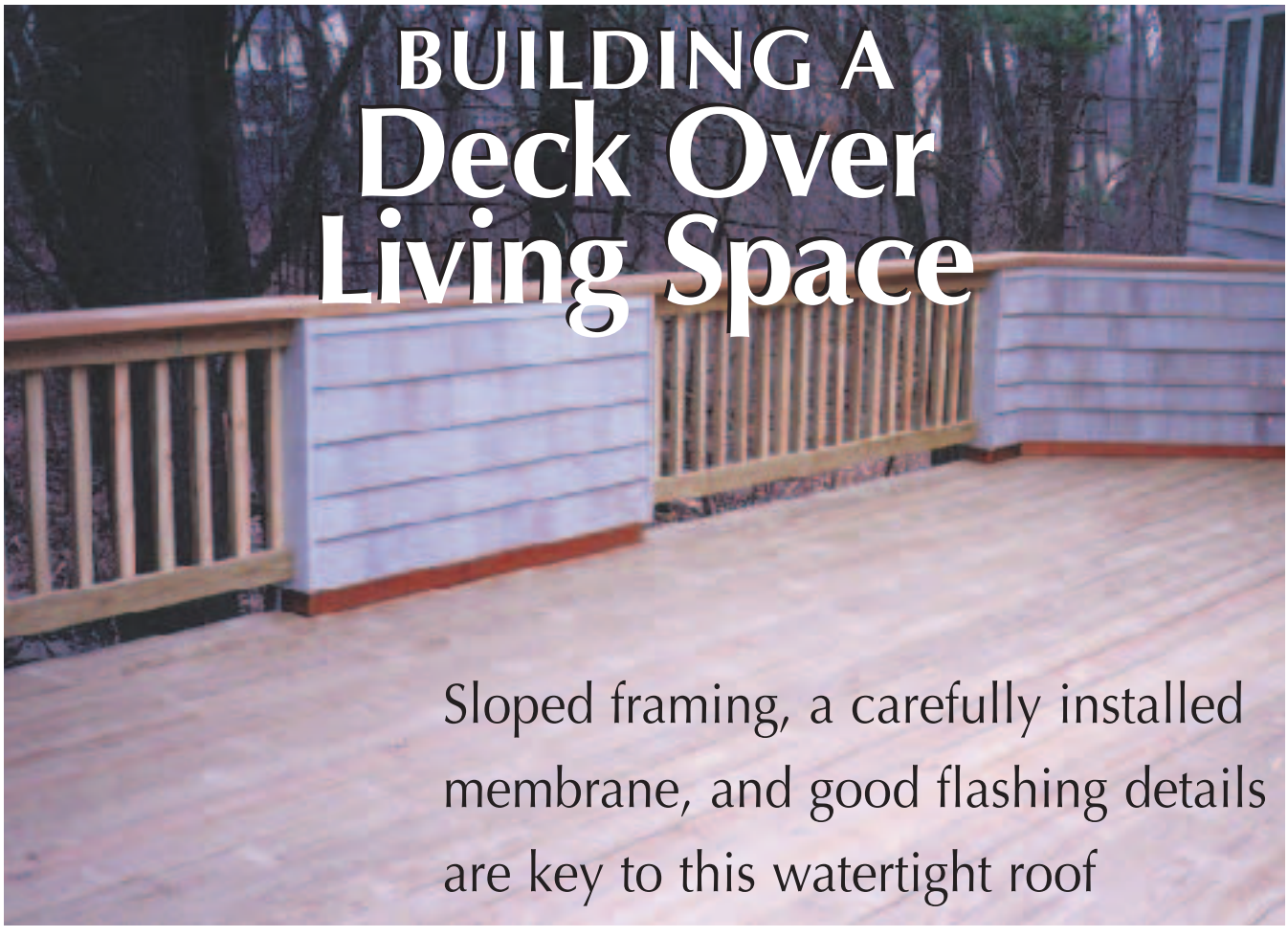

BUILDING A Deck Over Living Space

Sloped framing, a carefully installed membrane, and good flashing details are key to this watertight roof

by Thomas Buckborough

Building an outdoor deck on top of a finished room may not sound like the best proposition. But when a good past customer asked us to design a project that would do just that, we didn't hesitate. Adding to its complexity, the deck had an irregular shape because it was built to join two octagonal rooms of the house. We also had to control the water runoff from the house and direct it to a dry well to satisfy town conservation regulations. In addition to the deck, the design included another flat roof area, on a second level, that would have a decorative balustrade at its edge.

Many homeowners here in New England are concerned when I suggest a "flat" roof design. They worry that snow will be a problem, or that the roof will be more likely to leak. But a properly detailed EPDM (ethylene propylene diene terpolymer) membrane roof installed over a properly designed structure can actually be much tighter and less problematic than other roof types.

Of greater concern to me was the difficulty of venting a flat roof. Rather than get bogged down in devising a theoretically functional system, for this project I relied on a carefully installed airtight vapor barrier and mechanical control of humidity in the heated space — in effect, a "hot roof" approach (see "Vented vs. Unvented Roofs: The Great Debate," 1/96).

Railing Design

The first challenge was to design deck railings that would not only look good, but also allow roof

drainage while being rugged enough to resist lateral movement. There were four 45-degree corners to wrap the railing around. These would be difficult to treat with conventional square posts and rails. After considering the details for several weeks while designing the rest of the project, I decided to build a combination railing, with rail-height solid walls at the corners connected by open baluster railing sections and a low retaining curb.

A membrane roof should always provide positive drainage — the roof may look flat, but it shouldn't be level. In this case, the roof deck would pitch to a curbless edge, where a gutter would capture the runoff.

To frame the main roof deck, we installed a series of four flush steel I-beams that spanned the room below, eliminating the need for intermediate posts or exposed beams. We pitched the beams 1/8 inch per foot to establish drainage. The framing crew infilled 2x10 joists between the I-beams and sheathed the deck with a 3/4-inch T&G plywood subfloor. Our lead carpenter, Kevin Whitney, then framed the rail-height walls and curb sections. With the framing completed, we were ready to install the EPDM roof membrane.

EPDM Roofing

Our roofer, Jim McKenna, prepared the roof surface by installing an underlayment over the T&G deck ply. EPDM is typically installed over rigid insulation board or a proprietary soft fiberboard. However, concerned that the weight of the deck on top of the membrane would compress a soft underlayment and cause damage or premature wear to the EPDM, Jim chose 1/4-inch lauan plywood. Technically, you can bond an EPDM membrane directly to a plywood roof deck, but we wanted to start with a smooth, clean, nail- and splinter-free base. Jim fastened the lauan with 1 1/4-inch ring-barb copper nails, with the heads set flush and spaced 6 inches along the sheet edges and 12 inches in the field. The copper nails strongly resist pullout and won't rust.

The membrane we used, 60-mil Johns Manville UltraGard nonreinforced EPDM, is available in several widths; we used 10x100-foot rolls. Some rolls come treated with a talc-like powder; Jim orders it "clean," or talc free. He prefers to use Carlisle system adhesives and accessories, although the company won't sell its EPDM membrane to uncertified installers and will certify only large-volume commercial roofers. However, EPDM is EPDM, essentially identical from one producer to the next, so the adhesives are completely compatible.

To install the membrane, you roll it out to length on the roof, cutting it long enough to allow the ends to transition up sidewall terminations by at least 9 to 12 inches and hang over outside edges by 3 to 6 inches. Snapped chalk lines on the plywood guide the alignment of the upper edge of the membrane. Carlisle Sure-Seal 90-8-30A Bonding Adhesive, an extremely flammable, yellow synthetic rubber contact cement, is applied to both the membrane and the underlayment, using a 9-inch low-nap paint roller. It's then allowed to dry to the touch — from 5 to 50 minutes, depending on the temperature. You get about 60 square feet of coverage per gallon. To get a reliable bond, you don't want to install at temperatures lower than 40° F. The easiest way to apply the adhesive is to fold the lower half of the membrane lengthwise and coat the exposed backside and underlayment, then carefully unfold it into position and bond it to the underlayment by brushing it down with a soft-bristle push broom. Repeat the process on the upper half. It takes a few hands and a coordinated effort to control a long sheet and prevent trapped air bubbles and mis-bonds (see Figure 1).

Sealing seams. Obviously, tight seams between sheets are critical to leak-proof performance. Every sheet overlaps the previous one by 6 inches, and laps are given a special sealing treatment. The overlapping surfaces must be kept clear of adhesive. After all the sheets have been bonded to the roof, Jim folds each seam edge back and applies Carlisle Sure-Seal Primer to the bonding surfaces (Figure 2, next page). The primer prepares the surface for Carlisle Seam Tape, a 6-inch-wide,

Figure 1. Four hands are better than two to prevent wrinkles and trapped air bubbles in the EPDM bonding process.

Roof Deck Over Living Space

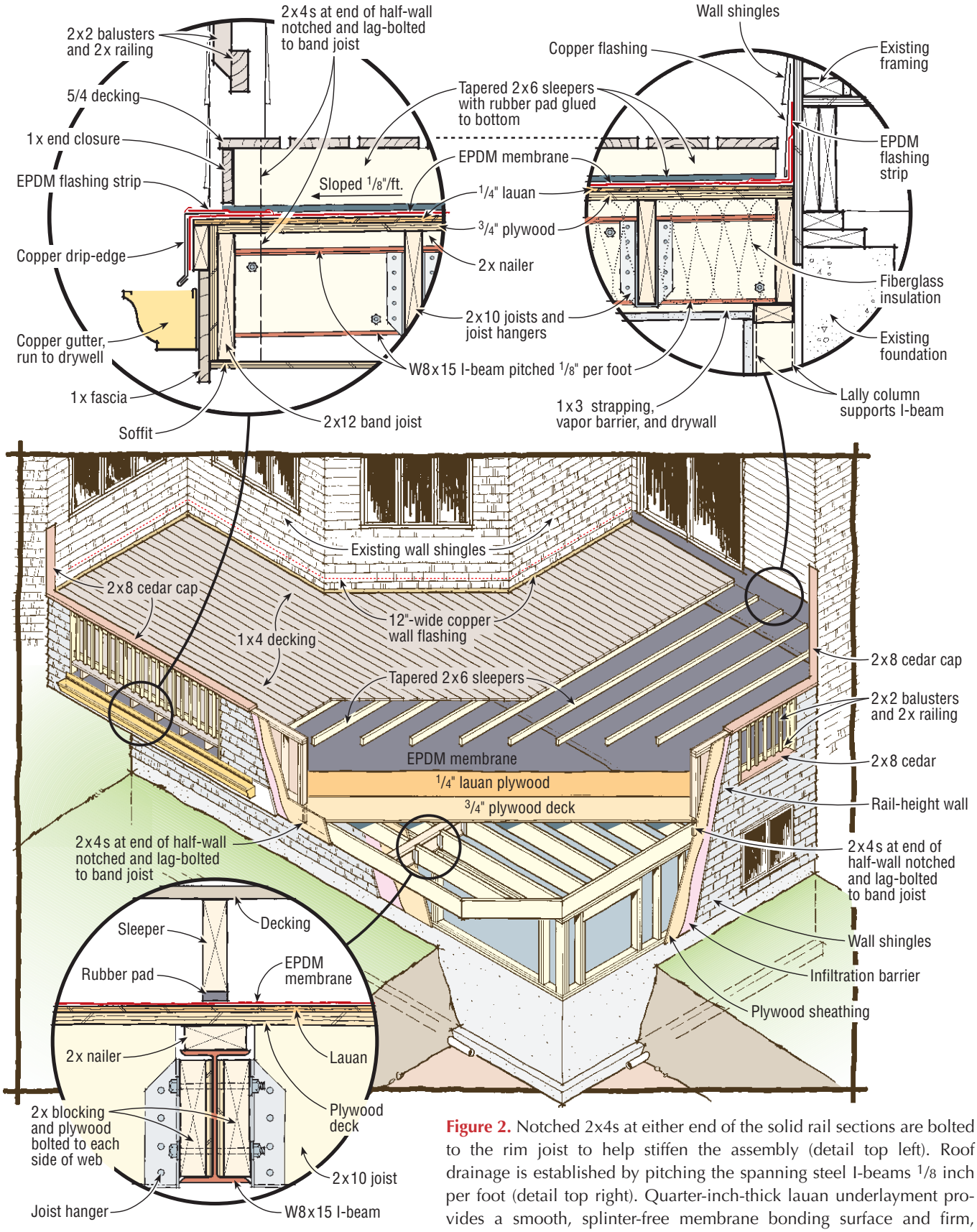

Figure 2. Notched 2x4s at either end of the solid rail sections are bolted to the rim joist to help stiffen the assembly (detail top left). Roof drainage is established by pitching the spanning steel I-beams 1/8 inch per foot (detail top right). Quarter-inch-thick lauan underlayment provides a smooth, splinter-free membrane bonding surface and firm, unyielding support for the 2x deck sleepers (detail lower left).

Figure 3. The overlapping seams in an EPDM membrane are treated separately from the main bonding operation. After brushing the seam with primer, the author applies a pressure-sensitive seam tape to secure and seal the edge (top). As a redundant fail-safe measure, the author applies a 6-inch-wide peel-and-stick rubber flashing strip over every seam in the membrane and seals the strip's edges with a lap sealant (above).

double-faced peel-and-stick seam sealer. Jim applies the tape, letting its edge stick out of the seam by about 1/4 inch to avoid pockets.

Any necessary joints in the membrane are treated in the same manner as the seams between courses — that is, prepared with primer on both surfaces, overlapped a minimum of 6 inches, and bonded with seam tape. To eliminate any doubt about the security of the seams, Jim goes one step beyond the prescriptive requirements. After brushing a 6-inch-wide stripe of primer down the center of each seam, he applies a 6-inch-wide, pressure-sensitive peel-and-stick flashing strip (Figure 3). After bonding the flashing with a steel roller, he carefully seals all edges with a finishing bead of proprietary lap sealant, applied with a caulking gun.

Covering corners. Uncured rubber, although less resistant to UV degradation than the roof membrane, is far more pliable and is therefore used to treat corners and junctions with multiple angles. The uncured rubber comes in pressure-sensitive peel-and-stick sheets and can be stretched to conform to the shape of the corner, then glued and lap-sealed in the same manner as a common seam seal, after priming the bonding surface.

You don't cut the roof membrane to form an inside corner but fold it back on itself in a triangular flap, and glue the folds into place against the wall. The flap gets covered with an uncured patch, with its edges lap-sealed.

To seal an outside corner, where the membrane must be cut to fit, Jim prepares two 9-x13-inch strips of rubber membrane and glues them in a double layer over the corner, wrapping the first layer 3 inches on one side and 6 inches on the other, then reversing the overlap on the second strip. He covers the three-way bottom of the corner with a circular patch of pressure-sensitive uncured rubber and finishes all edges with a bead of lap sealant. All corners on the patches are rounded to resist snags and uplift.

Figure 4. A custom-made two-piece lead-coated copper drip-edge conceals face-driven fasteners. The drip-edge will be sealed to the membrane with a 6-inch-wide rubber cover strip.

Metal Flashing

All of the flashing on this job was copper, either uncoated red or lead-coated. We capped the sidewall membrane terminations with a 12-inch-wide strip of red copper, to shield the rubber against possible puncture from feet or furniture. The wood shingle siding on this job begins just above the finished deck surface, leaving a narrow strip of flashing exposed.

Drip-edge. The perimeter drip-edge goes on after, and on top of, the membrane. A two-piece lead-coated custom drip-edge along the upper flat roof cleverly eliminates penetration of the membrane and any exposed fasteners (Figure 4). Jim face-nails the first piece to the fascia board, covering the dangling edge of the roof membrane. The secondary piece caps the first and is crimped tight along its lower edge, which kicks out to shed water. The flashing gets sealed to the deck membrane in a manner similar to the seam treatment, with a 6-inch strip of pressure-sensitive flashing rubber centered on the primed joint, pressure-bonded, then edge-sealed with lap sealant.

Jim soldered a custom red copper pan and drip-edge to direct roof runoff between the wall openings into a stock copper gutter (Figure 5). He ran a bed of lap sealant on the roof membrane, then nailed the copper in

Figure 5. A soldered copper drip pan, nailed on top of the membrane, is sealed under a self-sticking rubber flashing strip. A pliable self-sticking uncured rubber patch seals the junction of the outside wall corner and deck (left). The drip pan directs runoff into a copper gutter (right).

place on top. After soldering, the joints are cleaned with water to remove the excess flux, which could otherwise interfere with the roofing adhesive. If the copper requires further preparatory cleaning, Jim uses a clean rag soaked in toluene, which won't adversely affect the rubber. Avoid direct skin contact with this stuff, though — wear rubber gloves for protection — and work with plenty of ventilation.

Flashing penetrations. The balustrade posts that penetrate the membrane on the upper-level roof were tricky to flash. After the posts were secured in place, Jim ran a bead of lap sealant around them, then bedded a snug-fitting custom-made copper post sleeve and flange into the sealant (Figure 6). The flanges were nailed to the deck, then sealed with 6-inch pressure-sensitive rubber flashing glued to the membrane and the copper. Again, all edges received the lap-sealant treatment.

Figure 6. The roofing contractor installed custom flanged copper sleeves over the railing posts and plumbing vent. The flange is bedded in sealant on top of the EPDM membrane, then tightly covered under peel-and-stick rubber flashing strips.

Finishing Up

We covered the half-wall railings with wood shingle siding. We fashioned the infill baluster and railings from standard 2x2 pressure-treated wood. A running cap of 2x8 red cedar protects the overall assembly and ties the rails and walls together visually.

The finished deck rests on pressure-treated 2x6 sleepers, taper-cut to compensate for the 1/8-inch slope and bring the surface back to level. To protect the membrane from wear, we glued 1 1/2-inch strips of rubber, cut from a product called Walkway roof pads, to the bottom edge of the sleepers. These 2x2-foot pads have a pattern of rounded knobs molded into the underside to allow water to drain away in multiple directions. The sleepers are loose-laid on the deck on 16-inch centers. We screwed the 5/4x6 pressure-treated decking to the sleepers with stainless-steel square-head deck screws. This permits pieces of the decking to be removed at a later date, in the unlikely event that the membrane requires servicing.

Thomas Buckborough *is a general contractor and designer-builder in Concord, Mass.*

Sources of Supply

Carlisle SynTec
Carlisle, Pa.
800/479-6832
www.carlisle-syntec.com

Clendenin Bros.
Baltimore, Md.
410/327-4500
Ring-barb copper nails

Firestone Building Products
Carmel, Ind.
800/428-4442
www.firestonebpco.com
Walkway roof pads

Johns Manville
Denver, Colo.
800/654-3103
www.jm.com/roofing/