Roofing with Concrete Tile

by David Gustafson

A material designed to last 50 years should be installed with that in mind

Laying out and snapping a single line for valley cuts ensures a crisp looking closed valley and the chance to do the cutting all at once. The tiles on the right have already been cut and set aside.

Although I go through a lot of squares of wood and comp shingles in my roofing business, concrete tile is the material I like the best when it comes to long-term value. (In fact, it's what I've got on my own house.) About 25% of the roofs I do each year are concrete tile, and that number is rising.

Some of the reasons for its popularity in my area are its wide range of colors and profiles, and its fire resistance—it carries a Class A rating. But more than that, it's a roof that should last 40 to 50 years without much maintenance. If it's laid with care, that is.

In a lot of areas where tile is popular, production gets more emphasis than quality. Although a sloppy installation may not affect the tile's performance, it can really shorten the life of the roof system by bringing about the early demise of the underlayment, and consequently the deck and framing beneath.

Tile Specs

Concrete tile is just that: sand and portland cement in a 3/1 to 4/1 ratio. The mix is extruded under high pressure to create a nearly square tile that is largely impermeable. This is particularly important if you build outside the Sunbelt and have to deal with freeze-thaw cycles.

Size and weight. Depending on the manufacturer and style, concrete tiles cover about a square foot and weigh close to 10 pounds each. They are typically 16 1/4 to 17 1/4 inches long, average 13 inches wide, and include an interlocking channel about 1 1/2 inches wide on their left edge that is lapped by the next tile. On the underside, a *head lug* is designed to fit snugly over the edge of a 1x batten, and a series of ridges on the underside of the butt called *weather checks* rest on the tile below and keep rain from blowing under. All field tiles have from one to three prepunched nail holes at the head.

Concrete tiles are designed for a minimum 3-inch head lap, and the per-square-weight of between 900 and 1,000 pounds is based on that coverage. It's important to make sure your roof structure will carry the weight, particularly if a snow load will be added to it. On reroofs, it requires an inspection of framing, although there are lightweight concrete tiles like Marley's Duralite whose perlite content brings them down to the 600-pounds-per-square range.

Style. Although concrete tiles come in lots of different shapes with a host of ridiculous marketing names, they fall into three large categories (see Figure 1). The *high profile* styles imitate traditional clay tiles—Mission, Spanish, Barrel, or S tiles. *Low profile* tiles have less pronounced curves, but still have water channels running down the face of each tile. *Flat* tile imitates shakes or slate, and uses a staggered bond (offsetting joints from the courses above and below). They are also a little easier to fudge in keeping courses straight, and they don't leave the big voids at rakes, hips, and ridges that have to be sealed up with mortar or other material.

All manufacturers make a ridge/hip tile with a 120° spread, and a 90° rake tile. Some also offer *apex* tiles for hip and ridge intersections and hip starter tiles.

Color. One of the things that concrete tile manufacturers market the most aggressively is the huge variety of color, including roofs that blend different shades. This color can be surface-applied—an acrylic spray or slurry—or integral. Integral coloring, often referred to as *color-through*, doesn't offer as many choices and the colors are darker, but it has obvious advantages. (It's required in colder climates.) The colors are actually iron-oxide pigments at about 5% to 7% of cement weight.

However, you have to be careful of color variation in using a single, solid color. On a roof I did recently, I had to stop work and get the rep up to the site because the brown tiles I had been supplied were two distinctly different shades.

Manufacturers. There are more than half a dozen U.S. manufacturers; the best known in my area are Marley (50 Orchard Park Rd., Suite 24, Madison CT 06443; 800/521-5832), Lifetile (3511 North Riverside Ave., Rialto, CA 92376; 714/822-4407), and Monier (750 The City Drive South, Suite 200, Orange, CA 92668; 714/750-5366). They all make good tile, but each is guilty of a wider variation in quality than you'd expect with a manufactured product. This puts a lot of importance on how responsive the manufacturers are in your area. I'm small—I work by myself much of the time and do about 60 to 75 roofs a year—so I have to talk a little louder to get attention.

Along with color variation, tile breakage is the biggest product problem. Concrete isn't known for its tensile strength, but tile made from it should stand up to transport, roof loading, and cutting without falling apart. Although the tile receives both kiln and yard drying after manufacturing, I get some pretty green stuff at times. I typically bid and order for 5% breakage, but I've had jobs where it's exceeded 15%.

One area where most manufacturers shine is their instructional material and technical bulletins. Two other useful sources for this information are the National Tile Roofing Mfrs. Association (3127 Los Feliz Boulevard, Los Angeles, CA 90039), and the National Roofing Contractors Association (One O'Hare Centre, Suite 8030, 6250 River Road, Rosemont, IL 60018).

Cost

Because of the differences in tile quality, workmanship, loading access, and roof designs, it's tough to general-

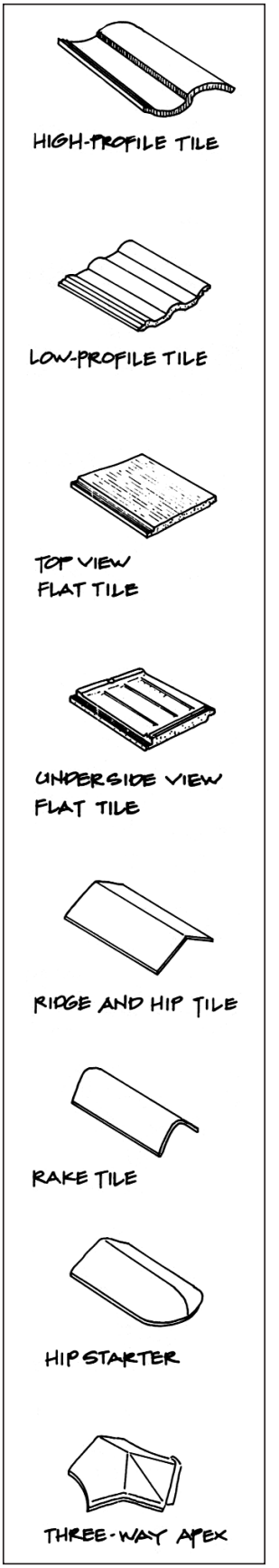

Figure 1. *Concrete roof tiles come in a variety of shapes that range from traditional clay profiles to flat slate and shake looks. Accessory tiles make capping ridges, hips, and rakes easier, but higher profile tiles still require mortar or a substitute to keep weather out.*

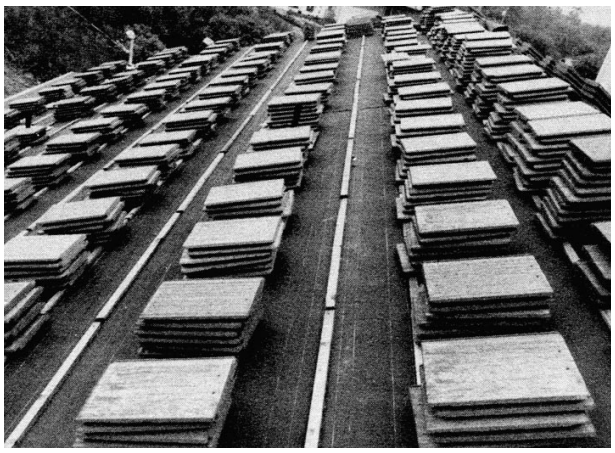

Figure 2. *The tile on the finished roof will be only as straight as the courses of 4-foot-long 1x2 redwood battens they hang on. Half-inch spaces between the battens allow drainage of moisture that makes it through to the underlayment.*

Figure 3. *This base flashing or "subjack" at the vent stack will be covered by tile and then by the top flashing that is sitting next to it. This kind of care helps the roofing system last as long as the tile itself.*

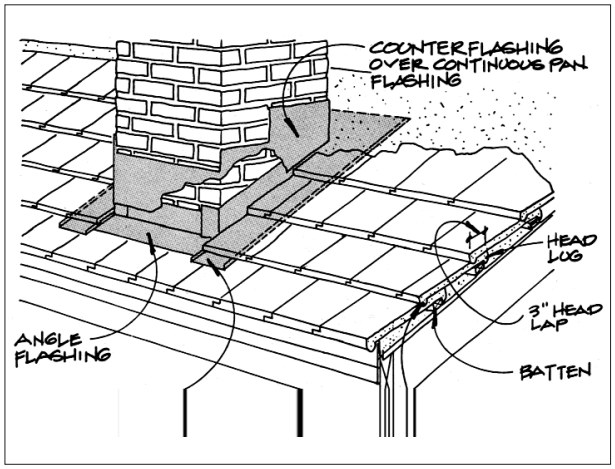

Figure 4. *This drawing shows how the flat tiles' head lugs fit over the battens on each course. Batten layout should allow for a lap of three inches. With flat tiles, chimney flashing is typical, although continuous pan flashing is often used instead of step flashing at the sides of the chimney.*

ize on what it costs for a concrete tile roof. Roofs around here vary from the simple 5/12 shown in the photos, to steep-pitched monsters with lots of complication.

In my area, concrete tile is competing with cedar shakes. Although cedar prices tend to be volatile, shakes that are pressure-treated for fire resistance are running about $190 a square installed; untreated shakes about $150.

A typical concrete tile job on a relatively simple roof comes in at around $200 a square (this breaks down to about $100 for materials for the tile, felt, battens, and fasteners; and $100 for labor, overhead, and profit). Given the quality of the cedar I've seen lately, it's no contest as to which is the better value. But keep in mind that I also did a concrete roof last year at $450 a square. It was 80 squares at 10/12 and up, with enough hips, valleys, and "bay outs" for ten roofs.

Timing

The timing with concrete tile is a little trickier than with most roofing. Ideally, you'd like all the trades—sheet-metal, siding, trim, paint—off the roof before you start. But at half a ton a square, tile roofing has to be loaded before stucco work can begin. This means you can (a) run the underlayment and battens, load the roof, and then wait; (b) start the roof but stay away from sidewall areas ("leave-outs"); or (c) complete the roof and watch the stucco guys break a couple of dozen tile and spread a couple of cubic feet of stucco on the roofing tiles.

The first two alternatives are the best for the roof, but they can play hell with the general contractor's draw, which is typically based on completing the shell. It also doesn't help my cash flow as a roofing contractor. I usually arrange a 3-draw system: completion of felt and batts, all work possible except "leave-outs," and final completion.

Prep

Spaced sheathing (1x6) is sometimes used with concrete tile, but I lay all of mine on a solid deck.

Underlayment. Once you get under a pitch of 3/12, a tile roof is largely decorative, and code (Chapter 32 of the Uniform Building Code for me) requires a built-up roof beneath the tile. Some manufacturers extend this precaution to 4/12 or even higher in snow country where the roof area is large.

We install 30-pound felt with a lap of 6 inches on pitches of 3/12 and above. Where there's a possibility of ice damming, a heavier base sheet or hot mop should be used to a point at least 2 feet above where the plane of the exterior wall intersects the roof.

Battens. These 1x2s (see Figure 2) are required at slopes over 7/12 to engage the head lugs of the tile. You don't need to use them on shallower pitches if you nail every field tile, but I've always found it easier to use them.

In climates where snow accumulates, a cold roof installation is required. By first installing *counter battens* that run from eaves to ridge, you ensure the circulation of cold air beneath the tile so the snow load has less chance to melt and create ice dams. (Even then, I've heard about problems with tile in high mountain ski resorts here in the West where lots of dormers and valleys and an annual snowfall of 12 feet or more spell trouble.)

In any climate, battens have to be rot resistant; we use redwood or western red cedar around here. My supplier stocks bundles of 100 lineal feet precut at 4 feet. A 1/2-inch space is required between each 4 footer for drainage. I use a pneumatic stapler and a 1 1/2-inch galvanized staple every 16 inches to keep them on the deck.

I start with a batten right at the edge of the eaves; you can also use a sheet-metal *eave riser* or raise the fascia up. The first course of tile will overhang this "kicker" by 1/2 to 1 1/2 inches depending on the style of gutter.

At the top of the roof, I nail another course of battens down 1 1/2 inches from the ridge nailer. Manufacturers suggest only 1 inch down, but I hate to have to wedge in the top course.

Since the battens determine the position of each tile course, they have to be laid out to accommodate the length of the tile being used, less the 3-inch head lap. But of course, it never works out perfectly. So to find the increment that will give the same exposure on each course, I stretch a premarked tape from top to bottom batten, and swing it in an arc until I hit the a layout mark perfectly. Then I just chalk a line at every layout mark along the tape. (I actually carry several tapes in my truck, each marked for a particular tile length.)

I leave out the second batten up from the eaves where the head lug of the first course would normally rest, and nail this course instead. Leaving out this batten gives a much better visual line as you look up the roof at the tile butts from the ground.

The ridge board at hips and ridges has to be exactly the right height so the tile just planes into it. The height varies with the pitch and style of tile and so do the versions of whose responsibility it is to install this. It should be in the contract.

Flashing

Most sheet-metal shops drop off the roof metal in the house's garage. Predictably, not everything fits, and there's always something missing. To try to beat this, I request in my contract that the metal be tacked loosely in place.

Eaves. A lot of guys just staple on that first batten and lay tile, but most tile manufacturers recommend some kind of protection for the edge of the roof. I use a shop-formed closure strip that counterflashes the inside wall of the gutter at the bottom, extends up and over the eaves batten, and runs up 6 to 8 inches on the roof.

Valleys. Closed valleys are preferred around here unless the roof will accumulate a lot of leaves and pine needles.

I use a sweat sheet beneath my 24-inch-wide valley tin. We use 28-gauge galvanized valleys here with a standard, 1-inch-high, central diverter rib. Like most other flashing used with concrete tile, the edges of the valley metal are break-formed with a 1/2-inch lip that turns up 30 degrees past vertical. I ask for an extra foot at the bottom of the valley so I can form it into the gutter.

Plumbing vents. Although it's a precaution that adds another few bucks to the job, I use a *subjack*—a standard base flashing integrated into the felt underlayment (see Figure 3). Then I work in the regular top flashing once I'm laying tile. Usually this is the neoprene boot type. They're great on most roofs, but I always wonder if the neoprene boot is going to last as long as the tile. What I prefer is the lead boot that allows me to bring the lead up the pipe and tuck it inside the vent stack. On tiles that have a higher profile than the ones shown here, you have to flash with lead in order to conform to their shape.

Chimneys. I double up my felt or use a heavier base sheet near chimneys and cove it up several inches onto the brick or under the chase siding. On flat tile, I use a typical saddle flashing at the top, and an angle flashing at the bottom that's bent one pitch steeper to keep it down on the roofing. Higher profile tile requires lead at the top and bottom.

At the side of the chimney or chase, we use continuous pan flashing with a counter flashing over it rather than step flashing (see Figure 4). The sides of the pan flashing are bent up like the valley metal to contain the water and bring it back out onto the roof.

Figure 5. *A gas-driven concrete saw with a diamond blade creates clouds of concrete dust, but cuts quickly with multiple passes. A painter's respirator protects the roofer.*

Figure 6. *Nailing tiles within 36 inches of a valley (without nailing into the valley metal) is required even on low slopes where field tiles aren't nailed. The 7d galvanized nails are driven just one tap short of snug to keep tiles from breaking and to give them a little room to move.*

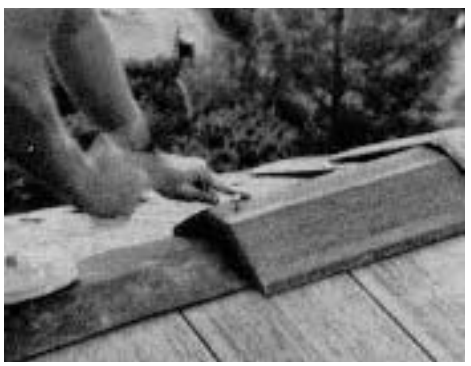

Figure 7. *After forming and fastening a lead flashing at the ridge (top), the author miters the rake tiles at the peak, and installs them along with the first ridge tile (bottom). Successive ridge tiles are daubed with mastic where they lap.*

Delivery and Stacking

In my area, there are three delivery options when ordering concrete tile: *ground drop*, *lift to eaves*, and *load pricing*. If there's a lift on the job that will handle the height, and my access is good, I will sometimes opt for a ground drop. More typically, I have the supplier send a two-story lift truck on a weekend when I can hire five or six young guys to help me stack. I seldom have the supplier load the roof, since it can add as much as $20 a square to the price.

Loading a roof with tile is work — about 15 tons worth. Typically we set up a fire brigade, passing the tile along two to four at a time. The last man positions them: On a gable roof he'll create stacks of six tiles with a tile space in between all the way across the roof on every other course. He'll leave the first two courses open, and stack the ridge course 12 tiles high. A hip is stacked a little differently because of all the cutting required. All manufacturers publish suggested loading plans. This precision prevents overloading any one part of the roof, creates paths for moving around, and lessens the chance of having to move the tile around again before laying it.

Installation

Because concrete tiles interlock, they are most easily laid with the water channel leading—right to left.

Field tile. With battens, setting field tile is largely a matter of picking them up and putting them down, particularly between 3/12 and 5/12 where there's little nailing involved.

It is important to get that first course in straight, and nailed off. I slide each successive tile in from the top until the lug contacts the batten (except on the first course) to make sure the interlocking edge is clear of debris. This ensures the roof will drain properly, and gives you a better chance of walking on tile without breaking them (*whenever* you walk on tile, put your weight in the middle of the tile at the head lap). Even though the battens are in place, I adjust every fourth or fifth tile to make sure the course is straight and parallel to previous courses. Lifetile and Monier tiles seem to have a little more slop in their water channels, which makes this easier.

Hips and valleys. I lay my hips and valleys out in place as I come to them, snap a chalkline, and make all these cuts at once.

For the closed valleys we use here, I pull a measurement that is one-full-tile-exposure away from the center ridge of the metal, and then lay out my tiles up the roof. For hips, I pull a measurement that is two-tile-exposures away to leave a path to the ridge and so the hip nailing board doesn't get in the way of the pieces I'm laying out.

Cutting. Valley and hip cuts are made on the roof with a portable saw. I use a gasoline-driven Stihl with a diamond blade; using multiple passes this setup cuts without effort. However, it produces a cloud of fine concrete dust and I use a painter's varnish mask to escape the worst of it (see Figure 5). You also need to sweep this dust off the roof when it accumulates so it doesn't stain already laid tiles or cause you to fall.

Straight cuts at rakes can usually be handled by breaking the tile along a line with a roofing hatchet rather than firing up the saw. These cuts are covered by the top of the rake tiles.

I also keep a cordless drill with me on the roof fitted with a 3/16-inch carbide drill bit. This allows me to drill a new nail hole in a tile where the original hole has been eliminated by a cut. The alternative suggested by most manufacturers is to set the heads of these pieces in roofing mastic, making sure the water channel is kept clear.

Nailing. On roofs of 3/12 through 5/12, only perimeter tiles have to be nailed if you're using battens. This actually means three tiles or courses (at least 36 inches) in from all eaves, rakes, valleys, and hips (see Figure 6). I'm not sure I always go that far in on valleys at low pitches, but I've seen too many guys just nail the starter course at the eaves and figure the rake, hip, and ridge tiles will hold everything else down.

On pitches of 6/12 through 11/12, you are required to nail each tile on every other course. At 12/12 and above, it all has to be nailed. I use 7d galvanized nails because they are the right length for nailing the first course without peaking through the V-groove sheathing on the open eaves, and they meet the code requirement of penetrating the batten by at least 3/4 inch above that. The nails should be driven just to the top surface of the tile, but not really snug.

In designated high wind areas (typically repeated wind velocities of 70 to 80 mph) or on roofs over 40 feet high, you need to:

- Nail all tiles regardless of the pitch
- Use tile clips to attach the nose of every eaves tile
- Use two nails on each rake tile
- Bed the nose of all ridge, hip, and rake tiles in mastic.

Rakes. Rake tiles are made to fit over each course of tile and attach with two 10d nails to the gable or barge rafter. The only tricky spot is where they miter at the peak of the gable. Manufacturers recommend running the first ridge tile over the top of the mitered rake tiles and filling the void with mortar. This will take care of the weather, but it doesn't look good to my eye.

Instead, I miter the last rake tiles carefully to meet at the top, and then start the first ridge tile just behind this intersection (or underneath it when it fits). But before nailing the parts together, I lay down a 9x12-inch piece of lead cut from a roll to make a crown over the ridge end. I form a lip on it (see Figure 7) that drains any water that makes it through, back out onto the roof. I use a similar formed-lead flashing where valleys die into the main roof and at hip/ridge intersections.

Finishing off hips and ridges. With flat tiles, hips and ridges require at least a layer of felt under the hip/ridge tiles. The tiles themselves should be fastened with at least a 10d nail, and then a dollop of mastic applied to the nail head and the 3-inch lap area before laying the next tile. The last tile will have an exposed nail head which should get a dab of silicone.

At the bottom of the roof where the hip tile shows the most, Monier manufactures a *hip starter* tile. It's rounded down at the nose for appearance, weather, and birds; the alternative is to use a regular hip/rake tile and close the end void with mortar or lead.

At the ridge, higher profile tile requires either a metal closure strip or mortar to close the voids between the field tile and the ridge tile. Mortar is a pain in the neck and nobody likes to do it—I charge $15 per lineal foot for "mud-in"—so most roofers use an asphalt-like material that comes in a roll with a removable paper backing (known as "Peel and Seal" after the best known brand) to deal with these voids. ■

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