Course Overview

- Describe Coastal Construction Manual (CCM, FEMA 55) history
- Describe updates made from the 3rd to 4th editions of CCM
- Define the scope and use of the 4th edition of CCM
- Overview the content of each chapter of the 4th edition of CCM
- Describe other coastal construction resources
- Summary
What is the CCM?

Coastal Construction Manual


FEMA P-55 / Volume I / August 2011
What is CCM?

• A **best practices document** for design and construction for a coastal environment
  • **Best practices** are techniques that exceed the minimum requirements of model building codes; design and construction standards; or Federal, State, and local regulations
  • When best practices exceed minimum requirements, this is noted in the manual
    • The coastal construction environment has unique design and construction requirements with regards to inland development
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CCM History

- Newest edition
  - Released in August 2011
  - 2 Volume publication
  - CCM Resources provided online on the Residential Coastal Construction Website [http://www.fema.gov/residential-coastal-construction](http://www.fema.gov/residential-coastal-construction)
The 2011 CCM, Fourth Edition (FEMA P-55), is a 2-volume publication:

- Provides a comprehensive approach to planning, siting, designing, constructing, and maintaining/retrofitting homes in the coastal environment
- Focus on 1-4 Family structures, up to three stories in height

Hurricane Katrina, 2005
Dauphin Island, AL
(Figure 10-3, FEMA P-55)
4th Edition of CCM

• The 2011 CCM, Fourth Edition (FEMA P-55), is a 2-volume publication:
  • **Volume I** provides information about: hazard identification, siting decisions, regulatory requirements, economic implications, and risk management
  • **Volume II** contains in-depth descriptions of design, construction, and maintenance practices
  • **CCM Resource Website** contains supplemental materials
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4th Edition of CCM: Changes and Updates

- Volume I
  - Descriptions of recent coastal storm events
  - Updated information on flood hazard identification
  - Expanded discussion of sea and lake level rise
  - New chapter on fundamentals of risk analysis and risk reduction
  - References to updated building codes and standards

Hurricane Katrina, 2005
Long Beach, MS
(Figure 2-5, FEMA P-55)
4th Edition of CCM: Changes and Updates

- Volume II
  - New chapter on pre-design considerations
  - New chapter on retrofitting for natural hazards
  - References to updated building codes and standards
  - New guidance on calculating wave slam on elevated buildings
  - Improved calculations for flood-borne debris impact
  - Improved guidance on foundation scour
  - Expanded and updated example problems

(Figure 8-12, FEMA P-55)
• Volume II Continued
  • Updated and expanded guidance on load combination calculations
  • New prescriptive wind load tables
  • Updated and expanded guidance on calculating wind loads
  • New mitigation techniques for the building envelope
  • New mitigation techniques for enhanced performance of the main wind force resisting system

Hurricane Charley, 2004 Florida
(Figure 11-45, FEMA P-55)
4th Edition of CCM: Changes and Updates

- CCM 4th edition references:
  - 2012 I-Codes
  - ASCE 7-10
  - ASCE 24-05
- CCM 3rd edition referenced:
  - 2000 I-Codes
  - ASCE 7-98
  - ASCE 24-98
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• Summary
Coastal Construction Process: CCM Chapters

Volume I

Understand Design Premise and Framework
Chapter 1

Learn from Past Events
Chapter 2

Identify Hazards
Chapter 3

Identify and Evaluate Site Alternatives
Chapter 4

Investigate Regulatory Requirements and Consider Risk
Chapters 5 and 6
Coastal Construction Process: CCM Chapters

Volume II

- Explore Pre-Design Considerations
  - Chapter 7
- Determine the Loads and Design the Building
  - Chapters 8 – 11
- Install Mechanical Equipment and Utilities
  - Chapter 12
- Construct the Building
  - Chapters 13
- Maintain the Building and Explore Retrofitting for Other Natural Hazards
  - Chapters 14 and 15
Residential Coastal Construction Website

CCM Resources

• For resources that augment the guidance and other information in the Coastal Construction Manual, see http://www.fema.gov/residential-coastal-construction
Planning, Building Standards, Design, and Construction Make a Difference
Course Overview

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- Summary
Chapter 1: Introduction addresses...

- Background
- Purpose
- Objectives
  - Properly plan for construction
  - Build a successful disaster-resistant structure
- Organization and use of CCM
Chapter 1: What is a Successful Building?

- Chapter 1 defines a **successful building**

- In coastal areas, a building is **successful** if after a design-level event:
  - Foundation is intact and functional
  - Building envelope (floors, walls, openings, and roof) is structurally sound and able to minimize penetration of wind, rain, and debris
  - Floodwaters did not enter
  - Utility connections are intact
  - Building is accessible and habitable
  - Any damage below the lowest floor did not result in damage to other parts of the building

CCM p. 1-3
Chapter 1: Planning for Construction

- CCM outlines the tasks prior to construction of a successful building:
  - Evaluate suitability of land for residential construction
  - Identify regulatory, environmental and other constraints on construction and development
  - Evaluate site-specific hazards
  - Evaluate techniques to mitigate hazards
  - Identify risk, insurance, and financial implications of siting, design, and construction decisions
Chapter 2: Historical Perspective addresses...

- Historical overview of past storm events
- Lessons learned from coastal flood and high wind events
- Importance of breaking the disaster-rebuild-disaster cycle

Hurricane Ike, 2008
Galveston Island Beach, TX
(Figure 2-11, FEMA P-55)
Chapter 2: Coastal Storm Events

Post-storm evaluation reports (BPsATs and MATs) for the following hurricanes are available at http://www.fema.gov/rebuild/mat:
- Andrew (1992)
- Iniki (1992)
- Opal (1995)
- Fran (1996)
- Georges in the Gulf Coast (1998)
- Georges in Puerto Rico (1998)
- Charley (2004)
- Ivan (2004)
- 2004 Season (Charley, Frances, Ivan, Jeanne)
- Katrina (2005)
- Ike (2008)
Chapter 2: Lessons Learned

2001 **TROPICAL STORM ALLISON** June, Houston, TX

2003 **HURRICANE ISABEL** September, Mid-Atlantic

2004 **HURRICANE CHARLEY** August, FL
- IBHS begins developing FORTIFIED program to build and retrofit safer residential buildings.

2004/05 **SEVERE WINTER STORMS** CA


2008 **FEMA Procedure Memorandum 50** establishes guidelines for mapping the Limit of Moderate Wave Action (LiMWA).

2008 **HURRICANE IKE** September, Galveston, TX

2009 **SAMOAN TSUNAMI** September, American Samoa

2009 Hawaii State Building Code adopts special wind region maps.

2009 IRC mandates freeboard in Zone V and Coastal A Zone.


2004 **HURRICANE FRANCES** September, FL

2004 **HURRICANE IVAN** September, AL
- In response to extensive storm surge and flooding, FEMA begins mapping production to identify the flood damage extent. If adopted by communities, the maps will allow claims to be paid in non-SFHAs. This is the forerunner to the post-Katrina ABFE mapping.

2004 **HURRICANE JEANNE** September, FL

2005 **HURRICANE KATRINA** September, LA/MS
- Mississippi and Louisiana adopt current model codes. Previous codes were outdated or non-existent.
- FEMA begins release of advisory BFES and recovery maps for the post-Katrina Gulf Coast. Communities are encouraged to adopt the ABFE maps to guide redevelopment until complete restudy of the flood risk is complete.
- In 2006, FEMA develops pre-engineered coastal foundations and publishes FEMA 550, *Recommended Residential Construction for Coastal Areas*.

Chapter 2: Breaking the Disaster-Rebuild Cycle

• Lessons learned from past events should be incorporated to avoid repeating past mistakes

Hurricane Ivan, 2004
Pensacola, FL
(Figure 2-15, FEMA P-55)

A FIRM (Flood Insurance Rate Map) generally shows a community's base flood elevations, flood zones, and floodplain boundaries. They are continually updated as new data is available.
Chapter 3: Identifying Hazards addresses…

- Coastline characteristics
- Coastal storm events
- Coastal hazards
- Coastal flood effects
- Erosion
- National Flood Insurance Program (NFIP) Flood Hazard Zones
- Flood hazard assessments for design purposes
- Milestones of FEMA Coastal Flood Hazard Mapping Procedures and FIRMS

(Figure 3-5, FEMA P-55)
Chapter 3: Common Oversights when Identifying Hazards

- Failure to identify all potential flood hazards (high water, wave action, high-velocity flow, erosion, scour, debris impact)
- Failure to check if FIRM accurately reflects current flood hazards
- Failure to account for future conditions:
  - Effects of multiple storms
  - Long-term erosion
  - Tidal inlet movement
  - Sea level rise

Hurricane Floyd, 1999
Oak Island, NC
(Figure 3-33, FEMA P-55)
Chapter 3: Design Framework

**Design Premise**
Anticipated loads must be transferred through the building in continuous paths to the supporting soils. Any weaknesses in the continuous paths are potential points of failure.

**Design**
- Continuous load paths
- Resist or avoid hazards
- Conditions greater than design conditions
- Constructability

**Successful Building**

**Funding**

**Risk Tolerance**

**Building Use**
- Layout
- Function

**Location**
- Hazards
- Loads/conditions
- Regulations
- Building codes and standards

**Materials**
- Durability
- Appearance
- Maintenance

CCM p. 1-4 and 7-3
Chapter 3: Identifying Hazards is Important

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- Hazards
- Loads/conditions
- Regulations
- Building codes and standards

**Materials**
- Durability
- Appearance
- Maintenance

**Successful Building**
Chapter 4: *Siting* addresses…

- Identifying suitable property for coastal residential structures
- Compiling information on coastal property
- Evaluating hazards and potential vulnerability
- General siting considerations
- Raw land development guidelines
- Development guidelines for existing lots
- Influence of beach nourishment and dune restoration on siting decisions

*Hurricane Dennis, 1999*  
*Kitty Hawk, NC*  
(Figure 4-3, FEMA P-55)
Chapter 4: Common Oversights when Siting

- Locating buildings too close to:
  - Shoreline
  - Other buildings
  - Protective structures
- Locating buildings and infrastructure on erodible dunes and bluffs
- Locating buildings and infrastructure near tidal inlets
- Not including **setback** from identified high hazard areas

(Figure 4-12, FEMA P-55)
Chapter 5: Investigating Regulatory Requirements addresses...

- Land use regulations
- National Flood Insurance Program
- Building codes and standards
- Best practices for exceeding minimum NFIP regulatory requirements
Chapter 5: Flood Hazard Zones

(Figure 3-52, FEMA P-55)
Chapter 5: Coastal vs. Riverine Flood Events

Riverine Flooding (Zone A): inundation, velocity, debris, duration

Coastal Flooding (Zone V, Coastal A Zone): waves, velocity, erosion, debris, scour, inundation, high wind

FEMA file photo

Hurricane Frederic, 1979
NOAA
Chapter 5: Common Oversights with Regulatory Requirements

- Treating all Zone A’s the same
  - Failure to account for the Coastal A Zone loads and conditions
- Believing long-term erosion setbacks render a building “safe” from future erosion
- Believing minimum standards (FIRM, NFIP, building code) automatically result in successful buildings

(Figure 4-8, FEMA P-55)
Chapter 5: Best Practices for Exceeding Minimum NFIP Regulatory Requirements

- Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements
  - Good tool for floodplain managers, designers, and local authorities having jurisdiction

<table>
<thead>
<tr>
<th>Zone V</th>
<th>Coastal A Zone</th>
<th>Zone A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendations and Requirements</strong>&lt;sup&gt;(a)&lt;/sup&gt;</td>
<td><strong>Cross Reference</strong>&lt;sup&gt;(a)&lt;/sup&gt;</td>
<td><strong>Recommendations and Requirements</strong>&lt;sup&gt;(a)&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>ZONING REQUIREMENTS</strong>&lt;sup&gt;(b)&lt;/sup&gt;</td>
<td><strong>Cross Reference</strong>&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td><strong>Recommendations and Requirements</strong>&lt;sup&gt;(a)&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Siting</strong></td>
<td><strong>Cross Reference</strong>&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td><strong>Recommendations and Requirements</strong>&lt;sup&gt;(a)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Recommendation: Define and evaluate vulnerability to all coastal hazards, including short- and long-term erosion, and site building as far landward as possible.</td>
<td><strong>NFIP</strong>: 60.3(e)(3), 60.3(e)(7)</td>
<td><strong>IBC</strong>: App. G401.2, App. G103.7</td>
</tr>
<tr>
<td>Requirement: New construction is landward of the reach of mean high tide. Manmade alterations of sand dunes and mangrove stands that increase potential flood damage are prohibited.</td>
<td><strong>IRC</strong>: R322.3.1</td>
<td><strong>ASCE 24</strong>: 2.3.2, Ch. 4</td>
</tr>
<tr>
<td></td>
<td><strong>FEMA P-499</strong>: 2.1, 2.2</td>
<td></td>
</tr>
</tbody>
</table>

**GENERAL REQUIREMENTS**

<table>
<thead>
<tr>
<th>Site of Construction</th>
<th><strong>Recommendation</strong></th>
<th><strong>Cross Reference</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site Limitations</strong>&lt;sup&gt;(b)&lt;/sup&gt;</td>
<td><strong>Recommendation</strong></td>
<td><strong>Cross Reference</strong></td>
</tr>
<tr>
<td>Requirement: Site building outside of SFHA or on highest and most stable part of lot.</td>
<td><strong>FEMA P-55</strong>: 2.3.2, Ch. 4</td>
<td><strong>ASCE 24</strong>: 2.2</td>
</tr>
</tbody>
</table>

*Footnotes:*
(a) Additional guidance can be found in the appropriate code or standard.
(b) These requirements are intended to minimize community risks and may be modified by local authorities.
(c) Cross references are to specific sections within the NFIP or related codes. For more information, please consult the codes and the Federal Register.
Chapter 6: *Fundamentals of Risk Analysis and Risk Reduction* addresses...

- Assessing risk
- Reducing risk
- Communicating risk to clients
Chapter 6: Common Oversights with Risk Analysis

• Misunderstanding the “100-year flood” (1% annual chance flood) concept

• Failure to understand how risks accumulate over time
  • Cumulative probabilities

• Not understanding ways to manage or reduce risk
Chapter 6: Misunderstanding the “100-Year Flood” and Accumulative Risk Over Time

100-Year Flood
- 1 percent chance each year
- 26 percent chance over 30 years
- This is the “base flood”

Burglary
- 0.6 percent chance each year
- 17 percent chance over 30 years

House Fire
- 0.35 percent chance each year
- 10 percent chance over 30 years

- Homeowners protect against burglary even though a flood is more likely if they live in a SFHA
- Fire is even less likely (10 percent chance over 30 years), yet homeowners protect against fire too
Chapter 6: Understand how to Manage Risk

- Risk reduction is a combination of:
  - Physical measures, such as design and construction using building codes and best practices
  - Residual risk still remains, but is significantly less than initial risk
  - Insurance can help manage risk
    - Can help recover damaged personal property

(Figure 6-1, FEMA P-55)
Chapter 7: Pre-Design Considerations addresses…

- The design process
- Design requirements
- Determining the natural hazard risk
- Losses due to natural hazards in coastal areas
- Initial, long-term, and operational costs
- Hazard insurance
- Sustainable design considerations
- Inspection considerations

(Textbox p. 7-10, FEMA P-55)
Chapter 7: Benefit-Cost

(Figure 7-3, FEMA P-55)
Chapter 7: Benefit-Cost

- Higher building elevation results in larger savings in insurance premiums

<table>
<thead>
<tr>
<th>Floor Elevation above BFE</th>
<th>Reduction in Annual Flood Premium</th>
<th>Annual Premium</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0%</td>
<td>$1,622</td>
<td>$0</td>
</tr>
<tr>
<td>1 foot</td>
<td>45%</td>
<td>$897</td>
<td>$725</td>
</tr>
<tr>
<td>2 feet</td>
<td>61%</td>
<td>$638</td>
<td>$984</td>
</tr>
<tr>
<td>3 feet</td>
<td>66%</td>
<td>$548</td>
<td>$1,074</td>
</tr>
<tr>
<td>4 feet</td>
<td>67%</td>
<td>$530</td>
<td>$1,092</td>
</tr>
</tbody>
</table>

Sample NFIP Flood Insurance Premiums for Buildings in Zone A; $250,000 Building/$100,000 Contents Coverage

(Table 7-2, FEMA P-55)

<table>
<thead>
<tr>
<th>Floor Elevation above BFE</th>
<th>Reduction in Annual Flood Premium</th>
<th>Annual Premium</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0%</td>
<td>$7,821</td>
<td>$0</td>
</tr>
<tr>
<td>1 foot</td>
<td>33%</td>
<td>$5,256</td>
<td>$2,565</td>
</tr>
<tr>
<td>2 feet</td>
<td>55%</td>
<td>$3,511</td>
<td>$4,310</td>
</tr>
<tr>
<td>3 feet</td>
<td>65%</td>
<td>$2,764</td>
<td>$5,057</td>
</tr>
<tr>
<td>4 feet</td>
<td>71%</td>
<td>$2,286</td>
<td>$5,535</td>
</tr>
</tbody>
</table>

Sample NFIP Flood Insurance Premiums for Buildings in Zone V Free of Obstruction Below the Lowest Floor; $250,000 Building/$100,000 Contents Coverage

(Table 7-3, FEMA P-55)
Chapter 8: Determining Site-Specific Loads addresses...

- Dead loads
- Live loads
- Tributary area
- Application of loads to buildings
- Flood loads
- Wind loads
- Seismic load
- Load combinations

Hurricane Ike, 2008
Bolivar Peninsula, TX
(Figure 8-15, FEMA P-55)
Chapter 8: Site-Specific Loads

Typical loads types and characteristics affecting loads for building design

Dead and live loads
- Flood
  - Hydrostatic
  - Buoyancy
  - Hydrodynamic
  - Breaking wave
  - Debris impact
  - Tsunami
- Building characteristics affecting loads
  - Height above grade
  - Obstructions below BFE
  - Foundation type/size

Site characteristics affecting loads
- Orientation in relation to flow
- Soil: erosion/scour potential
- Dune protection
- Building setback

Site characteristics affecting loads
- Ground roughness around site
- Debris potential

Other environmental loads
- Snow
- Rain

Site characteristics affecting loads
- Soil: liquefaction
- Depth of foundation members
- Soil: type of support material (e.g., bedrock, clay)

Wind
- Windward
- Leeward
- Uplift
- Acting on:
  - Main wind force resisting system
  - Components and cladding

Seismic
- Base shear

Factored design loads determined using appropriate load combinations

Building characteristics affecting loads
- Roof shape
- Building geometry
- Height above grade
- Number and location of openings

(Figure 8-1, FEMA P-55)
Chapter 8: Flood Loads

- CCM covers:
  - Design flood elevation
  - Design stillwater flood depth
  - Designing breaking wave height
  - Design flood velocity
  - Hydrostatic loads
  - Wave loads
    - Breaking wave loads
    - Wave slam
  - Hydrodynamic loads
  - Debris impact loads
  - Localized scour
  - Flood load combinations

**Equation 8.7. Lateral Wave Slam**

\[
F_w = f_w \cdot w = \frac{1}{2} \gamma_w C_r d_f b w
\]

(Eq. 8.7)

where:
- \( F_w \) = lateral wave slam (lb)
- \( f_w \) = lateral wave slam (lb/ft)
- \( C_r \) = slam coefficient incorporating effects of slam duration and structure stiffness for typical residential structure (recommended value is 2.0)
- \( \gamma_w \) = unit weight of water (62.4 lb/ft\(^3\) for fresh water and 64.0 lb/ft\(^3\) for saltwater)
- \( d_f \) = stillwater flood depth (ft)
- \( b \) = vertical distance (ft) the wave crest extends above the bottom of the floor joist or floor beam
- \( w \) = length (ft) of the floor joist or floor beam struck by wave crest
Chapter 8: Wind Loads

- CCM covers:
  - Determining wind loads using ASCE 7-10
  - Main Wind Force Resisting System
  - Components and Cladding
  - Tornado loads

(Example 8.5, Illustration A, FEMA P-55)
Chapter 9: Designing the Building addresses…

- Continuous load path
- Other load path considerations
  - Uplift due to shear wall overturning
  - Gable wall support
  - Connection choices
  - Building eccentricities
- Framing system
- Breakaway wall enclosures
- Building materials
- Appurtenances

Hurricane Hugo, 1989
South Carolina
(Figure 9-28, FEMA P-55)

(Figure 9-2, FEMA P-55)
Chapter 9: Importance of Continuous Load Path

- The load path must be continuous.
- Each link in the load path “chain” must be strong enough to transfer loads without breaking.
- Any weakness in the chain can cause damage or structural failure.
- Load paths must always take the loads into the ground.
- CCM walks through Links #1 through #8 on the example load path shown.
Chapter 10: *Designing the Foundation*

addresses...

- Foundation design criteria
- Foundation styles
  - Open
  - Closed
  - Shallow
  - Deep
- Foundation design requirements and recommendations
- Design process
- Pile foundations
- Pier foundations

(Figure 10-4, FEMA P-55)

Hurricane Katrina, 2005
Belle Fontaine Point, MS

(Figure 10-7, FEMA P-55)
Chapter 10: Foundation Styles

**Shallow**

- **Closed**
  - (Figure 9-3, FEMA P-55)

- **Deep**
  - (Figure 5D-16, FEMA P-259)

**Deep**

- **Open**
  - (Figure 13-6, FEMA P-55)

- **Closed**
  - (Figure 10-3, FEMA P-55)

CCM p. 10-2
Chapter 10: Foundation Design Process

- CCM walks readers through the foundation design process

1. Assume preliminary foundation design
2. Calculate loads on structure and foundation
3. Is foundation adequate?
   - Can it resist loads?
   - Are soils adequate to resist loads?
   - Are scour/erosion accounted for?
4. Revise foundation design (if no)
5. Final foundation design achieved (if yes)
Chapter 11: *Designing the Building Envelope* addresses…

- Floors in elevated buildings
- Exterior doors
- Windows and skylights
- Non-load-bearing walls, wall coverings, and soffits
- Roof systems
- Attic vents
- Additional environmental considerations

*Hurricane Katrina, 2005, Louisiana*  
(Figure 11-25, FEMA P-55)
Chapter 11: Roof Systems

- CCM discusses the hazards and damage to, and best practices for mitigating:
  - Asphalt shingles
  - Fiber-cement shingles
  - Liquid-applied membranes
  - Tiles
  - Metal panels and metal shingles
  - Wood shingles and shakes
  - Low-slope roof systems

(Figure 8-6, FEMA P-762)

CCM p. 10-24

Hurricane Ike, 2008
Texas
(FEMA file photo)

Northridge Earthquake, 1994
California
(FEMA P-55, Figure 11-51)
Chapter 12: *Installing Mechanical Equipment and Utilities* addresses...

Guidance on installation and protection from natural disaster for:

- Elevators
- Exterior-mounted mechanical equipment
- Interior mechanical equipment
- Electric utility, telephone, and cable TV systems
- Water and wastewater systems

(Figure 12-3, FEMA P-55)

(Figure 12-2, FEMA P-55)
Chapter 13: *Constructing the Building*

addresses...

Issues faced by builders when constructing:

- Foundations
- Structural framing
- Building envelope

Issues addressed include:

- Common challenges
- Substitution of materials
- Inspection points

(Figure 13-6, FEMA P-55)

(Figure 13-18, FEMA P-55)
Chapter 14: *Maintaining the Building* addresses...

- Effects of the coastal environment on the built environment
  - Corrosion
  - Moisture
  - Weathering
  - Termites

- Building elements that require frequent maintenance

- Hazard-specific maintenance techniques

(Figure 14-1, FEMA P-55)
Chapter 15: Retrofitting Buildings for Natural Hazards addresses...

- Some key points and FEMA resources regarding retrofitting
- Retrofitting techniques for natural hazards
  - Flood
  - High wind
  - Seismic
  - Wildfire
- Multi-hazard retrofitting

(Figure 15-3, FEMA P-55)
(Figure 15-17, FEMA P-55)
Retrofitting

• Combination of adjustments or additions to existing building features
• Intended to eliminate or reduce the potential for damage from natural hazards

Retrofitting is a specific type of hazard mitigation activity
Chapter 15: FEMA Retrofitting Resources

FEMA P-259 / January 2012

Wind Retrofit Guide for Residential Buildings
FEMA P-804 / December 2010

Earthquake Safety Guide for Homeowners
FEMA 530 / September 2005

Home Builder’s Guide to Construction in Wildfire Zones
Technical Fact Sheet Series
FEMA P-737 / September 2008

Homebuilders’ Guide to Earthquake Resistant Design and Construction
FEMA 232 - June 2006
Chapter 15: Mulithazard Retrofitting

Architects, engineers, and code officials must recognize...

It is important to approach retrofitting with a multi-hazard perspective!

- Retrofitting for one hazard may affect how a structure reacts to other types of hazards
- Retrofitting to withstand only one hazard may impair the structure’s resistance to other hazard types
  - Example: Elevating high on piles to mitigate flood hazard makes the building less resistant to seismic forces (if not properly addressed in the design)
Course Overview

• Describe CCM history
• Describe updates made from the 3rd to 4th editions of CCM
• Define the scope and use of the 4th edition of CCM
• Overview the content of each chapter of the 4th edition of CCM
• Describe other coastal construction resources
• Summary
Other Resources

• There are numerous resources besides CCM that coastal designers should use…
  • FEMA NFIP Technical Bulletins (TB)
  • FEMA P-499
  • FEMA P-550
  • FEMA Mitigation Assessment Team Reports
  • FEMA P-787
  • Other design and construction standards
FEMA NFIP Technical Bulletins

• A series of 12 technical bulletins that provide guidance concerning the how to comply with the building performance standards of the NFIP

• Some of the more recently updated include:
  • TB 1, *Openings in Foundation Walls and Walls of Enclosures*
  • TB 2, *Flood Damage-Resistant Materials Requirements*
  • TB 4, *Elevator Installation*
  • TB 5, *Free-of-Obstruction Requirements*
  • TB 9, *Design and Construction Guidance for Breakaway Walls*
FEMA P-499, Home Builder’s Guide to Coastal Construction

- A series of 37 technical fact sheets
- Provides technical guidance and recommendations concerning the construction of coastal residential buildings
- Information is aimed at improving the performance of buildings subject to coastal flood and wind forces
- Updated in 2010

Home Builder’s Guide to Coastal Construction
Technical Fact Sheet Series
FEMA P-499 / December 2010
FEMA P-550, *Recommended Residential Construction for Coastal Areas*

- A design manual that provides recommended designs and guidance for rebuilding homes destroyed by hurricanes in the Gulf Coast
- Prescriptive foundation designs are included
- Updated in 2009 to keep pace with developing codes and standards

*Recommended Residential Construction for Coastal Areas*

Building on Strong and Safe Foundations

FEMA
FEMA Mitigation Assessment Team (MAT) Reports

- Following a natural or manmade disaster, FEMA may deploy a MAT to assess key damage and document and building and infrastructure performance
  - Helps identify strategic national and local opportunities
- MAT reports are then written detailing the observations, conclusions, and recommendations for improving building and infrastructure performance in the face of a manmade or natural disaster
- There are currently 16 publically available MAT Reports
FEMA P-787, Catalog of FEMA Wind, Flood, and Wildfire Publications, Training Courses, and Workshops

• A catalog with brief descriptions of publications, courses, and workshops developed by the Building Science Branch of FEMA
  • Wind
  • Flood
  • Wildfire
• Updated in 2012
Other Design and Construction Standards

Course Overview

• Describe CCM history
• Describe updates made from the 3rd to 4th editions of CCM
• Define the scope and use of the 4th edition of CCM
• Overview the content of each chapter of the 4th edition of CCM
• Describe other coastal construction resources
• Summary
Summary

- You should now be able to:
  - Describe CCM history
  - Describe updates made from the 3\textsuperscript{rd} to 4\textsuperscript{th} editions of CCM
  - Define the scope and use of the 4\textsuperscript{th} edition of CCM
  - Have a general understanding of the content of each chapter of the 4\textsuperscript{th} edition of CCM
  - Describe other coastal construction resources
Sign Up Today for the 2-Day or 4-Day Residential Coastal Construction Courses!

• Visit the Emergency Management Institute's (EMI) website at http://training.fema.gov/ to sign up today!

• Also, visit the EMI website for a list of upcoming courses and course descriptions
For More Information

Visit FEMA’s Building Science webpage at http://www.fema.gov/building-science

Questions?
Visit the Frequently Asked Questions webpage at http://www.fema.gov/frequently-asked-questions

If you need additional information contact the Building Science Helpline at (866) 927-2104 or email FEMA-Buildingsciencehelp@fema.dhs.gov. Please allow up to 5 business days for a response.