On Site With Majrex

BY JIM BRADLEY

The OSB-sheathed double stud wall had limited drying in the outward direction, and in this cold climate, posed a risk of condensation **(1)**. Some of the external wall cavities were cluttered with wiring, meaning that a careful (and inspectable) insulation job was critical to performance **(2)**. The author chose to use netting to contain the blown insulation, and then apply Majrex directional vapor control membrane as a control layer for air transport and diffusion of vapor, allowing the building to dry to the interior if needed **(3)**.

Photos by Tim Healey/JLC

Good building science is important for every house in any climate—and homes with double stud walls and cathedral roofs in a cold climate are certainly no exception. And if you must do one thing, it's this: Make sure the wall and roof assemblies have the ability to dry.

As a construction manager for a custom homebuilder in northern Vermont, I take responsibility for the implementation of energy-efficiency details, as well as the critical building-science details. A large custom home we're currently wrapping up on the shore of Lake Champlain is a worthwhile example.

The double stud walls, sheathed with Zip System OSB panels, are 13 inches thick, and the unvented low-slope roof is framed with 18-inch-deep wood I-joists. Wall and roof cavities are both insulated with dense-blown cellulose. The roof also has another 1 to 4 inches of polyiso under the TPO membrane roofing.

In this example, where outward drying is constrained (especially for the roof), we've chosen to set up reliable drying to the interior. To do this, we installed Majrex directional vapor barrier membrane on the walls and ceilings, with the directional drying face pointed toward the interior.

THE DIRECTIONAL VAPOR CONTROL LAYER

For this application, we needed a variable vapor control material that permits good inward drying in summer, but slows the outward vapor drive in winter. Either Intello (from ProClima) or Majrex (from Siga) will perform in this way, as will MemBrain (from CertainTeed). For this project, we chose Majrex.

Carefully installed, Majrex controls vapor diffusion as well as air transport of moisture, but it's only as good as the installation details. With any moisture-control strategy, it's critical to control both air transport and diffusion of vapor, and to avoid discontinuities in the materials. The good vapor control achieved by this fabric could be compromised if we allowed air-driven moisture to bypass the control membrane. So we covered every inch of the interior, and we were careful to tape-seal around every outlet, every light fixture, and every penetration of any kind, as well as along the floor and the ceiling.

THE ENERGY CHALLENGE

This house is high performance, but only moderately so. The clients in this case didn't place an especially high priority on energy efficiency or power bills; they were more concerned with comfort and appearance. Large expanses of glass, for example, make the most of this home's exceptional water views (see "Installing Lift-and-Slide Doors," Apr/18); but all that glazing is a challenge for the space conditioning system.

Even so, our advisors at Efficiency Vermont, the state's energy-efficiency utility, are confident that the home's mini-split heat pumps can do the job. However, the owners wanted to be sure their floors wouldn't be cold underfoot, so we have also installed radiant-floor-heat tubing under the main floor's concrete slab, as well as beneath the bedroom floors. Highly insulated wall and roof assemblies were key to helping this custom package perform effectively.

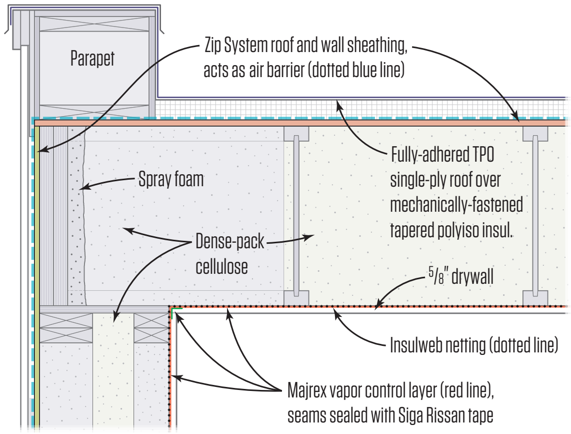
COLLABORATING WITH THE TRADES

In theory, you could use a membrane such as Majrex to contain your dense-blown cellulose insulation. In practice, that's not a great idea. Too many times, we have tried to dense-blow against a membrane in this class, and then when we come back later to inspect, the insulation has settled. The membrane seals so well that the blowing machine's air can't get out of the cavity, so the insulation stays fluffed up and doesn't pack densely enough. The manufacturers suggest cutting escape holes for air in the membrane, but that complicates the taping job. So instead, we used open netting to contain the insulation. That way, we would get a good install job and the ability to inspect easily. The added cost was negligible.

The insulation crew was fine with this, of course. But we had trouble later with the drywall crew. The first drywallers we hired had never worked on a house with this vapor-control detail, and when they arrived to hang drywall, they realized they couldn't use their usual methods. We had carefully sealed all the outlets and other penetrations, and they wouldn't be able to hang their sheets and then buzz out all the openings with a RotoZip—that would break all our well-crafted air seals. After a heated discussion at their van, that crew drove away without doing the job, and we had to find another contractor. Interestingly, the new drywallers we found were able to give us some practical tips about how to complete our air seals without interfering with their work. That's the future of high-performance construction: collaboration among the trades.

Jim Bradley is a project developer and manager with Hayward Design-Build in South Burlington, Vt.

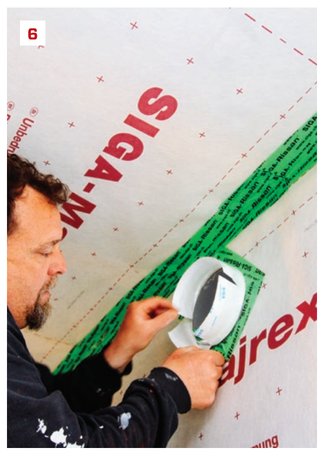
Directional Vapor Control Layer



4

5

6



The airtight outer skin of this building didn't allow good drying for the dense-blown, thick wall and roof cavities (illustration, top). The crew stapled up directional vapor barrier material after the cavities were blown with insulation **(4)**, taking care to seal all the seams at wall-to-ceiling intersections **(5)**, as well as around fixtures and wall penetrations **(6)**.

Concealed Gutters for a Modern Lake Home

BY JOE GRAINDA

My company recently built a large, high-end house with a modern design on a North Carolina reservoir. One of the most prominent features of this home was a wide overhang whose projections varied from just under 3 feet to more than 7 feet in some sections (around 4 feet was the typical overhang for most sections of the multiplane roof).

As a design element, the wide overhang provided ample shade and helped keep rainwater away from the structure, but it presented two challenges. First, to manage roof runoff, the owner (a successful concrete contractor who is very aware of water and site drainage issues) wanted gutters to collect the runoff from the vast and complex roof and deposit it far from the home's foundation. With wide overhangs, however, conventional downspouts on the exterior of the house were out of the question.

Second, in the wind zone for this North Carolina site, wide overhangs present an extreme uplift condition. To overcome these intense forces, the engineer specified some substantial structural elements to strengthen the roof. By cleverly integrating a unique system of concealed gutters with these structural roof elements, our team was able to successfully manage both challenges.

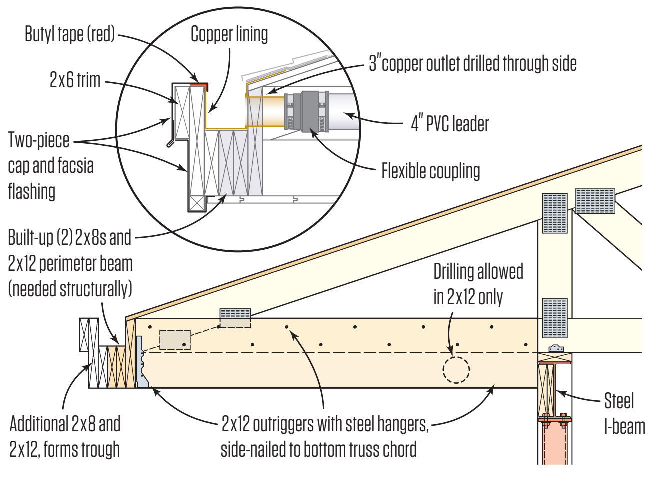
STRUCTURAL ELEMENTS

We framed the roof with trusses, but in order to handle the reaction forces at the fascia end of these trusses, the engineer specified a perimeter beam to tie the ends of the trusses together. We built up this structural component from a 2x12 and two 2x8s sandwiched together. This perimeter structure was secured to 2x12 outriggers with steel hangers and side-nailed to the overhang portion of each truss. The outriggers braced the perimeter beam back to a continuous steel I-beam that tied the tops of the exterior walls together (see illustration, right).

DRAINAGE COMPONENTS

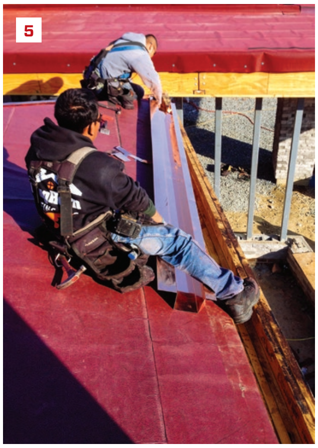
To form the gutter trough, we added another 2x8, followed by two 2x12s, to the perimeter beam. While these framing members were not strictly needed for the structure, they didn't hurt and they provided an easy means to create a channel that we could line with copper to create an integral gutter around the perimeter. In a few cases, the channel beams were placed high

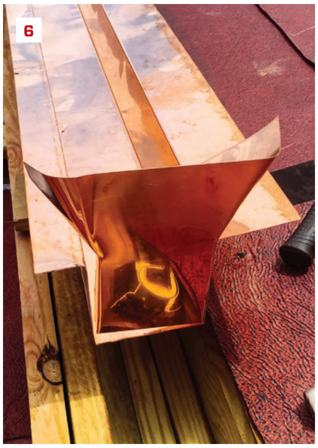
Concealed Gutter Detail



The engineer required three 2-bys for a perimeter beam; the outer members complete the gutter channel **(1, 2)**. Multiple 3-inch drainage outlets Y together and step up to 4-inch runs through the soffit area **(3)**. Vertical drains were routed through several concrete chimneys. Note the rubber sleeves connecting the PVC to the copper outlets at the gutter, and the transition to cast iron where drains run near living space **(4)**.

Photos by Grainda Builders; illustration by Tim Healey





Long runs for the copper liner were bent off site **(5)**, while the end caps **(6)**, corners, and outlets were fabricated on site, and secured with both rivets and solder **(7)**. The roof was dried-in early; the tape was temporary until the roof could be installed. A two-piece fascia cap and T&G soffits **(8)** finish off the installation. The entire gutter system is completely concealed.

enough on the roof that we could drill drainage outlets in the bottom of the channel. But in most cases, we had to drill through the side. The engineer allowed us to drill through the beam, but we had to limit the hole diameter to 3 inches.

To handle the sheer volume of water we expected from seasonal Carolina storms, we ganged multiple outlets, and enlarged to 4-inch pipe inside the eaves structure to reduce the number of leaders. To accommodate differential movement between the copper outlets and the PVC drains, we connected our drains to the gutter using rubber sleeves.

The PVC drains ran through the soffit area, turning to run parallel to the exterior walls. The engineer allowed us to drill through the 2x12 outriggers, as well, but not through the truss chords. While we didn't have a lot of room, we were able to pitch the drainage pipes to achieve the required 1/8 per foot (1%) slope needed for 3- and 4-inch pipe.

To drain out of the eaves area, we ran the PVC to numerous chimneys placed along the exterior walls. We core-drilled through the formed concrete chimneys to run our verticals inside to the foundation level. In areas where the vertical drains ran near living space, we transitioned to cast iron to limit noise. We then transitioned back to PVC below floor level where the drains joined to exit alongside the foundation perimeter drains to daylight, far from the house.

FINISH DETAILS

We pre-bent the long copper troughs off site and site-bent the end caps and outlets, mechanically joining the copper with rivets before soldering watertight seams. All this work was done after the roof had been dried in, so after installing the copper liner, we taped along the edge of the copper as a temporary measure until the roofing could be installed.

To finish off the fascia, we installed a two-piece aluminum fascia cap. The first piece nailed to the outer 2x12, and was counter-flashed by a second piece that locks in with cleats, so there were no visible fasteners from the ground. This second piece overlaps the copper liner but is separated with butyl tape so the two metals do not have a chance to galvanically react.

Once the project had been completed, you wouldn't know there were any gutters and downspouts on this roof. Yet this summer, a number of torrential thunderstorms have already passed through, and the system handily carried all the runoff away with no detectable spillover.

Joe Grainda is the president and founder of Grainda Builders, a luxury homebuilder based in Cornelius, N.C.