

# Innovative Concrete Homes

A variety of construction methods are being used

By Joe Nasvik and Bill Palmer

**B**eing innovative does not mean just being creative with design. It encompasses all aspects of the construction process. Of the many market applications for concrete homes each takes advantage of different benefits of the material. Many companies are innovating in the construction of concrete homes for very different reasons, as described here.

### Doing it the Mercedes way

Vince Heuser is the manager of Solid Wall Systems, a subsidiary of employee-owned Mercedes Homes, Cocoa, Fla. Heuser thinks Florida is the nation's most competitive market for home construction. Therefore, using concrete as the building material—in competition with steel frame, wood frame, and concrete block—is a challenge. In Heuser's world, he must win over a customer to an innovative approach in four areas:

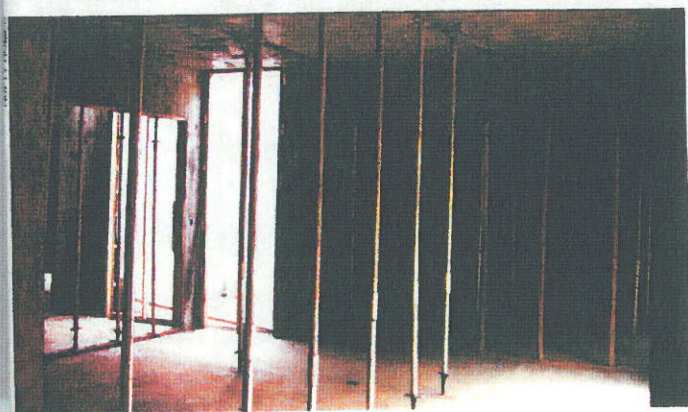
- The home must cost less than one built with other materials.
- The finished product must provide significant energy savings.
- The building must take less time to construct.
- Maintenance expenses must be reduced.

Solid Wall Systems is focusing its activity in central Florida, where its specialty is 1200- to 3500-square-foot homes; in the past 2 years it's completed 500. The company currently constructs



This all-concrete home located in the Raleigh, N.C., area has 10,000 square feet of living space. Jon Ruffy, the builder, states that the home will be on view for 3 years after construction is complete and will feature the latest technology for homes. Ruffy feels strongly that concrete is the best material for building homes.

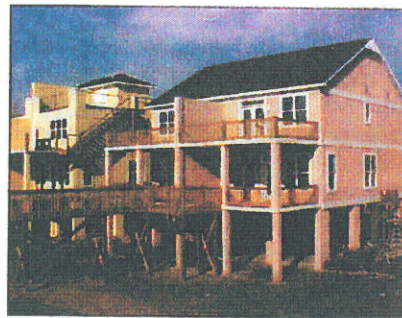
The Ruffy home features interior and exterior concrete walls and decks. When complete, the home will provide ultimate safety and energy savings for the new owners.



exterior concrete shells at the rate of two per day—soon to increase to three per day. Heuser says the concrete homes are less expensive and faster to construct than concrete block homes, so he targets developments that competitively bid the two materials. But in areas where wood frame is the norm, “We can equal the cost of wood frame con-

struction, but that’s not enough to get the job,” he notes.

Typically, crews erect aluminum forms for the exterior walls and place concrete the same day. They remove the forms the following morning and reassemble them on the next site. Heuser says that they don’t build interior concrete walls because they can’t compete



SECURITY BUILDING GROUP

The foundations for these vacation homes, located 100 feet from the ocean on Topsail Island, N.C., are held in place with 45-foot-deep caissons and are mounted on 10-foot columns. All the walls and ceilings for each home are concrete. Only the pitched roof, which sits on a concrete deck, is wood.

with the cost or speed of steel stud construction. A crew can complete all the interior walls with steel in one day, so they get the job. Concrete walls would take 2 days.

Solid Wall Systems builds 6-inch-thick concrete walls. Afterward it places ¾-inch closed-cell foam insulation (R-4) against the inside wall and ¼-inch furring strips over that, with electrical wiring between the furring strips. Plumbing is located in hollow interior walls. Crews use aluminum buck forms for windows and doors, leaving only a ¼-inch caulking gap between windows and concrete, producing an airtight structure. Energy savings result from this tightness and from the thermal mass and insulating value of the concrete walls, which absorb heat during the day and release it back to the environment at night—with little heat gain to the interior. Energy savings of 30% over block construction and 50% over wood are common.

“One added advantage we enjoy is locked-in concrete prices for a year,” Heuser adds. “Lumber prices are typically adjusted quarterly.”

#### Building in the face of hurricanes

Sue McLaughlin, the planning, zoning, and Coastal Area Management Act (CAMA) officer for North Topsail Beach, N.C., says that Topsail Island has the lowest elevation of all the barrier islands, and more than 375 homes have been destroyed by hurricanes over the past 15 years. The state recently changed the

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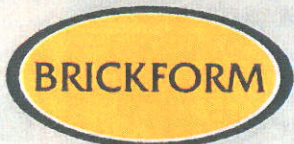
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building code requirements in hurricane-prone areas to require all buildings to withstand 130-mile-per-hour wind loads—up from 110 miles per hour. This change doesn't affect the design of a concrete home but necessitates elaborate changes for wood frame buildings.

Security Building Group, Raleigh, N.C., is currently building six duplex vacation homes on North Topsail Beach, about 100 feet from the high-tide line and only 8.5 feet above mean sea level. The floor slab for each home is perched on columns 10 feet above the sand, 4 feet above the base flood elevation.

Dave Pfanmiller, general manager of Security Building Group, said there are 28 caissons per dwelling, installed using the Continuous Flight Auger (CFA) method to a depth of 45 feet. Heavily

The Rastra panels on the Loveland home were assembled and grouted full, followed by structural steel and roofing.



reinforced grade beams 18x20 inches span the caissons, and columns 12x30 inches are located on top of the grade beams, with an 8-inch-thick structural slab

cast over the columns. After this, home construction begins. Tri-City Contractors, Raleigh, N.C., the structural concrete contractor for this project, used aluminum forms to construct all the walls and decks (ceilings). Each home has two floor levels and each entire floor level (all walls and decks) is cast monolithically. Only a truss roof above the second-story attic deck is made from wood.

The homes have a mass adjusted R-value equivalent to 30 and are airtight. Air-to-air exchangers will dehumidify and provide a constant 0.75 air change per hour, compared with the average four to five air changes per hour that leak into the average wood frame home. Pfanmiller feels that these homes will result in up to a 50% energy saving over comparable wood-framed homes.

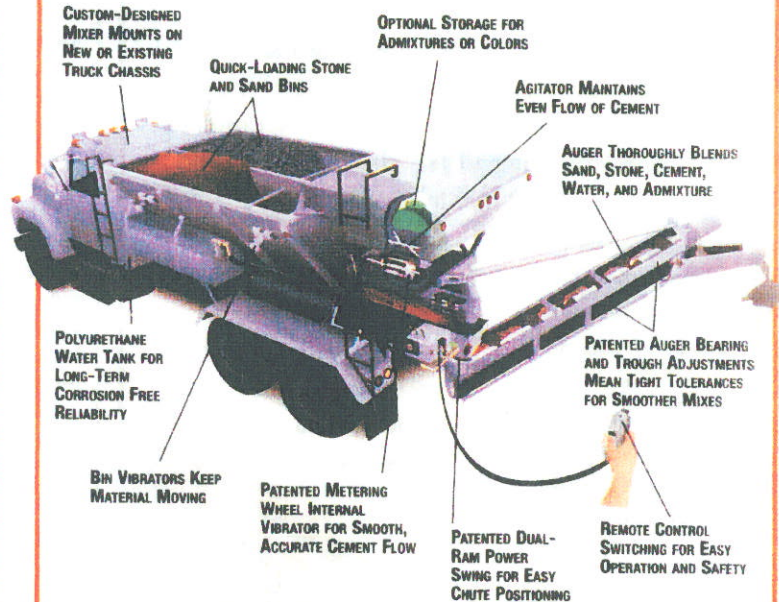
### The most innovative home in America

"This home delivers superior quality any way a homeowner might wish

to define it!" So says Jon Rufty, Rufty Homes, Cary, N.C. He should know. He's on the board of directors of the National Association of Home Builders (NAHB) and also on the board of directors of the Sky Blue Foundation, whose goal is to develop safer, disaster-resistant homes with lower insurance rates.

In his effort to develop guidelines for building higher quality homes, on this and previous projects Rufty has jointly researched and consulted with many organizations, including the NAHB Research Center and the Institute of Business and Housing Safety (IBHS). The IBHS and the insurance industry are currently drafting new construction

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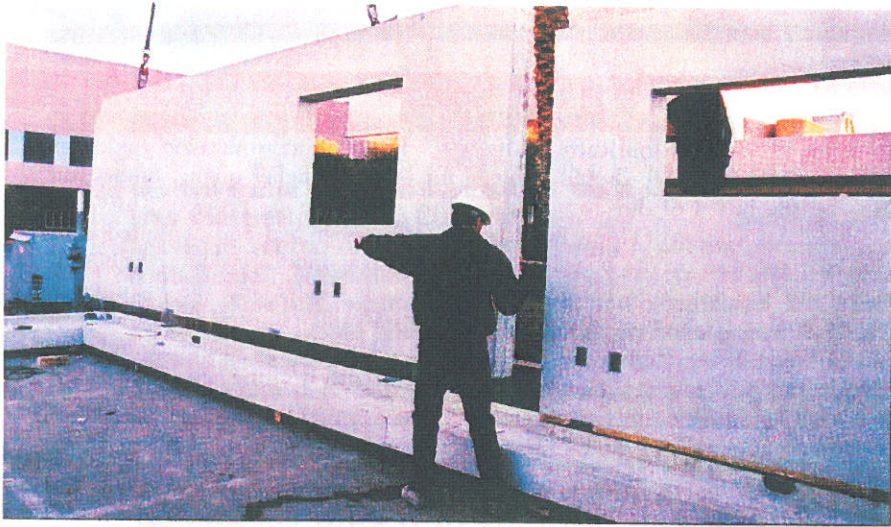
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A worker aligns the precast panels on the footing for PCA's show home in the parking lot at the World of Concrete. The panels were later moved to create a Habitat home.

standards for homes ("Fortified ... for safer living") and Rufty's will be one of the first built under the new standards. (For more information on these standards, go to [www.IBHS.org](http://www.IBHS.org).)

This new house will be 10,000 square feet with a price tag of \$2.5 million. Concrete is being used for all exterior and most interior walls and decks (floors and ceilings), with each level (ceiling and walls) cast monolithically using aluminum removable forms. Structural drop beams are included to increase the size of some rooms. In-floor radiant heat is used for the basement and main level to take advantage of the thermal mass of the concrete. In the lower level, the concrete floors will be decoratively stained, while the main level will use 2x2-foot limestone that flows into the exterior terrace. Isolation joints at the building line will prevent thermal bleed from the outside. Rufty will install ultra-high-efficiency dehumidifiers to filter and regulate both airflow and humidity.

Rufty believes the housing industry is "demand driven"—meaning that what the consumer wants is what the builder must provide. "Concrete allows the quality of a home to be superior in all ways," he says, and he is attempting to educate consumers in this regard.

Construction of this home will take 10 months with scheduled completion in July 2003; it will be open for public viewing for 3 years. Innovation, superior construction, creative design, comfort, quietness, energy conservation, safety, and low maintenance are some of the attributes of this home that

serves as a testament to concrete for residential construction.

#### Lightweight forming system for concrete floors

Lightweight, stay-in-place forms, both for walls and floors, now allow builders to construct concrete homes in virtually any style from ornate traditional to sleek contemporary. Leading residential and light-commercial building contractor Don McMath of McMath Construction Co., Mandeville, La., became a believer in lightweight concrete forms while constructing his own new home on the Gulf of Mexico.

"We weren't really excited about

building with concrete, simply because all of the concrete houses I've seen were mostly square or rectangular," notes McMath. But his architect, Michael Piazza of Mandeville, La., had designed a contemporary residence that contained only six right angles. McMath consulted with Rodney Hubbel of Force 5 Walls, a Madisonville, La.-based builder specializing in insulating concrete forms. "He assured us that with this system we could achieve what we wanted, and I think we've done that," says McMath. His new three-level concrete home with its cantilevered porches and balconies invites both owner and guests to enjoy the spectacular views of the Gulf. "Now I can't imagine doing it any other way, sitting right here on the Gulf of Mexico," says the veteran builder with nearly 30 years in the construction business.

Original plans called for a pan-and-deck roof and floor system. However, due to the exterior balconies, Hubbel suggested using lightweight concrete forms (Insul-Deck) to build the floors. This technique allowed contractors to pour one continuous floor throughout the home rather than a traditional pan-and-deck floor that would have required counterweighting for the cantilevered concrete balcony. Depending on the span length and loads that the floor

Architect Mike Piazza inspects the foam deck forms positioned atop ICF walls for the McMath home. Note the bracing for the cantilevered balconies.



had to support both during construction and in service, the polystyrene foam forms vary in depth from 7 to 12½ inches. The panels form 5-inch-wide concrete joists integral with the floor slab. Positioners are built into the forms for the steel rebar used to reinforce each joist, and a layer of mesh is placed in the deck. Given the harsh Gulf weather, the McMath home also has two transverse concrete beams cut laterally into the lightweight concrete forms to account for additional wind loads.

The engineers providing the foam floor forms individually numbered more than 200 panels to match the architect's drawings. Using this system, two men carried the panels to each of the home's three stories, placed them atop the walls, and trimmed each panel at the proper angle with an ordinary circular saw. Shoring was positioned on longer spans and under the cantilevered sections. Experienced crews can install the lightweight systems in an average of 1 minute per square foot, cutting labor time by 30 to 50 percent.

Even before the McMath home was completed, the concrete proved valuable when the home was hit by two tropical storms and a hurricane. "The house held up through all of the storms," said Mike Napier, an engineer with Insul-Deck.


#### Sustainable panels

Deena Loveland wanted a home on the small side but one that showed some style and imagination, and that incorporated sustainable materials. After some research, and in consultation with architect Brian Brand of Baylis Architects, Bellevue, Wash., she settled on a design with concrete walls built using a formwork system called Rastra. The Rastra panels in her home are free-standing monoliths, connected by lots of glass and steel, and sheltered with structural steel roof joists and steel roofing. The flooring in the single level, 2400-square-foot house that she has dubbed the "House of the Millennium" is stained concrete that extends out on all sides to create continuity between the home's interior and exterior. The interior is mostly one large living area. The only fixed interior walls are for the

bathrooms, with all other walls of easily movable partitions.

Rastra elements are like a cross between lightweight mortarless concrete blocks and insulating concrete formwork. Made from a material called Thastyron (a blend of recycled polystyrene beads and portland cement), standard square Rastra elements each

have an area of 12.5 square feet. For Loveland's home, Rastra panels were prefabricated into various shapes and sizes at the Scottsdale, Ariz., factory. Assembled onsite into walls, including closed end blocks to seal off the cavities, the elements enclose an open grid both horizontally and vertically. During panel assembly, reinforcement



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is placed into the grid, typically #4 bars at 15 inches on center vertically and 30 inches on center horizontally, and the cells are grouted solid with 3000 psi grout, similar to the grout used in a CMU wall. At the Loveland house, the Rastra was then coated with stucco on both the interior and exterior surfaces.

Steel erection, roofing, glazing, and all mechanical work followed. Loveland's home is now complete, including concrete inverted conical tables on the concrete patio overlooking Lake Sammamish near Seattle. There is an adjacent 500-square-foot guesthouse built using similar methods. Loveland's next project is to create a "street of dreams" of five homes constructed using different ICF techniques. Since the site of this development is near a freeway, she feels ICF construction is ideal, due to its noise-reducing properties.

### Habitat home at World of Concrete

Concrete is increasingly the material of choice for many Habitat for Humanity affiliates across the United States. For the International Builders Show and the World of Concrete this spring, the Portland Cement Association orchestrated the construction of a concrete show home using Dow Chemical's T-Mass system. With this precast technology, large panels were poured in a factory setting and transported to the Silver Lot at the Las Vegas Convention Center. The panels have a 2-inch exterior layer and a 4-inch interior layer of concrete with a 2-inch layer of extruded polystyrene insulation in the middle. This results in a material R-value of 11.33.

For the two big construction trade shows, PCA built this home without interior partition walls, but included

stained concrete floors, concrete roof tiles, and fibrous cement siding. A display in the museum-like home explained the most-common concrete wall systems currently being used: removable forms, concrete masonry, insulating concrete forms (ICFs), and precast concrete. Following the thousands of visitors to the home over 3 weeks, the panels were disassembled and the 1237-square-foot home was reconstructed in nearby Henderson, Nev., where it will be sold to a Habitat family. PCA's Team Concrete has brought many high-quality, affordable concrete homes to communities across the United States, including Atlanta, New Orleans, Kansas City, Houston, and Omaha.

More information is available at [www.cement.org/countonconcrete](http://www.cement.org/countonconcrete).

More photos of this home are available at [www.deenaloveland.com](http://www.deenaloveland.com). ■

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