California Building Code and the NFIP

John Ingargiola, Senior Engineer
FEMA Building Science Branch
CA Major Disaster Declarations and Federal Assistance

45 flood declarations

12 earthquake declarations

7 declarations, 2004-2016, total $267 million

$76
$78
$35
$21
$21
$7
$29
$7
California Flood Insurance

$520 million
• Paid since 1978

$23 million
• Paid 2011-2015

84 billion
Total coverage as of 2016

302,364 policies in force

527 NFIP communities

$217 million
Written Premium in-force as of 2016
Building Codes and NFIP

- NFIP Regulations (44 CFR Parts 59 & 60)
  - Local Floodplain Management Regulations*
    - or
    - IBC Appendix G*
  - Building Code
    - Flood Resistant Buildings and Development
    - ASCE 7
    - ASCE 24
Building Codes and NFIP

Local Floodplain Management Regulations*

or

IBC Appendix G*

* NFIP-consistent administrative provisions, community-specific adoption of FIS and maps, and technical requirements for development outside the scope of the building code (and higher standards, in some communities).
FEMA prepares excerpts from the I-Codes

NFIP Checklist (standard ordinance compliance checklist)

Excerpts of flood provisions, lists of changes between I-Code editions, and “Highlights of ASCE 24” available on FEMA Building Code Resources webpage.
# Comparison checklist

## NFIP- 2015 I-Codes and ASCE 24 Checklist – NFIP Requirements

**IBC (and Appendix G), IMC, IPC, IFGC, IRC, and IEBC**

<table>
<thead>
<tr>
<th>Required provisions [NFIP citations]</th>
<th>2015 I-Codes (IBC &amp; Appendix G, IMC, IPC, IFGC, IRC, and IEBC)</th>
<th>ASCE 24-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Citation of Statutory Authorization. [59.22(a)(2)]</td>
<td>In state authorizing/adoption or community’s adopting ordinance</td>
<td>ASCE 24 does not include administrative provisions</td>
</tr>
</tbody>
</table>
| 2. Purpose section citing health, safety, and welfare reasons for adoption. [59.22(a)(1)] | 101.3  
G101.2  
R101.3  
EB101.3 | ASCE 24 does not include administrative provisions |
| 3. Definitions [59.1] | See page 15, below | See page 15, below |
| 4. Adopt or reference correct Flood Insurance Rate Map (and where applicable, Flood Boundary Floodway Map) and date. [60.2(h)] | 1612.3  
Table R301.2(1)  
Note: both reference revisions of FIS and FIRMs; this provision does not override individual state limitations on “auto-adoption” of maps. | ASCE 24 does not include administrative provisions |
| 5. Adopt or reference correct Flood Insurance Study and date. [60.2(h)] | 1612.3  
G102.2  
Table R301.2(1) | ASCE 24 does not include administrative provisions |
| 7. Adequate enforcement provisions including a violations/penalty section specifying community actions to assure compliance. [60.2(e)] | 114  
G101.4  
R113 | ASCE 24 does not include administrative provisions |
| 8. Abrogation and Greater Restriction section (provide that floodplain management regulations take precedence over any less restrictive conflicting local laws, ordinances or codes). [60.1(h)] | In community’s adopting ordinance | ASCE 24 does not include administrative provisions |
| 9. Disclaimer of Liability (Degree of flood protection required by the ordinance is considered reasonable but does not imply total flood protection.) | In community’s adopting ordinance | ASCE 24 does not include administrative provisions |
ASCE 24, *Flood Resistant Design and Construction*

- Referenced by IBC, contains design requirements
- Highlights prepared by FEMA
- Available online (2005 and 2014 editions)
- Summarizes key requirements

2015 I-Codes reference ASCE 24-14.
Key changes between 2012 and 2015

- IRC
  - Minimum elevation is BFE + 1 ft, all flood zones
  - Coastal A Zone regulated like Zone V
  - Flood openings in all walls, including breakaway
  - Specific requirements for tanks (Zone A and Zone V)

- IBC (by changes to ASCE 24-14)
  - Performance of engineered flood openings
  - Flood Design Class 4 (Risk Category IV) at or above BFE + 2 ft or 500-year elevation, whichever is higher
  - Flood openings in all walls
  - New section for multi-story parking structures
Additional Elevation: Freeboard

- 2015 IRC now requires minimum elevation BFE + 1 ft
- Justified by reduced vulnerability to flooding
- Reduced cost of NFIP flood insurance

Note: Annual premiums calculated using the NFIP Flood Insurance Manual, October 1, 2014, for a one-story single-family home with no basement, no enclosure, and full replacement coverage. Premiums are based on the maximum available coverage of building coverage of $250,000 for building and $100,000 for contents coverage. Zone V building is assumed to be free of obstructions.
R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.

2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated to a height above the highest adjacent grade of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (15 mm) if a depth number is not specified.

3. Basement floors that are below grade on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.

Exception: Enclosed areas below the design flood elevation, including basements with floors that are not below grade on all sides, shall meet the requirements of Section 322.2.2.
R322.3.2 Elevation requirements.

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structure members supporting the lowest floor, with the exception of pilings, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.

2. Basement floors that are below grade on all sides are prohibited.

3. The use of fill for structural support is prohibited.

4. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.

5. Walls and partitions enclosing areas below the design flood elevation shall meet the requirements of Sections R322.3.4 and R322.3.5.
### IBC / ASCE 24-14: Freeboard

<table>
<thead>
<tr>
<th>Minimum Elevation* of Lowest Floor (Zone A: ASCE 24-14 Table 2-1)</th>
<th>Flood Design Class 1</th>
<th>Flood Design Class 2</th>
<th>Flood Design Class 3</th>
<th>Flood Design Class 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone A not identified as Coastal A Zone</td>
<td>DFE</td>
<td>BFE +1 ft or DFE, whichever is higher</td>
<td>BFE +1 ft or DFE, whichever is higher</td>
<td>BFE +2 ft or DFE, or 500-year flood elevation, whichever is higher</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Minimum Elevation of Bottom of Lowest Horizontal Structural Member (Zone V: ASCE 24-14 Table 4-1)</th>
<th>Flood Design Class 1</th>
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</tr>
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<tr>
<td>Coastal High Hazard Areas (Zone V) and Coastal A Zone</td>
<td>DFE</td>
<td>BFE +1 ft or DFE, whichever is higher</td>
<td>BFE +2 ft or DFE, whichever is higher</td>
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- **2015 IBC**, by reference to ASCE 24, requires the higher of BFE + 1 ft or 500-year flood elevation for Flood Design Class 4 ("critical facilities")

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Increasing importance, increasing protection
Significant revision with a lot of new content

RFL answers questions about coordinating building codes and floodplain management regulations

- International Code Council in coordination with FEMA
- Download from ICC or FEMA (not available in hardcopy)
- Based on the 2012 I-Codes, with notes for the 2015 edition
Two regulatory instruments that govern the same thing can create problems:

• Are wording differences meaningful?
• Does the “more restrictive” always prevail? Who decides?
• What’s the burden on the regulated public, design professionals, buildings and on every community to figure it out?
• Is there liability for failure to enforce the more restrictive?
IMPROVED Chapter 3, Differences Between NFIP Requirements and the I-Codes

- 26 topics

- Many I-Code and ASCE 24 requirements exceed the NFIP or are more specific than the NFIP.
### RFL Chapter 3: NFIP & I-Codes

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<tr>
<th>Topic</th>
<th>Requirement</th>
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<td>Adoption of FIS and FIRMs</td>
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<td>Flood Loads and Flood Resistance</td>
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<tr>
<td>Risk/Occupancy Category &amp; Flood Design Class</td>
<td>Registered Design Professional</td>
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<td>Building Official and Floodplain Administrator</td>
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<td>Inspections</td>
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<td>Record Keeping</td>
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<td>SI / SD</td>
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<td>Floodway</td>
<td>Variances</td>
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<td>Use of Fill</td>
<td>Crawlspace and Under-floor Space</td>
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<td>Dry Floodproofing</td>
<td>Livable and Habitable</td>
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**BASE FLOOD.** The flood having a 1-percent chance of being equaled or exceeded in any given year.

**DESIGN FLOOD.** The flood associated with the greater of the following two areas:

1. Area with a floodplain subject to a 1-percent or greater chance of flooding in any year; or
2. Area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated.
BASE FLOOD ELEVATION. The elevation of the base flood, including wave height, relative to the National Geodetic Vertical Datum (NGVD), North American Vertical Datum (NAVD) or other datum specified on the Flood Insurance Rate Map (FIRM).

DESIGN FLOOD ELEVATION. The elevation of the “design flood,” including wave height, relative to the datum specified on the community’s legally designated flood hazard map. In areas designated as Zone AO, the design flood elevation shall be the elevation of the highest existing grade of the building’s perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610mm).

*IRC: DFE is defined where used in R322.1.4.*
BFE & DFE

- IBC, ASCE 7 and ASCE 24 define BFE and DFE
- DFE = BFE unless a different flood hazard map is adopted
- Reasons a community might have DFE ≠ BFE include local decision to use a different map to delineate:
  - Ultimate development runoff (future conditions)
  - Storm of record
  - 0.2% annual chance (500-year) flood
  - Areas not on FIRMs
Does not define the terms.

Only non-residential may be dry floodproofed in lieu of elevation.

NFIP guidance: Residential includes where people live, used for sleeping purposes, cared for on 24-hour basis

Terms in the Flood Insurance Manual are used to determine which coverage limits apply and should not be used to determine which buildings may be dry floodproofed.
I-Codes: Residential & Non-Residential

- IRC: one- and two-family dwellings and townhomes not more than 3 stories
- IBC: all other buildings; sometimes call the “commercial” code, but also applies to residential occupancies not within the scope of IRC
- ASCE 24, for applicability of dry floodproofing:
  - Defines residential
  - Non-residential includes buildings that are not residential
  - ASCE 24-14 defines, in commentary, “mixed-use” and “residential portions of mixed-use buildings”
NFIP: Building Official & FPA

- NFIP communities must “legislatively designate” an official (typically called the Floodplain Administrator).
- The designated official performs pursuant to the authority in the adopted floodplain management regulations.
- Every community must adopt regulations and have a Floodplain Administrator, even if they have interlocal agreements or contract for services by another entity.
- Building Officials administer and enforce building codes pursuant to the authority of the adopted building code.

- If designated the Floodplain Administrator in local regulations, the Building Official could delegate functions, e.g., those not directly related to buildings, such as floodway encroachments.
NFIP: Inspections

- NFIP regulations do not specify inspections
- FEMA guidance suggests inspections at several times during construction
I-Codes: Inspections

- IBC and IRC call for a “lowest floor” or “floodplain” inspection: “upon placement of the lowest floor, including basement, and prior to further vertical construction” – at which time documentation of elevations is to be submitted.
- IBC and IRC require submission of “as-built” elevation documentation prior to final inspection.
- IRC calls for “as-built” elevation documentation (in Section R322).
NEW Chapter 4, Questions Related to Coordinating I-Codes and Floodplain Management

- 17 questions
- Answers should be developed in the context of each State or community existing statutes and codes
- Help evaluate options and make decisions:
  - Develop code-coordinated model ordinances
  - Continue use of “stand-alone” floodplain management ordinances and deal with differences and conflicts and coordination – not recommended
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<th>Question</th>
<th>Answer</th>
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<td>Is IBC Appendix G adopted?</td>
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</table>
Is Chapter 1 of I-Codes Adopted?

- Use I-Code Chapter 1, available through the California Building Standards Code
- Communities that don’t use I-Code Chapter 1 should include flood-related content in their locally developed administrative rules:
  - Content of plans to show zones, elevations, floodway
  - SI/SD determinations
  - Variances
  - Inspections
Appendices must be explicitly adopted.

IBC Appendix G includes floodplain management and administrative provisions not included in the body of the I-Codes.

- California makes IBC Appendix G available for local adoption
Local Code Amendments Allowed?

- California allows local amendments
  - More stringent
IMPROVED CHAPTER 5, Increasing Resistance to Flood Damage

- FEMA encourages adoption of requirements that exceed the NFIP (“higher standards”)
- NFIP Community Rating System recognizes higher standards
- FEMA’s post-flood investigations reinforce the value of some higher standards
- Chapter 5 includes brief explanations of benefits of 16 higher standards
- Suggested language to amend the I-Codes – in underline and strike-thru format
- States and communities interested in other higher standards can seek FEMA advice
### RFL: Higher Standards

<table>
<thead>
<tr>
<th>Amend The I-Codes</th>
<th>Ordinance or IBC Appendix G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Height (Freeboard)</td>
<td>Designate the Floodplain Administrator</td>
</tr>
<tr>
<td>Prohibit Enclosures Below Elevated Buildings</td>
<td>Manufactured Home Limitations</td>
</tr>
<tr>
<td>Limit the Size of Enclosures Below Elevated Buildings</td>
<td>Flood Protection Setback Along Waterways</td>
</tr>
<tr>
<td>Require Nonconversion Agreements</td>
<td>Subdivision Limitations</td>
</tr>
<tr>
<td>Treat Coastal A Zone Like Zone V</td>
<td>Compensatory Storage</td>
</tr>
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**Cumulative Substantial Improvement**

<p>| |</p>
<table>
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<tr>
<th></th>
</tr>
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<tbody>
<tr>
<td>Repetitive Flood Damage (Substantial Damage)</td>
</tr>
<tr>
<td>Limitation on Use of Fill</td>
</tr>
<tr>
<td>Design Certification of All Foundations</td>
</tr>
<tr>
<td>Protection of Critical and Essential Facilities</td>
</tr>
<tr>
<td>Flood Hazard Map Other Than, or in Addition to, the FIRM</td>
</tr>
</tbody>
</table>
Additional Height (Freeboard)

- Already illustrated the benefits of adding freeboard
- Although the I-Codes have some freeboard, some communities want to adopt even more additional elevation
  - Most effective way to protect buildings
  - Anticipate changes in flood levels (upland development, climate change)
  - Reduce risk for individual buildings (and lower NFIP flood insurance premiums)
Additional Height (Freeboard)

- IRC – to increase freeboard that is already in some sections, modify several sections to read: “…to or above the base flood elevation plus \{insert additional height\} or the design flood elevation, whichever is higher.”

Remember, 2015 IRC already has BFE + 1 ft in all flood zones; can add even more

- IBC – add subsection to 1612.4.1 to specify the minimum elevation is the higher of that specified in ASCE 24 or “the base flood elevation plus \{insert additional height\}, whichever is higher.”
Cumulative Substantial Improvement

- Some communities adopt a requirement to track improvements over a specific period of time (1-, 5-, 10-years or life of buildings) and require compliance when the accumulated cost equals or exceeds 50% of market value.
- Discourages phasing of work deliberately to avoid the Substantial Improvement trigger.
- Helps bring nonconforming buildings into compliance faster, especially in communities with shallow, repetitive flooding unlikely to ever cause Substantial Damage.
- Community must have good permit records.
In IBC and IEBC, modify definition:

**SUBSTANTIAL IMPROVEMENT.** Any combination of repair, reconstruction, rehabilitation, addition or improvement of a building or structure, taking place during a {number of years}–year period, the cumulative cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. For each building or structure, the {number of years}–year period begins on the date of the first permit issued for improvement or repair of that building or structure subsequent to {see Note}. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include either: *remainder unchanged*
Modify IBC Appendix G to Designate FPA

- For communities that assign floodplain management responsibilities to an agency other than the building department
- Another option is to designate in companion ordinance

G101.5 Designation of Floodplain Administrator. The [insert position title] is designated as the floodplain administrator. The Floodplain Administrator may delegate performance of certain duties to other employees.

[And replace “building official” with “floodplain administrator.”]
NEW CHAPTER 6, Model Code-Coordinated Floodplain Management Ordinances

Table 6-1: Selecting an Applicable Code-Coordinated Model Ordinance

<table>
<thead>
<tr>
<th></th>
<th>I-Codes with Chapter 1&lt;sup&gt;(1)&lt;/sup&gt;</th>
<th>I-Codes without Chapter 1&lt;sup&gt;(2)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-Codes with IBC Appendix G&lt;sup&gt;(3)&lt;/sup&gt;</td>
<td>Model Ordinance Version One</td>
<td>[FEMA has not identified any States in this situation]</td>
</tr>
<tr>
<td>I-Codes without IBC Appendix G&lt;sup&gt;(4)&lt;/sup&gt;</td>
<td>Model Ordinance Version Two</td>
<td>Model Ordinance Version Three</td>
</tr>
</tbody>
</table>

Always have draft revisions to your floodplain management regulations reviewed by the NFIP State Coordinator before adoption.
Written to explicitly coordinate – **work with** – the building codes

All requirements for buildings and structures are in the building codes

Some additional administrative provisions are in the ordinance
  - Adoption of FIS/FIRMs
  - Powers and duties of the FPA
  - Applications
  - Variances
IBC Appendix G or coordinated ordinances include requirements for development other than buildings are in the ordinance:

- Subdivisions
- Site improvements
- Manufactured homes
- Recreational vehicles
- Tanks
- Temporary structures
- “Other building work”
- Utility and Miscellaneous Group U buildings
What’s Next for You?

- Consider options for a code-coordinated ordinance
- Learn about the State’s process for adopting the I-Codes
- Work through questions in Chapter 4
- Consider higher standards
- Request review assistance
- Gain State/FEMA concurrence before adoption
Why Is FEMA Involved in Model Building Codes?

- Cornerstone of effective mitigation
- Return on investment
- Technology transfer
- Building code adoption tracking
- Promote adoption and enforcement of current disaster-resistant codes
Priority #4: Enable Disaster Risk Reduction Nationally

• Objective 4.2: Incentivize and facilitate investments to manage current and future risk

In collaboration with partners in the private sector—and at Federal, state, tribal, and local levels—FEMA will also support the development and adoption of more rigorous, risk-informed building codes and standards.
Sec. 323. Minimum Standards for Public and Private Structures (42 U.S.C. 5165a)

(a) In General - As a condition of receipt of a disaster loan or grant under this Act -

(1) the recipient shall carry out any repair or construction to be financed with the loan or grant in accordance with applicable standards of safety, decency, and sanitation and in conformity with applicable codes, specifications, and standards; and

(2) the President may require safe land use and construction practices, after adequate consultation with appropriate State and local government officials.

(b) Evidence of Compliance - A recipient of a disaster loan or grant under this Act shall provide such evidence of compliance with this section as the President may require by regulation.
Codes Integrated in FEMA Programs

- **Community Rating System**
  - CRS class depends on BCEGS score
  - Credits given for “higher standards”

- **Hazard Mitigation Assistance**
  - ASCE 24 as minimum criteria for elevation, dry floodproofing, and mitigation reconstruction projects
  - 5% initiative to adopt disaster-resistant building code or improve BCEGS score
  - Post-disaster code enforcement

- **Mapping of LiMWA on FIRM which delineates Coastal A Zone**
Links between Risk MAP and Building Code Issues

- What changes/updates to flood mapping have major building code impacts?
  - Riverine: Freeboard and Floodways (high velocity)
  - Coastal: Coastal Zone A
  - High Risk Flood Hazard Areas (alluvial fan, flash flood, mudslide, erosion-prone, high velocity flow, ice jam and debris)
“...has been designed and constructed in accordance with the accepted standards of practice (ASCE 24-05, ASCE 24-14 or their equivalent) and any alterations also meet those standards...”

All structural components are capable of resisting hydrostatic and hydrodynamic flood forces, including the effects of buoyancy, and anticipated debris impact forces.

I certify that the information in Section III on this certificate represents a true and accurate determination by the undersigned using the available information and data. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.
Resources

**Financial**
- FEMA planning grants, HMA 5% initiative, HMGP grants for code training, code improvements, improving BCEGS score
- FEMA Community Assistance Program – State Support Services Element (CAP-SSSE) ordinance assistance
- HUD Community Development Block Grants for code enforcement activities and resilient code development

**Technical**
- Model code-coordinated ordinances
- *Reducing Flood Losses through the International Codes*
- FEMA Building Code Resources (http://fema.gov/building-code-resources)
- Code, design and construction training
- Technical assistance
- Building Science publications
FEMA Building Code Resources

http://www.fema.gov/building-code-resources/

- Flood Resistant Provisions of the 2015, 2012 and 2009 I-Codes
- Highlights of ASCE 24-05 and ASCE 24-14, Flood Resistant Design and Construction
- Provisions of the I-Codes and ASCE 24 Compared to the NFIP
- Checklists demonstrating NFIP consistency
CodeMaster: A New Resource

- 12-step procedure for determining loads for design
- Based on IBC, IRC, ASCE 7 and ASCE 24
- Includes an example

Available from iccsafe.org/store
(search “CodeMaster”)
Codes Integrated in FEMA Programs – The Future

- **Public Assistance Program Minimum Standards**
  - Would require Applicant to use hazard-resistant standards referenced in I-Codes (e.g., ASCE 24)
  - Public comments received through July 8th

- **Disaster Deductible**
  - would include the establishment of a predetermined level of state disaster funding or investment in resilience before FEMA will begin to provide additional assistance through the Public Assistance program
  - Goal is to incentivize mitigation strategies and promote risk-informed decision-making to build resilience
  - Public comments received through March 21st

- **FEMA Policy 204-078-2: Disaster Risk Reduction Minimum Codes and Standards**
  - Directs FEMA offices and programs to require, where legally permissible, the use of minimum building codes and standards as a condition of accepting Federal disaster assistance and non-disaster assistance for the construction of buildings or structures.
FEMA Building Science Helpline

FEMA-BuildingScienceHelp@fema.dhs.gov
Helpline: (866) 927-2104

- Approximately 200 inquiries per year
- Common flood questions
  - Flood openings
  - Basements / below-grade areas
  - Substantial Improvement and Substantial Damage
  - Flood damage-resistant materials
- FAQ’s