



EPD

INTERNATIONAL EPD SYSTEM

Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Prefabricated reinforced concrete beams and columns

from

GOLDBECK Prefab Elements Sp. z o. o.

Programme:	The International EPD System, www.environdec.com
Programme operator:	EPD International AB
Company:	GOLDBECK Prefab Elements Sp. z o. o.
Type of EPD:	EPD of a single product from a manufacturer
EPD registration number:	EPD-IES-00XXXXX
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Validity date:	2030-08-04

An EPD may be updated or depublished if conditions change. To find the latest version of the EPD and to confirm its validity, see www.environdec.com



GENERAL INFORMATION

Programme Information	
Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	support@environdec.com
Product Category Rules (PCR)	
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)	
Product Category Rules (PCR): Construction Products – PCR 2019:14, Version 2.0.0, UN CPC 37520 – Prefabricated structural components	
PCR review was conducted by: Rob Rouwette, Pré Sustainability Contact via programme operator: EPD International AB (support@environdec.com)	
c-PCR-003 – Concrete and concrete elements, Included within PCR 2019:14 v2.0.0 after adoption in the International EPD System Original version: c-PCR-003 v1.0.1 Adopted as part of: PCR 2019:14 v2.0.0	
EPD calculation and LCA by: EXERGY Radosław Andrulowicz, ul. Powstańców Śląskich 32B/4, 45-092 Opole, Poland Authors of the LCA calculations: Radosław Andrulowicz, Bartosz Zymanczyk	
Third-party Verification	
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:	
<input checked="" type="checkbox"/> Individual EPD verification without a pre-verified LCA/EPD tool Third-party verifier: Agnieszka Pikus, Greenwise Approved by: International EPD System	
Procedure for follow-up of data during EPD validity involves third party Verifier: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but published in different EPD programmes, may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same first-digit version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have identical scope in terms of included life-cycle stages (unless the excluded life-cycle stage is demonstrated to be insignificant); apply identical impact assessment methods (including the same version of characterisation factors); and be valid at the time of comparison.

For further information about comparability, see EN 15804 and ISO 14025.



INFORMATION ABOUT EPD OWNER

Owner of the EPD:

GOLDBECK Prefab Elements Sp. z o. o.

Address:

Rakowice Małe 17, 59-600 Rakowice Małe, Poland

Contact:

sekretariat-Prefab Elements@goldbeck.pl

Description of the organisation:

GOLDBECK Prefab Elements Sp. z o. o. is part of the international GOLDBECK GmbH Group – one of the European leaders in industrial system construction. The company operates in Poland through its two precast concrete production facilities in Rakowice Małe and Toruń. GOLDBECK offers comprehensive design, prefabrication, and assembly of precast concrete elements used in office, industrial, and logistics buildings.



Product-related or management system-related certifications:

GOLDBECK Prefab Elements Sp. z o. o., operating production facilities in Rakowice Małe 17, 59-600 Lwówek Śląski, Poland and Toruń, Wapienna 62, 87-100 Toruń, maintains a robust quality management system supported by several product and process-related certifications confirming compliance with European and national technical standards. The certifications include:

- 1) Factory Production Control – the company has confirmation of the production of prefabricated elements in accordance with standards EN 13224; EN 13225; EN 13747; EN 14843; EN 14991; EN 14992; EN 15050; EN 15258,
- 2) Production of Precast Concrete and Reinforced/Self-compacting Concrete in accordance with German construction regulations (BayBO) and standards including DIN EN 206-1, DIN 1045-2, and DAfStb-Richtlinie SVB,
- 3) Precast Concrete Elements Not Covered by Harmonized Product Standards certified according to DIN 1045-4,
- 4) Factory Production Control - Structural Steel Components in compliance with EN 1090-1 + A1, execution classes EXC1, EXC2,
- 5) Manufacturer Qualification for Welding Reinforcing Steel under PN-EN ISO 17660-1 and 17660-2.

All certifications confirm that GOLDBECK Prefab Elements maintains production under continuous internal and external surveillance, following established European and German technical norms for structural concrete and steel prefabrication. These certifications support consistent quality and safety in the production of precast reinforced concrete elements.



PRODUCT INFORMATION

Product name:

Prefabricated reinforced concrete beams and columns

Product identification: Manufactured in accordance with applicable European and national standards, including:

- 1) EN 13369: Common rules for precast concrete products,
- 2) EN 13225: Linear structural elements,
- 3) DIN 1045-2 and DIN 1045-4: for German market applications,
- 4) Internal technical specifications of Goldbeck Prefab Elements Sp. z o. o.

UN CPC code:

37530 – Prefabricated structural components for building or civil engineering, of cement, concrete or artificial stone.

Other codes:

CPV: 45223800-4 – Assembly and erection of prefabricated structures.

NACE: C23.61 – Manufacture of concrete products for construction purposes.

CPA: 23.61.11 – Prefabricated structural components of concrete.

Product description:

The declared products are prefabricated reinforced concrete beams and columns designed for structural use in industrial, logistics, and commercial buildings. The elements are custom-engineered to meet project-specific static and geometric requirements and are produced using high-performance concrete and ribbed reinforcing steel. Depending on the application, prestressing technology may also be employed.

These products play a critical role in the load-bearing structure of buildings, ensuring stiffness, stability, and long-term durability. Their prefabricated nature allows for efficient on-site assembly, reduction in construction time, and improved quality control.

Prefabricated bar elements manufactured by GOLDBECK Prefab Elements are designed in accordance with the PN-EN 13225 standard and other applicable standards, meeting the highest requirements in terms of load-bearing capacity, durability and quality of workmanship. We offer solutions tailored to various structural applications, from simple load-bearing elements to more complex system solutions. These products include columns, beams, girders, joists, etc.

Application:

- load-bearing components in building structures, such as columns, beams, girders,
- used in industrial, warehouse, office, residential and infrastructure facilities.

Technical parameters:

- Concrete class: C30/37 to C50/60,
- Main reinforcement: B500B/B500SP steel,
- Manufacturing tolerances in accordance with PN-EN 13369 and PN-EN 13225,



- Possibility to design elements for specific loads and dimensions depending on the design specification,
- Fire resistance: classification REI 60–REI 240 (depending on design).



Name and location of production site(s):

- 1) GOLDBECK Prefab Elements Sp. z o.o.
Rakowice Małe 17, 59-600 Lwówek Śląski, Poland
- 2) GOLDBECK Prefab Elements Sp. z o. o.
ul. Wapienna 62, 87-100 Toruń, Poland

References to any relevant websites for more information or explanatory materials, if applicable:

GOLDBECK Prefab Elements Sp. z o. o.
www.goldbeck-produkcja.pl



CONTENT DECLARATION

The mass (weight) of one unit of a product, as purchased or per declared unit:

- Prefabricated reinforced concrete beams and columns produced in Rakowice facility: ~ **2362.50 kg/m³**,
- Prefabricated reinforced concrete beams and columns produced in Toruń facility: ~ **2170.00 kg/m³**.

Content of the product in the form of a list of materials and substances and their mass, per 1m^3 :

Basic and auxiliary production materials

Product content	Mass, t Location Toruń	Mass, t Location Rakowice
Material 1 / CEM I	0.3270	0.2751
Material 2 / CEM II	0.1551	0.1103
Material 3 / Limestone floud	0.1092	0.1379
Material 4 / Sand 0-2 mm	0.3270	0.6899
Material 5 / Gravel 2-8 mm	0.4960	0.4271
Material 6 / Gravel 8-16 mm	0.5764	0.4319
Material 7 / Admixture 1	0.0032	-
Material 8 / Admixture 2	0.0029	-
Material 9 / Admixture 3	7.7E-06	-
Material 10 / Admixture 4	0.0001	-
Material 12 / Reinforcing steel	0.0780	-
Material 13 / Structural steel (eco)	0.0434	0.1168
Material 14 / Structural steel	0.0473	0.1361
Material 15 / Admixture 5	-	0.0008
Material 16 / Admixture 6	-	0.035
Material 17 / Auxiliary materials	0.0044	0.0016

Information on the environmental and hazardous/toxic properties of a substances contained in the product: The product does not contain any hazardous or toxic substances. The declared share of biogenic/recycled materials: 2%.



LCA INFORMATION

Functional unit: m^3

Conversion factor to mass if mass is not used as functional/declared unit (not applicable for services):

- Prefabricated reinforced concrete beams and columns produced in Rakowice facility: $\sim 2362.50 \text{ kg/m}^3$,
- Prefabricated reinforced concrete beams and columns produced in Toruń facility: $\sim 2170.00 \text{ kg/m}^3$.

Reference service life: 50 years

Time representativeness: 2024

Geographical scope:

- Modules A1–A3 (raw material supply, transport, and manufacturing):
Modelled based on production facilities in Poland (Rakowice and Toruń), with potential sourcing of raw materials from EU suppliers.
- Modules A4–A5 (transport to site and installation):
Assumed distribution within Poland.
- Use stage (Module B) and End-of-life (Module C):
Assumed use and end-of-life scenarios modelled for European conditions (EU average waste treatment, recycling, and energy systems).



Database(s) and LCA software used: Ecoinvent v3.10, regionalized for EU

EPD/LCA Tool used: openLCA + EN15804 EPD plugin

Description of system boundaries:

- Cradle to gate with options, modules C1–C4, module D and with optional modules (A1–A3 + C + D and additional modules A4, A5).

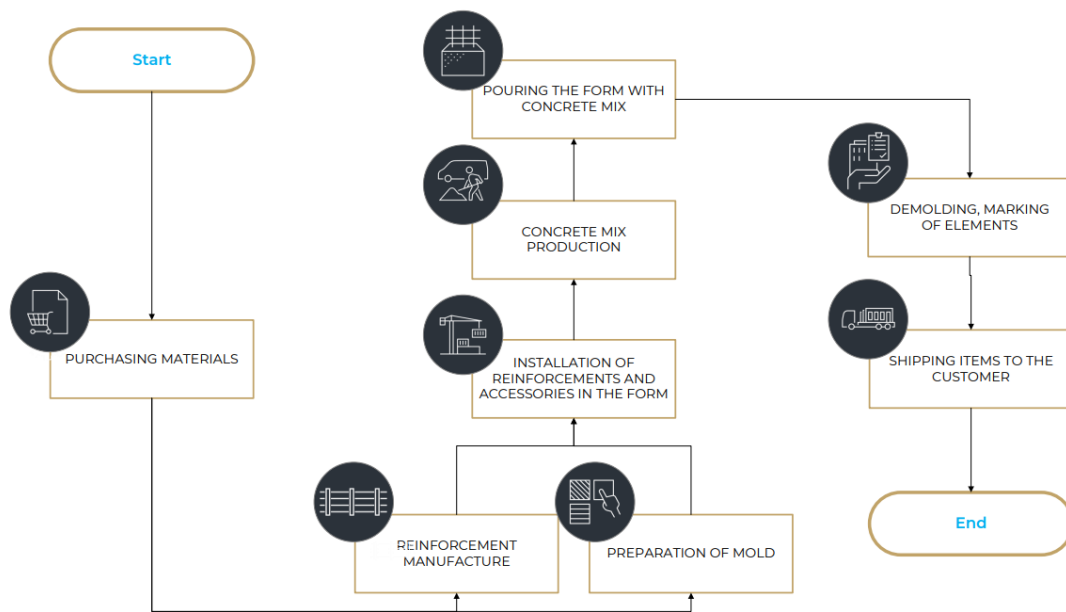


Included life cycle stages:

- A1–A3: Raw material supply, transport, and manufacturing,
- A4–A5 (transport to construction site and installation),
- C1–C4: Deconstruction, transport, waste processing, and disposal,
- D: Benefits and loads beyond system boundary (e.g., recycling potential of steel reinforcement).

Excluded life cycle stages:

- B1–B7 (use stage),
- These are excluded as the product does not require energy or maintenance during use and is assumed to be passive during its service life. The type of system boundary is defined in and permitted by the PCR 2019:14 Construction Products v2.0.0.

Process flow diagram:More information:

- Allocation procedure:
The production of precast reinforced concrete elements includes significant use of recycled steel, both for reinforcement and structural components. Reinforcing steel and structural steel are sourced from electric arc furnace (EAF) processes, with the eco-steel from Celsa Group having verified EPDs confirming >95% post-consumer recycled content.
As the recycled input materials contribute more than 10% to the GWP-GHG results of modules A1–A3, the GWP-GHG intensity of the recycled steel is declared:
 - Recycled steel (Celsa EAF) A1-A3: 356 kg CO₂e/tonne.
- Data quality and sources:
Data quality has been assessed according to PCR section 4.6.4. Primary data were collected from GOLDBECK Prefab Elements's production sites in Toruń and Rakowice for the reference years 2023–2024, covering material consumption, energy use, transportation, and internal processes such as reinforcement, concreting, curing, and demoulding.



The share of primary data contributing to the GWP-GHG results of modules A1–A3 exceeds 85%. Secondary data were sourced from ecoinvent v3.9.1 and verified third-party EPDs (e.g., for recycled steel). All datasets were evaluated for consistency, completeness, time representativeness, and geographic relevance.

- Modelling of infrastructure/capital goods:
In accordance with PCR section 4.3.6, the environmental impacts associated with capital goods (e.g., steel moulds, concrete batching plants, machinery) are not included in the LCA, as their contribution to overall impacts is considered negligible (<1%).
- Electricity in A3 and GWP-GHG intensity:
Electricity used in module A3 is supplied from the national grid (Poland). The climate impact of electricity is modelled using national average data:
 - Grid electricity (Poland): 0.756 kg CO₂e/kWh (GWP-GHG indicator; source: ecoinvent 2024. Electricity consumption covers machinery for reinforcement processing, concrete mixing, compressors, lighting, and auxiliary systems.
- Downstream scenarios and Module D:
Use stage modules (B1–B7) are not included, as the product does not require energy or material inputs during the use phase.
- Modules A4 and A5 model the transport of the precast product to the construction site and its installation. Transport (A4) is carried out using a EURO IV diesel truck over an average distance of 100 km, in line with c-PCR-003 recommendations. Installation (A5) includes the consumption of electricity and auxiliary materials. The electricity mix used for modelling is based on the Polish grid average: 0.756 kg CO₂e/kWh (GWP-GHG indicator; source: ecoinvent 2024). Other installation-related impacts, such as minor packaging waste or fastening components, are also included based on typical site practices.
- Modules C1 to C4 model the end-of-life processes of precast reinforced concrete elements. In C1, demolition is carried out using heavy equipment, such as excavators and cranes, with energy use and resulting waste estimated based on literature sources. In C2, waste is transported an average distance of 30 km by EURO IV trucks to treatment facilities. In C3, the concrete is crushed and processed into recycled concrete aggregate (RCA) or used as road base material, while reinforcing steel is sent for recycling and plastic components are directed to incineration. C4 includes landfilling of non-recyclable waste such as residual plastics, with emissions calculated using data from ecoinvent v3.10. Assumptions include 95% recovery of steel and 80% recovery of concrete based on national standards and industry best practice.
- Module D includes the potential environmental benefits from the recovery of materials at end-of-life. A system expansion approach is applied, with credits given for avoided primary production of steel and natural aggregate. Steel is assumed to be recovered at a rate of 95% and concrete at 95%, based on c-PCR recommendations and standard recycling efficiencies. Data for Module D are sourced from ecoinvent 2024.
- Characterisation methods and versions:
Environmental impact indicators follow the EN 15804+A2:2019 standard and the European Commission's Environmental Footprint (EF) 3.1 characterisation method.
Calculations were performed using One Click LCA v2024.03 (or equivalent software) in compliance with the PCR 2019:14 v2.0.0 and c-PCR requirements.



Modules declared, geographical scope, share of primary data (in GWP-GHG results) and data variation (in GWP-GHG results)

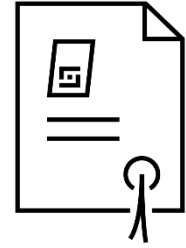
	Product stage			Construction process stage		Use stage							End of life stage Resource recovery stage				
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	EU	EU	EU	PL	PL	ND	ND	ND	ND	ND	ND	ND	EU	EU	EU	EU	EU
Share of primary data	>77%			>77%	>77%	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			0%	0%	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	<8%			<8%	<8%	-	-	-	-	-	-	-	-	-	-	-	-

The share of primary data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more primary data, to increase the representativeness of and comparability between EPDs. Note that the indicator does not capture all relevant aspects of data quality and is not comparable across product categories.



ENVIRONMENTAL PERFORMANCE

LCA results of the product(s) - main environmental performance results



Mandatory impact category indicators according to EN 15804

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m ³ of GOLDBECK prefabricated concrete reinforced beams and columns									
Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP – total	kg CO2e	5.68E+02	4.36E+01	1.09E+02	4.41E+00	1.31E+01	4.02E+01	8.58E+00	-1.56E+02
GWP – GHG	kg CO2e	5.64E+02	4.36E+01	1.60E+01	4.55E+00	1.31E+01	4.02E+01	8.57E+00	-1.56E+02
GWP – fossil	kg CO2e	5.64E+02	4.36E+01	1.60E+01	4.55E+00	1.31E+01	4.01E+01	8.57E+00	-1.55E+02
GWP – biogenic	kg CO2e	3.45E+00	2.99E-02	9.32E+01	-1.43E-01	8.96E-03	3.18E-02	2.11E-03	-3.21E-02
GWP – LULUC	kg CO2e	1.41E-01	1.43E-02	9.55E-03	3.45E-03	4.27E-03	6.90E-02	3.67E-03	-9.68E-01
ODP	kg CFC 11 eq.	1.29E-05	8.66E-07	1.28E-07	5.68E-08	2.60E-07	6.98E-07	3.92E-08	-6.91E-07
AP	mol H+ eq.	5.32E+02	1.79E-01	1.02E-01	3.91E-02	5.36E-02	2.98E-01	1.73E-02	-2.96E-01
EP-freshwater	kg P eq.	1.12E+00	7.61E-02	5.15E-02	1.99E-02	2.28E-02	1.38E-01	8.09E-03	-1.37E-01
EP-marine	kg N eq.	1.33E-01	2.24E-02	1.13E-02	6.05E-03	6.72E-03	4.52E-02	2.66E-03	-4.38E-02
EP-terrestrial	mol N eq.	9.99E-01	2.51E-01	1.33E-01	6.80E-02	7.51E-02	5.09E-01	3.00E-02	-5.05E-01
POCP	kg NMVOC eq.	3.43E+00	3.70E-01	1.76E-01	9.86E-02	1.11E-01	7.42E-01	4.38E-02	-7.40E-01
ADP-minerals&metals*	kg Sb eq.	1.17E-01	1.44E-04	6.46E-05	2.69E-05	4.28E-05	8.79E-05	5.09E-06	-8.73E-05
ADP-fossil*	MJ	2.16E+04	6.12E+02	1.75E+02	5.64E+01	1.84E+02	6.00E+02	3.29E+01	-5.96E+02
WDP*	m3	1.41E+02	5.04E+00	4.80E+00	8.94E-01	1.51E+00	4.53E+00	2.64E-01	-4.49E+00

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks. The results of the end-of-life stage (modules C1-C4) should be considered when using the results of the product stage (modules A1-A3).



Resource use indicators

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m³ of GOLDBECK prefabricated concrete reinforced beams and columns

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	5.62E+01	4.81E+00	5.46E+00	3.16E+00	1.44E+00	4.03E+00	2.35E-01	-4.04E+00
PERM	MJ	2.84E+02	6.25E+00	8.28E+00	5.26E+00	1.88E+00	5.61E+00	3.29E-01	-5.57E+00
PERT	MJ	3.40E+02	1.11E+01	1.37E+01	8.42E+00	3.32E+00	9.64E+00	5.64E-01	-9.61E+00
PENRE	MJ	8.69E+02	2.82E+02	7.33E+01	2.49E+01	8.46E+01	2.66E+02	1.46E+01	-2.66E+02
PENRM	MJ	2.50E+03	3.61E+02	1.06E+02	3.41E+01	1.09E+02	3.66E+02	2.00E+01	-3.62E+02
PENRT	MJ	3.37E+03	6.43E+02	1.79E+02	5.90E+01	1.94E+02	6.32E+02	3.46E+01	-6.28E+02
SM	kg	6.15E+01	4.18E-01	9.54E-01	5.85E-02	1.26E-01	2.47E-01	1.48E-02	-2.46E-01
RSF	MJ	3.30E+01	8.73E-02	4.95E-02	8.77E-03	2.62E-02	3.70E-02	2.11E-03	-3.70E-02
NRSF	MJ	4.86E+01	4.46E-02	4.53E-02	5.50E-02	1.34E-02	3.43E-02	6.10E-03	-2.62E-02
FW	m ³	1.10E+01	3.65E-01	1.65E+00	1.37E-01	1.10E-01	4.28E-01	8.13E-02	-4.18E-01

Waste indicators

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m³ of GOLDBECK prefabricated concrete reinforced beams and columns

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste disposed	kg	6.99E+01	3.91E+00	7.09E+01	1.19E+00	1.17E+00	1.36E+02	8.71E+00	-1.37E+02
Non-hazardous waste disposed	kg	2.31E+01	3.00E+00	8.82E+00	8.43E-01	8.99E-01	1.02E+02	6.54E+00	-1.01E+02
Radioactive waste disposed	kg	4.04E-03	8.60E-05	5.59E-05	9.03E-06	2.64E-05	6.45E-05	3.65E-06	-6.45E-05

Output flow indicators

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m ³ of GOLDBECK prefabricated concrete reinforced beams and columns									
Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
Components for re-use	kg	1.03E+01	3.44E-01	1.04E+00	4.79E-02	1.03E-01	6.42E-01	3.52E-02	-4.87E-01
Material for recycling	kg	1.05E+01	2.83E-01	7.79E-01	3.62E-02	8.47E-02	4.90E-01	2.66E-02	-4.92E-01
Materials for energy recovery	kg	1.92E+00	5.64E-02	3.65E-02	4.28E-03	1.69E-02	3.73E-01	2.02E-02	-2.52E-01
Exported energy, electricity	MJ	7.00E-01	1.11E-01	4.80E-02	6.02E-03	3.35E-02	3.71E-01	1.99E-02	-3.71E-01



ALTERNATIVE END-OF-LIFE SCENARIOS – SENSIVITY ANALYSIS

To assess the influence of end-of-life assumptions, two alternative scenarios were developed in comparison to the baseline (mixed) scenario, in accordance with the requirements of EPD International PCR 2019:14, v2.0.0, Section 4.8.4:

- 100% recycling, in which the entire mass after deconstruction is directed to recycling, while landfilling and energy recovery are omitted.
- 100% landfill, in which the entire mass is disposed of to landfill, while material recycling and energy recovery are omitted.

Mandatory impact category indicators according to EN 15804

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m³ of GOLDBECK prefabricated concrete reinforced beams and columns

Indicator	Unit	C3 (100% recycling)	C4 (100% recycling)	D (100% recycling)	C3 (100% landfill)	C4 (100% landfill)	D (100% landfill)
GWP – total	kg CO2e	4.24E+01	0	-1.65E+02	0	1.68E+02	0
GWP – GHG	kg CO2e	4.24E+01	0	-1.65E+02	0	1.68E+02	0
GWP – fossil	kg CO2e	4.23E+01	0	-1.64E+02	0	1.68E+02	0
GWP – biogenic	kg CO2e	3.35E-02	0	-3.38E-02	0	4.13E-02	0
GWP – LULUC	kg CO2e	7.27E-02	0	-1.02E+00	0	7.17E-02	0
ODP	kg CFC 11 eq.	7.36E-07	0	-7.28E-07	0	7.66E-07	0
AP	mol H+ eq.	3.14E-01	0	-3.12E-01	0	3.38E-01	0
EP-freshwater	kg P eq.	1.45E-01	0	-1.45E-01	0	1.58E-01	0
EP-marine	kg N eq.	4.77E-02	0	-4.62E-02	0	5.20E-02	0
EP-terrestrial	mol N eq.	5.37E-01	0	-5.32E-01	0	5.87E-01	0
POCP	kg NMVOC eq.	7.82E-01	0	-7.80E-01	0	8.56E-01	0
ADP-minerals&metals*	kg Sb eq.	9.26E-05	0	-9.20E-05	0	9.91E-05	0
ADP-fossil*	MJ	6.32E+02	0	-6.28E+02	0	6.43E+02	0
WDP*	m3	4.77E+00	0	-4.73E+00	0	5.16E+00	0

Resource use indicators

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m ³ of GOLDBECK prefabricated concrete reinforced beams and columns							
Indicator	Unit	C3 (100% recycling)	C4 (100% recycling)	D (100% recycling)	C3 (100% landfill)	C4 (100% landfill)	D (100% landfill)
PERE	MJ	4.25E+00	0	-4.26E+00	0	4.59E+00	0
PERM	MJ	5.91E+00	0	-5.87E+00	0	6.43E+00	0
PERT	MJ	1.02E+01	0	-1.01E+01	0	1.10E+01	0
PENRE	MJ	2.80E+02	0	-2.80E+02	0	2.85E+02	0
PENRM	MJ	3.86E+02	0	-3.81E+02	0	3.91E+02	0
PENRT	MJ	6.66E+02	0	-6.61E+02	0	6.76E+02	0
SM	kg	2.60E-01	0	-2.59E-01	0	2.89E-01	0
RSF	MJ	3.90E-02	0	-3.90E-02	0	4.13E-02	0
NRSF	MJ	3.61E-02	0	-2.76E-02	0	1.19E-01	0
FW	m ³	4.51E-01	0	-4.41E-01	0	1.59E+00	0

Waste indicators

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m ³ of GOLDBECK prefabricated concrete reinforced beams and columns							
Indicator	Unit	C3 (100% recycling)	C4 (100% recycling)	D (100% recycling)	C3 (100% landfill)	C4 (100% landfill)	D (100% landfill)
Hazardous waste disposed	kg	1.43E+02	0	-1.44E+02	0	1.70E+02	0
Non-hazardous waste disposed	kg	1.08E+02	0	-1.06E+02	0	1.28E+02	0
Radioactive waste disposed	kg	6.79E-05	0	-6.79E-05	0	7.14E-05	0

Output flow indicators

RESULTS OF THE LCA – ENVIRONMENTAL IMPACT according to EN-15804+A2: 1 m ³ of GOLDBECK prefabricated concrete reinforced beams and columns							
Indicator	Unit	C3 (100% recycling)	C4 (100% recycling)	D (100% recycling)	C3 (100% landfill)	C4 (100% landfill)	D (100% landfill)
Components for re-use	kg	6.77E-01	0	-5.13E-01	0	6.88E-01	0
Material for recycling	kg	5.17E-01	0	-5.19E-01	0	5.20E-01	0
Materials for energy recovery	kg	3.93E-01	0	-2.66E-01	0	3.95E-01	0
Exported energy, electricity	MJ	3.91E-01	0	-3.91E-01	0	3.89E-01	0

ABBREVIATIONS

Abbreviation	Description
GWP-total	Global Warming Potential – total
GWP-GHG	Global Warming Potential – greenhouse gases (excluding biogenic CO ₂ and land use change)
GWP-fossil	Global Warming Potential – fossil emissions
GWP-biogenic	Global Warming Potential – biogenic carbon
GWP-luluc	Global Warming Potential – land use and land use change
ODP	Ozone Depletion Potential
AP	Acidification Potential
EP-freshwater	Eutrophication Potential – freshwater
EP-marine	Eutrophication Potential – marine
EP-terrestrial	Eutrophication Potential – terrestrial
POCP	Photochemical Ozone Creation Potential
ADP-minerals&metals	Abiotic Depletion Potential – minerals and metals
ADP-fossil	Abiotic Depletion Potential – fossil fuels
WDP	Water Deprivation Potential
PERE	Use of renewable primary energy resources used as energy carrier
PERM	Use of renewable primary energy resources used as raw material

Abbreviation	Description
PERT	Total use of renewable primary energy resources
PENRE	Use of non-renewable primary energy resources used as energy carrier
PENRM	Use of non-renewable primary energy resources used as raw material
PENRT	Total use of non-renewable primary energy resources
SM	Use of secondary materials
RSF	Use of renewable secondary fuels
NRSF	Use of non-renewable secondary fuels
FW	Use of net fresh water
Hazardous waste disposed	Hazardous waste sent to final disposal
Non-hazardous waste disposed	Non-hazardous waste sent to final disposal
Radioactive waste disposed	Radioactive waste sent to final disposal
Components for re-use	Product components prepared for re-use
Material for recycling	Product components sent for material recycling
Materials for energy recovery	Product components used for energy recovery
Exported energy, electricity	Electricity exported to external systems

REFERENCES

1. **EPD International. (2021).** *General Programme Instructions for the International EPD® System, Version 5.0.0.* EPD International AB. Available at: <https://www.environdec.com/resources/programme-documents>
2. **EN 15804+A2:2019** – *Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.*
3. **ISO 14040:2006** – *Environmental management – Life cycle assessment – Principles and framework.*
4. **ISO 14044:2006** – *Environmental management – Life cycle assessment – Requirements and guidelines.*
5. **EN 15978:2011** – *Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method.*
6. **ecoinvent v3.10** – *Life Cycle Inventory database*, Swiss Centre for Life Cycle Inventories, www.ecoinvent.org.
7. **PCR 2019:14 Construction Products**, Version 2.0.0 (2025-06-02), The International EPD® System. Including **c-PCR Concrete and concrete elements**.
8. **OpenLCA 2.0** – *Life Cycle Assessment software*, GreenDelta GmbH, Berlin, Germany.
9. **GOLDBECK Corporate Design Portal** – *Basisguidelines and branding requirements*, <https://goldbeck-corporate-design-portal.azurewebsites.net>
10. **KOBIZE – Polish National Centre for Emissions Balancing and Management**, *Annual Polish electricity mix emission factors*, <https://www.kobize.pl>
11. **Construction Product Environmental Product Declarations (EPDs)** – Used as primary data sources for LCA modeling.
12. **GOLDBECK internal production data (2024)** – Data provided by GOLDBECK Prefab Elements Sp. z o. o. regarding:
 - material compositions (prefabricated concrete elements),
 - input volumes of raw materials and admixtures,
 - electricity and energy consumption in A3,
 - transport distances and logistics in A2 and C2,
 - end-of-life assumptions (C1–C4) and recovery potentials (D).
13. **EN 206** – *Concrete – Specification, performance, production and conformity*
14. **EN 1992 (Eurocode 2)** – *Design of concrete structures*
15. **EN ISO 9001** – *Quality management systems – Requirements*

VERSION HISTORY

The original version of the EPD.

