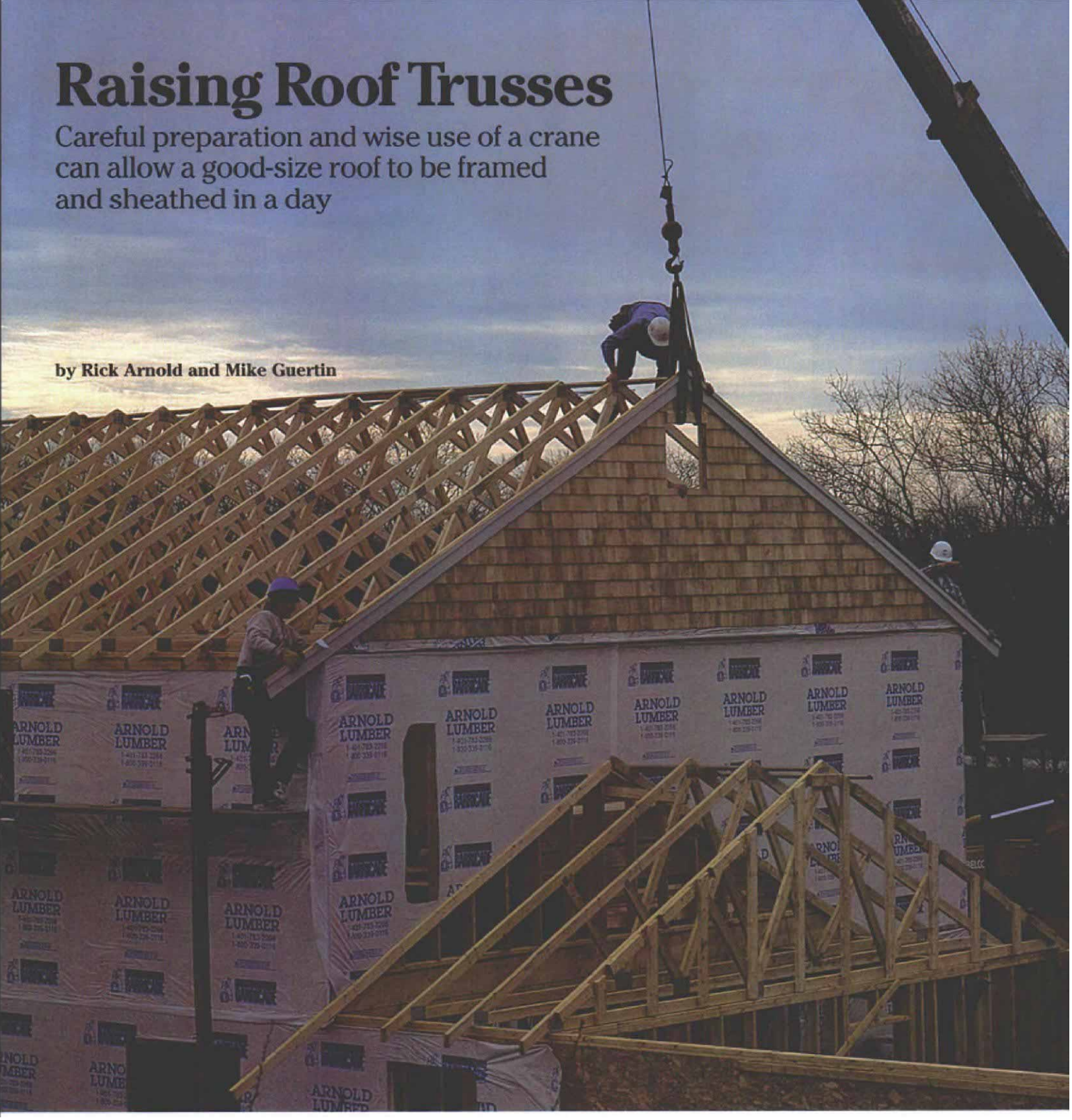
Raising Roof Trusses

Careful preparation and wise use of a crane can allow a good-size roof to be framed and sheathed in a day

by Rick Arnold and Mike Guertin



We learned truss raising the hard way. Fingers trapped between sliding trusses were broken, and backs were strained muscling 32-ft. wide trusses up two stories for steep-pitched colonial roofs. The process involved six or seven guys and usually lasted a whole frustrating, tiring day. The process was tough on the trusses as well. Lifting them flat would cause the truss plates to bend or pop, ruining the truss. If we were lucky enough to get all of the trusses installed in a day, we then faced the arduous task of lugging up all of the sheathing and roofing materials. After all of that hauling and lifting, there wasn't much enthusiasm or energy for swinging a hammer. Our lives got much simpler after we opened the phone book to the listing for "Cranes."

We have come to depend on a crane to lift the trusses for all but the smallest single-story roofs. In this article we'll discuss how we use a crane to assemble simple gable roofs. We'll cover hip and valley roofs in the February/March 1996 issue of *Fine Homebuilding*.

Before the roofing materials and trusses are dropped at the site, we anticipate where the crane will be positioned so that all materials are out of the way but still easily within reach. Before the trusses are lifted to the roof, the crane hoists the sheathing, the shingles and the interior-framing materials for the second floor (sidebar p. 55). The crane we hire can usually reach an entire

Instant, ready-made gable. With the sheathing, shingles and trim boards already attached, the only thing this gable needs is the vent. The crew will leave the peak of this gable just tacked in place until the overall length of the house is checked at the eaves and the peak.

Stacked for easy layout. With the trusses stacked neatly on the ground, layout lines are drawn on all of them at once. The line closest to the tail will be used to position the truss on top of the wall plates. The other lines are for ceiling strapping. The top chords are laid out for roof sheathing.

house and garage from one position near the outside middle of the building. We also keep the job site as clean as possible. Scrap lumber and debris can be accidents waiting to happen on raising day. Our scrap pile is always located out of the way but still within tossing distance of the house.

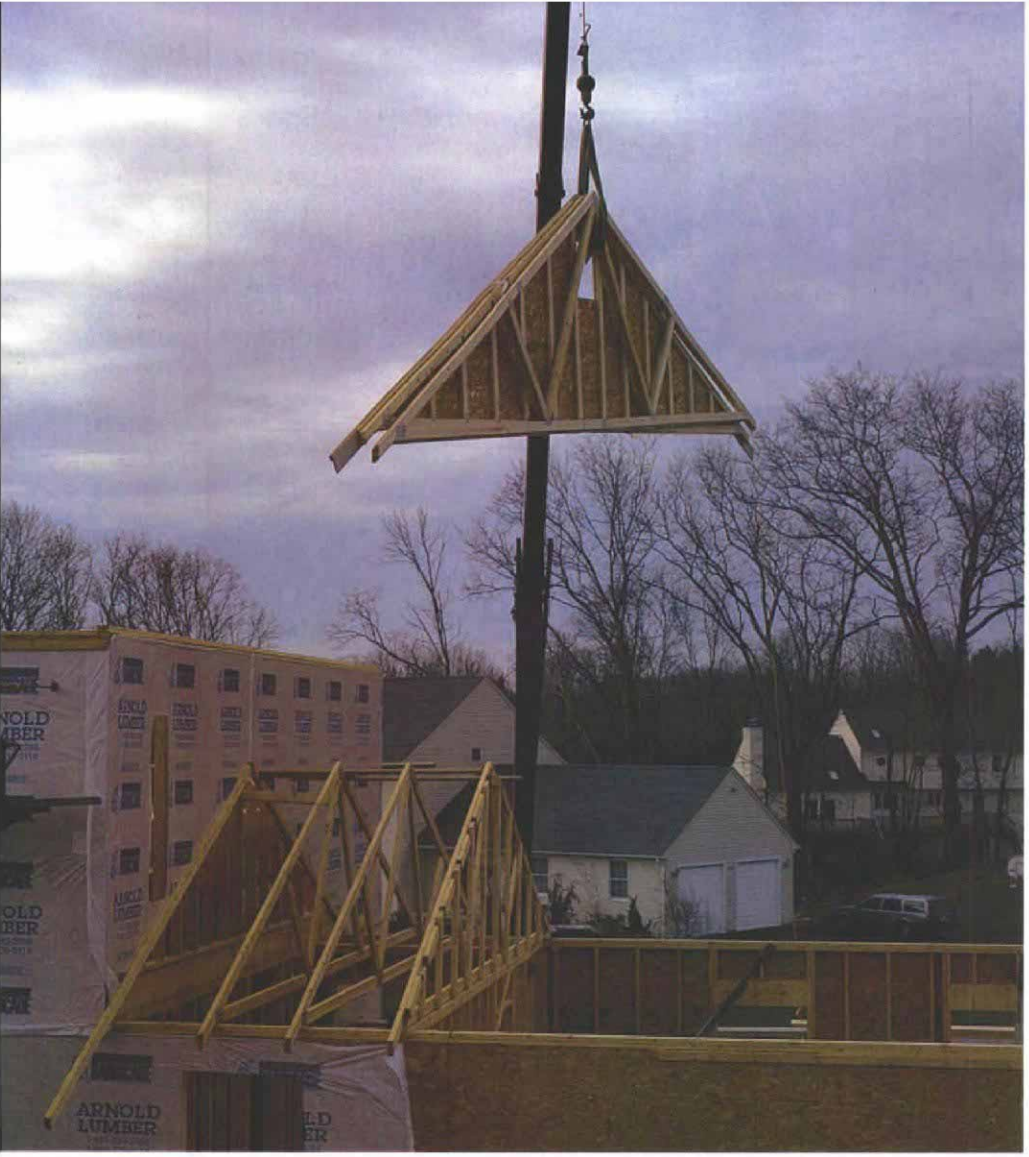
When the trusses arrive, we land them on top of 2x blocks as they come off the truck to keep them as flat and as much out of the dirt as possible. Sometimes trusses arrive as much as a week before they can be installed. If the trusses are not kept flat, they can warp, and after they've warped, they're much harder to install.

Layouts are done with the trusses on the ground—We mark three different sets of layout lines on the trusses before they ever get off the ground (top photo). The first set is for positioning the trusses on the walls. The second is for the strapping or furring strips to which we'll screw the drywall or plasterboard ceilings, and the last set of lines is for the roof sheathing. We also mark the front of the trusses near the tail of the top chord to avoid getting them spun in reverse when they're lifted. Before we mark these lines, the trusses need to be aligned on top of one another as closely as possible. We arrange them in a stack by tapping them back and forth with a sledgehammer until all of the bottom chords and ridges are in line. When the trusses are in a straight stack, we can make our layout lines.

In the past we aligned the trusses after they were raised. We would run a string from one gable peak to the other and bang the trusses back and forth with a sledgehammer until they lined up with the string. But all of that banging knocked the walls out of plumb, and the whole process took a lot of time. We also tried measuring in from the tail cuts to position the trusses but soon discovered that those distances varied significantly and that the peaks of the trusses didn't line up. Now we mark the wall position on the bottom chord of the trusses before we lift them; it's the quickest, most accurate way of ensuring that the trusses are installed in a straight line.

First we measure the overall width of the house where the trusses will sit. Then we locate the exact center of the bottom chord on the top truss of

Nails for attaching the gable truss are started on the ground. To facilitate setting the gable truss, nails are started along the bottom chord. When the truss is in position, a crew member on a ladder will drive the nails into the top plate of the gable-end wall.



The first gable truss is sent up with two regular trusses. By sending the first three trusses up together, the crane will be able to hold the gable truss steady while the other trusses are set and while braces are attached to the gable truss.

our pile and measure back half of the width of the building minus the thickness of the wall from that point. For example, if the house is 30 ft. wide with 2x4 walls, we would measure back 14 ft. 8⅜ in. from the center point (figuring the walls at 3⅝ in.). We mark each end of the top truss and then repeat the whole process on the lowest truss in the pile. We either snap a chalkline or scribe a line along a straightedge between the top and bottom marks to transfer the layout to the other trusses. We extend our position lines slightly onto the face of the bottom chord to make it easier to see the lines when the trusses are being dropped into place.

Ceilings in our region are typically strapped with 1x3 furring strips before the interior walls and wallboard are installed. Furring strips serve several functions, one of which is adding a structural element to the trusses. If we didn't use strapping, the truss engineer would require us to run three or four 2x braces the length of the building to tie the trusses together and also to keep the gable walls straight.

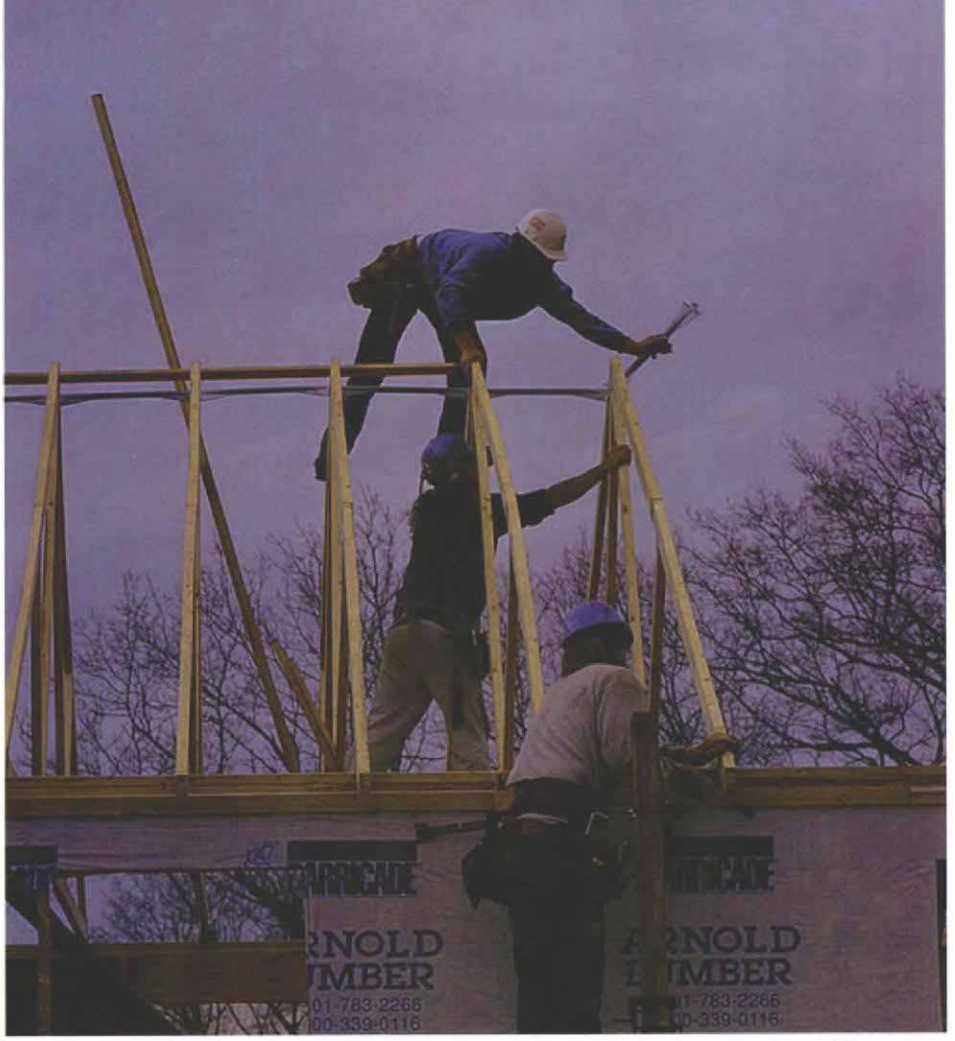
We mark the lines for the furring strips 16 in. o. c. from the positioning marks at one end of the truss. Again, the same marks are made on the top and bottom trusses, and lines are drawn or snapped between them. We run a lumber crayon up one side of each line to indicate which side of the line our furring gets nailed to once the trusses are set.

The last set of layout lines is for the roof sheathing. We usually fill in any ripped sheets at the bottom of the roof rather than at the top, so we begin our layout from the ridge. First we measure down along the top chord of the upper truss from the peak to the 4-ft. increment nearest the tail of the truss. We add ⅛ in. per sheet for the H-clips plus an extra ¼ in. to our overall measurement to be safe. For example, if the top chord of the truss is 17 ft. 6 in., we would measure 16ft. ¾ in. (4 sheets x ⅛ in. = ½ in.; ½ in. + ¼ in. = ¾ in.) If a ridge vent is being installed, we increase our extra amount to a full 1 in., and our layout line is at 16 ft. 1 ½ in. The top chords of the lowest truss in the pile are marked at the same points, and lines are drawn or snapped between the marks.

Gable trusses are sheathed and sided before they go up—Another big time-saver that we've found is sheathing, siding and trimming the gable-end trusses while they are still on the ground [bottom photo, p. 51). It saves us the hassle of setting up tall staging to work up high and requires just a little planning. Because the gable trusses sit on top of walls, we make sure that there are no humps in the wall or dips in the bottom chord of the truss. We check the walls by eye and string the bottom chord of the gable trusses. If necessary, we rip a little off the bottom of the bottom chord of the truss.

We always plan to extend our gable-truss sheathing down beyond the bottom chord of the truss a couple of inches. To set this overhang, we run a string between the seat positions of the truss and measure from the string to set our sheathing. We always leave the sheathing ¼ in. short to avoid any binding between the gable-wall sheathing and the truss sheathing when we're setting the truss. The gable truss must be lying absolutely flat when the sheathing is applied, or it may be impossible to straighten the truss when it's installed. Any sheathing that extends above the top chord gets trimmed off flush.

If no rake overhangs are called for, siding the gable goes quickly. We start by figuring out the approximate height of the top of the second-floor windows (they don't get installed until after the trusses) and determine the siding courses from there. It's best to start one or two courses up from the bottom of the truss sheathing so that the siding doesn't interfere with the truss installation. Wood siding allows us to adjust our course exposure slightly to blend the siding on the walls with the truss siding. We've never tried this technique with vinyl siding and suspect that it would



Spacers lock the peaks in position. One crew member holds the trusses in place while another attaches truss spacers (made by Truslock Inc.) along the peaks of the trusses. Strapping replaces the spacers so that only a couple of 16-ft. lengths of spacers are needed. The crew member at the rear of the house taps the truss into position on the wall plate and nails it home.

The front of the truss is left loose. With the trusses secured at the rear of the house and the peaks locked together, the front of each truss is allowed to float until after all of the trusses are in place. The walls can then be restrung and straightened if necessary before the fronts are nailed permanently.

be difficult to match the courses exactly. We're careful to nail the bottom course of the truss siding up high so that the course coming up from below can be slipped in later.

With no rake overhangs, we run the siding over the top chord of the truss but keep the nails 3 in. back from the top of the chord. The gable-vent hole can be cut out at this point, and the vent tacked in for installing the siding. The vent is then removed to give us a hole for our lifting straps, and it is reinstalled later (photo p. 50). When there are no gable vents, we leave off the last couple of siding courses at the top of the truss and cut a hole for the straps. We precut the missing siding pieces and tack them to the gable end to be nailed on later from a ladder.

After the siding is nailed on, we snap a chalkline 2½ in. down from the top edge of the top chord and cut the siding off to that line. We nail on a piece of 1x3 above the cut siding as a spacer. The rake boards and band moldings are nailed over the 1x3, and the height of the rake boards is adjusted to match the thickness of the roof sheathing. We leave the tails of the rake boards long and cut them off after the gable truss is set in place.

If rake overhangs are called for, we take extra care to keep the top chord of the truss perfectly straight while we're sheathing the truss. We make our overhangs out of a 2x4 ladder with waste sheathing nailed to the topside of it to keep it stable. The overhang assembly is nailed to the sheathed gable truss, keeping the top of the assembly flush with the top of the truss. We install ½-in. AC plywood on the underside of the overhangs for our soffits and nail the rake boards and band moldings to the outside of the ladder, again adjusting for the thickness of the roof sheathing. We side the gable the same as before except that now the siding butts to the plywood soffit and a 1x2 frieze board is added.

We often have a chimney or chimney chase on the gable ends of our houses. Before siding the truss, we meet with the mason and determine the location of the chimney so that we can break back the siding and rake trim to his dimensions. After the gable truss is installed, we drop a plumb bob from the gable siding to the fireplace footing and snap a chalkline for the mason to go by. The final step in propping the gable truss is starting nails in the bottom of the truss that will attach the bottom chord of the truss to the end-wall plate (bottom photo, p. 51).

Using a nailer saves a truss—After the trusses are ready, there are other preparations that make the raising go more smoothly. First we set up all of the staging front and rear. All of the walls that will receive the trusses are laid out, and strings are set up along the inside of the top plates for straightening the walls. We install adjustable diagonal braces to help straighten and tune the walls. We double-check the plans to see where the second-floor walls will be built in order to locate the best out-of-the-way places to drop materials (sidebar p. 55). We build a lot of two-story colonials with single-story attached garages. We save the cost of one truss by using a nailer in place of the truss that ordinarily would go against the wall of house (photo facing page). We slide one truss up before the crane arrives and use it as a template to mark the nailer location. After installing the nailer on the house wall, we set the truss in place and wait for the crane do the rest.

We also lay out ten 16-ft. pieces of 1x3 with 2-ft. centers for truss spacing and have another ten ready for diagonal bracing. We round up a bunch of clubs, 3-ft. to 4-ft. pieces of 2x4, to put under and between the piles of materials when the crane drops them off on the second floor.

Crew members have assigned tasks for the lift—As truss-raising day approaches, we watch the weather carefully. The best weather for raising trusses is calm and overcast. Wind is our worst enemy, and bright sun can make it difficult to see hand signals as well as trusses in midair.

We always shoot for an early start when the sun's angle is low and when the winds are usually calmest Before the actual lifting begins we round up all of the tools we'll need for the raising, including the truss spacers, a level and a straightedge for plumbing the first gable, and braces for holding and adjusting the first gable-end truss We also get the tag line ready, fill our pouches with nails and recheck the walls to make sure they are straight We also set up a ladder on the end of the house to make it easier to nail the bottom of the gable truss

We always prefer to be a little overstaffed on raising day Everyone has assigned duties, and the most important task is signaling the crane operator We have used the same operator for six years, and we try to have the same crew member do the signaling for every raising (sidebar right) For safety's sake we always review the hand signals with the crane operator and the crew member who will be signaling A thumb pointed in the wrong direction could get someone knocked off the staging in an instant The signal person should never leave the crane operator's sight unless he signals "stop and hold'

For lifting materials, two crew members on the ground strap and launch loads and two or three other crew members inside the house land and unstrap loads The signal person usually sits in a second-floor window where he can watch materials coming in and see the crane operator clearly After materials are secured on the second floor, we reposition the crew for the trusses

The signal person is now stationed on the staging at the front of the house to set truss ends and to signal the crane operator A second crew member is on the rear staging to orient the positioning marks on the trusses to the inside of the wall and to nail the trusses to the rear-wall plates Two other crew members work in the middle of the trusses tying them together at the peak when the crane drops them in. A crew member on the ground puts the trusses on the hook or strap and handles the tag line that steadies the trusses en route from the ground to the house A sixth person is useful but not absolutely necessary to act as a gofer and to help when needed

Lifting the first three trusses at once is safe and easy—Setting the first gable truss can be tricky The best way we've found is sending that truss aloft with two other trusses, but with the gable truss in a separate strap (photo p. 52). If we sent up the gable truss by itself we would have to depend on a brace with a steep angle to hold the gable until other trusses could be set Our method lets the crane hold the gable truss steady until two other trusses are set and safer braces can be attached. Here's how it works

After landing the first three trusses at the end of the house, the bottoms of the two regular trusses are kicked away from the gable about a foot so that they don't interfere with setting the gable truss We adjust the gable truss to its positioning mark at the rear wall, then drive all of the nails we'd started earlier to fasten the bottom chord of the truss to the top plate of the end wall

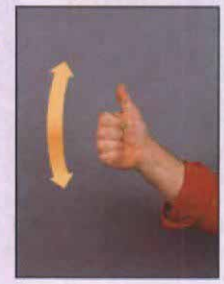
The strap holding the two regular trusses is then released, but the one holding the gable remains

Getting the signals straight

Communication between the crane operator and crew is essential for safe and smooth lifting. A designated signal person has the responsibility of directing the lifting operation through hand signals. Here are the four basic hand signals we use with all of our crane operators.

Cable up/cable down— To move a load straight up or down, the crane operator must take up or let out the cable holding the load. To signal this procedure to the operator, point one finger either straight up or straight down and spin your hand in a circle.

Boom up/boom down— Raising the boom on the crane moves the load toward the crane, and lowering the boom sends the load away. The signal for this procedure is a thumb pointed either up or down with the hand moving in an up or down motion.



Boom right/boom left— Moving a load side to side is accomplished by pivoting the crane and boom. Pointing a finger to one side or the other in the direction you want the load to move is the proper signal for this procedure.

Stop and hold— To hold a load still momentarily, for example, while positioning blocks on the deck for materials to land on, a fist held stationary in the air stops the crane operation until the next signal is given.—*R. A. and M. G.*

SEE ERRATA AT END OF ARTICLE

We use a short length of 1x3 with the same 2-ft layout as the wall plate to anchor the first two regular trusses to the gable Then the bases are nailed to the wall plates on the rear wall

Next, we brace the gable end with a couple of long diagonals running down to the subfloor The extra crew member then slides two 2x braces through the webs of the regular trusses and the top ends of the braces are nailed as high as possible to the gable end truss We make sure that the braces won't interfere with the bottom chord of the next truss we lift into place. We plumb the gable truss with a level and a straightedge and when it's ready, the extra crew member fastens the braces to 2x blocks that have been nailed through the subfloor and into joists Only after the braces have been nailed at both ends do we release the strap from the gable truss

After the first trusses are set, we usually lift two trusses at a time using a hook that the crane operator had made The rest of the trusses go up rather quickly One of the two crew members working the center of the trusses holds the trusses while the other fastens the Truslock truss spacers (left photo, p. 53) (Truslock Inc. Route 1, Box 135, Calvert City, Ky 42029, 800-334-9689) These spacers unfold, gripping the next truss and holding it at the proper spacing in one simple motion (see *FHB* #93, p. 98)

The two crew members working the middle of the trusses set the pace of installation and direct the others The crew member at the rear of the house continues to align the positioning mark on each truss with the inside of the rear wall and nails his end of the truss securely with three 16d nails The crew member at the front of the house just traps his end of the truss with a couple of nails (right photo, p. 53) After all of the trusses are up, we restraighten the walls and nail the front ends of the trusses with three 16d nails

The extra crew member follows the action, strapping the ridge of the trusses with the 16-ft 1x3s and tacking diagonal braces to secure the trusses until sheathing goes on After the ridge is strapped, the truss spacers can be removed and used further down the roof The top of the other gable end is tacked until we can set the distance between gables to the same measurement as the overall length of the house

The garage trusses are a breeze by comparison The first truss has been braced to the house wall We just set the trusses the same as before and plumb the garage gable after the crane leaves

Lifting the materials and setting the trusses for a 2,600sq ft to3200-sq ft house with an attached garage generally takes us three to four hours By the end of the day, we usually have the entire roof sheathed and our subfascias set with a crew of five or six. If for some reason we can't sheathe at least one side of the roof before we have to leave for the day, we put on plenty of diagonal bracing to secure the trusses in case the wind decides to kick up during the night.

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Photos this page: Scott Phillips

Let a crane do the heavy lifting

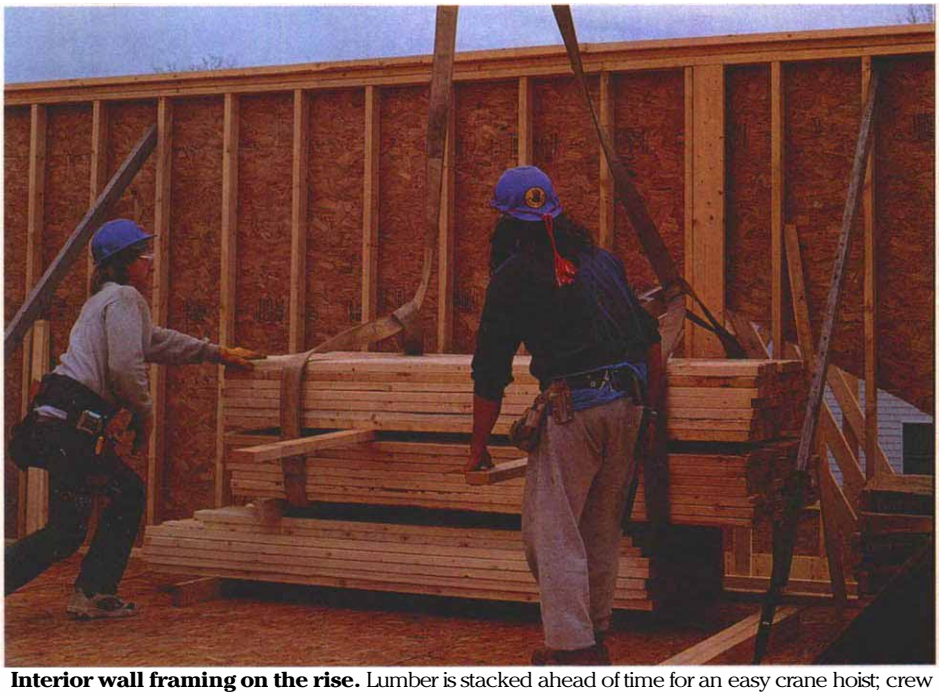
No matter what your physical condition, reducing the amount of bull work on the job is always welcome. A crane is one great way of saving muscles as well as man-hours and money (our crane operator usually charges around $65 per hour). Before the trusses are raised, the crane lifts the roof sheathing, second-floor interior-wall studs, furring strips and roof shingles to the second floor.

Materials are prepped for lifting ahead of time—With a rough count of all of the second-floor interior studs we'll need, we crown, cut and stack all of the framing stock on 3-ft. to 4-ft. scraps of 2x4 (top photo). The roof shingles are usually delivered the day before the truss raising, along with several extra pallets to stack them on. We generally stack 21 to 24 bundles per pallet and use a long hook that the crane operator made to feed the lifting strap through the pallet. We use 3-ft. 2x4s as strap spreaders to keep the lifting straps from crunching the top bundles of shingles (center photo). Roofing subcontractors love having the shingles on the second floor. Passing the bundles out a window, onto the staging and up to the roof is much easier and safer than hauling them up two stories on a ladder.

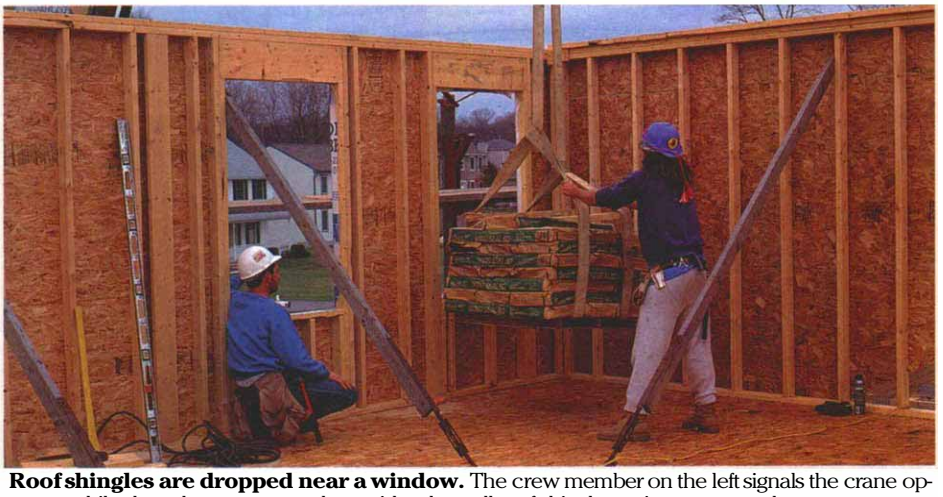
The roof sheathing is sent out at the same time as the shingles. Our lumberyard will band sheets of plywood in any quantity that we ask. Bundles of 15 to 20 sheets for ⅝-in. plywood or bundles of 20 to 25 sheets for ½-in. plywood seem to work best for us (bottom photo). When the sheathing is slid off the delivery truck, we ask the driver to put heavy-duty nylon load straps around the entire stack to keep the steel bands from snapping. Occasionally, we get lucky and are able to coordinate delivery of the sheathing and shingles with the actual lift. In those rare instances the crane plucks the sheathing and shingles right off the delivery truck and lifts them up to the second floor.

Placement of the materials on the second-floor deck takes a bit of planning—Roof sheathing and the furring will be used up before the ulterior walls are built so that material can go almost anywhere. The studs and the roof shingles, however, need to be positioned so that they won't interfere with framing the interior walls. We try to land the stacks near windows for easy handling, and because of the concentrated weight, we keep them away from the middle of the floor joists to avoid overloading them.

When rigging the bundles and stacks with the lifting straps, we try to keep the straps as far apart on the load as possible. The crane operator takes the strain slowly so that we can make sure the load is going to stay flat and even while it's in the air. It's not uncommon to have a load put back down on the ground to get the straps positioned just right. This minor hassle is infinitely preferable to a load coming apart or straps shifting and sliding while a load is in midair.—*R. A. and M. G.*



Interior wall framing on the rise. Lumber is stacked ahead of time for an easy crane hoist; crew members land the framing lumber inside the house where it will be out of the way until it's needed.



Roof shingles are dropped near a window. The crew member on the left signals the crane operator while the other crew member guides the pallet of shingles to its temporary home.

Prepackaged loads of sheathing are easier to handle. The lumber company bundles the sheathing in stacks of 15 to 20 sheets for easy strapping and lifting.

ERRATA

Use your finger, not your thumb

As a crane operator for the past 30 years, I was pleased to see crane signals published in Rick Arnold and Mike Guertin's article "Raising Roof Trusses" *(FHB* #99, pp. 50-55). I would like to note that the pictured signal for boom right/boom left (swinging the load), shown using the thumb, can be confused with the boom up/boom down signal from the operator's angle. This confusion could be dangerous for the erection crew.

The proper signal for boom right/boom left is to use the forefinger or all four fingers held horizontally pointing in the desired direction.

-Dennis J. DiSario, Philadelphia, Pa.