On the House

Preventing Frost Action on Structural Posts

Q. *In New York state, we built a pergola (a type of garden trellis) using 8x8 pressure-treated posts set 4 feet into the ground. During the first winter, the frost lifted the posts. What should we have done to keep the posts from heaving?*

A. *Ron Hamilton, owner of Hamilton General Contracting in Saylorsburg, Pa., responds:* For structural reasons, pergola posts should be deeply buried. (In contrast, when building a deck, it's better to set the pressure-treated posts on top of Sonotubes extending above grade.) In order to help resist wind uplift, pergola posts should be embedded in concrete, rather than in holes backfilled with dirt. But if the holes are backfilled with concrete, the concrete conforms to the irregular shape of the hole, allowing frost to grip the concrete and heave the post. I prefer to insert the buried section of the post into a Sonotube.

Check with your local building officials for information regarding the frost depth in your area. Your post holes should be dug to the frost depth plus 6 inches. Each hole should receive 6 inches of crushed stone for drainage. Drainage is important, since frost heaving is more likely in wet soil than dry soil.

The Sonotubes should extend from the crushed stone base to slightly above grade. After backfilling around the Sonotube with compacted dirt, insert the pressure-treated posts inside the Sonotube, holding the bottom of the posts about 6 inches above the crushed stone, to provide a space where concrete can flow under the posts. Then plumb and brace the posts and fill the Sonotubes with concrete.

Comparing Cedar Shingle Species

Q. *How do eastern white cedar and western red cedar shingles compare for durability? I've heard that red cedar is more durable, but I wonder if the difference is enough to affect the service life of roofing or siding.*

A. *Corresponding editor Paul Fisette responds:* The heartwood (but not the sapwood) of both red and white cedar is naturally decay resistant. Although the two species are listed in most handbooks as having heartwood with comparable rot resistance, the experience of many carpenters suggests that red cedar is a little more rot resistant.

Several factors may account for this. When grading white cedar, it is quite difficult to distinguish between heartwood and sapwood, so it is likely that at least some sapwood slips into the all-heart grades.

Another possible factor affecting shingle durability is grain orientation. The best grade of red cedar shingles (#1) is all heartwood, clear, and vertical grained. The best grade of white cedar shingles (extra clear) is all heartwood, clear, and typically flat sawn — although, like all flat-sawn lumber, some of the material is vertical grained. Since wood shrinks and swells twice as much tangent to the growth rings as it does perpendicular to them, vertical-grain shingles lie flatter on a roof or wall after experiencing repeated wetting and drying cycles. That's why flat-grained white cedar shingles are more prone to cupping, splitting, and failure and why I don't recommend using white cedar shingles on a roof.

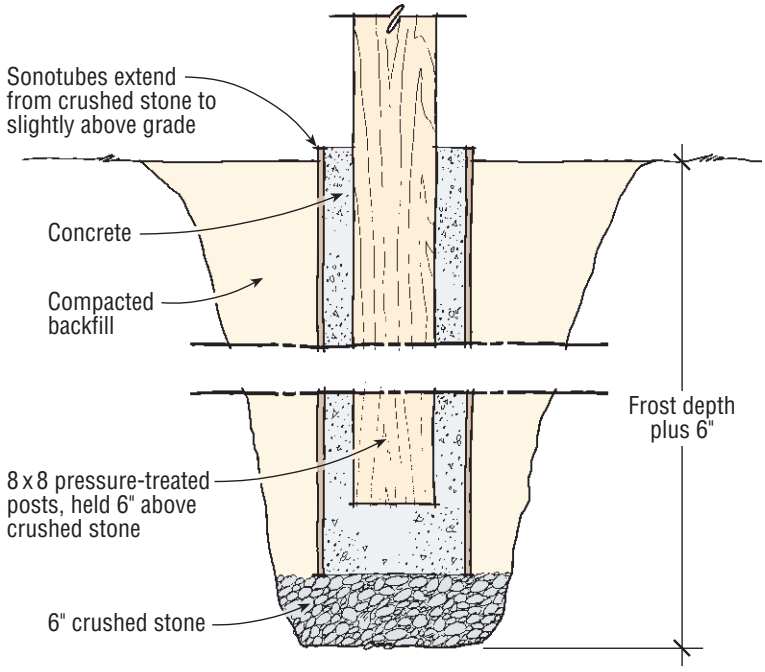
I expect 30 years of service from a high-quality red cedar roof and much less from a white cedar roof. As siding, either red or white cedar shingles, if properly installed and maintained, should last a human lifetime.

Shingle Overhang

Q. *How far beyond the drip-edge should an asphalt shingle extend? Is the amount of overhang the same at the rake as at the eave?*

A. *Architect and roofing consultant Harrison McCampbell responds:* Most

Pergola Post Footing



shingle manufacturers, along with the Asphalt Roofing Manufacturers Association's *Residential Asphalt Roofing Manual*, call for a 1/4-inch to 3/4-inch overhang at both rakes and eaves. In my opinion, the felt underlayment should also extend beyond the drip-edge (by 1/4 to 1/2 inch). Don't overdo the overhang — shingles that extend more than 3/4 inch can eventually bend and fracture, leaving the roof sheathing and fascia vulnerable to water damage.

Double-Side Vapor Barrier

Q. *As part of the gut remodel of a 1940 house near Houston, Texas, we installed 3/4-inch rigid foam over the exterior wall sheathing, followed by vinyl siding. On the interior, we exposed the 2x4 studs and installed fiberglass batts. Then we installed 1/2-inch foil-faced rigid foam followed by drywall. In that climate, will these "foam sandwich" walls trap moisture?*

A. *Joe Lstiburek, an engineer and principal with Building Science Corp. in Westford, Mass., responds:* Installing a vapor barrier on both sides of a wall is never a good idea in any climate. In the Houston climate, a vapor barrier should be located on the exterior, so your choice of exterior foam sheathing was a good one. The concern is the foam sheathing you installed on the interior.

The good news is that because of the thermal resistance of the interior foam, the wall cavity will rarely be below the dewpoint temperature of the exterior air (see "Psychrometric Chart," below). The bad news is that if moisture ever gets into the wall — say, due to a window leak or negative pressure caused by leaky attic ductwork — it won't be able to get out easily.

Should you take the foam sheathing off of the inside? That's a hard question. I say don't. If possible, watch the walls over the next few years; each year, cut open a small hole in several spots and look. If you did a careful job with exterior rain control and window and duct installation, the walls probably won't develop mold. If you get mold, you know what to do. But don't build a wall this way again, okay?

What's the Dewpoint?

Q. *When people refer to the dewpoint in a wall assembly, are they talking about a location or a temperature? How is the dewpoint calculated?*

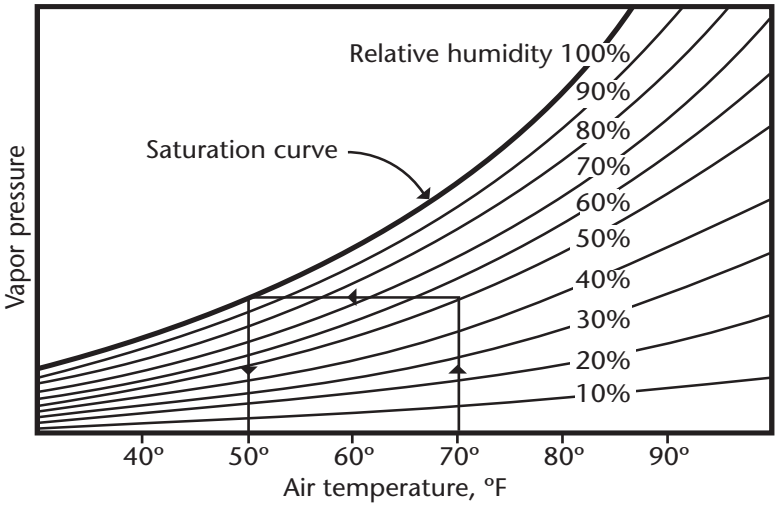
A. *Energy and sustainable design consultant Andy Shapiro responds:* The dewpoint is not a location; it is the temperature at which water will condense out of the air. Since the dewpoint changes with the amount of humidity in the air, as well as the air temperature, the dewpoint for a particular temperature and relative humidity is best looked up in a table or a psychrometric chart (see below).

Water from the air will condense on building components when they are below the dewpoint of the air that's in contact with them. Cold water pipes in hot, humid summers condense water and drip. Uninsulated basement floors in hot, humid summers are often below the dewpoint of the hot, moist outside air, so water condenses on them if the space is open to the outside. In an air-conditioned building in a warm, moist climate like the southeastern U.S., the drywall can be below the dewpoint of the outside air for months on end.

Just because a building component is below the dewpoint doesn't mean there will be a problem. Vinyl window frames and copper tubing aren't bothered by a little moisture. On the other hand, wood window components and drywall can't handle much moisture, especially if the wetting is prolonged and there is no opportunity for the components to dry out.

Determining whether a component in a wall assembly will ever get cold enough to permit condensation — that is, be below the dewpoint — can be complicated. If each element of a wall acted as a solid (which fiberglass doesn't), then the calculation of the temperature at any point in the wall assembly would be fairly easy. Halfway through the insulation value of the wall, the temperature would be halfway between inside and out.

In reality, such static calculations can be misleading, since wall materials can absorb some moisture without being damaged. More accurate calculations,



A psychrometric chart provides the dewpoint for any given air temperature and relative humidity. Say you have a relative humidity of 50% at 70°F. On the horizontal scale, locate the air temperature and move up to the curve that represents 50% relative humidity. Then move left to the saturation curve and down to find the dewpoint — 50°F in this case.

called dynamic calculations, take into account many additional factors but are so complex that they are best performed with computer software.

The good news is that this type of dynamic calculation is usually not needed — as long as builders employ good building practices that keep inside air out of walls in cold climates and outside air out of walls in cooling climates, and allow building components that occasionally get damp to dry out. One very good source for building details that avoid moisture damage is the Builder's Guide series from Building Science Corp. (978/589-5100; www.buildingscience.com).

One Furnace or Two?

Q. *What factors must be considered when deciding whether to use a large hot-air furnace with two zones or two smaller furnaces?*

A. *Jeri Donadee, vice president of H.B. McClure Co., a heating and cooling contractor in Harrisburg, Pa., responds:* A single unit is almost always more cost effective than multiple smaller units. Multiple units should be considered only if the house design will not permit adequate means of ducting the various zones from a single heating plant.

With a single unit, the installed cost, operating costs, and life-cycle maintenance costs are almost always lower. If the customer wants options like air conditioning, a humidifier, or an air cleaner, the installed cost advantage in favor of a single unit is even greater. Zone system manufacturers claim that the operating cost of a single unit can be 30% lower than the cost of two smaller units.

Porch Floor Board Orientation

Q. *I'm building a roofed porch with tongue-and-groove fir decking in New England. The boards will be primed and painted on all sides before installation. The joists run perpendicular to the building, and I'd like to install the flooring parallel to the long dimension of the porch. Does the orientation of the porch boards matter?*

A. *John Leeke, a preservation consultant from Portland, Maine, responds:* The drainage off the deck will definitely be better if the boards run from the house down the slope toward the edge of the porch. I usually slope my porch decks about 1/4 or 3/8 inch per foot. I've found that 1/8 inch per foot is not enough to get the water moving off the porch.

If you are concerned about end checks developing in the exposed end grain of the deck boards, I suggest treating the end grain of the boards with penetrating epoxy consolidant before any other finish is applied. This seals the end grain, limiting the movement of water in and out and minimizing checks.

Concrete Over Plywood Subfloor

Q. *Before installing a thin concrete or gypcrete floor over a plywood subfloor, what kind of membrane should be installed over the plywood?*

A. *Doug Mossbrook, president of Eagle Mountain HVAC, responds:* None. When gypcrete or concrete underlayment is applied over a standard plywood or OSB subfloor, I don't recommend using a membrane, which would prohibit the underlayment from adhering to the subfloor.

As the underlayment is poured, it tends to bond to the small cracks and crevices in the surface, providing an anchor. The bond allows the underlayment to become an integral part of the floor system, strengthening the underlayment and keeping it from cracking and shifting.

The only product we apply over the plywood subfloor is a water-based latex primer. The primer keeps the plywood from absorbing water from the underlayment, which might cause it to dry too rapidly, lowering its hardness and strength.

Got a question?
Send it to On the House, *JLC*, 186 Allen Brook Ln., Williston, VT 05495; or e-mail to *jlc-editorial@hanley-wood.com*.