

## **How To: Build Straw Bale Buildings**

### **Construction Sequence for Load Bearing and In-Fill Straw Bale Buildings General Guidelines**

#### **Step 1: Design and Site Considerations**

1. Keep it a small and simple house design to reduce financial and ecological costs.
2. Incorporate passive solar principles to take full advantage of the super-insulated bale walls. Orient long axis of building east to west for maximum solar gain and incorporate regionally appropriate amounts of glazing and thermal mass.
3. Select building materials that are energy efficient, have been recycled or salvaged are nontoxic, safe, and beautiful. Scrap yards with 2x4's and plywood can be very useful.
4. Site building appropriate to its function, aesthetics, land, and environment.

#### **Step 2: Selection and Storage of Bales**

1. Select only dry, compact bales and purchase as close to the time of the wall raising as possible.
2. Average the size of the bales for height, length, and width.
3. Store the bales off the ground in small, multiple, crowned stacks. Cover with good quality tarps that are securely fastened.

#### **Step 3: Foundation**

1. Make the foundation out of concrete or cob as wide as the hay bales and elevate it at least six inches above grade and four inches above the finished floor level.
2. Bales can be used as framework for foundation.
3. The bales can be tied down by a system that threads a long needle through the barrels to fasten them to the foundation. If a tie down system for the roof plate will pass through the foundation, provisions such as PVC pipe need to be placed.
4. Set any anchor bolts or eyebolts needed.
5. Place rebar pins every 3 feet in center of foundation for impaling (hammering the bales to the foundation) the first layer of bales.
6. Moisture-proof the top of the foundation with a paint cement sealer.

#### **Load – Bearing Bale Walls: Walls that hold the weight of the roof.**

(Steps 4 through 7 are different for load bearing and in-fill construction types)

#### **Step 4: Window and Door-Frames: (bucks)**

1. Fabricate window and door bucks.
2. Attach door bucks to the foundation with concrete bolts that go into the foundation.

### **Step 5: Wall-Raising**

1. Install 2x4 framed braces at the corners
2. If using the thread technique for hay bales, screw on 3-ft boards along the length sections of the foundation to the anchor bolts, adding sections with coupling nuts as needed.
3. Stack bales (laid flat), overlapping the joints, starting at corners and door bucks. Never Force bales into place.
4. Tie together corners at each layer tightly with polyester cord using a double fisherman's knot.
5. Install window frames as walls go up.
6. Level and adjust walls.
7. Hammer vertical stakes of reinforcements into the bale walls at 4<sup>th</sup>, 5<sup>th</sup>, and 7<sup>th</sup> courses with 5-ft long rebar or bamboo stakes, two per bale.
8. Moisture-proof tops of windowsills with plastic or black paper.

### **Step 6: Roof Plate or Bond Beam**

1. Protect top of walls from rodents and moisture with black paper and metal lath.
2. Construct and install roof plate or bond beam.
3. Attach roof plate to the foundation via the threaded cords and stakes, wire cable, or polyester cord strapping.
4. Pre-compressed bales can be bought and used on the walls if desired.

### **Step 7: The Roof**

1. Construct roof framework-rafters, trusses, recycled lumber, sustainable-harvested wood, steel beams, etc.
2. Install insulation, ceiling, and roof surfacing.

**IN-FILL BALE WALLS: Walls that do not directly support the roof the structure holds the weight.**

### **Step 4: The Structural Framework**

1. Engineer the structure to meet local requirements. (Note. Most structural buildings have to meet code so consult with the city to meet requirements. Multi-story construction is not advised. Plumbing, electrical, and other important features for homes need professional installation)
2. Construct post and beam, modified post and beam, timber frame, masonry columns with wood or concrete beams, steel frame or bamboo structure.

### **Step 5: The Roof**

1. Construct the roof leaving the space above the bale walls open to facilitate pinning the last course of bales. That means leave room next to the bale so a rebar or bamboo pin can be used to fasten the final layer.

### **Step 6: Door and Window Bucks**

1. Build the window and door bucks if they are not already part of the structure framework.
2. Install the door bucks

### **Step 7: Bale Walls**

1. Stack bales and notch to accommodate any column posts, or elements of the surface as needed. Starting each course at the corners and door or window bucks can be helpful. (See figure 1.b to see side view of wall)
2. Set window bucks in place as the walls go up
3. Pin the bale walls with rebar, wood, or bamboo, two per bale, so as to penetrate at least two and \_ courses of bales.
4. Protect the tops of the walls from rodents and moisture.
5. Moisture proof the tops of the windowsills.

### **Step 8: Wall Preparations**

1. Trim and curve bales at corners and openings. That means trim the hay sticking off the hay bales and make it flush and curving the corners to make the finish smooth and rounded.
2. Trim bale wall surfaces to get a good plastering surface (weed eaters work well), especially if not using stucco wire.
3. Fill any cavities in the wall with loose straw or a straw and mud mixture.
4. Install electrical boxes and wiring.
5. Provide attachment points for cabinets, shelves, siding, or Sheetrock.
6. Apply stucco netting to walls.
7. Apply black paper and expanded metal lath to any wood surface that will be plastered or stuccoed.

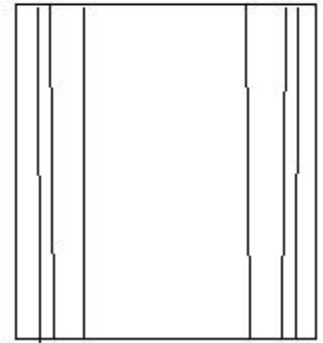
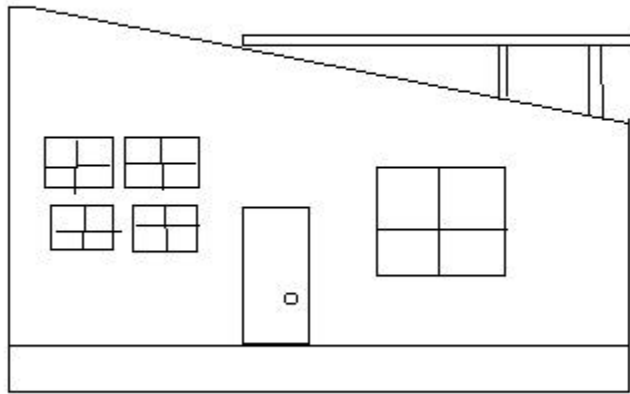
### **Step 9: Surfacing the Walls**

1. Allow building to fully settle (3-10 weeks) if not pre-compressed.
2. Apply stucco, plaster, siding, Sheetrock or paneling.

**References:**

Article, Straw Homes Mother Earth News, October/November 1993

**Staw Bale side view:**



By, Michael Roskam