Evaluating your FPM building design and construction requirements in a post-disaster environment

Cleveland, Ohio

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FLOOD FEST 2019: The Mitigation & Resilience Tour

WATER + ENVIRONMENT + TRANSPORTATION + ENERGY + FACILITIES
Concurrent Session Abstract

- Our goal is to share lesson learned that can help communities leverage resources and data for a variety of purposes (FEMA preliminary damage assessment, building safety evaluation, substantial damage, building performance assessment, etc.) especially evaluating floodplain management building design and construction requirements.

- This presentation will
  - focus on experience and lessons learned from past FEMA MAT deployments (emphasis on 2017 and 2018)
  - Identify actions communities can take in a pre and post disaster environment to effectively evaluate their floodplain management building design and construction requirements
  - share a variety of flood damage observations from recent hurricanes, as well as data the teams leveraged throughout the process to facilitate their building assessments
  - highlight mobile GIS applications and other technology used to help collaborate and coordinate
FEMA Mitigation Assessment Team Reports

- **Hurricane Georges... in the Gulf Coast**
  - Building Performance Assessment Report
  - Observations, Recommendations, and Technical Guidance
  - FEMA 549 / July 2006

- **Hurricane Katrina in the Gulf Coast**
  - Mitigation Assessment Team Report
  - Building Performance Observations, Recommendations, and Technical Guidance
  - FEMA P-337 / April 2009

- **Midwest Floods of 2008 in Iowa and Wisconsin**
  - Mitigation Assessment Team Report
  - Building Performance Observations, Recommendations, and Technical Guidance
  - FEMA P-365 / October 2009

- **Hurricane Sandy in New Jersey and New York**
  - Mitigation Assessment Team Report
  - Building Performance Observations, Recommendations, and Technical Guidance
  - FEMA P-782 / November 2013

- **Hurricane Ike in Texas and Louisiana**
  - Mitigation Assessment Team Report
  - Building Performance Observations, Recommendations, and Technical Guidance
  - FEMA P-177 / April 2009
Guess the event/location?

FEMA P-757 Hurricane Ike MAT Report
Figure 3-22. Linear scour features tend to align with canals and roads as storm surge returns to the Gulf. Houses such as this one were fortunate not to be undermined and lost during Ike, as many homes undoubtedly were (Bolivar Peninsula, TX).
Guess the event/location?

A. Hurricane Irma, Florida
B. Hurricane Michael, Florida
C. Hurricane Ike, Texas
D. Hurricane Harvey, Texas

FEMA P-2023 Hurricane Irma in Florida MAT Report
Scour [A] may have been increased by privacy walls [B], driveways (dotted blue line), and utility placement that led to preferred flow paths [C]. Water depth approximately 30” above slab. Yellow line indicates boundary of the area scoured. Figure 3-14 (Lower Matecumbe Key, FL)
Guess the event/location?

FEMA P-2023 Hurricane Irma in Florida MAT Report
Yellow line indicates boundary of the area scoured. The MAT did not determine whether scour contributed to the collapse. Figure 3-17 (Lower Matecumbe Key, FL)
Guess the event/location?

A. Hurricane Irma, Florida
B. Hurricane Matthew, Florida
C. Hurricane Sandy, New Jersey
D. Hurricane Florence, North Carolina

**FEMA 290 Fran BPAT**

*Hurricane Florence, North Carolina*

Shallow deck supports into frontal dune.

*Embedment of deck supports into frontal dune was often shallow. After erosion of the dune, the bottom of the support for this deck was left several feet above grade.*
"Dry floodproofing often requires extensive human intervention."

FEMA P-2023 Hurricane Irma in Florida MAT Report Figure 3-31: A high-rise residential building under construction was successfully protected by a dry floodproofing method that used flood panels and doors; the floodproofing was installed by the building contractor (Miami, FL)

The doors without [A] and with [B] the floodproofing system deployed. [C] shows the panel and post storage room. [D] shows a gap at the top of a doorway flood shield.

System took 10 workers 2 full days to install.

“In one case, a contractor failed to properly install the complete floodproofing system, allowing floodwater to enter the building through the unprotected area.”
The passive floodgate was not overtopped. Floodwater entered via the parking garage and by overloading an unreinforced masonry wall used to infill a below-grade wall penetration to an unused utility vault.

A. unreinforced masonry wall used to infill a below-grade wall penetration to an unused utility vault.
B. Understanding the potential source of flooding is critical.
Guess the event/location?

Figure 2-21 Survival of this properly elevated NC State Park public restroom demonstrates the State’s commitment to proper construction in coastal areas.

FEMA P-2023 Hurricane Irma in Florida MAT Report
Figures 3-41 & 42: Restroom in Long Key State Park that sustained structural flood damage. Elevated restroom with ground-level enclosure at Bahia Honda State Park, flood depth in enclosure was 5 feet. (Monroe County)
Guess the event/location?

Hurricane Florence, North Carolina
Town Creek, NC houses in and out of SFHA flooded

Source: https://youtu.be/lVWHtR8OnSw
Guess the event/location?

FEMA 338 Georges BPAT

FEMA P-2023 Hurricane Irma in Florida MAT Report
Figure 3-5 and Figure 3-6 show damage to adjacent elevated and non-elevated homes on the Atlantic Ocean shoreline of Big Pine Key.
Guess the event/location?

Figures 3-7 and 3-8 Elevated house built in 2002 (HWM, shown as the dotted red line) had much less damage than surrounding older slab-on-grade houses. Slab-on-grade house (located across the street from the elevated residence) has large debris pile [Zone AE]

FEMA P-2022 Hurricane Harvey in Texas MAT Report
Figure 3-17 Non-flood damage-resistant materials removed from the crawlspace of the adjacent elevated Harris County building built in 2014 [Zone AE]
### RESULTS

<table>
<thead>
<tr>
<th>Claim Amounts</th>
<th>Foundation Type</th>
<th>Year Built</th>
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<tbody>
<tr>
<td></td>
<td>Crawlspace</td>
<td>Slab</td>
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<tr>
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<tr>
<td><strong>Total</strong></td>
<td><strong>157</strong></td>
<td><strong>38</strong></td>
</tr>
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</table>

1. Initial FIRM is dated 1981; structures built 1982 and later would comply with NFIP requirements per the initial FIRM.
2. Updated FIRM for the area studied is dated 1999; structures constructed 2000 and later would comply with updated zone information shown on the 1999 or latest effective FIRM.

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**Figure 3-23:** Distribution of residences analyzed in the representative residential area, as of June 2018.
### RESULTS

<table>
<thead>
<tr>
<th>CLAIM AMOUNTS</th>
<th>FOUNDATION TYPE</th>
<th>YEAR BUILT</th>
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<td>26%</td>
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<td>12%</td>
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<tr>
<td>Total</td>
<td>157</td>
<td>100%</td>
</tr>
</tbody>
</table>

1. Initial FIRM is dated 1981; structures built 1982 and later would comply with NFIP requirements per the initial FIRM.
2. Updated FIRM for the area studied is dated 1999; structures constructed 2000 and later would comply with updated zone information shown on the 1999 or latest effective FIRM.

- Claims 71 of 157 < $50,000
- Foundation
  - 37 or 38 crawlspace < $50,000 (34 of 119 slab)
- Post-FIRM
  - 72 of 95 < $50,000
  - Post 2000 - 58 of 64 < $50,000
Mexico Beach, FL
Through early 2019, 180 Closed NFIP Claims
77 Zone AE Polices, Average Claim $123,200
133 Outside SFHA Policies, Average Claims $146,400

Summary of 2017 & 2018 observations

- Elevation and Foundation Type Matter
- Mother Nature does not follow directions/read a FIRM
- Scour and Erosion
  - Irma MAT
- Dry Floodproofing Lessons Learned
  - Irma MAT
  - Harvey MAT
Tools & data to evaluate FPM requirements in a post-disaster environment

**Data**
- Parcel – year built, foundation type, building characteristics
- Completed mitigation projects
- Building permits and plans
- NFHL and non-regulatory products
- MT-1 and MT-2s aka LOMA, LOMR, CLOMR, etc.
- Flood insurance Policy Holders
- Repetitive Loss Properties
- Elevation Certificates
- Location of Public and Critical Facilities
- Local Hazard Mitigation Plan/Strategy
- Historical Imagery/Street View

**Monitoring**
- Press/social media
  - Crowdsourcing
  - Heatmaps
- Damage assessments/Insurance claims
- High water marks
- Situation Reports
- First Responders/Search and Rescue
- Imagery/Civil Air Patrol Pictures
Tools & data to evaluate FPM requirements in a post-disaster environment

- Onslow County
  - 49 minute video, 12 miles
  - Mandatory Evacuation
  - Situational awareness
  - Legal restrictions
  - Processing
  - Coastal perspective
  - Efficient
  - Planned points of emphasis
  - Calibrate modeling
  - Document building performance
Tools & data to evaluate FPM requirements in a post-disaster environment

- Realtor Sites
  - Building characteristics – year built, size, materials, etc.
  - Exterior and interior pictures
  - Identified large break-away walls in this example
Tools & data to evaluate FPM requirements in a post-disaster environment

- **Applications**
  - ESRI Collector
  - Fulcrum

- **Public/self reporting**
  - Site elevations versus USGS HWM

- **Collaboration**
  - Teams Site
  - Slack Channel

- **Data analytics**
  - Information overload
  - Pre-established criteria/process
  - Event focused emphasis
Why do all this

- Evaluate effectiveness of requirements and practices in your community
- Must consider magnitude/probability of the event
- Jurisdictions goals related to building performance
- Own it – local policy/decisions versus one-size fits all
- Routinely reevaluate
- Validate/calibrate model
- Performance based design
Table 91. Prototype 7A: Building on Open Pile Foundation, Inundation Damage – Structure

<table>
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<th>Flood Depth</th>
<th>Min</th>
<th>Most Likely</th>
<th>Max</th>
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<tr>
<td>10</td>
<td>82</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 107. Prototype 7A: Building on Open Pile Foundation, Inundation Damage – Structure
Questions
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