Environmental Product Declaration

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for:

Precast concrete products - Hollow-core slabs

from

Perdanga, UAB

Programme:	The International EPD® System, www.environdec.com
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

Environmental Product Declaration

This is an Environmental Product Declaration for precast concrete hollow-core slabs, produced by Perdanga, UAB. The declaration is registered in accordance with the EPD programme of the International EPD® System and the Product Category Rules for Construction Products 2019:14, version 1.1. The EPD are used in both business-to-business (B2B) and business-to-consumer (B2C) communication.

Company information

Owner of the EPD:
Perdanga, UAB
e-mail: valaitis@perdanga.lt
www.perdanga.lt

Description of the organisation: The factory counts its age since 1961. Since 1992 the enterprise has been registered as the Limited Liability Company "Perdanga". Perdanga is the one of the largest producers of concrete products in Lithuania with a turnover of 28 MEUR. In year 2003 company established second factory in Vilnius. The Company's products were used in major construction projects: Klaipeda city waste-water treatment plant, Butinge Oil Terminal, Mazeikiai Refinery, Klaipeda Container Terminal, Cruise Terminal, production facilities of foreign capital companies "Philip Morris", Master Foods. Perdanga production is also exported to neighbouring countries – Latvia, Russia, Sweden and Norway. Company has implemented Quality management systems EN ISO 9001:2015 and EN ISO 14001:2015

Product-related or management system-related certifications: Hollow-core slabs has CE marking. Product is produced according to requirements of EN 1168. Common aspects which apply to all precast products are specified in EN 13369 and EN 206-1. Product is certified in Sweden and Norway. Hollow-core slabs are registered at Byggvarubedömningen.

Name and location of production site(s): Perdanga, UAB Dubysos str. 27, 91181 Klaipeda, Lithuania

Product information

Product name: Hollow-core slab

Product description: precast concrete hollow-core slabs are designed and manufactured by continuous forming, according to the floor plan provided by the customer with the specified openings. The end edge of the panels can be designed geometrically (cut diagonally or stepped).
Concrete class C45/55 or C50/60 is used to produce slabs. The standard width of the panels is 1200 mm. Narrower panels can be made by cutting them in lengthwise direction, but not narrower than 300 mm. The narrowing of the slabs of each cross-section height is performed depending on the number and position of the holes in the cross-section. Recommended dimensions of narrowed slabs can be found on the website of Perdanga UAB at www.perdanga.lt.
The length of the production lines for hollow-core slabs is 108 m. The formed concrete strip is cut into individual plates according to the design lengths. Perdanga UAB manufactures hollow-core slabs with a height of 200 mm, 220 mm, 265 mm, 320 mm, 400 mm, and 500 mm.
A computer program is used for hollow-core slab cross-section bearing capacity and reinforcement selection analyse. All products are certified by the Construction Products Certification Centre in Lithuania, Sweden, and Norway.

Precast concrete hollow-core slabs are widely used for prefabricated floors. Their popularity is determined by the economical cross-section and efficient production method, the variety of product heights and load-bearing capacity, smooth bottom surface and efficient use in building construction. Various openings and holes can be formed in the slabs.
Factory-made products are marked with date of manufacture, identification no. (if required in the order), weight specification, load size. Each product bears the factory quality control mark according to the authorized inspection. Hollow-core slabs without QC mark cannot be installed.
Permissible product tolerances may slightly increase the weight of the product. This must be considered when deciding what crane lifting capacity is required. In addition, the self-weight of the lifting equipment must be considered when selecting the crane.

UN CPC code: 375

Geographical scope: Europe

LCA information

Functional unit / declared unit: In accordance with the PCR the declared unit is 1 metric tonne of the product.

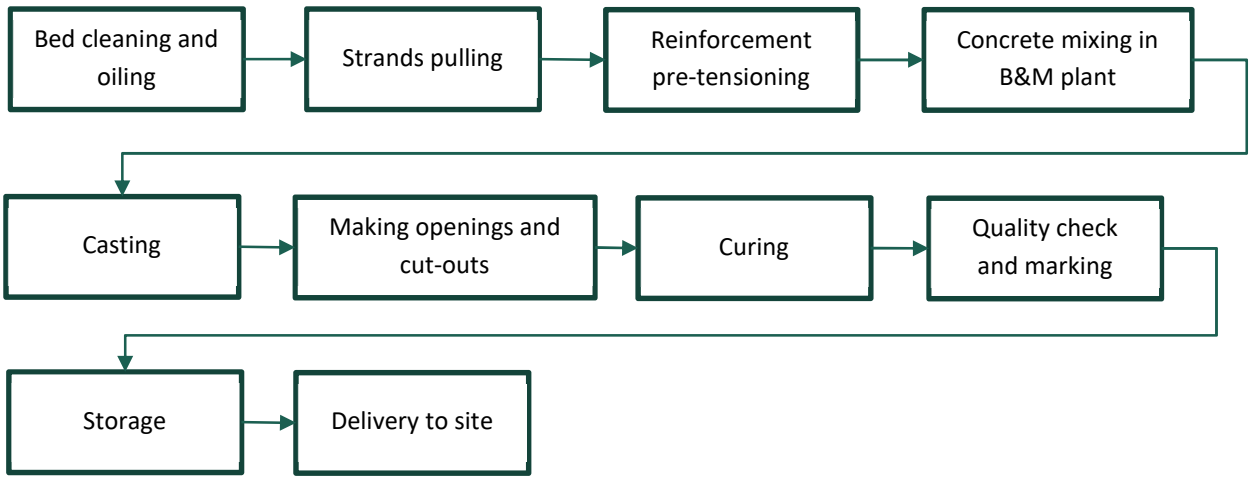
Reference service life: The reference service life for the precast concrete hollow core slab is set at 100 years.

Time representativeness: Primary data was collected internally. The production data refers to the average of the year 2020.

Database(s) and LCA software used: The Ecoinvent database provides the life cycle inventory data for the raw and process materials obtained from the background system. The used database is Ecoinvent 3.6. The LCA software used is One Click LCA.

Description of system boundaries:
Cradle to gate with options, modules C1-C4 and module D. The LCA was carried out considering the Product stage phases (A1, A2, A3), Distribution (A4), End of life (C1, C2, C3, C4), Potential environmental benefits (D) in accordance with EN 15804.

System diagram:



Data quality: The foreground data collected internally is based on yearly production amounts and extrapolations of measurements on specific machines and plants. Overall, the data quality can be described as good. The primary data collection has been done thoroughly.

Cut-off criteria: Life cycle inventory data for a minimum of 99% of total material and energy input flows have been included in the life cycle analysis. Although only materials having in summa less than 1% of weight of product were not used in calculations.

Modules declared:

	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	MND	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Description of the system boundary (X = Included in LCA; MND = Module Not declared; MNR = Module Not relevant)

Product stage:
A1: This stage considers the extraction and processing of raw materials as well as energy consumption.
A2: The raw materials are transported to the manufacturing plant. In this case, the model includes road transportation of each raw material.
A3: This stage includes the manufacture of products and packaging. It also considers the energy consumption and waste generated at production plant.

Production process description

Pre-stressed hollow-core slabs are produced on long beds - 108 m. Before every casting beds should be cleaned from small concrete particles and oiled. Cleaning is done by electrical vehycle with cylindrical brush. Same machine is spreding afterwords a thin layer of water based oil on the bed surface. Strands for pre-stressing are pulled over the production bed. Number of strands is calculated according to project reguirements for slab bearing capacity. After strands are fixed on both ends of production bed, pre-stressing starts. Single strand pre-stressing method is used with the help of PAUL pre-stressing machine. Casting of concrete is done by ELEMATIC extruder. If needed all openings or cut-outs are done in fresh concrete. After casting whole bed is covered with PVC coat for curing process. After curing whole concrete stripe is cut into pieces according to project specification. Slabs are delivered to production stockyard.

Construction process stage:
A4: This stage includes transport from the production gate to the construction site where the product shall be installed. Transportation is calculated based on data form manufacturer and a scenario with the parameters described in the following table. The transportation doesn't cause losses as products are packaged properly.

Parameter	Value/Description
Vehicle type used for transport	EURO 5 truck with a trailer with an average load of 16-32t
Distance	69 % of production: Truck – 146 km. 31 % of production: Truck – 443 km, Ship – 351 km.
Capacity utilization	56 % of the capacity in volume (truck), 50 % of the capacity in volume (ship)

Use stage:
In normal use scenario, it is assumed that no maintenance (B2), repair (B3), replacement (B4) and refurbishment (B5) is needed.

End of Life stage:
This stage includes the following modules:

C1: Deconstruction, dismantling, demolition

Consumption of fuel in demolition process is calculated according to transported mass. Energy consumption demolition is 10 kWh for 1000 kg. The source of energy is diesel fuel used by work machines.

C2: Transport of the discarded product to the processing site

It is estimated that there is no mass loss during the use of the product, therefore the end-of-life product is assumed that it has the same weight with the declared product. All the end-of-life product is assumed to be sent to the closest facilities such as recycling and landfill. Transportation distance to the closest disposal area is estimated as 50 km and the transportation method is lorry which is the most common.

C3: Waste processing for reuse, recovery and/or recycling

Based on Europe average 90% of steel are transformed into secondary material in a recycling plant. According to European Commission Waste Framework Directive by 2020, the preparing for re-use, recycling and other material recovery of non-hazardous construction and demolition waste shall be increased to a minimum of 70 % by weight. It is assumed that 70% of the concrete waste is recycled.

C4: Discharge (disposal)

The remaining 30 % of concrete and 10 % of steel are assumed to be sent to the landfill.

Benefits and loads beyond the system boundary (D):

Benefits of recyclable waste generated in the phase C3 are considered in the phase D. The recycled steel has been modelled to avoid use of primary materials. The scrap content in the studied product has

been acknowledged and only the mass of primary steel in the product provides the benefit to avoid double counting. 70 % of concrete is assumed to be converted into a raw material.

Content information

Product components	Weight, kg	Weight, %
Cement	149.42	14.94
Gravel	141.34	14.13
Breakstone	314.99	31.50
Sand	310.95	31.10
Reinforcement	20.14	2.01
Water	63	6.3
Additives	0.16	0.02
TOTAL	1000	100

No dangerous substances from the candidate list of SVHC for Authorisation are used in the product

Packaging

Distribution packaging: wooden gaskets. After use, packaging materials can be re-used or recycled.

Environmental Information

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Results per functional or declared unit											
Impact category	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP – total	kg CO2e	1.63E2	4.23E0	1.77E0	1.69E2	2.25E1	3.30E0	4.55E0	2.99E0	1.46E0	-1.84E1
GWP – fossil	kg CO2e	1.61E2	4.22E0	1.68E0	1.67E2	2.27E1	3.30E0	4.54E0	3.01E0	1.46E0	-1.84E1
GWP – biogenic	kg CO2e	2.20E0	7.76E-3	8.38E-2	2.29E0	1.54E-2	9.17E-4	3.30E-3	-2.47E-2	2.89E-3	-2.27E-2
GWP – LULUC	kg CO2e	4.42E-2	2.42E-3	7.00E-4	4.73E-2	7.21E-3	2.79E-4	1.37E-3	7.21E-4	4.33E-4	-9.44E-3
Ozone depletion pot.	kg CFC11e	6.77E-6	8.69E-7	3.84E-7	8.02E-6	5.29E-6	7.12E-7	1.07E-6	6.18E-7	6.01E-7	-9.02E-7
Acidification potential	mol H+e	4.85E-1	3.24E-2	9.42E-3	5.26E-1	1.24E-1	3.45E-2	1.91E-2	3.22E-2	1.38E-2	-9.90E-2
EP-freshwater[2)]	kg Pe	3.44E-3	7.05E-5	3.39E-5	3.54E-3	1.81E-4	1.33E-5	3.70E-5	4.10E-5	1.76E-5	-1.13E-3
EP-marine	kg Ne	1.17E-1	9.92E-3	3.34E-3	1.31E-1	3.56E-2	1.52E-2	5.75E-3	1.30E-2	4.77E-3	-1.98E-2
EP-terrestrial	mol Ne	1.38E0	1.10E-1	3.68E-2	1.52E0	3.93E-1	1.67E-1	6.35E-2	1.44E-1	5.25E-2	-2.38E-1
POCP (“smog”)	kg NMVOCe	4.00E-1	3.08E-2	1.05E-2	4.41E-1	1.21E-1	4.59E-2	2.04E-2	3.95E-2	1.53E-2	-9.20E-2
ADP-minerals & metals	kg Sbe	1.44E-3	7.35E-5	1.24E-5	1.53E-3	3.77E-4	5.03E-6	7.75E-5	2.85E-5	1.33E-5	-8.21E-4
ADP-fossil resources	MJ	9.16E2	6.34E1	3.1E1	1.01E3	3.50E2	4.54E1	7.07E1	4.15E1	4.08E1	-1.83E2
Water use[1)]	m3e depr.	4.36E1	3.3E-1	2.37E0	4.63E1	1.28E0	8.46E-2	2.63E-1	1.53E-1	1.89E0	-1.56E1

GWP = Global Warming Potential; EP = Eutrophication potential; POCP = Photochemical ozone formation; ADP = Abiotic depletion potential. 1) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator. 2) Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e.

USE OF NATURAL RESOURCES

Results per functional or declared unit											
Impact category	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Renew. PER as energy	MJ	6.99E1	1.95E0	1.58E1	8.76E1	4.32E0	2.45E-1	8.90E-1	1.16E0	3.30E-1	-1.72E1
Renew. PER as material	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total use of renew. PER	MJ	6.99E1	1.95E0	1.58E1	8.76E1	4.32E0	2.45E-1	8.90E-1	1.16E0	3.30E-1	-1.72E1
Non-re. PER as energy	MJ	9.17E2	6.34E1	3.05E1	1.01E3	3.50E2	4.54E1	7.07E1	4.15E1	4.08E1	-1.83E2
Non-re. PER as material	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total use of non-re. PER	MJ	9.17E2	6.34E1	3.05E1	1.01E3	3.50E2	4.54E1	7.07E1	4.15E1	4.08E1	-1.83E2
Secondary materials	kg	1.03E1	0.00	0.00	1.03E1	0.00	0.00	0.00	0.00	0.00	5.23E0
Renew. secondary fuels	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-ren. secondary fuels	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Use of net fresh water	m3	2.60E0	1.42E-2	2.02E-2	2.63E0	7.13E-2	4.01E-3	1.47E-2	5.63E-3	4.46E-2	-8.47E-1

PER = Primary energy resources

END OF LIFE – WASTE

Results per functional or declared unit											
Impact category	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste	kg	1.15E1	1.16E-1	3.28E-2	1.16E1	3.42E-1	4.88E-2	6.87E-2	0.00	3.80E-2	-5.46E0
Non-hazardous waste	kg	1.64E2	6.14E0	1.03E2	2.73E2	3.64E1	5.22E-1	7.60E0	0.00	2.77E2	-5.89E1
Radioactive waste	kg	3.95E-3	4.20E-4	1.33E-4	4.51E-3	2.40E-3	3.18E-4	4.85E-4	0.00	2.70E-4	-3.70E-4

END OF LIFE – OUTPUT FLOWS

Results per functional or declared unit											
Impact category	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Materials for recycling	kg	0.00	0.00	1.07E2	1.07E2	0.00	0.00	0.00	6.60E2	0.00	0.00
Materials for energy rec	kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exported energy	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML / ISO 21930

Results per functional or declared unit											
Impact category	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Global Warming Pot.	kg CO2e	1.59E2	4.18E0	1.66E0	1.65E2	2.25E1	3.27E0	4.50E0	2.99E0	1.43E0	-1.77E1
Ozone depletion Pot.	kg CFC11e	5.85E-6	7.01E-7	3.02E-7	6.85E-6	4.21E-6	5.63E-7	8.49E-7	4.93E-7	4.76E-7	-8.06E-7
Acidification	kg SO2e	3.60E-1	2.06E-2	4.42E-3	3.85E-1	7.07E-2	4.87E-3	9.25E-3	7.14E-3	5.77E-3	-7.43E-2
Eutrophication	kg PO4 3e	1.49E-1	4.51E-3	2.25E-3	1.55E-1	1.19E-2	8.57E-4	1.87E-3	2.03E-3	1.12E-3	-4.76E-2
POCP (“smog”)	kg C2H4e	2.40E-2	8.29E-4	3.02E-4	2.52E-2	3.48E-3	5.01E-4	5.86E-4	5.47E-4	4.23E-4	-1.03E-2
ADP-elements	kg Sbe	1.44E-3	7.35E-5	1.24E-5	1.53E-3	3.77E-4	5.03E-6	7.75E-5	2.85E-5	1.33E-5	-8.21E-4
ADP-fossil	MJ	9.16E2	6.34E1	3.10E1	1.01E3	3.50E2	4.54E1	7.07E1	4.15E1	4.08E1	-1.83E2

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:	info@environdec.com

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14 Construction products (version 1.1); Complementary PCR (c-PCR):C-PCR-003 (TO PCR 2019:14) - Concrete and concrete elements, version: 2019-12-20;
PCR review was conducted by: The International EPD® System
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: Vladimir Kočí, LCA Studio Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but from different programmes may not be comparable. EPDs 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.

References

- General Programme Instructions of the International EPD® System. Version 4.0;
- PCR 2019:14 Construction products (version 1.1)
- EN 15804:2012+A2:2019 Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products.
- ISO 14020:2001 Environmental labels and declarations – General principles.
- ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks.
- ISO 14044:2006 Environmental management. Life Cycle Assessment. Requirements and guidelines.
- ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations. Principles and procedures.

Tools and database

- One Click LCA tool;
- Ecoinvent 3.6 database

Contact information

EPD owner:	Perdanga, UAB www.perdanga.lt	
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Programme operator:	The International EPD® System https://www.environdec.com	

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