



# Santa Cruz Straw Bale

Net-zero energy use and whimsical details shine in a new family home

BY ANNI TILT

**A**s a rule, we make sure our clients are interested in sustainability and design in equal parts, and ideally, our clients are also fun, intelligent, and engaged. When we met Bernie and Erika at a cafe near our office four years ago, our firm was incredibly busy, and it didn't seem possible to add another project to our schedule. When the couple described their goals for the house and their property two blocks from the ocean in an eclectic neighbor-

hood in Santa Cruz, Calif., we hesitated. "I'll tell you what," Bernie said. "We'll throw in family surfing lessons." How could we refuse an offer like that?

Professors of biology and environmental studies at UC Santa Cruz with four children, Erika and Bernie have an active family life as well as being engaged with the outside world: their community, their professional lives, and the health of the earth. We wanted to provide a fun, comfortable house for their family while pushing the ecological envelope.



## BEST NEW HOME

Our 2012 award for best new home goes to Arkin Tilt Architects, who designed this house for two university professors and their family. The resource-efficient straw-bale construction and net-zero energy use reflect the homeowners' environmental sensibilities. The smart plan suits the infill building site as well as the couple's active lifestyle, and the fun, vibrant details reflect their personalities. Few houses work this hard.



**Surfer style.** Open to a park and a path to the ocean, this house reflects the owners' personalities and hobbies (photo left taken at A on floor plan). As a case in point, adjoining indoor and outdoor showers offer a place for sandy surfers to rinse off and clean up (photo right taken at B on floor plan).

While in a dense neighborhood, the site is bordered on the west by a lively public park that follows a creek to the nearby ocean. Although the park is narrow, it provides mature sycamore trees to the west, long vistas to the southwest, and easy access to the surf.

### Early design feedback leads to a winning plan

After gathering information on the site and the program needs, we quickly explored several design options with the family. On any given site, there are many different ways to solve the same problems, and

looking at options makes us think more broadly about the possibilities. The idea, of course, is not that the clients pick one of these initial plans but that they give us detailed feedback on each so that we can zero in on a single option that incorporates their specific needs. After reviewing three plans, we received about eight pages of comments from Erika and Bernie, which sent us back to the drawing board.

The result of this second round of design is a compact, two-story house that includes four bedrooms and an office, as well as a small, one-bedroom apartment with its own entrance. The exuberant south-



**Material palette found.** A driftwood column welcomes guests and supports the cedar-clad bump-out above. Straw-bale walls are finished with lime plaster while board-and-batten fiber cement marks the stick-framed stairwell. The front door and interior windows are Craigslist finds. Photo taken at C on floor plan.

ern facade and generous terraces are well exposed to the public park. Some folks may have wanted more privacy, but Erika and Bernie favor the connection to the landscape and to their neighborhood. The street-front presence is more subdued and offers only a small glimpse of the interior through the one large window.

One of our goals was to connect the front and rear entries to a common area with space for shoes, coats, and backpacks. The rear entrance also features an outdoor shower and a door that leads directly into an indoor shower, for quick cleanup when returning from the surf.

The two-story, sun-filled dining room is balanced by an intimate living space with a sitting bay facing the park. With no mechanical cooling system, natural ventilation occurs by simply opening windows, particularly the high windows in the dining space, providing an opportunity for flushing cool air through the house at night.

The second-story bedrooms are arranged to capture sunlight, and each has an interior window to share light with adjacent spaces. To create privacy, a bridge separates the master bedroom from the rest of the bedrooms.

In keeping with an efficient plan, all the circulation spaces serve several functions: The exposed framing in the stairwell becomes a bookcase, and a built-in bench in

the second-story hall provides a play area adjacent to the kids' bedrooms.

### Straw bale makes sense for some walls

We have long been proponents of straw-bale construction as a natural, carbon-sequestering, and resource-efficient building method. However, there are many other benefits besides its environmental qualifications: the high insulation value (conservatively tested at R-30) in combination with internal thermal mass; the breathability and acoustic qualities of the walls; and the old-world beauty of deep window and door openings.

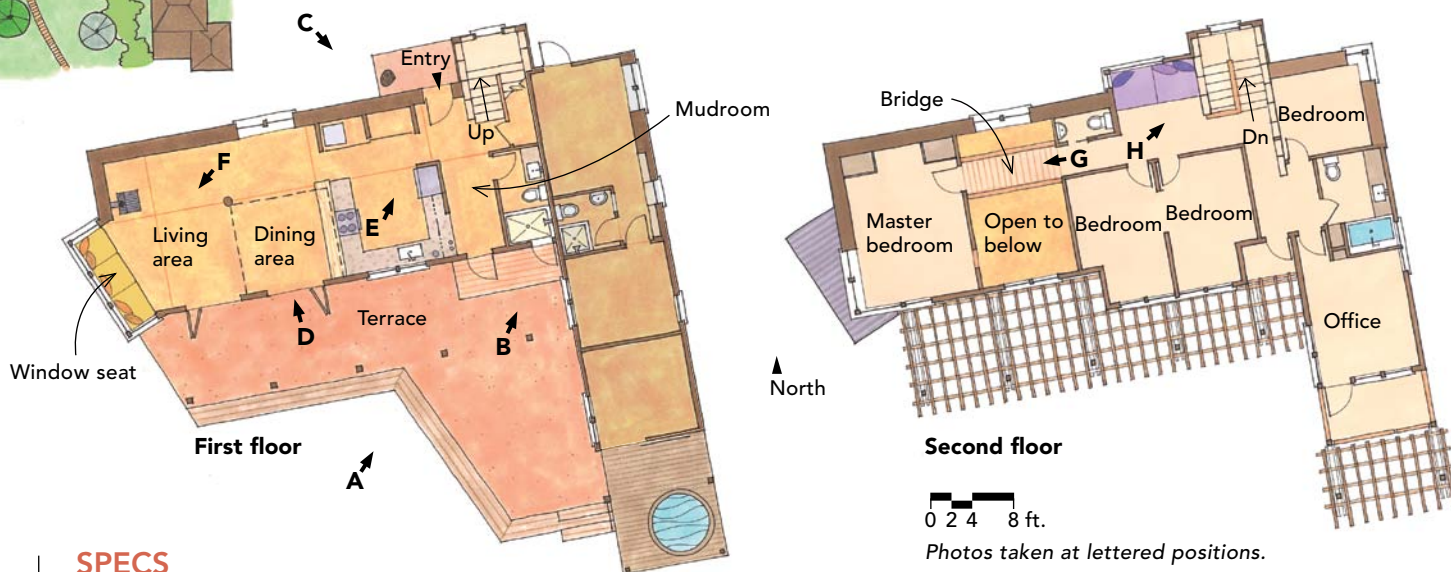
Best of all, straw-bale construction can engage community and personal connection to the home through a bale-raising, where the owners (and their friends) can participate in the building of their own home. Over the course of bale-raising day, the house is transformed from a skeleton into actual contained space. The bale-raising on this project featured many different age groups— young children, students from UC Santa Cruz, parents, and grandparents—as well as many skill levels, and there was an activity for everyone.

Of course, straw bales are fairly large building blocks, and not every wall is suited for this construction type.



## FAMILY PLANNING

The first floor reflects the owners' casual lifestyle. Front and back entries meet in the mudroom with a small adjacent bath. The rest of the floor is an open living space—including the kitchen, dining area, and living room—with two foldaway doors that open to the generous deck and yard. Upstairs, the master bedroom finds a bit of privacy across a bridge from the kids' bedrooms. The shaded space on the first floor is a separate apartment that is used as a rental property or in-law suite.



### SPECS

**Bedrooms:** 4 • **Bathrooms:** 2½ • **Size:** 2500 sq. ft. (including adjacent one-bedroom, one-bath apartment) • **Cost:** \$260 per sq. ft. • **Completed:** 2010 • **Location:** Santa Cruz, Calif. • **Architect:** Arkin Tilt Architects • **Builder:** MS Builders



# GREAT ROOM, GREAT DETAILS

The open kitchen, dining area, and family room (photo left, taken at D on floor plan) combine clean lines and whimsical details. The stained concrete floor, plaster walls, frameless cabinets, horizontal cedar paneling, and Parallam beams (top photo, taken at E) are a calming juxtaposition to the towering madrone tree and driftwood bridge railings. The angular window-seat bump-out (photo above, taken at F) offers a relaxing sanctuary from the opposing business end of the great room, where the entry mudroom and kitchen meet.



**Bridge to bedtime.** The bridge offers a bit of privacy by separating the master bedroom from the kids' rooms, and the open two-story space and interior windows in all the bedrooms allow sunlight to flow freely through the second floor to spaces below. Photo taken at G on floor plan.



**Double-duty framing.** In the stairwell, the interior walls are used for bookcases. A bump-out built-in turns the hallway into a play area. Photo taken at H on floor plan.

On the south wall, where there is extensive glazing for passive-solar gain, it made little sense to have bale walls; therefore, these walls are conventionally framed with 2x6 wood studs filled with blown-in cellulose insulation.

### Heat pump is the heart of the mechanicals

Erika and Bernie wanted an energy-efficient house that takes advantage of the local climate with the added comfort of radiant heat. Combining passive-solar strategies with an airtight, well-insulated building envelope and cutting-edge mechanical technology with energy-conserving fixtures and appliances, we were aiming for a net-zero-energy home with a minimal carbon footprint. However, it was a last-minute change that helped us to achieve such great efficiency.

Our initial intention was to use a mechanical system we have used on other projects: a gas-fired boiler with pre-heated water from solar collectors for the radiant flooring and domestic hot water, and a photovoltaic system designed roughly to offset electrical usage. This system works well. For true net-zero energy use, however, the

source of energy is important, and petroleum products are impossible to offset fully with on-site production. (If you're interested, the book *Energy Free: Homes for a Small Planet* by Ann Edminster has a thorough discussion of how net-zero energy use is calculated.)

During the permitting process, our mechanical consultant called to let us know that a highly efficient electric air-to-water heat pump—Altherma by Daikin, which has been in use in Europe for about 25 years—was now approved for use in California. The Altherma has allowed us to achieve true net-zero energy, but the learning curve was steep.

Lance Little, the mechanical contractor, had to attend a training seminar and has returned to the house several times to make adjustments. Because no additional heat was needed for the first seven months of occupancy, some adjustments were needed during a week of cold weather in January. It took some recalibration at that time to provide the right balance between heating and hot-water production. Fortunately, the unit is fully programmable, so Erika and Bernie can optimize efficiency year-round.

With good daylighting, fluorescent and LED light fixtures, and Energy Star-rated appliances, internal energy loads are low. The house was calculated to need about 6.4kw of photovoltaics. We put in a smaller array, about 5.2kw, on the theory that more could be added but that it would be preferable to have a smaller system that would encourage more conservative energy usage.

### Owner-inspired details

The whimsical character of this house reflects Erika and Bernie's love of nature and color, and their enthusiasm for salvaged and found materials.

My favorite details are the driftwood column that marks the entry and the madrone tree in the living space. We conceived of both early in the design with the collective faith that the right materials would turn up. The structural driftwood column was located promptly; it was a matter of logistics to get the huge log to the site and determine how to install it. The nonstructural interior column was more elusive, but serendipitously, just as we were wrapping up construction, the owners received a call that a madrone tree had just fallen on a friend's property. It was wrapped in blankets and tenderly brought to the site. Today, the branches rise up into the two-story dining space, reinforcing the "outside-in, inside-out" nature of this project. □

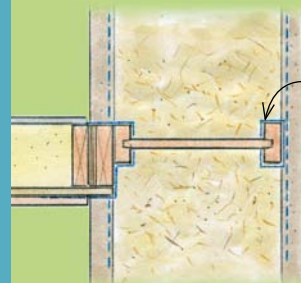
Anni Tilt's Bay Area firm Arkin Tilt Architects can be found online at [www.arkintilt.com](http://www.arkintilt.com). Photos by Brian Pontolilo, except where noted.

**Design video:** Scan here or visit [FineHomebuilding.com](http://FineHomebuilding.com) for an inside look at this home and those behind its design.



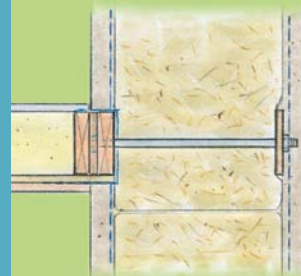
## Straw bale, in detail

### Partitions at I-joint



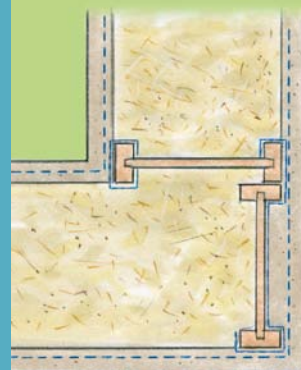
Partitions can be secured to I-joint flanges with nails.

### Partition without I-joint

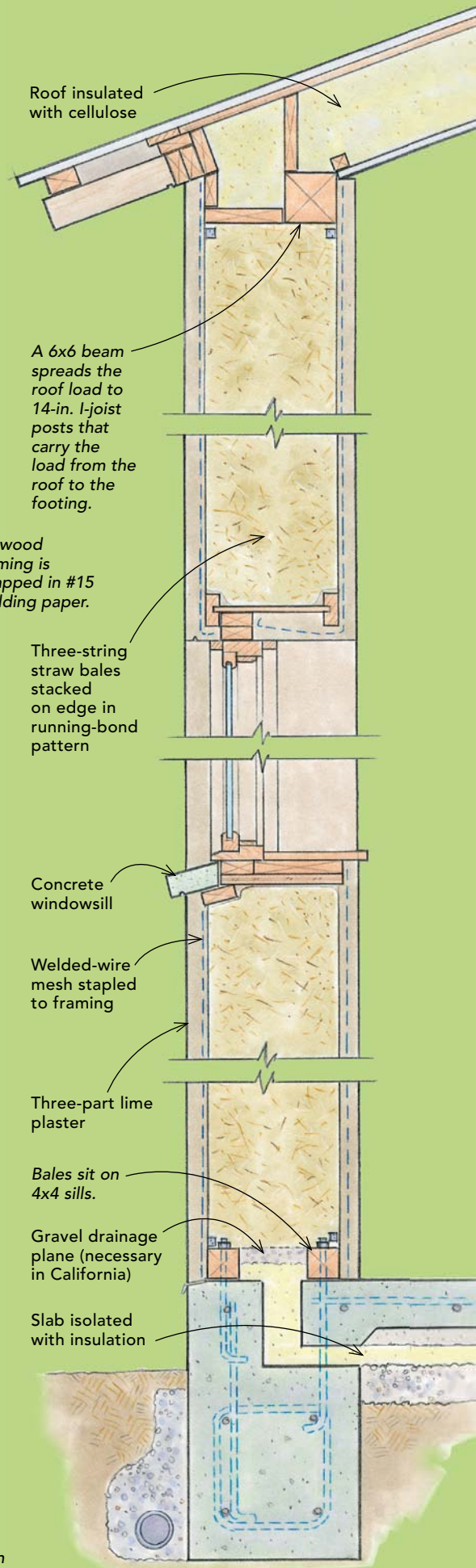


When a partition doesn't align with an I-joint, bolts and big washers are used to compress the bales for a secure attachment.

### Corners



As with an engineered stud wall, only two I-joists are used in the corner, which means more insulation and fewer retied bales.



Roof insulated with cellulose

A 6x6 beam spreads the roof load to 14-in. I-joint posts that carry the load from the roof to the footing.

All wood framing is wrapped in #15 building paper.

Three-string straw bales stacked on edge in running-bond pattern

Concrete windowsill

Welded-wire mesh stapled to framing

Three-part lime plaster

Bales sit on 4x4 sills.

Gravel drainage plane (necessary in California)

Slab isolated with insulation