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Builders learn to adapt to different regions and seasons

If there is one thing to be said about building homes in the U.S., it is this: There is, in fact, little that can be called standard building practice. From the frozen reaches of northern Alaska to the sweltering heat of the desert, the U.S. is host to some of the world's most extreme and divergent weather conditions, and to build a home in each environment often requires a uniquely local bag of tricks. In New Orleans, for instance, hurricane-driven rains can pelt a home at 140-plus miles an hour, while in the Pacific Northwest it is the near constant soak of rain that most threatens the life of a building.

To find out how builders are building in these and other extreme weather conditions, we called upon professionals from around the country and asked them to share a few ways they have found to outwit Mother Nature.

HEAT

In Phoenix, the summer heat can slap against the skin like a thousand tiny bee stings. The average daily high, from early June to late August, tops an easy 105 degrees, with record temperatures boiling to 120 degrees or more.

During the summer of 2010—the ninth-hottest summer on record—even the nights in Phoenix brought little relief, with an average nighttime temperature of 84 degrees and at least a few nights remaining well above 90.

Keeping out the heat is an obvious priority for homebuilders in such blistering climates, but as local homebuilder Jeff Lupien notes, in the Valley of the Sun there is more than just heat to

contend with.

“Unfortunately, the sun gets into everything out here,” says Lupien, a senior project manager with Kitchell Custom Homes, a high-end Phoenix homebuilder. The first and obvious line of defense for beating the heat, says Lupien, is building a well-insulated home, which Kitchell achieves by sealing the exterior with open-cell foam. The greatest challenge, beyond that, says Lupien, is combating the sun. A few of the more common and less-expensive approaches to beating the heat begin with the design and placement of the home, with the goal of orienting the home to the north and east and away from the sun. When this is not possible, however, Lupien recommends installing high-quality, Low-E, aluminum windows.

Two particular favorites of Kitchell clients, Lupien says, are Fleetwood Windows and Western Window, both of which manufacture a luxury, all-aluminum, Low-E window with thermally broken frames that help reduce the transfer of heat from the exterior to the interior. If a client wants a high-efficiency window without the tinted glass, Lupien often suggests a specialty glass, the Solarban 70Xl from PPG, which provides an equivalent solar control, without the tint.

Protecting the home’s exterior is another important concern, Lupien says, and for this Kitchell relies on materials that can handle the heat and resist fading. Stone and stucco are favored choices for the siding, or better yet, adds Lupien, synthetic stucco, like Western 1-Koat, from Western Stucco Co., which is more flexible and less prone to cracking.

For steep-pitched roofs, Lupien prefers a metal roof with a Grace Ultra underlayment, while for flat or low-pitched roofs, he recommends closed-cell foam sealed with a derby-gum membrane. The metal, he says, sheds the heat more efficiently than tile, and the derby-gum withstands UV deterioration far better than the more commonly used elastomeric coating. “In the cold country,” Lupien notes, “you want the sun to come in and warm the house, but here in Phoenix, we do everything we can to keep it out.”

RAIN

In the mid to late 1990s, what many called an epidemic swept through the Pacific Northwest, from Vancouver to southern Oregon, causing a major health concern and spurring a critical review of the region’s building codes and practices. The problem was widespread failure of

building envelopes, resulting in extensive black mold and rot damage and almost exclusively affecting homes and buildings built since the 1980s. By the time the full scope of the problem was realized, “the city of Seattle estimated that 50% of all multifamily structures (in the city) had undisclosed rot that needed remediation,” says Jim Freeling, the founding engineer of Seattle-based firm Building Envelope Engineers (BEE).

“What is going on,” Freeling says, “is that we have southwesterly winds…that take up storms from the South Pacific and hit us along the coast.” These storms, he explains, which might occur six to eight times a year, pelt the Pacific Northwest with rain and cause a phenomenon known as wind-driven rain, where unequal internal and external pressures turn the house into a straw that literally sucks up the moisture. The region’s then otherwise damp climate provides rain-soaked homes little opportunity to dry out.

The Pacific Northwest, explains Freeling, is damp more than 50% of the year, meaning that any moisture that infiltrates a building might remain moist for upwards of six months, and in a warm, wet wall, mold can germinate in a matter of days. That said, Freeling is less inclined to blame the weather. “I don’t blame the wind and the rain for the leaks,” he says. “It has to be in conjunction with poor construction practices.”

What happened, Freeling explains, is that in the early to mid-’80s, energy codes outpaced building practices, calling for tighter and tighter homes that, in effect, couldn’t breathe. In the pursuit of saving energy, the allowable rate of air flow in a home was restricted and ventilation reduced, but when coupled with more efficient windows, an interior vapor barrier and other measures, the result was, in effect, a vapor lock. What moisture got in a wall, stayed in the wall, rotting the wood and causing mold.

Not surprisingly, once the problem was understood, the solution was relatively simple: The wall needed to breathe. Today, explains Freeling, nearly every project in the region is built with a drainage plane (or rain screen) behind the exterior cladding, which sheds the exterior water, while allowing interior moisture to escape. Though there are numerous products used to create this drainage plane—from mesh-covered housewrap to plastic furring strips—Freeling relies on the older method of installing ¾-inch battens over an exterior housewrap and nailing the siding to the battens.

Typically, Freeling specs out any one of several housewraps from VaproShield—depending on need and budget—but he most prefers the company’s WallShield, which works like

Gore-Tex to keep out air and rain, while letting moisture escape.

"We are now wrapping a house like we dress ourselves in the winter," Freeling says. "These are sophisticated designer products and solely what we spec out in the Pacific Northwest."

COLD

When it comes to building homes in cold-weather climates, it's hard to contend with builders like Dave Dillard, president and treasurer of 3-2-1 Construction Inc. in Fairbanks, AK. The average winter temperature in Fairbanks, from early October to late April, rarely beats freezing, while midwinter lows can plummet to -25 degrees for days at a time.

"It is just amazing what we are trying to do here," Dillard says. "We are sometimes trying to keep a home 100 degrees warmer than the outside temperature." Dillard has been a Fairbanks builder for more than 30 years and has, in addition, held numerous, high-ranking positions in the Alaska State Home Building Association, the Interior Alaska Building Association and the National Association of Home Builders. In 2000, he helped develop the Cold Climate Housing Research Center (CCHRC), where he continues to serve on the board.

The CCHRC was founded in 2000 by Fairbanks builder Jack Hébert, owner of Hébert Home LLC, with a mission to research, develop and test building materials and methods for cold-weather climates around the globe. As Dillard explains, prior to the founding of the CCHRC, Alaskan builders often adopted building methods developed in other climates, only to have them fail in the Alaskan extremes. As an example, Dillard cites similar rot and mold problems experienced in the Pacific Northwest. "Several years ago, when energy got so expensive, we tightened up the envelope, but then we caused a vapor problem by not ventilating properly," he says.

The most recent innovation of the CCHRC, says Dillard, was introduced about five years ago and has quickly gained traction with Alaskan builders. It is an insulating method known as the Residential Exterior Membrane Outside-insulation Technique (REMOTE wall system), or as Dillard jokingly refers to it, "outsulation." The CCHRC borrowed much of REMOTE from an older, Canadian system, and after conducting a series of tests, made a few alterations and improvements.

In simple terms, REMOTE installs the vapor barrier and a percentage of the insulation on the exterior of the home's sheathing, bringing the dew point to the exterior of the wall and greatly reducing the potential for rot or mold within the wall cavity. The wall is constructed with a standard 2x4 or 2x6 framing, sheathed with plywood or OSB, and then covered completely with a nonpermeable membrane, such as Grace Ice and Water, Tyvek DrainWrap or 8 mil plastic. Four to six inches of foam insulation is then installed outside the membrane and secured to the house by furring strips and long screws. The siding is then attached to the furring strips.

Dillard then uses blown-in fiberglass insulation to fill the wall cavities, resulting in an airtight, well-insulated wall, with a drainage plane behind the siding, an impermeable membrane and a dew point outside the wall structure, rather than within the wall cavity. For any moisture that enters the wall, the interior vapor barrier is eliminated, allowing it to dry to the inside, where, of course, great effort is made to properly vent the home.

WIND

Since long before Hurricane Katrina, builders, architects and engineers were working to build more storm-resistant homes, but since the storm's shocking devastation an increased sense of urgency has developed in the market. Katrina, and other recent storms, made the worst of Mother Nature an immediate reality, and the fear of a repeat now concerns every community from Galveston, TX, to the southern Atlantic seaboard.

For two homebuilders in the region, both of which are working to outwit the wind, the solution has come down to a question of geometry and the difference between a circle and a square.

Deltec Homes, in Asheville, NC, has, since 1968, designed and manufactured a panel-system home that is literally outside of the box of thinking when it comes to withstanding wind. The company manufacturers a "circular" home, which is more accurately described as a multisided home containing up to 22 8-foot sides and encompassing up to 2,500 square feet per floor.

It is the spoke-like construction that makes a Deltec Home particularly resistant to hurricane winds, explains Steve Linton, the director of sustainable technologies at Deltec. As with the

spokes of a wheel, the floor and roof trusses radiate out from the center of the building, so that any force applied to one side of the house is displaced throughout the whole of the building, vastly increasing its strength. The circular design also diminishes the buildup of pressure on one side of the building, reducing the potential for an imbalance that can facilitate the intrusion of wind-driven rain.

In New Orleans, another company, Build Now, is taking an entirely different approach. Rather than look for an out-of-the-box solution, Build Now is building homes that build the box one better.

Build Now is a nonprofit, founded in the wake of Katrina with a mission to provide safe and affordable housing to some of the city's worst-hit residents. A leading feature of any Build Now home—38 of which have been built in the past two years—is that it is elevated on pillions buried some 30 feet into the ground. Breakaway trellis paneling is then used to skirt the home, which will allow any future flooding and fast-moving water to pass beneath the house with minimal impact. This, however, is only one of several measures used to improve the home, says architect William Monaghan, the founder of Build Now. To help increase the strength of the building, Monaghan designed the homes without overhangs, which, he explains, prevents any uplift on the roof during a storm, while also allowing the whole of the building to be locked together as one continuous unit.

Without overhangs, Monaghan explains, the rafter tails are cut flush to the framing and a 10-foot sheathing panel is used to tie the floor's rim-joists directly to the rafter tails. This, Monaghan notes, also provides a less-expensive option to metal hangers and other more costly means of tying down the roof.

On the exterior of the home, Build Now, as well as Deltec, then installs an impact-resistant housewrap, such as Typar StormWrap, which helps protect the house from damage caused by flying objects. To insure proper installation of the housewrap, Monaghan draws out detailed plans of everything from taping the seams to flashing the windows, which, he says, the importance of which cannot be overstated—no matter the weather conditions.