DAPHabitat System

www.daphabitat.pt

ENVIRONMENTAL PRODUCT DECLARATION

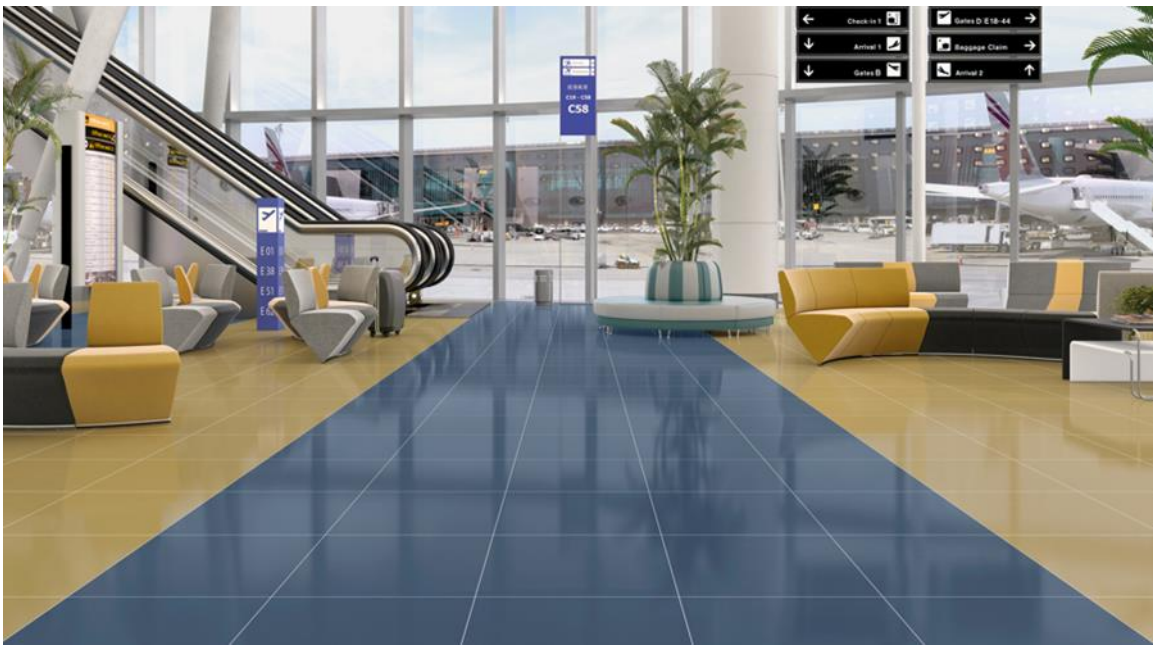
[according to ISO 14025, EN 15804:2012+A1:2013 and EN 15942]

DECLARATION NUMBER: DAP 012:2022

Porcelain Tiles

ISSUE DATE: 27/09/2022 VALID UNTIL: 27/09/2027

PAVIGRÉS CERÂMICAS S.A.



PAVIGRÉS GRUPO

centroHabitat
Plataforma para a Construção Sustentável

VERSION 1.1. EDITION JULY 2015

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1. GENERAL INFORMATION

1.1. The DAPHabitat System

Program operator:	Sustainable Construction Platform 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 401576
Website:	www.daphabitat.pt
Logo:	

1.2. EPD OWNER

Name of the owner:	Pavigrés Cerâmicas, S.A.
Production site:	Unidade de Fabril Pavigrés, Av. Alto das Domingas, 3780-244 – Aguim – Portugal Unidade Fabril Grespor, Av. Alto das Domingas, 3780-244 – Aguim Unidade Fabril Cerev, Zona Industrial da Quinta, 3050-481 – Mealhada Unidade Fabril Pavigrés II, Rua Indústrias, 3770-904 Bustos
Address (head office):	Av. Alto das Domingas, 3780-244 – Aguim – Portugal
Telephone:	00351 231 510 600
E-mail:	expediente@pavigres.com
Website:	https://pavigres.com/
Logo:	
Information concerning the applicable management Systems:	ISO 9001:2015 – Quality Management Systems ISO 14001:2015 – Environmental Management Systems
Specific aspects regarding the production:	CAERev.3 23312 – Manufacture of tiles, mosaics, and ceramic slabs

Organization's environmental policy:	PAVIGRÉS CERÂMICAS, S.A., has as: **Mission**: Create and produce ceramic flooring and wall that reinforce PAVIGRES prestige and trust in the global market, ensuring the Group's sustainability and development. **Policy**: Assuming, as a fundamental vector for its success, the permanent focus on the Customer, translated into the constant concern to anticipate and respond to market expectations. To present global and integrated solutions for ceramic wall and flooring, with products that stand out in the market for their recognized quality and aesthetic value. This Policy is aligned and developed in the following areas: • Promote and encourage the continuous improvement of its Management System, in order to guarantee high levels of performance of its processes, products and services, in order to meet and overcome the needs and expectations of the customers, shareholders and other relevant stakeholders; • Provide the company with the human resources by developing the skills of its employees, encouraging initiative, productivity and a responsible attitude in improving processes and procedures; • Fulfill the applicable compliance obligations, namely legal, regulatory, normative and others that Pavigrés subscribes as applicable; • Protect the environment by promoting the prevention of pollution through the management of the consumption of natural resources, water and energy, and the implementation of good practices, namely, prioritizing the recovery of waste over its elimination, whenever possible, in order to continuously improve the environmental performance; • Provide the necessary resources and means to comply with the strategic guidelines established, creating conditions for possible investments in new projects focused on the satisfaction of relevant stakeholders, in order to promote the financial consolidation of Pavigrés. The Management System Policy is thus assumed by PAVIGRÉS with **LOYALTY, RIGOR AND COMMITMENT**, being communicated to all employees and disclosed to other interested parties, as appropriate

1.3. Information concerning the EPD

Authors:	1. Centro Tecnológico da Cerâmica e do Vidro 2. PAVIGRÉS CERÂMICAS, 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. Pavigrés Cerâmicas, S.A., Av. Alto das Domingas, 3780-244 - Aguim (T) +351 231 510 600; E. qualidade@pavigres.com
Issue date:	27/09/2022
Registration date:	31/10/2022
Registration number:	DAP 012:2022
Valid until:	27/09/2027
Representativity of the EPD (location, manufacturer, group of manufacturers):	DAP of one (1) product class, produced in four (4) industrial units, belonging to one (1) single producer (Pavigrés Cerâmicas, S.A.).
Where to consult explanatory material:	www.pavigres.com
Type of EPD:	cradle-to-gate EPD

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 (s)**
This EPD was validated based on FDES registry number 20220730563, verified by the INIES (France) verification program on 09/27/2022	INIES Program Verifier

1.5. EPD Registration

Program Operator
(Plataforma para a Construção Sustentável)

PAVIGRÉS GRUPO

1.6. PCR of reference

Name:	1. PCR: Base models for products and construction services 2. Floor tiles 3. Wall tiles 4. EN 17160:2019 - Product category rules for ceramic tiles
Issue date:	1. November 2020 2. November 2020 3. November 2020 4. February 2019
Number of registration on the data base:	1. RCP-mb001 2. RCP001:2014 3. RCP002:2014 4. –not applicable
Version:	1. Version 2.1 2. Version 1.1 3. Version 1.1 4. – not applicable
Identification and contact of the coordinator (s):	1. PCR: Base models for products and construction services • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt • José Silvestre | jds@civil.ist.utl.pt 2. PCR: Floor tiles • Luís Arroja | arroja@ua.pt • Marisa Almeida | marisa@ctcv.pt 3. PCR: Wall tiles • Luís Arroja | arroja@ua.pt • Marisa Almeida | marisa@ctcv.pt
Identification and contact of the authors:	1. PCR: Base models for products and construction 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 tiles • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt • Ana Cláudia Dias | acdias@ua.pt 3. PCR: Wall tiles • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt • Ana Cláudia Dias | acdias@ua.pt
Composition of the Sectorial Panel:	1. RCP: Floor tiles • 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. 2. RCP: Wall tiles • 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 Cerâmica
Consultation period:	1. 18/11/2015 - 18/01/2016 2. 12/08/2013 - 30/11/2013 3. 01/08/2013 - 30/11/2013
Valid until:	1. December 2022 2. December 2022 3. December 2022

1.7. Information concerning the product/product class

Identification of the product: Porcelain tiles for covering floors and walls

Illustration of the product:

Brief description of the product:

Porcelain tiles produced by the PAVIFRÉS CERÂMICAS, S.A. group are used as floor and wall covering, both indoors and outdoors in residential and public areas. This product is waterproof and has high mechanical resistance, with a wide range of dimensional and aesthetic options available on the market, both in terms of visual effects, texture and colors.

Ceramic tiles are a material produced from clays, kaolins, sands and feldspars as main raw materials.

The ceramic tiles included in this study belong to the water absorption group BIa, classified according to EN 14411:2012, i.e. ceramic tiles with a water absorption of less than or equal to 0.5% (≤ 0, 5%).

This DAP shows the results per unit of mass (1kg) of the product. However, since the production process is the same, regardless of the thickness or shape of the products, it is possible to convert these results to other units – m^2, for example – using conversion factors, according to the weights indicated in the following table:

Table 1: Conversion factors

Thickness (mm)	Weight (kg/m^2)	Thickness (mm)	Weight (kg/m^2)
7,6	17,1	10,5	24,2
8,3	18,4	10,8	25,0
8,5	19,4	11,0	25,0
8,8	19,9	12,0	26,5
9,2	21,2	14,0	31,9
9,5	21,5	-	-

Note: Table of average weights per m^2 (kg/m^2), depending on the thickness of the product. For more accurate information on the weights per unit area of each reference, please consult the weights and packaging table on the PAVIGRÉS website.

Main technical characteristics of the product:

Table 2: Technical characteristics

Parameters	Value	Standard
Dimensional characteristics	Linear dimensions ± 0,3%; except width ≤97mm | ± 0,4% ; except formats > 597x597 mm | ± 0,2%. Orthogonality ± 0,3 %; except width ≤97mm | ± 0,4% Straightness of edges ± 0,3 %; except width ≤97mm | ± 0,4%. Flatness ± 0,3%; except width ≤97mm | ± 0,4% Thickness ± 3 %, except formats 600x600mm |± 0,4%	NP EN ISO 10545-2
Water absorption	≤0,1%	NP EN ISO 10545-3
Breaking strength in N	≥1500 N	NP EN ISO 10545-4
Rupture modulus N / mm^2	≥45 N/mm^2 | ≥460 kg/cm^2	
Deep scratch resistance (mm^3)	130 mm^3	NP EN ISO 10545-6

	Surface abrasion resistance (mm^3)	Indicated for each ref.	NP EN ISO 10545-7
	Linear thermal expansion ($x10^{-6}\ k^{-1}$)	≤7	NP EN ISO 10545-8
	Thermal shock resistance	Resistant	NP EN ISO 10545-9
	Frost resistance	Resistant	NP EN ISO 10545-12
	Resistance to hair cracking	Guaranteed	NP EN ISO 10545-11
	Resistance to household cleaning products and pool additives	Guaranteed	NP EN ISO 10545-13
	Resistance to low/high concentration acids and alkalis	To be confirmed case by case	NP EN ISO 10545-13
	Stain resistance	Tiles | Guaranteed Unglazed tiles | ≥ Classe 2	NP EN ISO 10545-14
	Lead and cadmium release	Below the limit of quantification: < 0,2 mg Pb/l < 0,02 mg Cd/l	NP EN ISO 10545-15
	Anti-slip features (slipperiness)	To be confirmed case by case	DIN 51130 DIN 51097 ENV 12633 BS7976-2

Description of the products application:

These products have a wide range of construction applications namely:

- Floor covering
- Wall covering
- Interior coverings
- Exterior coverings
- Residential areas and buildings
- Public areas and buildings
- Industrial areas and buildings

Reference service life:

According to EN 17160, the RCP of this product is based on EN 14411:2012 (Ceramic Tiles - Definitions, classification, characteristics, conformity assessment and marking), the reference life of the product is estimated at 50 years. No repairs, renovations or replacements are required during this lifetime.

Table 3: Ceramic stoneware properties

Parameters	Value
Reference life span	50 years
Declared product properties (outside the factory) and finishes.	See table 1
Theoretical application parameters (if imposed by the manufacturer), including references to appropriate practices	NF P 61-204-1 – DTU52.2
Quality of work	See cover image
Outdoor environment (for outdoor applications), e.g. weather, pollutants, UV and wind exposure, building orientation, shade, temperature	NF P 61-204-1 – DTU52.2
Indoor environment (for indoor applications), e.g. temperature, humidity, chemical exposure	NF P 61-204-1 – DTU52.2
Conditions of use, e.g. frequency of use, mechanical exposure	NF P 61-204-1 – DTU52.2
Maintenance, e.g. frequency, type and quality required and replacement of replaceable components	Wash with water and detergent twice a month

Placing on the market / Rules of application in the

EN 14411:2012

NP EN ISO 10545

market / Technical rules of the product:	DIN 51130 DIN 51097 ENV 12633 BS 7976-2
Quality control:	According to the technical standards of the product
Special delivery conditions:	Not applicable
Components and substances to declare:	The product is made up of a ceramic support (93-95% of the total weight corresponding to 20.0 to 20.4 kg) and enamel (glazing) and dyes (5-7% of the total weight corresponding to 1.1 to 1.5 kg). The total weight of the final product is 21.5 kg/m^2 (on average with a thickness of 9.5 mm). This product does not contain hazardous substances listed in the candidate lists of the REACH regulation above the 0.1% (declarative) threshold.
History of the LCA studies:	DAP project report nr 002:2019 (sistema DAPHabitat) e DAP nr 00000878 (ecoplatform) Project report FDES 20220730563 (sistema INIES - France)

Table 4: Composition of ceramic stoneware

Parameters	Percentage (%)	Weight (kg)
Ceramic support	93 – 95	20,0 a 20,4
Enamel (glazing) and dyes	5 – 7	1,1 a 1,5

Table 5 presents the reference flow of the life cycle analysis, the quantities of product studied required by the functional unit described, the possible complementary products and the quantities of packaging for the finished product.

Table 5: Description of the reference flow, complementary product and finished product packaging

Parameters	Units	Value
Reference flow		
Porcelain tiles	kg/m^2	21,5
Reference thickness	mm	9,5
Complementary product required for installation		
Adhesive mortar for ceramic tiles laying	kg/m^2	5,42
Final product packaging		
Paperboard	g/m^2	113
Plastic film	g/m^2	14
Wood	g/m^2	172

Declared unit:	1m² of ceramic tiles to cover and decorate the surface/floor inside a house during a reference grace period of 50 years, according to the installation conditions
Functional unit:	-
System boundaries:	cradle-to-gate EPD
Criteria for the exclusion:	According to point 6.3.5 of NP EN 15804, the exclusion criterion for unit processes is 1% of the total energy consumed and 1% of the total mass of inputs, with special attention to not exceeding a total of 5% energy and mass flows excluded in the product step. The following processes were not considered in this study, as they may be covered by the exclusion criterion or the scope of the standard: • Environmental loads associated with the construction of industrial infrastructure and the manufacture of machinery and equipment • Environmental burdens related to infrastructure (production and maintenance of vehicles and roads) for transporting pre-products; • Long term emissions.
Assumption and limitations:	For processes over which producers have no influence or specific information, such as the extraction of raw materials, generic data from Ecoinvent v3.7 databases were used. The dataset used to model the production of electricity and natural gas was adapted to the national reality. The electricity mix was updated for 2021 through information from the National Energy Networks (REN), the Regulatory Authority for Energy Services (ERSE) and the Directorate-General for Energy and Geology (DGEG), in order to obtain more accurate results. information regarding the environmental impacts generated by the electricity grid in Portugal. The natural gas process was modeled according to the information provided by the DGEG's Energy in Portugal report (2021), in relation to the countries of origin of its importation. The environmental impacts presented in this DAP (EPD) are related to a weighted average of all products from Pavigrés, Grespor, Cerev and Pavigrés II, manufactured in porcelain stoneware in 2021, based on the production of each manufacturing unit.
Quality and other characteristics about the information used in the LCA:	The primary data are for 2021 and they are representative of the manufacturing of products in Portugal. Sources are data from Pavigrés, official statistics and EN 17160:2019. Basic data comes from Ecoinvent 3.7 (2021).
Allocation rules:	In this study on porcelain tiles, there are no co-products produced associated with its manufacturing process. However, at the Pavigres factory, glazed floor tiles are also produced and at the Cerev factory, also wall tiles. At the Grespor and Pavigrés II factories only porcelain tiles are produced. For certain flows, the allocation was established based on measurements carried out at the level of each manufacturing unit. For all other flows, the allocation is in bulk. The energy was used according to the type of parameters and the type of process.
Comparability of EPD for construction products:	The EPD of construction products and services cannot be comparable in case they are not produced according to EN 15804 and EN 15948 and according to the comparability conditions determined by ISO 14025.

2. ENVIRONMENTAL PERFORMANCE OF THE PRODUCT

2.1. Calculation rules of the LCA

2.1.1. Flow diagram of input and output of the processes

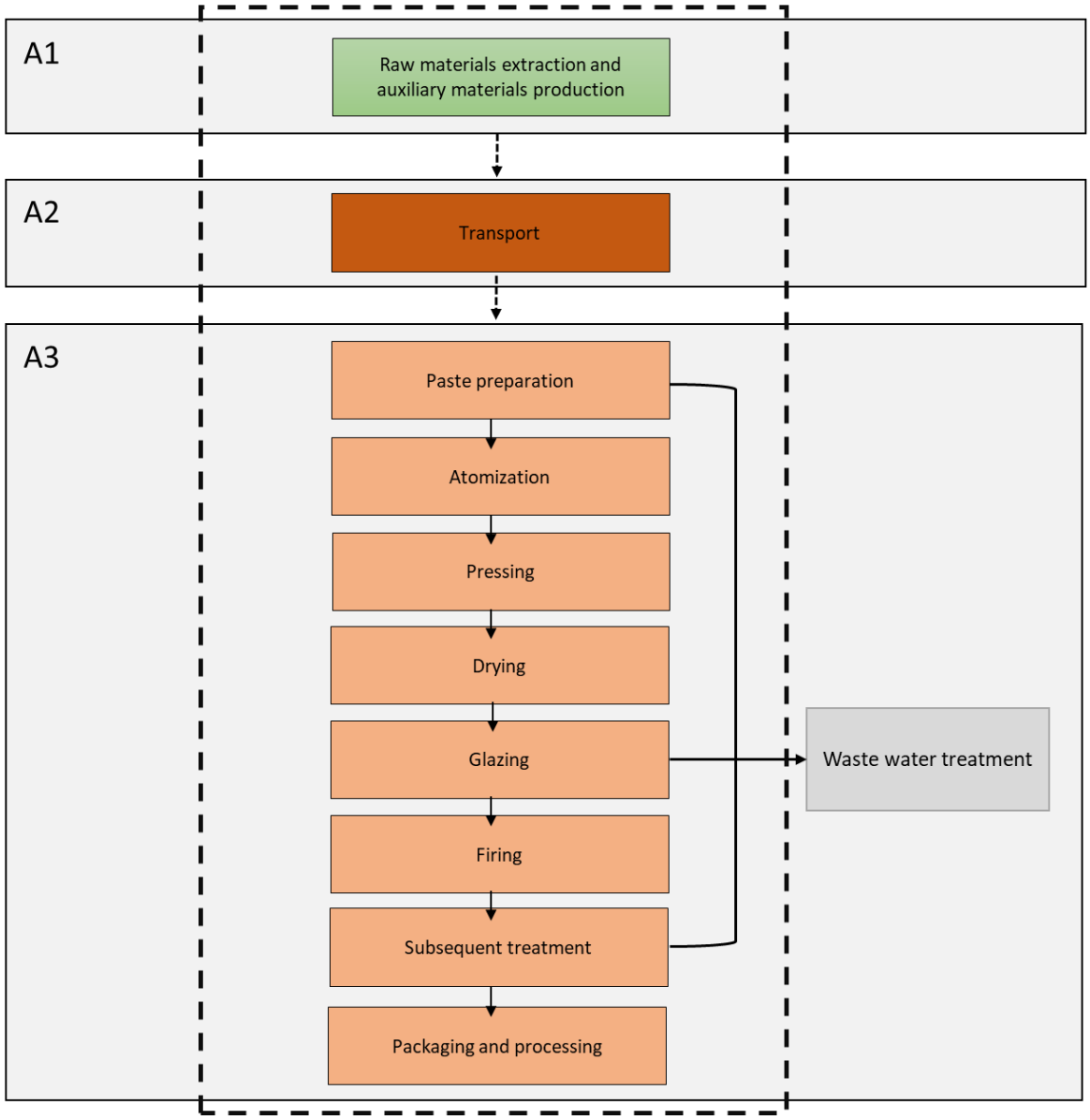

Figure 1: Stages of porcelain stoneware production (A1-A3).

This EPD evaluates the A1-A3 stage of the products life cycle, including the extraction and production stage of all products and materials used as raw materials, the transport of these materials from suppliers to Pavigrés industrial units and the processing of these materials to the production of the final products, including their packaging.

- **Production stage, A1 – A3**:

Steps A1 to A3 include the extraction of raw materials, their transport to the factory and the manufacture of the product.

A1 – Extraction and transformation of raw materials: this step includes the extraction and possible transformation of raw materials. Natural raw materials, synthetic raw materials and additives are used, the main ones being: clays, feldspars, sands and kaolins.

A2 – Transport: raw and auxiliary materials are transported by tanker truck or ship and then by tanker truck.

A3 – Production: this stage includes design and development, raw material storage, paste preparation, molding (pressing), drying, glazing or decoration, firing and sorting, further processing (e.g. polishing), packaging and storage .

Pavigrés Cerâmicas, SA. (at its Pavigrés, Grespor, Cerev and Pavigrés II units) is dedicated to the production of ceramic tiles (floor and wall, in porcelain and non-porcelain tiles, glazed and unglazed) by pressing atomized powder, followed by drying and firing. Natural raw materials, synthesized raw materials and additives are used, the main ones being: clays, feldspars, sands and kaolins.

Hard raw materials (sands, feldspars, etc.) are subjected to grinding, and clays are subjected to turbodilution; later, they are mixed and homogenized (storage and mixing), constituting the final composition of the ceramic paste.

The ceramic paste in the form of “barbotine” is then coloured and atomized (sprayed and dried), forming the ceramic powder which, after being homogenized, is pressed - conformation by pressing. The raw pressed tiles are subjected to a quick drying cycle, to eliminate their residual moisture and, finally, subjected to the firing process, an operation that will give it all the final physical-chemical characteristics.

The fuel used in the atomization, drying and firing processes is Natural Gas.

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	Usage	Maintenance	Repair	Replacement	Refurbishment	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
✓	✓	✓	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘

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**	1,26E+01	2,20E-06	2,58E-02	4,18E-03	1,87E-03	7,78E-04	1,71E+02
Transport	**A2**							
Manufacturing	**A3**							
Total	**Total**	**1,26E+01**	**2,20E-06**	**2,58E-02**	**4,18E-03**	**1,87E-03**	**7,78E-04**	**1,71E+02**

LEGEND:

Product stage

Units expressed per functional unit (1 m^2, which corresponds to an average weight of 21.5 kg/m^2)

2.3. Parameters describing the use of resources

		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 m³
Raw material supply	**A1**	2,59E+01	2,86E-04	2,59E+01	1,95E+02	1,33E-01	1,95E+02	0,00E+00	0,00E+00	0,00E+00	1,03E-01
Transport	**A2**										
Manufacturing	**A3**										
Total	**Total**	**2,59E+01**	**2,86E-04**	**2,59E+01**	**1,95E+02**	**1,33E-01**	**1,95E+02**	**0,00E+00**	**0,00E+00**	**0,00E+00**	**1,03E-01**

LEGEND:
Product stage

Units expressed per functional unit (1 m^2, which corresponds to an average weight of 21.5 kg/m^2)

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.

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**	2,38E-03	2,10E+00	3,33E-04
Transport	**A2**			
Manufacturing	**A3**			
Total	**Total**	**2,38E-03**	**2,10E+00**	**3,33E-04**

LEGEND:
Product stage

Units expressed per functional unit (1 m^2, which corresponds to an average weight of 21.5 kg/m^2)

2.5. Other environmental information describing output flows

Parameters	Units*	Results
Components for re-use	kg	0
Materials for recycling	kg	5,22E-01
Radioactive waste disposed	kg	0
Materials for energy recovery	kg	4,44E-02
Exported energy	MJ per energy carrier	0
* expressed by functional unit or declared unit		

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REFERENCES

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

✓ **PCR – basic module for construction products and services.** DAPHabitat System. Version 1.0, 2013 (in www.daphabitat.pt);

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

✓ **EN 15804:2012** 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.