

# Mitigation best practices



FEMA

## Building codes helped Bolivar Peninsula homes survive

“We opened the door and everything was just fine.”



Photo by Roy Tyson - FEMA

Jimmy and Debbie Bishop's house survived Hurricane Ike nearly unscathed. Their neighbor's older home, pictured on right, was built 4 to 5 feet lower and was significantly damaged.

**BOLIVAR PENINSULA, Texas** – Hurricane Ike tore across this 33-mile-long arm of land that juts out into Galveston Bay, leaving devastation in its path.

Unprotected by a seawall or other barrier, the peninsula suffered arguably the worst of Ike's fury. Winds of up to 110 mph and a 14-foot storm surge hit the peninsula broadside from the gulf, crossed far inland, and then doubled back around to drown it from the backside.

The full impact of the September 2008 storm on the people of the Bolivar Peninsula may never be known. Officials with the Galveston County Office of Emergency Management said 20 people were either confirmed dead or still missing months after the storm.

Some 5,300 buildings, most of them homes, were located on the peninsula before the storm. Afterwards emergency managers in aircraft could count 2,087

### At a glance

Hurricane Ike did its worst to the Bolivar Peninsula, but a few buildings survived. The sturdy, elevated home of Jim and Debbie Bishop came through with few scars.

rooftops, including those on sheds and skeletons of shattered homes. Only 102 buildings were left unscathed. The owners of a few surviving homes on Bolivar Peninsula, such as Jimmy and Debbie Bishop, have important stories to tell and lessons to share.

The Bishops came back to check on their vacation house a few days after the storm. The drive was eerie down Highway 87, the main road that runs the length of Bolivar Peninsula. To get to their



Photo by Roy Tyson - FEMA

Bolivar destruction.

home, they had to circle through a field, maneuvering around downed power lines, pieces of buildings and twisted debris.

“No matter how many pictures you see, the first-hand view of the reality compounds it 10 times,” Jimmy said. “Roads were covered with 2 to 3 feet of sand. There was debris everywhere. We couldn’t even find the street to our subdivision.”

Their subdivision, Sea Breeze, had about 35 houses before the storm and no more than a dozen afterward. Many of their neighbors’ houses, including the first two rows along the beachfront, had simply disappeared. Their house had been on the third row back from the beach; now it is open to the sea.

When they reached their house, they found the bottom-level breakaway walls gone, as the design had called for. Their stairs were a little askew but still sturdy enough to climb to the second-level living area.

“We opened the door and everything was just fine. Everything was just as it had been before the storm. If I had not been outside, I would not have known there was a storm,” Jimmy said. “The only thing out of place inside was one mirror that fell to the floor, and it wasn’t even broken. We were pleasantly surprised.”

Why did the Bishop house survive while neighbors’ homes did not?

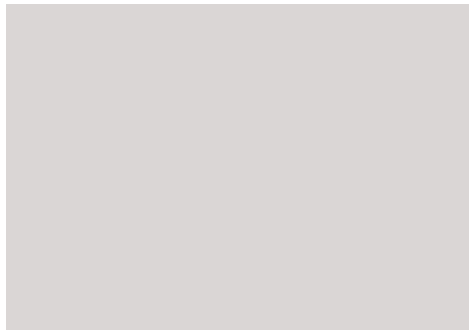
The Bishops’ house was the newest occupied home in the subdivision. Their builder, Mark Williams, has a nearby new house, still for sale, that also held up well in the storm. Both were built under the new coastal building codes and followed specifications provided by a structural engineer.

In keeping with the letter and the spirit of the code, the Bishop house is elevated high above the water, located back from the coast, held together with steel connectors, fortified with sturdy materials and shielded by a storm resistant roof. Impact-resistant glass on windows also helps protect the interior.

The building elevation may have been the most important safety factor. The required elevation was 16 feet, but the house was

raised an additional seven feet, as a margin of safety. The additional amount of height above the required elevation is called “freeboard.” It provides added protection and results in lower flood insurance premiums.

“That freeboard made all the difference,” said Chris Jones, a building sciences expert working with FEMA. He explained that building higher than required by a flood insurance rate map or a community regulation adds relatively little to the cost of new construction, yet provides substantial financial returns to the homeowner, both in the form of reduced flood insurance premiums and reduced future flood



damages. He added that the additional cost of building higher is usually recovered in a few years by a homeowner along the coast.

The builder was also pleased with the performance of impact-resistant windows in the storm. “I had a number of houses built with impact-resistant windows, and I didn’t have a single one of them give me a problem,” Williams said.

“If the windows had blown in, the house would have filled up with water,” Jimmy said. Luck also appears to have contributed to the home’s survival. Bishop felt fortunate that floating debris did not cause more damage. FEMA experts noted that nearby “scour” could have undermined the Bishop home if it had been a little closer. Scour – an area where the erosive force of water eats away at land – is an inherent risk that can’t be totally mitigated on the beach.

Jimmy empathizes with his neighbors. “Next door, our neighbor’s house is older and probably 4 to 5 feet lower than ours. It took the surge and the waves, and the beach

side of it is totally gone. It may have to come down,” he said. “We feel for these people.”

The Galveston County building codes made the difference, Jimmy said “You cuss the codes when you are building and they make you do all these things. We have friends who said, ‘Why on earth are you building your house so high?’ Now we know. That allowed the storm surge to go under our house and not knock it down.”

For the Bishops, the higher cost required to comply with the codes paid off. Jimmy said complying with the codes “doesn’t cost that much more because the building will have a longer life. In the long run, you will have less maintenance expense and grief by paying a little more up front.”



Bolivar before and after Ike Photo by USGS

Order FEMA-P 499 “Home Builders Guide to Coastal Construction” free by phone 800-480-2520 or go to [www.fema.gov/library](http://www.fema.gov/library).