Zero Waste—You Make It

Bamboo Flooring

Introduction

This fact sheet is provided as a tool to aid design professionals or other parties interested in sustainable building materials and to provide an analysis of bamboo flooring using applicable sustainable building criteria. This information can be used as a piece of a larger life-cycle analysis or simply to help in comparing bamboo to other flooring choices. This fact sheet is neither a full life-cycle analysis of bamboo flooring nor an endorsement of any product or manufacturer.

What Is Bamboo Flooring?

Bamboo is a member of the grass family that "matures in three years, regenerates without need for replanting, and requires minimal fertilization or pesticides."[1] The bamboo is harvested, sliced into strips, boiled in water with a preservative, and pressed flat. It is then laminated vertically or in three horizontal layers, and kiln-dried. Floors manufactured using the horizontal orientation may be prone to cupping, but this problem is eliminated when the center layer is oriented perpendicular to the top and bottom layers.

Some manufacturers also offer an engineered floor that utilizes a thin bamboo layer laminated over a non-bamboo material. One manufacturer now offers tongue-and-groove flooring made from bamboo-oriented strand board (OSB). This product is made using the post-industrial waste bamboo from floor manufacturing.

Bamboo flooring products are manufactured in varying dimensional tongue-and-groove strip sizes and lengths. These products are available either pre-finished or unfinished, and they are usually offered as either natural or amber colored. Costs range from $4 to $8 per square foot for higher quality products.

Where Can Bamboo Flooring Be Used?

Bamboo flooring can be used in most residential and commercial applications where carpet, wood, tile, or resilient flooring is used. Some applications may be inappropriate—a high moisture area, for example—so consumers should confirm with the supplier to make sure the application is appropriate.

Depending upon the product, installation may be glue-down or nail-down. In engineered products, bamboo may be floated, and it can be used with concrete or wood subfloors. Manufacturers report that bamboo floors are maintained in the same manner as wood floors and can be refinished.

Sustainable Building Criteria Used

Whether seeking parameters for life-cycle analysis or simply trying to make an environmentally informed decision about a building material, the criteria for analysis must be defined.

For bamboo flooring products, several criteria were evaluated to provide this basic tool for decision-making. These criteria are taken from the following sources:[2] LEED rating systems of United States Green Building Council; *Building Materials: What Makes a Product Green,* Environmental Building News, [3] and the California Integrated Waste Management Board's *Green Building Materials*[4] Web site.

When evaluating bamboo flooring materials, the two sustainability criteria most applicable for analysis are materials and resource efficiency and indoor environmental quality (IEQ).

Materials and Resource Efficiency

Materials and resource efficiency criteria look at various impacts on the environment that result from the extraction or harvest, manufacture, transportation, and disposal of the material.

Rapidly Renewable

One of bamboo's greatest benefits is the rate at which it renews itself. The three-to-five-year harvest cycle makes bamboo a rapidly renewable material, which is generally defined as having a harvest rotation of 10 years or less. In contrast,

most hardwood species used for flooring reach saleable size in 50 to 100 years.

Recycled Content Product

To be considered a recycled content material, the product should contain a certain amount of either postconsumer or post-industrial waste material. This is generally presented as a percentage of the total weight. The LEED Rating System has used 20 percent postconsumer and 40 percent post-industrial as minimum requirements for a product to be considered recycled content.

Some bamboo flooring products may be laminated over a core material made from medium density fiberboard (MDF), which generally contains some post-industrial wood fiber. The OSB flooring product also contains post-industrial recycled bamboo. It may—depending on the content percentage—be potentially considered a recycled-content material.

Transportation Issues

Nearly all bamboo for flooring is grown and manufactured in the Pacific Rim, generally in China or Vietnam. Therefore, any life-cycle analysis of these products should take into account both energy consumption and air emissions resulting from the transportation requirements of bringing the flooring to market.

Some green building rating systems or guidelines give preference to the use of materials that either originate or are manufactured locally, which is often defined as within a 500-mile radius from the project.

Durability

Durable materials require less frequent replacement, generate less waste, and may also realize lower long-term costs. According to manufacturers, bamboo flooring should last a lifetime (30 to 50 years). The one-time costs of installing bamboo flooring should be less than the costs for multiple installations of less durable flooring options. Therefore, over the long-term, the consumer should save money. Replacing the flooring generates waste, so reducing the rate of replacement also reduces waste generation.

Without a single standard measurement for durability, the only comparable data available at this time are the results from standard Janka-Ball Hardness tests (ASTM D1037). Bamboo flooring ranges “from slightly lower than red oak *(*1290 PSI*)* to significantly harder—1130 PSI to 1640 PSI,”[5] making it a relatively hard material.

Since most bamboo flooring can be refinished, it should have a longer life than less durable flooring options such as carpet and some resilient flooring. The following list is from the *Residential Rehabilitation Inspection Guide* of the U.S. Department of Housing and Urban Development.[6] Based on information provided by manufacturers and trade associations, it shows the life expectancy of several common flooring components used in residential applications:

- Oak or pine: lifetime.
- Slate flagstone: lifetime.
- Vinyl (sheet or tile) 20–30 years.
- Terrazzo: lifetime.
- Carpeting: 11 years.
- Marble: lifetime.

Since bamboo has a relative hardness comparable to oak, a very hard, durable wood, and exhibits similar properties to other wood floors, it is assumed to have a life expectancy comparable to wood flooring.

Indoor Environmental Quality

According to the U.S. EPA, Americans spend nearly 90 percent of their time indoors. Therefore, evaluating how products impact IEQ is necessary. These impacts may include emissions of volatile organic compounds (VOC) and/or formaldehyde. Several factors should be considered when looking at the indoor environmental quality impacts of a material. For example, these may include ventilation rates of the space applied, decay rates for volatile components, and the overall emissions from other components.

Volatile Organic Compounds

At this time, little data is available relative to the emissions of VOC from bamboo flooring material.

Formaldehyde

Some bamboo flooring products are manufactured using formaldehyde-based adhesives, and formaldehyde emissions vary from brand to brand. Some brands claim the use of formaldehyde-free glues and finishes. Some manufacturers reported formaldehyde emissions at various ranges, from 16 µg/m³ to 330 µg/m³. The California Office of Environmental Health Hazard Assessment has listed formaldehyde as a "chemical of special concern." The agency has published the reference exposure levels (REL) for toxicity for both Chronic[7] (3 µg/m³) and Acute[8] (94 µg/m³ for 1hour) exposures.

If you are considering bamboo flooring, inquire about VOC and formaldehyde emissions from the specific manufacturer or distributor. VOC and formaldehyde emissions should also be considered when choosing adhesives for glue-down installations, in the surface finishing material, and in the choice of subfloor materials.

Other Issues

Life-cycle analysis often includes examining environmental justice issues. Since most bamboo for flooring originates in the Asian Pacific Rim, the question of fair labor practices is a legitimate concern in the production and manufacture. To date, these practices have not been well documented. As a result, local product distributors may not have much direct control or be willing to say much about this issue.

Resources

The following Web sites offer information about sustainable building and materials.

- California Integrated Waste Management Board, Sustainable Building Program www.ciwmb.ca.gov/GreenBuilding/
- *Environmental Building News*, monthly, limited online version and ordering info www.buildinggreen.com/menus/news.cfm
- *Green Spec*, available online at www.buildinggreen.com/bg/gsmenu/index.jsp

CIWMB Contact Information

For more information about bamboo flooring, sustainable building materials, or sustainable building in general, please contact Gregory Dick of the CIWMB at gdick@ciwmb.ca.gov or (916) 341-6497.

Endnotes

[1] "Bamboo Flooring," *Environmental Building News*, November 1997 <www.buildinggreen.com/products/bamboo.cfm>

[2] LEED Rating System, version 2.1, 2002 <www.usgbc.org/LEED/publications.asp>

[3] "Building Materials: What Makes a Product Green," *Environmental Building News*, January 2000 <www.buildinggreen.com/features/gp/green_products.cfm>

[4] <www.ciwmb.ca.gov/GreenBuilding/Materials/>

[5] "Bamboo Flooring."

[6] U.S. Department of Housing and Urban Development, Residential Rehabilitation Inspection Guide. 2000 <www.huduser.org/publications/destech/inspection.html>

[7] <www.oehha.org/air/chronic_rels/pdf/50000.pdf>

[8] <www.oehha.org/air/acute_rels/pdf/50000A.pdf>

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, Flex Your Power and visit www.consumerenergycenter/.org/flex/index.html.

Publication #433-03-017 August 2003