



# International Code Council

## ICC/NSSA STANDARD FOR THE DESIGN AND CONSTRUCTION OF STORM SHELTERS

### ICC 500-2013 edition Public Comment Draft #1

The ICC Consensus Committee on Storm Shelters has held 4 public meetings to develop the first public comments draft of the ICC 500-2013 Standard for the Design and Construction of Storm Shelters. Public comments are requested on this first public comments draft. The public comment deadline is August 26, 2013. Go to <http://www.iccsafe.org/cs/standards/IS-STM/Pages/default.aspx> for more information.

Proposal No.  
**IS-STM1-11/12**

Section 101.2

Revise as follows:

**101.2 Scope.** This standard applies to the design, construction, installation, and inspection of storm shelters constructed as separate detached buildings or ~~constructed~~ as safe rooms within buildings for the purpose of providing safe refuge from storms ~~that produce high winds~~, such as tornadoes and hurricanes. Shelters designed and constructed to this standard shall be designated as either ~~to be~~ hurricane shelters, tornado shelters, or combined hurricane and tornado shelters.

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Proposal No.  
**IS-STM2-11/12**

Section 104.1 and 104.2

Revise as follows:

**104.1 Rooms or spaces within other uses.** Where designated storm shelters are constructed as a room or space within a building which will ~~designated areas~~ normally be occupied for other purposes, the requirements of the applicable building construction codes for the occupancy of the building, or the individual rooms or spaces thereof, shall apply unless otherwise stated in this standard.

**104.2 Dedicated facilities.** Where a facility is designed to be occupied solely as a storm shelter, the designated occupancy shall be A-3 as defined by the *International Building Code* for purposes of determination of applicable requirements that are not included in this standard.

**Exception:** *Where the facility has an occupant load of less than 50 persons as determined in accordance with Chapter 5, the designated occupancy shall be in accordance with Section 303 of the International Building Code.*

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Proposal No.  
**IS-STM3-11/12**

**Section 106.2**

**Revise as follows:**

**106.2 Special inspections.** Special inspections shall be provided for construction and installation of materials as required by authority having jurisdiction in accordance with the applicable building code, and Section 106.3 of this standard.

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Proposal No.  
**IS-STM4-11/12**

**Section 106.1.1**

**Revise as follows:**

**106.1.1 Peer Review.** Construction documents for community shelters designed for greater than ~~300~~ 50 occupants shall undergo a peer review by an independent registered design professional for conformance with the requirements of Chapter 3.

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Proposal No.  
**IS-STM5-11/12**

**Section 106.1.1**

**Revise as follows:**

**106.1.1 Peer review.** Construction documents for community shelters designed for greater than 300 occupants shall undergo a peer review by an independent registered design professional for compliance with the requirements of Chapter 3, Chapter 5, 6 and Chapter 7.

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Proposal No.

## IS-STM6-11/12

### Section 106.1.1

Revise as follows:

**106.1.1 Peer review.** Construction documents for community shelters designed for greater than 300 occupants shall undergo a peer review by an independent registered design professional for compliance with the requirements of Chapter 3. The peer review shall be submitted to the authority having jurisdiction with the construction documents identified in Section 107.

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Proposal No.

## IS-STM8-11/12

### Section 106.1.1

Add new text as follows:

**106.1.1.1 Peer review for essential facilities.** Construction documents for storm shelters in Risk Category IV (essential facilities) as defined in Table 1604.5 in the International Building Code as well as elementary schools, secondary schools, and day care facilities with an occupant load greater than 16, shall undergo a peer review by an independent registered design professional for compliance with the requirements of Chapter 3.

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Proposal No.

# IS-STM10-11/12

## Section 106.3

### Revise as follows:

**106.3 Special cases.** Special inspections shall be provided for proposed work comprised of:

1. Construction materials and systems that are alternatives to traditional materials and systems prescribed by the applicable code.
2. Unusual design and construction applications.
3. Anchors post-installed in hardened concrete for shelter anchorage in accordance with Section 106.3.1.

**106.3.1 Special Inspections to Verify Anchor Installation.** Special Inspection to verify the anchor installation, capacity and foundation adequacy according to the anchor manufacturer and shelter anchorage and foundation requirements provided in the shelter design information required in Section 107.2.1, quality assurance plans required in Section 107.3.2, and foundation and anchorage criteria required in Section 309.

## Section 202

### Add new definitions as follows:

**SPECIAL INSPECTION.** Inspection of construction requiring the expertise of an approved special inspector in order to ensure compliance with this standard and the approved construction documents.

**SPECIAL INSPECTOR.** A qualified person employed or retained by an approved agency and approved by the building official as having the competence necessary to inspect a particular type of construction requiring special inspection.

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Proposal No.  
**IS-STM11-11/12**

**Section 107.2.1**

**Revise as follows:**

**107.2.1 Design Information.** For the areas of a building designed for occupancy as a storm shelter, the following information shall be provided within the construction documents:

1. Type of shelter: tornado, hurricane or a combination of both.
2. A statement that the wind design conforms to the provisions of the ICC/NSSA Standard for the Design and Construction of Storm Shelters, with the edition year specified.
3. The shelter design wind speed, mph.
4. The importance factor, I.
5. The wind exposure category (indicate all if more than one is used.)
6. The internal pressure coefficient, GC<sub>pi</sub>
7. The topographic factor K<sub>zt</sub>
8. The directionality factor K<sub>d</sub>
9. A statement that the shelter has/has not been constructed within an area susceptible to flooding in accordance with Chapter 4 of this standard.
10. The Design Flood Elevation and Base Flood Elevation for the site (if applicable)
11. Documentation showing that components of the shelter envelope will meet the pressure and missile impact test requirements identified in Chapters 3 and 8 of this standard.
12. A floor plan drawing or image indicating location of the storm shelter on a site or within a building or facility; including drawing or image indicating the entire facility.
13. A storm shelter section or elevation indicating the height of the storm shelter relative to the finished grade, finished floor, and the host building, where applicable.
- ~~13~~ 14. The lowest shelter floor elevation and corresponding datum, except for residential shelters outside of special flood hazard areas.
- ~~14~~ 15. The occupant load of the storm shelter.
- ~~15~~ 16. The usable storm shelter floor area.
- ~~16~~ 17. Venting area (sq.in.) provided and locations in the shelter.

# IS-STM12-11/12

## Section 107.2

Add new text as follows:

**107.2.7 Safe Room Design Information Sheet.** The design information described Section 107.2 shall be supplied on a single sheet.

**Exception:** The documentation for 107.2.1 item 11 may be included in the project manual or an attachment to the single sheet.

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Proposal No.

# IS-STM13-11/12

## Section 107.2.1

Revise as follows:

**107.2.1 Design Information.** For the areas of a building designed for occupancy as a storm shelter, the following information shall be provided within the construction documents:

1. Type of shelter: tornado, hurricane or a combination of both.
2. A statement that the wind design conforms to the provisions of the ICC/NSSA Standard for the Design and Construction of Storm Shelters, with the edition year specified.
3. The shelter design wind speed, mph.
4. The importance factor, I.
5. The wind exposure category (indicate all if more than one is used.)
6. The internal pressure coefficient, GC<sub>pi</sub>
7. The topographic factor K<sub>zt</sub>
8. The directionality factor K<sub>d</sub>
9. A statement that the shelter has/has not been constructed within an area susceptible to flooding in accordance with Chapter 4 of this standard.
10. The Design Flood Elevation and Base Flood Elevation for the site (if applicable)
11. Documentation showing that components of the shelter envelope will meet the pressure and missile impact test requirements identified in Chapters 3 and 8 of this standard.

12. A floor plan drawing or image indicating location of the storm shelter on a site or within a building or facility; including drawing or image indicating the entire facility.
  13. The lowest shelter floor elevation and corresponding datum, except for residential shelters outside of special flood hazard areas.
  14. The occupant load of the storm shelter.
  15. The usable storm shelter floor area.
  16. Venting area (sq.in.) provided and locations in the shelter.
  17. Pre-fabricated shelter minimum foundation capacity requirements.
  18. Pre-fabricated shelter installation requirements including anchor location and minimum required capacity for each anchor.
  19. For pre-fabricated shelters, at least one prescriptive foundation design.
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Proposal No.

**IS-STM14-11/12**

Revise as follows:

**107.2 Information required.** The following information applicable to construction and operation of the storm shelter shall be supplied as part of ~~on~~ the construction documents.

**107.2.4 Inspections.** Where any special details are utilized in the design of the structure, or where any special investigations are required in addition ~~that are additional~~ to those required by the applicable building code, the construction documents shall contain a schedule of the inspections required and the criteria for the special installation.

**107.2.5 Special details.** The construction documents shall provide or include any special manufacturer's details or installation instructions for systems or equipment designed for the storm shelter.

**107.2.6 Special instructions.** The construction documents shall provide or include any special ~~contain~~ details or ~~of~~ special instructions required for the ~~specified~~ functional operation of the storm shelter, such as:

**107.3 Quality assurance plan.** The construction documents for community shelters shall contain a quality assurance plan in accordance with Sections 107.3.1 through 107.3.3.

**107.3.1 Detailed requirements.** A quality assurance plan shall be provided for the following:

*(No changes to Items 1 through 6.)*

7. ~~Requirements for~~ Components and cladding including soffits.
8. Corrosion resistance or protection of metal connectors providing load path continuity and ~~exposed to the elements that provide load path continuity.~~



9. Requirements for Critical support systems and connections and debris impact protection of the components and connections.

**107.3.2 Quality assurance plan preparation.** A quality assurance plan prepared by a registered design professional shall be provided for. ~~The design of each main wind force resisting system and each wind-resisting component shall include a quality assurance plan prepared by a registered design professional.~~

**107.3.3 Contractor responsibility.** Each contractor responsible for the construction of a main wind force resisting system or any component listed in the quality assurance plan shall submit a written statement of responsibility to the authority having jurisdiction, the responsible design professional, and owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain:

1. *(No changes.)*
2. *(No changes.)*
3. *(No changes.)*
4. *(No changes.)*

**Exception:** Prefabricated or panelized storm shelter components which have been inspected and labeled by an approved agency as meeting the requirements of the applicable building code.

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Proposal No.

**IS-STM15-11/12**

## **Section 107.3.1**

**Revise as follows:**

**107.3.1 Detailed requirements.** A quality assurance plan shall be provided for the following:

1. Roof cladding and roof framing connections.
2. Wall connections to roof and floor diaphragms and framing.
3. Roof and floor diaphragm systems, including connectors, drag struts and boundary elements.
4. Main wind force resisting systems, including braced frames, moment frames, and shear walls.
5. Main wind force resisting system connections to the foundation.
6. Fabrication and installation of components and assemblies of the shelter envelope required to meet missile impact test requirements of Chapter 3.
7. Requirements for components and cladding including soffits.

8. Corrosion resistance or protection of metal connectors exposed to the elements that provide load path continually.
9. Requirements for critical support systems connections and debris impact protection of the components and connections.

10. Foundation design

11. Pre-fabricated shelter installation requirements including anchor location and minimum required capacity for each anchor.

12. Pre-fabricated shelter minimum foundation capacity requirements.

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Proposal No.

**IS-STM16-11/12**

**Section 107.3.3**

Revise as follows:

**107.3.3 Contractor responsibility.** Each contractor responsible for the construction of a main wind force resisting system or any component listed in the quality assurance plan shall submit a written statement of responsibility to the authority having jurisdiction, the responsible design professional, and owner prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain:

1. Acknowledgement of awareness of the special requirements contained in the quality assurance plan.
2. Acknowledgement that control will be exercised to obtain conformance with the construction documents.
3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of reports.
4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

~~**Exception:** Prefabricated or panelized storm shelter components which have been inspected and labeled by an approved agency meeting the requirements of the applicable building code.~~

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Proposal No.

## IS-STM18-11/12

### Section 301.1.1

Add new text as follows:

#### 301.1.1 Anchor Calculations – Doors, Windows & Shutters

When anchoring of door, window or shutter framing to the shelter structure by means other than those listed, the use of standard accepted engineering practices for calculating pull out, shear load and anchor placement shall be accomplished by registered design professional for each type of alternate anchoring. Such calculations shall be documented and supplied as part of the Construction Documents.

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Proposal No.

## IS-STM19-11/12

### Section 108.2

Revise text as follows:

**108.2 Labeling.** Other than opening protectives, Pproducts, materials or systems shall be labeled by an approved agency when required by the applicable code or jurisdiction. Opening protectives shall bear a label denoting compliance with this standard.

### Section 202

Add new definition as follows:

**Label.** An independent certification and permanent label applied on a product that contains the name of the manufacturer or performance characteristics of the product or material and the name and identification of the Approved agency, and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency.

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Proposal No.

## IS-STM20-11/12

**Section 302.1, 302.2, 304.1, 306.3, 306.4, 702.1.4, 703.1.5, 703.6.5, 804.9.6, 804.9.7, 804.10.1, 806.1, 806.5 and 806.5.2**

Add new definition to Section 202 as follows:

**Impact-Protective System.** System or device such as a shutter, door, or other device mounted on the inside or outside of the exterior wall of a shelter and which has been demonstrated by testing to be capable of withstanding the impact of test missiles as detailed in this standard.

Revise as follows:

**302.1 Strength design.** For Strength Design or Load and Resistance Factor Design (LRFD), use the load combinations stated in ASCE 7, Section 2.3 with  $W$  determined in accordance with Section 304 of this standard. ~~Exception 1 to ASCE 7 Section 2.3.2 shall not apply.~~ ~~2.3.2 with the following additional load combinations with  $W$  in these additional load combinations being based on Section 304:~~

- ~~1. In load combination 3, replace  $0.8W$  with  $0.5W$~~
- ~~2. In load combinations 4 and 6, replace  $1.6W$  with  $1.0W$~~
- ~~3. Exception 1 shall not apply~~

**302.2 Allowable stress design.** For Allowable Stress Design (ASD), use the load combinations stated in ASCE 7, Section 2.4.1 with  $W$  determined in accordance with Section 304 of this standard. ~~with the following additional load combinations with  $W$  in these additional load combinations being based on Section 304:~~

- ~~1. In load combinations 5, 6, and 7, replace  $W$  with  $0.6W$~~

**306.3 Wall and roof openings.** All openings in the shelter envelope shall be protected by doors complying with Section 306.3.1, windows complying with Section 306.3.2, other impact-protective systems ~~opening protective device~~ complying with Section 306.4, or baffled to prevent windborne debris from entering the shelter protected occupant area in accordance with Section 306.5.

**306.4 ~~Opening Protective Devices.~~ Impact-protective systems.** ~~Opening protective devices~~ Impact-protective systems such as shutters and protective screens shall be tested for missile impact in accordance with Chapter 8.

**Exception:** Non-operable, permanently affixed shields or cowlings are excluded from pressure testing requirements of Section 806.5.

**306.4.1 ~~Opening protective devices~~ Impact-protective systems in tornado shelters.** ~~Impact-protective systems~~ ~~Opening protective devices~~ in tornado shelters shall be permanently affixed, and manually operable from inside the shelter.

**702.1.4 Exhaust or intake opening protection.** Air exhaust or intake openings that terminate outside of occupied shelter areas and occupant support areas shall comply with the provisions of Section 306.3 for exterior wall and roof impact-protective systems ~~opening protectives~~.

**703.1.5 Exhaust or intake opening protection.** Air exhaust or intake openings that terminate outside of occupied shelter areas and occupant support areas shall comply with the provisions of Section 306.3 for exterior wall and roof ~~impact-protective systems-opening protective devices~~.

**703.6.5 Location.** Emergency electrical power supply shall be accessible by a protected access route. The access route shall be located within the hurricane shelter or shall meet the provisions for exterior wall and roof ~~impact-protective systems-opening protective devices~~ in accordance with this standard.

**804.9.6-Opening Protective Devices. Impact-protective systems.** All shutter assemblies and other ~~Impact Protective Protection Systems~~ shall be impacted in the center of the closed opening, and at one interface corner as detailed in Figure 804.9.6-1. Panels and interface joints shall be impacted as shown in Figure 804.9.6-2. Interface hinge joints and primary latches, where present, shall be impacted as shown in Figure 804.9.5-2 on an additional specimen.

**804.9.7 Alcove or Baffled Entry Systems.** Debris impact testing described in this section is required for alcove/baffled access/egress systems meeting the requirements of Sections 304 and 305. Figure 804.9.7 illustrates an alcove/baffle system. Debris impact test requirements are presented for systems for which:

1. Storm debris impacts at least two ~~impact-protective systems-shelter protective elements~~ meeting the requirements of Section 306.2 prior to entering the protected occupant area. Straight missile paths and elastic impacts are assumed in determining missile trajectories. Test requirements for this type of system are presented in Section 804.9.7.1. Examples of this type of system are shown in Figure 804.9.7.1. The boundary between the protected occupant area and the unprotected occupant area shall be clearly marked on the floor and walls of the shelter.
2. Storm debris impacts initially an ~~impact-protective system-shelter protective elements~~ meeting the requirements of Section 306.2 and possibly rebounds to impact an entry door. Straight missile paths and elastic impacts are assumed in determining missile trajectories. The debris test requirements for this type of system are presented in Section 804.8.7.2. Examples of this type of system are shown in Figure 804.9.7.2-1 and Figure 804.9.7.2-2.
3. Storm debris impact on an entry door is limited to an angle less than 90 degrees by an ~~impact-protective system-protective elements~~. The debris test requirements for this type of system are presented in Section 804.8.7.3. Examples of this type of system are shown in Figure 804.9.7.3.

**804.10.1 Perforation.** Any perforation of the interior surface of the tested component of the shelter envelope by the design missile shall constitute a failure. For ~~impact-protective systems-opening protective devices~~, perforation or deflection that would result in impact of the protected component constitutes a failure.

**806.1 Pressure Testing Procedures.** Procedures for pressure testing wall assemblies, roof assemblies, door assemblies, window assemblies, and ~~impact-protective systems-opening protective devices~~ requiring pressure testing are presented in this section.

**806.5-Opening Protective Devices. Impact-protective systems.** External ~~impact-protective systems-opening protective devices~~ such as shutters and protective screens shall be tested for ability to withstand prescribed pressures if withstanding pressure is critical to their function when installed. Devices such as non-operable, permanently affixed shields or cowlings whose only function is to protect against debris intrusion need not be pressure tested.

**806.5.1—Opening Protective Devices. Impact-protective systems for Tornado Shelters.** External ~~impact-protective systems~~ ~~protective devices~~ for tornado shelters whose ability to withstand wind-induced pressure when installed is critical to their function shall be static pressure tested following procedures specified in ASTM E330 to a pressure of at least 1.2 times the pressures specified in Section 304.. Debris impact tests and pressure tests are permitted to be conducted separately.

**Exception:** ~~Impact-protective systems~~ ~~Protective devices~~ with a jamb or stop need be tested only with pressure away from the stop.

**806.5.2—Opening Protective Devices Impact-protective systems for Hurricane Shelters.** External ~~impact-protective systems~~ ~~protective devices~~ for hurricane shelters whose ability to withstand wind-induced pressure when installed is critical to their function shall be static pressure tested to a pressure of at least 1.2 times the shelter design wind pressures specified in Section 304 following the procedures specified in ASTM E330. Cyclic pressure tests conducted according to Section 805.5 shall be conducted after debris impact tests.

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Proposal No.

**IS-STM21-11/12**

### Section 305.1.2

Revise as follows:

**305.1.2 Missile criteria for hurricane shelters.** The debris impact test missile for all components of the shelter envelope of hurricane shelters shall be a 9 pound (4.1 kg) sawn lumber 2x4. The speed of the test missile impacting vertical shelter surfaces shall be a minimum of ~~0.40~~ 0.50 times the shelter design wind speed. The speed of the test missile impacting horizontal surfaces shall be 0.10 times the shelter design wind speed.

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Proposal No.

**IS-STM22-11/12**

Revise as follows:

**306.3.2 Testing of window assemblies and other glazed openings.** Operable and non-operable window ~~Window assemblies (operable and non-operable)~~ and other glazed openings including skylights, side lights and transoms, shall be tested for missile impact in accordance with Section 804 and cyclic pressure in accordance with Section 805 ~~and with cyclic pressures in accordance with ASTM E 1996.~~

Proposal No.

## IS-STM24-11/12

**307.1 Exterior cladding of hurricane shelters.** All exposed components and cladding assemblies and roof coverings of hurricane shelters shall be designed to resist rainwater penetration during the design windstorm and shall be designed and installed to meet the wind load requirements of Section 304.

Exception: Residential shelters which are fully enclosed in a Host Building constructed in compliance with the local building code.

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Proposal No.

## IS-STM25-11/12

Revise as follows:

**308.1.1 Stability.** In addition to structural stability requirements of Section 309, structural stability of a storm shelter shall also be determined for the building code design wind speeds (wind speeds which ~~are~~ is below the shelter design wind speeds) where the host building or components thereof could transmit forces in connections to the storm shelter that are equal to 1.5 times the nominal strength of the connections.

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Proposal No.

## IS-STM26-11/12

### Section 309.1.1 and 309.1.2

Revise as follows:

**309.1.1 Structural stability of storm shelter foundations.** ~~Foundations Other than host buildings designed in accordance with Section 308.1.1, foundations~~ and slabs that provide structural stability for storm shelters shall be designed to resist the combined uplift and lateral forces on the shelter that are calculated for the storm shelter design wind speed assuming the host building is totally destroyed by the windstorm.

Exception: Where the host building is designed in accordance with Section 308.1.1, the design of foundations and slabs shall not be required to assume the host building is totally destroyed by the windstorm.

**309.1.2 Calculation of resistance.** Structural stability of storm shelters shall be determined by engineering calculations for design wind pressures determined in accordance with Section 304. ~~Where For~~ storm shelters are anchored to foundations or slabs-on grade whose top surfaces extending outward from the shelter walls are at grade, the top surfaces of the foundations or slabs shall not be considered to have wind uplift forces acting on them ~~top surfaces of the slab~~.

**309.1.2.1. Slabs on grade.** Slabs on grade shall be designed for the applicable loads in accordance with Section 301. Where a slab on grade is being used to resist loads, the minimum thickness shall be 3½ inches (88.9 mm) and the minimum steel reinforcement for slabs on grade resisting forces on the storm shelter shall be 6 x 6 – W1.4 x W1.4 or No. 4 bars, 18 inches on center in either direction.

**Exception:** Concrete and concrete masonry storm shelters shall be permitted to be constructed within existing one & two family dwellings on existing slabs on grade without a foundation, under the following conditions:

1. Calculated soil pressure under the slabs on grade supporting the storm shelter walls ~~shall~~ does not exceed 2000 psf (95.8 kN/m<sup>2</sup>) for design loading conditions other than design storm shelter events and 3000 psf (143.7 kN/m<sup>2</sup>) for design storm shelter events.
2. The storm shelter is anchored at a minimum to the slab on grade at each corner of the structure and on each side of the doorway opening ~~minimum~~.
3. Reinforcing ~~The reinforcement requirements~~ in the slab on grade shall not be required where the ~~are waived~~ if dead load of the slab is not required to resist overturning.

**309.1.2.2 Joints in concrete slabs on grade.** Design calculations for concrete slabs on grade supporting storm shelters shall include the effect of expansion joints, contraction joints or construction joints where such slabs on grade ~~that~~ are utilized to resist tensile and shear loads from the supported ~~in concrete slabs on grade supporting~~ storm shelters.

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Proposal No.

**IS-STM28-11/12**

## Section 310.1

Revise as follows:

**310.1 Penetrations of storm shelter envelope by mechanical, electrical and plumbing systems and utilities.** Penetrations through the storm shelter envelope of mechanical, electrical and plumbing systems, including piping and utility lines, larger than 3-1/2 square inches (2258 mm<sup>2</sup>) in area for rectangular penetrations or 2-1/16 inches (52.38 mm) in diameter ~~for systems and utilities installed for any purpose,~~ shall be considered openings and shall be protected in accordance with Section 306.3. Penetrations of the storm shelter envelope shall not degrade the structural integrity of the storm shelter and missile impact resistance of the storm shelter envelope.

Penetrations of the shelter envelope by ~~hazardous~~ gas or liquid lines shall have automatic shutoffs to protect against leakage due to movement of the utility line. The threshold movements for shutoff shall be as defined by the codes and standards governing such utility lines.



Proposal No.

## IS-STM32-11/12

### Section 404.1.1, 401.1.2

Revise as follows:

Revise as follows:

**401.1.1 Minimum floor elevation of community shelters.** The lowest floor used for the occupied shelter and occupant support areas of a community shelter shall be elevated to the higher of the elevations determined by:

1. The flood elevation, including coastal wave effects, having a 0.2% annual chance of being equaled or exceeded in any given year; or
2. Two feet above the flood elevation having a 1% annual chance of being equaled or exceeded in any given year; or
3. ~~Two feet above~~ The flood elevation corresponding to the highest recorded flood elevation ~~if the area is not in a mapped special flood hazard area;~~ or
4. The maximum flood inundation elevation associated with a Category 5 hurricane event, including coastal wave effects. In areas where Category 5 flood elevations have not been established, the elevation associated with the highest established hurricane category shall apply; or in an area subject to storm surge inundation.
5. The minimum elevation of the lowest floor required by the authority having jurisdiction.

**Exception:** Items no. 1, 2, 3 and 4 shall not apply to shelters designed, constructed, designated and used only as residential tornado shelters.

**401.1.2 Minimum floor elevation of residential shelters.** The lowest floor used for the occupied shelter area of a residential shelter shall be elevated to the higher of the elevations determined by:

1. The minimum elevation of the lowest floor required by the floodplain ordinance of the community; or
2. One foot (304.8 mm) above the flood elevation corresponding to the highest recorded elevation ~~if the area is not in a mapped special flood hazard area or is in a mapped non-participating community; a flood hazard study has not been conducted for the area; or~~
3. The flood elevation, including coastal wave effects, having a 0.2-percent annual chance of being equaled or exceeded in any given year; or
4. The maximum flood elevation associated with a Category 5 hurricane event, including coastal wave effects. In areas where Category 5 flood elevations have not been established, the elevation associated with the highest established hurricane category shall apply.

**Exception:** Items 3 and 4 shall not apply to shelters designed, constructed, designated, and used only as tornado shelters.



Proposal No.

## IS-STM33-11/12

### Section 403.1

Revise as follows:

**403.1 Residential shelter siting.** Residential tornado shelters shall be located within the residence that the shelter is intended to serve, or shall be located on the site such that the maximum travel distance from the access opening for the shelter to the furthest exterior door of within 150 feet (45 720 mm) of the residence or residences that the shelter is intended to serve does not exceed 150 feet (45 720 mm).

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Proposal No.

## IS-STM34-11/12

### Section 404

Add new text as follows:

**404.1 Community Shelter Siting.** Community shelters shall be located outside of the following high-risk flood hazard areas:

1. Flood hazard areas subject to high-velocity wave action (V zones)
2. Floodways

**Exception:** Community shelters shall be permitted in flood hazard areas subject to high-velocity wave action (V zones) where permitted by the Board of Appeals in accordance with the provisions of the International Building Code.

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Proposal No.

# IS-STM35-11/12

1. Add new text as follows:

## SECTION 202

### DEFINITIONS

**AREAS OF CONCENTRATED FURNISHINGS.** The areas of a storm shelter or safe room with furniture or fixtures which cannot be easily moved, including areas such as bathrooms, locker rooms, and rooms with fixed seating or fixed tables.

**AREAS OF UNCONCENTRATED FURNISHINGS.** The areas of a storm shelter or safe room with furniture or fixtures which can be easily moved, including areas such as classrooms and offices.

**AREAS OF OPEN PLAN FURNISHINGS.** The areas of a storm shelter or safe room which are generally free of furniture or fixtures which cannot be easily moved and of interior partitions or other features which block movement through or otherwise subdivide the space.

2. Revise as follows:

**501.1.2.1 Calculation of usable floor area.** The usable shelter floor area shall be determined by using the following percentages:

1. Reducing the gross floor area of shelter areas with areas of concentrated furnishings or fixed seating by a minimum of 50 percent.
2. Reducing the gross floor area of shelter areas with areas of unconcentrated furnishings and without fixed seating by a minimum of 35 percent.
3. Reducing the gross floor area of shelter areas with areas of open plan furnishings and without fixed seating by a minimum of 15 percent.

Proposal No.

## IS-STM36-11/12

### Section 501.2

Revise as follows:

**501.2 Number of doors.** The number of means of egress doors from a space shall be determined based upon the occupant load for the normal occupancy of the space in accordance with the applicable building code. For facilities used solely for shelters, the number of doors shall be determined in accordance with the applicable building code based upon the occupant load as calculated in Section 501.1.

Where the applicable building code requires only one means of egress door, an emergency escape opening shall be provided in accordance with Section 501.4.

Exception: Shelters having an occupant load not exceeding 16 or are not required to have an emergency escape opening.

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Proposal No.

## IS-STM37-11/12

### Section 503.1

Revise as follows:

**503.1 Locks and latching mechanisms.** Locking and other latching mechanisms shall be permanently mounted on the assembly. Such mechanisms shall require no tools to be engaged in the locked position. Devices such as pins shall be permanently secured to the ~~assembly specimen~~ assembly through the use of chains or wires which must be of corrosion resistant material.

Proposal No.

## IS-STM38-11/12

### Section 503.1, 503.2 and 503.3 (new)

Revise as follows:

**503.1 Locks and latching mechanism.** Locking and other latching mechanisms shall be permanently mounted on the assembly. Such mechanisms shall require no tools to be engaged in the ~~locked~~ latched position. Devices such as pins shall be permanently secured to the specimen through the use of chains or wires which must be corrosion-resistant material.

**503.2 Multi-latching systems.** Products that are not categorized as means of egress/escape and are provided with more than one single-action ~~locking~~ latching mechanism shall be provided with permanently posted instruction on latching.

**503.3 Door latches.** Door latching hardware necessary for the door assembly to perform as designed for the storm shelter shall either:

1. Automatically engage when the door is in a closed position or
2. Be capable of being engaged by an occupant. Signage shall be provided with instructions for latching the door for emergency shelter use.

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Proposal No.

## IS-STM39-11/12

### Section 504.1.1

Revise as follows:

**504.1.1 Signage location.** At every entrance to a storm shelter, signage indicating “Tornado Shelter”, or “Hurricane Shelter”, or appropriate symbols as applicable, shall be installed. ~~The sign shall be both tactile and visual, meeting the requirements of ICC A117.1. The sign shall be no smaller than 8.5 inches by 11 inches (216 mm by 279 mm). The sign shall be mounted on or adjacent to the door, located in accordance with ICC A117.1.~~ The sign shall comply with the applicable requirements of ICC A117.1.

Proposal No.

## IS-STM43-11/12

### Section 803.1

Revise as follows:

**803.1 Test Specimen.** All parts of the test specimen shall be full size, using the same materials, details, methods of construction and methods of attachment as proposed for actual use. Testing of components consisting of wall, roof, door, or window assemblies shall be allowed in lieu of testing entire shelters. Except where failure of framing members may control the impact performance, wall and roof sections subjected to debris impact testing shall be a minimum of 4-feet (1219mm) wide by 4-feet (1219 mm) high unless dimensions of the actual assembly are less than these dimensions. Wall and roof sections subjected to pressure testing and wall sections where impact resistance may be controlled by framing members shall be a minimum of 4-feet (1219 m) wide and the full length of the span of the wall section from support to support.

Doors and windows shall be tested at the maximum size proposed for use. Opening protective devices (shutters) are to be tested at the maximum and minimum size proposed for use. Operable doors or windows shall be tested for the conditions of swing and latching as specified for use of the product. The specimen shall consist of the entire assembled unit and shall, when practical, be mounted as it will be installed in a shelter, and shall contain all devices used to resist wind forces and windborne debris. When it is not practical to install for testing a door or window frame as it will be mounted in a shelter, then the unit or assembly shall be mounted in a test buck to connect the specimen to the test frame/stand/chamber. Details of the mounting shall be described in the test report.

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Proposal No.

## IS-STM45-11/12

### Section 806.4.1

Revise as follows:

**806.4.1 Window Assemblies and Other Glazed Openings for Tornado Shelters.** Window assemblies and other glazed openings for tornado shelters shall be static pressure tested away from stops to a pressure of at least 1.2 times the design wind pressure following procedures detailed in sections ASTM E 330 ~~to the pressures specified in Section 304.~~ Pressure tests are allowed to be conducted separately from debris impact tests.

Proposal No.

## IS-STM46-11/12

### Section 502.3.1

Revise as follows:

**502.3.1. Stairs for residential shelters.** Limits on residential storm shelter maximum riser height.

Exception: The maximum height of risers for residential shelters which have a maximum rise between shelter floor level and shelter entrance level of 70 inches shall be 10 inches for 8 inch stair treads.

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Proposal No.

## IS-STM47-11/12

### Section 202

Add new definition as follows:

**PEER REVIEW.** A review of the storm shelter design by a registered design professional who is not in the same firm as the registered design professional who designed the storm shelter. The peer review includes checking the construction documents including the design criteria, applicable codes and standards, design references, calculations, construction drawings, shop drawings, and quality assurance plan for the storm shelter design.

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Proposal No.

## IS-STM48-11/12

### Section 106.1.1

Revise as follows:

**106.1.1 Peer Review.** Construction documents for community shelters designed for greater than 300 occupants shall undergo a peer review by an independent registered design professional for conformance with the requirements of Chapter 3. A signed and sealed report, fully describing the items reviewed, their compliance or non-compliance with applicable codes and standards, and recommendation of acceptance or rejection of the storm shelter design, or modifications to render the design acceptable, shall be submitted to the authority having jurisdiction prior to issuance of a permit for construction.

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Proposal No.

## IS-STM49-11/12

### Section 306.6 and 306.7 (NEW)

Add new text as follows:

**306.6 Door undercut.** Door or shutter assemblies for use in the shelter envelope with threshold at the level of exit discharge shall be limited to a 3/4" maximum undercut. Provide weather seal at door undercut where doors are exposed to weather.

**306.7 Joints, gaps, or voids in shelter envelope**-Joints, gaps, or voids in shelter envelope which open into the protected occupant area similar to masonry control joints, expansions joints, opening protective device shim spaces, air louver blades, grates, grilles, screens, or pre-cast panel joints shall be considered openings and shall be protected in accordance with sections 306.3 and 306.4.

**Exceptions:**

1. Joints, gaps, or voids 3/8" or less in width .
2. Joints, gaps, or voids that will not allow direct debris path through shelter envelope into the protected occupant area. Debris path shall impact at least two surfaces meeting the missile impact criteria of Section 305.1 prior to arriving at the protected occupant area. Straight missile paths and elastic impacts are assumed in determining missile trajectories.

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Proposal No.

## IS-STM50-11/12

### Section 702.1.1.1

Revise as follows:

**702.1.1.1 Location of ventilation openings.** Configuration of natural ventilation openings required for tornado shelters shall be such that a minimum of 25 percent of the required area is located within 46 inches (2581 mm) of the floor, or in the lower one-half of the height of the shelter, whichever is less, with the balance, but not less than 50 percent of the required area located a minimum of 72 inches (1829 mm) above the floor, or in the upper one-fourth of the height of the shelter, whichever is greater. Lower and upper openings shall be horizontally located at least 2/3 the diagonal distance of the shelter apart on opposite wall or the roof surface.

Proposal No.  
**IS-STM51-11/12**

**Section Table 702.2**

Revise wording for Toilet Facilities-Community (>50) to read:

2 minimum for the first 500 occupants and 1 additional per 500 occupants or portions thereof > 500 occupants.

**Table 702.2**

**Required Sanitation Facilities, Tornado Shelters**

<b>Storm Shelter Type</b>	<b>Toilet Facilities</b>	<b>Hand washing Facilities</b>
Residential, 1 & 2 Family Dwellings	NR	NR
Residential, Other	1	NR
Community ≤50 Occupants	1	NR
Community, >50 Occupants	2 minimum <u>for the first 500 occupants</u> and 1 <u>additional</u> per 500 occupants or portions thereof <u>≥ 500 occupants.</u>	1 per 1000 occupants

Proposal No.

## IS-STM52-11/12

### Section 703.1.3

Revise as follows:

**702.1.1.1 Location of ventilation openings.** Configuration of natural ventilation openings required for hurricane shelters shall be such that a minimum of 25 percent of the required area is located within 46 inches (1168 mm) of the floor, or in the lower one-half of the height of the shelter, whichever is less, with the balance, but not less than 50 percent of the required area, located a minimum of 72 inches (1829 mm) above the floor, or in the upper one-fourth of the height of the shelter, whichever is greater. Lower and upper openings shall be horizontally located at least 2/3 the diagonal distance of the shelter apart on opposite wall or the roof surface.

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Proposal No.

## IS-STM54-11/12

### Section 107.2.1, 303.1, 703.8 (NEW)

**303.1 Rainfall loads.** Rain loads shall be determined in accordance with ASCE 7. Rainfall rates for hurricane shelter roofs shall meet the following:

**303.1.1 Rainfall rate for the primary drainage system.** Rainfall rate for the primary drainage system shall be determined by adding 3 inches (76.2 mm) of rainfall per hour to the rainfall rate established from Figure 303.2.

**303.1.2. Rainfall rate for the secondary (overflow) drainage system.** ~~Where required,~~ The rainfall rate for the secondary drainage systems shall be determined by adding 6 inches (152.4 mm) of rainfall per hour to the rainfall rate established from Figure 303.2.

Add new Section 703.8:

**703.8 Rainwater drainage for hurricane shelter facilities with open or perforated screen roof.** Rainwater drainage shall be provided for facilities where it is possible that rainwater will be impounded and flood occupied shelter areas, critical support systems or access routes. The rainfall rate shall be determined by adding 6 inches (152.4 mm) per hour to the rainfall rate established in Figure 303.2.

#### **107.2.1 Design Information.**

#. For hurricane shelters, the rainfall rate of the roof primary drainage system.

#. For hurricane shelters, the rainfall rate of the roof secondary (overflow) drainage system where required.

#. For hurricane shelters, the rainwater drainage design rainfall rate for facilities subject to rainwater impoundment.

Proposal No.

**IS-STM55-11/12**

**Section 308, 202**

**Revise as follows:**

**SECTION 308 SHELTERS  
ENCLOSED OR PARTIALLY ENCLOSED IN A HOST BUILDINGS**

~~**308.1 Connection of Shelter Elements to a Host Building.** Where the host building does not otherwise qualify as a storm shelter under the provisions of this standard, connection of shelter elements shall be permitted to host building framing which is designed for wind forces equal to or greater than the design wind forces for the storm shelter.~~

~~**308.1.1 Stability.** In addition to structural stability requirements of Section 309, structural stability of a storm shelter shall also be determined for building code design for (wind speeds which are below the shelter design wind speeds) where the host building could transmit forces in connections to the storm shelter that are equal to 1.5 times the nominal strength of the connections.~~

~~**308.2 Storm shelters enclosed in host buildings.** Storm shelters enclosed in host buildings shall be designed and installed to meet the wind load requirements of Section 304.~~

**308.1 Storm shelters in host buildings.** Storm shelters enclosed or partially enclosed in host buildings or adjacent to other buildings not designed for the load requirements of Chapter 3 shall be designed and installed to meet the wind load requirements of Chapter 3 considering the shelter to be fully exposed.

**308.2 Storm shelters connected to host buildings.** Where an element or component of the host building is connected to a storm shelter, the storm shelter shall be designed to resist 1.5 times the nominal strength of the connection, in addition to the wind loads on the storm shelter required by Chapter 3.

**Revise the following definition:**

**Section 202**

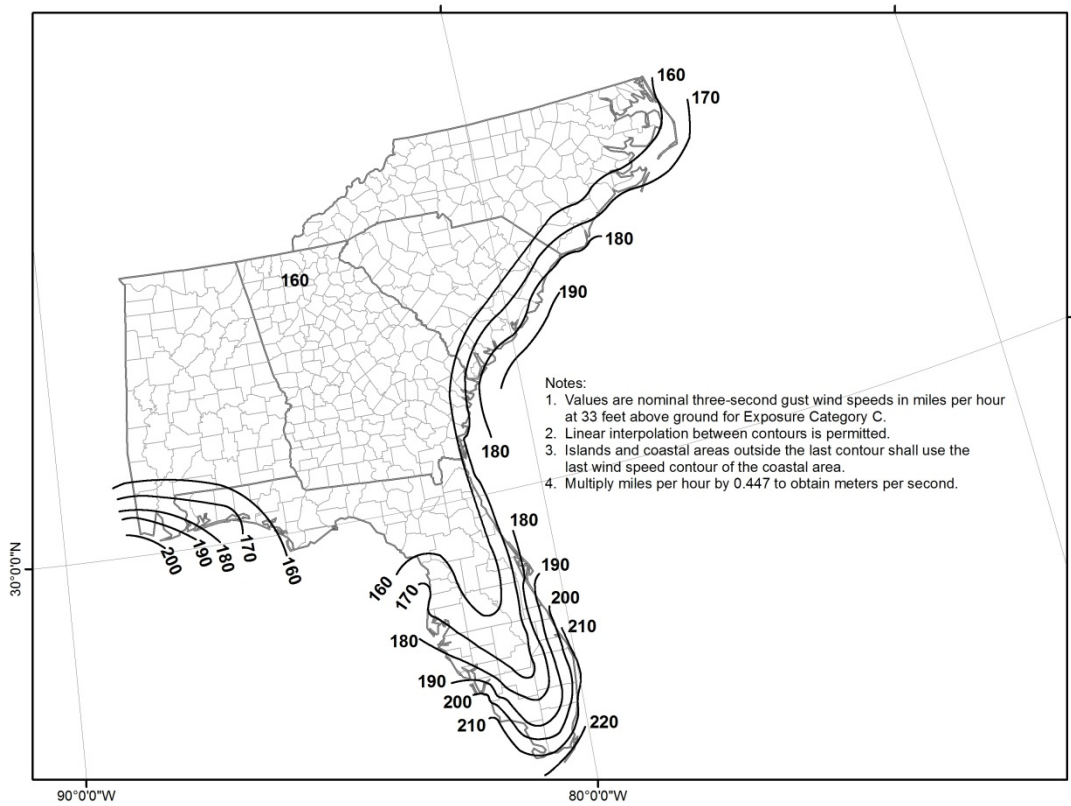
**HOST BUILDING.** A building which is not designed or constructed as a storm shelter that totally or partially encloses a storm shelter, or is connected to a storm shelter.

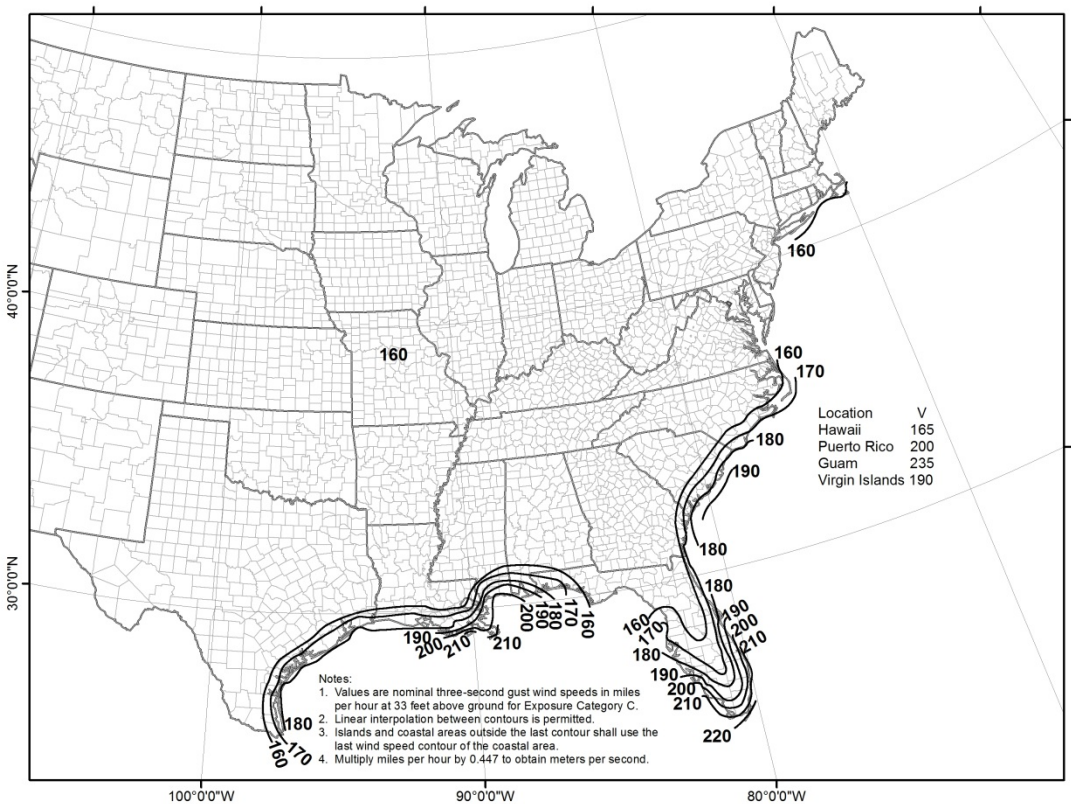
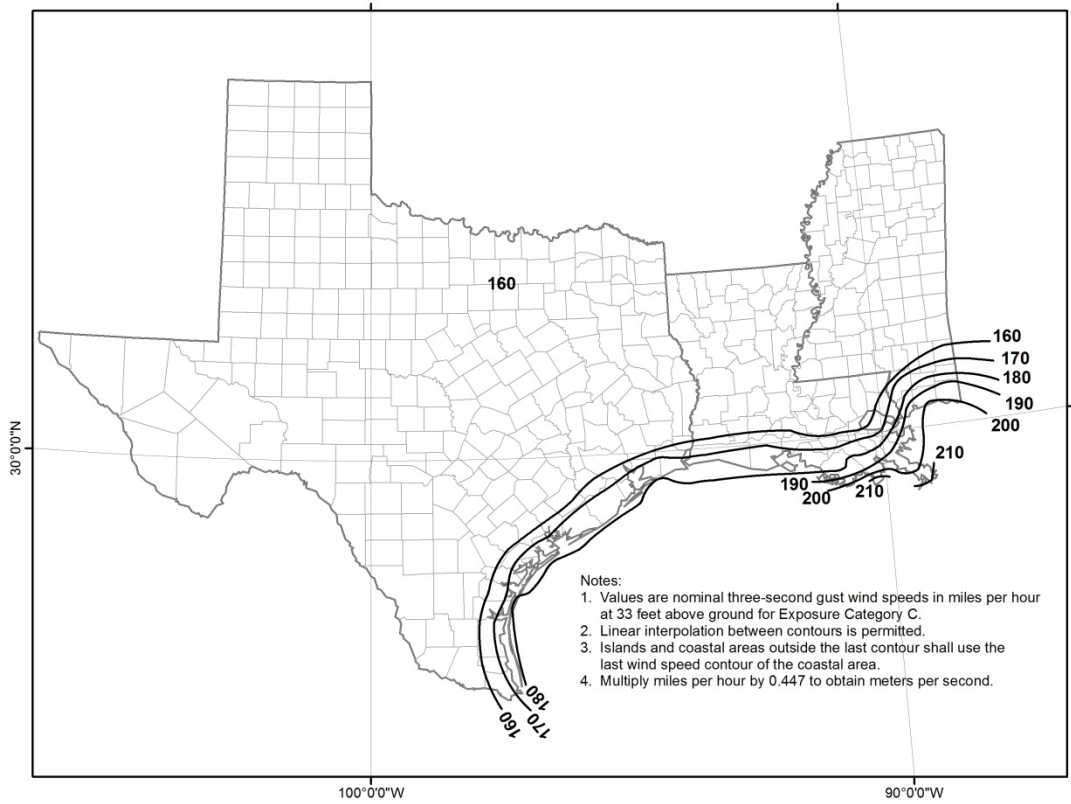
Proposal No.  
**IS-STM56-11/12**

**Section 308.1.1**

Replace the coastal wind maps with the following maps:

(figs. 304.2(2))





Proposal No.

## IS-STM57-11/12

### Section 303.4 (New)

**Section 303.4 Flood Loads.** Flood loads shall be determined in accordance with ASCE 7 using the flood elevations as specified in Section 401 of this standard.

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Proposal No.

## IS-STM58-11/12

### Section 107.2.1, 304

Revise as follows:

**107.2.1 Design information.** For the areas of a building designed for occupancy as a storm shelter, the following information shall be provided within the construction documents:

Items 1 – 3 : *No change to current text.*

4. The importance factor, *I*.

Items 5. – 16: *No change to current text.*

#### SECTION 304 WIND LOADS

**304.1 General.** ~~Design wind pressures~~ Wind loads shall be determined using Method 2, Analytical Procedure, from Section 6 of ASCE 7 except as modified by this section.

**304.2 Design wind speed.** For tornado shelters, the design wind speed shall be in accordance with Figure 304.2(1). For hurricane shelters, the design wind speed shall be in accordance with Figure 304.2(2).

**304.3 Wind directionality factor.** The directionality factor shall be taken as  $K_d = 1.0$ .

~~**304.4 Importance factor.** The importance factor, *I*, shall be taken as 1.0.~~  
~~**304.5 Exposure category.** For tornado shelters, wind loads shall be based on exposure category C. For hurricane shelters, use of exposure category B is not permitted.~~

**Exception:** For hurricane shelters, where exposure category B exists for all wind directions, MWFRS wind loads for the Main Wind Force Resisting System (MWFRS) only wind pressures shall be permitted to be based upon exposure category B when where exposure category B exists for all wind directions and is likely to remain exposure category B after a hurricane with a wind speed determined from Section 304.2.

**304.6 Topographic effects.** For tornado shelters, the topographic factor  $K_{zt}$  need not exceed 1.0.

**304.7 Enclosure classifications.** Enclosure classifications for storm shelters shall be determined in accordance with ASCE 7, Section 6.2. For determining the enclosure classification for community storm shelters, the largest door or window on a wall that receives positive external pressure shall be considered as an opening.

**304.8 Atmospheric pressure change (APC).** For tornado shelters classified as enclosed buildings, the additional internal pressures caused by atmospheric pressure change shall be considered. The internal pressure coefficient,  $GC_{pi}$ , shall be taken as +/- 0.18 when APC venting area of 1 square foot (0.0929 m<sup>2</sup>) per 1,000 cubic feet (28.3 m<sup>3</sup>) of interior shelter volume is provided. APC venting shall consist of openings in the shelter roof having a pitch not greater than 10 degrees from the horizontal or openings divided equally (within 10% of one another) on opposite walls. A combination of APC venting meeting the above requirements is permitted.

**Exception:** Calculation of venting area to relieve APC is not required ~~for hurricane shelters~~ for tornado shelters classified as partially enclosed. An internal pressure coefficient of  $GC_{pi} = +/- 0.55$  shall be used for tornado shelters where APC venting meeting the requirements of Section 304.8 is not provided, or where APC venting area requirements are not calculated.

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Proposal No.

**IS-STM59-11/12**

**Section 309.1.2.1**

Revise as follows:

**309.1.2.1 Slabs on grade.** New or existing slabs on grade shall be designed for the applicable loads in accordance with Section 301; ~~Where a slab on grade is being used to resist loads, however;~~ the minimum thickness shall be 3 ½ inches (88.9 mm) and the minimum steel reinforcement for slabs on grade resisting forces on the storm shelter shall be 6 by 6 – W1.4 by W1.4 or No. 4 bars, 18 inches on center in 2 either directions.

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