

**BENTLEY®****Declaration Owner**

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Product

AFFIXX™ Tile - Piece Dyed Nylon 6,6

Functional Unit

The functional unit is one square meter of floor covering provided and maintained for a period of 60 years.

EPD Number and Period of Validity

SCS-EPD-04586
EPD Valid December 29, 2017 through December 28, 2022

Product Category Rule

Product Category Rule (PCR) for preparing an Environmental Product Declaration (EPD) for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood. NSF International. Version 2. 2014.

Program Operator

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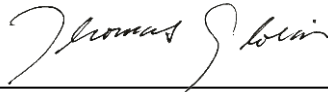
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Disclaimers: This EPD conforms to ISO 14025, 14040, ISO 14044, and ISO 21930.

Scope of Results Reported: The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.

Accuracy of Results: Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.

Comparability: The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

PCR review, was conducted by	Jack Geibig, EcoForm. jgeibig@ecoform.com
Approved Date: December 29, 2017 – End Date: December 28, 2022	
Independent verification of the declaration and data, according to ISO 14025:2006 and ISO 21930: 2007.	☐ internal ☒ external
Third party verifier	 Tom Gloria, PhD, Industrial Ecology Consultants

ABOUT Bentley Mills, Inc.

For more than 30 years, California-based Bentley Mills, Inc. has manufactured broadloom, carpet tile, and area rug products for interiors. Bentley's AFFIXX™ Tile, produced at the City of Industry, California manufacturing facility is a modular Tile with nylon 6,6 face fiber and a backing containing some recycled materials. Many of its products feature high performance and superior Textile Appearance Retention Rating (TARR), as well as Green Label Plus, NSF® 140 Platinum, and Cradle to Cradle Silver certifications.

PRODUCT DESCRIPTION

AFFIXX™ Tile, produced at the City of Industry, California manufacturing facility is a modular Tile with nylon 6,6 face fiber and a backing containing some recycled materials. It is certified Cradle to Cradle Silver, NSF 140 Platinum, and CRI Green Label Plus. The manufacturer warrants for a period of 15 years from the date of invoice.

PRODUCT PERFORMANCE

Table 1. *Product performance test results for Bentley AFFIXX™ flooring.*

Carpet Test Method	Test Results & Supporting Documentation
AATCC Test Method 134 Electrostatic Propensity of Carpets	≤ 3.5 kV
AATCC Test Method 16, Option 3 Colorfastness to Light	4 at 40 AFUs
ASTM E648 Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	Class 1, ≥ 0.45 W/cm ²
ASTM E662 Standard test Method for Specific Optical Density of Smoke Generated by Solid Materials	< 450 Dm Corrected ¹
ASTM D5252 Standard Practice for the Operation of the Hexapod Tumble Drum Tester / ASTM D7330 Standard Test Method for Assessment of Surface Appearance Change in Pile Floor Coverings Using Standard Reference Scales	3.0

PRODUCT APPLICATION

The Bentley AFFIXX™ Tile provides the primary function of floor covering in indoor commercial areas.



MATERIAL CONTENT

Table 2. Origin and availability of material content.

Component	Materials	Origin of Raw Material	Availability			Percent of Total
			Renewable	Non-Renewable	Pre- and Post-Consumer Recycled Content	
Facing	Nylon 6,6	United States		Fossil limited		29%
Primary Backing	Non-woven Polyester	Global		Fossil limited	45%/0%	4.2%
Carpet Protector/Stain Release	Proprietary	Global		Fossil limited		0.40%
Precoat	Vinyl Acetate Polymer	Global		Fossil limited		6.6%
Soap	Ammonium Lauryl Sulfate	United States		Abundant		0.03%
Filler	Calcium Carbonate	Global		Mineral abundant	100%/0%	12%
Fire Retardant	Alumina Trihydrate	Global		Mineral abundant		3.3%
Dispersant	Sodium Polyacrylate	Global		Fossil limited		0.003%
Thickener	Sodium Polyacrylate	Global		Fossil limited	35%/30%	0.10%
Adhesive & Laminate	Polyolefin	Global		Fossil limited		39%
Stabilizer	Fiberglass	United States		Fossil limited		2.2%
Scrim	Polyester	Global		Fossil limited	50%/50%	3.3%

The following regulated hazardous chemicals may be present based on a review of Material Safety Data Sheets for the product component materials

- Acetaldehyde (CAS 78-07-0)
- Calcium carbonate (CAS 47134-1)
- Continuous filament glass fibers (CAS 65997-17-3)
- Ethanol (CAS 64-17-5)
- Formaldehyde (CAS 50-00-0)
- Silica, quartz (CAS 14808-60-7)
- Urea Formaldehyde Binder (CAS 9011-05-6)

PRODUCTION OF MAIN MATERIALS

Alumina Trihydrate: A flame retardant that is derived from bauxite ore and refined to a fine white powder.

Ammonium Lauryl Sulfate: A foaming agent and detergent derived from petrochemicals.

Calcium Carbonate: An abundant mineral found worldwide and a common substance found in rocks. It can be ground into varying particle sizes.

Non-woven Polyester: Polyester fibers bonded together without being woven or knitted and derived from petrochemicals.

Nylon 6,6: A synthetic polymer that can be utilized for fiber applications and derived from petrochemicals.

Fiberglass: Continuous glass fibers reinforced with a thermosetting plastic. Its major ingredients are silica sand, limestone, soda ash, and petrochemicals.

Polyester: A synthetic fiber material produced from the polymerization of petrochemicals.

Polyolefin: A class of synthetic resins prepared by the polymerization of hydrocarbons and derived from petrochemicals.

Sodium Polyacrylate: An anionic polyelectrolyte utilized as a dispersing agent and derived from petrochemicals.

Vinyl Acetate Polymer: A thermoplastic prepared by the polymerization of vinyl acetate monomer, derived from petrochemicals.

PRODUCT CHARACTERISTICS

Table 3. Product characteristics for the Bentley AFFIXX™ Tile.

Characteristics		Description
Type of Manufacture		Tufted Carpet Tile
Yarn Type		Type 6,6 Nylon
Additional characteristics according to NSF/ANSI 140		Platinum
Sustainable certifications		NSF/ANSI 140 Sustainable Carpet Assessment, Cradle to Cradle Certified™
VOC emissions test method		CDPH Section 01350 Version 1.1
CRI TARR rating		2.5 – 4.0 Moderate – Extreme Traffic
Characteristics	Nominal Value	Unit
Thickness	5.5 (0.217)	mm (inch)
Product weight	2,630 (78)	g/m ² (oz/yd ²)
Surface pile thickness	4.57 (0.18)	mm (inch)
Number of tufts or loops / dm ²	8.32 (129)	Tufts per dm ² (Tufts per in ²)
Surface pile weight	522 (15.4)	g/m ² (oz/yd ²)
Pile fiber composition	19.86	%
Secondary backing	Fiberglass and Polyester Scrim	NA

ADDITIONAL ENVIRONMENTAL INFORMATION

The Bentley facility, located in California, is the first carpet manufacturing facility in the country to receive a Silver rating from the U.S. Green Building Council's Leadership in Energy and Environmental Design Green Building Rating System™ for Existing Buildings (LEED-EB). In 2013, Bentley achieved LEED-EBOM Gold Certification. For additional information regarding Bentley's LEED-EB Gold Certification, visit <http://www.bentleymills.com/wp-content/uploads/2014/02/BentleyLEEDBHighlights.pdf>.

The Bentley FULFILL™ reclamation program offers to take back any carpet (all Bentley products can be reclaimed) from any manufacturer, guaranteeing 100% landfill diversion. The program has diverted over 120 million pounds of material from the landfill. For additional information regarding the FULFILL™ program, visit <http://www.bentleymills.com/wp-content/uploads/2014/11/FULFILL-Fact-Sheet.pdf>.

All products manufactured by Bentley meet CRI Green Label Plus requirements and are tested each quarter. Carpet that is Green Label Plus certified contributes to Indoor Environmental Quality credit points in the LEED rating system.

The AFFIX™ Tile is Cradle to Cradle certified at the Silver Level. The Cradle to Cradle certification program is a multi-attribute green label that assesses product safety for health and the human environment, guides design for the future, and leads manufactures toward continuous environmental improvement.

Bentley's AFFIX™ Tile product is NSF® 140 certified at the Platinum level. NSF/ANSI 140: Sustainability Assessment for Carpet is the industry-leading standard for sustainability evaluation and certification of carpet products across their entire life cycle.

For additional information regarding Bentley's environmental efforts, visit <http://www.bentleymills.com/sustainability>

LIFE CYCLE ASSESSMENT

A cradle to grave life cycle assessment (LCA) was completed for this product group in accordance with ISO 14040, ISO 14044, ISO 21930, and Product Category Rule for Environmental Product Declarations for Flooring: Carpet, Resilient, Laminate, Ceramic, Wood (Version 2).

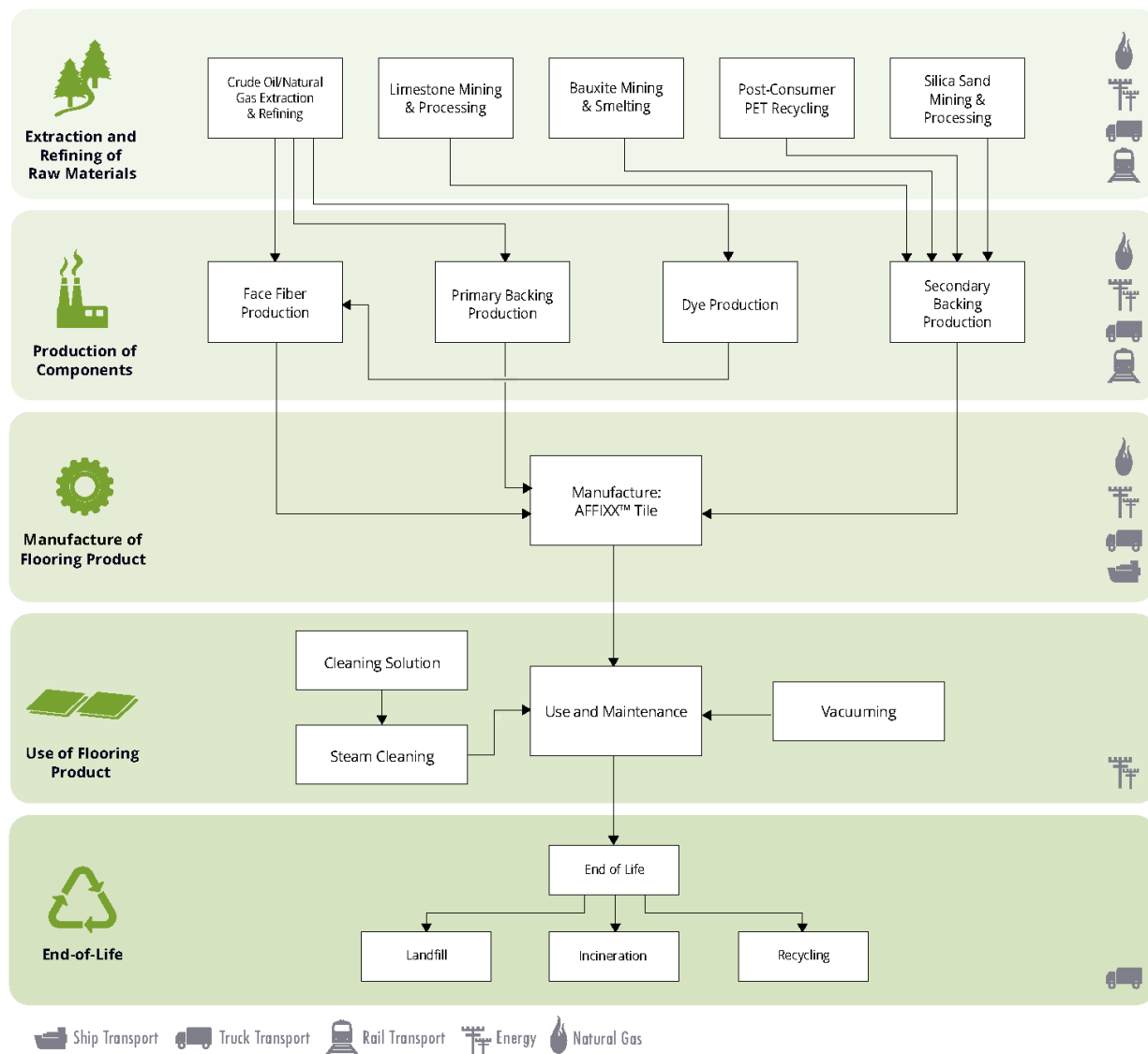


FUNCTIONAL UNIT

The functional unit is, according to the PCR, the total impact for the expected life of the building (60 years). But the service life is dependent on the product lifetime, which is 15 years in this case. The PCR consequently requires separate reporting of LCA results A) for 1 m² of floor covering - extraction/processing, manufacturing, delivery and installation and end of life, B) the average 1- year use stage, and C) for the 60 year life of the building as combined using A) and B), calculated from the reference service life (RSL) of the product.

PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of AFFIX™ Tile flooring. This includes resource extraction and processing, product manufacture, use and maintenance, and end-of-life.



LIFE CYCLE ASSESSMENT STAGES AND REPORTED INFORMATION

Sourcing/Extraction Stage (raw material acquisition)

This stage includes extraction of virgin materials and reclamation of non-virgin feedstock. Resource use and emissions associated with both extraction of the raw materials and manufacture of flooring components are included.

Manufacturing Stage

This stage includes all the relevant manufacturing processes and flows, including packaging. Production of capital goods, infrastructure, production of manufacturing equipment, and personnel-related activities are not included.

Delivery and Installation Stage

Delivery

This stage includes the delivery of the Tile to the point of installation. Modeling used in the life cycle assessment assumed an estimated distribution distance to point of sale of 2,500 miles via diesel truck, representing transport across the United States.

Installation

The AFFIX™ Tile is installed with Bentley's new hook and loop system for carpet tile and requires no adhesives for installation¹.

Waste

Waste generated during product installation can be disposed of in a landfill or incinerated.

Packaging

Table 4. Packaging material for the AFFIX™ Tile, Piece Dyed Nylon 6,6. Shown per 1 m² flooring.

Material	Amount (kg)	Percent of Total
Corrugated board	8.8x10 ⁻²	29%
White-lined chipboard	5.2x10 ⁻²	17%
Packaging film (LDPE)	4.9x10 ⁻³	1.6%
Wood pallet	0.16	52%

Use Stage

Cleaning and maintenance

The recommended product cleaning and maintenance are summarized in Table 5.

¹ <http://www.bentleymills.com/wp-content/uploads/2017/02/AFFIX-Spec-Sheet-20170214.pdf>

Table 5. *Cleaning and maintenance for the AFFIX™ Tile, Piece Dyed Nylon 6,6.*

Cleaning Process	Traffic, Soil Rating			Energy & Resource Use
	Light - 500 traffics or less daily	Moderate - 500-1,000 traffics daily	Heavy – 1,000-2,500 traffics daily	
Vacuuming	Twice or more each week	Once daily	At least once daily	Electricity
Interim Maintenance (Steam cleaning)	Once per year	Twice per year; should include pile lifting	Monthly; should include pile lifting	Electricity; Detergent; Water
Restorative Maintenance (Steam cleaning)	Once per year; should include pile lifting	Twice per year; should include pile lifting	Four times annually; should include pile lifting	Electricity; Detergent; Water

End-of-Life Stage

Recycling, reuse, or repurpose

Data for estimation of recycling rates for the product and packaging are taken from the Carpet America Recovery Effort's (CARE) 2015 Annual Report and the US Environmental Protection Agency's Municipal Solid Waste Report, respectively. For product materials, it is assumed that 4.6% are recycled, while recycling rates for packaging materials vary, depending on waste material type.

Disposal

For the remaining product materials not recycled, it is assumed that 5.5% are incinerated and 89.9% go to a landfill. Similarly, for packaging materials not recycled, it is assumed that 20% are incinerated and 80% go to a landfill. Transportation of waste materials at end of life assumes a 20 mile average distance to disposal, consistent with assumptions used in the US EPA WARM model.

LIFE CYCLE INVENTORY

In accordance with ISO 21930, the following aggregated inventory flows are included in the LCA, in addition to the LCIA and inventory flow requirements specified by the PCR:

- Use of renewable material resources
- Consumption of freshwater
- Hazardous Waste
- Non-hazardous Waste

All results are calculated using the SimaPro 8.3 model using primary and secondary inventory data. Classification for Use of Renewable Material Resources is based on review of elementary flows and resources considered renewable on a human time scale. Elementary flows related to use of wood, minerals, and land occupation were not included. Water consumption is also not included as this is reported separately. Based on this classification process, no renewable material resources are estimated for the product system under consideration.

Table 6. *Results for aggregated inventory flows, shown in kg per 1 m² of flooring maintained for 60 years.*

Parameter	Units	Extraction & Processing	Manufacturing	Delivery & Installation	Use	Disposal	Total
Freshwater consumption	kg	1,300	980	150	930	1.4	3,400
Hazardous wastes	kg	3.3x10 ⁻⁴	2.0x10 ⁻⁴	9.2x10 ⁻⁵	5.6x10 ⁻⁴	1.0x10 ⁻⁵	1.2x10 ⁻³
Non-Hazardous wastes	kg	3,7	0.56	7.3	0.82	15	27

LIFE CYCLE IMPACT ASSESSMENT

Life cycle impact assessment is the process of converting the life cycle inventory results into a representation of environmental and human health impacts. For example, emissions such as carbon dioxide, methane, and nitrous oxide (inventory) together contribute to climate change (impact assessment). The impact assessment for the EPD is conducted in accordance with requirements of the PCR. Impact category indicators are estimated using the CML 2001 (Oct 2013) characterization method. Aggregated inventory flows for energy use and wastes are also calculated. The LCIA and inventory flow results are calculated using SimaPro 8.3 software.

Table 7. Cradle to install and end of life for the AFFIX™ Tile. Results are shown per 1 m² flooring for an average 1-year time horizon. (Table A of the PCR)

Impact Category	Units	Extraction & Processing	Manufacturing	Delivery & Installation	Disposal	Total
Global Warming Potential, 100 year time horizon	kg CO ₂ eq	9.9 50%	4.7 23%	3.5 17%	1.9 9.4%	20 100%
Acidification Potential	kg SO ₂ eq	4.0x10 ⁻² 45%	3.3x10 ⁻² 37%	1.5x10 ⁻² 17%	4.4x10 ⁻⁴ 0.49%	8.9x10 ⁻² 100%
Ozone Depletion Potential	kg CFC-11 eq	1.6x10 ⁻² 48%	2.4x10 ⁻³ 7.4%	2.7x10 ⁻³ 8.4%	1.2x10 ⁻² 36%	3.3x10 ⁻² 100%
Photochemical Ozone Creation Potential	kg C ₂ H ₄	2.5x10 ⁻³ 49%	1.6x10 ⁻³ 31%	6.7x10 ⁻⁴ 13%	3.7x10 ⁻⁴ 7.1%	5.2x10 ⁻³ 100%
Eutrophication Potential	kg PO ₄ ³⁻ eq	4.1x10 ⁻⁷ 37%	2.2x10 ⁻⁷ 20%	4.7x10 ⁻⁷ 42%	1.6x10 ⁻⁸ 1.5%	1.1x10 ⁻⁶ 100%
Abiotic Depletion Potential, Elements	kg Sb eq	1.3x10 ⁻⁵ 56%	1.6x10 ⁻⁶ 7.0%	8.4x10 ⁻⁶ 36%	1.3x10 ⁻⁷ 0.57%	2.3x10 ⁻⁵ 100%
Abiotic Depletion Potential, Fossil Fuels	MJ	170 57%	74 24%	56 18%	1.3 0.42%	300 100%
Renewable Energy	MJ	4.9 36%	8.2 60%	0.59 4.3%	7.0x10 ⁻² 0.51%	14 100%
Non-renewable Energy	MJ	180 56%	83 25%	58 18%	1.5 0.47%	320 100%



Table 8. Average 1 year use stage impacts for the AFFIX™ Tile per 1 m² flooring. (Table B of the PCR)

Impact Category	Units	Use & Maintenance
Global Warming Potential, 100 year time horizon	kg CO ₂ eq	0.44
Acidification Potential	kg SO ₂ eq	3.3x10 ⁻³
Ozone Depletion Potential	kg CFC-11 eq	8.0x10 ⁻⁴
Photochemical Ozone Creation Potential	kg C ₂ H ₄	1.3x10 ⁻⁴
Eutrophication Potential	kg PO ₄ ³⁻ eq	1.1x10 ⁻⁸
Abiotic Depletion Potential, Elements	kg Sb eq	5.1x10 ⁻⁷
Abiotic Depletion Potential, Fossil Fuels	MJ	5.3
Renewable Energy	MJ	0.31
Non-renewable Energy	MJ	7.2

Table 9. Life cycle stage impacts for the AFFIX™ Tile per 1 m² flooring over an average building life of 60 years. (Table C of the PCR)

Impact Category	Units	Extraction & Processing	Manufacturing	Delivery & Installation	Use	Disposal	Total
Global Warming Potential, 100 year time horizon	kg CO ₂ eq	40 37%	19 18%	14 13%	26 25%	7.5 7.0%	110 100%
Acidification Potential	kg SO ₂ eq	0.16 29%	0.13 24%	6.2x10 ⁻² 11%	0.20 35%	1.8x10 ⁻³ 0.32%	0.55 100%
Ozone Depletion Potential	kg CFC-11 eq	6.3x10 ⁻² 35%	9.6x10 ⁻³ 5.4%	1.1x10 ⁻² 6.14%	4.8x10 ⁻² 27%	4.7x10 ⁻² 26%	0.18 100%
Photochemical Ozone Creation Potential	kg C ₂ H ₄	1.0x10 ⁻² 35%	6.5x10 ⁻³ 23%	2.7x10 ⁻³ 9.4%	7.9x10 ⁻³ 28%	1.5x10 ⁻³ 5.1%	2.9x10 ⁻² 100%
Eutrophication Potential	kg PO ₄ ³⁻ eq	1.6x10 ⁻⁶ 32%	8.9x10 ⁻⁷ 17%	1.9x10 ⁻⁶ 36%	6.8x10 ⁻⁷ 13%	6.5x10 ⁻⁸ 1.3%	5.1x10 ⁻⁶ 100%
Abiotic Depletion Potential, Elements	kg Sb eq	5.1x10 ⁻⁵ 42%	6.4x10 ⁻⁶ 5.2%	3.3x10 ⁻⁵ 27%	3.1x10 ⁻⁵ 25%	5.2x10 ⁻⁷ 0.43%	1.2x10 ⁻⁴ 100%
Abiotic Depletion Potential, Fossil Fuels	MJ	690 45%	300 19%	220 15%	320 21%	5.0 0.33%	1,500 100%
Renewable Energy	MJ	20 26%	33 44%	2.4 3.2%	19 26%	0.28 0.38%	74 100%
Non-renewable Energy	MJ	730 42%	330 19%	230 13%	430 25%	6.1 0.35%	1,700 100%

SUPPORTING TECHNICAL INFORMATION

Unit processes are developed with SimaPro 8.3 software, drawing upon data from multiple sources. Primary data were provided by Bentley Mills and some of its suppliers for their manufacturing processes. The primary sources of secondary LCI data are from the Ecoinvent LCI databases.

Component	Material Description	Material Dataset	Data Source	Publication Date
PRODUCT				
Secondary Backing, Adhesive & Laminate	Polyolefin	Ethylene vinyl acetate copolymer {GLO} market for Alloc Rec; Polyethylene, low density, granulate {GLO} market for Alloc Rec; Phenolic resin {GLO} market for Alloc Rec; Chemicals, inorganic {GLO} market for chemicals, inorganic Alloc Rec	Primary data; Ecoinvent	2015
Carpet Protector/Stain Release	stain/soil resistance	Chemical, organic {GLO} market for Alloc Rec	Proprietary data	2015
Secondary Backing, Dispersant	Sodium Polyacrylate	Acrylic dispersion, without water, in 65% solution state {GLO} market for Alloc Rec	Ecoinvent	2015
Face fiber*	face fiber – nylon 6,6	Nylon 6-6 {GLO} market for Alloc Rec; Nylon spinning and drawing	Ecoinvent; Carpet & Rug Institute	2015; 2006
Face fiber*	face fiber – nylon 6,6	Nylon 66 fiber /US	Primary Data	2012
Filler	CaCO ₃	Limestone, crushed, washed {GLO} market for Alloc Rec	Ecoinvent	2008
Secondary Backing, Fire Retardant	Alumina trihydrate	Aluminium hydroxide {GLO} market for Alloc Rec	Primary data	2015
Secondary Backing, Pre-coat	Pre-coat - Vinyl Acetate Polymer	Vinyl acetate {GLO} market for Alloc Rec	Ecoinvent	2015
Primary Backing	polyester	Polyethylene terephthalate, granulate, amorphous {GLO} market for Alloc Rec; Polyethylene terephthalate, recycled {GLO} market for Alloc Rec; Recycled postconsumer PET pellet {GLO} market for Alloc Rec; Carbon black, at plant/GLO	Primary data; Ecoinvent	2015
Scrim	polypropylene	Polypropylene, granulate {GLO} market for Alloc Rec	Ecoinvent	2015
Secondary Backing, Soap	Ammonium Lauryl Sulfate	Soap {GLO} market for Alloc Rec	Ecoinvent	2015
Secondary Backing, stabilizer	fiberglass	Glass fibre { GLO} market for Alloc Rec	Ecoinvent	2015
Secondary Backing, thickener	Sodium Polyacrylate	Acrylic binder, without water, in 34% solution state {GLO} market for Alloc Rec	Ecoinvent	2015
Continuous Dye	Continuous dyeing process	Continuous Carpet Dyeing LCI Summary	Carpet & Rug Institute	2008
Pigment	Pigment	Beta-copper phthalocyanine	Carpet & Rug Institute	2006
PACKAGING				
Packaging	Chipboard	Folding boxboard/chipboard {GLO} market for Alloc Rec	Ecoinvent	2015
Packaging	Corrugated board	Corrugated board, recycling fibre, single wall, at plant/RER	Ecoinvent	2007
Packaging	Packaging film	Packaging film, low density polyethylene {GLO} market for Alloc Rec	Ecoinvent	2015
Packaging	Pallet	Wood pallet (22kg)/RER	Ecoinvent	2003
TRANSPORTATION				
Transport	Truck	Transport, freight, lorry 16-32 metric ton, EURO4 {GLO} market for Alloc Rec	Ecoinvent	2015
Transport	Ship	Transport, freight, transoceanic ship {GLO} market for Alloc Rec	Ecoinvent	2015

*NOTE- Nylon yarn is modeled as a weighted average, based on a combination of primary and representative data representing multiple suppliers.

Data Quality

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 10 years old (typically 2006 or more recent). All of the data used represented an average of at least one year's worth of data collection, and up to three years in some cases. Manufacturer-supplied data (primary data) are based on annual production for 2015.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Actual processes for upstream operations are primarily North American. Surrogate data used in the assessment are representative of North American or European operations. Data representative of European operations are considered sufficiently similar to actual processes. Data representing product disposal are based on US statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative fabrication datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the flooring products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded. In total, these missing data represent less than 5% of the mass or energy flows.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources, and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.2 data where available. Different portions of the product life cycle are equally considered; however, it must be noted that final disposition of the product is based on assumptions of current average practices in the United States.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	Data representing energy use at the Bentley California facility represent an annual average and are considered of high quality due to the length of time over which these data are collected, as compared to a snapshot that may not accurately reflect fluctuations in production. For secondary LCI datasets, Ecoinvent v2.2 and v3.2 LCI data are used, with a bias towards Ecoinvent v3.2 data.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the flooring products and packaging is low. Actual supplier data for upstream operations was sought but not available for all suppliers and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years), but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

Allocation

Resource use at the City of Industry, California manufacturing facility (e.g., water and energy) was allocated to the product based on the mass per square meter of flooring product as a fraction of the total facility production volume.

The AFFIX™ Tile flooring system includes recycled materials, which are allocated using the recycled content allocation method (also known as the 100-0 cut off method). Using the recycled content allocation approach, system inputs with recycled content do not receive any burden from the previous life cycle other than reprocessing of the waste material. At end of life, materials which are recycled leave the system boundaries with no additional burden.

Impacts from transportation were allocated based on the mass of material and distance transported.

System boundaries

The system boundaries of the life cycle assessment for the AFFIX™ Tile flooring was cradle to grave. A description of the system boundaries for this study follows:

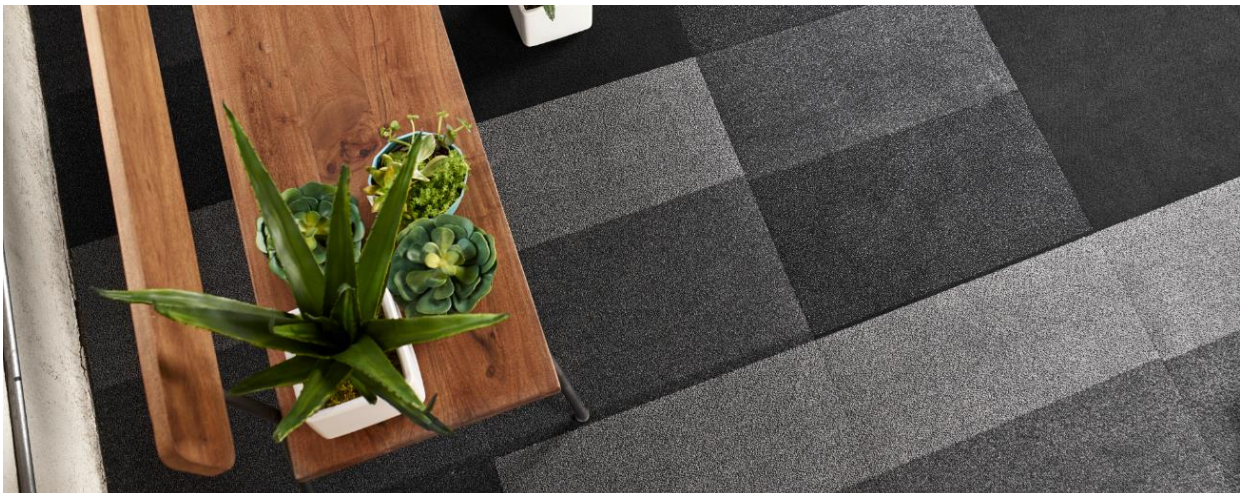
- **Sourcing/extraction stage** – This stage includes extraction of virgin materials and reclamation of non-virgin feedstock. Resource use and emissions associated with both extraction of the raw materials product component manufacturing are included. Upstream transportation is also included.
- **Manufacturing stage** – This stage includes all the relevant manufacturing processes and flows, including packaging. Production of capital goods, infrastructure, production of manufacturing equipment, and personnel related activities are not included.
- **Delivery and installation stage** – This stage includes the delivery of the Bentley Mills' flooring product to the point of installation.
- **Use stage** – The use stage includes the cleaning and maintenance of the floor covered during its lifetime, as well as extraction, manufacturing and transport of all sundry material for maintenance and cleaning.
- **End of life stage** – The end of life stage includes the transport of the floor covering to end of life processes including landfill, incineration, and recycling.

Cut-off criteria

According to the PCR, processes contributing greater than 1% of the total environmental impact indicator for each impact must be included in the inventory. In the present study, except as noted, all known materials and processes were included in the life cycle inventory.

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