The Latest in ICC 500 Storm Shelter and FEMA Safe Room Requirements

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Federal Emergency Management Agency
Region VII

New Editions of ICC 500 Storm Shelter Standard and FEMA Safe Room Guidance

- ICC 500 (Second Edition) released in December 2014
- FEMA P-361 (Third Edition) released in March 2015
- FEMA P-320 (Fourth Edition) released in December 2014
Outline

- Wind hazard and threat
- FEMA P-361 background
- ICC 500 background
- 2015 IBC storm shelter code changes
- ICC 500-14 review
- Differences between ICC 500 and FEMA P-361
- FEMA P-320 and Success stories

Recorded EF3, EF4, and EF5 Tornadoes in the United States from 1950 to 2013
Assessing Threat: Where Do Hurricanes Strike the Most?
FEMA Building Science Mitigation Objectives

Codes/Standard vs. FEMA Building Science Publications

Building codes and standards

- Written by technical expert panels/committees
- Consensus documents, publically balloted
- When adopted, may be enforced by the building department
- Can only reference other consensus codes and standards
- Products may be approved through code “evaluation services”
- Laboratories and testing agencies provide product approvals and compliance certificates
Codes/Standard vs. FEMA Building Science Publications (cont.)

Building Science Publications
- Written by technical expert panels/committees
- Evaluated by Review Committees, not publically balloted
- Typically, not adopted and therefore, not enforceable by the building department
- If adopted through special legislative rule or action, guidance may be enforced by the building department (rare)
- Only when part of a grant program does the design criteria change from “should” to “shall”

Terminology
- **ICC 500 Storm Shelter** – A building, structure, or portion(s) thereof, constructed in accordance with ICC 500, for the purpose of providing safe refuge from storms that produce high winds, such as tornadoes and hurricanes.
  - **Residential Storm Shelter.** Serves occupants of dwelling units and has an occupant load not exceeding 16 persons.
  - **Community Storm Shelter.** Any storm shelter not defined as a residential storm shelter.
- **FEMA Safe Room** – A building, structure, or portion(s) thereof, constructed in accordance with FEMA P-320 or FEMA P-361, which uses ICC 500 as a referenced standard and also specifies Recommended Criteria that is slightly more conservative than ICC 500.
FEMA Safe Room Publication Background

- Post-disaster studies have been conducted since the 1970s to determine safe room design.
- FEMA technical building science teams observe and assess building performance after disasters of national significance in the United States.
- FEMA has provided technical guidance on tornado protection since 1980, in TR-83A.
- FEMA was involved with the development of ICC 500, the first consensus code for storm shelters released in 2008.

FEMA-Funded Safe Room Grants

- FEMA’s recommended guidance in P-320 and P-361 are requirements for FEMA grants:
  - Over $985M in Federal funds granted to design and construct safe rooms.
  - Nearly 25,000 residential safe rooms.
  - Over 2,000 community safe rooms.
  - In 25 states and territories.
ICC 500, Standard for the Design and Construction of Storm Shelters

- First released in 2008
- ICC 500 took much of what was presented in the first edition of FEMA P-361 and updated and codified it
- ICC 500-14 Commentary published in February 2016

ICC 500 Purpose (Section 101.1)

The purpose of this standard is to establish minimum requirements to safeguard the public health, safety and general welfare relative to the design, construction and installation of storm shelters constructed for protection from high winds associated with tornadoes and hurricanes...
2015 IBC Code Requirement for ICC 500 Storm Shelters

423.3 Critical emergency operations. In areas where the shelter design wind speed for tornadoes per Figure 304.2(1) of ICC 500 is 250 MPH, 911 call stations, emergency operation centers and fire, rescue, ambulance and police stations shall have a storm shelter constructed in accordance with ICC 500.

Exceptions:
1. Group E day care facilities.
2. Group E occupancies accessory to places of religious worship.
3. Buildings meeting the requirements for shelter design in ICC 500.
ICC 500-14 Outline

- Chapter 1: Application and Administration
- Chapter 2: Definitions
- Chapter 3: Structural Design
- Chapter 4: Siting
- Chapter 5: Occupancy, Means of Egress, Access, and Accessibility
- Chapter 6: Fire Safety
- Chapter 7: Essential Features and Accessories
- Chapter 8: Test Methods for Impact and Pressure Testing
- Chapter 9: References

ICC 500-14 Chapter 1 – Application and Administration – Outline

- Section 101: General
- Section 102: Compliance Alternatives
- Section 103: Conventions
- Section 104: Occupancy
- Section 105: Applicable Building Code
- Section 106: Inspections and Structural Observations
- Section 107: Construction Documents
- Section 108: Design Information Signage and Labeling
Code Applicability

- In cases where P-361 or ICC 500 do not stipulate requirements, the applicable provisions of the building code adopted by the AHJ should apply.
- If no applicable building code is adopted, the most current version of IBC should be used (2015 or most current edition).
- For code requirements not related to structure or life-safety (e.g., plumbing), design for the normal use of a multi-use safe room unless otherwise directed by ICC 500 or the AHJ.

Permitting and Code Compliance

- Before construction begins, all necessary State and local building and other permits should be obtained.
- 2009 or later editions of IBC and IRC incorporate ICC 500 standard by reference.
  - Where these codes are adopted, ICC 500 compliance is triggered for storm shelter or safe room construction.
  - A properly designed and constructed FEMA safe room is considered to be an ICC 500 storm shelter.
- Some communities have chosen to use FEMA P-361 (or even P-320) as an alternate, more restrictive standard.
Peer Review

- Both FEMA P-361 and ICC 500 require peer review when:
  - Safe room is designed for more than 50 occupants
  - Safe room is in an elementary school, secondary school, or day care center and has an occupant load greater than 16
  - Safe room is in any Risk Category IV building (essential facility)
- Peer review must include Chapters 3, 5, 6, and 7 of ICC 500
- Peer reviewer must be independent registered design professional

Special Inspections

- A new requirement in ICC 500 (2014 edition) calls for special inspections for post-installed anchors in hardened concrete and masonry
- Safe rooms must be installed on foundation that has been designed to resist the loads
- ICC 500 does have minimum requirements for slabs
  - 3.5-inch thickness
  - 6 x 6 – W1.4 x 1.4 welded wire reinforcement, OR No. 4 bars at max spacing of 18 inches on center
- However these requirements may not be sufficient, depending on design. Always check loads and design of foundation.
Special Inspections (cont.)

If special inspection is triggered for post-installed anchors, inspection must verify:

- Post-installed anchor installation and capacity
- Foundation adequacy

Construction documents must provide:

- Minimum foundation capacity requirements
- Shelter installation requirements, including anchor location and minimum required capacity per anchor

Exception to inspection is permitted if the AHJ verifies that anchorage and foundation will comply with requirements

- If seeking exception, be very transparent with existing conditions and compliance with design

Installing Safe Room in Existing Building

Option 1: Verify Slab Below Safe Room

*Special inspection required per ICC 500 Section 106*
Installing Safe Room in Existing Building Option 2: Replace Slab Below Safe Room

Construction Documents

Construction documents should be prepared and maintained for all safe rooms, both residential and community. Per ICC 500, they may be required by the AHJ.

- Documents should include information required by applicable codes, AHJ, and ICC 500 Section 107 (with P-361 Table B1-1 exceptions)
- New requirements in Section 107.2.1 of ICC 500-14 include:
  - Foundation capacity and anchor location and capacity
  - Rainfall information for hurricane shelters
  - Calculations for number of sanitation facilities (for community)
### ICC 500-14 Chapter 3 – Structural Design Criteria - Outline

- **Section 301**: General
- **Section 302**: Load Combinations
- **Section 303**: Loads
- **Section 304**: Wind Loads
- **Section 305**: Debris Hazards
- **Section 306**: Component Design and Testing
- **Section 307**: Weather Protection
- **Section 308**: Connection to Foundations or Slabs
- **Section 309**: Penetrations of Envelope by Systems and Utilities

### Structural and Building Envelope Characteristics of Safe Rooms

- Structural systems are designed for higher wind speeds (and corresponding greater wind pressures) and larger and more energetic wind-borne missiles than conventional buildings.
- Envelope (roof, walls, and door assemblies) must resist the specified wind-borne debris impacts.

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*Moore, Oklahoma, 1999*
ICC 500 Section 303
Non-Wind Load Considerations

Modifications required for rain loads, roof live loads, and flood loads (including hydrostatic forces)

- Rain Loads: Determine per ASCE 7, but for hurricane safe rooms, add 6" per hour to ICC 500 Figure 303.2 rates
- Roof Live Loads: Determine per ASCE 7, but not less than:
  - 100 psf for tornado safe rooms
  - 50 psf for hurricane safe rooms
- Impact loading from collapse or laydown hazards may need to be taken under specific consideration

FEMA

ICC 500 Section 303
Non-Wind Load Considerations (cont.)

Flood Loads: Hydrostatic Loads (ICC 500 Section 303.3)
Design underground portions of safe room to resist buoyancy and hydrostatic loads assuming groundwater at surface elevation at entrance

See the Foundation and Anchoring Criteria for Safe Rooms Fact Sheet on the safe room website or at https://www.fema.gov/media-library/assets/documents/112029
ICC 500 Section 304.2
Design Wind Speeds: Tornado Safe Room

Notes:
1. Values are nominal three-second gust wind speeds in miles per hour at 25 feet above ground for Exposure Category C.
2. Multiply miles per hour by 0.47 to obtain meters per second.

Latest in ICC 500 and FEMA P-361 Requirements

ICC 500 Section 304.2
Design Wind Speed: Hurricane Safe Rooms

Notes:
1. Values are nominal three-second gust wind speeds in miles per hour at 25 feet above ground for Exposure Category C.
2. Multiply miles per hour by 0.47 to obtain meters per second.

Latest in ICC 500 and FEMA P-361 Requirements
**ICC 500 Section 305 Debris Hazards**

- All safe room building elements that protect the occupants should resist impacts from wind-borne debris
- Openings for ventilation should also be hardened to resist missile impact test criteria
- More detail on debris impact criteria in Chapter 8
Soil Cover as Protection from Debris Impact

- Exposed
- 3 ft min.
- 12 inches min.
- 12 inches min.
- 12 max.

Shelter

Laydown, Rollover, and Collapse Hazards

- Designing to representative test missile impact criteria will produce safe rooms with roof and wall assemblies capable of withstanding some impacts from slow-moving, large (or heavy) falling debris

- Impact loading from collapse or laydown hazards may need to be taken under specific consideration

Joplin, Missouri. 2011

Greensburg, Kansas. 2007
ICC 500-14 Chapter 4 – Siting – Outline

- Section 401: Flood Elevation Criteria
- Section 402: Hazardous Materials
- Section 403: Siting Proximity for Residential Shelters
- Section 404: Siting for Community Shelters

Differences between ICC 500 and FEMA P-361 Flood Hazard Siting for Community

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1. Zone V</td>
<td>1. Zone V and Coastal A Zone</td>
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<tr>
<td>2. Floodways</td>
<td>2. Floodways</td>
</tr>
<tr>
<td><strong>Exception</strong>: Item 1 shall not apply where permitted by the Board of Appeals in accordance with IBC</td>
<td><strong>Exception</strong>: Item 1 shall not apply where permitted by the Board of Appeals in accordance with IBC and after completing the 8-step decision-making process as provided by 44 CFR Part 9.6</td>
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</tbody>
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Red = more conservative  
Blue = less conservative
### Differences between ICC 500 and FEMA P-361 Flood Hazard Siting for Residential

<table>
<thead>
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<tbody>
<tr>
<td><strong>No siting restrictions</strong></td>
<td>1. Zone V and Coastal A Zone</td>
</tr>
<tr>
<td>Note: The 2008 edition of ICC 500 also did not have flood hazard siting restrictions for residential storm shelters</td>
<td>2. Floodways</td>
</tr>
<tr>
<td>3. Areas subject to inundation with any modeled hurricane category, including coastal wave effects</td>
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</tr>
</tbody>
</table>

Red = more conservative  
Blue = less conservative

### Differences between ICC 500 and FEMA P-361 Flood Hazard Elevation for Community

<table>
<thead>
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<tbody>
<tr>
<td>1. 0.2% + waves</td>
<td>1. 0.2% + waves</td>
</tr>
<tr>
<td>2. Highest recorded</td>
<td>2. Highest recorded</td>
</tr>
<tr>
<td>3. Surge from any hurricane Category + waves</td>
<td>3. Surge from any hurricane Category + waves</td>
</tr>
<tr>
<td>4. Local ordinance</td>
<td>4. Local ordinance</td>
</tr>
<tr>
<td>5. 1% + 2 ft.</td>
<td>5. 1% + 2 ft.</td>
</tr>
</tbody>
</table>

**Exception:** Items 1 and 3 shall not apply to tornado-only shelters  
**Exception:** Item 3 (only) shall not apply to tornado-only safe rooms

Red = more conservative  
Blue = less conservative
### Differences between ICC 500 and FEMA P-361 Flood Hazard Elevation for Residential

**ICC 500-2014**
1. 0.2% + waves
2. Highest recorded
3. Any hurricane Category + waves
4. Local ordinance

**Exception:** Items 1 and 3 shall not apply to tornado-only shelters

**Red = more conservative**
**Blue = less conservative**
**Green = additional requirement**

**P-361 (2015)**
1. 0.2% + waves
2. Highest recorded
3. Not even allowed in hurricane surge areas
4. Local ordinance
5. 1%

**Exception:** Item 1 (only) shall not apply to tornado-only safe rooms

### What to Do When a Flood Study Has Not Been Completed for Safe Room Site

- In areas that have no flood hazard study, the elevation of the flood of record should be used
- If no flood of record has been documented, then consult the AHJ
FEMA Safe Room Quick Guides

Quick guides includes flood elevation and siting criteria for community and residential safe rooms to be complaint with FEMA P-361 guidance.

Linked through FEMA Safe Room Resources website or:

- Community Safe Rooms: [http://www.fema.gov/media-library/assets/documents/101965](http://www.fema.gov/media-library/assets/documents/101965)

ICC 500-14 Chapter 5 – Occupancy, Means of Egress, Access and Accessibility – Outline

- Section 501: Community Shelters
- Section 502: Residential Shelters
- Section 503: Locks and Latching
- Section 504: Signage for Community Shelters
Occupant Density for Tornado vs. Hurricane Safe Rooms

Tornado safe rooms:
- Minimum 2-hour planning duration
- Less square footage required per occupant
- Fewer non-structural requirements
- Less warning time for occupants to get to safe room

Hurricane safe rooms:
- Minimum 24-hour planning duration
- More square footage required per occupant
- More non-structural requirements
- More warning time for occupants to get to safe room

(a) See Section B5.2.1.1 for guidance on minimum usable safe room floor area.
Number of Doors

- The number of doors for a safe room should be determined based on occupant load for normal occupancy of the space per applicable building code.
- Consider the paths to access the safe room; locate entrances to facilitate continuous flow of occupants during an emergency.
  - One way to determine the appropriate number of doors is to consider egress requirements and reverse the flow.
  - Designers have found that sizing hallways and doorways to be equal in width can reduce bottleneck.
- Door swing (inward or outward) depends on applicable building code for normal occupancy of the space.
- Where code requires only one door, an emergency escape is required for safe rooms designed for more than 16 occupants.

Access and Functional Needs

- Community safe rooms must meet the accessibility requirements of the American with Disabilities Act (ADA).
- When planning safe rooms that may house occupants with access and functional needs, refer to *Guidance on Planning for Integration of Functional Needs Support Services in General Population Shelters* (FEMA, 2010).
- Requirements for issues such as egress and emergency lighting are discussed in Chapter 10 of the IBC and NFPA 101 for healthcare facilities.
- Functional needs planning can affect overall safe room planning—do not ignore it!
Community Safe Room Signage Examples

Entrance sign with design information

ICC 500-14 Chapter 6 – Fire Safety – Outline

- **Section 601**: Fire-Resistant Construction
- **Section 602**: Fire Extinguishers
How Fire Safety Requirements Apply

Safe rooms should comply with fire protection and life-safety requirements of the model building code, the State code, or the local code where constructed (whichever is more stringent).

Fire Separation

**Community safe rooms:**
ICC 500 requires fire barriers and horizontal assemblies separating the safe room from other building areas to have a 2-hour minimum fire-resistance rating and to comply with applicable building code.

**Residential safe rooms:**
No requirements.
ICC 500-14 Chapter 7 – Essential Features and Accessories – Outline

- Section 701: General
- Section 702: Tornado Shelters
- Section 703: Hurricane Shelters

Safe Room Ventilation

- Ventilation for a safe room should comply with the building code or ordinances adopted by the AHJ. If no code is adopted, use the current edition of IBC or IRC

- Per ICC 500 Sections 702.1 and 703.1
  - Tornado safe rooms may be ventilated by natural or mechanical means
  - All hurricane safe rooms require natural ventilation
  - Community hurricane safe rooms with more than 50 occupants must be also ventilated by mechanical means
### Sanitation Management: Tornado Shelters per ICC 500 Table 702.2

<table>
<thead>
<tr>
<th>Storm Shelter Type</th>
<th>Toilet Facilities</th>
<th>Hand-washing Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential, one- and two-family dwellings</td>
<td>Not required</td>
<td>Not required</td>
</tr>
<tr>
<td>Residential, other</td>
<td>1</td>
<td>Not required</td>
</tr>
<tr>
<td>Community (50 or fewer occupants)</td>
<td>1</td>
<td>Not required</td>
</tr>
<tr>
<td>Community (more than 50 occupants)</td>
<td>2 minimum for the first 500 occupants and 1 additional per 500 occupants or portions thereof &gt; 500 occupants</td>
<td>1 per 1000 occupants</td>
</tr>
</tbody>
</table>

### Sanitation Management

- Support systems for sanitation facilities must be capable of supplying water and containing waste for the design capacity, and should be protected similar to the safe room.
- If the sanitation requirements for a multi-use safe room exceed the requirements for normal use, then additional facilities can include temporary fixtures, chemical toilets, or other means approved by the AHJ.
- Best practice is to provide a room or private area where toilets can be used; a portable screen may suffice.
Lighting

- Lighting per ICC 500 Sections 702.3 and 703.4
- Not required for residential safe rooms
- Community safe rooms (tornado and hurricane) must have emergency lighting systems
  - Lighting should last for at least the duration of safe room occupancy (2 hours for tornado, 24 hours for hurricane)
  - Standby power source for lighting is essential; battery-powered systems are good for short durations
  - Flashlights are permitted for tornado safe rooms with 50 or fewer occupants

Standby Power

- Standby power per ICC 500 Sections 702.3, 703.4, 703.5, and 703.6
- Standby power systems and all associated components essential to operation require protection from the safe room design event
**ICC 500-14 Chapter 8 – Test Methods for Impact and Pressure Testing – Outline**

- **Section 801:** General
- **Section 802:** Terminology
- **Section 803:** Test Specimens
- **Section 804:** Missile Impact Testing
- **Section 805:** Pressure Testing
- **Section 806:** Pressure Testing Procedures

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**Debris Impact Test Speeds for Tornado Safe Rooms**

<table>
<thead>
<tr>
<th>Design Wind Speed</th>
<th>Missile Speed and Shelter Impact Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>130 mph</td>
<td>80 mph Vertical Surfaces 53 mph Horizontal Surfaces</td>
</tr>
<tr>
<td>160 mph</td>
<td>84 mph Vertical Surfaces 56 mph Horizontal Surfaces</td>
</tr>
<tr>
<td>200 mph</td>
<td>90 mph Vertical Surfaces 60 mph Horizontal Surfaces</td>
</tr>
<tr>
<td>250 mph</td>
<td>100 mph Vertical Surfaces 67 mph Horizontal Surfaces</td>
</tr>
</tbody>
</table>
Wall and Roof Impact Tests

- No adequate method to model complexity of impacts
- Test specimen must be the exact design as the wall or roof that will be used on the safe room, including:
  - Type, size, thickness of materials
  - Type, size, and spacing of fasteners
  - Configuration of all components
- For more details, see Wall Sections That Passed Previous Missile Impact Tests on FEMA’s safe room website: [http://www.fema.gov/wall-sections-passed-previous-missile-impact-tests](http://www.fema.gov/wall-sections-passed-previous-missile-impact-tests)

Performance of Door Assemblies

- Door assembly includes:
  - Door, vision panel, hardware (locks and hinges), frame, and anchors into the safe room wall
- Installed door assembly must be the same type, size, configuration of materials, and swing direction used during testing
- Assemblies are debris-impact tested on the side of the door facing the exterior of the safe room
- Assemblies are pressure tested from both sides with positive pressure
- Residential Safe Room Door Fact Sheet: [www.fema.gov/media-library/assets/documents/99139](http://www.fema.gov/media-library/assets/documents/99139)
Performance of Glazed Opening Assemblies

- Glazed opening assembly includes:
  - Glazing, glazing frame, anchors into the safe room wall
- Installed glazing assembly must be the same type, size, and configuration of materials used during testing
- Debris-resistant glazing is laminated glass, polycarbonate, or a combination of these materials
- Glazing is permitted to break during testing provided that:
  - The missile does not perforate the glazing
  - The glazing remains attached to the frame
  - Ejected glass fragments do not perforate the witness screen

Impact-Protective Systems

- Impact-protective systems include shutters, doors, shields, and cowlings
- Protect openings at louvers, grates, grilles, precast panel joints more than 3/8 inch wide, plumbing vents, roof drains, and emergency generator exhaust vents
- Non-operable, permanently affixed shields or cowlings do not need to be pressure tested, but are required to be tested for resistance to missile impact
**ICC 500-2014 Chapter 8**

Test Methods for Impact and Pressure Testing

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**FEMA P-361 Safe Room Guidance**


- Detailed design and construction criteria for hurricane and tornado safe rooms
- Community and residential safe rooms
- Uses ICC 500 as a Referenced Standard
- Emergency management considerations not found in ICC 500
FEMA P-361 Reorganized

Decision Makers and Emergency Management Considerations

Part A
- A1: Purpose & Background
- A2: Extreme-Wind Risk Assessment and Analysis
- A3: Costs and Benefit-Cost Analysis
- A4: Operation & Maintenance Considerations for Community Safe Rooms

Design Professionals (same chapter sequence as ICC 500)

Part B
- B1: Application & Administration
- B2: Definitions
- B3: Structural Design
- B4: Siting
- B5: Occupancy, Means of Egress, Access and Accessibility
- B6: Fire Safety
- B7: Essential Features & Accessories
- B8: Test Methods for Impact and Pressure Testing

FEMA Recommended Criteria that is more conservative than ICC 500 is presented in a table at the beginning of each chapter and in Appendix D

Summary of Main Differences between ICC 500 and FEMA P-361

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Residential storm shelters may be designed according to ICC 500 wind speed maps</td>
<td>For ALL residential safe rooms, the design wind speed should be 250 mph, regardless of location.</td>
</tr>
<tr>
<td>Slightly less conservative elevation and siting restrictions with respect to flood hazards</td>
<td>Slightly more conservative elevation and siting restrictions with respect to flood hazards</td>
</tr>
<tr>
<td>Prepared construction drawings and details only when required by the authority having jurisdiction</td>
<td>ALL safe rooms require construction drawings and details</td>
</tr>
<tr>
<td>First aid kits in hurricane storm shelters and tornado storm shelters with more than 50 occupants (silent on first aid kit size)</td>
<td>ALL tornado and hurricane safe rooms have first aid kits rated for the occupancy of the safe room</td>
</tr>
</tbody>
</table>
APPENDIX D
Comparison Matrix of Differences Between ICC 500 Requirements and FEMA Recommended Criteria

<table>
<thead>
<tr>
<th>ICC 500 Reference</th>
<th>ICC 500 Requirements For Storm Shelters</th>
<th>FEMA Recommended Criteria For Safe Rooms</th>
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<tbody>
<tr>
<td>Section 107.1</td>
<td>Where required by the authority having</td>
<td>For all safe rooms, construction documents</td>
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<tr>
<td>General</td>
<td>jurisdiction, construction documents</td>
<td>shall be prepared, such documents shall</td>
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<td>shall be prepared. Such documents shall</td>
<td>contain information as required by the</td>
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<td>contain information as required by the</td>
<td>applicable building code and this section.</td>
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<td>applicable building code and this section.</td>
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<tr>
<td>Section 107.2.1</td>
<td>Design Information</td>
<td>2. A statement that the wind design</td>
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<tr>
<td>Design Information</td>
<td>For the area of a building designed for</td>
<td>conforms to the provisions of the</td>
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<td></td>
<td>occupancy as a storm shelter, the</td>
<td>ICC/NSF Standard for the Design and</td>
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<td>following information shall be</td>
<td>Construction of Storm Shelters, with the</td>
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<td>provided within the construction</td>
<td>edition year specified.</td>
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<td>edition year specified and</td>
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<td>the edition year specified and</td>
<td>to the provisions of FEMA P-361, with</td>
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<td>the edition year specified.</td>
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<td></td>
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<td>regardless of location.</td>
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<tr>
<td>Section 304.3</td>
<td>Design Wind Speed</td>
<td>For tornado shelters, the design wind</td>
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<td>For tornado shelters, the design wind</td>
<td>speed shall be in accordance with figure</td>
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<td>speed shall be in accordance with figure</td>
<td>304.2(1). For hurricane shelters, the</td>
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<td>design wind speed shall be in accordance</td>
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<td>with figure 304.2(2).</td>
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<td>accordance with figure 304.2(2).</td>
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FEMA P-320 Safe Room Guidance

Taking Shelter From the Storm: Building a Safe Room For Your Home or Small Business (2014)

- Understanding the Hazards, and Accessing Risks
- Safe Room Decision Guidance
- Construction Plans for residential safe rooms that hold 16 or fewer occupants
- Plans based on design criteria in FEMA P-361 and ICC 500
FEMA P-320 Drawings

<table>
<thead>
<tr>
<th>DRAWING #</th>
<th>SHEET TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR0.0</td>
<td>INDEX SHEET</td>
</tr>
<tr>
<td>SR0.1</td>
<td>GENERAL NOTES</td>
</tr>
<tr>
<td>SR0.2</td>
<td>GENERAL NOTES</td>
</tr>
<tr>
<td>SR0.3</td>
<td>TABLES</td>
</tr>
<tr>
<td>SR1.0</td>
<td>CMU SAFE ROOM PLANS AND DETAILS</td>
</tr>
<tr>
<td>SR1.1</td>
<td>CONCRETE SAFE ROOM PLANS AND DETAILS</td>
</tr>
<tr>
<td>SR1.2</td>
<td>ICE SAFE ROOM PLANS AND DETAILS</td>
</tr>
<tr>
<td>SR1.3</td>
<td>WOOD FRAME SAFE ROOM PLANS AND DETAILS</td>
</tr>
<tr>
<td>SR1.4</td>
<td>WOOD / CMU INFILL FRAME SAFE ROOM AND DETAILS</td>
</tr>
<tr>
<td>SR1.5</td>
<td>DETAILS FOR SAFE ROOMS THAT USE BASEMENT WALLS</td>
</tr>
<tr>
<td>SR2.1</td>
<td>SHEATHING REQUIREMENTS &amp; WOOD FRAME SAFE ROOM WITH STEEL SHEATHING</td>
</tr>
<tr>
<td>SR2.2</td>
<td>EXHAUST / VENTILATION DETAILS</td>
</tr>
</tbody>
</table>

Safe Room Success Stories
Questions

For questions pertaining to FEMA safe room guidance publications, please contact the Safe Room Helpline at Saferoom@fema.dhs.gov

Additional FEMA Building Science resources can be found at http://www.fema.gov/building-science