Elevating an Existing Home

If you live in Louisiana, your primary objective in raising a home is likely to be flood avoidance, even if you're not in an identified flood hazard area. Elevation is the most effective on-site method of reducing future flood damage. New buildings in designated flood hazard areas must have the lowest floor at or above the elevation of the base flood, the Base Flood Elevation (BFE). Nonresidential structures can meet the flood-protection requirement by dry floodproofing (sealing the building); residential structures do not have this option; they must elevate.

Elevation is required when a building has been substantially damaged or is being substantially improved. If the improvement is an addition of a room on the side, the addition – and sometimes the entire structure – must meet the requirements imposed on new construction.

Substantial means the cost of improvements (or repairs) as a percentage of the market value of the structure before improvement (or before damage) exceeds some threshold value. The maximum threshold value allowed by FEMA is 50%; in some Louisiana communities local governments have lowered the threshold to 40% or even 25%. The local permit office can tell you what the substantial damage and substantial improvement thresholds are in your community, and whether these are cumulative. If substantial improvement is not tracked cumulatively, the structure can be improved 40% this year, 30% next year, and so on – without triggering the substantial improvement provisions. If it is tracked cumulatively, the 30% improvement after a 40% improvement would exceed 50% and trigger the requirement to elevate.

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The elevation project

When the objective is to get the home's lowest floor higher, the first decision may be whether to elevate the building or tear it down and build a new one that has the floor at the desired height. The building must be examined to determine whether it will survive the elevation process. If not, reconstruction is the only option. If it is structurally sound, other factors may lead the owner to choose demolition and reconstruction, rather than elevating the existing structure. This decision may be influenced by rules that apply to grants or loans used to fund the project.

A complete elevation project includes design and drafting, preliminary site work, the actual lifting, rehabilitating the building with stairs, porches and decks, possibly altering the roof, repairing walks and driveways, and landscaping. Not all of these costs are eligible for grant funding. The entire job may be contracted to a single contractor or have portions of the job contracted to different contractors.

If the building is being lifted, the elevation contractor should have control of the job from the time the house has been prepared for lifting until it has been set on its new foundation. If the new foundation and supports are to be built by subcontractors, the elevation contractor, not the homeowner, should subcontract that work. This arrangement allows the elevation contractor to assume complete responsibility for the structural integrity of the elevated structure.

Several people will be involved in planning and executing the project, including the local permit official, utility companies, structural and civil engineers, architects, the elevation contractor and building and remodeling contractors.

Choosing a level of protection above BFE and above ground

If your primary objective is to avoid flood damage–the higher you go, the better. But, there are practical limits to elevation. The higher a building is raised, the greater the wind-load it transfers to the foundation. The elevated structure must have a foundation designed to withstand these extra forces.

Flood insurance benefits. Raising a structure does not remove it from the Special Flood Hazard Area (SFHA); therefore, it does not exempt the owner or the mortgage holder from flood insurance mandates. There are flood insurance advantages for exceeding the minimum elevation requirements. The difference between the Base Food Elevation and the actual elevation is called "freeboard"; the advantages of freeboard can be seen in the table, Flood Insurance vs Lowest-Floor Elevation.

Homeowner coverage penalties. The flood insurance savings associated with higher elevation may be offset by higher insurance premiums for wind and fire coverage (homeowners insurance), or loss of coverage through private insurers. There may be things you can do with the elevated foundation to reduce the impact of elevation on homeowner's coverage. Check with your homeowners insurance agent when you're deciding how high to elevate your home.

Flood Insurance vs Lowest-Floor Elevation

Comparison of flood insurance premiums for $120,000 in building coverage and $40,000 in contents coverage for a single-story residential building without a basement.

	AE-zones	VE-Zone
Pre-FIRM in SFHA	$1060	$1993
Post-FIRM in SFHA		
1 foot below BFE	$3328	$4260
at BFE	$ 993	$3127
1 ft above BFE	$ 517	$2412
2 ft above BFE	$ 341	$1624
3 ft above BFE	$ 276	$1224
Outside SFHA (B, C or X zone)	$ 772	$ 772

Rates and premium calculations for comparison purposes only. Flood insurance quotes should be given only by a licensed property insurance agent.

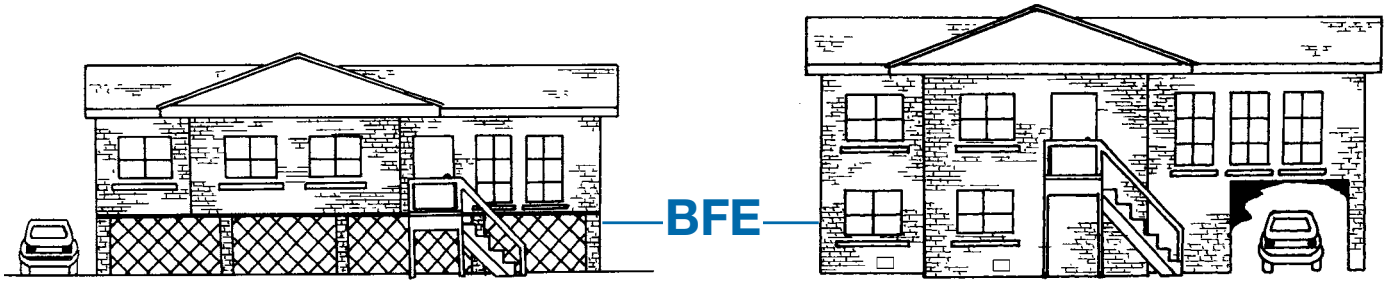
FIRM - Flood Insurance Rate Map

Pre-FIRM - Structure built prior to adoption of the community's first FIRM or before December 31, 1974. The owner may provide elevation information and elect to be rated as a Post-FIRM structure.

Post-FIRM - Structure built or substantially improved after adoption of the community's first FIRM and after December 31, 1974.

BFE - Base Flood Elevation. The water surface elevation of the 1% annual chance flood, also known as base flood or 100-year flood.

SFHA - Special Flood Hazard Area



The 5-foot elevation

- Easier access, shorter staircases
- Slightly lower cost to design and construct the new foundation and supports
- Limited usefulness of under-slab space
- Fewer homeowners insurance complications
- Wheelchair access requires 60-foot ramp, chairlift or porch lift

The 8-foot elevation

- Higher level of flood protection
- Slightly higher cost to design and construct the new foundation and supports
- Useful under-slab space (parking, access and limited storage)
- Greater reduction in flood insurance premiums
- Wheelchair access requires elevator or 96-foot ramp

Elevating by reference to a standard

BFE. The most common standard used for flood protection is the Base Flood Elevation (BFE) – the level of the base flood or the 100-year flood.

ABFE. After a disaster, FEMA may provide advisory elevation guidance, producing Advisory BFEs (ABFEs). Communities are encouraged to adopt the ABFEs for regulating development while new Flood Insurance Rate Maps (FIRMs) are being developed. The BFEs on the existing FIRMS continue to be used for rating flood insurance until the community adopts a new Flood Insurance Rate Map.

Height of the nearest drainage main inlet. If the home is in an area for which there is a man-made drainage system, it should be built higher than the inlet for the drainage system.

Flood of record. When an area has flooded to a depth higher than the BFE or ABFE, the height of that flood can be a better reference standard than the BFE or ABFE for avoiding future flood damage. Local government permit or drainage departments will often have records of past floods.

Height of the levee. A home that is protected from a flood source by a levee, will enjoy the best protection if the lowest floor is above the height of the levee. If not elevated to that height, elevating 3-5 feet off the ground provides a higher degree of protection against levee overtopping or problems with drainage system pumps than building to the lower BFE.

FIRMs are based on existing conditions

The BFEs do not take into account subsidence, sea-level rise, coastal land loss or development in the watershed, which will potentially increase future flood depths. In an effort to encourage better protection, many Louisiana communities require freeboard — building one or more feet above the BFE. Some extend that to require building a foot above the BFE, the flood of record, or the opening of the drainage system, whichever is higher. This would be a good choice by the homeowner, even when it is not required. Approximately 25% of flood insurance claims are paid on buildings that are near, but not in, A or V zones.

Elevating structures

Structures on piers or posts:

Buildings on piers or posts have been designed to be supported at identified load-bearing points that are accessible from above ground. They are not typically constructed with brick veneer, stone or concrete blocks and do not usually have fireplaces and other hard-to-lift components. Therefore, elevating them is relatively easy, in comparison with raising structures built on slab. It is most common to lift the floor, walls and roof as a unit and add a new foundation.

Structures on slab:

Three basic techniques have been used successfully to elevate buildings that are built on slabs: the slab, walls and roof can be lifted as a unit; the walls and roof can be lifted, leaving the slab on the ground; or, the roof can be removed, a second story added (forming the new first floor) and the roof replaced.

Structures lifted with the slab. By careful excavation and support, beams can be placed under the slab and lifted using a unified hydraulic system. This method is non-intrusive (the home's interior and exterior are not disturbed), but can be very disruptive to the landscape. Since the initial project, which was done in the Amite River Basin in the early '90s, slab homes have been elevated using this technique in several south Louisiana communities. The slab elevation process is described in the LSU AgCenter's 1996 publication, "Rising above the Flood," and the 1999 video "Above the Flood," which both document the Amite Basin project. The publication and video are available on the LSU AgCenter Web site.

Shoring technology is being used in southeast Louisiana to raise structures on slabs. Typically, short pile segments are pushed into the ground under the slab grade beams. If the slab was on pilings, the original piles have their tops cut back to make room for jack and pile segments. A concrete lifting pad is poured and used as a base for raising the structure. For higher elevations, the pads may be used for the first lift, and steel and a hydraulic jacking system used for continuing the lift. This method is less destructive of the landscape. Setting and finishing the raised structure would be the same for either slab-elevation method.

Structures lifted off the slab. When the home is removed from the slab, a temporary support system is constructed within the building. This support system keeps the building rigid and provides the surface base for lifting. Once the building is lifted, a new floor structure and foundation are constructed. It may be possible to build the new supports on the old slab. This procedure is used most often after a house has flooded and the walls are opened. The walls being open allows for the economical construction of the temporary support system. It is not practical, in most circumstances, to use this method for raising brick veneer or masonry block homes.

Abandoning the first floor. With some types of construction, the "elevation" can be achieved by removing the roof, building a new first floor, extending the walls and replacing the roof. What was once the living area is wet-floodproofed and abandoned, except for parking, limited storage and access to the new living area. Depending on the condition of the roof and the capability of the contractor, it may be possible to reuse the original roof structure. This technique can be used only if the original walls are made of flood-resistant materials (e.g., masonry) and are capable of supporting the weight and windloads of the added rooms.

All of these methods assume that the original slab and existing pilings are capable of supporting the weight and increased wind loading of the added foundation and/or walls. This will need to be verified by an engineer, and some improvements may be required before lifting can begin.

Choosing a new foundation for the elevated building

Building codes and flood damage prevention ordinances impose requirements on foundations in A and V zones. In all special flood hazard areas (SFHAs), the building must be designed, constructed and anchored to prevent flotation, collapse and lateral movement. Space below the Base Flood Elevation can be used only for access, parking and limited storage. Materials used below the Base Flood Elevation must be flood-resistant. If the area below the Base Flood Elevation is enclosed by a foundation wall, that wall must have flood openings that allow the space to flood freely. Failure to provide flood openings may lead to foundation collapse in a flood. It may also subject the owner to penalties or cause insurance premiums to be higher than they were before the building was elevated.

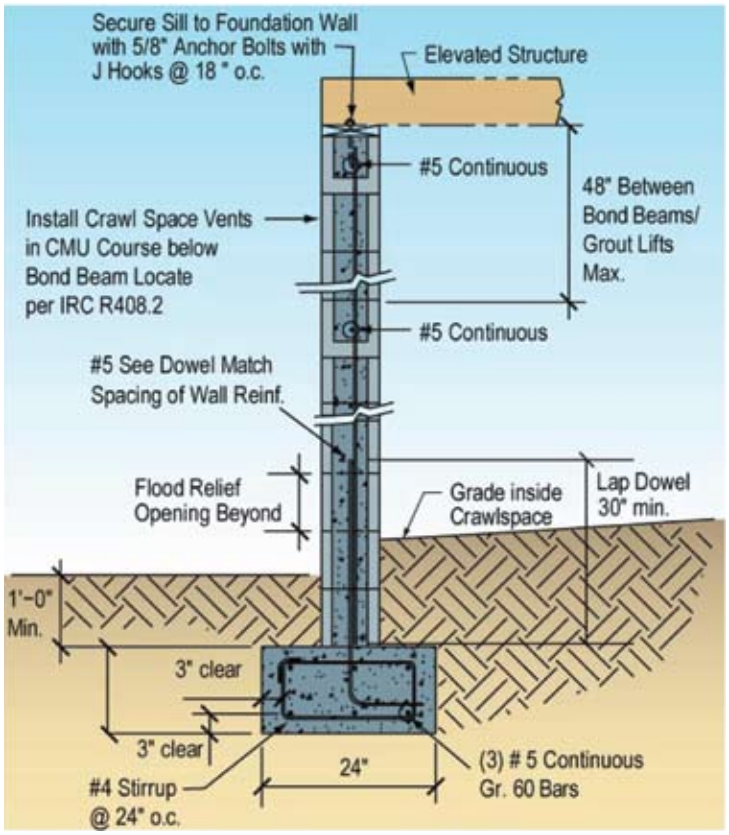
Raising the home on compacted fill or driving pilings are good options for new construction, but their use is difficult when an existing home is being elevated in place. The new foundation for your raised home usually will have to be dug and poured for below-grade support, with the above-grade part being built up to meet the support system of the elevated building. The best options will be a chain wall or concrete columns foundation.

In V zones the foundation must be designed and certified by an engineer. It must be open above grade and deep enough that it will not be undermined by scour. The area below the raised floor must be free of obstructions, but may have breakaway walls (unless restricted by local ordinance), lattice work, slatwork or screening. Foundation walls are not allowed in V zones. The community is responsible for verifying–through its building inspection system–that the foundation is built in accordance with the certified design. When pilings are required for below-grade support, some companies are using segmented pile systems, which are common in the shoring (house leveling) industry.

Foundation engineering design resource—FEMA 550

FEMA's publication 550, "Recommended Residential Construction for the Gulf Coast: Building on Strong and Safe Foundations," published in July 2006, provides pre-engineered foundation designs for elevated home construction in flood hazard areas near the coast. These foundation drawings are not stamped. Your engineer should review the foundation plan to assure that it is appropriate for your home, your flood and wind exposure and your soil conditions. Elevated foundation plans in V zones must be stamped by an engineer.

The designs in FEMA 550 use 1,500 pounds per square foot as the load-bearing strength of the soil. Many locations in Louisiana have soils with significantly lower load-bearing capacity.



Typical of the detail provided for a variety of foundation designs in FEMA 550.

Foundation walls

Masonry block walls are often used as a foundation for raised floors. There are some rules for enclosed spaces below BFE in flood zones and some principles of good practice that will help reduce mold and indoor air problems.

- Masonry foundation walls must be reinforced with rebar and have the cells filled with concrete.
- The floor of the area enclosed by the foundation wall–should be at a higher level than the ground outside the wall, so water does not collect under the home. It should be covered with a slab or with a sheet-type moisture barrier. The space, if not fully enclosed and conditioned, should have good air ventilation. The space can be fully enclosed and conditioned only if approved engineered openings are used to allow automatic entry and exit of flood water. Any materials used in the space must be flood-damage resistant.
- Support is required under the interior load-bearing walls. Interior support can be provided by additional masonry walls, masonry columns, or steel poles. All walls and supports should rest on a concrete foundation designed to carry the weight, lateral and uplift loads imposed by or on the structure.

Attachment of the raised home to the foundation wall is critical. This wall-to-foundation connection is required to prevent floatation and to withstand the shear and uplift forces of wind. Uplift and shear forces are often overcome by using metal straps, anchors and clips. Structural sheathing panels that bridge all the joints and have adequate attachment (close nailing pattern) can reduce the need for some of this hurricane hardware.

Over time, concrete-filled masonry develops cracks and crevices that can allow termites to move undetected from ground to building. Great care must be taken to add termite barriers in the soil (chemical treatment) and at the juncture between foundation wall and wood framing (physical barrier, such as a 4-inch-thick concrete cap on the wall, or a termite shield or screen).

Columns

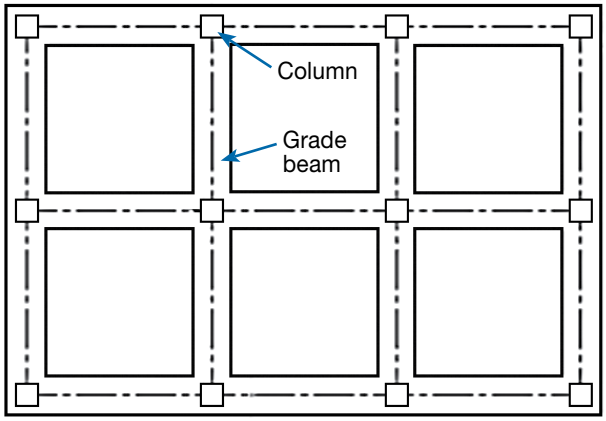
A good alternative for an elevated home's foundation is concrete columns on a grade beam base. Columns on a grade beam are appropriate in A zones, including A zones near the coast, as long as the potential for waves and scour is low. This foundation is recommended for elevations that do not raise the floor more than 8 feet off the ground. For this foundation to be used in a V zone, the columns would have to extend further into the ground and might need to have a larger cross-section.

Stacked concrete blocks–even when filled with rebar and concrete–must be tied to a steel-reinforced grade beam if they are to resist uplift and horizontal wind and water forces on the structure. Because they may provide ready access for termites to wood in the elevated building, care must be taken to place termite shields between the foundation and the home and to treat the ground around the foundation for termites.

In coastal Louisiana soils, where soils have limited bearing capacity, grade beams should be used under all columns, posts and piers to provide uniform load-bearing capacity and add rigidity.

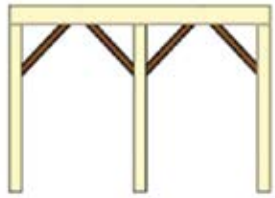
Pilings

Driven pilings can be used for above-grade support if the raised house is moved aside and brought back. Most structural movers have the ability to do this. Pilings may be round or square and can be treated timbers, steel or reinforced concrete. They are normally quite long and are driven into the soil until a stable base is reached. Some pilings are driven using a combination

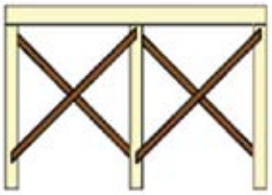


Typical grade beam/column plan view. Spacing between columns should not exceed 14-feet if standard FEMA 550 foundation plans are to be used. Columns must be securely attached to the grade beam.

Bracing and Bearing

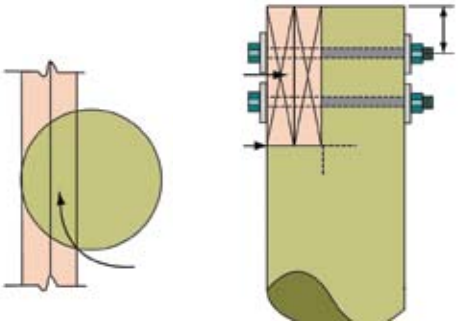


Knee bracing
3x or 4x treated wood members at 45 degrees to pile and located approximately 4 feet below end of pile



Diagonal bracing
2x or 3x treated wood members or steel rods, attached near top of pile and near ground

Typical options for bracing piles, post or columns.



Ideal beam to pile, post or column connection. Both bearing beams are fully supported with no over-cutting of the vertical support.

FEMA 499 Technical Fact Sheets 12 and 13 provide additional detail on installing pilings and on wood pile-to-beam connections, including compensating for misaligned piles.

of vibration and downward force, rather than being driven by impact alone.

Driven, long pilings are usually the best option if the structure is to be elevated more than 10 to 12 feet above the ground. Pile size, depth and layout will be determined by the foundation engineer and is based on soil conditions, building dimensions and exposure to wind, water and wave action. Accurate placement and alignment of pilings is important. As with foundation walls and columns, attachment of the house to the pilings is critically important.

Termites are a serious threat to homes in Louisiana. On treated wood pilings, select treatment chemicals that resist termites and decay. Inspect and treat areas around pilings as recommended.

Other Considerations

Regulation. Elevation is almost always subject to regulation. Check with the local permit department. If you are remodeling and the work is exempt from building codes, a permit is still required for construction and remodeling if the building is in a designated flood hazard area (A or V zone).

Insulation. When a raised wood floor is to be insulated, it must be done with consideration of climate. In an air-conditioned home, water will condense from the warm/humid air in the crawlspace onto the subfloor and joists. The method used should reduce the potential for trapping this moisture in the floor framing. This water must be allowed to either penetrate the flooring and be carried off by the air conditioner, or dissipate through the insulating material. The LSU AgCenter is participating in research projects on controlling moisture and insulating wood floors in crawlspaces.

Aesthetics. Many people are reluctant to elevate an existing home because they can't imagine how it will look. There are now many examples of elevated homes–some more attractive than they were before being elevated. You may be able to find a gallery of elevation on the Internet. Also, you may find some assistance in visualizing your project by contacting a design or architectural firm or university department. Several software packages allow you to manipulate images, so you can see how the elevated structure might look.

Access. The cost of stairs, decks, ramps and elevators cannot be overlooked. Also consideration should be given to whether these access features will be open or under roof.

Historic significance: FEMA's May 2008 publication P 467-2, "Floodplain Management Bulletin: Historic Structures" addresses how the National Flood Insurance Program (NFIP) treats historic structures. It also identifies mitigation measures that can be taken to protect historic structures from floods.

Obtaining financial assistance for elevation

Financial assistance that may be available to communities and individuals for flood damage reduction, either from the National Flood Insurance Program or from federal sources, can be used to elevate and/or relocate structures. Congress has authorized several programs for reducing damage in future disasters; some are strictly for repetitive flood-loss properties.

The rules governing use of funds often differ from one program to another. In addition, the availability of funds for a particular action may be influenced by the priorities established by federal, state and local program administrators. Some will support elective elevation, some only mandatory elevation. Some will support elevation above the required elevation, some only elevation to the required elevation. For some, but not all, programs it is permissible to use the funds to demolish the structure and rebuild on the same site at the required elevation – or at another site at the required elevation. Your best source for information about elevation funding assistance is your local building official or emergency manager.

If you have flood insurance from the National Flood Insurance Program, and if you are required to elevate as the result of flood damage, you can obtain funds for meeting the elevation requirement by filing a claim for Coverage D – Increased Cost of Compliance (ICC). Coverage D has a maximum benefit of $30,000. ICC funds are YOUR money, not federal funds; they can be used as the nonfederal match if such a match is required for participating in a federal grant funding program. In 2004, Congress authorized a change in Coverage D that would make it available for claim when the policyholder is receiving grant assistance for mitigation. If this change is implemented, the coverage would be available even when the home has not experienced flood damage. Check with your property insurance agent for more information about this coverage of the NFIP and your eligibility to file a claim for it.

In the post-disaster, recovery environment, additional federal programs can provide assistance for elevation. These include FEMA's Hazard Mitigation Grant Program (grants to communities), the Small Business Administration disaster program (loans to individuals) and specially authorized funds, such as the Community Development Block Grant funds through which Louisiana's Road Home program provided elevation incentive grants to individuals. For the Katrina/Rita recovery, some HMGP grants are going directly to individual participants in the Road Home Program, rather than to the community.

Additional information on these topics, as well as termite protection, energy efficiency and other better building practices, is available at **www.LSU AgCenter.com/Homebuilding**

www.BuildSaferStrongerSmarter.org

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Visit our Web site: www.lsuagcenter.com

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