



**Pekabex**

Environmental Product Declaration  
Type III ITB No. 136/2020

# Prefabricated prestressed elements



ITB is the verified member of The European Platform for EPD program operators and LCA practitioner  
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**Owner of the EPD**

Pekabex BET S.A.  
Address: Budowlanych 54A  
80-298 Gdańsk, Poland  
Website: [www.pekabex.pl](http://www.pekabex.pl)  
tel.: +48 61 821 04 00  
e-mail: [info@pekabex.pl](mailto:info@pekabex.pl)

**EPD Program Operator**

Instytut Techniki Budowlanej (ITB)  
Address: Filtrowa 1,  
00-611 Warsaw, Poland  
Website: [www.itb.pl](http://www.itb.pl)  
Contact: Justyna Tomaszewska  
[j.tomaszewska@itb.pl](mailto:j.tomaszewska@itb.pl), [energia@itb.pl](mailto:energia@itb.pl)

Issuance date: 12.12.2020; Revision date: 19.11.2021; Validity date: 12.12.2025

# 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-A3, C3, C4 and D modules in accordance with EN 15804 (Cradle-to-Gate with options)

**The year of preparing the EPD:** 2020

**Product standard:** PN-EN 13369, PN-EN 15050, PN-EN 13224, 13225, PN-EN 13747

**Service Life:** 50 years for standard products

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

**Declared unit:** 1 ton

**Reasons for performing LCA:** B2B

**Representativeness:** Polish product

# Manufacturer



Pekabex S.A. is a manufacturer of prefabricated structures in Poland.

The company produces traditional reinforced elements, as well as modern prestressed elements used in enclosed structures (e.g. production and storage halls, offices, trade objects, railway stations, parking places), engineering objects (e.g. bridges, tunnels), and atypical designs. We offer wide range of standard products and realize special orders for individual designs. Pekabex S.A. possesses six production plants located in Poznań, Gdańsk, Bielsko-Biała, Mszczonów and Marktzeuln.



Fig 1. A view of Pekabex S.A. (Poland).



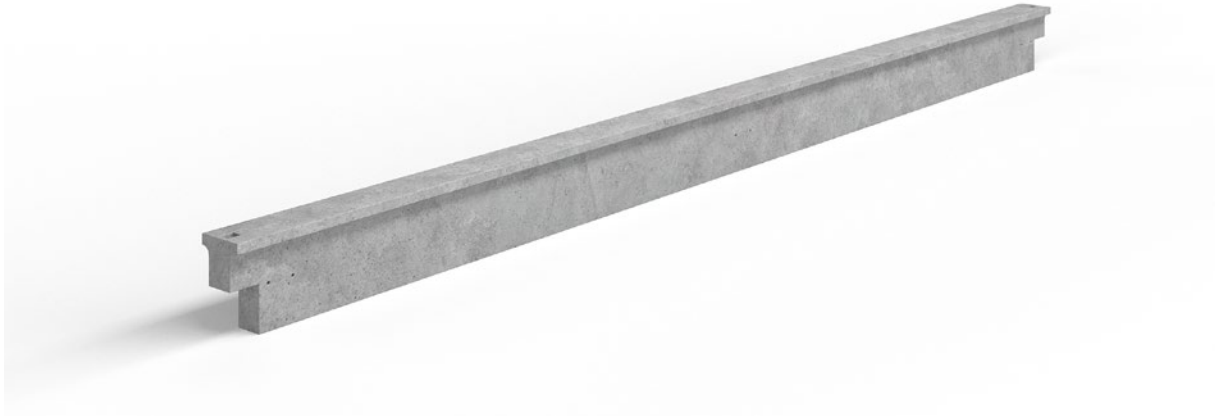
## Product description and application

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Prestressed elements are used for building construction. Products, such as beams, girders, slabs are available in various sizes and shapes.

**Prefabricated prestressed elements are offered in the form of:**

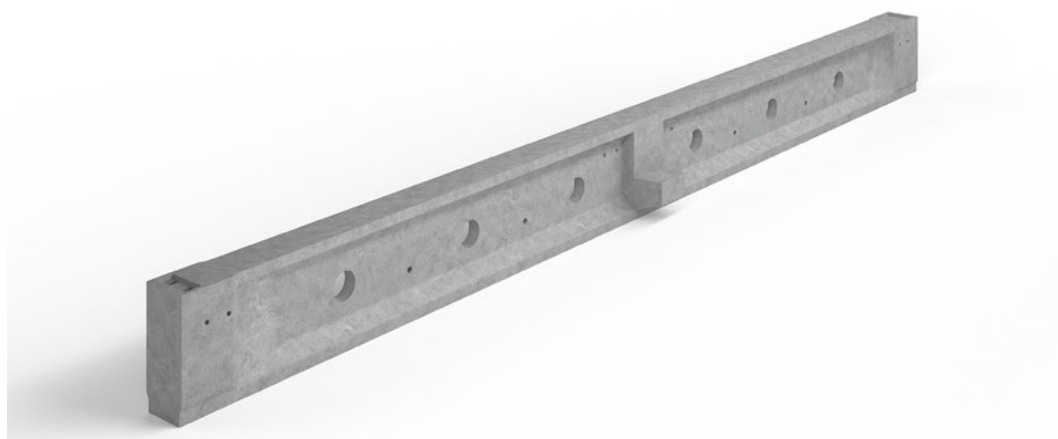
beams



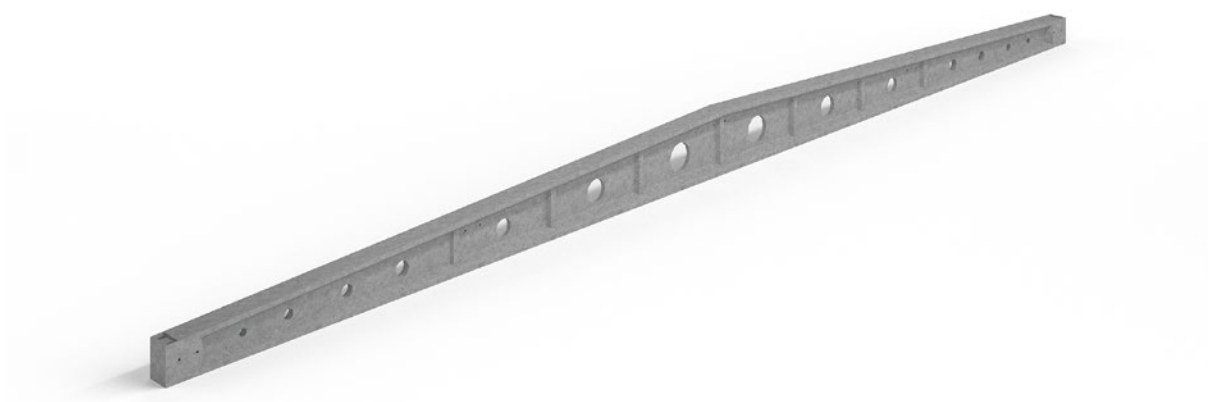
TT roof slabs



support roof beams



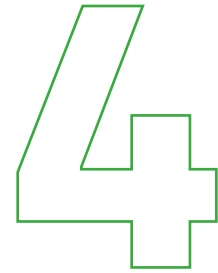
girders



Prefabricated prestressed elements possess certificates of Zakładowa Kontrola Produkcji No. 1487-CPR-107/ZKP/15, 1487-CPR-108/ZKP/15, 1487-CPR-109/ZKP/15, 1487-CPR110/ZKP/15, 1487-CPR-111/ZKP/15 and Nordcert certificate No. 2215.

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# Life Cycle Assessment (LCA) – general rules applied



## **Allocation**

The allocation rules used for this EPD are based on general ITB PCR A. Production of the prefabricated prestressed elements is a line process conducted in the manufacturing plant of Pekabex S.A. in Gdańsk (Poland). Allocation was done on product mass basis. All impacts from raw materials extraction and processing are allocated in module A1 of the LCA. Impacts of the manufacturing plants of Pekabex S.A. were inventoried and allocated to the prefabricated prestressed elements production based on the production volume. Water and energy consumption, associated emissions and generated wastes are allocated to module A3 of the LCA.

## **System limits**

The life cycle analysis (LCA) of the declared products covers: product stage – modules A1-A3, end of life – modules C3, C4 and benefits and loads beyond the system boundary – module D (cradle-to-gate with options) in accordance with EN 15804+A1 and ITB PCR A. The details of systems limits are provided in product technical report. Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included in the calculations. Packaging materials were not taken into consideration. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A1, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA.

## **Modules A1 and A2: Raw materials supply and transport**

Raw materials such as sand, gravel, cement, limestone, steel reinforcing components, additives and packaging materials come from both local and foreign suppliers. Means of transport include vehicles with loading capacity of <10t, 10 – 16t and >16t. For calculation purposes Polish and European fuel averages were applied.

## **A3: Production**

All of the components for precast production are coming to Pekabex by wheels deliveries or by train. Material for production is stored in designated for it places. Each of them is described in detail, exactly what material is to be there (e.g. aggregate entanglements, cement silos or designated zones for steel types, grades or diameters). Reinforcement elements are made partially automatically and manually. Ready reinforcement is placed in previously individually prepared forms. Concrete is poured into the prepared forms. Ready elements are kept in the formwork until the minimum design parameters are achieved. After evacuation, each element is checked by the quality control department, and then taken to an external warehouse, and then directly to the customer for the construction site.



A scheme of manufacturing of the prefabricated prestressed elements by Pekabex BET S.A.

**Modules C3, C4 and D: End of life**

At the end-of-life the steel reinforced concrete products are deconstructed with the use of heavy machinery. Recovered materials undergo re-use, recycling and landfilling according to the Polish treatment practice of industrial wastes - Table 1. The remaining materials are classified as inert wastes in the European list of waste products and are forwarded to a landfill in the form of mixed construction and demolition wastes. Environmental impacts declared in module C4 are associated with exchanges to process-specific burdens (energy,

land use) and infrastructure. Module D presents potential credits resulting from the use of crushed concrete wastes as aggregates for road foundation or ballast and the recycling of the steel reinforcement. Benefits and loads of steel scrap were calculated using a net scrap formulation proposed by World Steel Association where the net scrap is determined as a difference between the amount of steel recycled at end-of-life and the scrap input from previous product life cycle (assumed 70%). Impacts of materials that constitute less than 1.0% of the total system flows were not taken into consideration.

**Table 1. End-of-life scenario for the prefabricated prestressed elements**

Product	Material recover	Re-use	Recycling	Landfilling
Concrete waste	100%	95%	0%	5%
Steel	100%	0%	95%	5%

**Data collection period**

The data for manufacture of the declared products refer to period between 01.01.2019 – 31.12.2019 (1 year). The life cycle assessments were prepared for Poland as reference area.

**Data quality**

The values determined to calculate the LCA originate from verified Pekabex S.A. inventory data.

**Assumptions and estimates**

The impacts of the representative of the prefabricated prestressed elements were aggregated using weighted average. Impacts were inventoried and calculated for all products of the prefabricated prestressed elements.

**Calculation rules**

LCA was done in accordance with ITB PCR A document.

**Databases**

The data for the processes come from the following databases: Ecoinvent v.3.7.1, specific EPDs, ITB-Database. Specific data quality analysis was a part of external ISO 14001 audit.





# LIFE CYCLE ASSESSMENT (LCA) – Results



Declared unit

The declaration refers to declared unit (DU) – 1 tonne of the prefabricated prestressed elements manufactured by Pekabex S.A.

**Table 2. System boundaries for the environmental characteristic the prefabricated prestressed elements.**

Environmental assessment information (MNA – Module not assessed, MD – Module Declared, INA – Indicator Not Assessed)

Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to 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
MD	MD	MD	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MD	MD	MD

## Prestressed elements

### Environmental impacts: (DU) 1 tonne

Indicator	Unit	A1	A2	A3	A1-A3	C3	C4	D
Global warming potential	kg CO2 (100 years)	2,20E+02	3,00E+00	1,35E+01	2,36E+02	5,17E+00	1,39E-01	-7,38E+01
Ozone layer depletion	kg CFC11	1,05E-05	0,00E+00	0,00E+00	1,05E-05	7,83E-07	2,25E-08	-9,25E-06
Acidification	kg SO2	6,17E-01	3,66E-02	1,50E-02	6,69E-01	3,69E-02	1,01E-03	-2,89E-01
Formation of tropospheric ozone	kg ethylen (POCP)	1,49E-01	2,66E-03	1,28E-07	1,52E-01	1,10E-03	4,54E-05	-3,07E-02
Eutrophication	kg PO4	1,23E-01	6,45E-03	1,26E-03	1,31E-01	1,01E-02	2,33E-04	-7,02E-02
Depletion of abiotic resources	kg Sb equiv	3,95E-01	0,00E+00	5,00E-05	3,95E-01	2,60E-04	6,60E-08	-3,45E-04
Depletion of abiotic resources-fossil fuels	MJ	1,36E+03	4,09E+01	1,30E+02	1,53E+03	7,13E+01	2,10E+00	-7,98E+02

### Environmental aspects on resource use: (DU) 1 tonne

Indicator	Unit	A1	A2	A3	A1-A3	C3	C4	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	1,53E-03	INA	4,07E+01	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	0,00E+00	INA	1,50E-01	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw material)	MJ	1,26E+02	1,53E-03	1,38E+01	1,40E+02	4,13E+00	3,43E-02	-8,03E+01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	0,00E+00	INA	4,56E+02	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	0,00E+00	INA	8,52E-03	INA	INA	INA
Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw material)	MJ	1,64E+03	4,30E+01	1,36E+02	1,82E+03	7,27E+01	2,20E+00	-9,13E+02
Use of secondary material	kg	3,76E+01	0,00E+00	0,00E+00	3,76E+01	0,00E+00	0,00E+00	0,00E+00
Use of renewable secondary fuels	MJ	1,20E+02	2,15E+00	0,00E+00	1,22E+02	0,00E+00	0,00E+00	0,00E+00
Use of non-renewable secondary fuels	MJ	1,74E+02	0,00E+00	0,00E+00	1,74E+02	0,00E+00	0,00E+00	0,00E+00
Use of net fresh water	m3	INA	1,90E-05	INA	2,99E+01	INA	INA	INA

### Other environmental information describing waste categories: (DU) 1 tonne

Indicator	Unit	A1	A2	A3	A1-A3	C3	C4	D
Hazardous waste disposed [kg]	Mg	2,81E-02	1,13E-08	2,82E-03	3,09E-02	1,88E-04	4,66E-06	-2,59E-03
Non-hazardous waste disposed [kg]	Mg	1,86E+01	5,07E-06	2,06E+00	2,06E+01	6,13E-01	4,75E+01	-8,49E+00
Radioactive waste disposed [kg]	Mg	6,75E-03	2,93E-08	0,00E+00	6,75E-03	4,45E-04	1,40E-05	-1,97E-03
Components for re-use [kg]	Mg	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]	Mg	1,86E-01	0,00E+00	6,60E+00	6,79E+00	0,00E+00	0,00E+00	0,00E+00
Materials for energy recovery [kg]	Mg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy MJ per energy carrier	Mg	INA	INA	INA	INA	INA	INA	INA

## Verification

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

The basis for LCA analysis was PN-EN 15804 and ITB PCR A

Independent verification corresponding to ISO 14025 (subclause 8.1.3.)



external



internal

External verification of EPD: PhD. Eng. Halina Prejzner

LCA, LCI audit and input data verification: PhD. Eng. Justyna Tomaszewska, J.tomaszewska@itb.pl

Verification of LCA: Ph.D. Eng. Michał Piasecki, m.piasecki@itb.pl

## Normative references

- ITB PCR A General Product Category Rules for Construction Products
- 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
- ISO 15686-1:2011. Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A1:2013 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- KOBiZE Wskaźniki emisyjności CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, CO i pyłu całkowitego dla energii elektrycznej. Grudzień 2020

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dr inż. Agnieszka Winkler-Skalna  
Kierownik Zakładu Fizyki Ciepłej,  
Akustyki i Środowiska