

Enclosures and Breakaway Walls

Purpose: *To discuss requirements and recommendations for enclosures and breakaway walls below the Base Flood Elevation (BFE).*

Key Issues

- Areas enclosed by solid walls below the BFE (“enclosures”) are subject to strict regulation under the National Flood Insurance Program (NFIP). Note that some local jurisdictions enforce stricter regulations for enclosures.
- Spaces below elevated buildings can be used only for building access, parking, and storage.
- Enclosures in V Zone buildings must be breakaway (non-breakaway enclosures are prohibited). Breakaway enclosures in V Zones must be built with flood-resistant materials, meet specific design requirements, and be certified by a registered design professional.
- Enclosures (breakaway and non-breakaway) in A Zone buildings must be built with flood-resistant materials and equipped with flood openings that allow water levels inside and outside to equalize.
- Breakaway enclosure walls should be considered expendable, and the building owner could incur significant costs when the walls are replaced. Breakaway wall replacement is not covered under flood insurance policies.
- For V Zones, breakaway wall enclosures below an elevated building will result in higher flood insurance premiums; however, surrounding below-BFE space with insect screening, open lattice, slats, or shutters (louvers) can result in much lower flood insurance premiums (Figure 1) and will likely reduce damage during less-than-base-flood events. It is also recommended that breakaway walls be designed to break into smaller sections so that they're less likely to damage the foundation or the upper portions of buildings.

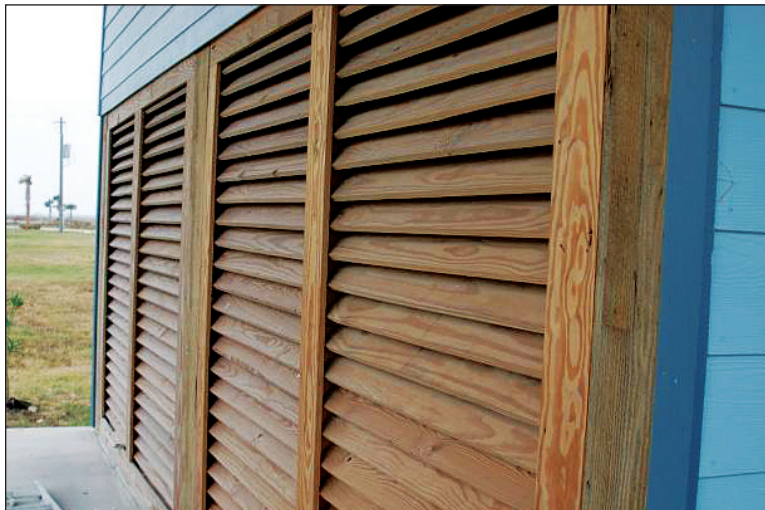


Figure 1. Wood louvers installed beneath an elevated house in a V Zone are a good alternative to solid breakaway walls.



WARNING

Designers, builders, and homeowners should realize that: (1) enclosures and items within them are likely to be destroyed even during minor flood events; (2) enclosures, and most items within them, are not covered under flood insurance, which can result in significant costs to the building owner; and (3) even the presence of properly constructed breakaway wall enclosures will increase flood insurance premiums for the entire building (the premium rate will increase as the enclosed area increases). Including enclosures in a building design can have significant cost implications.

The Hurricane Ike Mitigation Assessment Team (MAT) observed some breakaway walls in excess of 11 feet high. While FEMA promotes elevating homes above the BFE (i.e., adding freeboard), one of the unintended consequences appears to be the increasing size of flood-borne debris elements due to taller breakaway walls.



Space Below the BFE — What Can It Be Used For?

NFIP regulations state that the area below an elevated building can only be used for **parking, building access, and storage**. These areas must not be finished or used for recreational or habitable purposes. Only minimal electrical equipment is allowed and no mechanical or plumbing equipment is to be installed below the BFE.

What is an Enclosure?

An “**enclosure**” is formed when any space below the BFE is enclosed on all sides by walls or partitions. Enclosures can be divided into two types—breakaway and non-breakaway.

- **Breakaway** enclosures are designed to fail under base flood conditions without jeopardizing the elevated building (Figure 2) – **any below-BFE enclosure in a V Zone must be breakaway**. Breakaway enclosures are permitted in A Zones but must be equipped with flood openings.
- **Non-breakaway enclosures** can be constructed in an A Zone. They may be used to provide structural support to the elevated building. All A Zone enclosures must be equipped with flood openings to allow the automatic entry and exit of floodwaters. **It is recommended that they be used only in A Zone areas subject to shallow, slow-moving floodwaters without breaking waves (i.e., do not use in Coastal A Zones).**

Breakaway Walls

Breakaway walls must be designed to break free under the larger of the following Allowable Stress Design loads: 1) the design wind load, 2) the design seismic load, or 3) 10 pounds per square foot (psf), acting perpendicular to the plane of the wall (see Figure 3 for an example of a compliant breakaway wall). If the Allowable Stress Design loading exceeds 20 psf for the designed breakaway wall, the **breakaway wall design must be certified**. When certification is required, a registered engineer or architect must certify that the walls will collapse under a water load associated with the base flood and that the elevated portion of the building and its foundation will not be subject to collapse, displacement, or lateral movement under simultaneous wind and water loads. **Breakaway walls must break away cleanly and must not damage the**



Figure 2. Breakaway walls beneath this building failed as intended under the flood forces of Hurricane Ike.

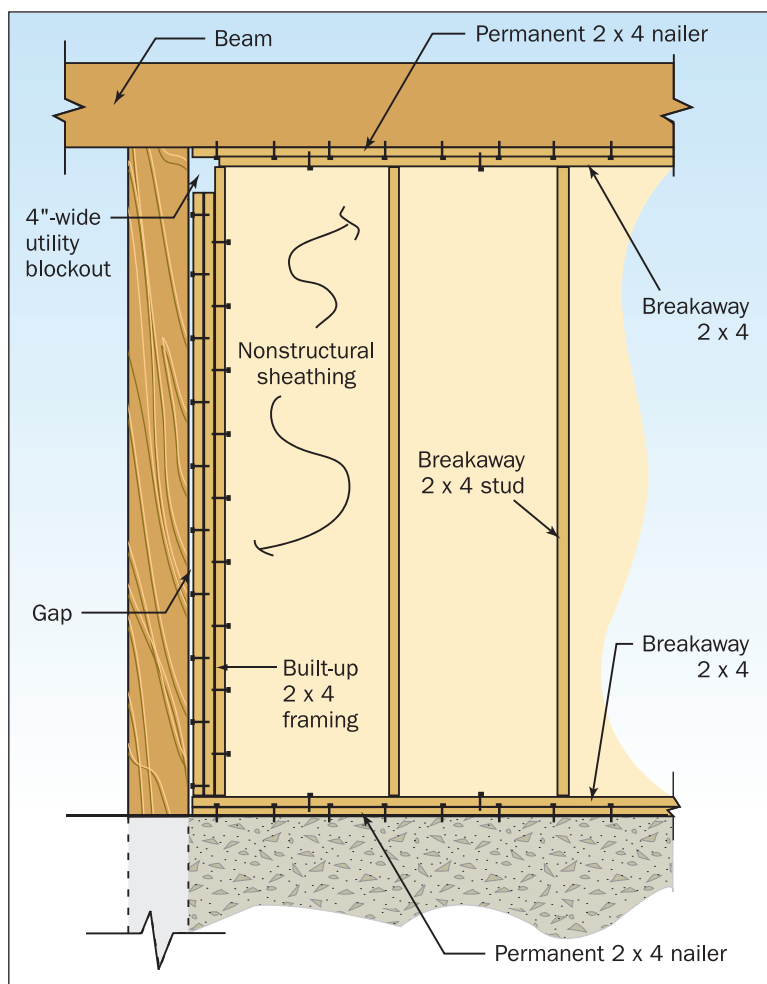


Figure 3. An example of an NFIP-compliant breakaway wall constructed of preservative treated or decay resistant lumber.

elevated building (Figure 4). **Utilities should not be attached to, or pass through, breakaway walls.** See FEMA (2008a) Technical Bulletin 9, *Design and Construction Guidance for Breakaway Walls* for more information.



Figure 4. Building siding extended down and over the breakaway wall. Lack of a clean separation allowed damage to spread upward as the breakaway wall failed.

Obstruction Considerations

A V Zone building, elevated on an open foundation without an enclosure or other obstructions below the BFE, is said to be free of obstructions, and will receive a favorable flood insurance premium (see FEMA (2008b) Technical Bulletin 5-08, *Free-of-Obstruction Requirements* for more information).

The following building scenarios are also classified by the NFIP *Flood Insurance Manual* as **free of obstructions**:

- Below BFE space is surrounded by insect screening and/or by wooden or plastic lattice, slats, or shutters (louvers), if at least 40 percent of the lattice and louver area is open. Lattice can be no thicker than $\frac{1}{4}$ inch; slats or louvers can be no thicker than 1 inch.
- Below BFE space is surrounded by a combination of one solid breakaway wall (or garage door), and all other sides of the enclosure are either insect screening, wooden or plastic lattice, slats, or louvers.

The following building scenarios are classified by the NFIP *Flood Insurance Manual* as **with obstructions**:

- Below BFE space is fully enclosed by solid breakaway walls.
- Below BFE space is enclosed by a combination of two or more solid breakaway walls, with the remaining sides of the enclosure comprised of either insect screening, or wooden or plastic lattice, slats, or louvers.

Flood Openings

Foundation walls and other enclosure walls of A Zone buildings (including Coastal A Zone buildings) must be equipped with openings that allow the **automatic entry and exit of floodwaters** (Figure 5).

A Zone opening requirements are as follows:

- Flood openings must be provided in **at least two of the walls** forming the enclosure.
- **The bottom of each opening is to be located no higher than 1 foot above the grade that is immediately under each opening. If the interior and exterior grades are different, the higher of the final interior grade and the finished exterior grade that is immediately under each opening is used to make the determination.**
- **Louvers, screens, or covers** may be installed over flood openings as long as they do not interfere with the operation of the openings during a flood.
- Flood openings may be sized according to either a prescriptive method (1 square inch of flood opening per square foot of enclosed area) or an engineering method (which must be certified by a registered engineer or architect).

Details concerning flood openings can be found in FEMA (2008c) Technical Bulletin 1-08, *Openings in Foundation Walls and Walls of Enclosures*.



Figure 5. Flood opening in a below-BFE enclosure wall.

Other Considerations

Enclosures are strictly regulated because, if not constructed properly, they can transfer flood forces to the main structure (possibly leading to structural collapse). There are other considerations as well.

- Owners may be tempted to convert enclosed areas below the BFE into habitable space, leading to life-safety concerns and uninsured losses. Buildings without enclosures below the lowest floor should be encouraged. If enclosures are constructed, contractors **should not stub out utilities in enclosures** (utility stub-outs make it easier for owners to finish and occupy the space).

- Siding used on the elevated portions of a building should not extend down over breakaway walls. Instead, a clean separation should be provided so that any siding installed on breakaway walls is structurally independent of siding elsewhere on the building. Without such a separation, the failure of breakaway walls can result in damage to siding elsewhere on the building (see Figure 4).
- Solid breakaway wall enclosures in V Zones will result in **higher flood insurance premiums** (especially where the enclosed area is 300 square feet or greater). Insect screening, lattice, slats, or louvers are recommended.

It is recommended to use insect screening, open wooden or plastic lattice, slats, or louvers instead of solid breakaway walls beneath elevated residential buildings.

- If enclosures are constructed in **Coastal A Zones, open foundations with breakaway enclosures are recommended** instead of foundation walls or crawlspaces. If solid breakaway walls are used, then they must be equipped with flood openings that allow floodwaters to enter and exit the enclosure. Use of breakaway enclosures in Coastal A Zones (or any A Zone) will not lead to higher flood insurance premiums.

It is recommended that flood openings be considered for solid breakaway walls in V Zones, even though they are not required by the NFIP. The presence of flood openings may relieve flood forces against the solid breakaway walls, reduce damage to the walls, and reduce flood-borne debris.

- Garage doors installed in below-BFE enclosures of V Zone buildings—even reinforced and high-wind-resistant doors—must meet the performance requirement discussed in the *Breakaway Walls* section of this Fact Sheet. Specifically, the doors must be designed to break free under the larger of the following Allowable Stress Design loads: design wind load, the design seismic load, or 10 psf, acting perpendicular to the plane of the door. If the Allowable Stress Design load exceeds 20 psf for the designed door, **the door must be designed and certified to collapse under base flood conditions**. See the *Breakaway Walls* section for information about certification requirements.

There are two other enclosure scenarios that should be mentioned, both of which have construction and flood insurance consequences. Contractors and designers should be cautious when an owner asks for either type of enclosure, and consultation with the community and a knowledgeable flood insurance agent is recommended.

- **Below-BFE enclosures** that do not extend all the way to the ground (sometimes called “hanging” enclosures or “elevated” enclosures, occurs when there is an enclosure floor system tied to the building foundation and above the ground – see Figure 6). In V Zones, the enclosure walls must be breakaway, and the enclosure floor system must either break away or the building foundation must be designed to accommodate flood loads transferred from the enclosure floor system to the foundation. In V Zones, the enclosure walls must be breakaway, and the enclosure floor system must either break away or the building foundation must be designed to accommodate flood loads transferred from the enclosure floor system to the foundation.



Figure 6. Example of an enclosure that does not extend to grade. This type of enclosure presents special construction and flood insurance issues. Contractors should proceed with caution when an owner requests such an enclosure.

- In A Zones, the enclosure walls must have proper flood vents, with the bottom no higher than 1 foot above the enclosure floor. These types of enclosures were not contemplated when flood insurance premium rate tables were constructed, and can result in significantly higher flood insurance premiums than had the enclosure walls extended to the ground. The NFIP is working to correct this rating issue; until then, owners will pay a substantial premium penalty for this type of construction.

■ **Two-story enclosures** below elevated buildings (see Figure 7). As some BFEs are established higher and higher above ground, some owners have constructed two-story solid wall enclosures below the elevated building, with the upper enclosure having a floor system approximately midway between the ground and the elevated building. These types of enclosures present unique problems. In A Zones both levels of the enclosure must have flood openings in the walls unless there is some way to relieve water pressure through the floor system between the upper and lower enclosures; in V Zones, the enclosure walls (and possibly enclosure floor systems) must be breakaway; special ingress and egress code requirements may be a factor; these enclosures may result in substantially higher flood insurance premiums.



Figure 7. Example of a two-story enclosure below the BFE. This type of enclosure presents special construction and flood insurance issues. Contractors should proceed with caution when an owner requests such an enclosure.

Additional Resources

FEMA. 2008a. *Design and Construction Requirements for Breakaway Walls*. Technical Bulletin 9-08, (<http://www.fema.gov/library/viewRecord.do?id=1722>).

FEMA. 2008b. *Free-of-Obstruction Requirements*. Technical Bulletin 5-08, (<http://www.fema.gov/library/viewRecord.do?id=1718>).

FEMA. 2008c. *Openings in Foundation Walls and Walls of Enclosures*. Technical Bulletin 1-08, (<http://www.fema.gov/library/viewRecord.do?id=1579>).

FEMA. 2009. *Hurricane Ike Recovery Advisory, Design and Construction in Coastal A Zones*, (<http://www.fema.gov/library/viewRecord.do?id=1569>).

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