Catalog of FEMA Flood and Wind Publications, and Training Courses

September 2007

FEMA

Contents

These publications and courses have been developed by the Building Sciences Section of FEMA's Mitigation Directorate.

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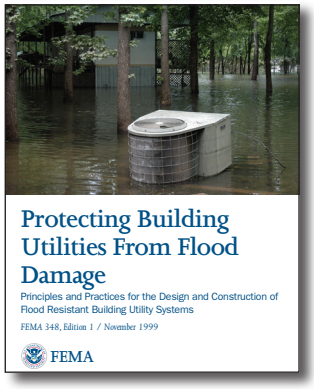
BUILDING SCIENCE PUBLICATIONS

Protecting Building Utilities From Flood Damage: Principles and Practices for the Design and Construction of Flood Resistant Building Utility Systems **(FEMA 348 – November 1999)**



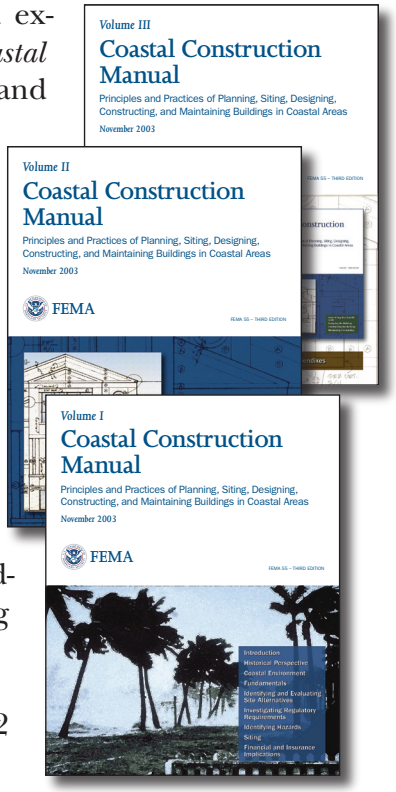
The overall objective of this document is to assist in the construction of buildings with utility systems that are designed and built so that the buildings can be reoccupied and fully operational as soon as electricity, sewer, and water are restored to the neighborhood.

Design and Construction Guidance for Community Shelters **(FEMA 361 – July 2000)**

This document presents important information about the design and construction of community shelters that will provide protection during tornado and hurricane events.

Community shelters are designed and constructed to protect a large number of people from a natural hazard event. The number of persons taking refuge in the shelter will typically be more than 12 and could be up to several hundred or more.

Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas **(FEMA 55 – November 2001)**



FEMA released the *Coastal Construction Manual*, an updated and expanded version of the manual first issued in 1985. The new *Coastal Construction Manual* is intended to help design professionals, state and local officials, and builders mitigate natural hazards to one- to four-family residential buildings in coastal areas.

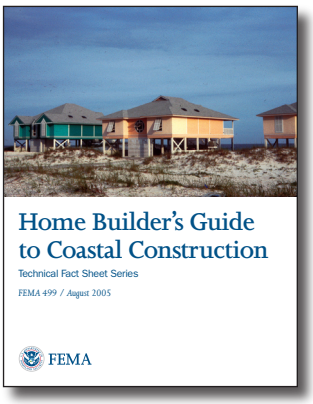
Building on the numerous findings from BPAT and MAT investigations conducted in various coastal areas of the United States, the manual presents state-of-the-art engineering techniques for siting, design, construction, and maintenance aimed at reducing damage from natural hazard events, including hurricanes, northeasters, and other coastal storms. Particular emphasis is placed on mitigating the simultaneous effects of high-velocity flow, wave action, debris impact, high winds, storm-induced and long-term erosion, and storm-induced scour. The manual also addresses multihazard issues such as the use of open foundations for buildings in seismically active coastal areas and the selection of building materials resistant to damage by water, windborne debris, and fire.

The manual consists of three volumes, with 14 chapters and 12 appendixes.

Taking Shelter From The Storm: Building a Safe Room Inside Your House (FEMA 320 – Second Edition, March 2004)

This document helps homeowners decide how best to protect their families from tornadoes and hurricanes. The document provides designs for in-home, free-standing, and underground shelters to protect families from the forces of wind and flying debris. The document also provides construction plans and specifications available in AutoCad and Microstation formats.

Home Builder's Guide to Coastal Construction Technical Fact Sheet Series (FEMA 499 – August 2005)

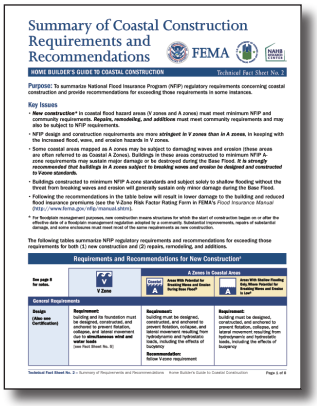


This document contains a series of 31 fact sheets that provide technical guidance and recommendations concerning the construction of coastal residential buildings. The fact sheets present information aimed at improving the performance of buildings subject to flood and wind forces in coastal environments. Photographs and drawings illustrate National Flood Insurance Program (NFIP) regulatory requirements, the proper siting of coastal buildings, and recommended design and construction practices for building components, including structural connections, the building envelope, and utilities. Many of the fact sheets also include lists of FEMA and other resources that provide more information about the topics discussed. Where appropriate, resources are accompanied by active web links.

Coastal Building Successes and Failures

This Technical Fact Sheet (No. 1) discusses how coastal construction requirements are different from those for inland construction, as well the characteristics that make for a successful coastal building.

Summary of Coastal Construction Requirements and Recommendations Building Successes and Failures



This Technical Fact Sheet (No. 2) summarizes National Flood Insurance Program (NFIP) regulatory requirements for new construction and for repairs, remodeling, and additions, and presents recommendations for exceeding those requirements in some instances.

Using a Flood Insurance Rate Map (FIRM)

This Technical Fact Sheet (No. 3) explains the purpose of FIRMs; highlights features of a FIRM that are important to coastal builders, including flood hazard zones and flood elevations; and explains how to obtain FIRMs.

Lowest Floor Elevation

This Technical Fact Sheet (No. 4) defines "lowest floor," discusses benefits of exceeding the NFIP minimum building elevation requirements, points out common construction practices that are violations of NFIP regulations, and discusses the NFIP Elevation Certificate. It also includes a copy of the certificate.

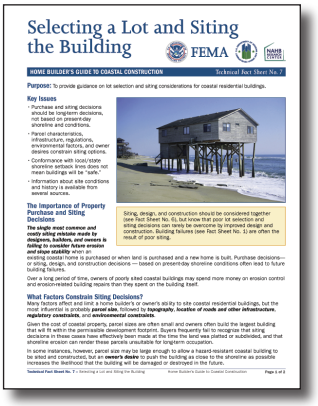
V-Zone Design and Construction Certification

This Technical Fact Sheet (No. 5) explains the certification requirements for structural design and construction in V zones. It also includes a copy of a sample certificate and explains how to complete it.

How Do Siting and Design Decisions Affect the Owner's Costs?

This Technical Fact Sheet (No. 6) discusses the effects of planning, siting, and design decisions on coastal home costs. Topics include initial, operating, and long-term costs; risk determination; and the effect on costs of meeting and exceeding code and NFIP design and construction requirements.

Selecting a Lot and Siting the Building

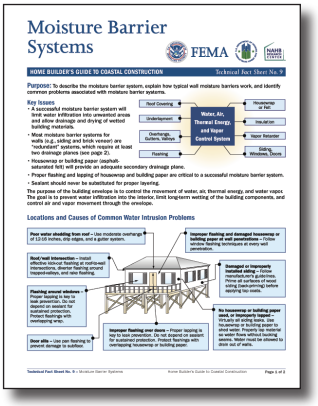

Selecting a Lot and Siting the Building
FEMA
HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION
Technical Fact Sheet No. 7

This Technical Fact Sheet (No. 7) presents guidance concerning lot selection and building siting considerations for coastal residential buildings. Topics include factors that constrain siting decisions, coastal setback lines, common siting problems, and suggestions for builders, designers, and owners.

Coastal Building Materials

This Technical Fact Sheet (No. 8) provides guidance on the selection of building materials used for coastal construction. Flood, wind, corrosion, and decay resistance are discussed, including protection recommendations.

Moisture Barrier Systems

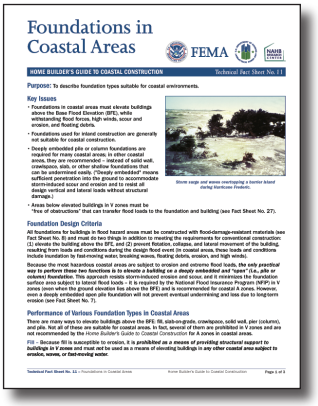

Moisture Barrier Systems
FEMA
HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION
Technical Fact Sheet No. 9

This Technical Fact Sheet (No. 9) describes the moisture barrier system, explains how typical wall moisture barrier systems work, and discusses common problems associated with moisture barrier systems.

Load Paths

This Technical Fact Sheet (No. 10) illustrates the concept of load paths and highlights important connections in a typical wind uplift load path.

Foundations in Coastal Areas


Foundations in Coastal Areas
FEMA
HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION
Technical Fact Sheet No. 11

This Technical Fact Sheet (No. 11) explains foundation design criteria and describes foundation types suitable for coastal environments. It also addresses foundations for high-elevation coastal areas (e.g., bluff areas).

Pile Installation

This Technical Fact Sheet (No. 12) presents basic information about pile design and installation, including pile types, sizes and lengths; layout; installation methods; bracing; and capacities.

Wood-Pile-to-Beam Connections

This Technical Fact Sheet (No. 13) illustrates typical wood-pile-to-beam connections; presents basic construction guidance for various connection methods, including connections for misaligned piles; and illustrates pile bracing connection techniques.

Reinforced Masonry Pier Construction

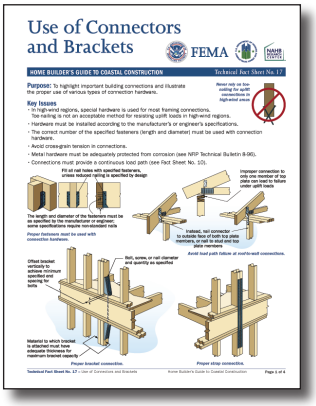
This Technical Fact Sheet (No. 14) provides an alternative to piles in V zones and A zones in coastal areas where soil properties preclude pile installation, but the need for an "open foundation system" still exists. It also includes recommendations for good masonry practice in coastal environments.

Foundation Walls

This Technical Fact Sheet (No. 15) discusses and illustrates the use of foundation walls in coastal buildings. Topics include footing embedment, wall height, materials and workmanship, lateral support, flood openings and ventilation requirements, and interior grade elevations for crawlspaces.

Masonry Details

This Technical Fact Sheet (No. 16) illustrates important roof-to-wall and wall-to-foundation connection details for masonry construction in coastal areas. Topics include load paths, building materials, and reinforcement.



Use of Connectors and Brackets

This Technical Fact Sheet (No. 17) illustrates important building connections and the proper use of connection hardware throughout a building.

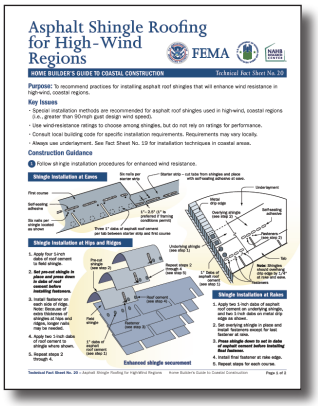
Roof Sheathing Installation

This Technical Fact Sheet (No. 18) presents information about proper roof sheathing installation and its importance in coastal construction; it also discusses fastening methods that will enhance the durability of a building in a high-wind area. Topics include sheathing types and layout methods for gable-end and hip roofs, fastener selection and spacing, the treatment of ridge vents and ladder framing, and common sheathing attachment mistakes.

Roof Underlayment for Asphalt Shingle Roofs

This Technical Fact Sheet (No. 19) presents recommended practices for the use of roofing underlayment as an enhanced secondary water barrier in coastal environments. Optional installation methods are also illustrated.

Asphalt Shingle Roofing for High-Wind Regions



This Technical Fact Sheet (No. 20) recommends practices for installing asphalt roof shingles that will enhance the wind resistance of roof coverings in high-wind, coastal regions. Issues include installation at hips, eaves, and ridges; shingle characteristics; weathering and durability; and wind resistance.

Tile Roofing for High-Wind Areas

This Technical Fact Sheet (No. 21) presents design and construction guidance for tile roofing attachment methods. Topics include uplift loads, uplift resistance, special considerations concerning tile attachment at hips and ridges, tile installation on critical and essential buildings, and quality control.

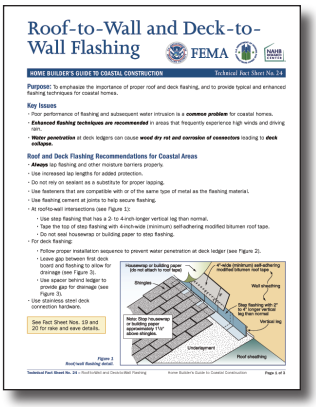
Window and Door Installation

This Technical Fact Sheet (No. 22) presents flashing detail concepts for window and door openings that provide adequate resistance to water intrusion in coastal environments, do not depend solely on sealants, are integral with secondary weather barriers (e.g., housewrap), and are adequately attached to the wall. Topics include the American Society for Testing and Materials (ASTM) Standard E 2112 and specific considerations concerning pan flashings, Exterior Insulation Finishing Systems, frame anchoring, shutters, and weatherstripping.

Housewrap

This Technical Fact Sheet (No. 23) explains the function of housewrap, examines its attributes, and addresses common problems associated with its use. Topics include housewrap vs. building paper and housewrap installation.

Roof-to-Wall and Deck-to-Wall Flashing



This Technical Fact Sheet (No. 24) emphasizes the importance of proper roof and deck flashing, and presents typical and enhanced flashing techniques for coastal homes.

Siding Insulation and Connectors

This Technical Fact Sheet (No. 25) provides basic installation tips for various types of siding, including vinyl, wood, and fiber cement.

Shutter Alternatives

This Technical Fact Sheet (No. 26) presents general information about the installation and use of storm shutters in coastal environments. Shutter types addressed include temporary plywood panels; temporary manufactured panels; permanent, manual closing; and permanent, motor-driven.

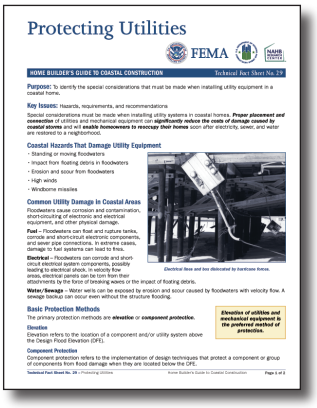
Enclosures and Breakaway Walls

This Technical Fact Sheet (No. 27) defines enclosures and breakaway walls, and discusses requirements and recommendations for their use below the Base Flood Elevation (BFE).

Decks, Pools, and Accessory Structures

This Technical Fact Sheet (No. 28) summarizes NFIP requirements, general guidelines, and recommendations concerning the construction and installation of decks, access stairs and elevators, swimming pools, and accessory buildings under or near coastal residential buildings.

Protecting Utilities


Protecting Utilities

FEMA

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION Technical Fact Sheet No. 29

Purpose: To identify the special considerations that must be made when installing utility equipment in a coastal home.

Key Issues: Hazards, requirements, and recommendations

Special considerations must be made when installing utility systems in coastal homes. ***Proper placement and connection*** of utilities and mechanical equipment can ***significantly reduce the costs of damage caused by coastal storms*** and will ***enable homeowners to reoccupy their homes*** soon after electricity, sewer, and water are restored to a neighborhood.

Coastal Hazards That Damage Utility Equipment

- Standing or moving floodwaters
- Impact from floating debris in floodwaters
- Erosion and scour from floodwaters
- High winds
- Windborne missiles

Common Utility Damage in Coastal Areas

Floodwaters cause corrosion and contamination, short-circuiting of electronic and electrical equipment, and other physical damage.

Fuel – Floodwaters can damage tanks, control and alarm circuit electronic components, and sewer pipe connections. In extreme cases, damage to fuel systems can lead to fires.

Electrical – Floodwaters can corrode and short-circuit electrical system components, possibly leading to electrical shock. In velocity flow areas, electrical panels can be torn from their attachments by the force of breaking waves or the impact of floating debris.

Electrical fuses and box dislocated by hurricane forces.

Water/Sewage – Water wells can be exposed by erosion and scour caused by floodwaters with velocity flow. A sewage backup can occur even without the structure flooding.

Basic Protection Methods

The primary protection methods are ***elevation*** or ***component protection***.

Elevation of utilities and mechanical equipment is the preferred method of protection.

Elevation

Elevation refers to the location of a component and/or utility system above the Design Flood Elevation (DFE).

Component Protection

Component protection refers to the implementation of design techniques that protect a component or group of components from flood damage when they are located below the DFE.

Technical Fact Sheet No. 29 – Protecting Utilities Home Builder's Guide to Coastal Construction Page 1 of 2

This Technical Fact Sheet (No. 29) identifies the special considerations that must be made when installing utility equipment, such as fuel, sewage, and water/sewage lines in a coastal home, and presents recommendations for utility protection.

Repairs, Remodeling, Additions, and Retrofitting

This Technical Fact Sheet (No. 30) outlines NFIP requirements for repairs, remodeling, and additions, and discusses opportunities for retrofitting in coastal flood hazard areas. Also presents recommendations for exceeding the minimum NFIP requirements. Definitions of "substantial damage" and "substantial improvement" are included.

References

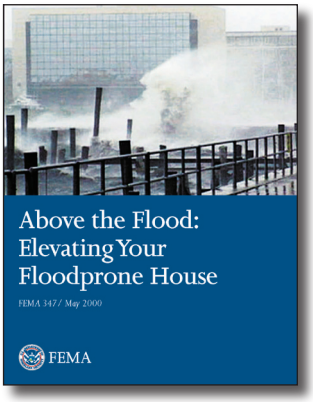
This Technical Fact Sheet (No. 31) lists references that provide information relevant to the topics covered by the *Home Builder's Guide to Coastal Construction* technical fact sheets.

HURRICANE PUBLICATIONS

Against the Wind: Protecting Your Home from Hurricane and Wind Damage (FEMA 247 – December 1993)

This brochure discusses actions homeowners can take before the next hurricane strikes, including improvements or temporary wind protection. It is important that these projects be completed before a hurricane threatens.

Above the Flood: Elevating Your Flood Prone House (FEMA 347 – May 2000)



This publication shows how floodprone houses in south Florida were elevated above the 100-year flood level following Hurricane Andrew and also presents alternative elevation techniques.

HURRICANE RECOVERY ADVISORIES

Asphalt Shingle Roofing for High-Wind Regions (September 2004)

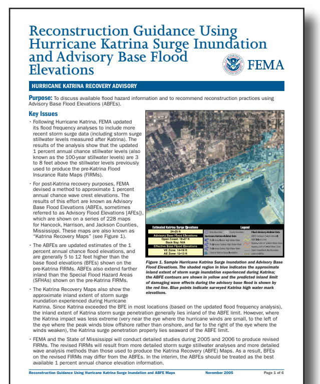
The purpose of this Hurricane Recovery Advisory is to recommend practices for installing asphalt roof shingles that will enhance wind resistance in high-wind coastal and inland hurricane-prone areas.

Roof Underlayment for Asphalt Shingle Roofs (November 2004)

The purpose of this Hurricane Recovery Advisory is to recommend practices for the use of roofing underlayment as an enhanced secondary water barrier in coastal and inland hurricane-prone areas.

Tile Roofing for Hurricane-Prone Areas (November 2004)

The purpose of this Hurricane Recovery Advisory is to recommend practices for designing and installing extruded concrete and clay tiles that will enhance wind resistance in high-wind coastal and inland hurricane-prone areas.


Reconstruction Guidance Using Hurricane Katrina Surge Inundation and Advisory Base Flood Elevations
FEMA
HURRICANE KATRINA RECOVERY ADVISORY

Reconstruction Guidance Using Hurricane Katrina Surge Inundation and Advisory Base Flood Elevations (November 2005)

The purpose of this Hurricane Recovery Advisory is to discuss available flood hazard information and to recommend reconstruction practices using Advisory Base Flood Elevations (AFBEs).

Initial Restoration for Flooded Buildings (November 2005)

This Hurricane Recovery Advisory is specifically intended for buildings subject to the effects of long-term flooding and widespread mold growth following Hurricane Katrina.

The ABC's of Returning to Flooded Buildings (November 2005)

Hurricane Katrina produced widespread flooding from both storm surge and levee breaches. The purpose of this Hurricane Recovery Advisory is to assist impacted individuals when they are able to reach their flooded property.


Attachment of Brick Veneer in High-Wind Regions
FEMA
HURRICANE KATRINA RECOVERY ADVISORY

Design and Construction in Coastal A Zones (December 2005)

The purpose of this Hurricane Recovery Advisory is to recommend design and construction practices in coastal areas where wave and flood conditions during the base flood will be less severe than in V Zones, but still cause significant damage to typical light-frame construction.

Attachment of Brick Veneer in High-Wind Regions (December 2005)

The purpose of this Hurricane Recovery Advisory is to recommend practices for installing brick veneer that will enhance wind resistance in high-wind regions.

Attachment of Rooftop Equipment in High-Wind Regions (May 2006, revised in July 2006)

The purpose of this Hurricane Recovery Advisory is to recommend practices for designing and installing rooftop equipment that will enhance wind resistance in high-wind regions.

Rooftop Attachment of Lightning Protection Systems in High-Wind Regions (May 2006, revised in July 2006)

The purpose of this Hurricane Recovery Advisory is to recommend practices for installing lightning protection systems that will enhance wind resistance in high-wind regions.

Designing for Flood Levels Above the BFE (July 2006)

The purpose of this Hurricane Recovery Advisory is to recommend design and construction practices that reduce the likelihood of flood damage in the event that flood levels exceed the Base Flood Elevation (BFE).

MITIGATION ASSESSMENT TEAM REPORTS

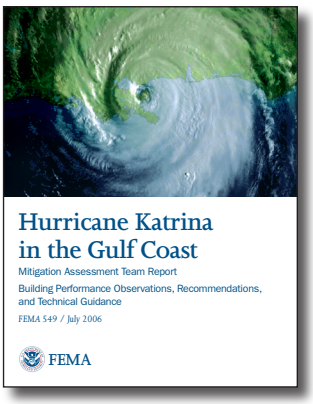
In response to disasters, FEMA assembles a team of national experts from the design and construction industry, as well as from FEMA Headquarters and Regional Offices. This group is known as a Mitigation Assessment Team (MAT; formerly known as a Building Performance Assessment Team [BPAT]) and comprises structural, wind, and civil engineers; architects; coastal scientists; building code experts; and flood preservation specialists, as well as representatives from other government agencies, laboratories, associations, and universities. The MAT evaluates and assesses damage from hurricanes and other natural disasters, and provides observations, conclusions, and recommendations on the performance of buildings and other structures impacted by wind and flood forces. The conclusions and recommendations of the MAT reports provide decision-makers with information and technical guidance that can be used to reduce future damage from natural disasters.

Hurricanes

Mitigation Assessment Team Report – *Hurricane Katrina in the Gulf Coast: Summary Report* (FEMA 548 – April 2006)

This is an 80-page summary of the almost 700-page FEMA 549 MAT report.

Mitigation Assessment Team Report – *Hurricane Katrina in the Gulf Coast: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 549 – July 2006)



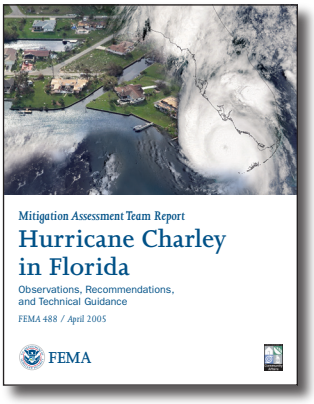
Hurricane Katrina was one of the strongest and most destructive storms to hit the Gulf Coast of the United States in the last 100 years. Katrina significantly exceeded the Base Flood Elevations (BFEs) by as much as 15 feet along parts of the Louisiana and Mississippi coasts. Flooding

extended well beyond the inland flood limits of the Special Flood Hazard Area (SHFA), and the highest storm surge in U.S. history was recorded along the Mississippi coast. The American Red Cross estimated that Katrina destroyed over 300,000 single-family homes in Louisiana and Mississippi.

Summary Report on Building Performance 2004 Hurricane Season (FEMA 490 – March 2005)

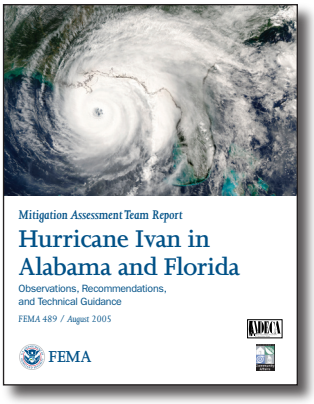
This is a 68-page summary of the observation, conclusions, and recommendations from FEMA 488 and FEMA 489.

Mitigation Assessment Team Report – *Hurricane Charley in Florida: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 488 – April 2005)



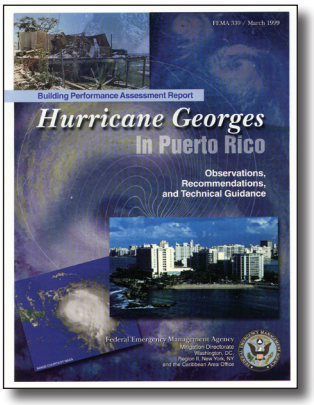
Hurricane Charley was the strongest hurricane to hit Florida since Hurricane Andrew. The storm made an unexpected eastward turn prior to landfall and the storm surge was not as high as originally predicted by the National Hurricane Center. Charley did not cause extensive flood damage to the built environment and the MAT's investigations revealed that the storm was a design-level wind event. For these reasons, the report addresses primarily the effects of high winds and the means to help mitigate them.

Mitigation Assessment Team Report – *Hurricane Ivan in Alabama and Florida: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 489 – August 2005)



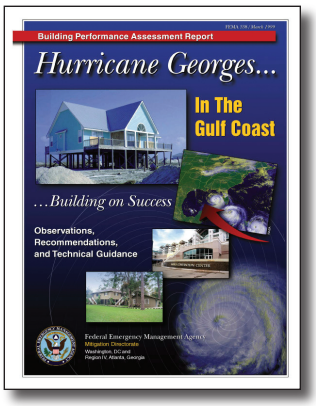
Hurricane Ivan approximated a design flood event on the barrier islands and exceeded design flood conditions in sound and back bay areas. This provided a good opportunity to assess the adequacy of National Flood Insurance Program (NFIP) floodplain management requirements as well as current construction practices in resisting storm surge and wave damage. FEMA was particularly interested in evaluating damages to buildings in coastal A Zones where V-Zone construction methods are not required.

Building Performance Assessment Report – *Hurricane Georges in Puerto Rico: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 339 – March 1999) – FEMA Item #9-1521



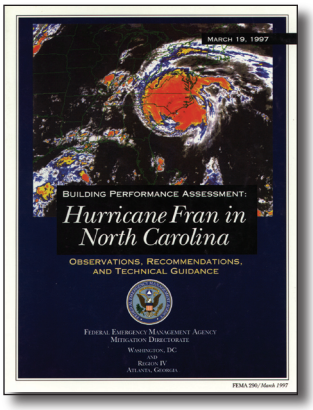
This report presents observations on the success and failure of buildings in Puerto Rico in withstanding the wind and flood forces generated by Hurricane Georges. Several examples of successful mitigation implementation were noted, but a significant amount of damage was incurred due to lack of compliance with and enforcement of existing building codes.

Building Performance Assessment Report – *Hurricane Georges in the Gulf Coast: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 338 – March 1999) – FEMA Item #9-1488



Hurricane Georges made landfall in the Ocean Springs/Biloxi, Mississippi, area. Over the next 30 hours, the storm moved slowly north and east, causing heavy damage along the Gulf Coast in Alabama, Florida, and Mississippi. Storm surges over the area ranged from more than 5 feet in Pensacola, Florida, to 9 feet in Pascagoula, Mississippi. According to the National Weather Service (NWS), the Town of Munson, Florida, in Santa Rosa County, received the highest recorded level of rainfall with more than 38 inches.

Building Performance Assessment Report – *Hurricane Fran in North Carolina: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 290 – March 1997) – FEMA Item #9-1078



Hurricane Fran made landfall near Cape Fear, North Carolina. Coastal areas experienced significant erosion and scour. Erosion caused by Hurricane Fran was exacerbated by the previous dune erosion caused by Hurricane Bertha, which made landfall in the same area only 2 months earlier. The erosion and scour added to the average erosion rate of 1 to 2 feet a year and left many oceanfront homes unable to withstand the loads experienced. The loss of supporting sand left many short pilings either completely exposed or embedded less than 2 feet.

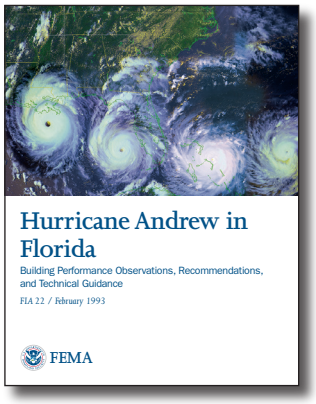
Building Performance Assessment Report – *Hurricane Opal in Florida* (FEMA 281 – August 1996) – FEMA Item #9-0301

Hurricane Opal was classified as a Category 3 storm on the Saffir-Simpson scale. Fifteen counties in the Florida Panhandle were declared Federal disaster areas. Most of the structural damage associated with the storm was to slab foundations; pile, post, column, and pier foundations; and framing systems. The damage was caused by coastal flood forces – storm surge, wind-generated waves, storm-induced erosion, and floodborne debris.

Building Performance Assessment Report – *Hurricane Iniki in Hawaii* (FIA 23 – March 1993) – FEMA Item #3-0181

Hurricane Iniki was the strongest and most destructive hurricane to strike the Hawaiian Islands in recent memory. The team investigated primary structural systems (i.e., systems in a building that resist lateral and vertical forces), and the effects of windborne and waterborne debris and the quality of construction and materials. The performance of exterior architectural systems, such as roofing, windows, and doors was analyzed.

Building Performance Assessment Report – *Hurricane Andrew in Florida* (FIA 22 – February 1993) – FEMA Item #3-0180



The team's investigation was similar to that conducted for Hurricane Iniki (i.e., the performance of primary structural systems and exterior architectural systems) and also included the effects of debris and the quality of construction workmanship. The loss of roof material and roof sheathing and the failure of windows and doors exposed interiors of buildings to further damage from wind and rain, resulting in significant damage to building interiors and contents that rendered many buildings uninhabitable.

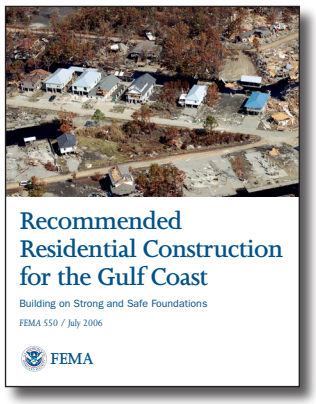
Tornadoes

Mitigation Assessment Team Report – Midwest Tornadoes of May 3, 1999 (FEMA 342 – July 1999)

On the evening of May 3, 1999, tornadoes tore through parts of Oklahoma and Kansas, in areas that are considered part of "Tornado Alley," leveling entire neighborhoods and killing 49 people. The storms that spawned the tornadoes moved slowly, contributing to the development and redevelopment of individual tornadoes over an extended period of time. The MAT report presents observations, conclusions, and recommendations intended to help communities, businesses, and individuals reduce future injuries and the loss of life and property resulting from tornadoes and other high-wind events.

MITIGATION PUBLICATIONS

Recommended Residential Construction for the Gulf Coast: Building on Strong and Safe Foundations (FEMA 550 – June 2006)



Every storm has shown that, while good design and construction cannot completely eliminate risk, they can significantly reduce the risk to life and damage to property. This design manual provides recommended designs and guidance for rebuilding homes destroyed by hurricanes in the Gulf Coast. The manual also provides guidance in designing and building less vulnerable new homes that reduce the risk to life and property.

Safe Room and Community Shelter Resource CD (FEMA 388 – October 2001)

This CD contains displays, posters, handouts, multimedia, and other resources that provide information about mitigating for tornadoes or other high-wind events and about the importance of safe rooms and community shelter construction in saving lives during such events. Also included are: safe room display panels that contain artwork for reproducing the exhibit panels used in the National Emergency Training Center Safe Room Exhibit, maps on tornado activity

in the United States, posters, booth display panels, FEMA's *Taking Shelter from the Storm* brochure, various handouts, and a safe room PowerPoint presentation.

Above the Flood: Elevating Your Floodprone House (FEMA 347 – May 2000)

This publication is intended for non-technical readers and describes how homeowners in Miami-Dade County, FL, elevated their damaged slab-on-grade masonry houses following the devastating effects of Hurricane Andrew (1992). The publication includes technical and regulatory guidance provided by FEMA to the homeowners in Miami-Dade County, an illustrated overview of the elevation techniques, and case studies demonstrating the techniques.

Homeowner's Guide to Retrofitting: Six Ways to Protect Your House From Flooding (FEMA 312 – June 1998)

This handbook is intended for non-technical readers who are interested in additional information on flood protection methods. Illustrated discussions of house elevation, wet and dry floodproofing, relocation, levees and floodwalls, and demolition are supplemented with cost estimates, checklists, and decision-making worksheets.

Engineering Principles and Practices for Retrofitting Floodprone Residential Buildings (FEMA 259 – January 1995)

This manual is intended for architects, engineers, and building professionals who need technical guidance concerning flood retrofitting techniques that can be applied to existing buildings. Detailed specifications, computation examples and cost data are presented.

RISK MANAGEMENT SERIES

The Risk Management Series (RMS) is a new FEMA series directed at providing design guidance for mitigating multihazard events. The objective of the series is to reduce physical damage to structural and nonstructural components of buildings and related infrastructure, and to reduce resultant casualties during natural and manmade disasters.

The RMS is intended to minimize conflicts that may arise from a multihazard design approach. A multihazard approach requires a complex series of tradeoffs. Security concerns need to be balanced with requirements in terms of earthquakes, floods, high speed winds, accessibility, fire protection, and aesthetics, among others. Designing to mitigate natural hazards should avoid considering manmade hazards as an afterthought, but rather as a critical concern to be studied early during the project cycle. Natural hazards are the largest single contributor to catastrophic or repetitive damage to communities nationwide. Manmade hazards can be categorized as rare events with a potential high impact and very difficult to predict.

Natural Hazard RMS Publications

Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds **(FEMA 424 – January 2004)**

FEMA 424 is intended to provide design guidance for the protection of school buildings and their occupants against natural hazards, and concentrates on grade schools (K-12). The focus is on the design of new schools, but the repair, renovation, and extension of existing schools is also addressed. The manual introduces concepts on multihazard design and performance-based design and presents a general description and comparison of the hazards, including charts that show where design against each hazard interacts with design for other hazards.

Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings **(FEMA 543 – January 2007)**

This manual concentrates on critical facilities (hospitals, schools, fires and police stations, and emergency operations centers). It is based on the behavior of critical facilities during Hurricane Katrina and makes recommendations on the performance of these types of buildings. It includes extensive information on the impact of storm surges to the Gulf area.

Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds **(FEMA 577 – June 2007)**

This publication provides design information for the construction of new hospitals and rehabilitation of existing ones with the purpose of improving their performance during the immediate aftermath of various hazard events. This manual is concerned with factors such as performance-based design and continuity of operations for this type of building. It provides a multihazard approach highlighting conflicts and benefits to consider when designing.

TECHNICAL BULLETINS

Guide-01 User's Guide to Technical Bulletins **(FIA-TB-0 – May 2001)**

This Technical Bulletin provides a list of available technical bulletins, a key word/subject reference index for all the bulletins, and information about how to obtain copies of the bulletins.

1-93 Openings in Foundation Walls **(FIA-TB-1 – April 1993)**

This Technical Bulletin provides guidance on the NFIP regulations concerning the requirement for openings in below-Base Flood Elevation foundation walls for buildings located in Zones A, AE, A1-A30, AR, AO, and AH.

2-93 Flood-Resistant Materials Requirements **(FIA-TB-2 – April 1993)**

This Technical Bulletin provides guidance on the NFIP regulations concerning the required use of flood-damage resistant construction materials for building components located below the Base Flood Elevation in Special Flood Hazard Areas (both A and V zones).

3-93 Non-Residential Floodproofing – Requirements and Certification (FIA-TB-3 – April 1993)

This Technical Bulletin provides guidance on the NFIP regulations concerning watertight construction and the required certification for floodproofed non-residential buildings in Zones A, AE, A1-A30, AR, AO, and AH whose lowest floors are below the Base Flood Elevation.

4-93 Elevator Installation (FIA-TB-4 – April 1993)

This Technical Bulletin provides guidance on the NFIP regulations concerning the installation of elevators below the Base Flood Elevation in Special Flood Hazard Areas (both A and V zones).

5-93 Free-of-Obstruction Requirements (FIA-TB-5 – April 1993)

This Technical Bulletin provides guidance on the NFIP regulations concerning obstructions to flood waters below elevated buildings and on building sites in Coastal High Hazard Areas (Zones V, VE, and V1-V30).

6-93 Below-Grade Parking Requirements (FIA-TB-6 – April 1993)

This Technical Bulletin provides guidance on the NFIP regulations concerning the design of below-grade parking garages beneath buildings located in Zones A, AE, A1-A30, AR, AO, and AH.

7-93 Wet Floodproofing Requirements (FIA-TB-7 – December 1993)

This Technical Bulletin provides guidance on the NFIP regulations concerning wet floodproofing of certain types of structures located in Zones A, AE, A1-A30, AR, AO, and AH.

8-96 Corrosion Protection for Metal Connectors in Coastal Areas (FIA-TB-8 – August 1996)

This Technical Bulletin provides guidance on the need for, selection of, and use of corrosion-resistant metal connectors for the construction of buildings in coastal areas.

9-99 Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings (FIA-TB-9 – September 1999)

This Technical Bulletin provides guidance on the NFIP regulations concerning the design and construction of breakaway walls beneath elevated buildings in Coastal High Hazard Areas (Zones V, VE, and VI-V30).

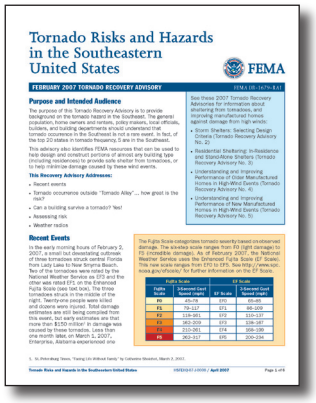
10-01 Ensuring that Structures Built on Fill In or Near Special Flood Hazard Areas are Reasonably Safe From Flooding (FIA-TB-10 – May 2001)

This Technical Bulletin discusses building techniques, including the use of fill, that can be used to ensure structures are reasonably safe from flooding.

11-01 Crawlspace Construction for Buildings Located in Special Flood Hazard Areas (FIA-TB-11 – November 2001)

This Technical Bulletin provides interim guidance on minimum NFIP requirements as well as best practices for crawlspace construction in the Special Flood Hazard Area.

TORNADO RECOVERY ADVISORIES


Tornado Risks and Hazards in the Southeastern United States

FEMA

FEBRUARY 2007 TORNADO RECOVERY ADVISORY

Purpose and Intended Audience

Recent Events

Tornado Risks and Hazards in the Southeastern United States (FEMA DR-1679-RA1 – April 2007)

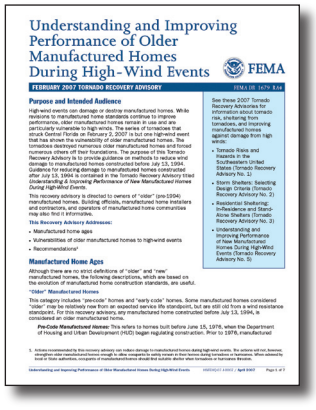
The purpose of this Tornado Recovery Advisory is to provide background on tornado hazards in the Southeast. The advisory identifies FEMA resources that can be used to help design and construct portions of almost any building type (including residences) to provide safe shelter from tornadoes, or help to minimize damage caused by these wind events.

Storm Shelters: Selecting Design Criteria (FEMA DR-1679-RA2 – April 2007)

The purpose of this Tornado Recovery Advisory is to identify the different types of shelter design guidance, code requirements, and other criteria that pertain to the design and construction of shelters for tornadoes and hurricanes. There are various storm shelter criteria, each of which offers different levels of protection to shelter occupants.

Residential Sheltering: In-Residence and Stand-Alone Shelters (FEMA DR-1679-RA3 – April 2007)

The purpose of this Tornado Recovery Advisory is to alert homeowners, renters, apartment building owners, and manufactured home park owners about the concept of in-residence and stand-alone storm shelters. The advisory also addresses areas of last resort for residents that don't have access to a shelter and emergency planning.


Understanding and Improving Performance of Older Manufactured Homes During High-Wind Events

FEMA

FEBRUARY 2007 TORNADO RECOVERY ADVISORY

Purpose and Intended Audience

Manufactured Home Ages

Understanding and Improving Performance of Older Manufactured Homes During High-Wind Events (FEMA DR-1679-RA4 – April 2007)

The purpose of this Tornado Recovery Advisory is to provide guidance on reducing damage from high-wind events, including tornadoes and hurricanes, to manufactured homes constructed before July 13, 1994. The advisory also discusses ages of manufactured homes, vulnerabilities of older manufactured homes to high-wind events, and recommendations for reducing damage from high-wind events.

Understanding and Improving Performance of New Manufactured Homes During High-Wind Events (FEMA DR-1679-RA5 – April 2007)

The purpose of this Tornado Recovery Advisory is to provide guidance on reducing damage from high-wind events, including tornadoes and hurricanes, to manufactured homes constructed after July 13, 1994. The advisory also discusses ages of manufactured homes, vulnerabilities

of new manufactured homes to high-wind events, and recommendations for reducing damage from high-wind events.

Tornado Risks and Hazards in the Midwest United States (FEMA DR-1699-RA1 – August 2007)

The purpose of this Tornado Recovery Advisory is to summarize facts about the Midwest tornado hazard, specifically the area served by FEMA Region VII, which includes Iowa, Kansas, Missouri, and Nebraska. The general population, specifically homeowners and renters, policy makers, local officials, builders, and building officials know and understand that tornado occurrence in the Midwest is not a rare event. In fact, more than half of the 20 states with the highest frequency of tornado occurrence on record, and 4 of the top 5 (Texas, Oklahoma, Kansas, and Nebraska) are located in the Midwest. In addition, this RA identifies FEMA resources that can be used to help design and construct shelters that provide safe haven from tornadoes. These resources also guide construction of most building types (including residences) to minimize damage from extreme wind events.

Storm Shelters: Selecting Design Criteria (FEMA DR-1699-RA2 – August 2007)

The intended audience for this Tornado Recovery Advisory is anyone involved in the planning, policy-making, design, construction, or approval of tornado shelters, including designers, emergency managers, public officials, policy or decision-makers, building code officials, and home or building owners. Homeowners and renters should also refer to *Residential Sheltering: In-Residence and Stand-Alone Shelters*. The purpose of this advisory is to present information on different types of shelter design guidelines, code requirements, and other criteria that pertain to the design and construction of tornado shelters. There are various storm shelter criteria, each of which offer different levels of protection to its shelter occupants.

Residential Sheltering: In-Residence and Stand-Alone Shelters (FEMA DR-1699-RA3 – August 2007)

The purpose of this Tornado Recovery Advisory is to alert homeowners, renters, and apartment building owners to the concept of in-residence and stand-alone storm shelters. The Advisory addresses considering the need for a shelter; in-residence shelter construction and retrofitting options; recommendations for sheltering when you cannot place a shelter within your home; best available refuge areas; and emergency supply kits and weather radios.

TRAINING COURSES

Numerous training courses have been developed and are offered at FEMA's Emergency Management Institute (EMI) in Emmitsburg, Maryland. For additional information, visit http://www.training.fema.gov

Retrofitting Flood Prone Residential Buildings, Course Number E279.

FEMA developed a technical training course on proper methods of retrofitting residential buildings. The course is available as a 1-week course offered several times a year at EMI or as a 2-day field-deployed version. FEMA will provide all course materials free of charge and may be able

to provide, under certain circumstances, expert trainers at no charge. For technical assistance in offering the field course, contact your NFIP State Coordinator, FEMA Regional Offices, or Disaster Field Office. To register, all applications must be submitted through your State Emergency Management Training Office.

Residential Coastal Construction, Course Number E386.

FEMA designed this 4½-day course to train participants on FEMA's *Coastal Construction Manual* (FEMA 55), which is the primary, state-of-the-art reference for planning, designing, and constructing residential structures in various coastal environments. The target audience is engineers, architects, and building code officials. Floodplain management, hazard mitigation, planning, and building officials with building science knowledge may also apply. The course is taught at EMI. An Independent Study Course is also available.

Courses have been developed for the following FEMA Mitigation documents (check the EMI web site above for updates):

Home Builder's Guide to Coastal Construction Technical Fact Sheets Series (FEMA 499 – August 2005)

This is a 1-day course.

Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings (FEMA 543 – January 2007)

This is a 2-day course.

In addition, a course based on ***Recommended Residential Construction for the Gulf Coast: Building on Strong and Safe Foundations*** **(FEMA 550 – July 2006)** is currently being developed.

All of these courses can also be offered at locations other than EMI.

Table 1. FEMA Flood and Wind Publications, and Training Courses

	Flood Damage	Wind Damage	Preparedness	Accessibility
Building Science Publications				
Protecting Building Utilities From Flood Damage (FEMA 348 – November 1999)	✔		✔	💻 🗐 ⊙
Design and Construction Guidance for Community Shelters (FEMA 361 – July 2000)	✔	✔	✔	💻 🗐 ⊙
Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas (FEMA 55, November 2001)	✔	✔	✔	🗐 ⊙
Taking Shelter From The Storm: Building a Safe Room Inside Your House (FEMA 320 – Second Edition, March 2004)		✔	✔	💻 🗐 ⊙
Home Builder's Guide to Coastal Construction Technical Fact Sheet Series (FEMA 499, August 2005)	✔	✔	✔	💻 🗐
Hurricane Publications				
Against the Wind: Protecting Your Home from Hurricane and Wind Damage (FEMA 247 – December 1993)		✔		💻 🗐
Above the Flood: Elevating Your Flood Prone House (FEMA 347 – May 2000)	✔		✔	💻 🗐 ⊙
Hurricane Recovery Advisories				
Asphalt Shingle Roofing for High Wind Regions (September 2004)		✔	✔	💻
Roof Underlayment for Asphalt Shingle Roofs (November 2004)	✔		✔	💻
Tile Roofing for Hurricane-Prone Regions (November 2004)		✔	✔	💻
Reconstruction Guidance Using Hurricane Katrina Surge Inundation and Advisory Base Flood Elevations (November 2005)	✔		✔	💻
Initial Restoration for Flooded Buildings (November 2005)	✔		✔	💻
The ABC's of Returning to Flooded Buildings (November 2005)	✔		✔	💻
Design and Construction in Coastal A Zones (December 2005)	✔		✔	💻
Attachment of Brick Veneer in High-Wind Regions (December 2005)		✔	✔	💻
Attachment of Rooftop Equipment in High-Wind Regions (May 2006, revised in July 2006)		✔	✔	💻
Rooftop Attachment of Lightning Protection Systems in High-Wind Regions (May 2006, revised in July 2006)		✔	✔	💻
Designing for Flood Levels Above the BFE (July 2006)	✔		✔	💻

💻 AVAILABLE ONLINE 🗐 AVAILABLE IN PRINT ⊙ AVAILABLE ON CD

Table 1. FEMA Flood and Wind Publications, and Training Courses (continued)

	Flood Damage	Wind Damage	Preparedness	Accessibility
Mitigation Assessment Team Reports				
Hurricanes				
Mitigation Assessment Team Report – *Hurricane Katrina in the Gulf Coast: Summary Report* (FEMA 548 – April 2006)	✔	✔	✔	💻 🗐 ⊙
Mitigation Assessment Team Report – *Hurricane Katrina in the Gulf Coast: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 549 – July 2006)	✔	✔	✔	💻 🗐 ⊙
Summary Report on Building Performance 2004 Hurricane Season (FEMA 490 – March 2005)	✔	✔	✔	💻 🗐 ⊙
Mitigation Assessment Team Report – *Hurricane Charley in Florida: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 488 – April 2005)		✔	✔	💻 🗐 ⊙
Mitigation Assessment Team Report – *Hurricane Ivan in Alabama and Florida: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 489 – August 2005)	✔	✔	✔	💻 🗐 ⊙
Building Performance Assessment Report – *Hurricane Georges in Puerto Rico: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 339 – March 1999) – FEMA Item #9-1521	✔	✔	✔	💻 🗐
Building Performance Assessment Report – *Hurricane Georges in the Gulf Coast: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 338 – March 1999) – FEMA Item #9-1488	✔	✔	✔	💻 🗐
Building Performance Assessment Report – *Hurricane Fran in North Carolina: Building Performance Observations, Recommendations, and Technical Guidance* (FEMA 290 – March 1997) – FEMA Item #9-1078	✔	✔	✔	💻 🗐
Building Performance Assessment Report – *Hurricane Opal in Florida* (FEMA 281 – August 1996) – FEMA Item #9-0301	✔		✔	💻 🗐
Building Performance Assessment Report – *Hurricane Iniki in Hawaii* (FIA 23 – March 1993) – FEMA Item #3-0181	✔	✔	✔	💻 🗐
Building Performance Assessment Report – *Hurricane Andrew in Florida* (FIA 22 – February 1993) – FEMA Item #3-0180		✔	✔	💻 🗐

Table 1. FEMA Flood and Wind Publications, and Training Courses (continued)

	Flood Damage	Wind Damage	Preparedness	Accessibility
Tornadoes				
Mitigation Assessment Team Report – *Midwest Tornadoes of May 3, 1999* (FEMA 342 – July 1999)		✔		💻 🗐
Mitigation Publications				
Recommended Residential Construction for the Gulf Coast: Building on Strong and Safe Foundations (FEMA 550 – June 2006)	✔	✔	✔	💻 🗐 ⊙
Safe Room and Community Shelter Resource CD (FEMA 388 – October 2001) CD		✔	✔	⊙
Above the Flood: Elevating Your Floodprone House (FEMA 347 – May 2000)	✔		✔	💻 🗐 ⊙
Homeowner's Guide to Retrofitting: Six Ways to Protect Your House From Flooding (FEMA 312 – June 1998)	✔		✔	💻 🗐
Engineering Principles and Practices for Retrofitting Floodprone Residential Buildings (FEMA 259 – January 1995)	✔		✔	💻 🗐
Risk Management Series				
Natural Hazard RMS Publications				
Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds (FEMA 424 – January 2004)	✔	✔	✔	🗐
Design Guide for Improving Critical Facility Safety from Flooding and High Winds – Training Course (FEMA 543 – January 2007)	✔	✔	✔	💻
Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds (FEMA 577 – June 2007)	✔	✔	✔	💻
Technical Bulletins				
Guide-01 User's Guide to Technical Bulletins (FIA-TB-0 – May 2001)		✔	✔	💻 🗐
1-93 Openings in Foundation Walls (FIA-TB-1 – April 1993)		✔	✔	💻 🗐
2-93 Flood-Resistant Materials Requirements (FIA-TB-2 – April 1993)		✔	✔	💻 🗐 ⊙
3-93 Non-Residential Floodproofing – Requirements and Certification (FIA-TB-3 – April 1993)		✔	✔	💻 🗐 ⊙
4-93 Elevator Installation (FIA-TB-4 – April 1993)		✔	✔	💻 🗐 ⊙
5-93 Free-of-Obstruction Requirements (FIA-TB-5 – April 1993)		✔	✔	💻 🗐 ⊙
6-93 Below-Grade Parking Requirements (FIA-TB-6 – April 1993)		✔	✔	💻 🗐 ⊙

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Table 1. FEMA Flood and Wind Publications, and Training Courses (continued)

	Flood Damage	Wind Damage	Preparedness	Accessibility
7-93 Wet Floodproofing Requirements (FIA-TB-7 – December 1993)		✔	✔	💻 🗐 ⊙
8-96 Corrosion Protection for Metal Connectors in Coastal Areas (FIA-TB-8 – August 1996)		✔	✔	💻 🗐 ⊙
9-99 Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings (FIA-TB-9 – September 1999)		✔	✔	💻 🗐 ⊙
1*0-01 Ensuring that Structures Built on Fill In or Near Special Flood Hazard Areas are Reasonably Safe From Flooding* (FIA-TB-10 – May 2001)		✔	✔	💻 🗐 ⊙
11-01 Crawlspace Construction for Buildings Located in Special Flood Hazard Areas (FIA-TB-11 – November 2001)		✔	✔	💻 🗐 ⊙
Tornado Recovery Advisories				
Tornado Risks and Hazards in the Southeastern United States (FEMA DR-1679-RA1 – April 2007)		✔	✔	💻
Storm Shelters: Selecting Design Criteria (FEMA DR-1679-RA2 – April 2007)	✔	✔	✔	💻
Residential Sheltering: In-Residence and Stand-Alone Shelters (FEMA DR-1679-RA3 – April 2007)	✔	✔	✔	💻
Understanding and Improving Performance of Older Manufactured Homes During High-Wind Events (FEMA DR-1679-RA4 – April 2007)		✔	✔	💻
Understanding and Improving Performance of New Manufactured Homes During High-Wind Events (FEMA DR-1679-RA5 – April 2007)		✔	✔	💻
Tornado Risks and Hazards in the Midwest United States (FEMA DR-1699-RA1 – August 2007)		✔	✔	💻
Storm Shelters: Selecting Design Criteria (FEMA DR-1699-RA2 – August 2007)		✔	✔	💻
Residential Sheltering: In-Residence and Stand-Alone Shelters (FEMA DR-1699-RA3 – August 2007)		✔	✔	💻
Training Courses				
Retrofitting Flood Prone Residential Buildings, Course Number E279	✔		✔	http://www.training.fema.gov
Residential Coastal Construction, Course Number E386	✔	✔	✔	http://www.training.fema.gov

Table 1. FEMA Flood and Wind Publications, and Training Courses (continued)

	Flood Damage	Wind Damage	Preparedness	Accessibility
Home Builder's Guide to Coastal Construction Technical Fact Sheets Series (FEMA 499 – August 2005)	✔	✔	✔	http://www.training.fema.gov
Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings (FEMA 543 – January 2007)	✔	✔	✔	http://www.training.fema.gov
Recommended Residential Construction for the Gulf Coast: Building on Strong and Safe Foundations (FEMA 550 – July 2006)	✔	✔	✔	http://www.training.fema.gov