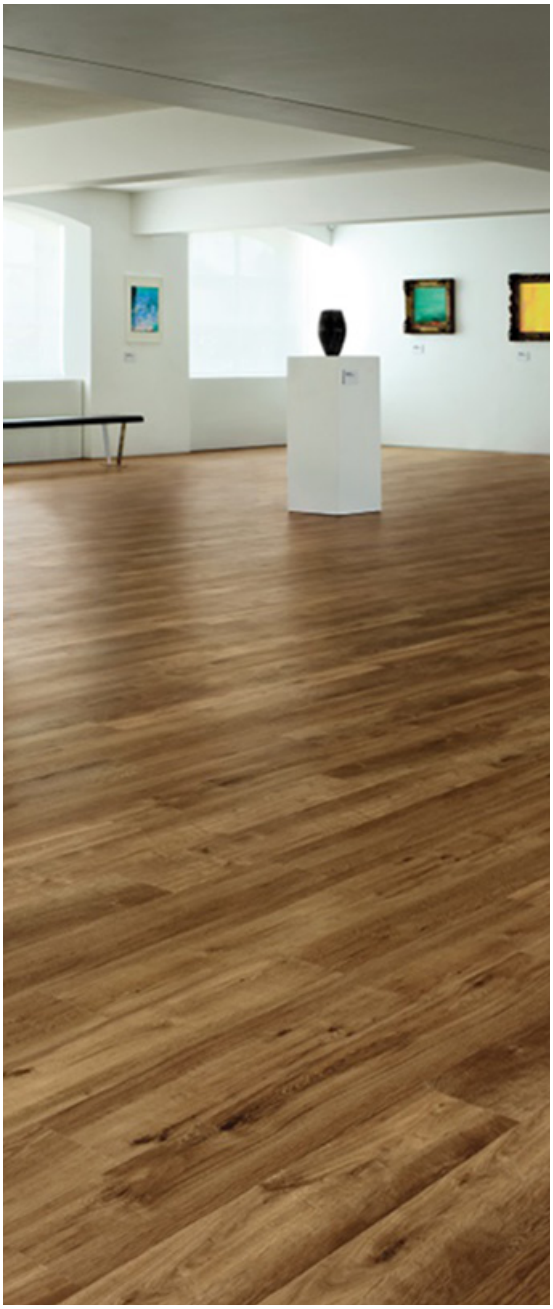
Environmental Product Declaration



Designflooring

PRINTED LUXURY POLYVINYL CHLORIDE FLOOR COVERING

In accordance with ISO 14025 and EN 15804

Contents

EPD Program holder	The International EPD System **www.environdec.com** Valhallavagen 81, 11427 Stockholm, Sweden
Product Category Rules (PCR)	PCR 2012:01 version 2, Construction products and construction services – 2015-03-03 EN 15804:2012+A1:2013- Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
Generic PCR review conducted by	Technical committee of the International EPD System
Independant Verification	internal ✓ external
Approved and verified by	Jane Anderson (Principal Consultant, Thinkstep) Email: jane.anderson@thinkstep.com
EPD prepared by	VFCONSULTANT – Dr Valery Fauchet Email: vfconsultant@sfr.fr www.vfconsultant.fr
Owner of the declaration	**Company Name:** Designflooring International Ltd Crab Apple Way, Vale Park, Evesham Worcestershire, WR11 1GP United Kingdom Phone: +44 (0)1386 820105 Email: michael.cheetham@designflooring.com Website: www.designflooring.com
Registration Numbers	S-P-00879
Issue date: 2016-04-14	**Valid to:** 2020-11-30

2. Product

2.1 Product description

This declaration for Luxury Vinyl Tile Representative Product for the European market covers a range of styles and colours.
Luxury Vinyl Tile is used in both commercial and residential interiors. It is commonly available in 2.0mm, 2.5 mm, 3.0 mm and 4.5 mm thicknesses. The average weight of this representative product is 5.003 kg/m².
Decorative applications and a transparent PVC wear layer are applied to the surface and a lacquer is used as a finish on the wear layer.
The products included in this EPD are Art Select, Monet, Van Gogh, Opus, Rubens, Michelangelo, HDC, in tile or plank format.
The UN CPC classification code is 36910 Floor coverings of plastics, in rolls or in the form of tiles; wall or ceiling coverings of plastics

Technical and functional specification

The table below shows the technical characteristics of the products

Products	Product thickness (mm)	Wear layer thickness (mm)	Product weight (kg/m²)	Product form	Classification ISO 10874
Art Select	3 mm	0.7 mm	5.33 - 5.80	Plank	23-34-43
Monet	3 mm	0.7 mm	5.56 - 5.84	Tile & plank	23-34-43
Van Gogh	3 mm	0.55 mm	5.69	Plank	23-33-42
Opus	2.5 mm	0.55 mm	4.83 - 4.98	Tile & plank	23-33-42
Rubens	2 mm	0.3 mm	4.02	Tile & plank	23-31
Michelangelo	2.5 mm	0.55 mm	4.63 - 4.74	Tile & plank	23-32-41
HDC	2.5 mm	0.55 mm	5.51 - 5.62	Tile & plank	23-32-41

2.2 Application

Luxury vinyl flooring is commonly used commercially in education, healthcare, aged care, speciality retail and commercial, light commercial, and residential interiors where long lasting performance is preferred.
The products considered in this EPD meet the specification of ISO 10582 (EN649) - Resilient floor covering - Heterogeneous polyvinyl chloride floor covering – Specification..

The products are classified according to characteristics 22, 23, 32, 33, 34, 43 of EN ISO 10874:2012 (EN 685).

2.3 Technical Data

The technical data sheets of the products are available at www.designflooring.com

Average construction and range of products

Characteristics		Average value	Unit	Minimum value	Maximum value
Product thickness		-	mm	2.0	3.0
Wear layer thickness		-	mm	0.2	0.7
Product weight*		5.003	kg/m²	4.020	5.840
Product size	Tiles	-	mm	305 x 305	915 x 915
	Planks	-	mm	229 x 76	1219 x 228

** To determine the average value, the actual volume of each product selling in the EU market was used proportionately to determine the overall average value of the weight of the representative product.*

2.4 Application rules

Product Standards:

- EN ISO 10582:2012 (EN 649) – Resilient Floor coverings – Heterogeneous vinyl floor coverings - Specification.
- EN ISO 10874:2012 (EN 685) – Resilient, Laminate and Textile Floor coverings - Classification.
- EN 13501-1:2002 – Fire Classification of construction products and building elements.
- EN 14041:2004 – Resilient, Textile and Laminate Floor coverings - Essential characteristics
  Designflooring floor coverings comply with European technical approval standards (CE Conformity and marking) and respective national approval standards for building products, e.g. the general technical approval of the German Institute for Building Technology (DIBt) and the French Regulation UPEC.

2.5 Base materials

Vinyl tile is made primarily from calcium carbonate (limestone), polyvinyl chloride, plasticizers, additives (i.e. pigments and stabilizers). It is structured with five layers: two PVC backing layers, one high definition photographic layer, one clear PVC embossed wear layer and a last PU protective layer.

Components	%	Comments
PVC	34.14	Polyvinyl chloride suspension
Acrylic polymer	0.02	Acrylic/methacrylate polymer
Filler	51.03	Calcium carbonate
Plasticizer	11.43	Diisononyl phtahlate and dioctyl terephthalate
ESO	0.34	Epoxidized soy bean
Ca/Zn stabilizer	0.40	Calcium/Zinc stabilizer
Ba/Zn stabilizer	0.66	Barium/Zinc stabilizer
Ba stearate	0.03	Barium stearate
UV stabilizer	0.04	Benzophenone derivatives
Carbon black	0.18	Carbon black
Lacquer	0.25	Polyurethane UV cured finish
Pigment	0.04	Titanium dioxide and a mixture of pigments
Recycled PVC external	1.49	Externally sourced PVC compound recyclates

Production of main materials

Limestone:
Calcium carbonate used as inert filler. It is an abundant mineral found in all parts of the world. It can be ground to varying particle sizes and is widely used as filler in formulated flooring systems.

Polyvinyl chloride:
Commonly abbreviated to PVC and derived from fossil fuel and salt, it is the third-most widely produced polymer, after polyethylene and polypropylene. Petroleum or natural gas is processed to make ethylene. Salt electrolysis produces chlorine. Ethylene and chlorine react together to produce ethylene dichloride, which is further processed at high temperature into vinyl chloride monomer. Polymerization of vinyl chloride monomer converts it into a fine white powder called vinyl resin. Recycled polyvinyl chloride is also used.

Plasticizers:
Plasticizers are colourless and odourless liquids commonly used in vinyl products to make them more flexible and /or durable. Plasticizers used in the production of these floorcoverings are DOTP [manufactured from DMT (a common material for producing fizzy drink bottles, for example) and 2- ethylhexanol] or DINP [manufactured from phthalic anhydride and isononanol].

Additives:
These products are used to make vinyl resistant to light and oxidation and are made of alkaline earth metal (barium or calcium) and zinc salts of fatty acids. These are viscous liquids.

Finish:
Polyacrylate UV cured lacquer.

Ink and Pigment:
Inks are used to print the decorative patterns.
According to the latest revision of Article 59, the Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorization and restriction of Chemicals (REACH), "the REACH list", of substances of very high concern' (SVHC) the product is not manufactured with or contains any of these substances above a concentration of 0.1% by weight.

2.6 Manufacture

In the first step, the raw materials are mixed and heated. The mixture is calendared in sheet to create the backing or the transparent PVC layers. The sheets are cut and laminated with a printed film. The semi-finished product is coated with a lacquer and annealed. Finally, the product is cut into tiles or planks and packaged. Quality checks are made at each step of the production process.
The product is manufactured in three factories located in China, Taiwan and South Korea.

2.7 Installation

Installation requires adhesive: 250 g/m² is used. Water based acrylic VOC compliant adhesive is recommended. During installation, 5% of the total material is cut off as waste. The scrap is modelled as being disposed of in landfill.

2.8 Use

The proper use of the described products is not a hazard to water, air and soil. It is inert in its proper use.
No damage to health is expected under normal use.
Indoor Air Quality VOC emissions comply with the requirements of:

- The DIBt/AgBB (2012) scheme.
- The requirements of the standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers (version 1.1) as defined by the California Department of Public Health (CDPH) – FloorScore.
- According to the French evaluation method, the product achieves - Class A+ - Construction product sanitary labelling Decree no 2011-321 (mars 2011) related to VOC emissions.

2.9 Reference service life

We cannot give a RSL for the products because there are many scenarios according to the building type, the maintenance regime and the country where the floor is used.

2.10 Disposal

Leftovers arising from construction site as well as used products from deconstruction should be primarily routed for disposal in landfill.

2.11 Further information

The products Opus and Opus+ are certified to NF-UPEC by the CSTB. The classifications are U3P3E2C2 and U4P3E2C2 (approval numbers 788/354-001.1 and 788/354-002.1).

3. LCA: Calculation rules

3.1 Declared unit

The declared unit is 1 m² of installed floor covering with a weight of 5.003 kg/m² for specified application and use areas according EN ISO 10582.

3.2 System boundaries

It is a cradle to grave with options EPD. The system boundary is based on the EN 15804 description.

- Modules A1-A3 include processes that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as waste processing.
- Module A4 includes transport of the floor covering to the place of installation.
- Module A5 includes the production of adhesive for the installation of the floor covering, the manufacture and the transport of the 5% extra product order for laying and landfilling of these 5% off-cuts and recycling of packaging material.
- Module B2 includes provision of cleaning agent, energy and water consumption for the cleaning of the floor covering. The LCA results in this EPD are declared for a one year usage.
- Module C1 considers electricity supply for the de-construction of the flooring.
- Module C2 includes transportation of the post-consumer waste to waste processing.
- Modules C3/I: end of life scenarios are declared for 100% incineration of the used products.
- Module C4/L: end of life scenario are declared for 100% landfilling of the used products.
- Module D is not considered in this study.

The table below shows the system boundaries according to EN 15804

Product stage			Construction stage		Use stage							End of life stage				Benefit load
Raw material supply	Transport	Manufacturing	Transport	Construction – installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction Demolition	Transport	Waste processing	Disposal	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3/I	C4/L	D
		X	X	X	NR	X	NR	NR	NR	NR	NR	X	X	X	X	MND

NR : module not relevant *MND : Module not determined*

3.3 Estimates and assumptions

Stage A4 – transport to customers: Average transport distance by ship is 19071 km from factory to UK warehouse. Transport distance by truck is 2090 km (40 km from factory to Asian ports and 2050 km from unload port to customers.

Stage A5 - installation: The leftovers from installation stage are considered as disposed in landfill. 65% recycling / 35% landfilling of the packaging is assumed for paper and cardboard. 100% landfilling is assumed for LDPE packaging. Pallets are 100% re-used. The materials for recycling leave the system without environmental burden and without crediting any value.

Stage B2 - use: there are various cleaning procedures of the floor dependent on its intended use. We assume a cleaning regime of a daily (openable) dust mop, a weekly damp mop and a monthly floor restoring. The use of an electric device (1.5 kWh, 600 m²/h) for 25% of these operations is assumed.

Stage C - end of life: Two scenarios are declared for end of life stages: incineration (module C3I) and landfilling (C4/L). It is assumed that no significant degradation of materials occurs during landfilling. It is considered that there are no significant emissions for more than 100 years. The incineration facility is considered to have a yield R<0.6 and the process is not considered as recycling.

3.4 Cut-off criteria

In this study, all available data from production are considered, i.e. raw materials used, utilised thermal energy, and electric power consumption. It can be assumed that the total sum of neglected processes does not exceed 5% of energy usage and mass. The manufacturer provided data on the transport expenditure for all relevant material flows. Machines and facilities required during production are not included.

3.5 Background data

For life cycle modelling of the considered products, the software OpenLCA v1.4.1 has been used to model the product systems considered in this study. All relevant background datasets are taken from the Ecoinvent V3.1 database. The system model of the database used is "Allocation, Ecoinvent default". The datasets from Ecoinvent date from 2012 to 2015 and are documented in the online documentation.

3.6 Data quality

The data quality can be described as fair to good. The primary data collection has been done thoroughly, all relevant flows are considered. Technological, geographical and temporal representativeness is given.

3.7 Period under review

The period under review is from April 2011 to March 2012.

3.8 Allocations

The production sites use the same assembly line to produce the same product types. The allocation of material and energy have been determined during the data collection process. The products constitutive of the representative product assessed in this study are considered to be homogeneous and qualitatively comparable over time.

3.9 Comparability

Environmental product declarations of construction products may not be comparable if they do not comply with EN 15804 and environmental product declarations within the same category from different programs may not be comparable.

4. LCA: Scenario and additional technical information

The following technical information is given for the declared modules

Module A4: transport to the construction site

Parameters	Values	Units
Litre of fuel (truck) Euro 3/Euro 5	0.18/0.16	l/km
Litre of fuel (ship)	2.15E-3	l/km
Transport distance (truck)	2090	km
Transport distance (ship)	16244	km
Capacity utilisation	85	%

Module A5: installation in the building

Parameters	Values	Units
Auxiliary (adhesive)	0.25	kg
Material loss	5	%

Module B2: maintenance

Name	Value	Unit
Maintenance cycle: Dust mop Damp mop - cleaner Spray buff - restorer	 260 52 12	number/year
Water consumption	5.8	l/m²/year
Auxiliary (detergent)	0.12	l/m²/year
Electricity consumption	0.22	kWh/m²/year

5. LCA: Results

It is noted that results reported in the tables below for this EPD represent an average of the seven LVT flooring ranges manufactured in three factories and based on the actual square metres produced, imported and sold on the European market.

Caution should be used when comparing the results presented in this EPD to the environmental performance of other vinyl tile products as the thickness or weight of floors will influence the environmental impacts.

The results for module B2 refer to a period of one year. The values of B2 have to be multiplied by the estimated service life to give the results corresponding to a time period.

Environmental impacts for one year use

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 land and water sources AP kg SO_2 equiv.	Eutrophication potential EP kg PO_4 equiv.	Formation potential of tropospheric ozone photochemical oxidants POCP kg Ethene equiv.	Abiotic depletion potential for non fossil resources kg Sb equiv.	Abiotic depletion potential for fossil resources MJ
Product stage	Total Production	A1-A3	7.21E+00	1.85E-07	3.32E-03	7.83E-03	2.41E-03	1.96E-05	1.24E+02
Construction stage	Transport	A4	2.90E+00	5.03E-07	2.92E-02	3.93E-03	1.05E-03	5.89E-06	4.18E+01
	Installation	A5	1.24E+00	1.26E-07	7.73E-03	4.16E-03	5.94E-04	5.84E-06	1.90E+01
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	8.34E-01	1.21E-07	4.07E-03	2.43E-03	2.20E-04	4.94E-06	1.41E+01
	Repair	B3	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND
	Operational Energy Use	B6	MND	MND	MND	MND	MND	MND	MND
	Operational Water Use	B7	MND	MND	MND	MND	MND	MND	MND
End of life	De-construction	C1	1.33E-02	1.98E-09	3.93E-05	1.40E-04	1.89E-06	2.33E-08	1.84E-01
	Transport	C2	2.56E-02	4.66E-09	8.59E-05	2.06E-05	4.29E-06	7.04E-08	3.81E-01
	Waste Processing	C3/I	1.05E+01	3.51E-07	8.14E-03	2.89E-03	4.81E-04	6.70E-06	1.69E+01
	Disposal	C4/L	3.24E-01	1.39E-08	4.01E-04	1.76E-02	6.91E-05	7.18E-08	1.27E+00
Potential benefits and loads beyond the system boundaries		D	MND	MND	MND	MND	MND	MND	MND

MND : Module not determined NR : module not relevant

Use of resources

Resources use			Use of renewable primary energy excluding renewable primary energy resources used as raw materials	Use of renewable primary energy resources used as raw materials	Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	Use of non renewable primary energy excluding non renewable primary energy resources used as raw materials	Use of non renewable primary energy resources used as raw materials	Total use of non renewable primary energy resources (primary energy and primary energy resources used as raw materials)	Use of secondary material	Use of renewable secondary fuels	Use of non renewable secondary fuels	Use of net fresh water
			MJ	MJ	MJ	MJ	MJ	MJ	kg	MJ	MJ	m3
Product stage	Total Production	A1-A3	1.10E+01	1.32E+00	1.23E+01	8.40E+01	8.08E+01	1.65E+02	2.81E-01	0.00E+00	0.00E+00	3.10E+01
Construction stage	Transport	A4	6.72E-01	0.00E+00	6.91E-01	4.32E+01	0.00E+00	4.36E+01	0.00E+00	0.00E+00	0.00E+00	1.73E-01
	Installation	A5	1.47E+00	0.00E+00	1.47E+00	1.56E+01	8.45E+00	2.40E+01	0.00E+00	0.00E+00	0.00E+00	3.27E+00
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	3.51E-01	4.30E-01	7.81E-01	1.73E+01	3.10E-01	1.76E+01	0.00E+00	0.00E+00	0.00E+00	1.02E+00
	Repair	B3	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
	Operational Energy Use	B6	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
	Operational Water Use	B7	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
End of life	De-construction	C1	2.73E-02	0.00E+00	2.73E-02	3.70E-01	0.00E+00	3.70E-01	0.00E+00	0.00E+00	0.00E+00	1.39E-01
	Transport	C2	4.91E-03	0.00E+00	4.91E-03	3.89E-01	0.00E+00	3.89E-01	0.00E+00	0.00E+00	0.00E+00	1.40E-02
	Waste Processing	C3/I	1.48E+00	0.00E+00	1.48E+00	2.04E+01	0.00E+00	2.04E+011	0.00E+00	0.00E+00	0.00E+00	2.40E+01
	Disposal	C4/L	3.80E-02	0.00E+00	3.80E-02	1.35E+00	0.00E+00	1.35E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-01
Potential benefits and loads beyond the system boundaries		D	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

MND : Module not determined NR : module not relevant

Wastes and other output flows

Wastes and other output flows			Hazardous waste disposed	Non hazardous waste disposed	Radioactive waste disposed	Components for re-use	Materials for recycling	Materials for energy recovery	Exported thermal energy	Exported electric energy
			kg	kg	kg	kg	kg	kg	MJ	MJ
Product stage	Total Production	A1-A3	1.14E-01	2.20E+00	1.28E-04	0.00E+00	3.28E-01	3.01E-03	0.00E+00	0.00E+00
Construction stage	Transport	A4	2.81E-02	3.23E-01	2.95E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Installation	A5	1.28E-01	8.57E-01	4.99E-05	7.70E-02	4.98E-02	4.77E-03	1.10E-01	3.67E-02
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	4.66E-02	3.92E-01	6.49E-05	0.00E+00	6.00E-03	6.00E-03	2.02E-01	2.10E-03
	Repair	B3	MND	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND	MND
	Operational Energy Use	B6	MND	MND	MND	MND	MND	MND	MND	MND
	Operational Water Use	B7	MND	MND	MND	MND	MND	MND	MND	MND
End of life	De-construction	C1	5.40E-04	4.91E-03	2.68E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	2.50E-04	1.99E-02	2.63E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste Processing	C3/I	2.46E+00	5.85E-01	9.62E-05	0.00E+00	0.00E+00	3.60E+00	6.08E+01	2.02E+01
	Disposal	C4/L	1.25E-03	5.02E+00	7.94E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries		D	MND	MND	MND	MND	MND	MND	MND	MND

MND : Module not determined NR : module not relevant

6. Life cycle interpretation

For the scenario 100% landfilling, non-renewable energy use for the processes of stages A1-A3 represents 61% of the non-renewable energy consumption and 66% of the total energy consumption. The construction stage is the second contributor (19% and 26% respectively), mainly because of the transport of the product. For this reason, the product stage is the main contributor to the global warming potential (78%, sourcing represents 43% and manufacturing 36%), for ozone depletion potential (98%), acidification potential (58%) and the abiotic depletion of fossil resources (78%). Construction stage is the second contributor for GWP, POCP and AP mainly because of the transport of the product. End of life is the first contributor to POCP (mainly because of the VOC and CO emissions) and for non-hazardous waste (disposal of the product).

For the scenario 100% incineration, the span of the non-renewable energy use is different. The product stage is the first contributor (61% PENRT and 50% PENRE), incineration is the second (24% PENRT and 29% PENRE). Construction stage is the third with the transport stage.

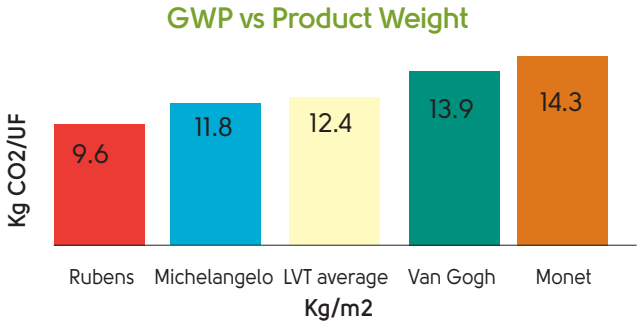
This scenario leads to an increase in the end of life of almost all impact categories and is significant for the acidification potential (21% vs 9%), ozone depletion potential (18% vs 3%), abiotic depletion of resources and water consumption. We can evaluate the variation of the impacts between the products. As the product and its life cycle is based on fossil carbon, the global warming potential (GWP, kg CO2/m²/y) is a good indicator to follow.

The variation of the GWP follows the variation of weight. Rubens weighing 20% less than the average product has a GWP 17% lower and Michelangelo weighing 6% less has a GWP 5% lower.

Above the weight of the average product, the variation of GWP to weight is the same. Monet (+13% weight) and Van Gogh (+18%) see their GWP increase in the same way (+12 and +17% respectively).

The product is manufactured in three factories, we can evaluate variation of the impact of the manufacturing site. The table below shows the variation of GWP according to the manufacturing site for the average product.

The Korean facility has the lower emissions, -25%, for the A3 manufacturing stage while the other facilities are around +5% in comparison with the average LVT but for the total life cycle, the variation is between -5% and +1%. The reason for this variation between sites is the energy mix of the different countries involving the nuclear and coal rates in their electricity production.



GWP kg CO2	South Korea	Average LVT	China	Taiwan
A3 stage	1.78	2.36	2.48	2.51
%	-25%	0%	5%	6%
Total life	11.79	12.3669	12.49	12.52
%	-5%	0%	1%	1%

References

ISO 10582	ISO 10582: 2012-04 Resilient floor coverings - Heterogeneous poly(vinyl chloride) floor coverings - Specification
ISO 14025	ISO 14025:2011-10 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
ISO 14040	ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework
ISO 14044	ISO 14044:2006-10 Environmental management - Life cycle assessment - Requirements & guidelines
EN 15804	EN 15804:2010-08 Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products
ISO 21930	Sustainability of construction products - Environmental declaration of building products
PCR 1201 V2	Product Category Rule 1201 - Construction products and services V2