Twisted Deck Boards

Q. *On more than one occasion, I have installed 5/4x6 pressure-treated wood decking with the growth rings facing down. We screwed the boards down with stainless steel screws, but the edges still curl and warp very badly. How can this be prevented?*

A. *Chris Donnelly responds:* Wood tends to shrink and swell about twice as much *along* its growth rings as it does *across* those rings. To see how this effects deck boards, let me illustrate two scenarios:

In the first, think of a regular flat-sawn board with the rings forming long arcs along the end of each board. As the board dries, the growth rings contract along their length. The longer rings will shrink from the shorter rings. Effectively, the rings are trying to straighten out, which cups the board towards the bark side of the tree. If the board is picking up moisture, the reverse happens. The individual growth rings expand along their length, with the longer rings expanding more than the shorter rings. This causes the board to cup towards the inside, or pith-side, of the tree.

In the second scenario, consider a board with one face toward open air and sunlight, while the other face is toward moisture coming up from the ground with poor air circulation under the deck. When one side of the wood is dry, and one side is wet, the dry side will tend to shrink and the wet side will expand. As a result, the board cups, regardless of the orientation of the growth rings.

If the problem is related to the first scenario, try using drier material, such as dried-after-treatment pressure-treated lumber (DAT) or kiln-dried material (KDAT). Or, choose vertical-grain material. I would not recommend laying out the boards to dry before installation, unless those boards are well constrained. The boards will still cup, leaving you with less usable material.

If the problem is related more to the second scenario, take steps to equalize the moisture differences on each face of the deck. Shading the deck, designing a deck with lots of underside ventilation, or even using a moisture barrier and gravel beneath the deck will all help.

Regardless of which scenario causes the problem, it's critical to finish and maintain the wood. Proper finishing helps slow the gain and loss of moisture, thereby minimizing cupping. Apply a water-repellent or penetrating stain while the wood surface is dry, or choose pressure-treated wood with a preapplied water-repellent. In either case, apply a new coat regularly each year.

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Heavy Roof Loads

Q. *We are designing a house with heavy clay roofing tiles (which weigh about 800 pounds per square). How should we calculate the dead loads for choosing our roof rafters?*

A. *Paul Fisette responds*: When it comes to using unusual materials, most building inspectors will require a qualified engineer to review the plans, calculate the loads, size the rafters, and stamp the plans. However, as long as you're aware of these requirements, the process of calculating dead loads is not that difficult.

Dead loads are simply the sum of the weights of all the building materials used to build a particular part of a structure. For example, the dead load of the roof might include the weight of the rafters, sheathing, roof covering, and anything else that is permanently attached to the roof structure, such as drywall on a cathedral ceiling. You need a good reference, such as *Architectural Graphic Standards*, to find a list of the weights of various building materials.

Once you establish how much each of the materials weighs, you simply add them to calculate how much the assembly weighs per square foot. This will be the dead load you use when you turn to the tables to select your rafters.

Asphalt shingles typically weigh about 3 pounds per square foot. The clay tiles you are using weigh about 8 pounds per square foot — adding 5 pounds to the design dead load. So, all things being equal, if you were able to use a rafter table for dead loads of 10 pounds per square foot for the asphalt roof, you should be able to use a rafter table for dead loads of 15 pounds per square foot for the tile roof.

When selecting rafters, remember that the tables define rafter span as the *horizontal projection*, or *footprint length*, of the rafter (see illustration, above). If you were to use the actual length of the rafter along its edge, you would be oversizing the rafter.

So if calculating dead loads is so easy, why do you need an engineer? Well, all things may not be equal when you change roofing materials. Deflection limits are based on live loads, but excessive dead loads will affect deflection. An engineer can tell you when this becomes a concern. Also, if you change the assembly, this may change the way the structure performs. For example, if skip sheathing is used in place of plywood for the roof tiles, you may change the way the structure responds to wind loading. Again, an engineer would be able to tell you if additional bracing is required. ■

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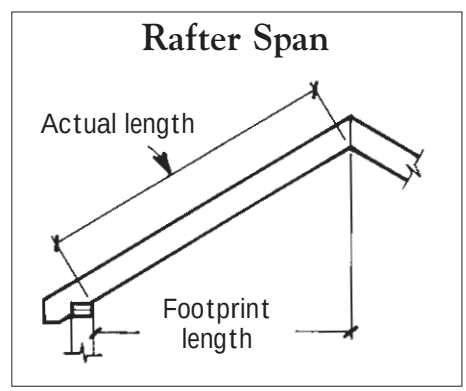

When selecting rafters from a span table, use the footprint length, not the actual length, to determine the span. Span tables cover a variety of live and dead load conditions. Asphalt shingle roofs require a 10-psf design dead load; heavier roofing materials like clay tile require a 15- or 20-psf dead load, depending on tile size.