

PFEIFER Hybridbeam®



Environmental Product Declaration Type III ITB No. 198/2021

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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information: This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically, a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1–A4, C1–C4 and D modules in accordance with EN 15804 (Cradle to Gate with options)

The year of preparing the EPD: 2021

Service Life: not declared by producer, calculation in accordance to EN 1990:2004

PCR: ITB-PCR A (PCR based on EN 15804)

Declared unit: 1 kg of hybrid beam

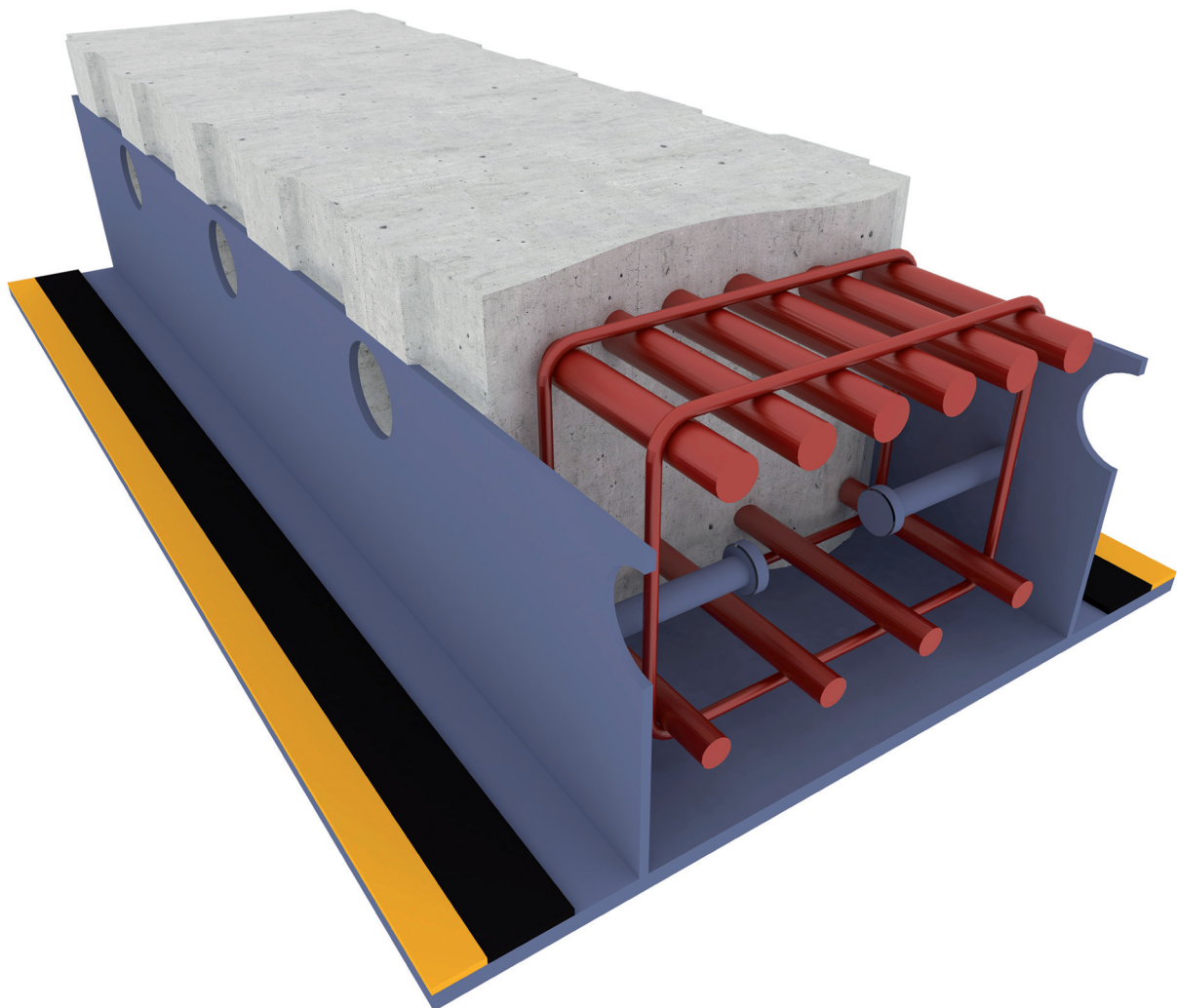
Reasons for performing LCA: B2B

Representativeness: Polish production, year 2020



PRODUCT DESCRIPTION

The PFEIFER Hybridbeam® is manufactured at the PFEIFER manufacturing plant. The Hybridbeam® has been designed as an intermediate beam with two steel flanges which allow precast floor slabs to be instantly supported. This enables slab assembly once the beams are in position on walls or columns. Installation is continued using continuity reinforcement passed through holes in the Hybridbeam®. This product is a supporting structure for concrete ceilings – a ready-made pre-fabricated element with a steel and concrete cross-section. It is a combination of two different materials – steel and concrete. The steel part takes on the tensile stresses, while the concrete part the compressive stresses, and both are connected to each other by means of head bolts welded to the internal steel surfaces, ensuring extremely high strength parameters. The Hybridbeam® is designed to fit the height of the ceiling. Thanks to this, the smallest possible structural height of the designed ceiling is obtained.



Typical cross-section of a Hybridbeam®

Base input materials used in the beam production presented in the process flow chart:

- concrete C60/75 acc. to EN ISO 206+A1:2016
- steel plates S460N/NL acc. to EN 10025-3, steel plates S235JR, S355J2 acc. to EN 10025-2
- ribbed bars (rebars) class A/B acc. to EN 1992-1-1:2008 and additional equipment : reinforcing equipment anchors and load-bearing reinforcement
- shear connectors (SD)
- fire protection paint system
- elastomer strip
- anticorrosion paint system acc. to PN-EN ISO 12944
- packaging material (weight less than 0.1% of total mass of product input)

Technical approvals/certificates:

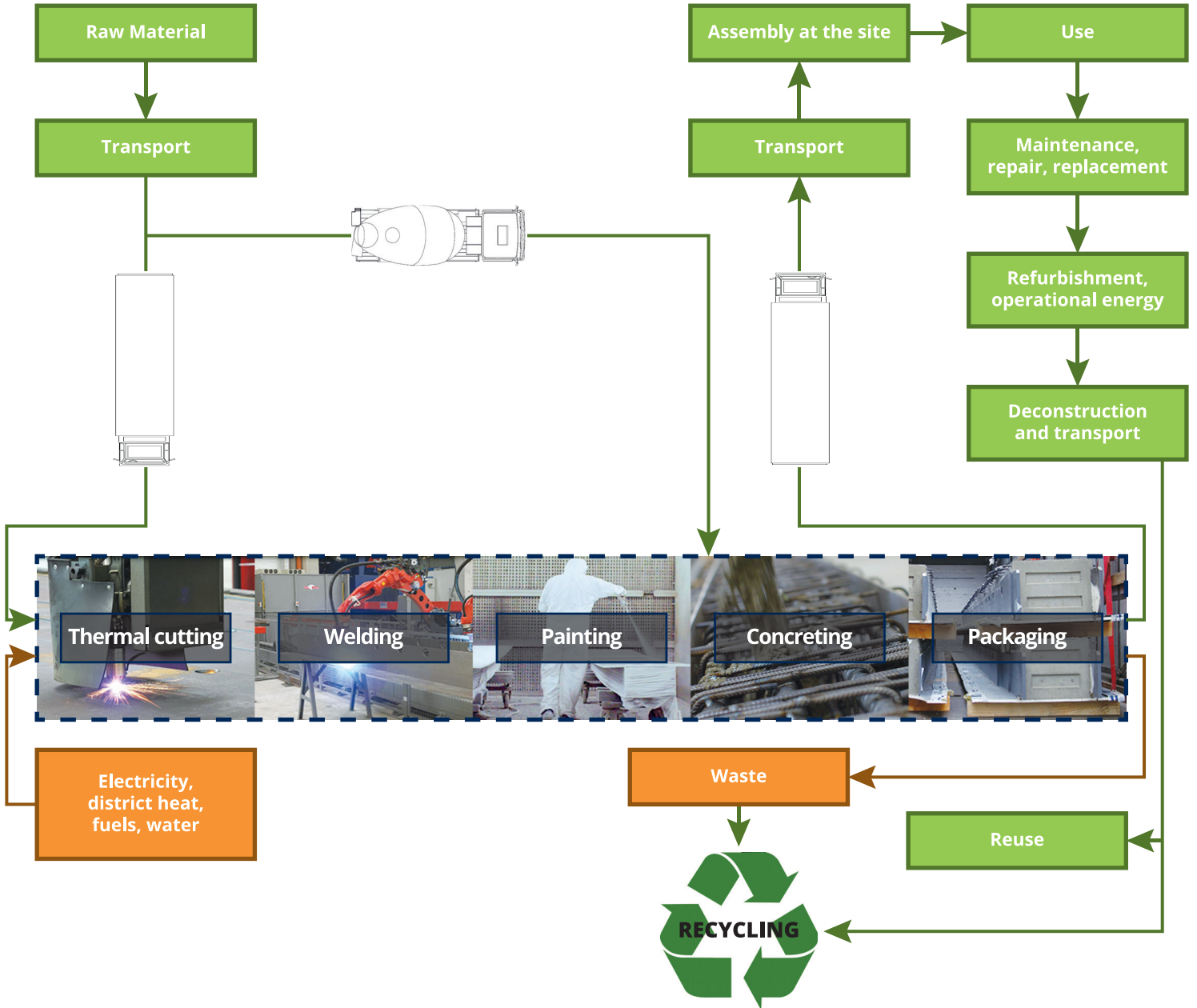
National Technical Assessment ITB-KOT-2017/0032 – Poland.

Product types:

Available in three types – as intermediate (BHM) and extreme (BHR) beams, as well as special beams (BHS).

Detailed product specifications can be found at www.hybridbeam.eu.

Scheme of the manufacturing process of the hybrid beam products



Life Cycle Analysis (LCA) – general rules

Unit

The declared unit is 1kg of Hybridbeam®.

Product assessment is carried out for five variants of the beam, and each variant has a different percentage of concrete.

System boundary

The life cycle analysis of the declared product covers "Product Stage" A1–A4 modules, "End of Life stage" C1, C2, C3, C4 modules and gains beyond system in D module (Cradle to Gate with options) in accordance with EN 15804:2012+A1 and ITB PCR A.

Allocation

The allocation rules used for this EPD are based on general ITB PCR A. Production of Hybridbeam® is a line process in a manufacturing plant located at Krępice, Poland.

Allocation of impact is done on product mass basis.

A1 – All impacts from raw materials production – concrete C60/75, steel plates S460N/NL, steel plates S235JR, S355J2, ribbed bars (Rebars) class A/B, shear connectors, fire protection paint system, elastomer strip, anticorrosion paint, packaging material, technical gases). 99% of impacts from a line production were allocated to product covered by this declaration.

A2 – includes transport of raw materials such as steel and concrete from supplier to manufacturing plant.

A3 – municipal wastes of the factory, energy supply (gas and electricity) was inventoried for the whole factory and 100% was allocated to the product assessed. Emissions in the factory are assessed using national KOBIZE 2019 emission factors for energy carriers.

System limits

99,5% materials and 100% energy consumption (electricity, gas, oxygen) was inventoried in factory and were included in calculation. In the assessment, all significant parameters from gathered production data are considered, i.e. all material used per formulation (99% of input is steel and concrete), utilized thermal Energy, and electric power consumption, direct production waste, and available emission measurements.

It is assumed that the total sum of omitted processes does not exceed 1% of all impact categories.

A1 and A2 Modules: Raw materials supply and transport

Reinforcing bars are produced in inventoried polish steel mills based on EAF technology (90% of recycled content). The steel plates used in the manufactory are produced in the mixed EAF/BOF technology. The concrete used for production contains about 20% of CEM I. The input steel product comes from suppliers providing environmental data (EPD or other) on production. Data on transport of the different input products to the manufacturing plants were inventoried in detail and modelled by an assessor. For calculation purposes, the European fuel averages are applied in module A2.

Module A3: Production

The production process is presented on page 4.

Module A4: Transport to the construction site

The following transport scenario to the place of use was assumed based on the manufacturer's declaration: large vehicle, 75% capacity over an average distance of 674 km. For calculation purposes European fuel averages are applied in module A4.

End of life scenarios (C and D modules)

The end-of-life scenario for all products has been generalized. The beams are disassembled (C1 module) by crane and power tools. The manufacturer declares the technology and the scenario in which the beams can be reused or adapted (change in length, fulfillment) to new applications after the end of their life cycle with a low expenditure of energy and materials (90%). Other materials (10%), steel and concrete are recyclable, and are typically recycled by demolition contractors, who sell the recovered steel as ferrous scrap. It is assumed that the recovered steel will be prepared (C3) for further steel production processes. Materials recovered from dismantled products are recycled according to the BAT treatment practice. The reuse, recovery and recycling potential for a new product system is considered beyond the system boundaries (module D) based on the World Steel recommendations and national practice (see references).

Table 1. End of life scenarios of Hybridbeam® products

Progress products	Material recovery	Reuse	Recycling	Landfilling
Steel products	100%	90%	10%	0%

Data collection period

The data for manufacture of the declared products refers to the period between 01.01.2020–31.12.2020 (1 year).

Data quality – production

The values determined to calculate A3 originate from verified Progress LCI inventory data. A1 values were prepared considering several specific EPDs for the European made steel products. Allocation for steel production impacts is done in accordance with LCI data for Steel products Report compiled by Braian Hughes and William Hare (2012 for World Steel Association).

Assumptions and estimates

The impacts of the representative products were aggregated using weighted average. Data regarding production per 1 kg of product were averaged for the analysed production of each product group. All production processes (A3) were assigned to different types of products in an equal way.

Calculation rules

LCA was done in accordance with ITB PCR A document. Characterization factors are CML ver. 4.2 based. ITB-LCA algorithms were used for impact calculations. A1 was calculated based on data from the database and specific EPD for steel, A3 and A2 are calculated based on the LCI questionnaire provided by the manufacturer.

Databases

The background data for the processes come from the following databases: Ecoinvent v.3.7, specific EPD for a steel producers (CMC, Arcelor, Celsa, Thyssen), cement CEM I (SPC), concrete C60/75 components (specific EPDs), KOBIZE and Tauron (Polish electricity mix and combustion factors for fuels). Specific (LCI) data quality analysis was a part of audit. The time related quality of the data used is valid (5 years).

Life Cycle Analysis (LCA) – results

Declaration scope

The following life cycle modules are included in the declaration (table 2).

Table 2. System boundaries (life stage modules included) in a product environmental assessment

Environmental assessment information (MA – Module assessed, MNA – Module not assessed, INA – Indicator not assessed)																
Product stage			Construction process		Use stage							End of life stage			Benefits and loads beyond the system boundary	
Raw material supply	Transport	Manufacturing	Transport to the construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/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
MA	MA	MA	MA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MA	MA	MA	MA	MA

The environmental characteristics have been prepared for five groups of beams having a different concrete content in the whole product:

Indication	Group No.	Concrete C60/75 mass content in a Hybridbeam® group	Data
	1+	>70%	see Table 5
	1	65–70%	see Table 6
	2	60–65%	see Table 7
	3	55–60%	see Table 8
	4	<55%	see Table 9

Table 3. Expected product group for each type of Hybridbeam®*

BHM	200	250	300	350	400	450	500	550	600
20	4	3	3	2	2				
27		2	2	2	1	1	1+		
32		3	3	2	1	1	1	1+	
40		2	1	1	1	1+	1+	1+	1+
45				1	1+	1+	1+	1+	1+
50				1+	1+	1+	1+	1+	1+

BHR	200	250	300	350	400	450	500	550	600
20	4	4	4	3	3				
27		2	2	2	2	1	1		
32		3	2	1	1	1	1	1+	
40		2	1	1	1+	1+	1+	1+	1+
45				1+	1+	1+	1+	1+	1+
50				1+	1+	1+	1+	1+	1+

* Approximate data detailed at the design stage.

Table 4. Expected product weight per meter*

BHM	20	27	32	40	45	50
200	194					
250	224		331	383		
300	254	324	367	458		
350	288	357	433	513	557	611
400	340	421	482	573	633	684
450		443	513	624	695	752
500		494	574	689	769	816
550			624	751	825	900
600				806	892	968

BHR	20	27	32	40	45	50
200	186					
250	216		312	383		
300	246	318	355	438		
350	279	347	416	504	546	603
400	322	411	466	571	617	670
450		445	516	624	673	743
500		472	552	680	757	817
550			612	741	825	891
600				787	871	959

* Approximate data detailed at the design stage.

Table 5. Environmental characteristics of the product – 1 kg of hybrid beam (group 1+)



Environmental impacts: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Global warming potential	kg CO ₂	7.57E-01	4.06E-02	1.02E-01	7.00E-02	4.72E-02	5.28E-03	8.71E-02	0.00E+00	-4.28E-03
Depletion potential of the stratospheric ozone layer	kg CFC 11	2.86E-08	0.00E+00	2.18E-08	0.00E+00	5.20E-10	0.00E+00	1.29E-09	0.00E+00	0.00E+00
Acidification potential of soil and water	kg SO ₂	1.55E-03	3.23E-04	2.96E-04	5.55E-04	4.15E-05	4.20E-05	9.21E-05	0.00E+00	-2.95E-05
Formation potential of tropospheric ozone	kg Ethene	2.96E-04	2.07E-05	2.30E-04	3.56E-05	2.15E-04	2.69E-06	3.87E-04	0.00E+00	-2.01E-07
Eutrophication potential	kg (PO ₄) ³⁻	2.47E-04	5.72E-05	1.47E-05	9.84E-05	1.73E-06	7.44E-06	7.17E-06	0.00E+00	-1.46E-07
Abiotic potential (ADP elements) for non-fossil resources	kg Sb	9.98E-04	0.00E+00	9.22E-04	0.00E+00	3.50E-04	0.00E+00	6.46E-04	0.00E+00	-1.51E-08
Abiotic depletion potential (ADP – fossil fuels) for fossil resources	MJ	6.58E+00	5.56E-01	1.31E+00	9.56E-01	5.40E-01	7.23E-02	1.01E+00	0.00E+00	-4.31E-02
Environmental aspects: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Use of renewable primary Energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.79E-01	5.56E-03	3.60E-02	9.56E-03	8.10E-02	7.23E-04	1.46E-01	0.00E+00	-2.93E-03
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	6.71E+00	5.84E-01	1.50E+00	1.00E+00	5.94E-01	7.59E-02	1.11E+00	0.00E+00	-4.69E-02
Use of secondary material	kg	1.19E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.94E-03
Use of renewable secondary fuels	MJ	1.28E-01	2.92E-02	1.10E-03	5.02E-02	0.00E+00	3.80E-03	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	1.85E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	5.44E-02	1.00E-06	3.28E-05	1.72E-06	1.71E-04	1.30E-07	3.10E-04	0.00E+00	-1.12E-05
Other environmental information describing waste categories: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Hazardous waste disposed	kg	1.50E-05	3.60E-06	4.33E-05	6.19E-06	7.20E-07	4.68E-07	1.38E-06	0.00E+00	-3.36E-11
Non-hazardous waste disposed	kg	1.15E-02	4.27E-03	4.86E-03	7.34E-03	6.50E-03	5.55E-04	1.17E-02	0.00E+00	-2.91E-05
Radioactive waste disposed	kg	8.59E-06	0.00E+00	7.14E-08	0.00E+00	7.20E-07	0.00E+00	1.30E-06	0.00E+00	-4.90E-08
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	9.08E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 6. Environmental characteristics of the product – 1 kg of hybrid beam (group 1)



Environmental impacts: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Global warming potential	kg CO ₂	7.98E-01	4.06E-02	1.02E-01	7.00E-02	4.72E-02	5.28E-03	8.71E-02	0.00E+00	-4.28E-03
Depletion potential of the stratospheric ozone layer	kg CFC 11	2.84E-08	0.00E+0	2.18E-08	0.00E+0	5.20E-10	0.00E+00	1.29E-09	0.00E+00	0.00E+00
Acidification potential of soil and water	kg SO ₂	1.63E-03	3.23E-04	2.96E-04	5.55E-04	4.15E-05	4.20E-05	9.21E-05	0.00E+00	-2.95E-05
Formation potential of tropospheric ozone	kg Ethene	3.05E-04	2.07E-05	2.30E-04	3.56E-05	2.15E-04	2.69E-06	3.87E-04	0.00E+00	-2.01E-07
Eutrophication potential	kg (PO ₄) ³⁻	2.55E-04	5.72E-05	1.47E-05	9.84E-05	1.73E-06	7.44E-06	7.17E-06	0.00E+00	-1.46E-07
Abiotic potential (ADP elements) for non-fossil resources	kg Sb	9.80E-04	0.00E+0	9.22E-04	0.00E+0	3.50E-04	0.00E+00	6.46E-04	0.00E+00	-1.51E-08
Abiotic depletion potential (ADP – fossil fuels) for fossil resources	MJ	6.96E+00	5.56E-01	1.31E+00	9.56E-01	5.40E-01	7.23E-02	1.01E+00	0.00E+00	-4.31E-02
Environmental aspects: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Use of renewable primary Energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.86E-01	5.56E-03	3.60E-02	9.56E-03	8.10E-02	7.23E-04	1.46E-01	0.00E+00	-2.93E-03
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	7.09E+00	5.84E-01	1.50E+0	1.00E+0	5.94E-01	7.59E-02	1.11E+00	0.00E+00	-4.69E-02
Use of secondary material	kg	1.28E-01	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	-2.94E-03
Use of renewable secondary fuels	MJ	1.23E-01	2.92E-02	1.10E-03	5.02E-02	0.00E+0	3.80E-03	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	1.79E-01	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	5.45E-02	1.00E-06	3.28E-05	1.72E-06	1.71E-04	1.30E-07	3.10E-04	0.00E+00	-1.12E-05
Other environmental information describing waste categories: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Hazardous waste disposed	kg	1.54E-05	3.60E-06	4.33E-05	6.19E-06	7.20E-07	4.68E-07	1.38E-06	0.00E+00	-3.36E-11
Non-hazardous waste disposed	kg	1.16E-02	4.27E-03	4.86E-03	7.34E-03	6.50E-03	5.55E-04	1.17E-02	0.00E+00	-2.91E-05
Radioactive waste disposed	kg	8.84E-06	0.00E+0	7.14E-08	0.00E+0	7.20E-07	0.00E+00	1.30E-06	0.00E+00	-4.90E-08
Components for re-use	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	8.76E-11	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	1.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 7. Environmental characteristics of the product – 1 kg of hybrid beam (group 2)



Environmental impacts: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Global warming potential	kg CO ₂	8.78E-01	4.06E-02	1.02E-01	7.00E-02	4.72E-02	5.28E-03	8.71E-02	0.00E+00	-4.28E-03
Depletion potential of the stratospheric ozone layer	kg CFC 11	2.80E-08	0.00E+0	2.18E-08	0.00E+0	5.20E-10	0.00E+00	1.29E-09	0.00E+00	0.00E+00
Acidification potential of soil and water	kg SO ₂	1.79E-03	3.23E-04	2.96E-04	5.55E-04	4.15E-05	4.20E-05	9.21E-05	0.00E+00	-2.95E-05
Formation potential of tropospheric ozone	kg Ethene	3.23E-04	2.07E-05	2.30E-04	3.56E-05	2.15E-04	2.69E-06	3.87E-04	0.00E+00	-2.01E-07
Eutrophication potential	kg (PO ₄) ³⁻	2.69E-04	5.72E-05	1.47E-05	9.84E-05	1.73E-06	7.44E-06	7.17E-06	0.00E+00	-1.46E-07
Abiotic potential (ADP elements) for non-fossil resources	kg Sb	9.46E-04	0.00E+0	9.22E-04	0.00E+0	3.50E-04	0.00E+00	6.46E-04	0.00E+00	-1.51E-08
Abiotic depletion potential (ADP – fossil fuels) for fossil resources	MJ	7.72E+00	5.56E-01	1.31E+0	9.56E-01	5.40E-01	7.23E-02	1.01E+00	0.00E+00	-4.31E-02
Environmental aspects: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Use of renewable primary Energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials))	MJ	4.00E-01	5.56E-03	3.60E-02	9.56E-03	8.10E-02	7.23E-04	1.46E-01	0.00E+00	-2.93E-03
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	7.85E+00	5.84E-01	1.50E+0	1.00E+0	5.94E-01	7.59E-02	1.11E+00	0.00E+00	-4.69E-02
Use of secondary material	kg	1.45E-01	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	-2.94E-03
Use of renewable secondary fuels	MJ	1.14E-01	2.92E-02	1.10E-03	5.02E-02	0.00E+0	3.80E-03	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	1.65E-01	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	5.46E-02	1.00E-06	8.58E-05	1.72E-06	1.71E-04	1.30E-07	3.10E-04	0.00E+00	-1.12E-05
Other environmental information describing waste categories: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Hazardous waste disposed	kg	1.62E-05	3.60E-06	4.33E-05	6.19E-06	7.20E-07	4.68E-07	1.38E-06	0.00E+00	-3.36E-11
Non-hazardous waste disposed	kg	1.17E-02	4.27E-03	4.86E-03	7.34E-03	6.50E-03	5.55E-04	1.17E-02	0.00E+00	-2.91E-05
Radioactive waste disposed	kg	9.34E-06	0.00E+0	7.14E-08	0.00E+0	7.20E-07	0.00E+00	1.30E-06	0.00E+00	-4.90E-08
Components for re-use	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	8.11E-11	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	1.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 8. Environmental characteristics of the product – 1 kg of hybrid beam (group 3)



Environmental impacts: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Global warming potential	kg CO ₂	9.59E-01	4.06E-02	1.02E-01	7.00E-02	4.72E-02	5.28E-03	8.71E-02	0.00E+00	-4.28E-03
Depletion potential of the stratospheric ozone layer	kg CFC 11	2.75E-08	0.00E+0	2.18E-08	0.00E+0	5.20E-10	0.00E+00	1.29E-09	0.00E+00	0.00E+00
Acidification potential of soil and water	kg SO ₂	1.95E-03	3.23E-04	2.96E-04	5.55E-04	4.15E-05	4.20E-05	9.21E-05	0.00E+00	-2.95E-05
Formation potential of tropospheric ozone	kg Ethene	3.41E-04	2.07E-05	2.30E-04	3.56E-05	2.15E-04	2.69E-06	3.87E-04	0.00E+00	-2.01E-07
Eutrophication potential	kg (PO ₄) ³⁻	2.83E-04	5.72E-05	1.47E-05	9.84E-05	1.73E-06	7.44E-06	7.17E-06	0.00E+00	-1.46E-07
Abiotic potential (ADP elements) for non-fossil resources	kg Sb	9.11E-04	0.00E+0	9.22E-04	0.00E+0	3.50E-04	0.00E+00	6.46E-04	0.00E+00	-1.51E-08
Abiotic depletion potential (ADP – fossil fuels) for fossil resources	MJ	8.48E+00	5.56E-01	1.31E+0	9.56E-01	5.40E-01	7.23E-02	1.01E+00	0.00E+00	-4.31E-02
Environmental aspects: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Use of renewable primary Energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials))	MJ	4.14E-01	5.56E-03	3.60E-02	9.56E-03	8.10E-02	7.23E-04	1.46E-01	0.00E+00	-2.93E-03
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	8.61E+00	5.84E-01	1.50E+0	1.00E+0	5.94E-01	7.59E-02	1.11E+00	0.00E+00	-4.69E-02
Use of secondary material	kg	1.63E-01	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	-2.94E-03
Use of renewable secondary fuels	MJ	1.05E-01	2.92E-02	1.10E-03	5.02E-02	0.00E+0	3.80E-03	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	1.52E-01	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	5.46E-02	1.00E-06	3.28E-05	1.72E-06	1.71E-04	1.30E-07	3.10E-04	0.00E+00	-1.12E-05
Other environmental information describing waste categories: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Hazardous waste disposed	kg	1.69E-05	3.60E-06	4.33E-05	6.19E-06	7.20E-07	4.68E-07	1.38E-06	0.00E+00	-3.36E-11
Non-hazardous waste disposed	kg	1.19E-02	4.27E-03	4.86E-03	7.34E-03	6.50E-03	5.55E-04	1.17E-02	0.00E+00	-2.91E-05
Radioactive waste disposed	kg	9.84E-06	0.00E+0	7.14E-08	0.00E+0	7.20E-07	0.00E+00	1.30E-06	0.00E+00	-4.90E-08
Components for re-use	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	7.46E-11	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	1.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 9. Environmental characteristics of the product – 1 kg of hybrid beam (group 4)



Environmental impacts: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Global warming potential	kg CO ₂	1.00E+00	4.06E-02	1.02E-01	7.00E-02	4.72E-02	5.28E-03	8.71E-02	0.00E+00	-4.28E-03
Depletion potential of the stratospheric ozone layer	kg CFC 11	2.73E-08	0.00E+0	2.18E-08	0.00E+0	5.20E-10	0.00E+00	1.29E-09	0.00E+00	0.00E+00
Acidification potential of soil and water	kg SO ₂	2.03E-03	3.23E-04	2.96E-04	5.55E-04	4.15E-05	4.20E-05	9.21E-05	0.00E+00	-2.95E-05
Formation potential of tropospheric ozone	kg Ethene	3.50E-04	2.07E-05	2.30E-04	3.56E-05	2.15E-04	2.69E-06	3.87E-04	0.00E+00	-2.01E-07
Eutrophication potential	kg (PO ₄) ³⁻	2.91E-04	5.72E-05	1.47E-05	9.84E-05	1.73E-06	7.44E-06	7.17E-06	0.00E+00	-1.46E-07
Abiotic potential (ADP elements) for non-fossil resources	kg Sb	8.93E-04	0.00E+0	9.22E-04	0.00E+0	3.50E-04	0.00E+00	6.46E-04	0.00E+00	-1.51E-08
Abiotic depletion potential (ADP – fossil fuels) for fossil resources	MJ	8.86E+00	5.56E-01	1.31E+00	9.56E-01	5.40E-01	7.23E-02	1.01E+00	0.00E+00	-4.31E-02
Environmental aspects: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Use of renewable primary Energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4.21E-01	5.56E-03	3.60E-02	9.56E-03	8.10E-02	7.23E-04	1.46E-01	0.00E+00	-2.93E-03
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	9.00E+00	5.84E-01	1.50E+0	1.00E+0	5.94E-01	7.59E-02	1.11E+00	0.00E+00	-4.69E-02
Use of secondary material	kg	1.71E-01	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	-2.94E-03
Use of renewable secondary fuels	MJ	1.01E-01	2.92E-02	1.10E-03	5.02E-02	0.00E+0	3.80E-03	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ	1.46E-01	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m ³	5.47E-02	1.00E-06	3.28E-05	1.72E-06	1.71E-04	1.30E-07	3.10E-04	0.00E+00	-1.12E-05
Other environmental information describing waste categories: (DU) 1 kg										
Indicator	Unit	A1	A2	A3	A4	C1	C2	C3	C4	D
Hazardous waste disposed	kg	1.73E-05	3.60E-06	4.33E-05	6.19E-06	7.20E-07	4.68E-07	1.38E-06	0.00E+00	-3.36E-11
Non-hazardous waste disposed	kg	1.20E-02	4.27E-03	4.86E-03	7.34E-03	6.50E-03	5.55E-04	1.17E-02	0.00E+00	-2.91E-05
Radioactive waste disposed	kg	1.01E-05	0.00E+0	7.14E-08	0.00E+0	7.20E-07	0.00E+00	1.30E-06	0.00E+00	-4.90E-08
Components for re-use	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	7.13E-11	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	1.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy	MJ	0.00E+00	0.00E+0	0.00E+0	0.00E+0	0.00E00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GENERAL INFORMATION

The process of verification of this EPD was in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. The EPD does not have to be recalculated after 5 years if the underlying data has not significantly changed.

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The basis for the LCA analysis was EN 15804: 2012 + A1 and ITB PCR A

Independent verification in accordance with ISO 14025 (subclause 8.1.3.)

external

internal

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Normative references

ITB PCR A General Product Category Rules for Construction Products

- National Technical Assessment ITB-KOT-2017/0032
- LCI DATA FOR STEEL PRODUCTS at https://www.worldsteel.org/en/dam/jcr:04f8a180-1406-4f5c-93ca-70f1ba7de5d4/LCI%2520study_2018%2520data%2520release.pdf
- ISO 14025:2006. Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- EN 15804:2012+A1 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- PN-EN 10080:2007 „Stal do zbrojenia betonu – Spawalna stal zbrojeniowa – Postanowienia ogólne”
- PN-EN 1992-1-1:2008 „Eurokod 2 – Projektowanie konstrukcji z betonu – Część 1-1: Reguły ogólne i reguły dla budynków”