

Still Standing: Building Performance in the 2017 Hurricane Season

2017 Mitigation Assessment Team Update



ASFPM Annual Conference

Phoenix, AZ - June 19, 2018

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FEMA

Building Science Branch

Agenda

- Mitigation Assessment Team Overview
- 2017 Hurricane MAT Overviews
- Recovery Advisories
- Improving Building Codes and Floodplain Management Regulations
- Preliminary themes across MAT Conclusions and Recommendations

The adoption and enforcement of strong building codes, standards, and floodplain management regulations reduces damages

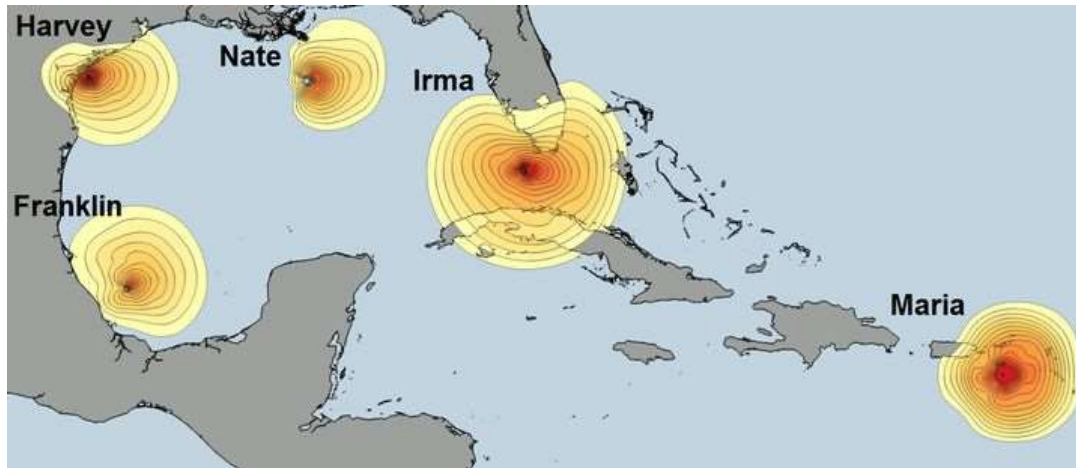
MAT Program Background

- Observes building performance under severe hazard events.
- Determines causes of building damage, failure and success.
- Evaluates performance of mitigation projects.
- Provides design and construction strategic recommendations for reducing damage and protecting lives in hazard areas.
- Draws on combined resources of federal, state, local, academia, and private sectors.
- Supports building science/building code elements of NDRF.



2017 Hurricane MAT Partners

- FEMA Mitigation Assessment Teams
 - Harvey – TX
 - Irma – FL, PR, USVI
 - Maria – PR & USVI

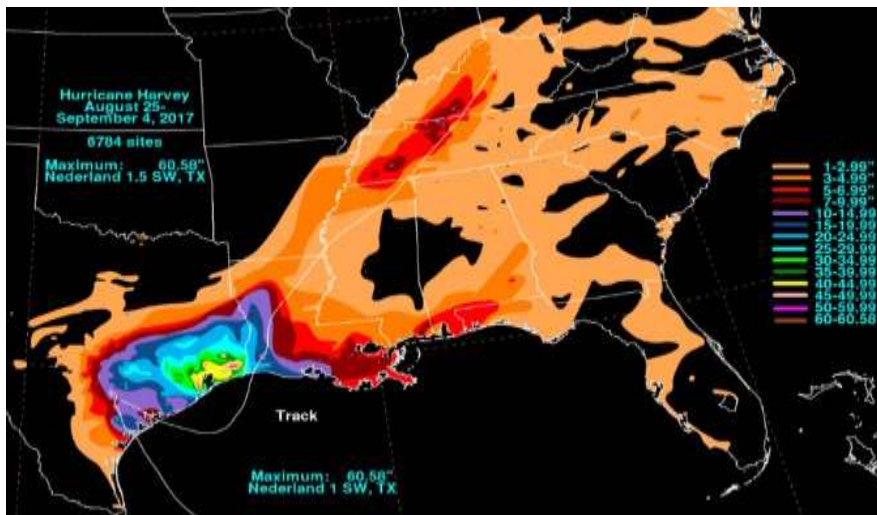


Source: www.rms.com



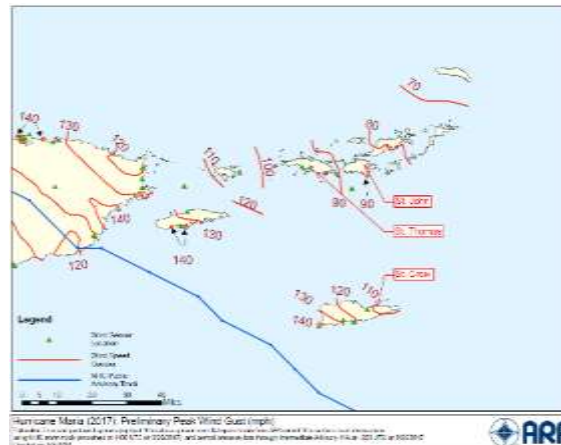
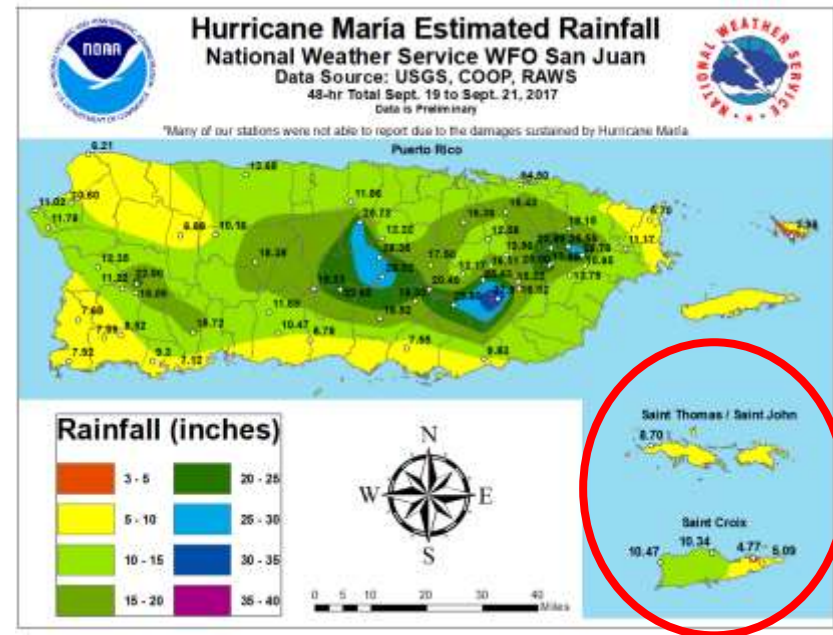
Hurricane Harvey - Texas

- Landfall as a Category 4 hurricane, August 25
- Winds of 130 mph near the Rockport and Fulton, TX
- System remained over Texas for several days, resulting in constant rain from Houston to western Louisiana.



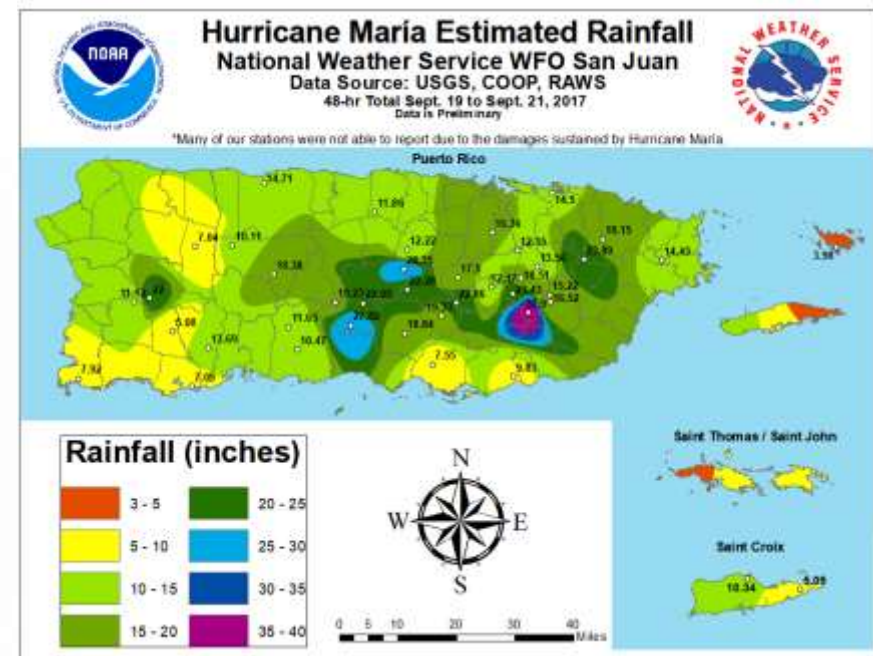
Hurricane Irma and Maria – USVI

- **Irma:** Passed USVI as Category 5, September 6, peak wind gusts 158 mph (St. Thomas/St. John). Rainfall 4-10 inches
- **Maria:** Passed USVI as Category 5, September 19/20, peak wind gusts 137 mph (St. Croix). Rainfall 8-12 inches
- **Both:** Damage primarily from wind with some localized flooding



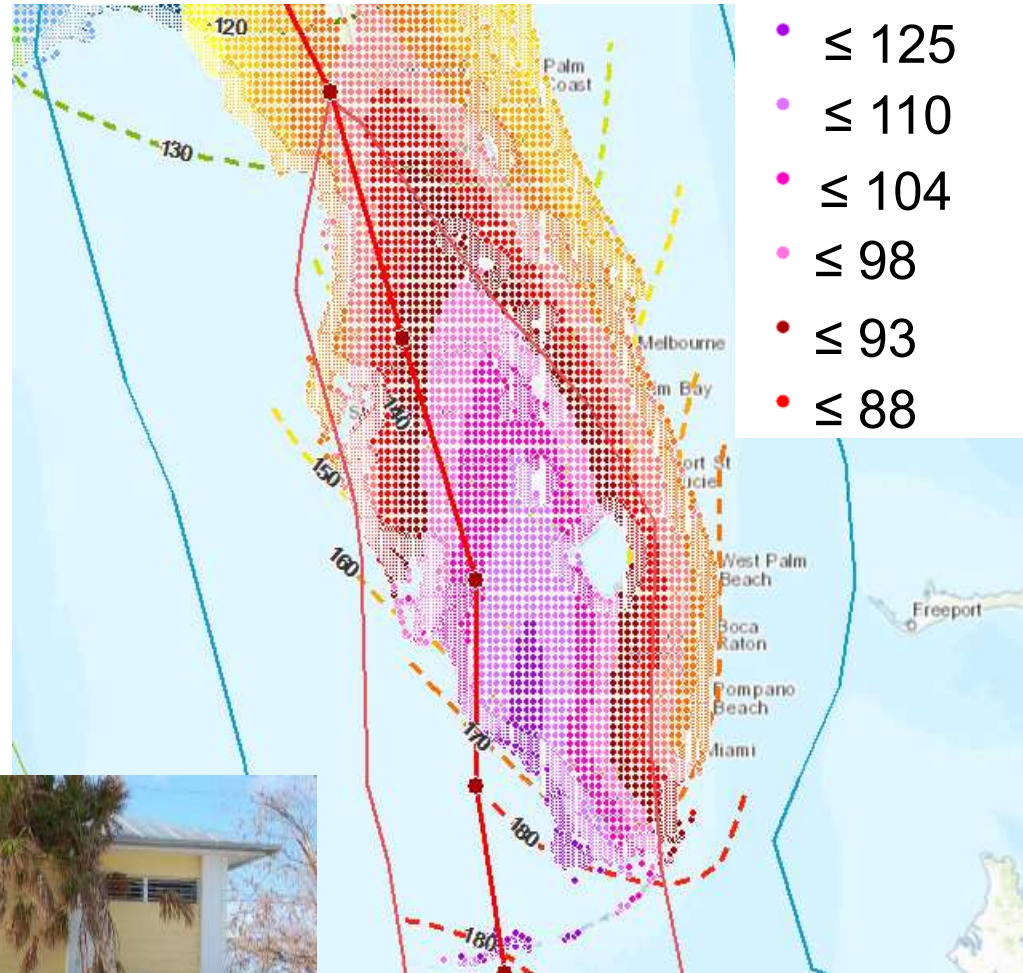
Hurricane Irma and Maria – Puerto Rico

- Landfall as a Category 4, September 20, with winds of up to 155 mph (H. Maria).
- Large amounts of rainfall, nearly 38 inches in one area.
- The maximum observed inundation levels experienced were 6-9 feet.



Hurricane Irma – Florida

- Eye in Keys, September 10 9AM EDT (130 mph-Cat 4, 928mb, NNW at 8 mph)
- Eye just east of Marco Island at 3:30PM EDT (115 mph-Cat 3, 940mb, N at 12mph)



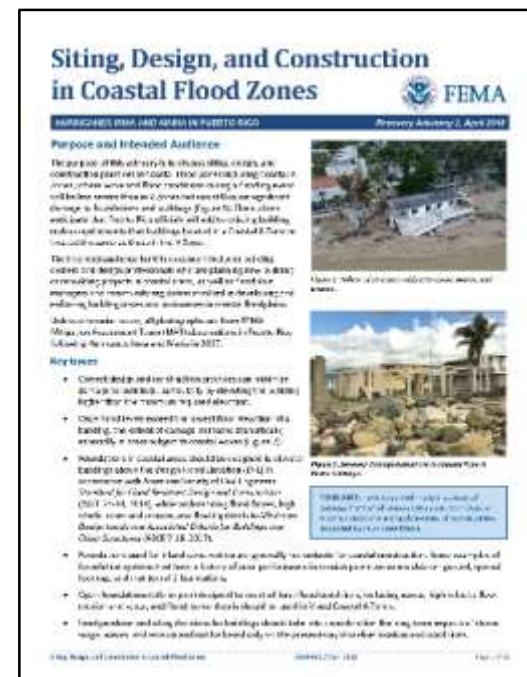
2017 FEMA Hurricane MAT Recovery Advisories

• USVI Recovery Advisories (5)

- ***Rebuilding Your Flood-Damaged House***
- Attachment of Rooftop Equipment in High-Wind Regions
- Installation of Corrugated Metal Roof Systems
- Design, Installation, and Retrofit of Doors, Windows, and Shutters
- Rooftop Solar Panel Attachment

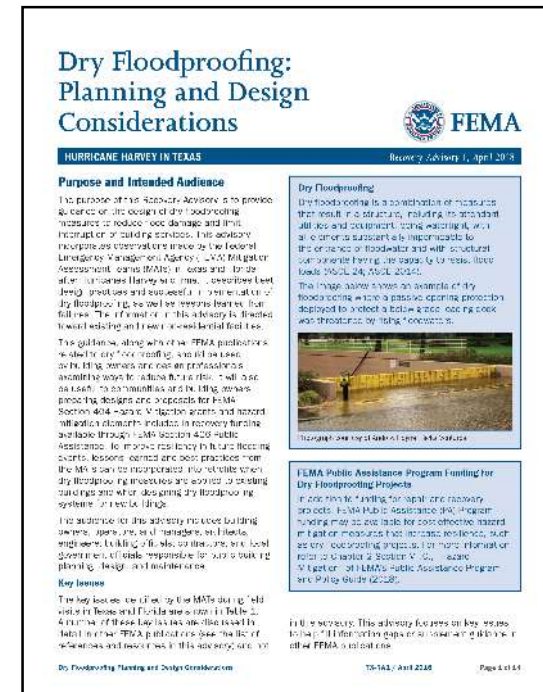
• Puerto Rico Recovery Advisories (6)

- Rooftop Equipment Maintenance and Attachment in High-Wind Regions
- ***Siting, Design, and Construction in Coastal Zones***
- Safe Rooms and Storm Shelters for Life Safety Protection from Hurricanes
- ***Minimizing Flood Damage to Existing Structures***
- Protecting Windows and Openings in Buildings
- Repair and Replacement of Wood Residential Roof Systems



2017 FEMA Hurricane MAT Recovery Advisories

- **Texas Recovery Advisories (2)**
 - ***Dry Floodproofing Planning and Design Considerations***
 - Asphalt Shingle Roofing for High Wind Regions
- **Florida Recovery Advisories (3)**
 - ***Dry Floodproofing Planning and Implementation***
 - Soffit Installation in High-Wind Regions
 - Roof Repair and Replacement Requirements in the 6th Edition (2017) FBC



Rebuilding Your Flood-Damaged House (USVI Recovery Advisory #1)

- How to Determine Your Flood Risk
 - Flood Insurance Rate Map (FIRM)
 - FEMA Map Service Center (MSC)
- Codes and Regulations That May Impact Your Decision to Rebuild
- Options to Minimize Risk of Future Flooding When Rebuilding
 - Relocate to a Site Outside of the SFHA
 - Participate in a Buyout or Acquisition Program
 - Elevate the House
 - Protect the Utilities
 - Wet Floodproofing



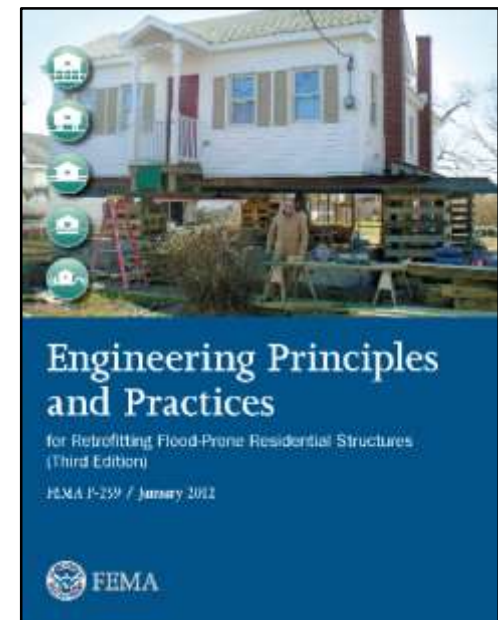
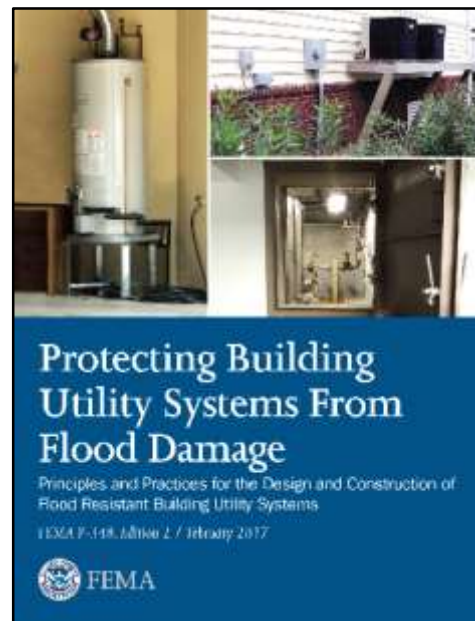
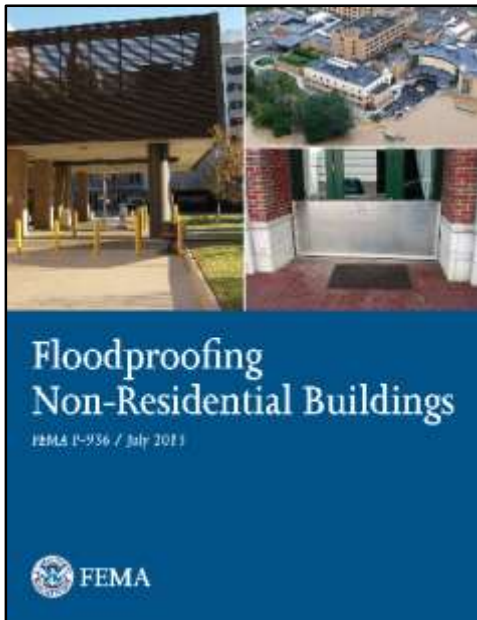
Siting, Design, and Construction in Coastal Zones (PR Recovery Advisory #2)

- Definition of Coastal Flood Zones
 - V, A, Coastal A Zones
- Coastal Flood Advisory Mapping Information
 - LiMWA
 - New 1- and 0.2-percent-annual-chance levels
 - Long-term erosion setback lines for 30-year and 60-year erosion areas
- Siting Structures in Coastal Flood Zones
- V Zone and Coastal A Zone Design and Construction
 - Open Foundations; Elevation; Flood-Resistant Materials; Continuous Load Paths; Freeboard; Screen, Lattice, Louvers, or Solid Breakaway Walls



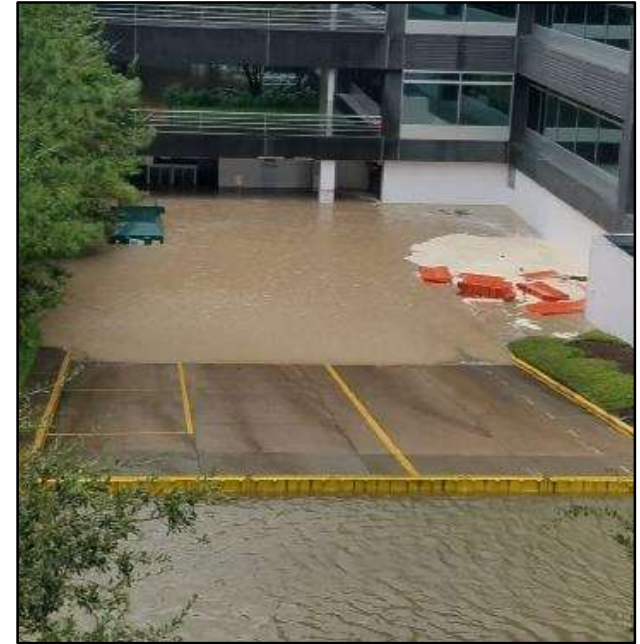
Best Practices for Minimizing Flood Damage to Existing Structures (PR Recovery Advisory #4)

- Achieving NFIP Compliance
- Wet Floodproofing for Existing Construction
- Flood Damage Resistant Materials
- Hydrostatic Openings
- Protect Building Utility Systems and Key Equipment/Contents



Dry Floodproofing Planning and Design Considerations (Texas Advisory #1)

- Dry Floodproofing System Failures
 - Opening protection overtopping
 - Structural failure of flood barrier
 - Failure to identify and protect lowest point of entry
 - Failure to maintain structural integrity of the flood barrier
 - Excessive or unexpected seepage
 - Sanitary sewer or storm water system flows
- Flood vulnerability assessments
- Planning, pre-design, and design considerations



Dry Floodproofing Planning and Implementation (Florida Recovery Advisory #1)

- Dry Floodproofing System Operations
- Operations, Maintenance, and Testing Plans for Dry Floodproofing Systems
 - Storage
 - Deployment Drills
 - Inspections
 - Labeling
- Integration with a Facility Emergency Operations Plan
- Deployment Considerations for Active Dry Floodproofing



Figure 6: Installed flood panels. Each flood panel has a unique ID number. Also note the tightener bracket at top.

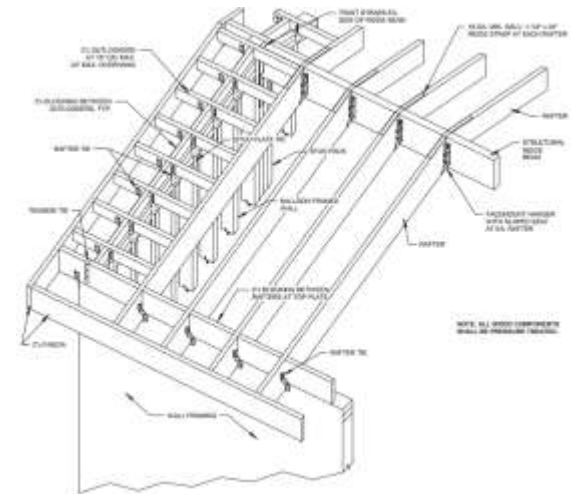
Post-Disaster Building Code Support

- Code Adoption Support in the USVI and PR
 - Assisting with the adoption of 2018 IBC/IRC
 - Supported code change proposals and local amendments that accounts for the unique conditions
 - Developed Fact Sheets: Changes in the Hazard Provisions of the IRC (2009 to 2018): Flood, Wind, Seismic
 - Provided model code-coordinated flood ordinances
 - Training and outreach
- Ensures that building codes and standards are consistent with Recovery Programs



Post-Disaster Building Code Support

- Code Enforcement Support in USVI and PR
 - Direct support for permitting departments
 - Prescriptive design guides for residential structures
 - Microzoning maps
 - Training



Post-Disaster Building Code Support

- Code Enforcement Support
 - Emergency Management Assistance Compact (EMAC) permit officials
 - Hazard Mitigation Grant Program (HMGP) Post-Disaster Code Adoption and Enforcement Mission
 - MAT and other PTS Support



Emergency Management Assistance Compact



MITIGATION ASSESSMENT TEAM

Houston, TX: A Case for Higher Standards



City of Houston Representative NFIP Claims

- City of Houston entered the NFIP in 1981

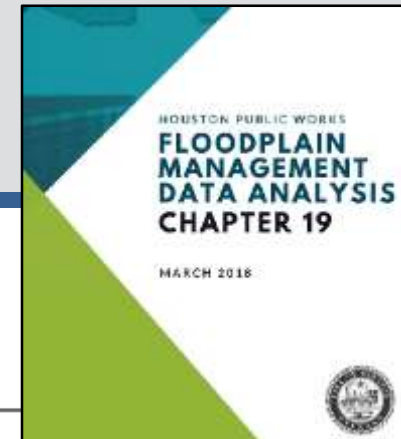
	Quantity		Average Claim	
Pre 1981	365	54%	\$175,028	
Post 1981	308	46%	\$86,870	50%

- Latest FIRM effective 2000 through 2017, City also had 1' freeboard requirement

	Quantity		Average Claim	
Pre 2000	454	67%	\$175,187	
Post 2000	219	33%	\$50,715	71%

A 71% reduction, claims were almost 3.5 times less

Changes to floodplain management requirements in Houston



RULES	EXISTING	PROPOSED
REGULATED AREA	100-year	100 + 500-year
ELEVATION	100-year + 1 foot	500-year + 2 feet
ZERO NET FILL	100-year	100 + 500-year
SUBSTANTIAL IMPROVEMENTS	100-year	100-year
ELEVATION OF ADDITIONS	100-year + 1 foot	500-year + 2 feet (exemption for small additions in 500-year)
FOUNDATION	All types permitted outside floodway	All types permitted outside floodway

Themes across preliminary conclusions and recommendations

- Adoption and Enforcement of Building Codes and NFIP Regulations
- Improving Codes and Standards / Going Beyond Minimums
- Improved Training

The adoption and enforcement of strong codes and regulations reduces damages



Questions?

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Topic categories: MAT and Building Science Updates

<https://www.fema.gov/fema-mitigation-assessment-team-mat-reports>

Pre-Marilyn Construction



Post-Marilyn Construction



Flood/Wind Building Science Helpline:
FEMA-BuildingScienceHelp@dhs.gov
(866) 927-2104

<http://www.FEMA.gov/Rebuild/BuildingScience>