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Straw-bale homes eco-friendly, energy efficient

Some owners save money by learning building techniques

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BOULDER - Building with straw bales, says Brian Fuentes, architect and owner of fuentesdesign LLC, a Boulder-based design firm, is "a way of putting together a building that is healthy, fun and meaningful to the current global situation."

Straw bales, made from a biodegradable agricultural byproduct, make for structurally sound, tightly built structures that are energy efficient, require less wood, and are relatively easy to construct. The straw bale building technology is one "the whole world can adopt," Fuentes says, "anywhere where there is straw and clay and a reasonable climate for it."

In most straw-bale buildings, the bales serve as in-fill inside a wooden post-and-beam frame. When covered with thick coats of stucco on the exterior and plaster on the interior the straw bale walls provide insulation. In this style of construction, the post-and-beam frame, not the bales, supports the weight of the structure. This non-load-bearing style is the preferred method for building straw bale homes. A less-popular style, the "Nebraska style," is load bearing, meaning the straw bales support the weight of the structure.

In a straw bale wall system, the stucco and plaster help support the building against wind and snow loads, like plywood in standard frame construction. The latest innovation in straw bale building has come from the use of earthen plasters, Fuentes says. These plasters use less cement or lime — both of which have a higher "embodied energy," the total amount of energy required for manufacturing and distribution.

Along with using straw bales and earth plasters, Fuentes tries to incorporate other products that have a low embodied energy. One of his buildings, a detached, 545-square-foot studio above a two-car garage, was built using lumber from the carport that had previously been on the site. Inside this North Boulder studio, the tongue-and-groove aspen ceiling and the gypsum in the final wall coverings both come from Colorado, reducing transportation costs.

Fuentes has used straw bales to construct new homes, studios, additions and remodels. On a number of these projects he worked with owner-builders. Since building a straw bale structure is more labor-intensive than standard frame construction, significant cost savings can come from owners constructing the home themselves, often with the help of friends and family.



STEVE PETERSON

Brian Fuentes, architect and owner of fuentesdesign, a Boulder firm that specializes in building straw bale homes. In this house, the ceiling is made of Colorado aspen, considered a renewable material since it can be cut down to the ground and will grow back.



STEVE PETERSON

A Fuentes-designed house insulated with straw bales and finished with lime-sand plaster. Straw bale walls have a high insulating value, rated R-28, which is double that of a conventionally framed wall system which has is rated R-14.

Homeowners can learn the necessary skills for building with straw bales at one of the many workshops offered by professionals, such as those held by the Colorado Straw Bale Association.

Fuentes estimates that contractor-built straw bale homes along the Front Range cost approximately \$150 per square foot. Owner-built straw bale homes vary in cost, depending on the amount of contract labor used.

The biggest challenge with using straw bales is keeping the bales dry. Bales purchased from a farmer need to be dry and uniformly compacted. During the building process, the bales need to be protected from rain and snow. And, Fuentes says, the long-term durability of the bales depends on designing and constructing a structure that permanently keeps the bales moisture-free.

Jeff Ruppert, owner of Odisea LLC, an engineering and consulting business with offices in Boulder and Carbondale, has 10 years of experience working on more than 360 straw bale construction projects. Considered one of the leading structural engineers in the straw bale building industry, Ruppert has been called on to investigate straw bale homes that have suffered moisture damage.

"The reason that straw bale is more susceptible right now is because most of the buildings are being built by owner-builders, or people with less skill and less knowledge about how to flash a window or how to design a building correctly, and they have failures," Ruppert explained. "Those (failures) are what people hear about. But, he said, problems such as these can happen "across the board" in construction. Conventionally built homes are no exception.

Contrary to what one might think, the dense bales and thick walls make for very

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fire-resistant construction. Fire tests have shown a straw bale wall can withstand two hours of 1,850-degree heat before cracks begin to appear, according to the Canadian Mortgage and Housing Corporation.

Straw bale walls also have a high level of thermal performance. Fuentes says reliable tests show the rating is close to R-28, which is double that of a conventionally framed 2-by-6 wall filled with R-19 fiberglass insulation. As commonly constructed, conventionally framed wall systems provide an R-value of 14.

Straw bale wall systems are also strong. Compression tests determined that walls built out of smaller, two-string bales, which are what Fuentes uses, were twice as strong

as a 2-by-4 wall with one-half-inch plywood on both sides, Ruppert said.

Other uses for straw in construction include mixing loose straw and clay to use in a straw-clay wall system, making prefabricated straw bale walls that are pre-finished with stucco and plaster, and manufacturing perfectly square straw bales for construction. But, Fuentes says, "I like the hand-applied, community effort behind straw bale construction ... anyone can build one."

The Colorado Straw Bale Association's annual conference is in Carbondale, May 20-21, 2006. For more information, visit: www.coloradostrawbale.org or call (303) 444-6027.