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Sustainability Floors the Industry

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Learning Objectives

1. Identify specific sustainability advances within the commercial flooring industry.
2. Understand the main sustainability considerations to take into account when evaluating different flooring systems.

3. Gain insight into common flooring applications for different building types and why specific materials work well for a particular market.
4. Understand which flooring system sustainability attributes that the LEED rating system recognizes and doesn't recognize with its current rating system.
5. Understand the issue of moisture accumulation between concrete floor slabs and low permeability flooring finishes, and how to combat it.

Just as mechanical and electrical building equipment continues to make advancements in sustainability, interiors are no exception, particularly flooring systems.

In fact, between newer environmentally focused standards, transparency initiatives and increasing levels of recycled and recyclable content in flooring products, it seems that flooring materials are as green as ever.

For example, NSF/ANSI 332 "Sustainability Assessment Standard for Resilient Floor Coverings" identifies environmental performance and sustainability attributes of products and provides a method of tracking sustainable product improvement over time. And FloorScore — developed by the Resilient Floor Covering Institute and Scientific Certification Systems — certifies hard-surface flooring and flooring adhesive products for compliance with strict indoor air quality (IAQ) emissions requirements.

Green Squared is the flooring industry's first sustainability standard for tile and tile installation materials. Developed by the Tile Council of North America (TCNA) under the American National Standards Institute (ANSI) process, this sustainability standard recognizes manufacturers for their environmental leadership and corporate social responsibility across a broad range of indicators. Scientific Certification Systems, UL Environment and NSF are among the first third-party certifiers accredited by TCNA to conduct evaluations under this standard.

Perhaps even more significant, six major flooring manufacturers recently kicked off a pilot program, Health Product Declaration (www.hpddworkinggroup.org), with the goal of creating a universal format for disclosing product ingredients with associated health information, which Peter Syrett, AIA, LEED AP, associate principal, Perkins+Will, New York, credits as "one of the strongest efforts towards transparency in the building products marketplace."

Explaining the importance of transparency, Syrett relates, "transparency is the concept that when consumers have access to unfiltered, detailed and meaningful information about products, they can make informed choices about their purchases. Foremost for building products, transparency is about peeling back the layers of opaqueness about material composition, and letting consumers know what a given product is made out of."

The Big Apple designer also gives a nod to InterfaceFLOR for its new Environmental Product Declaration (EPD) process which provides end-users with a detailed environmental footprint of its products.

Offering some perspective, Dominic Rice, vice president, sales and marketing, Armstrong Commercial Flooring, Lancaster, Pa., whose company was involved with the development of NSF/ANSI 332, only sees this trend continuing. “We’ve heard from designers and architects that sustainability will be more, not less, significant as a decision-making factor, and they expect to see greater regulation and wider mandates in this area.”

Market Check

Taking a quick look at the overall commercial flooring market, the Reading, Penn.-based market research firm, Market Insights/Torcivia, in its most recent U.S. FLOORreport, found that carpet continues to account for the lion’s share of the commercial marketplace at 70 percent, with ceramic tile at 13 percent, resilient flooring products at 11.2 percent, hardwood flooring accounting for 3.8 percent of the market and laminates at 1.9 percent.

Within the carpet industry, the popularity of carpet tiles continues to overshadow broadloom, while stone, marble and tile seem to be gaining traction with hard surfaces, according to Ralph O. Godfrey, R. Godfrey Consulting, Wildomar, Calif.

“While there’s still a good amount of wood flooring, we’re seeing people move away from it because it takes a lot to maintain. Instead, they’re going to flooring laminates as an alternative,” observes Godfrey, an industry veteran who offers consultation, certified inspections and expert testimony on all things flooring.

As for resilient flooring, the West Coast consultant is seeing more products that look like wood or stone, and for restaurants and chain stores, polished and finished concrete is frequently the flooring of choice.

Another trend, notes Angie Clarkson, LEED AP BD+C, registered interior designer, LWPB Architecture, Oklahoma City, is the growing popularity of solid and luxury vinyl flooring, as well as sheet vinyl and vinyl tile products which don’t require wax or stripping chemicals.

Sizing up the Options

When evaluating how different materials and products compare, sustainability-wise, it’s important to take a holistic view and consider a number of key variables such as life-cycle cost and maintenance in addition to recycling.

“Ideally, a sustainable material analysis should look at the entire life cycle of a product from extraction to disposal, and also critically examine a broad spectrum of factors such as embodied energy and material health,” states Syrett. “For example, for wood flooring, where and how it is harvested is an important consideration; for a synthetic material such as a commercial carpet tile, the composition can be very different depending on the manufacturer; and the transportation of a heavy material like concrete is energy intensive, so where it is being manufactured in relationship to the jobsite is a key environmental concern.”

To get started, the following is an abbreviated look at the sustainable pros and cons of different flooring materials.

Wood. While the use of salvaged or reclaimed wood, certified wood or bamboo, all contribute to the

perception that wood is a sustainable material, it's somewhat more complex than that.

For example, even though bamboo is desirable as a rapidly renewable material, it's almost exclusively grown in China and must be shipped overseas. Even if the wood is sustainably harvested or reclaimed, manufacturers usually add laminating adhesives and other chemicals, which are essential for durability and performance but can negatively affect indoor air quality.

Still, wood does have a number of green attributes to its credit, as the National Wood Flooring Association, citing a number of credible sources, lists the following (www.woodfloors.org/Green.aspx):

- Wood floors use less water and energy to produce than other flooring options.
- Wood is a carbon-neutral product that produces oxygen during its growth cycle and stores carbon during its service life.
- A good quality, well-installed hardwood floor offers a long service life.

Vinyl, Vinyl Composition Tile, Luxury Vinyl Tile. To its credit, VCT is considered to offer the lowest first cost and is therefore an excellent value, according to Clarkson. And while maintenance protocols for VCT and sheet vinyl typically require strong chemicals and strippers, manufacturers have recently been able to reduce the material's flooring maintenance requirements.

At the same time, most vinyl flooring contains polyvinyl chlorides, i.e., PVC, although the material is free of heavy metals and other plasticizers and, in many cases, still meets LEED requirements.

Carpet, Carpet Tiles. While carpet used to have a reputation of claiming huge areas of landfill space, this is slowly, but surely, changing.

"Much commercial carpet today can be completely recycled, including the backing systems," states Godfrey.

And thanks to the Carpet America Recovery Effort (CARE) — a joint industry-government initiative — reclamation and landfill diversion numbers are significantly increasing. According to CARE statistics, the recycling volume of carpeting increased by 10 percent from 2009 to 2010, with 60 percent going into engineered resins and plastic parts, 31 percent being reused in carpet, and 5 percent finding new life in carpet cushion.

Concrete. When evaluating concrete solely based on recyclability, Godfrey claims that it's probably one of the most recyclable materials around. And with more manufacturers substituting energy-intensive Portland cement with fly ash and other supplementary cementitious materials, concrete is becoming more sustainable.

Fly ash is a particulate matter that is a waste product of burning coal and collected from the smokestacks of coal-burning power plants. While the finished concrete product typically doesn't pose a risk, fly ash does contain heavy metals and workers are exposed to these chemicals during fabrication.

Additionally, the installation and polishing process can be rather labor intensive and when done improperly, concrete is vulnerable to cracking, says Kelli Griffith, LEED AP, NCIDQ, marketing director for the Debary, Fla.-based wholesale distributor, Commercial Flooring Distributors.

Laminates. According to the North American Laminate Flooring Association (NALFA), laminates are mostly recyclable and free from air-damaging chemicals. However, the adhesives can sometimes contain urea-formaldehyde.

NALFA counters that any formaldehyde emissions fall below California Air Resources Board regulations, and therefore are not harmful. Furthermore, because most products attach to a floating floor, as opposed to the subfloor, this eliminates the need for glues and adhesives during installation.

NALFA also points out that laminates can also take on the appearance of wood or stone, thereby sparing the use of these natural resources.

Linoleum. While linoleum often comes with a higher first cost, some view it as an alternative to VCT since it contains no PVC and doesn't require harsh strippers or cleaning chemicals, so in the long run, lower maintenance counterbalances the higher first cost.

Additionally, linoleum products — made from linseed oil, mineral oils and wood flour — are considered by many as sustainable and recyclable.

Rubber. While rubber is a very resilient, stain-resistant product suitable for many different applications, more individual research into a specific manufacturer is necessary before making a selection as its composition varies significantly between manufacturers. For example, some products are made using recycled tires or contain larger quantities of natural rubber, as compared to plasticizers and binders, and can be PVC-free. But other products are made from higher percentages of synthetic rubber and chemical additives, resulting in VOCs.

Porcelain, Ceramic Tiles. Based on their longer product life, porcelain and ceramic tiles are considered sustainable, however, they do require an energy- and water-intensive manufacturing process, which is sometimes exacerbated by the incorporation of recycled content, says Clarkson.

“These materials do have the advantage of being mostly composed of abundant natural resources, but the additional weight of the products increases their transportation footprint,” adds Vernon.

A More Thorough Analysis

As noted, a true sustainable profile requires much more than a few casual observations about a material's recycling properties and durability.

For example, according to Godfrey, if one is evaluating a flooring material based on life cycle, concrete is the best. But from a wearability and performance standpoint, carpet tile stands out as one of the best investments, he says.

Essentially, Clarkson points out that there is no perfect product. While on the one hand, VCT is one of the least expensive materials on the market, it has a comparatively high long-term cost, whereas rubber, while expensive to purchase, offers a low long-term cost. Meanwhile, linoleum, carpet tile and no-wax luxury vinyl tiles fall somewhere in between.

“The challenge is comparing across product types,” explains Armstrong's Rice. “That's why

establishing an independent standard is key.”

Consequently, NSF/ANSI 332, FloorScore, Green Squared and EPDs are all steps in the right direction. In addition, ISO 14044 Life Cycle Assessment considers the environmental impacts of a product from raw material extraction, manufacturing, transport, use and end-of-life disposition for a more holistic evaluation.

New tools are helping specifiers and building owners evaluate green features. For instance, ecoScorecard (www.ecoscorecard.com) is a platform to help specifiers search for green products and document a product’s environmental attributes according to assorted rating programs including LEED, Green Guide for Healthcare, Collaborative for High Performance Schools and Labs21.

Emily Hopps, PE, senior staff II, flooring practice group leader, Simpson Gumpertz & Heger, Boston, recommends the National Institute of Standards and Technology’s Environmental and Economic Stability application (www.nist.gov/el/economics/BEESSoftware.cfm), which calculates the environmental performance of differing commercial floor finishes.

Overall, there has been a lack of standards and rigorous life-cycle studies across multiple flooring materials. According to veteran flooring consultant, Lewis G. Migliore, LGM and Associates, Dalton, Ga., nothing has been developed to calculate recycled content or its effect on life expectancy, nor the recyclability of a product relative to life-cycle costing.

He says, “If the product can be recycled, the loop never ceases. The question then becomes how many times can a product be recycled and maintain its integrity: a question with no answer at this point in time.”

Though there have been reports and additional assessment programs worth examining. For example, Dovetail Partners published “Life Cycle Assessment of Flooring Materials: A Guide to Intelligent Selection” that looks at ceramic tile, vinyl, linoleum, bamboo, hardwood, carpet made of natural or a variety of synthetic fibers, and more (www.dovetailinc.org).

There’s also the Cradle to Cradle Certified program (www.c2ccertified.org) that reports to be a multi-attribute quality mark that assesses a product’s safety to humans and the environment, and design for future life cycles.

Consequently, designers must work with the available resources and be sure to ask good questions when analyzing different product choices.

To help see a product through multiple sustainability “lenses,” Syrett offers the following list of questions:

- What are the environmental impacts of daily, weekly and long-term cleaning?
- How will indoor air quality be impacted by cleaning or not cleaning this flooring system?
- Are there hidden long-term costs associated with the maintenance of this flooring system?
- What is the recycled content and where does it come from?
- How does the recycled content change the embodied energy profile of the product?
- Are there known or suspected health issues associated with the recycled content?
- Specifiers must then factor in initial cost, the estimated life cycle of the facility and the floor, and options for end-of-life recycling.

Overall, Syrett recommends a comprehensive comparison between products, which will require a lot of research and effort. But with experience, it becomes an easier process to navigate.

Sustainability issues aside, Godfrey points out that the sheer proliferation of product choices in recent years has made it very challenging to know if a specific product is appropriate for a particular application.

“It’s amazing how much inappropriate product gets installed,” observes Godfrey. “Twenty years ago, there were fewer products to deal with, so it was possible to do a lot of research. But now it’s very difficult to keep up with the new products. Still, if a designer specifies a product, he or she has to do some checking.”

Sharing a recent disaster story, Godfrey was called in to evaluate a failing tile installation. It turned out that a compressible, sound-retardant material had been installed under VCT flooring in a healthcare facility, ultimately requiring the replacement of 100,000 square feet of flooring material. If those involved had been aware that the underlayment was compressible, a more suitable product could have been specified and the whole problem avoided.

Commercial Flooring and LEED

Another significant factor influencing the commercial flooring market is how different products and installation types rank when it comes to obtaining LEED points. To that end, it’s important to understand which LEED credits can be achieved through flooring.

Some easier targets, says Clarkson, are indoor air quality points for materials and adhesives, recycled content and regional materials. Other categories include renewable materials and construction waste management, although Syrett points out that the number of credits a given product can contribute to vary greatly.

To give specifiers a basic idea, Syrett shares the following LEED credits listing for flooring systems, applicable to LEED for New Construction (LEED-NC), LEED for Commercial Interiors (LEED-CI) and LEED for Schools:

Materials and Resources

- MRc3 – Materials Reuse
- MRc4 - Recycled Content
- MRc5 - Regional Materials
- MRc6 - Rapidly Renewable Materials
- MRc7 - Certified Wood

Indoor Environmental Quality

- IEQp1 - Minimum IAQ Performance
- IEQc4.1 - Low-Emitting Materials—Adhesives and Sealants
- IEQc4.2 - Low-Emitting Materials—Paints and Coatings
- IEQc4.3 - Low-Emitting Materials—Flooring Systems
- IEQc4.4 - Low-Emitting Materials—Composite Wood and Agrifiber Products
- IEQc5 - Indoor Chemical and Pollutant Source Control

Pilot Credits

- Pilot c1 - Life Cycle Assessment of Building Assemblies and Materials
- Pilot c2 - PBT Source Reduction: Dioxins and Halogenated Organic Compounds
- Pilot c11 - Chemical

Avoidance in Building Materials

- Pilot c43 - MR - Certified Products
- Pilot c44- Transparency

At the moment, LEED generally doesn't award points for performance and durability, manufacturing efficiencies and corporate commitment to sustainability relevant to supply chain and operations; although a few pilot credits are beginning to address some of the following issues.

For example, while a project can earn a LEED credit if the flooring product uses 10 percent recycled content, this is not necessarily a true assessment of that product's environmental impact. However, the next version of LEED is expected to address a more holistic, life-cycle based approach to sustainability and emphasize performance.

A key issue Godfrey brings up is the importance of getting the mechanical systems up and running before installing the flooring systems because different products are very sensitive to temperature and humidity conditions.

"Most general contractors do not understand that you can't build a building like you used to build it if you're going for LEED certification," he observes.

With such a focus on specifying and installing products that may qualify for LEED points, contractors can easily fall into the trap of not considering how those products will perform within the greater context of the building.

For example, while bamboo is very eco-friendly, it's also extremely sensitive to environmental conditions. Similarly, carpet can start to expand once the switch to the HVAC system is flipped.

Market Applications

While specifiers have many choices when it comes to flooring systems, some materials are better suited for different building types than others.

"Every building type has unique code, maintenance and performance requirements that must be considered when selecting a flooring product," confirms Syrett.

Healthcare. One big trend Godfrey is observing in the healthcare market is the application of vinyl plank flooring, which lends an appearance of wood and offers a relatively easy install. Clarkson also identifies rubber, linoleum and carpet as common materials since they're durable and don't require waxing or stripping.

Education. The same materials also offer appeal to the education market for the same reasons. Still, many schools are sticking with VCT, and to a certain extent carpet tiles or broadloom.

“VCT is a traditional choice for schools because of its very low initial cost, ease of installation and broad color selection,” notes Clarkson’s LWPB colleague Lisa M. Chronister, AIA, LEED AP, principal.

While rubber is often more expensive, it offers better durability, sound attenuation and is easy to clean, she adds.

Corporate. As for office buildings, Godfrey remarks, “Corporate is all over the map, depending on how high-end a building owner wants to be. It depends on aesthetics, desire and budget.”

At the same time, Clarkson sees carpet as a popular option based on acoustics, IAQ and flexibility.

If high-end is the goal, combining carpet with wood, LVT or stone can lend a refreshing, upscale look, which can be a good strategy for sprucing up a corporate space, says Migliore.

Retail. Perhaps the biggest trend in the retail market is stained and polished concrete. But retailers are also choosing synthetic vinyl planking and wood, as well as stone, marble and ceramic tile, says Godfrey.

Meanwhile, Clarkson is also seeing carpet tile, linoleum and porcelain tile in these settings.

In summary, all flooring experts agree that while sustainability is a very desirable attribute, it cannot be prioritized at the expense of the product’s proper application and ultimate performance.

“If the wrong product is used, if the installation is compromised, or if it will cause replacement or failure, then all ‘green’ bets are off,” says Migliore. “The mantra must be ‘Get it in the door and keep it on the floor.’”

Essentially, the key is collecting as much data as possible to be able to make the most informed decision. As Syrett states, “the old cliché of ‘the devil is in the details’ is particularly true for evaluating the sustainable performance of materials. The more information one has, the better the evaluation will be.”

Consequently, the industry’s move toward transparency is very significant and bodes well for end-users moving forward.

When consumers have access to unfiltered, detailed and meaningful information about products, they can make informed choices about their purchases. Foremost for building products, transparency is about peeling back the layers of opaqueness about material composition and letting consumers know what a given product is made out of,” explains Rice.

[Take the quiz here](#)

Green Grouts and Mortars

A key aspect of flooring systems, manufacturers are making big strides in improving the quality and performance of grouts and mortars, in addition to boosting their eco-friendly attributes. For example, InterfaceFLOR has a Tactile line which enables glueless installation, in addition to other zero-VOC options.

“There are no longer VOC issues. And while mortars may still give off odors, it doesn’t mean they’re harmful,” explains Ralph O. Godfrey, R. Godfrey Consulting, Wildomar, Calif.

At the same time, Angie Clarkson, LEED AP BD+C, registered interior designer, LWPB Architecture, Oklahoma City, recommends looking carefully at a product’s technical data because sometimes waterborne or low-VOC products don’t offer the same holding power. “Similarly, an epoxy product may or may not meet the VOC limits referenced in the LEED system,” she adds.

Peter Syrett, AIA, LEED AP, associate principal, Perkins+Will, New York, also points out that epoxy grouts, which are quite common, often contain Bisphenol A (BPA), an endocrine disrupting chemical.

Combating Moisture

Perhaps the most significant factor driving the commercial flooring market is overcoming long-term performance issues when the floor finishes are placed on typical concrete floor slabs with elevated moisture levels, according to Emily Hopps, PE, senior staff II, flooring practice group leader, Simpson Gumpertz & Heger, Boston.

For instance, carpet tile and vinyl composition tile (VCT) have a relatively low permeability. This means that the moisture inherent to the concrete cannot dry into the ambient air and will tend to collect between the floor finish and the concrete. “Depending on the moisture levels in the concrete, significant amounts of moisture can accumulate at this interface and cause failures like delamination, buckling and blistering,” cautions Hopps.

Similarly, some wood and cork floors are prone to curling or buckling when exposed to moisture in concrete floors. Meanwhile, the low permeability of linoleum and rubber also creates a risk of debonding and blistering as a result of moisture accumulation.

“Because of these changes to the formulation of the floor finish materials and the concrete substrates, the moisture content of the concrete must be accurately measured prior to installation of floor finishes. In some cases, additional measures to mitigate high concrete moisture levels must be implemented before moisture-sensitive floor finishes can be installed,” recommends Hopps.

In addition, the engineer advises specifiers to select floor finishes that have the greatest chance of providing long-term performance, namely products offering higher permeability.

“Some more permeable alternative commercial floor finishes include ceramic tile; open-backed

carpet; polished or stained concrete, and semi-permeable cementitious urethane coatings,” she says. “These finishes can typically be applied directly to the surface of a concrete slab with high moisture content without fear of long-term moisture- or alkalinity-related problems.”

When such materials are not an option, then the application of a moisture-mitigation coating on the surface of the concrete slab prior to installation may be a way to ensure proper long-term performance, according to Hopps.

Explaining how it works, moisture mitigation coatings form a vapor retarder on the surface of the concrete to prevent slab moisture from contacting the floor finishes and withstand the high moisture and alkalinity levels in the concrete. “The moisture mitigation products with the best and longest track records are usually volatile organic compound-compliant, epoxy-based products applied as a coating to the surface of the concrete.”

If a typical water-based adhesive is used to install the floor finish, then a cementitious underlayment may be required between the moisture mitigation coating and the floor finish to level the floor and absorb the water in the adhesive and promote proper cure.