

# Straw-Bale Construction Basics



As building materials go, few things are more versatile, inexpensive and forgiving as straw-bales. This makes them ideal for owner-builders who may lack experience, cash or both. Bales can be formed into curved walls and arches, they can be notched, gouged, cut in half, split in half and if they still don't fit they can be persuaded with 'bale whackers' - a square block of wood mounted on a wooden handle. I bought 350, 2-string straw bales to build the walls of my 30 x 50 house; and they cost a whopping \$400. I made every mistake you can think of in the building process, and my house still turned out well. It is warm and snug despite the harsh Wyoming wind; and it has no source of heat other than a centrally placed propane stove, and some large south-facing windows.

I can teach you how to avoid my mistakes, and end up with more house for less money than I spent. By the way, my house cost less than \$40 dollars a square foot but appraised at \$70. Not bad for a guy who had never built anything except an 8'x12' shed before tackling a house.

Let's talk foundations. This is where I made my most costly mistake. We had decided that we wanted a wood floor, but we didn't want a basement. With only \$9,000 to start our project, we didn't want to put it all into a hole in the ground. So, we opted for a pole frame building with a floor suspended over a crawl space. You can do this, but you had better size your lumber for the added weight and width of a straw-bale and stucco wall. We were well into the construction when we found out that our poles were spaced too far apart to adequately support the finished house. The solution? Laboriously dig a footing trench between the poles all the way around the house and pour a 10" thick concrete wall to support the bale and stucco walls. In short, our house has two foundations. Moral of the story: If your climate is such that you need to dig 4' or more to get below frost line, you may as well build a basement. If not, pour a slab on grade or use a rubble trench with a concrete footing wide enough to support the bales. Wood foundations will take a lot of extra engineering, and in my location at least, are way too expensive compared to concrete.



Once you have a foundation, you can start stacking bales. First, make sure you have rebar pins sticking out of the foundation, every 2 feet or so, everywhere there will be straw bales. Your first course of bales should be impaled on these; put in enough of them so that each bale is held in place by at least two pins. If you haven't done so already, draw up some simple plans that show the location of every door and window and mark those locations on the foundation with markers or crayons. That way, you won't get confused and stack bales in the middle of your front door. Also mark the location of all framing members (poles, 4x4 posts, box beams, etc.) you will be using to support your roof. It is possible to support a roof with straw bales alone, but it can get complicated due to the settling that occurs as the bales are unevenly squashed down by the weight of the roof. Frame or pole construction, with straw bales stacked between and if necessary, around, the frame are simpler to design and build. And, as long as your foundation is adequate, you won't have to worry about uneven settling. We used treated 6" round poles placed 10' on center for our frame. These poles were hooked

together by a 2" x 12" and 2" x 6" header. The 2" x 12's were notched into the outside of each pole and the 2" x 6"s were placed flat along the tops of the poles. The result was a strong and economical "L" shaped header to support the roof trusses. If I had to do it over again, however, I would use a full width box beam frame, set 10 or 12 feet apart, and use a full width ladder frame header to support the roof. We had to do a lot of custom notching and fitting of bales around our poles and header. But, if you build 'posts' out of chip-board and 2"x4"s the same width as your bales, and make a header the same way, you won't have to do any of the time consuming cutting and notching that I had to do.

The bales should be stacked in a running bond; that is, each bale should straddle the joint between the two bales underneath it. Pin the bales together with rebar or bamboo, 2 per bale, and tie the bales to the frame with wire or lathe. There are many ways to do this. We used lengths of rebar tied together with heavy galvanized wire with the bales sandwiched between the rebar pieces. Once your walls are up, hang one inch chicken wire over all the straw, inside and out, pinning it securely with wires poked through the bales. Once this is done you're ready to stucco.

We used a fiberglass reinforced cement stucco manufactured by diamond wall. We hired a contractor to blow the first coat onto the bales eliminating all voids between the straw and the stucco. This not only makes for a stronger wall, but it helps to minimize the possibility of water vapor condensing in the voids between the bales and the stucco coat. Once the first coat is blown on, however, you can save a little money by troweling the rest by hand. It's time consuming and messy, but the materials themselves are cheap and the tools involved very simple. And, you could always rent a good sized mortar mixer, supply lots of food and throw a stucco party. You might not want to do this if you're a perfectionist, but stuccoing isn't rocket science, and just about anyone with a strong back can do it. When you apply stucco, be sure to scratch the surface between coats, and keep it damp for 24 to 36 hours after it's applied.



Other sources of straw bale lore include a very good book called "The Straw Bale Home". It's a bit pricey (\$30.00) but it is available at most book stores and I fervently wish I had bought it before I started on my house, instead of right in the middle of building when most of my major construction decisions had already been made. Happy bale stackin'.

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