

ROOFING WITH Concrete Tile



Our roofing company is located in Southern California, where most houses are roofed with concrete tiles. Until 30 or 40 years ago, almost all roof tiles installed in the United States were clay tiles, like those used for thousands of years in Europe and China. In the past few decades, though, concrete roofing tiles have edged out clay on residential roofs and now dominate the market.

by Fred Martin

Roof tiles, whether concrete or clay, are very resistant to fire. Although some traditionalists prefer clay tiles over concrete, there is no arguing with the main advantage of concrete tiles: They cost about half as much as clay (see “Concrete Tile vs. Clay Tiles,” page 3).

Consider the Weight

Standard-weight concrete roof tiles generally weigh between 9½ and 12 pounds per square foot — significantly more than asphalt shingles,

Felt underlayment
and metal flashing
are key to a leak-free
concrete tile roof

which weigh only 2½ to 4 pounds per square foot. For houses where weight is a concern, many tile manufacturers offer lightweight roof tiles weighing 5½ to 7 pounds per square foot. These tiles are made with a lightweight aggregate, like expanded shale, instead of sand.

If you're reroofing a house with existing asphalt shingles and you're not sure whether the roof structure is adequate to support concrete tiles, you should have the roof framing checked by an engineer before proceeding.

Tile Types

Concrete roof tiles are available in three basic profiles: mission S-tiles (or "Spanish S"), villa tiles (low-profile tiles with a double-S shape), and flat tiles, which are often designed to look like wood shakes or slates.

The job shown in this article used 17-inch-long Spanish S-tiles made by Eagle Roofing Products (see "Sources of Supply," page 9). These S-tiles lock together along the sides, where they form a lap joint.

Tile manufacturers provide trim tiles specifically designed to complement their various tile profiles. Most roofs will require at least two different types

of tile: standard field tiles and ridge tiles. For jobs using S-tiles, we trim the ridges, hips, and rakes with a simple barrel trim tile. Some styles of roof tile use a rake trim tile that differs from the ridge tiles. Some manufacturers also offer a "hip starter" tile, a trim tile designed to be installed as the bottom tile on a hip.

Low-slope installations. In general, the minimum slope for a tile roof is 3/12. If a customer insists on installing roof tiles on a roof with a pitch below 3/12, consult the tile manufacturer for installation specifications. Low-slope applications will require a carefully detailed waterproof membrane (for example, a self-sticking bituminous membrane) under the tiles. In addition, many tile manufacturers require that tiles on a low-slope roof be installed using a method that minimizes the number of fasteners that penetrate the membrane.

With or without battens? Concrete roof tiles can be either installed on battens parallel to the eaves or direct nailed to the felt-covered plywood or OSB sheathing. Here in San Diego, we have had excellent success direct nailing concrete roof tiles.

Most tile manufacturers permit direct nailing,



Figure 1. Each plumbing vent receives two layers of metal flashing. The primary flashing is galvanized and is installed at the same time as the asphalt felt (above). The secondary flashing is installed later, when the tiles go on. An S-tile roof gets secondary flashings made of aluminum, which is flexible enough to conform to the curve of the tiles (right).



except on roofs with a pitch steeper than 7/12 or in very cold climates subject to ice dams.

When battens are used, they are typically 1x2s, with one course of battens for each course of tiles. It's important to leave a gap of about an inch between the ends of adjacent battens, in order to allow a gap for water to drain. Battens should be no longer than 48 inches, for the same reason.

Necessary tools. The three most important tools for installing concrete roof tiles are a nail gun, a gas-powered cut-off saw or circular saw with a diamond blade, and a leaf blower for cleaning off the dust.

Prepping the Job

Roof tiles are not completely waterproof; in a driving rain, some water is likely to get past them. We install the asphalt felt carefully, because it is the most important waterproof layer on a tile roof.

Forty-pound felt. Tile manufacturers require, at a minimum, a single layer of #30 asphalt felt. Because a heavier felt is more durable and holds up better to foot traffic during tile installation, we always use #40 asphalt felt. The felt should be installed with a minimum 2-inch head lap and 6-inch side lap.

To avoid leaks at the sides of dormers, chimneys, and skylights, we carefully crease the felt and turn it up, rather than cutting it on the sheathing. For extra protection, we often use a peel-and-stick flashing membrane at penetrations such as roof vents, or at tricky areas around chimneys and skylights.

On tile roofs, all plumbing vent pipes get two layers of flashing. The primary flashing, a galvanized steel boot with a minimum skirt width of 6 inches, is installed at the same time as the asphalt felt. This flashing is bedded in asphalt roofing cement and is installed on top of one course of the asphalt felt, while the next felt course laps over the flashing (see Figure 1).

While workers are on the roof, it's possible to get a few unintended holes or rips in the felt. Because the felt, rather than the tiles, is the roof's waterproof layer, we're always careful to patch all such tears and holes with felt, roofing cement, or a high-quality caulk.

Ridge boards and hip boards. Concrete tile roofs require special nailers at ridges and hips. These nailers — ridge boards and hip boards — are lengths of 2-by lumber, installed on edge. The height of these nailers varies, depending on the configuration of

Concrete Tile vs. Clay Tile

The main advantage of concrete tiles over clay tiles is their lower cost. Proponents of clay tiles usually mention two advantages of clay over concrete tiles: better colorfastness and longer physical durability.

Colorfastness. The color of a clay tile is not affected by exposure to the elements; the same cannot be said of concrete tiles. Although most concrete roof tiles are manufactured with an integral pigment that colors the entire thickness of the tile, the color of concrete tiles will fade over time. "Concrete tile will never hold its color as well as clay," says Ken McGee, owner of The Tile Man, a supplier and installer of concrete and clay roof tiles in Louisburg, N.C.

Durability. Well-made concrete tiles should last a long time, although probably not as long as clay tiles; estimates range from 30 to 50 years. By contrast, many European clay tile roofs are still waterproof after a century of service. Traditional fired clay, although relatively easy to break, does not degrade from exposure to the elements. Because objects made from fired clay can't burn or rot, they are among the most durable objects known to archeology. Clay objects can easily last for thousands of years.

Although some early concrete roof tiles had durability problems, especially in areas with frequent freeze/thaw cycles, most concrete roofing tile manufacturers claim that today's concrete tiles are more consistent and durable than ever. Although there are reports of isolated cases of seriously deteriorated concrete roof tiles, tile manufacturers claim that such problems are rare and occur only when a bad batch of tiles gets through their quality-control systems.

"A few years ago, I saw a job up in the mountains where the concrete tile just disintegrated in the winter," says McGee. "It just fell apart. But that was unusual. Most of the manufacturers are very careful. I wouldn't let anyone knock concrete too much. You don't have to worry about concrete tile falling apart any more."

— Martin Holladay

the tiles being installed. The most common sizes used are 2x3s, 2x4s, and 2x6s (Figure 2). The ridge and hip boards are usually toe-nailed in place after the roof is felted and then individually wrapped with additional pieces of felt.

Flashing. On most of our jobs, a sheet-metal subcontractor installs the flashing. We generally use 26-gauge galvanized steel flashing, unless the customer is willing to pay for an upgrade to prepainted galvanized steel or copper. The eaves generally receive a drip edge made from 2¹/₂-inch-wide metal, which is installed under the asphalt felt. Our “W” valley flashing is 24 inches wide and is installed with clips, not nailed directly through the metal.

The sides of chimneys, dormers, and skylight curbs receive pan flashing, a rigid sidewall flashing that comes in 10-foot lengths. At the lower corners of the dormer or chimney, the pan flashing terminates onto a piece of aluminum or lead flashing, which conducts the water onto the top of a course of tiles below the roof penetration (Figure 3).

Laying Out the Courses

We adjust the exposure of the tiles as necessary to achieve equal courses from the eaves to the ridge, maintaining a minimum 3-inch lap. Because the

tiles we commonly use are 17 inches long, our maximum course height is 14 inches.

On asphalt shingle roofs, chalk lines are rarely necessary. With concrete tiles, on the other hand, every course needs a chalk line. These chalk lines correspond to the top of the tile courses and are snapped on the felt before the roof is loaded. On most jobs (especially on hipped roofs, which have no rakes), it's also helpful to snap at least one vertical chalk line, from eaves to ridge, to help keep the tiles aligned vertically.

Loading the roof. Once the chalk lines are snapped, we load the tiles onto the roof, using either a forklift or a “reach machine.” To avoid heavy point loads that might stress the roof framing or sheathing, we distribute the tiles around the roof in piles of approximately ten tiles each.

Installing the Tiles

Before any S-tiles are installed, we install bird-stop metal along the eaves. Birdstop metal has an L-shaped profile and comes in 10-foot lengths. One leg of the ell is nailed to the roof deck, on top of the felt and drip edge, and the other leg sticks up at a 90-degree angle. The upward-pointing leg has a wavy edge, conforming to the roof tiles.



Figure 2. Typically, hip boards — nailers that support the hip shingles — are 2x4s or 2x6s (above). Hip and ridge boards are installed after the roof has been felted and are later separately wrapped with felt (right).



Birdstop metal is designed to close the openings underneath the S-tiles while raising the end of the tile to the angle that matches the angle of the subsequent tile courses (Figure 4, page 6). The underside of an S-tile includes two parallel ridges designed to lock into the birdstop metal.

When installing flat tiles, we use an eaves riser instead of birdstop metal. An eaves riser has a straight edge, instead of a wavy edge, to match the flat tiles. Some roofers elevate the first course of tile with a raised fascia board rather than an eaves riser. The problem with a raised fascia is that unless the installation is carefully detailed with felt and fiberboard or anti-ponding foam (a wedge-shaped piece of foam to direct water over the fascia), water that leaks through the tiles can cause the fascia to rot.

Using an eaves riser or birdstop metal is simpler and eliminates the need for anti-ponding foam.

Laying out the tiles. After the birdstop metal is installed, the first course of tiles is laid out and nailed off. On subsequent courses, the top of each tile is aligned with a chalk line. With S-tiles, unlike flat tiles, the second course of tiles is not offset a half-tile width from the first course. S-tiles line up vertically like squares on a chessboard, rather than being staggered like courses of brick.

Concrete S-tiles must be laid out from left to right, as you're looking down on the tiles (with your back to the ridge), in order for the lap joints to engage. We generally lay out an entire course, from rake to rake, before nailing any tiles. We always eyeball the courses vertically, to be sure

Flashing Roof Penetrations

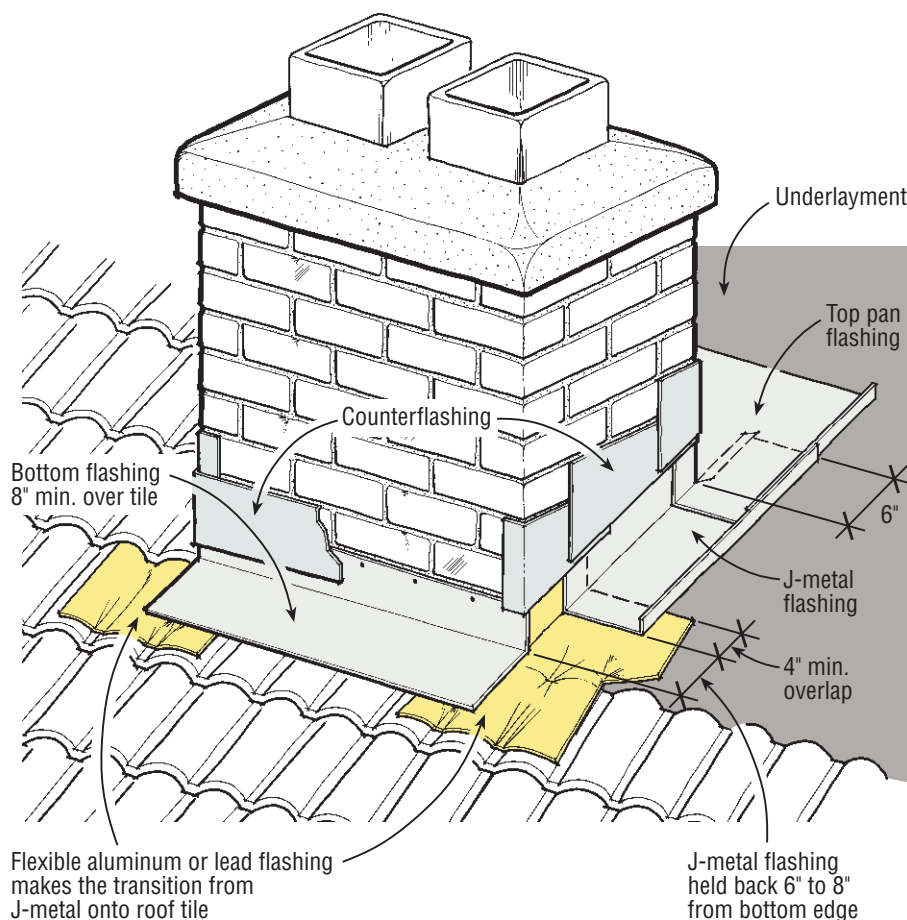


Figure 3. The sides of dormers, skylights, and chimneys are flashed with galvanized pan flashing, which terminates on a piece of flexible aluminum. The aluminum flashing conducts the water onto the top of a course of tiles below the roof penetration.

they line up. As long as they haven't been nailed, poorly aligned tiles can be adjusted by tapping them with a hatchet.

Nailing. Each concrete S-tile has been factory-punched for two nails: One nail hole is located in the pan (trough) of the S-curve, the other hole at the top of the curve.

Tile nails must be long enough to penetrate the sheathing by at least $\frac{3}{4}$ inch. Usually, each standard field tile gets a single $2\frac{1}{2}$ -inch-long (8d) galvanized nail, installed in the preferred nailing hole — the hole closest to the deck (Figure 5). As much as possible, we try to avoid penetrating any metal flashing with a nail.

Once a course of tiles has been laid out and aligned, we nail the entire course of tiles with a pneumatic nail gun. If the nail gun is properly adjusted, nailing depth is consistent, and we have no problems with cracked tiles from overdriven nails.

A tile's second nail hole (the one at the top of the S-curve) is used only when the preferred nailing hole falls over flashing that shouldn't be penetrated or when a cut tile is being nailed. We keep a

few loose $5\frac{1}{2}$ -inch-long nails handy for use in these high nail holes.

Tiles that have been cut and are too small to nail — for example, the small triangular tiles abutting valleys — are secured with a dab of asphalt roofing cement. New formulations of tile adhesive are available, but they are more expensive than asphalt roofing cement. The main use of these specialized tile adhesives is in coastal regions subject to very high winds (see "Roof Tile Fasteners for High-Wind Regions," 5/96).

Cutting Tiles

Concrete tiles are cut with a diamond blade, using either a portable circular saw or a gasoline-powered cut-off saw (Figure 6). If only a small corner needs to be trimmed and the cut area will be covered with flashing or a trim tile, it is often easier to knock off the corner with a hatchet than to cut it with a saw.

The concrete dust from a saw should be removed with a leaf blower, not left on the roof (Figure 7, page 8). Otherwise, the dust will mix with rain or dew, creating a hardened concrete paste that discolors the roof.

Plumbing vents. Concrete tiles are notched around



Figure 4. Birdstop metal is the flashing that raises the heel of the first course of tiles while closing the openings below it (left). The underside of an S-tile has two ridges designed to conform to the birdstop metal (right).

plumbing vents, which get primary flashing when the asphalt felt is installed. The secondary pipe flashing is either aluminum or galvanized steel, depending on the tile profile, and is installed when the tiles are nailed. Aluminum is used with S-tiles, because it is soft enough to be bent to conform to the curve of the tiles. Metal chimneys, like plumbing vents, get both a primary and a secondary flashing.

Valleys. The fastest way to complete a valley is to finish installing the large cut tiles while omitting the small triangular pieces closest to the valley. Once all the courses up the valley have been installed, we go back and insert the small triangular pieces (the last piece in each course, where the course intersects the valley). These are installed with a dab of roofing cement.

All of the valley tiles should run a little long. Once they are all installed, we snap a line along



Figure 5. Each S-tile receives a single nail in the lower nail hole (inset above). The upper nail hole is used to secure a cut tile that can't be nailed in the preferred hole. The most efficient way to install tiles is with a nail gun (above).



Figure 6. A small corner of tile can often be knocked off with a hatchet (above). Larger cuts are made with a saw equipped with a diamond blade (right).





Figure 7. Cutting tiles on the roof leaves fine cement dust, which should be thoroughly removed with a leaf blower. If the dust is left on the roof, it can turn into an unsightly cement paste when it rains.

Figure 8. Where tiles intersect a valley, they are cut roughly, so they run a little long. Then a chalk line is snapped, and the tiles are trimmed with a saw.



Figure 9. Rakes are trimmed with barrel tiles. Each tile is secured with two nails, which are driven horizontally into the rake board.

the valley and cut the tiles in place with the cut-off saw (Figure 8). These cuts must be made carefully, so as not to nick the valley flashing.

Rakes. Rake details differ, depending on the tile profiles being installed. The S-tiles we use are trimmed with a simple barrel trim tile. We secure each rake tile with two horizontal nails driven into the rake board (Figure 9).

Hips and ridges. Once all of the field tiles are installed, it's time to trim the hips and ridges. Each ridge tile is installed with a single nail into the ridge board. On the top of the nailed end of each ridge shingle, we lay down a bead of asphalt roofing cement to secure the unnailed end of the next ridge tile (Figure 10).

The last step is to install mortar to fill the gaps between the top course of field tiles and the ridge and hip tiles. We use a simple mortar mix — 1 part Portland cement to 3 parts sand. As an alternative to using mortar, some manufacturers offer an accessory ridge closure trim to seal these openings.

Walking on Concrete Tiles

If you're not careful, walking on installed roof tiles can break them. Concrete tiles are weakest when they are fresh from the factory, or "green"; they get stronger as they age. The best spot to



Figure 10. This style of ridge tile is used to trim roofs with flat tiles. Each ridge tile is secured at one end with a single nail and at the other end with asphalt cement.

place your foot is at the 3-inch-wide head lap, where the bottom of one tile is supported by the top of the tile on the course below. With S-tiles, it's also best to place your foot so it spans the tops of two tiles.

Even with care, it isn't unusual to break a tile after it has been installed. Luckily, replacing a broken tile isn't difficult. Gently lift the tile in the course above the broken tile (since the tiles are secured with a single nail, this is usually fairly easy). Scoot the tile to

one side as much as possible. Wiggle the broken tile to remove it, or break it if necessary. Be sure to pull out the nail, and patch the nail hole with roofing cement. Then slide in a new tile, along with a dab of roofing cement to secure it.



***Fred Martin** is the owner of Martin Roofing, a 53-year-old roofing company in San Diego, Calif., and is a past president of the San Diego Roofing Contractors Association.*

Sources of Supply

Concrete Roof Tile Manufacturers

Bartile Roofs

725 N. 1000 West
Centerville, UT 84014
800/933-5038
www.bartile.com

Columbia Concrete Products

8650 130 St.
Surrey, BC V3W 1G1
Canada
604/596-3388
www.crooftile.com

Eagle Roofing Products

2352 Locust Ave.
Rialto, CA 92377
800/300-3245
www.eagleroofing.com

Entegra Roof Tile

819 S. Federal Hwy.
Stuart, FL 34994
800/586-7663
www.rooftile.com

MonierLifetile

7575 Irvine Center Dr., Suite 100
Irvine, CA 92618
800/571-8453
www.monierlifetile.com

Pioneer Roofing Tile

10650 Poplar Ave.
Fontana, CA 92337
800/411-8453
www.pioneertile.com

Vande Hey-Raleigh

1665 Bohm Dr.
Little Chute, WI 54140-2529
800/236-8453
www.vhr-roof-tile.com

Westile

1742 S. Rooftile Rd.
Casa Grande, AZ 85222
800/562-8500
www.westile.com

Fasteners and Adhesives

Flexible Products

1881 W. Oak Pkwy.
Marietta, GA 30062
770/428-2684
www.flexibleproducts.com
Tile Bond polyurethane foam roof tile adhesive

Newport Fastener

977 N. Enterprise St.
Orange, CA 92867
800/645-7811
www.newportfastener.com
Flexim linseed-oil-based roof tile adhesive, and a variety of fasteners for tile roofs

OSI Sealants

7405 Production Dr.
Mentor, OH 44060
800/321-3578
www.osisealants.com
OSI Pro Series RT 600 roof tile adhesive

Polyfoam Products

10798 NW 53rd St.
Sunrise, FL 33351
888/774-1099
www.polyfoam.cc
Polyset AH160 expanding polyurethane roof tile adhesive

40-Pound Asphalt Felt

Fontana Paper Mills

13733 Valley Blvd.
Fontana, CA 92335-0339
800/634-8915
www.fontanafelt.com

Peel-and-Stick Flexible Flashing

Ridglass Manufacturing

3441 S. Willow Ave.
Fresno, CA 93725
888/743-4527
www.ridglass.com
Kwikwrap peel-and-stick membrane