

Enclosures and Breakaway Walls



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HURRICANE IKE RECOVERY ADVISORY

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

Key Issues

- Spaces below elevated buildings can be used only for building access, parking, and storage.
- 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.
- 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 by the flood insurance policy.
- 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). Use of these materials will allow floodwaters to pass into and out of the enclosed space and minimize damage to the enclosure “walls.” Although not required by the NFIP, installation of flood openings in breakaway walls may also reduce damage to the walls.

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

NFIP regulations state that the area below an elevated building can be used only for parking, building access,



WARNING

Designers and owners 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 by flood insurance and 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' 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 floodborne debris elements due to taller breakaway walls.



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

and storage. These areas must not be finished or used for recreational or habitable purposes. No mechanical, electrical, 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. **This Recovery Advisory recommends their use only in A-zone areas subject to shallow, slow-moving floodwaters without breaking waves.**

Breakaway Walls

Breakaway walls must be designed to break free under the larger of: 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 loading at which the breakaway wall is intended to collapse exceeds 20 psf, **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 elevated building when they do so** (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.



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

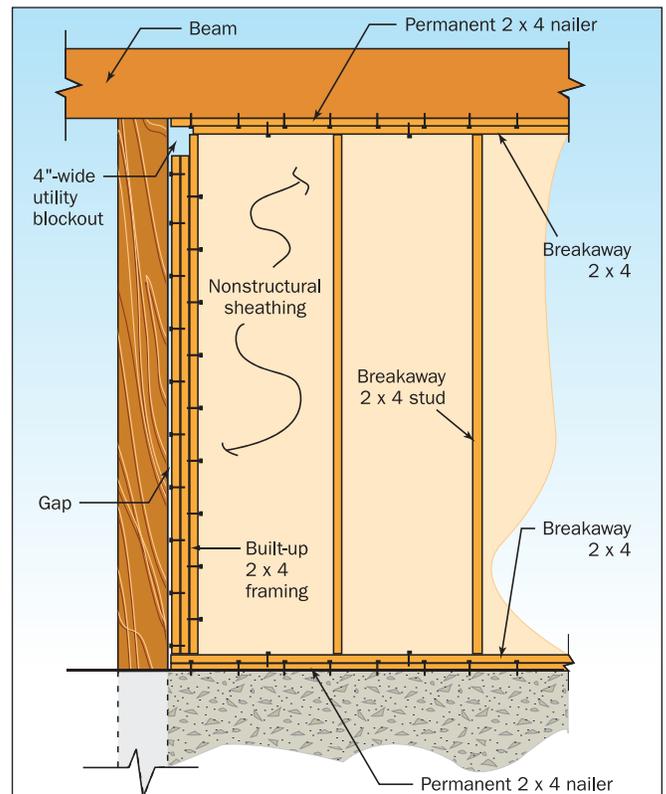


Figure 3. NFIP-compliant breakaway wall construction.



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 enjoys favorable flood insurance premiums (see FEMA (2008b) Technical Bulletin 5, *Free-of-Obstruction Requirements* for more information).

The following building scenarios are also classified by the NFIP 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 ½"; slats or louvers can be no thicker than 1".
- Below BFE space is surrounded by a combination of one solid breakaway wall (or garage door), and all other sides of the enclosure are insect screening, or wooden or plastic lattice, slats, or louvers.

The following building scenarios are classified by the NFIP 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 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 flood opening must be no more than 1' above the higher of the interior or exterior adjacent grade.**
- **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, *Openings in Foundation Walls and Walls of Enclosures*.

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. Construction without enclosures should be encouraged. 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 **significantly higher flood insurance premiums** (especially where the enclosed area is 300 square feet or greater). Insect screening or lattice, slats, or louvers are recommended instead.



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

- If enclosures are constructed in **Coastal A zones** (see the Hurricane Ike Recovery Advisory, *Design and Construction in Coastal A Zones*), **open foundations with breakaway enclosures are recommended** in lieu of foundation walls or crawlspaces. If solid breakaway walls are used, 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.

This Recovery Advisory recommends the use of insect screening, or open wood or plastic lattice, slats, or louvers, instead of solid breakaway walls beneath elevated residential buildings.

- 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 Recovery Advisory. Specifically, the doors must be designed to break free under the larger of the design wind load, the design seismic load, or 10 psf, acting perpendicular to the plane of the door. If the loading at which the door is intended to collapse is greater than 20 psf, **the door must be designed and certified to collapse under base flood conditions.**

This Recovery Advisory recommends 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 and reduce damage to the walls.

See the *Breakaway Walls* section for information about certification requirements.

References

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

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

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

FEMA. 2009. Hurricane Ike Recovery Advisory, *Design and Construction in Coastal A Zones*.