LaHouse
Home & Landscape Resource Center

Flood, Wind & Water Resistance Features Used in Building LaHouse

LaHouse is a showcase for best practices and code-plus construction. Its flood and wind resistance features meet or exceed the criteria of the ***Fortified for Safer Living*** program of the Institute for Business and Home Safety (IBHS).

LaHouse showcases multiple solutions across a range of price-points, integrating durability with other goals of sustainability: resource efficient, healthy, practical and convenient.

Flood

LaHouse is in Flood Zone "AE," with a Base Flood Elevation (BFE) of 24 feet. The minimum code requirement nationally for homes in Zone AE is to have the lowest floor at the BFE. Baton Rouge requires a foot above BFE, or BFE+1. The ***Fortified*** program requires BFE+3. The house and teaching center at LaHouse are protected to a design flood elevation (DFE) of BFE+3.

The house is elevated; the teaching center is dry floodproofed (see Special Features). Use of flood-resistant materials and methods in some places further protects the structure should flooding exceed BFE+3.

Wind

Baton Rouge is in the 100-110 mph wind speed zone. To meet the "Fortified" requirements, LaHouse is designed to resist the forces of 130 mph winds.
The geometry and dimensions contribute to inherent wind resistance. Its length is less that twice its width; it has no more than two stories; and ceiling heights do not exceed 10 feet.

Hurricane hardware ties the roof to the walls and the walls to the foundation to create a continuous load path that transfers wind forces on the house down to the ground. Roofing and other external materials are installed to high-wind specifications. Windows and door openings are protected either by installing hurricane-rated units or by providing external protection (impact-resistant shutters, panels and screens) .

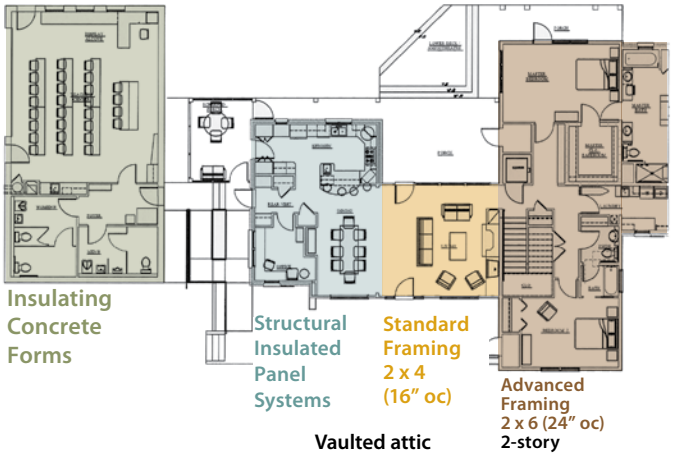
Water

South Louisiana has a hot, humid climate with average rainfall exceeding 60 inches per year. We spend twice as much time cooling homes as we do heating them. During the cooling time, moisture migrates from outside to inside. Water that is trapped in walls, keeping building materials wet, can result in mold, wood-rot and insect infestation.
LaHouse is built to:

- Shed rainwater and direct it away from the foundation.
- Catch water when it does get in through roofing, cladding or window and door frames.
- Minimize moisture penetration and condensation in walls.
- Provide drainage and drying potential for any condensate that forms.

Many of the water-resistance techniques are best construction practices; some are required by code.

Building Systems



Standard Framing

2x4 studs 16" on center

Most homes in Louisiana are wood framed with 2-by-4 studs. Typical practices include using extra non-load-bearing studs at corners to support wallboard, double top plates and uninsulated headers over windows and doors. Studs in this portion of LaHouse are laminated strand lumber (LSL), and overhead joists are engineered wood I-beams, which are stronger and straighter than lumber.

Insulating Concrete Forms (ICF)

ICF walls are made by stacking hollow blocks of rigid foam (as forms) and filling them with concrete. Plastic connectors, which hold the foam sides of the blocks at uniform separation, determine the thickness of concrete in the wall. Steel reinforcing bar (rebar) is placed in the cavity before the concrete is pumped in. The foam forms and plastic connectors stay in place as permanent parts of the wall assembly, thus providing continuous insulation, acoustic benefits and moisture barrier, as well as a backing for drywall, stucco, siding or other cladding.

Structural Insulated Panel System (SIPS)

Structural insulated panels combine structural framing and insulation into a single product. Rigid foam insulation is sandwiched

between two structural panels, or skins. The skins, which are glued to the foam, most commonly are oriented strand board (OSB) but can be steel, plywood or cementing material. SIPs can be cut on site or ordered from the factory with precut window and door openings and channels through the foam core for wiring. With precut panels, installation time can be less than half that of stick framing, with little construction waste. SIPS have high strength characteristics and are used for walls (4" foam) and roof (8"foam).

Advanced Framing/ Optimum Value Engineered

2x6 studs 24" on center

Advanced framing with 2-by-6 lumber is more energy efficient than standard framing, structurally sound and comparable in cost to standard framing. Floor, wall and roof framing are spaced and aligned at 24 inches on center, creating 2-foot modules. Advanced framing techniques eliminate lumber that is not necessary for load-bearing purposes. Examples of increased resource efficiency include the use of three-stud corner framing, drywall clips and insulated headers sized for the load-bearing need.

Foundation

Flood, Wind and Water

LaHouse has a flood protection level 3 feet above BFE. This provides a margin of safety and qualifies for the best flood insurance rating. The house is elevated; the garage/classroom is dry-floodproofed. Sill gaskets prevent air infiltration under wood sills.

Pier Foundation (Master Bedroom)

- Block piers—filled-cell concrete masonry units (CMUs)—are steel-reinforced and anchored to continuous concrete footing, not independent pads.
- Embedded hurricane straps connect piers to floor beams and to porch columns.
- Deck and subfloor are treated to prevent decay.
- Sealed rigid, 2-inch, foil-faced foam insulation system encases floor joists to maintain dry subfloor.

Crawlspace Foundation

(Master Bath/Utility Room)

- Reinforced CMU chainwall is anchored to reinforced concrete footing.
- Flood vents within 1 foot of grade allow floodwater to flow in and out freely. Some vents have code-compliant closures.
- Crawlspace ground is higher than surrounding grade so water does not collect under the house.
- Plastic ground cover reduces moisture in crawlspace.
- Wood subfloor is treated to prevent decay.
- Closed cell foam insulation (2 ½ inches) sprayed under subfloor to maintain dry subfloor.

Slab on Backfill Foundation

- Reinforced CMU stemwalls are anchored to continuous reinforced concrete footings.
- Reinforced concrete slab (cap over compacted soil/limestone backfill) is anchored to the stemwalls with rebar.
- Durable plastic sheeting under slab and waterproofing compound on upper stemwall prevent moisture migration.

Slab-on-Grade Foundation

(Garage/Classroom)

- Durable plastic sheeting provides moisture barrier under slab and wraps under grade beams.
- Low water-to-cement ratio concrete (fly ash, slag mix) for high strength and reduced curl.
- Use of wet curing blanket improved concrete strength without frequent rewetting.
- Exterior coating on the slab is part of the dry floodproofing system.

Roof

Wind

Keeping the roof on is a prime objective of the new codes. A hip roof, used for most of LaHouse, is more aerodynamically resistant to high winds than a gable roof. The roof pitch, 6:12, is strategically designed to minimize leaks and wind loads, yet ensure that water sheds away from the foundation.

Framing

Hurricane straps and clips connect rafters; straps wrap rafters, securing them to the walls. In the teaching center, hurricane hardware connects the rim band to the top plate, which has anchors in the concrete walls. Framing lumber is secured to the rim band with hurricane straps. Soffits and soffit vents made of sturdy materials are attached securely to framing members

Decking
Except in the SIPS section, decking is 19/32-inch OSB (two-story section) or plywood (elsewhere). Sheets are attached with ring shank nails (not staples) in a nailing pattern that is closer than customary. SIPS roof-panel seams are reinforced with embedded 2-by-8 planking.

Metal Roof
Metal roofing is impact resistant, wind resistant and recyclable. Hidden fasteners reduce leaks. Extra screws and edge details create 130-mph wind resistance. Panels are fabricated on site and "snap-locked" into place. High tech "cool color" coating reflects heat like a light color, saving energy and extending roof life.

Tile Roof
Concrete tile looks like clay but is more impact resistant. Two wind-resistant installation methods are used:

- Mechanical fastening with screws and hurricane clips on the first course through battens.
- Large-patty foam adhesive directly on adhesive membrane underlayment (no battens) and hip edge boards strapped to decking.

Shingle Roof Exhibit
- A table-top exhibit displays installation layers of high-wind installation of underlayment, drip edges, starter strip and wind-rated shingles.

Water
- Peel-and-stick membrane roof underlayments provide fully adhered secondary moisture barrier under tile, extending roof life.
- Deck seams under metal roof are sealed with bitumen tape to prevent water intrusion.
- Valleys, penetrations and seams at roof/wall intersections are flashed.

Walls

Wind
Sheathing and hardware contribute to shear and uplift resistance.

Framed Sections
- Structural sheathing is 15/32 inch.
- Anchor bolts with 3-inch washers spaced every 16 inches hold bottom plate to slab.
- Hurricane clips tie wall studs to bottom plate.
- Metal straps tie second-story studs to first-story studs.
- Sheathing on interior load-bearing walls.
- Seams in sheathing are backed by studs, sills or special blocking.
- Alignment of studs and rafters in advanced-framing section makes hurricane strapping easier and stronger.
- Exterior sheathing panels span the connection between first and second stories.

SIPS
- Anchor bolts tie bottom plate to slab.
- Hurricane plates and extra fasteners secure wall panels to bottom plates.

ICF
Concrete wall is anchored to slab with rebar.

Water
Layering of housewraps and flashings provide resistance to water and moisture penetration. Paperless drywall with a moisture-resistant core and other water-resistant materials provide extra protection from water damage. Vinyl wallpaper is avoided, so any moisture in the wall cavity can dry to the cooler, dehumidified home interior.

Drainage Planes and Vapor Barriers
- Walls have drains and vents behind bricks and sidings.
- Foil-faced foam board with taped seams provides air barrier, vapor barrier and a drainage plane behind brick veneer.
- Plastic mesh wrap provides drainage space behind fiber-cement siding.
- Crinkled stucco wrap with building paper overlay provides for drainage behind stucco.

A perforated, semipermeable housewrap may be used under sidings that do not leach surfactants – vinyl, metal and fiber-cement.

Nonperforated housewrap is used behind brick or wood. It retains its water repellency when exposed to surfactants that can leach from these materials.

ICF does not need a drainage plane, vapor retarder or air barrier.

Windows and Doors

Wind
Windows were selected and sized to meet code specified "design pressure rating" (DP) for a 130 mph wind zone. Windows and doors are no taller than standard 6-foot, 8-inch height. Larger openings could require additional strengthening measures. Impact-rated shutters (Bahama, colonial, roll-up, accordion), panels and screens

protect windows and doors that are not rated. Windows and doors without external protections are designed as impact units. Stained glass is shielded by a layer of impact-glass. The garage door is rated for both high wind pressure and impact resistance.

Water

Windows and doors are flashed to drain water outward. Sill flashings are rigid or flexible, include corner protection and have backdams or slope outward. Flashings are integrated shingle fashion with the housewrap to maintain a continuous drainage plane. Seams of foil-faced OSB are taped to provide a moisture barrier, vapor barrier and drainage plane all in one.

Special Features

Safe Room

The master bedroom closet serves as "safe room," designed to resist 150 mph wind. It is structurally isolated from the rest of the house. Every stud is securely fastened with hurricane straps at top and bottom. Walls and ceiling are clad with two layers of ¾-inch plywood installed in a staggered fashion, glued and screwed. Steel impact pocket door protects the main opening. The closet is a modified safe room, not FEMA-standard for tornadoes.

Dry Floodproofing – Floodwall

Dry floodproofing is a code-compliant alternative to elevation for nonresidential buildings only. Sealants and closures must extend 1 foot above the level that would be required if elevating, for the same level of protection credit in the flood insurance program.

To seal the walls, a waterproof coating was applied to the bottom 3 feet of the Teaching Center's exterior foam, which is covered with a no-lath synthetic stucco system that does not require penetrating fasteners. The exposed slab is coated with waterproofing compound. When flood proofing is complete, a watertight panel closure will protect the door to the breezeway. On the driveway side, a floodwall will extend out from the building and across to the driveway. During floods, the driveway opening will be blocked with removable panels. The system will require use of a sump pump.

Wet Floodproofing

Wet floodproofing refers to the use of flood damage resistant materials and methods to reduce damage from flooding, but it is not a code compliant alternative to elevation. The house powder room exhibits a drainable, dryable wall assembly with closed cell foam insulation, no OSB, removable plywood wainscoting, paperless drywall, solid tile flooring and freestanding cabinets.

The Louisiana House – Home & Landscape Resource Center is a public-private partnership, built with monetary gifts and donated materials. Please visit the Web site to see construction photos and lists of LaHouse key contributors, key partners and key allies on campus. You will also find directions to LaHouse and news about activities at the site.

Go to **www.LSUAgCenter.com/LaHouse**

Breezeway Roof

A very low-pitched roof acts like an airplane wing in high winds. Because the breezeway roof at LaHouse will experience high uplift forces, the front and rear beams are heavily reinforced and firmly anchored to the walls on each end. Anchoring in the SIPS wall required a pocket and steel plate. Rafters that run along the ICF and SIPS walls have strong ties into those walls.

Porch Protection and Closets

An impact-rated fabric screen system with an overhead track and anchor bolts below protects the windows and doors that open onto the front porch. Windows and doors opening onto the back porch are protected by accordion shutters (kitchen windows) and translucent, removable panels with pop-open tracks. The master bedroom windows and door are impact-rated units. Front and back porches have closets that can be used for easy storage of porch furniture when high winds are forecast.

Other features

- The ground slopes away from the house to prevent water soaking through the foundation or creating a condition of constantly high humidity on walls.
- Sewer lines have backflow valves to reduce the potential for a flooded sewer system to back up into the house.
- All electrical wiring; plumbing outlets; heating, ventilation and air conditioning equipment; and other mechanicals are at the same level of protection from flooding as the main structure. Parts of elevated systems that must extend below BFE are designed to prevent entry of floodwater.
- Roof ridge vent systems are designed to exclude wind-driven rain. The unvented attic (exhibit room) has no vents, eliminating risk of wind-driven rain entry.
- The geothermal heat pump has no outside compressor unit that could be subjected to wind or flood exposure.

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Pub. 3170 (online) 10/10