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Rammed earth construction creates a striking house

By Laurie Schreiber | Sep 23, 2010

(Photo by: Laurie Schreiber)

The rammed earth first story of this home is topped by a double-stud frame second story. The earthen look of the first story, the cedar shingles above, curved master balcony, deep overhangs, and framing elements result in a visual symphony of form and texture.

BAR HARBOR — A new home in Salisbury Cove uses a variety of sustainable energy techniques, including the ancient method of rammed earth construction.

Commissioned by Susan Turner and Karl Karnaky of Charleston, SC., and designed by Bar Harbor residential designer Barbara Sassaman, the construction of the house by Bar Harbor contractor Bill Shaw and his crew is almost complete. The house will be one of the featured homes on the Northeast Sustainable Energy Association's upcoming Green Buildings Open House tour Oct. 2. Sassaman and Shaw will be on hand to discuss their work.

The design of the house is striking, combining as it does the earthen feel of an ancient construction technique, the intriguing attractions of vintage elements reanimated by new use and the aesthetics of a contemporary sensibility.

The house was actually built from the land upon which it sits. Rammed earth construction is a labor-intensive technique for making earthen walls. The primary material is soil that is dug up at the building site. The technique involves building forms for the walls, then filling the forms with a mix of sand, gravel and clay or cement. The mixture is then compressed with a pneumatic tamper (or a hand tamper) to create a dense, stone-like structure that can last for centuries and even millennia. There are examples in Europe dating back to the Roman occupation and in the eastern United States dating back to pre-Revolutionary times. The Great Wall of China is partially made from rammed earth.

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Turner and Karnaky bought the Salisbury Cove property nine years ago, from a colleague of Karnaky's. The property came with a cabin that was in pretty bad shape. They salvaged as much as they could from the cabin, such as the yellow pine floors, a granite fireplace and a soapstone sink.

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Retired professors, Turner and Karnaky wanted their second home to be as energy-efficient as possible. Turner said she learned about the rammed earth technique years ago. After considerable research into alternative building methods in general, she said rammed earth emerged as the best choice for the first story. In 2000, the couple approached Sassaman, whose portfolio ranges from detail work to high-end residential construction, additions and renovations. The design was finalized in June 2008 and excavation began that August.

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Shaw didn't have any experience with rammed earth construction, but got in touch with a Massachusetts Institute of Technology graduate student in architecture, Joe Dahmen, who has traveled worldwide to study traditional and contemporary rammed earth architecture. With his advisor, assistant professor of building technology John Ochsendorf, Dahmen designed a 60-foot-long freestanding rammed earth wall, which he and a team of students and staff built in 2005 on the campus. Shaw took soil samples and passed them on to Dahmen, who conducted compression tests to come up with the proper mix of particles and binder. Traditionally, clay is used as a binder, but for the Turner/Karnaky house, Portland cement was used to stabilize the mix; a small amount of iron oxide was added as well, to give the walls a burnt sienna hue.

A year ago, Shaw's crew began the process of building the first-story walls. This involved, first, the construction of plywood forms to a height of 2 feet at time. The crew used a front end loader equipped with a tiller to mix slightly moistened piles of soil, cement and iron oxide.

The crew then poured the aggregate, by the bucket, in an evenly spread layer within the forms. A pneumatic backfill tamper – something like a jackhammer with a heavy weight on the bottom – was used to compress the soil to about half its volume. The next bucketload of aggregate could then be poured in. The method was repeated until the top of the form was reached. The aggregate was allowed to harden to rock-like consistency. The forms were built up as the walls got higher, so the crew could continue the process until the 8-foot height of the first-story wall was reached.

Now that the house is completed, Turner and Karnaky said they are thrilled with the results.

The couple recently took a visitor on a complete tour of their new home. From the beginning, the eye is struck by the structure's multiple levels and design elements. The molded quality and subtle striations and textures of the rammed earth construction is almost artistic in nature, reminiscent of the adobe architecture of the Southwest. There's an unfinished quality about this part of the construction that's attractive: the viewer can easily make out the rough texture and chips of the plywood that was used for the earth forms. This lends a bit of an archeological feel, like finding the impression of ancient bones in rock. In keeping with that idea, said Turner, the builders embedded coins and notes into the walls while they were constructing the layers.

Cement caps were used on areas that would be exposed to the elements, such as the porch balustrades and windowsills, and concrete bond beams lie atop the earth walls; the latter are covered by wood trim. The cement elements were needed, she said, to keep water from soaking and perhaps softening the walls. The second-story frame structure is finished with cedar shingles. The house is penetrated by four doors, one on each side; along with picture windows, two second-story balconies, and a rear porch that is roofed and screened. Solar panels and skylights are mounted on an environmentally friendly metal roof made from recycled aluminum and steel.

According to Turner, the roof is rated to keep the house cooler in the summer and warmer in the winter. The heavily insulated walls and ceiling, along with the triple-glazed windows, make it nearly impossible to hear anything outside the house unless the windows are thrown wide open.

Inside, the house features decorative beams and wide floor planks taken from an 1836 house in Dexter. Custom cabinetry in the kitchen was made by John Law in Tremont; their doors are made from pine boards that were taken from the 1836 house. The underside of the kitchen's soapstone sink, from the property's original cabin, is stamped with date 1940. Two skylights and big picture windows provide plenty of light throughout the day.

The nature of the rammed-earth construction, which results in exterior walls that are 24 inches deep, means that window seats or wide display areas come gratis at each window. Live-edge slabs of wood finish the interior sills at two of the windows. The living room's granite fireplace, created by mason Mark Nyborg with input from Karnaky and Turner, showcases a mantelpiece and diamond stone that were taken from the old cabin's fireplace.

Interesting details can be found throughout the interior. The downstairs bathroom features half-walls made of corrugated

galvanized steel and industrial pipes for the towel bars. The highlight of the upstairs bathroom is a brightly patterned Talavera sink handcrafted and hand-painted in Mexico. Pocket doors are built into some walls, using vintage pine boards. Shaw crafted banisters and railings from stripped limbs left in their natural shape. The master bedroom looks out on a curved balcony with a prospect to the sea. The bedroom's floor uses pine planks of variable widths taken from a 19th century granary.

Minimum energy use is the order of the day, with the use of low-energy appliances, triple-glazed windows, radiant floor heat, and composting toilets. Turner said she expects that the photovoltaic system will generate enough electricity in the summer to sell some back to their grid provider. In the winter, the house will consume electricity to keep the house from freezing, but the energy usage should zero out, she said.

The house tour will take place from 11 a.m. to noon. For more information, visit nesea.org/openhouse.

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