Curing Crawlspace Moisture Problems

by Howard Ferree

A lot of the repair work we do here in eastern North Carolina involves rotted wood in crawlspaces. Floor joists, beams, and subflooring can deteriorate quickly in this cool, damp environment. Many of the homeowners we have dealt with don't inspect their crawlspaces on a regular basis; in fact, some have never been beneath their houses and could not be persuaded to visit there under any circumstances. Who can blame them? From mere nuisances, like standing water and cobwebs, to downright dangers, such as wolf rats and poisonous

In some cases, ventilation may make the problem worse

Figure 1. Crawlspace moisture problems often go undetected because homeowners are reluctant to scramble through the low headroom and the tangle of wires, pipes, and fallen insulation. Left unchecked, however, water from plumbing leaks, surface drainage, and a high water table can spur the growth of mold and mildew, and eventually lead to decay of sills and joists.

Figure 2. Localized plumbing leaks are easy to find. The repair usually involves simply replacing a small section of subfloor and occasionally beefing up a spongy joist.

snakes, the typical crawlspace is a less-than-desirable place (see Figure 1). It is usually a termite treatment contractor or a home inspector who discovers the wood rot and reports it to the homeowner.

The moisture that causes crawlspace wood rot can come from leaky plumbing, rainwater, or condensing water vapor. If the damage is from a plumbing leak that has gone undetected for years, the source of the leak is usually easy to find and fix (Figure 2). Where rainwater has leaked in from windows, doors, roofing, or siding that were improperly installed or have been poorly maintained, the source can be a little harder to pinpoint. The cure, however, is often as simple as caulking a sill or tarring a piece of flashing on the roof.

Condensation. Sometimes, however, the wood rot is caused by water vapor that has condensed in the crawlspace. Some of the houses we have been under were so wet that it would have been more appropriate to wear a raincoat than coveralls. Although these were extreme cases, the moisture content was so high that water was dripping from joists, ductwork, plumbing pipes, and even the insulation overhead. In most of these situations, we found that the bottom of the subfloor behind the insulation was dry, indicating that we had a condensation problem and not a leak.

With plumbing and rainwater leaks, the wood rot is typically confined to one or two places. The repair involves beefing up a joist or patching a small section of subfloor. When condensation is the culprit, however, the extent of the damage can range from mere surface discoloration to complete decay of the entire floor system if the problem has gone unchecked.

One floor system we repaired had wood rot in about 30% of the joists and many of the girders and sills. The repair work was both unpleasant and expensive: In some areas of the crawlspace, we only had about 12 inches between the ground and the bottom of the joist to work in. Because of the poor working conditions, the repairs took three times as long as they should have. After facing a near mutiny from my crew, I decided that we would do those kind of repairs only if there were at least a couple of feet of headroom, or if we could remove the subfloor and work from above.

Condensation Causes and Cures

Eastern North Carolina has many attractive features, but its hot, humid summers are not among them. Combine that hot, humid air with the naturally high water table in some areas, and you have an extremely high potential for crawlspace condensation. Although most houses have been built to code,

many have been built in low-lying or flat areas without the proper backfill or drainage system. Even though the codes change constantly to try to keep up with the problems, we always try to convince our customers to pay for more than the code requires. After we explain what we plan to do and why, they generally see the wisdom of our preventive approach.

Crawlspace ground cover. When the cause of the condensation is not obvious, we usually start with the simplest and least expensive cure: We lay a poly vapor retarder over the entire floor of the crawlspace. The building code for our area does not recommend 100% coverage of the crawlspace area with a vapor retarder. This is to prevent the floor system and hardwood flooring from drying out and cracking. However, I have only heard of two cases in this part of the country where a poly sheet caused that problem. Most of the time the opposite is true, so we use full coverage to keep any moisture from the soil from migrating into the crawlspace.

We use clear 6-mil poly, lapping the seams about 4 feet. We cut around any posts or piers, and bring the sheet all the way out to the perimeter walls. Since the crawlspace doesn't get any traffic once the work is done, we've never had to weigh it down or tape it in place.

Drainage. Rainwater can enter through the foundation walls if the exterior grade is higher than the crawlspace grade. Waterproofing the foundation rarely works, however, because the water can still come up from underneath if the floor of the crawlspace is exposed dirt. Also, the crawlspace floor is usually never more than 8 to 10 inches below the outside grade. Since there is usually another 12 to 18 inches of foundation below that, we'd have to excavate to waterproof the wall properly.

If there is standing water, a less expensive and more effective solution is to add drainage pipes or a sump pump. Sometimes the water flows in shallow rivulets to a single collection point. In this case, we dig a shallow hole at the low point, then run solid PVC drainpipe through the foundation wall to daylight (Figure 3). If the exterior grade won't permit gravity drainage, we use a sump pump in the crawlspace and discharge the water well away from the building.

If the ground is generally wet but water isn't pooling in one spot, we dig shallow trenches through the crawlspace floor and use perforated PVC drainpipe to collect the water. Then we either pipe it to daylight or install a sump pump.

Ventilation

If the crawlspace is well drained and is sealed

Crawlspace Drainage Strategies

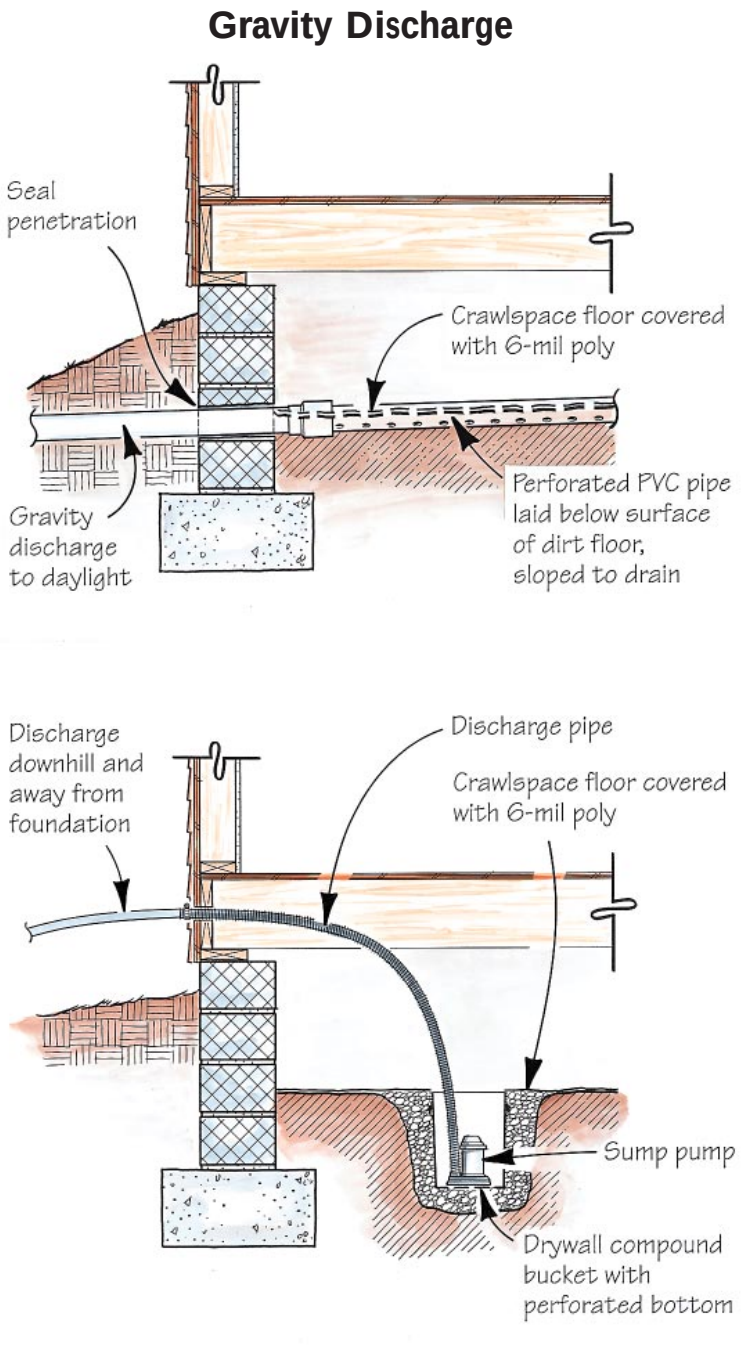

Figure 3. To remove standing water from a crawlspace, the author runs PVC drainpipe through the foundation to daylight (top). If the exterior grade is too high for gravity drainage, he installs a sump pump and discharges the water well away from the foundation (above).

Figure 4. Rather than seal the crawlspace completely, the author uses a dehumidistat to measure crawlspace humidity and a humidistat to measure outside humidity. When the outside air is at least 10% drier than the inside air, these controls activate the fan to vent the crawlspace.

against moisture from the ground, the condensation problem is usually caused by the crawlspace vents. At first, this makes no sense. "It looks like a humidity problem," you say, "so we'll just put some exhaust fans in and suck all that evil moisture right out!" We have found, however, that many of the houses with condensation problems already had exhaust fans running on either a timer or a thermostat. When I first encountered this problem, my immediate reaction was to install bigger fans. But as I looked into it a little further, I discovered that bigger fans just make a bad situation worse.

Consider the source. One of the first people I spoke with was the energy conservation officer at the local utility company, because he had nothing to gain from giving slanted advice (as is sometimes the case with overzealous salespeople). His commonsense reasoning was that the crawlspace venting pulls warm, humid air in and across the cold joists and ductwork in the crawlspace. When warm, humid air hits a cold surface, it condenses; the fans were just making the problem worse by speeding up the process.

His recommendations were to seal up the vents and caulk any cracks in the foundation. This solution runs contrary to code, and to the "more is better" rule of thumb for roof venting. But attic air is almost always warmer than the outside air and therefore does not create condensation the way the air in a cool crawlspace does. So please don't go out and seal up your ridge or soffit vents. If you have a moisture problem in an attic, more venting probably will help. I have yet to find an attic with a humidity problem from too much ventilation.

Test Case

At the time I first talked with the utility company, I was still having a condensation problem in my own crawlspace. When I built the house, I had put down poly on the floor of the crawlspace and covered it with a 2-inch-thick slush coat of concrete. You can imagine the sinking feeling I got when, after a couple of months, I discovered a small puddle of water in the middle of my concrete crawlspace floor.

After talking with the utility company, I immediately went home and closed my vents. Within a few months, condensation in the crawlspace had almost completely disappeared. So where did the remaining moisture come from?

I figured that I had done such a good job in sealing off the crawlspace that I had prevented the original moisture from escaping. So I decided to open the vents when it was cool and dry outside, and keep them closed the rest of the time. Bingo! End of problem. But this solution was impractical, especially for typical homeowners. Even if they were diligent enough to open and close the vents, determining when conditions were right would be a guessing game at best.

Humidistat Controls

One solution I've seen is to use humidistats on the fans instead of timers or thermostats, but the results are inconsistent. For a humidistat to work, the moisture content of the air outside must be lower than the moisture content of the air inside; if not, you will still get some condensation.

I reasoned that we needed to determine the moisture content of both the inside and outside air, so our most recent hookup involves a fan with both a humidistat and a dehumidistat (available from Tek Supply, 800/835-7877). With the dehumidistat located inside and the humidistat outside (Figure 4), the system is set up so that the fan will turn on only if the air outside contains about 10% less humidity than the air inside. Although this system does not take temperature into account, so far it seems to be working.

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