Environmental Product Declaration Type III ITB No. 421/2023

Issuance date: 09.05.2023
Validity date: 09.05.2028

Concrete -045-5-G-28-12-1-D-Q01 “ODN56” produced by CEMEX POLSKA

EPD Program Operator:

Instytut Techniki Budowlanej (ITB)
Address: Filtrowa 1, 00-611 Warsaw, Poland
Website: www.itb.pl
Contact: Michał Piasecki
m.piasecki@itb.pl, energia@itb.pl

Owner of the EPD:

CEMEX Polska Sp. z o.o.
Address: Ul. Krakowiaków 46, 02-255 Warsaw
Contact: +48 659926387
renata.markowska@cemex.com
Website: www.cemex.pl

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-A3, in accordance with EN 15804 (Cradle to Gate)

The year of preparing the EPD: 2023

Product standard: PN-EN 206+A1:2016-12

Service Life: no reference service life of concretes is declared as they are intermediate products used in construction

PCR: ITB-PCR A (PCR based on EN 15804) and EN 16908

Declared unit: 1 ton (Mg) of concrete mix (*EPD additionally provides results for 1 m^3 of concrete*)

Reasons for performing LCA: B2B

Representativeness: Polish, European

BASIC INFORMATION

Declaration covers specific concrete 045-5-G-28-12-1-D-Q01 (ODN56) produced by Cemex in Poland. Cement CEM I 42.5 N-SR3/NA used for concrete is produced in Poland at Gdynia plant (based on clinker from Rudniki and Chełm). Fly ashes are co-produced by electric plant EC Dolna Odra, aggregates by Kłodzino and BG stone (Aarsleff). The life-cycle assessment was carried out according to the following standards: PN-EN 15804, PN-EN ISO 14025, PN-EN ISO 14040 and the product categorization rules provided in document ITB PCR-A. Declared reference unit is 1 ton of concrete. LCA assessment was carried out using verified ITB algorithms dedicated to calculate the LCA and data collected by the industry and Ecoinvent data-set. Specific CEM I production (used in concrete) is characterized by high use of alternative fuels (80-90%) and high level of consumed renewable electric energy. Also estimated 30% of renewable energy is used in the production of concrete.

PRODUCTS DESCRIPTION

Concrete is specified and supplied in accordance with EN 206. Concrete is used for site-mixed structures, precast structures and structural precast products in buildings prefabricated structures and structural prefabricated products in buildings and buildings.
The product assessed is a specific 1 ton of mixed concrete, where the constituent proportions are provided in table 1.

Table 1. Concrete mix recipe 045-5-G-28-12-1-D-Q01 (ODN56) (per ton)

	in tones per concrete ton
CEM I 42,5 N-SR 3/NA / Gdynia CEMEX	0.15
Fly ash	0.026
sand 0/2	0.28
Aggegate 1; 2/8 / BG Stone - Aarsleff	0.48
Aggregate2; 8/16 / BG Stone - Aarsleff	
Additive 1 MasterAir	0.001
Additive 2 MasterGlenium	0.002
water	0.06

Table 1 values represent a specific factory produced mixed concrete produced in Poland by CEMEX. More detailed information is available in the respective manufacturer's documentation (e.g. product data sheets).

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 ton of representative concrete 045-5-G-28-12-1-D-Q01 (ODN56) (according to Table 1). In order to obtain the impact results for 1 m^3 of concrete, the values in the table 3 should be multiplied by the factor 2.3 (see table 4).

System boundary

The EPD covers the product stage analysis (“cradle to gate”). The selected system boundaries comprise the production of input raw materials’ extraction up to the finished product at the factory gate (ready concrete). The product stage contains: Module A1: extraction and processing of raw materials (ash, sand, gravel, additives, water, and cement) and fuels, Module A2: transportation up to factory gate of raw materials and primary fuels, Module A3: concrete production (mixing). Inputs and processes of product system are presented in Figure 1.

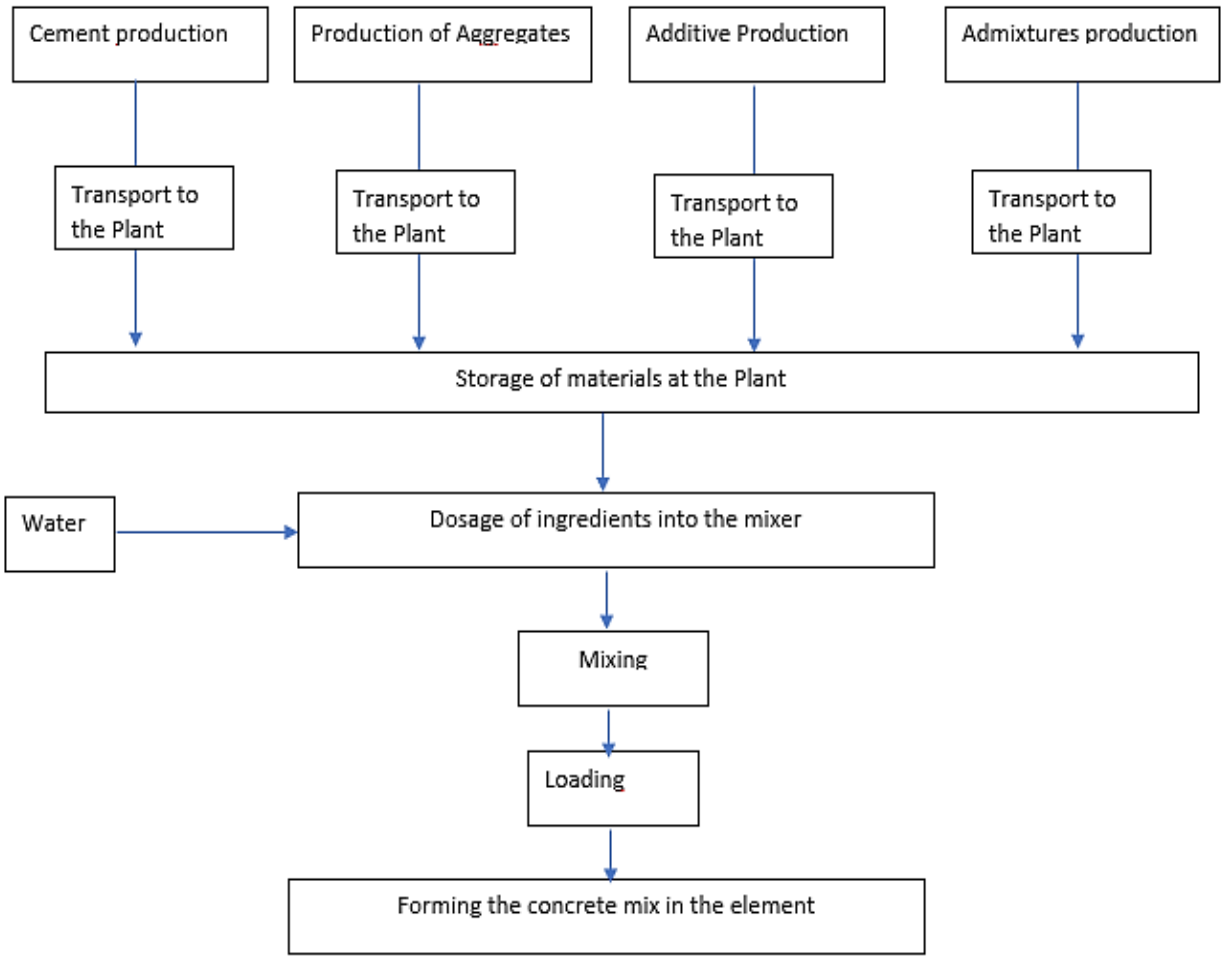

Figure 1. Concrete production - Inputs and processes of the product system

Allocation rules

The allocation rules used for this EPD are based on general ITB PCR A and EN 15804. As no co-products are produced, the flow of materials and energy and also the associated release of substances and energy into the environment are related exclusively to the concrete mix produced. Cement used is produced by Gdynia cement and the weighted average mass of CEM I 42.5 production was used for allocation. In the case of fly ash, eco-product from electricity production used as a cement constituent, economic allocation was applied. Minimum 99.5% of impacts from the production lines were allocated to product covered by this declaration. Emissions allocated in clinker production are assessed by CEMEX using international methods for ETS system declaration. The specific prices for fly ash declared by the producer were used for the economic allocation. Calculations for GWP indicator are made taking into account gross and net emissions. The indicated gross value includes the CO_2 emissions from waste incineration (excluding biomass fraction of fuels), net-value excludes impacts from alternative waste-based fuels.

System limits

In this assessment, all information gathered from data collection for the production of concrete has been modelled, i.e. all raw materials used, the electrical energy and other fuels used, use of ancillary materials and all direct production waste. Transport data on input was considered. No cut-offs have been made in accordance with EN 15804. The machines and facilities (capital goods) required for and during production are excluded, as is transportation of employees. Calculations for GWP indicator are made taking into account gross and net emissions.

A1 – A2 Modules: Raw materials supply and transport

Concrete according to EN 206 is made by mixing coarse and fine aggregates, cement and water in controlled proportions. Chemical admixtures are used to reduce water content and improve fresh and hardened concrete properties. The averaged compositions is provided in Table 1. CEM I production used (A1) in concrete are characterized by high use of alternative fuels (80-90%, Rudniki, Chełm) and consumed renewal green electric energy at the level of 100%. Transport of input materials to production plants was inventoried.

A3 Module Production

Substrates for concrete production are transported to the plant and then stored in silos. Electricity is used for production. Substrates are weighed and mixed according to of the process shown in Figure 1. The production uses cements produced by Gdynia plant the level of renewable energy (electric) in the production of concrete is at the level of 30%. Environmental impacts related to ash have been taken into account on the basis of the economical allocation.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2020 – 31.12.2020 (1 year). The life cycle assessments were done for Poland as reference area.

Data quality - production

The values determined to calculate A1 (cement) and A3 originate from verified CEMEX LCI inventory data. A1 values (raw materials) were prepared considering specific EPDs, Ecoinvent data and economic allocation data processed for ashes.

Assumptions and estimates

Data regarding production per 1 ton of product were averaged for the analyzed production. Due to the difficulty of separating the cement production processes from concrete in six cases, the data were aggregated as A1-A3. For the calculations, the arithmetical averages of the ranges of possible substances included in the mix were adopted, in accordance with the manufacturer's declaration.

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 EPDs (Cemex, CEM I). Modules 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.3.9 (sand, water, wind electricity production for Poland, transport, additives), specific EPD and specific emission reporting data for CEM I production by Cemex at Gdynia, specific EPDs for a raw material (sand, gravel, additives), allocated impacts for ash production calculated by ITB based on price and electricity production impacts, KOBiZE (combustion factors for selected fuels, polish electricity mix). Electricity provider PGE guarantees a certificate of origin of 100% renewable electricity used by CEMEX in Gdynia). Specific (LCI) data quality analysis was a part of audit. The time related quality of the data used is valid (5 years).

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account. In practice, this means that concrete may be compared in a specific application with the selected usage scenario.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to the unit DU – 1 ton of 045-5-G-28-12-1-D-Q01 (ODN56). Life cycle modules included in the analysis are presented in the Table 2. The results for 1 ton are presented in the table 3 and for 1 m^3 in the table 4.

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				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**
MA	**MA**	**MA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**

Table 3. Environmental product characteristic – 1 ton of concrete 045-5-G-28-12-1-D-Q01 (ODN56)

Environmental impacts: (DU) 1 ton		
Indicator	Unit	A1-A3 (cradle to gate)
Global warming potential (net value)[1]	kg eq CO_2	9.37E+01
Global warming potential (gross value)[2]	kg eq CO_2	1.22E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	7.75E-06
Acidification potential of soil and water	kg SO_2	2.44E-01
Formation potential of tropospheric ozone	kg Ethene	5.88E-02
Eutrophication potential	kg $(PO_4)^{3-}$	1.30E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	4.09E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	4.01E+02
Environmental aspects: (DU) 1 ton		
Indicator	Unit	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA
Use of renewable primary energy resources used as raw materials	MJ	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.08E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	4.52E+02
Use of secondary material	kg	1.19E+01
Use of renewable secondary fuels	MJ	4.21E+02
Use of non-renewable secondary fuels	MJ	2.01E+02
Net use of fresh water	m^3	3.21E+00
Other environmental information describing waste categories: (DU) 1 ton		
Indicator	Unit	A1-A3
Hazardous waste disposed	kg	6.01E-03
Non-hazardous waste disposed	kg	1.16E+01
Radioactive waste disposed	kg	1.19E-03
Components for re-use	kg	0.00E+00
Materials for recycling	kg	1.52E+00
Materials for energy recover	kg	0.00E+00
Exported energy	MJ	0.00E+00

[1)]net-value excludes alternative waste-based fuels in CEM production

[2)]The indicated gross value includes the CO_2 emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

Table 4. Environmental product characteristic – 1 m^3 of concrete 045-5-G-28-12-1-D-Q01 (ODN56)

Environmental impacts: (DU) 1 m^3		
Indicator	Unit	A1-A3 (cradle to gate)
Global warming potential (net value)[1]	kg eq CO_2	2.15E+02
Global warming potential (gross value)[2]	kg eq CO_2	2.81E+02
Depletion potential of the stratospheric ozone layer	kg CFC 11	1.78E-05
Acidification potential of soil and water	kg SO_2	5.60E-01
Formation potential of tropospheric ozone	kg Ethene	1.35E-01
Eutrophication potential	kg $(PO_4)^{3-}$	2.98E-01
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	9.41E-01
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	9.23E+02
Environmental aspects: (DU) 1 m^3		
Indicator	Unit	A1-A3
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA
Use of renewable primary energy resources used as raw materials	MJ	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	7,09E+02
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	1.04E+03
Use of secondary material	kg	2.75E+01
Use of renewable secondary fuels	MJ	9.69E+02
Use of non-renewable secondary fuels	MJ	4.62E+02
Net use of fresh water	m^3	7.38E+00
Other environmental information describing waste categories: (DU) 1 m^3		
Indicator	Unit	A1-A3
Hazardous waste disposed	kg	1.38E-02
Non-hazardous waste disposed	kg	2.67E+01
Radioactive waste disposed	kg	2.74E-03
Components for re-use	kg	0.00E+00
Materials for recycling	kg	3.50E+00
Materials for energy recover	kg	0.00E+00
Exported energy	MJ	0.00E+00

[1)]net-value excludes alternative waste-based fuels in CEM production

[2)]The indicated gross value includes the CO_2 emissions from waste incineration (excluding biomass fraction of fuels) in CEM production

RESULTS INTERPRETATION

The environmental impact of concrete production is mainly dependent on the environmental footprint of CEM I used (90% of impact). The rest 10% of the impact depends mainly on the environmental footprint of the aggregates, transport and the plant's electric energy use. The impact of CEM I (Gdynia) used is mainly influenced by the following factors: large content of cement clinker in the product mix (90-95%), share of alternative fuels in clinker production (85-90%), specific process emission of clinker production, electricity (100% wind electricity) used. The gross value of eq. CO_2 emissions (EN 15804/ISO 14067 based method) for concrete production by CEMEX is 122 kg of CO_2/ton concrete. The net value of eq. CO_2 emissions excluding impact of alternative waste-based fuels is 94 kg of CO_2/ton of concrete. Abiotic depletion potential (ADP-fossil fuels) for fossil resources is 401 MJ/ton.

VERIFICATION

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. 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 15804:2012+A1 and ITB PCR A
Independent verification corresponding to ISO 14025 (sub clause 8.1.3.) [X] external [ ] internal
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA \ LCI audit and input data verification: Ph.D. D.Sc. Eng. Michał Piasecki. m.piasecki@itb.pl

The purpose of this EPD is to provide the basis for assessing buildings and other construction works. A comparison of EPD data is only meaningful if all the data sets compared were developed according to EN 15804 and the product-specific performance characteristics and its impacts on the construction works are taken into account.

Signature Not Verified
Dokument podpisany przez
Michał Piasecki - ITB
Data: 2023.05.09 15:54:34 CEST

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- EN 206: Concrete. Specification.performance. production and conformity
- EN 197-1:2011: Cement - part 1: Composition. specifications and conformity criteria for common cements
- PN-EN ISO 14025:2010 Environmental labels and declarations. Type III environmental declarations. Principles and procedures2.
- PN-EN 15804+A2:2020-03 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products3.
- PN-EN 16908:2017-02 Cement and building lime. Environmental product declarations. Product category rules complementary to EN 158044.
- PN-EN ISO 14040:2009 Environmental management - Life cycle assessment - Principles and framework
- ECRA (European Cement Research Academy) – Background report “TR-ECRA 0181/2014 Environmental Product Declarations for representative European cements “

Instytut Techniki Budowlanej
00-611 Warsaw, Filtrowa 1

Thermal Physics, Acoustics and Environment Department
02-656 Warsaw, Ksawerów 21

CERTIFICATE № 421/2023
of TYPE III ENVIRONMENTAL DECLARATION

Products:

Concrete FFR/Z-045-5-G-28-12-1-D-Q01 "ODN56"

Manufacturer:

CEMEX Polska Sp. z o.o.

ul.Krakowiaków 46, 02-255 Warszawa, 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 on 9th May 2023 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, May 2023