Building A Pole Barn

Updated materials preserve the economy and speed of this traditional building method

by Rick Stacy

I have always avoided the construction of pole buildings, thinking they were better left to specialty companies. But when one of my regular customers asked me to build a combination barn/garage on poles, I decided it was time to become better educated on the subject. The first thing I discovered is that pole building now goes by the name "post-frame construction." I also learned that this building technique has adapted to the advent of new materials and methods, some of which I modified to fit the needs of the project. The result was a hybrid building that exceeded everyone's expectations.

The specs called for a 32x40-foot gambrel-roofed building with clear-span trusses on the front half to allow for unobstructed vehicle and tractor parking. The back half was to house a horse stall and tack room, with a full second deck for hay storage, supported by four interior posts. The clients had turned to me because they were dissatisfied with the steel-clad, industrial-looking buildings that local post-frame barn builders offered. They wanted a more

traditional barn look, with wood siding and standard asphalt shingles. They also wanted lots of custom details, including two 9-foot sliding front doors, an 8-foot sliding back door, two Dutch doors and jalousie windows for ventilation, and an angled peak overhang on the front.

Site Prep and Drilling

The basic concept of building post-frame style is a little bit like putting up a panel fence: dig a line of postholes, install a series of posts, attach horizontal supports or girts, and fill in the spaces with something solid. To begin, I roughly staked out the building area, then stripped the topsoil to a depth of about 10 inches and stockpiled it for finish grading. As is typical for this type of construction, a 4- to 6-inch layer of crushed stone paving mix was spread over the excavated area to serve as a base for the concrete floor, to be poured later. The stone also helped keep the mud under control during construction.

To define the building outline, I set up batter boards, using a transit to set the elevation. A line strung between the batter boards served as a reference for both leveling and squaring the building (see Figure 1). Since I had the use of a tractor, I attached a rented 12-inch-diameter auger to the power takeoff, and drilled 4-foot-deep holes for the posts, about 6 feet apart. The 12-inch auger bit did not offer much room for error with the 6-inch posts, and when it hit a rock, which happened with tedious regularity, it veered off center. Next time, I'd hire a commercial rig with a larger auger to drill the holes. Instead, my helper and I spent a lot of time digging in the hard-packed clay with picks and shovels, widening the sides of the holes to accommodate the posts. While we were at it, we flared out the base of the holes to provide a larger bearing area for the concrete, to better distribute the column load. Had I used a larger diameter auger, this would have been unnecessary. Nevertheless, one day and one snapped auger shaft repair (and several shear bolts) later, the holes were ready.

Figure 1. Batter boards and string guide the layout, and form stakes keep the grade board aligned. Temporary wood shims holding the grade board at the proper elevation were replaced later with crushed stone.

Figure 2. To resist uplift, short lengths of rebar were driven through holes drilled in the bottom of the posts.

Farewell to the 6x6

Laminated pressure-treated posts are rapidly rendering obsolete the 6x6 pressure-treated timbers formerly used in post-frame buildings. These laminated posts, which consist of three pressure-treated 2x6s nailed and glued together, have many advantages over timber posts. Preservative may not fully penetrate a 6x6 timber, especially if the center of the timber is not completely dry before treatment. Cracks, checks, and knots may also penetrate deep into the timber, weakening it. Defects in laminated 2x6 posts are less severe, and do not run through a built-up column. The grain direction and bows in the 2x6 members can also be alternated to work against each other, reducing the chance of twists and bends common in timbers. The strength of laminated posts is also more predictable than solid-sawn posts.

I special-ordered foundation grade, .60 pcf (pounds per cubic foot) pressure-treated 2x6s for the posts. These are a bit more expensive than the standard .40 pcf pressure-treated lumber that most yards stock, but the extra protection is worth it because they'll hold up longer underground. We nailed the poles together with ringshank, galvanized nails where the wood was to be below or near grade.

Traditionally, post-frame builders used naturally rot-resistant logs for poles, but these are difficult to obtain in my area and wouldn't give the finished appearance my clients expected. While a number of manufactured posts are available (see "Prefabricated Posts," below), for simplicity's sake I chose to use composite posts built up out of three full-length 14-foot pressure-treated 2x6s for each post.

Grade Board Suspension System

To anchor the posts, many post-frame builders simply dig a hole, drop in a bag or two of dry-mix concrete, and set the post to a string, letting ground moisture cure the concrete over time. Later, a pressure-treated grade board is attached to define the perimeter of the building. I was uncomfortable with this method, however. Instead, I wanted to pour wet concrete around the posts, which I planned to suspend from the permanent 2x10 grade board until the concrete set up. To do this, we drove form stakes at intervals alongside the grade board, checking the elevation against the string and shimming the sides and bottom when necessary to maintain the alignment. This left the grade board suspended above the ground a few inches, which simplified leveling. I filled this gap later with additional crushed stone.

The next step was to lay out the post locations on the grade board, lining them up with the auger holes. With the laminated posts still on the ground, we measured and marked the final height of the post and the siding girt locations, and started two 16-penny nails at the point that would be even with the top of the grade board. The posts were also drilled at the bottom to receive two lengths of 1/2-inch rebar, which projected about 3 inches from either side of the post (Figure 2).

Prefabricated Posts

To save costs, some post-frame builders build posts using pressure-treated lumber below grade and dimensional stock above grade, staggering the joints between the two materials (left). The location of the joint between the two materials is critical, so it's best to consult with an engineer before using this design.

The engineering is built into the prefabricated finger-jointed composite posts (middle) manufactured by Ohio Timberland Products (419/682-9713). The posts, which can be made to virtually any length, are available from regional suppliers or directly from the factory.

Another option is a laminated column manufactured by Stockade Buildings (800/548-6765) for its post-frame building system. The column sandwiches a 2x8 between two 2x6s, with the excess width of the 2x8 oriented toward the outside of the building (illustration). Horizontal 2x4 girts are butted flush to the 2x8, where they transfer lateral loads through the posts rather than relying on the resistance of the girt fasteners alone.

—R.S.

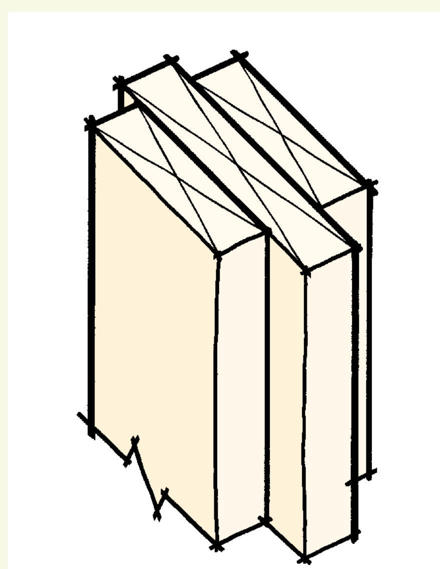

Figure 3. Prior to pouring the concrete, each perimeter post was diagonally braced to grade stakes and suspended over its post hole by a pair of 16-penny nails resting on top of the grade board (right). The four center posts were held at the proper elevation by nail-on cross-tees, and tied to the outside posts with lateral bracing (bottom).

Once embedded in concrete, the rebar would help to resist uplift. The laminated posts were oriented with the joints between boards running perpendicular to the grade board so that the weakest axis would receive lateral support from the girts.

With temporary 2-by braces staked in and ready to swing up as needed, we manhandled the posts into the holes until the two 16-penny nails came to rest on top of the grade board, where they held the post to rough height (Figure 3). It was then a simple matter to plumb the posts, spike them into the grade board, and attach temporary diagonal braces. As we went along, we used the upper girt to tie the top of the posts together and maintain proper spacing. Once all the posts were in place, we checked the grade board for alignment again, shimming and sledging it as necessary to adjust it to the string. The grade-board suspension system worked like a charm, enabling three men to set and plumb all of the posts in well under a day.

The four interior posts at the rear of the building were suspended from temporary cross-tees on the ground and braced to the outside posts. I was concerned that these posts would occasionally be bumped by the tractor that would be used to clean out the horse manure, so I beefed them up to triple 2x8s and later added knee braces for lateral support.

The next day the ready-mix truck arrived and it was an easy half-hour job to chute concrete into each hole to within two feet of grade, and send the driver on his way with no extra time charge. I decided to keep the concrete below grade and complete the backfill with tamped earth because of the tendency of the postholes to taper out at the top. Filling the holes to the top with concrete would create a cork-shaped plug, which might tend to pop up in a frost heave, bringing the post with it. After the pour, we checked the grade board a final time for alignment and made any necessary adjustments before the concrete set up. After it set, we tamped dirt into the holes in 6- to

8-inch layers to ensure solid embedding of the posts.

I'm aware of concern over encapsulating the bottom of the post in concrete, because water can become trapped in this pocket, but I believe that the compacted dirt over the concrete and a well-graded site will reduce the amount of surface water that penetrates. In addition, since concrete is porous, any moisture that gets in can get out, and the concrete around the post will eventually assume the moisture content of the surrounding soil. Plus, the .60 pcf pressure-treated posts should be able to withstand the moist conditions.

Direct-Bearing Headers

I have seen a lot of post-frame buildings with paired 2x8s nailed or bolted along either side of the top of the post to carry the roof trusses. With repetitive wind, snow, and dead loads, however, the headers can slip down over time, since only the fasteners resist these forces. Instead, I cut all of the posts to height in place, creating a shoulder for the headers to bear on by cutting short the outside 2x6s on every other laminated post. Each header, made up of three 14-foot-long 2x8s, rested on top of a post at midspan, and on a full 2x6 at each end (Figure 4). To prevent twisting, the headers were spiked through to the full-height center members in the posts.

Hybrid Roof Framing

After installing the remaining 2x4 girts, we framed the second floor over the rear half of the building. This deck provided a platform to begin installation of the gambrel trusses over the front half; we used attic-style trusses, which permit additional storage space (Figure 5). Once the trusses and tie-down connectors were installed, I laid out a pattern and a jig on the deck to fabricate the custom, two-piece rear gambrel rafters. The rafter joints were reinforced on both sides with 1/2-inch plywood gussets generously fastened with 11/2-inch staples. Once the rafters were nailed to the ridge board and

Figure 4. The triple-2x8 perimeter headers were supported by full posts at midspan, and by a shoulder at each end, created by cutting short the outside 2x6 on every other post.

Figure 5. Building the second-floor deck at the rear of the building first provided a work area for raising storage trusses over the front half of the barn (above). The joints in the two-piece site-built gambrel rafters were supported by triple-2x8 headers; second-floor posts bear directly over posts below (left).

Figure 6. The author uses the head trim to guide a plunge-cut kerf in the T1-11 siding (right). Custom-bent flashing fits into the kerf above windows and the sliding-door track valance shown here (middle), and is held in place and sealed with paintable rubberized caulk (bottom).

braced, we installed double 2x8 headers at the "break point," supported by posts that lined up with the four posts below, and nailed up 2x6 collar ties.

Siding and Doors

With the roof weathered in with tar paper, we installed $5/8$-inch T1-11, which served as sheathing and siding. I had special-ordered 9-foot sheets of Douglas fir to eliminate the need for Z-flashing at the side walls, which were just over 8 feet tall. The SYP T1-11 was much cheaper but, in my opinion, does not hold up as well as Doug fir. The homeowner sealed the bottom edge of the T1-11 with paint prior to installation, but I was still concerned that the plywood might wick moisture if it were nailed directly against the grade board. To help promote drying, I ripped some $1/4$-inch pressure-treated spacer strips and installed them horizontally behind the bottom edge of the siding to act as a capillary break. We also installed vertical blocking between the girts at the siding seams to improve resistance to wind-racking.

Big-span doors. The large door openings make the end walls vulnerable to racking from wind shear forces. An engineer I consulted offered a rule of thumb for compensating for this loss: Whenever plywood sheathing is eliminated from the end walls for an opening, it should be replaced on the interior surface of the end walls to either side of the opening. I used $3/4$-inch plywood to achieve this resistance.

Flashing details. Because the T1-11 served as both the sheathing and the siding, adequately flashing the heads of the windows and doors was a challenge. My solution was to cut an angled kerf $3/8$ inch deep into the T1-11, using the head trim as a guide. I set the shoe on my circular saw to about 20 degrees and dropped the blade into the cut. A custom-bent aluminum cap-flashing fit over the trim and into the kerf, sealed and held in place with a bead of rubberized caulk. At the sliding doors, I added a sloped 1x6 aluminum-covered cap over the door track to protect the track and rollers from the weather (Figure 6).

Sliding doors. On metal-sided barns, a sliding door frame is typically built using 2x4s on edge for the perimeter and horizontal 2x4 girts, with metal siding attached to the exterior. On wooden barns, vertical 3/4-inch tongue-and-groove boards are often used, with horizontal ties and cross-bracing. I wanted something a bit sturdier, so I built a frame out of 2-by stock on the flat, screwed on the T1-11, and applied decorative trim boards to the face. Metal mending plates tied the framing connections together and added rigidity on the inside. With this thicker door, it took a bit of fussing to figure out how to use standard off-the-shelf rollers, which are designed for a 1 1/2-inch-thick door. Ultimately, I mounted the rollers directly on the 2x4s and notched the T1-11 around them, then concealed the notch with the trim boards (Figure 7).

Tying Up the Details

With easy maintenance in mind, we chose to use a standard vinyl soffit with aluminum fascia. While this was not totally in keeping with the wood design, it was a worthy tradeoff for my clients, who did not relish the idea of having to climb 25 feet up in the air to paint overhangs.

To bring the subgrade to the proper elevation for the concrete floor that was to be poured at a later date, we added more stone under the grade board, filling areas where daylight was still showing. We also made sure that the site was well graded, and directed the aluminum gutters into a 4-inch PVC drain-tile that ran to daylight away from the barn. This also helped to reduce the chance of any frost action under the grade board.

Adding water and electric service from the house was a simple matter of trenching under the grade board. All in all, my customer and I were well satisfied with the end result. I'll be less hesitant the next time a post-frame opportunity comes my way.

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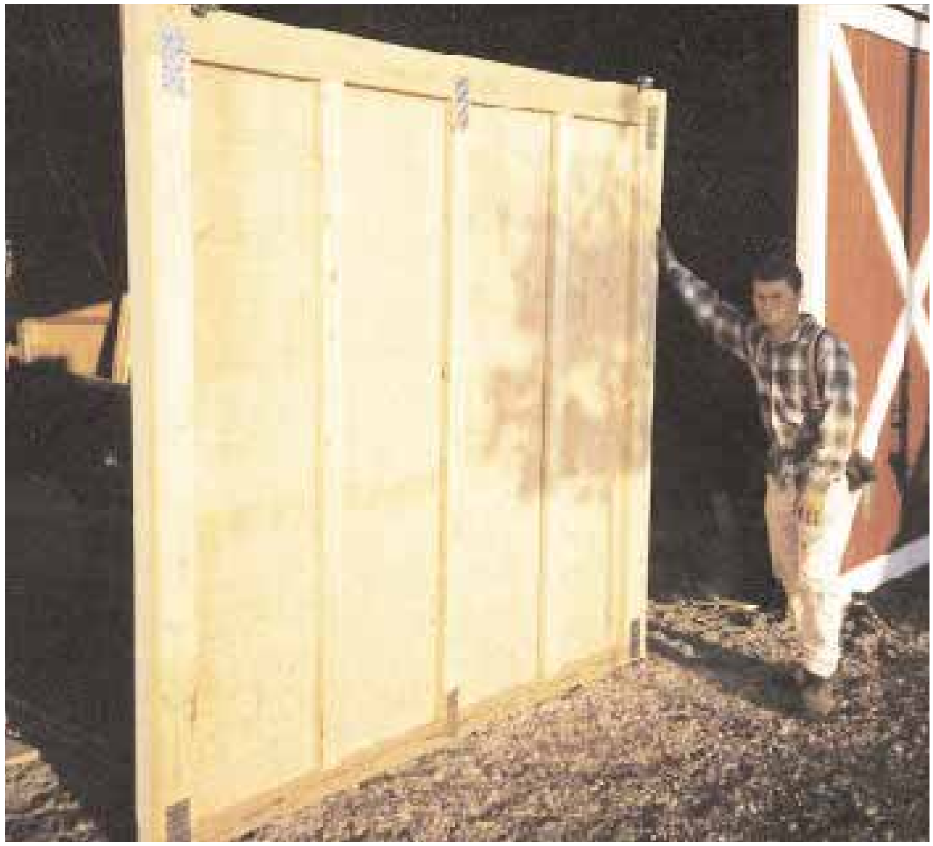

Figure 7. Metal mending plates reinforce the connections on 2x4 sliding door frames (above). Off-the-shelf hardware is concealed by decorative 1-by trim (left).