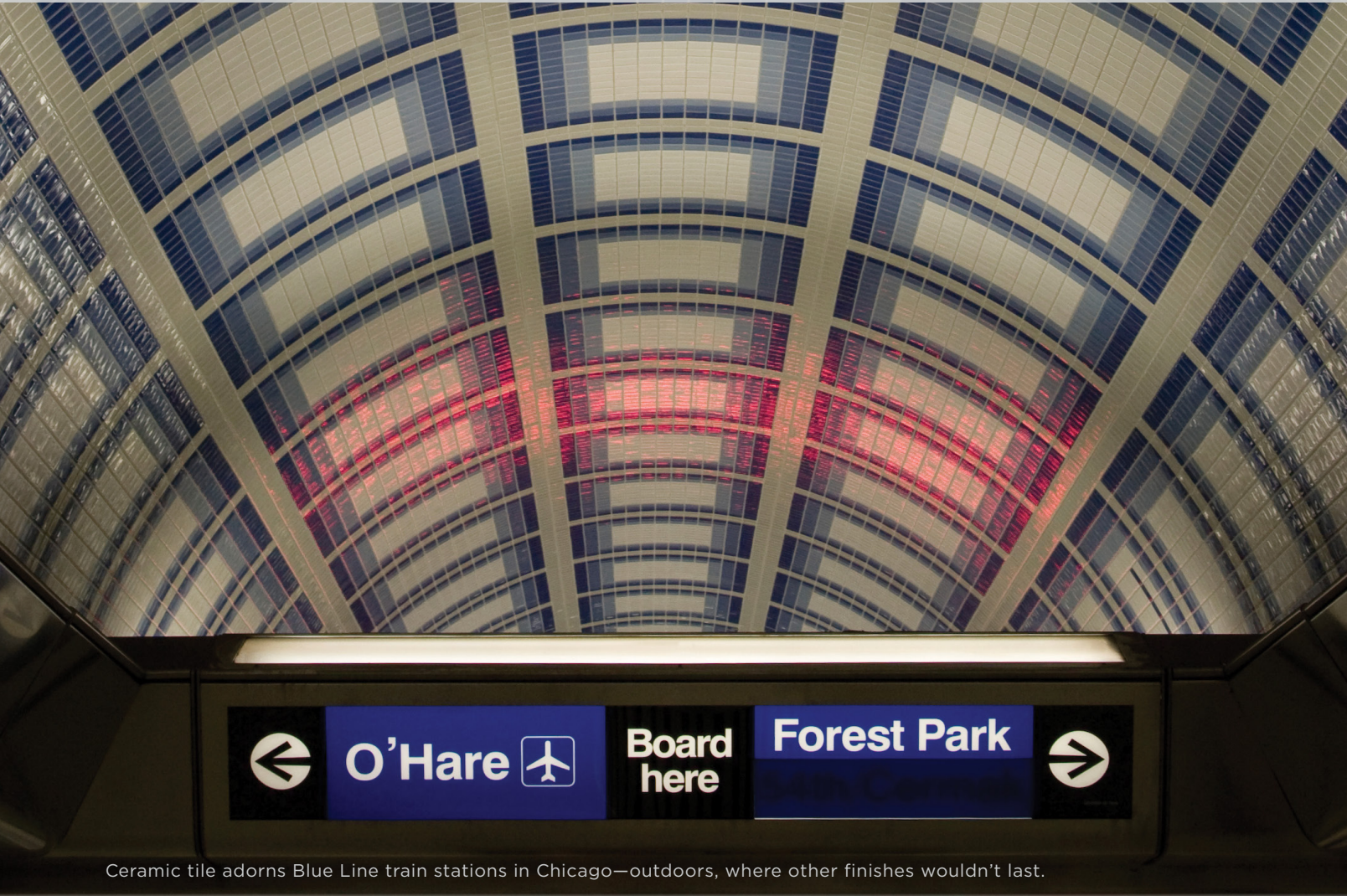


Sustainability

Starts with Standards



Ceramic tile adorns Blue Line train stations in Chicago—outdoors, where other finishes wouldn't last.

Design / Build it to Last

ANSI A137 product performance standards for ceramic and glass tiles

ANSI A118 product performance standards for mortars, grouts, and membranes

ANSI A108 installation and workmanship standards

TCNA Handbook: installation systems for ceramic, glass and stone tile



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2 Tile: The Natural Choice

Overview of ceramic tile's performance- and sustainability-related attributes.

4 Tile and Green Building: Credits and Requirements

At-a-glance guide to the credits, points, and compliance parameters applicable to ceramic tile in today's green building standards and rating systems.

6 Green Squared Certification: Stress-Free Sustainability

Summary of Green Squared® criteria for sustainable tiles and installation materials, and the rating systems that reference Green Squared Certified® products.

8 Ceramic Tile: For a Safe and Healthy Home

TCNA Bulletin outlining the properties of ceramic tile that make it a safe and healthy choice for residential installations.

11 Guide to the EPD for Ceramic Tile Made in North America

Overview of the many ways that specifying ceramic tile covered by the EPD can help meet product transparency requirements in popular green building standards and rating systems.

31 Guide to LEED v4 and Tile

LEED v4 offers numerous opportunities for garnering points toward LEED certification using ceramic tile. Guide is organized by LEED credit category for quick reference to the categories and compliance pathways applicable to ceramic tile.

49 TCNA Green Report: Life-Cycle Cost Study

Quick-reference data on various flooring options for cost per square foot over time.

TILE

THE NATURAL CHOICE



Stands the Test of Time

Ceramic tile has been the preferred choice around the world for centuries for its inherent beauty and durability, and because the natural materials used to make tile are so abundant. And the endless design options can make each installation a unique work of art to be enjoyed for generations.

Inspires Design

Explore unlimited design and customization possibilities. Mix colors, textures, patterns, shapes and styles to make every installation unique. Get the look of wood, natural stone, wallpaper, even delicate fabrics, but with the durability of ceramic tile. And with tiles following the latest color trends, color matching is a breeze. You can even take your design to the next level. Find a manufacturer that specializes in custom mosaic murals, waterjet cutting, or hand painting.



Provides Unequaled Versatility



Hypoallergenic



Easy to sterilize



Fire resistant



Chemical resistant



Enhanced traction products available



Stain resistant, easy to clean



Exteriors, including freeze/thaw climates



Dry, wet, and submerged applications



Durable: withstands heavy foot and wheel traffic

Delivers Robust Sustainability



Recycled Content and Waste Reclamation

Many factories are effectively closed loop facilities with zero waste, high levels of recycling, and efficient resource management.



Exceptional Life-Cycle Cost = Best Value

Ceramic tile has an exceptional life cycle. See the life-cycle cost study in this guide for data on how ceramic tile outperforms other floor finishes in terms of cost per square foot over time.



Regional Manufacturing and Raw Materials

With tile manufacturers in many regions of North America, tile and installation products made with local raw materials are widely available, greatly reducing the energy consumption and emissions of long distance shipping. In many cases, the raw materials are mined within 500 miles of both the manufacturing facility and the job site. Plus, the clays and other materials used to make tile are plentiful.



Best Indoor Air Quality and Zero VOCs

The high firing temperature of ceramic tile—generally more than 2000°F—burns off all organic compounds. Plus, ceramic tile is inhospitable to bacteria, fungi, mold, and other irritants that contribute to allergies and asthma. All this allows ceramic and glass tiles to easily meet low-emitting material requirements, contribute to pre-occupancy air quality plans, and provide superior indoor air quality for building occupants.



Lower Energy Needs

Tile can reduce the amount of energy needed for heating and cooling because of its exceptional thermal mass.



Reduced Heat Island Effect

Using light-colored tiles instead of traditional paving materials can lower an area's heat absorption, or heat island effect. Green buildings in urban areas in particular are required to reduce the potential heat island effect.



Building Material Reuse

Tile finishes are among the few surfaces that can be salvaged in a major renovation.



Eco-Friendly Maintenance

No harsh chemicals required!




Ceramic tile is an ideal choice for ventilated façade projects.

Tile can provide an aesthetic advantage, due to the wide range of colors, surfaces and sizes, allowing for virtually unlimited design opportunities.

A ventilated tile façade can reduce a building's energy consumption 20-30% due to the natural chimney effect it creates between the structure and the cladding. Hot air is evacuated in summer, and insulation is more effective in winter.

TILE AND GREEN BUILDING CREDITS AND REQUIREMENTS

| | Leadership In Energy and Environmental Design (LEED v4) | International Green Construction Code (IgCC - 2015) |
|--|---|---|
|  MULTI-ATTRIBUTE SUSTAINABILITY: CONFORMANCE TO GREEN SQUARED® | Pilot Credit—Certified Multi-attribute Products and Materials | 505.3.2 Multi-Attribute Standard (Verified Conformance) |
| LCA OR EPD | Building Product Disclosure and Optimization—Environmental Product Declarations | 303.1 Whole Building Life Cycle Assessment 505.3.1 Environmental Product Declaration |
| RECYCLED CONTENT | Building Product Disclosure and Optimization—Sourcing of Raw Materials | 505.2.2 Recycled Content Building Materials |
| PRODUCT REUSABILITY/ RECYCLABILITY | Building Life-Cycle Impact Reduction Building Product Disclosure and Optimization—Sourcing of Raw Materials | 505.2.3 Recyclable Building Materials and Components |
| REGIONAL MATERIALS | Building Product Disclosure and Optimization—Sourcing of Raw Materials | 505.2.5 Indigenous Materials |
| CONSTRUCTION/ DESIGN MANAGEMENT | Integrative Process Construction Indoor Air Quality Management Plan Indoor Air Quality Assessment Construction and Demolition Waste Management | 502 Construction Material Mgmt. 503 Construction Waste Mgmt. 804.2 Pre-Occupancy Baseline IAQ Testing |
| INDOOR ENVIRONMENTAL QUALITY | Low-Emitting Materials Thermal Comfort Interior Lighting | 806.2 Adhesives & Sealants 806.4 Flooring 806.5 Ceiling & Wall Systems |
| HEAT ISLAND EFFECT | Heat Island Reduction | 408.2 Site Hardscape |
| ENERGY EFFICIENCY | Optimize Energy Performance | 605 Building Envelope Systems |
| INHERENT DURABILITY | Building Life-Cycle Impact Reduction | General Conformance to A108 Committee Standards for Baseline Code Compliance |
| OTHER PRODUCT ATTRIBUTES OR MANUFACTURER ENGAGEMENT INITIATIVES | Open Space Building Product Disclosure and Optimization—Sourcing of Raw Materials Building Product Disclosure and Optimization—Material Ingredients Innovation | 105.4 Innovative Approaches and Alternative Materials, Design, and Methods of Construction and Equipment |



| Standard for the Design of High-Performance Green Buildings (ASHRAE 189.1-2014) | NAHB National Green Building Standard (ICC/ASHRAE 700-2015) | Green Globes for New Construction 2015 (v1.4) | |
|---|--|--|--|
| 9.4.1.4.3 Third Party Multi-Attribute Certification | 611.2 Sustainable Products | 3.5.1.2 Building Core/Shell Path B 3.5.2.2 Interior Fit-Outs Path B | MULTI-ATTRIBUTE SUSTAINABILITY: CONFORMANCE TO GREEN SQUARED' |
| 9.5.1 Life Cycle Assessment (Building) 9.4.1.4.1 Industry-Wide EPD 9.4.1.4.2 Product-Specific EPD 9.4.1.4.4 Product Life Cycle | 610.1 Life Cycle Analysis | 3.5.1.2 Building Core/Shell Path B 3.5.2.2 Interior Fit-Outs Path B | LCA OR EPD |
| 9.4.1.1 Recycled Content | 604.1 Recycled Content | 3.5.1.1 Building Core/Shell Path A 3.5.2.1 Interior Fit-Outs Path A | RECYCLED CONTENT |
| 9.4.1.1.2 Salvaged Material | 603.1 Reuse of Existing Building 603.2 Salvaged Materials 605.2 Onsite Recycling 605.3 Offsite Recycling | 3.5.3.1 Reuse of Building Façades 3.5.3.3 Reuse of Non-Structural Elements | PRODUCT REUSABILITY/ RECYCLABILITY |
| 9.4.1.2 Regional Materials | 609.1 Regional Materials | 3.5.1.1 Building Core/Shell Path A 3.5.2.1 Interior Fit-Outs Path A | REGIONAL MATERIALS |
| 9.3.1 Construction Waste Management 10.3.1.4 IAQ Construction Management Plan | 605.1 Construction Waste Management Plan | 3.1.1 Integrated Design Process 3.1.2 Environmental Mgmt. During Construction | CONSTRUCTION/ DESIGN MANAGEMENT |
| 8.4.2.1 Adhesives & Sealants 8.4.2.3 Floor Covering Materials 8.4.2.6 Ceiling & Wall Systems | 901.7 Hard-Surface Flooring 901.8 Wall Coverings 901.10 Adhesives & Sealants | 3.7.2.1 Volatile Organic Compounds | INDOOR ENVIRONMENTAL QUALITY |
| 5.3.2.1 Site Hardscape | 505.2 Heat Island Mitigation | 3.2.2.4 Heat Island Effect | HEAT ISLAND EFFECT |
| 7.4.2.1 Building Envelope Requirements | 702.2.2 Energy Performance Levels 703.2 Building Envelope | 3.3.2.1 Passive Demand Reduction 3.3.4 Building Opaque Envelope | ENERGY EFFICIENCY |
| 10.3.2.3 Service Life Plan | 602.1.6 Termite-Resistant Materials 602.1.11 Tile Backing Materials 901.6 Wall-to-wall Carpeting Not Installed | 3.5.5 Building Service Life Plan | INHERENT DURABILITY |
| 10.3.2.1.4.6 Building Green Cleaning Plan | 601.3 Building Dimensions and Layouts 601.7 Pre-Finished Materials | 3.5.9.2 Rainscreen Wall Cladding | OTHER PRODUCT ATTRIBUTES OR MANUFACTURER ENGAGEMENT INITIATIVES |

GREEN SQUARED CERTIFIED STRESS-FREE SUSTAINABILITY



Green Squared® is the world's only multi-attribute sustainability standard for tile and all the associated products needed to install it.

When you see the Green Squared Certified® mark, you know a product meets the broad array of rigorous sustainability requirements of the American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles and Tile Installation Materials (ANSI A138.1).

By addressing everything from raw material extraction to end of product life management, Green Squared is a true cradle-to-grave performance standard that eliminates the need to cross evaluate single-attribute sustainability claims.

Only products independently verified by any one of three leading certification bodies as conforming to the Green Squared standard may bear the Green Squared Certified mark. To be in conformance, products must meet a battery of requirements and electives, as set forth in the standard.

The certification program itself conforms to ISO 14024 Type 1 environmental labeling and declaration requirements.



Credits and Compliance in Green Building

Green Squared Certified products meet a host of requirements and fulfill a range of criteria in today's green building standards and rating systems:

- Green Globes for New Construction 2015 (v1.4)
- NAHB National Green Building Standard (ICC/ASHRAE 700-2015)
- Leadership in Energy & Environmental Design (LEED v4)
- International Green Construction Code (IgCC-2015)
- Standard for the Design of High-Performance Green Buildings (ASHRAE 189.1-2014)

See the Tile and Green Building chart for the specific sections of standards that Green Squared Certified products can help meet.

Find certified product lines at greensquaredcertified.com

Green Squared Criteria

| | |
|--|---|
| General Environmental Characteristics | Recycled Content/Reclaimed Waste Content |
| | Indigenous Raw Goods |
| | Environmental Packaging |
| | Durability |
| | Low Emissions |
| | Environmental Cleaning & Maintenance |
| | Solar Reflectance Index (SRI) |
| | Light Reflectance Value (LRV) |
| | Sound Abatement |
| | Third Party LCA & EPD |
| Environmental Product Manufacturing | Particulate Emissions |
| | Combustion and Fuel Usage |
| | Raw Goods Sourcing & Extraction |
| | Outsourced Packaging & Manufacturing Services |
| | Environmental Management Plans & Systems |
| | Utility Usage |
| | Renewable Energy |
| | Manufacturer Waste Diversion/Minimization |
| End of Life Product Mgmt. | Shipping Material Waste Minimization |
| | Manufacturer Guidelines on Clean Fill Usage |
| Progressive Corporate Governance | Post-Life Material Waste Minimization |
| | Social Responsibility Strategy |
| | Labor Law Compliance |
| | Environmental Regulation Compliance |
| | Health & Safety Regulation Compliance |
| | Voluntary Participation in Health/Safety Programs |
| | FTC Green Guides Compliance |
| | Continuous Community Involvement |
| | Public Disclosure |
| | Sustainability Reports |
| Certified "Green" Facilities | |
| Innovation | "Above & Beyond" Standardized Criteria |
| | Innovative Sustainability Technologies |
| | Carbon Footprint Awareness/Reduction Strategy |

Stress-Free Sustainability



CERAMIC TILE

GLASS TILE

INSTALLATION PRODUCTS



CREDITS

- LEED v4
- Green Globes
- NAHB National Green Building Standard

COMPLIANCE

- International Green Construction Code
- ASHRAE Standard for the Design of High-Performance Green Buildings
- GSA Facilities Standards for Public Buildings

CONFIDENCE

- Life Cycle-Based, Multi-Attribute Criteria
- Verification by Leading Certification Bodies
- Listed in National Institute of Building Sciences' Whole Building Design Guide

For certified product lines, visit www.greensquaredcertified.com

TCNA BULLETIN

CERAMIC TILE FOR A SAFE AND HEALTHY HOME

Ceramic tile is not only beautiful, it's also healthy for your home. It contains none of the chemicals that have been in the news associated with other flooring products, and it's long-lasting, easy to clean, fire-safe, and offers many slip-resistant choices.

Made of Clay and other Naturally-Occurring Minerals: Free of Formaldehyde, VOCs, and PVC

Ceramic tile* does not contain the chemicals in other floor coverings that are receiving increased attention for their possible adverse health effects, such as formaldehyde,¹⁻⁴ VOCs (volatile organic compounds)⁵⁻⁹ or PVC (polyvinyl chloride).¹⁰⁻¹¹

Zero VOCs. Some VOCs emitted by non-ceramic building products can contribute to a wide variety of health problems and "Sick Building Syndrome," according to various health experts.¹²⁻¹⁵ Because ceramic tile is fired at extremely high temperatures, producing an inorganic material, it has zero VOCs.*

Formaldehyde-Free. Ceramic tile* contains none of the formaldehyde found in some other floor coverings. Formaldehyde is a chemical long associated with respiratory disorders, and exposure is a particular concern for children and the elderly, according to the Centers for Disease Control (CDC).¹⁶⁻¹⁷ In fact, formaldehyde emissions for several wood-based building and flooring products have been federally restricted since 2011 under the Formaldehyde Standards for Composite Wood Products Act.¹⁸⁻²¹ As a fired product, ceramic tile is formaldehyde-free and not subject to this or any other such restriction.

PVC-Free. Ceramic tile* is also free from PVC, a resin used in other types of floor coverings, and regularly a subject of concern and discussion among health experts.²²⁻³³

The easy solution for flooring? Use ceramic tile, which is free of VOCs, formaldehyde, and PVC!



✓ **HEALTHY**

- VOC-Free*
- Formaldehyde-Free*
- PVC-Free*
- Hypoallergenic*
- Natural Ingredients†
- 60-Year Service Life*

✓ **SAFE**

- Non-Flammable*
- Zero Smoke Development*
- Slip Resistant Options

Occupant Safety

Of the many flooring choices available, ceramic tile stands out when slip/fall safety is a consideration because of the thousands of floor tile choices that are slip-resistant when wet. This is in stark contrast to floorings that, according to their manufacturers, must be kept dry in order to be slip-resistant.

Additionally, ceramic tile* is non-flammable and does not produce smoke in a fire, meeting the flame spread and smoke development requirements of Section 803 of the International Building Code (IBC) for interior wall and ceiling materials.

Environment

The UL-certified Environmental Product Declaration (EPD) for North American-Made ceramic tile shows that North American-Made ceramic tile has the lowest environmental impact across all impact categories, when compared to other floorings with generic EPDs³⁴⁻³⁵ evaluated under the same product category rules.³⁶ With a 60-year service life³⁴ this makes ceramic tile both cost-effective and the best choice for reducing negative environmental impacts, resource use, and demolition waste, when compared to flooring products that need to be replaced more frequently.

Disclaimer: The above information is general in nature and is not specific to any one building product. Ceramic tile products and their properties can vary among manufacturers, products lines, and even among tiles in the same product line. Likewise, non-ceramic tile products have their own properties and can also vary among manufacturers and products. Products that contain any of the chemicals referenced above may contain them in manners that are not known to be harmful and/or that comply with applicable health and safety regulations. Contact the manufacturer of a specific building product to learn about its particular characteristics. See opposite for notes and numbered references.

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Notes

¹Applies to fired ceramics free of any mesh backing or topical sealer. Not all mesh backings and topical sealers produce volatile organic compounds or contribute to flame spread. Consult manufacturer for specific product information if desired.

²Based on independent studies performed at TCNA Laboratory on tiles without mesh backing or topical sealers.

³More than 95% of a fired ceramic tile is made from clay and other raw materials found in nature.

⁴Per UL-Certified Environmental Product Declaration (EPD) for North American-Made Ceramic Tile.

Total Transparency

The EPD for North American-Made Ceramic Tile reports the environmental footprint of North American-Made ceramic tile across all major impact categories within a 60-year building service life. Specify ceramic tile covered by the EPD to fulfill requirements of leading green building programs.



The EPD is an initiative of the Tile Council of North America and participating members. Data analysis and modeling were performed by thinkstep. Third-party certification by UL Environment ensures conformance to ISO standards for EPDs and LCAs.



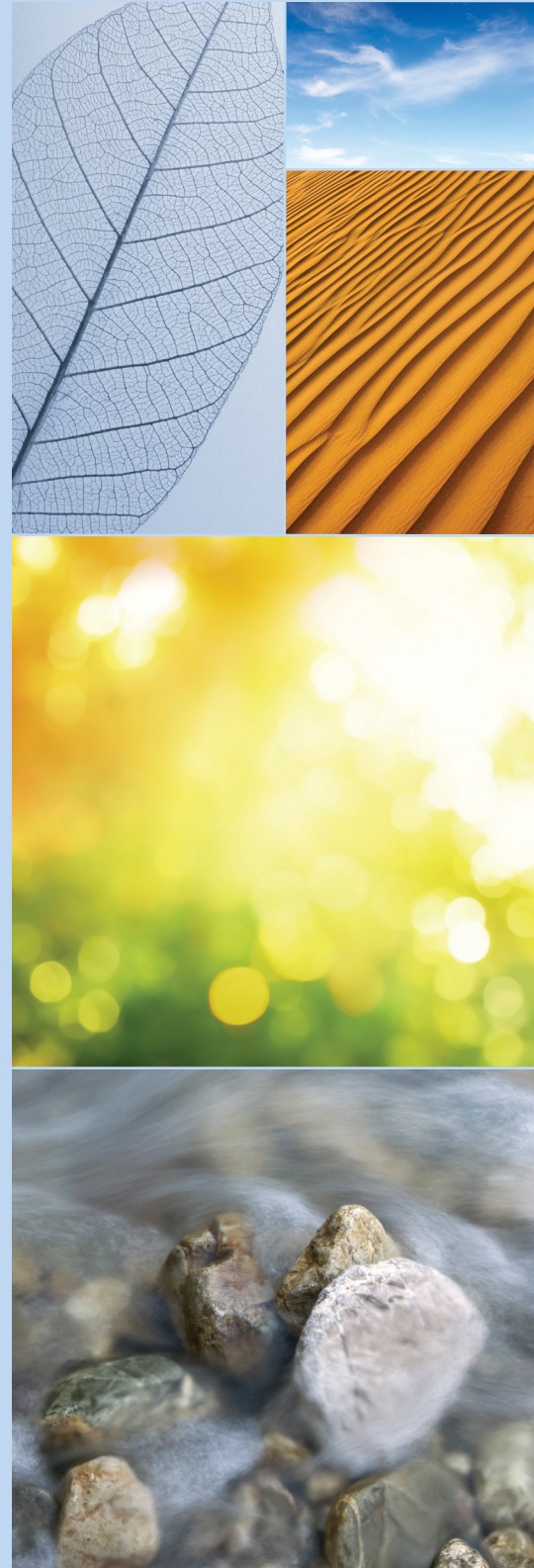
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UL-Certified
ISO STANDARDIZED
PCRS
Green Building Credits
Independently Verified
CREDIBILITY
Natural Resources
Tile Council
ATMOSPHERE
LOW ENVIRONMENTAL IMPACT
CRADLE-TO-GRAVE
ENERGY DEMAND
Carbon Footprint
LCA
60-YEAR IMPACT ASSESSMENT

Guide to the EPD for Ceramic Tile Made in North America

2017



NOW AVAILABLE

UL-CERTIFIED EPDs FOR TILE MORTAR AND GROUT

Now there are two more industry-wide, UL-certified EPDs to help specify tile installations and earn points in green building projects.

The North American-made tile mortar EPD and North American-made tile grout EPD, combined with the EPD for North American-made ceramic tile, provide an unprecedented amount of information on the environmental impacts of three major components of a full tile installation.

Architects, designers and building owners can garner three times the credit from a single tile installation using products represented by the EPDs.

The grout and mortar EPDs represent more than 2.5 billion kg of products produced annually in North America by major North American manufacturers. Like the industry-wide and UL-certified North American-made ceramic tile EPD, the mortar and grout EPDs are based principally on life cycle assessments (LCAs) that address myriad aspects—from extraction of raw materials through end of life—to quantify environmental impacts in accordance with international standards and North America's most commonly referenced green building requirements.

Download the EPDs for North American-made ceramic tile, mortar, and grout at www.TCNAtile.com.

CONTENTS

TOTAL TRANSPARENCY: THE NORTH AMERICAN-MADE TILE EPD

| | |
|--|----|
| The Credibility Process | 14 |
| Tile Covered by the North American-Made Ceramic Tile EPD | 15 |

CREDITS AND COMPLIANCE: NORTH AMERICAN-MADE CERAMIC TILE

| | |
|---|----|
| LEED v4 | 16 |
| Green Globes | 17 |
| NAHB National Green Building Standard | 18 |
| International Green Construction Code (IgCC) | 19 |
| Collaborative for High Performance Schools (CHPS) | 20 |
| ASHRAE 189.1 | 20 |
| CALGreen | 21 |
| GSA P-100 Facilities Standards | 21 |

TILE'S ENVIRONMENTAL FOOTPRINT: A 60-YEAR IMPACT ANALYSIS

| | |
|---|----|
| Global Warming Potential (GWP) | 22 |
| Photochemical Oxidant Creation Potential (POCP) | 23 |
| Ozone Depletion Potential (ODP) | 24 |
| Acidification Potential (AP) | 25 |
| Eutrophication Potential (EP) | 26 |
| Abiotic Resource Depletion Potential (ADP) | 27 |

EPD TRANSPARENCY SUMMARY

| | |
|--|----|
| UL Environment Summary of EPD Data by Category | 28 |
|--|----|

Just as nutrition labels inform the calorie conscious on food choices, an EPD informs with respect to sustainability. When using this EPD alongside other flooring products' generic EPDs, one thing is clear: Ceramic tile has the lowest 60-year environmental impact per square foot (and per square meter) across all major impact categories.

and participated in a cradle-to-grave evaluation of ceramic tile, from raw material sourcing/extraction, through manufacturing, delivery, installation, use, and end of life. The specific environmental impacts measured, and the methodology for measuring those, were dictated by the North American Product Category Rule (PCR) for flooring EPDs. Using product category rules developed for all flooring allows tile covered by the EPD to be compared to other flooring products evaluated under the same PCR. The standardized reporting required by the PCR additionally provides transparency and prevents green washing, as all parameters and impacts in the PCR must be reported, not just those areas in which a product performs well.

Tile Covered by the North American-Made Ceramic Tile EPD

Because the EPD is based on aggregated data from all participating manufacturers, it's a "generic" or "non-proprietary" EPD. As all major North American manufacturers participated, it covers well over 95% of North American-made ceramic tile.

To find out if a specific product line is covered by the certified EPD, contact its participating manufacturer: Arto, Crossville, Dal-Tile Corporation, Florida Tile, Florim USA, Interceramic, Ironrock, Porcelanite Lamosa, Quarry Tile Company, StonePeak Ceramics, and Vitromex de Norteamérica.



thinkstep



Environment

The EPD was initiated by Tile Council of North America (TCNA) and its participating members, with data analysis and modeling by thinkstep and third-party, independent certification by UL Environment.



EXTERNAL VERIFICATION

A panel of independent stakeholders verifies conformance to standards, applicability of the PCR, and that the information presented is accurate, not unsubstantiated marketing claims or other attempts at green washing.

EPD CERTIFICATION AND REGISTRATION

UL Environment certifies the EPD and registers it in its online Sustainable Product Database, a publicly available resource for authentic and credible environmental product information.



To download the EPD, visit www.TCNAtile.com

CREDITS AND COMPLIANCE

NORTH AMERICAN-MADE CERAMIC TILE

LEED v4

Under the credit category Building Product Disclosure and Optimization—Environmental Product Declarations, up to 2 points toward LEED certification can be earned by using products with EPDs, such as North American-made ceramic tile.

Option 1 (1 Point) Environmental Product Declaration

AND/OR

Option 2 (1 Point) Multi-Attribute Optimization

One point can be earned for using at least 20 different permanently installed “products,” which are construction materials that meet one of the specified disclosure criteria and are therefore eligible for the valuation associated with that disclosure criteria. Valuations for such materials are awarded on a per-material basis, and this LEED point is earned by using enough materials that their combined valuations total at least 20 “products.”

One point can be earned by using products with below-industry-average impacts, when those products comprise at least 50% of the total value of permanently installed products in the project and their environmental impacts are lower in at least 3 of the applicable impact categories: global warming potential, ozone depletion potential, acidification potential, eutrophication potential, photochemical oxidant creation potential, and fossil abiotic depletion potential.

| Disclosure Criteria | Valuation |
|---------------------|-----------|
| Proprietary LCA | ¼ product |
| Generic EPD | ½ product |
| Proprietary EPD | 1 product |

Materials that meet multiple criteria are eligible only for the highest valuation available; the valuations cannot be combined. Also, materials must be sourced from at least five different manufacturers.

EPD For this LEED point, only tile included in a generic EPD that also has a proprietary EPD showing below-industry-average impacts can contribute to meeting the 50% value threshold.

Sample calculation for a project with \$1,000,000 in permanently installed products, including \$100,000 of ceramic tile that has lower-than-industry-average environmental impacts in at least 3 categories.

EPD Tiles covered by the North American-made Ceramic Tile EPD can each contribute at least ½ product toward the 20-product requirement. For example, for a project with 10 different tiles covered by the EPD, the tiles would contribute 5 “products” toward the 20-product requirement (Example A). In the same scenario, if 3 of the 10 tiles also have a proprietary EPD, the same 10 tiles would contribute 6.5 “products” (Example B).

$$\frac{\$100K \text{ (tile value)}}{\$1M \text{ (all materials value)}} = 10\%$$

In the example above, tile’s contribution toward the 50% minimum would be 10%.

Example A

10 tiles
x .5 products
5 products

Example B

(3 tiles x 1 product)
+ (7 tiles x .5 products)
6.5 products

Green Globes

Under the provisions of Section 3.5.1.2, Path B: Prescriptive Path for Building Core and Shell and Section 3.5.2.2, Path B: Prescriptive Path for Interior Fit-Outs, using North American-Made ceramic tile can contribute toward the 30 available points for using products with EPDs. Points are awarded for using products with:

EPDs:
Generic or Proprietary AND/OR Third-Party Verified
Proprietary Life-Cycle Assessment AND/OR Third-Party Certification
to Multiple Attribute
Standards

Points are awarded based on the percentage of product used (based on cost) and on where it is used. Products with EPDs are valued the same, regardless of whether their EPDs are generic or proprietary; both contribute equally toward the value percentage.

| | Percentage of Products | Points |
|---------------------------------------|------------------------|--------|
| Section 3.5.1.2: Core and Shell | ≥ 40% | 20 |
| | 25% – 39% | 15 |
| | 10% – 24% | 10 |
| Section 3.5.2.2: Interior Fit-Outs | ≥ 40% | 10 |
| | 25% – 39% | 7 |
| | 10% – 24% | 5 |



Tiles covered by the EPD that are also Green Squared Certified® can be counted

twice when calculating the percent value for the tiles, because Green Squared® is an eligible third party, multi-attribute sustainability certification.

EPD Without limit, using ceramic tiles covered by the North American-Made Ceramic Tile EPD will contribute to this requirement, in direct proportion to the tile's value. Tiles that are also Green Squared Certified® will earn double points for also meeting the requirement for products with third-party certifications based on multiple attribute standards.

Sample calculation for a project with \$1,000,000 in interior fit-out materials including \$150,000 in tile covered by the EPD:

$$\frac{\$150\text{K (tile value, EPD)}}{\$1\text{M (value, all interior fit-out materials)}} = 15\% \text{ (5 points)}$$

Sample calculation for the same project, but with tile that is covered by the EPD and Green Squared Certified:

$$\begin{aligned} & \$150\text{K (tile value, EPD)} \\ & + \$150\text{K (tile value, Green Squared Certified)} \\ & \underline{\hspace{1.5cm}} \\ & \$300\text{K} \end{aligned}$$

$$\frac{\$300\text{K (tile value)}}{\$1\text{M (value, all interior fit-out materials)}} = 30\% \text{ (7 points)}$$

CREDITS AND COMPLIANCE

NORTH AMERICAN-MADE CERAMIC TILE

NAHB National Green Building Standard

NAHB National Green Building Standard is commonly referred to as ICC 700. North American-Made ceramic tile can help achieve up to 10 points under Section 610, Life Cycle Analysis, in this ANSI-approved standard and rating system for residential construction. The points in this section of the standard are awarded for using products with lower environmental impacts, compared to products intended for the same use.

To garner points, the selected product must improve upon multiple environmental impacts by an average of 15%, with the number of points awarded tied to the number of impact categories in which the selected product performs better.

| Number of Impact Categories | Points |
|-----------------------------|--------|
| 4 | 2 |
| 5 | 3 |

Applicable Impact Categories:

- Fossil fuel consumption
- Global warming potential
- Acidification potential
- Eutrophication potential
- Ozone depletion potential

The standard requires that the LCA tool used to determine the environmental impacts must be based on a reference service life of 60 years. It allows comparisons to be made between different types of products with the same use. It also allows comparison of individual product impacts to the industry averages for the same product type.



EPD The North American-Made Ceramic Tile EPD reports tile’s environmental impact over 60 years, as analyzed by GaBi LCA software, according to the requirements of the standard.

When choosing between tile and an alternate flooring material, using ceramic tile covered by the EPD is advantageous when building to this standard, because the EPD shows very low environmental impacts in all categories. In fact, tile covered by the EPD has the lowest impact in all six impact categories, as compared to the impacts reported for other common flooring options in their publicly available, generic EPDs. Refer to the 60-year impact analysis graphs included in this guide for details.

When choosing between specific tile products, tile covered by the generic EPD will also be advantageous when such products also have proprietary EPDs showing impacts that are on average 15% lower, as compared to the industry average reported in the generic EPD, in at least 4 categories.

Additionally, products that are Green Squared Certified® can also contribute points as detailed elsewhere in the NAHB Green Building Standard. Refer to the Tile and Green Building chart in *Tile: The Natural Choice* for details.

International Green Construction Code (IgCC)

Developed by the International Code Council (ICC), this standard provides model code language for states and municipalities to establish baseline sustainability requirements for new and existing buildings. Similar to other building codes, once adopted they are legally enforceable. Under Section 505.3, Multi-Attribute Material Declaration and Certification, the standard requires that at least 55% of the building materials used in the project meet transparency or multi-attribute sustainability provisions:

Building material has an EPD that has been verified by a program operator

AND / OR

Building material is verified by an approved agency as meeting the requirements of a multi-attribute sustainability standard recognized by IgCC

In calculating the percentage, calculations can be based on mass, volume, or cost. For a material that complies with both parameters, its value is doubled. Products with EPDs are valued the same, whether the EPD is generic or proprietary.



Tiles covered by the North American-made Ceramic Tile EPD, which has been verified by UL Environment, can contribute toward the 55% target.



Tiles covered by the EPD that are also Green Squared Certified[®] are worth twice as much, because the Green Squared[®] standard is one of the specified multi-attribute standards recognized by IgCC.



CREDITS AND COMPLIANCE

NORTH AMERICAN-MADE CERAMIC TILE

Collaborative for High Performance Schools (CHPS)

Under Section MW 7.1, Multi-Attribute Material Selection, 3 points are available for using products with EPDs. To earn them, the standard requires selection of at least 10 products with third party certified EPDs conforming to ISO 14025 and/or ISO 21930. Products are valued the same, whether their EPDs are generic or proprietary.

EPD

North American-made ceramic tile can contribute toward earning these points, as the EPD has been third-party certified by UL Environment as conforming to ISO standards for EPDs.

ASHRAE 189.1

This standard establishes pass/fail criteria for commercial green buildings. It is recognized by IgCC as an optional compliance path and provides jurisdictions with alternative green building criteria that can be enforced as law if desired by the municipality.

In this standard, Section 9.4.1.4, Multiple Attribute Product Declaration or Certification, requires that, by the time building occupancy is allowed, at least 10 different products installed in the building have a generic EPD, have a proprietary EPD, conform to a third-party, multi-attribute certification, or have a third-party reviewed life cycle assessment (LCA).

EPD

Each tile used covered by the North American-made Ceramic Tile EPD, counts as one product toward the ten-product threshold. Green Squared Certified® products can also contribute toward the threshold, as the Green Squared® standard is one of the specified multi-attribute certification programs recognized by ASHRAE 189.1.



CALGreen

This standard is part of the California Building Standards Code and is commonly adopted as model language by developers of green building standards and rating systems in other parts of the country.

Section A5.409.3 for Non-Residential Construction requires at least 50% use of materials or assemblies based on life-cycle assessment (LCA) of their global warming potential (climate change/greenhouse gases) and two more environmental impacts from the list below:

- Fossil fuel depletion
- Stratospheric ozone depletion
- Acidification of land and water resources
- Eutrophication
- Photochemical oxidants (smog)



Tile covered by the North American-made Ceramic Tile EPD is eligible for consideration under this section of CALGreen, as the EPD provides LCA data and addresses the referenced environmental impacts.

GSA P-100 Facilities Standards

This standard incorporates sustainability criteria into design standards for the construction of government-funded buildings. Section 3.4 (Interior Performance) sets forth several provisions for ceramic tile:

The “Baseline” and Tier 1 High Performance provisions specify that tiles conform to ANSI A137.1, the ANSI standard for ceramic tile, and be Green Squared Certified.®

The Tier 2 High Performance and Tier 3 High Performance provisions specify that tiles conform to ANSI A137.1, the ANSI standard for ceramic tile, be Green Squared Certified,® and have a publicly-available EPD.



With the North American-made Ceramic Tile EPD readily available, tiles covered by the EPD are eligible for use on Tier 2 and Tier 3 federal building projects, provided they are also Green Squared Certified® and meet the tile performance standards given in ANSI A137.1.



TILE'S ENVIRONMENTAL FOOTPRINT A 60-YEAR IMPACT ANALYSIS

Today, North American construction products are increasingly being evaluated based on their 60-year environmental footprint, a time frame chosen for the average service life of a building. Accordingly, the North American flooring Product Category Rule (PCR) requires EPDs to provide a life-cycle assessment (LCA) with a 60-year impact analysis. This appropriately includes the environmental impacts associated with acquiring a product's raw materials, manufacturing the product, and then delivering, installing, maintaining, and disposing of it, multiplied by the theoretical number of times the product would wear out and would have to be reinstalled (i.e. 60 years divided by the product's service life, in years).

In all six of the major environmental impact assessment categories, as included in the EPD for North American-made Ceramic Tile, the environmental benefits resulting from tile's inherent durability, long life, and low maintenance are clearly realized.

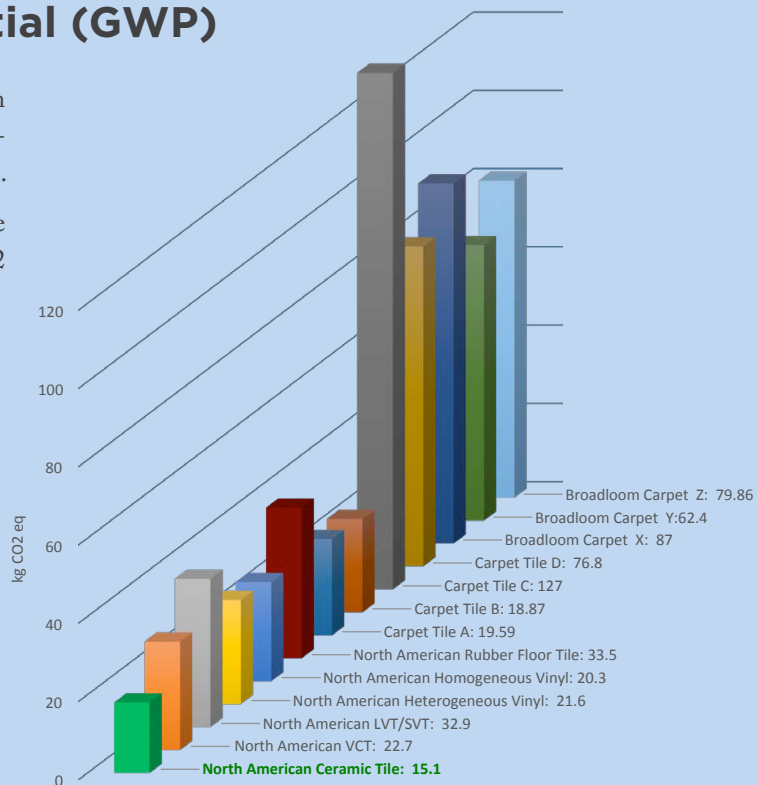
When its EPD is compared to the generic EPDs for other types of flooring, developed under the same PCR and using the same building service life, North American-made ceramic tile has the lowest impact across all major categories.

Global Warming Potential (GWP)

GWP, commonly referred to as "carbon footprint," is measured by emissions of carbon-equivalent gases and relates to climate change.

The North American-Made Ceramic Tile EPD reports a 60-year GWP of 15.1 kg CO₂ equivalent (eq.) per square meter.

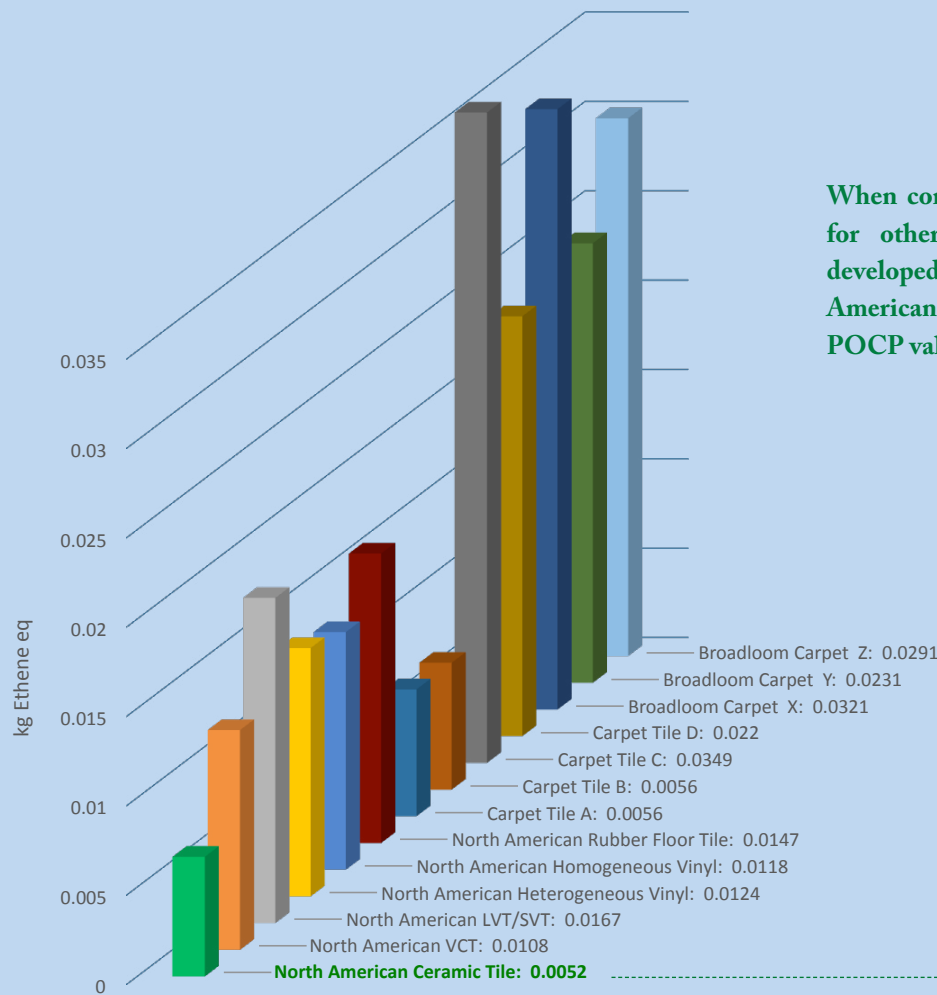
When compared to the EPDs for other types of flooring developed under the North American Flooring PCR, tile's GWP value is the lowest.



Photochemical Oxidant Creation Potential (POCP)

POCP is directly linked to smog formation. Smog is harmful to humans and animals, most notably for aggravating bronchial-related diseases; it also inhibits plant growth due to decreased UV radiation, and can discolor ground-level materials like building exteriors.

The North American-Made Ceramic Tile EPD reports a 60-year POCP of 0.0052 kg Ethene equivalent (eq.) per square meter.



When compared to the EPDs for other types of flooring developed under the North American Flooring PCR, tile's POCP value is the lowest.

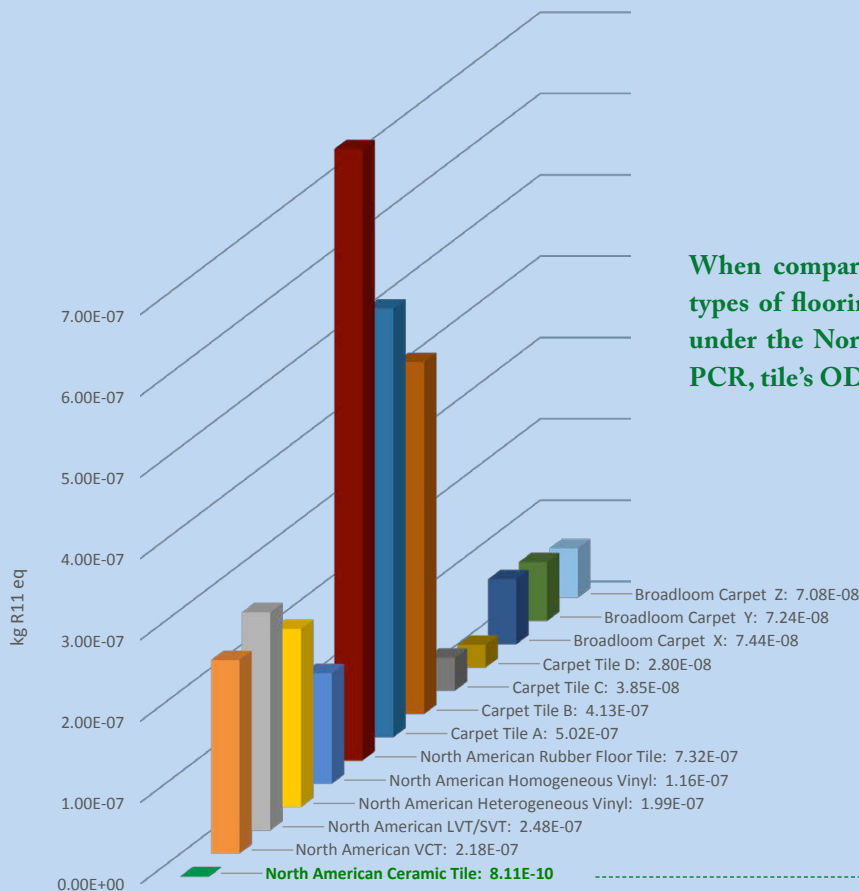
TILE'S ENVIRONMENTAL FOOTPRINT A 60-YEAR IMPACT ANALYSIS

Ozone Depletion Potential (ODP)

Ozone depletion occurs when chlorofluorocarbons (CFCs) and hydrofluorocarbons (HCFCs) reach the stratosphere, react with the sun, and break down the ozone layer. Decreased ozone can lead to an increase in the amount of UV-B radiation that reaches Earth's surface, having harmful effects on human health, animal health, terrestrial and aquatic ecosystems, biochemical cycles, and materials.

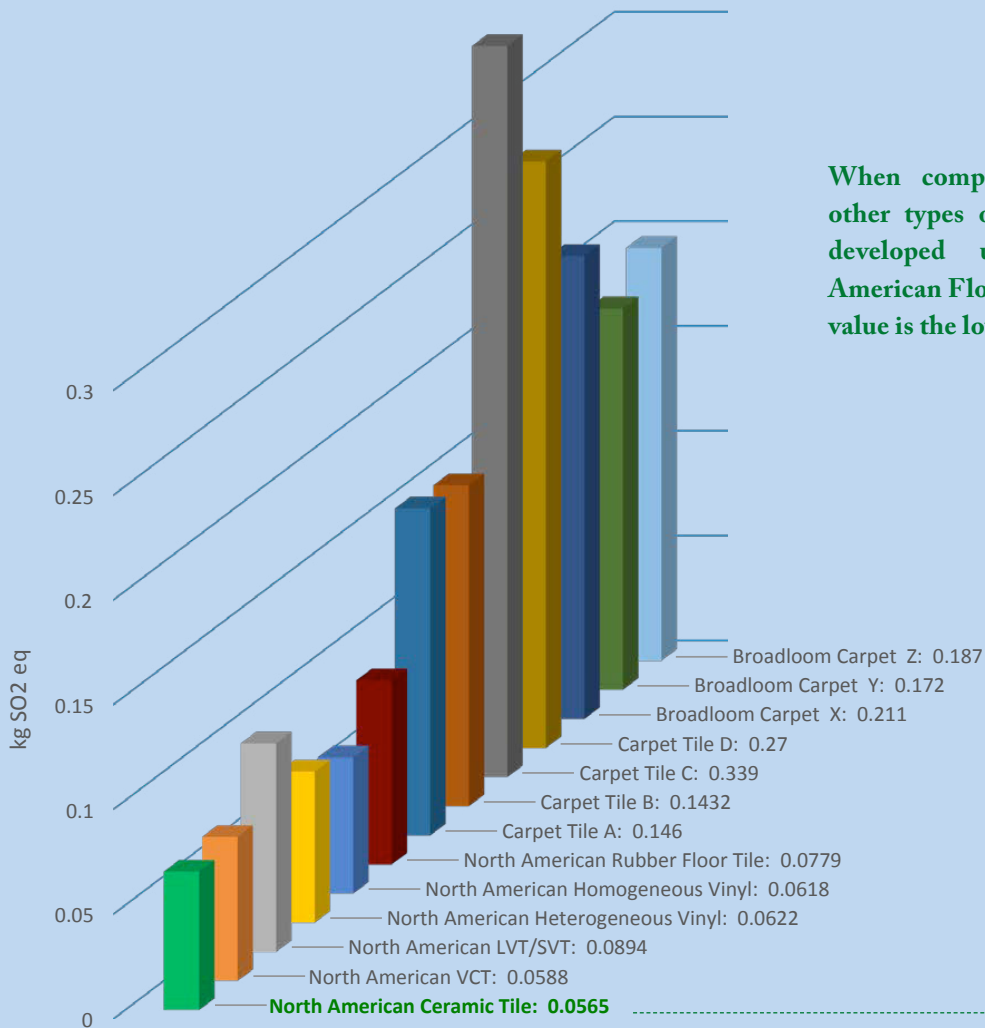


The North American-Made Ceramic Tile EPD reports a 60-year ODP of 0.000000000811 kg R11 equivalent (eq.) per square meter.



When compared to EPDs for other types of flooring products developed under the North American Flooring PCR, tile's ODP value is the lowest.

Acidification Potential (AP)



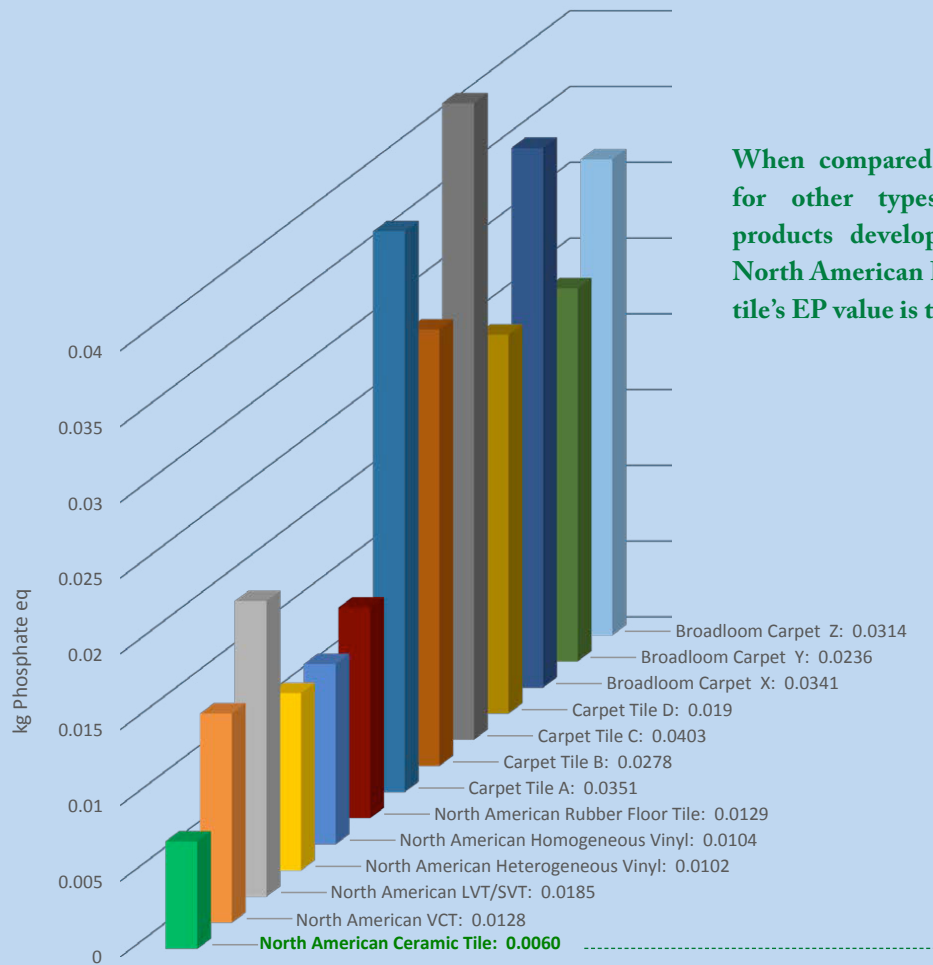
When compared to EPDs for other types of flooring products developed under the North American Flooring PCR, tile's AP value is the lowest.

Acidification occurs when soil, groundwater, surface water and atmospheric moisture pH levels are lowered. This can have a harmful impact on organisms, ecosystems, and man-made materials, including buildings.

The North American-Made Ceramic Tile EPD reports a 60-year AP of 0.0565 kg SO₂ equivalent (eq.) per square meter.

TILE'S ENVIRONMENTAL FOOTPRINT A 60-YEAR IMPACT ANALYSIS

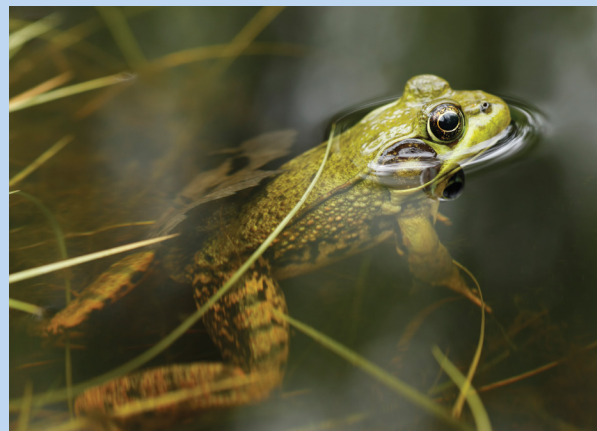
Eutrophication Potential (EP)



When compared to the EPDs for other types of flooring products developed under the North American Flooring PCR, tile's EP value is the lowest.

Eutrophication is the enrichment of a body of water (or ecosystem) with nutrients needed for photosynthesis, such as carbon dioxide and nutrient compounds containing nitrogen and/or phosphorus, commonly from fertilizer runoff and sewage. It is a significant cause of oxygen depletion in bodies of water, resulting from excess plant and algal growth, causing hypoxic conditions in which marine life cannot be sustained.

The North American-Made Ceramic Tile EPD reports a 60-year EP of 0.0060 kg Phosphate equivalent (eq.) per square meter.

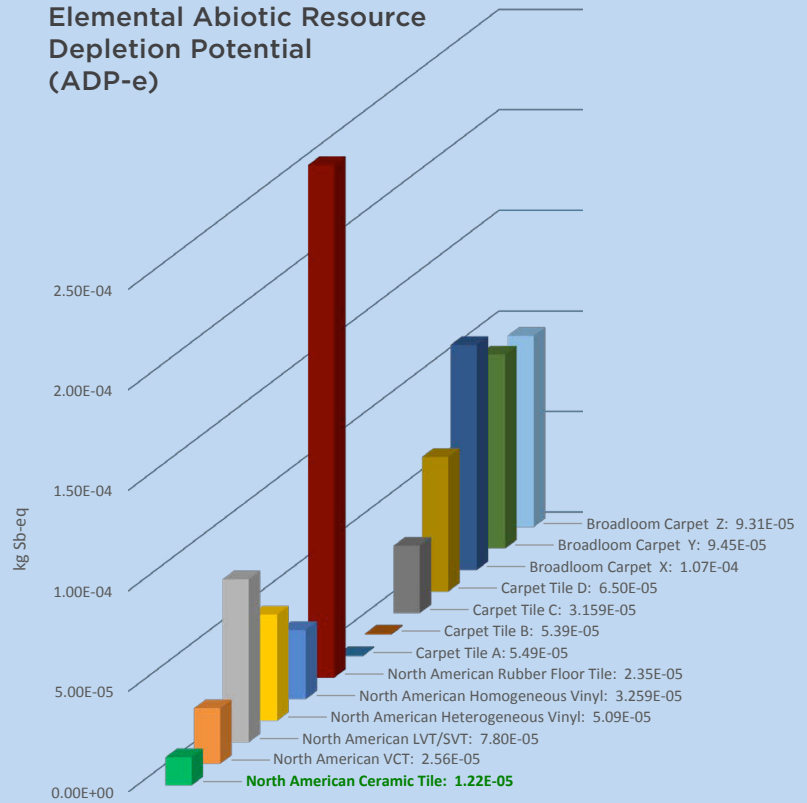


Abiotic Resource Depletion Potential (ADP)

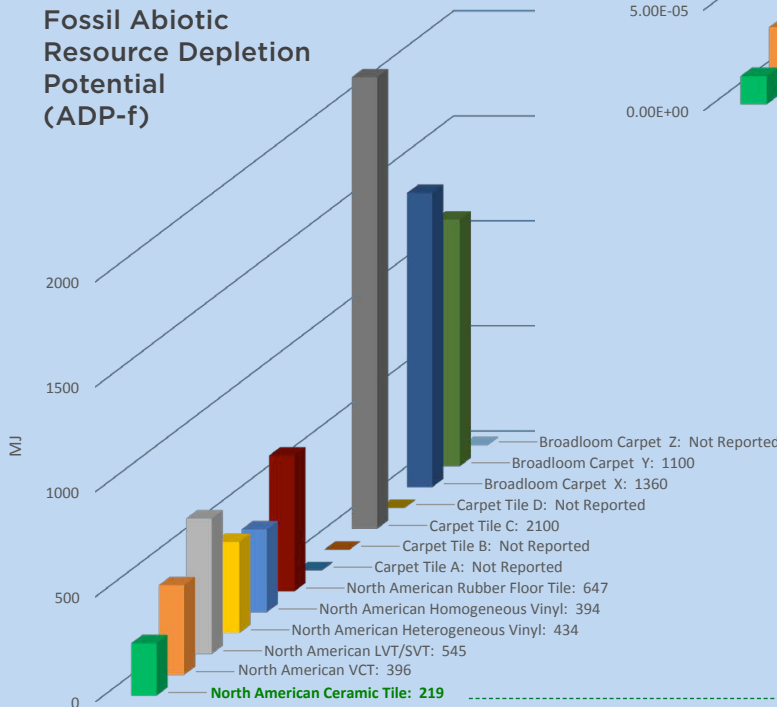
Abiotic resources are natural resources derived from non-living, non-organic materials. Since “non-living” can cover a wide variety of resources, ranging from renewable to non-renewable and finite to perpetual, there is debate about which types of resource depletion are worse, and whether or not all abiotic resources should be grouped together. Most commonly, LCAs take into account land, fossil fuels, and metals, and ADP can be considered elemental (ADP-e), or fossil (ADP-f).

The North American-Made Ceramic Tile EPD reports a 60-year ADP-e of 0.0000122 kg Sb equivalent (eq.) per square meter, and a 60-year ADP-f of 219 MJ per square meter.

Elemental Abiotic Resource Depletion Potential (ADP-e)



Fossil Abiotic Resource Depletion Potential (ADP-f)



When compared to EPDs for other flooring types developed under the North American Flooring PCR, tile has the lowest ADP-f value of those reported and the lowest ADP-e value among values reported in generic flooring EPDs.

EPD TRANSPARENCY SUMMARY

| | |
|-----------------------------|---|
| COMPANY NAME | Industry-Wide |
| PRODUCT TYPE | Porcelain, Pressed Floor, Mosaic, Quarry, Wall |
| PRODUCT NAME | Ceramic Tile: Made in North America |
| PRODUCT DEFINITION | Floor or wall covering which is inert, fire resistant, non-combustible, durable, easy to maintain and made of mineral-based natural materials. Manufacturers include: Arto, Crossville, Dal-Tile, Florida Tile, Florim USA, Inter ceramic, Ironrock, Porcelanite Lamosa, Quarry Tile Co, Stonepeak, and Vitromex. |
| PRODUCT CATEGORY RULE (PCR) | NSF PCR for Flooring (Carpet, Resilient, Laminate, Ceramic, and Wood) |
| CERTIFICATION PERIOD | October 24, 2014 to October 24, 2019 |
| DECLARATION NUMBER | 4786483078.101.1 |



LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

| | ATMOSPHERE | | | WATER | | EARTH | |
|-------|---|--|--|--|--|---|--|
| | | | | | | | |
| | Global Warming Potential refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere. | Ozone Depletion Potential is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution. | Photochemical Ozone Creation Potential happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog. | Acidification Potential is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life. | Eutrophication Potential occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life. | Depletion of Abiotic Resources (Elements) refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity. | Depletion of Abiotic Resources (Fossil Fuels) refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity. |
| TRACI | | | | | | | |
| CML | 15.1 kg CO2-Equiv. | 8.11E-010 kg R11-Equiv. | 0.0052 kg Ethene-Equiv. | 0.0565 kg SO2-Equiv. | 0.00604 kg Phosphate-Equiv. | 1.22E-005 kg SB-Equiv. | 219 MJ |

FUNCTIONAL UNIT One square meter of ceramic tile. Life cycle impact results are expressed for 60 years of use.



Environment

MATERIAL CONTENT

Material content measured to 1%.

| COMPONENT | MATERIAL | AVAILABILITY | MASS% | ORIGIN |
|-----------|-----------------|-------------------------------|-------|--------------------|
| Body | Clay | Mineral perpetual | 70.3% | US, Mexico, Europe |
| | Feldspar | Mineral perpetual | 5.3% | US, Mexico, Europe |
| | Sand | Mineral perpetual | 4.8% | US, Mexico, Europe |
| | Scrap | Pre-consumer Post-consumer | 4.2% | US, Mexico, Europe |
| | Kaolin | Mineral perpetual | 3.2% | US, Mexico, Europe |
| | Granite | Mineral perpetual | 1.3% | US, Mexico, Europe |
| | Lime | Mineral perpetual | 1.1% | US, Mexico, Europe |
| | Other Additives | Mineral perpetual | 4.0% | US, Mexico, Europe |
| Surface | Glaze & Stain | Mineral perpetual | 5.4% | US, Mexico, Europe |

ADDITIONAL ENVIRONMENTAL INFORMATION

| | |
|--------------------------------|-----------------------|
| PRE-CONSUMER RECYCLED CONTENT | VARIES % |
| POST-CONSUMER RECYCLED CONTENT | VARIES % |
| VOC EMISSIONS | ZERO/INORGANIC |
| WATER CONSUMPTION | |

RECYCLING OR REUSE

Ceramic tile can outlast multiple generations of building occupants and is commonly reused in an existing building or salvaged for use in a new building. Solid and inert, it can also be used in a variety of post-life applications such as clean fill, roadway paving, and raw materials used to manufacture new products. To represent a "worst case" scenario, this EPD reports environmental impacts based on 100% of all tile removal waste being disposed of in a landfill.

ENERGY

| | | |
|----------------------|---------|---------|
| RENEWABLE ENERGY | 4.42 % | 10.4 MJ |
| NON-RENEWABLE ENERGY | 95.58 % | 225 MJ |

MANUFACTURER CONTACT INFO

| | |
|---------|--------------------------------------|
| NAME | Tile Council of North America (TCNA) |
| PHONE | 864-646-8453 |
| EMAIL | |
| WEBSITE | www.TCNAtile.com |

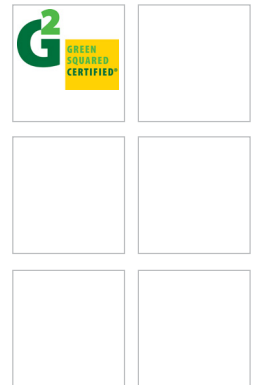
STANDARDS

ANSI A137.1 American National Standard Specifications for Ceramic Tile

ISO 13006 International Organization for Standardization Specifications for Ceramic Tile

ANSI A138.1/Green Squared® American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials

CERTIFICATIONS



www.UL.com/environment | environment@ul.com

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Green building standards and rating systems are living documents, and the consensus regarding their use and interpretation is ever-evolving. Check for updates to this guide at www.TCNAtile.com.





Guide to LEED v4 and TILE

2017

Raw Materials Sustainable Building Products
GREEN SQUARED CERTIFIED®
Materials and Resources
Transparency
Optimization CREDITS
INNOVATION
Tile Council Thermal Comfort
Open Space LCA ENERGY AND ATMOSPHERE **EPD**
LOW-EMITTING MATERIALS LIFE-CYCLE IMPACT REDUCTION
INDOOR ENVIRONMENTAL QUALITY



LEED (Leadership in Energy and Environmental Design) green building rating systems allow builders, owners, and tenants to evaluate the overall sustainability of their projects. Points toward LEED certification can be obtained by making sustainable choices while designing, constructing, and operating a new or existing building or major renovation. In LEED Building Design and Construction (BD+C) v4, there are 110 possible points. Through auditing by the U.S. Green Building Council (USGBC), the organization that developed LEED, a building can be awarded a certification ranging from LEED Certified (40-49 points) to LEED Platinum (80-110 points).

Changes implemented in Version 4 of LEED, which was released in late 2013, reflect increasing interest in life-cycle-based information for sustainable building materials. The completely revamped rating system takes a new, more flexible approach to building green. LEED v4 acknowledges product contribution not just by allocating points for specific attributes like recycled content, but also through increased perspective on the role products have in achieving a host of traditionally desired outcomes, such as energy efficiency, occupant comfort, and whole building performance. With more tile life-cycle information becoming readily available, design teams have the tools they need to creatively integrate tile installations into projects that meet performance-based credit requirements.

The building materials and systems chosen for a project play an important role in satisfying requirements needed to attain certification, and using ceramic tile can be quite advantageous, understanding the precise number of points earned depends on many factors and varies widely depending on project particulars. Sustainable applications for tile are virtually endless, limited only by the imaginations of architects, designers, and budgets.

This guide explains how ceramic tile can be integrated into projects that meet the criteria for pertinent LEED Credits in six LEED Credit categories: Integrative Process; Materials and Resources; Indoor Environmental Quality; Sustainable Sites; Energy and Atmosphere; and Innovation.

Credits, requirements, options, and other details found in LEED v4 were omitted in this guide where not relevant to tile and installation materials.

Green Squared Certified® products have extensive sustainability attributes that can help fulfill a broad range of LEED v4 criteria.

LEED points may be earned using a variety of approaches, and many factors can greatly influence the overall sustainability of any project.

Consult LEED Accredited Professionals (LEED APs) to help you better understand how tile installations can be integrated into projects to help achieve the desired sustainability and certification.



CONTENTS

MATERIALS AND RESOURCES

| | |
|---|----|
| Building Life-Cycle Impact Reduction | 34 |
| Building Product Disclosure and Optimization— Environmental Product Declarations | 34 |
| Sourcing of Raw Materials | 35 |
| Material Ingredients | 36 |
| Construction and Demolition Waste Management | 37 |

INDOOR ENVIRONMENTAL QUALITY

| | |
|---|----|
| Low-Emitting Materials | 38 |
| Construction Indoor Air Quality Management Plan | 38 |
| Indoor Air Quality Assessment | 39 |
| Thermal Comfort | 40 |
| Interior Lighting | 41 |

SUSTAINABLE SITES

| | |
|-----------------------|----|
| Open Space | 42 |
| Heat Island Reduction | 43 |

INTEGRATIVE PROCESS

| | |
|---------------------|----|
| Integrative Process | 44 |
|---------------------|----|

ENERGY AND ATMOSPHERE

| | |
|-----------------------------|----|
| Optimize Energy Performance | 45 |
|-----------------------------|----|

INNOVATION

| | |
|--|----|
| Innovation | 46 |
| Certified Multi-Attribute Products and Materials | 47 |

MATERIALS AND RESOURCES

Building Life-Cycle Impact Reduction

STATED INTENT

“To encourage adaptive reuse and optimize the environmental performance of products and materials.”

PERTINENT REQUIREMENTS

Option 1: Historic building reuse

Maintain the existing building structure, envelope, and interior nonstructural elements of a historic building or contributing building in a historic district.

Option 3: Building and material reuse

Reuse or salvage building materials from off site or on site as a percentage of the surface area. Include structural elements (e.g., floors, roof decking), enclosure materials (e.g., skin, framing), and permanently-installed interior elements (e.g., walls, doors, floor coverings, ceiling systems).

Option 4: Whole-building life-cycle assessment

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Tile’s inherent durability makes it one of the few interior surface coverings that can be reused in renovations without refinishing. Preservationists often incorporate exquisite historic tile installations into building restorations, honoring the industry’s rich artistic heritage.

Tile’s 60 year-plus lifespan and minimal environmental footprint offer significant advantages in a whole-building life-cycle assessment. And because Option 4 requires material selection based on a 60-year whole-building life-cycle assessment, specifying tile is an ideal way to contribute to this requirement.



Building Product Disclosure and Optimization—Environmental Product Declarations

STATED INTENT

“To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts. To reward project teams for selecting products from manufacturers who have verified improved environmental life-cycle impacts.”

PERTINENT REQUIREMENTS

Option 1: Environmental product declaration (EPD)

Use at least 20 different permanently-installed products sourced from at least five different manufacturers that meet one of the disclosure criteria below.

- Products with a product-specific, publicly available life-cycle assessment (LCA)
- Products with an industry-wide (generic) EPD
- Products with a product-specific EPD

Option 2: Multi-attribute optimization

Use products that comply with the criterion below for 50%, by cost, of the total value of permanently-installed products in the project.

- Products that demonstrate impact reduction below industry average in at least three impact categories

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

To ensure that tile is taken into consideration when making EPD-based product comparisons, TCNA released an industry-wide EPD in 2014 that provides a third-party verified, comprehensive analysis of the majority of ceramic tile produced in North America. This EPD is based on a life-cycle assessment (LCA) that addresses everything from sourcing and extraction of raw materials to end of product life options.

Some tile products that were included in the generic EPD have proprietary life-cycle data available, and those that demonstrate impact reduction below industry average can further contribute to this credit.

Building Product Disclosure and Optimization— Sourcing of Raw Materials

STATED INTENT

"To encourage the use of products and materials for which life cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts. To reward project teams for selecting products verified to have been extracted or sourced in a responsible manner."

PERTINENT REQUIREMENTS

Option 1: Raw material source and extraction reporting

AND/OR

Option 2: Leadership extraction practices

Use products that meet at least one of the responsible extraction criteria listed below for at least 25%, by cost, of the total value of permanently-installed building products in the project.

- Extended producer responsibility (EPR)
- Materials reuse
- Recycled content

Products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Query North American tile or related installation material manufacturers about whether or not sustainability reports are available from their raw material suppliers.

Tile can also fulfill responsible extraction criteria:

- Some North American tile manufacturers practice extended producer responsibility (EPR) through "take-back" programs.
- Tile's inherent durability makes it a great option as a reused or salvaged material (i.e. refurbished product), especially in decorative applications.



Vaulted ceiling with Guastavino tiles, Manhattan Municipal Building, New York City, completed in 1914.

- The production of tile and related installation materials often incorporates pre- and post-consumer recycled content.



Responsible extraction practices, including the use of recycled or reclaimed waste material in manufacturing, are required of Green Squared Certified® products.

With tile and related installation material manufacturing facilities located in many regions of North America, regionally manufactured products are likely available, and those meeting the above provisions can double their contribution to satisfying the requirements of this credit.

Building Product Disclosure and Optimization— Material Ingredients

STATED INTENT

“To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts. To reward project teams for selecting products for which the chemical ingredients in the product are inventoried using an accepted methodology and for selecting products verified to minimize the use and generation of harmful substances. To reward raw material manufacturers who produce products verified to have improved life-cycle impacts.”

PERTINENT REQUIREMENTS

Option 1: Material ingredient reporting

Use at least 20 different permanently-installed products from at least five different manufacturers that demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm).

AND/OR

Option 2: Material ingredient optimization

Use products that document their material ingredient optimization for at least 25%, by cost, of the total value of permanently-installed products in the project.

AND/OR

Option 3: Product manufacturer supply chain optimization

Use building products for at least 25%, by cost, of the total value of permanently-installed products in the project from manufacturers who engage in safety, health, hazard, and risk programs and require independent, third-party verification of their supply chain for minimization of health and safety hazards pertinent to chemical ingredients.

For options 2 and 3, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Tile and related installation materials are typically made of safe natural ingredients, and some manufacturers offer chemical inventories of their products, and/or have released health product declarations (HPDs) and other USGBC-approved material ingredient reports. Others provide such reporting on request. Additionally, material ingredient record keeping is required of Green Squared Certified® tiles and installation materials.

Inquire with manufacturers about whether they have voluntary ingredient reporting or optimization initiatives in place themselves or within their supply chain. Also ask about production and ingredient extraction locations as regionally manufactured products can double the contribution to the requirements of this credit.





Using broken ceramic tile in decorative applications is a time-honored practice, as evidenced in this early 20th-century mosaic designed by Antoni Gaudí in Barcelona, Spain.

Construction and Demolition Waste Management

STATED INTENT

“To reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials.”

PERTINENT REQUIREMENTS

Recycle and/or salvage nonhazardous construction and demolition materials:

Option 1: Diversion

Divert a minimum of 50% or 75% of the total construction and demolition material using a minimum of three or four material streams.

OR

Option 2: Reduction of total waste material

Do not generate more than 2.5 pounds of construction waste per square foot of the building’s floor area.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Tile products are solid, inert, and non-hazardous, and can be crushed and recycled into new materials or aggregates for the manufacture of new products, clean fill, or other beneficial reuse projects (e.g. roadways). Additionally, tile and related installation material packaging is widely recyclable. This comprehensive recyclability makes tile a good fit for a variety of material diversion streams.

A typical tile installation involves products of standard material lengths and quantities, largely eliminating off-cuts and scrap and reducing job-site waste. Moreover, new reduced-thickness tile technologies are allowing tile to be installed over existing materials, eliminating the need for waste-producing demolition. Tile installations clearly contribute to the minimal waste per square foot requirements of Option 2.

INDOOR ENVIRONMENTAL QUALITY

Low-Emitting Materials

STATED INTENT

“To reduce concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment.”

PERTINENT REQUIREMENTS

Option 1: Product Category Calculations

To demonstrate compliance, a product or layer must meet all of the following, as applicable.

Inherently non-emitting sources. Products that are inherently non-emitting sources of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) are considered fully compliant without any VOC emissions testing if they do not include integral organic-based surface coatings, binders, or sealants.

General emissions evaluation. Building products must be tested and determined compliant in accordance with CDPH Standard Method v1.1-2010, using the applicable exposure scenario.

Additional VOC content requirements for wet-applied products. All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Tile is VOC-free, due to its inherent inorganic properties, and is cited by this credit as an “inherently non-emitting source.” This means that ceramic tile may be used towards this credit without any requirements for testing.

Many tile adhesives, grouts, and backer boards with zero or very low VOCs are available; these materials are well below the thresholds of compliance in emissions and content standards.



Green Squared Certified® tiles and installation materials are verified as inorganic or within the content and emission limits specified by this credit.

Construction Indoor Air Quality Management Plan

STATED INTENT

“To promote the well-being of construction workers and building occupants by minimizing indoor air quality problems associated with construction and renovation.”

PERTINENT REQUIREMENTS

Develop and implement an indoor air quality (IAQ) management plan for the construction and preoccupancy phases of the building.

During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.

Protect absorptive materials stored on-site and installed from moisture damage.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

SMACNA guidelines focus predominantly on pollutant abatement through ventilation and air circulation management, also acknowledging that the extent to which such abatement is required can be minimized when a plan specifies the use of low-toxicity and low-VOC construction materials. Furthermore, a good IAQ management plan establishes strategies to protect a project from the effects of mold and moisture.

Because tile and related installation materials are non-toxic, inherently VOC-free, and resistant to damage from moisture and mold, they facilitate contaminant source control measures on a project.



LEED v4 CREDIT CATEGORY INDOOR ENVIRONMENTAL QUALITY



Tile's zero VOC emissions make it a perfect part of any indoor air quality management plan.

Indoor Air Quality Assessment

STATED INTENT

“To establish better quality indoor air in the building after construction and during occupancy.”

PERTINENT REQUIREMENTS

To be implemented after construction ends and the building has been completely cleaned. All interior finishes must be installed, and major VOC punch list items must be finished.

Option 2. Air testing

After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Tile products are helpful in achieving optimal air quality assessments, as they are VOC-free, formaldehyde-free, and non-toxic.

Tile cuts are typically made on wet saws, minimizing dust that could linger post-construction and adversely affect indoor air quality assessment. Impervious packaging and dust-reducing technologies in cement mortars and grouts also reduce airborne dust particles.

INDOOR ENVIRONMENTAL QUALITY

Thermal Comfort

STATED INTENT

“To promote occupants’ productivity, comfort, and well-being by providing quality thermal comfort.”

PERTINENT REQUIREMENTS

Option 1. ASHRAE Standard 55-2010

Design heating, ventilating, and air-conditioning (HVAC) systems and the building envelope to meet the requirements of ASHRAE Standard 55–2010, Thermal Comfort Conditions for Human Occupancy, with errata or a local equivalent.

OR

Option 2. ISO and CEN Standards

Design HVAC systems and building envelope to meet the requirements of the applicable standard:

ISO 7730:2005, Ergonomics of the Thermal Environment, analytical determination and interpretation of thermal comfort, using calculation of the PMV and PPD indices and local thermal comfort criteria;

and

CEN Standard EN 15251:2007, Indoor Environmental Input Parameters for Design and Assessment of Energy Performance of Buildings, addressing indoor air quality, thermal environment, lighting, and acoustics, Section A2.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Based on thermal comfort goals, consider whether a project is a candidate for natural conditioning, or the use of zero-energy strategies, such as cross ventilation, stack natural ventilation, passive solar heating, and thermal mass to moderate exterior conditions.

The inherent thermal mass of a tile installation, both as an interior finish or as an exterior building envelope component, helps moderate indoor temperature swings, creating a more stable and comfortable indoor environment. ASHRAE, ISO, and CEN standards all include compliance paths for natural conditioning, and the use of tile can strengthen a project’s candidacy for natural conditioning and help it meet pertinent requirements in the referenced standards.

For mechanically conditioned projects, or those with combined mechanical and natural conditioning, tile’s inherent thermal mass and capacity to moderate indoor temperature swings can help reduce the burden on HVAC systems, increase their efficiency, and introduce options for radiant and geothermal heating.



A tile installation’s inherent thermal mass makes it an ideal flooring choice to use in conjunction with radiant heating systems.

LEED v4 CREDIT CATEGORY INDOOR ENVIRONMENTAL QUALITY



The high light reflectance value (LRV) of light-colored tiles helps maximize the efficiency of interior lighting.

Interior Lighting

STATED INTENT

“To promote occupants’ productivity, comfort, and well-being by providing high-quality lighting.”

PERTINENT REQUIREMENTS

Option 2. Lighting quality

Strategy E

For 90% of the regularly occupied floor area, meet the following thresholds for area-weighted average surface reflectance: 85% for ceilings, 60% for walls, and 25% for floors.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Walls, floors, or ceilings with high surface reflectance, or light reflectance value (LRV), can facilitate improved interior lighting conditions, increase the efficiency of natural lighting, and reduce the number of artificial lighting fixtures needed.

Light beige, light grey, and off-white tiles often have LRVs around 60%, and LRVs for white tiles commonly exceed 85%. Tile is one of the rare surface coverings that can be used to cover floors, walls, and ceilings, creating a monolithic envelope that maximizes interior light reflectance. Furthermore, tiled surfaces are easily kept clean and are inherently colorfast, so tile maintains its LRV throughout its life cycle.

When specifying tile, refer to ASTM C609, the industry standard for determining LRV.



Some Green Squared Certified® products satisfy surface reflectance design needs, as an LRV criterion is an elective of the Green Squared® standard.

LEED v4 CREDIT CATEGORY SUSTAINABLE SITES

Open Space

STATED INTENT

“To create exterior open space that encourages interaction with the environment, social interaction, passive recreation, and physical activities.”

PERTINENT REQUIREMENTS

Provide outdoor space greater than or equal to 30% of the total site area (including building footprint). A minimum of 25% of that outdoor space must be vegetated.

The outdoor space must be physically accessible and be one or more of the following:

- A pedestrian-oriented paving or turf area with physical site elements that accommodate outdoor social activities
- A recreation-oriented paving or turf area with physical site elements that encourage physical activity

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Tile can be used as a highly decorative, sustainable, and durable paving material in all or some of the 75% of open space permitted to be hardscaped. It offers numerous design possibilities, and does not detract from its natural surroundings.

Tile is durable enough for a variety of outdoor applications, and is uniquely suited to both complement green spaces and blend them seamlessly with their urban surroundings.





Tile offers many advantages over other materials used for reducing heat island effects. Tiles commonly have solar reflectance values far higher and longer lasting than those of other materials, and are available in a virtually limitless array of shapes, sizes, colors, textures, and thicknesses.

Heat Island Reduction

STATED INTENT

“To minimize effects on microclimates and human and wildlife habitats by reducing heat islands.”

PERTINENT REQUIREMENTS

Use any combination of the following strategies:

Non-roof measures

Use paving materials with a three-year aged solar reflectance (SR) value of at least 0.28. If three-year aged value information is not available, use materials with an initial SR of at least 0.33 at installation.

High-reflectance roof

Use roofing materials that have a Solar Reflectance Index (SRI) equal to or greater than the values listed below:

| | Initial SRI | 3-Year Aged SRI |
|-------------------|-------------|-----------------|
| Low-sloped roof | 82 | 64 |
| Steep-sloped roof | 39 | 32 |

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Light-colored tiles can be used in myriad exterior installations: thick tile pavers, ventilated ceramic façades, and even as roofing components. Because tile is inherently colorfast, it maintains its SR and SRI value far longer than the three years required for this credit and is a great alternative to traditional paving and roofing materials.



Data is available for many Green Squared Certified® products, as solar reflectance is an elective criterion of the Green Squared® standard.

LEED v4 CREDIT CATEGORY

INTEGRATIVE PROCESS



Consider the advantages inherent in tile installations for both interior and exterior building finishes.

Integrative Process

STATED INTENT

“To support high-performance, cost-effective project outcomes through an early analysis of the interrelationships among systems.”

PERTINENT REQUIREMENTS

Beginning in pre-design and continuing throughout the design phases, identify and use opportunities to achieve synergies across disciplines and building systems.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

All components of an installation—tile, related installation materials, and tile substrates—can positively impact the influence of interior finishes and building envelope components on other building systems, and should be evaluated as part of a project’s integrative analysis.

Optimize Energy Performance

STATED INTENT

“To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic harms associated with excessive energy use.”

PERTINENT REQUIREMENTS

Establish an energy performance target

Option 1. Whole-building energy simulation

- Analyze efficiency measures during the design process and account for the results in design decision making.
- Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline.

Option 2. Prescriptive compliance: ASHRAE Advanced Energy Design Guide

- Building envelope, opaque

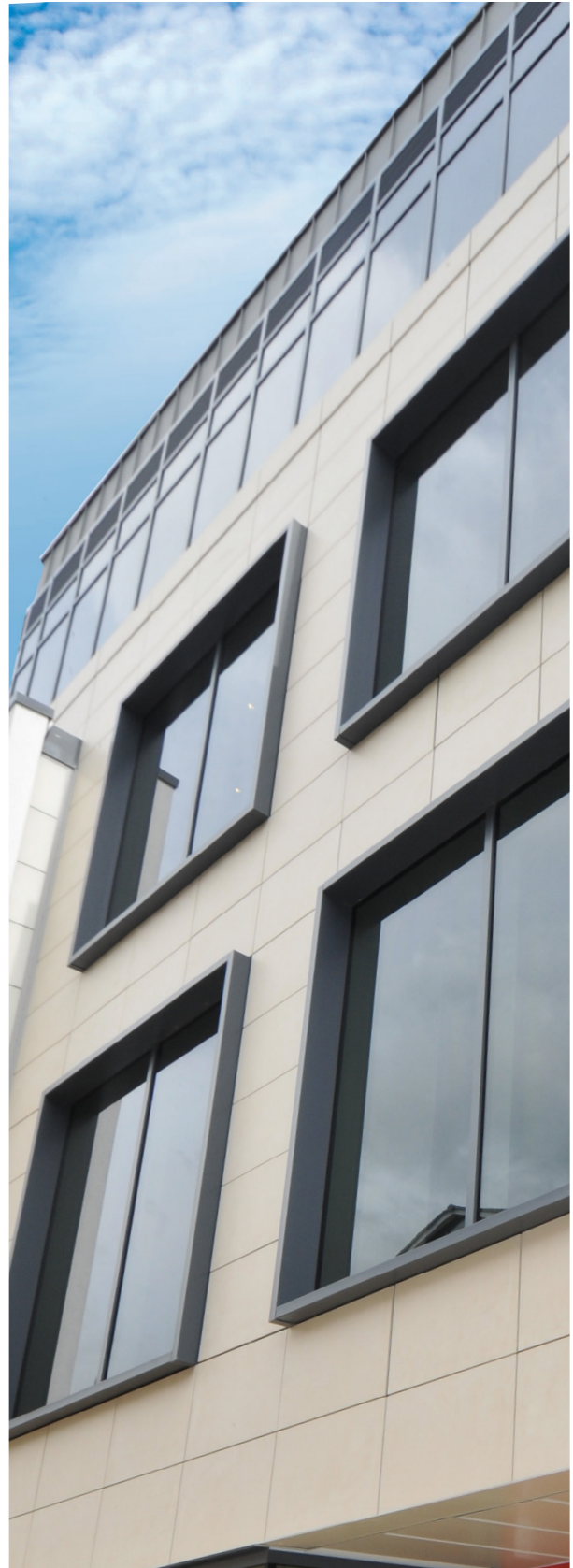
TIPS TO INTEGRATE TILE INTO YOUR DESIGN

The inherent thermal mass of a tile installation helps reduce peak heating and cooling loads and helps shift peak loads to non-peak hours, moderating indoor temperature swings and reducing the size of HVAC systems needed.

Radiant floor heating systems work particularly well with tile, and they can be far more energy-efficient than forced air heating systems.

Tile is an excellent option for a ventilated façade, which creates a “chimney effect” at the building exterior, evacuating hot air in the summer and improving insulation properties in the winter, potentially resulting in substantial energy savings.

Ventilated ceramic tile façades are highly colorfast, offer numerous design options, and can help increase a structure’s overall energy efficiency.



LEED v4 CREDIT CATEGORY INNOVATION



Silicone-based photovoltaic cells can be fused to porcelain tiles for façade and roof installations that produce as well as conserve energy.

Innovation

STATED INTENT

“To encourage projects to achieve exceptional or innovative performance.”

PERTINENT REQUIREMENTS

Option 1. Innovation

Achieve significant, measurable environmental performance using a strategy not addressed in the LEED green building rating system.

Option 2. Pilot

Achieve one pilot credit from USGBC’s LEED Pilot Credit Library.

Option 3. Exemplary performance

Achieve exemplary performance in an existing LEED v4 prerequisite or credit that allows exemplary performance, as specified in the LEED Reference Guide, v4 edition. An exemplary performance point is typically earned for achieving double the credit requirements or the next incremental percentage threshold.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Many tile products today incorporate new, advanced technologies including photovoltaic cells fused to tiles, antimicrobial additives in grout, photocatalytic tile surfaces, underlayments with geothermal channels, and much more. These innovative products offer the potential to generate and conserve energy, clean the surrounding air, and facilitate more sustainable interior and exterior environments. Consult manufacturers to learn about the many exciting technologies available or in research and development.

Refer to the LEED Pilot Credit Library frequently at www.usgbc.org to discover potential new credits that may be relevant to tile.

Many tiles and installation materials offer the potential to contribute to achieving double the credit requirements and/or achieving the next incremental threshold.



Consider using Green Squared Certified® products that have innovative properties, are sustainable beyond baseline certification requirements, or could potentially be piloted for additional contribution to LEED v4.

Certified Multi-Attribute Products and Materials

STATED INTENT

“To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts.”

PERTINENT REQUIREMENTS

Use products from manufacturers who have validated multiple environmental attributes relevant to the product via independent, consensus-based, third party certifications. The products must have earned and still maintain certification under the scheme. Only products which have undergone a life cycle assessment in conformance with ISO 14044 are eligible, and the manufacturer must publicly disclose all other credit achievement results of the product on which the certification has been granted. Use at least 25%, by cost, of the total value of permanently installed products in the project.

Approved third-party certification standards pertaining to tile and/or tile installation materials:



Green Squared® / ANSI A138.1
Standard for Sustainable Ceramic
Tiles, Glass Tiles, and Tile Instal-
lation Materials

Note: A full list of approved 3rd party certification standards for other types of building products, including wallboard, furniture, roofing, and other types of floor and wall coverings, is available at www.usgbc.org.

TIPS TO INTEGRATE TILE INTO YOUR DESIGN

Tiles or tile installation materials that are Green Squared Certified can contribute toward the 25% threshold required by this credit as indicated below. The manufacturer must disclose all aspects of Green Squared/ANSI A138.1 that were met to achieve certification, including Section 3.8.1, Life Cycle Assessment.

- 50% of the total product cost for baseline certification
- 75% of the total product cost if ANSI A138.1 criteria for Level 2 recycled/reclaimed content and/or Level 2 indigenous raw materials were met as part of the certification
- 100% of the total product cost if ANSI A138.1 criteria for Level 3 recycled/reclaimed content and/or Level 3 indigenous raw materials were met as part of the certification



Green Squared Certified® tiles and installation materials offer robust sustainability and versatility. This floor design was created using Green Squared Certified tiles, which were installed throughout an 8,000 sq.ft., LEED NC Platinum Certified facility.

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TCNA GREEN REPORT

LIFE-CYCLE COST STUDY



Because a tile installation will last as long as the building it's installed in, its environmental impacts are minimal when compared to other surface coverings that would

have to be replaced numerous times over the life of the building. This also means tile costs less per square foot over the long haul, whereas carpet, vinyl, and other floor coverings are significantly more expensive due to their replacement, maintenance, and refinishing requirements.

Construction cost consulting firm Scharf-Godfrey compared the life-cycle costs of various flooring types. The per year cost for each flooring type includes installation, maintenance, and removal costs. Their comparison, provided below, shows why ceramic tile is the natural choice for sustainable design and long-term value.

| Life-Cycle Costs for Floor Finishes (per square foot) | | | | |
|---|----------------|-----------------|-------------------|---------------|
| Floor Finish | Installed Cost | Life Cycle Cost | Expected Life (y) | Cost Per Year |
| Quarry Tile | \$6.83 | \$16.13 | 50 | \$0.32 |
| Glazed Ceramic Floor Tile | \$7.00 | \$16.30 | 50 | \$0.33 |
| Glazed Porcelain Tile | \$8.34 | \$17.64 | 50 | \$0.35 |
| Mosaic Tile | \$8.20 | \$17.50 | 50 | \$0.35 |
| Unglazed Porcelain | \$8.30 | \$17.60 | 50 | \$0.35 |
| Natural Hardwood | \$9.31 | \$20.80 | 50 | \$0.42 |
| Travertine-Turkish | \$12.50 | \$21.80 | 50 | \$0.44 |
| Marble | \$21.00 | \$30.30 | 50 | \$0.61 |
| Laminate | \$8.84 | \$17.77 | 25 | \$0.71 |
| Man-Made Hardwood | \$9.58 | \$18.51 | 25 | \$0.74 |
| Portland Cement Terrazzo | \$14.88 | \$24.27 | 30 | \$0.81 |
| Stained Concrete | \$12.40 | \$24.60 | 25 | \$0.98 |
| Carpet | \$3.22 | \$ 6.50 | 6 | \$1.08 |
| Resin Terrazzo | \$8.50 | \$16.53 | 15 | \$1.10 |
| Sheet Vinyl | \$6.90 | \$13.90 | 10 | \$1.39 |
| Poured Epoxy | \$8.18 | \$15.18 | 10 | \$1.52 |
| VCT | \$3.91 | \$18.35 | 10 | \$1.83 |

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