Framing Walls

Speed and efficiency are the results of a careful, well-thought-out layout

by Scott McBride

Plated and detailed. **Information written on the wall plates and the girders defines how the walls are put together. The author also lays out the second-floor joists or roof rafters before assembling the walls. Different-colored ink is used to denote a change in stud length. (Penciled guidelines were drawn on the lumber only for the sake of neatness in this article. It is not common practice for the author.)**

I've heard a lot in recent years about the speed and the efficiency of California framers, but I find it hard to imagine anyone faster than the Italian-American carpenters who taught me to frame walls in the suburbs north of New York City. These men worked with an extraordinary economy of motion.

I want to discuss wall framing in general and, more specifically, to point out some of the methods and tricks I learned while working with New York carpenters. Even though some of these framing methods differ from those practiced elsewhere in the country, they have worked well for me, and I think they can work for anyone who wants to be more efficient on the job.

Carpentry has a vocabulary all its own. Stud, jack and header all have meanings outside the carpentry world, but to a framing crew these terms have specific definitions as components of a wall. If you are confused by a sentence that reads, "Toenail the king stud to the bottom plate," then you should familiarize yourself with the drawing on the facing page.

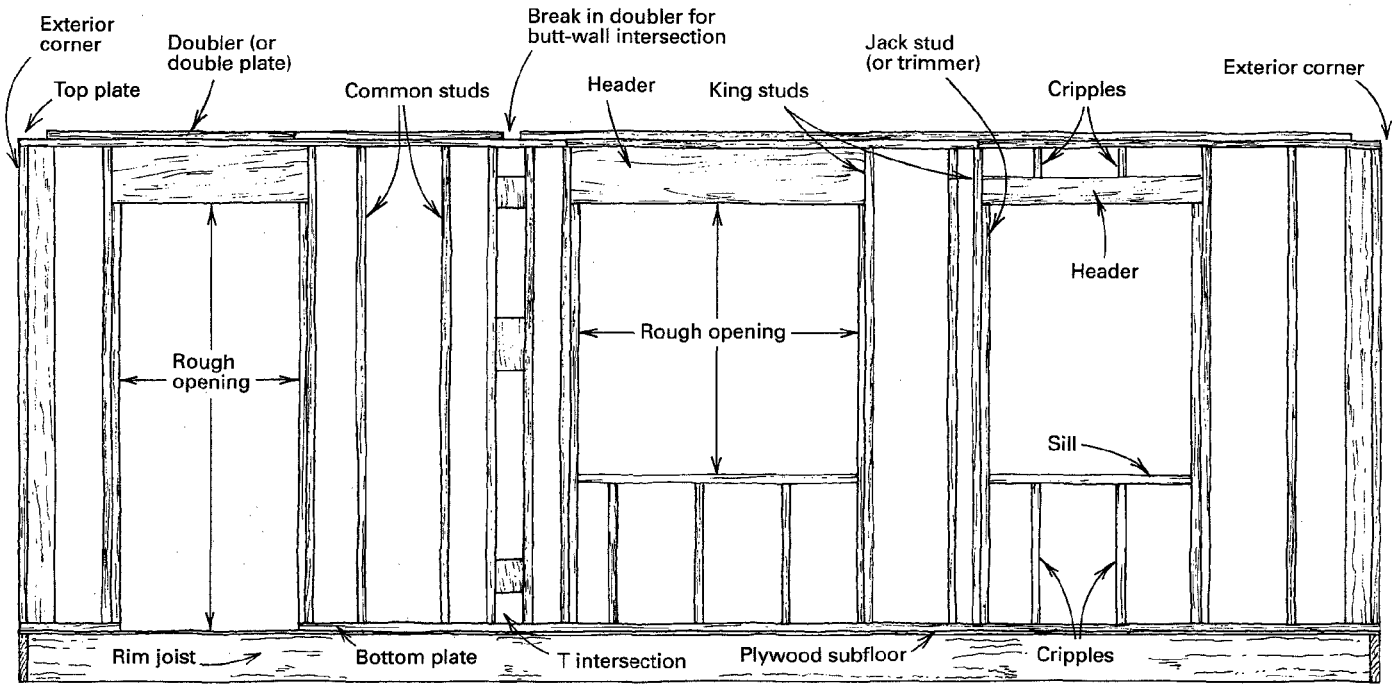
Snapping chalklines—The first step in any wall-framing method is snapping chalklines on the plywood deck to indicate the locations of the various walls. Wall locations will be shown on the plans. First, I snap lines for all the exterior perimeter walls. If I'm building 2x6 exterior walls—which I usually am these days—I use a 2x6 block to gauge a mark 5½ in. in from the edge of the deck at each end of each wall. To position the block, I sight down to the comer of the foundation or of the story below, aligning the outside edge of the block with this vertical line of sight (photo below). You can't depend on the rim joist (called the box beam in New York) for registering the block because the rim joist is often warped out of plumb. Staying in line with the true corner is desirable, even if it means a bump in the sheathing at floor level. Otherwise the building tends to grow as it goes up, causing inconsistencies in the span that can complicate the roof framing.

2x6 template. **A 2x6 block is used to mark an exterior wall's width on the plywood deck. The author sights down to the floor below to make up for possible irregularities in the alignment of the floor joists.**

After making a mark on all the comers of the deck at 5½ in., I connect the pencil marks with chalklines. I anchor the end of my chalkline with an awl tapped into the deck. When all the exterior walls are snapped out, I move on to the interior partitions, taking measurements from the plans and transcribing the lines onto the deck. I snap only one line for each wall and scrawl big Xs on the deck with my lumber crayon. The X indicates the side of the line where the wall goes. If there are 2x6 interior partitions as well as ones made of 2x4s, I indicate with my crayon which partitions are which.

Plating the walls—Plating is the process of cutting to length the bottom and top plates of the walls and temporarily stacking them on the deck (photo above). They can then be marked up to indicate where the various studs and headers will get nailed. In essence, I temporarily put all of the walls in place without the studs in them. My

The parts of a wall. *Carpentry has a vocabulary all its own. There is a specific name for every component of a framed wall.*



method of framing differs a little from some others in that I cut the doublers now and stack them on top of the other two plates for a three-layer package. Later I'll explain why I do this.

Before cutting any lumber, I think a little about the order in which I want to raise the walls because this sequence determines how the comers of the walls should overlap. Where walls intersect, one wall runs through the intersection. This is called the bywall. The other wall ends at the intersection. This is called the butt wall.

By-walls have bottom and top plates of the same length that run through the wall intersections. The doubler of a bywall is shorter than the top and bottom plates by the width of the intersecting wall's plates (drawing above). This allows the doubler from the intersecting butt wall to lap the top plate of the bywall. Nailing through the doubler at the lapped corner into the top plate of the intersecting wall holds the walls together.

It is a good idea to cull through your lumber and save your straightest pieces for the longest top plates and doublers. I use the next-best stuff for the bottom plates, which are easier to straighten by nailing to the subfloor. The crooked stuff I cut up for short walls.

There are a couple of things to keep in mind when you are cutting to length the plates and the doublers. Butt joints in the bottom plate can occur almost anywhere. Splices in the top plate—the middle layer—should be offset as much as possible from adjoining walls and beam pockets. Here's why: The integrity of the top-plate assembly—the top plate and the doubler nailed together—depends on having well-staggered joints. An interruption of the doubler is inevitable at wall intersections and beam pockets, so keeping the joints in the middle layer away from these points will maintain good overlap and avoid a weak spot. Splices in the doubler should be kept away from splices in the top plate by at least 4 ft.

If two walls cross each other, you'll have to let one of them run through the intersection and separate the other into two butt walls. The butt-wall doublers can split the overlap, with a joint in the middle of the bywall. Another option is to let one of the butt walls overlap in a full conventional tee. The other butt wall gets no overlap, but instead it is tied to the intersection with a sheet-metal plate on top of the doublers after raising the wall.

To commence plating, the bottom plates are toenailed to the deck on the chalkline, using 8d common nails about every 8 ft—just enough to hold them in position. The top plates—the middle layers—are then temporarily toenailed to the bottom plates. Finally, I lay down the doublers—the third layer—over the top plates, but instead of tacking them temporarily, I nail them home with 10d common nails staggered 24-in. o. c. I use 10ds here instead of longer nails because the 10ds won't penetrate the bottom plates.

Remember, at the corners where the walls meet, the orientation of the butt joints is reversed, creating the overlap in the doublers that will ultimately lock the walls together. I don't nail the overlap now because I'll have to separate the walls later.

Detailing the plates and the doublers— When all the plates are laid down and held together, and the doublers are nailed in place, I'm ready to mark them up, or detail them, with the information my crew and I will need to frame the walls. The first information recorded on the doublers is the width of the door and window rough openings in the exterior walls. The rough-opening marks I make on the top of the doubler are discreet, only about 1½ in. long. I'm saving most of that surface for a later step in the layout.

If windows or doors are shown on the plans dimensioned to centerlines, I measure from the outside corners and mark the centerlines on the outer edge of the doubler. Then I divide the rough-opening dimension of the door or window in half. For example, if the width of the rough opening for a pair of French doors is 6 ft. 4 in., I'll align 3 ft. 2 in. on my tape with the centerline, then mark lines at O and 6 ft. 4 in. To check my arithmetic, I turn my tape around end for end. The center should still be at 3 ft. 2 in. I make a V to indicate the rough-opening side of each line (top photo, facing page).

Rough openings for interior doors are marked the same on the interior-wall doublers as for exterior doors, but the plans will usually call out the size of the finished door rather than a rough opening. To find the rough opening of a door, I add 2 in. to the width. This allows for a ¾-in. thick jamb and a ¼-in. shim space on both sides.

After locating a rough opening on the doubler, find the length of its header. Openings of less than 6 ft. will require one jack stud, or trimmer, on each side of the opening to support the header. Each jack stud is 1½ in. thick, so the header needs to be 3 in. longer than the width of the opening. (Because of variations in the actual thickness of 2x stock—studs can vary in thickness from 1⅜ in. to 1⅝ in.—it is a good idea to measure the lumber you're working with, then do your addition.) Headers over 6 ft. long require double jack studs on each side. That means the length of the header must be 4 times 1½ in., or 6 in. longer than the width of the rough opening.

I use a 2x block as a template to mark the jack locations on the outside of the rough-opening

Drawings: Christopher Clapp

marks. I square the outermost mark down across the stacked edges of the three layers of 2x. This line indicates the end of the header and the inboard face of the king stud. The king stud is the full-length stud to which the jack stud is nailed. On the edges of the top and bottom plates, I show the king stud with an X and the jack stud with an O. For double jacks I use OO. After repeating the process on the other side of the opening, I measure between the outermost marks on the top of the doubler to verify the header length I arrived at earlier by arithmetic. And finally, I write the length of the header on the doubler.

Window headers are marked out the same way as for doors. As far as windowsill and bottom cripples are concerned, I usually come back to them after the walls are up. They aren't needed for structural reasons, and I'm usually in a big hurry to finish the framing and get the roof on. But if I'm going to sheath the exterior walls before they are tipped into place, I frame below the windows as I go. In that case I'll write the height of the window rough opening on the doubler as well as the width.

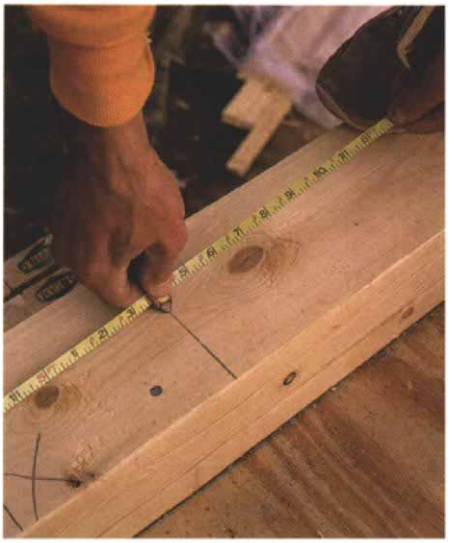
I think presheathing pays if you can have the plywood joint even with the bottom of the wall. But some builders, architects and inspectors require that the plywood joints be offset from the floor elevation to tie the stories together. You can still presheath in that case by letting the sheets hang over the bottom plate, but I think it becomes more trouble than it's worth. It's usually more economical to let the least skilled members of the crew hang plywood after the walls have been raised.

As soon as I've finished determining all the header sizes, I make a cutlist and give it to a person on the crew who can then get busy making headers while I finish the layout.

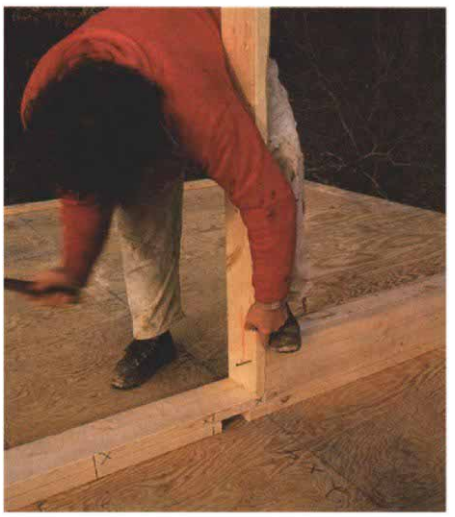
Detailing the doubler—After marking the rough openings on the edges of the top plates and the doubler, the focus shifts back to the top face of the doubler. It's time to lay out the structure that will eventually sit on top of the wall you're about to build. There are very logical reasons to do all this layout now. First, by doing it now, you won't have to spend a lot of time working off a stepladder or walking the plate after the walls are up, and the doublers are 8 ft. in the air. The work will already be done. Second, it is easier to align the studs in the wall you're currently building with the loads coming down from above. This is called stacking, and I'll discuss it further later in the article.

The structure that sits on top of the doubler may be either a floor or a roof. In either case I start by locating the principle members—girders in the case of floors, ridges in the case of a roof. I mark their bearing positions on the doublers. Then I measure their actual lengths, cut the members and set them on the doublers. I can now lay out the spacing for the joists or the rafters on the principle beams at the same time I put the corresponding layout on the walls.

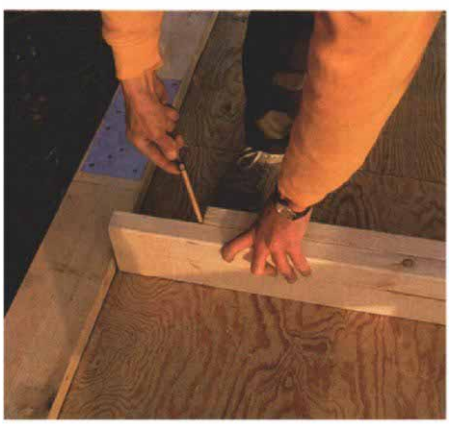
To ensure that the principle member is positioned correctly when it's eventually raised, I make a directional notation on the beam, such as north end, or driveway side. With the principle members in position, the first joists or rafters I locate are specials, such as stairway trimmers, dormer trimmers and joists under partitions.



Layout trick. **A flexible wind-up tape is used for layout. Hold a pencil against the tape and swing it across the plate to make marks. The farther the tape is away from the end of the plate, the straighter the lines will be.**



Headers and king studs. **Tipping the nailed-together doubler and top plate upside down on the deck makes it easy to toenail the header and attach the king stud.**



Scribing the jacks. **By holding a stud alongside the king stud and against the underside of the header, the jacks can be scribed without measuring. Visible on the bottom plate, half hidden by the carpenter's hand, is a galvanized plate nailed over joints in the plate.**

When all the specials have been marked, I lay out the commons. These are individual, full-length framing members (either joists or rafters in this case). The standard spacing is 16 in. o. c., but 12 in. and 24 in. are not uncommon. You want to minimize the cutting of your plywood, so the spacing of commons should result in 8 ft. landing in the middle of a framing member. Assuming 16-in. centers, I hook my tape on the end of the doubler and tick off 15¼ 31¼, 47¼, etc. As an alternative, you can tick off the first mark at 15¼ and then measure the remaining marks from there on exact 16-in. centers.

You can square the tick marks across the doubler with a square or use this trick: Clamp your pencil point against your tape at the given spacing by pinching them together between your thumb and fingers. Swing an arc across the plate (top photo, left), move your pencil to the next point, repeat and so on. The error caused by the curvature of the line is negligible, and it diminishes as you move outward. This trick works better with a flexible wind-up tape than with the stiffer, spring-return tape.

By now you're probably wondering if I'm ever going to start nailing the walls together. Be patient, we're almost ready.

Stacking studs—The spacing for the common studs in the walls is derived from the joist or rafter spacing in the structure that sits above. If joist or rafter spacing is the same as the stud spacing, both 16 in. o. c. for example, I simply extend the layout mark on the top of the doubler down across the edges of the plates. Aligning the framing members like this is called stacking. But if you have, say, joists on 12-in. centers and studs on 16-in. centers, every fourth joist should stack over every third stud. Stacking wherever possible helps to prevent deflection of the top plate, although it could be argued that the presence of sheathing and band joists makes such deflection unlikely. Stacking *does* facilitate the running of plumbing pipes as well as heating pipes or HVAC ductwork.

And on exterior walls, stacking studs from one story to the next makes installation of plywood sheathing more efficient. To support a special joist, such as a double 2x trimmer, I square the layout mark on the doubler down across the edges of the plates and indicate a special double stud.

Over door-header locations, I extend my pencil marks for the cripple-stud spacing across the edge of the doubler and the top plate, but I stop short of the bottom plate. Instead of marking an X here, I mark a C on the correct side of the line. This will show the carpenters where to put the cripple studs above the door header. Of course this step is unnecessary if the header sits tight against the top plate. At window headers I extend the mark across the bottom plate as well, writing C for cripple.

The studs in nonbearing partitions running perpendicular to the joists should also stack, al-

though it's not as crucial as for bearing walls. (A nonbearing partition is a wall that doesn't support a load.) For partitions running parallel to the joists, the placement of the common studs is discretionary. They can be laid out from either end of the wall.

Building corners—With the stud layout completed, there are only a few more details that need to be mopped up before nailing the walls together. At the end of the exterior bywalls I write CORNER, which means a U-shaped comer unit made up of two 2x6s and one 2x4. This corner design permits easy access for fiberglass insulation (top drawing, right).

Another step in the final layout is to mark out the studs that go at the end of each butt wall where they intersect a bywall. These inside corners provide nailing for drywall and baseboard and, for that matter, any other type of finish trim that might end in a comer.

Some carpenters preassemble channels to back up these T-shaped intersections. I find it easier to space a pair of studs in the bywall, separated by the flat width of a block. I add the blocks after the walls are raised: one in the middle for 8-ft. walls, two or more for taller walls. By using 2x6 blocks behind 2x4 partitions, and 2x8 blocks behind 2x6 partitions, I get a 1-in. space on both sides between the partition and the .bywall studs. This provides access for insulation. It also makes nailing drywall and baseboard easier because you don't have to angle the nail as much to catch the comerstud (middle drawing, right).

Corner posts for interior 2x4 partitions are made up of intermittent blocks that are sandwiched between full-length studs. This type of corner can also be used at the end of peninsular walls (bottom drawing, right). Write B to indicate the blocking.

The final layout step is to number each wall for identification and to indicate the raising sequence. As a convention I write the number on the left end of the doubler as I look down on it. I then write the same number in front of it on the deck in heavy crayon. These steps help prevent the wall from being installed backwards, which is easy to do. I put a slash under the 6 and the 9 to tell them apart. If there are different stud lengths within a story, I write the appropriate length next to the raising-sequence number that has been assigned to each wall. It's not a bad idea to use a different-colored crayon or marker to indicate different nonstandard stud lengths. For example, if I'm writing everything else out in black crayon, I use a red crayon to make the exceptions easy to spot.

Nailing the walls together—When the layout detailing is complete, the temporary toenails are removed from the bottom plate only. Each wall is now represented by a separate package containing the bottom plate, the top plate and the doubler. I stack these packages in an out-of-the-way place on the deck, along with the headers, the corner units and the principle beams for the structure above. Studs should be leaned against the edge of the deck where they can be reached, but not stacked *OH* the deck. The fastest and most accurate way to mass-produce nonstandard studs is with an improvised double-end cutoff arrangement. Nail two chopsaws or slidesaws to a bench at just the right distance apart. Two operators working together lift a stud onto the beds and cut off both ends. This method squares up both ends of the studs and cuts them to length.

When I'm nailing walls together, I usually start with one of the longer exterior walls. I lay the plate package on the deck, parallel to its designated location and pulled back from the edge of the deck by a little more than the length of the studs. You don't want to crowd yourself. I pull out the nails that hold the bottom plate to the top-plate assembly and spread the plates, moving the bottom plate close to the edge of the deck. I'm real careful not to turn the plate end for end.

I find the wall's headers and carry them over to their locations. If the header sits tightly against the top plate, I flip the top-plate assembly upside down and toenail the header down into the underside of the top plate. Then I stand a king stud upside down on the plate and through-nail it to the end of the header with 16d sinkers or 10d commons. I throw a few toenails through the king stud down into the plate as well (middle photo, facing page). Now I roll the assembly down flat on the deck.

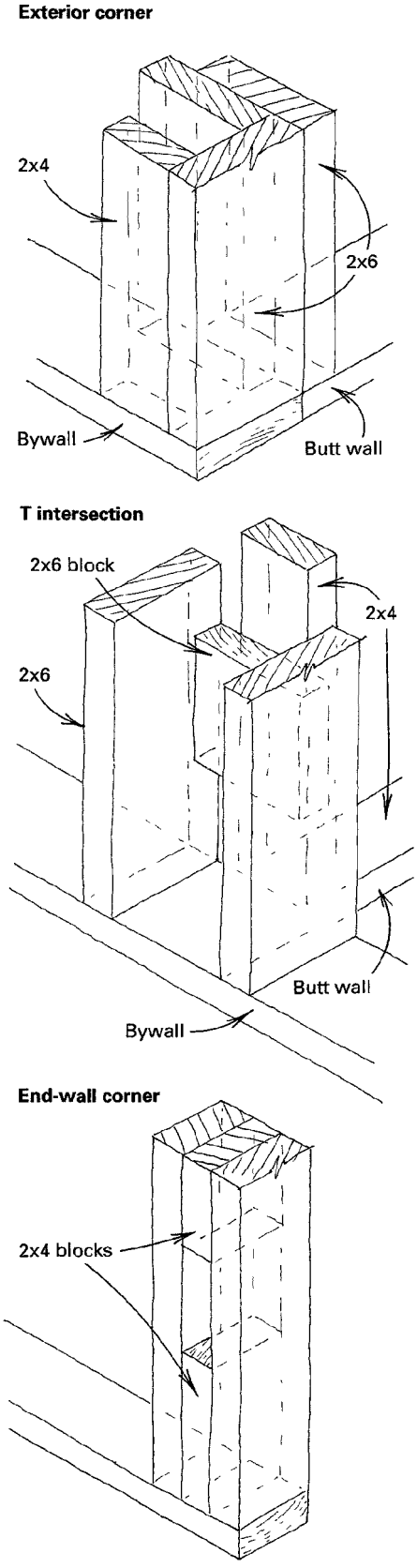
Some people precutall their jacks, but I like to make them as I nail the walls together. It's simple and fast: I take a common stud and lay it against the king stud, one end butted tightly against the header. Then I strike a line across the bottom end of the king stud onto the jack (bottom photo, facing page) and cut carefully, just removing the pencil line. I nail the jack to the king stud in a staggered pattern, 16 in. o. c. This method of cutting jacks in situ compensates for the variations in header width. The short cutoffs will be used up quickly for blocking.

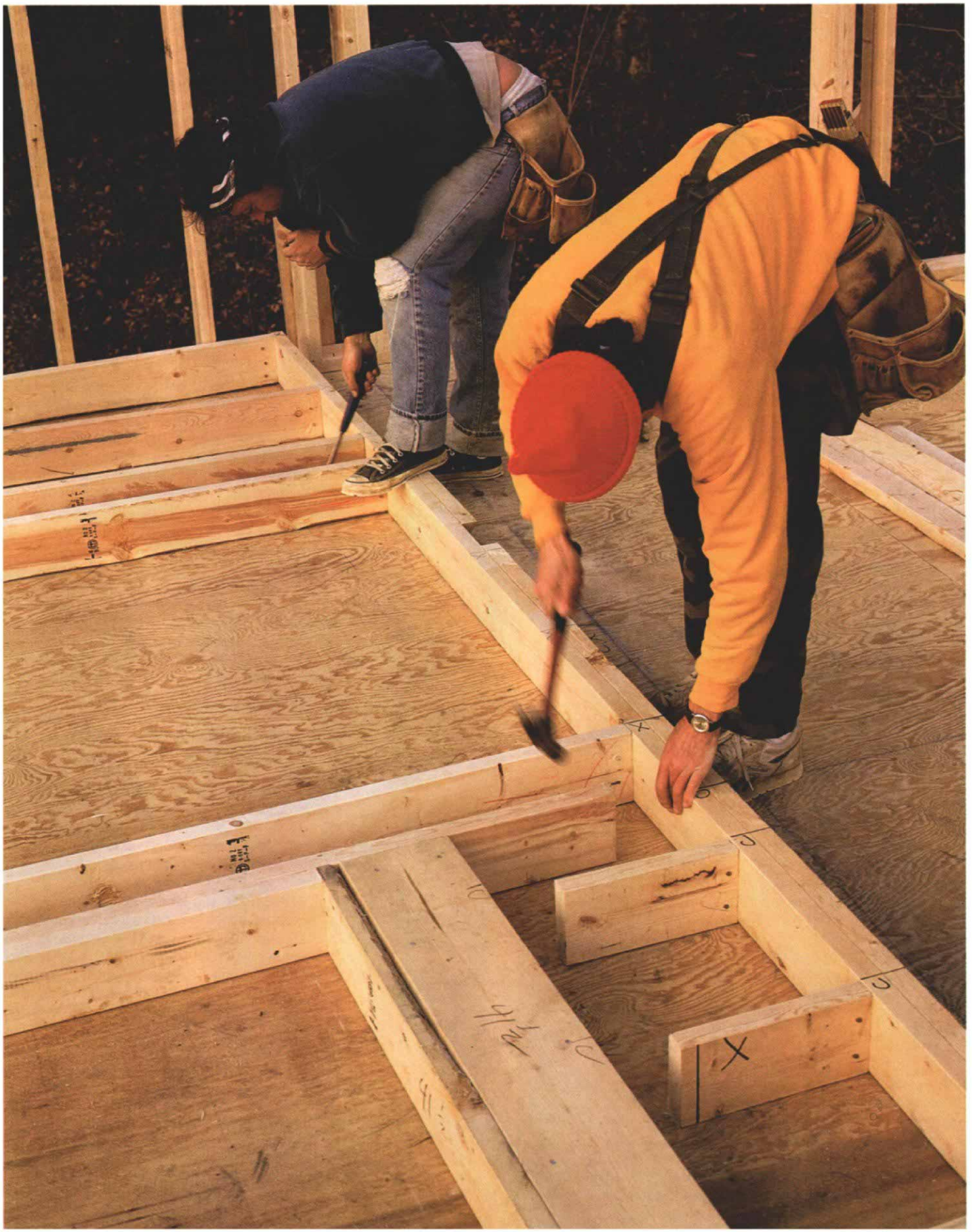
If the header is offset from the top plate by cripple studs, the wall-framing procedure is substantially the same, except that it's all done flat on the deck, toenailing cripples to the top plate and then to the header (photo p. 46).

Toenailing the studs—Because the top plate and the doubler are nailed together beforehand, the tops of the studs must be toenailed in place rather than through-nailed. Toenailing requires more skill than through-nailing; it might take a beginner a little longer to learn, but it's not as if it's something he won't have to leam eventually. And toenailing is stronger than through-nailing because it penetrates across the grain. As the walls are jockeyed around on the deck and moved into position to be raised, the bottom plates, which are through-nailed, loosen easily while the toenailed tops hold firm.

If you'd rather not toenail, or if you're using air nailers, which make toenailing difficult, you can tack the doubler to the top plate temporarily for layout purposes. Then pull the doubler off to through-nail the tops of the studs. And finally, nail the doubler back in place using an index mark to ascertain its correct position. Toenailing is the method I was taught years ago, and it's

Framing corners





Nailing the walls together. **After all the layout and cutting is finished, the wall components are nailed together. The author nails the doubler to the top plate before the wall is assembled. This then requires that the tops of the studs be toenailed to the plate, instead of through-nailed as in other methods. The pull-out strength of a toenail is greater than that of a through-nail into end grain.**

what I'm most comfortable with, so that's the method I'll describe.

When the headers and their jacks and king studs have been nailed in place, I stock the wall with common studs. One end of each stud rests on the top-plate assembly so that it won't bounce around when I start my toenails. I start at one end of the wall, lift up a stud, quickly eyeball it and lay it back down with the crown pointing to the left (because I'm right handed). I work my way down the length of the wall until I reach the end (photo right). For 2x6 walls I use 10d commons or 16d sinkers for toenailing. For 2x4 walls I use 8d commons or 10d sinkers. Starting at one end, I start my toenails in the upturned face of each stud—three nails for 2x6, two nails for 2x4. Ideally, the point of the nail should just peek through the bottom of the stud. I work my way down the row.

Bracing the top plate with my feet, I grab the first stud in my left hand. As I shove it away, I turn it 90° to the right so that it lies on edge, then I pull it back up firmly against the plate. Because the crown now faces up, the stud won't rock on the deck. One blow sets the nail, and two or three more drive it home (photo facing page). The stud will drift as it's toenailed, depending on the accuracy of the cut, the accuracy of the hammer blow and the hardness of the wood. Even if you are just a beginning carpenter, you'll quickly learn how far off the mark to start as a way of compensating for the force of your hammer blows.

Some carpenters drive a toenail in the 1½-in. edge of the stud to hold it in place, but I've always thought this was a superfluous practice that can be dispensed with. When I reach the end of the wall, I double back, firing nails into the other side of the stud—two nails for a 2x6 stud, one nail for 2x4, staggered with those on the other side.

When the studs, the jacks and the cripples are toenailed to the top plate, it's time to nail the bottom plate. The bottom plate gets through-nailed to the stud with 16d sinkers—three to a 2x6, two to a 2x4 (photo below right).

Crowning and toenailing. **Sighting down each stud determines its crown. All the studs are then laid on the top plates with the crowns facing the same direction. The toenails are then started in all the studs and nailed all at once, production-line style.**

Raising the walls—There are two schools of thought regarding the sequence in which the various walls should be raised. If space on the deck is tight, the long walls must be framed and raised before the other walls have been inflated with studs. Otherwise there won't be enough room. But if I have some room to spare, I'll start with the littlest walls.

I frame the walls and start piling them up. When the pile is finished, the little walls will be on the bottom, and the medium-length walls will be on top. Finally I frame and raise the long, exterior walls. Instead of bracing the long walls with a lot of diagonal 2x4s attached to scab blocks, I can pull an adjoining medium-length partition off the pile and drop it into place. This immediately buttresses the long wall. As I work from the perimeter of the house toward the inside, the pile diminishes, and the walls pop up quicker than dandelions.

It may go without saying, but when raising walls, especially long, heavy 2x6 walls, it is important to lift using the power in your legs rather than the smaller muscles in your back. After a wall has been lifted into a vertical position, I ask one man on the crew to line up the bottom plate to the chalkline on the deck while the others hold the wall steady.

The wall can usually be moved to the line by banging on it with a sledgehammer. I nail the bottom plate into the floor framing, one nail per bay. A bay is the space between studs.

All that remains is to rack the walls plumb and brace them (see *FHB* #23, pp. 68-71). The only braces sticking out into the room should be those necessary to straighten any long, uninterrupted walls that are crooked. The rest of the walls will have been braced by each other. With the next phase of the job already laid out, you're ready to rock and roll. □

Scott McBride is a contributing editor of Fine Homebuilding. *Photos by Charles Miller.*

Through-nailing. As **in other methods of framing, the author prescribes through-nailing the bottom of the studs, the jacks and the cripples. As he works his way down the plate, he aligns each component to its mark and nails it.**