Use Ceramic Tile & Stone for a Healthy Building Environment

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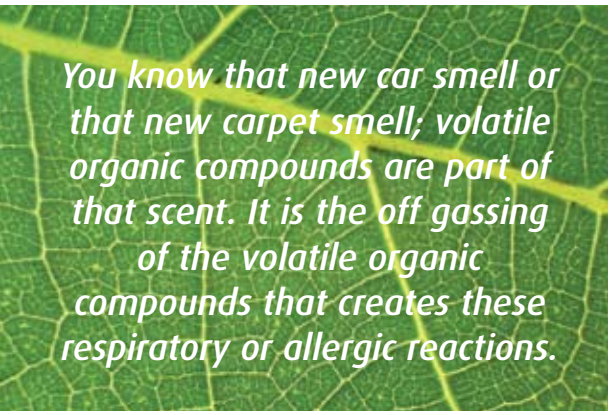
A young student has problems breathing when he is in school. He experiences itchy eyes, a runny nose and a constant headache. When he is not in school, he does not experience any of these symptoms. A young mother goes to work everyday and comes home feeling lethargic, she gets plenty of rest but she is always tired, but just during the week or when she is at the office. When she travels, she cannot understand why she is not as tired as when she is not traveling. She reasons to herself that she should be more tired when traveling. These types of stories are becoming more commonplace. In many cases, these types of symptoms point back to sick building syndrome. Sick building syndrome is the result of the off gassing of volatile organic compounds that may be present in building materials. These can include chemicals, odors from fibers or fumes from building materials as they are curing and drying. Many of the building materials used in today's construction methods do contain products that can cause some of the problems mentioned at the outset. There have been many questions and potentially even more solutions to these issues. While the construction business and the materials and methods used to build our buildings are vast, I will focus on just one area. That is the use of ceramic tile and stone as a finish material on floors as opposed to other types of flooring finishes such as carpeting, resilient or wood flooring and as a wall finish as opposed to using paint, vinyl wall covering or fabric wall covering. I will also answer several questions in this discussion. Why is ceramic tile and stone healthier for the building environment? Why is there a movement towards creating a healthier building environment? Let's examine the trend towards healthier and "greener" buildings.

BACKGROUND ON THE GREEN BUILDING MOVEMENT

The term "green" when used in discussions that concern buildings and construction; signifies healthy and environmentally friendly products and buildings. Before we can address the reasons why ceramic tile and stone should be used a finish material, we need to understand the green building movement. The respiratory and allergic reactions of building occupants can be traced back to reactions that they may have with some of the products that are in the structure. In one study, "it was determined that people are indoors approximately 90% of the time." (Ahuja, 2004, p.2) With that in mind, good indoor air quality is very important. The design community has long recognized this fact and has inspired federal and state organizations to create programs that are designed to target the issue of indoor air quality. In the year 2005, there are "29 Programs currently running" that have established guidelines to address this issue (R. Dooley, 2005, p. 1). One example of a State that began to enact standards for clean indoor air is the State of California. For example, note what the State of California EPA had to say on the matter of finish materials and adhesives that contain formaldehyde (a known polluter of indoor air), "One of the most common pollutants found in indoor air is formaldehyde, a carcinogen often emitted by pressed-wood products, adhesives and fabrics. It can cause severe headaches, sensory irritation, nausea, rashes and cancer. In their testing, the State of California EPA OEHHA has identified up to 60 hazardous substances, including formaldehyde that are commonly used in buildings. The project specifications for the Capitol Area East End Complex have established maximum modeled indoor-air chemical concentrations for those compounds and formaldehyde." (Air Quality Sciences, 2002, p.25). More and more end users and design professionals are recognizing that a healthy building environment is an essential part of the community. Hand in hand with the health issues of our buildings comes the sustainability and quality of building materials used. What does this actually mean? Simply put, sustainability can be defined as how long will the products used in a structure last before they have to be replaced or repaired. For example, for the purposes of our discussion, how long will the ceramic tile finish last on the wall as opposed to a coat of paint or an application of vinyl wall covering? Along with using products that do not harm the environment or humans, sustainability is also becoming a hot issue within the building community. The health and sustainability issues go hand in hand, since the frequency in which finishes are replaced impact the indoor air quality of buildings. With that said, the use of environmentally friendly products makes sense.

ENVIRONMENTALLY FRIENDLY PRODUCTS

In today's construction marketplace, the phrase 'environmentally friendly product' is thrown around a lot. What does this actually mean? Environmentally friendly products are products that do not harm the space that humans occupy and do not have any adverse impact on the ecology or environment during their harvesting, manufacturing, installation, curing/drying and while in service. In making the determination for whether a product is environmentally friendly or not; we can ask the following questions? Does the material break down over time? What is its half life? How long will it off-gas? How often does it need to be maintained and/or replaced? For example, there are some materials in the plastics family that just do not break down easily. They can stay in a land fill for hundreds of years. There are



several types of flooring products that fall into this category (e.g. vinyl composition tile, linoleum, rubber flooring). In addition, when these types of flooring materials are installed with a urethane type adhesive; they can be potentially dangerous to the environment for many years even when they are discarded. What is great about ceramic tile and stone is that they are mainly composed of basic materials that are found in the earth. There is not much that needs to be done to a slab of marble, limestone, slate, sandstone, granite or quartz; except maybe to alter its finish a little. That is easily accomplished by polishing the surface to a glimmering mirror like finish or just a bit to a softer honed finish. As far as the ceramic tile, the ingredients that go into it are mainly clay and shale that are then pressed or extruded into shape and then fired in high temperatures to achieve a very dense and durable finish. Porcelain tiles are gaining in popularity and use as well. These manufacturers have become so effective in their production processes, that the cost of ceramic and porcelain tiles is actually coming down as opposed to the cost of other types of flooring and wall finishes where the costs continue to increase. Therefore, vinyl flooring, carpeting and similar finishes that were considered inexpensive alternatives to ceramic tile and stone are actually at an even greater disadvantage. When a design professional was looking for an inexpensive alternative, they accepted the drawbacks of off gassing and short life cycles associated with these other types of finishes (e.g. vinyl composition tile, linoleum, carpet, rubber, paint, wall covering). They no longer have to compromise. Ceramic and porcelain tiles are high performance products. They are durable, dense, and easy to maintain. They do not stain easily, since they generally have absorption rates of less than 0.5%.

Ceramic tile and stone is also considered clean fill. If for any reason tile or stone is removed (and this is usually only because it looks dated), it can be buried in a land fill and will not harm the ecology or the environment. Unlike the adhesive mortars that are used to install resilient and wood floors or carpeting; tile and stone adhesives are typically portland cement based and do not pose any danger to the environment. They are inert once they harden and do not off-gas or emit any volatile organic compounds (VOC).

VOLATILE ORGANIC COMPOUNDS (VOC)

Volatile organic compounds are ingredients contained in building materials that may escape as they air dry or cure. As building materials cure or dry, an odor may be emitted. This is what may cause a person to develop reactions to the materials in a building. You know that new car smell or that new carpet smell; volatile organic compounds are part of that scent. It is the off gassing of the volatile organic compounds that creates these respiratory or allergic reactions. Some of the ingredients in building materials that off gas are formaldehyde, ozone, particles and volatile organic compounds. These ingredients exist in over 2000 chemicals (Ahuja, 2004, p. 2). Let's see why ceramic tile and stone is advantageous in the area of volatile organic compound emission.

ADVANTAGES OF CERAMIC TILE AND STONE

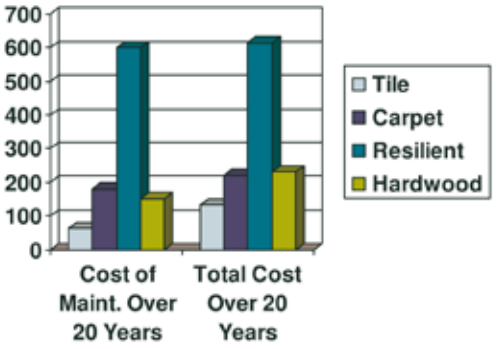
When a comparison is made of the volatile organic compounds contained in floor and wall finishing products, it is obvious to see why ceramic tile and stone is the better finish choice over the others. To demonstrate this fact, compare the following types of finishes and their volatile organic compound content (California Department of Health Services, 2004, p.3, 6, 7):

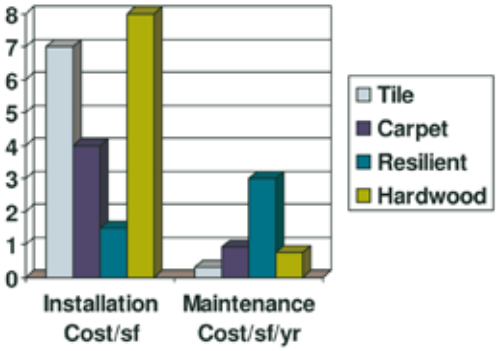
Ceramic Tile	0.0% grams/ litre
Stone	0.0% grams/ litre
Resilient Flooring	600 grams per litre
Carpeting (after 24 hours of installation)	
With polypropylene backing	399 grams per litre
With polyvinyl chloride backing	602 grams per litre
With polyurethane backing	83 grams per litre
Wood floors treated with a lacquer finish	350 grams per litre
Latex based paint	250 grams per l.(water based)
Vinyl wall covering	400 grams per litre
Fabric wall covering	400 grams per litre

In addition to the finishes mentioned above, the adhesives used for the application of the materials can also contribute to the total volatile organic compounds (TVOC) in a building environment. The following are the typical volatile organic compounds for the adhesives used for some of finishes listed above (California department of health services, 2002, p.7).

Ceramic tile and stone installed with a typical latex fortified portland cement based mortars:	<2.39 grams per litre
Multipurpose carpet and resilient flooring adhesives including a typical carpet or resilient flooring material:	
Multipurpose latex adhesive	976 grams per litre
Synthetic "low V.O.C." adhesive	698 grams per litre

As indicated, the TVOC contained in a typical ceramic tile and stone installation is practically nil. When compared against the other types of finishes; ceramic tile and stone contributes to a healthier building environment. Now manufacturers and promoters of the other finish types will tell us that the off gassing of the volatile organic compounds will diminish as time passes and that is true to an extent. There have been many strides made to manufacture these types of finishes and adhesives with lower volatile organic compound content. Several of the larger watchdog agencies have set stricter guidelines to ensure that this happens (South coast indoor air quality district, 2001, p.2). However, these types of finishes are still significantly higher in volatile organic compound content when compared to ceramic tile and stone. In addition, these other finishes do not have the durability and sustainability that ceramic tile and stone have. In fact, carpeting and resilient flooring have to be replaced every seven to ten years or so (The old farmer's almanac, 2005, p.1). Ceramic tile and stone has greater sustainability. In fact, many other cultures in Europe, Asia, the Middle East, Central and South America have been using ceramic tile and stone for years in many places that Americans typically would not use as finish materials. Most of the baths, kitchens, and foyers in these cultures are tiled from floor to ceiling whereas in our culture it may be limited to just the floors and base or just used in wet areas. One of the reasons for this is that tile and stone is easier to maintain. Therefore in the long run, ceramic tile and stone is actually more economical. The following charts reflect this fact. Chart 1 compares the maintenance costs and total costs (including initial installation costs and total maintenance costs) of ceramic tile with other finish materials over a 20 year period. Chart 2 compares the initial installation costs of ceramic tile to other finish types and the yearly ceramic tile maintenance costs





compared to other finish material types.

The per capita consumption of tile and stone in non – U.S. cultures is almost 3 to 4 times the consumption in the United States (Lindsay, 2001, p.65). This is also evidenced by the fact that tile and stone are durable building products that have been in place on some structures for hundreds if not thousands of years. Now that's sustainability! Can anyone make the same claim for other types of finish materials used in or on buildings? Ceramic tile and stone are also good fighters against mold and mildew. Tile and stone are not food sources for mold and mildew, whereas many of the other finish types are either made from ingredients that are food sources for mold or the finish itself is a food source for mold. In addition, ceramic tile and stone are inherently water resistant, whereas these other finish types, absorb and degrade when exposed to moisture, further adding to the mold issue. A building owner would certainly prefer the use of finishes in their structures that are resistant to the threat of mold and mildew.

CONCLUSION

Therefore, in light of all the information that has been gathered and presented, ceramic tile and stone are the natural choices to be used as a finishing materials that will provide long lasting benefits. These benefits include a long in service life cycle, no negative contribution to indoor air quality and the materials are very easy to maintain. When compared to other finish materials, the clear choice is to use ceramic tile and stone as a finish material in today's building environments. TT

References

Ahuja, V. (2004), Air quality sciences report. Downloaded from Google search engine, May 16, 2005.

Air Quality Sciences, (2002), Testing building materials for emissions. Troy: Adhesives and Sealants Industry, August 2002. Vol. 9, Iss. 7; page 24

Black, M. (2002) Sustainable building practices lead to healthier indoor air quality. Environmental design and construction, September / October 2002

Bowen, T. (2004) California tests conventional and "green" products for emissions. Architectural Record. New York, June 2004. Volume 192, Issue 6, page 299. Downloaded from the ProQuest Data Base on May 17, 2005.

Dooley, R. (2005) Green Building Movement: U.S. Green home Building Guidelines. NAHB Research Center Presentation, Coverings Trade Show, Orlando, FL 2005

California Department of Health Services (2002), Reducing occupant exposure to volatile compounds from office building construction materials: non binding guidelines. Retrieved from Google search engine data base on May 17, 2005.

Elliott, Lindsay. (2001) On the rocks, hard surface flooring will take your worst and come back shining. Award Magazine; Architecture, Construction, Interior Design. April 2001, Volume 15, Issue 2; page 65

Emmons, B. (2005) Commercial buildings are going 'green,' too. South Bend Tribune. April 16, 2005., page 1. Downloaded from the ProQuest Data Base on May17, 2005

Lohman, R. (2005) Polyurethanes in home construction. Modern Materials, May 2005 pages 18 & 19.

Press, L. (2004) Today's flooring adhesives are green and getting greener. Environmental Design + Construction. Troy: June 2004, Issue 5; page S10. Downloaded from the ProQuest Data Base on May, 17, 2005.

South Coast Air Quality Management District (2001), Downloaded from Google Search Engine, May 17, 2005.

The Old Farmer's Almanac (2005), Downloaded from Google Search Engine, June 10, 2005.