

# STRAW BALE CONSTRUCTION

## A Factsheet from Austin Energy's Green Building Program

Straw bale construction uses baled straw (wheat, oats, barley, rye and rice) in walls, covered by stucco. It is important to recognize that straw is the dry plant material left after a plant has matured, been harvested for seed, and is no longer alive. Do not confuse straw with hay bales, which are made from plant material that is green/alive. Hay is used for animal feed and not suitable for this application. Stucco-covered straw bales offer a thick wall system which is durable, healthy, and fire- and pest-resistant.

This technique for constructing walls has been recently revived as an alternative to standard stick-frame construction for building highly insulating walls (R-32). The technique was practiced in the plains states in the latter 1800's and early 1900's. Many of the early structures are still standing and being used. However, the approach of using bales directly, despite its history, is a new technique from a regulatory standpoint. The Green Building Program has assisted in the recent passage of a straw bale building code for the City of Austin. The technique has been applied to homes, schools, churches, community centers, government buildings, privacy walls and more.

## Why Choose Straw?

Two hundred million tons of straw is burned annually in the US. The stability and the resistance to weathering in straw are not desirable in agriculture, but quite desirable in construction. Approximately 10,000 acres of wheat and oats are harvested in the Travis County region each year. Eight to ten acres can supply sufficient straw to build a small house. The best time to obtain straw is at harvest time, May through June in our area.

Building walls with straw bales can sometimes be accomplished with the assistance of unskilled labor, aiding in the possibility of reducing the costs of this technique. The cost of straw bales will differ depending on what time of year you buy them. Transportation and handling costs also need to be considered. A rough estimate to consider is \$3.50-\$4.75 per bale, delivered. Bales must also be protected from getting wet. It is also important to be wary about the marketing of straw bale construction as a very inexpensive method of building. It is roughly similar in costs to standard construction. It is also only the wall system, and any building still requires a foundation, plumbing, electrical, roofing, finishes etc.

## Types of Straw Bale Construction

Two basic styles of straw bale construction have been used: post-and-beam construction with straw bale infill, and structural straw bale construction or "Nebraska" style (the weight of the roof is supported by the bales). A post-and-beam style uses bales as infill within a timber or steel frame structure. The frame adds to the expense in materials and labor. However, this approach may be desirable as it offers a roof under which to work during construction. A "Nebraska" style uses the bales as the structural wall system and sets trusses or roof framing on a wood plate (or concrete bond beam) placed on top of the wall. A threaded bar can penetrate through the top bales and be fastened to the plate for added roof stability. This system is easiest and least costly to use but will still require some good planning and probably the assistance of experienced people for consultation.

## Typical Construction

A standard foundation is usually built, and then dense and dry bales are stacked in a running bond (similar to bricks) and pinned with wood stakes or rebar. Newer systems may eliminate pins and use bamboo splints on the interior and exterior, which are tied through the bales to each other. Bales in Texas usually come with two-wires holding them together, weigh about 50 pounds and are usually 14 inches high, 18 inches wide, and 32-38 inches long. Wood window and door frames are installed during the bale raising. Utilities can be laid in the walls as they are built, or run in moldings, interior walls, under floors, or in the attic. Poultry or stucco netting is then mounted on both sides of the walls for plastering. Stucco lath is used around windows,

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doors, and corners for added strength. The wire netting and lath are typically held against the bales by wire pins into the bales. The windows are then installed, followed by two or three coats of stucco or plaster on the interior and exterior walls.

### **National Resources**

- Development Center for Appropriate Technology (DCAT), P. O. Box 41144, Tuscon, AZ 85717 (520) 326-1418, [www.azstarnet.com/~dcat/](http://www.azstarnet.com/~dcat/) (*consultation, advocacy, codes*)
- DAWN/Out on Bale by Mail, 1039 Linden St., Tuscon, AZ 85719, (520) 624-1673, [www.greenbuilder.com/dawn](http://www.greenbuilder.com/dawn) (*consultation, workshops, publisher of "The Last Straw"*)
- Sustainable Systems Support, P.O. Box 318, Bisbee, AZ 85603, (520) 432-4292, [sssalive@primenet.com](mailto:sssalive@primenet.com) (*consultation, workshops, videos, plans*)

### **Publications**

A Straw Bale Primer, Inhabitation Services, P. O. Box 58, Gila, NM 88038, \$10, 24pp., 1991

Plastered Straw Bale Construction, David Brainbridge, Bill & Athena Steen, 1994, 46pp., \$10

The Straw Bale House, Athena&Bill Steen, David Bainbridge, David Eisenberg, Chelsea Green Pub., 1994, 336pp., \$29

Build It with Bales: A Step-by-Step Guide to Straw Bale Construction, 2nd edition, Steve O. MacDonald & Matts Myhrman, Out on Bale, 1037 Linden St., Tuscon, AZ 85719, (520) 624-1673, \$29, 1997

Buildings of Earth and Straw: Structural Design for Rammed Earth & Straw Bale Construction, Bruce King PE, 169pp, \$24

Straw Bale Building: How to Plan, Design, and Build with Straw. Chris Magwood and Peter Mach, New Society Publishers, 2000, 234pp., \$25

### **Videos**

"Straw Bale Construction: The Elegant Solution" (30 minutes, overview, interviews)

"How to Build Your Elegant Home with Straw Bales" (90 minutes, video & manual, comprehensive, \$59)

"Building With Straw"

Vol.1, "A Straw Bale Workshop" (73 minutes, weekend workshop, \$25)

Vol.2, "A Straw Bale Home Tour" (68 minutes, tour of 10 structures, \$29)

Vol. 3, "Straw Bale Code Testing" (40 minutes, documents ASTM wall tests, \$39)

"The Straw Bale Solution" (30 minutes, interviews and workshops, \$29) [available from Black Range Films, Star Route 2, Box 119, Kingston, NM 88042, (505)895-5652, [strawbalecentral.com](http://strawbalecentral.com) as well as from the Straw Bale Association of Texas, [www.io.com/~whtefunk/sbat.html](http://www.io.com/~whtefunk/sbat.html)]

### **Newsletter**

"The Last Straw", HC 66, Box 119, Hillsboro, NM 88042, (505) 895-5400, [www.strawhomes.com](http://www.strawhomes.com)

### **Local Resources**

- Center for Maximum Potential Building Systems, 8604 FM 969, Austin, TX 78724, (512) 928-4786, [www2.cmpbs.org](http://www2.cmpbs.org) (*consultation*)
- City of Austin Green Building Program, Marc Richmond-Powers, 505-3701
- Straw Bale Association of Texas (SBAT), 3102 Breeze Terrace, Austin, TX 78722, (512) 302-6766 vm, [www.io.com/~whtefunk/sbat.html](http://www.io.com/~whtefunk/sbat.html), *monthly meetings on 4th Wed., 7pm, 1701 Toomey Rd., Austin, 78704*

### **Architects**

Gayle Borst, Stewardship Inc., 478-9033

Robert James, Architect, 450-0589

Ben Obregon, Architect, 263-0177

Marley Porter, Architect, 472-0272

### **Builders**

Bach Brothers Construction, Craig Bach, 261-4777

Bowerbird Construction, Keith Miller, 858-5395

Living Architecture, Marley Porter, 472-0272

Thangmaker Construction, Frank Meyer, 916-8100

This list does not constitute an endorsement or recommendation by the City of Austin, Austin Energy or the Green Building Program. Please check references thoroughly before employing the services of any contractor.