



Fixing the Bonus Room

A room over the garage shouldn't always be a warranty issue

BY MATT BOWERS

I'm a HERS rater and project manager for Airtight Services, a home-performance contractor in upstate New York. In the photo above, one of our carpenters is cutting open the gable-end wall over a garage on a brand-new house. He's starting one of the jobs that have become part of our bread and butter: an energy upgrade performed as warranty service for a home builder on a cold, leaky "bonus room" over the garage.

In our area, bonus rooms have been a common feature of new construction since the 1970s. That's because builders here have optimized their plans to fit more houses on a development, and one way they create inexpensive square footage is to build a second-story room over an attached garage, framing the roof and the bonus room in one quick step using an attic truss. The bottom chords of the

trusses form the garage ceiling as well as the bonus-room floor. Vertical webs of the trusses form the sidewalls of the room.

It's a frugal way to build what could be usable space, but the result is often uncomfortable space. Time after time, we are called because a homeowner has just moved into a house, and the room over the garage is 20°F colder than the rest of the house in the winter—the main house is a cozy 68°F, but the bonus room is in the 40s or 50s. We find this condition not only in older homes built under obsolete codes, but in brand-new houses built to comply with the 2009 International Energy Conservation Code (IECC) and even in homes built under the recently adopted 2015 IECC. The example shown in this story—a typical case—is warranty work on a new house built to comply with the 2009 energy code.

FIXING THE BONUS ROOM



To construct a typical bonus room, the builder first installs OSB subflooring on the truss chord **(1)**, then insulates the vertical sidewall truss webs with kraft-faced fiberglass batts **(2)**, stapling the facing to the sides of the 2x4 webs. Next, the builder applies drywall to the room walls—leaving space below the drywall **(3)** for the carpet installers to attach a tack strip. After carpet and trim are in place, a huge air gap remains at the base of the wall **(4)**, communicating with the cold vented attic.

Now that the 2015 IECC has been adopted in New York, rooms like this one are likely to cause new homes to flunk the building envelope airtightness standard. New York's new energy code requires homes to achieve no more than 3 air changes per hour at 50 pascals of pressure (3 ACH50) during blower-door testing.

The photos above show a typical bonus room at various stages of construction. Because the framing is basically a set of trusses, there is no wall plate at the bottom of the wall. As a result, there's a gap—typically a big gap—at the bottom of the wall. This allows air to leak freely into the room from the space behind the wall, which is connected to the outdoors via the roof eave soffit vents.

Bonus rooms have big leaks. In pressure diagnostics, if I close the door to a bonus room and isolate it, I often measure a 20- to 25-pascal difference between the bonus room and the main house—and you can feel the air pouring in under the door.

To make matters worse, the typical forced-air heat for a room like

this tends to underperform. The ducts serving the room typically are insulated to only R-4.2 and run the 24-foot length of the garage through unheated space and then back to the furnace in the basement—often the longest duct run in the house. The thermostat is generally located in the family room on the first floor. So, controlled by calls for heat from the warm inside of the house, the furnace would struggle to heat the bonus room adequately even if the bonus room weren't leaky, poorly insulated, and exposed on five sides to outdoor temperatures.

Bonus-room conditions can get extreme. We've walked into older bonus rooms, built in the 1970s or 1980s, with built-in dresser cabinets added to the knee wall, projecting into the cold space. One occupant's main complaint was frosty underwear on winter mornings. Homeowners in these situations aren't focused on their heating and cooling bills. They don't care what it costs, or how much they will save; they just want to be comfortable.



Working from outside, a carpenter cuts into unheated space above the garage next to the bonus room (5). Under the low roof, he finds the back of the bonus-room wall (6), with a plastic air barrier stapled to the wall over the fiberglass insulation (but not sealed at the top or the bottom). With the plastic removed, the R-19 batts bulge out beyond the 2x4 framing (7). Where the wall meets the floor, nothing blocks air from flowing through fiberglass batts installed under the subfloor (8).

CUTTING IN

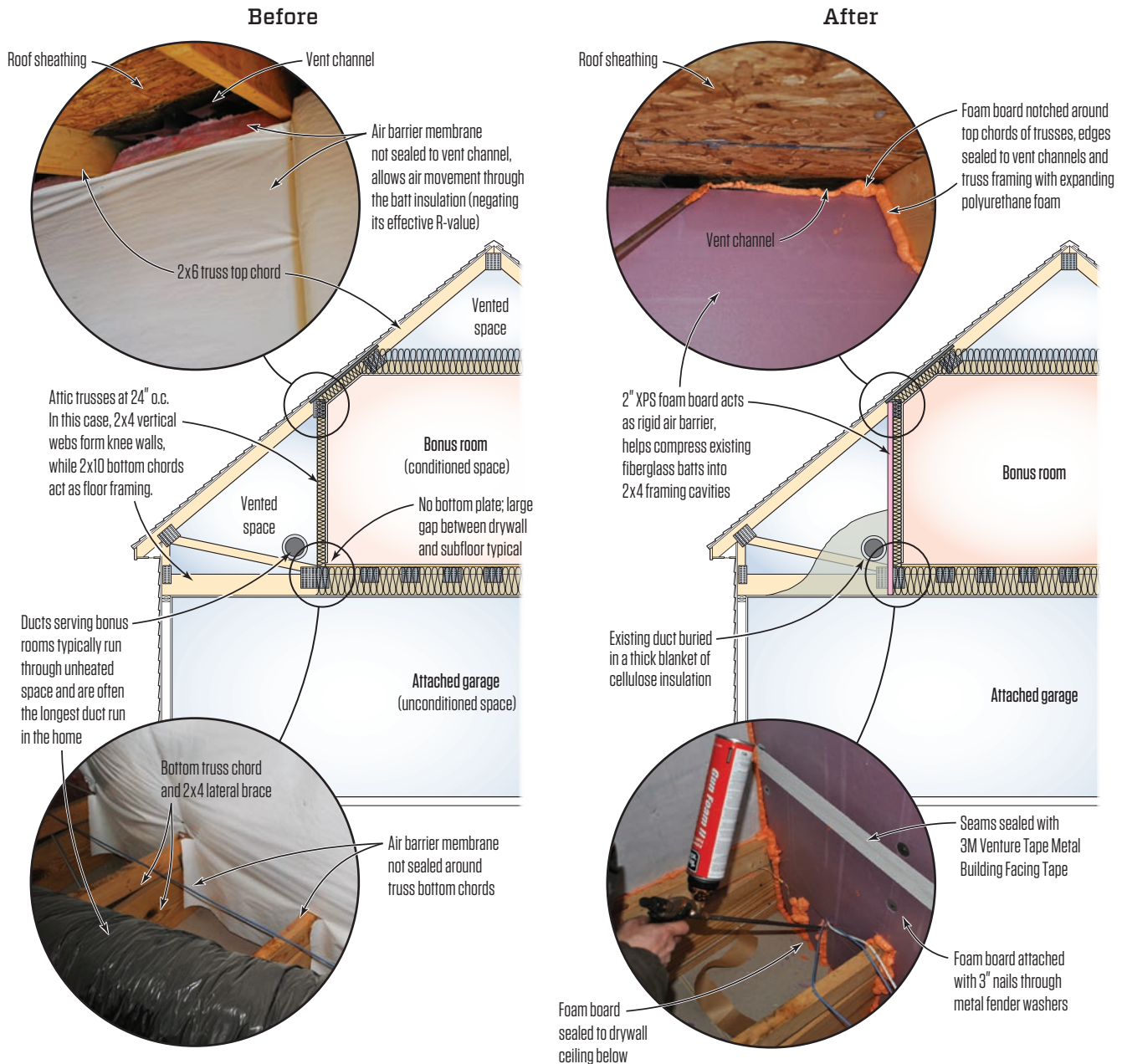
Before we start a job like this, I look in the bonus room to make sure that there aren't valuable things hanging on the walls. We are going to be nailing up an air barrier from the other side and don't want to knock anything off the wall. I also find out where the duct registers are, so that we'll have an idea of what to expect when we open up the space behind the wall. And finally, I like to double-check the room dimensions to make sure that when we cut open the gable end of the house, we won't cut into the occupied space. I take a measurement from the window to the knee wall inside the room, and then we measure off the same window when we choose a place to cut open the gable end.

Gaining entry through the gable end is the simplest approach. We could cut through the drywall from inside the room, or we could go in through the ceiling of the garage, but then it would be hard to patch up the holes we would make. Vinyl siding just unzips; then you take

a couple of nails out and peel back the housewrap, cut out a piece of sheathing, and climb in. On the way out (see photos, page 64), you replace the sheathing, tape up the housewrap, rehang the vinyl, and move along.

What we found in the space behind the bonus-room knee wall in this house is typical (see photos, above). The white plastic air barrier is not sealed at the bottom or the top. With the plastic sheeting removed, the R-19 fiberglass insulation bulges out from the 2x4 wall framing cavities. When I fold back that kraft-faced wall insulation at the bottom, we see the condition under the floor: two insulation batts stuffed up into the truss bays from below, with the lowermost batt's kraft facing stapled to the truss sides to hold the insulation in place. And it's a little hard to see in these photos, but the joint between the subfloor and the drywall is open half an inch, as in photo 3 on the facing page—and there's daylight between the baseboard and the carpet.

Bonus Room Energy Retrofit



As originally built (above left), the bonus room's air barrier allowed free airflow through the fiberglass insulation under the floor and in the walls. The author's repair (above right) created a rigid air barrier that air-sealed the living space, protected the floor and wall insulation from air infiltration, and boosted the wall system's nominal insulation value from R-19 to R-24.



Above, carpenters notch and fit 2-inch XPS insulation board over the wall studs, fastening the board with nails and washers as they compress the R-19 batts into the wall framing cavities **(9)**. They cover the whole wall with 2-inch (R-10) XPS, notching around the upper truss chords at the top of the wall **(10)**. They seal the foam board to the framing with gun foam, sealing duct penetrations at the same time **(11)**. Finally, they tape the seams between sheets of foam board to perfect the airtight seal **(12)**.

CREATING AN AIR BARRIER

On the left side of the illustration on the facing page, you can see the deficiencies that made this room so uncomfortable; on the right are the repairs that our crew made. When the original plastic air barrier membrane was installed, somebody took time to notch it out around the bottom chords of the trusses—but it was never sealed. Our goal was to seal our air barrier all the way around the truss chords and seal it to the drywall underneath.

Fabric wraps are difficult to work with, so we like to use a beefy rigid air barrier material here. For this job, we used 2-inch XPS foam, which adds R-value and is stiff enough to compress the existing R-19 batts into the 2x4 wall cavities (note: some jurisdictions may require a fire-rated material such as Dow Thermax at this location).

We notched the XPS out carefully to fit around the trusses, making sure the board contacted the drywall at the bottom of the truss cavity, and attached the boards with 3-inch nails and wash-

ers, which we have found give a better positive attachment than ordinary cap nails.

Compressing the R-19 batts into the 2x4 cavity gives an effective R-value of R-14; in new construction, a high-density R-15 batt would cost less and perform better. But with the XPS, our retrofit still achieves a nominal R-24. And by abating the convection and thermal bridging that had reduced the effectiveness of the original R-19 batts, our upgrade substantially boosts the wall's performance.

At the top of the wall, the existing air barrier membrane was never sealed to the vent channel installed under the roof sheathing—again, exposing the fiberglass to wind-washing. So when we notch the foam board around the top chords of the trusses, we seal the edges to the vent channel as well as to the trusses.

Finally, we seal the seams between the pieces of foam board using 3M Venture Tape Metal Building Facing Tape, which clings tenaciously and is much cheaper than some specialty tapes.



With the new foam-board air barrier in place and sealed with gun foam and tape, the crew augments the insulation wrap on the flexible heating duct with an additional 10-inch blanket of blown cellulose (13, 14). Then the carpenters nail the cut-out section of wall sheathing back in place, and reattach the housewrap and seal the seams with tape (15). Finally, they replace the vinyl siding (16), leaving no visible trace that any repair ever happened.

A BLANKET FOR THE DUCTWORK

As I mentioned earlier, the ductwork for a bonus room tends to be the longest duct run in the home, and it's usually only insulated to R-4.2. The airflow in the ducts suffers from friction losses, and the air loses heat to the cold attic space as it makes its way to the room. So after we seal up the insulated air barrier for the bonus-room knee wall, we install a thick blanket of cellulose insulation around the duct. This helps keep the supply air coming into the room nice and warm. We put about 10 inches of insulation on all sides of the duct—including below it—for a good R-30 to R-40.

With that done, all we have to do is go back out through the hole in the wall, nail the OSB sheathing back in place, staple the housewrap back onto the wall, and tape the housewrap seams. Then we reattach the vinyl siding, and we're done. It's a one-day job; start to finish, the whole job typically takes about three hours for each side of the room.

So how could a builder avoid this callback? Well, the big problem is the air barrier, and the major flaw is the floor-to-wall joint. So when the subfloor and the drywall are both installed, but before trim or carpet are installed, one good step would be to air-seal that joint with a can of gun foam—or better yet, with tape. Blocking nailed between the trusses behind the drywall at the wall base, to make up for the missing wall plate, would also help.

If you are hoping to meet an above-code standard or to surpass code-required insulation and airtightness levels in this relatively vulnerable room, there's another option: Specify a truss with a shorter knee wall, and frame a whole separate wall inboard of that for your room. That way, you'll have room for more insulation than an R-19 batt.

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