

# DRAWING STRAWS

Architects and builders practicing straw-bale construction are used to misconceptions, but many no longer feel they're drawing the short straw

**Every building material has its positive and negative attributes.** Some lack strength, flexibility, or durability while others are far too expensive or hazardous. However, few materials suffer from as many misconceptions (see sidebar, right) as straw bales, despite that it has stood the test of time—some structures have remained intact for decades.

"It's unfortunate that even in large jurisdictions many building officials still do not know enough about straw," says Lisa Swan, principal of Design Forward LLC. "Fortunately, most are still open to hearing the arguments. While they may not let you build out of straw without problems, there is at least the opportunity to mitigate the misconceptions."

Although the practice has been around since the 1800s, straw-bale construction saw its resurgence in the 1980s when the state of California outlawed the burning of fields. "Farmers needed to find a way to dispose of excess straw coming off of their fields," Swan explains. "The amazing thing that has come out of building with straw is that it is readily available, somewhat inexpensive, energy efficient with R-values as high as R60, and it's a fun building material. This blends well with the desire to save money and energy."

Most of Swan's homes are in more rural areas when people have acreage and can spread out rather than go up. "You can't go too high with straw, considering its weight of 70–80 pounds per bale," Swan says. "However this does not mean that commercial applications are out of the picture. For instance, the 70,000-square-foot transit center in

Santa Clarita is a prime example of a large-scale straw utilization because it is more sprawling."

Of course, straw does have one primary challenge—moisture. Professor P.J. Walker, director of the Building Research Establishment's Centre for Innovative Building Materials at the University of Bath, says overcoming the moisture concern is all about approach. "You can always find fault with any building material, but with the proper perspective you can also find suitable uses," he says. "The benefit is that producing straw for building purposes is not turning valuable land over from food production. It is very low carbon, and since it actually stores carbon, people can consider it carbon negative."

The best results occur when prefabricated options are embraced, allowing straw panels to be built under cover, Walker explains. "This route essentially eliminates the dryness worries," he says. "However, they still need to design and build the structures correctly so that water does not impact the straw-filled structure and create future structur[al] issues."

Walker's team at the University of Bath has been active in testing Modcell panels on a two-story test house against fire and wind—ultimately showing the true durability associated with straw construction. With the Modcell approach, straw is pre-compressed and framed in a unique solid timber enclosure to reduce settlement and provide retention against fire risk by removing air from the material. Walker also employed his knowledge on the design of a prefabricated, two-story

## THE TRUTH ABOUT BUILDING WITH STRAW BALES

Lisa Swan, principal of Design Forward LLC, debunks some common misconceptions surrounding straw-bale construction.

### Fire Susceptibility/

Bales are compacted to a point that they do not combust, Swan explains. "The outside will smolder and catch fire, but typically burn out," she says. "Usually if there are problems it is while a building is under construction and the bales are loose."

### Rodent Attraction/

Straw is the leftover material from growing other crops; it has no nutritional value to it whatsoever. "It isn't hay, so it doesn't attract the pests," Swan says.

### Durability Concerns/

This is especially true in California, where earthquakes dictate building-material selection. However, straw has proven to do quite well in shake tests. Understandably, the plaster breaks, but the bales stay together.

project in York. The EcoDepot utilizes the insulation properties of the straw to achieve a 76-percent reduction in energy use when compared to traditional counterparts.

Though the initial temptation may be to fully encapsulate the straw—thus avoiding any potential water penetration—this approach would be a mistake, Swan says, since straw bales inherently include anywhere from 8 to 20 percent water. "This is the primary reason

This Eastern Sierra home by Arkin Tilt Architects (right) has a secret that is helping its owners shave thousands of dollars off cooling and heating bills over time: Walls insulated with straw bales (see close up below). The wall finish—an earth-cement featuring soil excavated at the site—works with the bales to provide ample insulation as well as thermal mass. Photos: Edward Caldwell.



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—Professor P.J. Walker, Director, BRE Centre for Innovative Building Materials



we usually use water porous lime plaster with a small amount of concrete as the building exterior—so moisture can move out of the system," she explains. "You want the wall system to breathe, especially in the instance that water does penetrate the system."

Instead, the focus should be on including large overhangs to keep water off of the walls. In fact many of Swan's designs include three- or four-foot overhangs, or she will wrap the entire structure with porches.

Straw provides a number of creative ways to frame out windows and doors, whether inside or outside the two-foot opening. "The resulting variations in looks often include a host of curves, angles, or splaying. These configurations add character, flair, and fun that do not accompany many other materials," she says.

"Understanding how to address the potential issues encourages you to increasingly find interesting and creative designs." Utilizing the same straw-building tactics Swan promotes—lime plaster on the interior and exterior of the perimeter wall—the ultra-efficient Santa Clarita building demonstrates the fun aspect of building with straw through its modern design aesthetic.

"The focus on energy efficiency is here to stay, and as a result we are moving toward the inclusion of more green-building techniques as standard codes," Swan says. "Straw is definitely a piece of the equation. It is not the solution for every building but can be a wonderful alternative for one- or two-story facilities or homes." —by Peter Fretly