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Shelter from the Storm

If you built houses no hurricane could knock down, and the technology only added \$3000 to the price, would they sell?

Bill Lurz, Senior Editor
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Professional Builder

Florida-based Giant [Mercedes Homes](#) is betting the farm that home buyers are willing to invest an extra \$3000 to \$5000 to live in houses with cast-in-place solid concrete walls — 6 inches thick — that withstand hurricane winds of 200 mph.



Keep your eye on how this plays out. Another hurricane season like the last two and we may see half the country living in houses like those profiled in the next seven pages.

No Hindsight Here

Since 85 percent of Mercedes' production is in Florida, and the rest in the Carolinas and Texas, its gamble is looking more like a safe bet with each passing day. In fact, in the aftermath of Hurricane Katrina and the four storms that battered Florida last year, the technology Mercedes spent eight years (and millions of dollars) to develop just might be the kind of thunderbolt that changes the conventions of home building in a sizable chunk of this country. Mercedes' foresight gives the firm a sizable lead in a technology that seems destined to meet burgeoning demand head-on.

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"The way we look at it, there's a good chance some of the homes that will be rebuilt in Louisiana, Mississippi and Alabama will not use wood-frame construction," says Mercedes' Corporate Vice President of Operations Stuart McDonald. "We think many of them will use concrete technologies of one kind or another. It sure makes sense to me."

By the time home improvement guru Bob Vila finishes a 13-part TV series (begun last month) that features Mercedes building a new, 2400 square-foot, four-bedroom, cast-in-place concrete home in Punta Gorda, Fla., for a couple who lost their home to Hurricane Charley in 2004, home buyers from Chesapeake Bay to Brownsville, spooked by storms, may be clamoring for solid-wall houses. And Mercedes knows how to build them.

The firm has been working for years with University of Florida building scientists and engineers, housing technology consultants Steven Winter Associates, the Federal Emergency Management Administration, HUD's Partnership for Advancing Technology in Housing (PATH) and FLASH (the Tallahassee, Fla.-based Federal Alliance for Safe Homes). "We've been at it for eight years," says Mercedes COO Scott Buescher, "the last five with multiple public and private partners. After all, we build most of our houses in Florida, the state most vulnerable to hurricanes. It makes good business sense for us to build houses that are very hard to knock down. We made it a goal to build stronger houses than any of our competitors — stronger, safer, and more energy-efficient — and we want to build them faster than we've ever built houses using conventional concrete block or wood-frame construction."

(Mercedes closed 4579 homes in 2004 for revenue of \$932 million, enough to rank No.30 in *PB's* Giant 400.)



"We built four different kinds of concrete-wall houses before we settled on the cast-in-place technology we now use, which we call *Solid Wall Systems* (SWS). We've built 3000 of these houses. More than a third of our production is now in this technology," Buescher says, "and that percentage will keep going up. The best thing about SWS is that it's so versatile. We can build every house plan in our portfolio, across many different price points and architectural styles, attached as well as detached. And our customers can make changes to those plans."

"We can also get the forms up and pour concrete in a two-day process. Speed is the big weapon we have in getting the costs of this system down close to those of frame or concrete block. This will probably always be a little more expensive," Buescher says. "But we think the differential against frame will eventually be lower than the premium we now have against concrete block — about \$3000 to \$5000, depending on the size and complexity of the plan. We've yet to market this at all. When we do, we believe an even higher percentage of our buyers will decide to go to a solid-wall house."

Bunker Strong, But Beautiful

Mercedes opened two prototype homes this summer to test a new generation of its SWS technology, with some innovations aimed at what Buescher sees as the next battleground of builder versus nature. "We have the strength and wind resistance where we want it," Buescher says. "We have steel in the footings, which ties to the steel in the wall, which is tied to the steel wire mat in the wall, and that's tied to the steel around the perimeter of the house. So everything is tied down to the footings, encased in concrete, and then we wrap hurricane straps that are set in concrete up (see photo above) and around the roof trusses, with a double tie-down on both sides. So the strength of this structure is phenomenal."

"You can shoot a 2 x 4 through a concrete block wall at 120 mph," Buescher says. "If you do the same on this poured concrete wall, the 2 x 4

shatters or just bounces off. The studies we've done at the University of Florida show that this wall stands up to projectiles at 200 mph. We don't tell that to consumers because we don't want people saying we guaranteed their house would not be damaged in a 200 mph storm, but if we have a problem in a storm like that, we're pretty sure it won't come from wind or debris. It will be water penetration.



"One of the things we learned from the four hurricanes we had in Florida last year was that our houses were able to stand up structurally. We didn't have a bit of structural damage, but water was still getting in. We had University of Florida building scientists and engineers walk houses that came through two hurricanes in three weeks on the east coast of Florida. They analyzed where the water got in, and some of it you just wouldn't believe," Buescher says.

"A storm like that creates a pressure differential between the inside and outside. It's like a vacuum that sucks water into the house. Unless we learn to pressurize houses like airliners, water intrusion will always be a problem. We can't stop it completely, but we can reduce it. Water tightness is the next frontier, and that's what we're working on now."

Stopping the Water

The prototype houses were completed this past summer at Mercedes' Huntington Lakes development in Rockledge, Fla., in Brevard County. In addition to 6-inch-thick, cast-in-place concrete walls, the technology on display includes many innovations designed to limit water intrusion in rains driven horizontally by hurricane-force winds:

- Outswing entry doors that are more resistant to wind loads and prevent water from being forced past the weather-stripping common on in-swinging exterior doors.
- Removable hurricane shutters to protect window openings from wind-driven rain and debris impacts.
- Recessed seats in the foundation slab for walls and entry doors to prevent rain draining off the exterior from entering the home.
- Soffit vent openings limited and reconfigured to prevent water from being driven or sucked into eaves during pressure differentials.
- Baffled roof vents to make it more difficult for rain to penetrate into attic spaces.
- Elastomeric sealant at concrete form joints and snap tie locations to prevent water from entering at vulnerable seams.
- Secondary roof drainage plane made of a continuous peel-and-stick underlayment provides protection from rainwater penetration if roof shingles are lost or damaged during a storm.
- High-performance acrylic finish coatings prevent exterior of walls from absorbing water during heavy rains.

"We actually started before the hurricanes last year to study water intrusion issues," says Steven Winter Associates senior architect William Zoeller. "When those four storms blew through Florida, we went out and looked at houses that failed all over the state. Water intrusion was easily responsible for more damage than catastrophic structural failures. Hurricane Charley had some wind-caused failures. It was more of a fast-moving, compact, knock-a-house-down kind of storm. But the others were not. They just hung around for 24 hours dumping horizontal rain on building systems that were not designed to handle it.

"The more storms of that type we have, the more pressure there will be from consumers, the insurance industry — everyone to find solutions. Frame construction could go away in the Gulf states. That wall construction has some real limitations. It's essentially a cavity filled with a material (insulation) that absorbs water. It's sure not going to stand up to a hurricane like a 6-inch-thick solid wall of 3500 psi concrete."

Energy Efficiency Provides Payback

The prototype homes in Brevard County achieve Energy Star efficiency ratings by using windows with low-E glass, a tight building envelope facilitated by the cast-in-place concrete construction and a continuous barrier of foam insulation boards applied directly to the exterior of the concrete walls.

Mechanical systems were also carefully balanced to maximize efficiency and ducts were mastic-sealed to reduce air leakage. A high-efficiency heat pump provides efficient heating and cooling. And energy modeling helps predict and optimize efficiency.

Mercedes believes it is important to find ways to make solid-wall houses operate efficiently enough over time to pay back the investment consumers make upfront in the poured concrete wall system. "We're also working with the insurance industry to try to get lower home owner insurance premiums for these houses, since they are so much less likely to be damaged, even in a catastrophic storm," says McDonald.

Dr. Pierce Jones, director of the University of Florida's Program for Resource Efficient Communities, believes Mercedes will eventually find paybacks for customers not only in energy efficiency, but also in other benefits of the cast-in-place concrete technology.

"The two big advantages of the solid-wall systems that nobody seems to see at first are the reduction in the danger of damage from fire and from termites," Jones says. "The key advantage that promotes energy efficiency is that there's no cavity in a solid wall, so there's no place for air to flow. There's no air infiltration. And when they build these walls, they use very precise aluminum frames that allow them to create a 1/4-inch lip against which they can seat the windows.

"That not only helps to hold the sash in place during a wind storm, but also makes it simple to seal it to prevent water intrusion.

"In frame construction, imprecision in sealing windows can lead to small leaks that eventually cause wood decay and damage to the drywall. This is not to say that you can't create the same precision in a frame or block home. But when you do it with a metal form that's used over and over again, you always get the same result. In block or frame construction, you have to depend on the workmanship of the trades installing the window.

"Mercedes' system is precise, uniform and repetitive, like a manufacturing operation. That's what I like about it," Jones says.

He estimates the energy payback potential of Mercedes' solid wall homes at 15 percent to 20 percent in total energy consumption over conventional homes that meet the Florida Building Code, if the Mercedes houses qualify for Energy Star.

"This is a production builder," Jones comments, "and they are building a lot of entry-level homes that sell for close to \$100,000. Every dollar counts in that market segment, so not all of their divisions reach Energy Star performance, especially at those low price points. We've talked to them about putting their air handlers in conditioned space. When they do that, they easily reach Energy Star performance.

"The two houses in Brevard are Energy Star, but remember, Energy Star only applies to heating, cooling and hot water, which we estimate only accounts for 50 percent to 60 percent of the total energy load of a house. Where they are Energy Star, they are reducing heating, cooling and hot water expenses by 30 percent or more, so that means total energy bills are down 15 percent to 20 percent. That's enough to create a payback that will impress consumers. I think they should go solid-wall on all their houses, even at the starter home level.

Jones is excited to see Mercedes' division in Jacksonville, Fla., which now builds frame houses — as do competitors — beginning to offer cast-in-place, solid-wall construction to that market. "If they can go head to head against frame builders and win some of those buyers with the superior performance of this technology, it means solid-wall systems may have the potential to win buyers in Texas, Mississippi and the Carolinas. I'd like

to see that because these houses perform better over time, especially in catastrophic storms."

Big Payoff: Two-Story Homes

Mercedes is now working on a new prototype home that breaks one of the biggest barriers of all for a cast-in-place, solid-wall concrete home — two stories.

"It's under construction, and we think we can get the process of pouring concrete down to three days, which will make it faster than building a two-story frame house or a concrete block house with a frame second story — which is the norm here in Florida."

If the firm can accomplish pouring concrete for a two-story home, it will be a major advance over the current practice of placing a frame second story over a block first floor. "If Mercedes can do a two-story, pre-cast wall system, it will turn the housing industry in Florida on its head," raves Jones. "Frame second stories have failed badly in the hurricanes, all the way back to Andrew. When we looked at the failures and water intrusion problems after Hurricane Frances last year, most of them involved frame second stories. A decade ago, most of the worst failures associated with Andrew involved frame second stories blown completely off. I haven't seen this prototype yet, but I'm anxious to do so."

A Star Is Born

TV home improvement maven [Bob Vila](#) is making a star of Buescher and a number of other Mercedes employees who worked on the Punta Gorda home, but our guess is that the biggest star of all will be the house, and especially the poured-concrete wall system.

"We've already been swamped with inquiries just from a three-minute network news segment Vila produced," says Stuart McDonald. "We got Nielsen ratings that told us three million people saw it."

Vila devotes an entire show to the wall system, watching as a crew attaches No.5 steel reinforcing bars to existing rebars set in the stem walls, then explaining how the vertical rods run the entire height of the walls. Once the vertical rods are set, the crew is shown measuring and marking openings before setting the wire mesh that further reinforces the walls, then proceeding with the concrete pour.

Time will tell how much demand for this form of construction emerges from such exposure. Our guess is it will be enough to keep Mercedes busy and smiling about the investments made over eight long years. As for other builders who may want to jump on the bandwagon, get ready for a long learning curve.

"The big difference in this is that we had to invest millions of dollars upfront," Buescher says. "Then training people to use it is huge. How do you take a block mason or carpenter and train him to set forms and do concrete work? We never kept track of all those training costs, but we probably have \$2 million invested just in the forms. And we had to build cages to move the forms around on the jobsite because the forms weigh 100 pounds or more each.

"Then we had to build special trucks to haul the forms around, with fork lifts rigged on the back. We're still learning how to train people to be efficient enough to get it all done in two days."

Does it create a competitive advantage?

"Absolutely," Buescher says. "And every time a hurricane hits, that advantage grows."

The mystery is why Mercedes has not begun marketing the benefits of the solid-wall system — and the potential payback from energy savings — before now. "We're working on it," says McDonald. "We're thinking it through right now."

Without a doubt, Bob Vila has changed that thought process. Vila has also perhaps made the whole subject of

solid-wall concrete houses more interesting to other builders, especially Giants that can afford the investment.

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