# Remodeling in Masonry

by Dennis Gehman


## Two projects illustrate how a methodical approach and careful details keep old walls from crumbling

More than a third of the houses here in southeastern Pennsylvania were built before 1950, and many of them have structural masonry walls. We've worked on lots of these homes in our 21 years as remodelers, so we've learned what to look for when a homeowner wants to make major changes.

The big challenge when working with old masonry — whether brick or stone — is making sure the walls stay put, especially when the job requires making a large opening. Old stone or brick exteriors often depend on the surrounding earth, the interior framed walls, and the rafters to hold them in place, so if you disturb the surrounding support, you may weaken the masonry to the point of collapse. This is no hypothetical worry: I know of a contractor in the area who had a two-story stone wall come down during a remodeling project.

Every job is different. For that reason, most of the towns we work in require the plans to be stamped by a licensed structural engineer or registered architect. But even with proper design, the contractor still needs to know how to approach the structural changes so as to avoid big problems. In this article I'll describe a couple of recent masonry jobs that illustrate some of the issues we face.

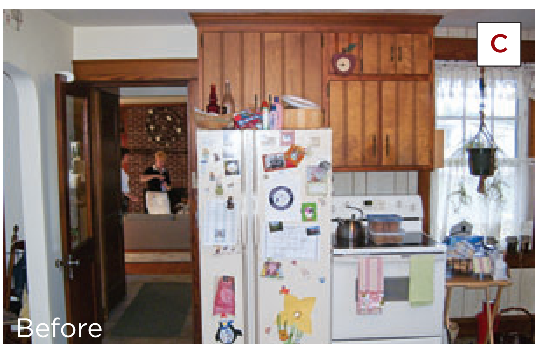
# Opening a Wall in a Brick House

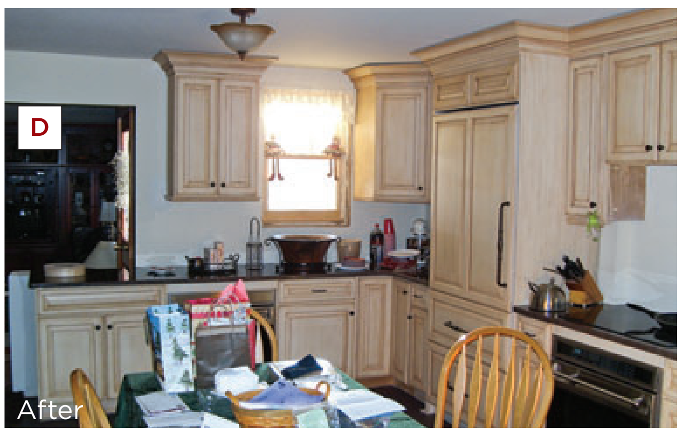
The owners of a 1920s brick home called my company hoping to expand and modernize their awkward L-shaped kitchen. They wanted to build an 8-foot-by-6-foot one-story addition on an inside corner in back of the house, break through the walls, and create a larger rectangular space for the kitchen (**see Figure 1**). The biggest challenge was that we would need to remove sections of the exterior bearing walls and insert new support beams while holding up the second story.

The original home was built with double-wythe structural brick — two brick walls mortared together with an occasional brick turned 90 degrees to tie the courses together. A later addition — the ell that formed the inside corner — had been stick-framed and clad with brick veneer. We worked with the client's architect to



**Figure 1.** A 48-square-foot addition on the back corner of this brick home created a larger rectangular space for the kitchen. The project required removing the first-story structural brick wall in the inside corner and supporting the second story with steel beams. Note the boxed-out column at the right rear of the new refrigerator (D), which encloses a lally column positioned where the original exterior wall used to be.

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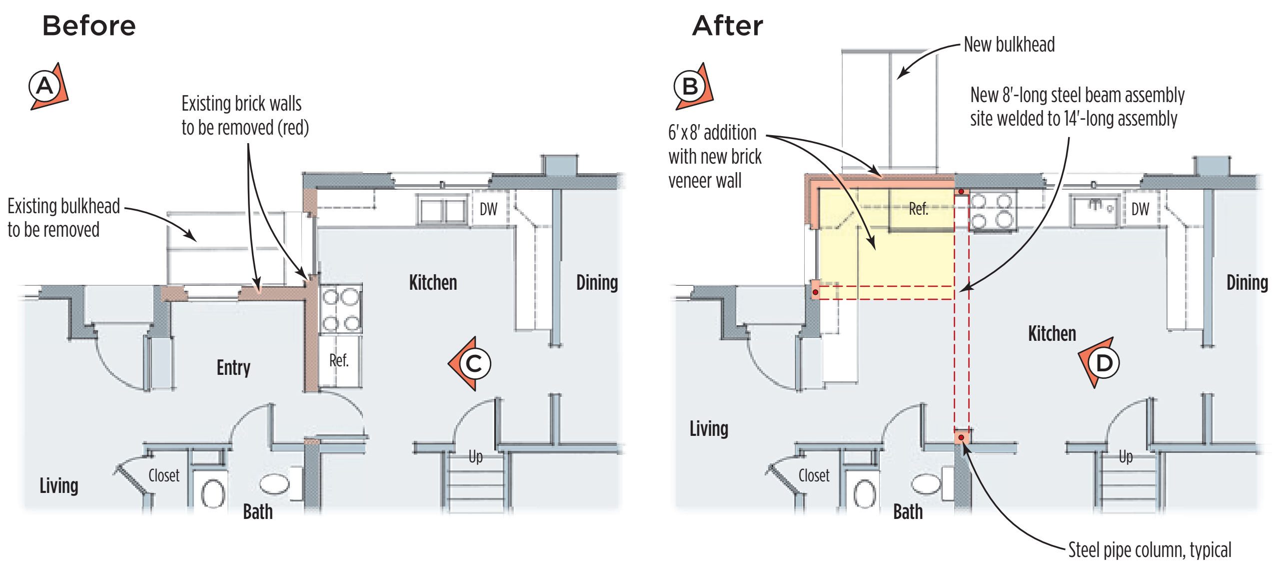


**Figure 1** (continued from previous page)

design structural steel beams that could be assembled in place to pick up the weight of the brick walls and the second-floor and roof loads (**Figure 2**). The plan for the double-wythe section called for two 9-inch C-channels — one on each side of the wall — bolted back-to-back. Steel angles welded along the bottom edge of each channel would be let into kerfs cut in the mortar joints, thus picking up the weight of the wall above. That way we would be able to install the steel supports before disturbing much of the existing brick, eliminating worries about the second-story walls coming down as we opened up the kitchen. The brick-veneer wall would have a single steel channel against the brick and an LVL under the framing.

## First the Addition

We began work by digging the hole for the addition and laying up the foundation (**Figure 3, next page**). Our own crew, which is trained in masonry, laid the block. (On small jobs, we try to keep as many tasks in-house as possible; it helps

## Brick Sandwich

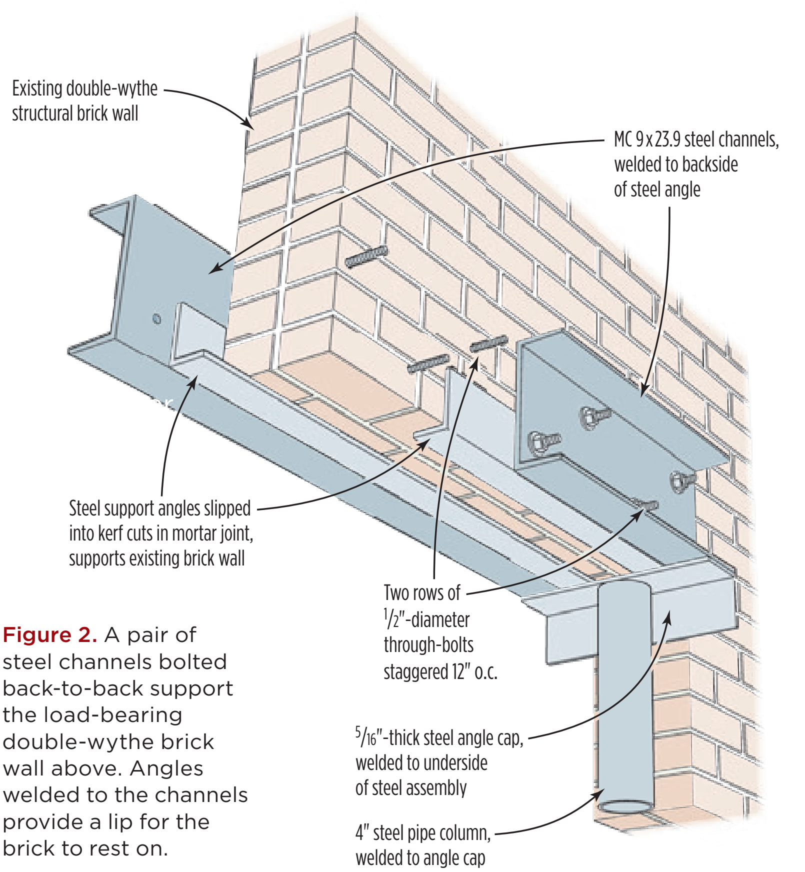


**Figure 2.** A pair of steel channels bolted back-to-back support the load-bearing double-wythe brick wall above. Angles welded to the channels provide a lip for the brick to rest on.

**Figure 3.** The block foundation of the small addition includes a shelf for the new brick veneer. After the deck was framed and the new masonry walls stabilized, a new precast bulkhead was craned into place.

us control the schedule, as there are fewer subs to manage.)

The clients wanted to retain the original bulkhead access, so we had a new precast unit installed, after first framing the deck to brace the new walls. We were ready for the steel; the subfloor gave us a convenient place for staging the exterior work.

## Assembling the Steel Beams

We first erected temporary support walls inside — from the second-story ceiling down to the ground in the basement — to pick up as much of the floor and roof load as possible. We then used a masonry saw and grinder to cut kerfs in the mortar joints to receive the steel angles (**Figure 4**). The veneer wall required only one 8-foot-long channel on the exterior face. The double-wythe wall of the original house needed two 14-foot-long channels, one of which we had to feed through a hole we made in the veneer wall. In fact, the only bricks we had to disturb during this process were the ones removed for the pass-through and several more inside where we needed vertical channels for the support posts. Because we had transferred the house loads to the temporary supports, we didn't have any problems.

We secured the beam assemblies with a staggered pattern of ½-inch through-bolts and brought in a welder to create a structural connection at the inside corner where the longer and shorter channels meet.

The ends of the beams are supported by 4-inch-diameter ¼-inch-thick steel columns with 5⁄16-inch-thick steel-angle caps welded on top (**Figure 5, next page**). The column bases sit on the existing foundation wall and are grouted into place.

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A

B

C

D

**Figure 4.** Working off the 6-foot-by-8-foot deck of the addition, the crew first kerfed the mortar joints to receive the steel angle (A) and made a hole to allow the 14-foot channel to pass inside at the second-floor level (B). The longer channel was installed first and bolted into place (C), then the shorter channel (D). The right-angle joint at the intersection of the steel channels was later welded.


**Figure 5.** Inside, the steel beams were supported at the ends on lally columns (A, B). The existing second-floor joists, which had been cut back to allow the steel to be inserted, were sistered with new full-span LVL joists (C).

**Figure 6.** The crew left a section of sheathing off the addition so they could more easily remove the brick from inside (top). Where the addition met the original house, the new and existing bricks were toothed together beside a downspout to help hide the transition (above).

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## New Brickwork

We waited until we had framed and sheathed the addition before removing any more brick (**Figure 6, previous page**). We started with a sledge, but after a few bricks were dislodged the rest popped out quite easily — reinforcing the importance of getting the steel beams in place first.

We had intended to re-use the old brick, but after trying to chip the mortar off we abandoned that idea. Fortunately, our bricklayer found a close match. The slight difference in color between the old and new brick would be most noticeable where the new addition met up with the original house. For a better blend, our bricklayer toothed the bricks together in that spot, and we also placed a downspout there. Where the addition meets the newer part of the house, the bricklayer used a simple vertical joint.

## Project Costs

Even with these structural issues, we were able to give the clients a fixed price, and — as with most of our estimates — it was close to the actual job costs. Our usual target gross margin is 40 percent, and on this project we hit 39 percent. One reason we're able to estimate so accurately is that we get input from everyone who will be involved in the project. On complex jobs like this, we always have a senior project manager on site during the estimate so we can anticipate issues that the architect, engineer, or estimator might not. In this case, our project manager was able to think through the entire process of getting the beam in place, including any potential problems.

The engineering and job-site procedures that are needed to keep masonry walls supported tend to make these types of projects expensive, and this was no exception. Our cost for the shell — including the structural work, new brick veneer, rough electrical, insulation, and finished drywall — was $56,570. The interior finishes — including cabinets, counters, sink and faucet, appliances, interior trim, painting, and flooring — were installed by another contractor and, according to the clients, added another $45,000 to $50,000 to the job.

# Supporting a Stone Facade

This job was simpler than the brick addition, but we still had to work around structural masonry — stone, in this case. The two-story house, built in the 1940s, had structural stone walls on the front facade and stick-framed vinyl-sided walls on the sides and rear. When the previous owners added a second-story master bedroom above the single-story attached garage, they unfortunately sided the front of the addition with vinyl (**Figure 7**). Not surprisingly, the new owners wanted to replace the vinyl with stone. And rather than stone veneer, they wanted matching 12-inch-thick structural stone, so they could replicate the deep window sills across the front.


**Figure 7.** An earlier master-bedroom addition above the garage was clad with vinyl siding (left); the new owners wanted to replace the vinyl with local stone that matched the rest of the front facade (above).

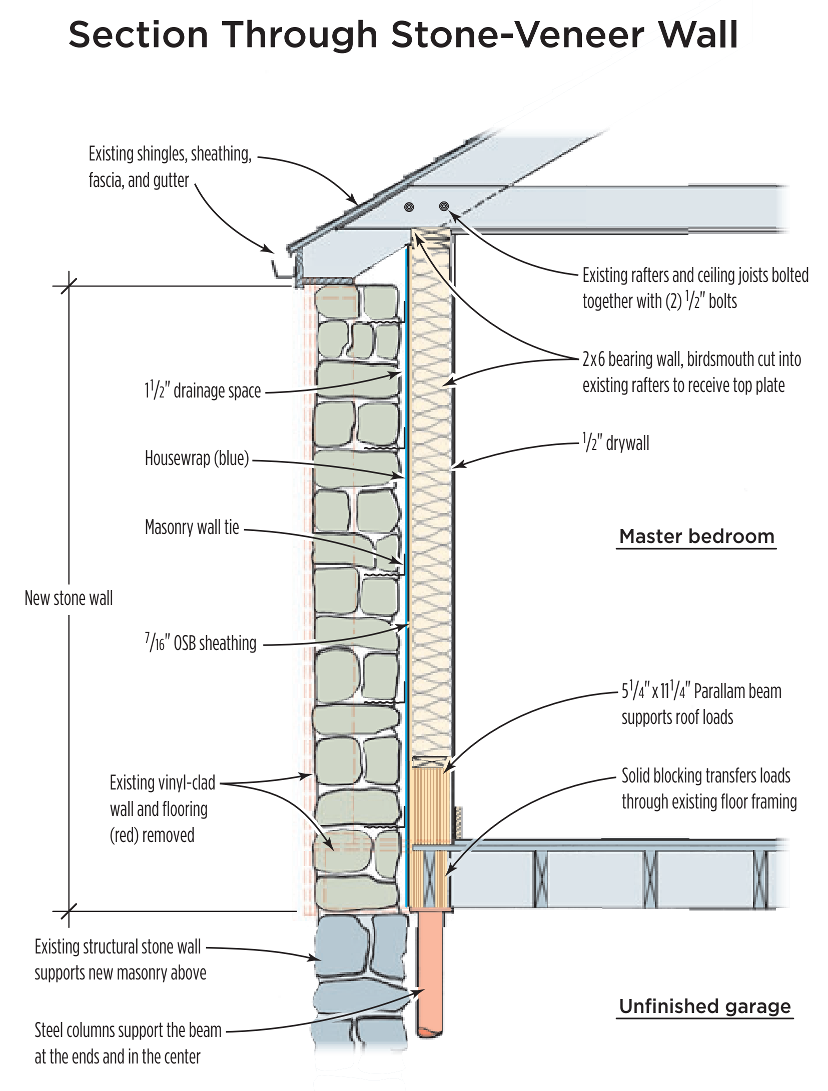


**Figure 8.** Because the existing garage door lintels were not capable of carrying the combined weight of the new stone and the roof loads, the engineer's plan called for a new Parallam beam set inside the stone on top of the second-floor joists to support the rafters. A pair of bolts at each ceiling joist connection prevented the roof from spreading as the work was done.

A review by our structural engineer revealed a problem: The lintels above the garage doors were not capable of carrying the weight of the additional stone plus the roof load. Reinforcing the lintels would mean stripping the existing stone down to the garage door heads and installing heavy pieces of steel. The homeowners didn't like that option, so we came up with a different plan: We would use the existing structural stone wall to carry the weight of the new masonry above, but support the roof on a new 2x6 wall built inside. To get the roof load safely to the existing foundation, the wall would be framed on a 5¼-inch-by-11¼-inch Parallam beam set on top of the bedroom floor, supported at each end and in the middle with steel columns (**Figure 8**).

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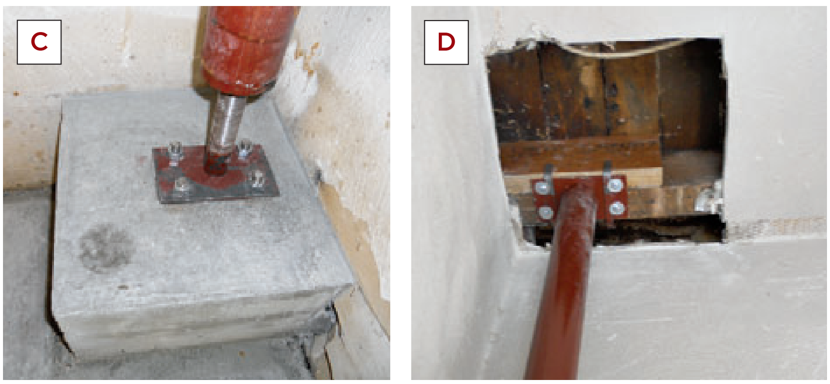

**Figure 9.** The $5\frac{1}{4}$-inch-by-$11\frac{1}{4}$-inch Parallam, slid into place through a rectangular hole in the gable wall (A), spans the width of the garage (B). Steel columns (C) support the beam at the ends and in the center. Solid blocking transfers the loads through the floor framing (D).

## Parallam Insert

The plan was to build the studwall and provide support before removing the existing vinyl-sided wall. We first removed a strip of the oak flooring, then slid the beam into place through an opening cut in the gable wall (**Figure 9**). Next, before building the new wall, we fastened the ceiling joists and rafters together with pairs of $\frac{1}{2}$-inch through-bolts so the roof couldn't spread when we removed the existing support. We cut birdsmouths in the rafter tails to accept the top plate of the new wall, which we then

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**Figure 10.** Birdsmouths were cut into the rafters to accommodate the new 2x6 wall framed on top of the Parallam (left). The face of the sheathing is $1\frac{1}{2}$ inches behind the back of the stone to allow for drainage (above).

framed. With the roof now safely supported, we tore out the existing vinyl-clad wall, then sheathed the new 2x6 wall (**Figure 10**). The clients wanted to re-use the existing windows, so we re-installed them on $\frac{3}{4}$-inch plywood jamb extensions projecting out from the new wall (**Figure 11**).

Like many old stone walls, this one had been built without vapor barriers, weep holes, or special flashings. Yet despite recent winters with lots of rain and snow, it had not developed any moisture problems — partly because the stone was pointed to create a smooth water-shedding surface, according to our stonemason.

Knowing this, we were comfortable relying on a layer of housewrap, tucked behind the existing stone at the sides and the base, as a secondary watershed. In the very unlikely event that water does reach the Tyvek, it will be able to drip down to the base of the wall through the $1\frac{1}{2}$-inch drainage space and into the unfinished garage.

Our part of this project took two workers $3\frac{1}{2}$ weeks. Total job cost was around \$40,000 — \$12,000 for the stone and \$28,000 for our work. The clients were pleased with the outcome, and the new stone will blend with the old even better as the surface weathers.

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**Figure 11 .** The original windows were reinstalled on plywood extension jambs set into the new frame wall (top). The new locally quarried stones should weather to more closely match the original (above).