Removing a Bearing Wall

Hide the new carrying beam in the ceiling, and they'll forget that wall ever existed

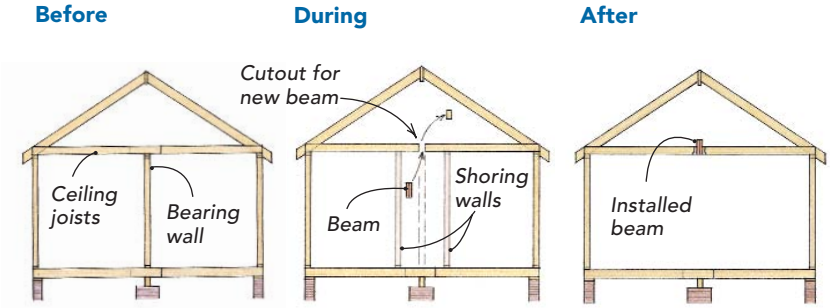
BY JOHN MICHAEL DAVIS

New Orleans has plenty of historic houses, and among my favorites are the shotguns. These colorful, modest dwellings acquired their name because to save space, they were built without hallways: One room leads directly into another, with all the doors lined up in a row. Therefore, if you were to fire a shotgun through the front door of one of these homes, the bullet would exit the back door without hitting anything, except maybe the person you were shooting at.

Most shotguns originally were built as doubles: These working-class homes were designed to fit two families onto the standard

WHY CAN'T WE JUST KNOCK DOWN THAT WALL?

Before you can remove a bearing wall, you have to design a system for carrying the load. In most cases, the solution is a beam supported by sturdy posts on both ends. The beam can be placed underneath the joists, or the joists can be cut back to allow the beam to be tucked into the ceiling cavity.

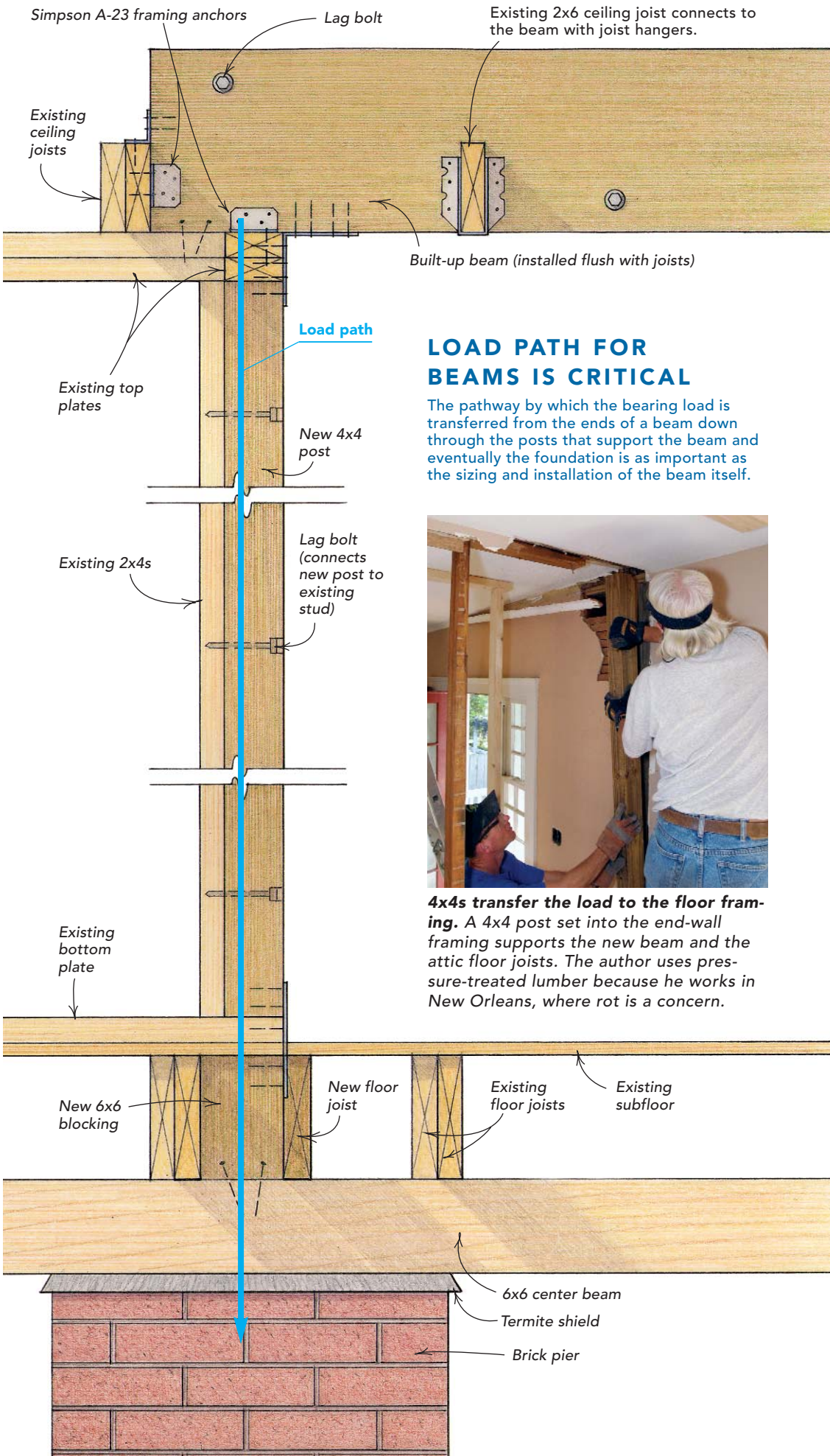


Drawings: Vince Babak



Both sides of the ceiling need shoring. *After the assembled beam is propped up along the condemned wall, temporary shoring walls—needed to support the joists after they're cut in two—are erected on both sides of the wall.*





LOAD PATH FOR BEAMS IS CRITICAL

The pathway by which the bearing load is transferred from the ends of a beam down through the posts that support the beam and eventually the foundation is as important as the sizing and installation of the beam itself.

4x4s transfer the load to the floor framing. *A 4x4 post set into the end-wall framing supports the new beam and the attic floor joists. The author uses pressure-treated lumber because he works in New Orleans, where rot is a concern.*

(30 ft. by 120 ft.) city lots of the time. Unfortunately, the center, or dividing, wall gives these narrow houses a claustrophobic, trailerlike feel. Shotguns have become extremely fashionable in recent years, and a common trend is to remove that wall (or part of it) and turn the double into a single. That's what we did on this job.

Exposed beams are easier to install

Because the center wall of a shotgun house is a bearing wall—this one carried the weight of the attic floor joists, which also served to tie together the exterior walls—we couldn't remove it without substituting a properly sized beam to distribute the load. If the client had not been offended by the idea of an exposed beam, I could have taken the easy route and placed the beam beneath the floor joists, supported by end posts.

But in a long, skinny home full of tiny rooms, my clients wanted to carve out one expansive space for entertaining, and anything that broke up that space was unacceptable. Although recessing the beam represented significantly more labor, once it was hidden away in the attic, the ceiling would become an unbroken plane with no indication that a wall ever had divided this room (drawing p. 80).

Verify the load path before the bearing wall comes out

From a structural standpoint, it's more important to determine how a beam will be supported than where it will be. On this job, I began determining the load path for the beam by stripping all the plaster and lath off the doomed wall. After the bones were exposed, I removed the corner studs from each end of the wall; then I drilled a ⅜-in. hole down through each end of its bottom plate—where the sole plate intersected the end wall. I was planning to support the beam with a 4x4 post tucked into each of the end walls, and these holes allowed me to see from below where the posts would go. Knowing the posts' locations was crucial in determining the path by which the load would be transferred to the foundation.

On those jobs where I don't find adequate structure to carry the weight of a post and beam, I either call in an engineer or simply pour a new concrete pad and add a post. In this case, I was fortunate: The posts on each end fell directly over the brick piers that supported the 6x6 center beam (drawing p. 81). All I had to do was wedge in 6x6 blocking to transfer the load from each post to the sill beam.

The 4x4 posts were cut to fit tightly between the top and bottom plates of the end walls (photo p. 81). Once the posts were in, they were lag-bolted to the adjacent studs.

Hidden beam starts out between shoring walls

The beam for this job consisted of three 2x12s nailed and glued together in standard fashion. I've used engineered beams on similar jobs. They are not readily available at my local lumberyard, though, so I tend to stick with dimensional lumber. This beam was about 1 ft. longer than the room we were working in because it was cut to extend beyond the posts and tie into the existing ceiling joists (drawing p. 81). Attic access was limited, so we had to assemble the beam on the ground and hoist it into place. Whenever it's possible to maneuver the lumber into the attic, though, I prefer to put together the pieces in the attic and lower the beam into position.

VIVID LINES AND A CHAINSAW MAKE FOR PRECISE CUTS

Bright-orange chalklines denote the edges of the beam, plus a ⅛-in. fudge factor (photo right). The cutlines are squared and drawn with a felt-tip marker to make them as visible as possible. Although a chainsaw cuts more quickly and accurately than a reciprocating saw (bottom photo), it's also messier. As the author severs the joists, his partner illuminates the cutline while using an exhaust duct ("Tools & Materials," p. 116) to remove sawdust and engine fumes.





Once the beam was cut to length, we placed it for the time being alongside the old studs so that the beam would be accessible after we'd put up the temporary shoring walls on both sides of the existing wall (photo p. 80). Our shoring walls consisted of 2x4 plates top and bottom, with studs wedged in tightly (2 ft. o. c.), then toenailed to the plates with a single 10d common nail. After the shoring was in place, we moved into the attic to make room for the new beam.

Lights, flooring and fresh air make attic work less onerous

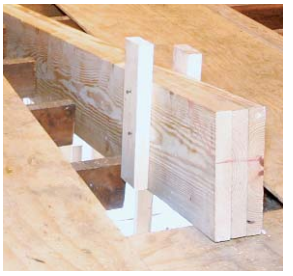
The first order of business was to make sure we had enough light and enough floor space in which to work safely. After scattering a slew of incandescent clamp lights around the perimeter of the attic, I hung an oversize 500w halogen work light directly overhead; the light I use for this type of work is equipped with a pipe-clamp base that's easily attached to the bottom of a rafter (Fostoria Industries; www.fostoriaindustries.com; 419-435-9201).

Once we could see what we were doing, we created a continuous 2-ft. wide walkway made of ½-in. plywood on each side of the work area (photos facing page). A handful of drywall



LEVERS AND PULLEYS HANDLE THE GRUNT WORK

The author uses a chain hoist and a web sling (photo to left) to raise the low end of the beam while his partner guides the high end into position from above. At the beginning of the lift, a pair of cleats nailed on each side of the beam engages the joists to prevent the beam from swinging forward (inset photo). Because the beam is cut to fit tightly between joists on each end, the beam is raised above them, then levered into position with a length of 2x4 (bottom photo).





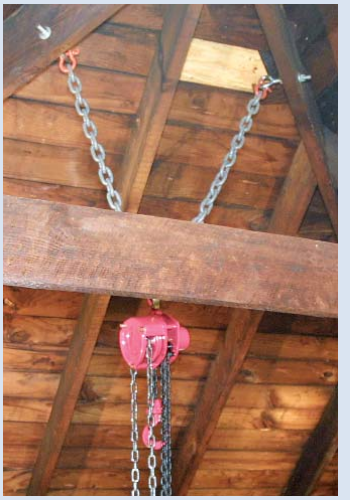
AUTO-SHOP TOOL HAS HOME-BUILDING APPLICATIONS

A ½-ton, hand-operated chain hoist like the one I have (Coffing Hoists; 800-477-5003; www.coffinghoists.com) is most often used by auto mechanics for pulling engines. But I've found that when used with a nylon web sling (W. W. Grainger Inc.; 847-535-5400; www.grainger.com), a chain hoist is an ideal tool for lifting beams.

Placement is critical: I try to locate the chain hoist about 3 ft. from one end of the beam, directly above the centerline. I hang the chain hoist from a short length of ⅜-in. thick chain suspended between two stout framing members; on this job, I used a couple of hip rafters (photo right).

A note of caution: The weak link in this lifting method is not the chains but the structure of the house. Whenever I'm hanging a chain hoist from a rafter or even a floor joist, I carefully examine that framing member for cracks, defects or insect damage. In this job, the rafters were 80-year-old longleaf pine 2x8s, so I had no doubt that they would hold.

—J. M. D.



If it can pull an engine, it can lift a beam. *Although it's primarily used by auto mechanics, a ½-ton, hand-operated chain hoist offers carpenters much-needed assistance when placing heavy beams.*



STRAIGHTENING PRECEDES FASTENING

After the beam has been securely fastened at each end, a small hydraulic jack (photo left) pushes the bottoms of the cutoff joists into plane with the bottom of the beam. One worker operates the jack from below, and the other toenails the joists to the beam when both are flush (inset photo). Each joist is firmly attached to the beam using a Simpson LU-26 joist hanger (photo below). Finally, the beam itself is reinforced using ½-in. lag bolts spaced 2 ft. o. c. (photo bottom right).



screws helped to keep the plywood in place.

I've suffered a lot over the years trying to get work done in steamy, stuffy attics, so before starting this job, I broke down and bought a squirrel-cage ventilator; this one was equipped with 10-ft. long ducts on both the intake and exhaust sides, so it could be used to bring in fresh air or to get rid of bad air, depending on the operation being performed. (To find out more about this device, see "Tools & Materials," p. 116).

Cutlines allow a little bit of wiggle room

I laid out the cutlines for the ceiling joists based on the centerline of the old wall. Using a 2-ft. level, I transferred that centerline from the top plate of the wall to the top edge of the joists on both ends; then I measured half the beam thickness each way and added ⅛ in. before marking the tops of the joists. Theoretically, this space gave me ¼ in. of play to ease raising the beam through the ceiling. Then I snapped two brightly colored chalklines (top photo, p. 82) and marked square cutlines on both sides of each joist.

Chainsaw cuts more quickly and accurately than a reciprocating saw

To allow room for the joist hangers that would tie the joists to the beam, I used a reciprocating saw to cut the ceiling an additional 2 in. back from the joist cutlines.

Until recently, I would have used a reciprocating saw to trim the floor joists as well, but I wouldn't have gotten a terrific cut. Even though some of the new extra-thick aggressive-tooth blades cut more quickly and accurately than their predecessors, reciprocating-saw blades always seem to wander from the cutline, especially when they're chewing their way through old, hard pine.

About a year ago, I bought a chainsaw for cutting firewood. Once I brought the tool to the job site, however, I was amazed to





discover how handy it is for carpentry work. The chainsaw cuts faster and deeper than a circular saw, and its wide, flat bar makes maintaining a square cut easy. With two reference lines on each joist and my focused attention, chainsaw cuts are incredibly accurate (bottom photo, p. 82).

You don't want to hit a nail with a chainsaw, however, so we made sure to check the cutlines carefully with the aid of a spotlight. Operating a chainsaw in an enclosed attic creates huge amounts of dust and fumes, so before we made any cuts, we set up the blower to function as an exhaust fan. My partner held the intake duct close to the saw's muffler while the exhaust duct ran down through the attic-access hole and out the front door of the house.



Remove the shoring and you've got one big room. *After the hidden beam is in place and all the connections have been double-checked for tightness, the shoring is removed, and the ceiling is ready for plaster.*

Chain hoist eases the strain of placing a 200-lb. girder

Until this point, we'd left the old wall in place because not only had we needed it to lay out our cuts, but also because it held the joists steady while we were cutting them. Once all the joists were cut, we knocked down the the old wall and were left with a clear opening ready for the beam. Two strong people should be able to raise a beam this size. I've already had one hernia repaired, however, and I've no desire to repeat that experience. So I let my chain hoist do the grunt work. A chain hoist is simply a block-and-tackle pulley that when hung from the rafters can be used to lift awkward objects, such as a beam (sidebar p. 83).

We placed a web sling beneath the low end of the beam and secured it with a couple of bent nails. I raised the beam from underneath (top photo, p. 83) while my partner guided from above. To prevent the bottom end of the beam from swinging out, we'd previously nailed two short cleats to the upper sides of the beam so that each rested against a ceiling joist (inset photo, p. 83). This contact point served as a pivot as we lifted the beam.

As luck would have it, even though I'd earlier run a dry line along the tops of the cuts to make sure they were straight, the bottom of one of the joists was out of square just enough to hang up the beam. This problem would have been a major hassle if we'd been hand-carrying the beam, but the chain hoist enabled us to make the fix simply and safely. All we had to do was lower the beam slightly and trim the offending piece.

When the lower end of the beam poked into the attic, we removed the pivot cleats and nudged the beam forward until it was able to drop down onto the plate of the end wall. The fit between the beam and the ceiling joists on each end was tight; as the hoist end of the beam was lowered, the other end had to be raised with a 2x4 lever to keep from binding (center photo, p. 83).

After the beam had settled into its final resting place, it was secured to the plates and to the joists with nails; then these connections were reinforced with Simpson A-23 framing anchors (Simpson Strong-Tie Co.; 800-999-5099; www.strongtie.com). The beam was directly fastened to the 4x4 supporting posts with Simpson A-44 framing anchors.

Joists are leveled before they're tied to the beam

We would use joist hangers as well as nails to join the cut joists to the beam, but first, we had to straighten the ceiling. To bring the joists into plane with the beam, we used a 2x4 stud and a small hydraulic jack. My partner operated the jack from below (photo top left, facing page) while I guided the top of the stud. When I could feel that the beam and the joist bottoms were flush, I nailed the two together (inset photo, facing page). After I nailed all the joists, we went back and reinforced all these connections with Simpson LU-26 joist hangers (photo bottom left, facing page).

To prevent any separation between the members of the beam, our final bit of redundancy was to install thirteen ½-in. by 5½-in. lag bolts through the beam (photo bottom right, facing page).

After we checked to make sure connections were secure, we knocked down the temporary walls (top photo) and cleaned up. Most of the time when I remove a bearing wall, I stick around to patch the gaps left in the plaster. On this job, the owners were going to take care of it themselves; they'll probably still call. □

John Michael Davis is a restoration carpenter in New Orleans. Photos by Tom O'Brien, except where noted

continued

Inset photo this page: John Michael Davis

Reader Response

Don't compromise the roof system

I just read "Removing a Bearing Wall" (*FHB* #152, pp. 80-85). To my astonishment, the author left out a critical detail. Because the ceiling joists are components in the roof system, care must be taken when cutting them. The joists not only support ceiling and attic loads but, more important, also form a truss system with the roof rafters, keeping the roof from "squatting" and exterior walls from bowing outward. When compromising these members, you must be careful.

First, you have to provide temporary support during construction. I recommend ½-in. threaded rod spanned from both top sill plates and through-bolted with a big washer. I place these rods every 4 ft. o. c. The objective here is to transfer the tensional forces from the ceiling joists to the rod. Once the temps are in place, the joists may be cut.

With the beam in place, you should reconnect the cut ends of the joists with minimum 24-ga. sheet-metal straps. I recommend the straps lap a full 24 in. on each side of the beam and be fastened with 8d nails every 4 in. I do not use truss nails because they tend to split the 2x joists.

Finally, all temps may be removed; however, if there is little interference with attic space, they can be left in place.

—*Keith Metler, Highland Park, IL*

John Michael Davis replies: I wish I could say that I had considered this issue and concluded that it didn't matter. But I never even thought about it, and that upsets me. I hate overlooking an angle. I don't think lateral spreading was a concern on this project for a variety of reasons. But because this article was a general how-to, we certainly should have addressed the issue. In addition to your suggestions for providing temporary lateral support, it seems as if you also could go outside and brace each wall at midspan from the top-plate area to the ground and a stake. This, or a variation, would not intrude into the attic work area. Thanks for your letter.