PORTLAND-LIMESTONE CEMENT TYPE IL

EPD
Environmental Product Declaration
for Portland-Limestone Cement Type IL

PATRAS PLANT

Programme: The International EPD® System
Programme operator: EPD International AB
EPD registration number: EPD-IES-0007582:003 (S-P-07582)
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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.
In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021

EPD®
THE INTERNATIONAL EPD® SYSTEM

ECO PLATFORM
EPD VERIFIED

EURO CERT

TITAN

> GENERAL INFORMATION

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
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CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14 Construction products; v.1.3.1;2023-07-08 c-PCR-001 Cement and Building Lime (EN 16908:2017+A1:2022) 2022-05-18 UN CPC: 3744
PCR review was conducted by: The Technical Committee of the International EPD System.
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by accredited certification body Third-party verification: Eurocert S.A. is an approved certification body accountable for the third-party verification The certification body is accredited by: ESYD, Accreditation number 21
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 registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same 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 equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about compatibility, see EN 15804 and ISO 14025.

> COMPANY INFORMATION

Owner of the EPD: Titan Cement Company S.A.

Contact: Panagiotis Papadeas, Environmental & Quality Director, Titan Greece, Cement Division

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Description of the organisation: Building materials manufacturer

Product-related or management system-related certifications: Product group classification: UN CPC 3744, The CEN standard EN 15804 serves as the core Product Category Rules, PCR 2019:14 Construction products; v.1.3.1;2023-07-08 c-PCR-001 Cement and Building Lime (EN 16908:2017+A1:2022) 2022-05-18, PCR review was conducted by The Technical Committee of the International EPD® System and Independent third-party verification of the declaration and data in accordance with ISO 14025:2006.

Name and location of production site(s): Patras cement plant, Drepano Achaias, Greece

› INTRODUCTION

Building on more than 120 years of industry experience and driven by its commitment to sustainable growth, TITAN Group has become an international cement and building materials producer, serving customers in more than 25 countries worldwide through a network of 14 integrated cement plants and three cement grinding plants. TITAN also operates quarries, ready-mix plants, terminals, and other production and distribution facilities. We create value by transforming raw materials into products – cement, concrete, aggregates, dry mortars and other building materials. We serve society's need for safe, durable, resilient, and affordable housing and infrastructure.

Climate change has mobilized organizations, in many sectors, towards a carbon-neutral future. In 2020, the Global Cement and Concrete Association (GCCA) announced its members' Climate ambition to drive down the CO_2 footprint of operations and products and deliver carbon-neutral concrete to society by 2050. Meanwhile, there is a growing need for enhanced transparency of environmental performance of building materials, such as greenhouse gas (GHG) emissions. Cement is the key ingredient in manufacturing concrete, the second most used commodity in the word and among the major contributors to the embodied GHG of buildings and infrastructure works.

TITAN is working across the built environment value chain to deliver a carbon-neutral future in a circular economy, life cycle context. Aiming for a 35% reduction of the net direct specific CO_2 emissions by 2030 (compared to 1990 levels), TITAN has defined a road map for developing low-carbon cementitious products and collaborating in carbon capture R&D projects at the cement plants. The publication of the cement Environmental Product Declaration (EPD) is an important milestone in the road map, helping to communicate to customers the environmental performance of TITAN Greece cements.

Cement and other building materials EPDs will help shape the way the construction industry analyses the environmental impact of buildings and infrastructure works, now and in the future. Our EPDs will also provide a rigorous, science-based framework for driving environmental improvement throughout TITAN's sites and supply chain, offering at the same time an advantage to customers wanting to be leaders in the sustainable infrastructure and building industry.

Cement plants

Cement grinding facility

Distribution centers

INTERBETON Regional ready-mix plants and quarries

3 Cement Plants   **1** Cement Grinding Facility   **31** Ready-mix Plants   **26** Quarries   **1** Dry mortar plant   **2** Processed engineered fuel facilities

PRODUCT INFORMATION

Product name: Portland-Limestone Cement Type IL

Product identification: Compressive Strength 28 days (psi): ≥ 3620

Product description: Cement is an important material used in building and civil engineering construction. It is a finely ground powder that, when mixed with water, forms a paste that sets, hardens, and adheres to other materials and after hardening retains its strength even underwater. It is used as the main raw material in the production of concrete, mortar, grouts and plasters.

This is a product-specific EPD for Portland-Limestone Cement Type IL which complies with the requirements of ASTM C595. This specific cement type is produced at the Patras plant, Achaia Greece of Titan Cement Company S.A.

This specific type of cement has wide range of applications and it is mainly utilized in construction works, ready-mixed concrete production and concrete products.

The product can be delivered in bulk via the following ways:

• Silo truck (bulk)

• Vessels (bulk)

The technical characteristics and composition of the product are shown in the tables below. Product declarations and certificates can be found on the company's website www.titan.gr.

Technical characteristics according to ASTM C595		TYPE IL
Mechanical properties	Compressive Strength 3 days (psi)	≥ 1890
	Compressive Strength 7 days (psi)	≥ 2900
	Compressive Strength 28 days (psi)	≥ 3620
Chemical properties	Sulfate content (SO_3, % w/w)	≤ 3,0
	Loss of Ignition (% w/w)	≤ 10,0
Physical properties	Initial setting time (min)	≥ 45,0
	Autoclave expansion (%)	≤ 0,80

Composition according to ASTM C595 (% by mass)*	
Clinker	85 - 95
Limestone (L)	5 - 15

*Gypsum is not included in the aforementioned composition

UN CPC code: 3744

› LCA INFORMATION

Functional unit / declared unit: The declared unit is one (1) tn (1.000 kg).

Reference service life: Not relevant due to the cradle-to-gate boundary conditions.

Time representativeness: The data used in this study cover the reporting year of 2023.

Database(s) and LCA software used: GCCA Industry EPD Tool for Cement and Concrete and Ecoinvent database (v.3.5).

Goal and scope: This EPD evaluates the environmental impacts of the production of one (1) tn Portland-Limestone Cement Type IL from Cradle to gate (A1-A3).

Data quality: ISO 14044 was applied in terms of data collection and quality requirements. The data concerning the modules A1 (raw material supply), A2 (transportation) and A3 (product manufacturing) were provided by Titan Cement Company S.A. and involved all input and output materials to the plant, the consumed utilities (energy, water) and the distances and means of transport for each input stream. Regarding electricity mix, Guarantees of Origin in combination with the latest (2023) residual electricity mix of the supplier as published in DAPEEP SA were utilized (https://www.dapeep.gr/viosimi-anaptixi/energeiako-meigma/), with a climate impact of 4,75E-01 kg CO_2 eq./kWh.

The background data for the module A1 e.g. electricity generation, raw materials and fuels production were recovered from GCCA Environmental Product Declaration tool (v.4.2). GCCA's Industry EPD Tool for Cement and Concrete is a web-based calculation tool for EPDs of clinker, cement, aggregates, concrete and precast elements, available in both International and North American versions. The present report refers to the International version only.

The latter complies with the latest cement and concrete PCRs registered at the International EPD® System (Environdec), namely c-PCR-001 Cement and building limes (EN 16908) for cement and c-PCR003 Concrete and concrete elements (EN 16757) for concrete and precast elements, both registered as complementary PCRs of PCR 2019:14 Construction products (EN 15804+A2).

The GCCA EPD tool (v4.2) is developed by Quantis https://quantis.com/ and verified by Studio Fieschi http://www.studiofieschi.it/en. The International EPD® System, which provides the framework to develop and publish EPDs based on ISO 14025 and EN 15804, gives the final approval of the tool's compliance with the rules. The underpinning database for the GCCA EPD tool is the version of the Ecoinvent database (v.3.5) and cement manufacturing data obtained through the GNR process (https://gccassociation.org/sustainability-innovation/gnr-gcca-in-numbers/).

The database of Ecoinvent v.3.5 was used to complete any missing data. Generic data used in this study concerning:

• CO_2 emission factors for different transportation way

• CO_2 emission factors for fuels and raw materials

• Specific emission factor of used energy mix (kg CO_2/kWh)

There is no missing data for the case of Patras plant, since all the required raw data were provided by the technical staff of the plant, using all the available sources which are:

i) The ERP system (SAP) that company uses

ii) Flow meters for consumed and recycled water
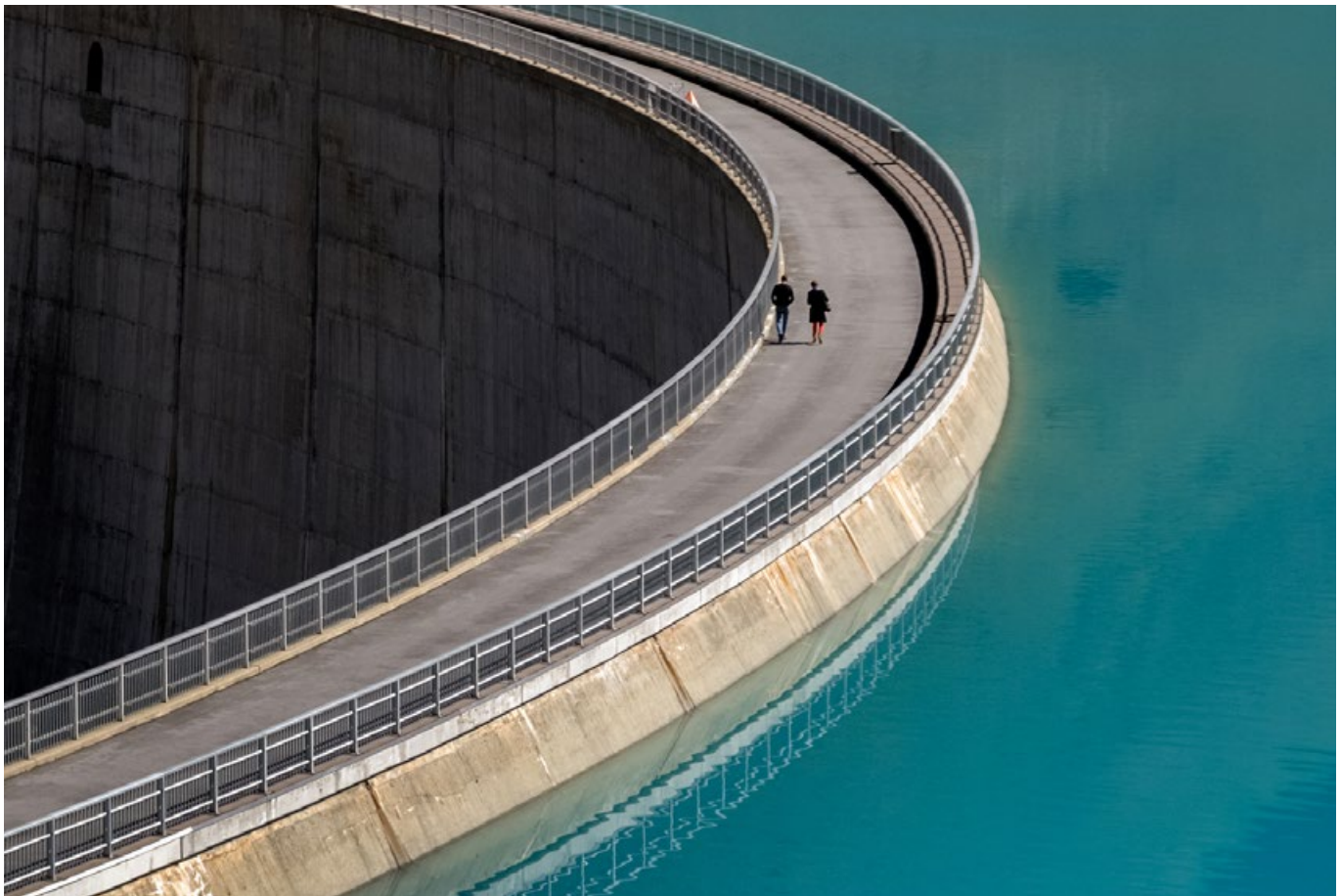
iii) Data, for emissions, which are continuously recorded, were obtained by the recording system that is installed in each cement plant (MEAC). The emissions are: Dust, NOx, SO_2, TOC, NH_3, HCl and HF

All the other emissions are spot measured by independent laboratory. The reports, which laboratory generates after the spot measurements, were utilized in order for average values to be calculated.

Geographical scope: Worldwide

Allocations: The allocation has been avoided where that was possible. Production was split into two sub-processes, clinker and cement, and the associated input and output data for each sub-process were recorded. When data could not be directly attributed to a specific product, they were assigned by physical properties (mass). No by-products occur during clinker and cement production; therefore, there is no need for allocations in by-products.

For water (consumed and recycled), wastes and emissions allocation, the "clinker to cement ratio" was used for allocating the volumes to clinker or cement respectively.

The study does not include the followings:

• Capital equipment production

• Equipment maintenance

• Human labour and employee transport

Assumptions: For the road and sea transportation a lorry >32 metric ton, EURO6 and bulk carrier for dry goods were used respectively. The cement recipe (materials percentage participation) was defined by the pre-verified and automated ERP system (SAP) that company uses.

The cement type Portland-Limestone Cement Type IL can only be delivered in bulk, thus there is no any contribution of the packaging in the environmental indicators of the product.

Cut-off rules: The cut-off rule for insufficient data or data gaps that are less than 1% of the total input mass or mass per module was applied. In case of insufficient input data or data gaps for a unit process, the cut-off criteria shall be 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input flows for the stages 'cradle through gate' shall be a maximum of 5% of energy usage and mass." (EN 15804:2012+A2:2019). Regarding the LCA model, the default cut-off criteria are applied for all processes from the Ecoinvent database. In addition, all custom processes developed for the specific purposes of the project are consistent with the rules and guidelines of the Ecoinvent database, and hence the same cut-off criteria are applied.

Comparability: EPD performance for construction products that they do not comply with EN 15804 may not be comparable. EPDs from separate programs but within the same product category may not be comparable as well.

Description of system boundaries:

The scope of this study is "Gradle to gate" covering the product stage (modules A1-A3), since the product fulfils the three conditions required by EN 15804:2012+A2:2019, about the exclusion of modules C1-C4 and D.

The EPD covers the product stage ("cradle to gate", A1-A3), since the three criteria of EN 15804 are met for the exclusion of stages B1-B7, C1-C4 and D.

SYSTEM DIAGRAM

The scope of this study is "Gradle to gate" covering the product stage (modules A1-A3), since the product fulfills the three conditions required by EN 15804:2012+A2:2019, about the exclusion of modules C1-C4 and D.

	Product Stage			Construction Stage		Use Stage							End-of-life Stage				Resource Recovery
	Raw Materials Supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction and 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	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	Global	Global	GR	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

More information: X= included, ND = module not declared
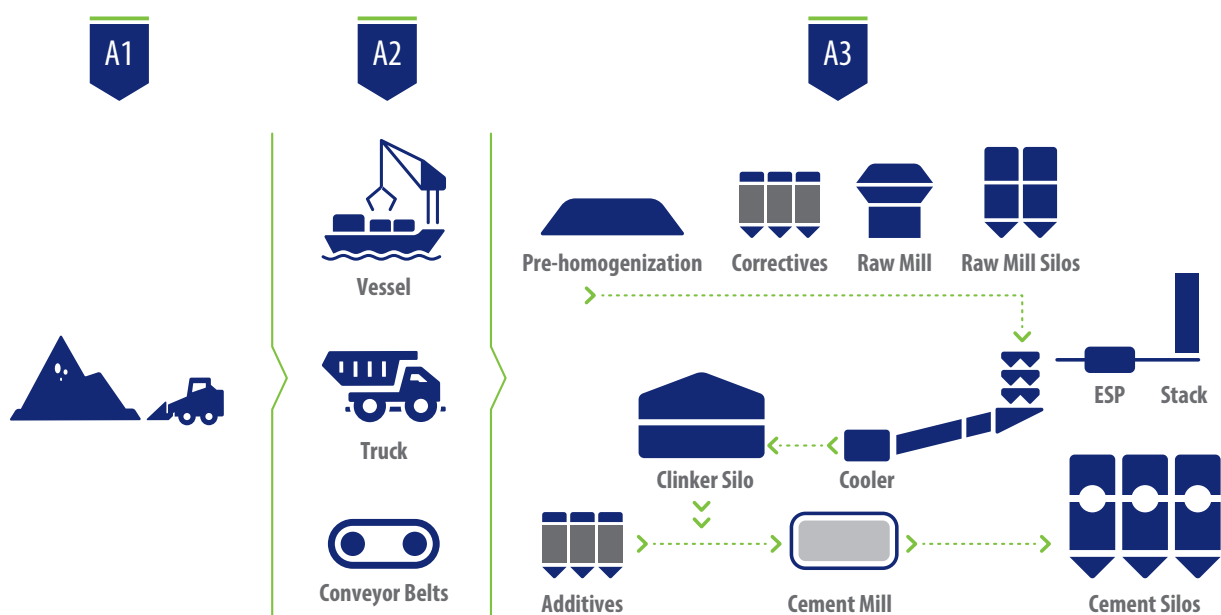
❯ ENVIRONMENTAL INFORMATION

For construction services, the total value of A1-A3 shall be replaced with the total value of A1-A5. 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.

Potential environmental impact – mandatory indicators according to EN 15804 Results per functional or declared unit		
Indicator	Unit	Tot.A1-A3
GWP-total	kg CO_2 eq.	7,98E+02
GWP-total (net)[1]	kg CO_2 eq.	7,96E+02
GWP-fossil	kg CO_2 eq.	7,98E+02
GWP-biogenic	kg CO_2 eq.	9,83E-02
GWP-luluc	kg CO_2 eq.	1,18E-01
GWP – GHG[2]	kg CO_2 eq.	7,98E+02
ODP	kg CFC 11 eq.	1,69E-05
AP	mol H+ eq.	1,65E+00
EP-freshwater	kg P eq.	4,21E-02
EP-marine	kg N eq.	2,96E-03
EP-terrestrial	mol N eq.	6,30E+00
POCP	kg NMVOC eq.	1,62E+00
ADP-minerals&metals[3]	kg Sb eq.	1,31E-04
ADP-fossil[3]	MJ	4,30E+03
WDP[3]	m^3	6,68E+01

Acronyms

GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; GWP - GHG = Global warming potential GHG; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption

Notes

1. According to the polluter pays principle (EN 15804) the system that generates the waste is responsible for declaring the impacts of waste processing until the end of waste stage is reached. The indicated value (net value) therefore does not include the CO_2 emissions from waste incineration. The use of imported energy from the waste within "use of secondary fuel" as a more appropriate indicator does not currently exist. This indicator is not mandatory by EN 15804.

2. This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

3. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

Parameters describing resource use

Results per functional or declared unit		
Indicator	Unit	Tot.A1-A3
PERE	MJ	2,75E+02
PERM	MJ	0,00E+00
PERT	MJ	2,75E+02
PENRE	MJ	4,30E+03
PENRM	MJ	0,00E+00
PENRT	MJ	4,30E+03
SM	kg	6,97E+01
RSF	MJ	6,48E+01
NRSF	MJ	0,00E+00
FW	m^3	1,84E+00

Acronyms

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Waste production

Results per functional or declared unit		
Indicator	Unit	Tot.A1-A3
HWD	kg	0,00E+00
NHWD	kg	0,00E+00
RWD	kg	0,00E+00

Acronyms

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed

Output flows

Results per functional or declared unit		
Indicator	Unit	Tot.A1-A3
CRU	kg	0,00E+00
MFR	kg	9,18E-01
MER	kg	4,31E-02
EEE	MJ	0,00E+00
EET	MJ	0,00E+00

Acronyms

CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported energy, electricity; EET = Exported energy, thermal

> ADDITIONAL INFORMATION

Titan Cement Company S.A. hereby declares that all cement products are in compliance with the REACH Regulation (EC) No 1907/2006, concerning the Registration, Evaluation, Authorization and Restriction of Chemicals. Cement does not contain any Substances of Very High Concern (SVHC) currently on the candidate list. REACH SVHC list is not static and is updated frequently, thus the company will continue to evaluate, research and review to fulfil the demands of the regulation. More information about cement safety handling is available at the Safety Data Sheet (SDS) published at the company's website www.titan.gr.

Differences versus previous versions

2023-12-08 Version 1
2024-12-13 Version 2
   New verification: New LCA based on 2023 production data.

References

- **GPI v.4.0:2021-03-29** General Programme Instructions of the International EPD® System
- **PCR 2019:14 v.1.3.1** Product Category rules | Construction products | The International EPD® System
- **EN 15804:2012+A2:2019/AC:2021** Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products
- **EN 16908:2017+A1:2022** Cement and building lime - Environmental product declarations - Product category rules complementary to EN 15804
- **ASTM C595/C595M** "Standard Specification for Blended Hydraulic Cements"
- **CPC 374, c-PCR-001** Cement and building lime (EN 16908:2017) | The International EPD® System
- **ISO 14020:2000** Environmental labels and declarations - General principles
- **ISO 14025:2006** Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- **ISO 14040:2006** Environmental management - Life Cycle Assessment - Principles and framework
- **ISO 14044:2006** Environmental management - Life Cycle Assessment - Requirements and guidelines
- **Industry EPD Tool for Cement and Concrete** (https://concrete-epd-tool.org/)
    • User Guide (v4.2, International version, 18 December 2023)
    • LCA Model (v4.2, International version, 18 December 2023)
    • LCA Database (v4.2, 23 April 2024)
- **DAPEEP SA:** Renewable Energy Sources Operator & Guarantees of Origin | Greece | www.dapeep.gr

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