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Mother Nature's wrath has always demanded respect, but in recent years it has become even more feared. If you live in a coastal area you are already strongly encouraged to increase your protection. Building code creators in these areas now are realizing that they've underestimated the potential for damage. But even if you live inland, increased incidents of rising rivers, high winds and temblors have caused growing concerns and you, too, may be considering protection options.

A round Deltec home stands strong and inviting against a darkening sky. Photo courtesy of Deltec Homes.
A variety of alternative building options exist that balance style, protection and environmental concern.

Engineered Wood

Traditional wood homes, if built to today’s stricter codes, can offer substantial resistance to high winds. Damage-assessment observations by APA-The Engineered Wood Association following Hurricane Katrina confirmed other independent reports that wood-frame buildings meeting recent code requirements performed “exceptionally well,” says Ed Keith, senior engineer.

The group participated in two damage-assessment teams, one organized by the Institute for Business & Home Safety (IBHS), a non-profit organization comprising insurance firms, and the other created by the National Science Foundation. “Empirical evidence suggests that code changes implemented after Hurricane Andrew (in 1992) resulted in improved structural performance,” the group’s report says. (The complete report, “Hurricane Katrina: Structural Performance of Wood-Frame Buildings in the Aftermath,” can be downloaded from APA’s site.)

Wood construction offers numerous benefits, including strength, affordability, fast construction, durability and aesthetic appeal, Keith notes. But too often, structural necessities that are covered up inside walls lose out in the budget to aesthetic desires or a focus on energy efficiency. Structural-wood sheathing often gives way to foam-type sheathing to provide more thermal insulation, he explains.
structure connects to the adjoining one (usually by threaded rods and bolts), to create one all-connected whole that eliminates any weak links in the chain. Hurricane straps, which connect the home to the foundation, also are available in various configurations. (For additional tips, see “Against The Wind,” a pamphlet produced by the Red Cross and the Federal Emergency Management Association).

Raised Flooring

Another option becoming more popular in the wake of Hurricane Katrina’s immense storm surge is the use of piers that lift a home’s flooring as high as four feet above the ground. The concept, promoted by the Southern Pine Council (SPC), consists of an assembly of beams, girders, joists and sheathing panels that elevates the living space, isolating it from moisture and pests. “American homes have been built on raised-wood floor systems since colonial times,” SPC says. “The aesthetic and practical reasons for building a raised home still apply today.”

The design works particularly well in the south, according to APAs Keith, where the water table is high and the danger from water surge in strong storms can be devastating. SPC notes that raised floor systems can expedite construction, create easy floor-plan changes, expand porch options, provide natural insulation, reduce flood risk and make modifying utilities easier.

Round Homes

A circular building more easily withstands heavy winds because there is no straight surface against which it can create pressure. That’s the concept behind the “circular” homes designed by Deetc Homes in Asheville, N.C. In actuality, the homes are constructed from prefabricated 9-foot-wide panels, creating polygons rather than circles. The company offers a variety of styles and designs, ranging from a small eight-panel size to a 22-panel model.

The key to the home’s design is the roof and floor systems, which are supported by the exterior wall panels and a central support. Both are truss systems similar to those used in traditional building, except they are radial, explains

The best approach, he says, is to install structural sheathing and use 2 x 6 studs rather than traditional 2 x 4s. The added depth allows high-density insulation to be used, replacing the need for foam on the exterior. It will add $1,000 to $1,500 to the home’s cost, he notes, and some adjustments to windows and doors may be needed, but it will provide a secure and energy-efficient home. The other option is to use 2 x 4 construction (“which to some builders is sacrosanct”) and double-sheathe the home, using structural sheathing as well as foam insulation.

“Studies have shown that if a home is fully sheathed with wood, it will be three times stronger,” he says. “If you add foam sheathing to that, you’ll have the best of both worlds.”

Connecting structural systems together has become a key element wherever wind loading is paramount, Keith adds. “Connecting floors to walls is the weakest link in housing construction;” he says. “Too often we see it done poorly, with the results being that the house blows apart.”

The best approach focuses on ensuring each component in the home’s...
Innovative, radial truss systems allow the creation of wide-open rooms in sleek, wind-resistant homes.

Photos courtesy of Deltec Homes.

A Deltec Home's roof trusses are supported at the center on a steel compression ring.

Joseph Schenk, director of sales and marketing for Deltec Homes. The roof trusses are supported at the center on a steel compression ring, while the floors are supported on 6-inch poles.

The design ensures the home's interiors are almost completely open, Schenk notes. A two-story home can be built with 2,500 square feet of space on each level, with the only ob-

stacle coming from a 6 inch support pole in the center of the first floor to support the second floor. "We can create huge rooms that couldn't be duplicated with typical wood trusses. That provides total design flexibility."

But it's the homes' high wind resistance due to the circular design that attracts most buyers. Schenk says the company has never lost a home to a hurricane, and the company's website is filled with testimonials from happy users who choose to build their homes in areas prone to hurricanes. "One such homeowner is profiled in this story's "EcoFascination" article on page 48. "The homes can be built anywhere from Washington state to Key West," he says.

Schenk estimates there have been approximately 5,000 Deltec homes built across the country since the mid-1980s.

Precast Concrete

Concrete homes offer high durability and can withstand high winds easily. Just as important, a concrete home can withstand the impact of windborne debris, which often causes as much damage as the wind pressure itself.

A variety of precast concrete components are being used in single-family homes today. These include:

- Solid wall panels, which often have insulation attached to the interior side. They also are used as foundation walls, eliminating many of the joints through which moisture can penetrate a basement.
- Insulated sandwich wall panels, which typically include 2 inches of insulation "sandwiched" between two layers of concrete. The design ensures the insulation
won’t settle while creating a structural wall that eliminates the need for other supports.

- Double-wall panels, in which the interior and exterior concrete layers are cast and then the space between is filled with foam insulation. The interior wall in both double-wall and sandwich panels can be used as the home’s interior without needing further finishing.

- Hollow-core planks for floors and ceilings that consist of long slabs with voids running through them to reduce weight without impacting structural strength. These planks provide large spans that don’t need added support, creating more design flexibility.

Precast concrete homes provide significantly more protection from wind-borne debris than other building materials, according to tests conducted by the Portland Cement Association (PCA), Precast/Prestressed Concrete Institute (PCI) and Dukane Precast in Naperville, Ill. Ten wall types were constructed, including wood, steel, concrete and insulated concrete forms, and various types of debris was propelled against each at varying speeds.

“...The frame walls lacked the weight and mass to resist the impact of the wind-driven debris,” the report said. “In each case, the debris traveled completely through the wall assembly with little or no damage to the ‘missile.’” Only the concrete walls stopped the debris from penetrating the walls, with only exterior finishing damaged.

PCA, PCI and Dukane Precast recently built a series of double-wall “fortified homes” in Bullington, Ill. (See “Xtreme Safety” in the Spring 2007 issue of ecoligical Home Ideas.) The homes also include tie-down connections, impact-resistant roof materials, windows and doors with high design-pressure ratings and siting work to eliminate the threat of flood or wildfire.

Straw Bales

An even more radical approach than most alternatives is home construction using straw bales. “Thousands of people have successfully built their own straw bale houses,” says Andrew Morrison, president of Strawbale Innovations and a general contractor through A.C. Morrison Construction in Jacksonville, Ore. Most straw bale homes use an entirely different form of construction than typical stick built homes. Instead, they feature post and beam construction.

The homes use timber frames as structural members, with tightly compacted straw bales as infill walls. “The bales are built up like Legos, alternating joints,” Morrison explains. The walls then are coated with 1 1/2 inches of plaster to create a weather-tight and weather-resistant design. This winter, Morrison was working on homes ranging from 1,700 to 3,200 square feet. “It’s fairly easy to learn how to construct them.” Although structural straw bale construction can be accomplished, the use of post-and-beam timbers to provide the structural support offers more flexibility and the capability of building more than one story tall.

The biggest difference in the design comes from the HVAC system, Morrison says. Straw bale homes work best with radiant heating, because such heating systems offer great efficiency in conjunction with the highly insulating straw walls. Heat pumps also can be used. The only other key difference comes in running electrical wires. Rather than drilling...
holes and pulling wires through walls, a
chain saw cuts grooves into the straw
bales to place the wire. Typically, plumb
ing bridges are avoided in exterior walls,
as pipe leaks would be difficult to detect
until they had done significant damage to
the straw.

The design is highly wind resistant,
as the typical 21-inch-thick walls offer
high density. Straw bale homes are also
about three times more fire-resistant
than typical frame construction. “It’s the
difference between lighting a crumpled
up piece of paper and a phone book,”
Morrison says. “Three houses are solid.”

In some locations, straw bale homes
are built to 150% of code requirements
because it is an alternative construction
method that only adds to their structural
soundness. “Straw bale homes have
survived high wind levels in many loca-
tions, including Kansas tornadoes,” says
Morrison. The homes can be problematic
in the South, however, because while they
can be designed to resist moisture from
rain and snow, high humidity can be a
challenge.

Even so, interest in this approach continues to grow, especially because of its
highly environmental use of materials. “We’re getting 1,200 members signing up
at our website every month,” Morrison says. “There has been a huge explosion in
interest in the last three to four years.”

Whether engineered wood techniques, round designs, concrete or straw bale
construction, the use of alternative building systems continues to increase as
more homeowners look for ways to create aesthetically pleasing homes that are
environmentally friendly, offer high energy efficiency and that will still be standing
after Mother Nature passes through.

By Craig A. Shutt

RESOURCES
American Red Cross, www.redcross.org
APA-The Engineered Wood Association, www.apawood.org
Concrete debris tests, www.cement.org/homes/brief07.asp
Deltac Homes, www.deltachomes.com
Dukane Precast, www.dukaneprecast.com
Finfruck, www.finfruck.com
Dukane Precast, www.dukaneprecast.com
Raised flooring, www.raisedfloorliving.com
Strawbale Innovations, www.strawbale.com

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