sustain

straight to the *points*

forbo
FLOORING SYSTEMS

creating better environments

Sustain: *straight to the points*

Forbo Flooring Systems' Sustainability Policy

As a global leader in flooring systems we have a responsibility, to all our stakeholders, to create a better environment. The way we serve and drive the market sets the pace and standard for world class flooring solutions. Sustainable development and 'creating better environments' is an integral part of all Forbo Flooring Systems' activities.

Founded in 1928, Forbo's first product was Linoleum - made from renewable natural materials, fully biodegradable and environmentally friendly, we have been at the forefront of sustainable awareness fulfillment for over 80 years. This global sustainability awareness has grown in the last decades becoming clear that natural resource depletion and global warming are two practices that can not continue as they have in the past if we are to fulfill our obligations to future generations. It is these obligations, to future generations, that we will comply to and in doing so act as a sustainable enterprise.

Forbo underwrites the broad and all inclusive definition for sustainable development as it has been accepted by the United Nations Commission on Environment and Development, General Assembly Resolution, 1987.

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"Developments that meet present needs without compromising the ability of future generations to meet their needs."

The United Nations' definition of sustainability recognizes three individual dimensions that together make up a sustainable policy, they are:

- **The Economic Dimension:** the way in which the company organizes its position in the market place to actively develop its sustainable profile by using its economic stability and profitability for continuous improvement.
- **The Social Dimension:** the way in which Corporate Social Responsibility and Corporate Governance are defined and followed within the company.
- **The Environmental Dimension:** The way in which measures specific to improving the environmental impact of the processes and products of the company are regulated and executed.

Forbo Flooring Systems supports these dimensions in a constructive and consistent manner through the following principles:

- "Compliance Plus" - a commitment to go above and beyond Government regulations and requirements
- Integrating Sustainability considerations into all our business decisions
- Regular monitoring of progress and review of sustainability performance
- Commitment to continuous improvement
- Promoting Sustainability throughout our value chain, and expecting our suppliers and customers to comply with this
- Ensure that all staff is fully aware of our Sustainability Policy and are committed to implementing and improving it.

Forbo Flooring Systems fully commits to being a sustainable partner to all our stakeholders.

Introduction

The starting point for sustainability in the built environment is, more often than not, LEED® or similar building rating systems. These ratings systems focus on the various attributes of a building and provide points that, once accumulated, allow the building to achieve a "rating". It is important to recognize that none of these building rating systems deal directly with products. The focus instead is on certain attributes of products, the percentage (usually by weight) of these attributes in the product, and finally the monetization (method of valuation) of those attributes to determine their contribution towards "points". These product related attributes include the following categories:

- Recycled Content
- Rapidly Renewable Materials
- PBT Source Reduction
- Acoustical Performance
- Indoor Environmental Quality
- Construction Waste Management
- Regional Materials
- Sustainable Attributes and Certifications

The following pages detail ALL Forbo Flooring Systems products and their specific contributions, by LEED® product and credit, to the attributes listed above, measured in accordance with ISO standards and definitions and third-party validated. Finally a monetization of these contributions is also included by product for reference.

By providing this information it is our hope to simplify the collection of points towards LEED® certifications and ensure that the claims made are legitimate and validated. Finally, as you read on, we wish to provoke your thoughts on how to move beyond point collection towards Silver, Gold, or Platinum ratings to a place further along the Green path, that of true sustainability.

Denis Darragh
General Manager
North America / Asia - Pacific

marmoleum® MCS

marmoleum® composition sheet
certified sustainable sheet

Suzuki School, Atlanta, GA
photo: Jim Roof Photography

material:	**Marmoleum® Sheet** Real, Fresco, Striato, Vivace, Piano, Mineral, Prisma, Graphic, Dutch Design, Walton **Marmoleum® Composition Sheet (MCS)**	
physical properties:	width length gauge	79″ (2 meters) 105 linear feet (32 linear meters) 1/10″ (2.5 mm) - Marmoleum 0.080″ (2.0 mm) - MCS
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)* post-consumer	46.5% (wood flour, tall oil) 0%
rapidly renewable materials: materials & resources credit 6 1 point (NC, schools, CS, CI)	33% by weight	linseed oil, pine rosin, jute
PBT source reduction: pilot credit 2: 1 point (NC, schools, CS, CI)	compliant	
acoustical performance: IEQ prerequisite 3 (schools)	noise reduction coefficient (NRC) ASTM C423-02a. sound absorption coefficient (SAA) ASTM C423-02a sound transmission class (STC) ASTM E423-04 impact sound transmission impact insulation class (IIC) ASTM E492-96	0.05 0.08 54 Marmoleum over a 6 inch concrete slab - IIC 27 Marmoleum installed on 2.0mm Corkment over a 6 inch concrete slab - IIC 42 Marmoleum over a wood joist construction - IIC 51
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM).	 listed
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	Forbo L-910, Forbo MS 855, weld rod
construction waste management: materials & resources credit 2 1-2 points (NC, schools, CS, CI)	compostable jobsite scraps packaging	check with Forbo for available markets 90% recyclable
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	facility: Forbo Flooring B.V. Assendelft, The Netherlands
regional extraction/process:	**ingredient**	**extraction location**
	linseed oil (flax)	Canada
	tall oil	United States
	gum rosin	Indonesia
	wood flour	Germany
	limestone	Germany
	pigment	Germany
	jute	India, Bangladesh
	topshield finish (water-based)	The Netherlands
sustainable attributes:	100% bio-based content (Radiocarbon Analyses conducted by Iowa State University, January 30, 2009)	
innovation & design: sustainable certifications - 1 point	SMaRT© Sustainable Products Standard	platinum level certification see Forbo sales rep for details

** recycled content calculated following Federal Trade Commission (FTC) –Part 260 - GUIDES FOR THE USE OF ENVIRONMENTAL MARKETING CLAIMS (wood flour, tall oil)*
** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

marmoleum® dual tile

marmoleum® composition tile
certified sustainable tile

Perrysburg High School, Perrysburg, OH
photo: WB Products

material:	**Marmoleum® Dual Tile**	**Marmoleum® Composition Tile (MCT)**	
physical properties:	size gauge	13″ x 13″ approx. (33 cm x 33 cm) 20″ x 20″ approx. (50 cm x 50 cm) 1/10″ (2.5 mm)	size 13″ x 13″ approx. (33 cm x 33 cm) gauge 0.080″ (2.0 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)* post-consumer	46.5% (wood flour, tall oil) 0%	
rapidly renewable materials: materials & resources credit 6 1 point (NC, schools, CS, CI)	23% by weight	linseed oil, pine rosin	
PBT source reduction: pilot credit 2 1 point (NC, schools, CS, CI)	compliant		
acoustical performance: IEQ prerequisite 3 (schools)	noise reduction coefficient (NRC) ASTM C423-02a. sound absorption coefficient (SAA) ASTM C423-02a sound transmission class (STC) ASTM E423-04 impact sound transmission impact insulation class (IIC) ASTM E492-96	0.05 0.06 55 Marmoleum over a 6 inch concrete slab - IIC 27 Marmoleum installed on 2.0mm Corkment over a 6 inch concrete slab - IIC 42 Marmoleum over a wood joist construction - IIC 51	
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM).	 listed	
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	Forbo T-940, Forbo MT 855	
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	facility: Forbo-Nairn Ltd. Kirkcaldy, Fife, Great Britain	
regional extraction/process:	**ingredient**	**extraction location**	
	linseed oil (flax)	Canada	
	tall oil	United States	
	gum rosin	Indonesia	
	wood flour	Germany	
	limestone	Germany	
	pigment	Germany	
	glass backing	United Kingdom	
	topshield finish (water-based)	The Netherlands	
sustainable attributes:	92% bio-based content (Radiocarbon Analyses conducted by Iowa State University, January 30, 2009)		
innovation & design: sustainable certifications 1 point	SMaRT© Sustainable Products Standard	platinum level certification see Forbo sales rep for details	

** recycled content calculated following Federal Trade Commission (FTC) –Part 260 - GUIDES FOR THE USE OF ENVIRONMENTAL MARKETING CLAIMS (wood flour, tall oil)*
** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

material:	Marmoleum® Decibel
physical properties:	width . . . . . .79" (2 meters) length . . . . . .105 linear feet (32 linear meters) gauge . . . . . .0.137" (3.5 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)* . . . . . .41.7% (wood flour, tall oil) post-consumer 0%
rapidly renewable materials: materials & resources credit 6 1 point (NC, schools, CS, CI)	27.5% by weight . . . . . .linseed oil, pine rosin, jute
PBT source reduction: pilot credit 2 1 point (NC, schools, CS, CI)	compliant
acoustical performance: IEQ prerequisite 3 (schools)	noise reduction coefficient (NRC) ASTM C423-02a . . . 0.05 sound absorption coefficient (SAA) ASTM C423-02a . 0.05 sound transmission class (STC) ASTM E423-04 . . . . . 53 impact sound transmission impact insulation class (IIC) ASTM E492-96 . . . . . Marmoleum decibel over a 6 inch concrete slab - IIC 48 Marmoleum decibel over a 6 inch concrete slab, including a ceiling plenum - IIC 60 Marmoleum decibel over a wood joist construction - IIC 53
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM) . . . . . .listed
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168. . . . . .Forbo T-940, Forbo MT 885, weld rod
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing . . . . . .facility: Forbo-Nairn Ltd. Kirkcaldy, Fife, Great Britain
regional extraction/process:	**ingredient** — **extraction location** linseed oil (flax) . . . . . .Canada tall oil . . . . . .United States gum rosin . . . . . .Indonesia wood flour . . . . . .Germany limestone. . . . . .Germany pigment . . . . . .Germany jute. . . . . .India, Bangladesh polyolefin . . . . . .The Netherlands topshield finish (water-based). . . . . .The Netherlands
sustainable attributes:	89.5% bio-based content (Radiocarbon Analyses conducted by Iowa State University, January 30, 2009)
innovation & design: sustainable certifications 1 point	SMaRT© Sustainable Products Standard . . . .platinum level certification see Forbo sales rep for details

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** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

material:	Bulletin Board®	Corkment Underlayment
physical properties:	width. . . . 48" (122 cm) or 72" (183 cm) length . . . 90 linear feet approx. (27 linear meters) gauge . . . 0.25" (6.0 mm)	width . . . 79" (200 cm) length . . 105 linear feet approx. (32 linear meters) gauge . . . 0.080" (2.0 mm), 1/8" (3.2 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*. . . . . .41.5% (wood flour) - Bulletin Board pre-consumer (post-industrial)*. . . . . .30% (wood flour) - Corkment Underlayment post-consumer 0%	
rapidly renewable materials: materials & resources credit 6 1 point (NC, schools, CS, CI)	23% by weight. . . . . .linseed oil, pine rosin, cork, jute - Bulletin Board 83% by weight. . . . . .linseed oil, pine rosin, cork, jute - Corkment Underlayment	
PBT source reduction: pilot credit 2 1 point (NC, schools, CS, CI)	compliant	
acoustical performance: IEQ prerequisite 3 (schools)	noise reduction coefficient (NRC) ASTM C423-02a . . .0.05 sound absorption coefficient (SAA) ASTM C423-02a . .0.05 sound transmission class (STC) ASTM E423-04 55	
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM) . . . . . .listed	
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168 . . . . . .Forbo L-910	
construction waste management: materials & resources credit 2 1-2 points (NC, schools, CS, CI)	compostable jobsite scraps . . . . . .check with Forbo for available markets packaging. . . . . .90% recyclable	
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing. . . . . .facility: Forbo Flooring B.V. Assendelft, The Netherlands	
regional extraction/process:	**ingredient.** — **extraction location** linseed oil (flax) . . . . . .Canada tall oil . . . . . .United States gum rosin . . . . . .Indonesia wood flour . . . . . .Germany cork granulate . . . . . .Portugal limestone . . . . . .Germany pigment . . . . . .Germany jute . . . . . .India, Bangladesh water-based ETC finish. . . . . .The Netherlands	
sustainable attributes:	100% bio-based content (Radiocarbon Analyses conducted by Iowa State University, January 30, 2009)	
innovation & design: sustainable certifications 1 point	SMaRT© Sustainable Products Standard . . . . . platinum level certification see Forbo sales rep for details	

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** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

material:	Marmoleum® Sustain Wall Panel	
physical properties:	panel sizes	38″ x 96″ for material that will run horizontal 48″ x 78″ for material that will run vertical
	panel thickness	0.36″ approx.
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	77% (wood flour, tall oil)
	post-consumer	0%
rapidly renewable materials: materials & resources credit 6 1 point (NC, schools, CS, CI)	10.7% by weight	linseed oil, pine rosin, jute
PBT source reduction: pilot credit 2 1 point (NC, schools, CS, CI)	compliant	
acoustical performance: IEQ prerequisite 3 (schools)	noise reduction coefficient (NRC) ASTM C423-02a	0.05
	sound absorption coefficient (SAA) ASTM C423-02a.	0.04
	sound transmission class (STC) ASTM E423-04	53
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM).	listed
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	facility: Laminate Works Inc. Dallas, TX, USA
regional extraction/process:	**ingredient**	**extraction location**
	Marmoleum sheet	The Netherlands
	MDF Backer	Arkansas, USA
	Phenolic Backer	Texas, USA
regional specific: **environmental priority** regional bonus credit 1.1-1.4 1-4 points (NC, schools, CS, CI)	The use of Forbo products can help with some Regional Priority Credits. Please contact Forbo for specifics as it relates to your project.	
sustainable attributes:	95% bio-based content (Radiocarbon Analyses conducted by Iowa State University, January 30, 2009) Carb Phase 2 Emission Standard	
innovation & design: sustainable certifications 1 point	SMaRT© Sustainable Products Standard	platinum level certification see Forbo sales rep for details

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material:	Marmoleum® Click	
physical properties:	panel dimensions	approx. 12″ x 36″ (300 mm x 900 mm)
	square dimensions	approx. 12″ x 12″ (300 mm x 300 mm)
	total thickness	9.8 mm
	surface	2 mm Marmoleum
	base material	6.8 mm HDF
	backing	1 mm cork
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	78.0% (wood flour, tall oil)
	post-consumer	0%
rapidly renewable materials: materials & resources credit 6 1 point (NC, schools, CS, CI)	8.3% by weight	linseed oil, pine rosin, jute
PBT source reduction: pilot credit 2 1 point (NC, schools, CS, CI)	compliant	
acoustical performance: IEQ prerequisite 3 (schools)	**Marmoleum Click with Vapor Barrier:**	
	noise reduction coefficient (NRC) ASTM C423-02a	0.05
	sound absorption coefficient (SAA) ASTM C423-02a	0.04
	sound transmission class (STC) ASTM E423-04.	53
	impact sound transmission impact insulation class (IIC) ASTM E492-96	marmoleum click over a 6 inch concrete slab - IIC 49 marmoleum click with a vapor barrier over a 6 inch concrete slab including a ceiling plenum - IIC 58 marmoleum click over a wood joist construction - IIC 53
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM).	listed
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	factory: Boxler GmbH & Co KG Germany
sustainable attributes:	98% bio-based content (Radiocarbon Analyses conducted by Iowa State University, January 30, 2009) Carb Phase 2 Emission Standard	
innovation & design: sustainable certifications 1 point	SMaRT© Sustainable Products Standard	platinum level certification see Forbo sales rep for details

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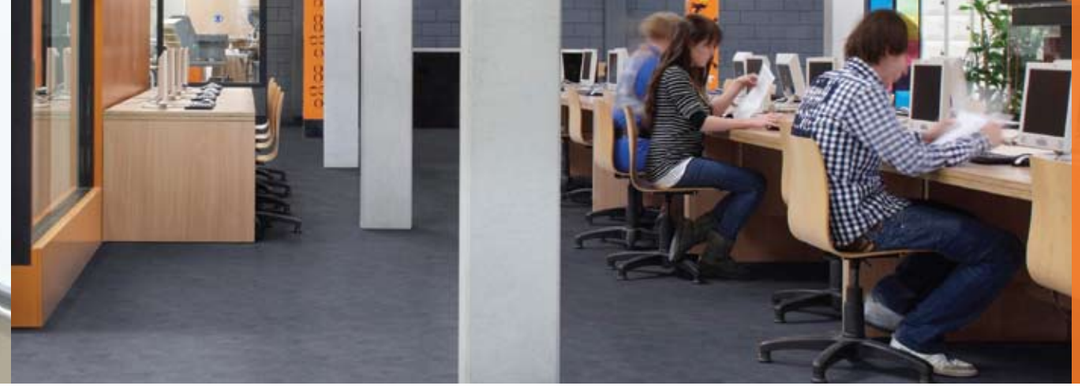
** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

desktop®



flotex®

material:	DeskTop	
physical properties:	width	72″ (183 cm)
	length	100 linear feet approx. (31 linear meters)
	gauge	0.080″ (2.0 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	30.5% (wood flour, tall oil)
	post-consumer	0%
rapidly renewable materials: materials & resources credit 6 1 point (NC, schools, CS, CI)	29% by weight	linseed oil, pine rosin
PBT source reduction: pilot credit 2 1 point (NC, schools, CS, CI)	compliant	
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM)	listed
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	Forbo L-910
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	facility: Forbo Flooring B.V. Assendelft, The Netherlands

regional extraction/process:	ingredient	extraction location
	linseed oil (flax)	Canada
	gum rosin	Indonesia
	wood flour	Germany
	limestone	Germany
	pigments	Germany
	paper	Germany
	water-based finish	The Netherlands

sustainable attributes:	100% bio-based content (Radiocarbon Analyses conducted by Iowa State University, January 30, 2009)

innovation & design: sustainable certifications 1 point	SMaRT© Sustainable Products Standard	platinum level certification see Forbo sales rep for details

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** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

material:	Flotex® Sheet Berlin, Calgary, Dakota, Journeys, Manila, Montana, Samba, Senya, Vienna, Collage, Field, Grid, Network, Vector	Flotex® Tiles Integrity, Montana, Palma, Penang, Samba, Samoa, Senya, Seoul, Silica, Oslo
physical properties:	width 79″ (2 meters) length 98′4″ (30 meters) gauge 0.17″ (4.3 mm)	tile size 20″ x 20″ approx. (50 cm x 50 cm) gauge 0.21″ (5.3 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)		
	pre-consumer (post-industrial)*	43% (Flotex tile) 0% (Flotex sheet)
	post-consumer	0%
acoustical performance: IEQ prerequisite 3 (schools)	noise reduction coefficient (NRC) ASTM C423-02a	0.10 (sheet) / 0.10 (tile)
	sound absorption coefficient (SAA) ASTM C423-02a	0.07 (sheet) / 0.08 (tile)
	sound transmission class (STC) ASTM E423-04	54
construction waste mgmt.: materials & resources credit 2 1-2 points (NC, schools, CS, CI)	Flotex Sheet and Flotex Tile:	reclamation/recycling via CARE
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM)	listed
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	Forbo FRS 920 or V-885 (sheet adhesive) Forbo FRT 950 (tile adhesive)
regional materials: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing: Flotex Sheet Conventional	Forbo Flooring UK Ltd., Ripley, United Kingdom
	manufacturing: Flotex Sheet HD	Forbo Flooring, Chateau Renault, France
	manufacturing: Flotex Tile	Forbo Flooring UK Ltd., Ripley, United Kingdom

regional extraction/process:	ingredient	extraction location
	recycled backing (Flotex tile only)	United Kingdom
	PVC	Germany
	plasticizer (Flotex sheet only)	Belgium
	chalk filler	United Kingdom
	polyamide 6.6	France
	glass tissue	The Netherlands
	masterbatch	United Kingdom
	glass net	United Kingdom
	polyester cellulose fleece	Sweden
	flame retardant filler	United Kingdom
	bonding agent	United Kingdom
	stabilizer	Italy
	antimony trioxide mix	United Kingdom
	anti-static agent	Italy

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** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

material:	Coral® Brush Activ, Classic, Duo, Grip	Nuway® Tuftiguard, Tuftiguard HD, Grid
physical properties:	**Coral Brush Activ, Classic, Duo** roll width . . . . 78.74″ (2 meters) roll length . . . 90.22 feet (27.5 meters) gauge . . . . . 0.394″ (10 mm) pile thickness . 0.276″ (7 mm) **Coral Grip** roll width . . . . 48″ (1.22 meters) roll length . . . 17 mm = 32.81 feet (10 m) 12 mm = 49.21 feet (15 m) gauge . . . . . 0.669″ (17 mm)/ 0.47″ (12 mm)	**Nuway Tuftiguard** application.. . . . internal and external (using Plain unbuffed wiper) wiper strips. . . . pile - standard colors scraper bars . . . aluminum & PVC standard colors height . . . . . 12 mm and 17 mm wiper strips . . . single and double construction . . . open and closed **Nuway Tuftiguard HD** application . . . . internal and external (using Plain unbuffed wiper) wiper strips. . . . pile - standard colors scraper bars . . . aluminum height . . . . . 12 mm and 17 mm wiper strips. . . . double only construction . . . closed only **Nuway Grid** application . . . . internal and external (using rubber inset) module width . . maximum 3000 mm module depth . . maximum 750 mm height . . . . . rubber: 19 mm, burford: 24 mm classic: 23 mm, brush activ: 23 mm
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	6% - 9.7% Nuway Tuftiguard, Tuftiguard HD 15.6% Nuway Grid 0% Coral
	post-consumer	17.9% - 29% Nuway Tuftiguard, Tuftiguard HD 46.8% Nuway Grid 0% Coral
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168.	Forbo FRS 920, V-885 (Coral)
indoor environmental quality: low emitting materials credit 4.3 (NC, schools, CS, CI)	Coral	
indoor environmental quality: indoor chemical & pollutant source control credit 5 (NC, schools, CS, CI)	Coral and Nuway	
construction waste mgmt.: materials & resources credit 2, 1-2 points (NC, schools, CS, CI)	Coral	reclamation/recycling via CARE
	Nuway.	aluminum & rubber recycled locally
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing: Coral	facility: Forbo Flooring Coral N.V., Krommenie, The Netherlands
	Nuway	facility: Forbo Flooring UK Limited, Telford, United Kingdom
regional extraction/process:	**Coral** solution dyed PA 6 . . . . .Germany aqueous dyed PA 6.6. . . .France aqueous dyed PA 6.6. . . .The Netherlands aqueous dyed PES . . . . .The Netherlands backing . . . . . .The Netherlands PVC. . . . . .Germany limestone. . . . . .Germany plasticizer. . . . . .The Netherlands colorpaste . . . . . .France	**Nuway Grid** aluminum carrier . . . . . Spain/China textile . . . . . The Netherlands fill in profiles . . . . . United Kingdom connecting strip. . . . . United Kingdom **Nuway Tuftiguard, Tuftiguard HD** aluminum scrapers. . . . Spain/China galvanized steel wire. . . United Kingdom tyre cord material. . . . Luxembourg

** recycled content calculated following Federal Trade Commission (FTC) –Part 260 - GUIDES FOR THE USE OF ENVIRONMENTAL MARKETING CLAIMS*

** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

material:	Smaragd® Classic and Marble	Eternal Wood
physical properties:	width . . . . . 79″ (2 meters) length . . . . 82′ (25 meters) gauge. . . . . 0.080″ (2.0 mm)	width . . . . . 79″ (2 m) length . . . . . 82′ (25 m) gauge . . . . . 0.090″ (2.2 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)* . . . . . .15.0% (obsolete material) post-consumer 0%	
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM). . . . . .listed	
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168 . . . . . .Forbo V-920, V-885, 660, weld rod	
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing . . . . . .facility: Forbo-Novilon BV Coevorden, The Netherlands	
regional extraction/process:	**ingredient**	**extraction location**
	PVC emulsion resin A . . . . . .France PVC emulsion resin B . . . . . .Germany PVC emulsion resin C . . . . . .Germany PVC suspension resin A. . . . . .Belgium PVC suspension resin B. . . . . .Germany PVC suspension resin C. . . . . .Hungary plasticizer . . . . . .Germany plasticizer . . . . . .Estonia alkyl benzoate . . . . . .Belgium carboxylic acid esters . . . . . .Germany CaCO3 (calcium carbonate) . . . . . .Norway stabilizer . . . . . .United Kingdom stabilizer . . . . . .Italy fatty acid ester . . . . . .United Kingdom azodicarbonamide . . . . . .Indonesia titanium dioxide . . . . . .Germany PU resin . . . . . .The Netherlands glass tissue . . . . . .The Netherlands water-based printing inks . . . . . .Belgium	

** recycled content calculated following Federal Trade Commission (FTC) –Part 260 - GUIDES FOR THE USE OF ENVIRONMENTAL MARKETING CLAIMS*

** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

material: **Tractionstep® Safety Floor**

physical properties:	width	.79" (2 m)
	length	.82' (25 m)
	gauge	.0.080" (2.0 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	.15.0% (obsolete material)
	post-consumer	.0%
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM)	.listed
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	.Forbo V-920, V-885, 660
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	.facility: Forbo-Novilon BV Coevorden, The Netherlands

regional extraction/process:	**ingredient**	**extraction location**
	PVC emulsion resin A	.France
	PVC emulsion resin B	.Germany
	PVC emulsion resin C	.Germany
	PVC suspension resin A	.Belgium
	PVC suspension resin B.	.Germany
	PVC suspension resin C	.Hungary
	plasticizer	.Germany
	plasticizer	.Estonia
	alkyl benzoate	.Belgium
	carboxylic acid esters	.Germany
	CaCO3 (calcium carbonate)	.Norway
	stabilizer	.United Kingdom
	stabilizer	.Italy
	fatty acid ester	.United Kingdom
	azodicarbonamide	.Indonesia
	titanium dioxide	.Germany
	PU resin	.The Netherlands
	glass tissue	.The Netherlands
	carborandum granuals	.The Netherlands

material: **Forbo Adhesives**
L-910, T-940, V-920, C-930, MS-885, MT-885, 660, V-885, Forbo Wall Base Adhesive FRS-920, FRT-950

recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	.0%
	post-consumer	.0%
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	
regional material: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	.facility: Para Chem Simpsonville, SC, USA
	Forbo 660 adhesive	.facility: Helmitin, Inc., Olive Branch, MS, US

** recycled content calculated following Federal Trade Commission (FTC) –Part 260 - GUIDES FOR THE USE OF ENVIRONMENTAL MARKETING CLAIMS*
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material: **ColoRex® SD/EC**

physical properties:	tile size	24.2" x 24.2" approx. (61.5 cm x 61.5 cm)
	gauge	0.080" (2.0 mm)
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	36.0%
	post-consumer	0%
indoor environmental quality: low emitting materials (flooring systems) credit 4.3 1 point (NC, schools, CS, CI) option 2	collaborative for high performance schools low emitting materials section 01350 Low Emitting Materials Table (LEM)	listed
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	Forbo C-930
regional materials: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	facility: Forbo Guibiasco SA Guibiasco, Switzerland

regional extraction/process:	**ingredient**	**extraction location**
	PVC	Germany
	plasticizer	France
	titanium oxide (TiO2)	Germany
	CaCO3 (calcium carbonate)	Italy
	stabilizer	Italy
	binder (chip coating)	Germany
	masterbatch	Italy
	lubrificants	Italy
	conductive element	Belgium

material: **Forbo Wall Base**

physical properties:	feet per carton	4" wall base = 120 linear feet per carton 6" wall base = 96 linear feet per carton
	gauge	1/8"
	style	cove or straight toe
recycled content: materials & resources credit 4 1-2 points (NC, schools, CS, CI)	pre-consumer (post-industrial)*	32.0%
	post-consumer	0%
indoor environmental quality: low emitting materials (adhesives & sealants) credit 4.1 1 point (NC, schools, CS, CI)	adhesives meet the requirements set forth in the SCAQMD Rule #1168	Forbo Wall Base Adhesive
regional materials: materials & resources credit 5 1-2 points (NC, schools, CS, CI)	manufacturing	facility: VPI Corporation Sheboygan, WI

regional extraction/process:	**ingredient**	**extraction location**
	resin	Mississippi, United States
	epoxidized soybean oil	Minnesota, United States
	wax	North Carolina, United States
	titanium oxide	Michigan, United States
	thermoplastic rubber	Mexico
	plasticizer	Louisiana, United States
	stabilizer	Indiana, United States
	clay	Georgia, United States
	stearic acid	Illinois, United States

** recycled content calculated following Federal Trade Commission (FTC) –Part 260 - GUIDES FOR THE USE OF ENVIRONMENTAL MARKETING CLAIMS*
** recycled content materials shall be defined in accordance with the International Organization of Standards document, ISO 14021 - environmental labels and declarations - self-declared environmental claims (type II environmental)*

LEED® beyond the credits

Many manufacturers think that listing the LEED® credits that they contribute to, or in some cases "think" they contribute to is enough. On the surface, this can make many products look to be equally suited for these LEED® projects. That is not necessarily the case when it comes to those LEED® credits that are financially based, such as Materials & Resource credits that involve Recycled Content and Rapidly Renewable Materials.

The chart below offers a comparison of financial contribution for various materials based on an average project. The chart includes the approximate total contribution along with an approximate contribution per square foot. The pricing is based on average sell price of material including contractor mark up for material only. Your contribution could be different depending on variables such as sell price, contractor markup, GC markup and aggressiveness of the bidding environment.

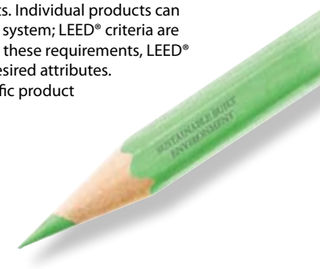
This chart is only meant as a guideline and final contribution will be determined as part of the submittal process based on the above variables for your actual project.

Forbo is a founding organizational member of the USGBC and supports the LEED® green building certification program as a voluntary, consensus-based national rating system for buildings designed, constructed and operated for improved environmental and human health performance.

Just because a product brochure or tradeshow booth displays the USGBC logo, it does NOT mean that the product or service is endorsed by the USGBC, or that it is certified under any LEED® certification systems.

USGBC answers the question "Can products be certified under LEED®?" this way:

No, LEED® applies to green building projects. Individual products can contribute to points under the certification system; LEED® criteria are performance-based. In attempting to meet these requirements, LEED® practitioners identify products that have desired attributes. However, some LEED® criteria require specific product data as part of a successful submittal.



	Materials & Resources Credit 4 1-2 points (NC, Schools, CS, CI) Recycled Content						Materials & Resources Credit 6 1 point (NC, Schools, CS, CI) Rapidly Renewable Materials			Materials & Resources Credit 4 & Credit 6 Recycled Content + Rapidly Renewable Materials		
	pre-consumer		post-consumer		pre- & post-consumer							average project size
	percentage	total contribution	percentage	total contribution	total contribution	contribution per ft²	percentage	total contribution	contribution per ft²	total contribution	contribution per ft²	
Marmoleum Sheet	46.5%	$5,623 - $6,372	0.0%	$0	$5,623 - $6,372	$0.56 - $0.64	33.0%	$7,980 - $9,040	$0.80 - $0.90	$13,603 - $15,417	$1.36 - $1.54	based on 10,000 ft² average project
Marmoleum Composition Sheet (MCS)	46.5%	$4,772 - $5,408	0.0%	$0	$4,772 - $5,408	$0.48 - $0.54	33.0%	$6,773 - $7,676	$0.68 - $0.77	$11,544 - $13,083	$1.15 - $1.31	based on 10,000 ft² average project
Marmoleum Decibel	41.7%	$8,613 -$9,761	0.0%	$0	$8,613 -$9,761	$0.86 - $0.98	27.5%	$11,359 - $12,874	$1.14 - $1.29	$19,972 - $22,635	$2.00 - $2.26	based on 10,000 ft² average project
Generic: Sheet Vinyl	5.0%	$663 - $752	0.0%	$0	$663 - $752	$0.07 - $0.08	0.0%	$0	$0	$663 - $752	$0.07 - $0.08	based on 10,000 ft² average project
Forbo Smaragd/Tractionstep	15.0%	$1,990 - $2,255	0.0%	$0	$1,990 - $2,255	$0.20 - $0.23	0.0%	$0	$0	$1,990 - $ 2,255	$0.20 - $0.23	based on 10,000 ft² average project
Forbo Eternal	15.0%	$1,990 - $2,255	0.0%	$0	$1,990 - $2,255	$0.20 - $0.23	0.0%	$0	$0	$1,990 - $ 2,255	$0.20 - $0.23	based on 10,000 ft² average project
Generic: Rubber Sheet Flooring	5.0%	$950 - $1,077	0.0%	$0	$950 - $1,077	$0.10 - $0.11	10%	$3800 - $4,307	$0.38 - $0.43	$4,750 - $5,383	$0.48 - $0.54	based on 10,000 ft² average project
Forbo Flotex Sheet	0.0%	$0	0.0%	$0	$0	$0.00 - $0.00	0.0%	$0	$0	$0	$0	based on 10,000 ft² average project
Generic Carpet	5.0%	$974 - $1,103	2.0%	$779 - $883	$1,558 - $1,986	$0.18 - $0.20	0.0%	$0	$0	$1,558 - $1,986	$0.18 - $0.20	based on 10,000 ft² average project
Forbo Flotex Tile	43.0%	$8,372 - $9,489	0.0%	$0	$8,372 - $9,489	$0.84 - $0.95	0.0%	$0	$0	$8,372 - $9,489	$0.84 - $0.95	based on 10,000 ft² average project
Generic Carpet Tile	15.0%	$2,446 - $2,772	2.0%	$652 - $739	$2,446 - $2,772	$0.31 - $0.35	0.0%	$0	$0	$2,446 - $2,772	$0.31 - $0.35	based on 10,000 ft² average project
Dual Tile,	46.5%	$8,835 - $10,013	0.0%	$0	$8,835 - $10,013	$0.88 - $1.00	23.0%	$8,740 - $9,905	$0.87 - $0.99	$17,575 - $19,918	$1.76 - 1.99	based on 10,000 ft² average project
Marmoleum Composition Tile (MCT)	46.5%	$5,443 - $6,169	0.0%	$0	$5,443 - $6,169	$0.54 - $0.62	23.0%	$5,385 - $6,103	$0.54 - $0.61	$10,828 - $12,272	$1.08 - $1.23	based on 10,000 ft² average project
Marmoleum Click 2	78.0%	$17,848 - $20,228	0.0%	$0	$17,848 - $20,228	$1.78 - $2.02	8.3%	$3,798 - $4,305	$0.38 - $0.43	$21,647 - $24,523	$2.16 - $2.45	based on 10,000 ft² average project
Forbo Colorex ESD Tile	36.0%	$6,662 - $7,800	0.0%	$0	$6,662 - $7,800	$0.69 - $0.78	0.0%	$0	$0.00 - $0.00	$6,662 - $7,800	$0.67 - $0.78	based on 10,000 ft² average project
Generic VCT	5.0%	$191 - $217	0.0%	$0	$191 - $217	$0.02 - $0.02	0.0%	$0	$0	$191 - $217	$0.02	based on 10,000 ft² average project
Generic: Rubber Tile Flooring	5.0%	$950 - $1,077	0.0%	$0	$950 - $1,077	$0.10 - $0.11	10%	$3,800 - $4,307	$0.38 - $0.43	$4,750 - $5,383	$0.48 - $0.54	based on 10,000 ft² average project
Generic: BioBased Tile	10.0%	$1,171 - $1,327	0.0%	$0	$1,171 - $1,327	$0.12 - $0.13	2%	$468 - $531	$0.05 - $0.05	$1,639 - $1,857	$0.16 - $0.19	based on 10,000 ft² average project
Forbo Entrance Systems: Nuway	6.0%	$191 - $216	17.9%	$1,137 - $1,289	$1,328 - $1,505	$11.06 - $12.54	0.0%	$0	$0	$1,328 - $1,505	$11.07 - $12.84	based on 120 ft² average project
Forbo Entrance Systems: Nuway HD	9.7%	$431 - $489	29.0%	$2,579 - $2,923	$3,011 - $3,412	$25.09 - $28.43	0.0%	$0	$0	$3,011 - $3,412	$25.09 - $28.43	based on 120 ft² average project
Forbo Entrance Systems: Grid	15.6%	$374 - $429	46.8%	$2,246 - $2,546	$2,621 - $2,970	$21.84 - $24.75	0.0%	$0	$0	$2,621 - $2,970	$21.84 - $24.75	based on 120 ft² average project
Forbo Entrance Systems: Coral	0.0%	$0	0.0%	$0	$0	$0	0.0%	$0	$0	$0	$0	based on 120 ft² average project
Forbo Wall Base	32.0%	$59 - $67	0.0%	$0	$59 - $67	$0.10 - $0.11	0.0%	$0	$0	$59 - $67	$0.10 - $0.11	based on 600 lin. ft. average project
Marmoleum Plains: Bulletin Board Cork	41.5%	$1,497 - $1,697	0.0%	$0	$1,497 - $1,697	$0.94 - $1.06	87.0%	$6,278 - $7,115	$3.92 - $4.45	$7,775 - $8,812	$4.86 - $5.51	based on 1,600 ft² average project
Marmoleum Wall Panels	77.0%	$5,011- $5,680	0.0%	$0	$5,011- $5,680	$2.09 - $2.37	10.7%	$1,393 - $1,578	$0.58 - $0.66	$6,404 - $7,258	$2.67 - $3.02	based on 2,400 ft² average project
Marmoleum Plains: Desk Top	30.5%	$36 - $41	0.0%	$0	$36 - $41	$0.30 - $.034	29.0%	$69 - $78	$0.58 - $0.65	$105 - $119	$0.88 - $0.99	based on 120 ft² average project
Corkment Underlayment	30.0%	$2,529 - $2,867	0.0%	$0	$2,529 - $2,867	$0.25 - $0.29	83.0%	$13,996 - 15,862	$1.40 - $1.59	$16,525 - $18,729	$1.65 - $1.87	based on 10,000 ft² average project

the manufacturer's perspective

Products with Sustainable Attributes vs. **Sustainable Products** vs. **Sustainable Manufacturers**

LEED®, the leading rating system globally for the design and construction of more sustainable buildings, has spawned an era whereby manufacturer's product design & development, and even more unfortunate, marketing, has been driven (sometimes erroneously) by the need to "generate contributions towards LEED® points." The onslaught of products offering sustainable attributes that were relatively unaudited, with non-transparent supply chains and non-verifiable chains of custody, containing ignorance-based claims has created a confusing landscape that in many cases has reduced the marketplace to an over-priced validation of the status quo.

> **" For a manufacturer, sustainability is as important to integrate into the entire product design and production process as quality control."**

The market perception that "sustainable" equals "more expensive" is erroneous. For a manufacturer, sustainability is as important to integrate into the entire product design and production process as quality control. When quality control was an afterthought consisting of an inspection at end of line, it was additional cost. When quality control was integrated throughout the design/development, and manufacturing process, it became a cost savings. The same is true of sustainability. When sustainability is an "add-on" attribute such as adding a bio-based component to a chemical based product, or creating a "backdoor third-party" process for calling production scrap in backings "recycled content", you only compromise the cost and integrity of the intended outcome. This is the reality of the use of "products with sustainable attributes."

Forbo believes in the design and manufacture of "sustainable products". There is no more vivid living example of this than Marmoleum. The sustainability of Marmoleum from "field to field" (Flax field to composting) is the most transparent and sustainable of any flooring material. As such, Marmoleum carries more third-party, independent, LCA (multi-attribute) based environmental certifications than any other flooring material. Marmoleum has, through clear third-party, publicly disclosed, verifiable documentation, the lowest environmental footprint of any manufactured flooring material as of the printing of this brochure. Sustainability has been integrated into every step of the process, from supply chain, through manufacturing, to installation and use, and finally end of life. But what about cost? It is no coincidence that through our MCT & MCS products, Marmoleum with Topshield also carries the lowest first cost of any occupancy-ready flooring material. The beauty of Marmoleum is that sustainability is an assumed attribute and it can compete very successfully in an aspirational world where sustainability is an assumed characteristic, not a marketing trend. This is the benefit of being a "sustainable product".

Further, Forbo strives to be a "sustainable manufacturer". We do not want to be a manufacturer that has one product platform (i.e. Marmoleum) that is sustainable, but rather one that recognizes that our entire product portfolio has to have the best environmental profile possible. As a case in point, in October 2008 Forbo acquired Bonar Floors and with that acquisition came the integration of Flotex into our product portfolio. Flotex is the most durable, maintainable alternative to textile flooring and at the time of acquisition carried almost every meaningful environmental certification for textile flooring available. In truth, it's environmental profile was not something we could immediately be proud of. We quickly focused resources on it and in less than a years time made an average of more than 10% improvement in the overall products environmental footprint. In the end, it carries no additional certifications or is recognized any different, but we know that we have made progress and have identified opportunities to make a lot more progress in the future. We will not make claims here of how it will improve in the future, we will only detail what we have already accomplished.

> **"We do not want to be a manufacturer that has one product platform that is sustainable, but rather one that recognizes that our entire product portfolio has to have the best environmental profile possible."**

Flotex Tile Improvements

Abiotic Depletion Potential	-1.46%
Acidification Potential	-2.59%
Eutrophication Potential	-0.33%
Ozone Layer Depletion Potential	-6.61%
Photochemical Ozone Creation Potential	-0.96%
Net Global Warming Potential	-1.54%
Total LCA-based Impacts	-13.50%

Flotex Sheet also saw similar improvements.

It is this element of transparency that is critical in the step to being a "sustainable manufacturer". We hope the information provided in the prior pages to accurately and openly document ALL our products and processes in the format (content and monetization) as prescribed by LEED® makes our commitment clear.

Sustainable Design, by Bill Reed, AIA, LEED®

Sustainable Design
Moving towards Integrated Design in a Disintegrated World

Incorporating "sustainability" into projects, codes, and governing principles is now seen by many to be of increasing relevance and even more, a basic framework for understanding our relationship with life on this planet. In the process of thinking about and practicing sustainability – from a building perspective in this article - these two questions will need to be addressed:

How far do we take it?
How do we realize it?

How far do we take it?

Sustainability is a term used in almost any context these days. A corporation states they need to grow in order to sustain their business. A dam project in India is justified because it will create a more sustainable economy. These organizations are using the term correctly within a limited perspective. However, it is in the larger systems perspective that the term takes on its intended focus. Here's a straightforward way to understand its intended usage within the larger environmental perspective, "If something is sustainable, it means we can go on doing it indefinitely. If it isn't, we can't." Jonathon Porritt (former director of Friend's of the Earth).

> "LEED® is like a set of training wheels to help people move to higher levels of systems thinking."

How do we get our hands around that? It's actually pretty simple. To get a general impression of some practice or product – whether its use is more or less sustainable than some alternative - we need to lift our heads out of our immediate sphere of action. This requires that we follow the implications of the practice or product logically - What was needed to produce this product? What happens to it after you're done using it? Take water for example: Where does it come from? Rain. Can you drink the rain? If, yes, why aren't you drinking it from your roof? If, no, from where do you get it? A well. Where does the well get its water? The rain. If you can't drink the rain, what makes it clean in the well? The earth. What kind of earth is required to clean the water? Healthy earth. What makes the earth healthy? Habitat – microbes, animals, plants in healthy diversity. So it seems we need habitat to create fresh water. Not many of us think of this when we have readily available tap water but this is a critical relationship that we ignore at the expense of fresh water for our future.

Even though thinking in systems seems like common sense - once you learn the knack and know what kind of questions to ask - it, in fact, does require a change in what we think is important and value. Change in our thinking practice can happen by slow evolution or in spurts; with bursts of understanding supported by training or asking questions of experts. In 2000 the U.S. Green Building Council officially launched the LEED® Green Building Rating System. It is a grading system that assigns points and assigns levels of performance to various criteria relating to our health and the health of the ecosystem. These points are grouped in general categories of energy and atmospheric pollutants; community issues; habitat; water quality and conservation; material resources; and the quality of our indoor environment including the issues of persistent toxics and pollutants.

The purpose of this rating system is to put these issues in front of us as a grouped system. The LEED® system grades a client and design team's willingness to reduce impact in these broad areas. It has been very successful in its impact on the marketplace. The danger is that users think that LEED® helps create sustainable buildings. It does not. It helps people create buildings that have some features that lead toward a sustainable future. **LEED® is like a set of training wheels to help people move to higher levels of systems thinking.** It is a score card to gauge performance of those at an entry level of green design and those who are ready to ask questions such as, OK, I understand what LEED® is about, what's the next level? Indeed, that's the question LEED® is meant to inspire. This is the evolutionary beginning to deeper systems thinking. In fact, one can't really do a LEED® building cost effectively without a reasonable level of integrated systems thinking. The last section of this article addresses a summary of this process.

So where to after LEED®? One might think that we simply need to do better and set higher performance benchmarks. Instead of saving 30% of our energy use compared to an energy code, the next step may be achieving a 70% improvement. This is certainly an important improvement but is it sufficient to reach a sustainable condition? **The answer is; any approach that limits the damage is important but insufficient.** It is essential that we begin to look at the earth and its life support systems not as mechanical constructs that we can manage by creating uniform conditions but as living and evolving systems of which we are an integral part. We need to participate with these systems on their own terms – meaning: it is essential for us to understand that we are a part of evolutionary patterns – birth, life, death, rebirth cycles. We are not above these patterns, nor below them, simply part of them. Until we learn how to swim in these conceptual waters we will continually find ourselves exhausted by kicking against the flow of life that - while damaged for our purposes - overall really isn't concerned whether we exist or not. It will fill in behind us just as water fills in behind our movement through it.

How do we realize this?

To realize any movement towards a sustainable condition requires change – change from the conventional way of thinking and doing things. As Albert Einstein said, **"Problems cannot be solved at the same level of awareness that created them."** Moving towards sustainability means that we need to move towards more complex system awareness.

For example, a conventional design process will have the architect design a building to meet typical functional and aesthetic requirements. The architect then sends the design to the mechanical and electrical engineer to make it comfortable and provide adequate light. In a systems design process – an integrative design process – the engineers, architect, and client are designing the building in a joint manner from the very beginning. Instead of simply adding more efficient equipment to the building - which alone can be costly - the engineer may alert the architect that the orientation and fenestration design of the building can alone save more energy than any level of equipment efficiency. Using daylight will further decrease energy costs and add greater quality of life to the building. Integrated decisions usually decrease the cost of the building while increasing its environmental performance.

While most architects and engineers feel they are "systems designers" by the nature of their work in delivering complex buildings – they usually are not. Sustainable design requires a different mindset or mental model. This model is able to look at systems in a more complex way. Instead of looking at just the physical elements of the building, the invisible connections between the elements need to be understood. These invisible connections and patterns, for example, may be manifest in the downstream impact of toxins in building materials, the multiple efficiency and cost relationships between the many variables in an HVAC system and the building envelope, or the impact on social systems due to logging practices or any raw material extraction. This level of analysis requires a rigorous level of enthusiastic and early engagement from the participants and an understanding of tools used to make these evaluations. Since no one has all of this knowledge themselves, the role of the team takes on great importance; the role of questioning takes on an equal importance in order to elicit answers beyond the conventional.

For teams to embrace this process a different mindset or mental model is required; a mindset that has the desire to change the way things are done. A mental model that is open and willing drives the successful integration of green design.

A systems approach requires a collaborative approach. The very strength of the integrative approach has in it a potential weakness – it depends on collaboration from the key players – the client, architect, engineers, interior designers, landscape architects. Fostering and working within a collaborative framework is hard because we have been trained to be "experts". The client expects it and the design team members feel they need to exhibit it. It is necessary to move from being 'experts' to being 'co-learners'. The basis of a systems approach is the establishment of a network of mutual learning. **No one person can know all the issues that need to be addressed; collective knowledge is far greater than individual knowledge (Boecker).**

By far, most successful green projects (i.e., projects that achieved the high environmental goals they originally set out to achieve, within budget) have done so, not because of adding technology and products to the building, but because they had the willingness to focus on the environmental issues – the invisible and critical connections – as essential to the success of the design. They had the willingness to ask many questions about the potential beneficial relationships between ALL the systems in the building, site and region and explore the many different ways to reach toward better ecological integration. **The environmental concerns were not secondary, nor were they dominant, just an integral part of the design.** The usual "right" answers were never assumed and they were always questioned.

> " The difficulty is accepting that the older conventional practices need to be reconsidered."

It is the role of the client, should they wish to reach towards cost effective sustainable building solutions, to select design teams (or green building experts) with expertise in integrated design and the design process to optimize systems in a cost effective manner. Even more important than green expertise however is the willingness or attitude of the design team to learn new ways of looking at systems and the willingness to change their design process.

The following is a list of the essential aspects of an effective integrative design process:
The Basic Elements of Integrated Design

1. Client (main decision maker) involvement in the design decision process
2. Select the right design team (ATTITUDE is critical – i.e. no experts, only co-learners)
3. Explore possibilities and potential - do not reinforce expectations and simplistic linear problem solving
4. Design the design process - create a roadmap to map the process so you don't default to old process patterns
5. Develop alignment around the deep purpose of the project - between the stakeholders and design team
6. Focus on the deep objectives of environmental targets. Goals arise out of working on potential (not a check list)
7. Identify Champions or a Core Team (to hold the aspirations through the project)
8. Optimization of the design of systems (using evaluation tools and an iterative process in predesign and schematic design – after this it can get expensive to add green technologies to a project that wasn't designed with these in mind from the beginning)
9. Follow through in Construction Process
10. Commission the project (make sure it performs the way it was designed to perform – just because it's built doesn't mean it works)
11. Maintenance and Monitoring (entropy happens – feedback is essential to maintain performance)

The process to incorporate sustainable thinking in any project is really not that difficult. **The difficulty is accepting that the older conventional practices need to be reconsidered.** Change is hard for humans. It is the process of changing that is actually the most exciting aspect of reaching towards sustainability. The technologies will always be improving in sometimes subtle and sometimes significant leaps. When we build in a sustainable manner it is the change of perspective, the change of heart, and a fundamental reawakening of an awareness of our relationships to the systems of life that makes all this worthwhile.

Children's Hospital of Pittsburgh, UPMC, Pittsburgh, PA
photo: Alexander Patho Photography

Design for the Whole, by Gail Vittori, LEED® AP BD+C

Co-Director, Center for Maximum Potential Building Systems

Design for the Whole

A crisis can be an opportunity, uniquely positioned to reveal unintended consequences and inconvenient truths. An example is the 1973 Oil Embargo, when members of the Organization of Petroleum Exporting Countries (OPEC) cut supply of oil to the U.S. and other countries in response to the U.S. support of Israel during the 18-day war with Syria and Egypt. Prior to the October '73 Embargo, the average price of a barrel of oil was $2.70; gasoline at the pump was about 35¢ per gallon in the U.S.. Let's just say that everything changed as the price of a barrel of oil skyrocketed by more than 300% in less than one year.

In response, a mad and noble dash towards energy conservation ensued throughout the nation. Buildings previously designed oblivious to their energy use were tightened up. New buildings were subject to increasingly stringent building codes and regulations, including the Energy Policy and Conservation Act of 1976. A rash of energy conserving products and materials and renewable energy-based materials equipment was developed and put into commerce. This rush to respond was driven by a singular focus—to reduce reliance on foreign oil by using less energy. Importantly, absent from this rush to respond was a recognition that buildings function as an interrelated web of systems—some readily visible, others not. In this systems view, changing one thing results in a cascade of impacts throughout a web of nested systems.

> **"The visibility, verifiability and transparency triumvirate is where the opportunity lies to create an accessible *right-to-know* platform for the materials economy."**

Many people point to the 1973 Oil Embargo as the "ahah" moment for what we commonly refer to as sick building syndrome and, in a broader sense, as a catalyst for green building. When buildings were leaky, chemical off-gassing from materials was virtually unknown. People may have suffered from long-term, low-dose exposure to a chemical free-for-all, but the correlation between symptoms and causation was obscure. Enter the tight, energy-efficient building, and the correlation was unmistakable. Buildings were making people sick.

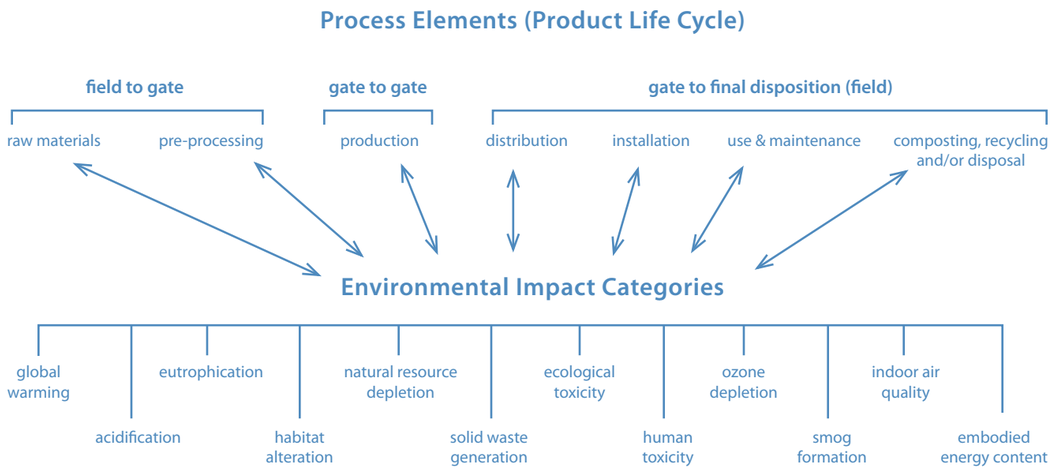
Moreover, the sense that a process defined the outcome came into sharper focus as the dots connecting cause and effect were extended through the life cycle—in shorthand, source, process, use, and re-source and requisite transportation. Additionally, with this heightened awareness, the ante was raised on what *should* be measured in this green frontier. Beyond environmental indicators, factors relating to human health, social equity, economic justice, green job creation, biodiversity, durability, global warming potential, water intensity, and a myriad of other considerations were collectively sharing and shaping this sphere of influence and consequence.

Process vs. Product: Today, put "green building" in a Google™ search and there are 111,000,000 hits; "sustainable products" 8,300,000 hits; "sustainable manufacturer" 2,640,000 hits. These are enormous numbers! Note there are 42 times as many hits for "green building" as for "sustainable manufacturer," and about four times as many hits for "sustainable products" as for "sustainable manufacturer."

Manufacturing is central to delivering sustainable products. Sustainable design is a process of integration within a defined context and recognized boundaries. **Rather than optimizing individual systems, the design process optimizes the whole system.** In doing so, it embraces the broader sphere of influence and consequence. Single attributes and singular system performance metrics bear a level of importance; however, their individual significance is dwarfed by the magnitude of impacts that occur through the whole system life cycle.

Visibility, Verifiability and Transparency: How can the life cycle become visible, so that decisions are informed and guided by meaningful data—a consumer's right-to-know for products? While radical transparency for some product groups such as cosmetics and cleaning products is gaining market visibility through efforts such as the GoodGuide™, products that we build with and that significantly define the indoor and ambient environments are only beginning to be the focus of emerging tools such as Pharos. The visibility, verifiability and transparency triumvirate is where the opportunity lies to create an accessible *right-to-know* platform for the materials economy. This frontier is ripe for coordinated innovation, collaboration and economic stimulation throughout the supply chain. Diverse stakeholder engagement can yield measures and metrics that celebrate transparency and instill an ethic that *value for all* will result from a process predicated by trust and verify.

Such a revolution in the materials economy is possible. Indeed, it is a global imperative: a whole systems approach in which the process and product share equal billing within a context of visibility, verification and transparency and where multi-attribute assessment— design for the whole—guards against single-attribute decision making described in the aforementioned limited albeit well-intentioned energy conserving measures of the 1970s. The collective interest to 'make it right' has never been greater. The collective opportunity to support this with honest words and measurable actions is our generation's to deliver.



A Company's Environmental Performance needs to be measured across the entire Life Cycle of the product, not just during production and the end of its useful life. The impacts should include all of the Process Elements and the effect of the Process Elements against all of the Impact Categories.

North American Headquarters
Forbo Flooring Systems
8 Maplewood Drive
Humboldt Industrial Park
Hazleton, PA 18202
T: 1-800-842-7839
570-459-0771
F: 570-450-0258
email: info.na@forbo.com
www.forboflooringNA.com
www.floorcostcomparison.com

Canada
Forbo Flooring Systems
3220 Orlando Drive
Mississauga, ON L4V 1R5
T: 1-866-661-2351
416-661-2351
F: 416-661-5362
email: info.na@forbo.com
www.forboflooringNA.com
www.floorcostcomparison.com

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