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Raising a Post Frame

This time-tested building system creates a lot of square footage, fast

BY ANDREW GRACE

For the last 15 years, I have been running my business out of a 20-ft. by 24-ft. garage, a shed, and a few box trailers. Serious organization is nearly impossible without centralized storage. Something we need is always somewhere else. (Case in point: As I was getting everything together for the move to a new workspace, I found 17 caulking guns I'd stashed over the years.) Recently, I bought a property that I've eyed for years, and it was finally time to design and build my world headquarters. The lot was relatively level, and my plan was to keep costs as low as possible since there wasn't a customer to invoice at the end.

I decided on post-frame construction, which is arguably the lowest-cost structure you can build and the perfect building for many uses, including as a huge workshop and as a storage building for my business. I chose components that I think will help my building last a long time, and I'll explain my choices later on. Post-frame buildings can be finished in as many ways as any other structure; here, I will take you through the frame.

What is a post frame?

Post-frame buildings, sometimes called pole buildings or pole barns, don't have continuous footings. They use holes dug or drilled below the frost line for soil bearing. Posts are either set on a concrete pad and buried or attached to a concrete pier above grade. These poles are then used to support the framing and cladding of the building. Also, post frames don't usually have sheathing; 2x4 girts are nailed horizontally to the posts to create fastening for the wall cladding. Purlins are attached perpendicular to the trusses to create attachment and bearing for the roofing, which is usually steel panels. The metal panels also give the building additional racking resistance.

I chose each building component myself, knowing that since I'd be using the building, it would be my chance to try some new things that I wouldn't beta-test on paying customers. Had I known the complexity of the many decisions I would have to make, I may have gone for a post-frame package, which are offered by several of my suppliers.

Consider your site

Post-frame buildings only really work on relatively flat sites. There are no block walls to do double-duty as retaining walls. The building pad has to be flat, and unless you want a natural water feature inside, you have to fill to the low side under the pad and not cut the high side. Even on my relatively flat lot, I had to fill 18 in. in one corner. That added up to about 150 tons of 2A modified gravel, which has a mix of particles from ¾-in. stone to coarse sand.

Site work for a post frame starts like it does for any other building. My lot was a hayfield, so tree clearing wasn't an issue. The excavator came and stripped the topsoil for the road, building pad, and parking. We ran all piping and conduit inside the building line and set batter boards and used stringlines to do the layout and

POUR THE FOOTINGS AND SET THE BRACKETS

Typically, post footings are holes drilled into the soil with a machine-mounted auger. These holes are topped with a concrete tube form set on grade and cut so that its height matches the height of the finished slab. Post brackets are then wet-set to a stringline, and framing begins after the cure. I've used this method, but it is nervewracking. I'm always worried the stringline or layout is off, which will result in a crooked wall. On my building, I tried a post-bracket system made by Concrete Pier Systems. It involves the same process as traditional wet-set brackets, but its plastic form and bracket attach to the mud board, keeping everything on layout.

Pour footings. *We used my skid steer equipped with an 18-in. auger to drill the building's 48-in. deep footings, adding up to 10 yd. of concrete. A pressure-treated 2x10 holds the above-grade plastic form and contains the concrete slab to be placed and finished later. Rodding the concrete footing with a piece of rebar prevents voids.*

Set the post brackets. *The brackets that attach the posts to the concrete piers are wet-set into the concrete and aligned to stringlines indicating the building footprint. Setting up the strings correctly and placing the post bases accurately is crucial for getting a straight, square building.*

Product photo, courtesy of Concrete Pier Systems.
Photos this page right, courtesy of the author.

PICK A SPOT TO START FRAMING

On a typical stick-frame building, most framers start with the longest exterior wall. With a large post-frame building, you have to think about machine access for setting the trusses. On my building, the gable end facing the street has an overhead door, and the back elevation does not. I decided to start framing at the gable end without an opening so I could use the large opening on the other end to bring the all-terrain forklift inside for lifting the first wall.

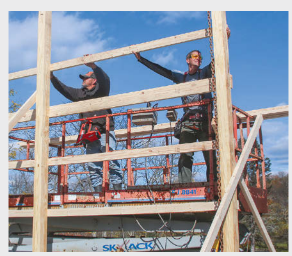
Check for level. *If you have a pier or bracket that is high or low, you can adjust the post length so that the eaves and top of the wall end up at the same height. Our footings were all within 1/8 in. of each other, so we didn't need to trim any posts.*

Lay out the posts. *It's much easier to do the girt layout with the posts in a pile on the ground. With the ends of the posts aligned, the girt locations are measured out with a tape measure before the marks are continued across the pile with a drywall square.*

Lengthen the gable posts. *Posts generally all come in the same length, based on the building's eave height. The posts have a loose center lamination that's custom-cut in the field to match the truss specified. Gable posts are extended by removing the center lamination and adding a longer section of 2x6 to match the height of the truss.*

Raise a gable wall. *I have seen other builders attach the wall girts to the posts on the ground and tilt the walls up whole. Since we had the telehandler, I decided to try it. Later we stood the posts one at a time by hand and ran the girts as we went. The latter method seemed safer and didn't take much longer, and we didn't have to listen to the noise of the machine.*

Square with chain. *Straightening walls with wood bracing is tough with big buildings, as the spans are too big for 16-ft. material. I used chains with a ratchet binder like truckers use to secure loads. Chains can be hooked together for big spans, and ratchet binders offer finesse for adjustments. The weight of the chain often will pull a wall square.*



Finish the girts. *With the wall braced plumb and pulled square, the rest of the girts are installed from a platform lift. The girts are spaced 24 in. on center and fastened with galvanized ring-shank nails.*

square the post footings. Then we laid out the common footing holes on 8-ft. centers and the footings on both sides of the garage and entry doors. I had 280 yd. (560 tons) of gravel trucked in and spread because I hate working in the mud.

Buried posts or above-grade brackets?

One of the big decisions when you're planning a post-frame building is whether to bury the posts or use above-grade brackets. The current thinking is that buried posts are bad because they rot. I have worked on 100-year-old barns with buried posts, so that has not been my experience. Still, I don't like putting posts in the ground because they're hard to get perfect. Moving a 20-ft. post that's 4 ft. in the ground is a wrestling match nobody wins. And I understand that if you're building a barn to keep rain and snow off your livestock, perfection isn't the goal; I want a precise layout because it makes the rest of the build more efficient, saving time and money. Above-grade steel brackets can be more easily set to a stringline for greater precision.

What kind of posts?

Next, I had to choose posts. There are a surprising number of options. Solid, pressure-treated 6x6s were the standard choice when I started out. Since then, laminated posts have become more common. Lami-

RAISE INTERSECTING WALLS

With the gable wall plumbed and braced, I framed the perpendicular eave walls next. This helped brace the gable wall and keep the building upright in the event of high wind during construction.

Prep the post. *The building's posts have a center lamination that is adjustable for different truss designs and field conditions. Once it's trimmed to fit the truss, it's nailed in place before the post is raised.*

Girts and posts work together. *The post is placed in its U-shaped base and tilted up into position. After checking for plumb, the 2x6 girt is nailed to the top and helps hold the post upright. This wider girt at the top of the wall has plenty of room for attaching an F-channel for the metal soffit and a J-channel for the metal siding. Additional posts are raised and girts attached as the wall is framed.*

Bridge openings. *Wide overhead doors need headers to transfer roof loads around the opening. Pairs of 2x12s at the top of the wall and above the opening support a shortened post that holds the truss end that lands above the door. The parts are tacked in place with nails and then fastened with structural screws.*

Make it straight. *Sometimes posts have a bow, but you can often force them straight with a sledgehammer and spring board braced against a nearby post. Once the girts are fully fastened, the post will remain straight.*

Check for plumb. Posts are made plumb before they are fastened to the post base. Otherwise the large screws would make it impossible to move them.

Hold down the posts. A tall post-frame building's surface area places strong wind loads and uplift forces on the post-to-pier connections. Line posts get six ½-in. by 3-in. lag screws and four ¼-in. by 2-in. structural screws.

PREP AND SET A GABLE TRUSS

It makes the most sense to work from one end of the building toward the opposite end. My building had a large overhead door on one gable, so we started at the opposite wall and worked toward the opening. If your building doesn't have a large opening to drive the forklift through, you may have to use a crane.

Block out overhangs. *To the end truss's top chord, 2x6 blocks are screwed to support a 2x6 subfascia. These two elements, with screw-down metal roofing on top, create the gable overhangs.*

Nail on purlin connectors. *Metal connectors that look like upside-down joist hangers hold the purlins that connect trusses. The purlins give strength to the frame and provide attachment for the metal roofing panels. A metal-connector nailer is a must for driving the thousands of required nails.*

Install the subfascia. *A 2x6 subfascia with plumb cuts at the ridge and eave is nailed to the 2x6 blocks to create the gable overhang.*

Lift and brace the gable. *With the overhang in place, the truss is lifted into position from outside the building. It is first screwed to the posts with structural screws and then braced with temporary diagonal bracing.*

nated posts usually consist of three 2x6s nailed or glued together. They are typically straighter and more stable than solid timbers and are available in longer lengths. They can be ordered treated, untreated, or even treated for the first 6 ft.

I ordered nail-laminated posts because I'm old-school and I trust mechanical fastening, but I'm told by component manufacturers that there is no performance difference between nailed and glued. Since I was using above-grade brackets, I chose untreated posts. The posts won't get wet, so I couldn't justify paying $600 more for treated posts, though I did hit the bottoms with some Anchorseal to make myself feel better.

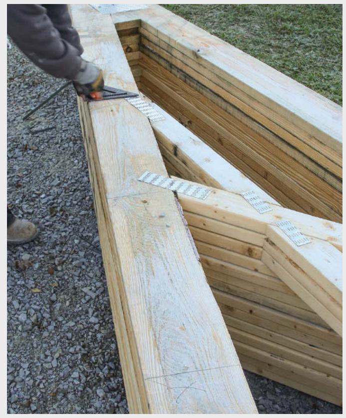
What kind of roof frame?

My next decision was about truss layout and purlins. The typical practice around here is for a 2x12 to be bolted to each side of the posts, creating a girder called a truss hanger. Trusses are then set on 4-ft. centers, 2x4 purlins are nailed flat on 2-ft. centers, and steel roof panels are screwed directly to the purlins. I was never wild about this system for several reasons. First, the roof bearing counts on fasteners. Even though I'm sure the engineering is sound and the ½-in. bolts will hold, it's not ideal for me. Second, it makes swinging the trusses hard. We use 16-ft. material for purlins, and you end up trying to slip a 40-ft. truss under 12 ft. of drooping 2x boards. And last,

PREP AND SET THE COMMON TRUSSES

Most post-frame builders use an all-terrain forklift for setting trusses. When choosing a rental machine, make sure it has enough reach to set the last few (three in my case) trusses from outside the building, because there's not enough room to place them from inside the structure with the other trusses in place. If the site is cramped, consider hiring a crane to set the trusses; moving them around the site with a forklift requires a lot of room.


Straighten the stack. *A few bumps with a sledgehammer help align the trusses end to end so that they form a perfect stack for layout. A piece of 2x6 protects the trusses from the sledgehammer blows. A lever made from a 2x4 screwed to a bottom truss is helpful for aligning the stack vertically.*



Lay out the purlins. *It's easier to do the purlin layout on the ground than it is with the truss on the frame. The 2x6 purlins are spaced 24 in. on center.*

Transfer the marks. *After double-checking the layout, use a framing square to transfer the layout from the truss on top to the rest of the stack.*

Cut the purlins. *Using a pair of bar clamps to hold the 2x6s, I cut the purlins to length. Purlins can be custom-cut as part of a post-frame package.*

Lift and set. *The truss is lifted and then lowered into the pocket between the outer post laminations. The post is persuaded in or out with a sledgehammer until the post's exterior side is aligned with the truss's bottom chord. The outer post laminations are trimmed with a reciprocating saw later to match the roof pitch.*

Lock it down. *Three 4-in. structural screws secure the truss end to the post, providing uplift resistance and strengthening the wall against high wind.*

Place and fasten the purlins. *The purlins are dropped into their hangers, which helps brace the truss. If the gable truss is plumb and the posts are all at the same height, the common trusses will be plumb and the purlins level.*

Nail the purlins to the hangers. *The purlin ends are held to their connectors with $2\frac{1}{2}$-in. nails. The connectors' double-shear nailing gives them better wind resistance than nails alone. A long pipe clamp reduces the space between wonky trusses so the purlins fit right.*

FINISH THE FRONT GABLE

To provide more room for maneuvering the forklift and lifting the trusses, the framing was left incomplete on the front gable. Once the common trusses were all in place, the gable wall was framed and the final truss was prepped and lifted, using the same overhang details as the other end.

Header comes first. *The building's front elevation has a 12-ft.-wide overhead door. Installing the header reinforces the wall so the truss creating the gable end can be set. Like the overhead door header installed before, it uses a pair of 2x12s fastened with structural screws to the posts on both sides of the opening.*

Set the second gable. *The final gable goes up like the first, with the overhang and purlin connectors installed before it's lifted into place and fastened to the posts forming the gable wall.*

Purlins seal the deal. *The purlins installed between the second gable and common truss complete the roof frame. With the framing largely done, the structure is sturdy and wind-resistant.*

it's unsafe. A bunch of workers scrambling around on a temporarily braced building is an accident waiting to happen.

I had my trusses designed for 8 ft. on center, and I was able to order my posts "center ply low," meaning a 5-ft. section of the middle ply was shipped loose. I cut it to length to allow for the depth of the truss at the building line to create a pocket. Each truss is dropped into the pocket and bolted to the post. This allows the load path to travel from the roof directly to the footing. On 8-ft. centers, purlins are typically 2x4s set on edge and nailed with a 40d nail to each truss. I don't think this approach properly addresses uplift, and you still end up climbing around on a temporarily braced roof. I found a saddle-style double-purlin hanger (MiTek JDS26) for attaching the purlins to the trusses. We were able to install the hangers while the truss was on the ground, cut all the purlins to length on the ground, and install them from a platform lift with a metal-connector nailer without ever getting on the roof. The well-fastened connectors resist uplift better than nails, and we were able to install the purlins faster, easier, and more safely than any other way I've tried.

Skin the outside

Without continuous sheathing, post-frame buildings can rack. Surprisingly, the metal roofing and siding is what helps the building

ADD DOOR AND WINDOW OPENINGS

Since the posts are the bearing members, entry door and window openings don't require conventional headers. Instead, 2x6 bucks screwed to the girts create window and door openings. I used the 8-ft. girt as the header height. Girts can be added if the top of the opening or the rough sill doesn't land on common girts. I used 2x6 girts at the tops and bottoms of windows to strengthen the wall and allow more room for window nailing flanges and trim.

Build window bucks. *A three- or four-sided buck creates the opening for entry doors and windows. It's framed to the door's or window's rough-opening size and fastened to the girts.*

Fully fasten. *The window buck is securely mounted to the frame with 3-in. screws driven through the girts into the buck behind them.*

Trim the girts. *The girts are trimmed in place to match the opening created by the 2x6 buck.*

Fill the voids. *The offcuts from trimming the girts are used to fill in between the girts around the opening, so the window's nailing flange is fully supported by solid framing.*

resist racking. Temporary bracing is important to hold the building plumb, level, and square until the cladding is installed. We did install internal X-bracing in the building corners, and we also installed all the roof-system bracing specified by the truss designer.

How did it turn out?

There are a lot of ways to build a post-frame building, and I'm sure most of them work. This was the best way I could think to do it, and when all is said and done, I'm pleased with the decisions I made. Three of us built a 3600-sq.-ft. building, most of which is 18 ft. high, without breaking our backs or the bank. We had a lot of help from an all-terrain platform lift and a telehandler, but we could have done it in other ways that take more time.

The toughest part for me was to stop thinking like a house framer. Post frames are a different animal. Widow and door framing takes some getting used to, and installing blocking for all the trim and flashing requires a fair amount of forethought. But the building is simple if you have strong carpentry fundamentals and, as with anything else, you focus on the details. □

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