# Framing a Strong Garage-Door

## Site-built shear walls help a building with large openings to stand up to high winds

BY JOHN SPIER

Images of collapsed buildings are pretty familiar these days, thanks to a number of severe windstorms in recent years. Among the most common of these catastrophic failures are the front walls of garages. A big storm blows in, the building racks to one side, and the entire roof drops to ground level in one swift motion. More than other structures or parts of a house, garages are prone to these failures because of their open floor plans, tall and narrow walls, and large door openings. The good news is that building codes and construction practices are responding to the problem with engineered solutions such as shear walls that can make these critical areas in a garage as strong as any other walls in a house.

### Shear walls fight wind

Shear walls are made by gluing and nailing sheathing to hardware-reinforced framing. They resist diagonal forces such as gale-force winds and seismic shifts. In general, walls' most common weak spots include narrow, tall spaces like those found around garage

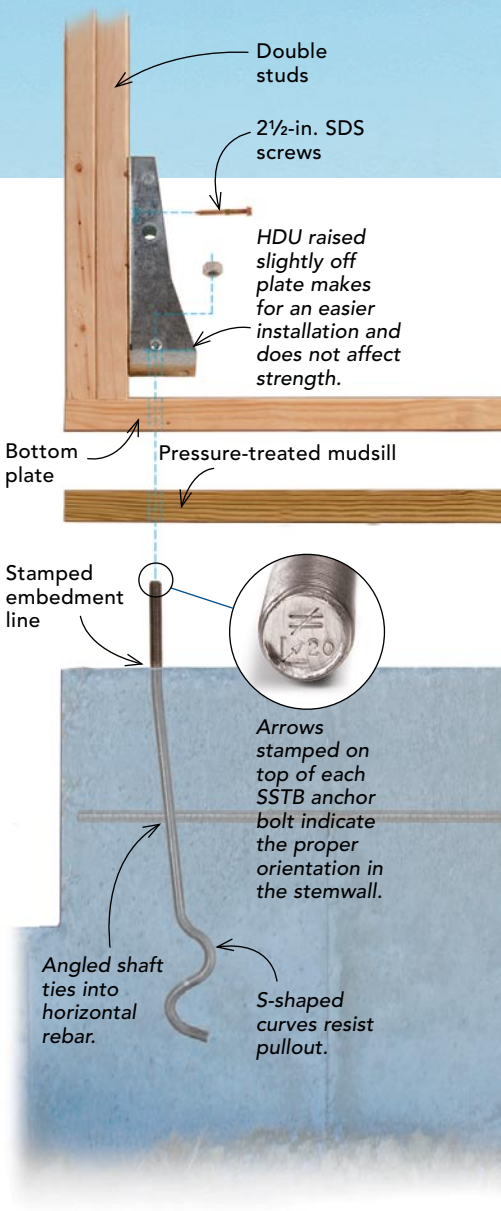
# Opening

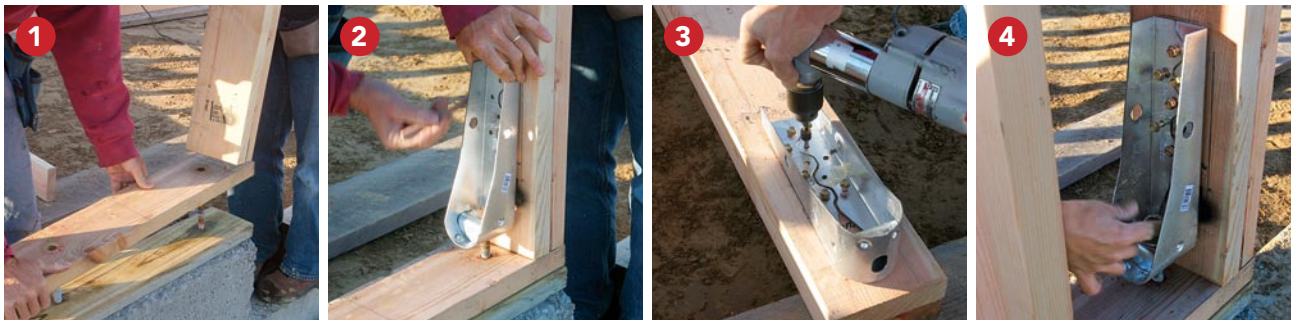
## ANCHOR THE SHEAR WALL

Tall, narrow walls like those found on the front of a garage can collapse in high winds or earthquakes. To strengthen these weak spots, building codes require the use of specially designed shear walls that stiffen the structure and resist lateral forces.

**To prevent walls from blowing over,** specialized anchor bolts (such as the SSTB from Simpson Strong-Tie) are installed before the concrete is poured. The bolts extend up and into right-angle hold-down hardware (HDUs) that's fastened to the double studs.

**To install the HDUs, (1)** place the bottom plate and preassembled king studs on the stemwall, **(2)** locate the HDU over the anchor bolt (leaving enough room to thread the nut onto the anchor bolt), and trace its outline onto the stud. **(3)** Next, fasten the HDU to the stud with the included Strong-Drive (SDS) screws, leaving them loose enough to offer a bit of wiggle room for final positioning. **(4)** Once the HDUs are in place, frame the rest of the wall and drop it in place over the anchor bolts and mudsill, then thread a nut onto each of the anchor bolts. There's no need to tighten the nut with an impact wrench; hand-tight, plus another half-turn with a socket wrench, is adequate. With the nuts in place, tighten the SDS screws to pull the hardware snug against the stud.



## SHEAR-WALL FRAMING MUST BE STIFF

Although the elongated anchor bolts and hold-down hardware prevent the building from uplifting or overturning in a strong wind, the framework still needs to be stiffened to prevent the walls from collapsing. In this case, that stiffness is provided by copious amounts of PL400 (or equivalent) construction adhesive, 7⁄16-in. sheathing, and a strict nailing schedule—all of which is detailed in the prescriptive tables of the *Wood Frame Construction Manual* (see below).

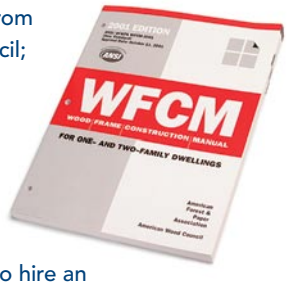


***Glue before sheathing.*** *After applying a thick bead of construction adhesive to each framing member, fasten the OSB sheathing with 8d ring-shank nails spaced 4 in. o.c.*



***Extend the front-wall sheathing 2⅞ in. beyond the double 2x6 studs.*** *The extended sheathing later will be nailed to the double trimmers that will support the LVL headers.*

## CHEAPER THAN AN ENGINEER




This $30 book (available from the American Wood Council; www.awc.org) includes all the details necessary to design and assemble code-approved, site-built shear walls that match the requirements of most projects. You won't have to hire an engineer to get a stamp of approval.



Inset photo, p. 64: Courtesy of American Plywood Association. Photos top right, p. 64; photo bottom right, this page: Krysta S. Doerfler. Drawings: Dan Thornton.

## TWO LVLS MAKE ONE LONG HEADER

On most two-door garages, the center section of the front wall has to be a shear wall. But because I satisfied the shear requirements for this wall without using the center divider between door openings, I decided to use one long built-up header to span both openings. Not only is this faster to build, but it also is stronger.

During installation, I support the LVLs with temporary 2x4 trimmers (photo left). Once the garage floor has been poured, I remove the temporary supports and replace them with permanent double 2x6 trimmers.

**Don't skimp on nails**

*To ensure a strong connection, fasten the two headers together with four 16d nails every 12 in.*



doors, and areas with numerous window and door openings. In the days before plywood, carpenters stiffened narrow spaces with diagonal wooden braces or metal bracing. Plywood exterior sheathing solved most shear-loading issues, with the occasional addition of a sheathed interior wall, but as house plans have become more complicated, weak areas have become more common.

In today's world of engineered solutions, builders often can rely on quantifiable specifications like the ones found in the *Wood Frame Construction Manual* (photo facing page) to build their own site-made shear walls. The manual details everything from nailing patterns to stud and plate layouts.

### The shear walls are built in place

Much of this wall system is easiest to build in place, especially because building on stemwalls with no slab in place means there isn't a flat space big enough to assemble a whole wall. But even if your site has a flat spot large enough to frame the walls on the ground, don't sheathe them until they are up and braced plumb, with the hold-down hardware bolted tightly to the studs. Each of the Simpson Strong-Tie HDU4 connectors used on this project requires 10 SDS screws, and tightening the hardware after the sheathing is applied is a surefire way to pull things out of square and plumb.

### Save time and improve strength with a continuous header

The header above a garage door is a critical structural element, especially in the project shown here: a freestanding 1½-story two-car garage with dormers and living space

***Add a center wall to make two openings.*** *With the shear-wall requirements already met, I frame the nonstructural center wall with notched 2x6 studs (photo left). The bottom plate of this center wall can be fastened with standard anchor bolts rather than with the longer SSTB bolts used under the shear walls. After we straighten the wall and double the top plate, the inside edge of the double LVL headers is furred out with 2x stock (photo below).*

above. I relied on TrusJoist (www.ilevel.com) to engineer the flooring system for this detached garage, and as part of that service, the company also specified the use of double LVL headers over each garage-door opening. Because I was able to satisfy the shear-wall requirements for this project without using the center divider between garage-door openings, I chose to span both openings with one built-up LVL header. This decision freed me to frame a nonshear and non-load-bearing center wall.

Once assembled, this shear-wall-reinforced garage frame should be strong enough to withstand any wind that comes along, and even an occasional earthquake. But it probably will get its ultimate test when my clients' teenage daughter is learning to put the car back in the garage. □

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John Spier is a builder on Block Island, R.I., and is the author of *For Pros by Pros: Building with Engineered Lumber* (The Taunton Press, 2006). Photos by Justin Fink, except where noted.

## Prefab shear panels

**If the garage wall in this project had been narrower, I wouldn't have been able to satisfy the engineering requirements with site-built shear walls. But I could have used prefab, pre-engineered shear walls that provide the required strength in narrower panels; they're made by Simpson (www.strongtie.com), iLevel (www.ilevel.com), and other manufacturers. The catch is that prefab panels are more expensive and can take several weeks to arrive on site. Also, they are not addressed in the prescriptive codes, so they can be used only where the entire structure has been certified by an engineer of record. The manufacturer can provide this engineering, but it's not a free service. Still, for a garage with wall panels as narrow as 16 in., prefab shear panels provide an elegant, elephantproof solution.**



Bottom photo: Courtesy of Simpson Strong-Tie