21st-Century Post-and-Beam

Modern hardware takes the place of time-consuming traditional timber-framing joinery in this 14x20 barn

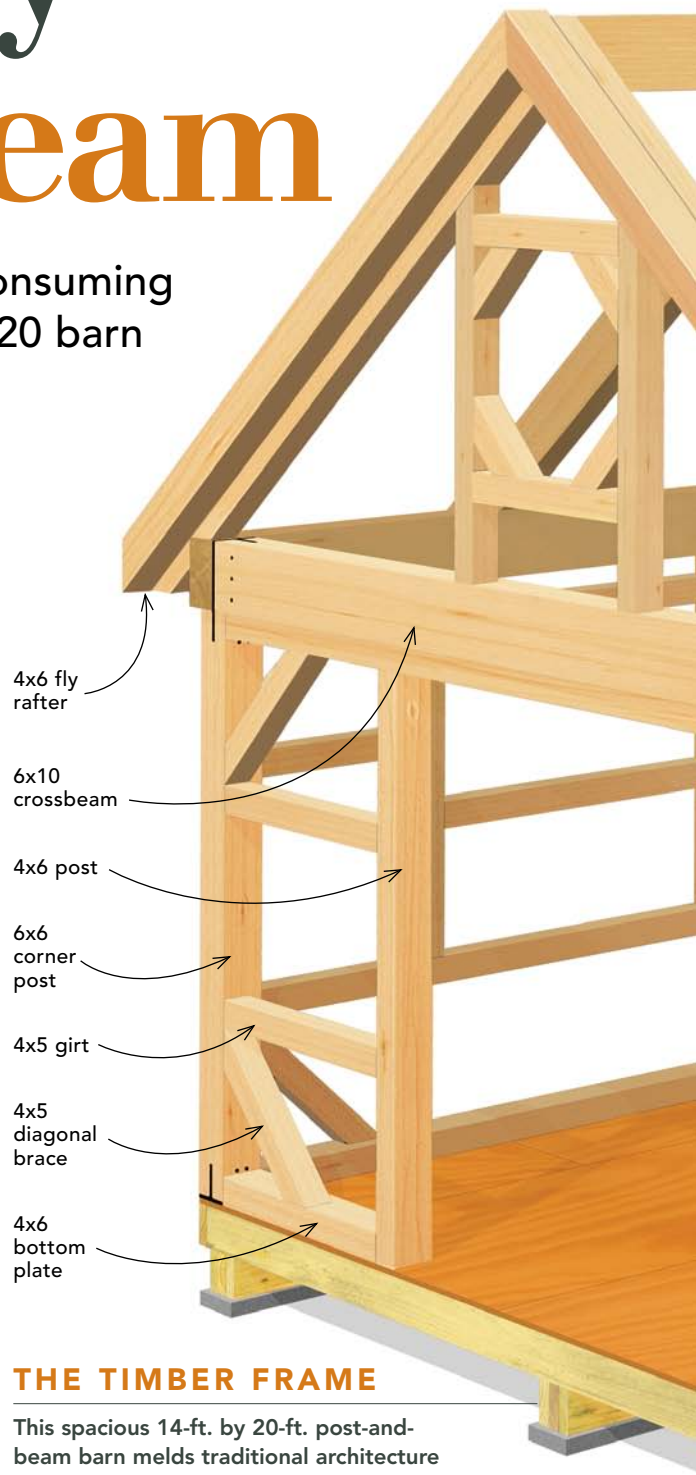
BY JOSEPH TRUINI

Unlike in a traditional post-and-beam structure, there's not a single mortise-and-tenon or scarf joint in this whole barn. Built on a conventional 2x6 floor, the frame is assembled with metal fasteners called T-Rex connectors. Each connector's flange is screwed to a supporting member, and its leg slides into a post or beam with a slot cut to receive it. These joints are held together with aluminum pins. This modern construction method might not impress timber-frame purists, but it does provide a quick and strong way to build a beautiful post-and-beam barn.

While it's attractive on the outside, what makes this barn truly special is what's visible on the inside: an exposed frame of large white-pine timbers that would warm the heart of any barn builder. Rough-sawn timbers, sometimes called "green" lumber, are cut to full dimension; a rough-sawn 6x6 post actually measures 6 in. by 6 in. Nominal-dimension lumber is milled and surfaced to slightly smaller sizes, so a nominal 6x6 is only 5½ in. sq., and a nominal 4x4 is 3½ in. sq.

You aren't likely to find large timbers such as those used in this structure at home centers or at most lumberyards, so you'll probably have to find a local sawmill to cut them. Most rural areas in forest country have a few such sawmills. Sources to help find them include woodweb.com and woodmizer.com. It's likely that these web sources don't come close to representing every local sawyer, so it may also be worth asking folks at lumberyards and with tree services (who may sell logs to mills). Many of these sawmills are low-tech operations, both in their equipment and in their marketing. For example, I only know when my local sawyer is open when I see that the cable he closes his driveway with is down. One advantage of finding a local sawyer is that because the material hasn't been marked up in price three times before you ever get a sniff of pine resin, it's likely to be a comparative bargain.

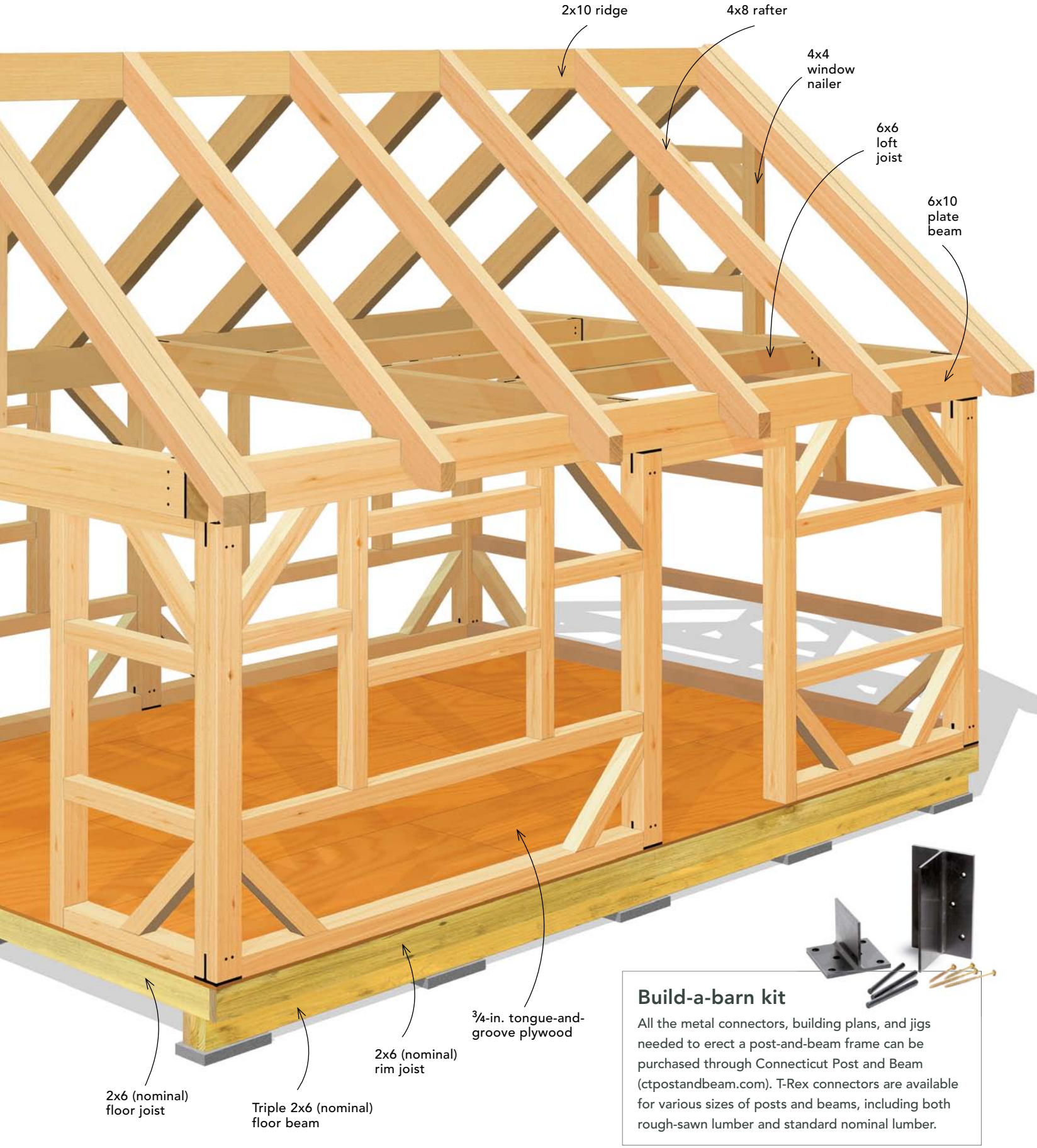
Joseph Truini is a writer from Roxbury, Conn. This article is an excerpt from his forthcoming book, *Building Sheds* (The Taunton Press). Photos by Geoffrey Gross, except where noted.



THE TIMBER FRAME

This spacious 14-ft. by 20-ft. post-and-beam barn melds traditional architecture with modern building methods, resulting in a timber-frame building that goes up surprisingly fast. The barn features a frame of rough-sawn 6x6 posts, 6x10 beams, and 4x8 rafters, with a few other sizes mixed in for girts, plates, and bracing. The walls are braced with diagonal 4x5s, and the window and door openings are framed with 4x4s or 4x5s, all sourced from a local sawmill. All frame components are milled from white pine. Other species of wood can work just as well, although most are heavier.

Photos: this page, Joseph Truini; facing page, Rodney Diaz. Drawings: Trevor Johnston.

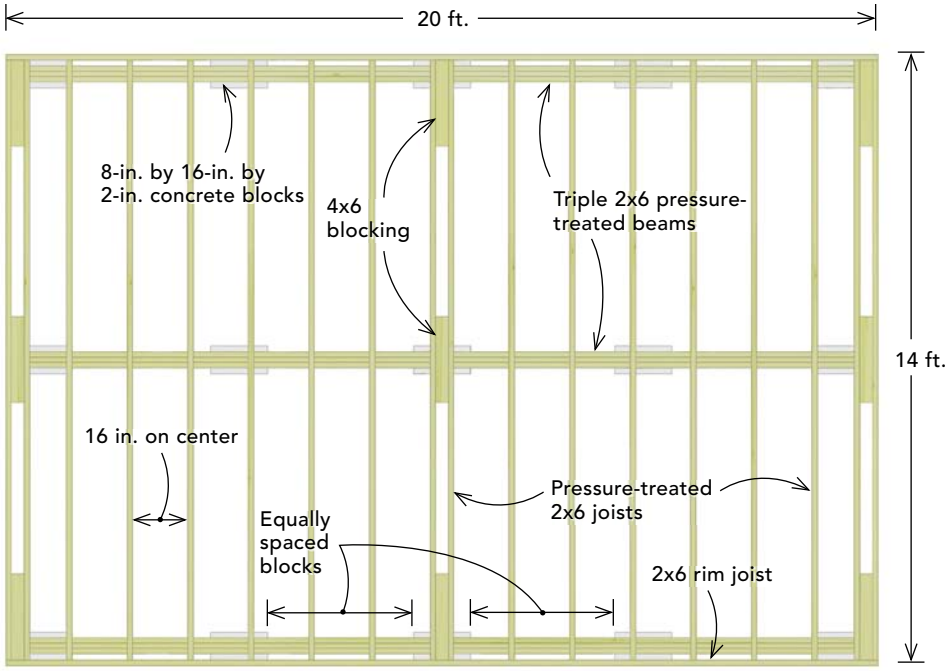


Build-a-barn kit

All the metal connectors, building plans, and jigs needed to erect a post-and-beam frame can be purchased through Connecticut Post and Beam (ctpostandbeam.com). T-Rex connectors are available for various sizes of posts and beams, including both rough-sawn lumber and standard nominal lumber.

ON-GRADE FOOTINGS AND A CONVENTIONAL FLOOR

Our local building department allowed us to build this 280-sq.-ft. barn on an on-grade foundation, meaning that we didn't have to dig down to the frost line. Other jurisdictions may require different footings, so check with your local building department. Here, dry-stacked 2-in. solid-concrete blocks support a conventionally framed floor system. The blocks are placed in holes dug through the topsoil to the underlying subsoil. They stick at least 4 in. out of the ground so that the framing isn't in contact with the dirt.



Lay three rows of blocks. *Space five stacks of blocks equally in each row, leveling the stacks with each other using a long 2x6 and a level. Add blocks or pieces of pressure-treated lumber as needed to achieve level. Check the rows of blocks for square by measuring the distances from corner to corner, making sure they are equal.*

Three beams support the floor. *Make each beam from three 20-ft.-long pressure-treated 2x6s joined with 3-in. decking screws spaced every 12 in. You also can splice 8-ft. and 12-ft. 2x6s, landing the joints on the footing blocks and making at least one layer of each beam continuous over each block. Check the diagonals for square.*

Start with the end and center joists. *Because of the support posts that will be placed at the corners and centers of the long walls, these locations each receive a pair of joists and extra blocking. Secure all joists with a pair of 3-in. corrosion-resistant deck screws.*

Install support blocking. *The structural posts that will support the frame require solid blocking below them. Cut 4x6 pressure-treated blocks about 2 ft. long, and fasten them between a pair of joists.*

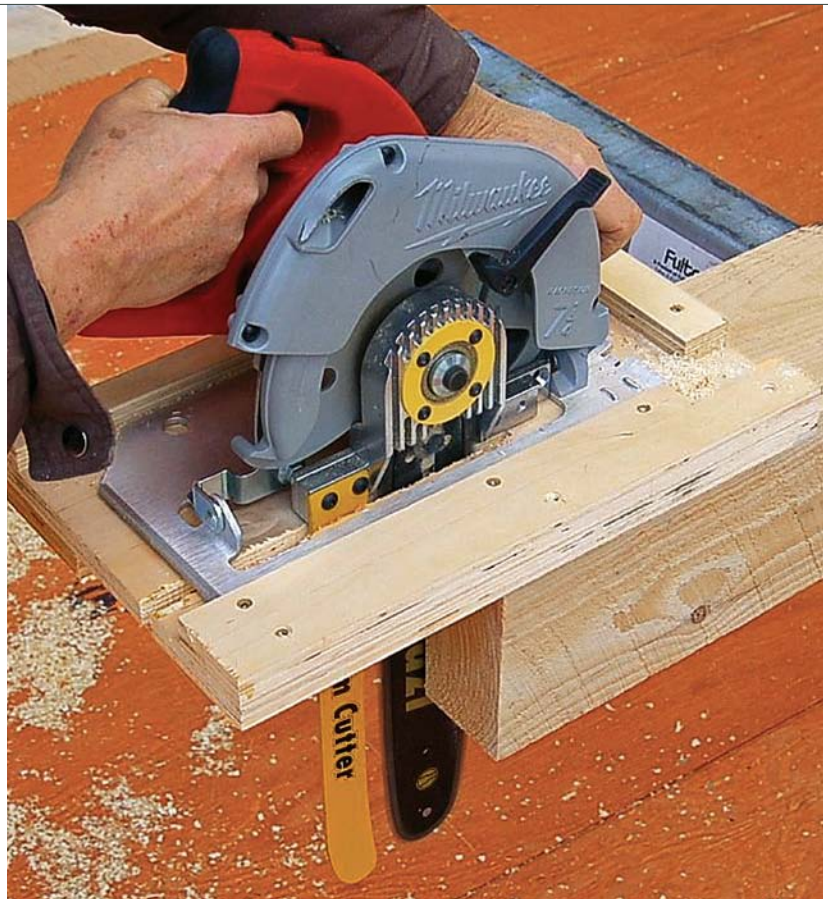
Fasten the rest of the joists. *Except for the center pair, the joists are installed on 16-in. centers, like most conventionally framed floors. Make the joists overhang the beams by 3 in., checking their alignment with a string.*

Nail on the rim joists. *Rim joists close off the floor framing and keep the joists standing upright. Secure them with three 16d hot-dipped galvanized nails driven into the end of each joist.*

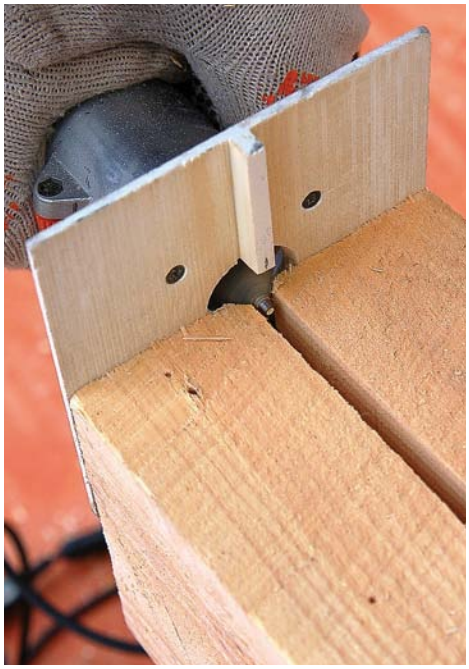
Sheathe the floor frame. *Make sure the end of each sheet of ¾-in. tongue-and-groove plywood falls on the center of a joist, and stagger the seams between sheets by 48 in. Fasten the plywood to the joists with 2½-in. decking screws spaced 10 in. to 12 in. apart.*

RAISE THE POSTS

Six 6x6 posts support the roof—one on each corner and at the middle of the two 20-ft.-long walls—and these are fastened to the floor below and the beams above with T-Rex connectors. Other posts used to frame door and window openings are simply toe-screwed in place. Large-capacity saws, which are available at most tool-rental dealers, are needed to cut the timbers accurately. We used three different saws, depending on the size of the timbers. We cut the rafters, ridge beam, diagonal braces, and other smaller timbers with a 12-in. sliding compound-miter saw or a 10-in. Big Foot circular saw. We cut the larger posts and beams to length with a Prazi Beam Cutter, a chainsaw fixture attached to a circular saw. We also used this fixture to cut slots in the ends of the posts and beams for the metal connectors.



Slot the posts. *Cut six 6x6 posts to 84 in. long, then use the Beam Cutter to make a ¼-in.-wide by 5-in.-deep slot in both ends of each post. To center the slots, make a plywood jig that guides the saw, and screw it to the post.*



Chamfer the slots. *A router fitted with a purpose-built plywood base and a 45° chamfering bit eases the edges of the slots to allow the T-Rex connectors to sit flat against the post ends.*

Insert a T-Rex connector into each slot. *Fasten the connectors temporarily to the posts with two 1⅝-in. screws. Draw a line across the edge of the metal connectors onto the posts. These reference marks help to ensure that the connectors are installed back to their original positions when assembly begins.*

A jig provides consistency. *This simple jig is made from scrap wood and two steel bushings. When screwed to the post, it provides a quick and accurate way to drill holes for the ½-in.-dia. aluminum pins that secure the posts to the connectors. Bore two holes clean through both the post and the connector with a ½-in. twist bit.*

Attach the connector. *With its edges flush with the edges of the plywood deck, fasten the connector to the floor and the blocking below with six 4-in.-long structural screws such as GRK's RSS construction screws, Screw Products' construction lag screws, or FastenMaster's TimberLoks.*

Secure the post. *Hammer a ½-in. by 6-in. aluminum pin through each hole. If a pin is hard to drive, the holes may be misaligned. Using a ½-in. twist bit, bore into the offending holes to lightly chamfer the edges of the holes in the metal connector. The slight chamfer will guide the pin.*

Braces hold the posts plumb. *Install the remaining five posts in a similar manner, securing each with two pins. Then, to hold them plumb, use a 4-ft. level and temporary 2x4 diagonal braces screwed to the posts.*

SET THE BEAMS

The 6x6 posts support an overhead framework of horizontal timbers: two 20-ft.-4-in.-long 6x10 plate beams that span the length of the barn (the ends of the plate beams overhang the end posts by 2 in.), three 13-ft.-long 6x10 crossbeams that run perpendicular to the plate beams, and three 6-ft.-4½-in.-long 6x6 joists that fit between two crossbeams to frame the loft. The eight beams and joists are cut to length, then both ends of the three crossbeams and three joists are slotted with the Beam Cutter. The plate beams don't require slots.

Fasten connectors to the beam. *Place the beam upside down on the floor next to the posts, extending it 2 in. beyond each corner post. Mark the connector locations from the posts, then screw the hardware to the beam, being mindful of the orientation of the connector and post index marks.*

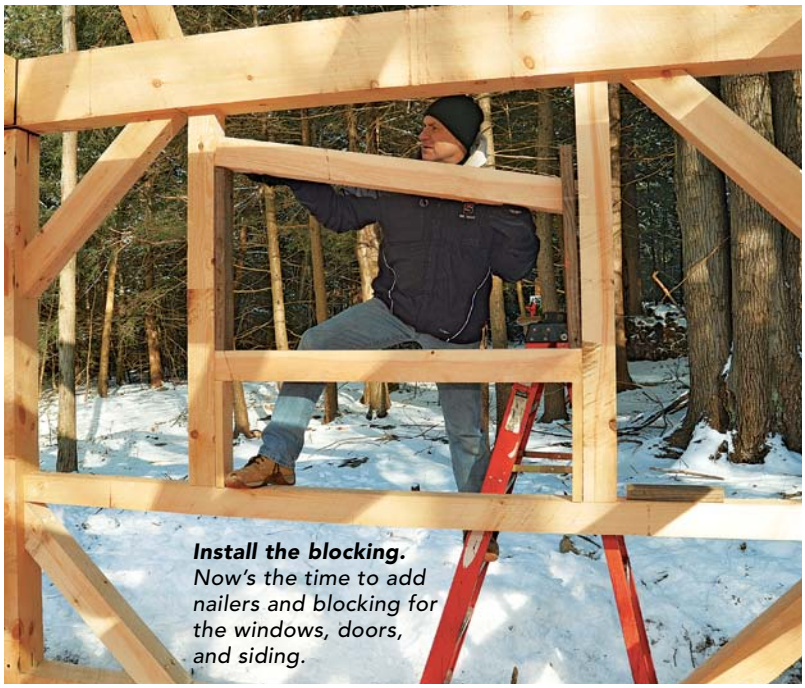
Raise the plate beams. *It takes at least four people to lift each heavy beam into place. Fit the legs of the connectors into the post slots, then secure the beam by driving two pins through the holes at each post. Lay out rafter locations on each beam.*

Prepare to install the 6x10 crossbeams. *Screw temporary 2x6 cleats to the posts, positioning them even with the bottoms of the plate beams. The cleats establish the height of the connectors and hold up the crossbeams until you can drive in the aluminum pins.*

Place the 6x10 crossbeams. *Lower each crossbeam into place, fitting the connectors into the slots. Resting the crossbeam on the 2x6 cleats, hammer three aluminum pins through each end of the crossbeam.*

Install the 6x6 joists. *To support the overhead storage loft, install three 6x6 joists similarly to the crossbeams. Screw the connectors flush to the tops of the crossbeams before installing the 2x4 joist-support cleats. With the 6x6 joists in place, drive two pins through each end of each joist.*

Brace the frame. *With the plate beams and crossbeams in place, add the permanent bracing. Secure the 4x6 bottom plate and the 4x5 wall braces with 8-in. TimberLok screws. Drill 1-in.-dia. ½-in.-deep counterbores for the screws to allow the holes to be plugged for a clean look.*

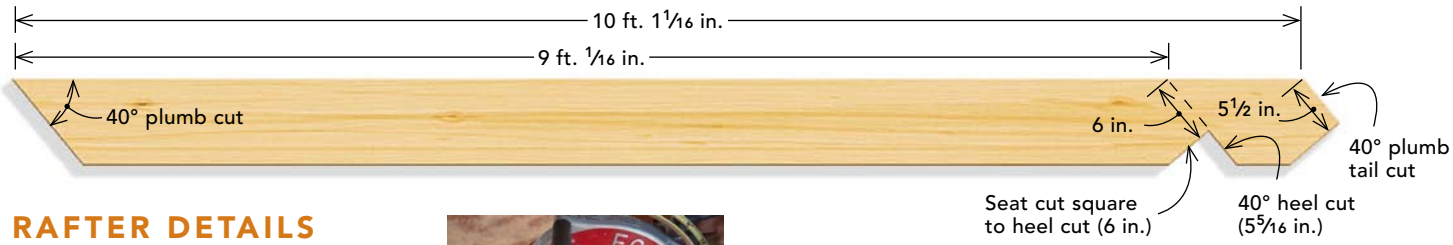


Install the blocking. *Now's the time to add nailers and blocking for the windows, doors, and siding.*

RAISE THE ROOF

The roof is also built with rough-sawn white-pine timbers, including 12 4x8 rafters spaced 44 in. apart; four 4x6 fly rafters, which create an overhang at each end of the gable roof; and a 2x10 ridge that runs between the rafters at the roof peak. To make the roof deck rigid enough to span between the rafters and lend a more traditional look to the interior, the roof is sheathed with full-thickness rough-sawn 1x8 pine boards, which are then covered with plywood above to create a substrate for shingles. When the underside of the roof frame is viewed from inside, all of that exposed wood blends perfectly into the barn's timber frame, and it appears to be a traditional skipped-sheathed roof deck. Another benefit of this technique is that the shingle nails won't poke through the underside of the roof deck.

It takes two to raise rafters. *Working off a scaffold plank eases the task of setting rafters. Start by fastening the lower ends of the second and fifth pair of rafters to the plate beam with two 10-in. screws.*



RAFTER DETAILS

Cut each rafter from a 12-ft. 4x8. The plumb cuts at the top and bottom of the rafter, as well as the heel cut of the bird's mouth, are 40° and so make a 10-in-12 roof slope.

Cut the rafters with a big saw. *You also can use a standard 7 1/4-in. saw, but you'll have to either cut from both sides or finish the cut with a reciprocating saw or handsaw.*

Raise the ridge. *Like the plate beams, the 2x10 ridge is 20 ft. 4 in. long. Before placing it, make layout marks on it that correspond to those on the plate beams. Push the ridge up between the rafters, and secure each rafter to the ridge with two 6-in. screws. Install the remaining rafters.*

Add the four 4x6 fly rafters. *The fly rafters are the same length as the main rafters, but they have no bird's mouths. Hold them against the gable-end roof rafters with their top edges flush, and fasten them with 10-in. screws about 16 in. apart.*

Sheathe the roof. *Work from scaffolding to install the first 5 ft. of 1x8 skip sheathing. Use 10d nails to hold the 1x8s to each rafter. Follow with a layer of ½-in. CDX plywood fastened with 6d nails driven into the rafters so that they don't poke through the roof deck. After sheathing the lower half of the roof, nail roof brackets into the rafters, and place scaffold planks to finish sheathing the roof to the ridge.*

Work from roof scaffolding. *Use an approved scaffold plank with the brackets. Standard construction-grade lumber can bend excessively and crack.*

Rake boards are the final wood on the roof. *Made from 1x pine, the rake boards cover the ends of the sheathing boards and plywood on the gable. A 1x6 pine fascia board runs across the rafter tails.*

Shingles finish the roof. *You can use a variety of roofing materials, from metal panels to wood shakes. For reasons of cost, we used good-looking GAF Weathered Wood architectural asphalt shingles.*

VERTICAL-BOARD SIDING

The barn's walls are sided with rough-sawn, 1x8 tongue-and-groove pine installed vertically in keeping with traditional barn architecture. Pine siding is readily available, affordable, and attractive. However, it isn't very weather resistant and must be protected—and then maintained—with an exterior stain or paint. Lower-maintenance sidings include naturally rot-resistant western red cedar and redwood. Unfortunately, cedar and redwood are typically much more expensive than pine. Siding the upper half of the gable ends first means that tools or ladders won't bang against and damage siding below. Regular wood-siding nails have thin shanks and are meant to support lightweight cedar clapboards or shakes, so they shouldn't be used. This heavy pine tends to bow and warp, which can pull regular nails free. Here, 8d double-hot-dipped galvanized spiral-shank decking nails from Maze Nails were used.

Start mid-gable. *Cut each piece longer than necessary, with the upper end cut at 40°. Face-nail the right-hand piece plumb, with its tongue to the right. Rip and glue a spline in the groove, and install the left piece with its tongue facing left. Side in both directions for symmetry.*

Trim the gable siding to length. *Snap a chalkline on the siding 1 in. below the bottom edge of the crossbeam. Cut along this line by screwing a 2x4 to the wall to guide a circular saw.*

Run the siding. *The bottom siding on the gable ends butts to the overhanging crossbeam. The lengths should be consistent now, so you can cut a bunch of pieces assembly-line style.*

Keep the siding plumb. *Check every couple of feet to be sure the siding isn't sneaking out of plumb. It is particularly important to check when siding runs above and below a window opening.*

Notch the boards as needed. *With a window or door opening, hold the siding piece in place temporarily, and mark the cut from the back. To notch around rafter tails, measure and draw lines with a square.*

Persuading warped siding. *Green, rough-sawn pine isn't known for its straightness. It can be levered tight to the previous piece by driving a chisel into the framing, prying the siding against the previous piece, and nailing.*

Routing an opening. *Nailing short siding boards such as those over the barn's large door can split them. It is often better to side over an opening and then cut it out with a router. Drill a starter hole, and rout in a clockwise direction using a bearing-guided bit.*

BUILD AND INSTALL THE WINDOWS

Along the sides are a fixed transom window and several barn-sash windows, which use a clever and traditional opening detail. These windows, made from rotproof cellular PVC, came from Connecticut Post and Beam. Similar units are available through lumberyards but may need to be specially ordered. Wood units can be used as well. In contrast to the barn's straight lines and square architecture is a pair of 30-in.-dia. round windows set in the gable.

SIMPLE BARN SASH

There is no mechanism to these windows. Closed, they simply sit on the sloped sill, held by the overlapping exterior trim and a barrel bolt. Open, they lean inward against keepers.

Trim the barn-sash opening with PVC. *Install the angled sill first, followed by the casing legs. The casing overlaps the opening by ¾ in.*

Install the barn-sash keepers. *Screw foot-long pieces of 2-in.-thick pine, with ¾-in. dowels installed in them, to the inside of the posts. This provides a stop for the window sash when open.*

Set the sash. *The barn sashes simply slip into place. A small barrel bolt at the top of each sash keeps it closed.*

Framing for a round window isn't round. *Space two posts a little more than the window diameter apart, and fill in the corners with angled nailers.*

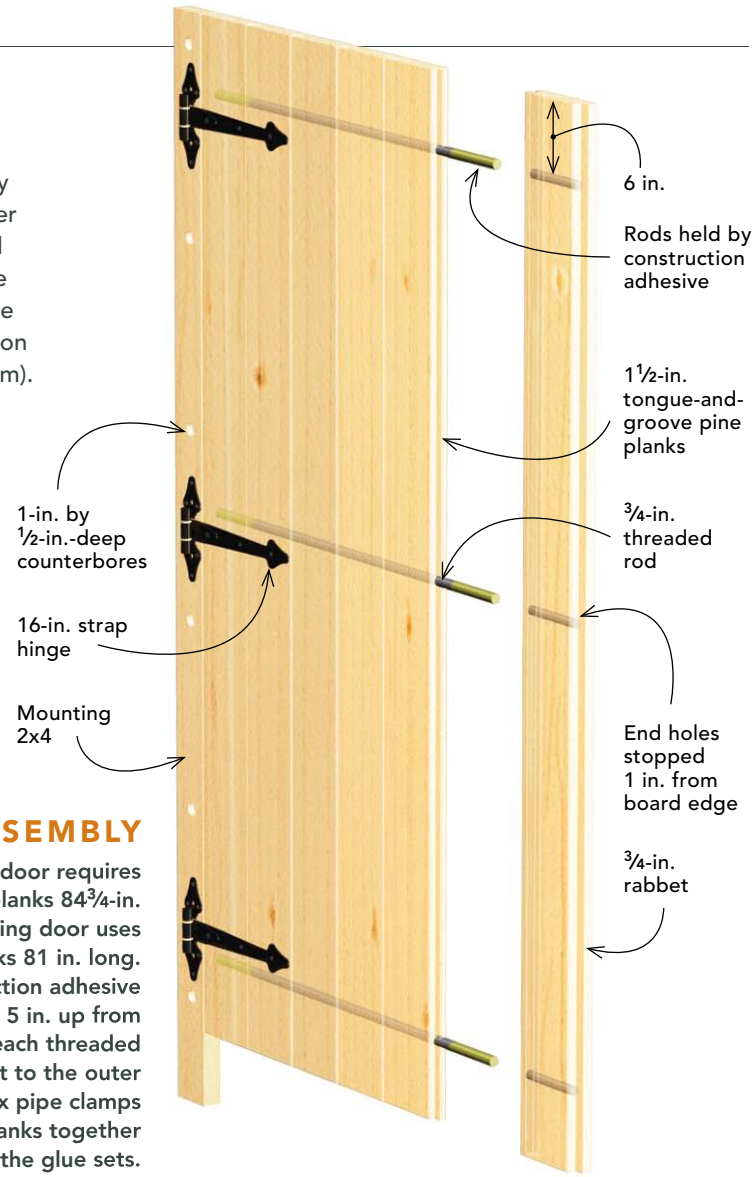
Cut out the circle. *From inside, drive a screw through the opening's centerpoint. Outside, attach a string to the tip of the protruding screw, and tie a pencil to the other end exactly 15 in. from the centerpoint. Use this site-made compass to draw a 30-in.-dia. circle onto the siding, and then cut out the opening with a jigsaw.*

Set the round window. *Holding the window flat against the siding, fasten it through the flange and into the siding and timber frame with 2½-in. exterior trim-head screws.*

MAKE THE DOORS

This barn has a 42-in.-wide sliding door and a 72-in.-wide hinged double door. These doors are made the same way from 1½-in. by 6¾-in. tongue-and-groove pine planks. Each door is held together with three ¾-in. threaded rods installed in holes carefully aligned and drilled through the edges of the planks with a drill press. The main difference between the doors is in the hardware: The double doors hang from 16-in. strap hinges, while the sliding door rides on traditional barn-style hardware (all hardware from betterbarns.com).

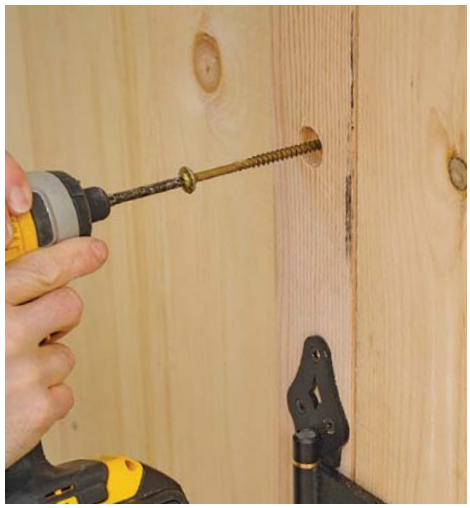
Set the first door. *Attach the 91-in.-long mounting 2x4 to the door so that its top is even with that of the door. Use three 16-in. strap hinges to connect the two. Place the door in its opening.*



DOOR ASSEMBLY

Each hinged door requires six pine planks 84¾-in. long. The sliding door uses seven planks 81 in. long. Construction adhesive smeared about 5 in. up from the end of each threaded rod secures it to the outer planks, and six pipe clamps draw the planks together until the glue sets.

Plumb the first door. *Hold the door in its opening, securing the top of the mounting 2x4 with a 6-in. screw through the top counterbore. Check the door for plumb.*



Secure the door. *When the door is plumb, drive a 6-in. screw in the bottom counterbore, and then screw the remaining counterbores. Hang the second door similarly, being sure that it works in concert with the first.*

Plug the counterbores. *Although there's no structural need to counterbore and plug the holes, it sure makes the barn look finished.*

Top photo, facing page: Joseph Truini

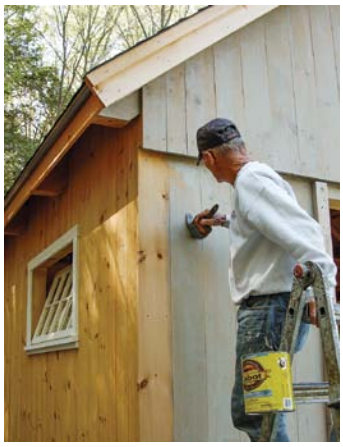
THE FINAL DETAILS

Because pine siding isn't rotproof, it has to be finished with paint or stain. The plank floor in the loft has to be installed as well, and stone dry-stacked below the barn's floor will complete the traditional look.

Traditional hardware hangs the sliding door. *The bar-and-trolley system shown here was common on old barns. Other systems are available, but they yield a more utilitarian aesthetic.*

Floor the loft. *Use a rubber mallet to drive the 1½-in. tongue-and-groove planks tight, then face-nail them to the joists with 16d ring-shank nails.*

Close off the bottom of the frame. *Dry-stacking local stone between the ground and the barn mimics a traditional barn foundation. It also keeps out larger animals, while allowing some air circulation.*



Paint or stain. *Pick a nice day to finish the exterior. Be sure to paint or use penetrating stain on the end grain of the bottom pieces of siding to prevent water from wicking up and causing rot.*