

# Fixing Shear Wall Nailing Mistakes

by Scott McVicker, S.E.

In last month's column, I looked at some common problems with the installation of shear wall hold-downs. This month's column looks at issues related to nailing off the structural panels that carry the shear forces in a shear wall.

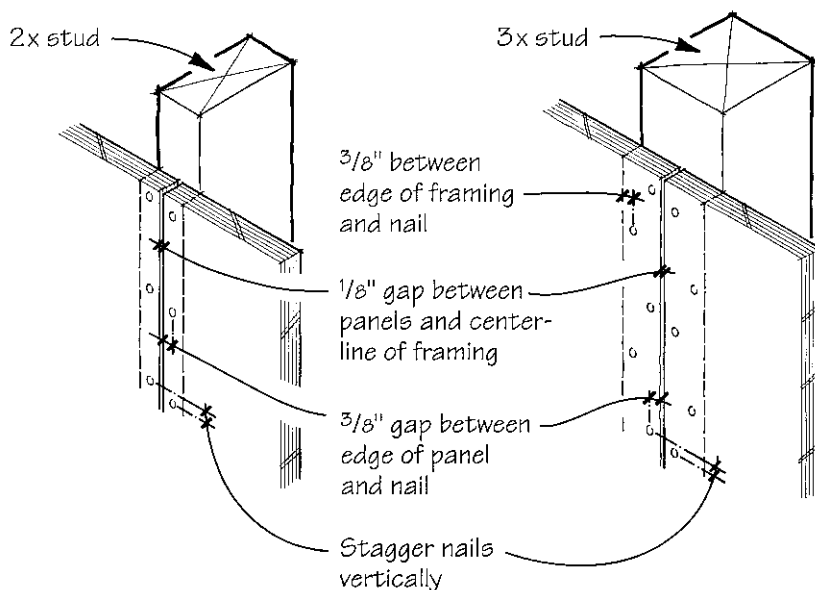
Tests done at the American Plywood Association have shown that nailing is the controlling factor in shear wall performance. Shear walls fail in one of three ways: the nails bend, the plywood (or OSB) buckles and pulls

through the nail head or pulls out the nail, or the framing lumber fails. The lumber failure — typically splitting — is also a result of nailing. The lumber splits either because the nails are placed too close to the edge, or because too many nails have been driven along a grain line, wedging the lumber apart (see Figure 1). This problem has prompted current codes to require wider framing members at panel edges where shear forces exceed 350 pounds per foot. This affects shear wall fram-

ing where nails are spaced closer than 6 inches on-center.

Because the controlling component in shear wall design is the nailing, it's no surprise that the correction for field problems generally involves installing additional fasteners. Often you can continue to use nails for the fix, but where the nails are closely spaced or where the framing and sheathing have dried out with age (making them more likely to split), wood screws are the right choice. In some cases, sistering on more lumber to provide a sound nailing surface is your best choice.

## Proper Nailing at Panel Joints



**Figure 1.** Where shear panels break on a stud (left), leave a  $\frac{1}{8}$ -inch gap and hold nails back  $\frac{3}{8}$  inch from the panel edges. Where nails are spaced closer than 6 inches on-center, code now requires 3-by framing; the reduced nail spacing would tend to split a 2x4.

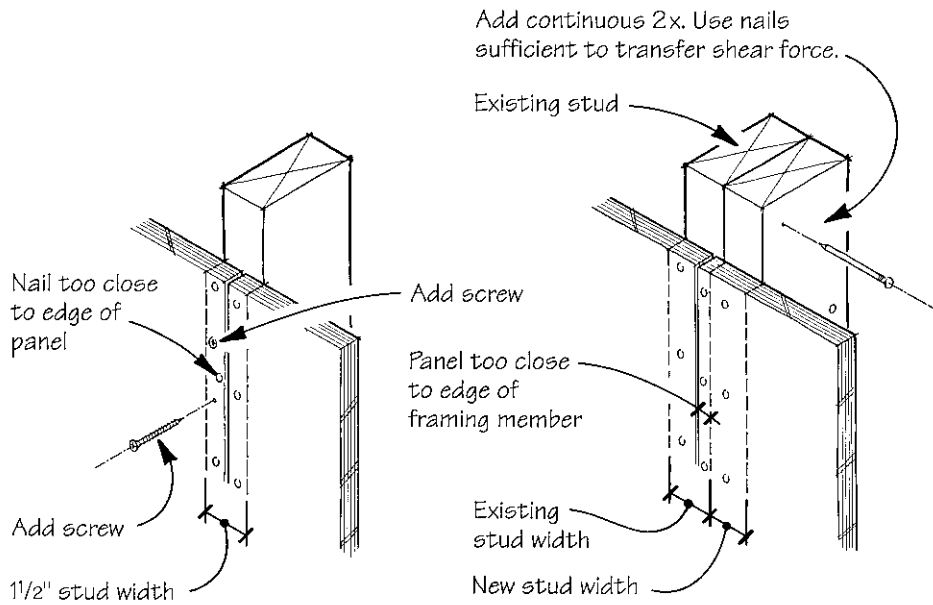
## Nailing Too Close to the Edge

One of the most common field mistakes is nailing too close to an edge — either the edge of the plywood panel or the edge of a stud or plate. Code requires nails to be  $\frac{3}{8}$  inch back from the edge of the plywood. Where two panels break on a stud, you have to leave a  $\frac{1}{8}$ -inch gap *and* make sure both panels have a strong  $\frac{1}{2}$  inch of bearing. In a perfect world, the sheathing would always fall dead center (minus a sixteenth) on the stud. In the real world, it doesn't always happen that way and perfect by-the-book shear nailing can be difficult to achieve. Fortunately, if you ever get red-flagged, there are some simple solutions (Figure 2, next page).

## Overdriven Nails

Nails that rupture the outer plies of the structural panel decrease the shear strength of the assembly because there

## Fixes for Common Nailing Errors



**Figure 2.** If you nail too close to the edge of a panel (left), install two screws of the same diameter in predrilled holes on both sides of the stray nail. When the panel edge falls so close to the edge of the stud that it's impossible to nail correctly (right), nail on a second framing member for backing. The two studs must be securely attached to one another to transfer all the shear forces.

is less of the nail shaft bearing against the plywood and resisting lateral forces (Figure 3). Overdriven nails are also more likely to allow the plywood to buckle and pull through. Pneumatic clip-head nails are especially prone to this problem. The fix is to predrill the holes and add a screw on both sides of the overdriven nail.

### Nailing to the Wrong Member

Another common mistake happens when the plywood sheathing gets tacked up over the shear wall framing, and the guy coming along to shoot in the shear nailing forgets to carefully mark where the shear wall boundary falls (Figure 4, next page). Putting the boundary nailing schedule into the

wrong member weakens the shear wall. Fortunately, the fix is easy enough — more nails in the right place. Taking the time to snap some chalk lines in the first place is the cure.

Note in Figure 4 that one sheathing panel falls completely within the shear wall and one extends beyond it. Code requires boundary nailing at the boundaries and at all panel edges within the shear wall, but if a panel extends beyond the shear wall, you may be able to use field nailing at the panel edge outside the shear wall boundary. An exception would be if the designer intended to use the framing above and below the window opening in conjunction with the adjacent full-height walls to create one big shear wall with an opening in it. In that case, the design might call for additional blocking or strapping and closer nailing all the way to the plywood edge.

### Nailing Into Too Narrow a Stud

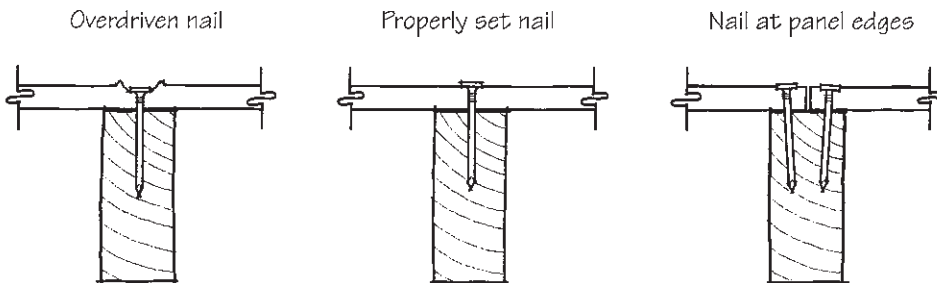
The 1997 *Uniform Building Code* requires 3-by studs at panel edges where the design shear exceeds 350 pounds per foot. This is a change from the earlier code, which would have allowed you to use 2-by framing with 4-inch on-center nailing for this condition. Word of code changes is slow to get around, so if you get caught with a 2-by stud with 4-inch nailing, there are a couple of things you can do.

You can add studs to each side of the offending stud, with plenty of 16-penny nails to transfer the forces. Then provide boundary nailing to the new studs. Check with your designer for the specs.

Or you can add sheathing to the inside face of studs, under the gyp-board, with edge nailing to different members (to avoid splitting) at 6 inches on-center. The combination of interior and exterior sheathing will make up for the loss of strength caused by the narrow boundary stud.

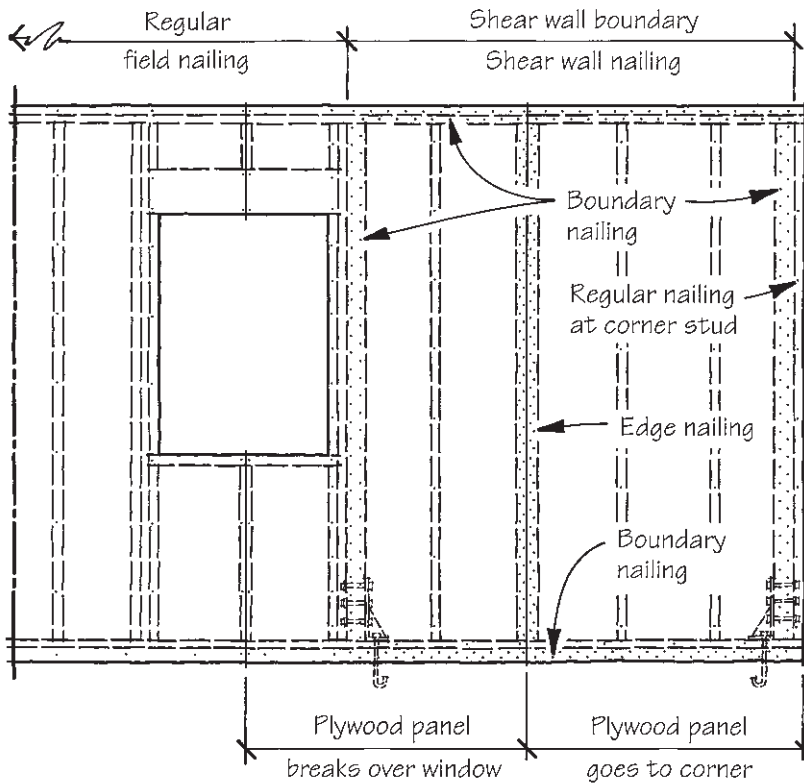
Of course, it may be that the plans called for 4-inch boundary nailing because the design shear just exceeded the allowable shear for 6-inch on-cen-

## Setting Nails



**Figure 3.** A nail that ruptures the outer plies of the panel (left) has less shear strength and should be reinforced with screws, as in Figure 2. A properly set nail should either sit snugly on top of the plywood (middle) or slightly dimple the outer ply. When panels break on a 2x4 (right), set the nails at a slight angle to ensure proper embedment into the framing.

# Nailing to the Right Members



**Figure 4.** This illustrates code nailing for a shear wall designed to handle forces above 350 pounds per foot. Note that where plywood edges fall within the shear wall boundary, 3-by framing is required to prevent splitting from the close nailing pattern. Where a plywood edge falls outside the shear wall boundary, however, as at the window opening, standard sheathing nailing is permitted.

ter nailing. As long as the design shear is less than 350 pounds per foot, the assembly is okay.

## Choosing Nails

Finally, use the right nails. The *Uniform Building Code* accepts galvanized box nails as equivalent alternates to common nails for shear wall nailing. The galvanization increases the diameter of the thinner box nail, making the plywood think it is bearing on a common nail. If you use untreated box nails, the shear wall will have less strength.

You can also use many of the available pneumatic nails and staples, but you have to be careful. These fasteners have varying strengths depending on shank diameter and gauge (code report *NER-272* provides this information). Rather than trying to make nail substitutions on your own, the best plan is to let your designer know the brand and type of sheathing nail you like to use, and let him or her design accordingly. And as I mentioned earlier, I would avoid clip-head nails.



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