ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO14025 and EN15804 for

Porcelain Tiles

from

Kaleseramik Çanakkale Kalebodur Seramik Sanayi A.Ş.

Programme :	The International EPD® System	EPD Turkey, fully aligned regional programme
Programme Operator :	EPD Turkey www.epdturkey.org	EPD International AB www.environdec.com
EPD Registration Number:	S-P-00874	
ECO Platform Reg. Number:	ECO-00000716	
Publication Date:	28.05.2018	
Validity Date :	14.05.2023	
Geographical Scope:	Global	

INFORMATION

The LCA for this EPD is conducted according to the guidelines of ISO 14040/44 and the requirements given in the Product Category Rules (PCR) document for Construction Products and Construction Services (2012:1, Version 2.2) and SUB-PCR-D bricks, blocks, tiles, flagstone of clay and siliceous earths (construction product) with reference to EN 15804 and the general program guidelines by The International EPD System in accordance with ISO 14025 standards.

The inventory for the LCA study is based on the 2016 production figures for porcelain manufactured by Kaleseramik Çanakkale Kalebodur Seramik Sanayi A.Ş. (Kale) in their Çan production plant located in Çanakkale, Turkey.

The LCA was modelled with SimaPro 8.4 LCA software using the impact factors and the Ecoinvent database (V3.2) for secondary data and Turkish Life Cycle Inventory Database (TLCID) developed by Turkish Centre for Sustainable Production Research and Design (SÜRATAM) for local data.

EPD Programme	The International EPD® System **www.environdec.com**
EPD Programme Operator	EPD Turkey, Istanbul - Turkey **www.epdturkey.org**
EPD Owner	Kaleseramik Çanakkale Kalebodur Seramik Sanayi A.Ş. **www.kale.com.tr**
Declared Unit	1 m^2 average porcelain tiles
CPC Code	3731
EPD Based on Product Category Rules (PCR)	The CEN standard EN 15804 serves as the core PCR The International EPD® System's PCR 2012:01 Construction products and Construction services, Version 2.2, 2017-05-30 SUB-PCR-D bricks, blocks, tiles, flagstone of clay and siliceous earths
PCR Review Conducted by	The Technical Committee on the International EPD ® System. Chair Massimo Marino. Contact via www.environdec.com info@environdec.com
Independent Verification and data, according to ISO 14025:2006	☐ Internal ☑ External ☐ EPD® Process Certification
System Boundaries	☐ Cradle to Gate ☐ Cradle to Gate with Option ☑ Cradle to Grave
Approved and Verified by	Vladimír Kočí, PhD
LCA Report and EPD Prepared by	Metsims Sustainability Consulting **www.metsims.com**

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 Norm.

The EPD certificate, its background data and the results will be used for business-to-business communications and is expected to be a reliable document for green building designers, architectures, manufacturers of construction products and the other stakeholders in the construction sector to understand the potential environmental impacts caused by porcelain tiles.

For more information about this Environmental Product Declaration or its contents, please contact
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ABOUT KALE

Laying its foundation with Çanakkale Ceramic Factories Corporation in 1957, Kale Group pioneered the formation of the ceramics industry in Turkey, and has become an industry giant with its investments. It has grown over the course of time with investments in construction products, machinery and equipment manufacturing, defence, chemistry, electrical appliances, energy, IT, transportation, tourism and food industries. Kale Group is currently comprised of 17 companies, and is regarded as one of the most important industrial enterprises of Turkey with over 5000 employees, spanning over a geography across Çanakkale to several locations in Turkey to Italy and Russia. Today, Kale Group is Europe's 3rd and the world's 12th largest ceramics manufacturer. Kale Group provides its products to consumers in over 100 countries via more than 400 sales points.

Kaleseramik, a company of Kale Group, manufactures ceramic tiles with a production capacity of 66 million m^2 ceramic tile/year. Kaleseramik's tile products take place in market under Çanakkale Seramik, Kalebodur and Kale brand names.

Kaleseramik that aims for continuous development has received the following certifications within the scope of the system standards; TS EN ISO 9001:2015, ISO 10002:2006, TS EN ISO 14001:2015, ISO 50001:2011, ISO 27001 and OHSAS 18001:2014.

PRODUCT INFORMATION

Kaleseramik Porcelain Tiles are primarily made of clay, kaolin and feldspar but they also include other raw materials. The production technology of tiles is dry pressing. The required composition is blended with water to form slurry. This slurry then fed into spray driers to form uniform granules ready for compaction. These granules are then shaped to form the green body. The formed green body may then be glazed if required. The green ceramic body is fired at high temperatures, resulting in a hard body. The Kale porcelain tiles comes in glazed and non-glazed porcelain tiles with non-glazed matt, glossy or anti-slip surface options, in the dimensions of 20x20cm, 30x30cm, 40x40cm, 30x60cm, 60x60cm and 60x120cm, allow the designer to meet the requirements of projects, thanks to the superior technical characteristics, as well as colours and patterns. This EPD declaration is applicable to average Kaleseramik Porcelain tiles.

Technical Specification		**Kaleseramik Porcelain Tiles**	**Related Standards**
Water Absorption (%)		<0.5%	ISO 10545-3
Breaking Strength(N)	Thickness ≥ 7.5 mm	1700 N	ISO 10545-4
	Thickness < 7.5 mm	-	
Modules of Rupture (N/mm^2)		Min. 35	ISO 10545-4
Impact Resistance		Compliant	ISO 10545-5
Resistance to Surface Abrasion for Glazed Tile		Class: 1-2-3-4-5	ISO 10545-7
Linear Thermal Expansion Coefficient (100°C)		Compliant	ISO 10545-8
Resistance to Thermal Shock		Compliant	ISO 10545-9
Crazing Resistance for Glazed Tiles		Resistant	ISO 10545-11
Frost Resistance		Resistant	ISO 10545-12
Resistance to Low Concentrations of Acids and Alkalis		GLA-GLB	ISO 10545-13
Resistance to High Concentrations of Acids and Alkalis		Compliant	ISO 10545-13
Resistance to Household Chemicals and Swimming Pool salts (glazed & unglazed)		Min. GB	ISO 10545-13
Resistance to Stain		Min. Class 3	ISO 10545-14

Areas of Use

Ceramic covering material can be used in several applications such as interiors, exterior façades, pools, public places, commercial buildings, etc. It is important to select the suitable ceramic tile for the area of application. Ceramic porcelain tiles are used for inside and out-side applications. Thanks to its superior technical characteristics, the product may be utilised in the following areas: commercial buildings, residential areas , public buildings education and cultural buildings, floors, walls and exterior facades; and floors of outdoor facilities such as gardens, terraces, pool sides and recreation areas.

No substances included in the Candidate List of Substances of Very High Concern for authorisation under the REACH Regulations are present in the ceramic tiles manufactured by Kaleseramik, either above the threshold for registration with the European Chemicals Agency or above 0.1% (wt/wt).

SYSTEM BOUNDARY

PRODUCT STAGE

A1. Raw Material Supply includes raw material extraction and pre-treatment processes before production. In this report, production for each product starts with raw material acquisition.

A2. Transport is relevant for delivery of raw materials to the plant and involves forklift usage within the factory.

A3. Manufacturing stages include production of granules by spray drying, forming, drying, glazing, firing and packaging. Transport is only relevant for delivery of raw mate-rials to the plant and forklift usage within the factory.

CONSTRUCTION PROCESS STAGE

A4. Transport includes transportation of ceramic tiles to the construction site. Kaleseramik transport tiles by road haulage (89%), railway (8%) and seaway (3%) to the distribution centres. From there, local road transport of 50 km with Euro 5 class truck with capacity of 27 tones is assumed.

A5. Installation of the Product stage includes the adhesive mortar usage in the construction site in addition packaging waste transportation and disposal processing. For 1 m^2 ceramic tile installation; 3.3 kg mortar and 0.8 L water usage assumed. A 3% (in mass) wastage is assumed during the installation.

Packaging waste scenario is created separately depending on the geographic location of the installation process. Packaging waste is assumed to end up at packaging recycling streams due to the relevant national law in Turkey, which requires at least 54% of the packaging waste to be recovered in 2016. For Europe case; according to the Directive 94/62/EC of 20 December 1994 on packaging and packaging waste, 60% of the packaging waste is assumed to go to reuse, recovery, and recycling. Average distance from waste container to destination is assumed as 30 km.

USE STAGE

B1. Use stage concerns emissions into environment. Use phase is not relevant for this product.

B2. Maintenance includes cleaning facilities with water and detergent. Kaleseramik advices to use detergent containing stain remover or neutral low-sulphate and rinse with tap water after cleaning. 0.2 mL detergent and 0.1 L water use is assumed to wash 1 m^2 Kaleseramik ceramic porcelain tiles. Maintenance cycle of Kaleseramik ceramic porcelain tiles is 4 times a year.

B3. Repair: Kaleseramik ceramic tiles require no repairing during the use phase and therefore no impacts should be declared in module B3.

B4. Replacement: Kaleseramik ceramic tiles require no replacement during the use phase and therefore no impacts should be declared in module B4.

B5. Refurbishment: Kaleseramik ceramic tiles require no refurbishment during the use phase and therefore no impacts should be declared in module B5.

B6. Operational Energy Use: Operational energy use is not relevant for this product.

B7. Operational Water Use: Operational water use

END OF LIFE STAGE

C1. De-construction, demolition at the end of RSL is usually conducted with a selective deconstruction/ demolition. The environmental impacts generated during the C1 phase are very low and therefore can be neglected.

C2. Transport (Waste) includes the transportation of the discarded tiles and adhesive mortar to final disposal. Average distance from waste container to final destination is assumed as 50 km.

C3. Waste Processing concerns crushing of discarded ceramic tiles before recycle or reuse. The environmental impacts generated during the C3 phase are very low and therefore can be neglected.

C4. Disposal construction and demolition waste scenario is created separately depending on the geographic location of the use phase. After domestic usage, ceramic tile products end up at construction and demolition waste landfills as their final fate and modelled as such in the LCA. For Europe's construction and demolition waste scenario, 50% of the waste is assumed to go to recycling according to EU Construction and Demolition Waste Protocol published on 09/11/2016.

PRODUCT STAGE

A1. Raw Material Supply

A2. Raw Material Transport

A3. Manufacturing

Green ceramic body preparation

Forming

Drying

Frit Preparation

Glaze&Paste Preparation

Glazing

Firing

Packaging & Storage

CONSTRUCTION PROCESS STAGE

A4. Transport to construction site

A5. Installation of the Product

USE STAGE

B1. Use

B2. Maintenance

B3. Repair

B4. Replacement

B5. Refurbishment

B6. Operational Energy Use

B7. Operational Water Use

END OF LIFE STAGE

C1. Deconstruction and Demolition

C2. Transport

C3. Reuse, Recovery and Recycling

C4. Disposal

ENVIRONMENTAL PERFORMANCE RELATED INFORMATION

Functional Unit/ Declared Unit	The declared unit is the production of 1 m^2 average porcelain tiles (22.0 kg)
Goal and Scope	Evaluation of environmental impacts for 1 m^2 average porcelain tiles from cradle to grave.
System Boundary	The system boundary covers A1 - A3 product stages referred as 'Raw material supply', 'Transport' and ' Manufacturing' , A4 - A5 'Construction', B1 - B7 'Use' and C1 – C4 'End of life' stages.
Cut-Off Rules	For this LCA study, no cut-off criteria was applied.
Background Data	For local data specific for Turkey, TLCID (V1.01) developed by SÜRATAM was used. For any other background data the Ecoinvent database (V3.2) was used.
Data Quality	Raw materials, energy and water consumption, waste and material and product transport data is collected from Kale.
Period Under Review	All primary data collected from Kale is for the period year of 2016.
Allocations	There are no co-products in the production of ceramic tile manufactured by Kale. Hence, there was no need for co-product allocation. Kale sources raw materials from different locations across Turkey and other parts of the world and by different means of transport (truck and ship). For this reason, transport was allocated according to tonnages for almost all raw materials bought by Kale. Kale manufactures various ceramic tiles in the Company's Çanakkale plant in Turkey. Electricity and combined heat power (CHP) powered by natural gas are used. Raw materials, transport, packaging, waste, and energy consumption data were allocated for each product using related production tonnages from Kale's Çanakkale plant for the average product.

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw Materials Supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste processing	Disposal	Reuse-Recycling-Recovery Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	NR	X	X	X	X	NR	NR	X	X	X	X	MND

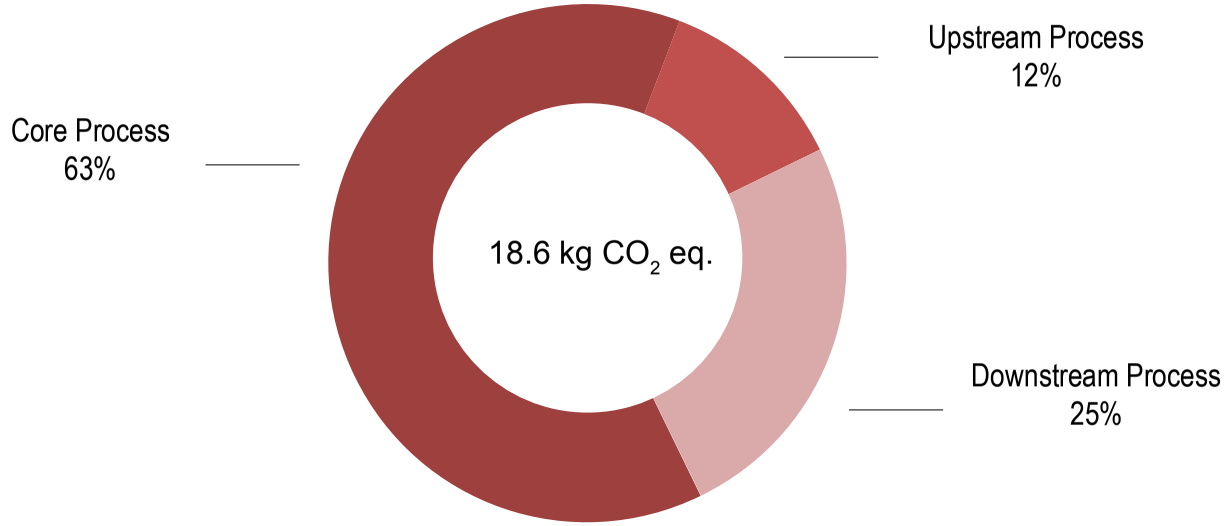
Description of the system boundary (X = Included in LCA, MNA= Module Not Declared, NR=Not Relevant)

The results of the LCA with the indicators as per EPD requirement are given in the following tables for product product stage (A1 - A3), construction process (A4, A5), use stage (B1 - B7), and end of life (C1 - C4). The system boundaries in tabular form for all modules are shown in the table above.

All energy calculations were obtained using Cumulative Energy Demand V1.09 methodology, while environmental impacts are calculated with the CML-IA baseline V4.2 within SimaPro LCA Software. The net fresh water use reflect the water consumption during manufacturing processes.

LCA RESULTS

ENVIRONMENTAL IMPACTS FOR 1 m² CERAMIC PORCELAIN TILES																
		Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	TOTAL
GWP	Fossil	[kg CO_2 eq.]	14.0	1.67	0.968	NR	0.028	0.134	0.000	0.000	NR	NR	0.000	1.35	0.000	0.134	18.3
	Biogenic	[kg CO_2 eq.]	$9.61x10^{-3}$	$565x10^{-6}$	$218x10^{-3}$	NR	$491x10^{-6}$	$82.1x10^{-6}$	0.000	0.000	NR	NR	0.000	$82.9x10^{-6}$	0.000	$581x10^{-6}$	$229x10^{-3}$
	Land Use & Transformation	[kg CO_2 eq.]	$5.41x10^{-3}$	$589x10^{-6}$	$553x10^{-6}$	NR	$125x10^{-3}$	$1.39x10^{-3}$	0.000	0.000	NR	NR	0.000	$60.4x10^{-6}$	0.000	$82.1x10^{-6}$	$133x10^{-3}$
	Total	[kg CO_2 eq.]	14.0	1.67	1.19	NR	0.153	0.136	0.000	0.000	NR	NR	0.000	1.35	0.000	0.135	18.6
ODP		[kg CFC11 eq.]	$1.21x10^{-6}$	$288x10^{-9}$	$39.2x10^{-9}$	NR	$5.85x10^{-9}$	0.000	0.000	0.000	NR	NR	0.000	$252x10^{-9}$	0.000	$24.7x10^{-9}$	$1.82x10^{-6}$
POCP		[kg C_2H_4 eq.]	$2.45x10^{-3}$	$390x10^{-6}$	$185x10^{-6}$	NR	$103x10^{-6}$	0.000	0.000	0.000	NR	NR	0.000	$247x10^{-6}$	0.000	$39.3x10^{-6}$	$3.42x10^{-3}$
AP		[kg SO_2 eq.]	$39.3x10^{-3}$	$11.5x10^{-3}$	$3.02x10^{-3}$	NR	$413x10^{-6}$	0.000	0.000	0.000	NR	NR	0.000	$6.42x10^{-3}$	0.000	$1.01x10^{-3}$	$61.7x10^{-3}$
EP		[kg PO_4^{3-} eq.]	$44.5x10^{-3}$	$5.41x10^{-3}$	$2.02x10^{-3}$	NR	$560x10^{-6}$	0.000	0.000	0.000	NR	NR	0.000	$1.32x10^{-3}$	0.000	$350x10^{-6}$	$54.2x10^{-3}$
ADPE		[kg Sb eq.]	$3.81x10^{-6}$	$29.3x10^{-9}$	$59.9x10^{-9}$	NR	$51.0x10^{-9}$	0.000	0.000	0.000	NR	NR	0.000	$3.95x10^{-9}$	0.000	$23.4x10^{-9}$	$3.98x10^{-6}$
ADPF		[MJ]	231	24.7	5.45	NR	0.489	0.000	0.000	0.000	NR	NR	0.000	20.8	0.000	2.26	285
Legend		GWP: Global Warming Potential, ODP: Ozone Depletion Potential, POCP: Formation Potential of Tropospheric Ozone Photochemical Oxidants, AP: Acidification Potential, EP: Eutrophication Potential, ADPE: Abiotic Depletion Potential for Non-fossil Resources, ADPF: Abiotic Depletion Potential for Fossil Resources, NR: Not Relevant														



LCA RESULTS

OUTPUT FLOWS AND WASTE CATEGORIES FOR 1 m² PORCELAIN																
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**TOTAL**
HWD	[kg]	3.44	0.000	0.000	NR	0.000	0.000	0.000	0.000	NR	NR	0.000	0.000	0.000	-	3.44
NHWD	[kg]	4.47	0.000	0.240	NR	0.000	0.000	0.000	0.000	NR	NR	0.000	0.000	0.000	25.0	29.7
RWD	[kg]	-	-	-	NR	-	-	-	-	NR	NR	-	-	-	-	-
Legend	HWD: Hazardous Waste Disposed, NHWD: Non-Hazardous Waste Disposed, RWD: Radioactive Waste Disposed, NR: Not Relevant															
RESOURCE USE FOR 1 m² PORCELAIN TILES																
PERE	[MJ]	63.26	0.940	0.771	NR	1.01	0.000	0.000	0.000	NR	NR	0.000	0.037	0.000	0.050	66.1
PERM	[MJ]	0.000	0.000	0.000	NR	0.000	0.000	0.000	0.000	NR	NR	0.000	0.000	0.000	0.000	0.000
PERT	[MJ]	63.26	0.940	0.771	NR	1.01	0.000	0.000	0.000	NR	NR	0.000	0.037	0.000	0.050	66.1
PENRE	[MJ]	231	24.7	5.46	NR	0.489	0.000	0.000	0.000	NR	NR	0.000	20.8	0.000	2.26	285
PENRM	[MJ]	0.000	0.000	0.00	NR	0.000	0.000	0.000	0.000	NR	NR	0.000	0.000	0.000	0.000	0.000
PENRT	[MJ]	231	24.7	5.46	NR	0.489	0.000	0.000	0.000	NR	NR	0.000	20.8	0.000	2.26	285
SM	[kg]	0.000	0.000	0.000	NR	0.000	0.000	0.000	0.000	NR	NR	0.000	0.000	0.000	0.000	0.000
RSF	[MJ]	0.000	0.000	0.000	NR	0.000	0.000	0.000	0.000	NR	NR	0.000	0.000	0.000	0.000	0.000
NRSF	[MJ]	0.000	0.000	0.000	NR	0.000	0.000	0.000	0.000	NR	NR	0.000	0.000	0.000	0.000	0.000
FW	[m³]	0.013	-	0.001	NR	0.020	0.000	0.000	0.000	NR	NR	-	-	-	-	0.033
WSI	[m³]	21.0	0.182	0.293	NR	0.165	0.000	0.000	0.000	NR	NR	0.000	0.081	0.000	0.036	21.8
Legend	PERE: Use of renewable primary energy excluding 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 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 resources, SM: Use of secondary material, RSF: Use of renewable secondary fuels, NRSF: Use of non-renewable secondary fuels, FW: Use of net fresh water, WSI: Water Scarcty Imdex, NR: Not Relevant															

REFERENCES

/ISO 9001:2015/ Quality Management System

/ISO 10002:2006/ Customer Satisfaction Management System

/ISO 14001:2015/ Environmental Management System

/ISO 50001/ Energy Management System

/ISO 27001/ Information Security Management System

/OHSAS 18001:2014/ Occupational Health and Safety Management System

/ISO 14020:2000/ Environmental labels and declarations - General principles

/EN 14411/ Ceramic tiles. Definitions, classification, characteristics, evaluation of conformity and marking

/ISO 10545-2/ Ceramic tiles - Part 3: Determination of dimensions and surface quality

/ISO 10545-3/ Ceramic tiles - Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density

/ISO 10545-4/ Ceramic tiles - Part 4: Determination of modulus of rupture and breaking strength

/ISO 10545-5/ Ceramic tiles - Part 5: Determination of impact resistance by measurement of coefficient of restitution

/ISO 10545-6/ Ceramic tiles -- Part 6: Determination of resistance to deep abrasion for unglazed tiles

/ISO 10545-7/ Ceramic tiles - Part 7: Determination of resistance to surface abrasion for glazed tiles

/ISO 10545-8/ Ceramic tiles - Part 8: Determination of linear thermal expansion

/ISO 10545-9/ Ceramic tiles - Part 9: Determination of resistance to thermal shock

/ISO 10545-10/ Ceramic tiles - Part 10: Determination of moisture expansion

/ISO 10545-11/ Ceramic tiles - Part 11: Determination of crazing resistance for glazed tiles

/ISO 10545-12/ Ceramic tiles - Part 12: Determination of frost resistance

/ISO 10545-13/ Ceramic tiles - Part 13: Determination of chemical resistance

/ISO 10545-14/ Ceramic tiles - Part 14: Determination of resistance to stains

/DIN 51130/ Testing of floor coverings; determination of slip resistance; work rooms and work areas subject to pronounced risk of slipping

/EN 15804/ EN 15804:2012+A1:2013, Sustainability of construction works - Environmental Product Declarations — Core rules for the product category of construction products

/ISO 14025/ DIN EN ISO 14025:2009-11: Environmental labels and declarations - Type III environmental declarations — Principles and procedures

/ISO 14040/44/ DIN EN ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006) and Requirements and guidelines (ISO 14044:2006)

/PCR for Construction Products and Construction Services/ Prepared by IVL Swedish Environmental Research Institute, Swedish Environmental Protection Agency, SP Trä, Swedish Wood Preservation Institute, Swedisol, SCDA, Svenskt Limträ AB, SSAB, The International EPD System, 2012:01 Version 2.2, Date 2017-05-30.

/SUB-PCR Bricks, blocks, tiles, flagstone of clay and siliceous earths/ (construction product) (v2.2.) The International EPD® System, 2012:01 Version 2.2, Date 2018-03-09.

/The International EPD® System/ The International EPD® System is a programme for type III environmental declarations, maintaining a system to verify and register EPD®s as well as keeping a library of EPD®s and PCRs in accordance with ISO 14025.www.environdec.com

/Ecoinvent / Ecoinvent Centre, www.Eco-invent.org

/TLCID/ Turkish Life Cycle Inventory Database, Turkish Centre for Sustainable Production Research and Design - SÜRATAM , www.suratam.org

/SimaPro/ SimaPro LCA Package, Pré Consultants, the Netherlands, www.pre-sustainability.com

/Kaleseramik/ User's Guide for Ceramic Tiles

VERIFICATION & REGISTRATION

Programme	**The International EPD System** www.environdec.com EPD registered through the fully aligned regional programme: EPD Turkey www.epdturkey.org
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