

Advantages of Raised-Floor Foundations in Floodplains

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SUMMARY

Coastal regions have seen a dramatic increase in residential development the last 10 years. Many home buyers are moving to be closer to the water for a better quality of life or more active outdoor lifestyles. Coastal residents are justifiably concerned about resisting flood damage, given the nature and extent of flooding and hurricanes in recent years.

BACKGROUND ON FLOOD MITIGATION STRATEGIES

Many owners of coastal homes rely on flood insurance as one way to mitigate the financial consequences of flood damage. The National Flood Insurance Program (NFIP) has set standards for communities to reduce the risk of major flood damage through building elevation requirements. Communities that participate in the NFIP require homes in mapped floodplains to have the lowest floor at least as high as the base flood elevation (BFE). The BFE is the predicted high-water mark of the 1 percent-annual-chance flood, or “100-year flood.” In parts of Mississippi and Louisiana, new advisory BFEs issued after assessments from Hurricanes Katrina and Rita may govern the height requirements.

METHODS TO RAISE FOUNDATIONS

There are three common methods to raise the height of the first living floor: construct a solid perimeter wall (raised-floor or crawlspace), drive pilings to elevate the building, or haul in fill to create a raised pad on which a concrete slab foundation is poured.

In 2003, 53 percent of all new U.S. homes were built as slab-on-grade, and in the South, an even higher percentage of the homes are built on slabs. The trend seems to be increasing despite the fact that raised-floor foundations are easier on the environment and easier and less expensive to build.

Raised-floor foundations are the best choice for infill and redevelopment, for accommodation of future additions, and for good performance during floods. Using a raised-floor foundation to elevate your home has some significant benefits, as described below.



Photo: Jeffrey Jacobs, Looney Ricks Kiss Architects

GRADE AND SOIL

Fill that is used to elevate a home in the floodplain can cause adverse environmental impacts. Most communities specify a maximum 2:1 slope for fill, in part to make lawn maintenance safer. That slope requirement can lead to significant areas of ground disturbance, loss of mature trees, and possible wetland encroachment. Changes in drainage patterns can increase the chance of flood damage on nearby properties, creating liability. Fill that is used to elevate homes on slab foundations may slump when saturated or be eroded by moving floodwaters, leading to structural damage when the slab is left unsupported.

Homes on raised-floor foundations are less likely to experience differential settlement, which is common in many floodplains where expansive clays and soft organic soils are often found. Leveling work common in many parts of the country, even for relatively new homes, is easy to accomplish and less expensive when homes are on raised-floor foundations.

CONSTRUCTION

Construction of a raised-floor foundation is easier to schedule because concrete and masonry work do not have to wait on plumbing installation and inspection, as is the case with slab foundations. In areas with poor soils, the contractor does not have to find a source of good fill.

In floodplains where the water is predicted to be more than 3 to 4 feet deep, many owners raise their homes even higher. Not only does this better protect the home from flooding, it also reduces the cost of flood insurance and allows the area underneath to be enclosed. Enclosed areas must not be livable but can be used only for parking, limited storage, and building access. Basements are not allowed under new homes in floodplains; instead, the crawlspace created by a raised-floor foundation can be used for storage.

COST CONSIDERATIONS

The Southern Pine Council found that the cost of home construction of a raised-floor foundation compares favorably to the cost of slab-on-grade. However, the added cost of trucking in quantities of clean fill and creating adequate compaction to elevate the slab above the flood elevation makes slab-on-fill homes more expensive. The cost differential increases as the height above grade increases. Construction costs associated with building a raised-floor foundation do not increase significantly with height increase, unlike elevated slab-on-grade.

In fact, added height above flood level is a selling point in homes. The higher the home is above the flood level, the less vulnerable it is to flood damage. A two-story home that has a \$250,000 flood insurance policy from the NFIP will save nearly \$300 each year if it is raised 3 feet above the BFE.

MAINTENANCE CONSIDERATIONS

Accessibility for future maintenance and utility (water, sewer, electrical, plumbing) modifications can be easier and less expensive in homes with a raised-floor foundation. No need to jackhammer the slab to access original installations.

One of the most significant benefits of a raised-floor foundation is the separation it creates from the biggest source of home moisture: the ground itself. With proper design, construction, and maintenance practices, the home can remain dry with few moisture-related problems. To ensure that moisture protection is taken into account, building codes require that crawl spaces have positive drainage, a vapor retarder on the ground, air vents, and underfloor insulation.

CODE REQUIREMENTS FOR ENCLOSURES UNDER ELEVATED FLOODPLAIN BUILDINGS

When homes are constructed in mapped floodplains, certain code requirements apply to elevated homes

on crawl spaces or that have enclosures with non-load-bearing walls. The requirements are found in the International Building Code, the International Residential Code, and local floodplain management ordinances that are adopted to participate in the NFIP. The requirements vary depending on the type of floodplain shown on the NFIP maps. In "A Zone" floodplains raised-floor foundations must have flood openings (also called flood vents) to allow for the automatic inflow and outflow of floodwaters. This reduces differential hydrostatic pressure which can cause structural damage.

Flood openings must be provided in at least two exterior walls, installed less than 12 inches above grade. The number and size of openings depends on whether the prescriptive or performance approach is used. The prescriptive approach requires a total net open area equal to 1 square inch for every square foot of enclosed area. If used as flood openings, standard air vent units must be disabled in the open position.

The performance approach to flood openings allows the use of certified, engineered vent openings, provided the certification addresses the requirements of the code and the NFIP. Generally, fewer penetrations of the crawl space wall are required when engineered flood vents are used.

For more detail, contact the author.

CONSIDERATIONS FOR IN-FILL DEVELOPMENT AND OLDER HOMES

Raised-floor foundations are easier to construct on in-fill lots or when an older home is demolished to make way for a new home, especially when the new home has to be elevated to meet floodplain requirements.

Many owners of flood-prone homes and communities are pursuing federal grant funds to physically lift older homes and attach them to new foundations so the buildings are less vulnerable to flooding. Called "elevation-in-place," this process is easiest when the home is replaced on a raised-floor foundation. It is less expensive than bringing in fill and it requires less work area for the contractor.

CONCLUSION

As Gulf Coast rebuilding continues and more people seek to build in flood-prone coastal areas, it is important that design and construction practices adhere to code and incorporate best practices.

Raised-floor foundations and proper flood venting of enclosed areas below the BFE are two important approaches that can reduce construction costs,

reduce the cost of flood insurance premiums, and, most important, reduce the risk of damage while helping homeowners avoid the stress caused when a home is flooded.

About the Contributor

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RESOURCES

More Best Practices

The following AIA Best Practices provide additional information related to this topic:

- 11.07.01 Planning for Concealed Site Conditions
- 11.10.05 Vulnerability Analysis and Security Assessment
- 11.06.01 Mold: A Design Checklist

For More Information on This Topic

See also “Site Analysis” by Floyd Zimmerman, FASLA, in *The Architect’s Handbook of Professional Practice*, 13th edition, Chapter 17, page 529.



See also the 14th edition of the *Handbook*, which can be ordered from the AIA Bookstore by calling 800-242-3837 (option 4) or by email at bookstore@aia.org.



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Key Terms

- Design
- Site Analysis
- Environmental Analysis
- Floodplain