



ΣΚΥΡΟΔΕΜΑ
ΤΡΙΚΑΛΩΝ ΕΠΕ

EPD

Environmental Product Declaration for Ready Mixed Concrete

43 - C20/25, XC1, 31.5, S3

41 - C25/30, XC2 XC3, 31.5, S3

44 - C30/37, XC4 XF1, 31.5, S3

Programme The International EPD® System, www.environdec.com

Programme operator: EPD International AB

EPD registration number: ????????????

Publication date: ????????????

Valid until: ????????????



In accordance with ISO 14025:2006 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.

> 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

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 1.11; 2021-02-05

c-PCR-003 Concrete and concrete elements (EN 16757); Version 2019-12-20

UN CPC: 375

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:

EPD process certification EPD verification

Third party verifier:  Business Quality Verification P.C

Accredited by E.S.Y.D., Accreditation No. 1218

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.

Environmental Product Declaration in accordance with ISO 14025 and EN 15804. This EPD is in accordance to the corresponding LCA analysis.

> COMPANY INFORMATION

Owner of the EPD: SKIRODEMA TRIKALON EPE

Terma Patoulas, 42100 Trikala, Greece

Contact: Papakostas Theodoros

SKIRODEMA TRIKALON EPE, Greece, T: + 30 694 587 5643, E: papakostasteo@yahoo.com

Description of the organisation: Building materials manufacturer

Product-related or management system-related certifications:

The company is certified with ISO 9001:2015 Quality Management System.

> INTRODUCTION

SKIRODEMA TRIKALON presents a company dedicated in ready mixed concrete production which is based in Trikala. Since 1973 has been active in the production and marketing of ready-mixed concrete. SKIRODEMA TRIKALON establishment in the market as the most reliable supplier of ready-mixed concrete is a result of the quality excellence of the services it offers to its customers.

Having the know-how, the technology and as its main concern the production of high quality concrete, SKIRODEMA TRIKALON can cover all your needs.

> PRODUCT INFORMATION

Product name:

43 - C20/25, XC1, 31.5, S3

41 - C25/30, XC2 XC3, 31.5, S3

44 - C30/37, XC4 XF1, 31.5, S3

Product identification:

Compressive Strength 28 days (Mpa): 25, 30 and 37

Product description: Concrete is a material formed by mixing cement, coarse and fine aggregate and water, with or without the incorporation of admixtures and additions. Fresh concrete is manufactured at ready-mix batch plants and is delivered to the construction sites in a liquid state. Fresh concrete is placed, compacted and hardened in the desired shape, via a chemical reaction: the hydration of cement. The cement is the binding agent in concrete: it is a finely ground powder that when hydrated

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 C20/25, XC1, 31.5, S3 - C25/30, XC2 XC3, 31.5, S3 - C30/37, XC4 XF1, 31.5, S3 concrete mix designs which complies with the requirements of ELOT EN 206 and the Concrete Technology Regulation KTS 2016. These specific concrete mix designs are produced regionally by SKIRODEMA TRIKALON.

These specific types of concrete have a wide range of applications and are mainly utilized in civil engineering works and in residential and commercial construction.

The product is delivered in bulk with ready-mix trucks.



> LCA INFORMATION

Functional unit / declared unit: The declared unit is one (1) cubic meter (m³).

Production Process: SKIRODEMA TRIKALON manufactures ready-mixed concrete in a state-of-the-art facility in Trikala. The production process is fully automated to ensure superior quality products, conforming to the national and European concrete standards. The raw materials (cement, aggregates, water, admixtures etc.) are accurately weighed according to the proprietary SKIRODEMA TRIKALON mix designs to produce ready-mixed concrete with specific characteristics (strength, durability, finishability, pumpability etc.). Once manufactured, the fresh concrete is transported with concrete trucks to the construction sites.

Time representativeness: The data used in this study cover from January 2021 to December 2021.

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 one cubic meter of concrete for modules 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 SKIRODEMA TRIKALON, incorporating cement EPD data for Titan Cement Company S.A. and involved all input and output materials to our premises. Regarding electricity mix, the latest (2020) national residual electricity mix as published in DAPEEP SA, were utilized (<https://www.dapeep.gr/viosimi-anapixi/energeiako-meigma/>). The background data for the module A1 e.g. raw materials (amount used by type) as well energy consumption, waste production and transport distances of raw materials and aggregates from cement plants, quarries have been obtained from the company's Quality Assurance system and correspond the exact and accurate mix designs for each ready-mix plant. Core indicators for every cement type / cement sourcing plant are obtained from the TITAN CEMENT S.A. publicly available cement EPDs.

The GCCA Environmental Product Declaration tool (v3.0). GCCA's Industry EPD Tool for Cement and Concrete is a web-based calculation tool for EPDs of clinker, cement, concrete, mortars and pre-cast 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 (v3.0) is developed by Quantis <https://quantis-intl.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:

- CO₂ emission factors for different transportation way
- CO₂ emission factors for plant diesel and raw materials
- Specific emission factor of used energy mix (kg CO₂/kWh)

There is no missing data for these concrete mixes, since all the required raw data were provided from the Quality Assurance system that company uses. Data collection and processing for EPD and LCA development is performed according to SKIRODEMA TRIKALON quality systems

Geographical scope: National (Greece)

Allocations: The allocation is performed according to the PCR. As no co-products are produced, the flow of materials and energy and the associated release of substances and energy into the environment is related exclusively to the concrete produced. No by-products occur during ready mix concrete production; therefore, there is no need for allocations in by-products.

The study does not include the followings:

- Capital equipment production
- Equipment maintenance
- Human labour and employee transport

Assumptions:

This EPD Process is certified using GCCA international modelling of energy use and environmental impact to obtain a suitable estimation for products manufactured.

Pre-defined cement and clinker data provided by the GCCA tool are used for TITAN cements manufactured at Kamari, Patras and Thessaloniki cement plants.

- All modelling assumptions adopted from the GCCA Tool.
- Raw material (inbound) transport distances are generated from company data and are accurate across operations.
- Concrete mixes are assumed to use an equal amount of site fuel and energy and responsible for an equal amount of waste flows.
- The calculation of the bill of materials for every plant is based on company data. The concrete mix design (materials percentage participation) was defined by the pre-verified and automated Quality Assurance system that company uses.
- Water usage in batching operations is, per mix design.

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 "Cradle to gate" covering A1-A3.

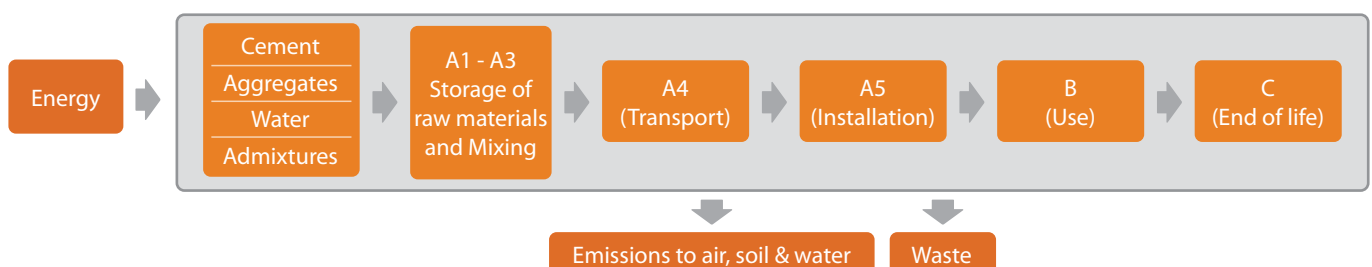
The technical characteristics and composition of the product are shown in the table below.

Mechanical properties		
Product name	Minimum Compressive Strength $f_{ck,cube}$ (Mpa)	Product Density (Kg/m ³)
43 - C20/25, XC1, 31.5, S3	25	2.363
41 - C25/30, XC2 XC3, 31.5, S3	30	2.369
44 - C30/37, XC4 XF1, 31.5, S3	37	2.386

The data of density and strength are based on the standards ELOT EN 12350.06 and ELOT EN 12390.03 respectively.



UN CPC code: 375



SYSTEM DIAGRAM

The scope of this study is Cradle to gate, A1-A3.

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 for reuse, recovery and/or recycling	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

More information: X= included, MND = module not declared



The final product does not contain dangerous substances of high concern from the candidate list of SVHC for Authorization.

• **A1-A3 Product stage**

- A1 Raw materials supply: this module takes into account the extraction and processing of raw materials and the associated energy that is produced prior to manufacturing concrete.
- A2 Transport: this module includes the transport of the different raw materials from the supplier to the ready-mix plant.
- A3 Manufacturing: this module includes the consumption of energy and water during the concrete manufacturing process, as well as the transport and management of the factory-produced waste. The manufacture of concrete or mortar consists mainly of a mixing process of different components.

> CONTENT INFORMATION

PRODUCT	CONCRETE DENSITY (Kg/m ³)	CEMENT	COARSE AGGREGATE	FINE AGGREGATE	WATER	ADMIXTURES
43 - C20/25, XC1, 31.5, S3	2.363	12-13%	34-37%	41-45%	7-8%	0,20%
41 - C25/30, XC2 XC3, 31.5, S3	2.369	12-13%	36-39%	41-45%	7-8%	0,20%
44 - C30/37, XC4 XF1, 31.5, S3	2.386	14-15%	35-38%	40-44%	7-8%	0,20%



41 - C25/30, XC2 XC3, 31.5, S3

Core environmental impact indicators		
Indicator	Unit	A1-A3
GWP-tot	kg CO ₂ eq.	2.19E+02
GWP-fos	kg CO ₂ eq.	2.19E+02
GWP-bio	kg CO ₂ eq.	6.38E-02
GWP-luc	kg CO ₂ eq.	3.79E-02
ODP	kg CFC ₁₁ eq.	7.21E-06
AP	mol H ⁺ eq.	4.85E-01
EP-fw	kg PO ₄ eq.	3.85E-02
EP-fw*	kg P eq.	1.26E-02
EP-mar	kg N eq.	9.54E-04
EP-ter	mol N eq.	1.59E+00
POCP	kg NMVOC _{eq.}	4.18E-01
ADPE	kg Sb _{eq.}	1.56E-04
ADPF	MJ	7.27E+02
WDP	m ³ eq.	9.00E+01

Acronyms

GWP-total = Global Warming Potential total; **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

1. Eutrophication aquatic freshwater shall be given in both kg PO₄⁻³ eq and kg P eq.
2. 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.

Outputs		
Indicator	Unit	A1-A3
CRU	kg	0.00E+00
MFR	kg	1.66E-01
MER	kg	0.00E+00
EE	MJ	0.00E+00

Acronyms

CRU = Components for re-use; **MR** = Materials for recycling; **MER** = Materials for energy recovery; **EE** = Exported energy

Use of resources		
Indicator	Unit	A1-A3
PERE	MJ	5.28E+01
PERM	MJ	0.00E+00
PERT	MJ	5.28E+01
PENRE	MJ	8.26E+02
PENRM	MJ	0.00E+00
PENRT	MJ	8.26E+02
SM	kg	1.13E+01
RSF	MJ	4.43E+01
NRSF	MJ	6.01E+01
NFW	m ³	2.16E+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; **NFW** = Use of net fresh water

Other environmental information describing waste categories		
Indicator	Unit	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

Additional environmental impact indicators		
Indicator	Unit	A1-A3
PM	Disease incidence	ND
IRP	kBq U235 eq.	ND
ETP	CTUe	ND
HTPC	CTUh	ND
HTPNC	CTUh	ND
SQP	dimensionless	ND

Acronyms

PM = Potential incidence of disease due to pm emissions; **IRP** = Potential human exposure efficiency relative to U235; **ETP** = Potential comparative toxic unit for ecosystems; **HTPC** = Potential comparative toxic unit for humans; **HTPNC** = Potential comparative toxic unit for humans; **SQP** = Potential soil quality index

44 - C30/37, XC4 XF1, 31.5, S3

Core environmental impact indicators		
Indicator	Unit	A1-A3
GWP-tot	kg CO ₂ eq.	2.49E+02
GWP-fos	kg CO ₂ eq.	2.49E+02
GWP-bio	kg CO ₂ eq.	6.53E-02
GWP-luc	kg CO ₂ eq.	3.91E-02
ODP	kg CFC ₁₁ eq.	8.04E-06
AP	mol H ⁺ eq.	5.39E-01
EP-fw	kg PO ₄ eq.	4.11E-02
EP-fw*	kg P eq.	1.34E-02
EP-mar	kg N eq.	1.03E-03
EP-ter	mol N eq.	1.78E+00
POCP	kg NMVOC _{eq.}	4.67E-01
ADPE	kg Sb _{eq.}	1.60E-04
ADPF	MJ	8.04E+02
WDP	m ³ eq.	9.03E+01

Acronyms

GWP-total = Global Warming Potential total; **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

1. Eutrophication aquatic freshwater shall be given in both kg PO₄⁻³ eq and kg P eq.
2. 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.

Outputs		
Indicator	Unit	A1-A3
CRU	kg	0.00E+00
MFR	kg	1.90E-01
MER	kg	0.00E+00
EE	MJ	0.00E+00

Acronyms

CRU = Components for re-use); **MR** = Materials for recycling; **MER** = Materials for energy recovery; **EE** = Exported energy

Use of resources		
Indicator	Unit	A1-A3
PERE	MJ	5.78E+01
PERM	MJ	0.00E+00
PERT	MJ	5.78E+01
PENRE	MJ	9.13E+02
PENRM	MJ	0.00E+00
PENRT	MJ	9.13E+02
SM	kg	1.30E+01
RSF	MJ	5.08E+01
NRSF	MJ	6.90E+01
NFW	m ³	2.17E+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; **NFW** = Use of net fresh water

Other environmental information describing waste categories

Indicator	Unit	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

Additional environmental impact indicators

Indicator	Unit	A1-A3
PM	Disease incidence	ND
IRP	kBq U235 eq.	ND
ETP	CTUe	ND
HTPC	CTUh	ND
HTPNC	CTUh	ND
SQP	dimensionless	ND

Acronyms

PM = Potential incidence of disease due to pm emissions; **IRP** = Potential human exposure efficiency relative to U235; **ETP** = Potential comparative toxic unit for ecosystems; **HTPC** = Potential comparative toxic unit for humans; **HTPNC** = Potential comparative toxic unit for humans; **SQP** = Potential soil quality index

> ADDITIONAL INFORMATION

Differences versus previous versions

First EPD version – No previous versions

References

- **GPI v.4.0:2021-03-29** General Programme Instructions of the International EPD® System
- **PCR 2019:14 v.1.11** 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 197-1:2011** Cement - Part 1: Composition, specifications and conformity criteria for common cements
- **c-PCR-003** Concrete and concrete elements (EN 16757) Version 2019-12-20
- **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 (v3.0, International version, 25 November 2020)
 - LCA Model (v3.0, International version, 25 November 2020)
 - LCA Database (v3.0, 1 April 2021)
- **DAPEEP SA:** Renewable Energy Sources Operator & Guarantees of Origin | Greece | www.dapeep.gr
- **ELOT EN 206 EN 206+A1** Concrete – Part 1: Specification, performance, production and conformity
- **Hellenic Concrete Technology Regulation KTS 2016**



> CONTACT INFORMATION

EPD owner		Terma Patoulas 42100, Trikala, Greece email: papakostasteo@yahoo.com
LCA author		22A Halkidos Str. 111 43, Athens, Greece email: info@titan.gr • www.titan.gr
Programme operator	 THE INTERNATIONAL EPD® SYSTEM	Valhallavägen 81, 114 27 Stockholm, Sweden email: info@environdec.com www.environdec.com
Verifier		3hs Septemvriou 144, Athina 112 51, Greece email: info@bqv.gr www.bqv.gr