DESIGNING, SPECIFYING AND BUILDING WITH WOOD

WoodSource

WINTER2009

Preserved Wood Preserves Nature with Walkways and Platforms

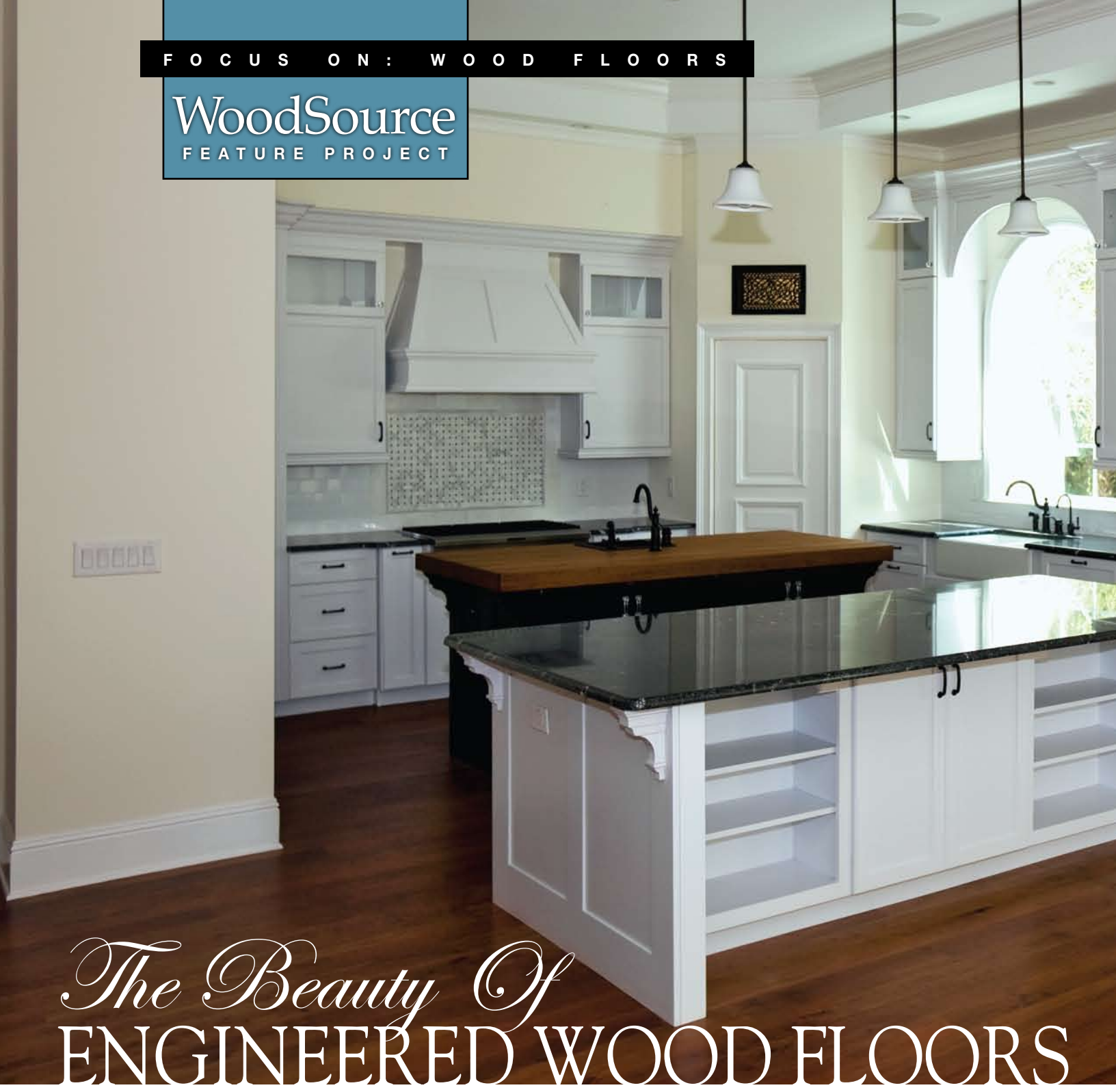
The Design of a New Chapel Showcases Innovative Use of Components

A Reliable System of Standards & Quality Control for Wood in Construction

Beautifying with WOOD

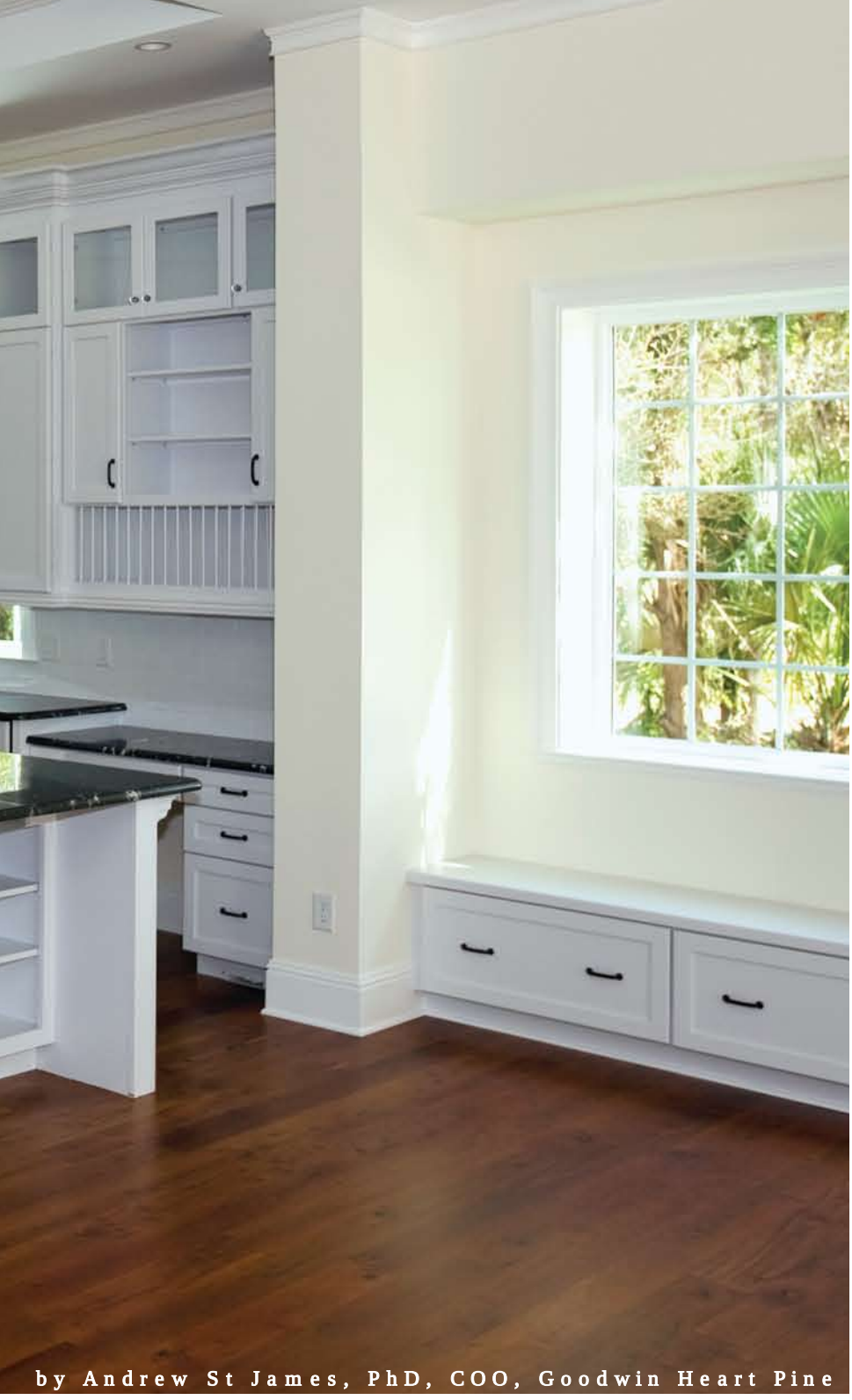
PRSRT STD
U.S. POSTAGE
PAID
BOLINGBROOK, IL
Permit No. 619

WoodSource
FEATURE PROJECT



The Beauty Of ENGINEERED WOOD FLOORS

Wood products make up much of the structure and many of the furnishings in North American homes. Traditional solid wood products are increasingly giving way to engineered wood products. Improved product performance and reduced cost have been driving the change toward engineered products. This is true of engineered wood flooring which continues to increase in market share. To explain both limitations of solid wood products, and some of the behavior of their engineered counterparts, it helps to start with an understanding of the basic structure of wood itself. One goal is to explain the mechanisms in wood which cause it to shrink or swell, and how best to deal with these factors.



Wild black cherry, precision engineered flooring

Photo by David Millonig
Courtesy of
Charles Rinek Construction, Florida

by Andrew St James, PhD, COO, Goodwin Heart Pine

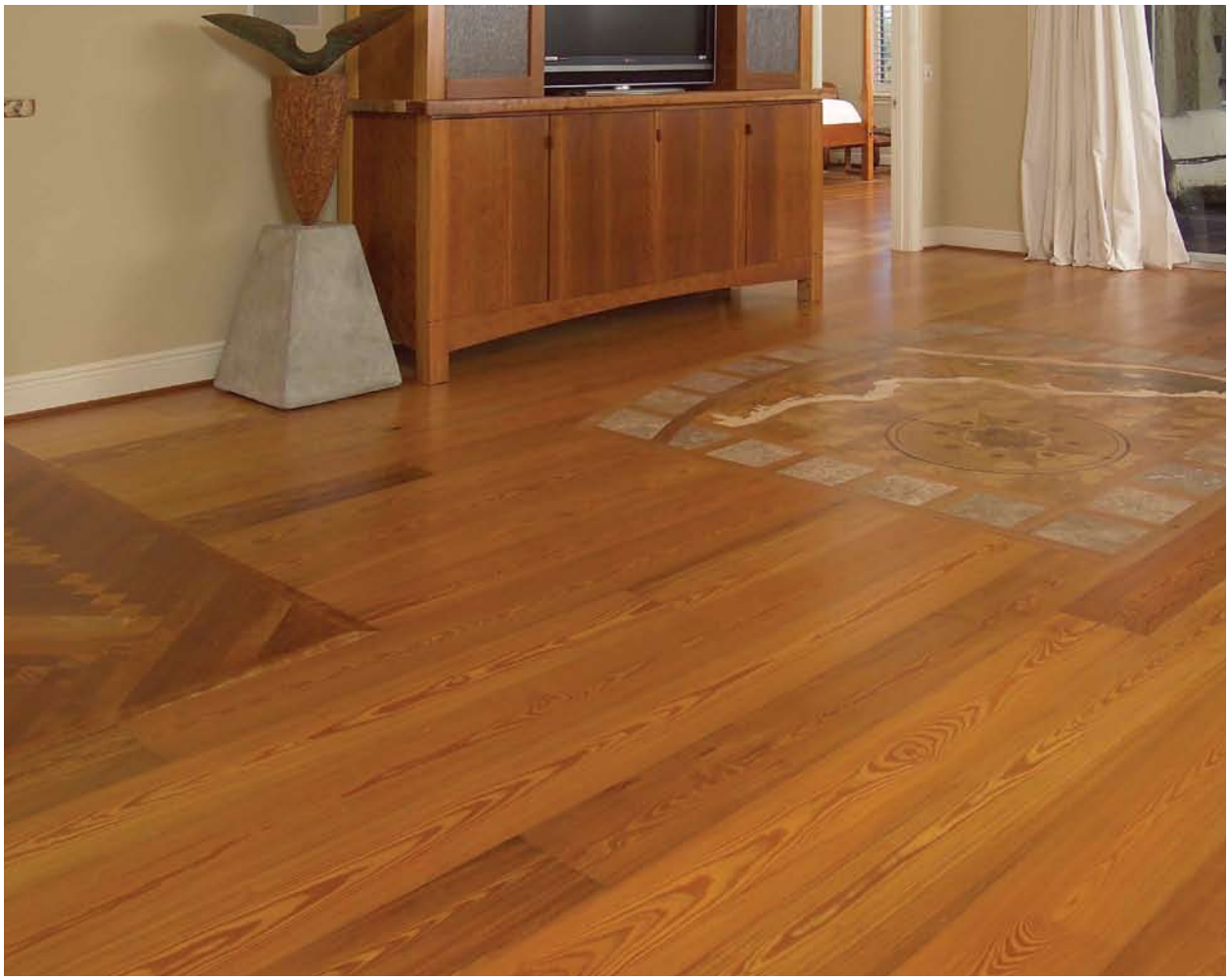
SHRINK OR SWELL: THE PROPERTIES OF WOOD

The vast majority of wood cells have a tubular shape. Typically, the long dimension of a cell is vertical in the main stem of a tree, and the radius is significantly smaller than the length. The basic arrangement of these cells is in circles or rings around the center of the tree stem. Most woods also have a relatively small percentage of ray cells which have the long dimension aligned radially out from the center of the stem. In living wood, the hollow cell centers contain liquid that is mostly water, commonly referred to as free water. When wood is going to be used in the interior of a structure, it is dried beyond the point where all the free water has been removed.

The strength of the wood comes from the stiffness of the cell wall where cellulose, hemi cellulose, and lignin comprise the major constituents. Many of the woods' structural properties derive from the extremely long cellulose molecules in the cell wall. Cellulose molecules lie in a parallel configuration along the long direction of the cell and have numerous areas that attract and chemically bind water. The process of water attaching to cellulose molecules (sorption) directly causes wood to shrink or swell. The actual water attached to cellulose molecules is called bound water. In the absence of liquid water, the amount of bound water equilibrates with the local environment based on the relative humidity of the atmosphere around the wood. If you change the relative humidity in a house, and maintain the new value, all of the wood products will change size until they reach equilibrium with the new relative humidity. This change takes a significant amount of time, so in practical terms, seasonal changes rather than hourly or daily changes in relative humidity are important when looking at the behavior of wood.

For solid wood, the amount of shrink or swell varies significantly with different orientations in the wood. Boards with the growth rings parallel to the face, also known as plain sawn, show the largest increase and decrease in width caused by moisture changes. In most North American species, boards with the growth rings perpendicular to the face, called vertical or quarter sawn, show about half of the expansion and contraction of plain sawn wood. If you compare the rate of expansion or contraction across the face of a plain sawn board to the length change it is typically 50 to 100 times greater across the face. The wood experiences much less movement along the direction of the cellulose molecules

Furniture makers understand the importance of accounting for the shrink/



Goodwin river-recovered antique heart pine named National Flooring Association's "Reclaimed Wood Floor of the Year 2008 Photo by Scott S. Smith (SSSphotographic.com)

swell differences by allowing movement between cross grain solid wood pieces. Additionally, wood floor installers apportion for movement across a floor by leaving expansion gaps next to walls. When expansion or contraction, due to moisture change, is of critical importance vertical grain or quarter sawn flooring is often used. Traditionally, the use of solid wood flooring directly over concrete has been avoided because of moisture issues.

Shrinking and swelling in engineered wood products is greatly reduced by gluing thin layers together with the alternate layers turned ninety degrees. This cross ply construction has shrink/swell characteristics that are dominated by the low expansion coefficient in the direction of the cellulose molecules, resulting in a reduction of the shrink/swell across the face by a factor ranging from 10 to 20 times.

THE FACTS ABOUT ENGINEERED WOOD FLOORS

Even with the advent of elastomeric adhesives, and a variety of concrete sealing systems, laying solid wood flooring directly to concrete presents numerous installation problems. Solid wood products tend to have boards with some bow or crook and most adhesives lack the initial holding power to keep these boards straight. Traditionally, crooked boards were pulled into place with nails, a procedure not possible over concrete. Additionally, when solid wood is used over a concrete subfloor there is the threat of moisture coming up from the concrete, potentially resulting in cupping or buckling of the wood floor. These potentially costly problems are significantly reduced by using an engineered wood floor.

Typically in engineered flooring, a face material of the desired species is adhered to a plywood backer. There are three common ways of cutting the face material. In the first, thin veneers are pealed from logs in a process similar to that used in making plywood. The resulting product tends to have the less desirable expanded grain pattern associated with plywood and is limited to thin wear layers. The alternative process of slicing faces eliminates the distorted grain pattern, but is again limited to relatively thin wear layers. Finally, sawing the wear layers allows a natural grain pattern, either plain sawn or vertical grain patterns, as well as thicker wear layers. Engineered flooring with a thick sawn face can be refinished the same number of times as a solid floor can be resanded.

Engineered wood flooring offers the advantage of using a smaller amount of the high quality primary wood for the faces with lesser quality secondary

wood in the backer. Admittedly, some of the lesser quality engineered flooring contains smaller pieces that are not suitable for use in solid flooring, resulting in a chopped up look. However, higher quality engineered flooring is produced from full size primary wood pieces and maintains the same aesthetically pleasing look as a traditional floor.

As 'green' building has become more prominent, more products are available with environmentally certified 'green' faces or backers. On the negative side, some engineered wood flooring is made with glue which emits formaldehyde. In some cases, glue containing formaldehyde is used to adhere the face to the backer or, in other instances, it is the glue in the plywood backers. Formaldehyde emissions are being limited in products sold in California as regulated by the CARB standards. If you want to have an assurance of low emissions consider using certified products.

In addition to the cut of the face material and the glue, the details of the profile are also important. Some of the major manufacturers of engineered wood flooring have found that a tong and groove system set too near the top of the product increases the risk that the flooring will not remain flat. A rule of thumb is to have at least two plies of the plywood backer above the top of the groove. This also helps avoid bumps from nails along the top of the tong which can telegraph to the surface and be visible in the installed product.

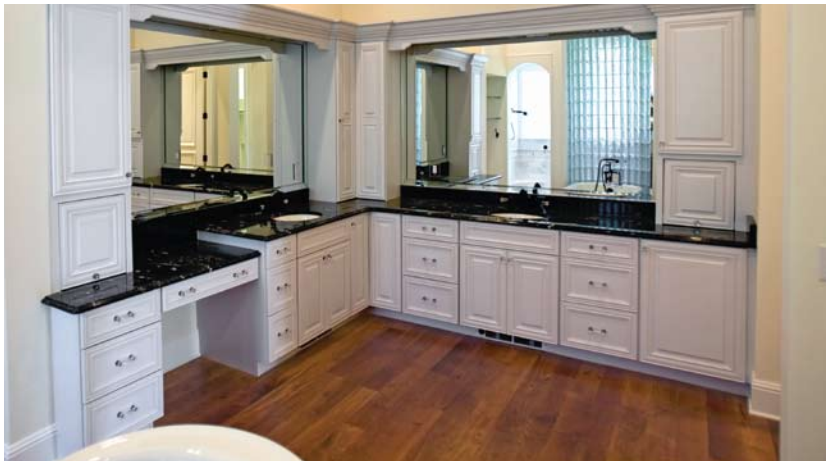
INSTALLATION: DEALING WITH MOISTURE ISSUES

The three most common installation techniques for either solid or engineered wood flooring are full spread glue, nailing, or floating over a foam pad. On occasion, snap together is sometimes available for floating installations of engineered flooring. Overall, subfloor type, ease of installation, and the feel and sound underfoot are all considerations when choosing the installation technique. In similar installation situations, engineered wood with straighter pieces and generally more precise milling is easier to install than solid wood.

The Top Ten Reasons Your Clients Should Choose A Wood Floor

by Carol Goodwin

1. **Wood is a natural product in a diverse selection of colors and grain patterns.** Who hasn't marveled at the beauty of a home with a fine wood floor? There are more choices now than ever before… a wood floor for every taste.
2. **Wood is the easiest floor to clean, requiring far less chemicals.** Whenever someone says, "I think tile or carpet might be easier to clean," I point to my wood floor cleaning tools -- a swivel mop and a non-aerosol spray. I can clean my wood floors in less than half the time it takes to vacuum, scrub or shampoo other floor coverings. Wood doesn't trap dust and fumes like carpet and doesn't grow mold in the grout like tile. Best yet, fewer chemicals are needed.
3. **It's the best choice for the environment. Production is cleaner than alternatives.** Wood production is much cleaner than other building materials and sends less solid waste to the landfill than manufacturing steel or concrete. And wood is more energy efficient. The cellular structure of wood traps air, giving it superior insulating properties. It takes 15 inches of concrete to equal the insulation qualities of just one inch of wood.
4. **You can redecorate by changing your wood floor with stains, faux finishes and inlays.**
5. **Wood is a smart investment.** There is no depreciation on a wood floor. Real wood floors offer beauty for a lifetime – or longer! Carpet is replaced 3 to 6 times before most solid wood floors ever need repair.
6. **Finishes can be easily repaired or reapplied.** As long as maintenance procedures have been followed, wood floors can be refinished instead of adding to the landfill, like many other floor coverings when they are replaced.
7. **Wood floors give a little on your spine and legs and are better for your joints.** Don't be surprised if your doctor recommends a wood floor for your spine and joints. Wood floors tend to give a little beneath you. Have you ever noticed that your feet get tired faster if you are standing on stone or tile than when you are standing on a wood floor?
8. **Wood is an ideal choice for people with allergies.** Wood floors do not harbor dust mites or mold and do not trap dust or fumes. According to the American Lung Association, wood floors in the bedroom and other main living areas can improve air quality.
9. **Wood floor sales return more money back to the wood industry to support good forest management.** The greatest threat to primary forests in this and other countries is conversion to other forms of land use. Wood floors are a high-end use of forest products that produces a good profit, thereby ensuring the perpetuation of the forest.
10. **Wood is our greatest renewable resource.** And all the replanting is good for the environment. Scientist have shown that young trees use more carbon dioxide than older trees, much like younger animals need more food to survive.



A significant majority of the problems with wood floors are moisture related. Most of the problems can be avoided by choosing the correct product and then combining pre-installation testing with proper installation techniques. The installation site needs to be brought to occupancy conditions prior to the delivery of the wood flooring. It is also important to achieve the proper moisture content in the flooring. The expected equilibrium moisture content in service for each project should be determined in advance, accounting for two important factors: the average moisture conditions and range for high humidity to low humidity. In addition, the subfloor should be tested for moisture levels prior to installing the flooring. Ideally, both the flooring and the subfloor should be close to the expected long term moisture content. Certain product should be left in the original packaging until just before installation, and the importance of following the manufacturer's instructions can't be overemphasized.

Additional steps to avoid possible moisture issues involve pre-installation monitoring. Tools to aid in the procedure of moisture monitoring include Moisture Meters, which register electrical resistance or capacitance measuring the moisture content of most wood subfloors or wood flooring, and it is recommended that a vapor retarder (not barrier) is used directly under wood floors nailed to a wooden subfloor. Digital hygrometers and humidity data recorders are suggested to monitor the relative humidity at the installation site prior to installation. With either vented crawl spaces, or pier construction in hot humid climates, it is often prudent to install a vapor retarding layer at the bottom of the flooring system. The concern in these instances is water vapor migration from the outside air into the flooring.

Moisture measuring techniques for concrete sub floors such as calcium chloride (ASTM F-1869), in-situ relative humidity (ASTM F2170-2), or calcium carbide are available. When the moisture level is too high for direct installation, surface sealers (trowel on moisture cured urethane, latex, epoxy), impregnation with silicate compounds, and roll out membrane barriers are available. Another consideration for concrete subfloors is the possibility of water introduction at a later time. Once water enters concrete it tends to diffuse through the slab and move to other areas. Thus, it is often prudent to use an approved sealer on a slab even if it currently tests within the acceptable range for moisture to help avoid future problems.

Perimeter expansion space is usually used for both solid wood flooring and engineered wood flooring. This allows the flooring to expand when the humidity increases without hitting a vertical obstruction and buckling. In installations where it is expected the relative humidity will increase significantly for part of the year, field expansion, sometimes called washer rows, should be considered for solid wood floors. Typically, field expansion is not used for engineered floors. However, it is often suggested that glue down engineered not be pulled together with excessive force where the resulting slight give in a looser installation allows for expansion in the damp seasons.

It is not just high moisture conditions which can cause wood floor problems. Significant periods of excessively low humidity can cause cracks to develop in solid wood flooring. Even the inherently more stable engineered flooring can cup in extreme dry conditions. As with any construction material, the intrinsic properties of the components determine the limits of satisfactory performance in use. Simply put, you are better to avoid situations which push the limits of the products performance. For example, it is well understood that wood floors should be avoided in wet areas such as bathrooms. On the opposite end of the spectrum, we see that excessively dry conditions can also cause problems. Understanding these problematic circumstances prior to installation offers ways to rectify an issue before it originates, like avoiding consistently damp rooms or installing a humidification system during construction for a dryer condition.

CHOOSE WISELY... CHOOSE WOOD

There are many advantages to wood flooring. Usually the appearance is the most important feature considered when choosing a wood floor. The direct benefit of adding value to the home is a recognized bonus. Wood floors are durable and easy to live with. Modern finishes require little maintenance and can be cleaned without the use of harsh chemicals, furthering its value as being environmentally sound or 'green' friendly. A NWFA study indicates that sequestering carbon during use and a carbon neutral life cycle are also environmental advantages of wood flooring. Additionally, the long service life reduces the amount of solid waste. And an important benefit for the homeowner: wood is hypo allergenic, thus avoids problems associated with some other floor coverings.

AND IN CONCLUSION...

Understanding the reaction of wood to changing conditions and familiarity with good installation practices will help avoid many future problems. With this said, the development of engineered wood floors, advanced adhesives, and new concrete sealing systems allow the possibility of using wood floor in situations which were considered impractical in the past. *WS*

Andrew St.James is COO of Goodwin Heart Pine Company, www.heartpine.com.