

ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	EUROROC - European & International Federation of Natural Stone Industries
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
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Issue date	07.05.2014
Valid to	06.05.2019

Tiles and Slabs from natural stone EURO-ROC

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General Information

EURO-ROC

Programme holder

IBU - Institut Bauen und Umwelt e.V.
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10178 Berlin
Germany

Declaration number

EPD-EUR-2013253-CBG1-EN

This Declaration is based on the Product Category Rules:

Dimension stone for roof, wall and floor applications, 07-2012
(PCR tested and approved by the independent expert committee)

Issue date

07.05.2014

Valid to

06.05.2019

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhard Lehmann
(Managing Director IBU)

Tiles and Slabs from natural stone

Owner of the Declaration

EUROROC - European & International Federation of Natural Stone Industries
Gluckstrasse 10
65193 Wiesbaden, Germany

Declared product / Declared unit

1 ton tiles and slabs from natural stone

Scope:

This documentation includes information related to 1 ton tiles and slabs from natural stone which are produced by the 10 EUROROC member companies. Collected data in purpose of Life Cycle Assessment are based in the years of 2009 to 2011. EUROROC association EPD declares a weighted average referring to the annual production volumes of participants. EUROROC association represents 60% to 65% of European natural stone producers. EUROROC states that the 10 members are representative for all of its members, because the technology is similar. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm EN 15804 serves as the core PCR

Independent verification of the declaration according to ISO 14025

internally externally

Mr Carl-Otto Neven
(Independent tester appointed by SVA)

Product

Product description

Natural stone is a naturally occurring building material that had emerged in the course of millions of years. According to the rock genesis, which has a significant impact on technical properties, the following main groups of natural stones can be distinguished:

- a) Igneous rock
- b) Sedimentary rock
- c) Metamorphic rock

Natural stones are used as tiles (thickness up to 12 mm), slabs (thickness more than 12 mm up to 80 mm) or massive slabs (thickness more than 80 mm) with different sizes.

The declared product is an average natural stone from these three rock types with an average thickness of 40 mm as an average of 10 different companies, weighted by their production volumes. The shares of the rock types of the total production volume of all manufacturers is: igneous rock 27%, sedimentary rock 64%, metamorphic rock 9%.

At the quarry, natural stones are mined and later go through block sawing, calibration, polishing, and sizing in order to meet the customer request on dimensions and surface quality.

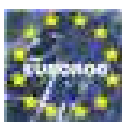
Placing on the market

For the placing on the market in the EU/EFTA the Regulation (EU No 305/2011 applies. The products need a declaration of performance taking into consideration the /EN 771-6 – specification for masonry units; part 6: Natural stone masonry units/ and the CE-marking.

Application

For the application and use the respective national provisions apply.

Natural stone slabs are used for flooring, cladding, stairs, monuments, kitchen tops, cubic building elements and many other applications.



Natural stones with their unique physical and aesthetic properties comprise an ideal raw material for the construction industry.

Natural stones find numerous uses in the construction industry from outdoor applications including stone patios, pool decks/coping, steps, walkways and stone walls to interior applications for flooring, bathroom/kitchen renovations, stairs, fireplace re-faces, or manufactured veneers and they significantly contribute to the improvement of the quality and the overall aesthetics and performance of buildings and open spaces.

The European stone sector has a leading position in the global stone and equipment market.

Specifications for products of natural stone are:

- /EN 771-6, Specification for masonry units - Part 6: Natural stone masonry units/
- /EN 1341, Slabs of natural stone - Requirements and test methods/
- /EN 1342, Sets of natural stone - Requirements and test methods/
- /EN 1343, Kerbs of natural stone - Requirements and test methods/
- /EN 1467, Natural stone - Rough blocks - Specifications./
- /EN 1468, Natural stone - Rough slabs - Specifications./
- /EN 1469, Natural stone - Finished products, slabs for claddings - Specifications/
- /EN 12057, Natural stone - Finished products, modular tiles
- – Specifications/
- /EN 12058, Natural stone - Finished products, slabs for floors and stairs. Specifications./
- /EN 12059, Natural stone - Dimensional stone work - Specifications./

Technical Data

The following construction data are classified into the three major stone groups:

- Igneous rock
- Sedimentary rock
- Metamorphic rock

Name	Value	Unit
Compressive strength acc. to /EN 1926/	a) 100 - 300	N/mm ²
	b) 20 - 240	N/mm ²

	c) 100 - 280	N/mm ²
Flexural strength acc. to /EN 12372/	a) 5 - 25	N/mm ²
	b) 1 - 20	N/mm ²
	c) 5 - 40	N/mm ²
Water absorption acc. to EN 13755	a) 0.1 - 1	M.-%
	b) 0.1 - 10	M.-%
	c) 0.3 - 2	M.-%
Gross density acc. to EN 1936	a) 2.000 - 3.000	kg/m ³
	b) 1.700 - 2.900	kg/m ³
	c) 2.600 - 3.000	kg/m ³
Thermal conductivity	1.2 - 3.4	W/(mK)
Wear resistance acc. to DIN EN 14157	14 - 35	mm
Specific heat capacity	0.92	kJ/kgK

Base materials / Ancillary materials

The base materials are:

- Igneous rock
- Sedimentary rock
- Metamorphic rock

Each product consists of 100% of only one rock type.

For the transportation of natural stone to the customers, depending on the type of product, wooden pallets, polyethylene films, and Styrofoam packaging is used. The average amounts of ancillary materials are included in this declaration.

Because of the natural rock source, natural stones do not contain harmful substances.

For some special applications, e.g. kitchen tops and bathrooms, some natural stones are treated with silicone resin based products.

Also some natural stones having many cracks and pores are filled with epoxy or polyester.

Reference service life

Reference service life is not relevant due to cradle to gate boundary conditions.

Compliance with social standards

Evidence of compliance with social standards of production in the EPD. As all relevant quarries of this study are in Europe, safety provisions for the workforce and absence of child labour are guaranteed .

LCA: Calculation rules

Declared Unit

This EPD refers to 1 ton of tiles and slabs from natural stone.

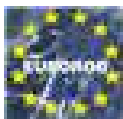
Results refer to a weighted average of EUROROC member companies, therefore also averaging the three major stone groups. The average thickness of the product is 0.04 m.

It means 1 ton of product is equal to 9.11 m².

Declared unit

Name	Value	Unit
Declared unit	1	t
Gross density	2744	kg/m ³
Conversion factor to 1 kg	0.0003644	m ³ /kg

Natural stone units are produced from thin tiles with 10 mm thickness up to massive slabs with more than 100 mm thickness. Therefore this EPD is declared for average thickness of 0.04 m



System boundary

Type of EPD: Declaration of a product as an average from several manufacturers plants.

The study is a cradle-to-gate LCA study including the transport to costumers; it covers all of the production steps from raw materials in the earth (i.e. the cradle) to finished products (i.e. the gate) ready to be installed at the customers (including the transportation to installation site).

This definition includes all the activities associated with the production at stone manufacturing sites and upstream activities; from the mining and the processing of raw materials, transport to site and the consumption of any material or energy resources during any of these production stages.

Some activities are not considered in this study on the basis that their influence on the environmental impact is negligibly small (a concept known as materiality). Such activities include capital equipment, business travel, administration, cleaning services etc.

Downstream processing into manufactured products and their use has not been included in the inventory. For example, the treatment with silicone resin, epoxy or polyester based products for special applications, like kitchen tops and bathrooms, is not included in the LCA. This would contribute around 0.3% of mass. This EPD describes the production of 1 ton of natural stone products, from mining, transporting, and production (sawing, calibration, polishing, and sizing). Further optional treatments of the surface (with products based on silicone resin, epoxy or polyester) are not considered.

Lengths, widths and thicknesses are available to meet the various design specifications and requirements.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

LCA: Scenarios and additional technical information

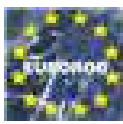
This EPD is applicable to different products of natural stone, which are used in the construction and building industry.

The analysis of the product life cycle includes production of the basic materials, transport of the basic materials, manufacture of the product and the packaging materials and is declared in module A1-A3. On site waste treatment is also declared in module A3. Neither use-phase nor end-of-life is included in the LCA calculation. This needs to be considered on next level by the evaluation of buildings.

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel [truck]	0.00135	l/100km
Litres of fuel [train]	0,00474	L/100km
Transport distance	411	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	2744	kg/m ³

80% distance with truck and 20% distance with train



LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement ¹⁾	Refurbishment ¹⁾	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	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	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 ton tiles and slabs from natural stone

Parameter	Unit	A1 - A3	A4
Global warming potential	[kg CO ₂ -Eq.]	2.55E+2	2.05E+1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	5.81E-8	3.58E-10
Acidification potential of land and water	[kg SO ₂ -Eq.]	7.25E-1	1.3E-1
Eutrophication potential	[kg (PO ₄) ³⁻ -Eq.]	6.75E-2	3.12E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	4.17E-2	-4.69E-2
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	3.2E-5	7.64E-7
Abiotic depletion potential for fossil resources	[MJ]	3.39E+3	2.83E+2

RESULTS OF THE LCA - RESOURCE USE: 1 ton tiles and slabs from natural stone

Parameter	Unit	A1 - A3	A4
Renewable primary energy as energy carrier	[MJ]	5.52E+2	1.11E+1
Renewable primary energy resources as material utilization	[MJ]	0.0E+0	0.0E+0
Total use of renewable primary energy resources	[MJ]	5.52E+2	1.11E+1
Non renewable primary energy as energy carrier	[MJ]	3.88E+3	2.84E+2
Non renewable primary energy as material utilization	[MJ]	0.0E+0	0.0E+0
Total use of non renewable primary energy resources	[MJ]	3.88E+3	2.84E+2
Use of secondary material	[kg]	0.0E+0	0.0E+0
Use of renewable secondary fuels	[MJ]	0.0E+0	0.0E+0
Use of non renewable secondary fuels	[MJ]	0.0E+0	0.0E+0
Use of net fresh water	[m ³]	8.29E-1	1.23E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 ton tiles and slabs from natural stone

Parameter	Unit	A1 - A3	A4
Hazardous waste disposed	[kg]	8.44E-2	0.0E+0
Non hazardous waste disposed	[kg]	5.23E+2	3.68E-2
Radioactive waste disposed	[kg]	1.96E-1	3.95E-4
Components for re-use	[kg]	0.0E+0	0.0E+0
Materials for recycling	[kg]	0.0E+0	0.0E+0
Materials for energy recovery	[kg]	0.0E+0	0.0E+0
Exported electrical energy	[MJ]	0.0E+0	0.0E+0
Exported thermal energy	[MJ]	0.0E+0	0.0E+0

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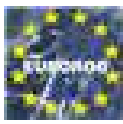
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PCR 2013, Part B

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ISO 15944

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Natural stone test methods - Determination of flexural strength under concentrated load

EN 13755: 2008-08

Natural stone test methods - Determination of water absorption at atmospheric pressure

EN 14157: 2005-07

Natural stone test methods - Determination of the abrasion resistance

EN 1936: 2007-02

Natural stone test methods - Determination of real density and apparent density, and of total and open porosity

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