-11	1.26E-11	1.94E-12	5.14E-12	6.9E-12	2.46E-12	6.15E-09
NHWD	kg	4.01E-01	1.01E-04	1.69E-03	8.28E-06	2.19E-05	1.31E-05	5E-02	-1.07E-02
RWD	kg	9.31E-04	1.13E-06	1.14E-06	9.24E-08	2.45E-07	6E-07	1.03E-07	-3.36E-05
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	1.86E-01	0	5.59E-04	0	0	9.21E-01	0	0
MER	kg	0	0	0	0	0	0	0	0

EEE	MJ	0	0	1.2E-01	0	0	0	0	0
EET	MJ	0	0	2.17E-01	0	0	0	0	0

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 kg Bole

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	ND	ND	ND	ND	ND	ND	ND	ND
IR	kBq U235 eq	ND	ND	ND	ND	ND	ND	ND	ND
ETP-fw	CTUe	ND	ND	ND	ND	ND	ND	ND	ND
HTP-c	CTUh	ND	ND	ND	ND	ND	ND	ND	ND
HTP-nc	CTUh	ND	ND	ND	ND	ND	ND	ND	ND
SQP	SQP	ND	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 (carcinogenic); HTP-nc = Potential comparative toxic unit for humans (not carcinogenic); 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.

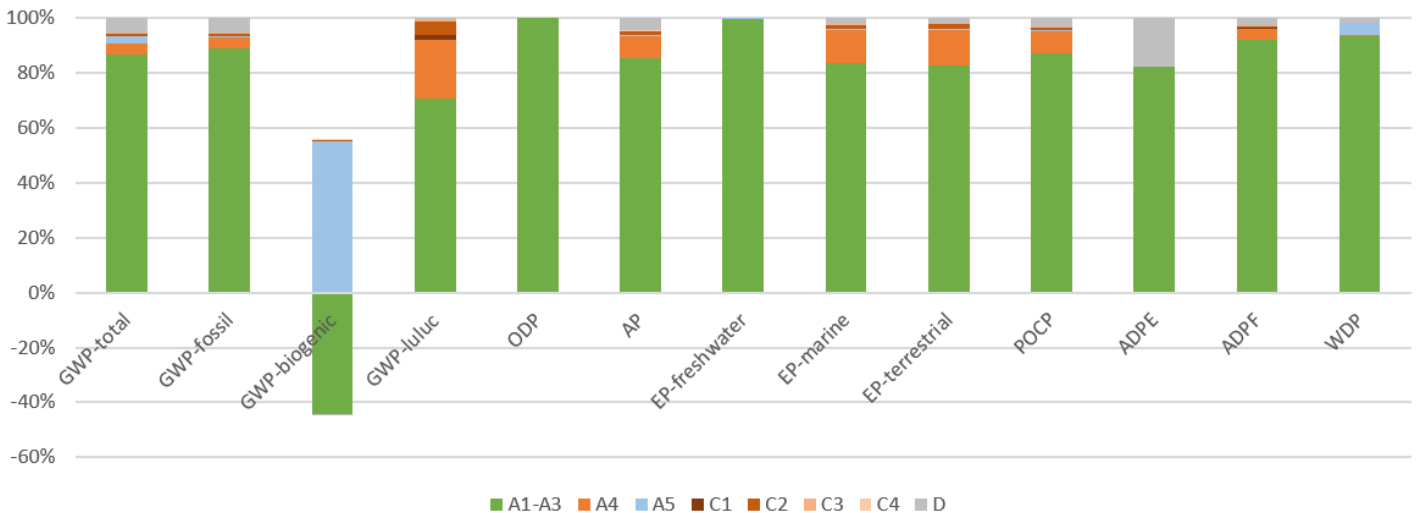
Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – carcinogenic”, “Potential comparative toxic unit for humans - not carcinogenic”, “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

The dominance analysis shows that, overall, the Production phase (Modules A1–A3) dominates the potential environmental impacts over the life cycle. In almost all environmental categories, the reinforcing steel from the main supplier dominates the environmental impacts – only the GWP-luluc, EPD-marine and EP-terrestrial indicators are dominated by the

suppliers' transport (Modules A1–A3) and transport to the construction site in Module A4. All other life cycle phases (A5 and the C modules) have only a minor influence on the results of the environmental indicators (<10%).

Dominance analysis



The deviation of the individual products from the declared average product ranges from -27% to +54% with regard to the

environmental impact indicators for modules A1–A3. Only the biogenic GWP indicator shows greater deviations, as this indicator is influenced almost exclusively by biogenic packaging and the amount of packaging required depends on the highly variable size of the bolts.

7. Requisite evidence

When used as intended, no adverse effects on the environment or health are to be expected. The product is encased in

concrete and has no contact with indoor air or the building envelope. No certification is required by law for the product.

8. References

Standards

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EN 1992-1-1

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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.

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AVV

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Biocidal Products Regulation

Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products, in the Official Journal of the European Union L 167/I, 2012.

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 list

European Chemicals Agency (ECHA): CMR substances from Annex VI of the CLP Regulation that have been registered under REACH and/or notified under CLP.

Candidate List

European Chemical Agency (ECHA): Candidate List of substances of very high concern for Authorisation, in: <https://echa.europa.eu/candidate-list-table>.

Further reading

BBSR table

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UBA

Optimisation of building demolition for the recovery and processing of building materials whilst removing pollutants (particularly sulphate) from the RC material, as well as a life cycle assessment comparison of primary and secondary raw material use, including recycling, German Environment Agency, Berlin, 2013, <https://www.umweltbundesamt.de/system/files/medien/461/publikatione>

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

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com



Programme holder

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

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com



Author of the life cycle assessment

brands & values GmbH
Hollerallee 14A
28209 Bremen
Germany

+49 421 70 90 84 33
info@brandsandvalues.com
www.brandsandvalues.com



Owner of the Declaration

Schöck Bauteile GmbH
Schöckstraße 1
76534 Baden-Baden
Germany

+49 7223 967-0
schoeck@schoeck.com
www.schoeck.com