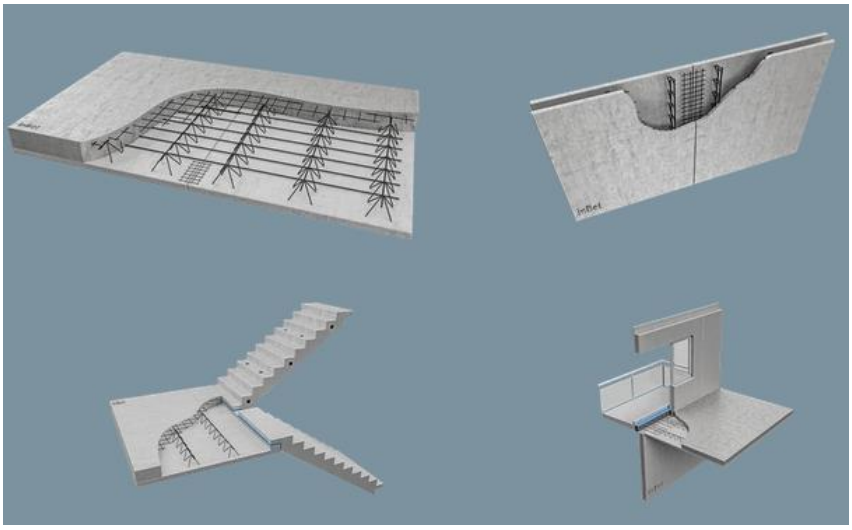
Type III Environmental Product Declaration No. 379/2022

Issuance date: 23.11.2022
Validity date: 23.11.2027

Precast concrete structures

filigree slabs, shell/double walls, one/three layer walls, balconies, stairs, columns, beams and other precast concrete products



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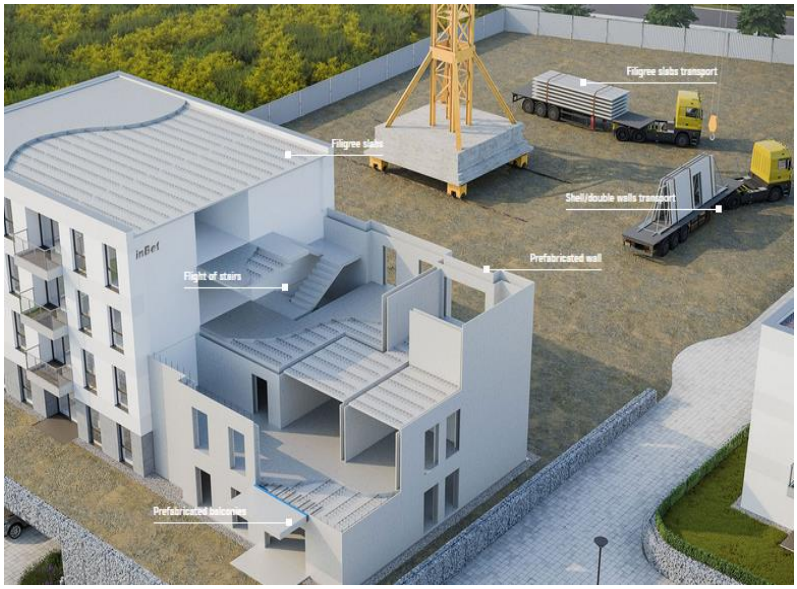
ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

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): modules A1-A3A1-A3, C1-C4 and D in accordance with EN 15804
The year of preparing the EPD: 2022
Product standard: EN 13369
Service Life: 50 years for standard product
PCR: ITB-PCR A (PCR based on EN 15804)
Declared unit: 1 ton of the reinforced concrete product
Reasons for performing LCA: B2B
Representativeness: Polish, European

MANUFACTURER



The inBet company was established in 1999 in Kolbudy (Poland) on the basis of the Rolbet prefabrication plant. The basic products are filigree floor slabs and prefabricated walls, e.g. composite and layered as well as flights, balconies and other prefabricated elements for residential and industrial construction. Company focus on the high quality of products and approach each project individually and flexibly to meet the requirements of our customers. The technical facilities, including two circulating technological lines for the production of floor slabs and composite walls, are among the most modern in Poland. They ensure efficiency of the production process and compliance with stringent quality standards. Currently, the products can be found on many construction sites in northern Poland and Scandinavia.

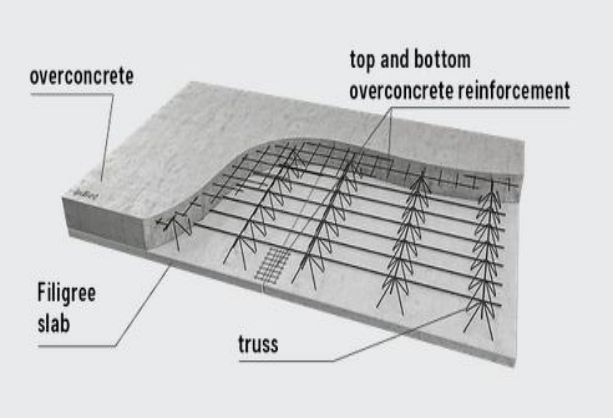
This EPD covers range of precast concrete products including: filigree slabs, prefabricated walls, ceilings, stairs, balconies, massive slabs, beams and columns.

PRODUCTS DESCRIPTION

Certificate granted by Certification Authority confirms that a company established and implemented its production system for precast reinforced concrete elements according to the Standards EN 13369 Common Requirements for Precast Concrete Elements for:

Filigree slabs

- design of the ceiling as an element of the „inBetPref" system
- designing the shapes and dimensions of the ceiling tailored to customers' needs
- welded mesh for overconcrete reinforcement cut according to the design
- thickness of the filigree slab from 5 cm to 7 cm
- weight of the prefabricated element from 125 to 150 kg/m^2 of the slab
- max. filigree slab dimensions 2.5m x 12.0m
- slab's chamfering 83°/83° or 90°/90°
- deliveries up to 175 m^2 on a transport trailer

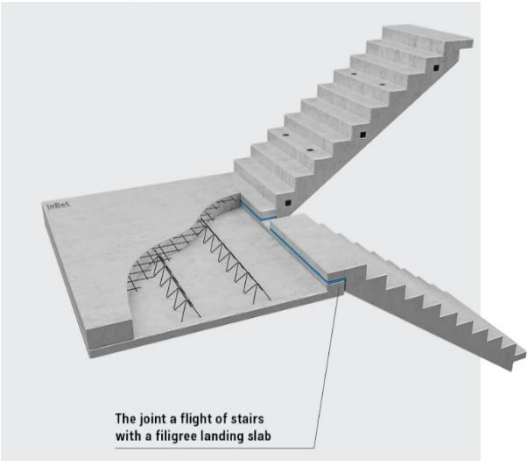


Prefabricated balconies

- workshop design of the prefabricated element as an element of the „inBetPref" system
- the shapes and dimensions of the element tailored to customers' needs
- reduction of labour and costs of execution of complicated formwork and reinforcement on the construction site
- possibility of prefabricating a balcony with a water-stop threshold
- elimination of thermal bridges by installing balcony insulation connectors at the prefabrication stage
- high quality of prefabricated elements allows to resign from finishing layers
- possibility of making non-slip surfaces

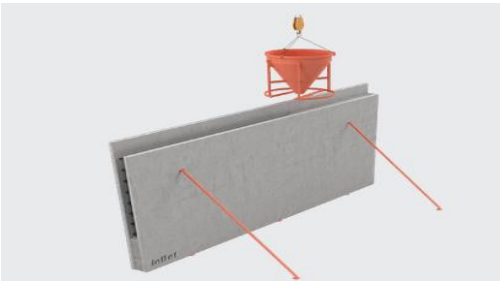
Flight of stairs

- workshop design of the prefabricated element as an element of the „inBetPref" system
- designing the shapes and dimensions of the element tailored to customers' needs
- reduction of labour and costs of execution of complicated formwork and reinforcement on the construction site
- ensuring efficient communication during construction (eliminates the need to use temporary stairs)
- assembly of the stairs with the use of a landing in the „inBetPref" system speeds up the construction
- high quality of prefabricated elements allows to resign from finishing layers
- possibility of making non-slip surface

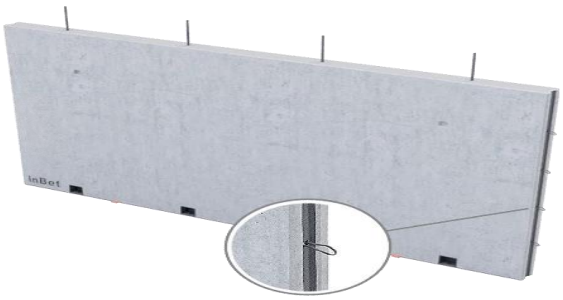


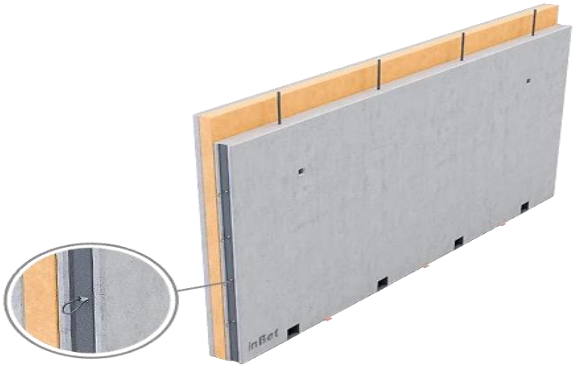
Prefabricated walls (shell/double walls, one-layer wall, three-layer walls)

- design of walls as „inBetPref" system
- designing the dimensions according to custom needs
- vast range of possibilities used in housing, public utility and industrial construction
- application to interior and exterior walls
- high quality of prefabricated walls surface eliminates the need for plastering
- possibility of installing window and door joinery at the prefabrication stage



- possibility of installing additional accessories (holes, electrical boxes, conduits, etc.)
- minimizing the scope and time of installation and finishing works on the construction site
- optional insulation layer (styro foam) that functions as thermal and acoustic insulation wall thickness ranging from 20 cm to 38 cm





LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 ton of precast concrete structure.

System boundary

Type of the EPD is: cradle to gate - with options. The following life cycle stages were considered. Production stage including: A1 – Raw material extraction and processing, A2 – Transport to the manufacturer and A3 – Manufacturing. End-of-life stage: C1- Deconstruction, C2 – Transport to waste processing, C3 – Waste processing, C4 – Disposal (landfill). This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of waste state or disposal of final residues. EPD includes D module- declaration of all benefits and loads beyond product system. Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A2, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA.

Allocation

The allocation rules used for this EPD are based on general ITB's document PCR A (EN 15804+A2). The total average product mass recipe per unit was used for the calculations based on input materials mass divided by the mass of all precast products. The input substances ranges are average values and the composition of specific products complying with the EPD can deviate from these concentration levels in individual cases. In the case of a specific specification of the effects of a particular product, it is necessary to contact the manufacturer.

System limits

All raw materials submitted for the formulations and production data were taken into consideration. In the assessment, all available data from production have been considered, i.e. all raw materials/elements used as per formulation process, utilized thermal energy for heating, and electric power consumption. Thus, material and energy flows contributing less than 1 % of mass or energy have been considered. It can be assumed that the total sum of neglected processes does not exceed 1 % of energy usage and mass per modules. Machines and facilities required during production are neglected. The production of etiquettes was not considered.

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

A1 module includes raw materials used in the production of the reinforced concrete product such as water, cement CEM II/A-M (S-LL) 52.5 N, aggregates, steel in bars and meshes and additives, Styrofoam. Raw materials for prefabricated concrete elements production come from local suppliers and from more distant locations. Means of transport include lorries (100% inventoried). For calculation purposes Polish and European fuel averages were applied.

Module A3: *Production*

The figure 1 show the working process during the production of reinforced concrete product. The raw materials: aggregates, cement, cement additives, steel and other inserts (e.g. EPS insulation) and water are used for elements formation. Prefabricated elements are stored in forms until concrete reaches its utility parameters. Ready-to-use prefabricated elements are packed and distributed.

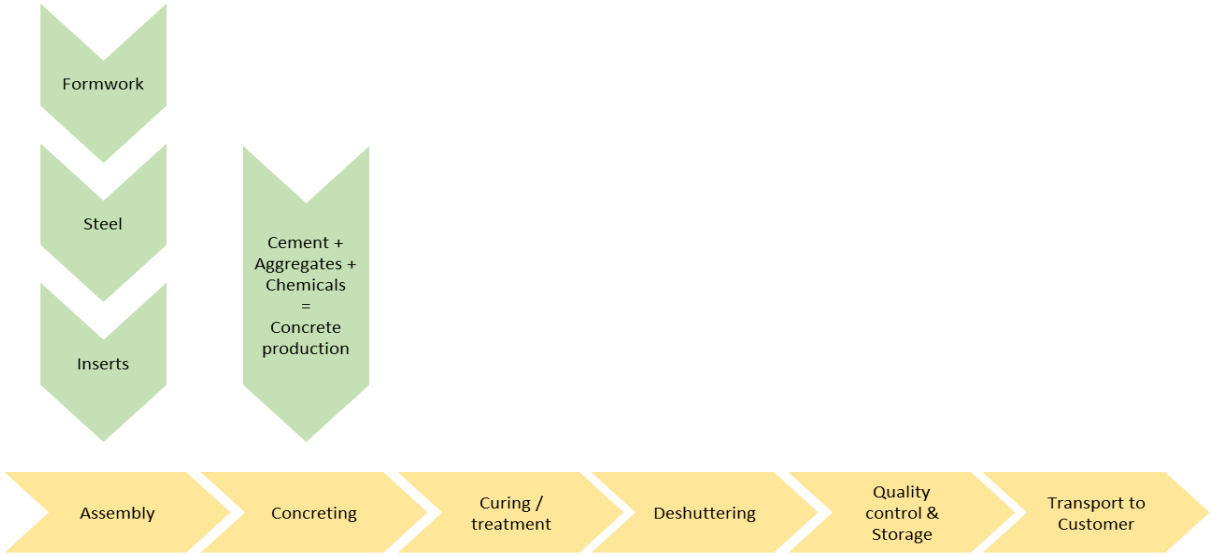


Fig. 1. A basic scheme of manufacturing process

Modules *C and D: End-of-life (EOL)*

The product (at the end of life in building) is to be removed form a building using mechanical equipment. In the adapted end-of-life scenario, the de-constructed products are transported to a waste processing plant distant by 100 km on > 16t lorry EURO 5, where undergo shredding with the use of crawler gear crusher equipped with magnetic separator (115 kW, electric drive) – module C3. 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 landfill. Module D presents potential credits resulting from the use of crushed concrete wastes as aggregates for road foundation or the recycling of the steel reinforcement. Module D presents credits resulting from the recycling of the primary steel scrap, calculated in accordance with the net scrap approach developed by World Steel Associated. Net scrap is an amount of steel recycled at end-of-life minus scrap input from previous product life cycles. Each scenario assumes that rate % of the material is sent to that scenario (table1).

Table 1. End-of-life scenario for the product components.

Product	Material recovery	Re-use	Recycling	Landfil
Concrete	100%	0%	95%	0%
Steel	100%	0%	95%	0%
Other	100%	0%	0%	100%

Regarding the recycling material of metals, the metal parts in the EoL are declared as end-of-waste status. Electricity at end-of-life (module D) has been modelled using an average EU-27 electricity mix as the location where the product reaches end-of-life is unknown.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2021 – 31.12.2021 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Data quality

The data selected for LCA originate from ITB-LCI questionnaire (1 plant) completed by producer and verified via data audit. No data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency is judged as good. The background data for the processes come from the following resources database Ecoinvent v.3.9) and specific EPDs. The background data for energy is national based on KOBiZE/GUS reports (Polish electricity mix and combustion factors for fuels). Specific (LCI) data quality analysis was a part of the input data verification.

Assumptions and estimates

The impacts of the representative product were aggregated using mass averaged approach per unit.

Calculation rules

LCA was performed using ITB-LCA tool developed in accordance with EN15804+A2. Emission of greenhouse gases was calculated using the IPCC 2013 GWP method with a 100-year horizon. Emission of acidifying substances, Emission of substances to water contributing to oxygen depletion, Emission of gases that contribute to the creation of ground-level ozone, Abiotic depletion, and ozone depletion emissions where all calculated with the CML-IA baseline method

Additional information

Polish electricity mix used (production) is 0.698 kg CO_2/kWh (KOBiZE 2021). European electricity mix used is 0.430kg CO_2/kWh for the end of life (Ecoinvent v3.9, RER).
There is no harmful emissive potential.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 ton of prefabricated concrete product The following life cycle modules (table 2) were included in the analysis. The following tables 3-6 present the environmental impacts of the life cycle of prefabricated product.

Table 2. System boundaries for the environmental characteristic included in LCA

Environmental assessment information (MD – Module Declared, MND – Module Not 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	MND	MND	MND	MND	MND	MND	MND	MD	MND	MD	MD	MD	MD	MD

Table 3. Life cycle assessment (LCA) results of the precast concrete product- environmental impacts (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	3.50E+02	8.34E+00	7.41E+01	4.33E+02	5.85E+01	1.67E+01	6.67E+00	7.96E+00	-3.40E+01
Greenhouse potential - fossil	eq. kg CO_2	3.46E+02	8.31E+00	5.93E+01	4.13E+02	5.68E+01	1.66E+01	6.65E+00	7.89E+00	-3.40E+01
Greenhouse potential - biogenic	eq. kg CO_2	4.10E+00	2.84E-02	1.48E+01	1.90E+01	1.66E+00	5.68E-02	2.27E-02	5.98E-02	-1.07E-01
Global warming potential - land use and land use change	eq. kg CO_2	3.32E-01	3.26E-03	5.02E-02	3.86E-01	1.99E-02	6.52E-03	2.61E-03	7.82E-03	-3.24E-02
Stratospheric ozone depletion potential	eq. kg CFC 11	1.25E-05	1.92E-06	3.65E-06	1.81E-05	1.16E-06	3.85E-06	1.54E-06	2.67E-06	-2.23E-06
Soil and water acidification potential	eq. mol H+	1.69E+00	3.37E-02	6.45E-01	2.37E+00	6.31E-01	6.75E-02	2.70E-02	6.92E-02	-3.92E-01
Eutrophication potential - freshwater	eq. kg P	7.20E-02	5.59E-04	1.20E-01	1.92E-01	1.08E-01	1.12E-03	4.47E-04	1.77E-03	-2.19E-02
Eutrophication potential - seawater	eq. kg N	4.44E+01	1.02E-02	1.32E+00	4.57E+01	9.13E-02	2.04E-02	8.15E-03	2.39E-02	-4.89E-02
Eutrophication potential - terrestrial	eq. mol N	3.08E+00	1.11E-01	1.00E+00	4.19E+00	7.72E-01	2.22E-01	8.89E-02	2.61E-01	-5.97E-01
Potential for photochemical ozone synthesis	eq. kg NMVOC	1.78E+00	3.40E-02	2.44E-01	2.06E+00	2.16E-01	6.80E-02	2.72E-02	7.56E-02	-2.18E-01
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	2.85E-03	2.95E-05	5.65E-04	3.44E-03	2.77E-04	5.89E-05	2.36E-05	2.39E-05	-2.54E-03
Abiotic depletion potential - fossil fuels	MJ	6.79E+03	1.23E+02	8.60E+02	7.78E+03	9.63E+02	2.47E+02	9.87E+01	1.94E+02	-4.60E+02
Water deprivation potential	eq. m^3	2.44E+02	5.70E-01	2.95E+02	5.40E+02	1.99E+01	1.14E+00	4.56E-01	9.35E-01	-2.11E+01

Table 4. Life cycle assessment (LCA) results of the precast concrete product – additional impacts indicators (DU: 1 ton)

Indicator	Unit	A1-A3	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA

Table 5. Life cycle assessment (LCA) results of the precast concrete element- the resource use (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of renewable primary energy resources	MJ	2.41E+02	1.77E+00	7.17E+01	3.14E+02	7.14E+01	3.54E+00	1.42E+00	2.76E+00	-4.60E+01
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Consumption of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total consumption of non-renewable primary energy resources	MJ	6.82E+03	1.23E+02	8.68E+02	7.81E+03	9.66E+02	2.47E+02	9.87E+01	2.04E+02	-4.51E+02
Consumption of secondary materials	kg	5.13E-01	4.14E-02	1.26E+00	1.81E+00	8.80E-02	8.27E-02	3.31E-02	1.52E-02	1.18E+02
Consumption of renew. secondary fuels	MJ	4.73E-02	4.56E-04	3.00E-03	5.07E-02	4.90E-04	9.11E-04	3.65E-04	3.96E-04	-1.36E-02
Consumption of non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	3.55E-01	3.55E-01	7.79E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net consumption of freshwater	m^3	5.45E+00	1.55E-02	6.41E+01	6.96E+01	2.61E-01	3.10E-02	1.24E-02	9.80E-02	6.27E-01

Table 6. Life cycle assessment (LCA) results of the precast concrete element– waste categories (DU: 1 ton)

Indicator	Unit	A1	A2	A3	A1-A3	C1	C2	C3	C4	D
Hazardous waste	kg	1.00E+01	1.38E-01	5.31E+00	1.55E+01	9.96E-03	2.77E-01	1.11E-01	7.69E-02	1.66E+00
Non-hazardous waste	kg	2.58E+02	2.46E+00	6.54E+01	3.26E+02	5.18E-01	4.92E+00	1.97E+00	5.02E+02	4.18E+01
Radioactive waste	kg	6.90E-03	9.21E-06	7.60E-04	7.67E-03	7.22E-04	1.84E-05	7.37E-06	1.22E-03	1.41E-04
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	2.02E-02	3.82E-04	6.77E+01	6.77E+01	9.96E-04	7.64E-04	8.05E+02	1.44E-04	3.21E-03
Materials for energy recovery	kg	1.29E-03	3.09E-06	4.91E-05	1.34E-03	8.72E-06	6.18E-06	2.47E-06	1.71E-06	2.98E-04
Exported Energy	MJ	1.71E+01	0.00E+00	1.54E+01	3.25E+01	2.87E+00	0.00E+00	0.00E+00	0.00E+00	6.44E-01

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 EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (sub clause 8.1.3.) ☒ external ☐ internal
External verification of EPD: Halina Prejzner, PhD. Eng. LCA, LCI audit and input data verification: Michał Piasecki, PhD., D.Sc., Eng.

Note: The declaration owner has the sole ownership, liability, and responsibility for the declaration. Declarations of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- EN 13225 Precast Concrete Elements: Bar-shaped construction elements.
- EN 13747 Precast concrete products - Floor plates for floor systems
- EN 14843 Precast Concrete Elements: Stairs.
- EN 14991 Precast concrete products - Foundation elements
- EN 14992 Precast concrete products - Wall elements
- EN 15258 Precast concrete products - Retaining wall elements
- 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+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business

Signature Not Verified
Dokument podpisany przez Michał Piasecki; ITB
Data: 2022.11.23 10:40:26 CET

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Thermal Physics, Acoustics and Environment Department
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CERTIFICATE № 379/2022
of TYPE III ENVIRONMENTAL DECLARATION

Product:

Precast concrete structures
filigree slabs, shell/double walls, one/three layer walls, balconies, stairs, columns, beams and other precast concrete products

Manufacturer:

InBet Sp. z o.o.
ul. Przemysłowa 10, 83-050 Kolbudy, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

EN 15804

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 28th November 2022 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director
for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, November 2022