INTERBETON

EPD

Environmental Product Declaration for limestone aggregates

Drymos Quarry

Programme: The International EPD® System, www.environdec.com
Programme operator: EPD International AB
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EPD® THE INTERNATIONAL EPD® SYSTEM

ECO PLATFORM EPD VERIFIED

EURO CERT

In accordance with ISO 14025 and EN 15804:2012+A2:2019/AC:2021

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.

The EPD covers multiple products (list at page 7), based on the average results of the product group


CAT
CAT
329D

GENERAL 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

Accountabilities for PCR, LCA and independent, third-party verification

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product category rules (PCR):
PCR 2019:14 Construction products (EN 15804:A2), Version 1.3.1, dated 2023-07-08, International EPD System
CPC 15200 & CPC 15320 under the UN CPC classification system v2.1

PCR review was conducted by: Technical Committee of the International EPD System

Life Cycle Assessment (LCA)

LCA accountability: EcoVibes
EcoVibes – Environmental Consultants (https://ecovibes.gr/en info@ecovibes.gr)

Third-party verification

Independent third-party verification of the declaration and data, according to ISO 14025:2006:
☒ EPD verification by accredited certification body

Third party verification: EURO CERT
Eurocert S.A. (https://www.eurocert.gr/ info@eurocert.gr) is an approved certification body accountable for the third-party verification
The certification body is accredited by: ESYD
Hellenic Accreditation System E.SY.D. https://esyd.gr/main/

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, or not compliant with EN 15804, 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 comparability, see EN 15804 and ISO 14025.

COMPANY INFORMATION

Owner of the EPD: Interbeton Building Materials S.A., a member of TITAN Group. 22A Halkidos Str., 11143 Athens, Greece

Contact: Manos Kontekakis, Quality Assurance & Control Administrator and Quality & Environmental Assurance Systems Administrator Aggregates Operations / Tel. 2144056191 / email: kontekakis@titan.gr

Description of the organisation: Building materials manufacturer

Geographical Scope:

National (Greece)

Name and location of production sites, all located in Greece

(https://www.interbeton.gr)

1. Thisvi
2. Tanagra
3. Malakasa
4. Xirorema (Aspropyrgos)
5. Volos
6. Lepenou (Agrinio)
7. Drymos
8. Tagarades
9. Leros
10. Rethymno
11. Zoforoi

Description of the organisation

Building on 121 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.

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 roadmap for developing low-carbon aggregate and cementitious products and collaborating in carbon capture R&D projects at the cement plants and quarries.

The publication of this aggregates EPD is an important milestone in the road map, helping to communicate to customers the environmental performance of INTERBETON aggregates.

Aggregates 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 and INTERBETON'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.

Product-related and management system-related certifications and environmental measurements:

- Quality Management System (EN ISO 9001:2015)
- Environmental Management System (EN ISO 14001:2015)
- Occupational health and safety management systems (EN ISO 45001:2018)
- 12 Declarations of Performance for the different types and fractions of aggregates, according to Annex III EU Regulation No.305/2011 (ELOT EN 13242/EN 12620/EN 13043)
- Dust measurements in the environment at the limits of the Drymos quarry/PM10 (EN ISO 17025, CEN/TS 15675, EN 12341, Greek Law 14122/549/E.103)
- Noise level measurements at the limits of the Drymos quarry (EN ISO 17025, CEN/TS 15675, IEC 61672-1:2002, IEC 60651:2001, IEC 60804:2000 & IEC 61942:2003, Greek Law 1180/81 (Article 2, Table 1))

Name and location of production site:

Drymos Quarry, "Deve Karan" location, Region of Central Macedonia (Greece)

PRODUCT INFORMATION

Product name: Limestone aggregates

Product identification: The technical standards (Hellenic Body for Standardization - ELOT and CEN Standards applying to aggregates according to Declarations of Performance) which the aggregate types are compliant with, are presented in Table 1 below.

Table 1. Product types manufactured at the declared site (according to the Declarations of Performance)

Product types (English)	Product types (Greek)	EN-13242 1)	EN-12620 2)	EN-13043 3)	EN-13139 4)
Crushed sand 0/4	Άμμος θραυστή 0/4		X		X
Full gradation material 0/4	Υλικό πλήρους διαβάθμισης 0/4			X	
Mixed Gravel 0/31,5 (0150)	Ανάμικτο Αμμοχάλικο 0/31,5 (πρ. ΠΤΠ-Ο150)	X			
Mixed Gravel 0/31,5 (0155)	Ανάμικτο Αμμοχάλικο 0/31,5 (πρ. ΠΤΠ-Ο155)	X			
Crushed Gravel 31,5/63	Σκύρα θραυστά 31,5/63	X			
Crushed Gravel 8/16	Γαρμπίλι θραυστό 8/16		X	X	
Crushed Gravel 16/31,5	Χαλίκι θραυστό 16/31,5		X	X	
Embankment Material E4 0/63	Υλικό Επιχωμάτωσης Ε4 0/63	X			
Crushed Gravel 4/8	Ρυζάκι 4/8		X	X	

1) EN-13242+A1:2007 - Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction
2) EN-12620+A1:2008 - Aggregates for Concrete
3) EN-13043/AC:2006 - Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas
4) EN 13139:2002 Aggregates for Mortar

Product description:

The product types are limestone aggregates manufactured by INTERBETON S.A. The declared site is Drymos (Thessaloniki), a crushing site of INTERBETON in Greece.

In 2022 (reference year of the assessment), around 1,8 million tons of aggregates were produced at the site (product list in Table 2). The product types are intended to be used as, e.g. asphalt, concrete and filling material in civil engineering.

Aggregates are produced in various fractions (product types). From blasted rock to finely crushed 0/4 mm sand (granules between 0 and 4 mm in diameter). There are 13 types of aggregates mentioned in this EPD (10 main and 3 mixes), representing the products manufactured at the declared site (see Table 2). According to International EPD® System's GPI 4.0 Section 9.3.1, the approach of a declared average product was chosen for this study.

According to the "Mineralogical – Petrographic study of Drymos quarry sample (ELOT EN 932.3 - 28.09.2020), results showed that the parent rock is limestone consisting almost entirely of calcite (CaCO3) (about 98,5%), while dolomite is found in its mass (CaMg(CO3)2) (about 1,5%).

Physical – Mechanical properties of the studied aggregates:

- Compressive strength of parent rock (mean) 88,5 MPa (ELOT 408, §3.1)
- Resistance to fragmentation: Los Angeles Coefficient 23-30 (depending on aggregate's size) according to EN 1097-2
- Particle Density on a saturated and oven-dried basis (ρssd) 2,69 (Mg/m3), according to EN 1097-6.

Table 2: Product types (according to excavation and production)

No.	Products/Aggregates	Diameter (mm)
1	Pre-Crushed (Prospasma)	0-31,5
2	Embankment Material E4	0-63
3	Crushed Limestone	0-90
4	Crushed Material for Lime	40-90
5	Crushed Gravel (Skyra)	31,5-63
6	Crushed Gravel (Haliki)	16-31,5
7	Crushed Gravel (Garbili)	8-16
8	Crushed Gravel (Rizaki)	4-8
9	Full Gradation Material	0-4
10	Sand	0-4
11	Mixed Gravel 150*	0-31,5
12	Mixed Gravel 155*	0-31,5
13	Mixed Material *	0-16

* Mixed product types are produced from mix ratios of main product types

UN CPC code:

The product declared is classified according to the United Nations Central Product Classification (UN CPC) 15200 and 15320.

Geographical scope: Worldwide

LCA INFORMATION

Functional unit / declared unit: one (1) ton (1.000 kg) of average limestone aggregate

Reference service life: Declaration of the RSL is only possible if B1-B5 are included, so RSL is not assessed.

Time representativeness: The data used in the LCA study cover the reporting year of 2022.

Database(s) and LCA software used: ecoinvent database version 3.9.1, openLCA software version 2.0

Description of system boundaries:

The LCA assessment considers all identifiable activities to provide, as comprehensive as possible, a view of the average product cradle-to-gate life cycle. According to EN 15804:2012+A2:2019/AC:2021 and PCR (Section 2.2.2) all three conditions are valid for the studied system, thus modules A1-A3 are being declared.

The system under study (Figure 1) includes raw material (limestone) extraction from limestone quarry (A1) and transportation to the processing facility (A2), production (in terms of modules) and transportation of fuels and energy, production and transportation of machinery consumables and product participating in production processes, processing of raw materials to produce the final product (A3).

The 10 basic (main) product types are being produced after several individual crushing and sieving processes that take place in primary and secondary crushing facilities. The 3 mixed product types are produced after mixing in a particular way and with a specific ratio basic product types, as stated in Excel sheets, using building machines (loaders). Electricity and fuel production for processes of module A3, are included in module A1 as instructed in EN 15804 (§6.3.5.2).

Data and assumptions are intended to reflect current equipment, processes and market conditions.

Personnel-related impacts, such as transportation to and from work, are not accounted in the LCI.

System diagram

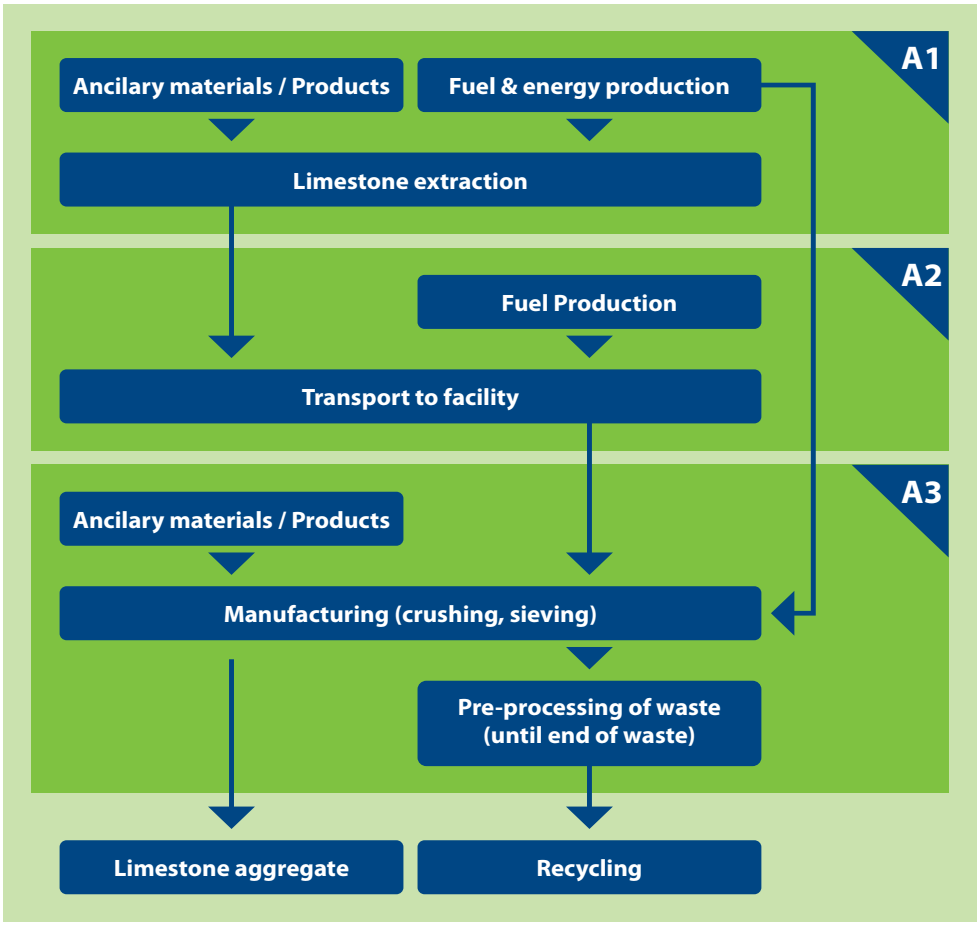
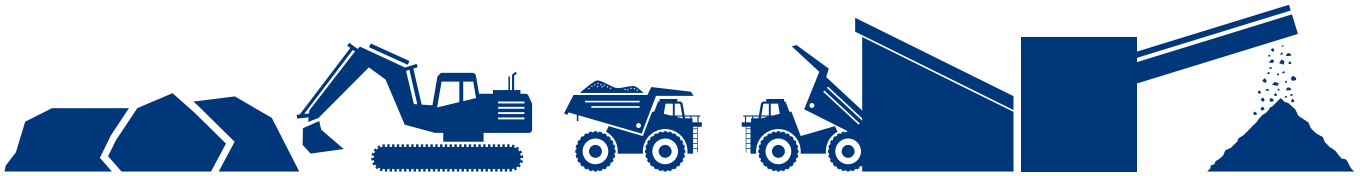


Figure 1. Flow diagram of the studied product system according to declared modules



More information:

- **Cut-off criteria**

All product components and production processes are included when the necessary information is readily available or a reasonable estimate can be made. It should be noted that generic data from the ecoinvent database (version 3.9.1) are included in the background system of this study in order to be as comprehensive as possible. As allowed by the PCR "Construction Products" (v.1.3.1), inventory flows from infrastructure and equipment processes have been excluded (without being considered as cut-offs).

- **Primary data**

Modules: Primary data have been collected directly from INTERBETON's Drymos quarry production process. The Input/Output data on the LCI were categorized into three main groups, excavation/extraction (module A1), transportation to processing facility (module A2) and production/processing (module A3). More specifically, A1 includes excavated material, water, explosives (AN-FO, Ammonite), diesel and excavation area, A2 includes diesel and A3 includes total production, water, and production area data.

Quantities and electricity: For the 13 product types, production quantities and electricity consumption were also given as primary data (Table 2 above). Electricity was calculated from INTERBETON, according to each product type's usage of specific processing equipment (crushers, sieves, conveyor belts, dust filters), so that electricity consumption has been partitioned among the product types. It should be noted that the mixed product types (Mixed Gravel 150, Mixed Gravel 155, Mixed Material) occur during crushing and sieving processes and do not require any additional diesel consumption for their mixing (Table 2). For each product type of Table 2, a consumption in kWh/ton and then an average value of electricity consumption was calculated, at 1,63 kWh/ton of average product. In this way (rather than calculating a consumption in kWh/ton from total or averaged total electricity consumption and production mass) better accuracy was achieved.

Waste: Waste outputs (Table 3) regard production machinery consumables and their handling routes with coding according to EU Directive 2008/98. Even though the corresponding input consumables have a mass that is negligible compared to total input mass (almost 10^{-6} order of magnitude and much less than the <1% cut-off threshold according to EN 15804), they are considered in the LCI for purposes of I/O balance and with the assumption that no consequences to the environment are hidden. The end of waste system boundary has been placed according to the financial value (positive/negative/neutral) of the waste to the producer.

Table 3. Waste primary data

Waste type	Quantity (ton/year)	Disposal/Recovery (EU 2008/98)	Value to the Producer	End-of-waste system boundary
Excavation				
Used lubricating oil	5,376	R9	+	Gate of the producer's facility
Used oil filters	0,938	R13	-	Handler's facility
Used absorbents	0,056	R13	-	Handler's facility
Scrap metal	18,800	R12	+	Gate of the producer's facility
Production				
Used lubricating oil	0,248	R9	+	Gate of the producer's facility
Used batteries	0,116	R3	+	Gate of the producer's facility
Used absorbents	0,067	R13	-	Handler's facility
Used oil filters	0,030	R13	-	Handler's facility
Used packaging	0,170	R13	-	Handler's facility
Metal components	8,540	R12	+	Gate of the producer's facility

Transportation: Transportation distances of materials, fuels and wastes have been recorded according to information from the producer (INTERBETON), based on site-specific averages (from supplier to INTERBETON and from INTERBETON to handler). Empty returns are also included for all transportation.

Land use occupation and transformation: Specific data on the area of excavation site and processing facility combined with the total service life of the quarry and the average annual production are included in the LCA study.

Note: A full list of primary data sources and I/O values is available in the accompanying LCA study and the Microsoft Excel file. For calculation rules please refer to section "Allocation". For transformation of I/O of combustible material into I/O of energy, the net calorific value of fuels was applied according to EN 15804 requirements (section 6.4.2).

• Generic data

Additional datasets describing the remaining aspects of the life cycle were collected from the ecoinvent database v3.9.1. The datasets regard the particulate matter (PM2.5 and PM10) emissions during production, the upstream production of materials (water, explosives), fuels (diesel), energy (electricity) as well as operation of machinery and vehicles. For the waste oil filters, it was assumed that the whole quantity was consisted from metal scrap, since the metal parts are the main constituent. The waste packaging was assumed to consist of mainly metallic materials, as a worst case scenario.

Electricity mix: National residual mix of Greece calculated from the Moderator of Renewable Energy Resources and Safety of Origin (DAPEEP) for 2022 and also published by the Association of Issuing Bodies. For the allocation of electricity derived from natural gas combustion to combined cycle power plant (CCPP) production and conventional power plant (CPP) production, a recording of Greek power plants was made (80% CCPP and 20% CPP). For hydroelectric production, the modelling choice of run-off river technology was applied, as most appropriate. Regarding the allocation of wind power production to the various available technologies regarding turbines' capacity (<1 MW, 1 - 3 MW, >3 MW), the values of the corresponding registry of ecoinvent for the Greek electricity production mix were used.

• Data Quality

In the following Table 4, the overall quality of primary (site-specific) and generic data is assessed, according to the requirements of EN 15804.

Table 4: Overall data quality

Criteria	Data Type	Quality level	Comments
Geographical representativeness	Primary	Very good	Collected from the quarry
	Generic	Good	Depict average values in Greece and Europe (main material contributors and market for the product)
Technical representativeness	Primary	Very good	Actual processes
	Generic	Good/Fair	Good for processes of major share to overall mass/energy such as electricity generation Fair for processes with lesser share in mass/energy, such as oil filters
Time representativeness	Primary	Very good	Almost the entirety of data from 2022
	Generic	Fair	Majority of them have been recorded within the last 10 years

• Allocation

In all three modules under study (A1-A3) there are no co-products occurring from the production of the main product. The wastes that occur come from the use of auxiliary materials (that are no part of the final product) and constitute a quantity that is far less than the <1% cut-off threshold (placed around 0.001% of the declared unit of the product). Thus, and in accordance to PCR (section 4.5), co-product allocation is deemed not possible. In this way, the suggested practice from PCR (subsection 4.5.1) that "a conservative assumption shall always allocate more environmental burdens to the product that is the object of the EPD" is applied.

• Electricity at manufacturing

As required by the Construction Products PCR v.1.3.1 (Section 4.8.1), Table 5 declares the energy source behind electricity used in the manufacturing process in A3 and is 0.676 kg CO2eq./kWh (using the GWP-GHG indicator).

Electricity mix	Contribution to GWP-GHG (kg CO_2 eq/kWh)
Natural gas	49,45%
Lignite	14,13%
Oil	10,25%
Hard coal	5,57%
Solar	9,63%
Wind	4,93%
Hydro	3,24%
Biomass	0,71%
Geothermal	0,22%
Nuclear	1,08%
Unspecified	0,81%

• Packaging

No packaging is used, limestone aggregates are delivered as bulk material.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	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	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	GR	GR	GR														
Specific data used	>90%			-		-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	>10%			-		-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-		-	-	-	-	-	-	-	-	-	-	-	-

CONTENT INFORMATION

The product declared does not contain any substances of very high concern (SVHC) according to REACH. The below table presents the content declaration for the average product. The product does not contain biogenic carbon and there is no packaging material.

Product	Product components	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
Average Aggregate	Limestone	1000	0	0

RESULTS OF THE ENVIRONMENTAL PERFORMANCE INDICATORS

In below Tables, the units and reference models of each impact category that was calculated, are summarized. These impact indicators, along with the rest of the indicators that are mandatory according to EN 15804, are all included in method "EN 15804+A2" which is part of openLCA LCIA method package included in ecoinvent v.3.9.1 (EN 15804 add-on v.2). The reference models are in line with the requirements of EN 15804 (EF 3.0) and all the disclaimers referring to the indicators are declared, as shown below (EN 15804, 7.2.3.3, Table 5).

Impact category	Unit	Model
Climate change, GWP fossil	kg $CO_{2\ eq}$	IPCC 2013 100y + EC-JRC
Climate change, GWP biogenic	kg $CO_{2\ eq}$	IPCC 2013 100y + EC-JRC
Climate change, GWP land use and land use change	kg $CO_{2\ eq}$	IPCC 2013 100y + EC-JRC
Climate change, GWP total	kg $CO_{2\ eq}$	IPCC 2013 100y + EC-JRC
Climate change, GWP-GHG	kg $CO_{2\ eq}$	IPCC 2013 100y
Ozone depletion potential	kg CFC 11 $_{eq}$	Steady-state ODPs, WMO 2014
Acidification potential	molc $H_{+\ eq}$	Accumulated Exceedance, Seppälä et al. 2006, Posch et al., 2008
Eutrophication, freshwater	kg P $_{eq}$	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication, marine	kg N $_{eq}$	EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe
Eutrophication, terrestrial	mol N $_{eq}$	Accumulated Exceedance, Seppälä et al. 2006, Posch et al.
Photochemical ozone formation	kg NMVOC $_{eq}$	LOTOS-EUROS ,Van Zelm et al., 2008, as applied in ReCiPe
Depletion of abiotic resources - ADPE elements	kg Sb $_{eq}$	CML 2002, Guinée et al., 2002, and van Oers et al. 2002.
Depletion of abiotic resources - ADPF fossil fuels	MJ	CML 2002, Guinée et al., 2002, and van Oers et al. 2002.
Water use	m^3 deprived	Available WAter REmaining (AWARE) Boulay et al., 2016
Particulate matter, HH	Disease incidence	SETAC-UNEP, Fantke et al. 2016
Ionising radiation, HH	kBq U-235 $_{eq}$	Human health effect model as developed by Dreicer et al. 1995 update by Frischknecht et al.,2000
Ecotoxicity, freshwater	CTUe	Usetox version 2 until the modified USEtox model is available from EC-JRC
Human toxicity, cancer effects	CTUh	Usetox version 2 until the modified USEtox model is available from EC-JRC
Human toxicity, non-cancer effects	CTUh	Usetox version 2 until the modified USEtox model is available from EC-JRC
Land use/SQP	dimensionless	Soil quality index based on LANCA
"Use of resourses" Indicators	MJ, Kg & m^3	Cumulative Energy Demand (LHV), PRé Consultants
"Waste production" Indicators	Kg	Environmental Development of Industrial Products – EDIP
"Output flows" Indicators	Kg & MJ	openLCA LCIA methods, Anderson 2022

Mandatory impact category indicators according to EN 15804

Results per declared unit					
Core environmental impact indicators					
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**
GWP-fossil	kg CO_2 eq.	2,35E+00	3,66E-01	2,96E-04	2,72E+00
GWP-biogenic	kg CO_2 eq.	9,22E-03	7,94E-07	1,01E-05	9,23E-03
GWP-luluc	kg CO_2 eq.	2,59E-04	2,14E-07	7,15E-07	2,60E-04
GWP-total	kg CO_2 eq.	2,36E+00	3,66E-01	3,07E-04	2,73E+00
ODP	kg CFC 11 eq.	7,62E-08	1,25E-11	5,29E-12	7,62E-08
AP	mol H+ eq.	1,54E-02	3,76E-03	1,50E-06	1,92E-02
EP-freshwater	kg P eq.	1,22E-03	1,03E-06	2,62E-07	1,22E-03
EP-marine	kg N eq.	4,82E-03	1,90E-03	2,77E-07	6,72E-03
EP-terrestrial	mol N eq.	5,31E-02	2,08E-02	2,49E-06	7,40E-02
POCP	kg NMVOC eq.	1,64E-02	5,52E-03	8,03E-07	2,19E-02
ADP-minerals&metals*	kg Sb eq.	1,12E-05	1,46E-09	8,64E-10	1,12E-05
ADP-fossil*	MJ	3,66E+01	2,89E-03	6,72E-03	3,66E+01
WDP*	m3	2,93E-01	2,15E-04	1,52E-04	2,93E-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; 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

* **Disclaimer:** The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Additional mandatory and voluntary impact category indicators*

Results per declared unit					
Additional environmental impact indicators					
Indicator	Unit	A1	A2	A3	A1-A3
GWP – GHG**	kg CO_2 eq	2,34E+00	3,66E-01	3,00E-04	2,70E+00
PM	Disease incidence	2,66E-07	1,16E-07	8,08E-09	3,90E-07
IRP***	kBq U-235 eq	3,63E-02	5,86E-06	1,82E-04	3,65E-02
ETP-fw****	CTUe	1,19E+01	8,16E-03	8,98E-04	1,20E+01
HTP-c****	CTUh	8,04E-10	1,55E-11	1,27E-13	8,20E-10
HTP-nc****	CTUh	1,46E-08	7,16E-11	3,26E-12	1,46E-08
SQP****	dimensionless	4,95E+01	1,19E-03	1,07E+01	6,02E+01

Acronyms

PM = Potential incidence of disease due to PM emissions; IRP = Potential Human exposure efficiency relative to U235; ETP-fw = Potential Comparative Toxic Unit for ecosystems; HTP-c = Potential Comparative Toxic Unit for humans - cancer; HTP-nc = Potential Comparative Toxic Unit for humans – non-cancer; SQP = Potential soil quality index

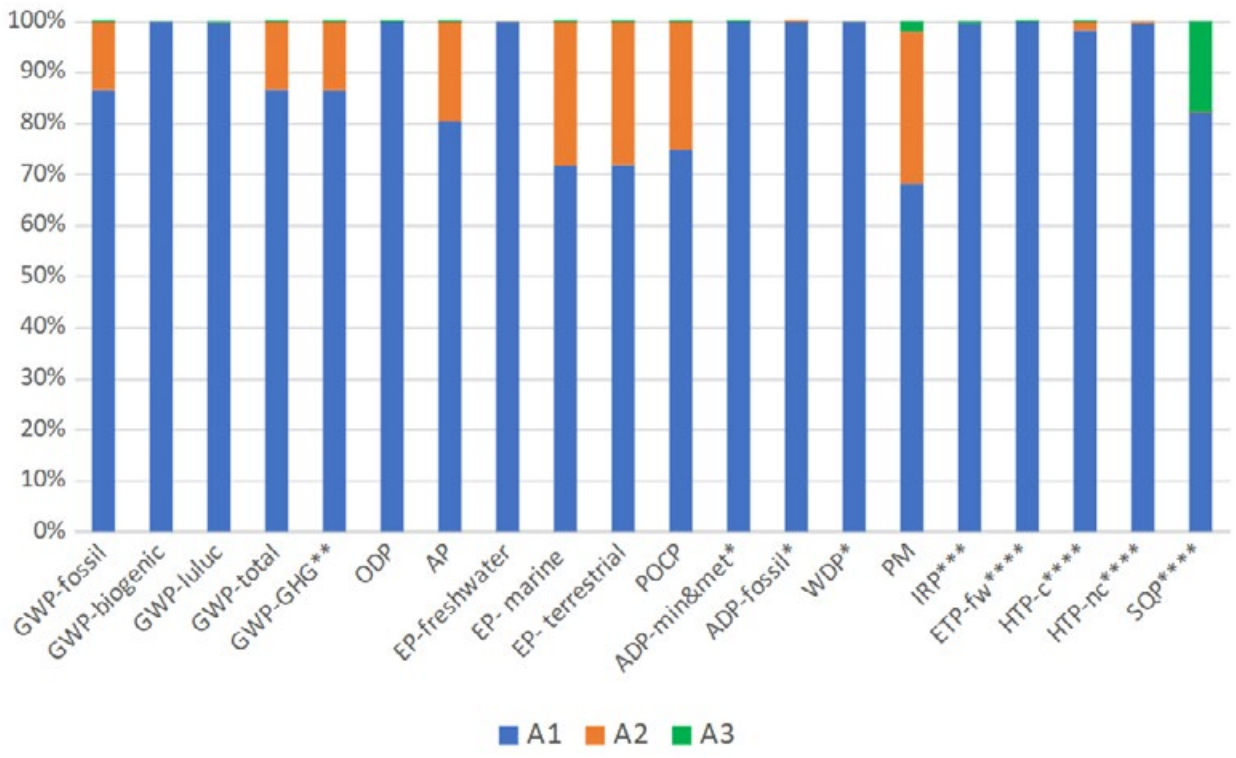
* Mandatory GWP-GHG indicator calculations and results for the LCA Assessment (According to EN 15804, 7.2.3.2). All the rest indicators in the above table are voluntary (optional).

** 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 CO2 is set to zero.

*** Disclaimer: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

**** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Relative contribution of core and additional indicators to Modules



Resource use indicators

Results per declared unit					
Indicator	Unit	A1	A2	A3	A1-A3
PERE	MJ	8,36E-01	9,68E-05	1,21E-03	8,37E-01
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	MJ	8,36E-01	9,68E-05	1,21E-03	8,37E-01
PENRE	MJ	3,43E+01	2,71E-03	6,62E-03	3,43E+01
PENRM	MJ.	2,35E+00	1,77E-04	1,02E-04	2,35E+00
PENRT	MJ	3,66E+01	2,89E-03	6,72E-03	3,66E+01
SM	kg	9,64E-02	1,03E-05	8,71E-05	9,65E-02
RSF	MJ	4,98E-02	9,95E-07	5,03E-05	4,99E-02
NRSF	MJ	9,48E-03	9,95E-07	5,00E-05	9,54E-03
FW	m^3	1,43E-02	5,06E-06	2,01E-03	1,63E-02

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

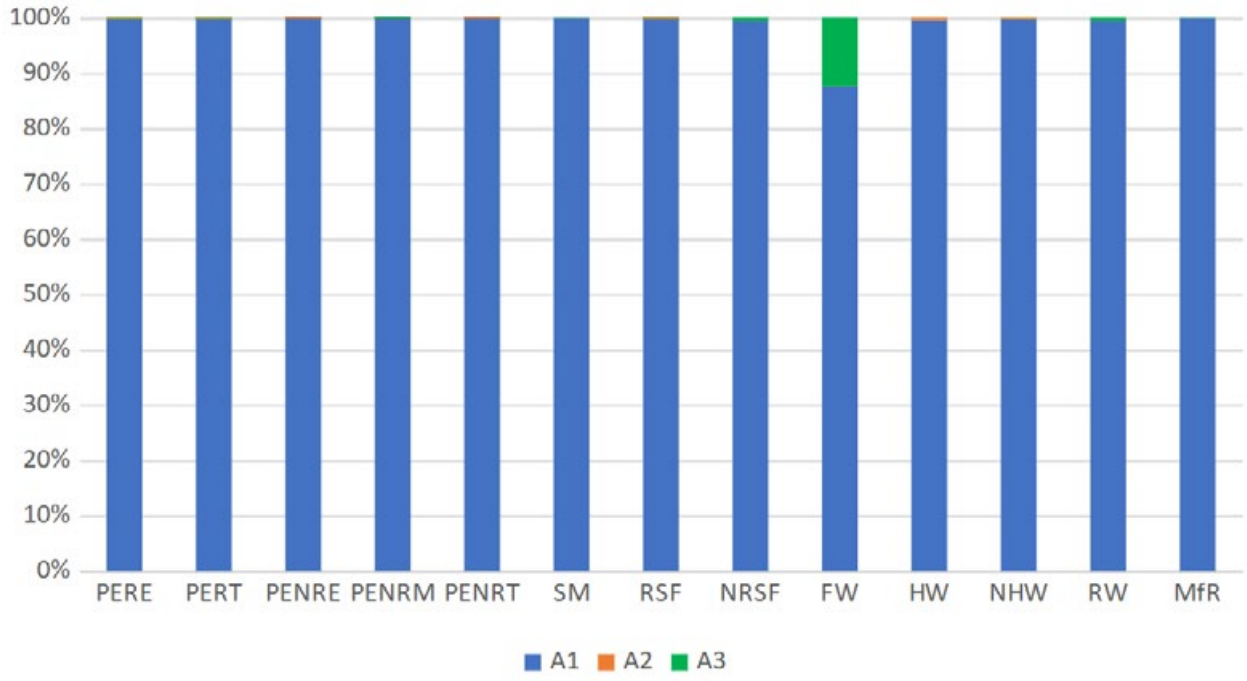
Waste indicators

Results per declared unit					
Indicator	Unit	A1	A2	A3	A1-A3
Hazardous waste disposed	kg	3,30E-02	1,37E-04	5,99E-06	3,31E-02
Non-hazardous waste disposed	kg	4,82E-02	1,16E-04	2,60E-05	4,83E-02
Radioactive waste disposed	kg	8,80E-06	1,48E-09	4,68E-08	8,84E-06

Output flow indicators

Results per declared unit					
Indicator	Unit	A1	A2	A3	A1-A3
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling	kg	9,06E-02	5,56E-06	8,41E-05	9,07E-02
Materials for energy recovery	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, electricity	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy, thermal	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Relative contribution of resource use, waste and output flow indicators to Modules



ADDITIONAL INFORMATION

Interested parties can find more details about the company's environmental actions on topics related to environmental management, climate change and circular economy, in the link below:

https://www.titan.gr/en/sustainability/environment

Integrated Annual Report 2022: https://www.titan-cement.com/newsroom/annualreports/

Differences versus previous versions

Original version

References

Anderson J. 2022. How is waste and recovery reported in Environmental Product Declarations (EPD)? Construction Products Association.

Association of Issuing Bodies (2023), European Residual Mixes 2022, Version 1.0, 2023-06-01

DAPEEP (2023), Energy mixture of suppliers for 2022

ecoinvent database, version 3.9.1, https://ecoinvent.org/

EN 15804:2012+A2:2019: Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products.

EPD International (2021), General Programme Instructions for the International EPD® System. Version 4.0, dated 2021-03-29. www.environdec.com

EPD International (2019), General Programme Instructions for the International EPD® System. Version 3.01, dated 2019-09-18. www.environdec.com

European Union, 2008. European Parliament and Council Directive (EC) 2008/98 on waste. Off. J. Eur. Union 3–30.

Gaidajis G. Angelakoglou K. Botsaris P. N. & Filippidou F. 2011. Analysis of the recycling potential of used automotive oil filters using the life cycle assessment approach. Resources Conservation & Recycling 986–994. https://doi.org/10.1016/j.resconrec.2011.05.008

Global Energy Observatory, globalenergyobservatory.org, visited on April 2021

Hellenic Republic, (2019), National Energy and Climate Plan, Ministry of the Environment and Energy

ISO (2006c), ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 14026:2017, Environmental labels and declarations — Principles, requirements and guidelines for communication of footprint information

ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006)

ISO 14044:2006/A1:2018 Environmental management - Life cycle assessment - Requirements and guidelines – Amendment 1 (ISO 14044:2006 / Amd 1:2018)

Mineralogical – Petrographic study of Drymos quarry sample (ELOT EN 932.3 - 28.09.2020)

PCR 2019:14 Construction products (EN 15804:A2), Version 1.3.1, dated 2023-07-08, International EPD System

Regulation (EU) no. 305/2011 – Construction Products Regulation (CPR), https://eur-lex.europa.eu/ LexUriServ/LexUriServ.do?uri=OJ:L:2011:088:0005:0043:EN:PDF

UEPG (European Aggregates Association) https://uepg.eu/

United Nations Statistics Division (2015). Central Product Classification, version 2.1. https://unstats.un.org/unsd/classifications/unsdclassifications/cpcv21.pdf

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