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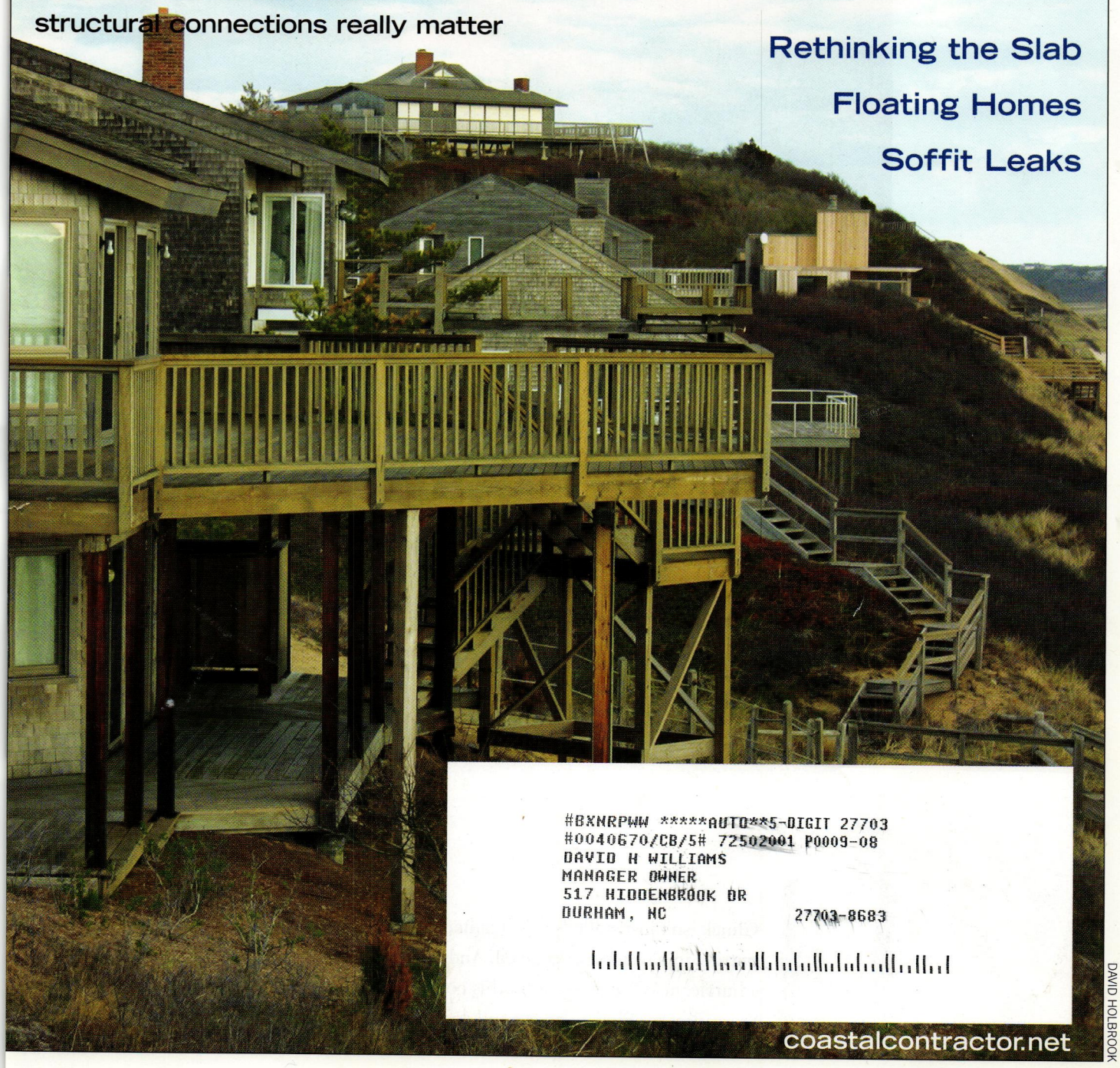
Why material choices and structural connections really matter

Rethinking the Slab

Floating Homes

Soffit Leaks



DAVID HOLBROOK

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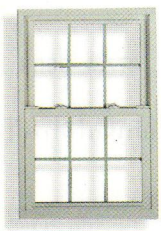
Hurricane Chuck stalled over Hilto



Chuck isn't just stalled, he's steamed. Because the windows he was supposed to be putting in haven't even arrived. And now everybody's schedule looks like it was hit by a hurricane. Of course, all of this could have been avoided had the builder ordered StormBreaker Plus™ windows and doors from Simonton. Nobody can deliver your order

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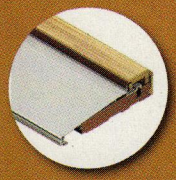

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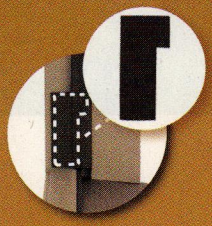

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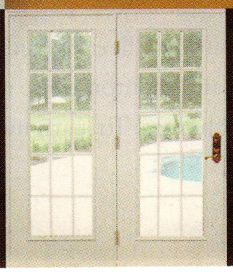

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~Table of Contents

March/April 2008

Features

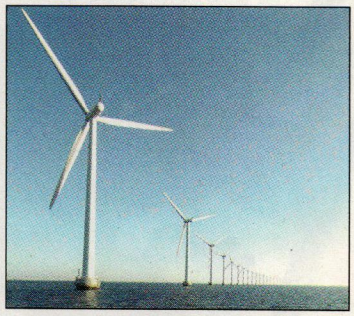
Coastal Resources: Safe and Durable Coastal Decks

A casual inspection of just about any wooden boardwalk or ocean-side deck provides ample evidence of what a harsh coastal environment can do. Fortunately, there is help at hand to guide builders toward code-conforming deck design and good construction practice. *Design for Code Acceptance 6: Prescriptive Residential Deck Construction Guide*, or the DCA6, is a 20-page document branded by the AF&PA, the International Code Council, and Fairfax County, Va. Frank Woeste highlights sections of the DCA6 that may be of special interest to the coastal deck contractor. — *page 24*

p. 40

High and Dry

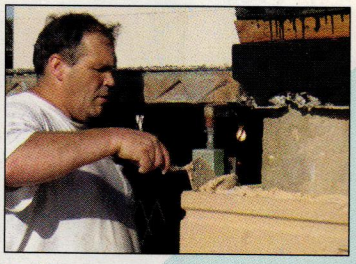
In the flood-prone Gulf region, an elevated home is a no-brainer. The classic poured-concrete slab-on-grade — a simple monolithic pour with nothing more than a thickened edge at the perimeter — is not enough where floodwaters from a storm surge or rising water levels pose a threat. Using a raised perimeter stem wall can elevate the slab above flood levels. In colder coastal climates, where the risk of flood is not as great as the risk of frost heave, stem walls that extend below frost depth protect the slab. As Ted Cushman explains, in either case, the construction is similar. — *page 34*



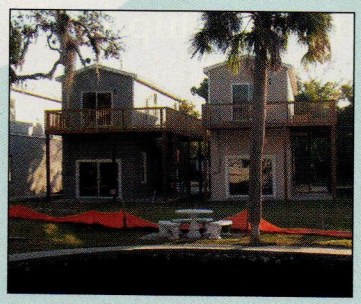
p. 9

Floating Out the Storm

The devastation and aftermath of Hurricane Katrina set Bill and Bryan Spatz in motion rethinking what type of foundation makes sense in flood-prone areas. The Noah's Ark Project is a steel-framed modular home built on a barge. The home looks like a typical 2,700-square-foot home with an asking price of about $525,000, belying the fact of its unique design. For residential builders, it's a study in what a coastal home can become in the hands of a commercial developer, and for the industry as a whole, it's a concept that pushes the boundaries of how to build to protect against hurricane damage. — *page 40*



p. 15



p. 56

Departments

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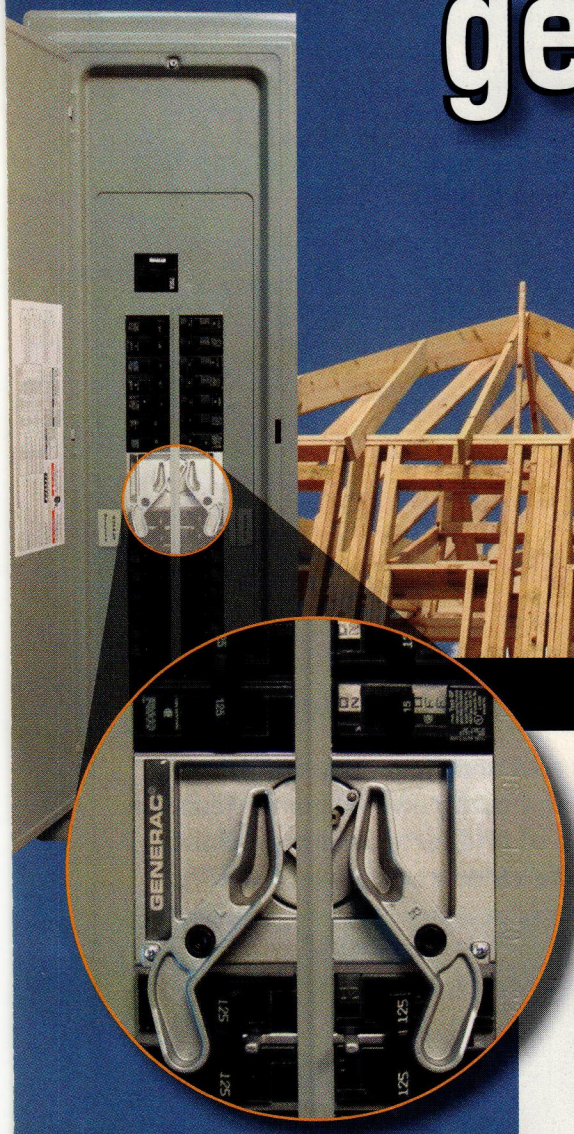

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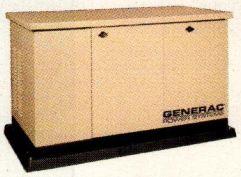

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Recalculating the Cost of Stainless Steel Hardware

Ted Cushman is right on when he notes that the corrosion of metal hardware in contact with treated wood can be worse in the field than what lab results show ("Fasteners for Treated Wood," *Soundings*, January/February 2008). Within months of building my first coastal deck after CCA was phased out, there was red rust on the G-185 hangers and hot-dipped nails and bolts I used. That's when I began using isolation membranes.

While Grace does make a butyl-based peel-and-stick, Vycor Deck Protector is an asphalt-based material, not butyl-based, as we reported in the last issue.

I've used Grace Vycor Deck Protector and other similar peel-and-stick membranes as isolation membranes, and all are asphalt-based (not butyl as noted in the article).

The working temperature range for asphaltic membranes is pretty good but not as wide as butyl adhesives used in window flashing tapes. I find membrane adhesion is weak below 40°F, especially on damp treated lumber. Still, even with isolation membranes, G-185 galvanized hardware, and other proprietary coatings, I'm becoming more of a fan of stainless steel hardware for exterior connections in coastal areas regardless of how aggressive or inert the lumber treatments are. Galvanized coatings — no matter how thick — are still going to give way to the steel beneath. It's only a matter of time before rust sets in, be it two years, five years, or 20 years.

Stainless steel hardware is not very costly when you look at other expenses on a job. And I've found that the labor cost saved by not applying isolation membranes and trimming off the excess when "upgrading" to stainless almost covers the extra cost.

Mike Guertin
East Greenwich, R.I.

A Summit of Ideas

Please join our editors to explore how we can make coastal construction safer and more lucrative for everyone involved. Coastal builders, remodelers, architects, and code officials will all benefit from joining forces around sound building science and engineering practice. The first-annual **Coastal Contractor Summit** will be held May 12–14, 2008, in Ft. Lauderdale, Florida. For more information, visit www.coastalsummit.com.

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A Charge in the Air

Alternative energy plans trigger heated debates

When South Texas fishing guide Walt Kittelberger founded the Lower Laguna Madre Foundation in the 1990s, it was to fight would-be developers on South Padre Island. Then he and his group took on the U.S. Army Corps of Engineers over dredging.

Now, Kittelberger and his fellow advocates have a new foe: two wind-power farms that Kittelberger says could forever alter the shores of Laguna Madre, a shallow lagoon along 100 miles of South Texas coast known for its fishing and birding. "It would change a pristine rural environment into an industrial zone," he predicts.

COASTAL ALTERNATIVES

Coastal residents from California to Florida are accustomed to oil drillers seeking purchase off their shores. Thanks to rising energy prices and the new emphasis on domestic energy independence, residents now face an expanding list of other energy producers eyeing beaches or local waters. Wind-farm companies may be the best known, thanks to the pitched battle over the 130-turbine Cape Wind in Nantucket Sound. But other coastal energy projects in the offing include huge liquefied natural gas terminals, intended to process natural gas imported on international cargo ships, and wave energy farms, which use turbines to harvest energy from waves and currents.

Some, especially in longtime energy states such as Texas and Louisiana, welcome the new producers as sources of jobs and revenues. But others oppose local coastal energy projects on environmental, aesthetic, or safety grounds.

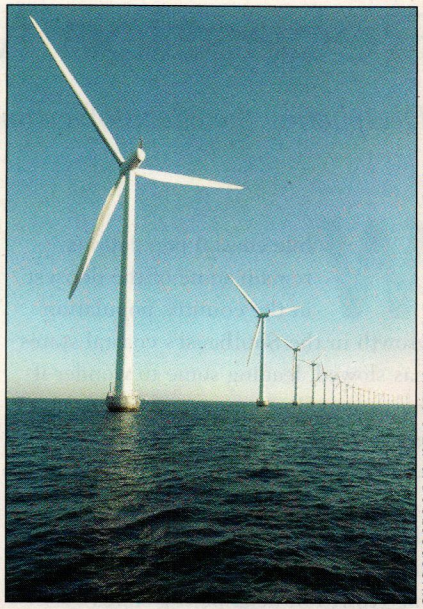
With members on both sides, the American Shore & Beach Preservation Association, a national coastal protection group, has not endorsed or opposed any one energy project or industry. But coastal energy production "is becoming more and more of an issue for us," says Harry Simmons, president.

Babcock & Brown and PPM Energy are pursuing two wind farms in South Texas' sparsely populated Kennedy County that together would contain hundreds of 400-foot tall wind turbines. With the best energy-producing winds in the country's interior, the project would be one of only a handful of land-based coastal farms nationwide, says Laurie Jodziewicz, a policy manager with the American Wind Energy Association. But several large offshore wind farms have been proposed, including Cape Wind in Massachusetts, and at least one each off the New York and Delaware coasts.

ENERGY DEMANDS

The population density on the coast is a double-edged sword for wind-energy producers: while it may mean opposition from local residents, the higher population increases the demand for electricity, says Jodziewicz. "People are located near the coast, so you don't have to move the power as far," she says. "Bigger transmission lines can be more expensive."

Wind-farm opponents have labeled them "avian Cuisinarts," saying local and migrating birds strike and are killed by their rotating turbines. For offshore farms, concerns range from marred beachfront views to encroachments on fishing grounds. For onshore ones, opponents complain that road building carves up rural lands. That and the threat to birds migrating north across the Gulf are both concerns for Kittelberger, who has joined other advocates in filing two lawsuits over the Texas farms. "For us the single biggest thing is the enormity of their footprint," he says.



SANDIA NATIONAL LABORATORIES © EC/ G. BOULOUGOURIS

Industrial wasteland? Critics contend that wind farms, like this one off the coast of Denmark, are environmental disasters. Advocates consider them a beautiful site compared with the ravages induced by climate change.

Jodziewicz responds that high bird fatalities seen with the earliest wind farms have fallen off in newer, better-placed ones. And the companies plan to take measures to limit the danger to migrating birds, she says. As for onshore development, the turbines typically require only small gravel roads and may even increase shoreline access for recreational fishers, she notes.

Similar debates are only becoming more common on the coast, and not just over wind farms. Dozens of liquefied natural gas terminals have been proposed along the Gulf and East Coast, and fishermen have already raised concerns about large-scale wave energy farms. "What I've learned," says Kittelberger, "is to not underestimate them. They are coming." — *Aaron Hoover*

Recession Means Decline

Deciphering the effects of a slump

While coastal populations remain some of the densest in the country, population growth in the Southeast's coastal states has slowed, leading some to wonder if hurricanes, insurance, and higher taxes are reversing Americans' decades-old affection for warm Atlantic shores.

But demographers say the housing downturn is probably the leading cause of slumping growth in Florida and slowing growth in neighboring states reported by the Census Bureau in its most recent estimate of annual state population changes.

"I attribute at least some of it to the

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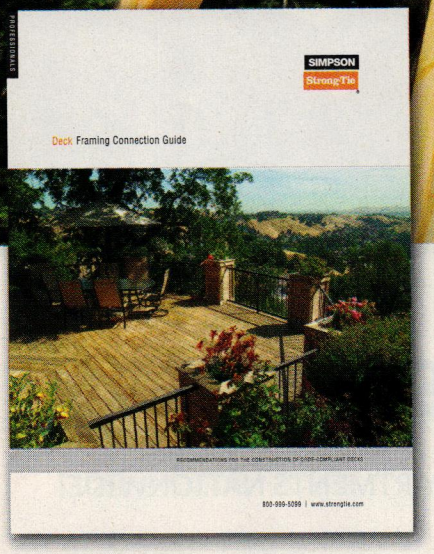

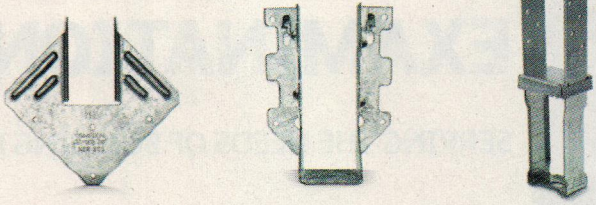

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Circle #22

housing market slump and the difficulty of getting credit for people who want to move to a new place," says William Frey, a demographer at the Brookings Institution.

The Census numbers show Florida's population grew 1.07% between July of 2006 and 2007, down from 1.81% during the same period the previous year — the biggest drop since at least 2000. Georgia's population growth rate slowed from 2.57% to 2.16%, while the rate stabilized in North and South Carolina after speeding dramatically in 2005. On the Gulf Coast, growth slowed in Texas and Alabama and went from negative to positive in Louisiana and Mississippi, but the latter numbers reflected people returning to the states after losses following Hurricane Katrina.

Florida's population grew by 193,735 residents from July of 2006 through last July. Still, that was way down from 321,481 the year before — spurring a spate of news and editorials contending that Florida is losing its luster.

But Stan Smith, director of the University of Florida's Bureau of Business and Economic Research, says that while fears of hurricanes, Florida's spiraling insurance rates, and property tax burdens could be partly to blame, the housing slowdown is probably the leading cause. "In previous times, during recessions, the migration to Florida slowed considerably," Smith says.

Demographers elsewhere in the Southeast also ranked housing as important.

Bill Tillman, North Carolina's state demographer, says the state had not experienced the same housing boom as Florida and as a result was not seeing as pronounced a slowdown in population growth. To the contrary, unlike in Florida and elsewhere, applications for building permits in North Carolina went up in 2007.

Judy Hadley, a demographer with Georgia's Governor's Office of Planning and Budget, ties the Peach State's slowing growth to the "current housing issues."

But she adds the Census Bureau had also changed its methodology this year, reducing estimated growth numbers across the board. She says Georgia's six coastal counties continue a long-standing growth trend.

Most demographers are optimistic about their states' outlooks, though Hadley notes that Georgia needs to find solutions to a current water crisis if it expects to continue growing — something increasingly true in neighboring states as well. Frey emphasizes the Southeast will remain attractive because of its warm weather, comparatively inexpensive, newly built homes, and friendliness to industry. — *A.H.*

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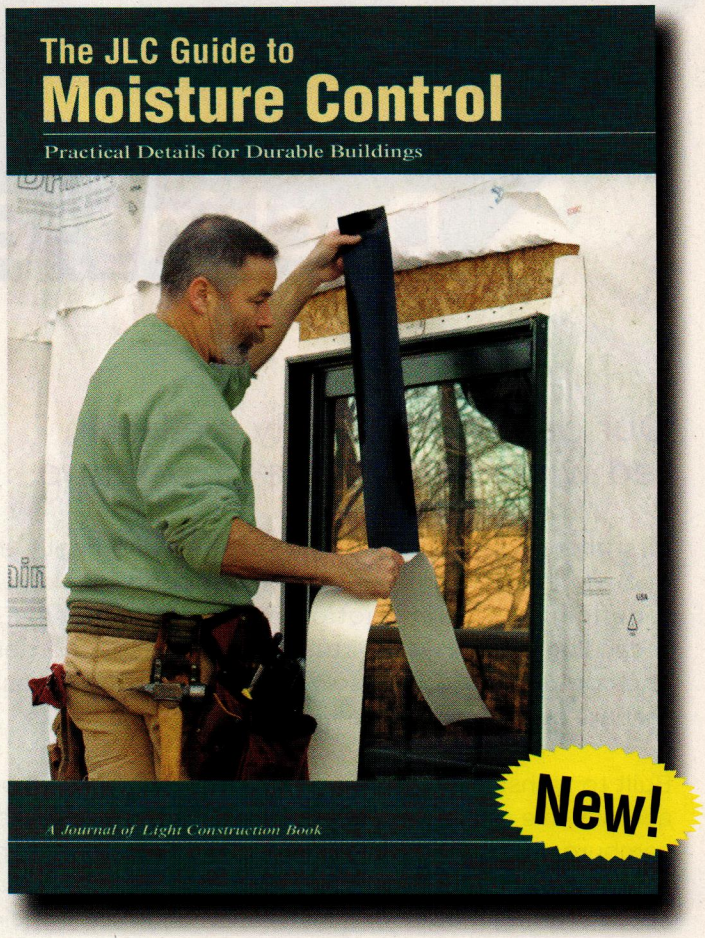

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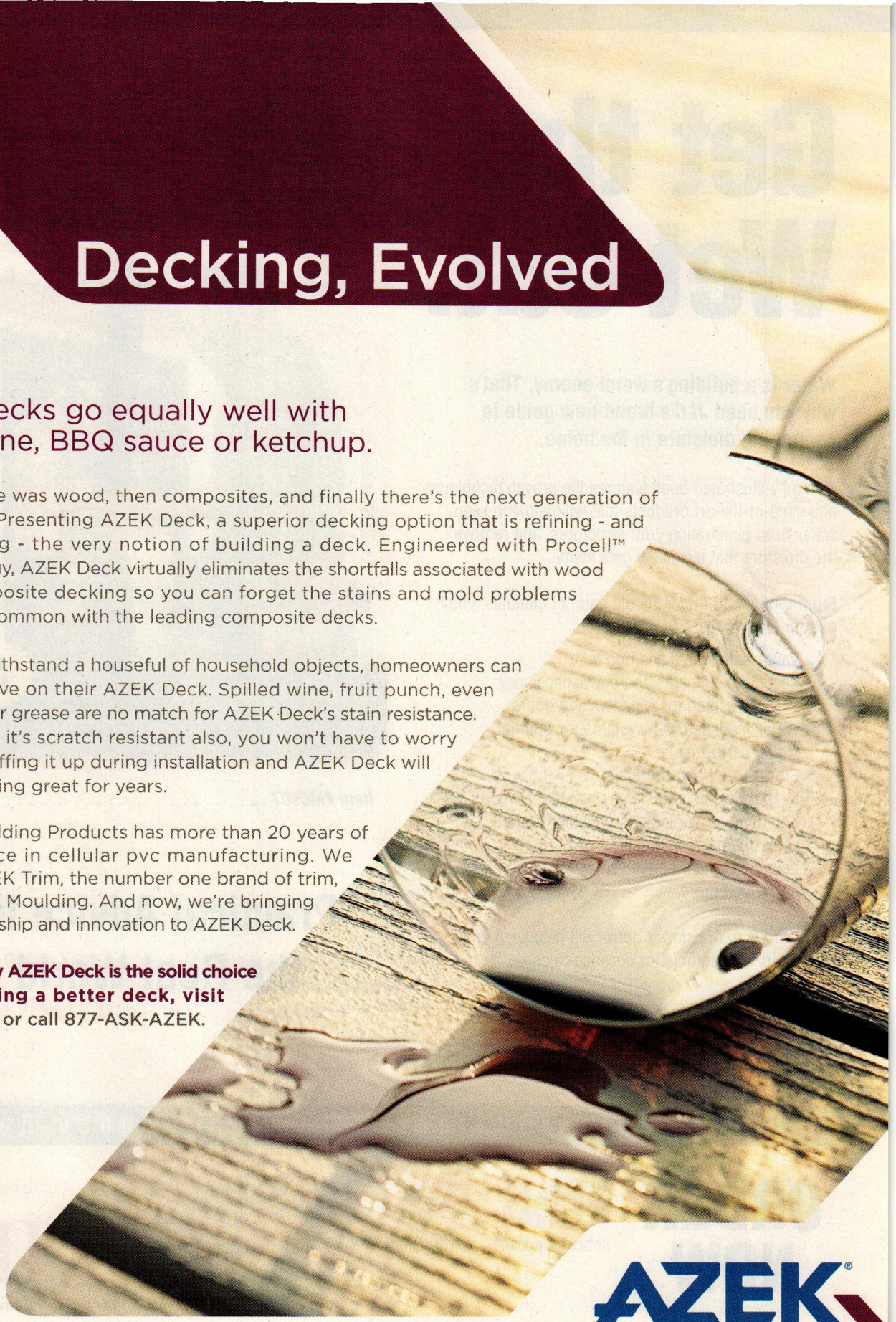

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Fixing Wright's Wrongs

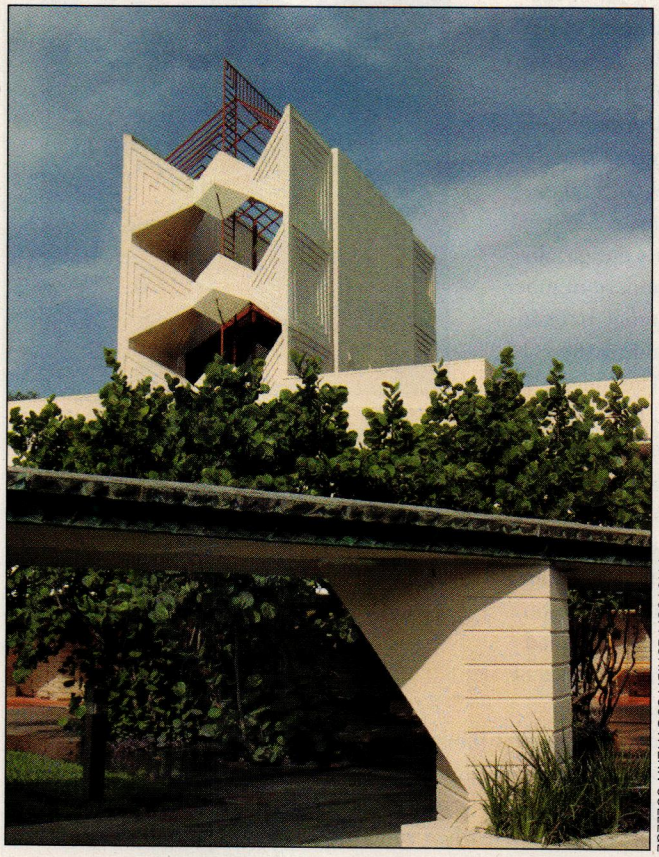
A master mason takes the architect to school

by Aaron Hoover

Few masons would call concrete block walls art, and Ken Uracius is no exception. But Uracius, who specializes in historic masonry preservation, feels the word squares up nicely with the main structural elements of the buildings in his latest project: a little-known Florida college campus designed by Frank Lloyd Wright.

"Usually when you get into block work, it's just unitary, nothing fancy," says Uracius, of Holden, Mass., who travels the nation restoring old masonry buildings. "This block work is actually making a statement." (See "The Remaking of Wright's Blocks," page 16.)

But as sometimes happens with art, Wright's unique system of grooved block and rebar composing a dozen buildings at Florida Southern College in Lakeland, Fla., has proved more aesthetic than practical. A half-century after they were finished, the nation's largest single collection of Wright-designed buildings is crumbling.



PHOTOS: FLORIDA SOUTHERN COLLEGE

Lesson for architects: A stellar design, such as Frank Lloyd Wright's for a series of buildings at Florida Southern College, must still contend with practical reality. In this case, the harsh Florida climate has taken a toll out of the elaborate masonry, requiring the down-to-earth attentions of mason Ken Uracius.

BUILDING A LEGACY

Wright is known for his low-slung Prairie-style homes in the Midwest. But when then Florida Southern President Ludd Spivey sent Wright a telegram in 1938 seeking a meeting about "plans for a great education temple in Florida," Wright didn't hesitate.

"I think he was excited about leaving a legacy for himself in terms of a fairly large composition of buildings," says Jeff Baker, an Albany, N.Y.–based architect in charge of the Florida Southern restoration. "But I think he was also attracted by the opportunity to leave his mark on future generations."

Spivey's telegram to Wright led to 12 signature structures completed between 1941 and 1958. Perhaps the most spectacular is the Water Dome, a circular pool ringed with jets that create a dome of water. The dome never functioned as Wright intended — until October, when it became the first major project completed in the estimated $50 million restoration. The chapel, with its elaborate iron tower and covered walkways, which Wright called Esplanades, is among the other items getting attention.

MATERIAL MATTERS

Wright liked to use indigenous materials — a concept that is making its way back into the industry via the green building movement — and he tapped coquina from the site in some of the first buildings, Baker says. But he relied far more on another Florida resource: sand. Trucked south from St. Augustine, the sand was the prime ingredient in the three-and-a-half-inch "textile blocks" used to face all the buildings. Workers built the blocks on site with a concrete mixture and wooden molds.

The design was unique, and as it turns out, uniquely flawed. Each block has smooth faces and sides, but is indented with beveled squares or half-round circles at the edges where a block

The Remaking of Wright's Blocks

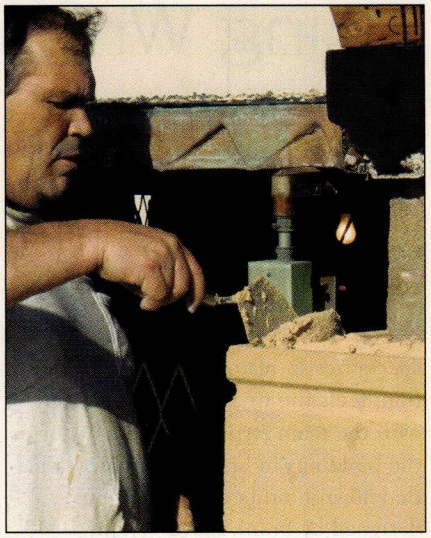
In accordance with Wright's belief that each structure should be composed of inexpensive local materials that grow out of the ground, the blocks used in the 12 buildings at Florida Southern College were formed from coquina and sand — both from Florida — and cement. Their dimensions, 3 feet by 9 inches, were, like all the measurements in Wright's campus design, divisors of 18, the standard number of feet between orange trees in the groves surrounding the college at the time. The indents in their surfaces and the colored glass inserts in some of the buildings blocks call to mind origami folds and textile patterns, alternating light and shadow in motifs that carry throughout the collection.

Using a pneumatic ram, Haley Mills tamps the coquina, sand, and cement mixture into Wright's original molds. A key to the performance of the blocks is a graded aggregate — a range of sand particles that allows for denser packing, ultimately leading to a more impervious block.

According to master mason Ken Uracius, the blocks failed because the material science of the day hadn't caught up to Wright's design criteria. The first flaw was in the recipe itself. Wright used a sand mix that was evenly graded, allowing for bigger air pockets and greater vapor permeability. We learned 50 years later the importance of sand gradation, said Uracius, explaining that when sand includes more grain sizes, smaller grains fill in the interstices between larger ones. The new mix includes a wide range of sizes and a higher percentage of cement.

More detrimental was the use of iron rebar. Because the architect wanted no visual separations between his blocks, he embedded iron rods in the walls to hold the wall together in lieu of mortar. An ineffective grouting technique contributed to the problem: where there was no grout, water collected in the grooves, corroding the reinforcing. Wright had no way of knowing that iron would rust like that, said Uracius. It was supposed to last forever.

Uracius said that the biggest challenge was that without mortar joints, builders lose a key method for keeping walls even: adjusting the amount of mortar between blocks. It's hard to cover up errors when you're running block to block, says Uracius. With no mortar, any variations in block size must be adjusted in the blocks themselves. Because Wright's design calls for several different molds for each wall, variations are common and a challenge that adds days to the job of building a wall. Uracius is still experimenting to find the best technique for assembling the blocks. — *Cathleen Drake Nelson*



Master mason Ken Uracius grouts blocks on a test wall of a campus pumphouse, taking care to pack the grout evenly to avoid pockets where water can collect.

butts against its neighbor. Rather than mortar the blocks atop each other in the long tradition of masonry, Wright stacked them with no mortar at all, relying instead on a gridwork of horizontal and vertical grooves to accept rebar, and filling the cavities around the rebar with grout.

That seemed to work fine, but not for long, Uracius says. The wet grout typically failed to flow down the grooves between courses or the narrow cores within the blocks, resulting in pockets where the rebar remained exposed. As time passed, water found its way in, sometimes by soaking directly through the porous block. As the rebar rusted, it expanded. Because the grooves were so narrow, this was enough to dislodge the grout and crack the block, exploding the walls from within.

Some fared better than others, but restoring all 12 buildings will require thousands and thousands of new blocks, Uracius said. After eight months tinkering with a large experimental wall (the pump room of the Water Dome, which

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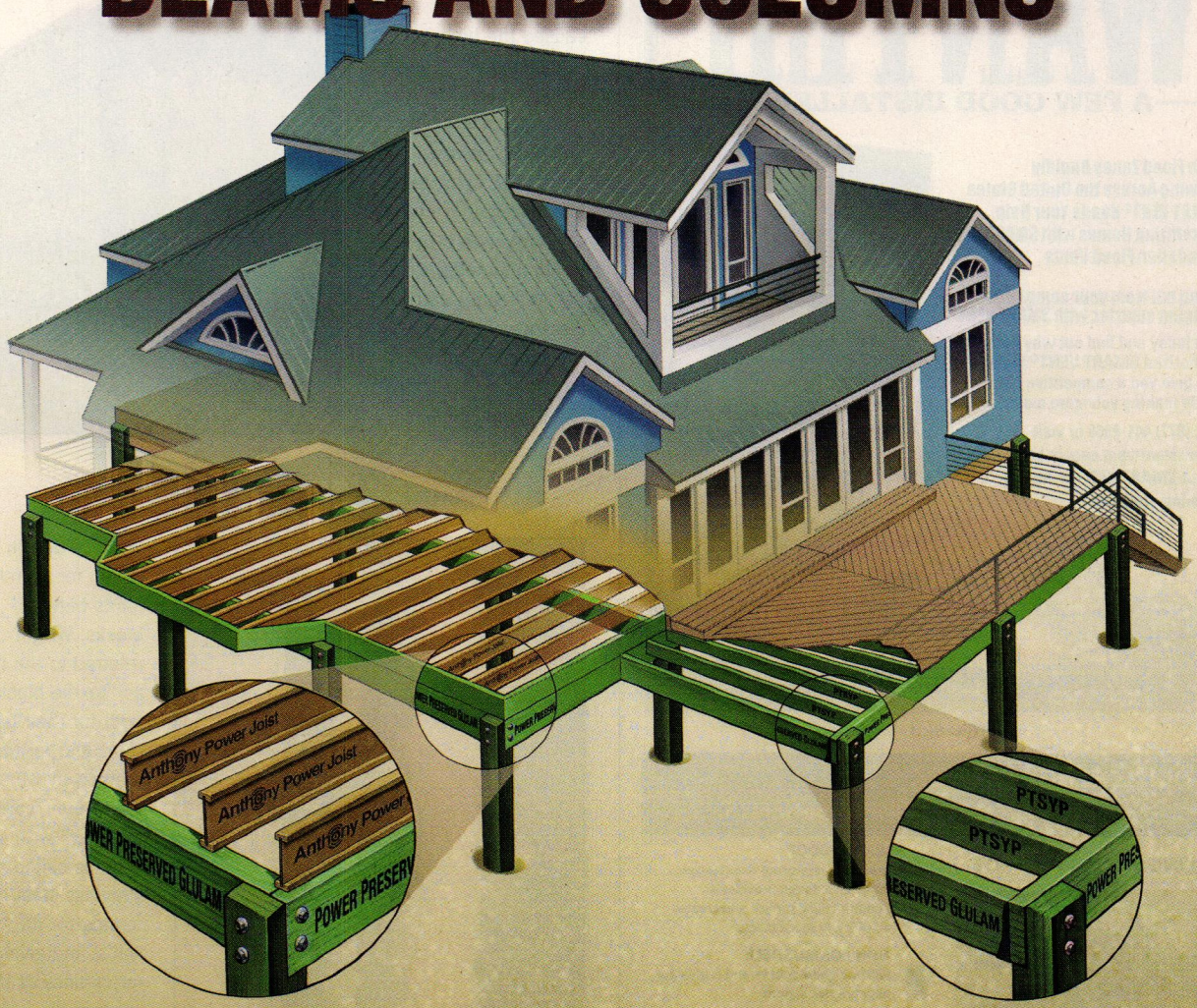

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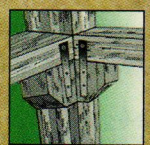
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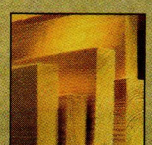
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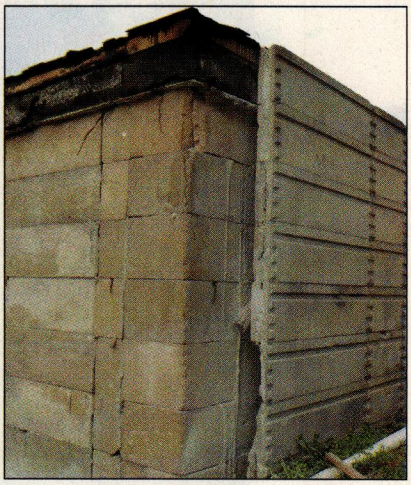
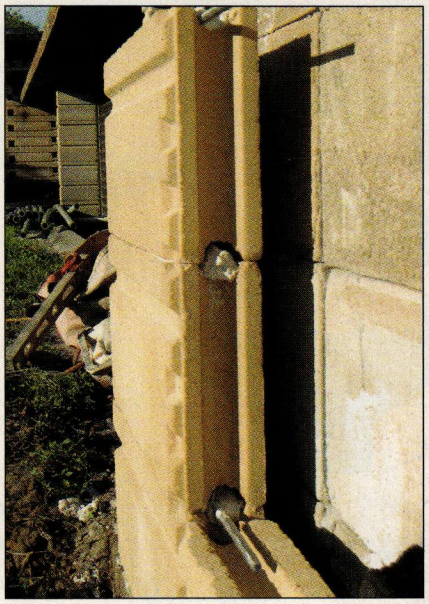


Water intrusion into the porous block caused the high-iron steel rebar specced by Wright to corrode, and the expansion of the iron in the narrow cores blew apart the block over time. In his day, steel was a new, wondrous material that was supposed to last forever, but material science had yet to catch up to the architect's innovations.



Wright's design called for seamless joints between blocks. Wright referred to the bricks as "textile blocks" both for their textures and for the method by which they were "woven together" with steel. Uracius called for stainless steel reinforcing for the new walls, and given the importance of the rebar in the wall's design, this is hardly an extravagance.

has served as the mason's de facto laboratory), Uracius thinks he can stick to Wright's design, partly by building the blocks with more consistent and better materials. For the walls, he thinks he can use stainless steel rebar and a layer of silicon between each block. The seal the silicon creates, he says, will allow him to fill the grooves with mortar under pressure.

Uracius said that when he first arrived in Florida, he thought Wright was insane. "But they sort of grow on you, these buildings," he said. "Now I'm kind of interested in seeing what I can do."

Aaron Hoover of Gainesville, Fla., is a frequent contributor to Coastal Contractor.

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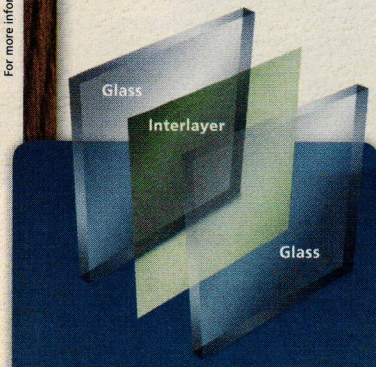

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Understanding Water Intrusion

The power of wind-driven rain may be more insidious than you think

Rain falls from the sky. That's no news flash, but it's curious how conditioned we have become to expect that ... and only that. Coming from above, we expect rainwater to flow downhill, and we detail the exterior accordingly: we lap roofing, housewrap, flashings, and siding with the bottom layers under the top, so the surfaces that will be presented to the weather shed water down and away from the structure. Reverse lapping (installing the bottom course over the top course) is a sin; that catches water. Everybody knows that.

We are much less prepared to think about how water gets driven uphill and pushed with enormous pressure through the smallest cracks and crevices in the facade. In particular, we don't tend to think much about those exterior surfaces that face the ground, such as soffits and the underside of cantilevered floors. Yet wind pressure makes these surfaces as vulnerable as any others.

Research at the University of Florida using a "wind machine" — a monstrous propeller fan capable of moving air and water at hurricane-force speeds (for a description of this apparatus, see "Blown Apart," *Backdoor*, September/October 2006; www.coastalcontractor.net) — has demonstrated just how insidiously high winds can drive water into a building. Richard Reynolds, a builder based in Bradenton, Fla., who participated in the research, shared his observations of water intrusion through soffits during simulations blowing near-100-mph air and water. It's worth spending a moment to visualize the phenomenon Reynolds describes and rethink any conventional ideas we might hold about water intrusion through soffits. It's far more powerful than you might imagine.

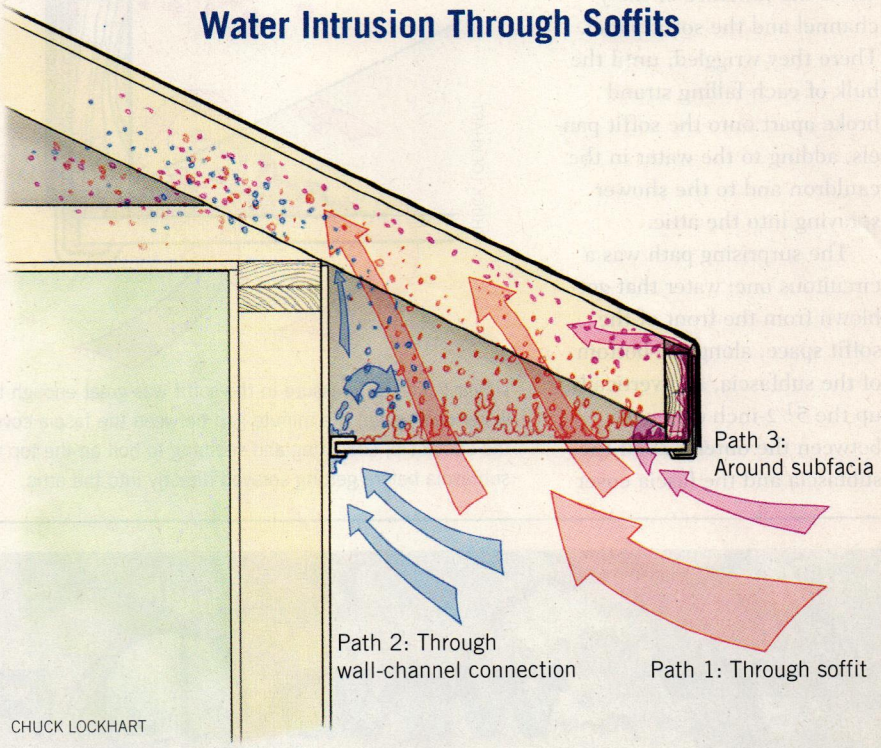

FIGURE 1. Observations of wind-driven water blown at speeds around 100 mph revealed three principal paths for water blowing into the attic. The observer said the air and water appeared like a "cauldron of boiling water," out of which the spray of water droplets saturated attic and ceiling surfaces in a matter of minutes. For the test, the roof and fascia were wrapped with a peel-and-stick roofing membrane to isolate the intrusion points to the soffit area.

Richard Reynolds explains: Three principal paths of water flow were observed (**Figure 1**). The largest path was, as one might expect, water entering through the flat soffit panels. From one angle of view, the water immediately above the soffit had the appearance of a cauldron of boiling water, with a somewhat pervious pool of water immediately above the panels consisting of boiling spirals (dynamic stalagmites) of water extending upward an inch or so. Some of those spirals were breaking into drops that were either so large they fell back down or they became airborne, turning into a shower of droplets that blew into the attic.

Another path was made evident by high-speed digital photography (1,000 frames per second). This showed up as water that initially hit the wall just below the soffit panel, then got forced into the space above the soffit by getting blown between the J-channel

against the wall and the ends of the soffit panels. These thick, stringlike formations of water, on the order of an inch long and perhaps a quarter-inch in diameter, appeared to float relatively slowly in the air just above the juncture of the J-channel and the soffit panel. There they wriggled, until the bulk of each falling strand broke apart onto the soffit panels, adding to the water in the cauldron and to the shower spraying into the attic.

The surprising path was a circuitous one: water that got blown from the front of the soffit space, along the bottom of the subfascia, and vertically up the 5 1/2-inch distance between the outer face of the subfascia and the fascia cover (**Figure 2**). The air blowing through this circuitous path was at a low enough wind speed to allow water to collect on the top edge of the subfascia. However, the air blowing along that path blew through the collected water, producing water droplets and giving the appearance of boiling water here as well. These droplets tended to disperse into the attic, because they were introduced into the air stream at a higher elevation.

All three paths produced water droplets that entered the air stream flowing into the attic. The total accumulation of water that got deposited in the attic was enough to saturate ceiling drywall in just a few minutes.

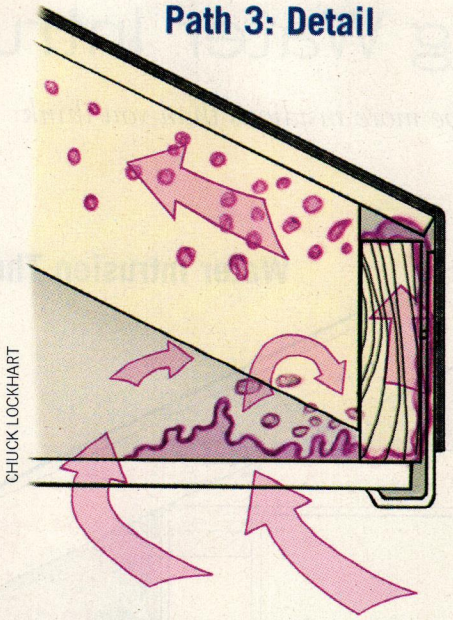

FIGURE 2. The air pressure in the soffit was great enough to force water up through the minute gap between the fascia cover and the subfascia, collecting and seeming to boil on the top of the subfascia before getting sprayed directly into the attic.

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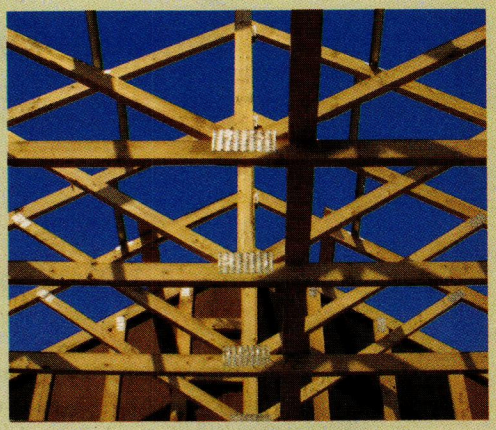

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Circle #19

Safe and Durable Coastal Decks

All deck builders should refer to the DCA6 — prescriptive guidelines for residential deck construction — and coastal builders should pay extra-close attention to the material choices and structural connections outlined in its pages

by Frank Woeste

A casual inspection of just about any wooden boardwalk or ocean-side deck will provide ample evidence of what a harsh coastal environment can do. Heat, ultraviolet light, elevated moisture levels, and salt spray all take a toll. The apparent degradation of materials evidenced by splintering, splitting, and rusting call attention to one of the coastal contractors' highest priorities: designing and building safe and durable decks. Fortunately, there is help at hand to guide deck builders toward code-conforming deck design and good construction practice.

THE DCA6

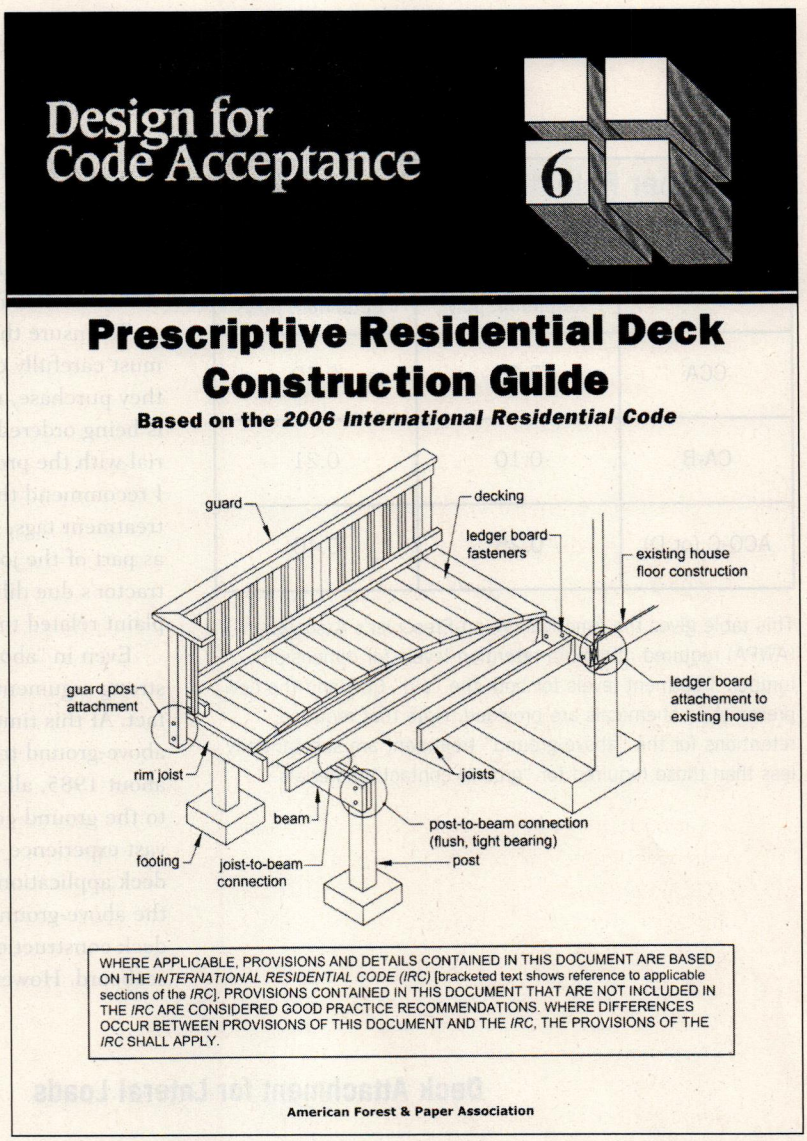
The reference document for safe residential construction is the International Residential Code (IRC), which has been adopted with some modifications by most states and jurisdictions. While the 2006 IRC provides comprehensive prescriptive design guidance on the foundation and structural framing of the residence from the walls inward, the available guidance on the design of an attached deck, until recently, has been very limited. In recognition of this deficit of information, the American Forest & Paper Association (AF&PA) developed and published *Design for Code Acceptance 6* (DCA6): *Prescriptive Residential Deck Construction Guide*, which is available on the Web at www.awc.org/Publications/DCA/DCA6/DCA6.pdf. The document is 20 pages and is branded by the AF&PA, the International Code Council, and Fairfax County, Va. The reader's attention is directed to the bottom of page 1, where the basis of the document is stated—IRC sections are bracketed when they form the basis of a section, while other sections are considered "good practice recommendations."

While every section of DCA6 is important to deck safety, the purpose of this article is to give background on sections of the DCA6 that may be of special interest to the coastal deck contractor. All discussion is referenced to bracketed page numbers and sections of the DCA document.

MINIMUM REQUIREMENTS: DECAY ISSUES FOR LUMBER COMPONENTS

Building a safe deck starts with selecting appropriate materials. The DCA6 [item 2, page 2] provides builders with two options for real wood decking: naturally durable species, such as redwood or western cedars, or pressure-treated lumber. Both deserve care-

Essential reference. *The Design for Code Acceptance 6: Prescriptive Residential Deck Construction Guide*, provides practical guidance for designing and building safe, durable decks. Download and print the document at www.awc.org/Publications/DCA/DCA6/DCA6.pdf.



ful study by the deck contractor who is focused on durability.

Naturally durable species. While such woods as redwood and cedar are widely considered to be naturally durable species, only the "heartwood" of redwood, cedars, black locust, and black walnut is actually considered decay resistant by the IRC. The sapwood, the outside part of a log, does not qualify. According to the USDA *Wood Handbook* (1999), "Untreated sapwood of substantially all species has low resistance to decay and usually has a short service life under decay-producing conditions." Only the *average heartwood* of species is rated in Table 3-10 of the *Wood Handbook*. Corner sapwood is permitted if 90% or more of the width of each side on which it occurs is heartwood.

Given these restrictions, it is unlikely that the typical decking lumber available will consistently meet the IRC's definition of "naturally durable wood." To ensure deck durability, the deck contractor should consider special-ordering "all heartwood" in conformance with model code definition of naturally durable wood.

Pressure-treated lumber. Pressure-treated lumber works well for both the substructure and the decking. However, contractors should pay close attention to the retention level used for lumber on all parts of the deck.

Deck disaster? This is not an atypical condition of the materials and connections for decks built near the ocean. Heat, ultraviolet light, elevated moisture levels, and salt spray exact a stiff toll on wood decks in relatively short periods. A condition like this should raise safety concerns for both the deck builder and the general contractor.

PT Lumber Retention Levels		
Preservative	Above Ground (Minimum Retention, pcf)	Ground Contact (Minimum Retention, pcf)
CCA	0.25	0.40
CA-B	0.10	0.21
ACQ-C (or D)	0.25	0.40

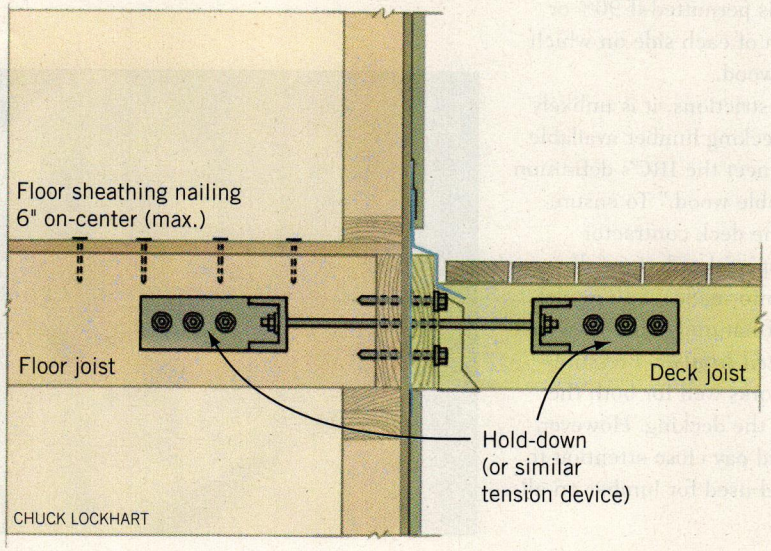
This table gives the American Wood-Preserver's Association (AWPA) required minimum retention levels for dimension lumber. Treatment levels for both the "old" CCA and the new preservative chemicals are provided. Note that required retentions for the "above ground" treatment are substantially less than those required for "ground contact" materials.

Citing the IRC, the DCA6 is clear: "All lumber in contact with the ground shall be rated as 'ground-contact.' " The difference in retention levels between "ground contact" material and "above ground" material is significant, as shown in the table at right.

To ensure the right treatment level, deck contractors must carefully examine the treatment tags on the lumber they purchase, making sure that "ground contact" material is being ordered and delivered when required. Once material with the proper retention level is purchased for the job, I recommend that contractors keep a sample of the lumber treatment tags, along with a copy of the PT lumber invoice, as part of the job file. This will help to substantiate the contractor's due diligence should a construction defect complaint related to the deck ever arise.

Even in "above ground" applications, however, there is a strong argument for using materials suited for ground contact. At this time, the adequacy of the new PT chemicals at above-ground treatment levels is largely unknown. Since about 1985, all the PT lumber in our area was CCA-treated to the ground-contact level. As such, deck contractors have vast experience using the ground-contact southern pine in deck applications. After the transition to the new chemicals, the above-ground material came to be readily available for deck construction in the Virginia area and along the eastern seaboard. However, the durability of the new preservatives

Deck Attachment for Lateral Loads



The lateral load connection required by section R502.2.2 of the 2007 IRC requires hold-down tension devices like those shown here. This type of connector is required in at least two locations per deck, and each device must be designed for an allowable stress capacity of at least 1,500 pounds.

and lower treatment levels in deck applications is unknown at this time. Faced with uncertainty on this subject, I would strongly recommend that contractors consider returning to the practice of using "ground contact" lumber for all above-ground deck parts.

Solid-sawn deck posts (timbers) embedded in the ground may even require a preservative treatment level that is above the "ground contact" treatment level typically used for 2-inch dimension lumber. (For additional information on the recommended treatment for timbers in the ground, please visit www.southernpine.com/pdf/tpsp_table4.pdf and refer to category "Lumber/Timbers," subcategory "Ground Contact or Fresh Water." Structural deck posts covered here are in the realm of "Critical Structural Components.") Also keep in mind that regardless of the PT wood materials selected, decks should be inspected annually for evidence of decay and unsafe conditions.

Corrosion protection of metal parts. Item 4 of the Minimum Requirements in the DCA6 covers the corrosion resistance of fasteners and metal hardware. Coastal contractors should skip right to the fourth bullet point, which trumps the previous three bullets wherever the job site is located near the ocean:

- Fasteners and connectors exposed to, and located within 300 feet of, a saltwater shoreline shall be stainless steel grade 304 or 316.

"Fasteners" include all nails, screws, lag screws, and bolts. "Connectors" are typically joist hangers and other framing hardware that is fabricated from rolled steel. In the interest of deck safety and increased durability, the provision should be considered by the contractor and owner for decks greater than 300 feet from a saltwater shoreline.

Assumed design loads. DCA6 is based on an assumed live load of 40 psf and the 10 psf dead load.

The 40 psf live load (LL) anticipates occupants *only* with typical deck furniture such as lightweight tables and chairs. It does not anticipate heavy loads such as large planters, portable pools, the water in a hot tub, or any other load

Based on Table 5 of the DCA6, the table at right shows the required fastener spacing for southern yellow pine, Douglas-fir larch, or hem-fir deck ledgers that will be secured to a 2-inch nominal spruce-pine-fir band joist or engineered-wood rim board. While the spacing values for 1/2-inch lag screws and bolts are easy to select from this table, careful study of footnotes 1 to 9 is crucial before using the data.

Noncompliance with any of the footnote provisions could produce a disastrous in-service result. For example, footnote 3 directly relates to the photo on page 28 (top left), which shows the result of overlooking the Z-flashing on a ledger.

Fastener Spacing for Deck Ledgers

Joist Span	Rim Board or Band Joist	6'-0" and less	6'-1" to 8'-0"	8'-1" to 10'-0"	10'-1" to 12'-0"	12'-1" to 14'-0"	14'-1" to 16'-0"	16'-1" to 18'-0"
Connection Details	**On-Center Spacing of Fasteners[4,5]**							
1/2"-diameter lag screw with 15/32" maximum sheathing[1]	1" EWP[6]	24"	18"	14"	12"	10"	9"	8"
	1 1/8" EWP[6]	28"	21"	16"	14"	12"	10"	9"
	1 1/2" Lumber[7,9]	30"	23"	18"	15"	13"	11"	10"
1/2"-diameter bolt with 15/32" maximum sheathing	1" EWP[6]	24"	18"	14"	12"	10"	9"	8"
	1 1/8" EWP[6]	28"	21"	16"	14"	12"	10"	9"
	1 1/2" Lumber[7,9]	36"	36"	34"	29"	24"	21"	19"
1/2"-diameter bolt with 15/32" maximum sheathing and 1/2" stacked washers[2,8]	1" EWP[6]	24"	18"	14"	12"	10"	9"	8"
	1 1/8" EWP[6]	28"	21"	16"	14"	12"	10"	9"
	1 1/2" Lumber[7,9]	36"	36"	29"	24"	21"	18"	16"

[1]The tip of the lag screw shall fully extend beyond the inside face of the band joist.
[2]The maximum gap between the face of the ledger board and face of the wall sheathing shall be 1/2".
[3]Ledgers shall be flashed or caulked to prevent water from contacting the house band joist.
[4]Lag screws and bolts shall be staggered.
[5]Deck ledgers shall be minimum 2x8 pressure-preservative-treated No. 2 grade lumber or other approved materials as established by standard engineering practice.
[6]When solid-sawn pressure-preservative-treated deck ledgers are attached to engineered wood products (oriented strand board or structural composite lumber, including laminated veneer lumber), the ledger attachment shall be designed in accordance with accepted engineering practice. Tabulated values based on 300 lb. and 350 lb. for 1" and 1 1/8" EWP rim board, respectively.
[7]A minimum 1"x9 1/2" Douglas fir-larch laminated veneer lumber rim board shall be permitted in lieu of the 2" nominal band joist.
[8]Wood structural panel sheathing, gypsum board sheathing, or foam sheathing not exceeding one inch thickness shall be permitted. The maximum distance between the face of the ledger board and the face of the band joist shall be one inch.
[9]Fastener spacing also applies to southern pine, Douglas fir-larch, and hem-fir band joists.

Premature decline. On a beachfront home in Virginia, no Z-type flashing was installed over the ledger-to-house connection, which led to extensive decay.

beyond the weight of occupants.

Dead load (DL) is defined as the self weight of the structure and the weight of fixed objects. The use of a 10 psf DL anticipates wood framing with wood or plastic decking. It does not include the dead weight of a hot tub or any other permanently attached objects.

For coastal contractors, especially, it should be noted that the DCA6 does not address lateral loads on decks produced by wind or seismic events. For this, builders should turn first to the 2007 IRC, which does address the issues of lateral loads on decks as shown in the illustration on page 26. These new deck provisions to the 2007 IRC can be viewed at www.iccsafe.org/cs/codes/2007-08cycle/2007Supplement/IRC07S.pdf.

As a matter of good construction practice, the deck contractor should formally communicate these load assumptions to the homeowner by reviewing the DCA6 Minimum Requirements [items 5 and 6, page 2]. If the customer's expectations call for loading conditions that go beyond occupant loading, you will need to get a design professional involved.

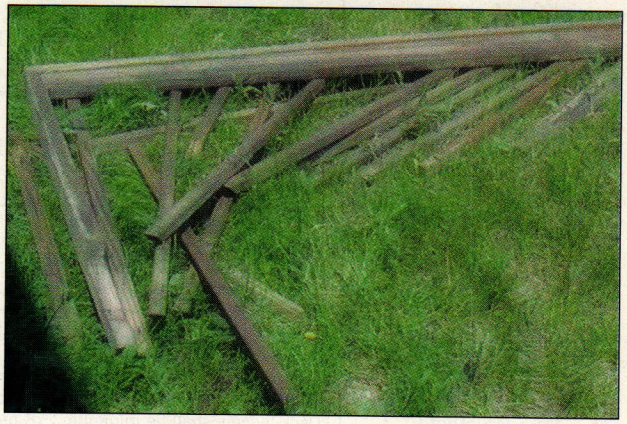
JOISTS AND BEAMS

Maximum joist spans provided in the DCA6 [page 3] are based on No. 2 grade lumber and wet-service conditions. The tabulated spans are less than common residential floor spans because the assumed wet-service conditions reduce the strength properties of the lumber.

All carrying beams (multiple deck girders) must bear fully on supporting posts, while the joists above should fully bear on the beams. Such "wood-to-wood" bearing provides the most efficient connection possible between wood framing members. Bolting the beams to the sides of the post is not an efficient connection. In the case of a 2x beam bolted to a 6x6 post, for example, the force is applied to the beam members perpendicular-to-grain and the bolt forces are applied parallel-to-grain in the post. In this situation, the capacity of a typical 1/2-inch bolt in the perpendicular-to-grain loading is relatively low under wet-service conditions. Splitting is also likely to occur when two (or more) bolts are aligned vertically in the beam, because the shrinkage rates between the beam members and the post are dramatically different (about 40:1).

LEDGER ATTACHMENT AND FLASHING

Based on deck collapses and injuries reported in media sources, the connection of the deck ledger to the house band joist is the most critical structural element of a deck. But the integrity of the connection is based on the assumption that the house band and deck ledger has no decay [DCA6 Table 5, page 12]. Therefore, flashing the connection is easily as important as the connection design (fastener size and spacing).



Deadly rail. The photo above shows an example of a grossly deficient guardrail system that produced a fatality and another injured party. In this case, a young man died after falling through the guardrail with posts that were nailed only to joists on the end of the deck. Note the notched 4x4 posts — a detail that is *not* permitted in the DCA6.

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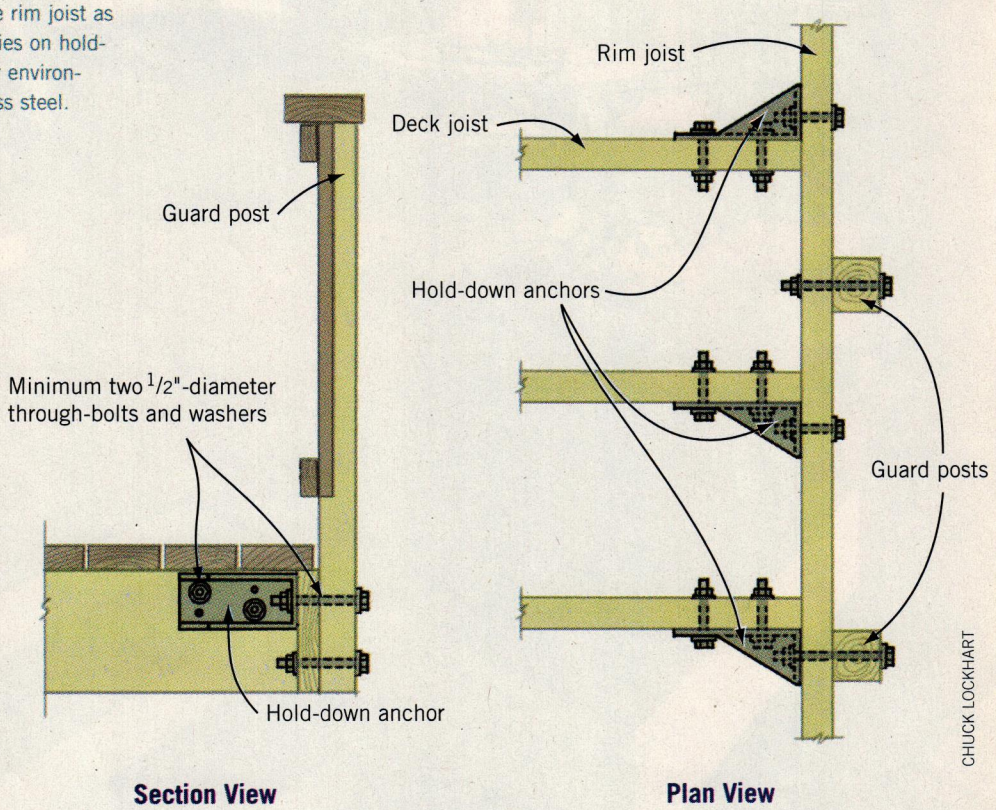
Hold-downs required. To meet code, guard posts for deck guards that run perpendicular to the deck joists must be attached to the rim joist as shown at right. This connection relies on hold-down anchors, which in a saltwater environment should be made from stainless steel.

Guard Post to Rim Joist Detail



CHUCK LOCKHART

Ledger fastening. The fastener spacings from DCA6 Table 5 (shown on page 27) are based on tests of simulated deck-ledger to band-joist connections performed at Virginia Tech and Washington State University that form the basis of an IRC code proposal. The design data (except for engineered wood product [EWP] rim boards) with footnotes were adopted into the 2007 IRC. Since the publication of the ledger fastener table in the 2007 IRC, AF&PA has added EWP rim boards to the DCA6 Table 5 based on tests at APA.

Ledger flashing. The critical role of effective ledger flashing cannot be overemphasized. The photo at the top of page 28 underscores the result from overlooking the Z-flashing on a beachfront home. If for any reason the wall sheathing and house band joist are exposed to water, decay will follow because the typical ledger connection is "water trapping," and significant decay is the likely outcome.

Best practice calls for not *only* including the Z-flashing recommended by DCA6 but also providing self-adhesive flashing against the house. This type of membrane is strongly recommended in coastal conditions to help protect against water infiltration resulting from wind-driven rain.

Ledger connection to cantilevers. Without a connection detail by a professional engineer, a deck ledger should never be supported off the end of a cantilevered floor [DCA6 Figure 18] because the load path is not complete. It is extremely difficult to transfer the vertical load from the deck ledger to the floor joist of the house using fasteners, because the rim joist/house band is bearing on "air" instead of a plate with a high wood-to-wood bearing capacity. This situation is depicted in the photo on page 32. It is extremely dangerous and likely to collapse under relatively low deck loads (possibly dead load only).

GUARD REQUIREMENTS

In the vernacular of DCA6 [pages 15–16, 18–19], a deck's "guard" is the guardrails or handrails surrounding the deck. All deck surfaces greater than 30 inches above grade are required to have a guard. Details for a proper guard can be found in DCA6 Figure 24. At stake here is the protection of the occupants against severe injuries and fatalities (see photo, page 28). Falls through decks guards are generally grave, and among problems with decks, only deck ledger failures are reported more frequently in the media.

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What About Plastic Decking?

While the DCA6 covers only wood, the advent of wood-plastic-composite and plastic materials raises legitimate questions regarding the suitability of these materials for decks. Materials used for decking surfaces and guardrail systems must be proven by tests, have a current Evaluation Report (ER), and be approved for use by the code official.

Evaluation Reports, such as those that are issued by ICC Evaluation Services (www.icc-es.org), are acceptable alternatives to the code-prescribed requirements, and the elements covered by the evaluation reports are made code-compliant via the modification procedure. In Virginia, as well as most other states, the code official is empowered to accept alternative materials and methods as equivalent to code-prescribed requirements as long as there is a basis for the approval of the alternative.

The basis can be an evaluation report (ER) issued by a nationally recognized evaluation service, or it could be a report issued by a registered design professional wherein equivalency is established. In any case, the code official has the final say as to whether to accept or not to accept the alternative. It is extremely important for the deck contractor to obtain a copy of the ER for the product and to make sure the "conditions of use" of the product are not violated by the specific application. For discussion of the weatherability of plastic decking, refer to "Materials Report: Plastic Decking," Spring 2005; www.coastalcontractor.net.

DCA6 Figure 26 shows the rail post construction needed to meet the intent of the IRC code (shown in the illustration "Guard Post to Rim Joist Detail," page 30). By code, the top of the rail must *safely* resist a 200-lb. outward force. "Safely" in this case means that a safety factor is applied to a test of a detail to prove that it can work in the field, because tests rely on virgin material and perfect fabrication that doesn't always exist on site. In an effort to determine what constitutes a safe rail post connection to the end of deck joists, we tested numerous details at Virginia Tech. All lagged and through-bolted connections failed to meet the 500-lb. test load, despite numerous attempts to reinforce the connection with blocking. Only the connection that relied on a metal hold-down anchor, such as the Simpson HD2AHDG (www.strongtie.com/products/connectors/HDA-HD.asp) or DeckLok (www.mtdecklok.com/railpost.htm), passed the test (as illustrated in "Guard Post to Rim Joist Detail," page 30).

Wrong! Deck joists (framed with PT framing lumber) have been hung from a ledger that is lagged into the rim board of a cantilevered I-joist system. Even if the lag screws were to be positioned to penetrate the I-joist flanges, the connection would be dangerously weak. It is likely to collapse under very low loads, possibly the dead load of just the deck structure itself. DCA6 strictly prohibits the connection of a deck to a cantilevered overhang.

As mentioned previously, stainless steel connectors and fasteners are recommended in DCA6 for saltwater shoreline exposure. DeckLok is one source for 304 and 316 stainless steel hold-down anchors that resisted the 500-lb. load used in the Virginia Tech guard post tests.

LANDMARK STEP

The publication of DCA6 by the AF&PA is a landmark step in advancing the cause of safe decks in order to prevent injuries and fatalities from deck collapses. While I have only commented on a few sections with respect to deck safety and durability, the entire DCA6 is important and deserves careful study and consideration by the professional deck contractor. For decks applications and conditions that fall outside the scope of DCA6, the contractor should seek professional design input and evaluation by the local jurisdiction through the permitting and inspection program.

Frank Woeste, Ph.D., P.E., is Professor Emeritus at Virginia Tech University, Blacksburg. All photos by the author. A list of his publications can be viewed at www.vtwood.forprod.vt.edu/resumes/woeste1101.pdf. Questions, comments, and suggestions are welcome and may be sent to the editor at coastal-editorial@hanleywood.com.

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High and Dry

by Ted Cushman

Elevated slab foundations solve both structural and moisture problems

In a coastal environment, house foundations need to be water tolerant as well as strong and stable. The classic poured-concrete slab-on-grade — a simple monolithic pour with nothing more than a thickened edge at the perimeter — is not enough where floodwaters from storm surge or rising water levels pose a threat. A coastal slab foundation often needs to be elevated above flood levels using a raised perimeter stem wall, or, in colder climates, it needs a deep frost wall. In either case, the construction is similar.

GOOD FIT FOR FLORIDA

Ask building science consultant Joe Lstiburek why he likes slab foundations, and he'll give you a simple answer: because they're not crawlspaces. "The best crawlspace in the world," says Lstiburek, "is one filled with concrete and called a slab."

For northern climates, Lstiburek says, a raised wood floor system built on piers or a crawlspace foundation may be easier to insulate, especially if you're after the affordable advanced insulation and air-tightness levels desired by the U.S. Department of Energy's Building America program (www.eere.energy.gov/buildings/building_america). "Farther north, we go with the crawlspace, and we insulate underneath the floor with rigid insulation," he says. But in South Florida the elevated slab foundation comes into its own — there, under-floor or perimeter insulation is inconsequential, while the method's durability and flood tolerance are a major advantage.

"For an elevated slab," Lstiburek explains, "you do a block foundation or a poured stem wall, you fill the

In the flood-prone Gulf region, an elevated home is a no-brainer. But damp conditions and termites are an everyday fact of life that can makes for one ugly crawlspace. The solution? Fill the crawlspace with drainable, compacted soils and cap it with a slab.

LSU LAHOUSE

Elevated "Cap Slab"

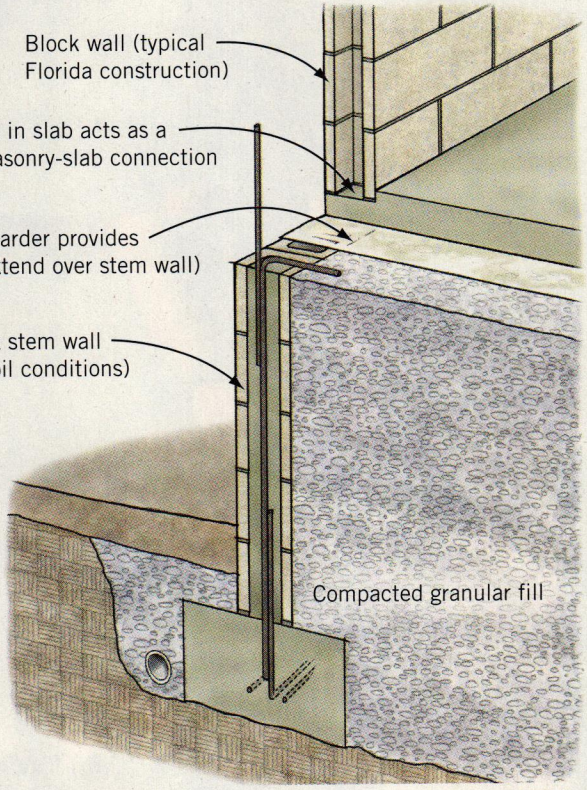

FIGURE 1. In Florida, where the first-floor living space is typically built with block, building scientist Joe Lstiburek recommends a seat formed into the perimeter of a raised slab. This detail functions as a kind of flashing that allows the water that will store up in the concrete block to drain to the exterior, rather than seep in over the first floor.

CHUCK LOCKHART

Elevated Slab for Louisiana Conditions

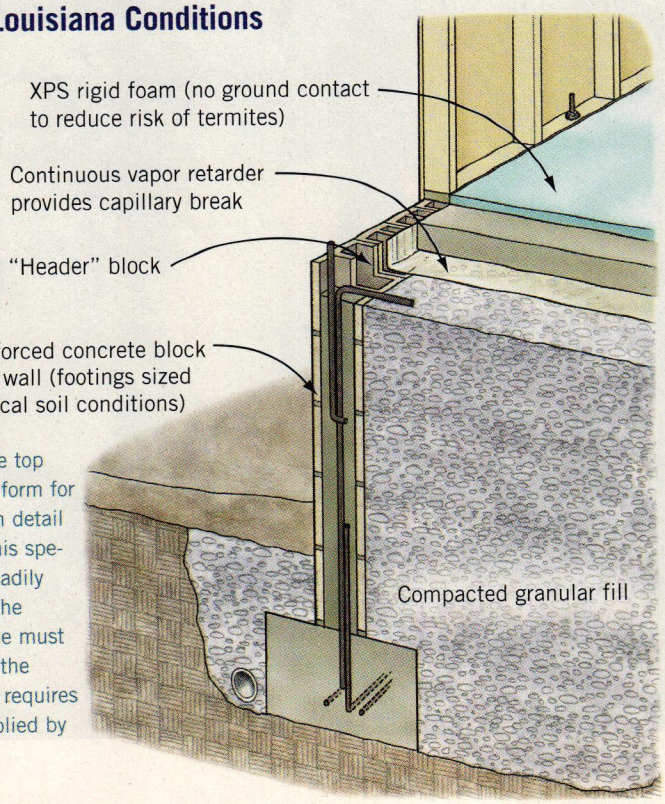

FIGURE 2. An L-block on the top course, which serves as a form for the cap slab, is a common detail for stem-wall slabs, but this specialty block may not be readily available in all markets. The moisture-barrier membrane must extend all the way across the stem wall — a detail that requires a liquid waterproofing applied by hand under the sill plate.

CHUCK LOCKHART

whole thing with fill material, and then I like to put a topping slab, a cap slab, on the top — and that locks everything together." (See **Figure 1**.) It's typical in South Florida to build one-story houses and the first story of two-story houses using concrete masonry units (CMUs). "We put an inch-and-a-half seat in the perimeter of the cap slab, as a seat for the block wall," says Lstiburek. "So we have our stem wall, then a cap slab, and then another block wall on top of the slab — and then we insulate on the inside of the block wall. I think that's a real nice way of raising the slab."

NOT SO EASY

Farther along the Gulf Coast, Louisiana building scientists are trying to introduce the elevated slab technique to builders facing the state's massive post-Katrina rebuilding problem. Even before the storm, Louisiana State University's extension program used an elevated slab as one of several foundation systems for the "LaHouse" building demonstration project on the LSU campus (**Figure 2**).

Elevation works. The building's finish floor sits 3 feet above the site's official Base Flood Elevation, or BFE, notes project director Claudette Reichel, Ph.D. "We recommend elevating every home in this area because it gives you the lowest flood insurance premium," she explains. Base Flood Elevations are only a statistical estimate of the flood risk, and in levee-protected areas (which includes much of southeastern Louisiana), flood projections rely on expected levee performance, not just on topography, climate, or historic flood records.

"In all of southeast Louisiana, the whole New Orleans area and beyond, once the levees were repaired and certified to supposedly withstand a Category 3 hurricane — well, that's within the one percent probability. But if you get a stronger storm, or something goes wrong

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FIGURE 3. Lacking locally available L-blocks, a builder in Louisiana resorted to cutting standard-size blocks to create the slab form. While effective, this work-around increased the cost of completion.

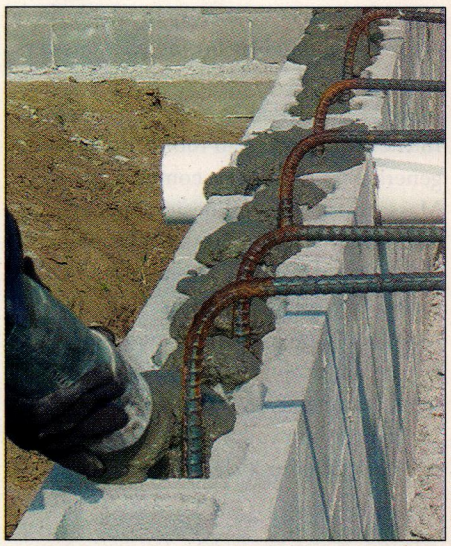

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FIGURE 4. In termite-infested locations, every core in any block wall should be fully grouted.

and a levee breaks or a pump system fails, you are going to flood way above that," Reichel explains. While the biggest premium break comes at 2 feet above the BFE, the LSU program suggests a viable alternative is going one extra foot — and using flood-tolerant materials and methods even above that (see "Low Country Rx: Wet Floodproofing," July/August 2006; www.coastalcontractor.net).

Practical details. Although elevating the slab has proved practical in Florida, says Reichel, translating any new method to tradition-minded Louisiana can involve complications. To begin with, labor in the masonry trade proves much more expensive in Louisiana than in Florida, so a block stem wall becomes a more costly option. Also, the design specified for LaHouse by a local engineer called for L-shaped "header blocks" as a top course for the stem wall. This course serves as a form for the slab, but the details hit a snag when it turned out that local masonry suppliers did not stock this specialty block. The builder adapted by manually cutting standard block out into the required shape (**Figure 3**), but that was a time-consuming work-around.

Nevertheless, the LaHouse project serves to demonstrate some important principles for the Gulf region. Protection against ground moisture is key in wet, rainy Louisiana; for the LaHouse, a strong poly membrane was placed between the slab and the subgrade, and the top surfaces of the perimeter block wall were waterproofed by hand with a liquid waterproofing compound. Traditional practice in Louisiana, even for slabs placed directly on ground with no stem wall, has been to place poly beneath the slab area, says Reichel. But rarely does this moisture barrier extend beneath the thickened slab edge. Because moisture can wick along slabs from the edge and add to interior air moisture loads as well as stress flooring materials, a capillary break must be provided under the entire slab to keep the living space dry. Installing a capillary break and moisture barrier may be simpler with Lstiburek's "cap slab" method than with header blocks, Reichel notes.

Termites are another serious issue in Louisiana, and the LaHouse program emphasizes a strategy of multiple lines of defense. All the cores in the perimeter block stem wall were filled to block the insects' travel path (**Figure 4**). Besides traditional soil treatments, the LaHouse also uses mesh termite screens around pipe penetrations, and the entire framed structure uses borate-treated framing lumber.

Will the elevated slab technique catch on in Louisiana? Despite local supply and labor hurdles, some Louisiana builders are already using the method, says Reichel. But even with the simpler Florida-style cap slab process favored by Lstiburek, she observes, the scarcity of masonry labor makes the stem-wall/slab combination a relatively high-cost option. "The higher-end homes favor that way to elevate," she reports, but the more conventional, more economical pier-and-beam foundation system is more common. Very few stem-wall crawlspaces are being built, she reports, because with masonry labor, that is also more costly.

For now, at least, the elevated slab is one more chapter in the Gulf Coast's long

saga of recovery — a story in which there are many good ideas but no easy answers.

NORTH-COAST SLABS

In the Northeast, slab foundations, in general, are much less common. But Massachusetts-based design/builder Andrew DiGiammo has been building slab-on-grade in this basement market for many years, when it fits. On a recent multifamily project of 12 one-story duplex homes, for example, he used slab foundations because it was economical.

"Even when you build a basement, you still have to pour a slab," he notes. A slab-on-grade does double duty as foundation and first floor. Plus, the design brings the living space closer to the outside grade. "As soon as you go to a wood-framed floor deck on top of a foundation wall, you raise your floor at least another foot above grade," DiGiammo points out. "Now you have to build stoops and stairs, and some of our older customers don't like that — they don't want to negotiate three steps to get inside. With a slab-on-grade, it's one step and in — just enough to keep the snow out."

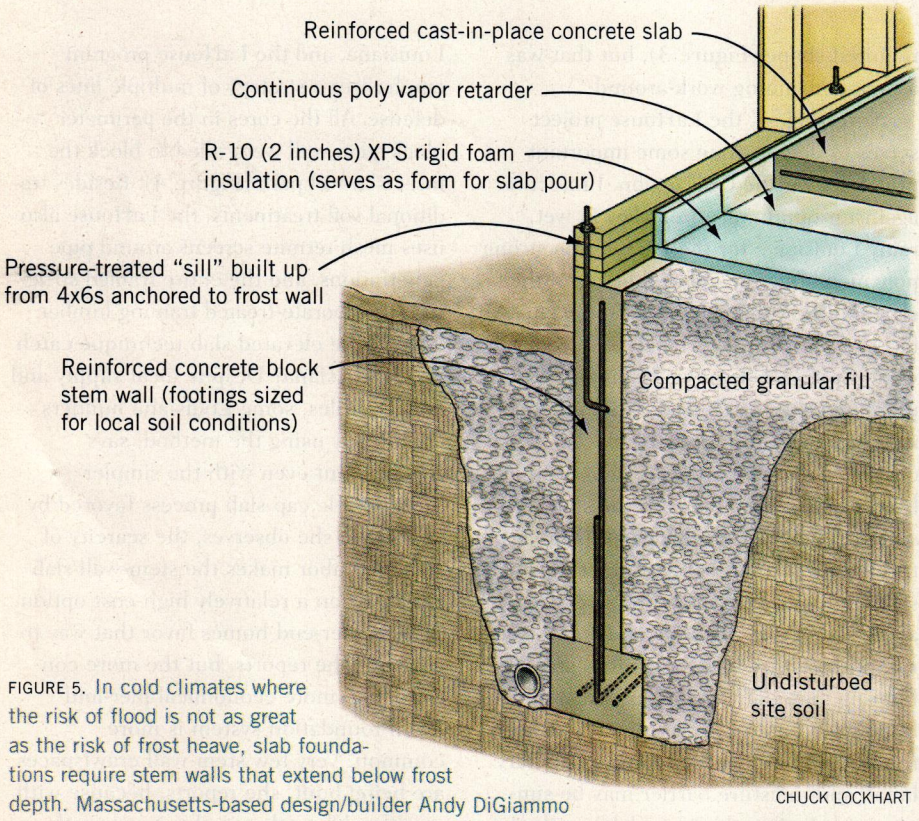
Slab foundations also allow DiGiammo to avoid the risk of wet basements where water tables are high. "It's one thing if we're building someone's $2 million dream home on a wet site; we'll engineer a solution to keep the water out of the basement. The customer's willing to pay for that," says DiGiammo. "But when we do a whole set of duplexes or town homes, we don't want to create 60 units with water in the basement — or come up with a $12,000 solution for each unit to keep the water out."

Elevating the concept. Suitably sited, the slab-on-grade solution can also work well for homes in the Coastal A zone, where builders are required to place the first-floor living area above the base flood elevation for the site. "In the A zone, I often do a slab-on-grade only because you can't have a living area or mechanical area below the base flood elevation," says DiGiammo. "A full basement doesn't have much value if the homeowners can't use it."

In the relatively cold climate of Massachusetts and Rhode Island, foundations must rest below the frost line for stability, and insulating the slab perimeter is the trickiest part of the foundation design. "I've seen it with infrared photography," says DiGiammo. "If you don't create a thermal break at the edge of the slab, all your heat just screams for that spot." DiGiammo's preferred method is to create a base of compacted structural fill inside the poured-concrete frost wall, and install a mudsill made of four treated-wood 2x6 members directly on top of the wall. Then he installs 2 inches of rigid foam insulation on top of the gravel, and tacks 1 inch of the foam to the treated-wood sill to form the edge of the slab (**Figure 5**). "The foam serves as a thermal break, and it's also our expansion joint," he explains.

Contributing editor Ted Cushman has been covering construction business and technology since 1993.

Slab-on-grade with frost wall
(northern coastal climate outside of flood zones)



CHUCK LOCKHART

FIGURE 5. In cold climates where the risk of flood is not as great as the risk of frost heave, slab foundations require stem walls that extend below frost depth. Massachusetts-based design/builder Andy DiGiammo uses this detail where the budget and scale call for an affordable foundation. When the flood risk is high, the stem-wall height can be increased. But if the water table and flood risk are low, DiGiammo prefers to keep the slab near grade for accessibility.

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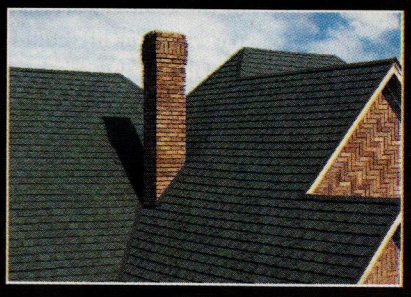

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Floating Out the Storm

A concept home designed to resist flood and wind rises out of the wreckage of New Orleans

by Clayton DeKorne

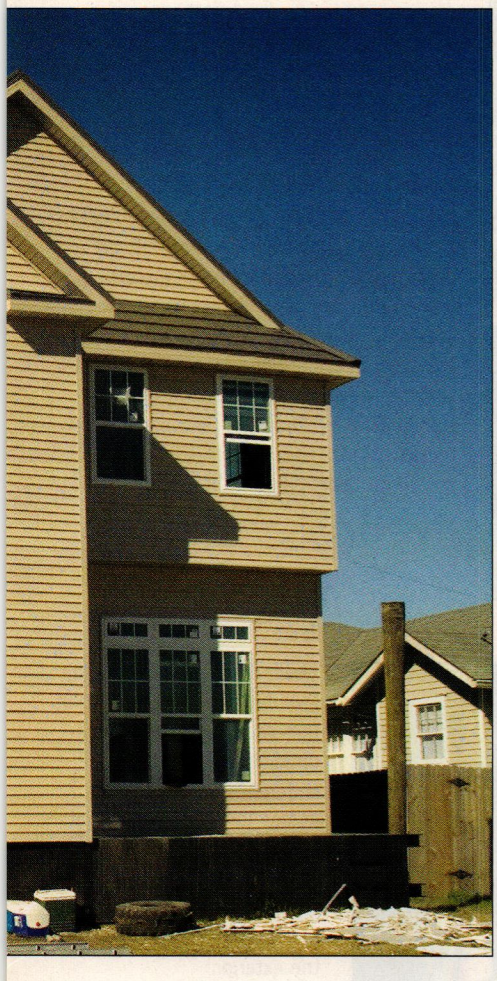
By now, images of the devastation wrought by Hurricane Katrina have been forever etched into the history of the United States. For the people displaced by this vast storm, however, the memory of Katrina is anything but trite. In the weeks and months after Hurricane Katrina made landfall near Buras-Triumph, La., over a million people evacuated the ruined regions of the Gulf Coast, resettling in every state in the country wherever life could be reconstructed.

During this exodus, refugees who made it to Indiana were directed to Terre Haute, where 27,000 square feet of floor space in the recently completed but still nearly empty shopping center had been loaned to charity groups for use as a sorting and distribution center of much-needed supplies. Displaced victims came from all over the state to accept whatever was available. The surge in donations and recipients was tremendous, recalls Chicago-based Bill Spatz, chairman of Spatz Development, the parent company of Spatz Centers, which owns the shopping center. "I called my son Bryan [president of Spatz Development] in D.C., and said, 'We gotta do something.' The scale of destruction [from Katrina] is unlike anything we've seen in this country before. We couldn't sit back and just watch it."

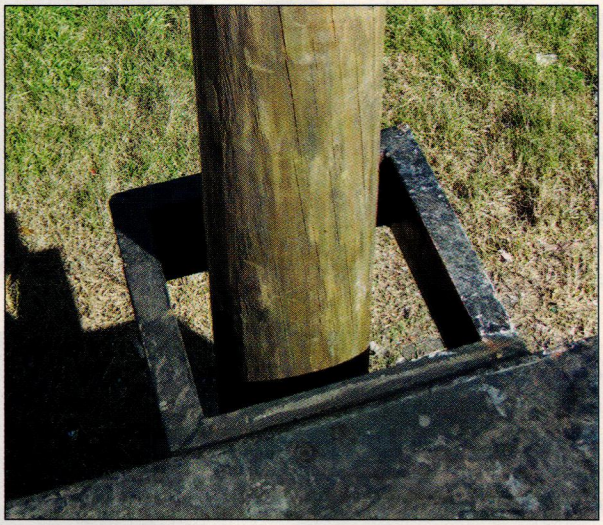
That brush with the aftermath of Katrina set Bill and Bryan Spatz in motion developing what would eventually be dubbed the Noah's Ark Project — a steel-framed modular home built on a barge. It sits on dry land on Louisville Street in the Lakeview area of New Orleans — one of the neighborhoods hardest hit by the surge of Hurricane Katrina that spilled into Lake Ponchartrain and overcame the 17th Street Canal levee. The home looks like a typical 2,700-square-foot house with an asking price of about $525,000, belying the fact of its unique structure. For residential builders, it's a study in what a coastal home can become in the hands of a commercial developer, and for the industry as a whole, it's a concept that pushes the boundaries of how to build to protect against hurricane damage.

RETHINKING A FOUNDATION

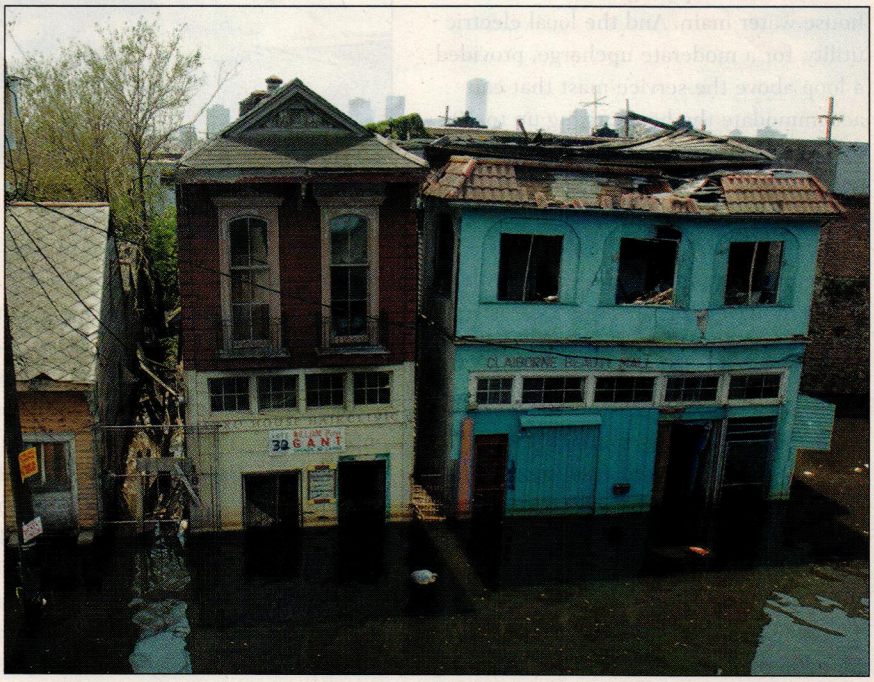
Katrina will be remembered first and foremost as a flood event. In and around New Orleans, the higher-



The shell of the home was contracted out to a modular home builder that constructs homes in a tornado-plagued Midwest. The homes are framed in steel and sheathed with OSB that is glued and screwed to the exterior walls to create a perfectly rigid shell. Impact-resistant windows and steel shingles complete the package.



To keep the home from floating down the street, the steel foundation is tethered to pilings located near the home's corners.



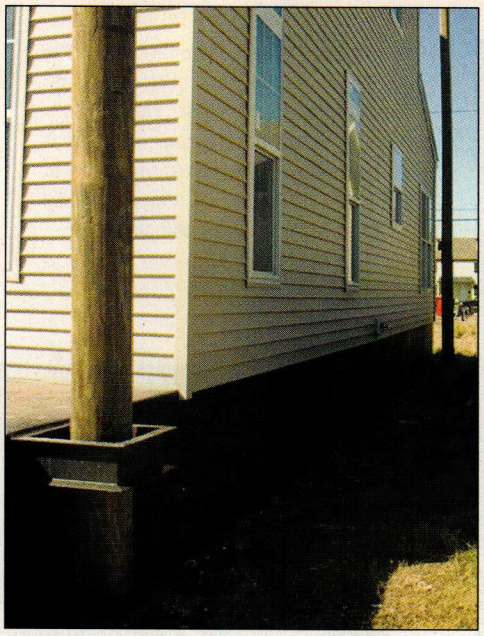
JOCELYN AUGUSTINO/FEMA

The city of New Orleans got hit from two directions — on the east side from the surge funneling in from the Intercoastal Waterway, and on the north side from a swollen Lake Pontchartrain. In both cases, the rising water breached the levees, submerging more than 80% of the city. This setting established the design challenge for Spatz Development's floating home.

than-expected surge inundated the levees, filling up the low-lying land like a bathtub. The midtown Lakeview district was overrun when several panels of the 17th Street Canal levee failed, releasing a wall of water from the lake that filled up midtown and parts of Metairie.

In the face of such a flood risk, Bill Spatz reasoned that any rebuilding efforts in the area ought to involve homes that can rise above the water. He contracted with barge-builder Marine Inland Fabricators of Panama City, Fla., to craft a 3-foot-tall barge — in essence a floating crawlspace welded together from plate steel and iron trusses that could carry the weight of a steel-framed, 2,700-square-foot home. It functions as a crawlspace through which to route water and sewer lines, but it remains completely outside the thermal envelope, and all the HVAC for the house stays within the modular units above it.

Floating Out the Storm



Noah's Ark Project, as the home has been dubbed by Spatz Development, sits on a barge. Sections were built off site and craned into position. While this land-based vessel has been engineered to float the structure in rising floodwater, it also needs support to keep it from sinking into the soft local soils. Therefore, the barge sections rest on a slab, which is itself supported on approximately 30 pilings.

To keep the home from floating down the street, pilings were driven some 30 feet into the ground on either side of the foundation near the house corners. Then, a pair of steel brackets was slipped around each piling and welded to the barge. These brackets are oversized to provide ample room to slip up the pole as the waters rise. The toughest part of this detail, said Spatz, was finding straight timber pilings, and taking care when driving them in, so the 10 feet that rose out of the ground remained perfectly plumb.

FLEXIBLE UTILITIES

A movable foundation presents a few unusual challenges with utility hookups. As the foundation begins to float, the water, sewer, and electrical lines must either disconnect or move with it.

Water and electrical proved easy enough: flexible piping serves as the house water main. And the local electric utility, for a moderate upcharge, provided a loop above the service mast that can accommodate the house rising up to 10 feet. The sewer was a bit more of a conundrum. After exploring a number of break-away connections, Spatz opted for a manual disconnect. This was in part a cost consideration: a simple valve with a gasketed disconnect was less expensive. But the rationale here also had to account for reconnecting the sewer once the floodwater subsides and the house settles back down. It's highly unlikely it will come back to the exact same spot, and a manual disconnect would be easier to reconnect or replace.

WIND BREAKER

The house itself was contracted out to Benchmark Construction & Development, a modular home builder in Columbus, Ohio, which specializes in wind-resistant homes for the tornado-prone Midwest. According to Spatz, the house is designed to withstand wind gusts up to 200 mph.

SPATZ DEVELOPMENT

Spatz originally thought the foundation would be built as three self-contained barge units. But to keep costs within bounds, it was built as one large barge in three sections. This meant individual sections had to be tied together with steel bridging inside and seam-welded on the exterior.

The exterior walls are framed in steel and sheathed with 3/4-inch OSB that is screwed and glued to the frame, creating a series of perfectly rigid boxes. Impact-resistant windows and doors complete the package, providing what Spatz calls an impenetrable shell.

For siding, Spatz opted for vinyl, which he feels can be a durable siding option for a coastal home when installed correctly. He uses commercial-grade (0.048- to 0.055-inch-thick) panels with a double-thickness nail hem and a stiffer square edge rather than a post-formed edge. He recommends doubling up on the number of fasteners per panel, using screws instead of nails. "There's no reason vinyl siding should blow off in a storm if it gets installed correctly," Spatz explains. "Whether it usually does is another matter."

For roofing, Spatz chose steel roof shingles. The advantage of these over asphalt shingles is once again the connection. Most steel shingle systems are screwed into a steel track that is itself screwed down to the roof deck. "Pull-off is rare, even in an F2 tornado," claims Spatz. Steel shingles come in a wide range of styles from tile to slate and shake look-alikes. For its debut on Louisville Street, the first home for the Noah's Ark Project has a shake-style roof.

"All in all, this home looks like any other," says Spatz. "No one would know how unique it really is."

Clayton DeKorne is editor of Coastal Contractor. *Photos by Jon B. Barry, www.artkeep.com, except where noted.*

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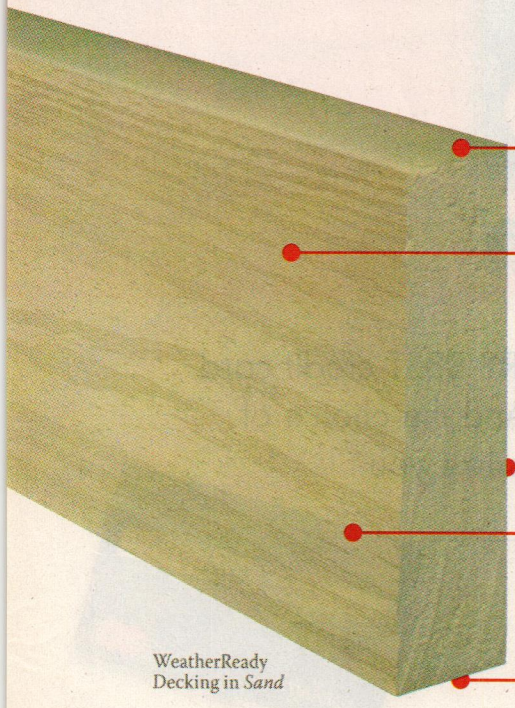

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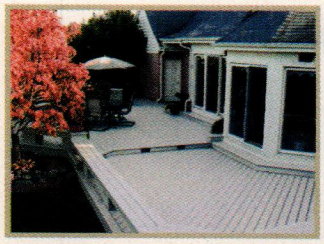

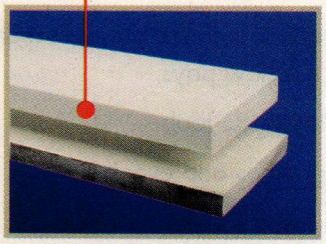

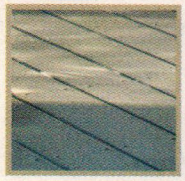

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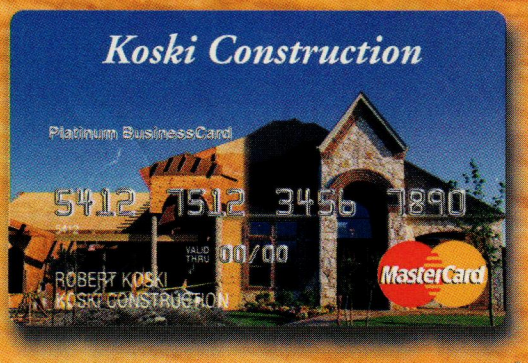

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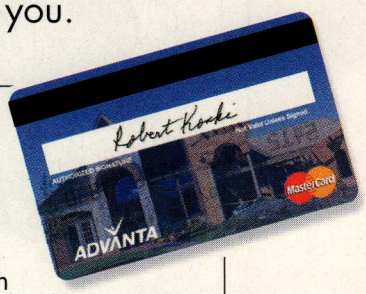

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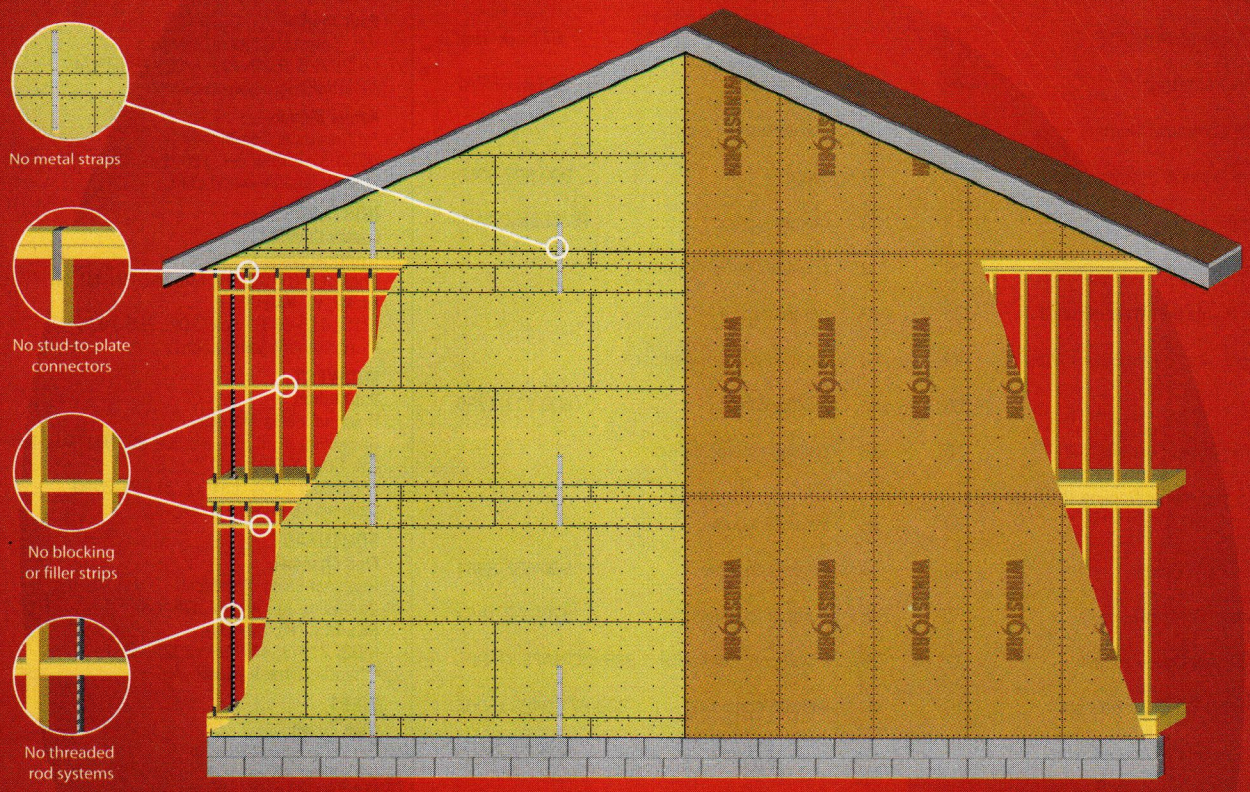

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Green Toilet

As water resources grow scarce and expensive, water-efficient water closets have become must-have green fixtures for coastal homes. Toto, the company that has set the de facto standard for low-flush toilets in both the residential and commercial markets, offers a dual-flush toilet that ranks as one of the most reliable and most water-efficient units available. The **Toto Aquia** offers two flush options: a standard 1.6-gallon flush for solid wastes and a 0.9-gallon flush for liquid wastes and paper. The manufacturer estimates that a typical family of four will save approximately 7,000 gallons of water per year with this toilet, compared with a standard 1.6-gallon-per-flush toilet. Toto toilets are known for reliably removing solids and keeping the bowl clean. For more information, contact Toto USA, 888/295-8134, www.totousa.com.

TOTO AQUIA

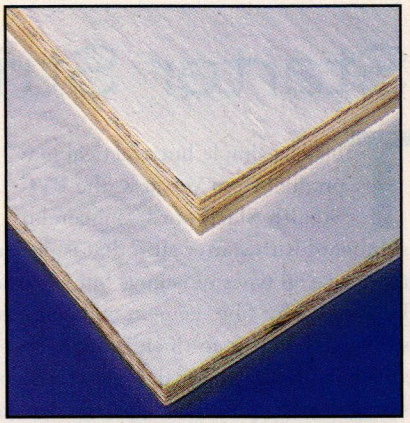
Cool Roof

Several research projects — by the Florida Solar Energy Center, by Oak Ridge National Laboratories, and by the Lawrence Berkeley Laboratories — all substantiate that the single most effective way to cut cooling loads in a warm climate is to make roofs reflective. The coating on **Follansbee Terne II steel panels** is formulated with tiny reflective pigments. The percentage of reflectivity depends on the color, but with this coating, even a brown panel can reflect 25% of the sun's radiation. Lighter panels reflect more, reaching a high of more than 70% with white panels. (By comparison, black asphalt shingles reflect less than 5% of the sun's heat, meaning the roof is absorbing 95% of the solar radiation it sees, while white-colored asphalt shingles reflect about 25%.) Follansbee Terne II metal roofing panels consist of a base sheet of steel coated with ZT (zinc/tin) alloy, which the manufacturer claims makes these panels one of the most salt-resistant metal roof options for coastal homes. Under extremes, the panels reportedly withstand up to 17,750 hours without visible rust. For more information, contact Follansbee Steel, 800/624-6906, www.follansbeeroofing.com.

FOLLANSBEE TERNE II

Cool Attic

Falling short of reflecting heat away from the roof surface, the next best defense against heat gain is to reduce radiant emissions. When any warm mass heats up, it discharges radiant energy. In this case, the warm mass is the roof assembly, which emits radiant heat into the attic. Adding a "radiant barrier" — a shiny surface under the roofing — can substantially reduce radiant heat gains and Georgia-Pacific's **Plytanium Thermostat** radiant-barrier roof sheathing offers an easy way to get this done. These plywood panels have a Kraft-paper and foil laminate on one side that gets installed facing *into* the attic, shiny-side down facing into the air space. For more information about radiant barriers, see the *Radiant Barrier Attic Fact Sheet* (www.ornl.gov/sci/roofs+walls/radiant). For more information about Plytanium Thermostat roof sheathing, contact Georgia-Pacific, 800/284-5347, www.gpweatherbuilt.com.



PLYTANIUM THERMOSTAT ROOF SHEATHING

Steel Driving Gun

As standing-seam metal roofs have gained market share as durable performers in high-wind regions, installation tools are catching up, making installation faster and easier than the old-school method using bulk screws and a screw gun. **Simpson Strong-Tie** has launched the first auto-feed system specifically designed for driving collated screws into the pre-existing hole of a standing-seam panel clip. With collated screw strips, high-wire fumbling for bulk screws can be eliminated from the job, saving time and minimizing screw waste. "We saw a 50% increase in speed when we used the tool with our 10-foot panels," said Lindoll Wallace, supervisor at Collis Roofing in central Florida. "Since the tool uses collated screws, the guys aren't bent over as far, which reduces back strain. Plus, they aren't holding individual screws in their mouths or slipping and driving the bit into their fingers." Simpson Strong-Tie offers a full line of pancake head self-drilling and self-piercing fasteners for standing-seam metal roofing, as well as ultra-low-profile pancake fasteners for use with snap-and-seam profile metal panels. For more information, contact Simpson Strong-Tie, 800/999-5099, www.strongtie.com.

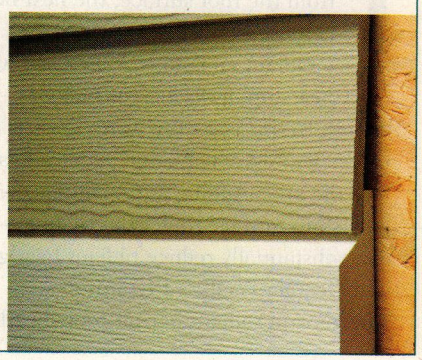
Have a Blast

MICRO-BLASTER II

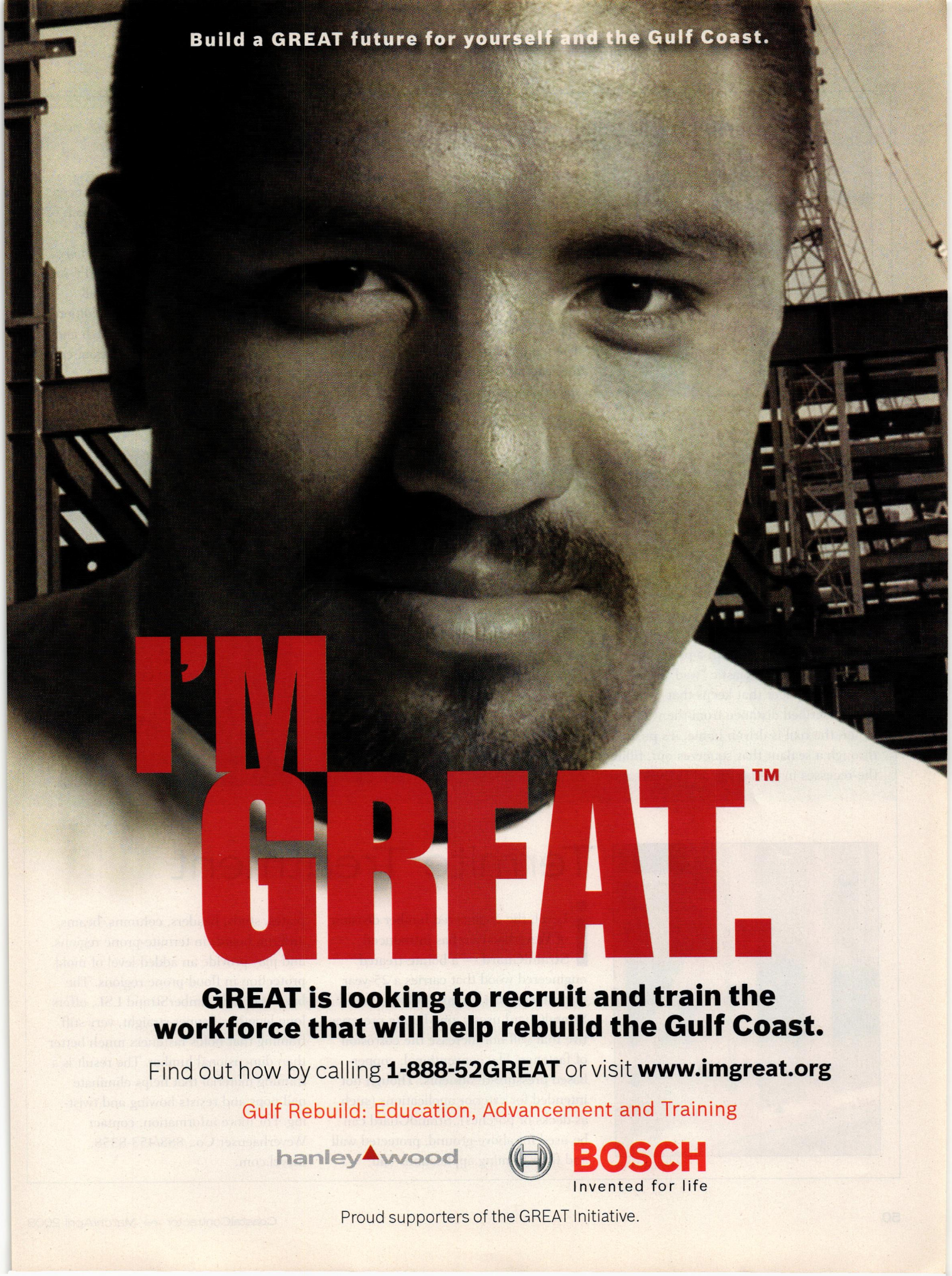
Nothing incites the will to destroy more than a hunk of old concrete at the start of a job, a boulder in the septic tank pit, or bedrock at the (not quite) bottom of an excavation. Enter the **Micro-Blaster II** — a compact demolition tool that uses air-triggered cartridges to blast material apart. A user begins by drilling a deep (up to 16-inch) hole into the unwanted materials, dropping in one or two proprietary charge cartridges, and remotely triggering the charge with a pulse of 100-psi air from a small CO_2 canister. The power cartridges generate pressures up to 100,000 psi — enough force to split apart several hundred pounds of rock. A manifold system and multiple heads can be configured to initiate up to six simultaneous blasts, allowing masses of up to several tons to be cracked apart in one shot. The Micro-Blaster can be used alone or to enhance the use of hydraulic hammers, without the need for a special blasting license. Or, if you just like watching things blow up, the video footage on the company's Web site will satisfy. Not quite as fun as The Beer Cannon (search "beer cannon 101"; www.youtube.com), but eminently more useful. For more information, contact 888/497-9970, www.ezebreak.com.

Starter Strip Marries Skirtboard

This is a simple but practical new product from Versatex: the **PVC Stealth Skirtboard** — a combo skirtboard with starter strip that is designed to receive all types of sidings but is particularly useful for fiber cement and composite sidings. The 5/4-inch-thick plank features an angled top ridge for the first course of siding to rest upon. This tapered edge also allows water to run off, and because it is made from low-maintenance cellular PVC, it can come into direct contact with the ground or masonry. Stealth Skirtboard comes in 18-foot lengths sized at 5/4 x 6-inch and 5/4 x 8-inch widths with a smooth matte finish or with a textured wood-grained finish to match most fiber-cement sidings. For more information, contact Wolfpac Technologies, 724/266-7928, www.versatex.com.



PVC STEALTH SKIRTBOARD



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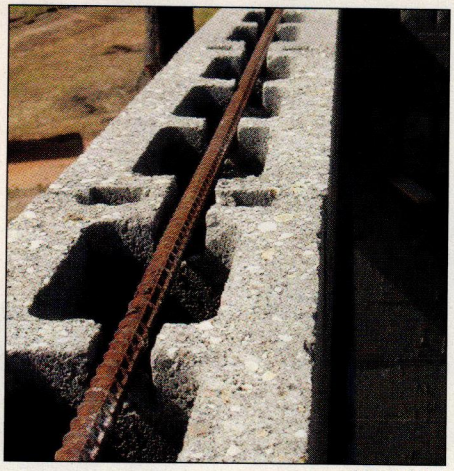


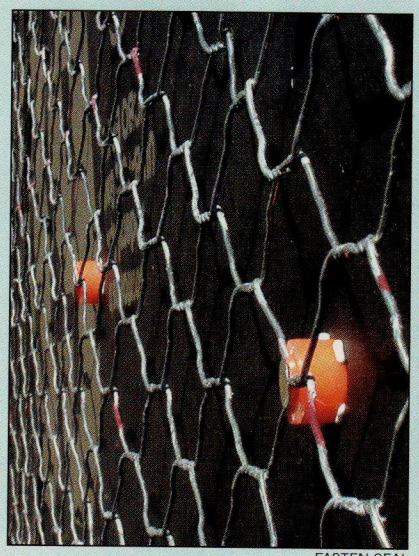
VOBB BLOCKS

Precision Dry Stack

Taking the premise that the mortar joint is the weakest part of a concrete block wall, the **VOBB Block Wall System** eliminates it altogether. The system relies on interlocking plastic clips and shims to temporarily hold the blocks level and aligned until the grout cures to lock them permanently in place. The manufacturer claims this block system can be installed faster and with less skilled labor than conventional CMUs, not only because a mason doesn't need to bed each block, but because much of the cutting can be avoided. VOBB blocks are made based on a grid of six inches, with blocks in 18, 12, and 6-inch lengths, conforming to typical wall lengths and door openings. In addition, all VOBB blocks are 6 inches high and 6 inches wide. For more information, contact Verott Oaks Building Blocks, 337/781-0705, www.vobb.com.

Self-Sealing Furring Nail

For solving water-intrusion problems in stucco, the **Fasten Seal furring nail** not only furs out the lath so it's properly placed in the middle of the stucco, but it also seals the nail hole, so water can't leak into the framing. Each Fasten Seal nail consists of a 1¾-inch ASTM-rated lath nail with a preassembled, bright-orange plastic "wad" — the cylindrical spacer that keeps that wire lath at a prescribed distance from the wall. When the nail is driven home, it's pushed through a sealant that squeezes out, filling the recesses in the bottom of the wad and creating a uniform seal around the nail hole. Fasten Seal was invented by Kirk Anderson, a site supervisor for a stucco contractor in California whose responsibility included troubleshooting moisture damage following the heavy El Niño rains of the late 1990s. In many cases, the problems identified by building forensics pointed toward the lath fasteners that penetrated the water-resistive barrier. Anderson knew there had to be better way than caulking every nail hole, and Fasten Seal is his answer. For more information, contact Fasten Seal, www.fastenseal.com.



FASTEN SEAL

STRANDGUARD

Termite Treatment

iLevel, the engineered lumber division of Weyerhaeuser, has introduced **StrandGuard** — a borate-treated engineered wood that carries a 25-year warranty against fungus and termites. StrandGuard uses a zinc-borate preservative that will not increase the corrosion of fasteners like conventional, copper-based pressure-treatments. Though not intended for exterior applications (such as decks or porches), StrandGuard can be used for above-ground, protected wall and floor framing applications (sill plates, studs, headers, columns, beams, and rim board) in termite-prone regions, and may provide an added level of mold protection in flood-prone regions. The base material, TimberStrand LSL, offers long lengths of super-straight, very stiff framing that holds fasteners much better than dimensional lumber. The result is a framing material that helps eliminate nail pops and resists bowing and twisting. For more information, contact Weyerhaeuser Co., 888/453-8358, iLevel.com.

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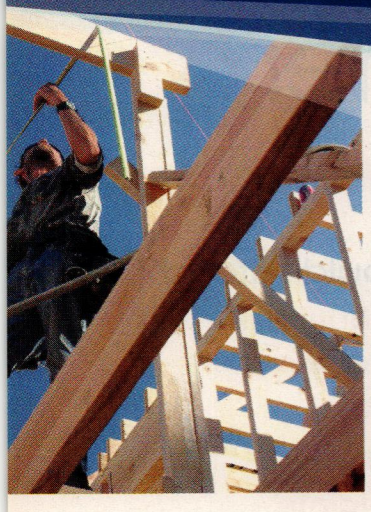

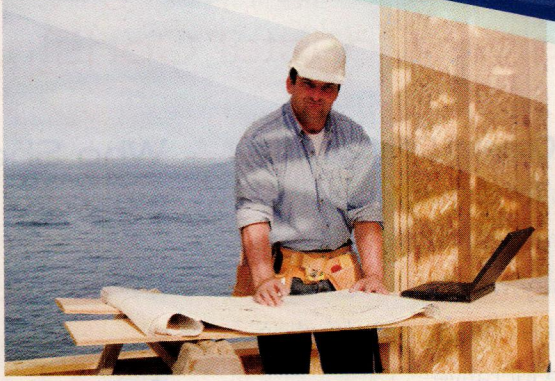

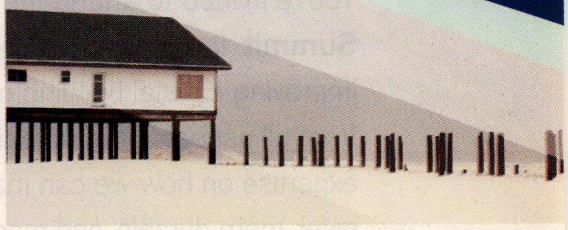

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Pre-conference registration ends May 9, 2008 at 5pm. If you wish to register after this date, you must do so ON-SITE.

Attendance Policy

Attendance at this event is reserved exclusively for coastal construction professionals, engineers, architects and service providers who have paid a fee as official sponsors of this event. Hanley Wood, LLC reserves the right to renew, accept and/or reject all registrations. If you plan to bring a guest, please note that person will be charged as an additional registrant if s/he attends the conference or activities.

Press attendance is allowed only with the written permission of Hanley Wood editors. Press must be registered through Hanley Wood in Washington, DC.

Questions?

E-mail coastalsummit@hanleywood.com
or visit www.coastalsummit.com

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May 12–14, 2008
Marriott Harbor Beach Resort
Ft. Lauderdale, FL

Coastal CONTRACTOR SUMMIT

hanley wood

Conference Program

Monday, May 12, 2008

4:00–7:00pm **Registration**

6:30–7:30pm **Welcome Reception**

Tuesday, May 13, 2008

8:00–8:30am **Breakfast**

8:30–8:45am **Welcome & Introduction**

Clayton DeKorne, *Editor, Coastal Contractor*

8:45–10:00am **Keynote Presentation**
New Approaches to Minimizing Water Intrusion in Attics

Dr. Tim Reinhold, *V.P. Engineering, Institute for Business and Home Safety (IBHS)*

The history of recent hurricanes demonstrates that wind-driven rain entering a home at the roof plane and through the soffits is a primary cause of damage. Dr. Reinhold, a leader in developing effective solutions to mitigating hurricane damage, will describe products and approaches to fend off expensive water problems, and help us understand what to look for when selecting roofing materials.

10:00–10:15am **Coffee Break**

10:15–11:15am
Hurricane-Resisting Retrofits

Richard Reynolds, *Owner, RG Reynolds Homes*

Builder and remodeler Richard Reynolds will examine prescriptive retrofit measures for bracing gable-ends, strengthening the roof diaphragm, and securing wall-to-roof connections in existing homes. Because all of these measures are pending or in review by the Florida Building Code, Mr. Reynolds will explain the critical details and provide insight into how builders can have a positive effect on the code revision process.

11:15am–12:15pm
Flood-Resistant Design and Construction for Coastal Homes

Christopher P. Jones, *P.E.*

As Katrina taught only too well, storm surges can obliterate and swamp homes. Christopher Jones, an engineer from Durham, N.C., who co-wrote the current edition of FEMA's classic Coastal Construction Manual (FEMA 55), will describe the awesome forces of storm surge and will examine proven coastal building practices used to moderate flood damage.

12:15–1:30pm **Networking Luncheon**

1:45–3:00pm **Wind Workshop**

Part 1: **Wind and How It Works**

Dr. Forrest Masters, *University of Florida, Department of Civil and Coastal Engineering*

Prior to the 2004 hurricane season, most of Florida's windspeed data came from ocean buoys or from airplanes that measured winds above sites where hurricanes cause damage. Today, researchers employ a variety of new tools to measure ground-level wind speeds, providing practical knowledge about destructive winds and driving rain. This session is aimed at giving building professionals a better understanding of the eddies and pressures that wreak havoc on buildings.

3:00–3:30pm **Coffee Break**

3:30–4:45pm **Wind Workshop**

Part 2: **Real-World Wind Effects on Homes**

Dr. David Prevatt, *University of Florida, Department of Civil and Coastal Engineering*

This session builds on our knowledge of high-wind events by examining the real-world effects on buildings. Using full-scale simulations of wind pressure and driving rain, researchers have arrived at a much better understanding of structural weaknesses and water entry points in homes.

5:00–6:00pm **Reception**

6:00–8:00pm **Networking BBQ**

Wednesday, May 14, 2008

8:00–8:30am **Breakfast**

8:30–9:30am
Walls that Work in Coastal Climates

Claudette Reichel, *Lousiana State University, La House Project Chair*

In the unforgiving coastal climate, contractors have to be students of building science. This session will focus on the products and techniques that enable structures to withstand the sensational forces of "wind events" and storm flooding, as well as the incessant regional challenges from termites and high humidity. The presentation will examine common failures and outline the best practices for controlling the dynamic interaction of heat and moisture.

9:30–9:45am **Coffee Break**

9:45–10:45am **Selling Coastal Homes**

Stuart McDonald, *V.P. Operations, Mercedes Homes*

Stuart McDonald of Florida-based Mercedes Homes developed the company's Strong Wall System — a cast-in-place concrete wall system that proves stronger than conventional walls and solves water intrusion problems. McDonald will share the practical details of building these walls, as well as the realities of pricing, marketing, and selling a home with hurricane-resistant upgrades.

10:45–11:45am
Panel Discussion: Standing Together

How can policy makers, code officials, design professionals and contractors work better together to provide the quality housing that today's customers demand? Bring your ideas, comments, concerns and additional questions to this moderated discussion, as we explore the path forward with all the speakers participating in the Coastal Contractor Summit.

11:45am **Conference Adjourns**

Register Today!

May 12–14, 2008

Marriott Harbor Beach Resort
Ft. Lauderdale, FL

Coastal CONTRACTOR SUMMIT

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Work and Play at A Gorgeous Venue

Marriott Harbor Beach Resort | Ft. Lauderdale, Florida

Enjoy the resort's quarter-mile of private beach. If you're up for snorkeling or scuba, Fort Lauderdale is recognized as one of the world's top diving locales. The Harbor Beach Resort boasts two reefs and four dive sites. Or take advantage of available parasailing, ocean kayaking, sailing on a catamaran, and jet skiing.

Bordered by rock-waterfall gardens and ringed by palm trees, the heated, 8,000-square-foot lagoon-style pool provides an alternative to the beach. The adjacent Resort Fitness Center is well-equipped and available to hotel guests 24 hours a day. Guests can enjoy on-site tennis and volleyball.

For golf enthusiasts, championship golf courses are nearby. Harbor Beach guests enjoy playing privileges at a selection of private courses.

If you're seeking relaxation and rejuvenation, the Spa at Harbor Beach is an oasis of tranquility offering a broad menu of massage therapies and salon services. The spa has a fully equipped Fitness Center and Movement Studio, complete with classes and personal instruction.

Accommodations

Hotel accommodations have been reserved at the Marriott Harbor Beach Resort in Ft. Lauderdale at a discounted group rate of $239 single/double per night. All reservations must be made by Monday, April 21, 2008.

To make hotel reservations, please call the hotel directly at 1-800-222-6453 or use the hotel info link on www.coastalsummit.com

Attendees should identify themselves with the Hanley Wood Coastal Contractor Summit to receive the discounted room rate. Attendees are responsible for their own hotel and travel arrangements.

Don't miss the premier event to learn how to construct **safe homes** in demanding coastal environments. Join the industry's **best and brightest** and walk away with **valuable new contacts.**

▶ Register at **coastalsummit.com**

Affordable Coastal

A piece of Floridiana lives on

When the owners of a Palm Beach County waterfront mobile home park voted to sell the land to a developer earlier this year, it seemed like the official end to one of Florida's storied 1950s-era seaside mobile home villages.

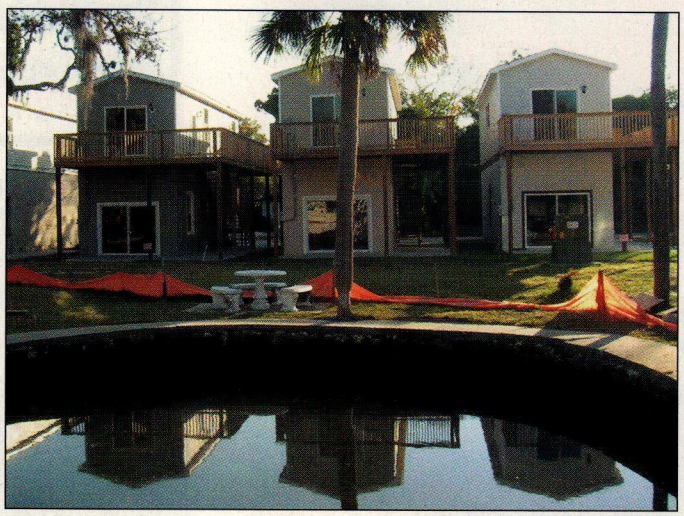
But it may be too early to write the park's obituary. Although Briny Breezes residents sold out, and plans for multi-million-dollar condos move ahead, the bulldozing of Florida's roughly 5,580 mobile home parks has slowed. The main causes: a real estate crash that's resulted in a glut of single-family homes and condos, and increasingly organized campaigns among park residents and affordable housing advocates.

"Anecdotally, the number of mobile home parks is decreasing, but at a slower rate today than a few years ago," says Jim Ayotte, executive director of the Florida Manufactured Housing Association.

Statewide, momentum is building to save the parks. The town of Davie, in South Florida's Broward County, has 31 mobile home parks containing nearly a quarter of the town's housing stock. Public pressure late last year spurred town officials to slap a year-long moratorium on redevelopment of the parks while they worked on a plan to preserve them. Earlier this fall, the Miami-Dade Board of County Commissioners passed a similar, four-month-long moratorium covering the county's 47 mobile home parks.

ENTER THE MODULAR

A new trend in coastal parks offers one possible solution for these sites: swapping aging, ground-level mobile homes for elevated modulars — at a price that comes close to the rock-bottom affordability of traditional mobile home parks.



TRIBIRD DEVELOPMENT, INC.

TriBird's 545-square-foot, one-bedroom, one-bath modulars, built atop nearly 14-foot concrete block walls that double as garages, comply with all flood and wind regulations. These, like most, have canal frontage just off the Gulf of Mexico.

Helped by a new state law that removed regulatory hurdles, TriBird Development is converting a 43-unit mobile home park, located in Hudson along Florida's sparsely populated north-central Gulf Coast, to a 43-unit modular home park. Many of the homes have water views, and all have guaranteed access to community docks with boating access to the Gulf of Mexico via a freshwater spring and canal. But their most distinguishing characteristic is price: $69,900 — a rare species in Florida, to be sure.

FILLING A NICHE

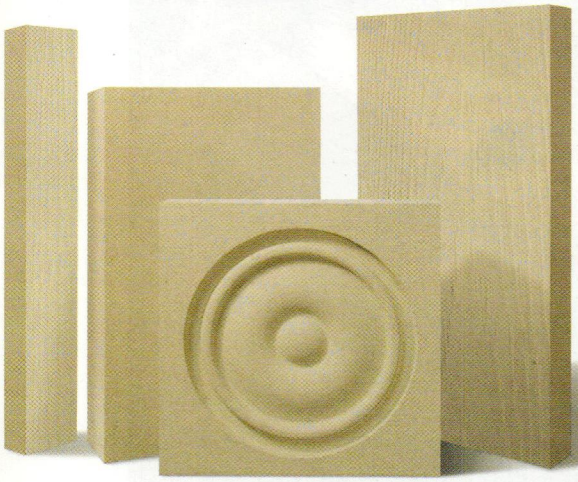
TriBird president Brad Birdsell, his brother, and father bought the run-down park in 2005. They considered carving it up into residential home sites or converting it to condominiums. But with so many condos on the market, and any redevelopment requiring rezoning, they decided to try the raised modulars. "We felt this was one thing that was lacking," Birdsell says. "Not everybody needs a 2,500-square-foot house on the water."

The Florida state legislature helped pave the way for the new approach. A law passed in 2007 frees mobile home parks to redevelop as modular parks that follow identical rules, allowing residents to own their own structures while renting the land beneath them.

The Florida Manufactured Housing Association lobbied for the law to give park owners a way to upgrade without redrawing their typically tiny lot sizes.

TriBird charges owners between $400 and $500 lot rent per unit. Birdsell insists that when considered with a mortgage, insurance, and property taxes — single-unit owners pay a 43rd share — the total monthly cost is far less than a more traditional, higher-priced single-family home and lot.

So for now, the spirit of the Florida mobile home park lives on, with at least some residents even improving their waterfront views. — *Aaron Hoover*



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5/4 (1″)		✓	✓	✓	✓	✓

- All available in 12 ft. lengths
- Other widths available upon request

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- Smooth edges for finished appearance
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8:34 AM

Hurricane Marge changes course. Again.

It's impossible to predict exactly where this charming, but chronically indecisive homeowner will go. This morning, she's decided her foyer needs to be a little more "open." Which means, for the umpteenth time, you have to rethink the window package. Fortunately, you thought ahead, and chose StormBreaker Plus™ windows and doors from Simonton. StormBreaker Plus not only gives Marge the ultimate in hurricane protection, it gives her dozens of tasteful, contemporary designs to choose from. Which means you can give Marge exactly what she wants. Even if she's not sure exactly what that is. To learn why hundreds of coastal remodelers trust StormBreaker Plus, call 1-800-SIMONTON or visit www.simonton.com.

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