Respect Wood Movement

Learn to anticipate and accommodate this unstoppable force of nature

BY ASA CHRISTIANA

Despite advances in technology, wood remains an unmatched building material. It's strength-to-weight ratio is higher than steel's, yet wood is less expensive in much of the world.

From solid softwoods and hardwoods to "engineered" products such as plywood, MDF, OSB, LVL, and much more, wood is used widely in the building trades. It can be cut and shaped with basic tools, and joined quickly and powerfully with nails and screws, among other things. Better yet, wood is a renewable resource. However, as every experienced contractor knows, these organic products perform very differently from more inert materials like steel, concrete, drywall, and tile. In fact, engineered-wood products perform differently from solid wood, and solid wood is far from consistent. "Green" wood performs differently from dried lumber, and even after kiln drying, movement due to relative humidity is still a factor. Different wood species have very different rates of seasonal expansion and contraction.

Ignore these realities, and serious problems will develop—mostly after construction when the fixes range from frustrating to expensive to impossible.

When 2x joists shrink at different rates than engineered beams, floors get springy and sloped, drywall cracks, windows and doors stick, reveals become uneven, and crooked gaps appear around the room. Use wet framing lumber, and trapped moisture turns into mold, nails and screws pop, and grout lines crack. Rush through construction without letting moisture dissipate and lumber acclimate, and all sorts of problems arise, from scribed joints opening up to entire floors buckling. Even normal seasonal wood movement will cause problems if you don't plan for it, such as door panels shrinking to reveal a strip of unpainted wood. The list goes on.

If you know a little of the science behind wood movement, there's almost always a solution. And when there isn't a solution, your job becomes appreciating, or helping your clients to appreciate, wood's organic nature and what to expect. □

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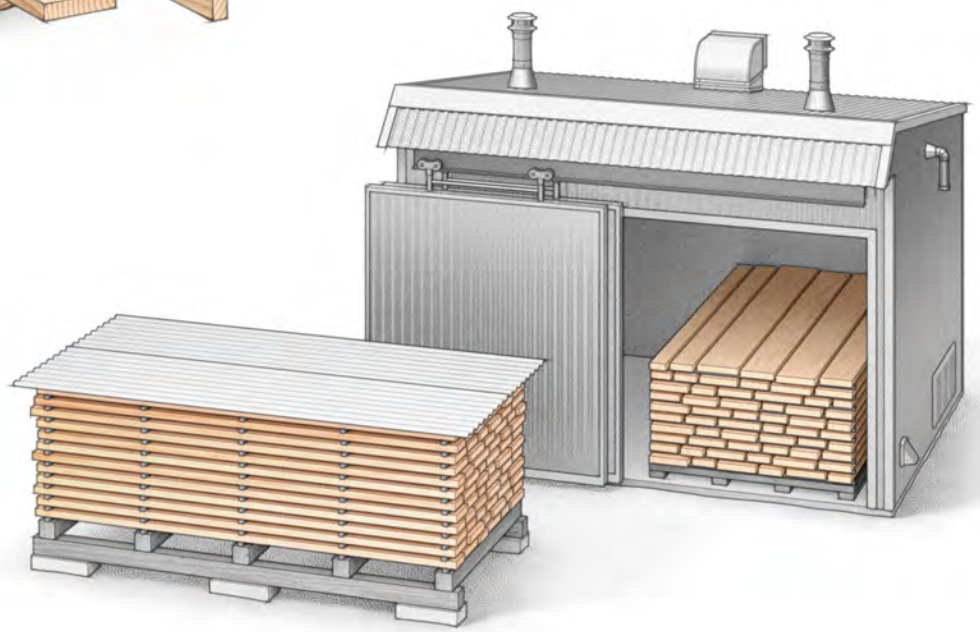
THE FORCES OF NATURE

WHY WOOD MOVES

What makes wood so strong (and beautiful) is its grain, which runs up the trunk and keeps trees standing through everything from hurricanes to ice storms. The long cells that make up wood grain are also what make wood move. While those long, bundled cells change very little along their length, they expand and contract significantly across their width. That difference is important.



GRAIN PLAYS A PART

Wood shrinks and expands more in the direction of the tree's rings than it does from the center of the tree outward. The first type of movement is called tangential, or tangent to the rings, and the second is radial, or radiating outward. This helps explain why engineered-lumber beams, with their mix of grain orientations, are often more stable in height than solid beams, and why quartersawn boards, with their "vertical" grain, are more stable than boards that are flatsawn. Shrinkage numbers vary widely by wood species as well.

DRYING AT A GLANCE

As wood dries, the first thing to go is the water inside the cell cavities, which is called free water. That eliminates a lot of weight and brings a board to just under 30% moisture content (MC). Next to go is the moisture in the cell walls, called bound water. This is when wood shrinks significantly, by between 5% and 10% of a board's width (hardwoods a bit more, softwoods a bit less). For interior applications and framing, the optimal MC before installation is somewhere in the seasonal range for interior woodwork in a conditioned house—below 12% MC in most regions. For exterior wood, MCs are higher.

Wood can be dried slowly in an outdoor stack and then brought indoors for the final push, or the process can be accelerated in a heated kiln, which has the added benefit of hardening the resinous sap left in the cells.

No matter how the wood is dried, it will always remain hygroscopic, meaning that it will always take on and release moisture in an effort to come to equilibrium moisture content (EMC) with the relative humidity of its environment. This can mean significant changes in thickness and width but not typically in length. This process is constant, even after installation, but is most problematic during the installation phase, when moisture content is most unstable.

MANAGING MOISTURE CHANGES

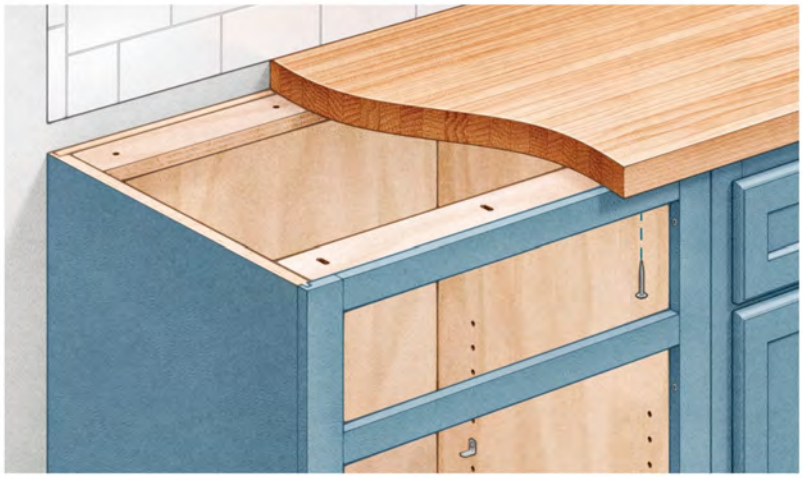
Many of the most dramatic changes in moisture content happen when lumber is installed wet or is soaked during or after installation before being covered up. As it dries, this wet lumber shrinks substantially, which can lead to cracks, dips, bumps, and squeaks. If the wood is bone dry, plan for it to expand. If it's soaked, plan for it to shrink.

A FEW TOOLS MAKE A BIG DIFFERENCE

When it comes to managing moisture, you can fly by the seat of your Carhartts, or you can eliminate guesswork and callbacks with a couple of indispensable tools. One is a chart of seasonal EMCs across your region, which is easy to find online. The other is a pin-style moisture meter for taking readings. You do need to check sample boards in a couple of spots, and the pins leave a mark, but it's generally easy to hide those.

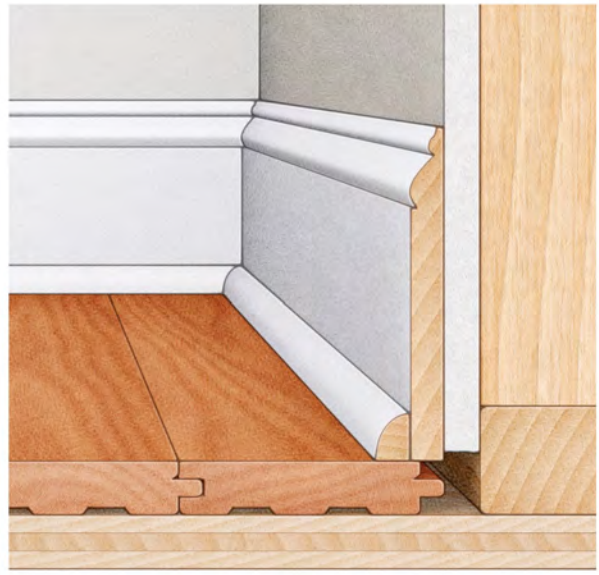
CONTROL THE ENVIRONMENT

In new construction, the best way to deal with moisture in the framing lumber and moisture that evaporates off freshly taped drywall and painted walls is to get the HVAC system up and running and/or to bring in dehumidifiers. If flooring, trim, and cabinetry are installed while the house is at peak moisture content, everything will open up as it dries out.



GIVE IT A PLACE TO GO

In finish work, directing wood movement is often the key. When fastening a wood countertop to cabinetry, choose which way you want the wood to expand by using oblong pilot holes that allow for movement in the chosen direction. If the countertop butts up to a tile backsplash, plan for it to move forward. If the front overhang must remain consistent, put the oblong holes toward the back.



WOOD FLOORING

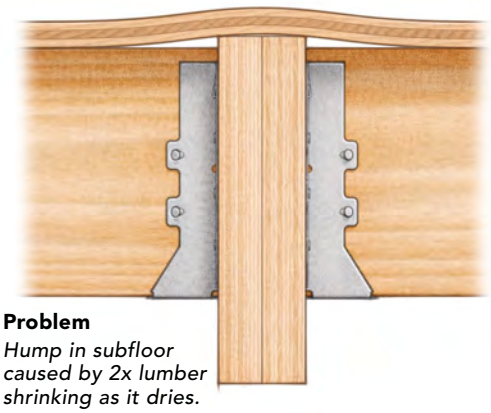
Strip flooring is the classic example of the dangers of wood movement. Despite that, many installers still get it wrong. If the flooring has not reached equilibrium (a moisture content that matches the relative humidity of the house) before being fastened, it will either shrink and leave gaps between boards, or expand and buckle. Monitor the moisture level before installation, and always leave room for expansion under the baseboard.

SOME RESISTANCE CAN HELP

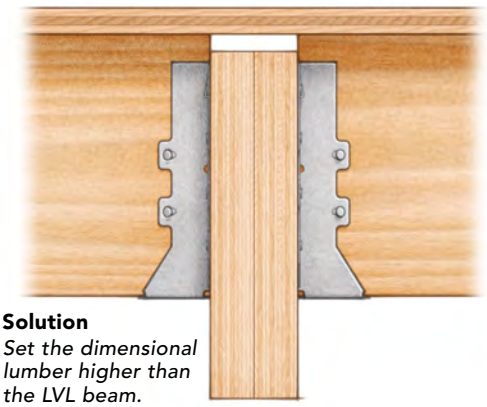
Large amounts of wood movement simply can't be controlled, but small measures can help in common situations. For example, miters always want to open when boards shrink or expand, so reinforcement—with biscuits or screws, for example—can help a lot. For very large miters, you can use veneered plywood with solid-wood edging to minimize gapping.

DECK PLANKS

Pressure-treated deck planks are the most popular choice for skinning a deck. These boards also tend to have a very high initial moisture content. If installed with a standard gap, these boards will shrink and leave you with excessive space between planks. Instead, install wet deck boards tight to each other. When they dry, the gaps between rows will be just right.



Problem
Hump in subfloor caused by 2x lumber shrinking as it dries.



Solution
Set the dimensional lumber higher than the LVL beam.

WHERE ENGINEERED WOOD MEETS SOLID LUMBER

Engineered lumber may have a moisture content of 4% to 6%, and dimensional framing lumber can be anywhere between 6% and the point of fiber saturation (28%). If wet joists, for instance, are installed flush with a superdry engineered beam, you will eventually get a hump in the subfloor. The only way to avoid these situations is to get specific about the differential in moisture content and plan accordingly (see "You can also get specific," right).

BEAMS AND HEADERS UNDER DRYWALL

Headers and beams are among the widest surfaces that get covered by drywall. As these pieces of wood dry out and shrink, taped drywall seams—or the drywall itself—can crack. To avoid this, never place seams over a beam or header, and avoid placing fasteners through the drywall in these areas so the wood can move without cracking the drywall.

You may have lumber options

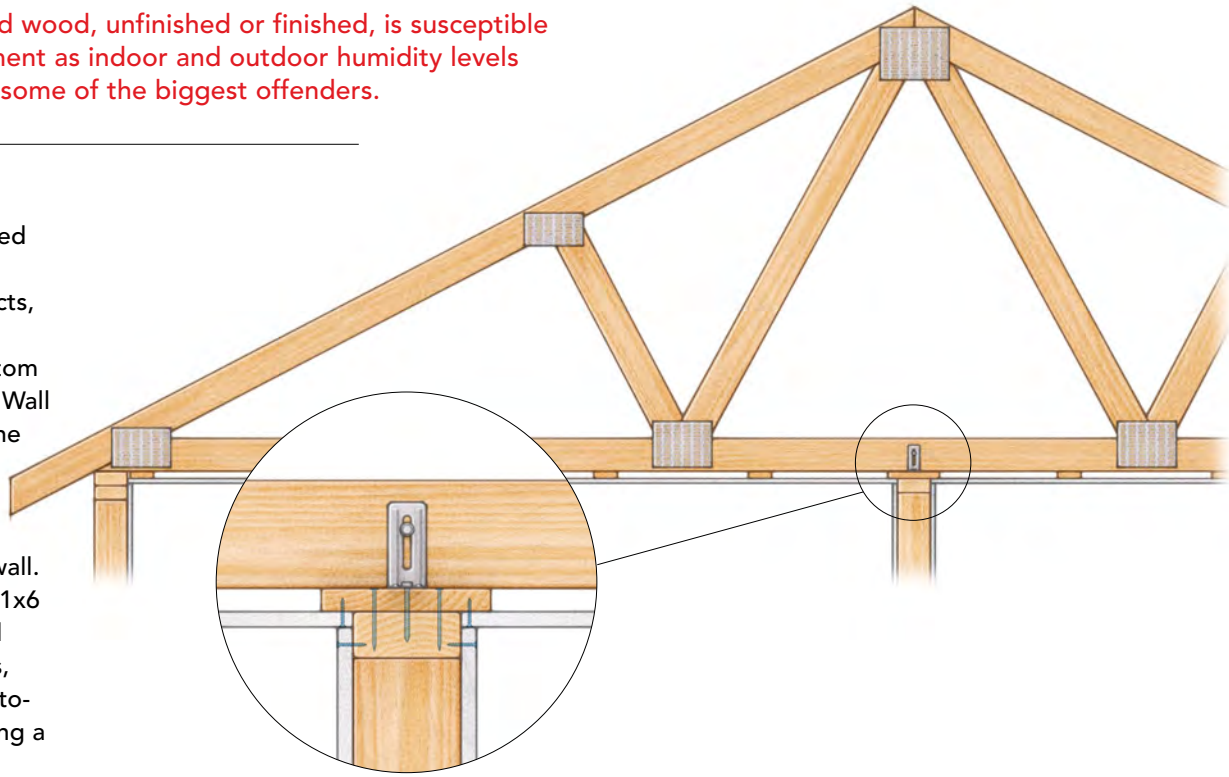
Not all lumberyards stock the full array of options, but the most typical are AD (air-dried), S-DRY (surfaced-dried), KD (kiln-dried)—all of which have moisture contents at or below 19%—and S-GRN (surfaced-green), which means that the boards were above 19% MC at the mill. Some builders choose lumber with a higher moisture level for new construction because it's less expensive and less prone to splitting when fastened. For remodels, go with the drier stuff because it will integrate better with the already dried and shrunken existing lumber. Keep in mind, though, that moisture content is measured at the mill, not at the lumberyard, where storage may be either indoors or outdoors.

You can also get specific

Many builders factor in wood movement with a suitable guesstimate based on experience. You can get pretty specific about it, though. A good rule of thumb is that a board will change width by 1% for every 4% change in moisture content. Let's say you have 2x12 joists and want to know how much they are likely to shrink as the newly framed house dries out. If the joists have been waiting outdoors and your moisture meter gives you a reading of 18%, and the conditioned house will eventually bring them to, say, 6%, you can take the difference (12%) and divide it by 4%, which gives you 3%. Rounding for simplicity, 3% of shrinkage across the width of a 2x12 equals about ⅜ in.

MANAGING SEASONAL CHANGES

Even properly dried wood, unfinished or finished, is susceptible to seasonal movement as indoor and outdoor humidity levels change. These are some of the biggest offenders.



TRUSSES

As the 2x lumber used to build roof trusses expands and contracts, it lifts the drywall attached to the bottom chord of each truss. Wall plates fastened to the trusses, especially near the center of a span, will lead to cracks in the drywall. To avoid this, add a 1x6 between the drywall and the truss chords, and make the plate-to-truss connection using a roof-truss clip.

GAPS IN TRIM

Miter joints are the mainstay of traditional window and door casing, and these relatively wide surfaces are notorious for opening up during the heating season. As the wood shrinks, the long point of the joint usually stays fairly tight, but the short point opens. The best fix for this is to include a biscuit or Domino tenon between pieces, both of which are strong enough to resist this small amount of seasonal movement.

SHINGLE SIDING

Cedar shingles should be installed with a slight gap if they are bone dry from the supplier or if humidity levels are low. This leaves room for expansion without buckling. A conservative rule is to expect ⅛ in. of expansion for every 4 in. of shingle width. So an 8-in.-wide shingle needs ¼ in. of room.

PANELS AND PANELING

Solid-wood door panels and tongue-and-groove paneling are notorious for shrinking and revealing one or more strips of bare wood. For doors, consider using plywood panels or finishing the panels prior to assembling the doors. For paneling, prime and paint each piece, including the tongues, before fastening to the wall.

DOORS

Tight reveals around a cabinet door or interior door look nice, but in many climates, tight in the winter can lead to too-tight-to-open in the summer. A ⅛-in. reveal is standard for cabinet-door applications and for most interior and exterior doors as well.

CAULK CAN'T ALWAYS SAVE THE DAY

It's common for builders to rely on caulks and sealants to fill gaps—both intentional and unintentional—in finish carpentry applications. But in some situations, particularly with scarf joints and miters, caulk only makes the movement more noticeable. Caulk-filled joints may look OK when a gap exists, but as the wood expands and the joint tightens, the caulk is pushed out and looks like a bubble.

Why engineered wood doesn't move (as much)

In general, engineered-wood products are more stable than solid lumber. This is due to the amount of adhesives used and the way the wood is incorporated. In plywood, for example, the wood veneers still take on and release moisture, but they are too weak to overcome the rigid gluelines, which keep the product relatively stable. That said, engineered-wood products still do expand and contract to various degrees, so follow your supplier's recommendations.