# Rot-Resistant Deck Details

For a deck that lasts, seal cut ends, space deck boards far enough apart, and reduce places where leaf litter can collect

by Kim Katwijk

Millions of wood decks are built every year. Unfortunately, many of them will deteriorate long before they should. As a deck builder in the Pacific Northwest, I have a lot of experience demolishing and replacing rotted decks. I want what I build to last, so when I tear down a rotting deck, I try to figure out what went wrong.

## Know Your Enemy

Rot is a fungus, an organism that feeds on and destroys natural materials like lumber. The spores it uses to reproduce are nearly everywhere and will grow wherever conditions are right. There are many different types of rot, but they all require food and moisture to survive. If you understand how these organisms grow, you can build decks that are less hospitable to them.

***Food source.*** Most decks — particularly the structural framing — are made

**Figure 1.** Pressure-treated hem-fir lumber is incised to increase penetration, but often the colored preservative barely soaks in at all, as is evident on this piece of blocking. The end cut should have been coated with preservative; the brown staining visible on the end grain is a sign of rot.

from woods that are susceptible to rot. Because the companies that treat lumber use local materials, the wood you use depends on where you work. From Denver east, builders use pressure-treated southern pine, a kind of wood easily penetrated by chemical preservatives. On the West Coast, we use pressure-treated hem-fir, a species group that does not accept chemicals very well. Frequently, only the outer surface contains preservatives, so the interior of the lumber is unprotected and susceptible to rot (see Figure 1).

***Moisture.*** Wood won't deteriorate unless moisture is present. Green lumber often contains enough moisture to rot, but even materials that start out dry can become wet when they're exposed to the weather, washed, or used as a surface for potted plants.

Some kinds of rot fungi, the wet rots, require a wood moisture content of 30 percent or more to survive. Many types of rot will do just fine as long as the wood has a moisture content of at least 20 percent, a threshold easily reached in damp climates like ours.

People often speak of "dry rot," but if lumber is dry, it will not decay. So-called dry rot fungi are a specific type of brown rot that sends out hyphae, strands of tissue that can transport moisture from surrounding wood. But this can't happen unless the surrounding wood is wet. If you can keep a deck below 20 percent moisture content, it won't rot.

## Collection Zones

A typical deck harbors hundreds of places where organic matter can collect and sit. I call them collection

**Figure 2.** On this deck (above), water got between the fascia and rim, partially rotting the fascia and completely destroying the rim. When the fascia was removed, the rim collapsed. Here (right), the author installs composite decking on a pressure-treated frame that will completely cover the fascia and rim, avoiding this potential collection zone. The lattice separating the fascia and rim joist will also help to drain away water.

zones. Every time it rains or the wind blows, leaf litter — leaves, needles, twigs, dirt, dust, and grass clippings — finds its way into the gaps and cracks in the deck. The collected material holds moisture, so that a deck full of collection zones mimics the natural habitat of fungus — wet fallen wood on a forest floor.

A collection zone can be very small. For example, when a baluster is nailed to the face of a rim joist, the area where the two pieces meet is a collection zone. Poor deck design and building practices increase the size and number of these zones. Once the collected material becomes wet, rot will attack any unpreserved wood in the area.

The best way to prevent this is by limiting the size and number of the collection zones. If you prevent moisture and debris from getting into places they can't get out of, you reduce the potential for rot.

***Fascia detail.*** Some common building practices create perfect collection zones. For example, many carpenters rim the deck with a fascia board (Figure 2, facing page). There is usually no airflow between the fascia and the framing, so the 20 percent moisture content required for rot can be maintained over long periods of time. Water takes debris down between the fascia and the rim joist. Once organic matter gets into this collection zone, there is no way to get it out.

It's best not to use a fascia at all, but if one is required, cantilever the deck boards one inch over it. This detail greatly decreases the likelihood of rot because it reduces the size of the areas that dirt and moisture can get into. One way to compare construction details is by looking at how many linear feet of collection zone each design creates (Figure 3).

***Built-up beams.*** It's common practice to double or triple up 2-by material to form beams. Unfortunately, the space between the pieces is a perfect collection zone. It's better to carry loads with solid 4-by or 6-by beams.

## Attaching Ledgers

Another common building practice is to use flashing to keep moisture from getting between the house and ledger. The Uniform Building Code requires flashing, and many contractors meet the requirement by installing an L-shaped piece of metal. The hori-

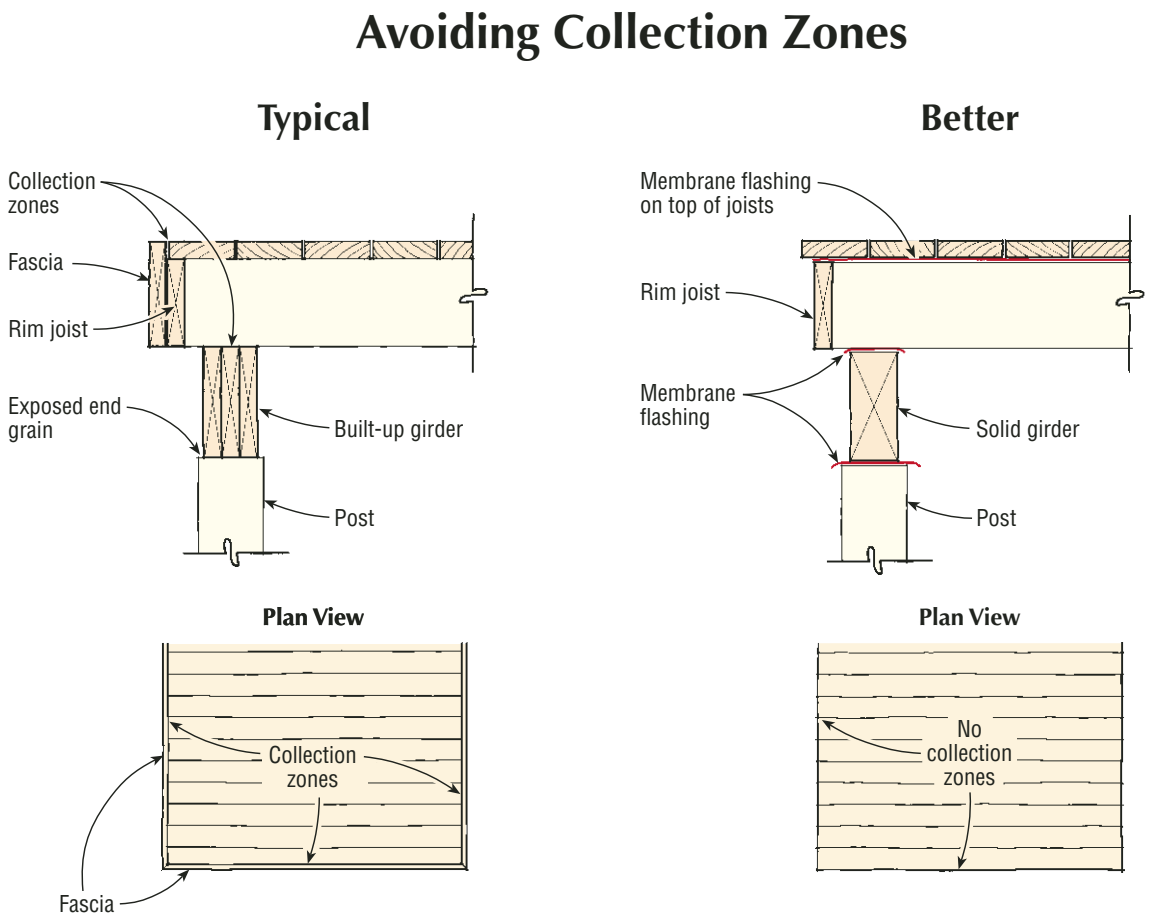


**Figure 3.** Wrapping a 12-by-16-foot deck with fascia (left) creates 40 linear feet of potential collection zones at the rim joist. Running the deck boards parallel to the house and overhanging the fascia will reduce the collection zones to a cumulative 12 1/2 inches (1/4 inch per gap x 50 gaps = 12 1/2 inches). While some water and debris will get in, the greatly reduced amount will be much less likely to cause rot.

zontal leg covers the top of the ledger and the vertical leg goes up the wall and is lapped by the building paper and siding above. Most carpenters install the ledger in the same plane as the joists, so the deck surface ends up an inch or more higher than the horizontal leg of the flashing. This creates a perfect collection zone, because if something falls in toward the house, the flashing will prevent it from falling through to the ground (Figure 4). If enough organic matter collects on the flashing, it can induce rot in the adjoining deck board or invade the siding above.

There are many ways to deal with this problem, but whatever you do, you still need to flash the connection. The simplest method is to use a ledger that is taller than the joists and install it so the top edge will be in the same plane as the deck boards once they're installed. The flashing should come down the wall from behind the siding and building paper, run across the top of the ledger, and end in a lip that laps down the face (Figure 5, next page).

Another option would be to space the ledger off the building so that there is a minimum 1/2-inch gap between the ledger and the wall. Most debris will fall through a 1/2-inch gap; any leaf litter that doesn't can be cleaned out. (Since it's impossible to eliminate every single collection zone, we tell clients that if they want the deck to last, they will need to maintain it by removing any leaf litter that collects.) This type of connection is trickier than it looks, so we hire an engineer to design it to support the necessary loads (see "Load-Tested Deck Ledger Connections," 3/04).

## Deck Boards

Many carpenters use 16-penny nails to space deck boards. This creates a 1/8-inch-wide gap that forms a perfect collection zone between boards and on top of every joist (Figure 6, page 6). It's nearly impossible to remove leaf litter from such a narrow gap. Once the organic matter gets in, it will start to rot the deck boards and the joists below. Some contractors think they don't have to worry about this because they use redwood or cedar decking. Unfortunately, decking is no longer

**Figure 4.** Although it's common practice to bring an L-shaped flashing down the wall and kick it out over the ledger, the resulting pocket can collect debris and rot both the decking and the siding above.

made from old-growth lumber. Most of the deck boards you can buy now contain a lot of sapwood, which, unlike heartwood, has very little resistance to rot.

The way around this problem is to install decking with a larger gap. We never use a gap less than 1/4 inch wide; a 3/8-inch gap is preferable. Organic matter will not collect in the larger space, but will fall through. Where it does collect on top of joists, the space is wide enough to be raked clean with a screwdriver or deck-cleaning tool. The larger space also allows air to circulate and dry out the decking and structure below.

The same rules apply to composite decking such as Trex. Captured organic matter may not affect the deck boards, but it will pile up on and rot the framing below.

***Placement of boards.*** It's amazing how much leaf litter will fall through a 1/4-inch gap and land on top of a beam. It's good practice to plan where the decking will land and position beams and joints so they are not directly under a gap. Another way to minimize this collection zone is by running the deck boards at a 45-degree angle to the framing and beam. Less leaf litter will land on the beam because the gaps that pass over it will be farther apart.

***Maintenance.*** We tell clients to maintain their decks by washing them with a deck-cleaning product like Defy TimberWash or Sun Frog Deck Cleaner (see "Sources," page 8). I recommend doing this twice a year after major pollen events, which in this area land in October and March.

Wood decks should be stained and sealed to prevent sun damage and to repel moisture. To increase absorption, this work should be done during the driest months of the year. We use Wolman F&P Finish and Preservative, Sun Frog Deck Sealer, or one of the TWP deck and furniture finishes.

## Wood Railings

Many carpenters install 2x2 balusters by nailing them to the rim joist and then lapping over them with a fascia. This is easier than other methods, but it's poor practice, because it creates two rot zones, one where the baluster hits the rim and another where the baluster

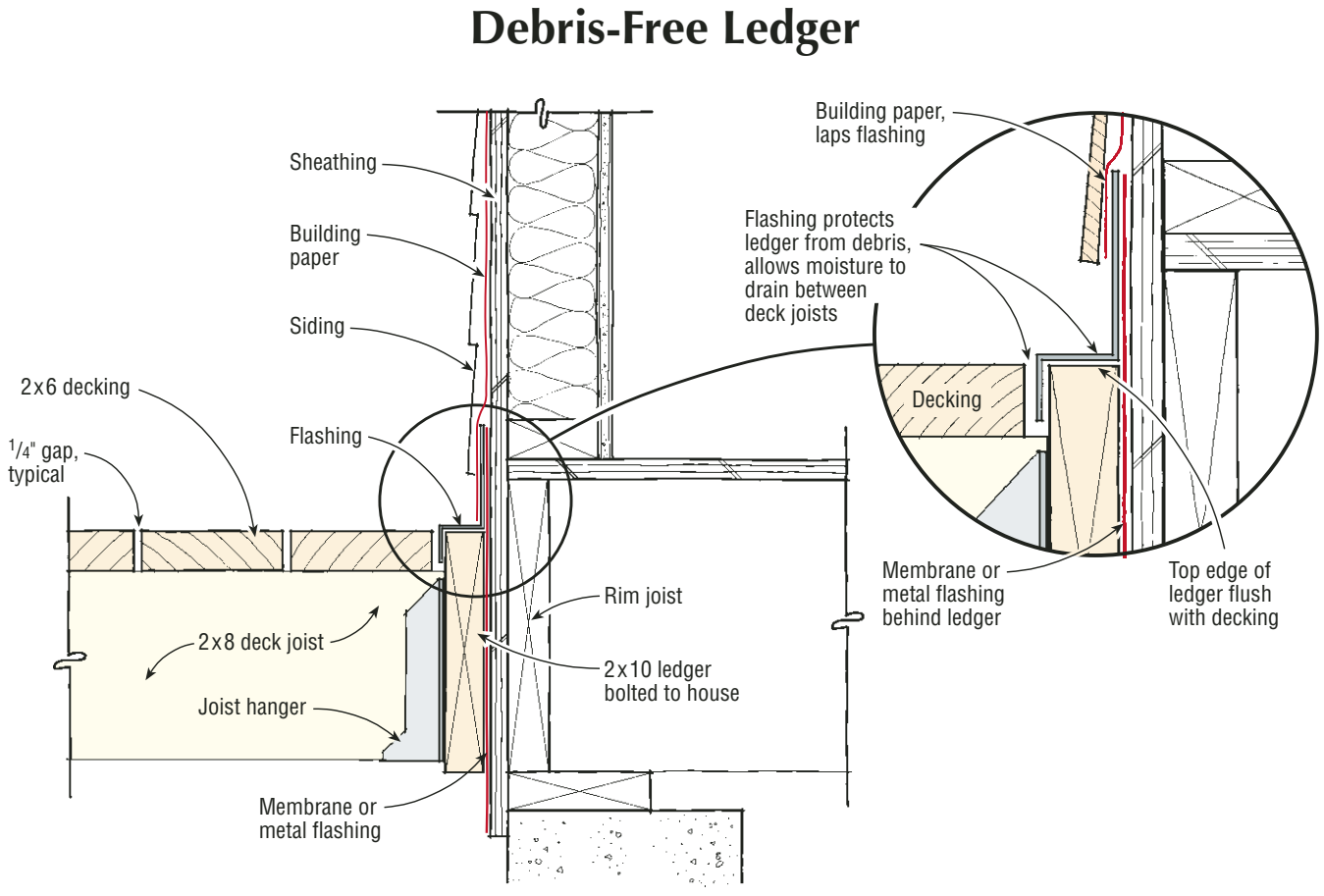


**Figure 5.** To avoid creating a collection zone between the house and the deck, position the ledger flush to the deck boards. There are two pieces of flashing, one behind the ledger and another over the top of it.

hits the fascia (Figure 7, next page). There are so many nails in the rim that it ends up looking like a pincushion. The large number of fasteners can split the balusters or rim and allow water to get into the wood.

To prevent rot, it's better to install posts every 5 feet or so and span between them with rails that support the balusters. Avoid notching posts, but if a post must be notched where it hits the rim, the notch should extend high enough to lap onto the deck boards. This is better than butting deck boards into the side of the post, because it takes what would have been a vertical crack and turns it into a horizontal one that debris has a hard time getting into. Lap or no lap, the joint between the post and decking should be sealed with caulk.

## Pressure-Treated Lumber

The substructure of a deck needs to survive the harshest conditions, so in most cases it should be made from pressure-treated lumber. Currently, alkaline copper quat (ACQ) is the most common chemical for pressure-treating wood. Pressure-treated lumber is graded on the basis of how much chemical preservative is retained by the material. Retention is measured in pounds per cubic foot (pcf); the higher the pcf of preservative, the better the lumber will be able to resist rot. With ACQ, standard practice is to use .25 pcf material above ground, .40 pcf material for lumber that will be in contact with the ground, and .60 pcf material for pilings and marine applications.

To be on the safe side, we frequently frame substructures with .60 pcf lumber. Even so, there is no guarantee that the structural members won't rot. This is because the chemicals are unlikely to penetrate all the way through the material, especially large structural members like 4x4s, 4x6s, and 4x8s. This problem is more common on the West Coast, where hem-fir is used, but it can also

**Figure 6.** Most carpenters space deck boards too tightly (above), leaving enough room for debris to get in but no way to clean it out. On this deck, organic matter collected at every gap and joint (above left), as well as between a rim joist and blocking that landed under a gap in the deck boards (left).

happen with southern yellow pine.

To help the chemicals penetrate more deeply, the pressure treaters incise (cut slits in) the surface of the lumber. But wood expands and contracts as it gains and loses moisture, and this can cause cracks to open and admit water and organic matter to areas that aren't preserved. Under certain conditions, the lumber will rot from the inside out.

***Sealing cuts.*** There's not much you can do about checking and cracking, but you *can* protect the untreated wood that is exposed when you drill or cut pressure-treated hem-fir. We treat cuts with a liquid preservative that contains 9 percent copper naphthenate (Figure 8, next page). There are many such products on the market. Two of the better-known brands are Jasco Termin-8 Wood Preservative and Wolman Wood End Cut Preservative. We brush this material onto all end cuts and into any holes we drill in the wood.

***Untreated lumber.*** Pressure-treated lumber is not very attractive, so there are times, especially for upper-level decks, when we use untreated lumber for beams. You should do this only when there will be enough airflow to discourage the growth of rot.

To prevent the material from rotting, we take a couple of precautions. First, we contaminate the food source by treating the wood with a borate product such as Tim-bor. Frequent wetting may cause the borate to leach out of the wood, so it's necessary to coat borate-treated surfaces with a water-repellent sealant.

We also create a moisture barrier by sealing the top edges of joists and beams with strips of torch-down roofing material (Figure 9, next page). Torch-down roofing is designed to stand up to UV rays and will self-seal where nails penetrate it. We make the membrane stick by heating it with a torch, and produce a drip edge by allowing it to project about 1/2 inch beyond the edges of the lumber. Grace Construction Products recently introduced a

**Figure 7.** Nailing balusters to the rim joist creates pockets that trap moisture and debris, which can cause rot (below).

product designed specifically for this purpose, Vycor Deck Protector.

## Other Details

Lumber won't rot if you keep it dry. We try to keep posts up off the ground by installing them on piers formed with Sonotubes. The piers extend 6 inches above grade; to prevent moisture from wicking up the post, we seal the lower end with torch-down roofing material. We also use this material to seal the top ends of posts, especially when they're made from untreated lumber.

It's important to create opportunities for airflow under low-level decks. If the design calls for skirting, we enclose the area below with open lattice or vertical boards with gaps of at least 3/4 inch between them. To encourage airflow, we space the deck boards 3/8 inch apart. When the deck is low and air circulation is limited, we frame the substructure with .60 pcf treated lumber.

***Kim Katwijk*** *is a deck builder in Olympia, Wash.*

**Figure 8.** It's a good idea to coat pressure-treated yellow pine end cuts with extra preservative. With hem-fir, which doesn't accept pressure treatment well, it's an absolute necessity to do so.

**Figure 9.** To keep this deck — which is framed with untreated lumber — from rotting, the author coated it with a borate preservative and covered the upper surfaces with torch-down roofing membrane.

## Sources

**Defy TimberWash** (deck cleaner)
SaverSystems
800/860-6327
www.saversystems.com

**Sun Frog** (deck cleaner, stains, and sealers)
Sun Frog
800/488-3764
www.sunfrog.com

**Termin-8** (end-cut solution)
Jasco Chemical Corp.
888/345-2726
www.jasco-help.com

**Tim-bor** (borate preservatives)
Nisus Corp.
800/264-0870
www.nisuscorp.com

**TWP** (stains and sealers)
MFG Sealants
800/297-7325
www.woodsealants.com

**Vycor Deck Protector** (self-adhering membrane)
Grace Construction Products
617/876-1400
www.graceconstruction.com

**Wolman F&P** (stains, sealers, and end-cut solution)
Wolman Wood Care Products
800/556-7737
www.wolman.com