# BENTLEY

**Environmental Product Declaration** 2.5 mm LVT

Programme: The International EPD<sup>®</sup> System Programme operator: EPD International AB EPD registration number: S-P-09263 Publication Date: November 2, 2023 Valid Until: November 2, 2028 www.environdec.com In accordance with:

■ ISO 14025 ■ ISO 21930

(co-off)

□ EN 15804

R



Programme and Programme Operator	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com as provided by EPD North America
General Program instructions and Version Number <sup>1</sup>	General Programme Instructions for the International EPD® System. Version 4.0. 2021-03-29
Manufacturer Name and Address	Bentley Mills 1461 Don Julian Rd. City of Industry, CA, 91746
Declaration Number	S-P-09263
Declared Product and Functional Unit	2.5 mm LVT 1 m² of installed flooring and with a building service life of 75 years
Reference PCR and Version Number <sup>2</sup>	UL Part A: Life Cycle Assessment Calculation Rules and Report Requirements, Version 4.0 UL Part B: Flooring EPD Requirements. UL 10010-7, Version 2.0
Product's intended Application and Use	Commercial Flooring Applications
Product RSL	30 years
Markets of Applicability	North America
Date of Issue	November 2, 2023
Period of Validity	5 years from date of issue
ЕРД Туре	Product Specific
Range of Dataset Variability	N/A
EPD Scope	Gradie-to-Grave
Fear of reported manufacturer primary data	2021 Sphara Managad I CA Content Database 2022 1 (formarly CoBi Database)
LCA Software and Version Number	Sphera I CA for Experts 10.7 (formerly GaBi)
LCIA Methodology and Version Number	TRACI 2.1 CML 2001-Jan 2016 IPCC AR5
Part A PCR review was conducted by:	Lindita Bushi, PhD, Chair Hugues Imbeault-Tétreault, Eng., M.A.Sc. Jack Geibig
The sub-category PCR review was conducted by:	Jack Geibig (Chair) Thomas Gloria, PhD Thaddeus Owen
Independent third-party verification of the declaration and data, according to ISO 14025:2008.	EPD Process Certification         EPD Verification         Pre-Verified Tool
This declaration was independently verified in accordance with ISO 14025: 2006. The UL Environment "Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report," v4.0, based on CEN Norm EN 15804 (2012) and ISO 21930:2017, serves as the core PCR, with additional considerations from the USGBC/UL Environment Part A Enhancement (2017) Internal	Janes Mellentine, Thrive ESG
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	James Mellentine, Thrive ESG
The procedure for follow-up of data during EPD validity, as defined by the GPI, involves third party verifier:	⊠ Yes □ No
<sup>1</sup> Not all requirements in the GPI are fulfilled, particularly the req	uirement, for construction products, to follow EN 15804 for certain aspects of the LCA method.

<sup>1</sup>Not all requirements in the GPI are fulfilled, particularly the requirement, for construction products, to follow EN 15804 for certain aspects of the LCA method. <sup>2</sup>This EPD is based on a PCR that satisfies procurement rules at the federal, state, and municipal levels which call for EPDs based on the UL Part B PCR. The UL Part B PCR was used to meet regulatory (example: Buy Clean California Act, etc.) and market expectations (example: Building Transparency EC3 comparisons, LEED and existing vendor procurement requirements, product scoring programs, etc.). The EPD should not be used outside of this context.

Limitations:

Environmental declarations from different programs (ISO 14025) may not be comparable.

Comparison of the environmental performance of Flooring Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR.

Full conformance with the PCR for Products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

The EPD owner has the sole ownership, liability, and responsibility of the EPD.



# **Product Definition and Information**

#### **Company Description**

For more than 40 years, Bentley Mills, Inc. has defined design, color, quality, and customer service in the commercial flooring industry. Our California-based brand manufactures and markets award-winning broadloom, carpet tile, area rug, and luxury vinyl tile products for interiors across the globe. With luxury, timelessness and crafted quality at the forefront of our product design, Bentley is consistently recognized for leadership in design, performance, and customer service to the architecture and interior design community. And as a California-based company, we are committed to sustainable commerce and social responsibility. We continue to evolve our product lines to mirror our eco-conscious philosophy and achieve top industry certifications. We proudly operate our headquarters in a LEED-EBOM® Gold manufacturing



Ultraviolet (UV) Cured Polyurethane Coating placed above the decorative layer to protect against fading from sunlight. Ceramic beads added for abrasion and scratch resistance.

Protective Wear Layer 20 mil thickness for commercial applications

Printed Decorative Film Layer offers a wide range of colors and patterns.

Core Layer stabilizes the structure.

Base Core Layer stabilizes the structure

Backing Sheet Layer provides dimensional stability and balance for the structure.



#### **Product Description**

The 2.5mm Luxury Vinyl Tile (LVT) from Bentley is a highly durable flooring product designed to withstand heavy rolling traffic. It features several layers that contribute to its performance and longevity. With a wide range of colors available, it offers both durability and aesthetic versatility. The product is FloorScore® certified, indicating that it meets stringent indoor air quality (IAQ) standards. With its exceptional durability and FloorScore® certification, Bentley's 2.5mm LVT is an excellent option for commercial environments.

2.5 mm LVT is within CSI MasterFormat section 09 65 19 and UN CPC 36910.



### Application

Bentley Mills LVT products are used as interior flooring in medium to high traffic areas in commercial settings, among others.

# **Properties of Declared Product as Delivered**

Bentley Mills LVT products are delivered packaged in a cardboard box with plastic airbags to protect the tiles during transportation to the customer. Multiple boxes are then stacked on a wooden pallet with cover boards, corner protectors, plastic wrap, and plastic strapping for shipment.

Parameter	Standard	Value
Tile Size	-	18" x 36" (457 mm x 914 mm)
Plank Size	-	6" x 48" (152 mm x 1,219 mm) 9" x 48" (229 mm x 1,219 mm)
Wear Layer Thickness	ISO 24340	0.5 mm
Overall Thickness	ISO 24346	2.5 mm
Flexibility	ASTM F137	No cracks or breaks
Chemical Resistance	ASTM F925	Slight change maximum
Resistance to Heat	ASTM F1514	<u>ΔΕ &lt;</u> 8
Resistance to Light	ASTM F1515	ΔE <u>&lt;</u> 8
Squareness	ASTM F2055/F2421	<u>&lt;</u> 0.10 in.
Dimensional Stability	ASTM F2199	<u>&lt;</u> 0.020 in/lin ft
Flooring Radiant Panel	ASTM E648	<u>&gt;</u> 0.45 W/cm <sup>2</sup>
Smoke Density	ASTM E662	<u>&lt;</u> 450 dmc flaming
Slip Resistance	ASTM D2047 Dry	<u>&gt;</u> 0.50

#### **Flow Diagram**



Figure 2: Process Flow Diagram

### Manufacturing

All Bentley Mills LVT products are manufactured by a supplier in South Korea and sent to City of Industry, California, to be distributed by Bentley Mills. The manufacturing process begins with heating and mixing



raw materials for the bottom layer, calendering materials into a thin sheet, cooling them, and winding them into rolls. Middle layers are also mixed and calendered. The top layer is printed into sheets and adhered to the middle and bottom layers. The assembly is laminated and coated with a UV coating. Following the coating process, the LVT is annealed, cut, and packaged before being shipped from the supplier to Bentley Mills for distribution. Packaging materials are either recycled, landfilled, or incinerated based on waste classification mentioned in Sections 2.8.5 and 2.8.6 in Part A of the reference PCR.

Material	Percent
Filler	52%
PVC	36%
Plasticizer	11%
Stabilizers and Pigments	1%
Other materials	<1%

Table 2: Product Composition

Table 3: Product Packaging, per m<sup>2</sup> of installed product

Material	Value	Unit
Cardboard	1.18E-01	kg
Chipboard	4.75E-03	kg
Corner Protectors	2.38E-03	kg
Hotmelt Adhesive	1.18E-03	kg
Pallet	8.08E-02	kg
Plastic Wrap	3.56E-04	kg
Plastic Strapping	1.18E-03	kg
Poly Bag	1.18E-03	kg

#### Transportation

It is assumed that all raw materials are delivered to the supplier manufacturing facility in South Korea via truck, based on global region. Distances were calculated using the supplier location and the location of manufacturing.

The product is delivered from the manufacturing facility in South Korea to Bentley Mills in California, USA, via truck and ship, then distributed to customers in North America via truck. Distribution distance to customers is based on the PCR Part B: Flooring EPD Requirements UL 10010-7.

#### **Product Installation**

Bentley Mills LVT products should be installed according to manufacturer instructions on the Bentley Mills website at <u>https://www.bentleymills.com/technical/</u>.

Installation of Bentley Mills LVT primarily consists of application of adhesive to the prepared subfloor. A hand trowel and acrylic spread adhesive are required for installation, but manufacturing of these tools are not included in the study as these are multi-use tools and the impacts per functional unit is considered negligible. The recommended coverage rate of the adhesive identified by Bentley Mills is used for this study. All waste generated during installation, including packaging waste, is disposed of according to the tables found in Section 2.8.5 of *Part A: Life Cycle Assessment Calculation Rules and Report Requirements* from UL Environment.



#### Use

The table below shows the parameters for the use phase scenario undergoing study while Table 9 shows the total material and energy inputs required in the study. These inputs were taken from Resilient Floor Coverings Institute's (RFCi) maintenance guidelines indicated in its industry wide EPD for vinyl tile. Excluded from this model is the use of finish and finish remover, as specified by the RFCi industry average EPD for vinyl tile. This is because Bentley Mills products do not require finishes and thus are not relevant. Vinyl tile products are typically not repaired or refurbished and are only replaced if the product fails or a new look is desired. Detailed maintenance instructions for Bentley Mills LVT are provided on the Bentley Mills website: <a href="https://www.bentleymills.com/technical/">https://www.bentleymills.com/technical/</a>.

Level of Use	Cleaning Process	Cleaning Frequency	Consumption of energy and resources
Commercial/ residential/ industrial	Dust mop	Daily	None
	Damp mop/ neutral cleaner	Weekly	Hot water, neutral detergent
	Spray buff	Monthly	Electricity

Table 4: Maintenance Procedure

#### Reference Service Life and Estimated Building Service Life

The reference service life of Bentley Mills 2.5 mm LVT is assumed to be 30 years given that the product is installed as per manufacturer guidelines. This product has a reference service life (RSL) of 30 years, consistent with the average LVT lifetime used in the Resilient Floor Covering Institute LCA and EPD for vinyl tile (RFCi, 2018). Therefore, after initial installation in a building with an estimated service life (ESL) of 75 years, 1.5 replacements are required.

#### Reuse, Recycling and Energy Recovery

Reuse, recycling, and energy recovery are not applicable for this product currently. Bentley Mills is an active member of the Resilient Floor Covering Institute. Through their membership with RFCI and their own research and innovation, Bentley is continually working to develop reuse and recycling solutions for their LVT.

#### Disposal

The product is assumed to be 100% landfilled as specified in Sections 2.8.5 and 2.8.6 of Part A: Life Cycle Assessment Calculation Rules and Report Requirements from UL Environment.



## Life Cycle Assessment Background Information

### **Declaration of Methodological Framework**

The LCA follows an attributional approach.

#### **Functional Unit**

The functional unit of the flooring product is one (1)  $m^2$  of installed flooring. The mass per product and per functional unit for the product is presented in the table below.

Table 5: Functional Unit Details

Product	Product Weight	Functional Unit Weight	Unit
2.5 mm LVT	4.42	4.99	kg

#### **System Boundary**

This EPD is a Cradle-to-Grave study.

Tahle	6.	S1	/stem	Rounds	arv	and	Modu	ILDO
IUDIC	υ.	$\cup$		Dounde	лу	anu	would	103

Module Name	Description	Analysis Period	Summary of Included Elements
A1	Product Stage: Raw Material Supply	2021	Raw Material sourcing and processing as defined by secondary data.
A2	Product Stage: Transport	2021	Shipping from supplier to manufacturing site. Fuel use requirements estimated based on product weights and estimated distance.
A3	Product Stage: Manufacturing	2021	Energy inputs required for manufacturing products from raw materials. Packaging materials and manufacturing waste are included as well.
A4	Construction Process Stage: Transport	2021	Shipping from manufacturing site to project site. Fuel use requirements estimated based on product weights and mapped distance.
A5	Construction Process Stage: Installation	2021	Installation materials, installation waste and packaging material waste.
B1	Use Stage: Use	2021	Use of the product.
B2	Use Stage: Maintenance	2021	Cleaning energy, water, and materials, including refinishing the product.
B3	Use Stage: Repair	2021	Product typically not repaired during use.
B4	Use Stage: Replacement	2021	Total materials and energy required to manufacture a replacement.
B5	Use Stage: Refurbishment	2021	Product typically not refurbished during use.
B6	Operational Energy Use	2021	Operational Energy Use of Building Integrated System During Product Use
B7	Operational Water Use	2021	Operational Water Use of Building Integrated System During Product Use
C1	EOL: Deconstruction	2021	No inputs required for deconstruction.
C2	EOL: Transport	2021	Shipping from project site to waste disposal.
C3	EOL: Waste Processing	2021	Waste processing if incineration as chosen disposal pathway per Part A of the PCR.
C4	EOL: Disposal	2021	Disposal modeled by region as per Part A of the PCR.

# BENTLEY

Module<br/>NameDescriptionAnalysis<br/>PeriodSummary of Included ElementsDBenefits beyond systemMNDCredits from energy or material capture.

#### **Estimates and Assumptions**

All estimates and assumptions are within the requirements of ISO 14040/44. The majority of the estimations are within the primary data. The primary data was collected as annual totals for electricity usage and production volume. For the LCA, the utility usage information was divided by the production to find a utility consumption per unit mass. Another assumption is that the installation tools are used enough times that the per square meter impacts are negligible.

#### Cut-Off Criteria

A cut-off rule of 1% has been applied to this assessment, meaning the included inventory data must account for greater than 99% of the total material and energy inputs into the system. Furthermore, greater than 99% of the environmental impacts from the product system must be accounted for in the assessment. No known material or manufacturing inputs or outputs are deliberately excluded from this EPD. Cumulative excluded inputs within the life cycle account for less than 1% of the total mass inputs, energy inputs, and environmental impacts.

#### **Data Sources**

Primary data were collected by facility personnel and from utility bills and was used for all manufacturing processes. Whenever available, supplier data was used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production was utilized from Sphera Managed LCA Content Database 2023.1.

#### **Data Quality**

The geographical scope of the manufacturing portion of the life cycle is South Korea. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered good. The primary data provided by the manufacturer represent all information for calendar year 2021. Time coverage of this data is considered good. Primary data provided by the manufacturer is specific to the technology used in manufacturing their product. It is site-specific and considered of good quality. Data necessary to model cradle-to-gate unit processes was sourced from Sphera Managed LCA Content LCI datasets. Improved life cycle data from suppliers would improve technological coverage.

#### **Period Under Review**

The period under review is calendar year 2021.

#### Allocation

General principles of allocation were based on ISO 14040/44. To derive a per-unit value for manufacturing electricity, allocation based on total production by mass was adopted. As a default, secondary Sphera Managed LCA Content datasets use a physical basis for allocation.

Of relevance to the defined system boundary is the method in which recycled materials were handled. Throughout the study recycled materials were accounted for via the cut-off method. Under this method, impacts and benefits associated with the previous life of a raw material from recycled stock are excluded from the system boundary. Additionally, impacts and benefits associated with secondary functions of materials at end of life are also excluded (i.e., production into a third life or energy generation from the



incineration plant). The study does include the impacts associated with reprocessing and preparation of recycled materials that are part of the bill of materials of the products under study.

#### **Comparability and Benchmarking**

The user of the EPD should take care when comparing EPDs from different companies. Assumptions, data sources, and assessment tools may all impact the uncertainty of the final results and make comparisons misleading. Without understanding the specific variability, the user is therefore, not encouraged to compare EPDs. Even for similar products, differences in use and end-of-life stage assumptions, and data quality may produce incomparable results. Comparison of the environmental performance of Flooring Products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR for Products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

Comparison of the environmental performance of construction works and construction products using EPD information shall be based on the product's use and impacts at the construction works level. In general, EPDs may not be used for comparability purposes when not considered in a construction works context. Given this PCR ensures products meet the same functional requirements, comparability is permissible provided the information given for such comparison is transparent and the limitations of comparability explained.

Pr	Production		Construction			Use						End c	of Life		Benefits & Loads Beyond System Boundary	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw Material Supply	Transport	Manufacturing	Transport to Site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction	Transport	Waste Processing	Disposal	Reuse, Recovery, Recycling Potential
Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	Х	MND

Table 7: Life Cycle Stages Included in the Study

X = Module Included in LCA Report, MND = Module not Declared



# Life Cycle Assessment Scenarios

Table 8: Transportation to Building Site (A4)

	Transportation by Ship	Transportation by Truck					
Weight of Products Transported [kg]	5.22						
Volume of Products Transported [m <sup>3</sup> ]	0.0107						
Vehicle Type	Bulk commodity carrier, 1,000 to 250,000 dwt payload capacity, deep sea	Truck - Heavy Heavy-duty Diesel Truck / 53,333 lb payload - 8b					
Fuel Efficiency [L/100km]	15,134	42					
Fuel Type	Heavy fuel oil	Diesel					
Distance [km]	10,400	850					
Capacity Utilization [%]	53%	68%					
Capacity Utilization Volume Factor	1						

#### Table 9: Reference Service Life

Name	Value
RSL [years]	30
Declared product properties (at the gate) and finishes, etc.	See Table 1 for technical details
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Per industry standards
Indoor environment	Can be installed in any typical indoor environment, assuming manufacturer's installation instructions and recommendations are followed
Maintenance	See Use section above for maintenance instructions

Table 10: Installation at building site (A5)

	Value						
Adhesive [kg]*	3.50E-01						
Product Loss During Installation	5%						
Installation Waste Sent to Landfill	2.21E-01						
Packaging Waste to Landfill [kg]	8.70E-02						
Packaging Waste to Incineration [kg]	2.40E-02						
Packaging Waste to Recycling [kg]	9.70E-02						
Biogenic Carbon Contained in Packaging [kg]	3.14E-01						
No freshwater, electricity, or fuels are used in installation.							
*Emissions from the adhesive during installation were considered for this assessment. However, no emissions							
were modeled due to the manufacturer-recommended adhesives having low- to no-VOC content.							



Name	Value	Unit						
Maintenance process information	Industry wide EPD by RFCi	-						
Maintenance cycle	1,560 (weekly)	Cycles/ RSL						
Maintenance cycle	3,900 (weekly)	Cycles/ ESL						
Net freshwater consumption	0.435	m³/ ESL						
Detergent Finish Finish Remover	8.90 Not required Not required	kg/ ESL kg/ ESL kg/ ESL						
Electricity (for spray buffing)	1.70	kWh/ ESL						
Power output of equipment	1.10	kW						
No waste or direct emissions occur during regular maintenance								

Table 12: End-of-Life Scenario Details (C1-C4)

	Value
Collected as mixed construction waste [kg]	4.77
Waste to Landfill [kg]	4.77
Distance to Landfill [km]	161
Waste to Incineration [kg]	0
Distance to Incineration [km]	0
Waste to Recycling [kg]	0
Distance to Recycling [km]	0



#### Life Cycle Assessment Results

All results are given per functional unit, which is 1 m<sup>2</sup> of installed flooring over an estimated building life of 75 years. Environmental Impacts were calculated using the Sphera LCA for Experts software platform. Impact results have been calculated using IPCC AR5, TRACI 2.1, and CML 2001-Jan 2016 characterization factors. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. The Impact Category Key tables give definitions of relevant acronyms.

The LCIA impact categories referenced below are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

Abbreviation	Parameter	Unit
IPCC AR5		
GWP	Global warming potential (100 years, includes biogenic CO2)	kg CO <sub>2</sub> eq
TRACI 2.1		
AP	Acidification potential of soil and water	kg SO <sub>2</sub> eq
EP	Eutrophication potential	kg N eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
SFP	Smog formation potential	kg O₃ eq
CML 2001-Jan	2016	
ADPF	Abiotic depletion potential for fossil resources	MJ, net calorific value

#### Table 13: Impact Category Key – LCIA Indicators

#### Table 14: Impact Category Key - Biogenic Carbon Indicators

Abbreviation	Parameter	Unit				
BCRP	Biogenic Carbon Removal from Product	[kg CO <sub>2</sub> ]				
BCEP	Biogenic Carbon Emission from Product	[kg CO <sub>2</sub> ]				
BCRK	Biogenic Carbon Removal from Packaging	[kg CO <sub>2</sub> ]				
BCEK	Biogenic Carbon Emission from Packaging	[kg CO <sub>2</sub> ]				
	Biogenic Carbon Emission from Combustion of Waste from Renewable					
DOLW	Sources Used in Production Processes					
CCE	Calcination Carbon Emissions	[kg CO <sub>2</sub> ]				
CCR	Carbonation Carbon Removals	[kg CO <sub>2</sub> ]				
CWNP	Carbon Emissions from Combustion of Waste from Non- Renewable					
	Sources used in Production Processes					

#### Table 15: Impact Category Key – Resource Use, Waste, and Output Flow Indicators

Abbreviation	Parameter	Unit							
Resource Use Parameters									
RPRE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)							
RPRM	Use of renewable primary energy resources used as raw materials	MJ, net calorific value							

# BENELEY LOSANGELES

Abbreviation	Parameter	Unit			
NRPRE	Use of non-renewable primary energy excluding non- renewable primary energy resources used as raw materials	MJ, net calorific value			
NRPRM	Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value			
SM	Use of secondary materials	kg			
RSF	Use of renewable secondary fuels	MJ, net calorific value			
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value			
RE	Recovered energy	MJ, net calorific value			
FW	Net use of fresh water	m <sup>3</sup>			
Waste Parameters and Output Flows					
HWD	Disposed-of-hazardous waste	kg			
NHWD	Disposed-of non-hazardous waste	kg			
HLRW	High-level radioactive waste, conditioned, to final repository	kg			
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg			
CRU	Components for reuse	kg			
MR	Materials for recycling	kg			
MER	Materials for energy recovery	kg			
EE	Exported energy	MJ			



#### Bentley Mills 2.5 mm LVT – Results

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
IPCC AR5															
GWP [kg CO <sub>2</sub> eq]	6.12E+00	5.34E-01	7.07E-01	0.00E+00	2.31E+00	0.00E+00	1.12E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.85E-04	0.00E+00	1.03E-01	MND
TRACI LCIA Impacts															
AP [kg SO₂ eq]	9.44E-03	6.72E-03	1.62E-03	0.00E+00	3.05E-03	0.00E+00	2.75E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-06	0.00E+00	5.29E-04	MND
EP [kg N eq]	8.98E-04	3.13E-04	2.43E-04	0.00E+00	3.28E-04	0.00E+00	3.45E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E-07	0.00E+00	8.48E-04	MND
ODP [kg CFC 11 eq]	2.52E-12	1.26E-15	1.55E-13	0.00E+00	1.21E-13	0.00E+00	4.02E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.86E-19	0.00E+00	4.91E-15	MND
SFP [kg O₃ eq]	2.22E-01	1.32E-01	3.02E-02	0.00E+00	6.14E-02	0.00E+00	5.91E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E-05	0.00E+00	9.65E-03	MND
CML 2001-Jan 2016															
ADPF [MJ]	1.50E+02	7.11E+00	1.51E+01	0.00E+00	4.69E+01	0.00E+00	2.61E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.33E-03	0.00E+00	1.55E+00	MND
Carbon Emissions and	Uptake														
BCRP [kg CO <sub>2</sub> ]	0.00E+00	MND													
BCEP [kg CO <sub>2</sub> ]	0.00E+00	MND													
BCRK [kg CO <sub>2</sub> ]	3.14E-01	0.00E+00	1.57E-02	0.00E+00	0.00E+00	0.00E+00	4.95E-01	0.00E+00	MND						
BCEK [kg CO <sub>2</sub> ]	0.00E+00	0.00E+00	3.18E-01	0.00E+00	0.00E+00	0.00E+00	4.78E-01	0.00E+00	MND						
BCEW [kg CO <sub>2</sub> ]	0.00E+00	MND													
CCE [kg CO <sub>2</sub> ]	0.00E+00	MND													
CCR [kg CO <sub>2</sub> ]	0.00E+00	MND													
CWNR [kg CO <sub>2</sub> ]	0.00E+00	MND													

#### Table 16: LCIA results for 2.5 mm LVT, per m<sup>2</sup> of installed flooring.



Table 17: Resource use, waste, and output flow results for 2.5 mm LVT, per m<sup>2</sup> of installed flooring.

Impact Category	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Resource Use Indicators															
RPR <sub>E</sub> [MJ]	1.33E+01	2.04E-01	2.40E+00	0.00E+00	4.84E+00	0.00E+00	2.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E-04	0.00E+00	1.87E-01	MND
RPR <sub>M</sub> [MJ]	3.18E+00	0.00E+00	1.59E-01	0.00E+00	0.00E+00	0.00E+00	5.00E+00	0.00E+00	MND						
NRPR <sub>E</sub> [MJ]	9.00E+01	7.17E+00	1.24E+01	0.00E+00	5.20E+01	0.00E+00	1.67E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.38E-03	0.00E+00	1.60E+00	MND
NRPR <sub>M</sub> [MJ]	3.38E+01	0.00E+00	1.69E+00	0.00E+00	0.00E+00	0.00E+00	5.32E+01	0.00E+00	MND						
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
FW [m <sup>3</sup> ]	3.12E-02	6.73E-04	3.11E-03	0.00E+00	4.58E-01	0.00E+00	5.28E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.34E-07	0.00E+00	1.98E-04	MND
Output Flows and Waste	Categories	6													
HWD [kg]	3.67E-05	1.98E-11	4.01E-06	0.00E+00	1.30E-09	0.00E+00	6.10E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.55E-14	0.00E+00	3.98E-11	MND
NHWD [kg]	1.23E-01	5.26E-04	3.17E-01	0.00E+00	1.52E-01	0.00E+00	7.78E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.68E-07	0.00E+00	4.75E+00	MND
HLRW [kg]	3.08E-06	2.33E-08	2.42E-07	0.00E+00	2.16E-06	0.00E+00	5.05E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-11	0.00E+00	1.97E-08	MND
ILLRW [kg]	2.59E-03	1.96E-05	2.20E-04	0.00E+00	1.81E-03	0.00E+00	4.28E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-08	0.00E+00	1.77E-05	MND
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
MR [kg]	2.19E-03	0.00E+00	1.09E-04	0.00E+00	0.00E+00	0.00E+00	3.45E-03	0.00E+00	MND						
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	MND
EE [MJ]	3.77E-02	0.00E+00	1.23E-01	0.00E+00	0.00E+00	0.00E+00	2.41E-01	0.00E+00	MND						



# Life Cycle Assessment Interpretation

For global warming impacts, the replacements stage (B4) is the greatest contributor. This follows the fact that with a reference service life of 30 years, there are 1.5 replacements that need to occur during the 75 years of building operation, apart from the initial product installation. This includes raw material extraction, manufacturing, distribution, install and end of life (for replaced product) for every replacement.

If the impacts from maintenance are set aside to observe impacts from other phases, the product stage (A1-A3) is the greats contributor to the global warming impacts. Within raw the product stage, raw material extraction drives impact, specifically PVC. This is a fossil-based materials, which makes up the majority of the product based on weight, explaining its presence as top contributors within the product stage.

The maintenance stage (B2) is also an important contributor following the product stage. This is primarily due to the consumption of energy and resources used to maintain LVT over the course of its lifetime.

Trends for all other TRACI impact categories follow the trends of global warming, where replacements and raw materials contribute the most to life cycle impacts. For eutrophication and smog formation potential, distribution to customer (A4) is also a significant contributor.

# BENTLEY

# Additional Environmental Information

#### **Mandatory Environmental Information**

No substances required to be reported as hazardous per the EPA's Resource Conservation and Recovery Act (US EPA, 2023) were identified during the LCA associated with the production of this product.

#### **Environmental and Health During Manufacturing**

Information on Bentley Mills' sustainability programs, sustainability resources, and sustainability certifications can be found at Bentley Mills' sustainability website at <a href="https://www.bentleymills.com/sustainability/">https://www.bentleymills.com/sustainability/</a>

#### **Environment and Health During Installation**

All recommended personal protective equipment (PPE) should be utilized during installation, as indicated on the SDS and installation guidelines, found online at <u>https://www.bentleymills.com/technical/</u>.

#### **Extraordinary Effects**

Fire

2.5 mm LVT flooring has received a Class I critical radiant flux,  $\geq$  0.45 W/cm<sup>2</sup>, ASTM E648.

#### Water

There are no environmental impacts associated with the product being flooded.

#### **Mechanical Destruction**

Should the product become flooded, the water should be removed through means of extraction and drying and the product should behave as originally intended. There are no environmental impacts associated with the product being flooded.

#### **Environmental Activities and Certifications**

2.5 mm LVT has the following environmental certifications. These certifications can be accessed with the links below:

- Material Ingredient Disclosure via Health Product Declaration (HPD): HPD
- VOCs via FloorScore® (CDPH V1.2-2017): FloorScore Certification

#### CML - Department of Industrial Ecology. (2016, September 05). CML-IA Characterisation Factors. Retrieved from https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisationfactors

- International EPD System. (2021). *General Programme Instructions of the International EPD System. Version* 4.0.
- IPCC. (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
- ISO. (2006). *ISO 14025: Environmental labels and declarations Type III environmental declarations Principles and procedures.* Geneva: International Organization for Standardization.
- ISO. (2006). ISO 14040/Amd 1:2020: Environmental management Life cycle assessment Principles and framework. Geneva: International Organization for Standardization.
- ISO. (2006). ISO 14044/Amd 1:2017/Amd 2:2020: Environmental Management Life cycle assessment -Requirements and Guidelines. Geneva: International Organization for Standardization.
- ISO. (2017). *ISO 21930: Sustainability in buildings and civil engineering works Core rules for environmental product declarations of construction products and services.* Geneva: International Organization for Standardization.
- RFCi. (2018). Industry-Wide EPD: Vinyl Tile. Resilient Floor Coverings Institute.

References

- UL Environment. (2018). Part B: Flooring EPD Requirements, UL 10010-7, Version 2.0.
- UL Environment. (2022). Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL 10010, V4.0.
- US EPA. (2012). TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. Version 2.1 - User Guide. Retrieved from https://nepis.epa.gov/Adobe/PDF/P100HN53.pdf
- US EPA. (2023). Resource Conservation and Recovery Act, Subtitle C. US EPA.

WAP Sustainability Consulting. (2023). Life Cycle Assessment for Bentley Mills Luxury Vinyl Tile.