BUILDING TOUGH

Rebuilding a Flooded House

Post-Harvey, a builder sets his new home on a tall crawlspace

BY DAVE YELOVICH

When Hurricane Harvey brought 5 feet of floodwater to my neighborhood in Friendswood, Texas, my family and I faced a choice. Like all of our neighbors' houses, our 1970s-era ranch house was badly damaged. What should we do? Should we repair the house sitting at grade where it stood? Should we elevate the existing house on a new foundation? Or should we tear the whole place down and start over?

But those decisions would have to wait, because after any flood, the first thing they tell you to do is clean up. Partly that's for health reasons: There's going to be a parade of insurance folks and government folks marching through to evaluate things, and the house can't be full of rotted junk. And for insurance reasons, you need to clear out everything that's damaged, make lists, and take plenty of photos to document your losses.

If you let everything sit there waiting for someone to make a decision, insurance policies typically won't cover the increased damage that will result if mold takes over the entire house. Flood insurance coverage usually applies only to the immediate effects of the water, not to things that happen later.

So as soon as the water went down and we could go back to the house, we gutted the walls and put all the debris out at the curb. And then sure enough, along came the insurance people, FEMA, the Small Business Administration (SBA), and all the other federal and local agencies to see what was going on.

Photos by Dave Yelovich

IS THE HOUSE WORTH SAVING?

This wasn't our first rodeo. Our house backs up against a creek, and it had flooded 18 inches deep during Tropical Storm Allison in 2001. That time around, flood damages penciled out to about 46% of assessed value, just barely below the 50% threshold that would

Up to the eyebrows. The author's house, which backs onto a creek in Friendswood, Texas, flooded 5 feet deep in Hurricane Harvey **(1)**. All the interior materials and finishes were ruined, including the wood flooring shown here **(2)**.

have required us to elevate the building when we rebuilt.

This time, I knew the damage was much worse. But because of some policy maneuvers by the city, we might theoretically still have the option of repairing the house where it stood. With help from the estimators at my company, we worked up a schedule and got some pricing on that work. I figured the cost of that option at about $150,000.

What if we were to elevate the existing structure, slab and all? That idea was all over the news, so I got a couple of bids. To be sure of being high and dry, we wanted to go up 8 feet, because we had gotten 5 feet of water in the flood. Depending on the company, raising our existing house that high would cost somewhere between $200,000 and $250,000; and then we'd still be facing $150,000 in repair work, plus incidental site work, plus a premium for the fact that the work would be higher up in the air. So bottom line, we'd be looking at $400,000 to $450,000—an awful lot of money for us to come up with, for saving a house that would never be worth that much. The idea seemed like a non-starter.

One of the guys from work said, "Hey Dave, no offense, but you're not getting younger. If you rebuild this house at grade now, can you do this again in five or ten years? Why don't you tear it down and rebuild higher? Because otherwise, you know it will flood again."

It wasn't what we wanted to hear, but he was right. We live on a creek, and creeks go up and down. If we left the house sitting there, we were going to have to gut it out again someday. Preserving and elevating it was too expensive, especially for an outmoded 1970s house. When we took the emotion out of the equation, and just looked at the situation as if we were accountants trying to get the best deal for a client, the answer was clear: Knock it down, rebuild it up in the air, and do the whole thing right.

Cleanup. The first priority in any flood is to clean up, in order to minimize health risks and prevent ongoing damage from mold and rot. The author's family and friends gutted out all the walls **(3)**, revealing existing outdated structural details such as gypsum sheathing and diagonal bracing **(4)**. All the debris was dumped at the curb **(5)**.

WHETHER TO SAVE THE SLAB

The existing house was built in 1975 on a monolithic slab-and-grade-beam foundation. Almost 14 years ago, however, I had installed concrete piers to help support the slab. I knew there were elevation readings taken at that time, so I called the slab company and asked them to re-check the slab's elevation to see if it had moved. After adjusting for the half-inch flooring we had stripped off, they found that the slab hadn't moved even $1/8$ inch in 14 years. So that was good.

Then I asked a colleague from work to inspect the slab and assess it. He concluded that there was nothing wrong with the existing slab, and he pointed out that even though our new home would be one story taller than the original house, we were using HardiePlank siding instead of brick veneer—so our new house, although it was larger, would weigh less than the house we were replacing.

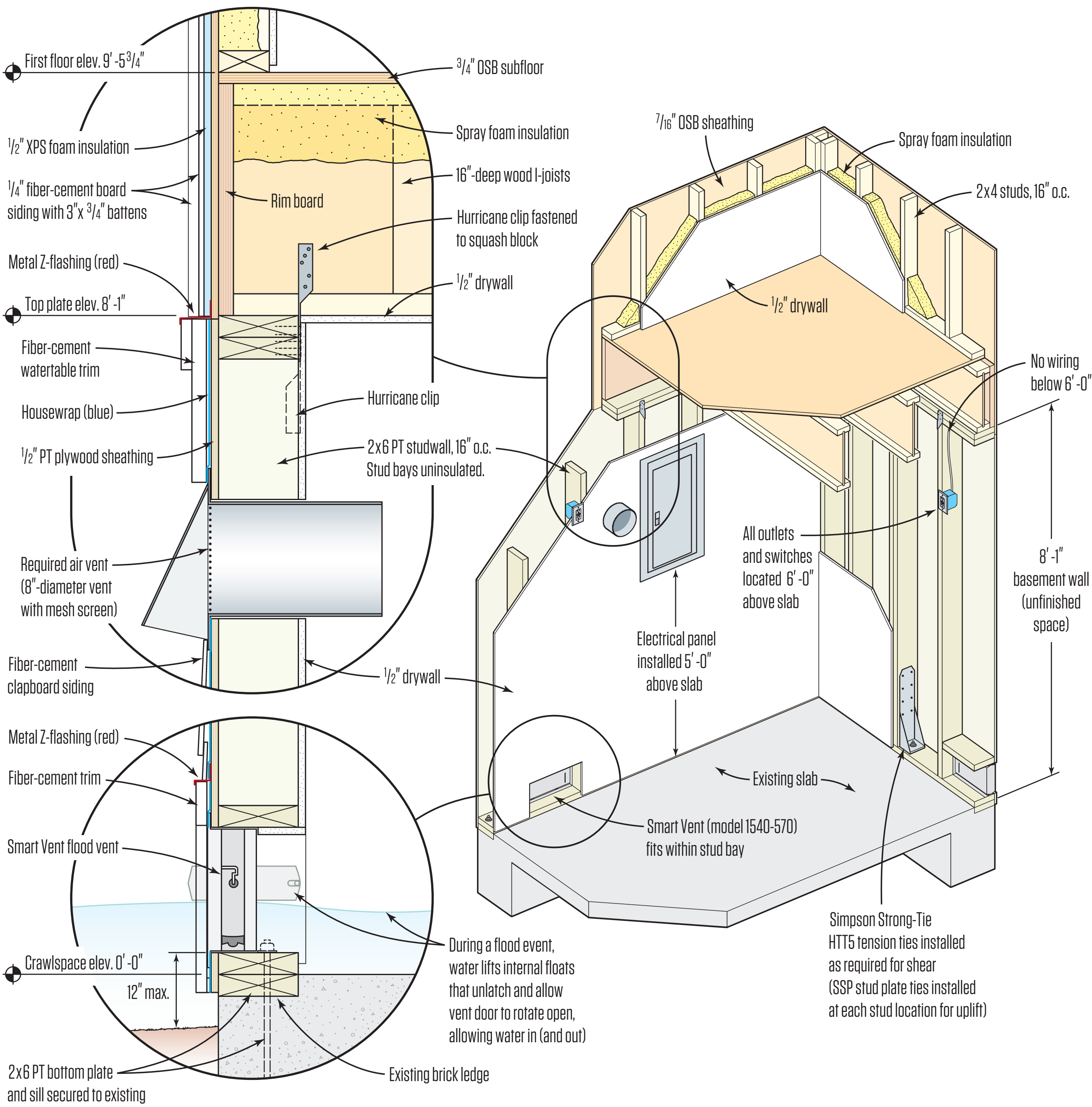
After considering all that, we decided to re-use the existing slab—which saved us about $50,000 compared with the cost of demolishing the slab and building a new foundation to replace it.

HOW HIGH SHOULD WE GO?

When I started to ask questions at the building department, I learned that a new house at this location would need to have the lowest framing member for its first occupied floor situated 2 feet above base flood elevation (BFE). When I had our existing slab surveyed, we found out that the slab sits 6 inches below the BFE. So if I built our new house on a crawlspace, that crawlspace would need to be at least $2\,1/2$ feet high.

I said to the flood-plain manager, "Well, we flooded 5 feet deep in Harvey. If we duplicate Harvey, and I've built $2\,1/2$ feet high, we'll just flood again."

Vented Crawlspace for a Flood Plain



The author coined the term "Texas basement" for this 8-foot-tall space, with room for storage, that is detailed like a crawlspace with flood vents at the wall base, ventilation openings near the ceiling, and shear-wall details engineered to handle the uplift and lateral forces of 120-mph hurricane-force winds.

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Anchors and vents. The author secured the crawlspace wall sole plates to the existing foundation using Titen HD structural bolts from Simpson Strong-Tie **(6, 7)**. The space's 8-foot walls are detailed as shear walls for windstorm resistance **(8)**, including 4-inch-o.c. nailing and beefy hold-downs. Flood vents operate automatically to relieve water pressure in case of a flood **(9)**.

Besides that, I'm 6 feet tall, and I wanted to be able to use my crawlspace for storage and such, not crawl around it on my stomach. The flood-plain manager told me that I could build higher than 2 1/2 feet if I wanted to; but he could only require me to build 2 1/2 feet high.

Well, studs are 8 feet long, and so is plywood. And considering that we had already experienced 5 feet of floodwater, I decided that if I had to go up anyway, I would go up 8 full feet and have a full one-story space that I could stand up in and use. Technically, it's still a crawlspace, and it would still have to be detailed as a crawlspace: unoccupied, with flood vents and air vents. But I began to call it my "Texas basement."

THE TEXAS BASEMENT

The demo company used Bobcats to scrape the slab, and in the process, they either cut off or bent over all the existing anchor bolts. So we had to replace all of those, using Titen HD bolts from Simpson Strong-Tie. The engineer called for 1/2-inch bolts 6 inches long, set at 32 inches on-center, but all my supplier had were 5/8-inch bolts 8 inches long. My engineer was fine with that change—and at the same price for a much beefier connection, so was I. Our guys did wear out a few drill bits putting those bolts in, though—40-year-old concrete is hard.

Besides being in a flood plain, we're also in a hurricane exposure area with a 120-mph design wind speed. So the anchor bolts are just the lowest element in a wind-resisting load path that goes all the way up to the ridge. All the exterior walls, as well as some of the interior partitions in the crawlspace, are detailed as shear walls, with 1/2-inch treated plywood on the treated studs, nailed with galvanized nails at 4 inches on-center in every stud. Some of the interior shear walls go right up through the upper-story partitions all the way up to the ridge. We used Simpson HTT5 hold-downs at the ends of the shear-wall panels, and Simpson SSP stud plate ties to tie studs to the sole plate at the foundation, and Simpson H-2.5A hurricane ties at the top of the wall to tie the studs to the wall plates.

We used treated wood (UC3B, which is rated for aboveground use, but not rated for ground contact) for the entire crawlspace wall system. All the plates are treated, all the studs are treated, and all the posts are treated. The lowest untreated piece of wood is the top plate of the 8-foot lower wall.

Technically, I could have used treated wood for just the part of the structure that lies at or below the BFE. I've seen some buildings on which they've done just that: used an 18-inch-wide strip of treated plywood at the bottom of the wall. But treated plywood is only a few bucks more a sheet, so we framed and sheathed all the way up the "crawlspace" wall with treated studs and plywood. To make sure the framers didn't accidentally mix in any

Resilient details. Hurricane clips at the top of the crawlspace wall form part of the uplift and shear load path **(10)**. Closed-cell spray foam defines the thermal boundary of the first occupied floor **(11)**. Power and mechanicals are elevated above the level of the Harvey floodwaters **(12)**. Screened vents provide cross-ventilation **(13)**, required by code for an uninsulated crawlspace.

untreated wood, we didn't have anything but treated wood shipped to the site until our Texas basement walls were all framed.

We installed about a dozen Smart Vent flood vents, strategically placed around the base of the walls. For aesthetic reasons, we placed them all on the side and back walls; but then again, the back of the house is where the creek is. Smart Vent provided engineering services to spec out the vents. They were easy to install because they're sized to fit neatly between two studs at 16 inches on-center. We just blocked in for them and installed the siding right over the opening. Then we cut the siding out with a recip saw and popped in the vents, adding a little trim for looks.

At the top of the wall, 8-inch round ducts provide the required ventilation. These are also spread around the walls to allow cross-ventilation and are screened to keep the bugs out. On a hot day, the space under the house seems to stay about 10°F cooler than the outdoors.

The "Texas basement" has ceiling lights and wall switches and outlets, but the electrical panel for the space is located 5 feet above the floor, and the outlets and switches are 6 feet up. I've installed shelving at 5 or 6 feet high as well, to keep our belongings dry if it floods. We also lifted the air-conditioning equipment up almost 10 feet, to be above any future floodwaters.

The inside walls of the space are drywalled to comply with the local fire code. The next time our creek floods the house, we'll have to strip that material out and replace it. Otherwise, our 8-foot-tall crawlspace is ready for another Harvey. And we rebuilt our entire house, using modern energy and building-science details, for less than what it would have cost us to elevate the existing one as it stood, not counting repairs.

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