Tiling a Deck

Fiberglass grating is a sturdy, drainable substrate option for exterior stone and ceramic tile

by Kim and Linda Katwijk

Not many deck builders offer tile as an alternative to wood or composite decking. That's a shame, because stone or ceramic tile is well-suited for both indoor and outdoor use, making it an excellent flooring choice for clients who want a seamless transition from their kitchen to their deck. Another selling point is that tile is extremely durable and holds up well under the heavy foot traffic that you find at an entry. And where stone has been used for pathways or on a patio, installing a matching or complementary pattern on the deck can be a great way to tie the landscaping together.

Substrate

Tile is tough but has little structural strength. It needs to be well supported by a stable substrate that can withstand 300-pound concentrated loads with minimal deflection (see Substrates and Deflection, facing page). Plywood and concrete are conventional substrates, but I've seen too many problems—caused by moisture getting trapped underneath the tile—on exterior tile installations using them. A few years ago, looking for a better alternative that would also allow water to drain through the assembly, I began installing deck tiles over McNichols square-mesh molded fiberglass grating panels (mcnichols.com/products/grating/molded/square-mesh-molded/) instead.

I was familiar with these waffle-like grating panels from my years spent in heavy commercial construction, where they're often used for catwalks and scaffolding. The panels are available in different sizes and thicknesses, but I typically use 4-foot by 12-foot by 1-inch-thick panels with a 1 1/2-inch-square grid. They're heavy (about the weight of a sheet of 3/4-inch-thick MDF), and cost about $333 per panel at my local distributor. They're tough as nails and very stiff (you can find load tables for both concentrated and uniform loads on the manufacturer's website).

When I use these panels, I skip the grout and butt the tiles as closely together as possible. This system prevents leaves and other debris from accumulating between the tiles, yet still allows water to drain through them easily. If you need to keep the area under the deck dry, you'll need to install an under-deck drainage system (see "Low-Cost Deck Drainage," May/June 2007). I've been successfully installing deck tile this way for more than a decade.

Framing

It's easier to install stone or tile on a rectangular deck than on a curved one, but it's certainly possible to tile a curved deck. The design shown here, for example, is an ellipse with the sides squared off (for more about how to lay out an ellipse, see "Building an Elliptical Deck," May/June 2012). The three steps wrap around the deck, rounding off the corners and keeping the elliptical shape to give the small deck a unique look.

We framed the 4-foot-6-inch by 10-foot-8-inch deck our standard way, with 2x6 PT joists 12 inches on-center attached to the deck ledger at the house and bearing on a 4x6 beam. Since the frost depth in this area is only 12 inches, we supported the beam with three 4x4 posts resting on 12x12 fixed saddle piers.

We ran the joists long, laid out the ellipse, then cut each joist to form the deck's elliptical shape. We installed blocking between the joists to form the rim joist, then nailed and screwed 2x6 drop blocks to the back side of the rim blocking and outside joists. We fastened more blocking to the drop blocks to provide support for the stair stringers (**Figure 1**). To limit deflection and prevent cracks or breaks in the stone, I installed extra stair stringers and additional blocking to support the edges of the grating.

Figure 1. To provide plenty of support for the fiberglass grating substrate, the deck joists were installed 12 inches on-center, and the stair stringers were laid out and installed so that the maximum span between them at the bottom tread was no more than 16 inches on-center.

Substrates and Deflection

The Tile Council of North America, or TCNA (tcnatile.com), recommends that structures supporting tile deflect no more than L/360 (where L=span) under both uniform and concentrated loads. Some large natural stone tiles that aren't as uniformly strong as ceramic tile may require an even stiffer structure. These deflection limits apply both to the framing supporting the substrate and to the substrate itself (for example, when a concentrated load is applied between joists).

According to load tables published by grating-manufacturer McNichols, a 12-inch-wide section of one of its 1-inch-thick grating panels deflects 0.131 inch under a concentrated 300-lb. load, and 0.123 inch under a uniform load over an 18-inch span. Though this deflection is more than the 0.05 inch (18/360 = 0.05) called for by the TCNA, the author believes that the flexibility of the adhesive used to glue the tile to the substrate, as well as the stability of the grating itself, contributes to the performance of this system.

Incidentally, exterior stone or tile should never be installed directly over PT plywood, which expands and contracts as it gets wet and dries out. To minimize cracking and popped tiles, the TCNA always recommends the use of an uncoupling/waterproofing membrane over exterior plywood substrates. —*Andrew Wormer*

Figure 2. The fiberglass grating panels can be cut to fit with a circular saw. Here, the deck surface fits just beneath the door threshold, with the framing sloped slightly away from the house for drainage.

Figure 3. Cellular PVC trim was used to form the curved fascia trimming the stair risers. A heat gun was needed to warm up the trim and make it flexible enough to bend around the tight curves. When heating and bending PVC lumber, keep the gun moving to avoid blistering the trim.

The fiberglass grating panels can be cut with a circular saw to fit any shape (**Figure 2**). They're installed with proprietary stainless steel clips that are wedged into the grid squares, then fastened to the framing with stainless steel screws. This leaves the top of the grate perfectly smooth and ready for tile.

I used gray ½-inch Azek trim boards as the fascia on the stair risers (**Figure 3**). To bend some of the pieces around the tight corners of the ellipse, we had to apply heat with a heat gun to make the pieces more flexible.

Tile Installation

Careful layout is one of the keys to a successful tile installation. On this project, we made sure that the ½-inch-thick by 16-inch-square natural slate tiles on the two outside edges would be even, and that there would be a full stone tile at the center front edge. That determined the position of all the remaining tiles, including the 6-inch-wide trim pieces at the wall (**Figure 4**).

Instead of setting the slate in mortar, we glued the tiles to the grate. We've tested and used many different adhesives, and have had good success with Chem Link M-1, a polyether structural adhesive sealant (chemlink.com). We like this water-cured, low-VOC adhesive because it doesn't shrink and remains very flexible.

For best adhesion, the tile needs to be as clean as possible. First, we washed and dried each tile to remove any stone dust.

Figure 4. The author planned the framing and the tile layout so there would be full tiles, rather than small cut pieces, along any edge. Anywhere that tiles needed to be cut, no piece was narrower than 4 inches.

Figure 5. To ensure good adhesion, each slate tile was washed off with water, thoroughly dried with compressed air, and wiped down with denatured alcohol before glue application and installation.

Figure 6. The tiles were glued to the fiberglass grating with a structural adhesive, which was applied to the back of the tile with a caulk gun and then spread with a V-notch trowel.

Figure 7. At the edges of the deck and the steps, the tiles needed to be scribed, then cut to fit with a wet saw.

Figure 8. The tiles were butted closely together and installed without grout, allowing water to drain between the tiles and through the fiberglass grating.

Then we wiped the backs of the tiles with denatured alcohol to remove any oils or dirt before applying the adhesive (**Figure 5**).

We applied the glue to the tile using a caulk gun, then spread it out with an 1/8-inch V-notch trowel (**Figure 6**). The cured glue is tenacious, so we left about a 1/2-inch-wide glue-free margin on all sides of the tile to save a lot of messy clean-up time later on.

Where tiles needed to be cut to fit the edge of the elliptical shape of the deck, we simply dry-fit the tile, scribed a line on the underside following the edge of the riser, then cut the tile to the line with our wet saw (**Figure 7**). After the tiles were installed, we smoothed out the cut edges and eased the corners using an angle grinder fitted with a diamond blade (**Figure 8**).

This is not a "by-the-book" construction method, but I feel very confident in recommending it. The deck shown here is about 8 years old and looks as good as the day we built it, with no cracked or popped tiles. ❖

Contributing editor Kim Katwijk and his wife Linda own Deck Builders Inc. (artistryindecks.com), in Olympia, Wash.