ASFPM Nonstructural/Floodproofing Workshops

Barriers
Floodwalls & Levees

ASFPM Nonstructural/Floodproofing Committee

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Super Storm Sandy Impacts
Floodwalls and levees are not permitted to address substantial damage (SD) or substantial improvements (SI) nor do they bring new structures into compliance with NFIP regulations. In addition, floodwalls and levees do not affect NFIP flood insurance rates or mandatory purchase of insurance.

NFIP regulations do not permit floodwalls and levees in a regulatory floodway unless hydrologic and hydraulic analysis demonstrates that the proposed floodwall or levee would not result in any increase in flood levels during the base flood.
<table>
<thead>
<tr>
<th><strong>Advantages</strong></th>
<th><strong>Disadvantages</strong></th>
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<tbody>
<tr>
<td>Protects the area around the structure from inundation without significant changes to the structure</td>
<td>Does not satisfy the NFIP requirements for bringing substantially damaged or improved structures into compliance</td>
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<td>Eliminates pressure from floodwaters that would cause structural damage to the home or other structures in the protected area</td>
<td>May fail or be overtopped by large floods or floods of long duration</td>
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<td>Costs less to build than elevating or relocating the structure</td>
<td>May be expensive</td>
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<td>Allows the structure to be occupied during construction</td>
<td>Requires periodic maintenance</td>
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<td>Reduces flood risk to the structure and its contents</td>
<td>Requires interior drainage</td>
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<td>Reduces the physical, financial, and emotional strains that accompany flood events</td>
<td>May affect local drainage, possibly resulting in water problems for others</td>
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<td>Does not reduce flood insurance premiums</td>
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<td>May restrict access to structure</td>
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<td>Requires considerable land (levees only)</td>
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<td>Does not eliminate the need to evacuate during floods</td>
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<td>May require warning and human intervention for closures</td>
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<td>May violate applicable codes or regulations</td>
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**A significant portion of the material in this presentation is taken from FEMA “Engineering Principles and Practices” & “Floodproofing Nonresidential Structures”.”
Floodwalls

A floodwall is a freestanding, permanent engineered structured structure designed to prevent encroachment of floodwaters. Floodwalls are typically constructed of reinforced concrete or masonry, provide a barrier against inundation, protect structures from hydrostatic and hydrodynamic loads, and may deflect flood-borne debris and ice away from the structure.

This presentation is generally limited to the application of this measure for single structures or a small cluster of structures.
Types of floodwalls

- Depends on its weight for stability
- Resists overturning by the dead weight of the concrete/masonry construction
- Resists sliding
- Appropriate for low walls or lightly loaded walls
- Easy to design and construct
- Requires a large volume of material
- Most common in residential applications
- Reinforced-concrete cast-in-place or concrete block
- Stability is partially achieved thru the weight of the soil on the heel portion
- Reinforced concrete core is the principal structural element of the wall
- May be aesthetically altered with brick or other
Counterfort and Buttress

- Similar to cantilever wall except it can be used where the cantilever is lone or when very high pressures are exerted behind the wall.
- Counterfort or immediate transverse support bracing, are designed at intervals along the wall to reduce the design forces.
- Generally economical for walls exceeding 20 feet (not generally for residential)
- Buttress very similar to counterfort except....
Building and Site Considerations in Floodwall Design

- Identify flood hazards
- Evidence of seepage/cracking in foundation walls
- Soil types and conditions
- Identify various floodwall options and designs
- Number and size of floodwall openings required
- Utility penetrations through or under the floodwall
- Local building codes/requirements
- Owner preferences

**Operations and Maintenance plan & cost**
Closures

Concrete or Brick Flood Wall

Closure Panel

Closure Track

Latching dogs are commonly used to secure a closure panel

Side-hinged closure

Drop-in closure
Closures
Levees

Levees are not made of manmade materials like floodwalls but rather compacted soil. Levees are more commonly used to protect single residential structures, non-residential buildings and/or agricultural facilities than floodwalls. However, given their relative cost and the amount of land that is required for construction, levees are a less common mitigation measure than many of the other floodproofing options.
Items to be considered for Levees

- Does the natural topography around the structure lend itself to this technique?
- Is suitable impervious fill material readily available? Fill is a significant portion of the costs. May be more economical if the structure doesn’t have to be protected on all four sides.
- Impervious fill material such as CH, CL, or SC should be used to eliminate concerns of seepage and stability.
- Do local, State, Federal laws, regulations, or ordinances restrict or prevent the construction of a levee?
- Has coordination with local, State, and Federal officials been arranged?
- Will the construction of a levee alter, impede, or redirect the natural flow of floodwaters?
- Project must not result in increased upstream flood hazards. An H&H analysis may be required to determine the effects of the project.
- Will flood velocities allow for the use of this technique?
- Do the flood velocities along the water side of the levee embankment exceed 8 cfs. If so, scour protection may be required.
- What is the duration of flooding?
Standard design Criteria

- Maximum settled levee height of 6 feet
- Maximum levee crest width of 5 feet
- Levee floodwater side slope of 1 vertical on 3.5 horizontal
- Levee land side slope: Soil type may require flatter slopes
- One foot of freeboard
- Operation & Maintenance
Must design for interior drainage

Closures for residential structures should be passive if possible.