

The Six Pillars of Healthy, Sustainable Flooring

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Since the LEED® rating system was developed in the late '90s, there has been an increased focus on designing more efficient buildings. But with the LEED evolution to v4 and the creation of the WELL® Building Standard (IWBI, 2018), the focus has shifted from environmental efficiency to human health and well-being of building occupants. One reason for this shift is the growing number of studies documenting the relationship between indoor environmental quality and human health and well-being.

Truly sustainable building or product designs consider the three lenses of sustainability: social (people), economic (profits) and environmental (planet). By balancing these three (3) lenses, sustainability becomes a reality. And because of the intrinsic relationship between these three (3) lenses, improving sustainability of one can positively impact the others. For example, to improve the sustainability of a product, manufacturers must improve the impacts of their manufacturing facility or work with their suppliers to improve the sustainability aspects of their supply chain.

The Six Pillars

For a flooring product to be truly sustainable, the same is true. The design of the product should consider social, economic, and environmental lenses.

As manufacturers strive to reduce the cost of their products, they seek out less expensive materials, implement process improvements to reduce energy, and/or select suppliers who are closer to the

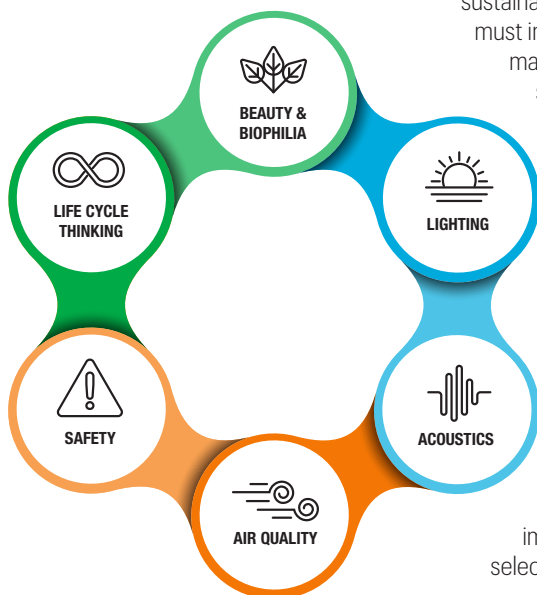
manufacturing facility, or offer alternative modes of transport. Many of these “cost reduction” projects also have a positive environmental and social sustainability impact. Less expensive materials typically cost less, because they may take less energy to make. Less energy equates to less greenhouse gases which results in better air quality.

But the selection of a flooring product should not be based solely on the impacts associated or embodied in a product. Life cycle thinking must also be considered which leads to the six pillars of healthy, sustainable flooring: Beauty/ Biophilia, Lighting, Air Quality, Acoustics, Safety and Life Cycle Thinking.

Beauty & Biophilia

Historically, flooring selection has been based on design – both functionality as well as aesthetics. When the Living Building Challenge (ILFI, 2014) introduced a Beauty Petal, they introduced the idea that a project should meaningfully integrate public art and contain design features intended solely for human delight and the celebration of culture, spirit, and place appropriate to the project’s function. Flooring can be an expression of art and can contribute to the intent of the LBC’s Beauty & Spirit criteria. Similarly, WELL includes a mandatory Feature – Beauty & Design I – which requires thoughtfully designed environments that positively impact the mood and comfort level of occupants.

Evidence Based Design, as well as workplace surveys (Capitol One, 2018), show that people are happier in workspaces with art. Flooring can be a source of beauty. It can provide pops of color, or connect the interior space to the outdoors through designs inspired by nature.



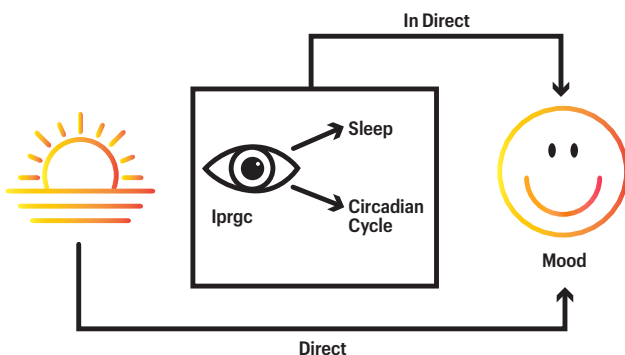
This idea of connecting the indoor environment with the outdoors is the basis of biophilic design. Biophilic design is a sustainable design strategy that strives to reconnect people with the natural environment. It is a necessary complement to environmentally sustainable architecture, which decreases the environmental impact of the built world, but does not always address the human reconnection with the natural world.

Since the creation of the first LEED rating system, credits such as the Indoor Environmental Quality for Daylighting and Views have given a nod to biophilic design principles. This optional LEED Credit encourages daylit spaces and spaces with nature views. WELL encourages biophilic design through two related features. The first, Feature 88, is a mandatory pre-condition which requires the development of a biophilic plan. This plan must address how the WELL building incorporate nature and nature-inspired patterns into a space as well as how the building provides opportunities for human-nature interactions both within the building and in the site space external to the building. The second, Feature 100, Quantitate Biophilia, encourages project teams to include water features, plantings, and access to outdoor areas.

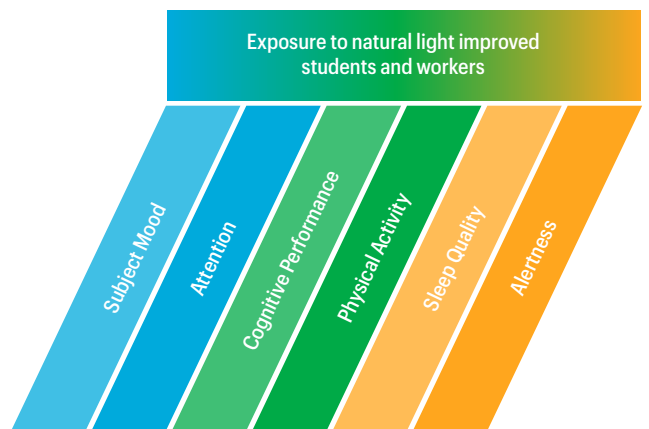
Lighting

Biophilic elements are not restricted to visual elements introduced into a building such as flooring inspired by nature designs, plants, or water features. Biophilic elements can stimulate all of our senses including auditory, olfactory and tactile. A water feature, for example, can be seen and heard, whereas lighting can be seen and felt. As shown in Figure 1 light directly impacts our moods, but light also enters our eyes through intrinsically photosensitive retinal ganglion cells (ipRGCs) and influences behaviors that are essential for our health and quality of life (LeGates, 2014), but are independent of image formation such as:

- Synchronization of the circadian clock to the solar day
- Tracking of seasonal changes
- Regulation of sleep



Hard surface flooring with high light reflectivity placed near a window can act as a ground level light shelf and drive daylight further into a space (Mistrick, 2014). Driving daylight further into a space can impact both the social and environmental elements of sustainability. The social elements include the physiological benefits mentioned above – improved mood and health and quality of life benefits; physiological benefits such as a reduced risk of myopia or nearsightedness (Sherwin JC, 2012) in children; as well as cognitive benefits such as productivity and student performance improvements (Mott, 2012).



Additionally, high light reflective flooring can impact the environmental elements of sustainability by reducing the energy required to illuminate an interior space. High light reflectivity value (LRV) flooring can be coupled with lower wattage lighting, to produce equivalent luminance levels when compared to higher watt lighting paired with flooring with lower light reflectivity. A study by Penn State University, found that replacing flooring with a LRV of 10 with a LRV of 60 could reduce energy by as much as 16% in an empty classroom (Mistrick, 2014).

Air Quality

Per the U.S. Environmental Protection Agency, we spend up to 90% of our time indoors. What we bring into our buildings stays in our buildings. So, it is critical that we do not bring in materials that off gas or release chemicals that will degrade our indoor air quality. Both the LEED Low Emitting Materials Credit and WELL VOC Reduction Feature encourage us to select low-emitting materials for our spaces. Many flooring products are available to meet both of these requirements. The USGBC Environmental Quality Technical Advisory Committee (TAG) maintains a table of product emissions certification programs such as FloorScore® that meet the requirements of the LEED Low Emitting Materials credit. Not all flooring certifications are the same, but this list provides a quick comparison of emissions certification.

Armstrong Flooring™

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Despite our best efforts, unwanted chemicals from perfumes, nail polishes, clothing and other sources will make their way into our spaces, which is why air exchanges are important. Feature 15, Increased Ventilation, in the WELL Rating System encourages project teams to increase the rate of fresh air supply to improve human health despite increasing costs associated with re-conditioning fresh air.

Acoustics

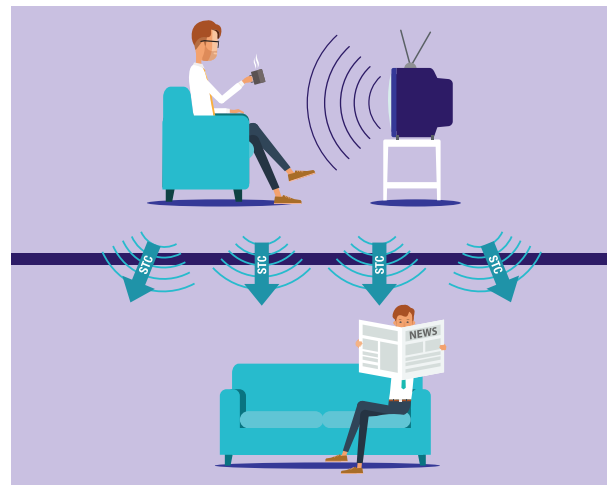
Acoustics has become an ever-increasing factor in modern construction. Whether in healthcare, education, residential housing, or any other industry, acoustics plays an important role in nearly every sector of the market. For example, there are guidelines on how loud classrooms should be, how much noise workers can be exposed to, and even the level of privacy required in sensitive office spaces. To accomplish these goals, numerous metrics and standards have been created to assess various acoustic characteristics of building components. For this reason, it is important to understand these metrics; however, to understand the metrics you must first understand the acoustic issue that you are trying to solve.

Noise Reduction Coefficient

If you want to reduce noise in the space or room, then you will want to consider the Noise Reduction Coefficient (NRC) of the product. From a flooring perspective, carpet will typically have a higher NRC than resilient flooring. However, products designed to absorb sound such as acoustical ceiling tile or acoustic wall board will always have the greatest NRC values. WELL Building Feature 80, Sound Reducing Surfaces, emphasizes this point as it only includes NRC requirements for Ceiling and Walls, because the contribution or absorptive ability of all flooring is too low to truly absorb room noise.

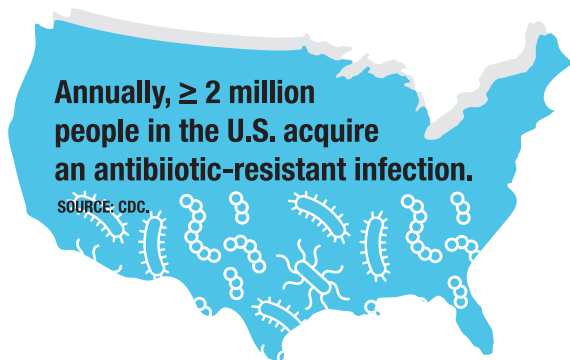
Impact Insulation Class (IIC) and Sound Transmission Class (STC)

Flooring does play a role in blocking both air vibration (e.g. human voice) and impact noise (e.g. rolling carts, high heels). The key to both IIC and STC is to know that both are measured on a flooring structure. Therefore, always determine the structure used to measure the IIC and STC. Unless the structures are the same, the values are not comparable. Delta IIC values are comparable. Delta IIC calculates the IIC contribution of the flooring product.



Safety

All flooring should meet fundamental safety requirements. For the WELL Feature 11, Fundamental Material Safety, this means that the flooring should not contain asbestos and should contain less than 100 ppm of lead. To comply with the Americans with Disabilities Act, floor and ground surfaces must be stable, firm, and slip resistant. International Building Code requires flooring to meet fire safety requirements; however, Section 804 of the code exempts resilient flooring from the fire testing requirements. Unlike carpet, which can be flammable, traditional hard surface floor coverings (e.g. linoleum, vinyl tile and sheet) are not considered fire hazards. The WELL Feature 25, Toxic Material Reduction, limits the use of certain halogenated flame retardant in flooring; however, because vinyl is naturally fire retardant it does not require additional fire retardants.



Antibiotic resistance is one of the biggest public health challenges of our time. Each year in the U.S., at least 2 million people get an antibiotic-resistant infection, and at least 23,000 people die (CDC, 2019). While the Centers for Disease Control recommends adding antimicrobials to high-touch products such as door knobs or light switches, it does not recommend adding antimicrobials to low-touch surfaces such as flooring. The LEED Medical Furniture and Medical Furnishings Credit supports this concept by encouraging project teams to select products that contain less than 100 ppm of added antimicrobials.

Finally, flooring can contribute to building safety by serving as a wayfinding system to direct and guide both building occupants and visitors through a facility.

Life Cycle Thinking

A truly sustainable flooring system considers life cycle and provides space appropriate performance and durability. Life Cycle Thinking (LCT) goes beyond production site and manufacturing processes to include environmental, social and economic impacts of a product over its entire life cycle.

The flooring life cycle can begin with the extraction of raw materials from natural resources in the ground and the energy generation. Materials and energy are then part of production, packaging, distribution, use, maintenance, and eventually recycling, reuse, recovery or final disposal. Through transparency, companies openly disclose where their ingredients and energy come from. They talk about how the products impact society and the environment and what happens to them at the end of their useful life. Product information should be transparent enough to allow individuals to make a value-based flooring selection decisions.

The Environmental Product Declaration Credit in LEED v4 supports life cycle thinking by encouraging project teams to select products and materials that have completed life-cycle assessments.

Additionally, both LEED v4 Materials Ingredients Credit and the WELL Material Transparency Feature encourage project team to select products for which manufactures have disclosed the ingredients to 1000 ppm. Additionally, WELL Feature 25 Toxic Material Reduction, limits the amount of halogenated flame retardants and ortho-phthalates in flooring products.

Sustainability means different thing to different people; however, there is alignment on the three lenses of sustainability: people, profit and planet. These three lenses translate to flooring. By using the six pillars of healthy, sustainable flooring, designers and consumers should be able to better select the product that is right for them.

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