

DECKS



Decks Over Roofs Three proven methods for building durable, leakproof decks above living space

BY DOUG HORGAN

Our Washington, D.C., metro-area remodeling company is often asked to build decks above finished spaces, and we have several reliable methods that we can use, depending on the job. Most of the time, we install these decks over pressure-treated sleepers that rest on the roofing, tapering the sleepers to follow the slope of the roof. Another approach is to support the deck with adjustable pedestals that rest on the roofing. The roof details are similar in this case, but pedestals are more suited to square or rectangular finishes, rather than linear decking, and are easier to adjust for multiple roof planes. One of the cleanest methods is to use existing parapet walls to support joists that span above the roofing. It's rare we have a building where this will work, but

when we do, it's inexpensive and reliable with few complications.

This article describes our preferred methods for building decks over living space, though there are other rooftop deck solutions, such as adhered walking-surface membranes, which we have installed for some clients. This article won't cover mortar-set stone or tile applications, either. These are challenging and expensive installations, and I've covered some key details about them in a previous article, "Repairing Stone Patios Over Living Space" (Jul/16).

ROOFING DETAILS

Regardless of the decking installation method, we've learned a few lessons about decking materials and roofing details. For example,



When installing decks over living space, the author adheres to a code-mandated minimum 1/4-inch-per-foot roof slope, which can be achieved by either sloping the roof framing or using a tapered insulation system. While uniformly deep 2-by “floating” sleepers laid across a sloped roof may be installed (1), most clients prefer a level walking surface, so sleepers are typically tapered (2).

some types of synthetic decking change size significantly with changes in temperature, and some manufacturers specifically recommend against installation over floating sleepers (we don’t normally anchor our sleepers to the roof deck, so they are “floating” on the membrane below). The one time a client asked us to use a brand that says not to do this, they were not willing to take the risk. We weren’t either, so we don’t know for sure if this would actually cause a problem.

A problem we did create once was to install ipe decking over a shallow roof that didn’t fully drain. The puddles of water made such a difference in moisture conditions that the decking cupped up after each rain. In retrospect, proper slope, wider spacing between boards to allow drying, or a synthetic decking would have avoided this issue.

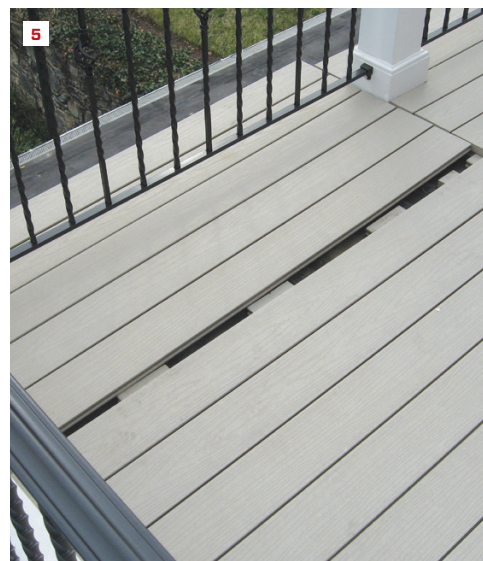
Roof installation keys. For the roofing that goes under a rooftop deck, we’ve developed a set of installation procedures (see “Low-Slope Roofing Details That Work,” Nov/19). First, we use a heat-seamed membrane—almost always TPO (thermoplastic polyolefin)—because the joints don’t require regular resealing, unlike the glued joints of EPDM. We’ve seen a lot of premature EPDM roof failures, typically at seams and joints rather than in the middle of a sheet. Whether those are due to poor workmanship or material problems, it’s not practical to remove a deck to fix the roofing, so we use roofing that doesn’t need regular maintenance.

In addition, we always install the membrane with a minimum 1/4-inch-per-foot slope. This is code, and a good idea. Even with this much slope, complicated seam buildups can sometimes pond water, which can lead to freeze-thaw damage, smelly biological growth,

and warped wood decking. One way to create the necessary pitch is to add tapered ribs to the top of the framing before sheathing the roof (see Sloped Framing With Tapered Sleepers, page 34).

Another way to add the needed pitch is to install sloped roof insulation above the roof sheathing, which allows for simpler flat framing. Tapered exterior insulation can also be used to fix existing framing that doesn’t have enough slope (see Tapered Insulation With Pedestal Supports, page 36). We typically use R-15 fiberglass-faced polyiso above-sheathing rigid foam, which is the code-recommended minimum in our climate zone, 4A (for other climate zones, see section R806.5 of the International Residential Code). From a building science perspective, this is a better assembly than rafter bays filled with fiberglass batts, and it’s less expensive than using lots of spray foam under the roof sheathing. Our typical goal for total roof insulation is between R-38 and R-49, depending on the jurisdiction we’re working in, but the approach we use also depends on the balance between air-permeable and air-impermeable insulation.

One wrinkle with common foam roof insulation, however, is that it is not strong enough for concentrated loads like sleepers. Our solution, which helps to distribute loads over a wider area, is to add strong high-density cover boards over the foam prior to roof membrane installation. I like the 1/2-inch-thick R-2 polyisocyanurate cover boards, such as GAF EnergyGuard HD, Carlisle SecurShield HD, and Firestone Isogard HD, that are available from our roofing suppliers. Gypsum-based cover boards are also available, such as Georgia-Pacific’s DensDeck Prime, which has fiberglass facers that aren’t mold food and a coating that the roof membrane adhesive



Though not usual, sleepers may be fastened to 2-bys laid on the flat, which helps distribute loads over a wider area **(3)**, particularly when a protection board is not installed between the roof membrane and insulation or when a roof insulation with a lower compressive strength is used. Removable access panels are recommended on the deck above both the high and low ends of the roof **(4, 5)**, to provide access to the roofing membrane for maintenance.

readily adheres to. To counter uplift, the cover boards are glued to the foam insulation with a polyurethane adhesive applied in a zigzag, 9-inch-on-center pattern.

Fastener location. One trick to installing the cover board—and any multilayer insulation—is to fasten only the bottom layer, then use glue for the layers above that. This common method is familiar to most roofers, and can be cheaper, as it saves a lot in fastener cost. The most important benefit is that it keeps the fastener heads away from the underside of the roof membrane. When we add sleepers or pedestals on top of a membrane, it's best to not have a screw head right under it, because a sleeper could rub or punch down on the screw head and puncture the membrane.

Protection layer. Once the firmly supported heat-seamed membrane has been installed with the proper slope, the next step is to put down a protective layer to isolate the roof membrane from the movement of the sleepers. This movement is caused by temperature and moisture changes, as well as by people walking on the deck. There was a time we would cut strips of roofing membrane and put one under each sleeper, but now we roll out (without adhesive) EPDM over the whole area. The full coverage provides better protection during construction, plus the black color of the loose-laid EPDM membrane is less visible through the gaps between deck boards, compared with the light-colored TPO.

SLEEPERS

We typically cut sleepers from pressure-treated 2-by stock. Usually we taper these so the deck is level, rather than lay them flat

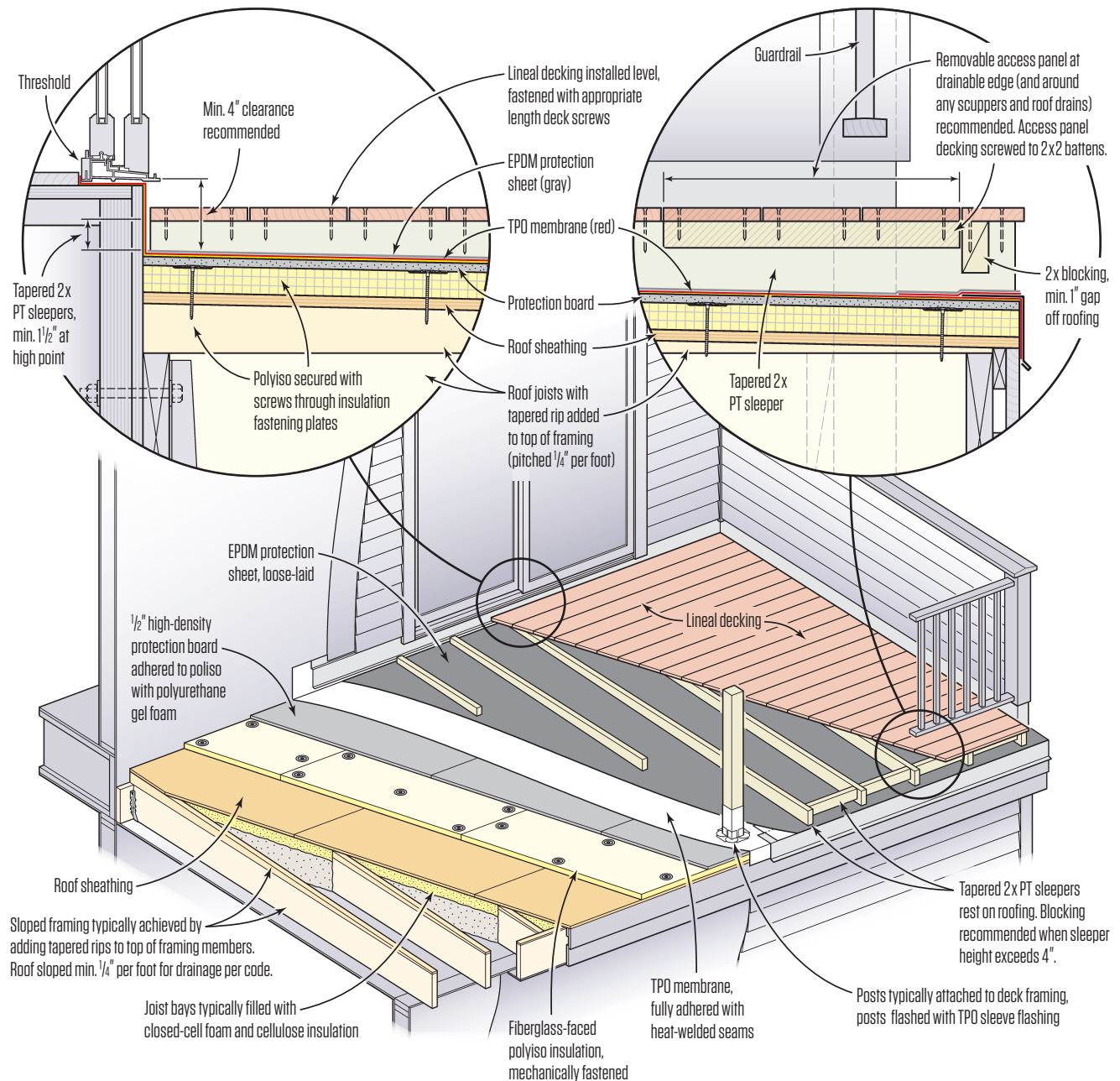
following the roof slope below. Leaving at least 1½ or 2 inches at the short end of the taper allows enough wood for the fasteners to grab, plus enough room underneath the decking to wash out debris later. Once the decking is added, the total height is around 2½ to 3 inches, which places the top of the decking roughly from 1½ inches below to flush with the threshold—we typically design our decks with a minimum of 4 inches of clearance from roofing to door thresholds. When sleepers are more than 4 inches high, we block between them to keep them vertical, leaving a space underneath the blocking to allow for drainage.

Guardrail posts. When the sleepers are tall and enough blocking has been added, they can be used to anchor railing posts. When the sleepers are not beefy enough, we've resorted to custom-welded steel angles. Anchoring posts to sleepers can be tricky structurally, but if our engineer can come up with a solution that meets the IRC's 200-pound load requirement (500 pounds after applying the required 2.5 safety factor), this approach prevents leaks at posts anchored through the roofing membrane to the house framing.

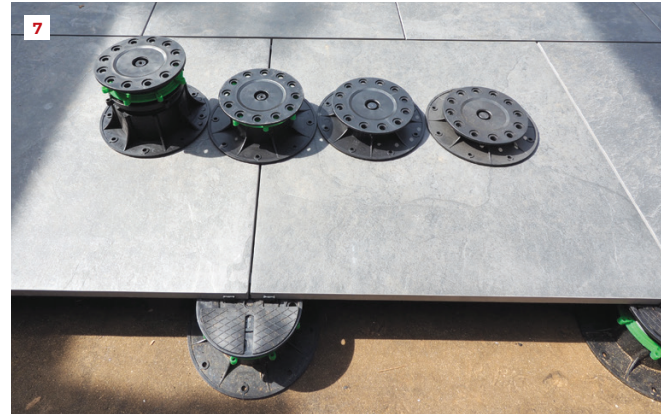
But we have also found TPO post sleeve flashing to be pretty reliable, so we're comfortable putting posts through the membrane when necessary. We definitely cover the entire post with a good WRB all the way to the top to prevent the classic "water leaked through a crack in the post" that can still happen with the best roofing job (for a post connection detail that will work with a raised parapet, see page 43 in "Low-Slope Roofing Details That Work," referenced above).

Removable deck sections. For clients to be able to clean out

Sloped Framing With Tapered Sleepers



The scenario above shows the roof system adequately pitched for drainage via sloped roof framing. In any sleeper system, the design should accommodate proper clearances between door thresholds, decking, and roofing membrane. Here, a 1/2-inch-thick protection board is installed to protect the TPO roofing membrane from the insulation fastener plates, while EPDM sheets are "loose laid" over the TPO membrane prior to the installation of the sleepers, to isolate the roofing membrane from the sleepers.



Pedestal supports are well-suited for roof systems with multiple slopes, including tapered roof-deck insulation sloping towards scuppers for drainage (6). Most pedestals are adjustable and are supplied by their manufacturers in varying heights depending on the roof configuration (7). Installation is a simple matter of following the manufacturer's layout and adjusting the pedestals so that they are level with each other (8) as each paver (9) or decking panel (10) is installed.

drains or scuppers at the low end of the roof, access to the roof membrane is crucial. But over the years, we've found that decking screws are challenging to remove: The coated ones rust and get stuck, while the stainless steel ones are too soft and snap or cam out.

So, instead of attaching all of the deck boards to the joists, we screw some of them to 2x2s set next to the joists, creating a removable section of decking of three or four boards. This keeps the spacing correct—with a 1/8- to 1/4-inch gap between boards for drainage—and allows the boards to be lifted easily. Don't make the mistake of making the removable section too large; when the materials are soaking wet, they can be quite heavy. I've struggled wrestling with 25-square-foot panels (they must have weighed well over 100 pounds each) and would recommend keeping them smaller than 10 square feet where possible. We like to make removable sections at the high end as well so we can stick a hose in to wash debris down the slope.

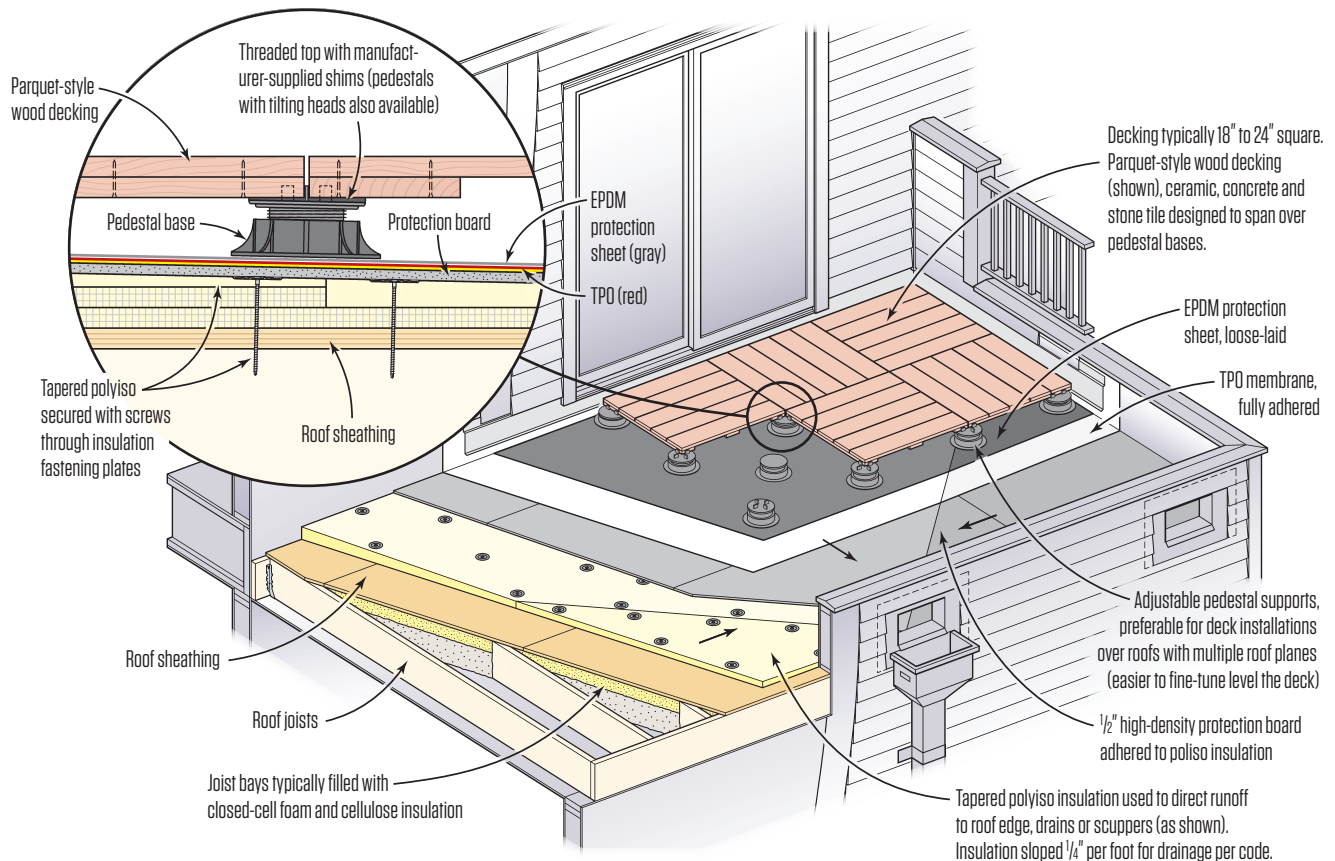
Fastener length. One detail I wouldn't have thought needed

to be mentioned is to use screws that are shorter than the depth of the sleepers. Yes, I watched with my own two eyes as a co-worker drove 3-inch screws through 3/4-inch decking over 1 1/2-inch-thick sleepers. Yes, I paid the roofer to come fix the holes. Yes, that person kept working for us for years afterward, and he's still a friend—just one of those days, I guess.

PEDESTAL SUPPORTS

For clients who want a stone or tile deck over finished spaces, pedestal systems are a great alternative to traditional stone and tile assemblies. Mortared assemblies are expensive, requiring multiple layers of specialty materials and constant on-site vigilance during installation. They also build up to nearly 3 inches thick, which may not fit in a remodel situation—unlike with pedestal or sleeper systems, water can't drain through the walking surface of a mortared assembly and significant clearance has to be left under doors. Setting materials in mortar essentially

Tapered Insulation With Pedestal Supports



Here, tapered insulation panels are used to pitch the roof system towards scuppers (as shown) or roof drains. The 1/2-inch-thick protection boards installed over the insulation protect the TPO membrane from insulation fastener plates, while EPDM sheets isolate the roofing membrane from the pedestal bases. Especially well-suited for deck installations over roofs with multiple roof planes, adjustable pedestals allow for fine-tuning the deck to level.

guarantees efflorescence, which must be managed, and freeze-thaw damage is always a possibility with tile or stone set in mortar. Most clients don't like the tilted surface, which must be sloped 1/4 inch per foot for drainage. And, should a leak occur, it's a daunting task just to access it, usually involving a tile subcontractor, diamond saws, rotary hammers, temporary rain protection, and a mess.

Adjustable pedestal supports, which—like sleepers—can be set level, are available from a number of suppliers. They basically consist of two cylinders that thread into each other so their height can be adjusted. These suppliers also offer pedestal-compatible decking materials, typically in 24-inch-by-24-inch sections, including wood (in parquet-style pallets), ceramic tile, concrete, and natural stone pavers designed to span over the pedestal bases.

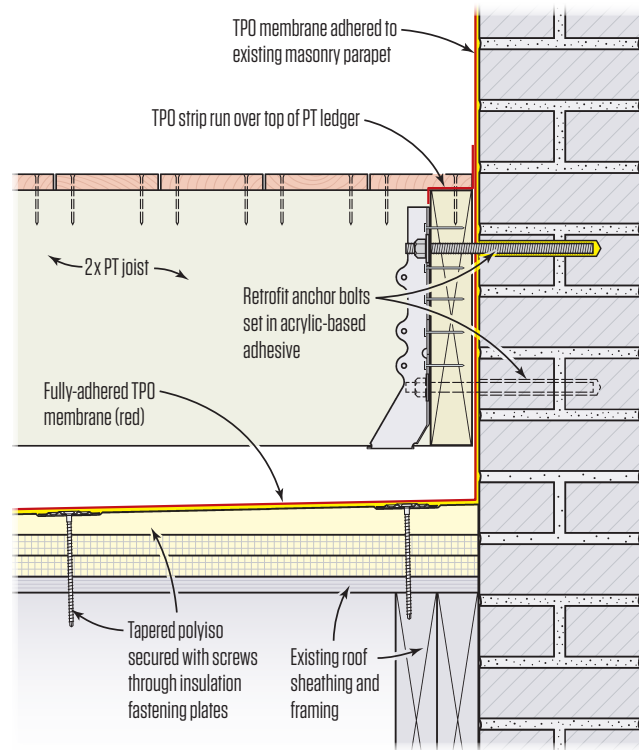
The pedestals install right over a normal low-slope roof (we use

the same methods as for sleepers, with supportive cover boards under a heat-seamed membrane and a protection layer). If we ever need to fix a leak, we can just lift up the decking pieces and pedestals and get to work. Although the joints between the tile, stone, and concrete decking pieces aren't grouted, the installed walking surface looks like what most clients expect with a mortar-set assembly. Pedestal systems are much easier and less expensive than mortar-set materials, and much easier to live with later.

When we order pedestals, we work with a supplier and send it a drawing showing the slope(s) of the roof; the supplier works out the layout details and sends us sets of different types of pedestals, as they have a limited adjustment range and come in shorter and taller versions. We lay them out correctly per the plan, fine-tune the height, and drop the walking surface on top. Some pedestal systems need to be shimmed to account for the slope of the roof,



Suspended Deck Detail



Where the roof deck is enclosed by a masonry parapet, ledgers can simply be bolted to the house framing and parapet to support standard deck joists **(11)**. Ledger flashing is needed to keep water from penetrating the bolted ledger connections **(12)**, which are typically specified by an engineer (see drawing, above right).

but we've also used pedestals with base levelers or threaded top sections that can be tilted slightly in lieu of shimming.

The sets we've used also include little shims that can be used to level any pieces that are different thicknesses, since the corners of four different pieces land on the pedestals. When the surface is wood, we usually install it ourselves (we have terrific carpenters), but recently we had a mason install a tile deck; their wet saw was the right tool to cut the 24-inch tiles at the deck perimeter, and they have a patient and careful guy who set the pedestals just right.

SUSPENDED DECK

When adding a rooftop deck to a masonry townhouse, we can often simply bolt ledgers into the masonry parapet walls and span joists all the way across, rather than install sleepers or pedestals. This is a simple solution, but it will work only on certain buildings. This makes for a clean install with little complication to the waterproofing and roofing. In fact, we often leave existing roofing in place when it's relatively new and doesn't seem to have any existing problems.

Depending on the wall construction, our engineers have provided us with bolted ledger connection details using various types of fasteners, lately specifying anchored bolts with acrylic-based adhesives for several types of wall. Apparently, epoxy adhesives lose a lot of strength when the temperature is high, so acrylic-based adhesives are preferred for rooftop applications that are exposed to the hot sun.

To reduce the chances of water flowing behind the bolted ledgers and penetrating the bolt holes, we flash the tops of the ledgers, typically with a TPO strip sealed to the wall and running over the ledger (see Suspended Deck Detail, above). Even though our fastener holes are not large, it seems prudent to try to keep the area behind the ledger dry.

Once the ledger and joists are installed, finishing goes a lot like any deck. Decking and railings (if needed) go in as they would on other types of deck systems. We do like to make accesses at the high and low points of the roof to make it easy to clean leaves and gunk.

Doug Horgan is vice president of best practices at BOWA, a design/build remodeling company in McLean and Middleburg Va.