DAPHabitat System

www.daphabitat.pt

ENVIRONMENTAL PRODUCT DECLARATION

[according to ISO 14025, EN 15804:2012+A1:2013 and EN 15942]

Registration Number: DAP 018:2022

Glazed wall tiles

ISSUE DATE: 28/10/2022 **VALID UNTIL: 27/10/2027**

CINCA - COMPANHIA INDUSTRIAL DE CERÂMICA, S.A – MEALHADA UNIT

VERSION 1.1. EDITION JULY 2015

Index

1. GENERAL INFORMATION

1.1. The DAPHabitat System

Program operator:	Associação Plataforma para a Construção Sustentável www.centrohabitat.net centrohabitat@centrohabitat.net
Address:	Departamento Engenharia Civil Universidade de Aveiro 3810-193 Aveiro
Email address:	deptecnico@centrohabitat.net
Telephone number:	(+351) 234 401 576
Website:	www.daphabitat.pt
Logo:	

1.2. EPD owner

Name of the owner:	CINCA - Companhia Industrial de Cerâmica, S.A.
Production site:	Travasso, 3050-510 Vacariça
Address (head office):	Rua Principal, nº 39 – 4505-374 Fiães
Telephone:	(+351) 227 476 400
E-mail:	cinca@cinca.pt
Website:	www.cinca.pt
Logo:	
Information concerning the applicable management Systems:	ISO 9001:2015 – Quality Management Systems ISO 14001:2015 – Environmental Management Systems
Specific aspects regarding the production:	NACE/$CAE_{Rev.3}$ n.º 23312 – Manufacture of ceramic tiles and flags

Organization's environmental policy:

CINCA - Companhia Industrial de Cerâmica, S.A.:

Mission:

CINCA is an industrial company producer of wall and floor tiles whose mission is to meet the needs of customers and users of their products by providing a wide range of high-quality wall and floor tiles with competitive prices and lead times, complemented by an extensive customer service.

Policy:

The Integrated Quality, Environment and Safety at Work policy at CINCA is based on the participation of all employees of the organization in the planning department, implementation and maintenance, targeting actions for continuous improvement:

- of quality. By manufacturing, developing and implementation of products and services that meet the requirements of markets and customers, satisfying their needs within the highest standard of quality, exceeding the requirements of applicable norms;
- of environmental performance. Through the identification and control of environmental aspects and impacts of the company, ensuring the reduction and prevention of pollution as well as conservation of natural resources;
- of energy performance. By identifying and monitoring the energy consumptions, establishing plans for the rational use, improvement of efficiency and reduction of consumption in order to reduce costs, greenhouse gas emissions and other related environmental impacts;
- of safety at work. For the prevention of hazards, accidents and occupational diseases, based on continuous training, qualification and appreciation of its employees.

Quality, Environment and Safety at Work:

Conscious of its role in building a future based on sustainability, CINCA has developed, implemented and maintains an Integrated Management System covering the vectors Quality, Environment, Energy and Safety that is based on the international recognition of the reference norms ISO 9001, ISO 14001, ISO 50001 and ISO 45001.

The permanent monitoring of processes and systems enables to improve the quality with minimum waste and maximum resources in order to minimize the environmental impacts of their activity.

Commitment:

CINCA, which is part of a healthy guideline in a social and industrial environment, strives for the welfare of those who relate to them (customers, suppliers, employees and society in general) and works on a continuous improvement of its products, manufacturing processes and methods of work, without ignoring the environment and in strict compliance with the required norms, laws and regulations.

Therefore, the Board of CINCA commits to inform the present integrated policy to the whole organization, as well as to maintain and continuously improve its Integrated Management System, so that it is appropriate, effective and publicly acknowledged in pursuit of the guidelines here expressed.

1.3. Information concerning the EPD

Authors:	1. Centro Tecnológico da Cerâmica e do Vidro 2. CINCA - Companhia Industrial de Cerâmica, S.A.
Contact of the authors:	1. CTCV materials: habitat | iParque – Parque Tecnológico de Coimbra - Lote 6 | 3040-540 Antanhol - Portugal (T) +351 239 499 200 Marisa Almeida: marisa@ctcv.pt 2. CINCA - Companhia Industrial de Cerâmica, S.A., Rua Principal, nº 39 – 4505-374 Fiães (T) +351 227 476 400
Emission date:	28/10/2022
Registration date:	31/10/2022
Registration number:	DAP 018:2022
Valid until:	27/10/2027
Representativity of the EPD (location, manufacturer, group of manufacturers):	EPD of one (1) product class, produced one (1) industrial plant (CINCA - Companhia Industrial de Cerâmica, S.A. – unit of Mealhada).
Where to consult explanatory material:	www.cinca.pt
Type of EPD:	EPD from cradle to grave (A1-D)

1.4. Demonstration of the verification

External independent verification, accordingly with the standard ISO 14025:2009 and EN 15804:2012+A1:2013	
Certification Body	**Verifier**
(CERTIF – Associação para a Certificação)	(Ricardo Mateus)

1.5. EPD Registration

Program Operator
(Plataforma para a Construção Sustentável)

1.6. PCR of reference

Name:	1. PCR: Basic module for construction products and services 2. PCR: Floor covering 3. PCR: Wall covering 4. EN 17160:2019 - Product category rules for ceramic tiles
Issue date:	1. November 2020 2. November 2020 3. November 2020 4. 27-Feb-2019, entry into force 15-Apr-2019
Number of registration on the data base:	1. PCR-mb001 2. RCP001:2014 3. RCP002:2014 4. --
Version:	1. Version 2.1 2. Version 1.1 3. Version 1.1 4. --
Identification and contact of the coordinator (s):	1. PCR: basic module for construction products and services • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt • José Silvestre | jds@civil.ist.utl.pt 2. PCR: Floor coverings • Luís Arroja | arroja@ua.pt • Marisa Almeida | marisa@ctcv.pt 3. PCR: Wall coverings • Luís Arroja | arroja@ua.pt • Marisa Almeida | marisa@ctcv.pt
Identification and contact of the authors:	1. PCR: basic module for construction products and services • Marisa Almeida; Luis Arroja; José Silvestre; Fausto Freire; Cristina Rocha; Ana Paula Duarte; Ana Cláudia Dias; Helena Gervásio; Victor Ferreira; Ricardo Mateus e António Baio Dias 2. PCR: Floor coverings • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt • Ana Cláudia Dias | acdias@ua.pt 3. PCR: Wall coverings • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt • Ana Cláudia Dias | acdias@ua.pt
Composition of the Sectorial Panel:	2. RCP: Floor coverings • RMC - Revestimentos de Mármore Compactos, S.A. • Dominó – Indústrias Cerâmicas, S.A. • MAS – Manuel Amorim da Silva, Lda. • Sonae Indústria, SGPS, S.A. • APICER – Associação Portuguesa da Indústria de CerâmicaRCP 3. : Wall coverings • RMC - Revestimentos de Mármore Compactos, S.A. • APICER – Associação Portuguesa da Indústria de Cerâmica • Sonae Indústria, SGPS, S.A. • Gyptec Ibérica - Gessos Técnicos, S.A.
Consultation period:	1. 18/11/2015 - 18/01/2016 2. 01/08/2013 - 30/11/2013 3. 12/08/2013 - 30/11/2013
Valid until:	1. December 2022 2. December 2022 3. December 2022 4. --

1.7. Information concerning the product/product class

Identification of the product:

Glazed wall tiles. Grupo BIII (EN14411)

Illustration of the product:

Double Firing White Body Wall Tile – eg. Diamond Safari Green

Brief description of the product:

CINCA designs, develops, manufactures and sells ceramic wall tiles public and private areas covering (indoor and outdoor), including residential, retail and service buildings. This product is available in the market in a panoply of aesthetic and dimensional options, as much in visual effects as of texture and colours.

In this EPD the results are given per 1 m^2 of average product, with 11.64 kg/m^2. The values corresponding to each of the marketed thicknesses are proportional to the mass, and can be calculated using the values presented in Table 1, which also presents the values of the specific weight (kg/m^2) for the different thicknesses of the material.

Table 1: Conversion factors

Thickness (mm)	Weight (kg/m^2)	Conversion factor to m^2
5.8	9.6	0.82
6.0	9.9	0.85
7.0	11.6	1.00
7.5	12.4	1.07
8.0	13.3	1.15
9.0	14.9	1.28
10.0	16.6	1.43

NOTE: The average weights per m^2 (kg/m^2), depend on the thickness of the product. For more precise information on the weights per unit area of each reference, please contact CINCA.

Main technical characteristics of the product:

Table 2: Technical characteristics

Essential Characteristics	Performance	Test Standard	Harmonised Technical Specification
Reaction to Fire	Class A1	CWT (Dec. 96/603/EC)	EN 14411:2012
Release of Dangerous Substances, for:			
- Cadmium	NPD	EN ISO 10545-15	
- Lead	NPD	EN ISO 10545-15	
Bond Strength / Adhesion, for:	See Note (1)		
- Cementitious Adhesives (Type C2)	> 1 N/mm²	EN 12004 4.1	
- Dispersion Adhesives (Type D1)	> 1 N/mm²	EN 12004 4.2	
- Reaction Resin Adhesives (Type R2)	> 2 N/mm²	EN 12004 4.3	
Thermal Shock Resistance	Pass	EN ISO 10545-9	
Durability, for:			
- Internal Uses:	Pass	-	
- External Uses: Freeze-thaw Resistance	No	EN ISO 10545-12	

Note (1): The laboratorial determination regarding the adhesion of ceramic tiles to mortar / cement glue is merely indicative and relevant only under certain specific circumstances, namely, according to the harmonized standard, "*only when the tile is used on walls subject to requisites against the fall of objects in trafficable areas.*". The results obtained and declared are a result of tests carried out under ideal laboratorial conditions, and therefore a correlation between the declared adhesion results and the performance of the tile in use may not exist, since application techniques and the different types of support can strongly influence the final performance.

Note (2): Under Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18th of December 2006 (REACH), article 3, number 3, floor and wall tiles are considered articles and are not expected to release any substances when used in normal and reasonably predicted conditions, reason why any safety data sheet for its fixing, transport or use in the market, is not necessary.

Note (3): Wall and floor tiles are not classified as hazardous according to the Regulation (EC) No. 1272/2008 of the European Parliament and of the Council of 16th of December 2008.

NPD: No Performance Determined

Description of the products' application:

Ceramic wall tiles for indoor wall finishes, excluding the use as wall coverings in areas when subject to specific regulations on hazardous substances (ex: when glazed products are used on surfaces where they have direct contact with food).

Gazed wall tiles for coating interior walls in the following applications:

- Areas and residential buildings

	• Areas and public buildings • Areas and industrial buildings
Reference service life:	The service life of the tiles is generally more than 50 years (CEN,2012). In addition, according to the US Green Building Council, the service life of the tiles could have the same service life as the building itself. Therefore, 50 years can be considered as the realistic service life for the tiles.
Placing on the market / Rules of application in the market / Technical rules of the product:	• EN 14411:2012 - Ceramic tiles - Definitions, classification, characteristics, evaluation of conformity and marking. • EN ISO 10545 – Ceramic wall and floor (several parts) • DIN 51130:2014 - Slip resistance test for flooring • DIN 51097:2016 - Ramp testing • BS 7976-1:2002+A1:2013 - Pendulum testers Specification • Regulation (UE) n.º 305/2011 from the European Parliament and of the Council, of 9 March 2011, laying down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
Quality control:	Quality control according to the technical standards of the product.
Special delivery conditions:	Not applicable
Components and substances to declare:	Not applicable
History of the LCA studies:	--

2. ENVIRONMENTAL PERFORMANCE OF THE PRODUCT

2.1. Calculation rules of the LCA

Declared unit: --

Functional unit: 1 m^2 of double fired wall tiles (average of all wall tiles produced) for wall coverings, and for a reference service life (RSF) of 50 years.

Parameter	Value	Unit of measure
Unit of measurement	1	m^2
Weight	11.64	kg/m^2
Conversion factor to 1 kg	0.0859	m^2/kg

System boundaries: EPD from cradle to grave

Criteria for the exclusion: According to paragraph 6.3.5 of EN 15804, the exclusion criterion for unitary processes is 1% of the total energy consumed and 1% of the total mass of the inputs, paying particular attention not to exceed a total of 5% of energy and mass flows excluded in the product step.

The following cases were not considered in this study, as they may fall under the exclusion criteria:

- Environmental loads associated with the construction of industrial infrastructures and the manufacture of machinery and equipment;
- Environmental loads relating to infrastructure (vehicle and road production and maintenance) for the transport of pre-products;
- Long term emissions.

All flows in known inputs and outputs were considered

Assumption and limitations: For processes over which producers have no influence or specific information, such as the extraction of raw materials, generic data from the Ecoinvent v3.3 databases were used.

The dataset used to model the production of electricity and natural gas was adapted to the national reality. The electric mix was updated for the year 2019 through information from the National Energy Networks (*Redes Energéticas Nacionais* - REN), the Energy Services Regulatory Authority (*Entidade Reguladora dos Serviços Energéticos* - ERSE) and the General Board of Energy and Geology (*Direção Geral de Energia e Geologia* - DGEG) in order to obtain more up-to-date results regarding the environmental impacts generated by the electricity grid in Portugal. The natural gas process was modelled according to the information provided by the DGEG Energy Report in Portugal (2019), regarding the countries where the importation comes from.

The environmental impacts indicated in this EPD are a weighted average of all Mealhada ceramic tiles for wall products fabricated in 2019.

The modules from A5 to C4 are scenarios based on average data, included in the PCR created by the European Federation of ceramic tile manufacturers /CET PCR 2014/ and subsequently implemented in the EN 17160 - Product category rules for ceramic tiles.

Quality and other characteristics about the information used in the LCA: The production data collected correspond to the year 2019 and are in line with reality. The generic data used belong to the Ecoinvent v3.3 databases and meet the quality criteria (age, geographical and technological coverage, plausibility, etc.) of generic data.

The validity period of the background data from the Ecoinvent database is between 2013 and 2019. Most of the information (energy and water consumption, emissions of pollutants, atomized powders and ceramic production) are measured or calculated directly at the company level, which is specific and is checked. Carbon dioxide emissions (related to carbonate oxidation) are collected through the ETS (Emissions Trading Scheme) declaration.

Detailed data were obtained for mixtures of raw materials (collected with primary data from the company) and for dyes, frits, and other raw materials for glaze production.

The overall quality of the data can be considered good.

Allocation rules: The consumption of energy and materials has been allocated to the product in question based on the mass of ceramic tiles produced annually. No further allocations were applied in the modules subsequent to the production phase. Some ceramic waste is recycled internally. Credits for energy recovery of packaging materials and end of life of the product

	have been considered.
Comparability of EPD for construction products:	The EPDs for construction products and services are not comparable if they are not produced in accordance with EN 15804 and EN 15942 and in accordance with the comparability conditions determined by ISO 14025. For each ceramic product, manufactured in the Cinca - Mealhada Industrial Unit, the environmental impacts were determined by multiplying the results of this study by mass scale factors.

2.1.1. Flow diagram of input and output of the processes

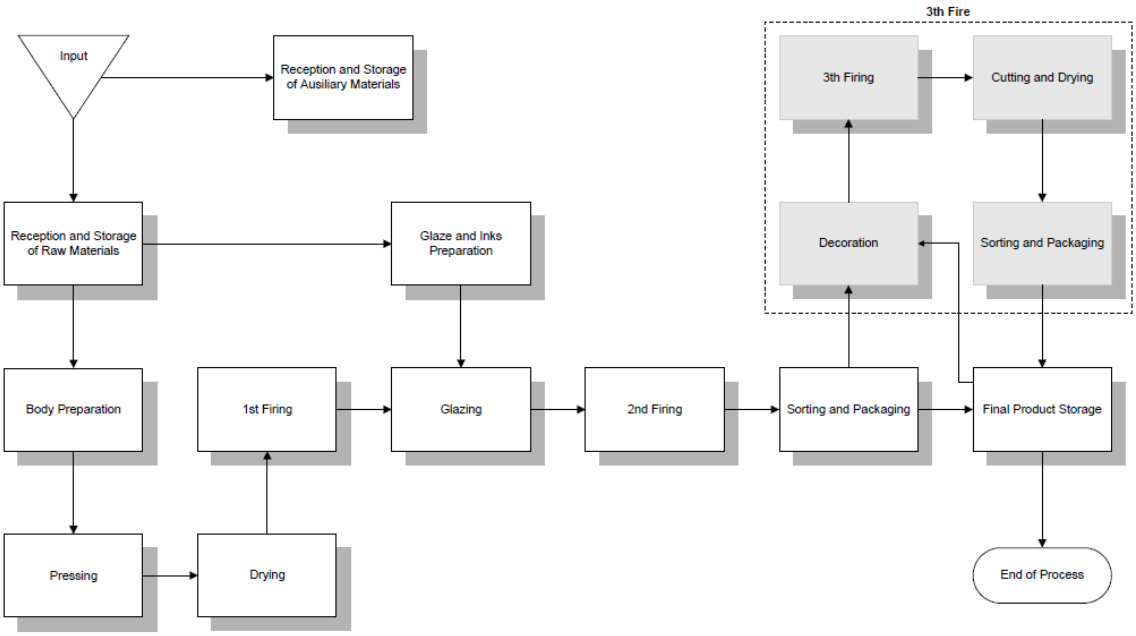

Figure 1 - Production process of the ceramic tile covered by this EPD.

Production Unit Mealhada:

Body Preparation

It starts by weighing raw materials on fixed scales, one being used for weighing hard materials (dolomite, tile and sand) and another for clay materials (clays and kaolin).

The hard materials, after being weighed, are sent to the mill's preload hoppers by means of web conveyors.

Then, the hard materials enter the mills to be ground.

After the end of the grinding, the mills are discharged to the mixer diluters.

The clay materials, after being weighed, are transported to dosing feeders mounted on the thinners, being dispersed in water and mixed with the hard materials from the mills.

After the dilution and mixing process is finished, the paste is screened through a sieve to separate impurities. Then the slip passes to agitators, aiming to maintain homogeneity.

The slurry is pumped to the atomiser's service stirrer, once again being sieved and deferrized and ready to be atomized.

Drying is done by the atomization process. The slurry containing about 35% water leaves the atomizer in the form of a powder made up of spherical particles, containing a residual moisture of 5.5%.

The powder travels on a belt conveyor to the elevator, which deposits in the silos. In these, there is a 24-hour stay so that moisture is homogenized.

Glazes Preparation

This unit consists of mills coated with high density alumina, which use balls of this same material.

Enamels and dyes are ground together with deflocculants.

Then the discharge is made to the vats, passing the material through a sieve.

If necessary, the glass is deferrized and sieved again.

Pending its use in glazing, the glass is kept under agitation in the vats.

Manufacture of Tiles

The atomized paste is automatically transported from the storage silos to the press silos, passing through a classification sieve.

In the presses, the dies with the desired shapes for production are assembled.

The pressing is done dry, the number of outputs of the press depends on the format in production.

The drying cycle reduces the moisture content of the material to less than 1%.

After cooking, the tile is placed in containers, going to the biscuit store, where it awaits glazing.

The glazing operation starts with the feeding of tiles cracked to the glazing lines, the material being chosen in order to eliminate defects, (broken corners, cracks, etc.). Before the application of the glass, the tile undergoes an operation of deburring the edges, brushing and moistening the surface, being ready to receive the glass. Depending on the type of tile to be produced, various application techniques can be used: curtains, spray guns and digital printing machines can be used simultaneously.

After glazing the tile is placed in cars that are transported to the park by computerized robots.

Before entering the oven, the tiles pass through a dryer to eliminate moisture due to the application of the glass.

The selection phase comprises three stages: pre-selection, choice and palletizing.

In the pre-choice, the direct analysis of the cars with cooked material is made, to determine the lots to be chosen and to detect deficiencies.

The choice (properly speaking) involves operators and electronic equipment, the material being classified according to lots, defects, etc.

The tile is packed in boxes, which are duly identified by inscriptions.

Finally, the boxes are palletized, that is, properly arranged on pallets, after which they go to the warehouse.

3rd Fire

The 3rd Fire section makes decorated products (inserts, lists) using serigraphic processes on material produced in 2nd Fire, also making cuts to obtain materials with smaller formats.

Usually, the process starts with drying the material to be decorated (usually the 2nd Fire finished product), and then one or more decorations with paints and ceramic glass are applied, through various alternative processes, the most common being flat screen printing. After the decorations are applied, cooking is carried out at significantly lower temperatures than the normal cooking temperatures in the 2nd Fire.

Finally the product is chosen and packed manually.

2.1.2. Description of the system boundaries

(✓= included; ✖ = module not declared)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport	Construction installation process	Use	Maintenance	Repair	Replacement	Rehabilitation	Operational energy use	Operational water use	De-constructions, demolition	Transport	Waste processing	Disposal	Re-use, recovery, recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The entire life cycle of the product (type of EPD: « **cradle-to-grave** ») and the Modules described below are considered:

Modules **A1-A3** include those processes that provide energy and material input for the system (A1), transport up to the factory gate of the plant (A2), manufacturing processes as well as waste processing (A3).

Module **A4** includes the transport from the production site to the customer or to the point of installation of the tiles. Three scenarios were considered for the transport: 300 km (truck), 1390 km (truck) and 6520 km (ship) according to EN 17160.

Module **A5** considers all tile installation steps (like adhesives consumption) also packaging waste processing (recycling, incineration, disposal). The default values were according to EN 17160. Credits from energy substitution are declared in module D.

Module **B1** considers the use of tiles. During the use of ceramic tiles no hazardous indoor emissions are expected to occur.

Module **B2** includes the cleaning of the tiles. Provision of water, cleaning agent for the cleaning of the tiles, incl. waste water treatment, are considered.

Modules **B3-B4-B5** are related to the repair replacement and refurbishment of the tiles. If the tiles are properly installed no repair, replacement or refurbishment processes are necessary. For this reason Modules B3-B4-B5 are not considered according to EN17160.

Modules **B6-B7** consider energy use for operating building integrated technical systems (B6) and operational water use for technical building-related systems. No operational energy or water use are considered. Cleaning water is declared under B2.

Module **C1** refers to the demolition and de-construction process of the tiles from the building. According to EN17160 it is considered negligible.

Module **C2** considers transportation of the discarded tile to a recycling or disposal process. It was considered 20 km.

Module **C3** considers every process (collection, crushing process etc.) properly for recycling the tiles (70% following EN17160).

Module **C4** includes all the landfill disposal processes, including pre-treatment and management of the disposal site (20 km) (30% following EN17160).

Module **D** includes benefits from all net flows in the end-of-life stage that leave the product boundary system after having passed the end-of-waste stage.

2.2. PARAMETERS DESCRIBING ENVIRONMENTAL IMPACTS

		Global warming potential; GWP kg CO_2 equiv.	Depletion potential of the stratospheric ozone layer; ODP kg CFC 11 equiv.	Acidification potential of soil and water, AP kg SO_2 equiv.	Eutrophication potential, EP kg $(PO_4)^{3-}$ equiv.	Formation potential of tropospheric ozone, POCP kg C_2H_4 equiv.	Abiotic depletion potential for non-fossil resources kg Sb equiv.	Abiotic depletion potential for fossil resources MJ, P.C.I.
Raw material supply	**A1**	-	-	-	-	-	-	-
Transport	**A2**	-	-	-	-	-	-	-
Manufacturing	**A3**	-	-	-	-	-	-	-
Total	**Total**	1.64E+01	2.41E-06	2.65E-02	2.96E-03	2.26E-03	6.05E-05	1.86E+02
Transport	**A4 – Scenario 1 (a)**	4.68E-01	8.64E-08	7.77E-04	9.17E-05	3.88E-05	2.00E-08	6.67E+00
	A4 – Scenario 2 (a)	2.17E+00	4.00E-07	3.60E-03	4.25E-04	1.80E-04	9.28E-08	3.09E+01
	A4 -Scenario 3 (a)	4.55E-01	7.62E-08	1.15E-02	1.12E-03	3.05E-04	3.84E-09	5.90E+00
Construction installation process	**A5**	1.22E+00	9.54E-08	2.47E-03	3.50E-04	1.76E-04	1.84E-06	8.66E+00
Use	**B1**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Maintenance	**B2**	3.68E-02	4.42E-09	2.26E-04	1.68E-05	1.29E-05	1.90E-08	1.37E+00
Repair/Replacement/Refurbishment	**B3 – B5**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Operational energy/water use	**B6 – B7**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
De-construction and demolition	**C1**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Transport	**C2**	3.12E-02	5.76E-09	5.18E-05	6.12E-06	2.59E-06	1.34E-09	4.45E-01
Waste processing	**C3**	3.35E-02	6.01E-09	2.59E-04	5.74E-05	5.06E-06	1.68E-09	4.67E-01
Disposal	**C4**	2.47E-02	4.43E-09	1.61E-04	3.48E-05	3.67E-06	1.21E-09	3.45E-01
Re-use, recovery, recycling potential	**D**	-1.66E-02	-2.48E-09	-1.05E-04	-2.20E-05	-3.27E-06	-5.12E-09	-2.21E-01

N.R.– not relevant according to EN 17160 - Product category rules for ceramic tiles

LEGEND:

- Product stage
- Construction process stage
- Use stage
- End - of - life stage
- Benefits and loads beyond the system boundary

NOTES: P.C.I. – Net calorific value
Units expressed by functional unit (1 m^2).
a) three transport scenarios were considered according to EN 17160: Scenario 1: 300km (truck); Scenario 2: 1390km (truck); Scenario 3: 6520km (ship)

2.3. Parameters describing resource use

		Primary energy						Secondary materials and fuels, and use of water			
		EPR MJ, P.C.I.	RR MJ, P.C.I.	TRR MJ, P.C.I.	EPNR MJ, P.C.I.	RNR MJ, P.C.I.	TRNR MJ, P.C.I.	MS kg	CSR MJ, P.C.I.	CSNR MJ, P.C.I.	Net use of fresh water m^3
Raw material supply	**A1**	-	-	-	-	-	-	-	-	-	-
Transport	**A2**	-	-	-	-	-	-	-	-	-	-
Manufacturing	**A3**	-	-	-	-	-	-	-	-	-	-
Total	**Total**	2.92E+01	3.43E-03	2.92E+01	2.13E+02	2.43E-01	2.13E+02	0.00E+00	0.00E+00	0.00E+00	7.50E-02
Transport	**A4 – Scenario 1 (a)**	9.83E-03	0.00E+00	9.83E-03	7.09E+00	0.00E+00	7.09E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-04
	A4 – Scenario 2 (a)	4.55E-02	0.00E+00	4.55E-02	3.29E+01	0.00E+00	3.29E+01	0.00E+00	0.00E+00	0.00E+00	6.13E-04
	A4 – Scenario 3 (a)	7.73E-03	0.00E+00	7.73E-03	6.27E+00	0.00E+00	6.27E+00	0.00E+00	0.00E+00	0.00E+00	8.50E-05
Construction installation process	**A5**	1.66E+00	0.00E+00	1.66E+00	1.11E+01	0.00E+00	1.11E+01	0.00E+00	0.00E+00	0.00E+00	4.82E-03
Use	**B1**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Maintenance	**B2**	2.00E-02	0.00E+00	2.00E-02	1.49E+00	0.00E+00	1.49E+00	0.00E+00	0.00E+00	0.00E+00	5.08E-04
Repair/Replacement/Refurbishment	**B3 – B5**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Operational energy/water use	**B6 – B7**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
De-construction and demolition	**C1**	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
Transport	**C2**	6.55E-04	0.00E+00	6.55E-04	4.73E-01	0.00E+00	4.73E-01	0.00E+00	0.00E+00	0.00E+00	8.83E-06
Waste processing	**C3**	7.44E-04	0.00E+00	7.44E-04	4.97E-01	0.00E+00	4.97E-01	0.00E+00	0.00E+00	0.00E+00	1.18E-05
Disposal	**C4**	5.14E-03	0.00E+00	5.14E-03	3.69E-01	0.00E+00	3.69E-01	0.00E+00	0.00E+00	0.00E+00	1.82E-05
Re-use, recovery, recycling potential	**D**	-1.25E-01	0.00E+00	-1.25E-01	-3.59E-01	0.00E+00	-3.59E-01	0.00E+00	0.00E+00	0.00E+00	-3.03E-03

N.R.– not relevant according to EN 17160 - Product category rules for ceramic tiles

LEGEND:

- Product stage
- Construction stage
- Use stage
- End – of - life stage
- Benefits and loads beyond the system boundary

EPR = use of renewable primary energy excluding renewable primary energy resources used as raw materials; **RR** = use of renewable primary energy resources used as raw materials; **TRR** = total use of renewable primary energy resources (EPR + RR); **EPNR** = use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **RNR** = use of non-renewable primary energy resources used as raw materials; **TRNR** = total use of non-renewable primary energy resources (EPRN + RNR); **MS** = use of secondary material; **CSR** = use of renewable secondary fuels; **CSNR** = use of non-renewable secondary fuels.

NOTES: Units expressed by functional unit (1 m^2).
P.C.I. – Net calorific value
a) three transport scenarios were considered according to EN 17160: Scenario 1: 300km (truck); Scenario 2: 1390km (truck); Scenario 3: 6520km (ship)

2.4. Other environmental information describing different waste categories

		Hazardous waste disposed kg	Non-hazardous waste disposed kg	Radioactive waste disposed ** kg
Raw material supply	**A1**	-	-	-
Transport	**A2**	-	-	-
Manufacturing	**A3**	-	-	-
Total	**Total**	6.33E-01	1.31E-03	2.45E-04
Transport	**A4 – Scenario 1 (a)**	2.79E-04	1.77E-05	4.84E-05
	A4 – Scenario 2 (a)	8.20E-05	1.29E-03	2.24E-04
	A4 – Scenario 3 (a)	3.48E-06	2.82E-04	4.27E-05
Construction installation process	**A5**	1.90E-02	1.94E-01	3.89E-05
Use	**B1**	N.R.	N.R.	N.R.
Maintenance	**B2**	7.13E-07	1.07E-03	5.40E-07
Repair/Replacement/Refurbishment	**B3 – B5**	N.R.	N.R.	N.R.
Operational energy/water use	**B6 – B7**	N.R.	N.R.	N.R.
De-construction and demolition	**C1**	N.R.	N.R.	N.R.
Transport	**C2**	1.18E-06	1.86E-05	3.23E-06
Waste processing	**C3**	1.22E-06	2.92E-05	3.37E-06
Disposal	**C4**	9.04E-07	2.99E+00	2.50E-06
Re-use, recovery, recycling potential	**D**	-4.99E-07	-2.12E-01	-3.15E-06

N.R. – not relevant according to EN 17160 - Product category rules for ceramic tiles

LEGEND:

- Product stage
- Construction stage
- Use stage
- End – of - life stage
- Benefits and loads beyond the system boundary

NOTES: Values expressed by functional unit (1 m^2)

** The radioactive waste component does not come from the activity of PAVIGRÉS (A3). It is a component derived from the upstream activities (A1 and A2), namely from the production of electricity.

a) three transport scenarios were considered according to EN 17160: Scenario 1: 300km (truck); Scenario 2: 1390km (truck); Scenario 3: 6520km (ship)

2.5. Other environmental information describing output flows

Parameters	Units*	Results
Components for re-use	kg	N/A
Materials for recycling	kg	8.48E+00
Materials for energy recovery	kg	6.25E-01
Exported energy	MJ by energy carrier	N/A

* expressed by functional unit (1 m^2)

N/A - not applicable

3. SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

3.1. A4 Transport to the building site – Construction process stage

The scenarios for A4 transport to the building site were according to EN 17160 regarding Product category rules for ceramic tiles.

Destination	Type of transport	Average distance (km)
National	Truck with a capacity of 25 tons	300
Europe	Truck with a capacity of 25 tons	1 390
International (Outside Europe)	Transoceanic freight ship	6 520

3.2. A5 Installation of the product in the building – Construction process stage

For the installation stage the scenario was also according to the options defined in EN17160 and Almeida, 2019. The option chosen was 3.3 kg of cementitious adhesive for each m^2 of ceramic tile. The ceramic material loss considered was 3%. The waste included also the packaging waste.

Option 3 (medium size tiles)	Value	Unit of measure
Cementitious adhesive	3.3	kg

3.3. B1 Use stage

According to the specific PCR for Product category rules for ceramic tiles - EN 17160, the environmental impacts generated during the use phase are very low and therefore can be neglected. Ceramic tiles are robust and have a hard, abrasion-resistant surface.

There are no impacts on the environment during the use stage.

3.4. B2 Maintenance

Ceramic covering products shall be cleaned regularly, depending on the type of building: residential, commercial, healthcare. Thus, the consumption of water and cleaning agents has been considered. The values declared in this stage refer to a time period of 50 year. The scenario for maintaining ceramic floor and wall tiles was conservative and according to EN 17160. The scenario used for maintaining ceramic floor tiles was for residential use, using 0.134 ml detergent and 0.1 l water to wash 1 m^2 of ceramic wall tiles once every three months.

Parameter	Value	Unit of measure
Water consumption	0.1	l
Detergent consumption	0.134	ml
Wall tile maintenance cycle	200	Number per RSL

3.5. B3 Repair

In general the service life of ceramic tiles is the same as the building life time. Repair, replacement and refurbishment is not required for ceramic tiles.

Thus according to EN 17160, ceramic tiles require no repairing during the use phase and therefore no impacts should be declared in the repair phase.

3.6. B4 Replacement

In general the service life of ceramic tiles is the same as the building life time. Repair, replacement and refurbishment is not required for ceramic tiles.

3.7. B5 Refurbishment

In general the service life of ceramic tiles is the same as the building life time. Repair, replacement and refurbishment is not required for ceramic tiles.

Thus according to EN 17160, ceramic tiles require no repairing during the use phase and therefore no impacts should be declared in the refurbishment phase.

3.8. B6 Use of energy

This module is not relevant for ceramic tiles, according to EN 17160.

3.9. B7 Use of water

This module is not relevant for ceramic tiles, according to EN 17160.

3.10. [C1 – C4] End of life of the product

C1: This module, according to the PCR developed in EN 17160, is not relevant for ceramic tiles.

C2: The ceramic tile demolition waste is transported from the building site to a container or treatment plant by truck and an average distance of 20 km is considered, according to the default scenario of EN17160.

C3-C4: the end-of-life scenario is described in the following table:

Destination	Value	Unit of measure
Recycling (C3)	70	%
Landfill (C4)	30	%

3.10.b Benefits and Loads Beyond the Product System Boundary (D):

Module D includes credits from materials recycling of tiles and packaging and energy credits from thermal recovery of the packaging.

According to EN 17160, after the demolition/deconstruction stage, ceramic tiles can be crushed and then used in a range of different applications:

- road construction in filled embankment;
- concrete aggregates;
- when ceramic tiles are crushed, it forms recycled ceramic aggregates which can be integrated as a partial substitute of natural aggregate in hot-mix asphalt [8];
- recycled ceramic aggregates can be used in the construction of landfills [8];
- recycled ceramic aggregates can be utilized in the construction of sub-based courses on secondary roads [8].

In this case, and according to the Environmental Nacional Agency (APA, 2020), in Portugal the valorization rate of ceramic materials in construction and demolition waste is aprox. 75%.

3.11. Additional Information on Release of Dangerous Substances to Indoor Air, Soil and Water during the Use Stage

Cinca products have achieved the GREENGUARD Certification by third-party, which is related to indoor air pollution and the risk of chemical exposure.

GREENGUARD Acceptable IAQ Criteria		168 Hour Product Measurement	Product Compliance for IAQ
TVOC[a]	≤ 0.5 mg/m³	< 0.003 mg/m³	Yes
Formaldehyde	≤ 0.05 ppm	< 0.003 ppm	Yes
Total Aldehydes[b]	≤ 0.10 ppm	< 0.003 ppm	Yes
4-Phenylcyclohexene	≤ 0.0065 mg/m³	< 0.003 mg/m³	Yes
Individual VOCs	all ≤ 1/10 TLV	----------[c]	Yes

[a] "TVOC" is the sum of all VOCs measured via TD/GC/MS which elute between n-hexane (C6) and n-hexadecane (C16) quantified using calibration to a toluene surrogate.
[b] "Total Aldehydes" is the sum of all measured normal aldehydes from formaldehyde to nonanal, plus benzaldehyde. Heptanal through nonanal are analyzed using TD/GC/MS. The remaining aldehydes are analyzed using HPL/UV methodology. All aldehydes are quantified to authentic standards.
[c] All individual VOCs detected met the criteria of less than 1/10 the ACGIH established threshold limit values (TLVs).

Target List Aldehydes at 24 Elapsed Exposure Hours		
CAS Number	**Compound**	**Emission Factor (µg/m².hr)**
4170-30-3	2-Butenal	BQL
75-07-0	Acetaldehyde	BQL
100-52-7	Benzaldehyde	BQL
5779-94-2	Benzaldehyde, 2,5-dimethyl	BQL
529-20-4	Benzaldehyde, 2-methyl	BQL
620-23-5 / 104-87-0	Benzaldehyde, 3- and/or 4-methyl	BQL

123-72-8	Butanal	BQL
590-86-3	Butanal, 3-methyl	BQL
50-00-0	Formaldehyde	BQL
66-25-1	Hexanal	BQL
110-62-3	Pentanal	BQL
123-38-6	Propanal	BQL

BQL denotes below quantifiable level of 0,04 µg based on a standard 18 L air collection volume for TVOC and individual VOCs and 0,1 µg based on a standard 45 L air collection volume for formaldehyde and total aldehydes.

3.12. Other additional information

Environmental protection

The manufacturing of CINCA's floor tiles is based on Best Available Techniques (BAT) in the industry, with the aim of reducing natural resources and energy to a minimum.

100% of manufacturing recyclable residues are reutilized in the manufacturing. Production lines reutilize closed water circuits that are adequately treated resulting in a part discharge of residual waters into the environment. Gas emissions levels are analysed periodically to confirm its conformity with local and European rules and regulations. Whenever necessary appropriate treatment systems are in place.

The cardboard boxes and wooden pallets are non-reusable and therefore are sent to the respective recycling centres.

Permanent monitorization of all processes and systems allow for improved quality, minimizing waste and resources to reduce any environmental impact to a minimum. CINCA has strict environmental control systems implemented, which in many aspects, are beyond that required by National and European Union regulations.

CINCA's Integrated Management System is submitted periodically to third party evaluation that monitor CINCA's capacity to comply with legal regulations, as well as the achievement of targets set out by the company itself.

Under normal conditions of use, life span of ceramic floor tiles is higher than any other product conceived for the same use.

Ceramic products are considered inert and no particular care is required in its treatment as a residue. In the event of replacement, ceramic tiles are easy to recycle and may be used as raw materials for other industries.

All packaging materials (boxes, plastic and wooden pallets) are totally recyclable and easily reutilized.

CINCA

REFERENCES

✓ **Almeida. M.** (2019). Desempenho ambiental de produtos no sector cerâmico em Portugal. Tese de doutoramento. Universidade de Aveiro.

✓ **Direção-Geral de Energia e Geologia (DGEG)** – Energy in Portugal Report (2019)

✓ **Direção-Geral de Energia e Geologia (DGEG)** – Monthly Data of Electrical Energy (2019). (in http://www.dgeg.gov.pt?cr=15125)

✓ **Ecoinvent database v3.7** (2019). (www.ecoinvent.org)

✓ **EN 15804:2012+A1:2013** Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products;

✓ **EN 15942:2011** Sustainability of construction works – Environmental product declarations – Communication format business-to-business.

✓ **EN 17160:2019** – "Product category rules for ceramic tiles".

✓ **Entidade Reguladora dos Serviços Energéticos (ERSE)** – Special Regime Production (PRE) (2019) (in http://www.erse.pt/pt/desempenhoambiental/prodregesp/2019/Paginas/2019.aspx)

✓ General Instructions of the DAPHabitat System, Version 1.0, Edition March 2013 (in www.daphabitat.pt);

✓ **Instruções Gerais do Sistema DAPHabitat**, Version 1.0, March 2013 (in www.daphabitat.pt);

✓ **ISO 14025:2009** Environmental declarations and labels – Type III environmental declarations – Principles and procedures;

✓ **Redes Energéticas Nacionais (REN)** – Information Centre – Monthly Statistics (2019). (in http://www.centrodeinformacao.ren.pt/PT/InformacaoExploracao/Paginas/EstatisticaMensal.aspx)

✓ **PCR – basic module for construction products and services.** DAPHabitat System. Version 2.0, 2015 (in www.daphabitat.pt);

✓ **Regras para a Categoria de Produto (RCP) – Revestimento de Paredes.** Wall covering. RCP002:2014. DAPHabitat System. Version 1.0, February 2014 (in www.daphabitat.pt);

✓ **Regras para a Categoria de Produto (RCP) – Revestimento de Pavimento.** Floor covering. RCP001:2014 DAPHabitat System. Version 1.0, February 2014 (in www.daphabitat.pt).